Media, Representation, Persistence and Relief: the Role of the Internet in Understanding the Physical and Social Dynamics of Catastrophic Natural Hazards.

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The number of recorded natural hazards has increased throughout the past four decades and recent events such as the L'Aquila, Italy earthquake and the Sichuan, China earthquake demonstrate the persistent threat posed by such events.

When a natural hazard occurs, the ensuing disruption to society is more often than not captured and reported by the news media. Thus, the news media is a valuable source of natural hazard event information. However, much of the previous work utilising natural hazard news media has focused on manual collation and examination of printed news media on a country- or event-specific basis.

The Internet allows for real-time communication and broadcasting of natural hazards information and provides an ever-growing archive of the temporal and spatial patterns within natural hazard event occurrence. Thus, an alternative technique of news media collation, using web-based news media sources, is presented throughout this study. Two web-based natural hazard news media databases were created and information pertaining to the temporal and spatial occurrence of earthquakes, floods and landslides over a five year period (2005-2009) was collated.

This thesis will examine the data generated by both databases and will focus upon the understanding of the temporal and spatial variability in news media coverage of natural hazard events. Statistical analysis of temporal and spatial trends within recorded news media coverage of hazard events is presented. Analysis of long-term time series data is coupled with an in-depth short-term analysis of individual hazard event coverage. In addition to the statistical analysis of identified trends, this study will explore the characteristics of media response to natural hazards within the context of the wider socio-political climate.

It is proposed that the geophysical processes involved within each hazard event type, coupled with event-specific characteristics (fatalities, location etc.), control the subsequent news media coverage of an individual event. A series of natural hazard news media models are presented to show the inherent differences within recorded coverage of natural hazard event types.

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List of Abbreviations

The following abbreviations have been referred to throughout this thesis:

AP – Associated Press

AFP - Agence France-Presse

B-B - Balakot-Bagh Fault, India

CRED - Centre for Research on the Epidemiology of Disasters

DEC - Disasters Emergency Committee

DFO - Dartmouth Flood Observatory

Em-Dat - Emergencies Database

FLD - Fatal Landslide Database

GAALFE - Global Active Archive of Large Floods

GNA - Google News Archive

GNAT - Google News Archive Tool

GNAT-Db - Google News Archive Tool Database

GSN – Global Seismographic Network

GNR – Global News Report

IFRC - International Federation of Red Cross

ILC - International Landslide Centre

NatCat – MunichRe's Natural Catastrophe Service

NAAHD - National Association for the Advancement of Haitian Descendents

NHRSS-Db - Natural Hazard Really Simple Syndication Database

RSS - Really Simple Syndication

SAARC – South Asian Association for Regional Cooperation

TRMM - Tropical Rainfall Monitoring Mission

UDF - User Defined Function

UNDRI - United Nations Disaster Risk Index

USGS - United States Geological Survey

WANNP - World Association of Newspapers and News Publishers

Glossary of Terms

Affected - The most accurate total number of people affected by an event or events reported within the recorded news media of an event or events.

Fatalities - The most accurate total number of deaths caused by an event or events reported within the recorded news media of an event or events.

Peak Event Article Count - The peak of each event curve indicates the point at which media coverage reached its maximum.

Total Event Article Count - The sum of all articles pertaining to a single event.

Event Duration (GNAT-Db) - The total number of days an event recorded coverage above 2% of the peak article count.

Event Duration (NHRSS-Db) - The total number of days an event was reported within the timeframe of NHRSS-Db

Non-Fatal Event - A natural hazard event that caused no casualties.

Low Fatality Event - A natural hazard event that caused less than 10 fatalities.

Medium Fatality Event - A natural hazard event that caused between 10 and 100 fatalities.

High Fatality Event - A natural hazard event that caused between 100 and 1,000 fatalities.

Extreme Fatality Event - A natural hazard event that caused 1,000 fatalities or more.

Chapter One: Introduction

The agility of the Internet offers researchers the opportunity to gain insight into the social response to natural hazards (Dunbar, 2007). The collation of web-based hazard event inventories and the online publication and archiving of natural hazard related news reports, provide researchers with the information and tools necessary for analysing the changing scientific response, media reaction and public attitudes towards natural hazard events. Therefore, the overall aim of this study is to assess the changing social response to different hazard events through the analysis of the temporal and spatial variability in reporting of the global occurrence of natural hazards. In order to address this aim three cumulative yet sequential objectives have been defined.

1.1. Natural Hazards and Geophysical Events

As populations continue to increase, the demand for land and resources increases and the concentration of economic activity and exposed assets continues to grow in ever-expanding cities (Alexander, 1993). People are forced to settle and develop on previously marginal land, such as floodplains and hillslopes (Annan, 1999). This migration, coupled with the effects of climate change, may aggravate both the occurrence and the nature of geophysical events, and expose more people to their effects increasing the prevalence of natural hazards such as floods and landslides occurring in these areas.

The number of natural hazards recorded by the Centre for Research on the Epidemiology of Disasters (CRED, 2009) has increased considerably since the 1970's, with 4,020 hazard events reported between 2000-2008, compared to the 1,230 recorded events between 1970-1979 (CRED, 2009). Whether or not this recorded increase in hazard events is due to a real increase in event numbers as a function of overcrowding and increased land pressure, or as a function of improved monitoring, recording and reporting remains unclear (Blaikie *et al*, 1994). However, recent events, such as the Sumatra-Andaman earthquake on December 26, 2004, Cyclone Nargis throughout April 27 to May 3rd, 2008, and the Sichuan earthquake on May 12, 2008, which, combined, killed nearly half a million people, demonstrate the persistent vulnerability to natural hazards still inherent within modern society (Haque and Etkin, 2007). If event numbers are on the increase, then efforts to understand and militate against their impacts clearly cannot keep pace with this change.

1.1.1 Earthquakes

Between 1999 and 2009 over 20 million people were affected by earthquakes and more than 226,000 people lost their lives, the majority of which (143,925), were due to two single events: the 2005 Kashmir earthquake (which affected both the Indian and the Pakistani sides of Kashmir) and the 2008 Sichuan, China earthquake. Earthquakes are rapid onset events, occurring over timeframes of seconds to minutes (GNS, 2009). The impacts of earthquakes vary spatially and temporally: the area hit, the time of day, and the levels of development, awareness and mitigation can all affect the destructive power of an earthquake (Chang *et al*. 2000). However, due to global seismic monitoring via national and international initiatives (for example, the United States Geological Survey's, 'Global Seismographic Network'), the occurrence, intensity and location of earthquakes are now well documented, allowing for better tracking of the impacts of earthquake events. However, the temporal occurrence of earthquake events remains essentially random and therefore unexplained and unpredictable (see Epstein, 1966; Vere-Jones, 1969; Sornette *et al*., 1989; Faenza *et al*., 2003; Corral, 2004; Dietrich and Richard-Dinger, 2008).

1.1.2. Landslides

Like earthquakes, landslides are rapid onset events. However, the required sub-surface characteristics involved in rendering an area/slope susceptible to failure - the geological or morphological characteristics of the area - and the trigger required to initiate the movement – often heavy or prolonged rainfall or damage from seismicity - can occur over a longer timeframe. Landslides are one of the most destructive geological hazards and, according to CRED, are the 6th most significant natural hazard. They affected over 3.5 million people and killed 9,461 between 1991 and 2001 (CRED, 2009). However, work at the International Landslide Centre (ILC) at Durham University suggests that a more accurate figure for landslide fatalities between the same 10-year period would be closer to 75,000. The reason behind this disparity is believed to be the number of small-medium hazard events that occur in relatively remote areas and are not recorded within large global datasets and many fatalities being attributed to other 'causes', namely earthquakes. This demonstrates the potential gain of using a more sensitive approach with higher fidelity. Such disparity amongst disaster datasets, which are substantially used to guide emergency response initiatives, inform post-disaster recovery and to steer wider policy, is a major concern as under and/or over representation of disaster statistics could lead to misguided or morally inequitable decisions.

The economic impact of landslides is also considerable, accounting for a reported US$1.4 billion damage between the same 19-year period (CRED, 2009), though this figure is likely to be substantially higher. Despite these figures, landslides in such areas as India and Nepal remain under-researched and under-publicised (Gurung, 2008), as will be shown throughout this thesis. As with many hazards, developing nations are often hit worse by landslides, with nations such as India and Nepal losing 2-3% of GDP per annum due to slope failures (SAARC, 2007). Despite mountainous countries spending US$millions each year trying to rebuild areas affected by landslides (Gurung, 2008), they often lack the understanding and capability needed to predict accurately and affectively, mitigate against and respond to landslide events. Policies are therefore commonly reactive rather than proactive. In comparison to earthquake monitoring, landslide monitoring and prediction is intensive, site-specific, and often expensive, process restricting research and monitoring initiatives to Western government schemes, academic research, or lucrative industries, such as mining.

1.1.3. Floods

Whereas earthquakes and landslides are rapid onset events, floods often occur over a much longer timescale, with events lasting for many weeks and even months, often preceded by a period of awareness or anticipation as flood waters rise. Between 1999 and 2009, floods affected approximately 900 million people, and killed 51,851 (CRED, 2009). Worldwide economic flood damage within the same 10-year period is estimated at approximately US$200 billion (CRED, 2009). Like both earthquakes and landslides, the social and economic risks posed by flood hazards affect those residing in developing nations more so than anywhere else, with nations across Asia often worst affected (Few and Franziska, 2006). Increasing populations and land use, coupled with unsatisfactory mitigation and response initiatives and the consequences of global climate change, mean millions of people are at risk from flooding (Rakodi and Treloar, 1997; Timmerman and White, 1997; McGranahan *et al*., 2006). At present, 21% of people living in developing nations reside in areas within 10 metres above sea-level (McGranahan *et al*., 2007), with an increasing number living on flood-plains and/or areas potentially affected by cyclone-induced storm surges (*ibid*).

Although a hazard event often occurs over a relatively short timeframe (hours to months), the legacy of an event can often affect an area, or nation as a whole, for a much longer time period. Since the vast majority of losses, both social and economic, from natural hazards occur in developing nations (IFRC, 2002), the loss of essential infrastructure, valuable farmland and housing, coupled with the subsequent rehabilitation and rebuilding costs can exacerbate a nation's economic problems and lead to massive humanitarian concerns (Nicholls, 2004). South and Southeast Asia in particular are affected by a number of often coincidental, contiguous and/or contemporaneous natural hazards, particularly earthquakes, floods and landslides

(Karim, 2008), although not all countries within these regions are exposed to the same frequency and severity of hazards (*ibid*). Countries such as Bangladesh, Cambodia and Lao People's Democratic Republic are particularly worst hit by hazard events in the region, with thousands of deaths reported yearly and the economic impacts of hazard events severely hindering socio-economic development (Bildan, 2003). For example, flooding in Bangladesh throughout July and August 2007 and flooding following Cyclone Sidr, which struck Bangladesh on November 15, 2007, caused the deaths of over 4,000 people (UNICEF, 2007) and led to a 30% increase in the price of oil and 15% increase in the price of rice (World Bank, 2008) due to nation-wide shortages of both commodities. These increases in prices, among others, coupled with the direct recovery costs, led to an economic loss estimate of around US$3 billion – or approximately a 4% loss to national GDP (World Bank, 2008). This placed an inordinate fiscal burden upon the already deprived nation and led to an increase in unemployment and decrease in public expenditure (World Bank, 2008), which in turn will have wider socio-economic impacts for years to come.

1.2. The News Media and Natural Hazards

Public concern regarding natural hazard events is becoming more prominent in everyday life and the subsequent social construction of 'risk' and 'concern' regarding natural hazards has developed as an intrinsic aspect of contemporary society (Blaikie *et al*. 1994). The division between daily risks and those risks posed by natural hazards are arguably becoming less well defined. This has, in part, been attributed to the reported increased media attention of global hazard events (Singer and Endrenny, 1994). The expected increase in both natural hazards and social vulnerability due to, among other factors, global climate change, is likely to lead to an increase in the number of natural hazards occurring and hence reporting in an increasingly responsive news media (Ashlin and Ladle, 2007). Thus, investigating the temporal and spatial trends, and subsequent social impact, of this increase in news media coverage of natural hazards poses an important area of research (*ibid*). The media also plays a critical role: not only does it inform the public, but the media also establishes the profile of events and processes within policy. Therefore, today, the media holds a principal position *within* society.

The news media has developed into an extensive and powerful tool, with newspapers, the internet and 24-hour news network channels controlling and filtering much of the information that reaches people on a daily basis (Benthall, 1993). This means that the news media acts as an important source of natural hazard information and has an influential and persuasive role within society. It informs, shapes, and ultimately governs a society's understanding, perception and response to all manner of issues, including natural hazard events (Burkhart, 1991; Fischer, 1994; Goldberg, 2003). Thus, analysis of the temporal and spatial trends within news media coverage of natural hazard events can be used to improve our understanding of a both the physical hazard itself and also society's reactions to such events, and, in turn, improve our knowledge of public understanding and preparedness for natural hazards.

Electronic and print news media are a major source of information for a large portion of the world's population (World Association of Newspapers and News Publishers, 2007). For many, a daily newspaper, online news source or nightly television news report is their sole information source for current events and may affect how they perceive apparent risk, impacts and influence from such natural hazards (Rattien, 1990). Overall, global circulation of paid newspapers rose 2.6% in 2007, mostly due to improving readership in India and East Asia, where 107 million newspapers are sold daily and 74 of the top 100 best-selling world newspapers are located (WANNP, 2007). Despite this increase in Indian and Asian newspaper distribution, readership of daily printed newspapers has fallen by 3% and 1.9% in the United States and Europe respectively. This drop in Western newspaper readership is believed to be due to increasing online newspaper readership, with internet-based news media increasing in popularity and usage over the past 10 years (WANNP, 2007). A collaborative worldwide survey of newspaper editors by Reuters and a top market research service found that 44% of those asked believed most people would be reading their news online within 10 years (2017) (WANNP, 2007).

Multinational news agencies, such as Reuters, Associated Press (AP) and Agence France-Presse (AFP), circulate news stories, which reach over 1 billion people on a daily basis collectively and provide up-to-the-minute online information for the press and public (WANNP, 2007). The propagation of such stories between and across agencies directly reflects interest in events. National and international daily newspapers, such as *The London Times, China Daily* and *New York Times*, as well as many smaller local newspapers, such as the *Surabaya Post* of Jakarta, Indonesia; the *Correio da Bahia* of Salvador, Brazil; and the *Madhya Pradesh Chronicle* of Bhopal, India, either publish their content online as well as print or have developed two independent news desks: one for traditional printed media and one for online content, in an effort to improve readership numbers. There is widespread interchange between agencies of news stories, which again describes society's wider interest in any given event.

The increase in mainly freely available online news content, now allows a user to search thousands of worldwide newspapers and locate stories on an issue of their interest. In addition to more people reading more stories, there is greater choice of what to read and how to gain access to the material from this plethora of sources. Within this context any individual story is therefore likely to gain national or international exposure, which even if not read, may contribute to a wider awareness of the event or issue, if not the detail contained within each individual story. For example, the menu-focused graphical user interfaces of news web-pages expose headlines, such that a reader may be aware of event occurring, without ever reading the story in detail.

Local newspapers in particular are an excellent source of information regarding natural hazard events. Events that may have been missed by larger national and international papers, due to space constraints or a lack of interest in the issue, are often reported extensively in local media. It is widely acknowledged that natural hazards commonly adhere to scaling in magnitude and frequency, in which large numbers of small events, a moderate number of medium sized event and a few large events, are commonplace (Malamud *et al*. 2004). Critically, the implication is that the smallest events, those that *only* amount to single or double figures of fatalities, can be the majority contributor to net fatalities. In compiling event inventories, capturing such small events is therefore of vital importance. For example, a landslide in the Philippines that resulted in four deaths will not be published by *The Times of London*, but will be published, both in print and online, by the *Philippine Daily Inquirer*[1]. This improves the likelihood of the event being picked up by other news sources and being disseminated further afield, thus improving common knowledge of such events, both across scales, and through space. Technologies such as bite-sized Really Simple Syndication (RSS) feeds, discussed below, act to perpetuate this awareness. I suggest that the value of the story purely being published, and being online, should therefore not be underestimated in affecting awareness.

1.3. Utilising Media Coverage of Natural Hazards

It is the online publication, coupled with the ability to search for such reports via Internet search engines, which can help track and document the occurrence of small to medium-scale hazard events, which may have otherwise been missed. The vast network of news media information that is developing has already been shown to be a valuable asset when examining hazard events and has proven to be an accurate method of tracking hazard event occurrence. For example, on-going work between the ILC and Durham University has been based upon the manual collation use of daily

[1] http://globalnation.inquirer.net/cebudailynews/news/view/20091126-238457/Urduja-triggers-floods-landslides

news media coverage of landslide events to assess the geographical distribution of fatal landslides at both a global, regional and local scale (see Petley *et al*. 2005, 2007). To do this, a Fatal Landslide Database (FLD) was established in 2002, whereby news reports, academic papers, personal communications and government and humanitarian aid agency reports regarding landslide events that have caused fatalities are collated on a daily basis (Petley *et al*, 2005).

Previous work in the area of news media coverage analysis has focused on English-language newsprint and television news network coverage of a small number of socio-political events throughout the 1990's and early 2000's (see Thompson and Annan, 2007 and Livingston, 1996 for a detailed examination of news media coverage of the 1994 Rwanda genocide and 1998 Sudan famine, respectively). However, technology has progressed rapidly since these studies were undertaken and the Internet (particularly search engines), online news media databases, and global news feed collators, make it possible to search rapidly the archives of thousands of news media outlets from around the globe. This allows for studies of a much larger spatial and temporal scope to be performed and improves our ability to monitor accurately, interpret, and understand the social response to the ever-increasing number of hazard events that affect society on the scale at which variations in events are apparent: the global scale.

The methodology employed in creating FLD allows for the inclusion of the important, and often overlooked, small to medium-scale hazard events through the inclusion of local-level news media reports in the database. In light of this, two news media based hazard databases were established to expand the work produced by ILC and Durham University: one design based upon already proven RSS feed technology, the Natural Hazard RSS Database (NHRSS-Db), and the other upon a custom designed piece of software, Google News Archive search Tool (GNAT-Db). The focus of both databases was the collation of news media coverage of earthquake, flood and landslide events. It was also decided to increase the number of available news media sources and extend the spatial coverage of both databases by including news sources in multiple languages: Spanish, Portuguese and Chinese.

This thesis will examine the data generated by both the NHRSS-Db and GNAT-Db and will centre upon the statistical analysis of temporal trends within news media coverage of recorded hazard events. Analysis of long-term time series data, coupled with short-term analysis of individual hazard event coverage, will allow for a greater understanding of the temporal and spatial differences in news media coverage of different hazard events to be established. However, the basis of this study is deeply rooted in modern geo-political thought and media psychology, and as such, the socio-political rationale behind variations in recorded news media coverage of 12 case study events will be discussed.

1.4. Thesis Outline

Following the introduction to the research project in Chapter One, Chapter Two will set forth the motivation behind the current study, along with the overarching research aim and the objectives.

Chapter Three will present an appraisal of literature pertaining to the temporal and spatial characteristics of news media coverage of natural hazards. The focus of my examination will be on the reasons behind which events receive potential coverage by the news media and why I have coupled these with the wider implications of such variations in coverage; namely the relationship between coverage of an event and foreign policy and humanitarian intervention. A number of theories will be examined with regards to how and where an event is reported, and what such trends can tell us about a society's understanding, perception and response to natural hazard events. This will be followed by a review of current research into hazard event monitoring and cataloguing, including an examination of previous attempts at the characterisation of global vulnerability and risk. I will examine a number of national and global hazard databases and compare their methods and outputs.

Following the review of literature, Chapter Four will present a detailed explanation of the methods used to collate and organise the recorded hazard news media data. An explanation of the information required to fulfil the project's aims and objectives will be followed by a detailed systematic description and justification of each process undertaken in the creation of both NHRSS-Db and GNAT-Db.

The findings from both databases will be presented over four chapters. The first of these four chapters, Chapter Five, will summarise the broad-scale foundation results of both NHRSS-Db and GNAT-Db. Focus will be on a discussion of the general coverage patterns within each event type, including the identification of prominent trends and significant events. In addition to this, recorded hazard events and fatality statistics will be presented.

The second results chapter, Chapter Six, will consist of a detailed analysis of the short-term and long-term temporal changes within recorded coverage of each event type within both NHRSS-Db and GNAT-Db. Focus will be on the examination of variations and comparisons of event type data on a year-by-year basis, as well as seasonal and more long-term trends. This data will be presented along with fatality data sourced from the Dartmouth Flood Observatory (DFO), ILC and United States Geological Survey (USGS).

The third results chapter, Chapter Seven, will consist of an examination and analysis of the trends within aggregate statistics for both NHRSS-Db and GNAT-Db. The relationships between individual event parameters of both databases will be presented, allowing for the identification of database-wide trends within the relationship between, for example, the number of fatalities recorded for an event and the total number of articles recorded. Analysis will focus on the relationships between total event article count, peak event article count, event duration and recorded event fatalities. Following this, an analysis of the magnitude-frequency distribution of events within both databases will be presented, along with an analysis of the differences within recorded cumulative coverage of individual events and event types, which enables events of different magnitude to be directly compared.

The fourth, and final results chapter, Chapter Eight, is an analysis and discussion of 12 events recorded within GNAT-Db, four of each event type under analysis. Focus will be on the variability and inter-linked nature of the factors that control natural hazard media coverage. Background information to each event will be followed by an analysis of the recorded news media coverage for each case study, including a discussion of the development of reported fatalities and possible reasons behind variations in recorded news media coverage.

Following the presentation, analysis and discussion of the results, Chapter Nine, will explore the characteristics of media response to natural hazards within the context of the wider socio-political climate. Literature will be used to support a number of theories giving possible explanations to the trends in news media coverage outlined in the previous chapters.

Chapter Ten, will review the aims and objectives of the study and outline how each was achieved. In doing this, the overall project findings will be summarised and put into context with the wider academic knowledge base. Following this, the limitations of the project will be discussed and possible solutions will be outlined. The applications of the study's findings will then be outlined and the possibilities of future work based upon this study will be considered.

Chapter Two: Research Rationale, Aim and Objectives

2.1. Research Rationale – The Sumatra-Andaman earthquake

At 07:58, local time on December 26, 2004 a 9.3Mw earthquake occurred off the coast of Sumatra, Indonesia. The earthquake was the second largest ever recorded by a seismograph (the first being the 9.5Mw Valdivia, Chile earthquake of May 22, 1960). The undersea megathrust earthquake caused a series of tsunami which affected most coasts bordering the Indian Ocean, mainly Indonesia, Sri Lanka, India and Thailand. The most powerful tsunami reached coastal regions two hours after the earthquake onset, reaching two kilometres inland and heights of up to 30 metres (Paulson, 2005). In total, 186,983 people were killed, with a further 42,883 people recorded as missing and presumed dead, and 1.1 million people were displaced (Scott and Simpson, 2009). The death toll, the international extent of the damage, and the vast socio-economic recovery cost required made the Sumatra-Andaman earthquake the worst natural hazard event in 30 years (CRED, 2009).

As the extent of the damage and death toll from the Sumatra-Andaman earthquake became apparent, global news media organisations rushed to provide coverage of the event. CNN deployed over 80 reporters to the worst affected regions and provided 24-hour television coverage in the days following the event (Brown and Minty, 2006). Powerful images of engulfed cities, dead bodies and grief stricken families were published and broadcast around the world. Three days after the event occurred, the Disasters Emergency Committee (DEC), which is an umbrella organization of 12 principal UK aid agencies, received in excess of US$300 million in donations from the British public, the highest level of public donations ever for a single event (DEC, 2005). By January 1, 2005, six days after the event, US$1.8 billion had been pledged by international governments, humanitarian agencies and the global public. Coverage of the event remained on the front pages of national and international newspapers for weeks after the event (Wynter, 2005). It was the sheer volume of news media coverage that is believed to be the main reason behind the unprecedented public generosity and global humanitarian relief effort (Downman, 2005).

The Sumatra-Andaman earthquake is one of the most discussed and studied major hazard events over the past decade (Ashlin and Ladle, 2007). This event demonstrated the vulnerability to natural hazards still inherent within modern society and the ensuing media coverage of the event displayed the power and reach of modern news media. Critically here, I argue that the agility and investment in ‘people on the ground’ in the immediate post-event aftermath made by news agencies presents a unique metric or barometer of the magnitude and character of any individual event, such that the media response itself becomes a valuable measure of the event being reported. Crudely, I hypothesise that media interest is broadly proportional to impact (e.g. the number of fatalities or financial damage); an interest that is socially and culturally conditioned, manifest by considerable variations in the location of the event and of those who ultimately finance the media response. Understanding the news media coverage of events like the Sumatra-Andaman earthquake therefore can, in turn, improve our knowledge of the changing social, and potentially the physical, response to natural hazard events. A familiarity with society's reactions to such events will help to comprehend the public preparedness and response to future natural hazards.

2.2 Research Aim

The fundamental issue under consideration throughout this study is the understanding of the changing social response to different hazard events through the analysis of temporal and spatial trends within natural hazard news media. I will attempt to investigate what this data tells us about the social response and what, if any, aspects of the character of the event does this information have the potential to articulate. Therefore, the overall aim of this study is to assess the changing social response to different hazard events through the analysis of the temporal and spatial variability in reporting of the global occurrence of natural hazards. In order to address this aim three cumulative yet sequential objectives have been defined.

2.3. Research Objectives

1. To collate a continuous database of web-based news media coverage relating to geophysical hazards for a period of five years.

To achieve the overall aim of this study a number of news media coverage statistics were required. To obtain this information, two news media databases were created – NHRSS-Db and GNAT-Db - both of which collated data on the timing and intensity of web-based news media coverage regarding earthquakes, floods and landslides. These three event types were chosen due to the differing temporal and spatial trends inherent within their occurrence and impact. For example, earthquakes occur regularly but rarely cause significant damage (USGS, 2009a). However, when a large earthquake occurs in a highly populated area the impact is often widespread and devastating (Horwich, 2000; Rose *et al*., 2002). In comparison, flood and landslide events occur regularly and hence frequently cause damage and fatalities (Clarke and Rendell, 2006; Salvati *et al*., 2007). Thus, the cumulative effect of both is often much greater than might popularly be thought. This data is the foundation of the study and the source data required to achieve subsequent objectives.

2. Assess the temporal and spatial dependence of news media coverage as a function of event type, timing magnitude and location.

Using the databases established, a number of quantitative analytical processes were undertaken to uncover temporal and spatial characteristics within recorded media coverage of hazard events. Statistical analysis of the resultant data was split into time-series analysis of long-term event type coverage profiles and short-term cumulative and regression curve analysis of event type coverage and individual event coverage. Long-term time-series analysis focused on the identification of any annual or seasonal trends in hazard reporting and short-term analysis focused on the identification of patterns within coverage of individual events and events of different types.

This quantitative analysis aimed to uncover any trends within the recorded coverage statistics that may explain why a hazard event is reported in a particular way. For example, is there a trend between the numbers of fatalities an event records and the total level of coverage it receives, and what controls the duration of event coverage: location, fatalities, or physical event magnitude?

3. Explore the characteristics of media response to natural hazards within the context of the socio-political climate.

Possible socio-political reasons behind the trends identified in objective two will be discussed within the wider socio-political context of the news media. A number of theories will be presented, based upon wider literature and previous work in the area, which aims to explain the recorded temporal and spatial variations in news media coverage of natural hazard events.

Chapter Three: A Review of the Literature

3.1 Natural Hazard Research: Geophysical Processes, Social Science and Vulnerability

"In natural hazard and disaster studies, both the physical and societal aspects require attention."

~ Haque et al., 2006: 155

3.1.1. Natural Hazards and the Media: Geophysical Processes

Every year natural hazards result in high death tolls and injuries, mass property damage, and economic loss (Dunbar, 2007). Natural hazard events "present an extraordinary research opportunity for examining overall social structure, as well as specific institutions such as the news media" (Dynes and Drabek, 1994: 5–23). When a natural hazard occurs, the ensuing disruption to society is more often than not captured and reported by the news media, indeed there may be a tendency to dwell upon the dramatic, rather than the arguably more pervasive and accumulatively influential chronic affects.

The media has been shown to be a powerful tool in deciding the salience of issues and determining the public's agenda, with public opinion often shaped by the reaction of the press (Bagdikian, 1992; McCombs and Shaw, 1972, 1993; Dynes and Drabek, 1994). Natural hazards, and their subsequent social disasters, are often seen as a 'social phenomenon' mediated through the public's collective cultural imagination and, ultimately, disseminated by the news media (Furedi, 2007). Thus, studying the changing relationships between natural hazard events and the media can provide researchers with the opportunity to observe and document society's understanding and response to such events (Dynes and Drabek, 1994).

The fundamental aim of this study is to understand the changing social response to different hazard events through the analysis of temporal and spatial trends within natural hazard news media. To achieve this aim, it is first necessary to understand the individual elements under examination, that is, the research and theory surrounding both natural hazards and the news media.

The discussions pertaining to natural hazard research are diverse, with detailed academic discourse on the subject as a whole within a number of key academic studies (see Bryant, 2005 and Keller and Blodgett, 2007 for an excellent examination of both the geophysical and sociological effects of natural hazards). The subject is one that has increased in precedence within the academy over the past 50 years and, due to the sheer number of interrelated aspects inherent within the study of natural hazards and their social impacts, has also risen to prominence across subjects as broad as Geography, Sociology, Engineering and Psychology (Freudenburg *et al.*, 2008). In order to appreciate fully the complex and interrelated causes, features and consequences of natural hazards, an understanding of both the geophysical earth processes and socio-economic impacts involved is essential.

The focus of this study is the analysis of variations in both long-term and short-term news media coverage of earthquake, flood and landslide events. It is hypothesised that the differing physical processes involved in each natural hazard type under examination will affect how events of that nature were reported by the news media. The physical is therefore entwined within the social. However, I found no academic literature that dealt with this issue directly. A number of studies discuss the news media coverage of particular natural hazards, but no research was found that discussed the differences between, for example, earthquake news media coverage compared to that of floods and landslides. A clear gap in the academic literature is apparent and this study aims to address this gap.

By understanding the physical processes and characteristics of a landslide event, for example, it is possible to see more clearly, how news media coverage of such an event will develop both temporally and spatially. Bolt's (2003) technical examination of seismology, which provides an ideal foundation with regards to the geophysical processes of earthquakes, coupled with Parker's (2000) in-depth analysis of the physical hydrological processes involved in floods and Glade *et al* (2005) detailed discussion of the mechanics of slope failures, among many others, provided the fundamental geophysical information – notably concerning the timing, magnitude, frequency and location of events - required throughout this study. Given that a great deal of academic literature is available concerning the characteristics and physical processes involved in earthquakes, floods and landslides, a detailed review of such material is outside the scope of this trans-disciplinary study.

3.1.2. Natural Hazards and the Media: Social Science and Vulnerability

In his discussion of the "arising complexities between human population and nature," Hewitt (1983:277) argued that the multifarious features of catastrophic hazards cannot be fully explained by conditions and/or behaviours peculiar to the events; these can only be explained by considering the social patterns of living and societal responses to extreme events. Thus, to understand fully natural hazard events, and therefore trends within the resultant news media coverage, it is necessary to examine the social aspects of such events, as well as the geophysical processes involved. Hewitt (1983) argued, "hazards are neither explained by nor uniquely linked with geophysical processes that may initiate damage." This is not to imply that geophysical processes are irrelevant, but simply that too much causality in the derivation of risk has been attributed to them.

Social Science's attention on natural hazards has grown steadily over the past half century. Initially, natural hazards were simply seen as elements of the physical environment and caused by extraneous forces, devoid of human input (see Burton and Kates, 1964; Tobin and Montz, 1997). However, this notion has been reassessed and it is now widely accepted that socio-economic factors are as important as the geophysical processes in understanding the effects of natural hazards (Blaikie, 1994; Cannon, 1994; Cutter, 1996; Masozera, 2007; Montz, 2009). As such, Social Science's interest in natural hazards has grown and issues of 'risk', 'vulnerability' and the integration of these into livelihoods and well-being, have become principal areas of modern hazard research, providing a valuable means of addressing natural hazards within a geophysical, social, political and environmental context (Abramovitz, 2001; Bankoff, 2001).

Bankoff (2001), and later Furedi (2007), discuss what they term as the 'vulnerability paradigm' present within contemporary natural hazard research, and society as a whole. Furedi (2007) put forth the idea that current Western cultural discourse and imagination now regards the world as "an increasingly out of control and dangerous place" (Furedi, 2007:473). It is widely accepted that the public and the media are more interested in a 'human story' (Adams, 1986; Freudenburg *et al*., 1996; Devereux, 1998; Curran and Gurevitch, 2005). This is demonstrated particularly well within the modern reactionary news media, which often focuses on the social vulnerability present within an event, and society as a whole (Ashlin and Ladle, 2007).

It is through selection and coverage that the media frame and add context to an event (Perlmutter, 1998), with the modern world often described as 'vulnerable' and some regions classified as more 'dangerous' than others (Bankoff, 2001). The media often employ emotive imagery and rhetoric to exaggerate the appearance of vulnerability in such regions and 'frame' them as 'vulnerable' (Adams, 1986; Eldridge, 1993; Dunwoody and Griffin, 1994). By framing regions of the world in this way, two zones now exist: one zone where disasters occur regularly and individuals are seen as 'more vulnerable' and one where they occur infrequently and individuals are seen as 'less vulnerable' (Hewitt, 1997). However, events such as Hurricane Katrina, which killed

1,836 people in the USA and was one of the most expensive natural hazard events in history, contradict this zoning of vulnerability, and the shock to the news media vulnerability paradigm is reflected within the high level of news media coverage of the event (Tierny *et al*., 2006; Bennett *et al*., 2007; Vorhees *et al*., 2007).

The patterns of vulnerability present within society and the, albeit simplistic, depiction of regions as 'more' or 'less' vulnerable are central elements of natural hazard research (Oliver-Smith and Hoffman, 2002). However, within the literature, vulnerability has several different connotations, with subtext and implication varying depending on the research orientation and author perspective (Cutter, 1996; Cutter *et al.*, 2003). This lack of consensus regarding definition and context means vulnerability remains a litigious principle (Cutter, 1996; Wisner, 2004). For some, vulnerability is a purely theoretical notion, used primarily as rhetoric within socio-economic discussions and by the media to evoke empathy for an event, person or issue (Blaikie *et al*., 1994; Adam, 2000). For others, vulnerability is fundamentally a mathematically presentable figure; a *measure* of susceptibility to hazards, whereby the population affected or number of casualties can be used to classify the vulnerability of an area (Noy, 2009). It is becoming increasingly common to express vulnerability in the form of economic language, with hazard events often ranked by the subsequent level of economic damage. Though fiscal measures ultimately make it difficult to draw global or even regional scale comparisons between events and their impacts (Bankoff, 2001).

It must be noted that this is not a study about defining vulnerability, but a consideration of the temporal and spatial variations within susceptibility/vulnerability/well-being as a useful proxy for considering the occurrence and variations within hazard event size, impact and resultant news media coverage.

Whatever the definition of vulnerability being used, one must discuss the issue in context to the event being examined. Vulnerability changes in both space and time and from one event to another (Cutter, 1996). Vulnerability conditions the actions and responses of individuals and organizations differently for each hazard event encountered and these elements alter for every event; no two people will act or respond to a natural hazard in the same way (Oliver-Smith and Hoffman, 2002). It is therefore necessary to consider both the individual societal aspects of a natural hazard and the physical processes involved to understand fully how and why each event received the level of coverage it did. To do this I will be exploring the way in which the location of a natural hazard event can affect the level of news media coverage it receives. 12 short case studies, taken from a variety of locations, will be presented in

Chapter Eight, along with a discussion of the variations within recorded news media coverage of each.

3.2. The News Media: Representation, Coverage and Persistence

"The existence of a disaster does not automatically mean that it will be treated as news."

~ Quarantelli and Wenger, 1990: 3

The media provide a vital source of natural hazard and extreme event information to the public and the scientific communities (Stempel, 1991; Fischer, 1994) and it has been argued by many that the media significantly influence how governments, and society as a whole, perceive and respond to natural hazards and disasters (see Nigg, 1987; Ploughman, 1997; Perez-Lugo 2001, 2004; Pasquare and Pozzetti, 2007). I argue that it is critical to understand the degree to which news media coverage is proportional to actual impact, however this is defined.

Mass communication and the media are inextricably linked with natural hazards (Rattien, 1990). Natural hazards embody the 'breaking news' or reactionary mentality of modern media and as such are often allotted large sections of electronic and print media capacity (Perez-Lugo, 2004). A natural hazard represents an extraordinary opportunity to examine social structure (Ploughman, 1997) and can provide the emotive framing news agencies require to gain public attention (Robinson, 1999; Rodrigue, 2004). Analysis of news media coverage of natural hazards and humanitarian crises not only provides insight into the events themselves, but also the social, cultural, and political responses to such events, as well as the structure of the media as an industry and as a conduit for information transfer (Becker, 1967; Molotch, 1970; Molotch and Lester, 1974; Molotch, 1979; Boykoff and Boykoff, 2004).

There is academic dispute as to the explanation and rationale behind which disasters receive press coverage and why (Wenger and Friedman, 1986). Moeller (2006) discusses media bias and coverage of international disasters in length and draws upon several examples of varying scale. The article is a rhetoric-fuelled dialogue aimed at portraying media as dispassionate accountants only concerned with ratings and commodities, while this may hold some purchase, I argue this is an overly generalised view of a highly complex and variable media. However, the article provides case studies of what are referred to as 'orphaned disasters' (Annan, 2005); those which were omitted from most mainstream media sources, such as the 2005 Guatemalan mudslide, the 2005 Bam earthquake and, to some extent, the ongoing genocide in the Democratic Republic of Congo. Reasons for why such disasters were excluded by the media are presented, including: issues of timing, whereby a relatively small disaster occurs at the same time as one of unprecedented magnitude and as such is overlooked; and, where rapid onset events overshadow coverage of long-term chronic disasters. Despite case studies being provided, little detail is given with regards to reasons or conjectures underlying such disparities.

Ploughman (1995) and later Natsios (1996), Olsen *et al.* (2003) and Wrathall (2007) suggest that a number of preconditions must be fulfilled if Western media are to focus heavily on a specific humanitarian crisis. Wrathall (2007:178) identifies four factors that "appear to affect the newsworthiness of natural hazards:" 1) the uniqueness of the event; 2) the size and severity of impact of the event, especially in relation to the loss of life and damage to property; 3) the location of the event and 4) the availability of "informed sources" and the capacity of local communication lines to disseminate information to the outside world." I would also argue that in the event of the internet and an increased significance of imagery, that the ability to capture an iconic representation of such an event is key (e.g. figure 3.1). A wide-area event, such as an earthquake, may not be as photogenic as a localised landslide; the wide-scale may therefore be too enormous or extensive to capture and hence contemplate. So within this context, for example, a foreign disaster must be more serious than an equivalent contemporaneous domestic disaster, and the farther from the West the affected country is geographically, politically, culturally, or racially, the higher the death toll is assumed for the story to receive attention (Ploughman, 1995). This spatial variability, or bias in Western media is discussed at length in Moore (1958), Galtung and Ruge (1965) and later Fischer (1989).

Figure 3.1. Example of the ability of iconic imagery of a single, devastating event.

Source: USGS, 2008

3.2.1 Representation and Persistence: Temporal News Media Trends

As well as the spatial disparities of news media coverage of disasters and humanitarian crises, in parallel there is a temporal dimension to the level of news media coverage specific events receive. However, within the literature reviewed, it is clear that little attention has been paid to chronological changes in news media coverage of humanitarian crises and no academic assessments exist as to the temporal changes in news media coverage of natural hazards and disasters, as they evolve.

Livingston (1996:83) stated that, "the world does not have an appetite for more than one crisis at a time." In agreement with Livingston, Downs (1972:508) argued that "public attention rarely remains sharply focused upon any one domestic issue for very long" and that public attention is cyclical, with 'ups and downs' related to background or antecedent policy issues, external announcements and actions. Downs contends that the cyclical nature of public attention to policy problems owes more to the agenda setting process than to the actual scale of the problem. To this end, Downs (1972) developed an 'issue attention cycle' model, an analytical tool used to understand the different stages within the level of interest in a particular issue over a temporal scale (see figure 3.2). Downs' model focused on the effects of policy announcements on public attention of a number of prominent environmental issues throughout the 1970s, namely the conservation of land, water pollution, and the threat to endangered species.

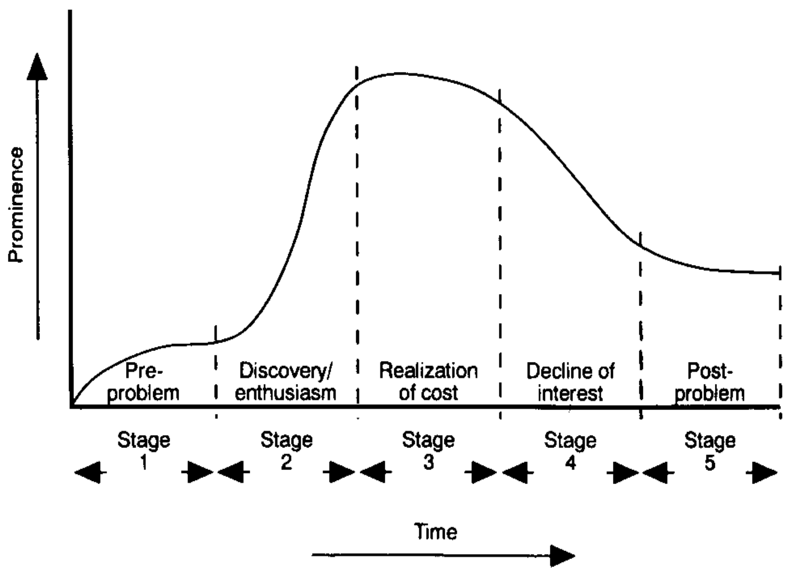

Figure 3.2. Schematic diagram representing Downs' (1972) 'issue attention cycle.'

Source: Kirkwood, 1994

Downs' (1972) 'issue attention cycle' has five main stages:

1) The pre-problem stage:

   'This prevails when some highly undesirable social condition exists but has not yet captured much public attention, even though some experts or interest groups may already be alarmed by it.'

2) Alarmed discovery and euphoric enthusiasm:

   'As a result of some dramatic series of events … or for other reasons, the public suddenly becomes both aware of and alarmed about the evils of a particular problem.'

3) Realising the cost of significant progress:

   '… realisation that the cost of "solving" the problem is very high indeed.'

4) Gradual decline of intense public interest:

   'The previous stage becomes almost imperceptibly transformed into the fourth stage: a gradual decline in the intensity of public interest in the problem.'

5) The post-problem stage:

   'an issue that has been replaced at the centre of public concern moves into a prolonged limbo.'

~ Downs (1972:39-41)

Much of Downs' discussion is based upon a wide range of theoretical literature from a number of prominent natural history theorists, namely Herbert Blumer, Warren Spector and John Kitsuse. Downs' model later formed the basis of many studies examining the interpretive processes within the mass media, namely (Gans, 1979; Gitlin, 1980; Tuchman, 1978).The profound complexity of the model put forth by Downs is made evident by the volume of socio-psychological, organisational, political and cultural processes identified and utilised within production of the model.

However, whereas Downs' model relied solely upon theoretical and conceptual notions of public interest, the method used throughout this study used web-based news media statistics to directly measure the level of interest in natural hazard events. Since the level of news media coverage of an event is taken to denote the level of public 'interest' in the event (McCombs and Shaw, 1972; Kasperson *et al*., 1988; Fan and Tims, 1989; Devereux, 2007; Song, 2007; Carey and Adam, 2008), it was possible to measure directly and hence characterise the level of interest for hazard events. This allowed, innovatively, for the Downs 'issue attention cycle' (figure 3.2) to be quantified and refined much more rigorously in respect to the speed and fidelity of web-based media.

This had not been possible previously due to the difficulty and time-consuming nature of manual news media collation. This study also exploits RSS technology, which expedites the process of news media collation by automating much of the process, and lends larger temporal and geographical scope to the study.

Such a diverse conceptualisation like Downs', which is based upon contentious socio-political notions, undoubtedly appears, in the author's own words, "untidy" (Downs, 1972). However, the subject matter under examination is itself "untidy". The complex nature of public interest in contemporary issues means that a detailed and adaptable conceptualisation is needed to comprehend fully the effects of policy issue announcements and exogenous actions on public attention. Whereas Downs' utilisation of the 'issue attention cycle' model focused upon environmental and ecological issues, Wozniak (2007) employed the model as a way to assess temporal changes in news media coverage, an indicator of public interest, of humanitarian crises. Wozniak (2007) used the principles of Downs' 'issue attention cycle' as a theoretical foundation when assessing news media coverage of the Darfur crisis over a period of three years. By assessing news media coverage on a temporal basis, the author was able to analyse the effects of various external announcements and actions on the magnitude and duration of news media coverage of the event. Wozniak concluded that, although Downs' 'issue attention cycle' is best suited for long-term social issues, it remains a useful analytical tool for assessing the ups and downs of attention towards issues of foreign policy. Wozniak suggested that the underlying mechanics within the 'issue attention cycle' could be used to develop a model that dealt with issues of a much shorter timeframe; hence response could be considered scale free. One might therefore argue that bulk monitoring of regional or global media response to, landslides for example, would comprise a superimposition of response cycles as events of various magnitude occur episodically through time. Consequently, I argue that unlike the direct effects, media response between events is intimately linked; such that coverage of a large event may reduce coverage of smaller recent events. This interaction in coverage is inherently geographical (in both the social and physical guises), which will be explored further below. Such modification of Downs' original model allows for the news media coverage of natural hazard events, which transpire over periods of time much shorter than the issues examined by both Downs and Wozniak, to be assessed.

As explained in Chapter One, news media audiences are changing and the dominant forms of news media are also changing. Today's news media networks allow for near-instant global dissemination of news stories, making it possible for knowledge of events to be reported and circulated around the globe within seconds. On a global scale (spatial and temporal), lags between occurrence and reporting are essentially now negligible (Stallings, 1990; Wark, 1994; Kitzinger, 1999; Livingston and Bennett, 2003). As technology continues to improve in terms of availability, usability and speed, new forms of news media propagation are developing, whilst traditional forms are adapting to the changing market (Chung, 2008). Audiences want to receive information as it happens, when it happens. This development within the media-audience dynamic has had a feedback effect upon the form and structure of today's media attention cycle in that since the public now receives news quicker the demand for up-to-the-minute information is higher (Chung, 2008). It is likely that Downs' original 1972 'issue attention cycle,' which employed interpretive processes based upon print and broadcast news media of the time, is unsuitable in terms of describing twenty-first century news media trends.

The speeding up of the news process, in conjunction with other aspects of modern life (for instance the Internet, 24-hour news channels and on demand television), is believed to have shortened the attention spans of modern day audiences (Dayan and Katz, 1992; McCombs, 1997; Seiter, 1999). This change in news media dissemination and audience reception is likely to result in a twenty-first century 'issue attention cycle' much different to Downs' original 1972 model. I hypothesise that it is likely that the duration of each stage will be much shorter and the prominence distribution or 'audience interest' level, will be much more distinct, resulting in an earlier, sharper peak in today's 'issue attention cycle.'

The reactionary nature of media response and media interest may also show a much more short-lived interest in events (Chung, 2008), as more stories are available. Also, given the vastly increased number of media sources available and accounted for across the internet, which in turn enables and enhances the ability of media agencies to pick and choose what stories they deem news-worthy, it is likely that statistics on present day activity are likely to be much more reflexive of actual interest, and potentially therefore the magnitude of interest is likely to more closely mirror the nature of the event. I seek to redraw and redefine Downs' 'issue attention cycle' in respect of web-based media in the context of natural disasters.

3.2.2. Policy, Public Opinion and Humanitarian Aid

It is commonly stated that intense news media coverage of any issue will lead to positive feedback of increased public interest (Discenna and Stover, 2009). Sood *et al.* (1987) and, more recently, Robinson (2002) examined the effects of intense news media coverage of humanitarian crises on public opinion and policy decisions concerning the events in question. These authors agreed that intense news media coverage will inevitably lead to increased foreign policy and military intervention: what is known as the ‘CNN effect’ (Sood *et al.*, 1987; Robinson, 1999). Through detailed quantitative analysis of news media coverage data and qualitative interview-based research, Robinson (2000) presents a number of case studies, including foreign policy intervention in Rwanda (1994) and U.S military intervention in Somalia (1992) and Kosovo (1999), which show the positive relationship between intense news media coverage of an event and foreign policy and military intervention. However, Robinson (1999:302) addressed the issue of what determines the level of humanitarian assistance (excluding military action and government foreign policy) and argued that “existing research on media influence in humanitarian disaster situations actually fails to clarify the significance of media impact on humanitarian intervention decisions.”

Olsen *et al.* (2003) also considered the relationship between news media coverage and humanitarian funding and alleged that there is no substantial evidence of a positive relationship between news media coverage and the attraction of humanitarian funds within the academic literature. Olsen *et al.* (2003) propose a basic hypothesis that the volume of emergency assistance any humanitarian crisis attracts is determined by three factors working in conjunction or independently: 1) intensity of news media coverage; 2) the degree of political interest in the affected region and 3) the strength of humanitarian NGO’s and international organisations present in the affected region. The authors argue that news media coverage intensity and framing - the portrayal of human suffering – alone rarely lead to the attraction of humanitarian funds. Lumsdaine (1993) also emphasises the importance of the three factors outlined by Olsen *et al.* (2003) as well as issues of colonial past – and hence the inherited migrant associations - and the democratic status of recipient regions. However, Lumsdaine (1993) presents only simple correlations of the variables and as such cannot study the interactions and relative magnitude of each variables’ effects in depth due to limited data. Alesina and Dollar (2000) improve on Lumsdaine’s (1993) work and thoroughly examine the patterns and interactions of humanitarian crises and aid allocation. The authors conclude that, although intense news media coverage of events may bolster public and governmental donations, “there is virtually no evidence on the relative importance of different variables” (Alesina and Dollar, 2000). What is evident from these studies is the lack of a consistent and globally transferable measure of media and/or society interest in specific events.

In their discussion of the quality of news media coverage relating to geological hazards in Italy between 2002-2003, Pasquare and Pozzetti (2007) put forth the view that academic research on media reporting of natural hazard events and disasters primarily focuses on three aspects: 1) how the media report on such events; 2) the difference between print and broadcast coverage of such events and 3) audience acquisition and response to news media coverage of such events.

My own review of relevant literature pertaining to news media coverage of natural hazards and disasters confirms Pasquare and Pozzetti's (2007) findings. What is apparent is that most research on the subject focuses on the socio-political aspects of natural hazard and disaster news media coverage (see Adams, 1986; Dunwoody and Griffin, 1994; Singer and Endreny, 1994; Freudenberg *et al*., 1996; Piotrowski and Armstrong, 1998; Kitzinger, 1999; Curran and Gurevitch, 2005). The Social Science element of hazard reporting remains paramount, with most research into the relationship between hazards and the media focusing on 'social disasters,' namely the 1984 Ethiopia famine, the 1994 Rwanda genocide and the 1998 Sudan famine (see Eldridge, 1993; Mermin, 1997; Moeller, 1999; Robinson, 1999). Little attention has been paid to the relationship between the media and physical natural hazard occurrence and few studies have undertaken a comparative analysis of the different ways in which different hazard events types are reported. Many academic works were found to compare and contrast events of the same type, for example Miles and Morse (2007) examine the differences in reporting and the construction of public perceptions of risk with regards to Hurricane Katrina and Hurricane Rita, but no work was found that examines the differences in reporting among, earthquakes, floods and landslides. It is also clear that no academic research has focused on the temporal and spatial patterns present within global hazard reporting.

Throughout the review of relevant literature, no studies were found to have developed a consistent method of measuring media or society's interest, and no studies were found to have employed the media as a tool for improving our understanding the dynamics of natural hazard events. The current study aims to address both of these issues by using the media as a tool for measuring and tracking the temporal and spatial patterns within the level of societal/media interest in a natural hazard event.

There is a gap within the academic literature exists with regards the relationship between the news media coverage of an event and the subsequent humanitarian intervention and giving. As explained, most studies reviewed focus on foreign policy and military interventions in response to intense news media coverage of wars and civil strife. No quantitative work was found that concentrated on how the level of news media coverage of a natural hazard event can affect the subsequent humanitarian response. The current study will address this gap in the literature by providing a greater understanding of media trends, which, in turn, can be linked to patterns in humanitarian response.

3.3. Data and Databases: Attempts at global characterisation of hazard and risk

"In a disaster, accurate information, like clean water, is an indisputable good."

~ Keen and Ryle, 1996: 4

Palm (1990) highlighted the need for a macro-scale approach to natural hazard research and outlined the need for global-scale databases of hazard event occurrence and the characterisation of risk from such events. The author argued that much of the previous work that attempted to examine macro-scale natural hazard occurrence fell short of the detail needed to extrapolate valuable patterns and trends that pertain to driving mechanisms of given detail of the epidemiology of individual disasters. Despite the fact that 98% of those affected by natural hazards come from developing nations (Franks, 2006; O'Brien *et al*, 2007), the vast majority of academic research into hazard events is undertaken in developed nations. A method of articulating this disparity is via a comparison of the location of academic studies, as compared to the location of event fatalities, here in the context of landslides (see figure 3.3). Thus, an imbalance is often present within global hazard datasets, with focus on the event types that affect developed nations and/or those which are novel or unique enough to attract academic research and its funding. Those regions which experience the majority of the impact are therefore those which are most infrequently researched, bar East Asia which includes the intensive investment of the Japanese and Taiwanese governments.

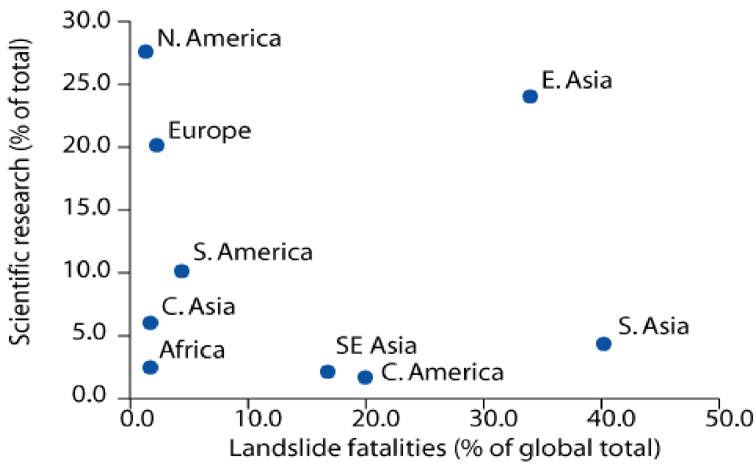

Figure 3.3. Graph showing the relationship between the location of academic studies (scientific research) and the location of fatality inducing landslides with data taken from the proceedings of four Landslide focussed geoscience conferences

Source: ILC, 2008

Guitiérrez *et al.* (2005) and Peduzzi *et al.* (2005), among many others, have attempted to correct this imbalance by undertaking a global approach to hazard identification and risk categorization. For example, Guitiérrez *et al.* (2005) undertook a multivariate analysis of global earthquake fatalities in an attempt to counter the disparity in the quality of data between developed and developing nations. Such global datasets are ideal for the assessment of large-scale trends and the regional categorisation of risk (Peduzzi *et al*., 2005) and make it possible to identify the most exposed areas that are argued to require more attention. However, the resolution of such data often falls short of that needed when trying to display local-level event fluctuations that are in turn sensitive to the actual conditions that led to each event. Coarse scale inventories and susceptibility models that are built upon these are notoriously bad at over predicting the event likelihood (Peduzzi *et al*., 2005). It is argued that smaller national, regional or event based datasets are required to measure small-to-medium scale perturbations in trends, which can then populate global datasets, improving both resolution and coverage hand in hand.

For example, the work done by Guzzetti (2000) on the occurrence of landslides in Italy and Petley *et al.* (2007) on the occurrence of fatal landslides in Nepal, are examples of the in-depth local-level research that is required to improve global hazard datasets. These can potentially be used as training data sets to define and inform wider scale inventories, but again without relatively high resolution local data, these approaches are difficult to verify. The research performed by Petley *et al* (2007) into landslides in Nepal is now part of a larger independent global database of fatality-inducing landslides currently being collated at the ILC, Durham University (see Petley *et al*, 2005). FLD (Petley *et al.*, 2005) is the most up-to-date global-level fatal landslide database and has successfully identified a number of 'vulnerable' regions, as well as demonstrating the historical underestimation of global landslide fatalities, which are patterns that previously had not be articulated. The database also helps to identify those areas which are perhaps not well covered by the media used to collate such databases. For example, if we assume that the magnitude of events scales as suggested by Malamud *et al* (2004), wherever a large event occurs, it is likely that a large number of smaller events may occur also, aggregated through time. The media in remote, or area distanced by language, may only report the largest events, for example those seen in Central America. This is apparent in figure 3.4 below, which maps the magnitude of events worldwide throughout 2007. It clearly shows detailed data of all event magnitudes in Nepal and China for example, where one could argue that the media is sensitive and reactive to events of most if not all magnitudes, whereas in Africa and South America, only large events appears, on the whole, to have been recorded, despite the theoretical suggestion that events of all size should be present.

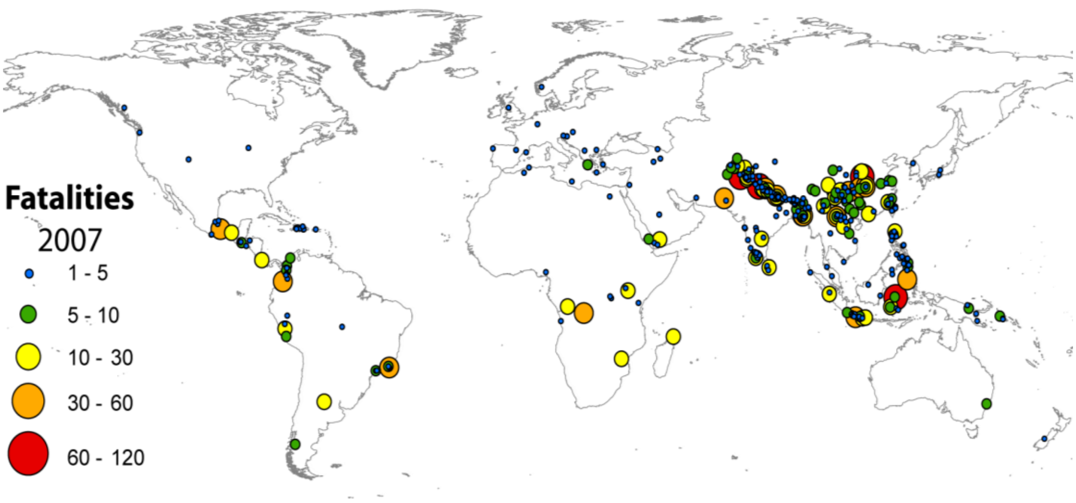

Figure 3.4: International Landslide Centre fatal landslides database, 2007, showing disparities in event magnitude coverage across the globe.

Source: ILC

However, an issue arises about aggregating the findings from independent national and global datasets with other databases. Differences in research approaches, data input methods, event characteristic definitions, analysis methods, and the overall capacity of the database itself, often make it impossible to compare findings from multiple hazard datasets.

Both quantitative and qualitative work centred on the collation of natural hazard and vulnerability data often measure data and/or situations that are regarded as highly subjective (Wisner *et al*., 2004). Due to the difficulty in quantifying such subjective principles, societal vulnerabilities are often ignored within the hazards literature (Cutter *et al.*, 2003). This difficulty in computation has led to the discussion of social losses in disaster situations being almost totally absent from post-disaster analysis and loss estimation reports (*ibid*). Instead, vulnerability, in one form or another, is increasingly being expressed in numerical terms (Bankoff, 2001). Such numerical expression allows for the production of large hazard databases whereby events can be collated and ranked by various forms of abstracted loss information, for example, casualties, economic damage, and number affected. The benefits of such aggregating approaches are deemed to outweigh the inevitable methodological limitations, such as issues regarding inconsistencies within data and ambiguity of terminology.

There are numerous social, economic, and demographic characteristics available to measure the vulnerability of a community or the effects of a disaster (King and MacGregor, 2000). However, there is disagreement over what is the best way of *measuring* a disaster (see Birkmann, 2006). Loss information, be it fatality numbers or economic loss, is used as a major input to a range of important local, national and global decisions. Trends and spatial patterns in disaster losses are used to assess policy successes and failures and consequently form a major part of policies regarding such issues as flood insurance, recovery expenditure and global climate policy (Downton and Pielke Jr., 2005). Thus, having accurate data is key to help decision makers allocate proportionate disaster relief and assistance where it is needed, in a timely manner.

Economic disaster data (damage caused) is increasingly used to illustrate the destructiveness of a disaster or the subsequent vulnerability of an affected area (Downton and Pielke Jr., 2005), partly in response to the need to insure against future losses. Downton and Pielke Jr. (2005) assess the accuracy and value of economic disaster loss data with particular attention to U.S.A. flood damage data. The authors discuss the advantages of using economic data and the uses of such data in federal government decision making. They conclude that such economic data is often inexact due to the complexities of direct and indirect disaster costs but its use is necessary in effectively gauging the value of research and design strategies, as well as improving the accuracy of the disaster loss knowledge base and facilitating policy decisions regarding disaster assistance and bilateral spending. It is also clear that the elongated timescale for the economic *clean-up* after disasters limits the ability to constrain ultimate final impacts in this manner.

However, due to the uneven global distribution and variability of economic power, comparison of vulnerability or disaster destructiveness in economic loss terms is complex and often-unrepresentative (King, 2001). For example, four of the costliest disasters in 2005, in terms of financial losses, were the North American hurricanes Dennis, Katrina, Rita and Wilma, which combined caused the deaths of 1,308 people and caused over US$170 billion in economic losses (SwissRe, 2006). In comparison, the four costliest disasters in terms of fatalities in 2005 were the earthquakes in Pakistan and Indonesia and the mudslides of Pakistan and Central America, which together claimed 93,230 lives but only resulted in US$5 billion in economic losses (*ibid*). The questions here are: were the North American hurricanes ‘bigger disasters’ or ‘more important’ than the Asian and Central American earthquakes and mudslides? And how do you take into account the fact that economic value is not equal across the globe and the societal value of US$1 is different in the USA compared to Balakot, Kashmir? One solution might be to normalise global impacts by a relative measure of fatality cost – the ratio of aggregate long-term economic impact vs. aggregate fatality totals, for each country, yet this approach again introduces a further subjective modification.

Consequently, it has been argued that, in order to compare accurately disaster data across a number of scales and for a number of events types, we must compare aspects that are universal and comparable: the casualties and/or fatalities (Dao and Peduzzi, 2003). Whereas economic value and property value differ on both a temporal and spatial scale, life ultimately holds the same value throughout the world (Dacy and Kunreuther, 1969; Buehler, 1975; Epple and Lave, 1988; Berz, 1991; Webb *et al.*, 2000). Fatalities can therefore be used as a common universal *currency*, allowing for disasters of varying types, over a variety of temporal and spatial scales, to be compared and ranked within a number of hazard databases.

3.3.1. Natural Hazard Databases: Methods and (In)Consistencies

To understand fully the implications of using large hazard databases of post-disaster loss information throughout this project, it is necessary to examine the methodologies and outputs of the major datasets, which will be used to provide case study information.

Inconsistencies in data and ambiguity of terminology present within global hazard datasets make comparisons of the data at any scale difficult (Guha-Sapir and Below, 2002). Resolution, both in terms of temporal and spatial scale, is often too course in global databases to provide valuable information regarding trends and patterns at scales smaller than national level. Guha-Sapir and Below (2002) found that all of the databases studied severely differed on their coverage of small- to medium- scale events. This has unfavourable consequences when using such databases to study natural hazards at a scale other than global since, as hypothesised by authors such as Guzzetti *et al* (2002), Malamud (2004); Turcotte and Malamud (2004), a number of natural hazards appear to follow a power-law magnitude-frequency distribution, whereby the small- to medium-scale events represent a significant proportion of the total impact. Thus, it is necessary to verify accurately and document such events to calculate the associated level of risk present within any given area.

Guha-Sapir and Below's (2002) detailed study of the commonalities and differences between three major global disaster data-sets (CRED's Em-Dat, SwissRe's Sigma database and MunichRe's NatCat database) raise important issues over the scale and methodologies used to produce such databases. The authors focus primarily upon the issue of the differing methodologies used to accumulate each data-set. Much of the data is collated from a variety of public sources, news agencies, insurance reports and aid agencies, where strict working definitions are often missing (Dao & Peduzzi, 2003).

The authors believe that this lack of standardised methodologies is the major downfall of all three databases. For example, inconsistent working definitions and differing inclusion criteria, such as the number of fatalities or number affected, mean that events included in one database may be overlooked by another, effectively altering the representative nature of the database and its precision and completeness (Downton and Pielke Jr., 2005). For instance, in Guha-Sapir and Below's (2002) analysis of global disaster databases, the authors chose a number of case studies, based on countries with high vulnerability and exposure to natural hazards, and compared data for a selection of events. However, the authors did not attempt to capture the full spectrum of event size, event characters, or variations within.

In some instances, fatality data and economic loss data differed widely and there were serious inconsistencies within event recording. For example, Guha-Sapir and Below (2002) note that NatCat recorded four separate floods in India in June 1994, each causing over 10 fatalities and thus meeting Em-Dat criteria for inclusion. However, no records of floods in June were found in the Em-Dat database, but the authors did note that a flood in July causing 150 fatalities was reported in Em-Dat and it was presumed that this was a cumulative report of the previous four floods. This raises the critical problem in aggregating databases of multi-event disasters, in which the label of one macro-scale event may encompass a population of small events. Critically the components of such macro-scale events may involve various mechanisms (e.g. floods and rainfall-triggered landslides), leading to misleading attribution. Therefore, the scale of investigation of the epidemiology of an event within the database is critical. There are numerous examples where the initial event, for example an earthquake, may not directly kill people, yet building collapse and landslides, which subsequently occur as a direct result, are actually the physical processes that lead to the fatalities: hence at what stage or resolution is the blame or cause attributed?

Similarly, the authors noted that, in October 1991, NatCat reported one earthquake resulting in 2000 deaths and a landslide resulting in 600 deaths occurring in India, while Em-Dat and Sigma reported one earthquake causing approximately 1,500 deaths (Guha-Sapir and Below, 2002). The authors speculate that such inconsistencies are due to confusion over the identification of the controlling factors for each event identified and a lack of consistent working definitions and terminology with regards to event classification and dating. Such variation in the data reduces the accuracy and representative power of each database and makes comparison of data from all three databases difficult.

Data provided by Em-Dat is presented at a country-by-country level but detailed geo-references are not presented (Guha-Sapir and Below, 2002). Natural hazards, in particular earthquakes, multi-landslide events and floods, are not constrained by administrative boundaries and the areas physically affected by such hazards are often wide and cross boundaries (Peduzzi *et al*., 2005). When such events occur it is likely that a single event spanning several administrative boundaries will be classed as multiple events among multiple countries, effectively altering event statistics and consequently the accuracy and representative nature of the database (Guha-Sapir and Below, 2002).

Such examples, also assessed by Peduzzi *et al*. (2005), illustrate that the current approach, based upon the limits of administrative boundaries, needs to change to one of identification of affected areas by geo-physical models. Peduzzi *et al*. (2005) and Guha-Sapir and Below (2002) argue that precise details regarding the area affected by individual hazards need to be identified in order to evaluate the population at risk. Such knowledge on the area affected constitutes a compulsory step towards identifying those at risk and understanding why a hazardous event turns into a disaster (Peduzzi *et al*., 2005).

In comparison to the global datasets based upon fatality numbers or economic damage, Mosquera-Mechado and Dilley (2008) compare 'risk rankings' derived from two global risk analyses: the United Nations Disaster Risk Index (UNDRI) and Columbia University's Global Natural Disaster Risk Hotspots Project. It was found that, due to both studies sharing a common theory of disaster causality, results were comparable. However, Pelling (2004) quantitatively compared UNDRI's report and the Hotspots Project and ascertained that, despite having key principles in common, they are not comparable. It was found that initial geographical analyses used by both datasets varied greatly. For instance, results were relative, rather than absolute, and were expressed differently and even the selection of hazards considered by each was different.

This example shows how subjective vulnerability and risk calculations are and how the availability of data and methodological choices can affect overall results. Subjective decisions concerning what vulnerability indicators or variables are used can alter results pertaining to vulnerability analysis or risk ranking of a selected area and subsequent federal decision-making. The fundamental endeavour of both the UNDRI report and the Hotspots Project was to use global data to ascertain patterns in both vulnerability and risk. In doing so, Em-Dat mortality rates were used by both as reasonable indicators of risk. However, Em-Dat mortality rates were used as the basis for selection of vulnerability variables in the UNDRI report, and were used directly in the calculation of vulnerability in the Hotspots Project. Although this difference in vulnerability calculation is noted by the authors as certainly affecting subsequent risk calculations, no estimate to the degree of influence is provided.

Regional and global hazard databases provide the information required by governments, aid agencies and local councils to predict and prepare for hazard events. However, as has been discussed, the resolution of such databases and the inconsistencies with regards to working definitions and methods often make such work difficult, with data often unrepresentative of the risk present at a regional scale. Ongoing work by ILC has shown the problems inherent within large-scale global hazard databases, like CRED's Em-Dat, and has shown the potential for understanding the temporal and spatial occurrence of hazard events through the analysis of hazard news media. The current study will utilise the work undertaken by ILC and will produce a global hazard database that can also be used to address regional-scale issues.

3.4. Data Analysis

"Since our understanding of emerging complex systems is not rich, we are confronting a high degree of uncertainty regarding future trends and event prediction."

~ Haque and Etkin, 2007:277

My overall aim for this research is the analysis of time series data regarding the level and magnitude of news media coverage of natural hazards and the social impact of the variations within. Large unexpected events occur infrequently but have been known to affect, and even control, long-term dynamics of various complex systems, to which I equate the global news media (Sornette, 2002; Mueller *et al*. 2003). Natural hazards represent an example of these unexpected events that can have major impacts upon complex societal systems, including the news media. Much attention has been paid to the effects of large-scale events on complex systems and there is a large literature base on the issue relying on a wide range of example studies. The aim of this review is the identification of previous studies that examined the trends within natural hazard event occurrence and the possible application of such studies for understanding the relationship between natural hazard event occurrence and news media coverage of such events.

Statistical investigations of large databases, such as global and regional landslide inventories and global earthquake occurrence datasets, allow for quantitative analysis to determine internal trends, endogenous and/or exogenous forcings, and external noise. It is necessary to perform such analysis to understand how complex systems, such as the hazard-media response system discussed throughout this study, function and how trends within such systems can aid in the prediction of future events.

3.4.1. Natural Hazards: Magnitude-Frequency Relationships

A number of complex natural phenomena have been shown to exhibit power-law magnitude-frequency statistics (Malamud and Turcotte, 2006). For example, it is widely accepted that earthquakes follow a power-law distribution, whereby large events are much rarer than small events (Gutenberg and Richter, 1954). More recently, a number of studies have found that, landslides and floods also follow power-law magnitude-frequency statistics (Turcotte and Malamud, 2004; Malamud and Turcotte, 2006 respectively).

A number of theoretical and philosophical models have been proposed that present evidence for power-law behaviour in various systems within nature. One of the best known of these is Per Bak's (1988; 1996) concept of self-organised criticality, illustrated by the notion of a sand pile which grows with every grain added until it reaches a point known as a 'state of criticality.' Once this point has been reached, each additional grain will cause a series of 'landslides', the magnitude of which adheres to a power-law distribution. However, due to the intricate and complex structure of the sand pile, it is impossible to predict whether a particular grain of sand will cause a barely perceptible ripple or a catastrophic 'crash.' Admittedly, there is a great deal of extrapolation to go from a laboratory experiment on sandpiles to actual landslides as the physics of failure are very different, yet the cascading nature of event magnitude and frequency appears comparable. Nevertheless, Per Bak's model provided the basis for understanding power-law statistics within natural hazard events and the concept of self-organised criticality paved the way for a series of statistical models that aim to explain the variations in such complex systems.

A number of natural hazard studies have used Per Bak's sandpile model and the 'shock to system' approach to model and better understand the magnitude-frequency distributions of such events. For example, Guzetti *et al* (2002), Teixeira (2006) and Hungr *et al* (2008) have shown that landslide magnitude-frequency distributions are often well approximated by power-law functions. The wider theory of self-organised criticality has also been used to uncover power-law statistics within volcanic eruptions (Pyle, 2000), flood events (Malamud and Turcotte, 2006), forest fires (Turcotte and Malamud, 2004) and asteroid impacts (Chapman, 2004).

Power-law studies of natural hazards allow for the probability of a particular event occurring in a certain period to be calculated in what is known as the "recurrence interval" (Malamud, 2004). Previous studies regarding the power-law magnitude-frequency distribution of natural hazard events proclaimed that such events follow a Gaussian distribution in magnitude and a Poisson distribution in timing, with values of the distribution decaying symmetrically about a central peak (Malamud, 2004). However, an increasing number of studies have found that natural hazards actually follow "heavy tailed" power-law distributions, whereby the distribution of events decay much more slowly than the exponential decay present within a Gaussian distribution (Malamud, 2004). This difference in distribution means that the large events that were believed to be very rare, are actually much more likely to occur (Malamud, 2004). Such findings have repercussions and affect the way in which such events are perceived and prepared for.

The focus of the current study is the analysis of time series data regarding the level of news media coverage recorded for natural hazard events and the identification of trends within coverage of events of different sizes (magnitude) and type. The current study will examine the magnitude-frequency distribution of hazard events recorded within both NHRSS-Db and GNAT-Db to uncover whether recorded events follow the same power-law distribution as presented by the aforementioned authors. Analysis will focus on the relationship between the frequency of an event (the number of events recorded) and the size, or magnitude, of an event (total number of recorded news media articles). In doing so, we hope to uncover the societal affects of hazard events of different sizes and to possibly gauge society's perception and preparedness for such events.

The above examples of complex systems have shown how the principles behind the 'shock to system' approach and other methods used to assess complex and self-organising systems can be applied to a wide range of examples and utilised within a number of disciplines. Per Bak's concept of self-organised criticality and Sornette's analysis of complex systems and 'shock to system' events are, in essence, linked to Downs' (1972) 'issue attention cycle.' Though the conceptual processes used are often quite complicated, all consider the effects of exogenous and endogenous factors upon the occurrence of an event and examine how to predict the likely changes in 'interest' over time. The principle behind the methods of data analysis used may be able to provide valuable insight into how the news media responds to large unexpected natural hazard events and improve our understanding of the complex interwoven relationship between natural hazard events and the news media at the heart of this review.

3.5. Literature Review Conclusion -

"Mass communication is inextricably entwined with disasters and hazard mitigation."

~ Rattien, 2007:36

As has been shown, socio-political and geophysical research into the causes and effects of natural hazard media coverage has varied greatly in method and interpretation over time (see Gregory (2000) for a rich and detailed discussion of the discipline's history).The media has been shown to be among the most significant and salient providers of natural hazards and extreme events information to the public (Fischer, 1994) and significantly influences how society perceives and responds to natural hazard events (Pasquare and Pozzetti, 2007). However, there is little academic literature that utilizes the power of the news media to assess the temporal and spatial changes in hazard event occurrence and no literature was found that examines the different trends within news media coverage of natural hazard events of different types (earthquakes, floods and landslides for example) as they evolve and occur. I argue that the value of this data is rich, and may yield insight into both the geography of natural hazards (spatially and temporally) and also elucidate the nature of society's response.

The analysis of hazard databases presented here has outlined the complications and limitations of both local- and global-level datasets and has shown that all hazard datasets have their limitations. Due to the lack of consensus regarding methods and definitions of key concepts and components of risk categorisation, hazard databases are often incomplete or uneven in their geographical coverage. However, ongoing work by ILC and the production of FLD has shown that the news media can be used to address issues of geographical discrepancy within coverage.

It has also been shown through the review of data analysis work that such statistical and theoretical work could provide a greater understanding of the differences between natural hazards in both time and space and their effects on the underlying system dynamics of media patterns as a whole. However, it is clear that there are gaps within the literature with regards to the effects of both medium- and large-scale hazard events upon the underlying system dynamics of the media.

The work outlined throughout this review will help towards understanding the mechanisms and relationships between the occurrence of natural hazard events and the news media coverage of such events. The main objective of this project is the identification and explanation of the trends and patterns within natural hazards media coverage. This will not only improve our understanding of the patterns inherent within natural hazards media coverage but will also improve our understanding of the occurrence of natural hazard events and the changing social perceptions and responses to hazard events.

An alternative technique for understanding the variability in news media coverage of natural hazard events and the spatial occurrence of such events is utilised throughout the current study. This chapter will outline the methods used to collate two web-based news media databases that were created. Both databases collated data pertaining to, among other things, the timing and level of news media coverage regarding earthquakes, floods and landslides. This data became the foundation of the study and the source data required to achieve the overall study aim and objectives.

To achieve the overall aim of this study - the assessment of the variability in reporting of the global occurrence of natural hazards - it was necessary to obtain information regarding the level and magnitude of news media coverage pertaining to natural hazard events. To statistically analyse and compare the temporal and spatial variations within news media coverage of different natural hazard events, a number of news media coverage statistics were required: data pertaining to the event under examination within the recorded news media articles (location, size, magnitude etc.), the date on which the articles were published, the location of the publications, the total number of articles published concerning a particular event, and the duration of coverage for each event. The news media has been shown to be an accurate depiction of public interest in, and understanding of, an event or issue (Becker, 1967; Nigg, 1987; Ploughman, 1997; Perez-Lugo, 2001, 2004; Boykoff & Boykoff, 2004; Pasquare & Pozzetti, 2007). Thus, by assessing the temporal and spatial trends within recorded news media coverage of natural hazard events, this study will examine the occurrence of such events, as well as the characteristics of the media response to, and social interest in, natural hazards.

4.1. Using the Internet and the News Media

The news media has also been found to be an accurate source of natural hazard event information and the Internet allows for real-time communication and broadcasting of such information and provides an ever-growing archive of the temporal and spatial patterns within natural hazard event occurrence (Anderson, 1997; Marincioni, 2007). As such, a natural hazard event has become more than a discrete event; the resolution of the media now details the evolution of such events. For example, Petley *et al* (2005) have shown that the news media can be a useful source of natural hazard information and that the Internet is a valuable resource for hazard database collation. The most successful attempt at hazard event cataloguing using news media data is the ongoing production of FLD at ILC, Durham University (Petley *et al*, 2005). The global database has allowed for the examination of temporal and spatial trends within fatal landslide occurrence and has successfully demonstrated the historical underestimation of landslide fatalities by global hazard databases, such as CRED's Em-Dat.

By cataloguing the information cited within news media coverage of natural hazard events, such as event location, date, and subsequent fatality numbers, a detailed hazard event database can be created. This data can then be used to assess patterns within the occurrence and magnitude of hazard events over the timeframe available.

4.2. Data Collection & Collation

Much of the previous work in the area of media coverage analysis has focused primarily on English-language newsprint and television news network analysis over the past decade (Quarantelli and Wenger, 1990; Cowan *et al.*, 2002; Miles & Morse, 2007). However, the Internet allows for much larger and detailed searches and it is now possible to search thousands of newsprints, obtain search engine and website statistics, and retrieve data regarding emergency events and the subsequent government and humanitarian responses to natural hazard events. This is how we achieved objective one; the creation of NHRSS-Db and GNAT-Db. The methods used to create both databases will be discussed.

4.3. Natural Hazard Really Simple Syndication Database (NHRSS-Db)

4.3.1. RSS Technology

Really Simple Syndication (RSS) technology allows the user to subscribe to a regularly updated 'feed,' which can then be automatically downloaded and viewed at their leisure. RSS feeds contain full summarised text of the published articles in question, as well as metadata, such as publication ownership; date of publication; and article URL, all of which are published in a standardised XML format allowing the user to easily import the data into a number of programs.

RSS feeds have become increasingly popular and most major websites/organisations offer the ability to subscribe to their content via RSS. For example, major news networks, such as Associated Press, BBC and CNN, all offer users the opportunity to subscribe to a number of pre-selected and personalised RSS feeds. As well as news networks, various organisations provide RSS 'feeds' linked to selected web content. For example, the USGS provide breaking news RSS feeds tailored towards specific natural hazards and/or global regions. The user can quickly and easily subscribe to a feed purely concerned with 'landslides' in 'South Asia.'

4.3.2. Google News and Google Alerts

Google News is a web-based news media aggregator provided by Google Inc. Google News "aggregates headlines from news sources worldwide, groups similar stories together and displays them according to each reader's personalized interests" (Google, 2009). Although the exact algorithms used for accumulating news are commercially confidential, examination of the dataset gives insight into its workings. Included news articles are selected by a number of computer algorithms based upon factors including how often and where a news story appears online (note that Google ranks page orders by connection weighted by popularity, not popularity alone). Articles are also ranked by characteristics of the content such as time of publication, location, language and diversity. The aim of this method is to provide a collection of articles within a large temporal and spatial range and avoid political viewpoint and ideology (Google, 2009).

Google News also provides the user with the opportunity to set up personalised RSS feeds, or 'Google Alerts,' using the results from any search performed on the Google News website. For the current study, a range of keywords (see table 4.1) was used to set up various automated Google Alerts. These Alerts relayed all available news articles pertaining to the keywords submitted, which are emailed in batches, moderated in total by Google. At present, approximately 4,500 websites are covered by the English language Google News search engine (Google, 2009). Bias exists with regards to what websites are utilised by Google News, but these, along with the websites themselves, are not published by Google.

On average, Google Alerts are updated every six hours with the latest news reports pertaining to the chosen keywords delivered to the users e-mail account or an online RSS reader, such as the Google News Reader. Over the 21 month period between January 23, 2008 and September 30, 2009, the results from each Google Alert were sequentially and periodically imported into a single spreadsheet. Approximately 2,400 individual Google Alerts were recorded over the analysis period with a total of 62,719 news articles recorded.

As well as English-language Google Alerts, Alerts were created for a selection of keywords in Spanish, Portuguese, and Chinese (see table 4.1). This allowed for a greater number of websites to be accessed and it improved both the temporal and spatial aspects of the study by providing a much wider geographical view of what natural hazard events were making the headlines during the timeframe of the study. In doing so, the temporal and spatial variation in the social interest in natural hazards where recorded over a number of years.

Keywords		Source
Climate Change Debris Flow Earthquake Hurricane Mudslide Rockfall	Cyclone Drought Flood Landslide Mud+Slide Volcano	UK/U.S.A – news.google.com
Terremoto (Earthquake) Inundación (Flood) Derrumbamiento (Landslide)		Spain – news.google.es
地震 (Earthquake) 洪水 (Flood) 山崩 (Landslide)		China – news.google.cn
Terremoto (Earthquake) Inunda (Flood) Desmoronamento (Landslide)		Brazil – news.google.com.br
Terremoto (Earthquake) Inundación (Flood) Derrumbamiento (Landslide)		Colombia – news.google.com.co

Table 4.1: Table showing the keywords included within NHRSS-Db and the subsequent source Google News website

4.3.3. Data Organisation and Information Extraction

The XML format of the Google Alerts allowed for easy database querying and data mining whereby specific information could be extracted, which, for this study, included event date; publication date; news source; publication location; country of interest; fatality numbers (if any); Google search language; and news source URL.

At this point it was possible to remove any false positives due to language commonalities. By searching the database for a number of keywords I felt would produce false positives (see table 4.2) it was possible to remove articles with headlines such as '*Why Obama's not leading by a landslide – The Boston Globe*[2]' or '"*Made-In-*

[2] http://www.boston.com/bostonglobe/editorial_opinion/oped/articles/2008/09/18/why_obamas_not_leading_by_a_landslide/

India" games set to flood market – Business Standard[3]*.*' The result was a media database purely concerned with natural hazard events.

Removal Keywords
Obama
Election
Victory
Financial
Market

Table 4.2: Table of NHRSS-Db removal keywords

Through the use of a number of data mining techniques, including detailed lookup tables, User Defined Function's (UDF) and keyword extraction tools, it was possible to extract vital information from the individual article headlines.

"SW China Landslide kills seven, injures seven" – Xinhua

Above is an example of a typical headline recorded within NHRSS-Db. The headline, in this case, is followed by the name of the news agency who published the article, in this case the Chinese press agency '*Xinhua*'. A lookup table, consisting of event type keywords such as 'earthquake' 'flood' 'landslide,' was used in conjunction with a UDF to identify the event type under examination within each article recorded. For the example article headline given above, the word 'landslide' was referenced and so the UDF identified this, using the lookup table, and returned an event type reference. This allowed for articles to be grouped by event type.

A second lookup table was created that included press agency names and the location of that agency, including city, country, region, region code and UN country code, was created. This was used in conjunction with a UDF that allowed for the news agency name to be extracted from the headline, which, in turn allowed for the location of the publisher to be generated and the relevant city, country, region, region code and UN country code to be assigned to each article recorded.

A third lookup table, consisting of a list of 192 United Nations recognised countries and major cities within these countries, was used in conjunction with a third UDF to extract country names from the recorded article headlines. For the example article headline

[3] http://www.business-standard.com/india/storypage.php?autono=314807

above, the UDF returned ‘China’ and then assigned the appropriate region, region code and UN country code. This process was undertaken for the entire NHRSS-Db and provided information regarding the country of interest referenced within each of the headlines that included a country or city reference. Following this, a manual inspection of articles that did not reference a country or city within the recorded headline was performed and appropriate data was input.

A fourth lookup table and UDF combination was used to extract fatality numbers from the headlines, where applicable. Numbers within the headline, in both numeric and alphanumeric format, were extracted when certain keywords were present within the article headline (see table 4.3). For the example headline, the UDF returned ‘seven’ as the phrase ‘kill’ was present within the headline. This was then transferred to numeric format to allow for easier data analysis.

Headline Fatality Lookup Keywords
Kill
Dead
Death
Die
Fatal

Table 4.3: Table of headline fatality lookup keywords

4.3.4. Event Identification, Inclusion and Exclusion

Once location, publication and fatality information were extracted, it became possible to begin event identification. In an effort to identify all hazard events within NHRSS-Db, two methods of event identification were used. First, the NHRSS-Db was sorted by the date recorded articles were published on and then filtered by country and event type. This made it possible to identify groupings of recorded articles pertaining to individual events recorded throughout the database. In addition, CRED’s Em-Dat, DFO’s GAALFE, ILC’s FLD, and USGS’s GSN, were used to identify earthquake, flood and landslide events that had occurred between January 1, 2005 and September 31, 2009. Identified events were then searched for within NHRSS-Db by narrowing the timeframe of the database and using event specific keywords, such as “Peru + earthquake,” to identify recorded articles pertaining to the event. Events were then colour coded and given event ID numbers to improve database sorting.

4.3.5. Coverage Statistics

Once individual events had been identified (see appendix one for a full list of events and relevant statistics) coverage statistics for these events were generated. Total coverage statistics were calculated by totalling the cumulative number of articles written for each hazard event. In conjunction with this, peak article count for each event was recorded by identifying the date on which the most coverage was recorded. Calculating the number of days individual event coverage persisted for identified the duration of each event. Only events that had five or more days continuous coverage were used for overall database analysis because the analytical methods used later on in the study, namely the fitting of regression curves, required events to have a minimum of five data points for results to be functional. However, events consisting of one to four days continuous coverage will still be discussed as they represent a large number of the events recorded within the NHRSS-Db and their existence represents valuable information with regards to media values and the popularity of event stories.

Comparison and analysis of a number of key database variables, such as total event coverage (the sum of all articles pertaining to a single event), peak event coverage (the maximum daily event coverage throughout its duration), event duration (the maximum number of days the event occurred in the NHRSS-Db, up until a numerically defined point), event location (the country and region where the event occurred) and fatalities (the maximum number of deaths reported in the media for each event), allowed for a number of aggregate statistics and full database trends to be revealed. Statistical tests, including regression analysis, curve fitting, and time series analysis were then performed on the individual event data, as well as the full database aggregate statistics. This analysis allowed for an in-depth investigation and comparison of trends within news media coverage of individual events, events of different magnitudes, and events of different types. This, in turn, provided the data required to accomplish objective two, assessment of the temporal and spatial dependence of media coverage as a function of event type, timing, magnitude and location.

4.3.6. Limitations of NHRSS-Db

A number of limitations were found to exist within the NHRSS system used:

- Language issues – The Microsoft Translation system used was not precise enough to translate accurately many of the articles, particularly Chinese headlines. Individual translation of the approximately 43,000 foreign language articles recorded was outside the scope of this study.

- Available timeframe – The timeframe available (2008-2009) is not long enough to encapsulate a large enough sample of different event types of different sizes from different areas of the world.
- Regional media development – Those areas that are most affected by the natural hazards being studied were found to be the least well connected into the global media.
- Google news source and article filtering – The selection criteria and algorithms used by Google to source news articles are unknown and there is an apparent cap on the number of articles reported and delivered to users of the Google Alert system.

4.4. Google News Archive Search Tool Database - GNAT-Db

4.4.1. Google News Archive

It was decided to develop a second hazard news media database in response to the limitations of NHRSS-Db outlined above. A Google News Archive Search Tool (GNAT) was developed to increase the timeframe under analysis and improve the level of data available to us.

The Google News Archive (GNA) is a web-based historical archive of major newspapers, magazines, and news and legal archives provided by Google Inc. Both content that is freely accessible to all users (BBC News, Time Magazine and Guardian articles) and content that requires a fee, (including articles within the Washington Post Archive and New York Times Archive) are aggregated and at least the title and context is made available. A keyword search system allows users to search GNA and articles are presented in date order. A list of the news sources available within GNA is not available outside Google Inc. but, as with the Google News website, approximately 4,500 sources can be searched (Google, 2009). Articles published within the past 30 days do not feature within GNA and are only available on the regular Google News website (Google, 2009). Thus, a 30-day lag period is present within GNA. However, when articles are transferred to GNA and made available for searching, the original publication dates are included.

4.4.2. Google News Archive Search Tool

I decided that news data recorded within GNA over the past five years (2005-2009) would provide an accurate representation of hazard news media coverage at the time. This was due to the increased propagation of online news content over the past 10 years (WANNP, 2007). However, it is likely that an upward trend in overall online news media content is present due to the continued increase in online news content but the extent of this trend is not known. Manually searching GNA for daily records of hazard-related news articles over five years would be an extensive and lengthy process. To combat this, a Google News Archive Search Tool (GNAT) was developed, which automatically queries GNA for specified keywords throughout a specified date range and automatically returns the number of articles recorded within GNA. GNAT extracts the number of articles recorded within GNA per keyword per day for the individual date or date range specified. The output from each GNAT search is a Microsoft Excel spreadsheet containing the date; article count; and URL link to the subsequent GNA webpage. GNAT allows for quick and efficient searching of GNA, compared to manual day-by-day searches. Whereas NHRSS-Db only contains news reports picked up by the RSS feeds from the day the database was initiated, GNAT allowed me to search the entire 200-year GNA for news articles pertaining to earthquakes, floods and landslides, extending the timeframe under analysis.

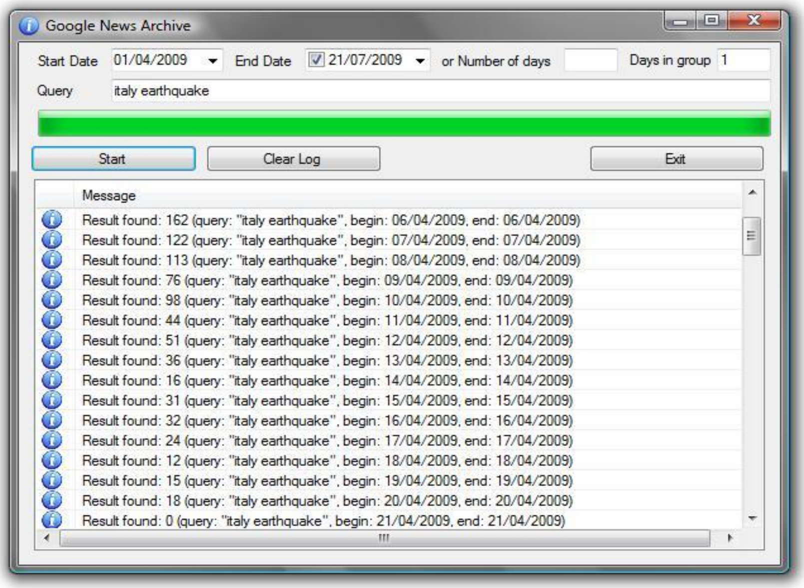

Figure 4.1: GNAT user interface

4.4.3. Keyword Searching

GNAT searches were performed for the three event types between January 1, 2005 and September 30, 2009. In an effort to avoid false positives within GNAT-Db due to language commonalities, a number of keywords were excluded from the three GNAT searches (see table 4.2). For example, when searching for landslide, the terms 'election' and 'victory' were excluded. Due to the publicity surrounding the 2008 USA presidential election, the terms 'Obama' and 'McCain' were excluded from all GNAT searches. Analysis of GNAT results including and excluding these keywords found that they removed the majority of erroneous search results.

4.4.4. Data Organisation

After the event type GNAT searches outlined above were performed, the three long-term natural hazard news media datasets were combined to create GNAT-Db. It was decided that, to limit the amount of noise within the dataset and distinguish any temporal trends, that the raw data produced by GNAT would be filtered or 'smoothed' by calculating a five-day running average for each event type dataset.

4.4.5. Event Identification, Inclusion and Exclusion

Due to the timescale of GNAT-Db, a large number of natural hazard events were recorded. It was decided to identify 99 events, 33 of each event type under analysis, within GNAT-Db. To identify individual events for further analysis prominent peaks within each long-term event type dataset were examined. The timeframe of each peak was noted and events recorded within Em-Dat, GAALFE, FLD, and GSN during this period were identified and searched for using GNAT. In addition to this, hazard events identified within NHRSS-Db and those from the author's own knowledge were also searched for. Events were chosen to demonstrate the differences in spatial and temporal hazard news media coverage of events of varying magnitude/impact. In order to achieve an equal spatial distribution of events, it was attempted to obtain a range of differing magnitude events for each region. However, like event selection for NHRSS-Db, the selection of events was wholly dependent upon the events being adequately represented. Only events that had consistent coverage for five days or longer were included in the GNAT-Db to ensure statistical analysis of individual events was possible. This meant that many events had to be omitted, which, when coupled with the subjective nature of event selection, meant events within GNAT-Db tend towards medium- to large-scale magnitude/impact, with small-scale events, both in terms of coverage and magnitude, underrepresented within GNAT-Db.

4.4.6. Information Extraction

Due to the nature of GNAT output, only the number of reported articles related to the keywords searched was directly available. Thus, the level of information available for each article recorded was limited. Information regarding the location of the event was already known. However, information regarding article publisher and location and fatality information could not be directly obtained. Manually analysing each recorded article within GNAT-Db was out of the scope of this study due to time constraints. Thus, no publisher information is available throughout GNAT-Db. However, event fatality information was deemed to be a crucial event statistic and analysis was undertaken to obtain this information. By examining the headlines of recorded articles for each of the 99 events, fatality information was obtained, including the development in recorded fatalities for each event over time. This information, coupled with the daily number of recorded articles, allowed for the identification of any trends within recorded coverage related to fatalities. This, in turn, allowed me to achieve objective two, assess the temporal and spatial dependence of media coverage as a function of event type, timing, magnitude and location, and examine what affects such event characteristics can have on recorded coverage, if any.

4.4.7. Coverage Statistics

Once all 99 events had been identified within GNAT-Db (see appendix two), coverage statistics for these events were generated. The process of generating coverage statistics for total coverage, cumulative coverage and peak coverage for events within GNAT-Db was the same for generating coverage statistics for events within NHRSS-Db as outlined in section 4.3.5. However, calculating event duration for events within GNAT-Db was more complicated. To do so, a sensitivity test was undertaken whereby a percentage of the peak article count was used to denote the lowest article count available and results below this number were discarded. 10% and 5% of the peak article count for each event was tested but were found to cut off too much of the later event data and often removed important secondary peaks in coverage. 2% of the peak article count was then tested and was chosen to denote the end point of event duration as it only removed a minor amount of data points at the end of each events coverage, and performed well for both small and large event magnitudes and coverages.

As with the statistical analysis performed on events within NHRSS-Db, a number of statistical analysis techniques, including regression analysis, curve fitting, and time series analysis were performed on the individual event data and full GNAT-Db aggregate statistics, and results were recorded within GNAT-Db. This analysis allowed for an in-depth investigation and comparison of trends within news media coverage of individual events, events of different magnitudes, and events of different types. This, in turn, provided the data required to accomplish objective two, assessment of the temporal and spatial dependence of media coverage as a function of event type, timing, magnitude and location.

4.4.8. Case Study Analysis

Once all event data and coverage statistics were obtained for all 99 events within GNAT-Db, 12 case studies, four of each event type were chosen for in-depth analysis. This was done to examine further the trends within event coverage and identify any event-specific case study events which were selected to represent an equal spatial distribution and a relative range in event magnitude/severity (see table 4.4) within each event type. The number of fatalities per event was chosen to be the measure of magnitude as this is the universal factor present within all natural hazard events, allowing for the comparison of all geo-physical events recorded.

Event	Event Type	Date	Fatalities
L'Aquila, Italy	Earthquake	06/04/2009	299
Sichuan, China	Earthquake	12/05/2008	68,712
Kashmir, Pakistan Administered Kashmir	Earthquake	08/10/2005	74,698
Niigata Chuetsu Oki, Japan	Earthquake	16/07/2007	7
Indiana, USA	Flood	01/06/2008	3
Haiti	Flood	01/08/2008	600
Lao Cai, Vietnam	Flood	08/08/2008	119
Queensland, Australia (Nov 2008) Queensland, Australia (Feb 2009)	Flood	20/11/2008 04/02/2009	0 21
Southern Leyte, Philippines	Landslide	16/02/2006	1,126
Bukit Antarabangsa, Malaysia	Landslide	04/12/2008	5
Chittagong, Bangladesh	Landslide	11/06/2007	128
La Conchita, California	Landslide	10/01/2005	14

Table 4.4: Table of GNAT-Db case studies

4.4.9. Limitations of GNAT-Db

A number of limitations were found to exist within the GNAT system used:

- By analysing the events recorded within both NHRSS-Db and GNAT-Db, it became apparent that differences within both data accumulation methods were often substantial, with NHRSS-Db often recording much higher coverage statistics. For example, 14,398 articles were recorded in NHRSS-Db with regards to the Bihar, India floods, compared to 1,000 articles recorded for the same event within GNAT-Db.
- Absolute coverage appears to be less – This may reflect selective archiving by Google, the details of which are not published.
- Spatial element – Due to presentation of data collated using GNAT, it was too difficult to extract information regarding where articles were published. Thus, an important spatial element with regards to 'interest' in events was unavailable.
- Event superimposition – Unlike events identified within NHRSS-Db, identifying individual events within GNAT-Db long-term event type datasets is much more

difficult. Hence, the difference in method for collating event type data and individual event data outlined above.

4.4.10. BBC News Data

During the collation of both NHRSS-Db and GNAT-Db it became apparent that BBC News articles featured prominently within both databases. A report published in 2007 by Google News Reports (GNR), which is a service that monitors trends within articles presented by Google News, reported that BBC News was the 14th most referenced source on Google News throughout 2007 (GNR, 2007). In light of this, it was decided to approach BBC News with a request for access to their extensive archive of news reports. However, after meeting with BBC News personnel, it was decided that it would not be possible to collate the level of information required within the timeframe of this study. It is hoped that this study will act as a proof of concept and that future work will involve BBC News.

4.4.11. Humanitarian Assistance Data

The initial research proposal involved the collection and collation of data concerning the amount, origin and distribution of humanitarian assistance provided in response to the selected natural hazard events within both NHRSS-Db and GNAT-Db. Such data is available from a number of government organisations, such as the Department for International Development (DfID), and non-governmental organisations and humanitarian assistance agencies, such as the DEC and Oxfam GB. Organisations were contacted and asked to supply information regarding the level of public and private donations and the level of support assistance provided in response to events within both databases. The aim of this was to compare statistically the level of humanitarian assistance provided in response to individual events to the geophysical and socio-economic severity of the event and various recorded news media coverage statistics. This would allow for any correlations between the magnitude of natural hazard events, the volume of media coverage, and the level of humanitarian assistance provided to be identified and assessed.

However, due to privacy issues and time constraints, the required information could not be obtained in the resolution required or in time for adequate analysis to be performed. Many of the organisations contacted could not provide specific data regarding the level of assistance provided for the events recorded within both databases because they did not respond to the event, did not record such data, assistance was dispersed through other organisations, or privacy policies prohibit the dissemination of assistance data.

Chapter Five: Results: General Database Characteristics

This chapter will outline a summary of the characteristics of both NHRSS-Db and GNAT-Db. In this chapter, I aim to set out foundation information regarding both databases by beginning with a discussion of the coverage trends within recorded media coverage of both databases. The focus will be on comparisons between recorded coverage all three event types under examination. This will be followed by the identification and comparison of the hazard events recorded within both databases.

5.1. NHRSS-Db: Recorded Media Coverage

Figure 5.1 displays a five-day running average of the total recorded article count for the three event types under examination. In conjunction with this, figure 5.2 displays a five-day running average of each of the three individual event type datasets within NHRSS-Db: earthquake, flood and landslide. Due to the daily variability in recorded news media coverage, a five-day running average is presented to smooth the data, reducing daily fluctuations and rendering more visible any temporal patterns.

Flood and landslide news media coverage was recorded from the outset: January 23, 2008. However, earthquake coverage collation did not start until May 13, 2008, in response to the May 12, 2008, Sichuan, China earthquake. Note that NHRSS-Db cannot be altered retrospectively in the same manner as GNAT-Db, for which data is archived by Google News. A chronological summary of trends and wider news events, below, gives the context for considering media response to hazards.

As can be seen in figure 5.2, recorded flood news media coverage is, on the whole, higher than both earthquake and landslide coverage. However, earthquake and landslide coverage does surpass flood coverage on several occasions when a prominent event has occurred. For example, on September 3, 2008, recorded earthquake coverage surpassed both flood and landslide coverage following a 6.1Mw earthquake in Southwest China on September 1, 2008, which killed 32 and injured 467. Similarly, on October 7, 2008 recorded landslide coverage surpassed both earthquake and flood coverage following a landslide in Shanxi Province, China on September 30, which killed 41 people.

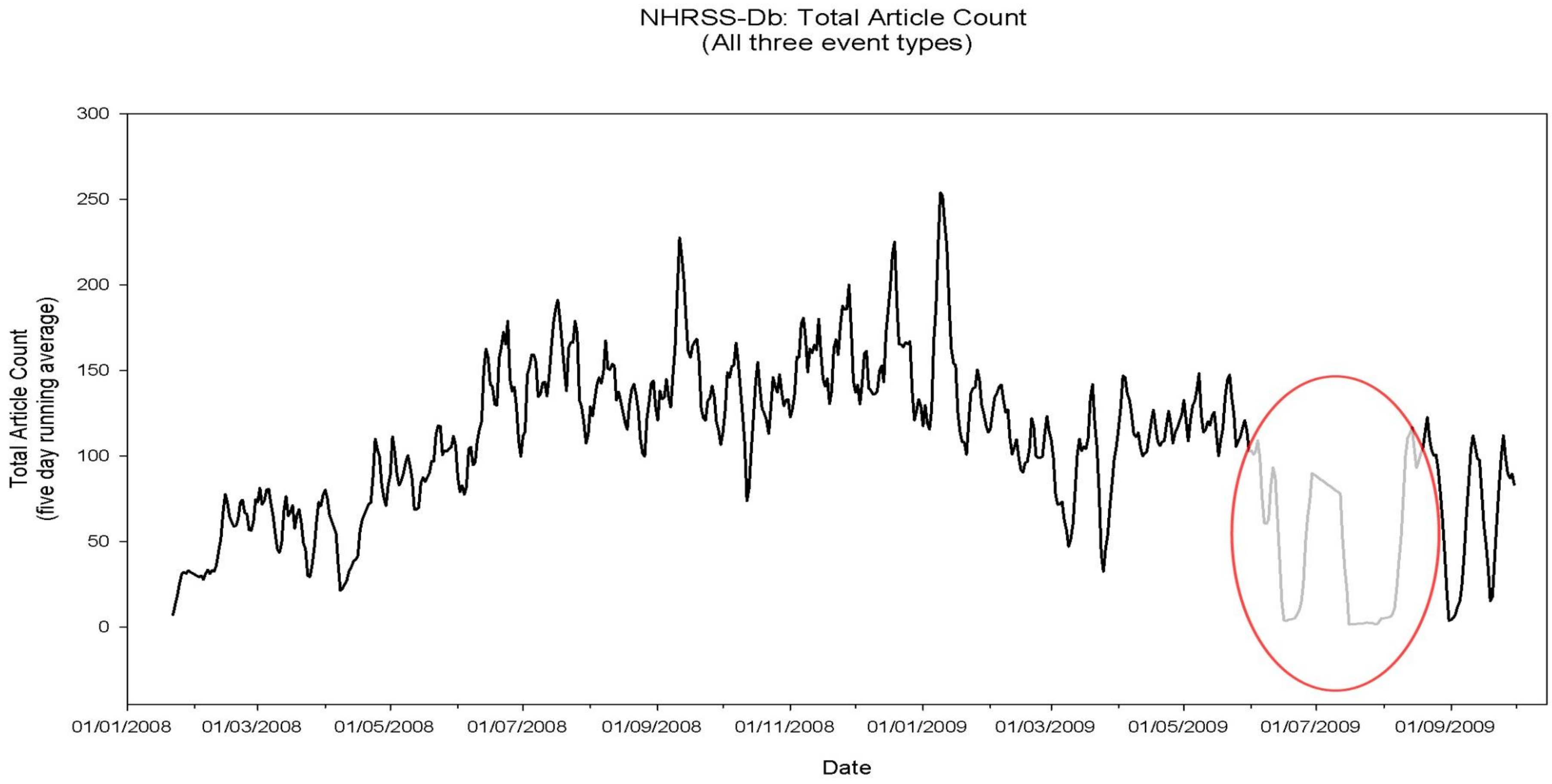

Figure 5.1: Total NHRSS-Db – five-day running average.

Highlighted section indicates an anomaly within the recorded data due to an intermittent fault with the server used to store the downloaded data occurred.

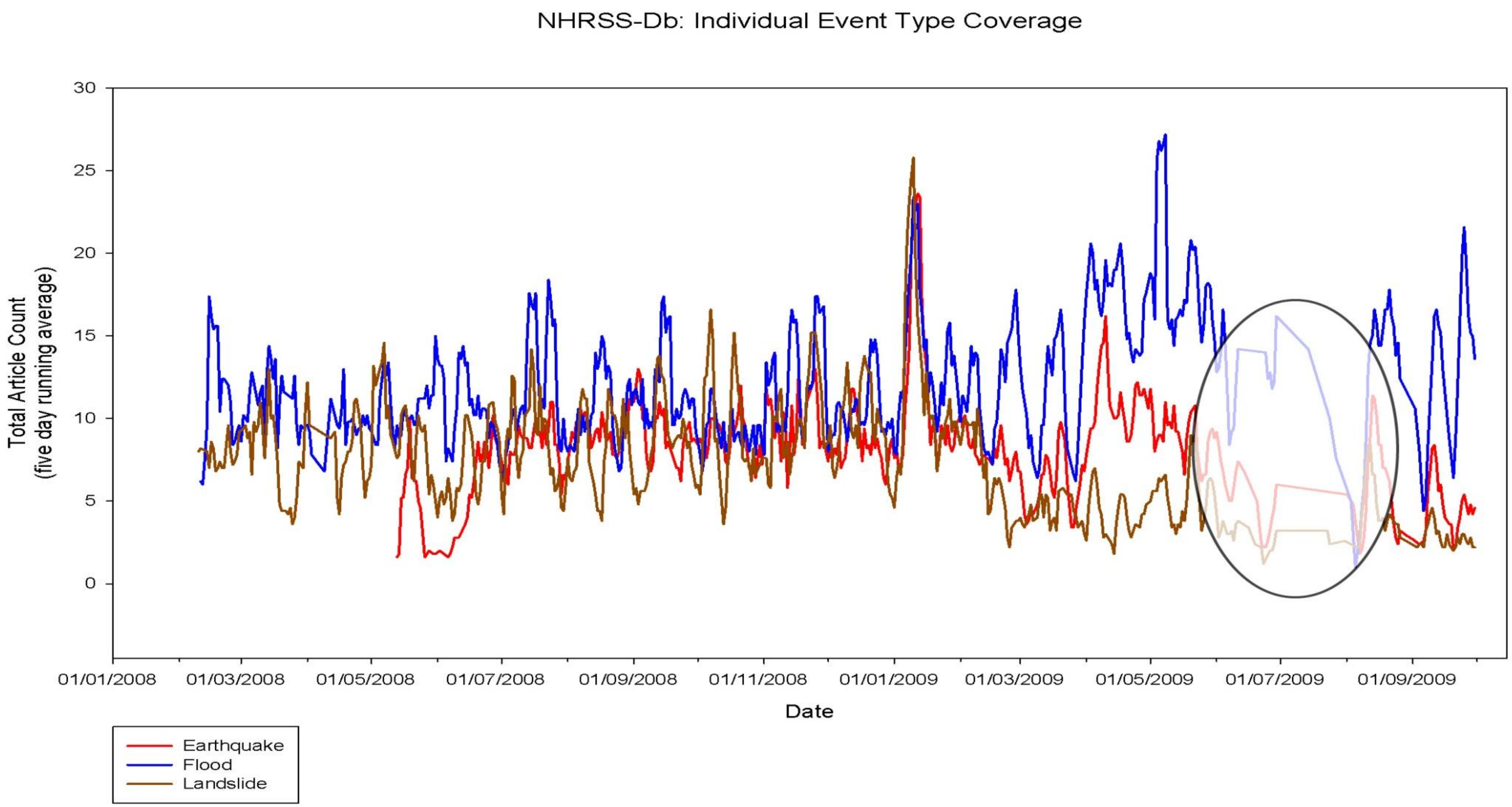

Figure 5.2: NHRSS-Db: Individual event type datasets; earthquake, flood and landslide – five-day running average

Highlighted section indicates an anomaly within the recorded data due to an intermittent fault with the server used to store the downloaded data occurred.

Prior to the inclusion of earthquake coverage on May 13, 2008, a period of low hazard news media coverage is recorded during the month of April, 2008. Analysis of hazard news media during this low coverage period found that a number of natural hazard events did occur, including major flooding across northeast USA; a 5.2Mw earthquake in Illinois, USA, which caused severe damage to a number of buildings; and a series of fatal landslides around the Three Gorges Dam area of China. However, analysis of the wider news media at this time found that a number of major economic and socio-political events occurred throughout late March and April 2008. The launch of a long-range rocket by North Korea and the announcement of future nuclear weapons tests on April 5, 2008, which sparked international debate and condemnation of the state; the 21st NATO Summit in Bucharest on April 3, whereby the ongoing naming dispute between Greece and the Republic of Macedonia and the longstanding differences between NATO and Russia were headlining discussion points; and the formation of a coalition government in Kenya, Africa and the election of Raila Odinga as Prime Minister following months of unrest that led to approximately 1,500 deaths (Reuters, 2008). It is likely that coverage of these events dominated news media interests throughout April, 2008 and made it less likely coverage. The possible reasons behind such variation within news media coverage and the selectivity of the media will be discussed in more detail in Chapter Nine.

Following the low coverage period throughout April, 2008, total recorded news coverage can be seen to increase throughout May and June, 2008. This is, in part, due to the inclusion of earthquake coverage. However, as can be seen in figure 5.2, a simultaneous drop in recorded coverage of all three event types occurred throughout the first seven days of June, 2008. Earthquake coverage drops from 10 articles on May 19, 2008 to one article on June 6, 2008; flood coverage drops from 15 articles on May 31, 2008 to seven articles on June 5, 2008; and landslide coverage drops from 10 articles on May 23, 2008 to three articles on June 7, 2008. Analysis of the wider news media at this time found that ongoing political developments in the Democratic Republic of Nepal regarding the abolition of the Maoist government, a car bomb explosion outside a Danish embassy in Islamabad, Pakistan, which killed five people, and controversial presidential elections in Zimbabwe all dominated the news media and are likely to have led to the drop in recorded hazard news media.

A second simultaneous drop in the coverage of all three event types occurs on July 2, 2008. Earthquake coverage drops from 11 articles on July 24, 2008 to five articles on July 29, 2008; flood coverage drops from 18 articles on July 23, 2008 to eight articles on July 29, 2008; and landslide coverage drops from 12 articles on July 19, 2008 to four articles on July 29, 2008. Analysis of the wider news media at this time found that a series of bombs in Bangalore and Gujarat, India and Istanbul, Turkey between July 25 and July 27, 2008, which killed 20 people and injured 174 in total, dominated the news media.

Following the simultaneous drop in event type coverage on July 29, 2008, total recorded coverage begins to increase and throughout July, 2008 to October, 2008. A prominent peak in total coverage is recorded on September 11, 2008. This peak of 227 articles is in response to an increase in recorded coverage of each event type following a 6.0Mw earthquake in Iran on September 10, 2008, which killed seven people and severely damaged an oil refinery; continued coverage of major flooding across India, which killed in excess of 200 people; and a landslide in northern China on September 10, which killed 258 people.

From October 12, 2008 total recorded coverage can be seen to increase. However, a prominent dip in coverage is recorded between December 26, 2008 and January 1, 2009. This drop in coverage is also recorded each year within the overall internet news media activity dataset, as shown in figure 5.3. This dip in coverage is likely due to a reduction in overall press activity during the Christmas season. However, drops in coverage are not recorded during other religious holidays, such as Eid ul-Fitr (the Islamic holiday celebrating the end of Ramadan) or Yom Kippur and Hanukah (the Jewish Day of Atonement and the Jewish Festival of Lights respectively). This is likely due to the western focus of GNAT-Db and the omission of keywords in both Arabic and Yiddish.

The overall database peak of 254 articles is recorded on January 9, 2009. This peak in recorded hazard news media coverage is due to peaks in all three hazard types relating to reports of an earthquake ‘storm’ in Yellowstone National Park, USA; a series of earthquakes in Pakistan, Irian Jaya, Costa Rica, and Greece; a number of fatal landslides in Guatemala, Indonesia and Nepal, which killed 157 people in total; and major flooding in Fiji, India and Vietnam.

After the January 9, 2009 peak, total coverage begins to decrease, reaching a low of 32 articles on March 25, 2009. This low in hazard news media coverage coincides with a number of major socio-political events that are likely to have dominated news media at this time and overshadowed natural hazard events. For example, a series of bushfires across the state of Victoria, Australia throughout February and March, 2009, which killed 173 and injured 414; a terrorist attack on the Sri Lankan cricket team in Lahore, Pakistan, which led to the deaths of eight people on March 3, 2009; a military *coup d’état* in Madagascar on March 17, 2009; and the sentencing and imprisonment of Josef Fritzl, who enslaved and raped his daughter for 24 years, all dominated global news media.

Following the March 25, 2009 dip in coverage, total recorded coverage can be seen to increase to 147 articles on April 3, 2009 following flash flooding and the failure of the Situ Gintung dam in Indonesia, which killed 99 people on April 1, 2009. Total coverage then increases and remains at a steady high level throughout April and May 2009. This is due to increased earthquake coverage following the L'Aquila, Italy earthquake on April 6, 2009 and an increase in recorded flood coverage following a series of floods in Brazil throughout May, which killed 19 and left 186,000 people homeless and widespread flooding across Southern China, which affected over 2.75 million people.

Between June 4, 2009 and September 30, 2009, the pattern of total recorded coverage can be seen to change dramatically. Little to no coverage is recorded for several days throughout this period, namely June 12, 2009 to June 23 and August 31, 2008 to September 3, 2008. Also, throughout July, 2008 coverage is only recorded on four out of 31 days. It is unclear as to why little to no coverage was recorded on these days as no faults with the Google Alerts system were noted. Analysis of hazard news media coverage during the recorded low coverage periods using GNAT suggests that a number of hazard events did occur. For example, coverage of the June, 2008 Midwest, USA floods continued throughout July, 2008 and heavy rains caused major flooding throughout the Ukraine and Romania in late July; a 6.8Mw earthquake struck Honshu, Japan, on July 23, 2008, injuring 100 people; and landslides in China, Guatemala, Nepal and Vietnam killed 123 people in total. The occurrence of fatal hazard events during the recorded low coverage period, coupled with the lack of faults in the Google Alert system, suggests that an intermittent fault with the server used to store the downloaded data occurred.

5.2. GNAT-Db – Recorded Media Coverage

Due to the methodology used, GNAT-Db allowed for a much greater timeframe to be analysed compared to that of NHRSS-Db. Coverage begins on January 1, 2005 and continues until September 30, 2009. Again, recorded coverage is presented as a running five day average to reduce daily noise and improve trend identification. Like NHRSS-Db, GNAT-Db coverage is divided into the three event types under analysis: earthquakes, floods, and landslides. However, in addition, news media coverage relating to the Iraq War was also downloaded along with a representation of overall internet news media activity. To gauge overall internet news media activity the article 'the' was searched for. As shown in figure 5.3, plotted here on a log scale, overall internet news media activity is fairly constant, with no long-term trend identified.

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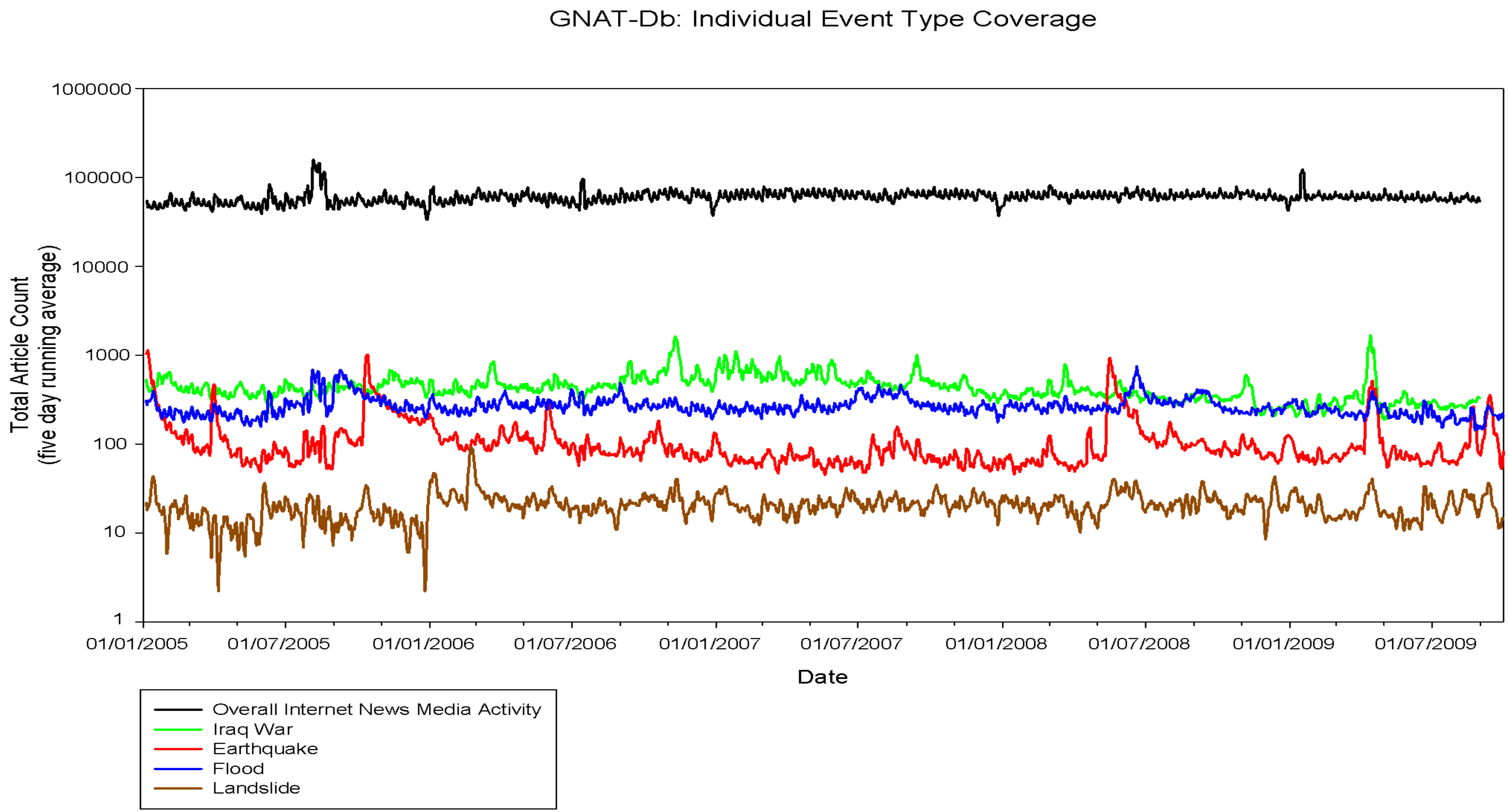

Figure 5.3: GNAT-Db: individual event type datasets - five day running average.

Note log scale.

In comparison to NHRSS-Db, a number of database-wide coverage characteristics within GNAT-Db can be identified. For example, the recorded article count for each event type does not fall to zero, like in NHRSS-Db. This is likely due to the greater number of sources available within GNA and, thus, the increased likelihood that articles pertaining to each event type will be recorded. As a result of the longer timeframe and greater, more consistent, coverage statistics available within GNAT-Db, a number of temporal coverage patterns are discernible, compared to the shorter, more sporadic data recorded within NHRSS-Db. For example, it can be seen in figure 5.3 that the long-term (yearly) rate of recorded coverage is constant for each event type; the medium-term (seasonally/monthly) rate of recorded coverage is more variable; and the short-term (daily) rate of coverage is sporadic. An example of a temporal pattern within GNAT-Db is the clear medium-term seasonal trend visible within the flood dataset, with an increase in coverage throughout Northern Hemisphere summer months. It is also possible to easily identify individual short-term event signatures within GNAT-Db due to the recorded peaks and subsequent gradual declines in coverage. Unlike NHRSS-Db event type coverage, there are obvious visual differences between event type coverage within GNAT-Db. For example, the size of peaks, the global average rate of coverage, and the level of noise during low activity periods differ for each event type.

Total recorded earthquake coverage differs notably from that of recorded flood coverage. Earthquake coverage is characterised by prominent event-led peaks and on the whole, generates media interest rates below that of floods coverage and above that of landslide coverage. However, GNAT-Db total earthquake coverage is dominated by the six prominent peaks (events), whereby earthquake coverage surpasses recorded flood coverage, followed by, what could be argued to be an asymptotic decay curve with duration over a period often more than a year, which is only then overridden after another large magnitude earthquake:

1. Continued coverage of the Sumatra-Andaman earthquake on December 26, 2004, reached peak coverage of 1,146 articles on January 7, 2005, surpassing flood coverage by 846 articles.
2. Coverage of the Nias Earthquake on March 28, 2005 reached 471 articles on April 1, 2005, surpassing flood coverage by 184 articles.
3. Coverage of the Kashmir, Pakistan Administered Kashmir earthquake on October 10, 2005 reached peak coverage of 1,020 articles on October 14, 2005, surpassing flood coverage by 649 articles.
4. Coverage of the Yogyakarta earthquake on May 27, 2006 reached 298 articles on June 1, 2006, surpassing flood coverage by 35 articles.

5. Coverage of the Sichuan, China earthquake on May 12, 2008 reached peak coverage of 932 articles, surpassing flood coverage by 781 articles.
6. Coverage of the L'Aquila, Italy earthquake on April 6, 2009 reached peak coverage of 517 articles on April 16, 2009, surpassing flood coverage by 90 articles.

In comparison to earthquake events, flood events, and to a lesser extent landslide events, are characterised by longer duration and lower total/peak coverage. The physical nature of flood events, and to lesser extent landslides, means that such events are often predictable; incoming storms and monsoon seasons can be tracked, rainfall intensity can be predicted, and slope integrity can be calculated. This means that the media and the public are able to prepare for the events and coverage will build up over time.

Like NHRSS-Db flood coverage, recorded GNAT-Db flood coverage remains on average higher than both recorded earthquake and landslide coverage. Flood coverage appears consistent, with little variation in the week-on-week range of recorded coverage. A seasonal trend in total recorded flood coverage is noted, whereby total coverage increases during the Northern Hemisphere summer months of June to September. This trend will be discussed in greater detail in my following chapter.

In comparison to relatively high flood and earthquake coverage, recorded landslide coverage is low in total and, unlike recorded earthquake coverage, landslide events are not easily identified as peaks within the recorded landslide coverage dataset. The exception to this is the coverage peak recorded for the Southern Leyte, Philippines landslide on February 22, 2006 when recorded landslide coverage peaked at 90 articles and surpassed recorded earthquake coverage by five articles. The Southern Leyte landslide killed 1,126 people and is by far the single largest landslide event recorded within GNAT-Db.

Recorded GNAT-Db landslide coverage represents the lowest recorded event type. This adheres to the CRED rank order of global disaster impacts, which could similarly be argued to be a measure of global awareness. However, the detail and sensitivity of the GNAT-Db may give insight into the degree of mis-attribution of fatality cause in disasters – for example, the earthquake trigger being assigned the net fatalities during an earthquake where in fact landslides may account for many of these. The landslide dataset begins with a period of high variability, with recorded landslide coverage throughout 2005 displaying a very different coverage pattern to that of following years. Coverage appears more erratic, with two notable and substantial drops in total coverage on April 7 and December 26, 2005, where coverage falls to two articles on both occasions. Analysis of wider news media focus around both dates found that, on April 7, 2005, the wider news media was focused on the death of Pope John Paul II on April 2, 2005, and on December 26, 2005, the media were focused on events of a festive nature.

Following the recorded variability in 2005, recorded landslide coverage throughout 2006 to 2009 appears less erratic, with little short-term variation. It is unclear why data recorded throughout 2005 demonstrates such variability and is, on average, lower compared to following years. This may reflect a general increase in both absolute media coverage, in combination with enhanced media and society sensitivity to hazards. However, comparison of the earthquake dataset and landslide dataset shows that when landslide coverage decreases, it commonly coincides with an increase in earthquake coverage following a major earthquake event, namely the Sumatra-Andaman earthquake on December 26, 2004, the Nias Earthquake on March 28, 2005, and the Kashmir, Pakistan Administered Kashmir earthquake on October 10, 2005. This selective characteristic of event superimposition and sensitisation within the media will be discussed further throughout this study.

5.3. NHRSS-Db – Recorded Hazard Events

Spatial information regarding the distribution of recorded hazard events within both NHRSS-Db and GNAT-Db is presented in figures 5.4 and 5.5. In conjunction with this, summary information for each of the three event type datasets within both databases is presented in table 5.1 and the largest events recorded within each event type within each database are presented in table 5.2.

It must be noted that the discrepancy between total event type NHRSS-Db figures presented above and individual event analysis figures presented herein is due to the differing methods used to collate the entire database and individual event datasets, as outlined in Chapter Four, most notably the inherent selectivity of the RSS feed, which can be viewed in both a positive (noise filtering) or negative (bias inducing) manner.

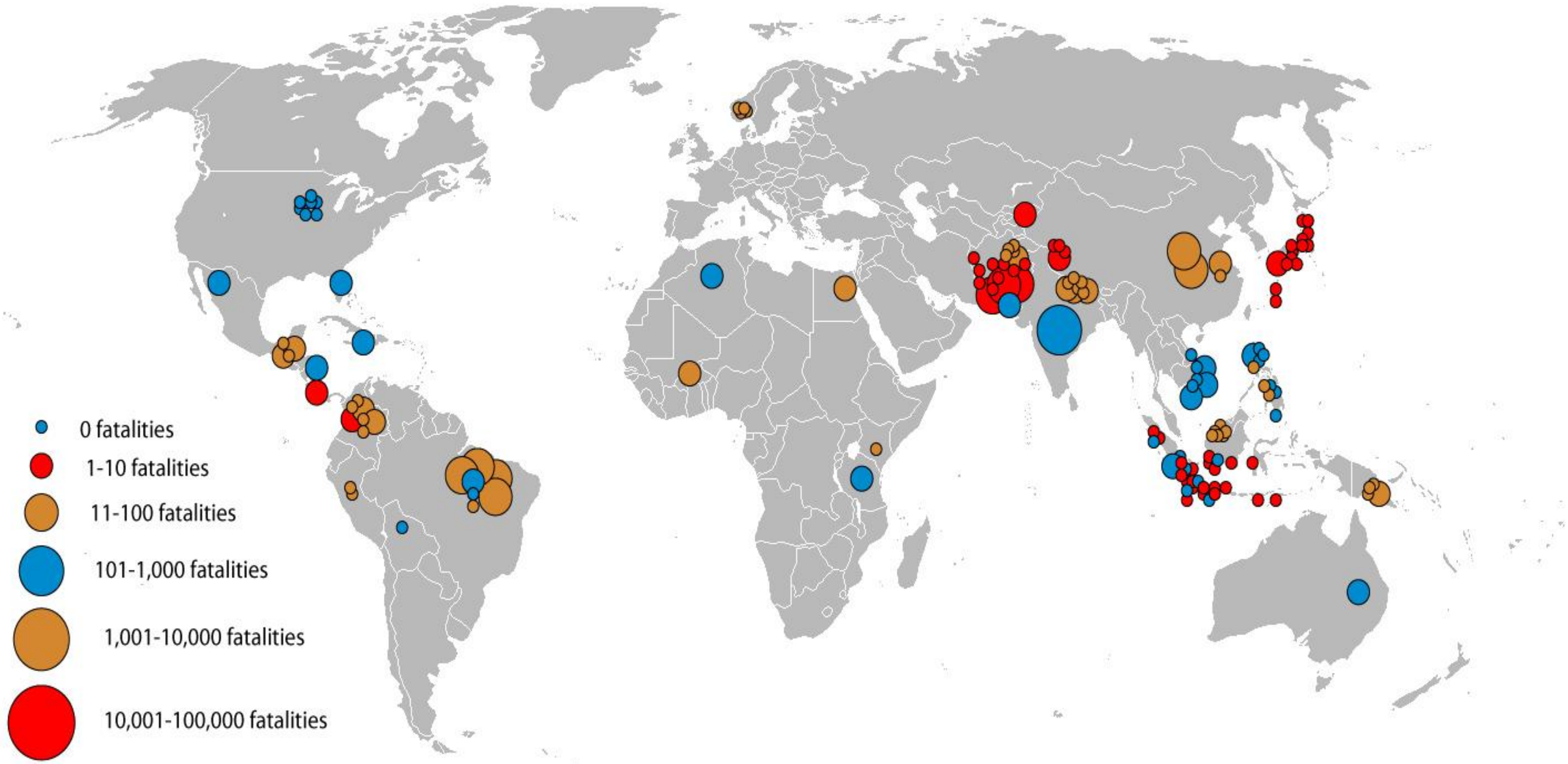

Figure 5.4: NHRSS-Db: Recorded event location map

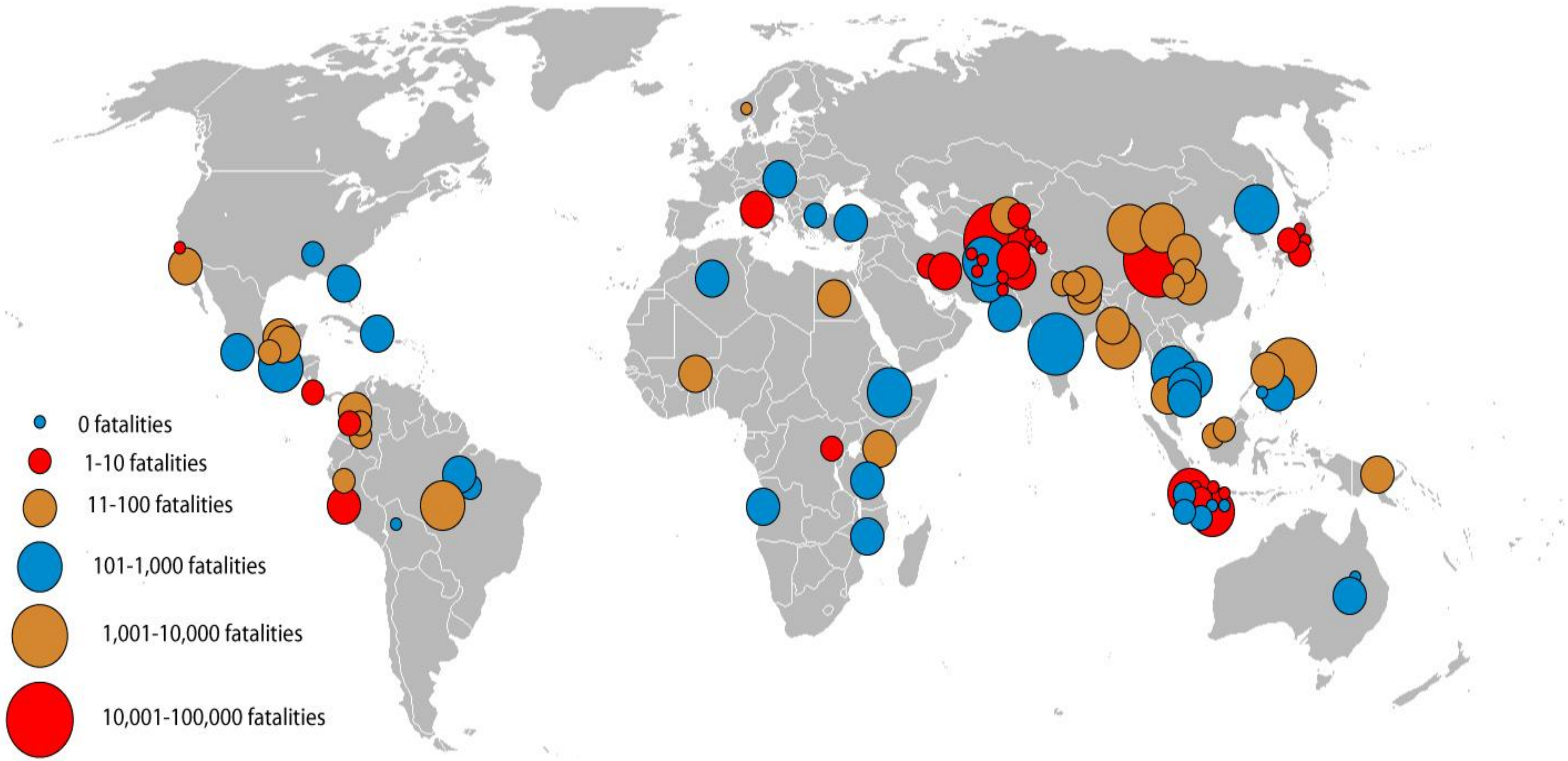

Figure 5.5: GNAT-Db: Recorded event location map

	NHRSS-Db				GNAT-Db			
	EQ	**FL**	**LS**	**Total**	**EQ**	**FL**	**LS**	**Total**
Date Range	13/05/08 - 30/09/09	23/01/08 - 30/09/09	23/01/08 - 30/09/09	23/01/08 - 30/09/09	01/01/05 - 30/09/09	01/01/05 - 30/09/09	01/01/05 - 30/09/09	01/01/05 - 30/09/09
No. of recorded events	59	40	59	158	33 (31)	33	33	99 (97)
Total Recorded Fatalities	706	3,241	1,532	6,779	152,389 (9,177)	4,453	2,442	159,284 (16,072)
Average Total Article Count	1,111	847	726	1,014	1153 (260)	174	67	465 (165)
Average Peak Article Count	622	216	308	520	100 (60)	17	12	43 (29)
Average Event Duration (days)	4	18	5	8	29 (12)	23	16	23 (18)

Figure 5.1: Table showing summary information for recorded hazard events within NHRSS-Db and GNAT-Db

Bracketed figures represent those calculated excluding the Kashmir, Kashmir Administered Pakistan and Sichuan, China earthquakes.

	NHRSS-Db			GNAT-Db		
	EQ	**FL**	**LS**	**EQ**	**FL**	**LS**
Event	Pakistan EQ 3	Bihar Floods	China LS 1	Kashmir EQ	Bihar Floods	Leyte LS
Date Range	27/10/2008 – 16/12/2008	12/07/2008 – 23/02/2009	08/09/2008 – 21/10/2008	08/10/2005 – 12/05/2006	25/08/2008 – 28/09/2008	16/02/2006 – 06/04/2006
Total Fatalities	300	2,400	276	74,500	2,400	1,126
Total Article Count	15,107	14,398	17,575	18,806	1000	533
Peak Article Count	5,832	2,136	3,706	1,110	73	59
Event Duration (days)	51	227	44	218	35	50

Figure 5.2: Table showing summary information for the largest events recorded within the NHRSS-Db and GNAT-Db.

As can be seen in figure 5.4, the majority of hazard events recorded within NHRSS-Db are distributed throughout Asia. In total, 115 (72%) of 158 events were recorded throughout Asia, with 98 (62%) recorded throughout South and Southeast Asia. Of the remaining 43 events, 33 (20%) are distributed throughout the Americas; with 28 (17%) throughout Central and South America and 9 (5%) events in North America, five (3%) events are recorded in Africa, four (2%) events are recorded in Europe, and one (0.5%) event is recorded in Australia. This trend in the location of event occurrence is similar to that presented by CRED (see Em-Dat natural disaster trends, 2009[4]) and Petley *et al*. (2005), with the majority of events located throughout Asia. However, in comparison to the data presented by CRED, Africa does not record a significant number of events. This is likely due to a number of socio-political issues and will be discussed in greater detail in Chapter Nine.

The majority of events, 113 (71%) of 158, recorded fatalities of 10 or below and only 12 (7%) events recorded fatalities in excess of 100. Again, this scaling in event magnitude is similar to that presented by CRED, with the majority of hazard events causing few fatalities and a relatively small number of events causing large numbers of casualties.

In total, 6,779 fatalities were recorded within NHRSS-Db. Flood events represent the majority of these fatalities: 3,241 (48%). However, 2,400 of those 3,241 (74%) recorded flood fatalities are the result of one event: the Bihar, India floods of September 2008. Flood events also represent the event type with the longest event duration: 18 days on average. When the Bihar, India floods are removed this average drops to 12 days, but remains much higher than both average landslide and earthquake duration; five days and four days respectively.

The relatively low average earthquake and landslide event duration within the NHRSS-Db is due to 33 of the 59 (55%) recorded earthquake events and 29 of the recorded 59 (49%) landslide events lasting only one day. When these events are omitted, the average earthquake event duration increases to nine days and landslide duration increases to 10 days. In comparison, 12 of the 40 (30%) flood events were one-day events. It is likely that fewer one-day flood events were recorded due to the prolonged physical duration or characteristics of flood events compared to those of earthquakes and landslides. Note here, I refer to the period during which the event is perceived to be dynamic or actually ‘happening’, which is not synonymous with the inevitable duration of the event aftermath. For example, earthquakes, and to a lesser extent landslides, are rapid onset events, the effects of which usually occur at the time of the event. In comparison, floods usually occur over a number of days, even weeks and

[4] Available online at: http://www.emdat.be/natural-disaster-trends

months, often with a lengthy build up period and a continued actively damaging period as floodwaters recede. Although not possible with the resolution of the present dataset, I would hypothesize that, to a certain extent, the manner with which media reflects this aftermath period does reflect the physical processes in action. So, for example, the decay of media interest, if data of a high enough resolution was available, I suggest would reflect a similar decay curve function to that of infiltration and run-off of the floodwaters.

All of the 33 one-day earthquake events recorded by NHRSS-Db were non-fatal. In comparison, the 29 one-day landslide events recorded by the NHRSS-Db totalled 556 fatalities (23% of the total 2,442 fatalities recorded). Non-fatal landslides are therefore unlikely to be captured in the media, despite their relative frequency, and relative risk to society. For example, the Three Gorges Dam, China landslide of April 20, 2008 resulted in 200 fatalities but only recorded one day's coverage. By comparison, a number of earthquake and flood events of equal or less magnitude recorded coverage for much longer. For example, non-fatal floods in the Philippines on January 2, 2009 recorded 16 days of coverage. This raises the question: why do some fatal landslides receive disproportionately less coverage compared to events of equal or less magnitude? This issue is a focal point of this study and will be exhibited throughout my results chapters and will be discussed at length throughout Chapter Nine.

Despite floods representing the most fatalities and the longest events within NHRSS-Db, earthquake events represent the highest average total and peak article counts. Average total article count for earthquake events is 1,110 articles, much higher than both flood total count (847 articles) and landslide total count (726 articles). Average earthquake event peak article count (622 articles) is over double landslide peak count (308 articles) and just under three times flood peak count (216 articles), despite representing substantially fewer fatalities. It is likely that the high average total and peak article counts recorded by earthquake events are due to the geophysical nature of earthquakes. Earthquakes occur without warning and thus shock is a major component of the event. This is likely the basis of the social interest surrounding earthquakes, and the reason why earthquakes hold public appeal and feature prominently within the media, despite rarely causing fatalities (Gaddy and Tanjong, 1986; Smith, 1992; Barrett, 2000). Present technology is also such that any earthquake anywhere in the world can be recorded remotely and reported, which is not the case for landslides and floods.

The three largest events recorded within NHRSS-Db, in terms of magnitude (fatality number) and total article count are the 2008 Balochistan, Pakistan earthquake, the

2008 Bihar, India floods, and the 2008 Shanxi Province, China landslide. In total, these three events account for 2,976 fatalities, 43% of the total recorded fatalities. Event coverage parameters - total recorded article count, peak recorded article count and event duration - for each event are substantially higher than the average. For example, total article count for the September 8, 2008 Shanxi Province, China landslide is 17,575 articles, 24 times greater than the average total article count for a landslide event recorded in NHRSS-Db.

5.4. GNAT-Db – Recorded Hazard Events

As can be seen in figure 5.5, the overall spatial distribution of hazard events recorded within GNAT-Db differs only slightly to those within NHRSS-Db. Again, the majority of events, 63 (63%) of 99, are recorded within Asia, with 38 (38%) recorded with South and Southeast Asia. Following this, 20 (20%) events are recorded throughout the Americas; 4 (4%) events in North America and 16 (16%) events throughout Central and South America. However, in comparison to NHRSS-Db, more events are recorded throughout Africa, Europe and Australia, 9 (9%), 5 (5%) and 2 (2%) respectively. Again, this trend in event location occurrence is similar to that presented by CRED but Africa remains underrepresented.

Compared to NHRSS-Db, events within GNAT-Db are, on average, much larger in magnitude. Fewer low fatality (zero to 10) events were recorded, 39 (39%) compared to 113 (71%) in NHRSS-Db, and more medium (11 to 99) and high (100+) fatality events were recorded; 38 (38%) compared to 34 (21%) and 21 (21%) compared to 12 (7%) respectively. The medium to high fatality focus of GNAT-Db is due to the exclusion of low coverage and low magnitude events outlined in Chapter Four.

Average event coverage recorded within GNAT-Db is, overall, much lower than that recorded within NHRSS-Db. For example, the 2008 Bihar, India floods is the largest recorded flood event in both databases. However, NHRSS-Db recorded 2,136 articles at the peak of coverage for this event, but GNAT-Db only recorded 73 articles. Total coverage reached 14,398 articles in NHRSS-Db and the event was recorded for 227 consecutive days. In comparison, GNAT-Db only recorded 1,000 articles and coverage only lasted for 35 consecutive days.

This discrepancy in coverage statistics is due to the two slightly different collation methods used by both databases. Although both databases are based upon Google News searches, NHRSS-Db records the individual news article and all the websites and news agencies that disseminate that story (in its entirety or in part), whereas GNAT-Db only records the individual articles. This issue, along with its implications, will be discussed in Chapter Ten.

Due to the extended timeframe available within GNAT-Db, a number of large earthquake events were recorded and chosen for analysis, namely the October 10, 2005 Kashmir earthquake and the May 12, 2008 Sichuan, China earthquake. Due to the magnitude of these two events they represent 143,212 (94%) of the recorded 152,389 fatalities and skew various aspects of the GNAT-Db earthquake dataset upwards. For example, average total article count (1,153 articles) is over six times higher than flood coverage (174 articles) and 17 times higher than landslide coverage (67 articles). The average earthquake peak article count (100 articles) is also nearly six times higher than average flood peak count (17 articles) and nearly nine times higher than landslide peak count (12 articles).

When the Kashmir and Sichuan earthquakes are omitted, floods represent the event type with the longest duration, 23 days on average, followed by landslides, 16 days, and earthquakes, 12 days (29 days including the Kashmir and Sichuan earthquakes). This is the same pattern demonstrated within the NHRSS-Db. However, as can be seen in table 5.1, average GNAT-Db duration figures are much higher the those recorded within NHRSS-Db. The reason for this is a combination of the differing methods used for event selection and those used to collate both databases. NHRSS-Db is based upon a system of Google Alerts, whereby a selection of news reports are delivered to the user on the day they are published. In comparison, GNAT-Db is based upon GNA, which offers a wider selection of news sources. The availability of a greater number of sources within GNA allows for more articles from more sources to be accessed. As duration appears to increase with the geographical breadth of coverage, event duration from within GNAT-Db is invariably longer. Also, the event selection criteria used in the production of the GNAT-Db meant no events lasting less than four days were included. This was to allow suitable regression analysis to be performed on the individual event datasets, and to enable the isolation of media response to individual events, which would be impossible otherwise. Had these events been included, it is likely that average event duration would have been lower and would have been similar to that recorded within NHRSS-Db.

When the Kashmir and Sichuan earthquakes are omitted from the dataset, earthquake events represent 9,177 (57%) of the total 16,072 recorded fatalities. However, 5,778 (36%) of the total recorded earthquake fatalities correspond to the May 27, 2006 Yogyakarta, Indonesia earthquake. Following earthquake fatalities, floods and landslides represent 27% and 15% of total recorded fatalities respectively.

The three largest events recorded within each of the event type datasets within GNAT-Db are the October 10, 2005 Kashmir earthquake, the 2008 Bihar, India floods and

February 17, 2006 Southern Leyte, Philippines landslide. These three events represent 78,026 (49%) of the 159,284 total recorded fatalities. As with the three largest events recorded within NHRSS-Db, these three events display event coverage parameters above the average. For example, the duration of coverage recorded for the Kashmir earthquake was 218 days, seven times longer than the average duration for an earthquake event recorded in GNAT-Db, 29 days. The peak article count recorded for the Bihar, India floods was 73 articles, four times greater than average peak article count recorded for a flood event recorded in GNAT-Db. The total article count for the Southern Leyte, Philippines landslide is 533 articles, seven times greater than the average total article count for a landslide event in the GNAT-Db, 67 articles. Sources within GNA allow for more articles from more sources to be accessed. As duration appears to increase with the geographical breadth of coverage, event duration from within GNAT-Db is invariably longer. Also, the event selection criteria used in the production of the GNAT-Db meant no events lasting less than four days were included. This was to allow suitable regression analysis to be performed on the individual event datasets, and to enable the isolation of media response to individual events, which would be impossible otherwise. Had these events been included, it is likely that average event duration would have been lower and would have been similar to that recorded within NHRSS-Db.

This chapter will examine the short-term and long-term temporal changes within recorded coverage of the three individual event types within both NHRSS-Db and GNAT-Db. Focus will be on variations in coverage on a year-by-year basis, the examination of seasonal trends within each event type, and the comparison of recorded coverage levels and recorded fatality data.

6.1. NHRSS-Db – Earthquake Coverage

6.1.1. Recorded News Media Coverage – 2008

Figure 6.1 shows individual event type coverage over the 20 month analysis period, January 23, 2008 to September 30, 2009. As before, data is presented as a five-day running average to reduce daily fluctuations and rendering more visible any short- to medium- to long-term temporal patterns.

NHRSS-Db earthquake coverage begins on May 13, 2008 following the Sichuan, China earthquake. An initial peak of 10 articles occurs on May 19, 2008, relating to the Sichuan earthquake. After this point, a low coverage period is recorded between May 26, 2008 and June 6, 2008, whereby only 12 articles are recorded during this 12-day period. A simultaneous low period is recorded in the flood and landslide datasets. Analysis of wider news media trends at the time suggests that coverage of the Danish embassy bombings in Islamabad, Pakistan on June 2, 2008 may have dominated news media at this, decreasing recorded natural hazards coverage.

Excluding the aforementioned low period in coverage, 2008 coverage shows very little variance. The range in article coverage throughout the 2008 NHRSS-Db earthquake dataset is low, eight articles. Two overall peaks of 13 articles are recorded: September 3, 2008, following a 6.1Mw earthquake in Southwest China on August 30, 2008, which killed 32 people; and November 25, 2008, following reports that Chinese officials had formerly identified 19,000 of the 69,227 people killed in the May 12, 2008 Sichuan, China earthquake on November 21, 2008 and coverage of a 6.8Mw earthquake off the Southwest coast of Sumatra, Indonesia on November 22, 2008.

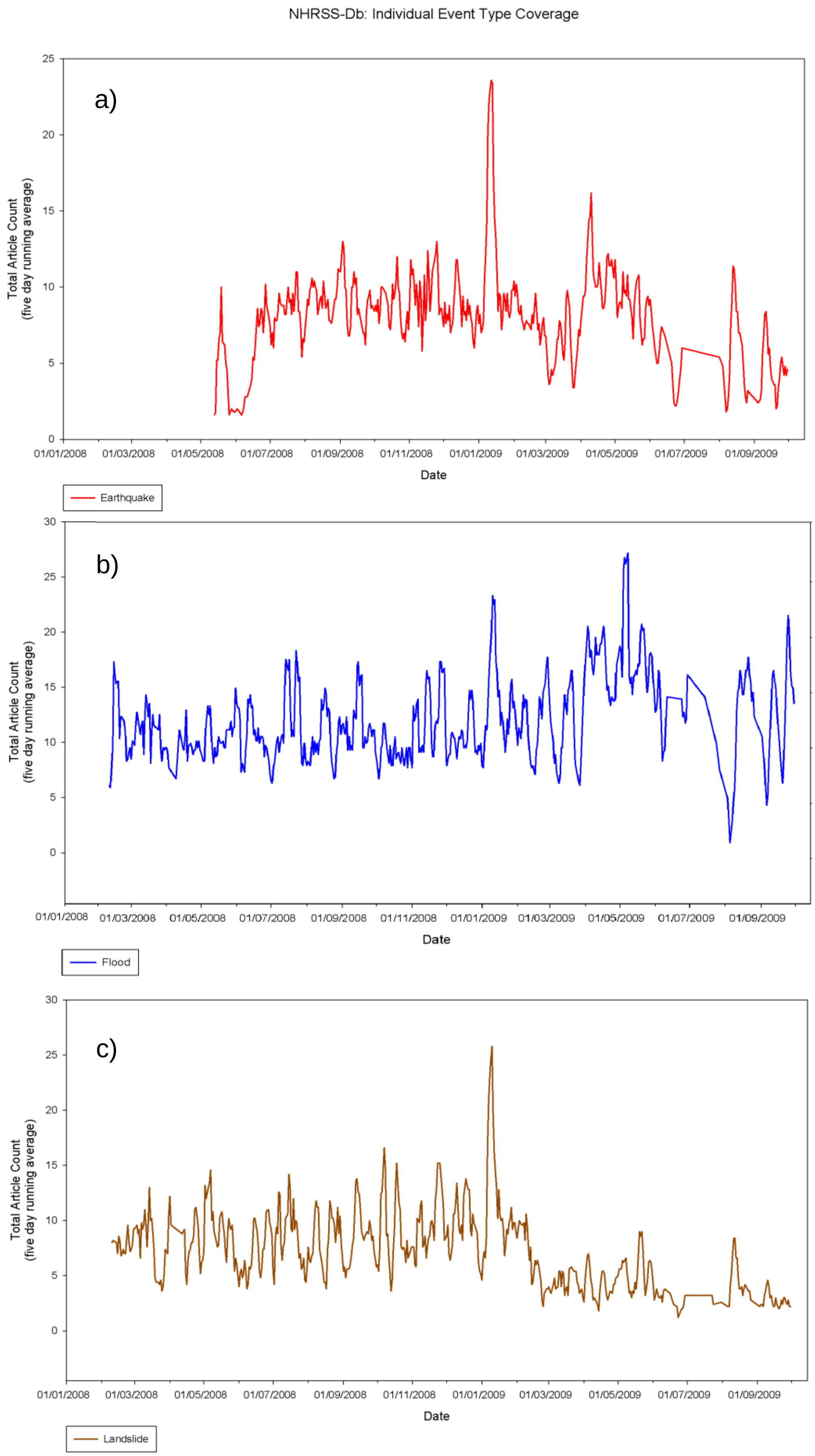

Figure 6.1: Individual NHRSS-Db event type coverage

a) Earthquake b) Flood c)Landslide

		Earthquake				Flood				Landslide			
	Season	Average Daily Article Count	Low	High	Range	Average Daily Article Count	Low	High	Range	Average Daily Article Count	Low	High	Range
2008	Summer	8.3	1	22	21	11	2	35	33	8.1	1	26	25
	Winter	9.5	1	39	38	12.3	1	35	34	9.5	1	42	41
2009	Summer	5	1	17	16	12.4	1	28	27	3.3	1	11	10

Table 6.1: Table showing NHRSS-Db summary seasonal data

6.1.2. Recorded News Media Coverage – 2009

The overall dataset peak of 23 articles is reached on January 12, 2009. This coincides with coverage of a 6.1Mw earthquake in Costa Rica on January 8, 2009, which killed 40 people, and media recapping of the previous year's events, namely the Sichuan, China earthquake. Following this peak, coverage declines rapidly, reaching eight articles on January 18, 2009, six days after the peak. Coverage continues to decline, reaching three articles on March 4, 2009. There is then a momentary escalation in coverage following small earthquakes in Australia, Indonesia, Japan and USA but again coverage declines to three articles on March 25, 2009. Coverage can then be seen to grow over the following 14 days, reaching a peak of 16 articles on April 10 following the L'Aquila, Italy earthquake on April 6, 2009.

Following coverage of the L'Aquila, Italy earthquake, recorded coverage then decreases slowly over the following 73 days, reaching a low of two articles on June 22, 2009. Between June 22, 2009 and August 7, 2009 only 10 data points are recorded out of the possible 46. Examination of the database, coupled with investigation of news media at the time, revealed that a number of database collation errors may have occurred, whereby no Google Alerts were recorded. Following this low period, a peak of 17 articles is recorded on August 11, 2009 following a 6.1Mw earthquake in Tokyo, Japan on August 9, 2009. This reaffirms previous observations of a gradual decline in news media coverage of earthquakes which appears to occur over a timescale approaching in excess of a year, only interspersed by subsequent high magnitude earthquake events.

6.1.3. NHRSS-Db Earthquake Summary

Earthquake coverage appears predominantly event led. However, a near-constant base level of earthquake coverage is apparent due to the regular occurrence, and subsequent reporting of, earthquake events, combined with what appears to be a perpetual re-reporting of previous events. The memory of both recent and historic events is also observed to contribute to this background level of interest in the media of earthquakes. It appears that earthquakes of all magnitudes, both in terms of physical intensity and impact, are recorded, possible as a function of the relatively advanced technology of earthquake recording due to the global scale and sensitivity of these methods.

The earthquake dataset is dominated by two prominent peaks in coverage: the January 12, 2009 peak of 23 articles following coverage of the January 8, 2009 Costa Rica earthquake coupled with New Year news media recapping of the May 12, 2008 Sichuan, China earthquake; and the April 10, 2009 peak of 16 articles following coverage of the April 6, 2009 L'Aquila Italy earthquake. These peaks demonstrate very different characteristics: the January 12 peak displays a rapid build up and decay, whereas the April 10 peak displays a slower build up followed by a progressive decay over several months. It is believed the slower decay in coverage of the April 10 peak is due to the higher magnitude and interest surrounding the April 6 L'Aquila, Italy earthquake compared to that surrounding the January 8 Costa Rica event. It appears that, when a prominent peak in earthquake coverage occurs, in response to a large event like the L'Aquila, Italy earthquake, coverage declines much slower, and often decreases to a rate below that before the event. It appears that news media interest in earthquake events as a whole decreases over time following a large event, with general earthquake news and the reporting of smaller events becoming less newsworthy over time. In effect, news media attention becomes saturated, to the point where an earthquake event simply is not news, unless it is an event larger than the previous. This apparent decrease in earthquake news media interest following a large event can also be seen in the GNAT-Db earthquake dataset and will be discussed further in section 6.4.

6.2. NHRSS-Db – Flood Coverage

6.2.1 Recorded News Media Coverage - 2008

On average, total recorded flood news media coverage is higher than both earthquake and landslide coverage throughout the 20 month analysis period. However, peaks in earthquake and landslide coverage surpass flood coverage six and 11 times, respectively. Overall, recorded flood coverage throughout 2008 appears very different to that recorded in 2009, with coverage appearing much lower and less erratic. A range in recorded coverage of 12 articles is recorded compared to 26 in 2009.

Peaks in coverage recorded throughout 2008 appear more prolonged, with slower build up and decay periods compared to those in 2009. The overall peak in 2008 was 18 articles and was recorded on July 23, 2008, following a flood at a coal mine in Guangxi Province, China on July 22, 2008, which killed 56 people. Five other prominent peaks are recorded throughout the year, each recording 17 articles, one article fewer than the overall peak:

1. February 15, 2008 relating to coverage of floods in Jakarta, Indonesia, which killed 12 people on February 8, 2008 and major flooding across Bolivia on February 13, 2008, which killed 60 people.
2. July 14 and 17, 2008 following coverage of a flood in a coal mine in Shanxi Province, China on July 14, which killed 10 people, and the announcement on

July 17 that areas of England will receive £31 million from the Government to aid rebuilding after the 2007 floods.

3. September 15, 2008 following continued coverage of widespread flooding across Northern India throughout September, which killed 200 people.
4. November 25, 2008 following coverage of major flooding and landsliding across Brazil, which killed 79 people.

6.2.2. Recorded News Media Coverage - 2009

Like earthquake coverage, recorded flood coverage increases dramatically in early January, 2009, following coverage of flooding across mid-West USA in the first week of January and New Year reports recapping flood events throughout 2008 during the depths of the Northern Hemisphere winter. In comparison to 2008, recorded flood coverage throughout 2009 displays a much greater range in recorded article counts, with a peak of 27 articles being recorded on May 8, 2009, and a low of one article recorded on August 5, 2009. This range of 26 articles is the highest recorded out of the three event types under examination, with landslide coverage recording a range of 24 and earthquake coverage recording 22.

Coverage increases rapidly on March 27, 2009 following flooding across mid-Western states of USA. Coverage remains at a high level throughout April following major flooding across Eastern Africa before reaching the overall dataset peak of 27 articles on May 8, 2009 following widespread flooding across Brazil, which displaced 270,000 people.

Coverage of all three event types becomes very erratic throughout June 29, 2009 and August 5, 2009, with only four data points recorded within this 36-day period. As discussed with regards to the NHRSS-Db dataset, due to the simultaneous decrease in recorded coverage of all three event types, it is likely that an error occurred within the recording and collation of the NHRSS-Db at this time.

As with all three datasets, flood coverage begins to increase after August 5, reaching 16 articles by August 14 following major flooding and landsliding across Taiwan triggered by Typhoon Morakot, which killed 500. The final peak recorded in 2009 is 21 articles on September 25 in response to major flooding throughout Cambodia, the Philippines and Vietnam triggered by Tropical Storm Ketsana, which killed 350 people.

6.2.3. NHRSS-Db – Flood Summary

It appears that the peaks recorded within total NHRSS-Db flood coverage are not a function of event magnitude. The overall dataset peak coincides with a non-fatal event in Brazil and a number of fatal events recording fatalities in excess of 350 record much lower peaks. It also appears that follow up reports regarding the economic cost of previous events record high volumes of coverage.

A number of recorded events also include reports of landslides causing fatalities. However, the actual cause of death, be it a flood or landslide, is rarely reported. Thus, a level of miscounting and replicating of stories is apparent within the flood and landslide datasets. It is unclear as to how this affected the overall database and will be discussed further throughout this study.

It was expected that a considerable difference would be noted between summer and winter coverage. However, this was not the case. Monthly average coverage varies little throughout 2008. In comparison, coverage in 2009 increases markedly throughout April to June but, due to the possible collation error, coverage throughout peak summer months (July through September) is inadequate to draw such conclusions.

6.3. NHRSS-Db – Landslide Coverage

6.3.1. Recorded News Media Coverage - 2008

Recorded landslide coverage varies little on a month-to-month basis throughout 2008, with no seasonal pattern displayed. The range in coverage is 13 articles, with a peak of 16 articles recorded on October 7, 2009 and a low of three articles recorded on October 13, 2009. This dataset does not display the apparent seasonality in that observed by Petley *et al*. (2005), who demonstrated a peak in fatalities associated with the onset and duration of the South Asian and East Asian summer monsoon periods respectively.

Five prominent peaks are visible throughout the dataset, corresponding with five landslide events:

1. 13 articles were recorded on March 13, following a landslide in Southwest China on March 11, 2008, which killed 20 people.
2. 14 articles were recorded on May 7, following coverage of a landslide in Kashmir, which killed 12 people on May 1, 2008.
3. 14 articles were recorded on July 15, following a landslide in Bangladesh on July 3, 2008, which killed 10 people and a landslide in Southwest China on July 8, which killed nine people.
4. 16 articles, the overall 2008 peak, were recorded on October 7, following continued coverage of a landslide in Shanxi Province China on October 1, 2008, which killed 41 people.
5. 15 articles were recorded on November 23, following a landslide in the Philippines on November 22, which killed five people.

The above events demonstrate the lag time inherent within the coverage of landslide events. All but one of the landslide events referenced are within East and Southeast Asia. The location of the event may be a function of the time required to reach peak coverage. For example, the March 11 Southwest China landslide and the November 22 Philippines landslide occurred in highly populated areas and reached peak coverage within two days. In comparison, the May 1 Kashmir landslide occurred in a sparsely populated area with limited media networks and so coverage took longer to reach peak, six days.

6.3.2. Recorded News Media Coverage – 2009

Recorded NHRSS-Db landslide coverage throughout 2009 appears very dissimilar to that of 2008 coverage. 2009 coverage begins on low of four articles recorded on January 1. This quickly increases, reaching the overall dataset peak of 25 articles on January 10. This peak in coverage is due to media focus of the Guatemala landslide on January 7, 2009, which killed 37 people. Following the peak in coverage, recorded landslide coverage begins to decline. As shown in figure 6.1, monthly average recorded coverage throughout 2009 is considerably lower than corresponding monthly coverage throughout 2008.

Recorded 2009 NHRSS-Db landslide coverage does not demonstrate the consistent, and relatively high range, peak-trough distribution of the 2008 dataset. Excluding the overall peak on January 10, 2009, landslide coverage for the rest of the year does not reach higher than 11 articles, with the majority of coverage below six articles. Average monthly coverage levels can be seen to decrease throughout the year, from a high of 12 articles in January to a low of 2 in September.

As previously discussed with regards to flood coverage (throughout section 6.2), landslide coverage details a dip in recorded articles throughout July. An overall dataset low of one article is recorded on June 23, 2009. Coverage then increases to three articles on June 29 and remains at this level until July 23 as no data points are recorded during this 24-day period. Coverage then reaches eight articles on August 11 following landslides in Taiwan on August 10, 2009, triggered by Typhoon Morakot.

6.3.3. NHRSS-Db - Landslide Summary

Recorded landslide coverage represents the lowest dataset recorded. Like flood coverage, it was expected that recorded NHRSS-Db landslide coverage would present a seasonal trend, with coverage increasing throughout Northern Hemisphere summer months. However, like flood coverage, this was not the case.

As with both earthquake and flood coverage, landslide coverage throughout 2009 differs to that of 2008 coverage. Landslide coverage appears to decrease dramatically and displays smaller peaks in coverage. It is possible that, due to the dominance of earthquake and flood events such as the L'Aquila, Italy earthquake and widespread flooding across Brazil, that these events reduced the likelihood of landslide events being reported despite a number of high fatality events being recorded. However, the prominent data gap (as highlighted in figures 6.1.a - 6.1.c) dominates the 2009 dataset and makes examination of events and trends within the timeframe difficult.

Due to the daily fluctuations in coverage, total recorded coverage for all three event types recorded within NHRSS-Db does not appear to be sensitive to event occurrence. Events of varying sizes and locations are almost indistinguishable from the background noise present within the dataset.

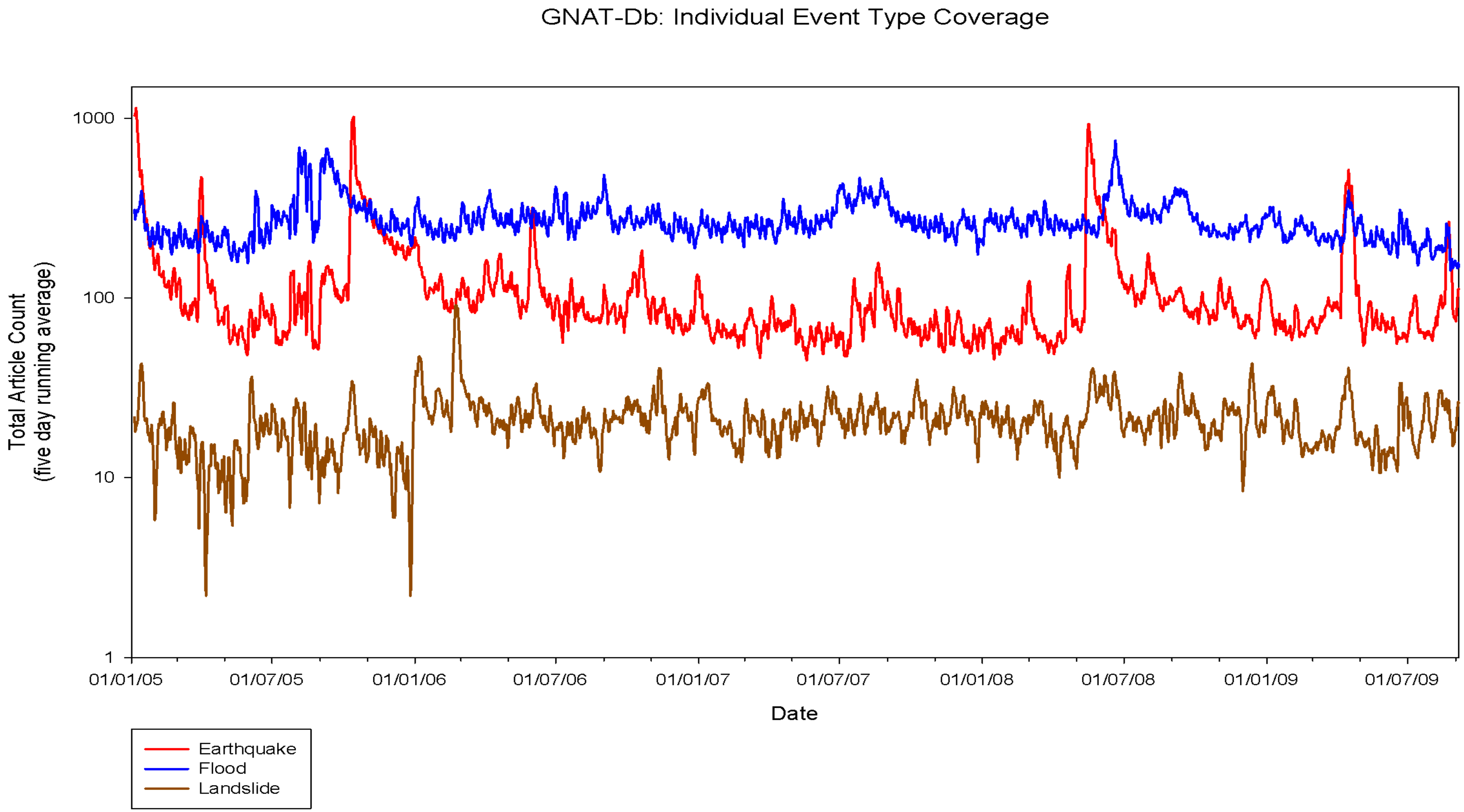

Figure 6.2 Individual GNAT-Db natural hazard event type coverage - five day running average.

Note log scale.

		Earthquake				Flood				Landslide			
	Season	Average Daily Article Count	Low	High	Range	Average Daily Article Count	Low	High	Range	Average Daily Article Count	Low	High	Range
2005	Summer	92	18	416	398	371	108	1,560	1,452	17	0	54	54
	Winter	166	57	429	372	255	138	618	480	25	0	114	114
2006	Summer	92	34	303	269	294	141	752	611	20	0	48	48
	Winter	75	36	191	155	249	142	502	360	22	0	63	63
2007	Summer	80	27	259	232	332	147	541	394	22	0	43	43
	Winter	65	30	190	160	255	122	465	343	21	0	40	40
2008	Summer	129	59	553	494	354	12	1,050	866	24	184	66	44
	Winter	80	36	162	126	248	137	470	333	22	0	52	52
2009	Summer	103	28	420	392	204	78	55	401	21	7	479	48

Table 6.2: Table showing GNAT-Db summary seasonal data

GNAT-Db

Due to the nature of the GNAT-Db, a longer dataset is available compared to that of the NHRSS-Db. However, due to the search criteria and event selection process outlined in Chapter Four, continuous fatality and event number statistics are not available. Instead, fatality figures and event occurrence statistics covering the five year timeframe under analysis were sourced from GAALFE, FLD and GSN.

6.4. GNAT-Db – Earthquake Coverage

It was predicted that earthquake coverage would be event-led, with increasing peaks in coverage equating to the magnitude of the event. I shall explore this hypothesis below.

6.4.1. Recorded News Media Coverage – 2005

The GNAT-Db earthquake dataset starts with the tail-end coverage of the December 26, 2004 Sumatra-Andaman earthquake. From a peak of 1,048 articles on January 7 2005, 12 days after the event, recorded earthquake coverage begins to decrease steadily until March 26 when coverage falls to 78 articles. Coverage then rapidly increases to 471 articles on April 1, 2005 following the Nias earthquake, which killed 1,300 people. Coverage then begins to decrease, reaching the 2005 low of 48 articles on May 29. Coverage then fluctuates over the following four months.

On October 12, 2005 999 articles were recorded following the October 10, 2005 Kashmir, Pakistan Administered Kashmir earthquake. Excluding coverage of the Sumatra-Andaman earthquake, the Kashmir earthquake recorded the highest peak article count within GNAT-Db. Coverage then decreases steadily over the following two months before increasing to 218 articles on January 1, 2006. Analysis of the coverage at this time found that much of the coverage recorded on January 1, 2006 was New Year recapping of events over the past year, namely the Kashmir earthquake. It is likely that this New Year coverage did not record 218 articles alone, but instead increased the already high level of coverage still reporting on the Kashmir earthquake. Following this, an overall downward trend in earthquake coverage can be seen throughout 2006 and the first six months of 2007. During this time a number of prominent peaks are recorded. However, following each peak, overall coverage continues to decrease, reaching a dataset low of 44 articles on May 20, 2007

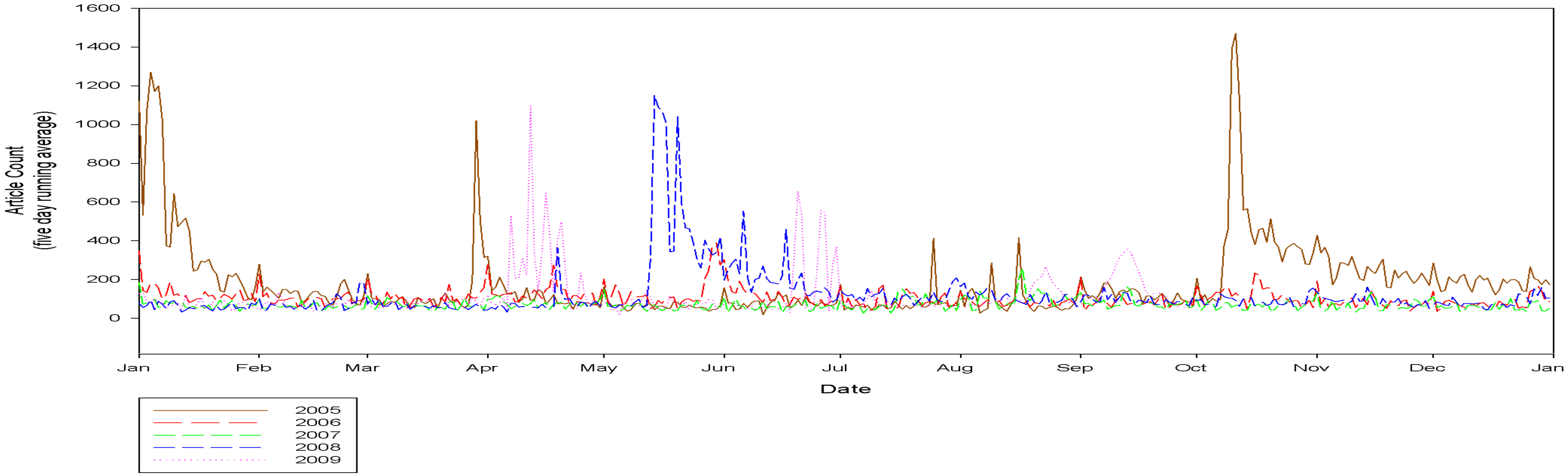

Figure 6.3: GNAT-Db recorded yearly earthquake coverage overlay

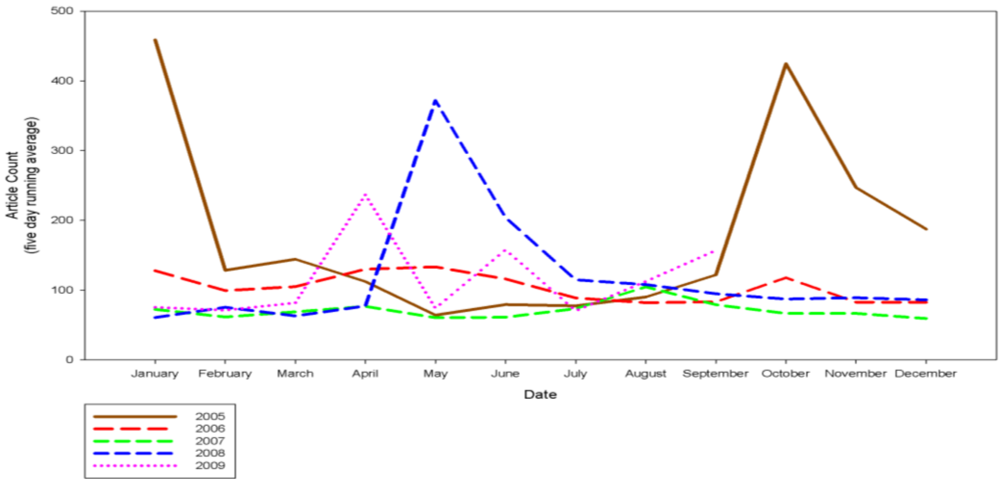

Figure 6.4: GNAT-Db recorded average monthly earthquake coverage overlay

6.4.2. Recorded News Media Coverage – 2006

The first prominent peak in coverage in 2006 was 155 articles on April 2, 2006. This was in response to a 6.0Mw earthquake in Lorestan, Iran on March 31, 2006, which killed 70 people and affected 330 villages. Coverage begins to decrease over the following seven days, reaching 110 articles on April 11, 2006. However, coverage then increases rapidly, reaching 176 articles on April 20, 2006 following coverage of the centennial anniversary of the 1906 San Francisco earthquake, which killed over 3,000 people. Coverage then begins to decrease, falling to 79 articles on May 16, 2006, the lowest level of coverage recorded in 2006 so far.

The 2006 dataset peak was recorded on June 1, when 318 articles were recorded in response to the May 27, 2006 Yogyakarta, Indonesia earthquake, which killed 5,778 people, the third largest fatality count recorded within GNAT-Db. Following peak coverage of this event, coverage falls to the lowest level recorded throughout 2006, 56 articles on July 10.

Coverage fluctuates between July and October, 2006 in response to a number of events. For example, a non-fatal 7.2Mw earthquake struck off the coast of Java, Indonesia on July 19, 2006 and recorded 128 articles on July 21 and 118 articles were recorded on September 1, 2006, when 800,000 people took part in a large-scale earthquake drill in Tokyo, Japan. Following these events, coverage increases throughout October, reaching 177 articles on October 19, 2006. This increase in coverage was due to anniversary coverage of the October 8, 2005 Kashmir earthquake. Again, following this peak, the overall downward trend in earthquake coverage continues, reaching 62 articles on December 12, 2006.

Like at the end of 2005, recorded coverage begins to increase over the last week in 2006 as a number of reports are recorded that recap over the past years events. This New Year recapping peaks on January 1, 2007 when 131 articles are recorded.

6.4.3. Recorded News Media Coverage – 2007

Following the January 1 peak, the overall downward trend in recorded earthquake coverage continues, reaching the aforementioned dataset low of 44 articles on May 20. However, three events occurred throughout March to May, 2007, each recording a prominent peak in coverage. The first, an earthquake near Padang, Sumatra on March 6, which killed 70 people, recorded a peak of 88 articles on March 8, 2007. Following this, a 8Mw earthquake off the coast of the Solomon Islands, which killed 15 people, recorded a peak of 102 articles on April 5, 2007. The final event, a rare non-fatal 4.7Mw earthquake near Kent, England on April 29, 2007 recorded 91 articles on May 1, 2007.

A period of low coverage is recorded between May 20 and July 7, 2007, with no major earthquake events recorded. However, following this, overall earthquake coverage increases throughout July to September, 2007 in response to a series of events, each of which correspond to a prominent peak in coverage. On July 20, 128 articles were recorded in response to the 6.6Mw Niigata Chuetsu Oki offshore earthquake, which occurred on July 16, 2007, killing seven people. This earthquake will be examined in greater depth in Chapter Eight. A peak of 157 articles was recorded on August 20, 2007 following the August 15 central Peru earthquake, which killed 520 people. The third peak in coverage was in response to a series of non-fatal earthquakes off the coast of Sumatra, Indonesia on September 12 to 13, 2007. Following coverage of these events, overall earthquake coverage decreases throughout the remainder of 2007. Like previous years, an increase in coverage begins in the last week of December as a number of reports are published recapping the past year's events. This increase in coverage peaks on January 7, 2008 when 73 articles were recorded.

6.4.4. Recorded News Media Coverage – 2008

Following the January 7 peak, coverage decreases rapidly, falling to 45 articles on January 16, 2008. Following this, overall earthquake coverage increases throughout February, 2008, following coverage of three events: a 5.0Mw earthquake in Rwanda on February 3, 2008, which killed 40 people; a non-fatal 6.7Mw earthquake off the South coast of Greece on February 14; and a non-fatal 5.3Mw earthquake in Northeast England on February 29. Overall earthquake coverage then decreases throughout March, falling to 49 articles on March 26, 2008.

On April 11, 2008 coverage begins to increase rapidly, increasing from 60 articles on April 11 to 151 articles on April 21. This rapid increase in coverage was in response to two non-fatal earthquakes that occurred in Midwest USA on April 18 and 21, 2008. Coverage then decreases rapidly, falling to 66 articles on May 6, 2008.

On May 11, 73 articles were recorded. This quickly rose to 112 on May 12 as reports of a large earthquake in Sichuan Province, China emerged. Coverage then increased rapidly, reaching the second highest peak recorded within the earthquake dataset, 932 articles, on May 17, 2008, five days after the event occurred. Coverage of the May 12, 2008 Sichuan, China earthquake will be examined in greater depth in Chapter Eight.

Following the peak on May 17, a downward trend in earthquake coverage can be seen, Although a number of prominent peaks are recorded, overall coverage decreases throughout the remainder of 2008, reaching a low of 59 articles on December 17, 2008. Coverage then increases rapidly, reaching a peak of 127 articles on December 30, 2008 in response to reports of a non-fatal 5.1Mw earthquake in Northern Italy on

December 23, a non-fatal 4.9 earthquake in Northern Yunnan Province, China on December 26 and a series of over 100 earthquakes in Yellowstone National Park, USA on December 29. Following this, coverage begins to fall throughout the first two weeks of January, 2009, reaching a low 62 articles on January 12, 2009.

6.4.5. Recorded News Media Coverage – 2009

Overall earthquake coverage increases steadily throughout the first three months of 2009. Two peaks are visible during this upward trend: the first, 91 articles on February 7, was in response to two non-fatal earthquakes on February 3: a 3.0Mw earthquake in New Jersey, USA and a 6.0Mw earthquake in Central Peru. The second peak, 101 articles on March 21, was in response to a non-fatal 7.9Mw earthquake that struck Nuku'alofa, Tonga on March 20, 2009.

On April 6, 2009, a 6.3Mw earthquake struck L'Aquila, Italy killing 293 people. On the same day, 77 articles were recorded. This rose to 168 articles on April 7 and peaked at 517 articles on April 16, 10 days after the event. Coverage of the L'Aquila, Italy earthquake will be examined in greater depth in Chapter Eight.

Following the April 16 peak, coverage decreases, falling to 54 articles on May 5, 2009. Between May 5 and September 30, two further prominent peaks are visible. The first, 103 articles on July 10, was in response to reports that Michelle Obama and Sarah Brown had visited some of the worst affected parts of Italy following the April 6 earthquake. The second peak, 266 articles, was recorded on August 23 and is the seventh highest peak recorded within the entire GNAT-Db earthquake dataset. Analysis of recorded articles on this day found that the peak in coverage was due to the cumulative coverage of a number of non-fatal earthquake events: a 5.2Mw earthquake that struck New Zealand's South Island on August 18, a 6.5Mw earthquake in Taiwan on August 18, a 4.9Mw earthquake that occurred in Northeast India on August 19, and a 5.0Mw earthquake that struck Anchorage, Alaska, USA on August 20.

6.4.6. GNAT-Db – Earthquake Summary

Earthquake occurrence does not follow a distinctive long-term temporal pattern like floods and, to a lesser extent, landslides. This is due to the Poisson distributed tectono-physical triggers that govern earthquake occurrence, compared to the more seasonal and hence predictable climatic conditions and the societal decisions that commonly determine flood and landslide occurrence. Thus, recorded earthquake coverage was not expected to follow a long-term trend and that high magnitude events would record the highest peaks. However, it can be seen that a trend in recorded earthquake coverage exists, whereby overall coverage decreases following a large event. This trend can be seen following the Sumatra-Andaman earthquake, the Kashmir earthquake and the Sichuan earthquake.

This pattern suggests that, after a large earthquake event such as Kashmir or Sichuan, total earthquake coverage will steadily decrease over time, with periodic peaks representing other earthquake events, until another large event occurs. Very large earthquakes, like Kashmir and Sichuan, are rare. Therefore, in terms of their magnitude and frequency, they are significant events within natural hazard news media and high coverage parameters are inevitable. It is therefore necessary to understand how these events affect overall earthquake coverage and the coverage of other events.

When a small-to-medium earthquake event occurs shortly after a large event, the coverage may appear high because it occurs in addition to the already high level of coverage following the large event, but, when individual coverage of the later event is examined, coverage is much lower. For example, on August 1, 2008, a peak of 177 articles was recorded. This peak coincided with a non-fatal 5.8Mw earthquake in Southwest China on August 1. However, it is likely that this event would not have appeared so prominent if it had not occurred during the decay coverage of the May 12, 2008 Sichuan, China earthquake. It appears that coverage of the August 1 event acted to 'top up' the already high earthquake coverage. There is also some evidence to suggest that if a small event follows a large event, then the total media interest will tail off in a manner proportional to the small event, and hence interestingly may curtail the longer-term interest in the earlier larger event. In comparison, it is possible that an event occurring after a large, well publicised event, may not record a level of coverage as high as expected because the news media are still preoccupied with the former event.

6.5. GNAT-Db – Flood Coverage

It was predicted that a seasonal trend would be present within recorded flood coverage, whereby overall coverage would peak during the Northern Hemisphere summer months of June-September due to the increase in flood event occurrence, reflecting the onset of South Asian and Southeast Asian monsoon seasons.

6.5.1. Recorded News Media Coverage – 2005

2005 flood coverage begins with a peak in coverage of 395 articles on January 14 following major flooding in Ohio, USA and Northern England, UK. Following this, overall flood coverage decreases over the next five months, falling to 155 articles on May 31.

The 2005 dataset is dominated by two peaks at the end of the summer season: 688 articles on August 5, 2005 and 680 articles on September 9, 2005. The August peak is due to coverage of the widespread flooding across China's Hubei and Heilongjiang Provinces, which killed 764, and the September peak is due to a combination of the 2005 European floods, which killed 16 people in Romania and 20 people in Ukraine, and coverage of Hurricane Katrina, which caused flooding across New Orleans and led to the deaths of 1,836 people.

When GAALFE fatalities are compared to GNAT-Db coverage statistics both datasets display similarities with regards to the timing of increases in event fatalities and news media coverage. Throughout 2005, GAALFE recorded two major peaks in flood fatalities. The first is throughout June to August, 2005 when fatalities peaked at 1,385 in July. The second peak in fatalities is in October, when 4,067 fatalities are recorded. These two peaks relate to a number of events across these four months:

- June, 2005: Major floods occurred across China, including Hunan Province, where 160 people died; Heilongjiang province, where 117 people died; and the Guangxi Zhuang Autonomous Region, where 200 people died. Major flooding also occurred in Gujarat, India, where 200 people lost their lives.
- July, 2005: Following on from the floods in June, continued monsoon rains in July caused severe flooding across Maharashtra State, India, leading to the deaths of 987 people and a further 126 died in Karnataka State, India.
- August, 2005: Hurricane Katrina led to major flooding across the states of Louisiana, Mississippi, and Alabama, causing the deaths of 1,053 people.
- October, 2005: Hurricane Beta caused major flooding along Nicaragua's Caribbean coast, killing 2,000. Heavy rains from a low pressure system in the Bay of Bengal led to flooding across Southern India, which killed 279 people. Tropical Storm Stan caused major flooding and landslides across much of Guatemala, leading to the deaths of 2,000 people.

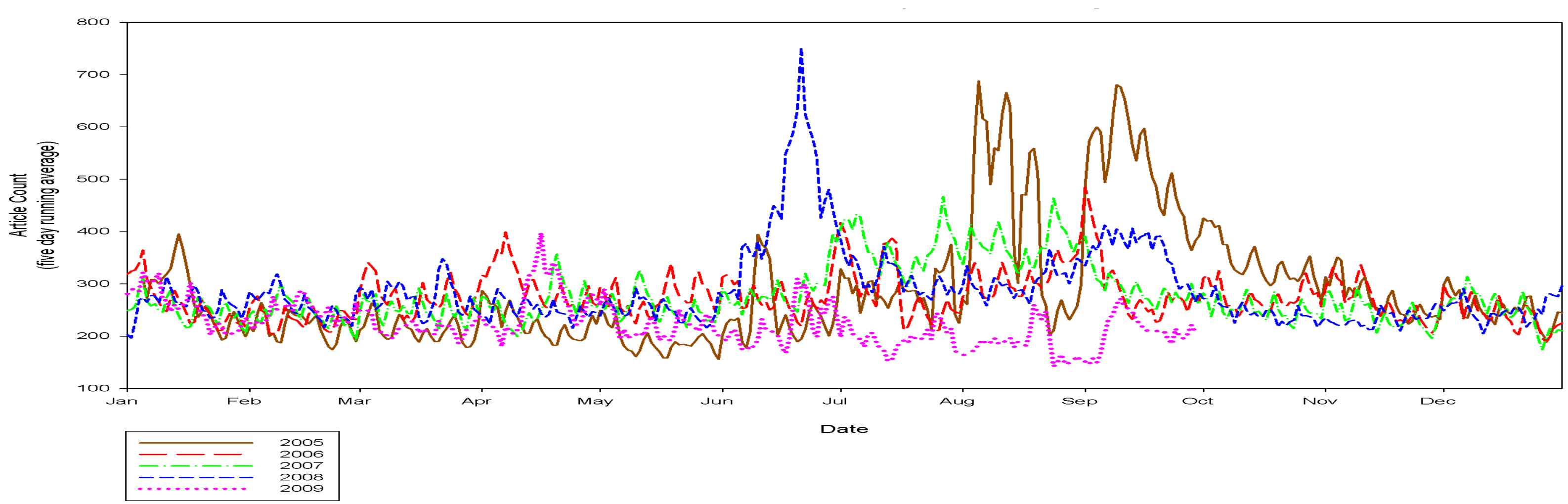

Figure 6.5. GNAT-Db recorded yearly flood coverage overlay

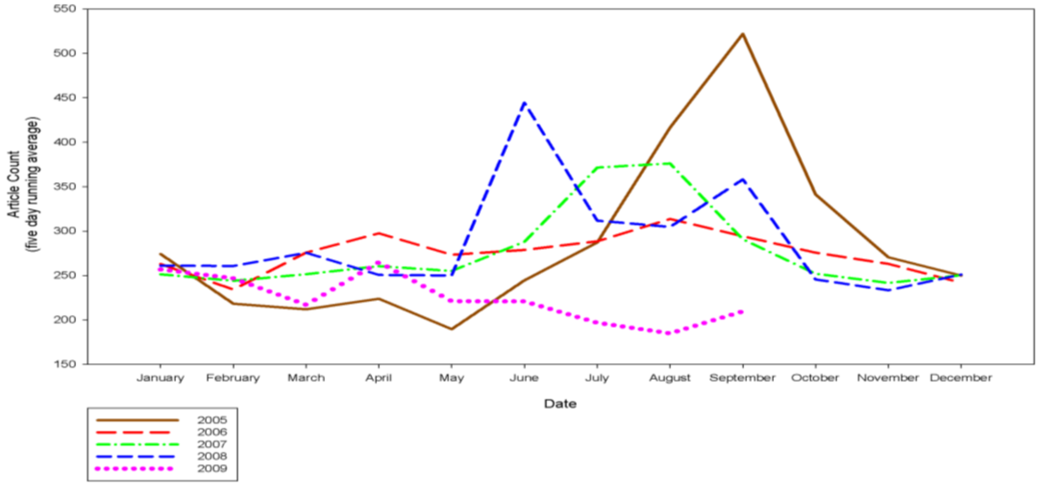

Figure 6.6: GNAT-Db recorded average monthly flood coverage overlay

Recorded flood news media coverage can be seen to increase throughout June, 2005. However, recorded coverage drops throughout July, despite the level of recorded fatalities increasing due to the Indian floods. It is possible that flood coverage decreased in July, despite the increase in fatalities, due to a decrease in the public interest of the Indian floods owing to the length of the event. Flooding in India persisted for several months throughout 2005 and, as was discussed in Chapter Three, public interest in such events is finite, with interest decreasing over time as the event becomes less 'newsworthy' (Thøgersen, 2006).

Recorded coverage increases rapidly throughout the first week of August, reaching 688 articles on August 5. This peak is followed by a rapid decrease in coverage, whereby coverage falls to 202 articles on August 23. Analysis of wider news trends at the time found that the news media was focused on Israel's unilateral disengagement plan, whereby all Israeli's were evicted from the Gaza Strip and West Bank from August 22, 2005.

Following the low point on August 23, flood coverage increased rapidly, reaching 680 articles on September 9, 2005. This was in response to increased coverage of flooding across Southeast USA caused by Hurricane Katrina. Coverage can then be seen to decrease steadily over the remainder of 2005, falling to 194 articles on December 27. Like New Year earthquake coverage, flood coverage can be seen to increase throughout the last days of December and early January due to news media recapping events over the past year.

6.5.2. Recorded News Media Coverage – 2006

In comparison to 2005, recorded coverage throughout 2006 does not display such prominent peaks in coverage. However, a clear trend is visible, whereby overall flood coverage increases throughout summer months. The 2006 peak in coverage, 484 articles, was recorded on September 1, 2006, following major flooding across Ethiopia, which killed 384; flooding in Rajasthan, India, which killed 93; and continued reports of the North Korea floods that killed over 500 people in August, 2006. Following this peak, coverage decreases rapidly, reaching 232 articles 12 days later on September 13, 2006. There is a swell in coverage throughout late October and early November in response to reports of meltwater floods in Western New York State, USA; floods across Southeast Texas, USA, which killed four; and flash floods across Eastern Kenya, which killed 21 and left 60,000 people homeless. However, coverage begins to decrease again, reaching an overall low of 188 articles on December 27, 2006.

Recorded DFO fatality data throughout 2006 displays one prominent summer peak in July, 2006, with a smaller secondary peak throughout October and November, 2006. These two peaks in recorded fatalities were due to:

- July, 2006: Typhoon Bilis caused major flooding and landslides throughout the Philippines and China, killing 28 and 628 people respectively. Monsoon rains across North Korea led to the deaths of an estimated 575 people. Monsoon rains caused severe flooding across large parts of India and Pakistan, particularly Rajasthan, India, where 457 people drowned and Muzaffarabad, Pakistan, where 248 died.
- October, 2006: Heavy rains caused flooding across coastal and Northeastern Kenya, killing 150. A longer than usual Dayr[5] rainy season led to the worst flooding in Somalia in 50 years, killing 132.
- November, 2006: Typhoon Durian caused severe flooding and mudslides across Vietnam and the Philippines, killing 526 people.

As expected, recorded coverage in response to the deadlier July, 2006 floods is higher than that for the October/November events. However, the peak in 2006 news media coverage occurred on September 1, 2006. This, apparently randomly occurring, peak in flood news media is in fact due to the combined continued coverage of a number of long-term flood events, namely the major flooding across Ethiopia, the South Asia monsoon floods in Rajasthan, India, and the East Asia monsoon flooding across North Korea. Due to the collating process used by DFO, these events were recorded as occurring throughout August, 2006. However, these events persisted for a total of 78 days and, thus, coverage persisted throughout August and early September, 2006.

Coverage decreases throughout December 2006, falling to 188 articles on December 27, 2006. Analysis of wider news interests found that a number of socio-political events occurred that are likely to have dominated the news media throughout December, limiting the level of hazard news media coverage. Following this low point, coverage begins to increase as the news media recap on flood events over the past year. Coverage increases, reaching a peak of 311 articles on January 5, 2007.

6.5.3. Recorded News Media Coverage – 2007

Recorded 2007 flood coverage displays a definite seasonal pattern in reporting. Coverage can be seen to increase in late May, and continuing throughout July and August. Three peaks in coverage are recorded throughout this time. On July 5, 2007,

[5] The Dayr rainy season usually extends from October to December and affects Somalia and neighbouring countries.

433 articles appeared following major flooding across China that affected millions, flash floods in Baluchistan, Pakistan that killed 30, and floods in Northern England that killed three. Moreover, on July 27, 2007 following floods in China that killed 100 and continued coverage of the Northern England floods of early July the peak of 467 articles was reached for 2007. Looking to August, we note that 464 articles emerged on August 24, 2007 following increasing reports of major flooding in North Korea and flooding across Midwestern USA that killed three people.

Following the summer peak in coverage, recorded flood coverage decreases steadily throughout the remainder of the year, reaching a low of 174 articles on December 26, 2007. Recorded 2007 fatalities show peaks in fatality numbers throughout June to August, 2007 and November, 2007. These peaks are in response to a series of flood events:

- June, 2007: Heavy rains caused severe flooding in the Guangdong-Meizhou Provinces, China, causing the deaths of 600 people. Monsoon rains across the Chittagong region of Bangladesh caused major flooding and killed 126 people. Monsoon rains caused flooding across Andhra Pradesh, India and Karachi, Pakistan, killing 127 people and 230 people respectively. Cyclone Yemyin, flooded large areas of Baluchistan Province, Pakistan, killing 280 people.
- July, 2007: Monsoon rains caused severe flooding across West Bengal, India, killing 958 people. Heavy rains flooded 26 states across Sudan, killing 150 people. Continued monsoon rains flooded large areas of Assam State, India, killing 96. Heavy rains led to severe flooding across Yunnan Province, China, killing 170 people. Monsoon flooding across India and Bangladesh killed 1,071 people.
- August, 2007: Heavy rains across Nigeria led to flooding across three states, killing 101 people. The worst floods in a decade caused major flooding across North Korea, killing 454 people. Heavy rains across Ghana and Burkina Faso killed 153.
- November, 2007: Tropical Cyclone Guba caused severe flooding across Papua New Guinea, killing 170. Flooding caused by Cyclone Sidr led to the deaths of 3,447 people across Bangladesh.

Recorded GNAT-Db flood coverage follows the increase in recorded fatalities, reaching peak coverage throughout June to September. However, recorded coverage does not peak during November in response to the recorded 3,750 deaths as expected, but, in fact, decreases throughout November. Further analysis shows that the exclusion of articles concerned with ‘cyclone’ within the GNAT-Db may have skewed recorded coverage as articles relating to floods caused by Cyclone Sidr were mostly removed from the dataset.

Coverage decreases rapidly in late December, falling to 174 articles on December 26. This fall in flood coverage coincided with global political upheaval following the assassination of former Pakistan Prime Minister Benazir Bhutto, which dominated news media at the time. Recorded flood coverage begins to increase, reaching a peak of 314 articles on January 11, 2008, following major flooding in Karangayar District, Indonesia on December 29, 2007, which killed 87 people.

6.5.4. Recorded News Media Coverage – 2008

As can be seen in figures 6.5 and 6.6, recorded flood coverage throughout 2008 followed the same seasonal distribution as past years, with peak coverage occurring, as predicted, in the summer months. The overall 2008 dataset peak of 752 articles was recorded on June 20. A second prominent peak of 412 articles follows this on September 5. These two peaks in flood coverage are in response to major, non-fatal flooding in Iowa, USA throughout June, 2008 and severe flooding in Bihar, India throughout September, 2008.

In conjunction with the increases in flood coverage in June and September, recorded 2008 DFO fatalities display two peaks at the same time: June, 2008 and August through September, 2008.

- June, 2008: Heavy rains throughout the majority of June led to severe flooding across the Western Guangdong, China, killing 176. Typhoon Fenshen caused major flooding throughout the central region of the Philippines archipelago, resulting in 1,000 deaths.
- August, 2008: Tropical Storm Kammuri caused major flooding across Southern Vietnam and Laos, killing 100 people and 130 people respectively. Monsoon rains in India led to flooding surrounding the Saptakoshi and Kosi rivers, killing 400 people and led to the inundation of the entire island of Majuli, Assam killing 900 people.
- September, 2008: Large parts of the Bihar, India were flooded following heavy rains and the release of water from the Ujani and Virbhatkar dams, killing 2,400 people. Flooding in Haiti following the series of summer hurricanes was exacerbated when Hurricane Ike led to increased flooding and the deaths of a further 58 people.

Despite higher fatality figures being recorded throughout August and September, largely due to the Assam and Bihar, India floods respectively, the recorded GNAT-Db flood coverage peak on June 20, 2008 (752 articles) is 1.8 times higher than the peak recorded on September 5, 2008 (412 articles). This is likely due to external socio-political issues throughout September, namely the ongoing political crisis in Thailand, the first proton beam circulation at the Large Hadron Collider and a train collision in California that killed 25 people and injured 130.

Two periods of low flood coverage are recorded on May 31, 2005 and June 18, 2009. Major non-hazard socio-political events occurred on these dates, including the announcement of W. Mark Felt as “Deep Throat”; France and the Netherlands voting resoundingly to reject the European Constitution on May 31, 2005 and major protests in Iran following the re-election of Mahmoud Ahmadinejad on June 12, 2008, all of which dominated the news media at these times.

After the second peak in coverage in September, 2008, recorded coverage slowly declines over the following 96 days, reaching a low of 204 articles on December 10, 2008. An increase in coverage can then be seen, whereby recorded articles increase throughout the remainder of 2008 and peak on January 5, 2009, following major flooding in Venice, Italy and follow-up coverage regarding the financial costs of the June, 2008 Iowa, USA floods.

6.5.5. Recorded News Media Coverage – 2009

Recorded coverage throughout 2009 differs to that recorded in previous years, with overall flood coverage decreasing throughout the year and peak coverage being reached in April, not the summer months of June to September.

Following the aforementioned January 5 peak, coinciding with the Venice floods, coverage decreases over the next four months, reaching a low of 180 on April 6. Coverage can then be seen to increase rapidly, with a peak of 397 articles recorded on April 16 coinciding with major non-fatal flooding across Eastern Australia on April 1 and widespread non-fatal flooding across Midwestern USA throughout early April, 2009.

Following the peak on April 16, overall flood coverage can be seen to decrease over the following four months, reaching a low of 142 articles on August 28, the lowest recorded level of coverage within the entire GNAT-Db flood dataset. Within this period of decline, three prominent peaks in coverage are recorded. The first, 310 articles on June 21, was in response to continued coverage of the Midwestern USA floods, namely the reporting of the need for better flood defences on June 17, and increasing coverage of fatal flooding in Czech Republic, which killed 10 people. The second peak, 244 articles on July 26, was in response to flooding in Gujarat, India, including a flash flood in Orissa, Eastern India, which killed 36 people. The final peak in the recorded

2009 dataset, 258 articles on August 20, was in response to flooding in Taiwan triggered by Typhoon Morakot, which killed 500 people, and continued flooding across 29 provinces in China, which killed over 500 people.

6.5.6. GNAT-Db: Flood Summary

As expected, recorded flood coverage demonstrated a seasonal pattern in reporting, with an increase in coverage throughout the Northern Hemisphere summer months of June to September. GNAT-Db is therefore a good monitor of the physical occurrence of flood events. However, as identified, overall recorded flood coverage does not fully match the variation in fatalities recorded by DFO, as was expected. A number of high fatality time periods do not record high levels of coverage and several prominent peaks in coverage are not in response to high fatality events.

Unlike recorded earthquake coverage, the sensitivity of recorded flood coverage to hazard events appears much weaker, with individual flood events not as easily identified within the dataset. This is likely due to a combination of the physical processes within the events in question and the characteristics of the media coverage of such events. Floods are often slow onset events and so the news media coverage of them develops over time, unlike the almost instantaneous coverage of rapid onset earthquake events. In addition, flood events are often superimposed upon one another due to the duration of coverage of each event. Thus, the sensitivity of the total flood dataset to events of different sizes and different locations is difficult to determine. However, individual event analysis will address the sensitivity of GNAT-Db to events of different magnitudes and locations.

6.6. GNAT-Db – Landslide Coverage

It was predicted that a seasonal trend would be present within recorded landslide coverage, whereby overall coverage would peak during the Northern Hemisphere summer months of June-September due to the increase in flood event occurrence, reflecting the onset of South Asian and Southeast Asian monsoon seasons, as discussed by Petley *et al*. (2005).

6.6.1. Recorded News Media Coverage – 2005

As can be seen in figure 6.7 and 6.8, recorded landslide coverage throughout 2005 displays a very different coverage profile to the rest of the dataset. Recorded coverage appears much more erratic, with prominent peaks and dips, and is, on average, much lower throughout 2005 compared to later years.

A peak of 42 articles is recorded on January 13, 2005 following the La Conchita, USA landslide, which killed 10 people. This event will be discussed in greater detail in

Chapter Eight. However, following this peak, an overall downward trend in coverage is recorded throughout the first five months of 2005. This downward trend appears to coincide with the continued decay coverage of both the December 26, 2004 Sumatra-Andaman earthquake and the May 27, 2005 Nias earthquake. It is likely that, due to the number of fatalities involved (229,986 and 5,778 respectively) and the magnitude of the press coverage (155,558 and 1,310 articles respectively), that coverage of these two events dominated hazard news media coverage at the time.

The recorded downward trend culminates on April 7, 2005 when only two articles were recorded. This is likely due to the wider news media focusing on the death of Pope John Paul II on April 2, 2005. Following this, coverage fluctuated throughout the remainder of April and May, 2005 and recorded a peak of 36 articles on June 5, 2005 following a non-fatal landslide in Laguna Beach, USA on June 1, 2005, which destroyed a number of luxury homes.

A peak of 34 articles is recorded on October 12, 2005 following a landslide in El Salvador, which killed 23 people, and a landslide in Southeast China, which killed 50 people. Recorded coverage then begins to decrease steadily over the next 80 days, reaching a low of only two articles on December 26, 2005. This decrease in coverage coincides with the increase in recorded earthquake coverage following the October 8, 2005 Kashmir earthquake. The recorded December 26 low coverage period is likely due to a combination of continued press concentration on the Kashmir earthquake and the previously discussed Christmas season focus of wider news media, both of which are likely to have reduced media interest in landslide events.

Following the December 26 low coverage period, recorded coverage increases rapidly, reaching a peak of 47 articles on January 6, 2006. This increase in coverage coincides with the Al Dafeer, Yemen landslide, which killed 56 people on January 1, 2006 and a landslide in Cijeruk, Indonesia, which killed 70 people on January 3, 2006.

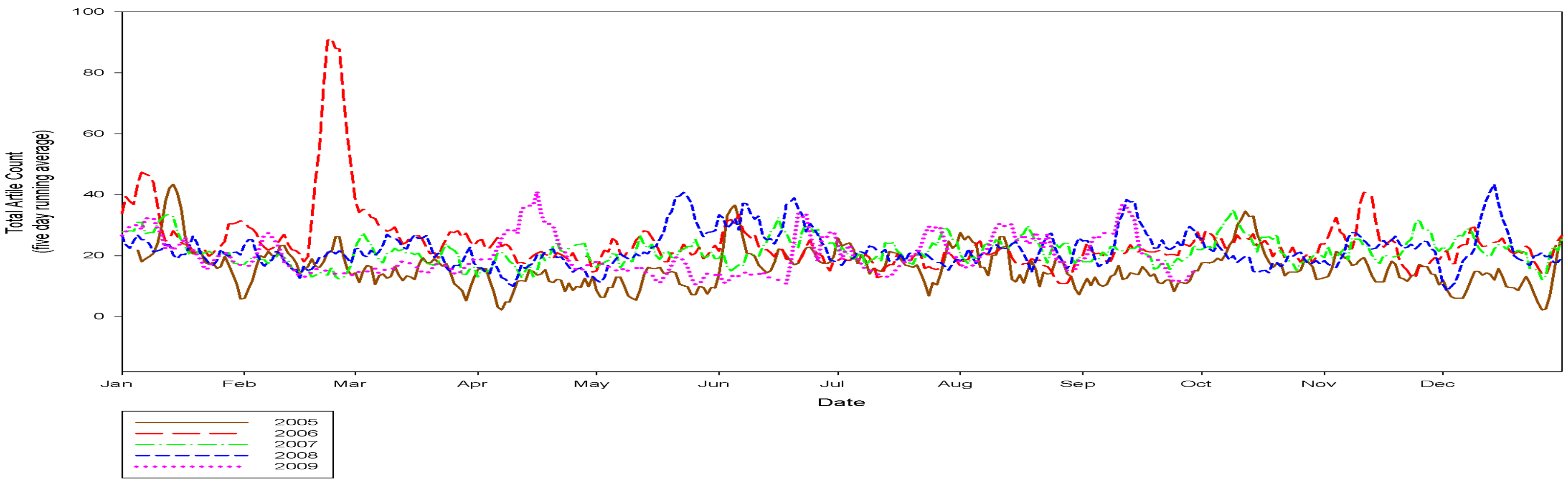

Figure 6.7. GNAT-Db recorded yearly landslide coverage overlay

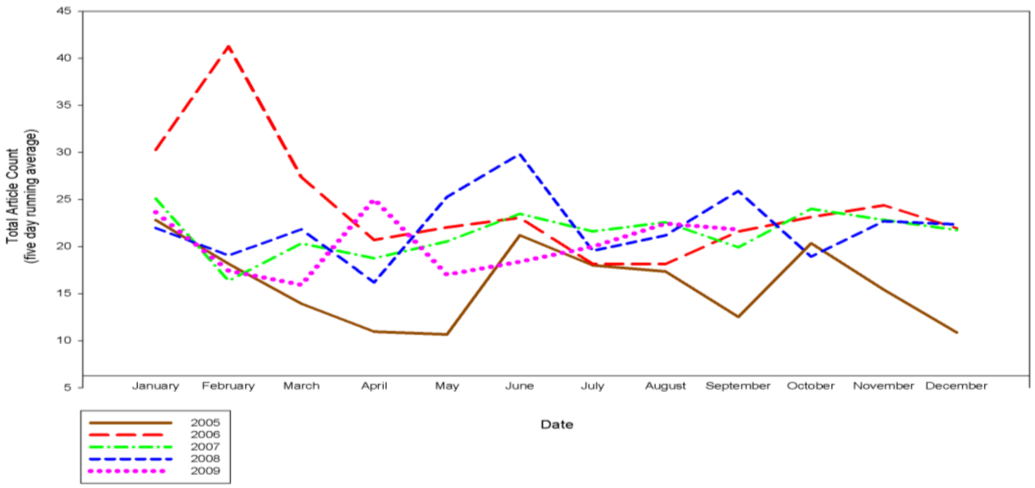

Figure 6.8: GNAT-Db recorded average monthly landslide coverage overlay

6.6.2. Recorded News Media Coverage – 2006

In comparison to 2005 coverage, recorded 2006 coverage displays less variable behaviour and much less variability. However, recorded 2006 coverage does record a much larger range, 79 articles compared to 2005's 41. This is due to the combination of the overall dataset peak being recorded in 2006, along with no extreme low coverage points.

The 2006 peak in coverage, and the overall GNAT-Db landslide dataset peak, was recorded on February 22, 2006, when coverage reached 90 articles following the Southern Leyte, Philippines landslide on February 17, 2006, which killed 1,126. This landslide was the largest recorded within both NHRSS-Db and GNAT-Db and will be discussed in greater detail in Chapter Eight. Following this peak in coverage, an overall downward trend in coverage can be seen over the following six months with only one prominent peak occurring on June 6, 2006.

The June 6 peak of 33 articles was due to coverage of a landslide in Northwest Pakistan on June 3, 2006, which killed 10 people, all of whom were members of the same family. Following this, coverage continues on an overall downward trend.

A prominent low coverage period of 11 articles was recorded on August 26. Analysis of wider news trends at the time suggests that this was due to the news media focusing on a Pulkovo Airlines crash in Ukraine, which killed 171 people, including 45 children, and the escape of Natascha Kampusch, who had been kidnapped eight years prior. Following this low point, coverage begins to increase, reaching 40 articles on November 11, 2006. However, post-analysis of recorded articles on this date found that, although results had been filtered to remove articles relating to political elections, a number of recorded articles were concerned with US elections on November 7, 2006, which saw the Democrats take control of the House of Representatives for the first time since 1994 and Arnold Schwarzenegger was re-elected as Governor of California.

As with coverage of both earthquakes and floods, recorded landslide coverage decreases on December 26, 2006. Following this, coverage begins to increase over the following 16 days.

6.6.3. Recorded News Media Coverage – 2007

Recorded GNAT-Db landslide coverage for 2007 displays a coverage profile different to surrounding years, with no prominent peaks recorded and a relatively low range in coverage, 23 articles. However, overall coverage does increase steadily throughout the year, with the maximum monthly average coverage rate of 23 recorded in October.

There was a peak of 32 articles on January 11, 2007 following a landslide on the island of Sangihe, Indonesia on January 9, 2007, which killed 16 people. Coverage can then be seen to decline over the following 45 days, reaching a low of 12 articles on February 25, 2007. This decrease in landslide coverage is unexpected since heavy rainfall caused a number of large landslides to occur throughout Java, Indonesia on February 18-22, 2007, killing eight people. It is likely that this dip in landslide coverage, despite an apparent newsworthy landslide event, is due to the occurrence of a number of more 'newsworthy' socio-political events at the time. For example, the announcement by President George W. Bush to send 21,500 more troops to Iraq on January 12, the killing of five people by a gunman in a Salt Lake City, Utah shopping mall on February 12, 2007 and coverage of the build up to the 79th Academy Awards ceremony in Hollywood, USA.

Following this low period, coverage increases rapidly, reaching 27 articles on March 3, 2007. This increase in coverage is due to coverage of a large landslide that caused damage to a number of properties in an affluent part of North Beach, San Francisco on February 28, 2007.

On June 16, 2007 recorded coverage peaks at 32 articles in response to a number of landslides that occurred throughout Bangladesh, killing 128 people. Coverage then fluctuates over the next three months before reaching the overall 2007 peak of 35 articles on October 9. This peak in coverage is due to a large non-fatal landslide in La Jolla, California, which damaged several properties and led to the evacuation of 77 families.

The last notable peak throughout 2007 coverage occurred on November 25 when 30 articles were recorded following a large landslide near the Three Gorges Dam, China, where a bus was buried, killing all 30 passengers on board. Following this, coverage decreased and, as with previous years, a low coverage period is recorded on December 26, 2007.

6.6.4. Recorded News Media Coverage – 2008

In comparison to recorded 2007 coverage, 2008 displays a greater range in recorded articles, 35, and a number of prominent peaks and low points.

Following the December 26, 2007 low point, coverage increases to 26 articles on January 1, 2007, likely due to a number of New Year recap reports of landslides in the previous year. Following this, coverage decreases, falling to 12 articles on February 15, 2007. A peak of 27 articles is then recorded on March 8, 2008 following two separate non-fatal landslides events in Los Angeles, USA. After this peak, recorded coverage can be seen to decline steadily over the following 31 days, reaching a low of 10 articles on April 8, 2008. Coverage then increases to 21 articles on April 17, 2008 following a large landslide in the Hubei Province, China, which inundated 37 properties, including a school, and forced hundreds to be evacuated.

A rapid decrease in coverage can be seen at the end of November, 2008, reaching a dataset low of eight article on December 1, 2008. This low coverage period is quickly followed by a rapid increase in coverage, with the overall 2008 peak in coverage, 43 articles, recorded on December 13, 2008 following a large landslide in the Ampang region of Malaysia that killed five people and destroyed 14 bungalows in the Bukit Antarabangsa township. The coverage of this event will be discussed in greater detail in Chapter Eight.

6.6.5. Recorded News Media Coverage – 2009

Following the December 13, 2008 peak in coverage, an overall downward trend in coverage can be seen over the first six months of 2009. However, a number of prominent peaks are recorded during this time. For example, on January 7, 32 articles were recorded following a series of landslide events throughout the first week of 2009; on January 1, 2009 a landslide at the Three Gorges Dam, China killed three construction workers and heavy rains caused severe landsliding across Java, Indonesia, killing 120 people; and on January 5, 2009 a large landslide occurred in Guatemala City, Guatemala, killing 35 people and destroying properties and infrastructure throughout the northern part of the city.

A second peak in coverage is recorded on February 6, 2009 when 27 articles were recorded. However, as with the recorded peak on November 11, 2006, this peak in coverage is in response to a number of high profile election results across the world, namely the election of Nuri al-Maliki as the Prime Minister of Iraq and the controversial re-election of Robert Mugabe as President of Zimbabwe.

A low period of landslide coverage is recorded between February 16, 2009 and March 26, 2009, before the 2009 peak in coverage, 41 articles, is recorded on April 16, 2009. This peak in coverage is in response to reports of a landslide in Kyrgyzstan on April 16, 2009, which killed 16 people and the announcement by Chinese officials that 113 people have been punished after negligence at a coal mine in the Shanxi Province, China caused a landslide that engulfed an outdoor market and killed 277 people in September, 2008. In addition to these events, all three event types record a peak at this time and it is likely due to coverage of the L’Aquila, Italy earthquake on April 6, 2009. A number of reports recorded at this time regarding hazard events referenced both the L’Aquila, Italy earthquake and the event in question. It is therefore reasonable to assume that a level of miscalculation occurred within the dataset, with a number of articles being recorded twice, or even three times; one in each event type dataset.

Chapter Seven: Individual Event Analysis - Aggregate Statistics

This chapter will focus on the examination and analysis of trends within aggregate statistics for both NHRSS-Db and GNAT-Db, which examine the characteristics of a sub-set of events extracted from the databases. The relationships between individual event parameters of both databases will be presented. This will allow for the identification of database-wide trends within the relationship between, for example, the number of fatalities recorded for an event and the total number of articles recorded. Analysis will focus on the relationships between total event article count, peak event article count, event duration and recorded event fatalities. Following this, an analysis of the magnitude-frequency distribution of events within both databases will be presented.

7.1. NHRSS-Db – Aggregate Statistics

7.1.1. Fatalities vs. Total Article Count

Total event article count relates to the cumulative volume of coverage each event received, which, in turn, is used to denote the wider level of interest in an event. Total article count is taken to be a robust indicator of interest in an event as overall coverage is less likely to be affected by exogenous influences upon the media than, for example, event duration. It was predicted that total event article count, and therefore interest, for a natural hazard event would increase as reported fatalities increased i.e. a positive linear relationship would exist between reported fatalities and the level of media interest. However, as can be seen in figure 7.1, the relationship between total coverage and fatalities varies for each event type considerably from this trend.

Total flood coverage appears to be directly proportional to the number of recorded fatalities, with a significant relationship presented for floods (r-squared = 0.7), compared to insignificant relationships for earthquakes (r-squared = 0.13) and landslides (r-squared = 0.42). However, the scatter within the distribution of the data is due to a number of events exhibiting coverage parameters at variance to the trend. For example, five non-fatal flood events record total coverage levels of between 69 and 915 articles. In comparison, five fatal flood events, with fatalities between 12 and 110, recorded total coverage levels below 82 articles.

In comparison to floods, landslides demonstrate a weaker positive relationship between fatalities and total event article count. For example, eight fatal landslide events recorded a total of one article, yet six fatal landslide events recorded total coverage levels in excess of 100 articles despite recording fatalities of 10 or fewer. Despite the greater scatter within landslide data points, the overall distribution of landslide coverage does appear to follow that of floods, with increasing coverage of more fatal events.

The similarity within the distribution of flood and landslide data points may be due to the similarities within the physical characteristics of both event types, namely the degree to which the occurrence of such events can be predicted and/or anticipated relative to precipitation, and therefore more easily reported. However, it remains unclear from the data why some landslide events receive disproportionately lower total coverage levels and some record higher than expected total coverage levels. Possible socio-political reasons behind the variability in landslide reporting will be discussed further in Chapter Nine.

In comparison to floods and landslides, recorded earthquake events demonstrate a weak linear relationship, with earthquakes recording relatively high levels of total coverage, regardless of the number of fatalities reported. In total, 49 (83%) of the 59 earthquake events recorded were non-fatal events. However, 25 (51%) of these recorded in excess of 100 articles, with five (20%) recording between 1,941 and 4,728 articles. Of the 10 recorded fatal earthquake events, the relationship between total event coverage and reported fatalities is the weakest of the three event types under examination, with an r-squared value of 0.13 compared to 0.7 for fatal flood events and 0.4 for fatal landslides. It is likely that earthquake events record relatively high levels of total coverage, regardless of the number of fatalities, due to the shock value inherent within such events. Earthquakes are unpredictable and, as such, embody the ‘breaking news’ and reactionary mentality of modern news media, as discussed in Chapter Three.

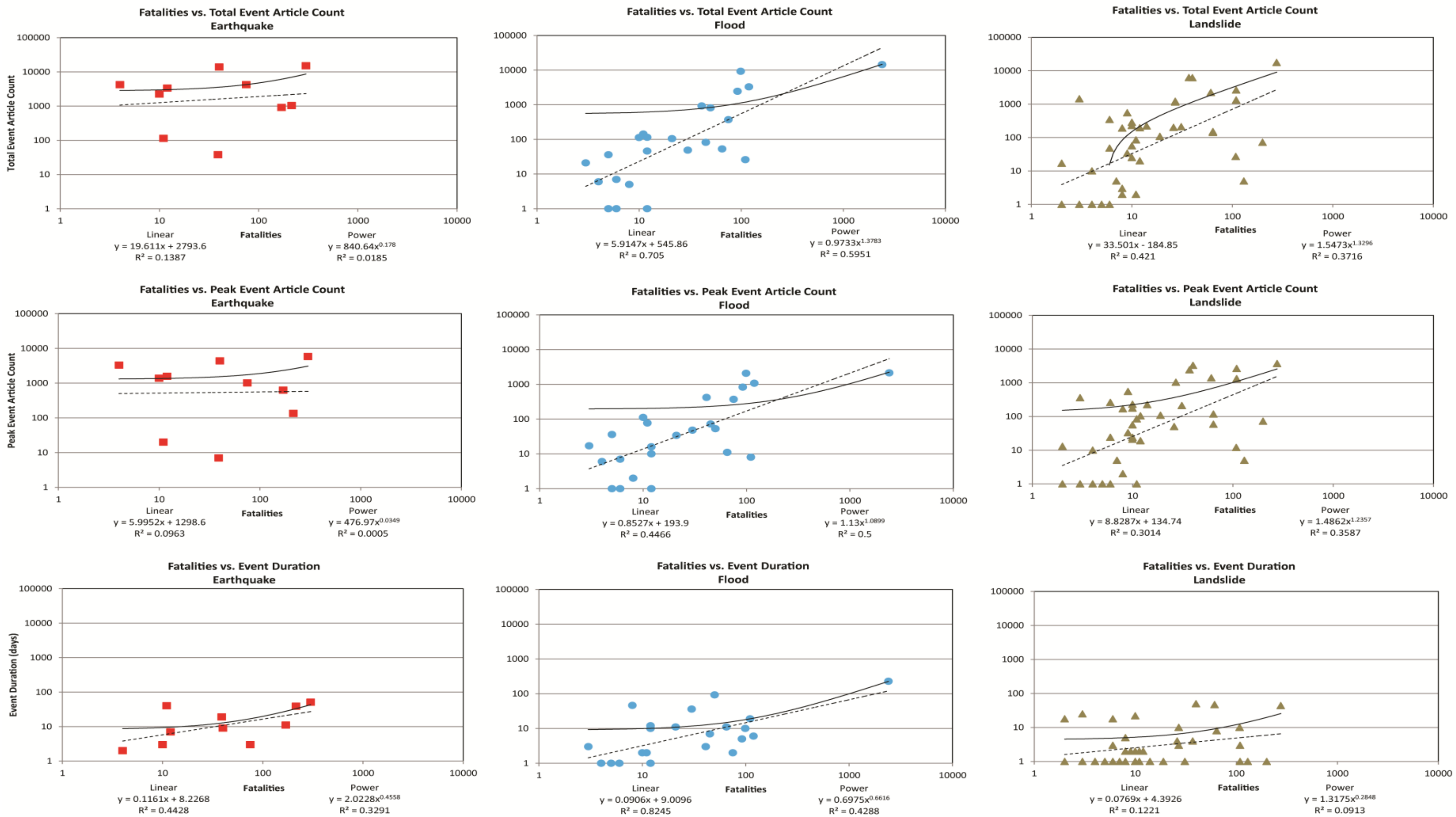

Figure 7.1: NHRSS-Db individual event type aggregate statistics

Note log scale

—— Linear regression - - - - Power regression

7.1.2. Fatalities vs. Peak Article Count

Peak article count represents the maximum number of articles recorded for an individual event in one day. It therefore displays the maximum significance that the event was given by the media in terms of concentration of published reports. It was predicted that peak article count would represent the most sensitive coverage parameter and would be closely linked to the nature of the hazard event.

Flood events display the strongest relationship between fatalities and peak article count (r-squared = 0.44) and, like the relationship between fatalities and total event article count, coverage of flood events appears to scale with fatalities in a more regular manner compared to earthquakes and landslides. Floods display the least amount of scatter within the distribution of data points, with little variance from the mean. However, one event, the July 12, 2008 Bihar, India floods, is a noticeable outlier due to magnitude of the event: 2,400 fatalities were recorded, 2,281 more than the second most fatal flood event recorded. In comparison to peak earthquake and landslide coverage, the majority (17 out of 24) of fatal landslides record a peak in coverage of fewer than 100 articles. It is likely that the nature of flood events is the reason for the relatively low peak article counts of most flood events. Flood events are, on average, the longest events recorded within NHRSS-Db and floods often persist for a number of weeks, or even months. The temporal nature of a flood event means that coverage often progresses steadily over time. Thus, total coverage remains relatively high, but average peak coverage remains relatively low.

As with total earthquake event article count, a weak linear relationship is evident between fatalities and peak article count (r-squared = 0.09) for earthquakes. The majority of fatal earthquake events record high peak article counts irrespective of total fatality numbers. Only two fatal landslides recorded peak article counts of fewer than 100, the remaining eight recorded between 134 and 5,832 articles. As discussed with regards to total event article count, the likely reason behind earthquakes recording consistently high peak article counts is due to the rapid onset and social interest in earthquake events.

As with peak earthquake article count, a weak linear relationship is evident between fatalities and peak landslide event article count (r-squared = 0.3). Due to the obvious co-linearity between total event article count and peak article count, the same eight fatal landslide events that recorded only one article each, have a peak of only one article. Again, landslide events, irrespective of recorded fatality numbers, receive a disproportionate level of news media. It is unclear from the data why this is so.

7.1.3. Fatalities vs. Event Duration

Event duration represents the total number of consecutive days that an event was recorded within NHRSS-Db, before falling beneath my event end cut-off. It was predicted that event duration would be more a function of what else is featured in the news media, than as a function of the event magnitude itself.

As shown in figure 7.1 no general pattern is displayed between event duration and recorded fatality numbers. 74 of the 158 (46%) events recorded within NHRSS-Db are single day events. However, recorded fatalities for these events range between two and 200. For example, the April 20, 2008 Three Gorges Dam, China landslide killed 200 people, but only recorded one day's coverage.

Flood events display the strongest relationship between fatalities and event duration (r-squared = 0.82), compared to earthquakes (r-squared = 0.44) and landslides (r-squared = 0.12). 12 of the 40 (30%) recorded flood events were single day events, all of which recorded fewer than 12 fatalities. In comparison, two non-fatal flood events, the June 7, 2008, Indiana floods and the November 23, 2008, Indiana floods, recorded 82 and 56 days respectively of continuous coverage. Flood event duration is therefore highly variable and does not appear to be a function of event magnitude.

49 of the 59 (83%) earthquake events recorded reported no fatalities. Recorded coverage duration for these events is relatively low, between one and six days. In comparison, recorded fatal earthquakes display a much higher range in duration, between two and 51 days.

In comparison to the relatively strong relationships between fatalities and event duration for earthquake and flood coverage, landslides display a very weak relationship (r-squared = 0.12). 29 of the 59 (49%) landslide events recorded within NHRSS-Db recorded a single day's coverage and a further 10 events only recorded two days of coverage. However, the fatalities for these low coverage events range between zero and 200. In comparison, two events recorded two and three fatalities but recorded 18 and 25 days coverage respectively.

Overall, the relationship between fatalities and event duration of hazard events within NHRSS-Db is weak. As with the relationship between fatalities and total and peak event article count, landslide events appear to receive a disproportionate level of news media coverage with regards to duration.

7.2. GNAT-Db – Aggregate Statistics

As can be seen in figure 7.2, aggregate statistics presented for GNAT-Db, differ greatly from those presented for NHRSS-Db. The general distributions of each event coverage parameter within GNAT-Db are very similar, with each GNAT-Db distribution displaying similar clustering. The majority of events (78 out of 99) within GNAT-Db record fatality figures between zero and 100. Thus, the majority of events within each event parameter cluster, with only the extreme events (1,000+ fatalities) noticeably outside the general distribution. However, the distribution of these extreme events adheres to a power-law distribution and it appears that a power-law magnitude/frequency relationship exists between fatalities and total event article count, peak article count, and event duration within extreme events, discussed below in further detail.

The clustering displayed within the GNAT-Db distribution is due to the selection criteria used for event inclusion: only prominent events, in terms of fatality numbers and/or recorded coverage, were selected for inclusion. Thus, a number of relatively small events were omitted and focus of GNAT-Db was on medium- to large-scale events.

7.2.1. Fatalities vs. Total Article Count

Overall, the relationship between fatalities and total article count within GNAT-Db represents the strongest trend out of the three event parameters under examination. In comparison to NHRSS-Db, earthquakes represent the strongest relationship between fatalities and total event article count (r-squared = 0.94 compared to 0.13 for the NHRSS-Db), with a positive linear relationship presented. However, two events fall outside this trend. The July 16, 2007 Niigata Chuetsu Oki, Japan earthquake caused seven fatalities but 925 articles were recorded, the fifth highest article count recorded within GNAT-Db. Coverage of the Niigata Chuetsu Oki, Japan earthquake will be discussed in greater depth in Chapter Eight. In comparison, the June 18, 2008 Indonesia earthquake, which killed 1,300 people, only recorded a total article count of 61 articles, markedly fewer than six non-fatal earthquakes recorded within GNAT-Db. The ‘articles per fatality’ can therefore be observed to vary considerably between events.

In comparison to the relatively strong relationship between earthquake fatalities and total article count recorded within GNAT-Db, landslides (r-squared = 0.71) and floods (r-squared = 0.46) demonstrate weaker yet still statistically significant positive linear relationships; a marked difference with the results found in the NHRSS-Db analysis. The relatively low magnitude of the flood relationship is likely due to the inclusion of a number of high profile yet low magnitude events. For example, the June 1, 2008 Indiana, USA floods killed three people but recorded the third highest total article count.

In comparison, the low media profile, high magnitude August 8, 2008 Lao Cai, Vietnam floods killed 119 people but only recorded 26 articles. Both the Indiana, USA floods and the Lao Cai, Vietnam floods will be discussed further in Chapter Eight.

7.2.2. Fatalities vs. Peak Article Count

In comparison to NHRSS-Db, GNAT-Db earthquakes display a much stronger relationship, with an r-squared value of 0.58, compared to a statistically insignificant 0.09. This is likely to be due to inclusion of extreme events, like the Kashmir and Sichuan earthquakes, which recorded both high fatality figures and high peak article counts, which skew the distribution. However, a number of events fall outside this general trend. As displayed in NHRSS-Db, earthquakes record relatively high levels of peak event coverage, seemingly regardless of the fatality numbers. For example, the December 8, 2008 Pakistan earthquake recorded the ninth largest fatality count, 170 fatalities, but recorded the second highest peak article count, 564 articles. This was 221 more articles than the Sichuan, China earthquake, which killed 68,542 more people, and 387 more articles than the Yogyakarta, Indonesia earthquake, which killed 5,608 more people. It could be attributed to the sensitisation of this region, and hence the media, to such events by the devastating 2005 earthquake.

In comparison, as shown in NHRSS-Db coverage, landslides appear to receive a disproportionate level of news coverage, irrespective of recorded fatality numbers. The relationship between landslide fatalities and peak article event count increases in GNAT-Db compared to NHRSS-Db, with an r-squared value of 0.5 compared to 0.3. This increase is likely due to the inclusion of fewer non-fatal and low-fatality landslide events within GNAT-Db. Only one non-fatal event is recorded within the landslide GNAT-Db dataset (1%), compared to 29 in NHRSS-Db (49%). Thus, less low magnitude, high profile events were included within GNAT-Db that may have skewed the trend downwards.

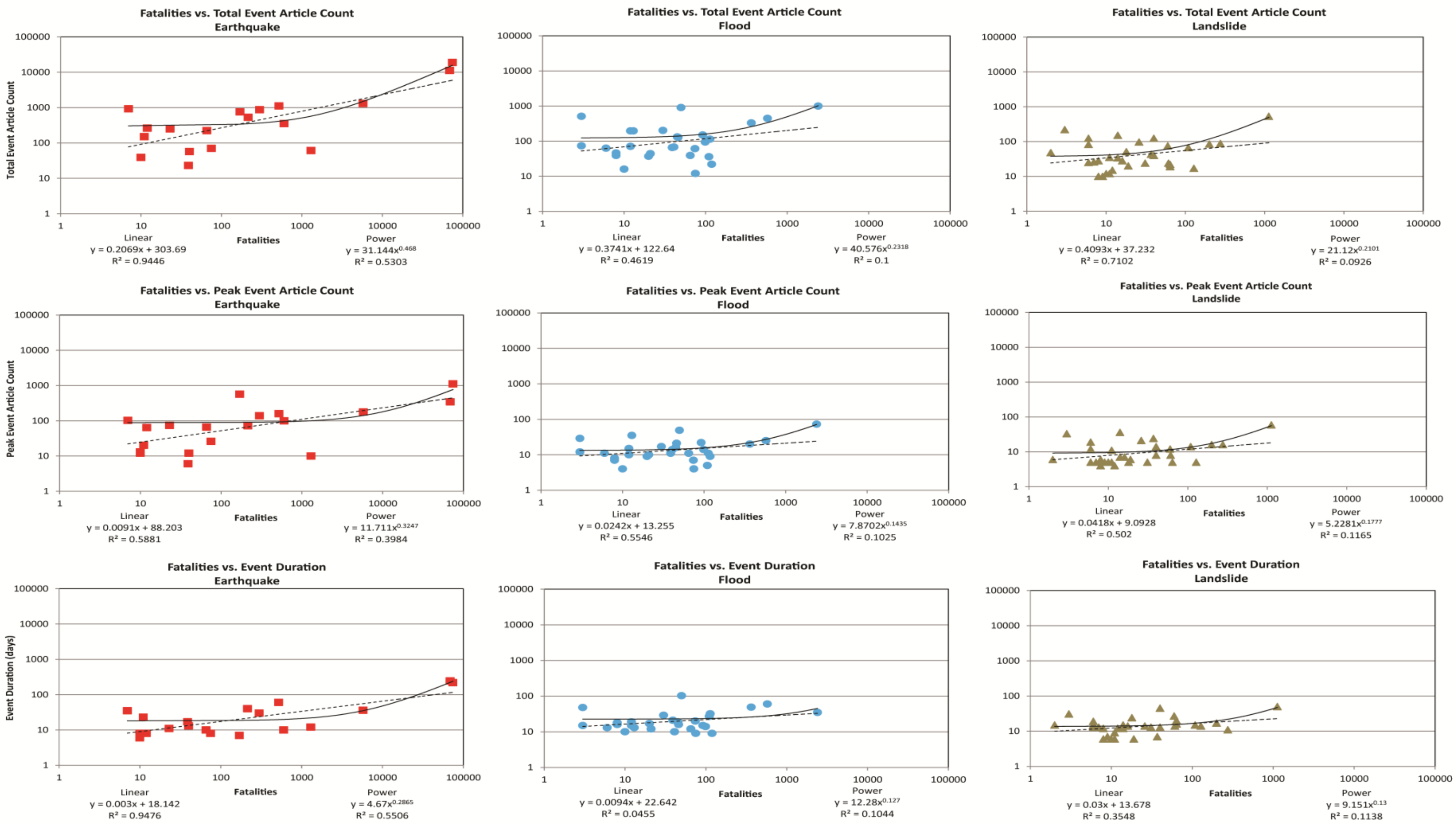

Figure 7.2: GNAT-Db individual event type aggregate statistics

Note log scale

——— Linear regression   - - - - Power regression

7.2.3. Fatalities vs. Event Duration

Earthquake events display the strongest relationship between fatalities and event duration (r-squared = 0.94), compared to landslides (r-squared = 0.35) and floods (r-squared = 0.04). Extreme earthquake events, those that cause in excess of 1,000 fatalities, appear to adhere to a magnitude-frequency relationship. However, excluding these extreme events, the duration of coverage for earthquake events is relatively low compared to flood and landslide events. This is likely due to the instantaneous nature of the events. Earthquakes often only occur for a few seconds or minutes and so the coverage of such events could be suggested to be short also if impact is limited. In comparison, floods, and to a lesser extent landslides, can occur over a scale of days to months and so coverage would be expected to persist for longer.

Floods demonstrate a weak relationship between fatalities and event duration (r-squared 0.04) and event scatter is much greater than that for earthquakes and landslides. This differs greatly from that recorded within NHRSS-Db, whereby floods demonstrated the strongest relationship between fatalities and event duration (r-squared = 0.82). This is likely due to the method of event inclusion within GNAT-Db. The fourth longest event recorded within GNAT-Db (48 days) was the June 1, 2008 Indiana, USA floods, which only killed three people. By comparison, the most fatal event recorded within GNAT-Db, the August 15, 2008 Bihar, India floods, which killed 2,400 people, only recorded coverage for 35 days. In addition, five non-fatal flood events recorded event durations between five and 26 times longer than the August 8, 2008 Lao Cai, Vietnam floods and the October, 19, 2008 Honduras floods, which killed 110 and 119 people respectively.

The relationship between landslide fatalities and event duration within GNAT-Db increases in comparison to NHRSS-Db, with an r-squared value of 0.35 compared to 0.12. This relatively strong relationship is due to the decrease in the number of single day and low duration events recorded within GNAT-Db compared to NHRSS-Db. No landslide events were recorded in GNAT-Db with event durations lower than six days. This is in comparison to the 52 (88%) events that recorded 10 days of coverage or less within NHRSS-Db, 29 of which (55%) were single coverage days.

7.3. Individual Event: Aggregate Statistics Summary

Of the three event coverage parameters discussed, total article count and peak article count appear to be functions of event magnitude (recorded fatalities). In comparison, the relationship between recorded fatalities and event duration is relatively weak. The general distribution of GNAT-Db aggregate statistics - a clustering of events with only extreme events standing out - is likely due to the subjective selection process used for event inclusion: low coverage and low duration events were excluded from analysis and focus was on medium- to large-scale events, in terms of both fatalities and coverage. Thus, it is likely that NHRSS-Db represents a more accurate display of the relationships between natural hazard event magnitude and news media coverage parameters.

As predicted, the largest events, in terms of fatalities, within all three event parameters represent the maximum values recorded, excluding event duration of the Bihar, India floods, which recorded the fifth longest duration. From this analysis, it appears that major events, regardless of event nature, will record high levels of news media coverage. In comparison to this, coverage of smaller events displays much greater variability (scatter). It is likely that this is due to specificity of interest in the event, with local-level interest and spatial variability in response conditioning coverage of such events. It is these smaller events whose coverage is more inherent geographically, in as much as media interest is more greatly conditioned by timing, location, impact and event character.

As noted in analysis of NHRSS-Db aggregate statistics, earthquake events within GNAT-Db appear to receive the highest levels of total and peak coverage, regardless of the magnitude of the event. In comparison, landslides appear to receive a disproportionate level of interest within both databases.

In total, 49 of the 59 (83%) earthquake events recorded within NHRSS-Db were non-fatal events. 22 of these events (44%) occurred in Indonesia and 16 (32%) occurred in Japan. Total recorded article count for these events ranged from one article to 4,728, with a mean article count of 459. However, the coverage of these events is very short lived, with event duration ranging from one day to six, with a mean event duration of 1.6 days. This is undoubtedly due to the shock of the event and the lack of follow up information required (search and rescue operations, assigning of blame etc.). All of the recorded Indonesia earthquakes occurred after the high fatality Yogyakarta and June 2008 Indonesia earthquakes and all the recorded Japan earthquakes occurred after the relatively high fatality Eastern Honshu and Niigata Chuetsu Oki earthquakes. It is clear from this analysis that, following a high magnitude event, the news media is conditioned towards reporting on subsequent events, even if they are of much lower magnitudes. It also appears that the same trend, albeit to a lesser extent, can be seen in the non-fatal landslide events recorded within NHRSS-Db. In comparison to the recorded non-fatal earthquake events, non-fatal landslide events record much lower coverage parameters, with a range in total article count between one and 290 (mean = 24 articles) and event duration ranging between one and 10 days (mean = 2.5 days).

In total, 14 of the 60 (23%) landslide events recorded were non-fatal events. Four (28%) of these events occurred in Kashmir after the fatal May 1, 2008 event; three (21%) occurred in the Bukit Antarabangsa township, Malaysia, following the earlier October 17 and November 14, 2008 fatal events; and two (14%) occurred in Nepal. Landslide events in Nepal are commonplace and as such news agencies, specifically those in Nepal, regularly report on events, even non-fatal events. In comparison to the aforementioned events, four (28%) events occurred in Norway but did not follow an earlier fatal event. Instead, these four events occurred in quick succession, with the last event recording the highest total article count.

It was predicted that the location of an event would be a controlling factor with regards to the level of coverage an event recorded. However, no trends are visible among the location of events and the subsequent coverage parameters within both databases. It is believed that a larger dataset, with a greater number of comparable fatal events, is required to examine the spatial trends within event magnitude, coverage and location. Non-fatal 'Eastern' events were expected to record little to no coverage, with non-fatal 'Western' events expected to record relatively high levels of coverage. However, from the above analysis, it appears that the sensitivity of the news media to the occurrence of non-fatal hazard events may in fact be more responsive after a large event has occurred in that area, more so than the actual location of the event: 'Eastern' or 'Western.'

7.4. Magnitude-Frequency Statistics

As discussed in Chapter Three, a number of natural hazards have been shown to exhibit power-law magnitude-frequency statistics (Malamud, *et al*. 2004; Malamud and Turcotte, 2006). Various studies have found that earthquakes (Gutenberg and Richter, 1954), landslides (Turcotte and Malamud, 2004), floods (Malamud and Turcotte, 2006) and forest fires (Malamud *et al*., 1998) adhere to scaling in both magnitude and frequency, with the occurrence of a large number of small events, a moderate number of medium sized events and a few large events. When magnitude-frequency statistics for such natural hazard events are plotted on a log-log graph, a linear trend is apparent, showing the proportional relationship between the number of small events (a lot) to medium events (a medium amounts) to large events (a small amount). Such analysis allows for the prediction of median (i.e. the average in terms of magnitude) and theoretical maximum (the point at which the line on the graph crosses the y=0 axis) sized events. However, Turcotte and Malamud (2004) noted that, within the log-log magnitude-frequency distribution of landslides, a rollover exists within the distribution of the smallest recorded events. This means that there are fewer small events recorded than would be expected. However, this could be due to the inherent difficulty in recording the smallest events (Petley *et al*., 2005) or a physical phenomenon, or a mixture of the two.

It is therefore proposed that, since a power-law magnitude-frequency behaviour is observed in a range of inventories for natural hazards and geophysical events, the same scaling of event occurrence should be apparent within events recorded by the news media and coverage. This will be discussed here.

7.4.1. NHRSS-Db: Magnitude-Frequency Statistics

Figures 7.3 and 7.4 represent the magnitude (number of fatalities)-frequency (number of recorded events) distribution of hazard events recorded within both NHRSS-Db and GNAT-Db. As expected, the magnitude-frequency distribution of events within NHRSS-Db, as shown in figure 7.3, follow a power-law scaling. However, small (non-fatal) events, within the flood and landslide datasets are lower than expected, displaying the same rollover as described by Turcotte and Malamud (2004). Thus, it appears that both small flood and landslide events are underrepresented within NHRSS-Db. In comparison, small events recorded within the earthquake dataset adhere to power-law scaling. However, earthquake events that caused between one and 10 fatalities appear much lower than would be expected on a linear scale.

7.4.2. GNAT-Db: Magnitude-Frequency Statistics

In comparison to NHRSS-Db magnitude-frequency statistics, those presented for GNAT-Db display a weaker power-law magnitude-frequency relationship. As can be seen in figure 7.4, large events within all three event type datasets follow the predicted power-law scaling. However, as with NHRSS-Db flood and landslide events, smaller events appear to rollover, with much fewer events recorded than would be expected. Each event type dataset appears to rollover at different points, denoting a difference in median event size for each event type. Thus, the ratio of small to medium to large events is different for each event type.

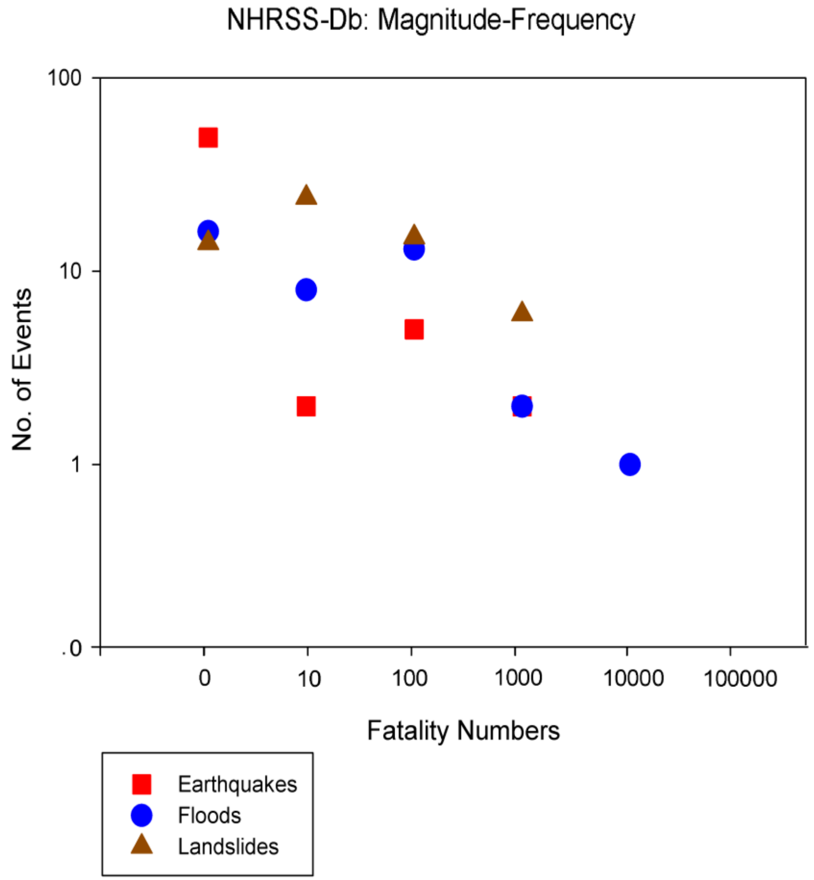

Figure 7.3: NHRSS-Db magnitude-frequency graphs

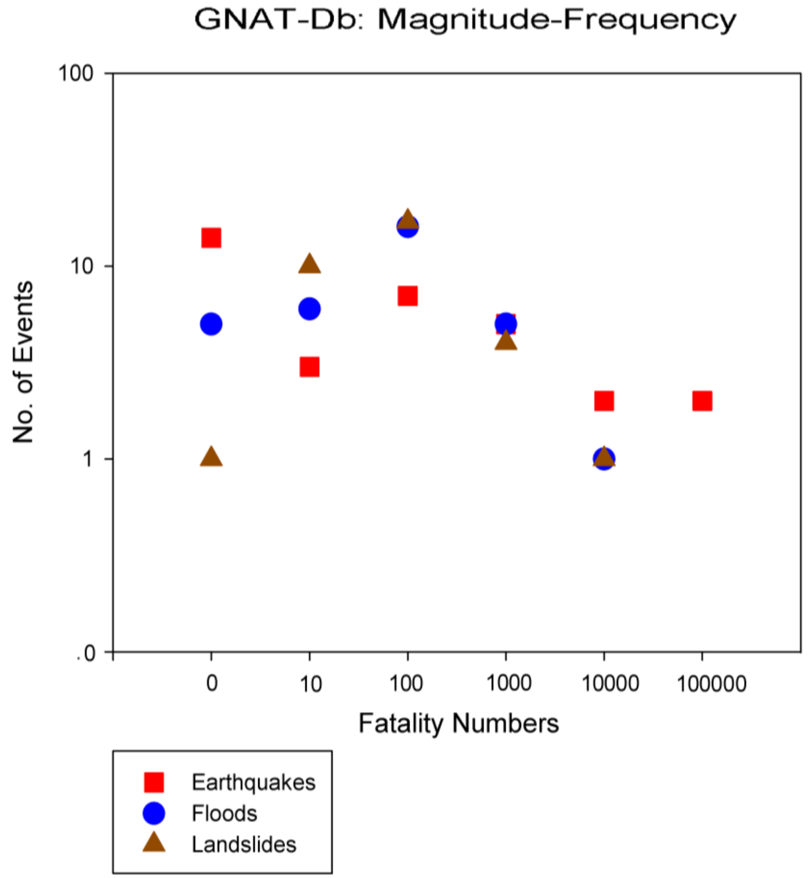

Figure 7.4: GNAT-Db magnitude-frequency graphs

7.4.3. Magnitude-Frequency Statistics Summary

In both databases small earthquake events appear to be well represented, with no recorded rollover point. This is likely due to the way in which earthquakes are recorded and reported. The science involved in the recording of earthquakes is astute enough that even the smallest events are recorded and reported. In comparison, it is likely that small flood and landslide events rely more upon the efficiency of news media reporting: adequate intelligence networks or a concerned audience for example.

It must be noted that the graphs presented here do have their flaws. For example, the data does not cover a wide range of event magnitudes and the number of events recorded for each data point is very small. Thus, the data may be statistically questionable. In conjunction, hazard events recorded within GNAT-Db were chosen based upon a number of subjective decisions. For example, coverage duration of an event had to be longer than five days and events were often chosen due to previous knowledge of the event. It is therefore unlikely that small events, both in terms of fatality numbers or coverage, are represented well within GNAT-Db. This would account for the rollover displayed for such events within GNAT-Db. However, the same rollover is present within NHRSS-Db events, which represents a less subjective event dataset because events are included as they occur and no event selection criteria was utilised. It can therefore be assumed that, with regards to this data, the apparent underrepresentation of small hazard events is in fact an accurate representation of small-scale hazard occurrence.

7.5. Cumulative Coverage

The cumulative coverage for each of the events recorded in GNAT-Db was normalised by both time and article count, making all events comparable irrespective of size or duration. This allows for scale free comparison between events of different magnitudes, to attain whether news media coverage of individual events is more a function of event type than magnitude and or duration.

Earthquake coverage, as shown in figure 7.5.a, displays the most variation within individual coverage. On average, large earthquake events, shown by the increased line thickness, follow a concave pattern, while small to medium events follow a more linear build-up. This represents an instantaneous reporting and coverage for the largest events, compared to a slower accumulating coverage for smaller events. Large events are also characterised by a steady accumulation of coverage, compared to small-medium events whose coverage is more stepped in nature, mainly as a function of their dominance by single or small numbers of reports as compared to the wider coverage of larger events in which such single events are less significant.

Cumulative landslide coverage, figure 7.5.c, shows less variation on an individual event basis. The range of coverage is more condense and, on average, events follow a concave build-up. Unlike earthquake coverage, event size patterns are less discernable, with no clear grouping of events of a similar magnitude. Landslide coverage is also, on average, stepped in nature, with all events displaying a progressive stepped accumulation of coverage over time. This is likely due to the nature of events involved within a landslide event. For example, the occurrence of the event, the search for survivors, the end of the search and rescue operation, and the explanation as to why the event occurred, all occur on a stepped timeline. It is therefore likely that the news media coverage of such events records this stepped occurrence.

Compared to earthquake and landslide cumulative coverage, flood coverage accumulation for all 33 events is much more compact and displays much less variation on an individual event level. On average, flood coverage follows a more linear build-up, with the majority of events featuring much shorter steps in coverage compared to those in both landslide and earthquake coverage. The majority of flood events within GNAT-Db are of a similar magnitude. However, a number of small events, those that killed one to 10 people, are recorded and these events display a distinct grouping tendency and show very little variation from a linear build-up.

Perhaps more interestingly, net differences are observed between the three event types. Given the scale free nature of the graphical display, this must reflect the physical nature of the event and/or the tendency for a different media response as a function of event type, irrespective of magnitude, duration and impact.

For each normalised event the hypsometric integral, which is the ratio of area beneath the hypsometric curve to total graph area, was calculated. The hypsometric integral for each event was then compared to event type averages, regional averages, event magnitude averages and the distribution of integrals for all events of each type.

The standard deviation, which is the measure of variability within the data around the mean, was calculated for each event type. The standard deviation for all flood event hypsometric integrals is 0.05097, which indicates that all data points tend towards the mean of all flood hypsometric values with little inter-event variability, validating the compact variation in normalised cumulative flood build-up.

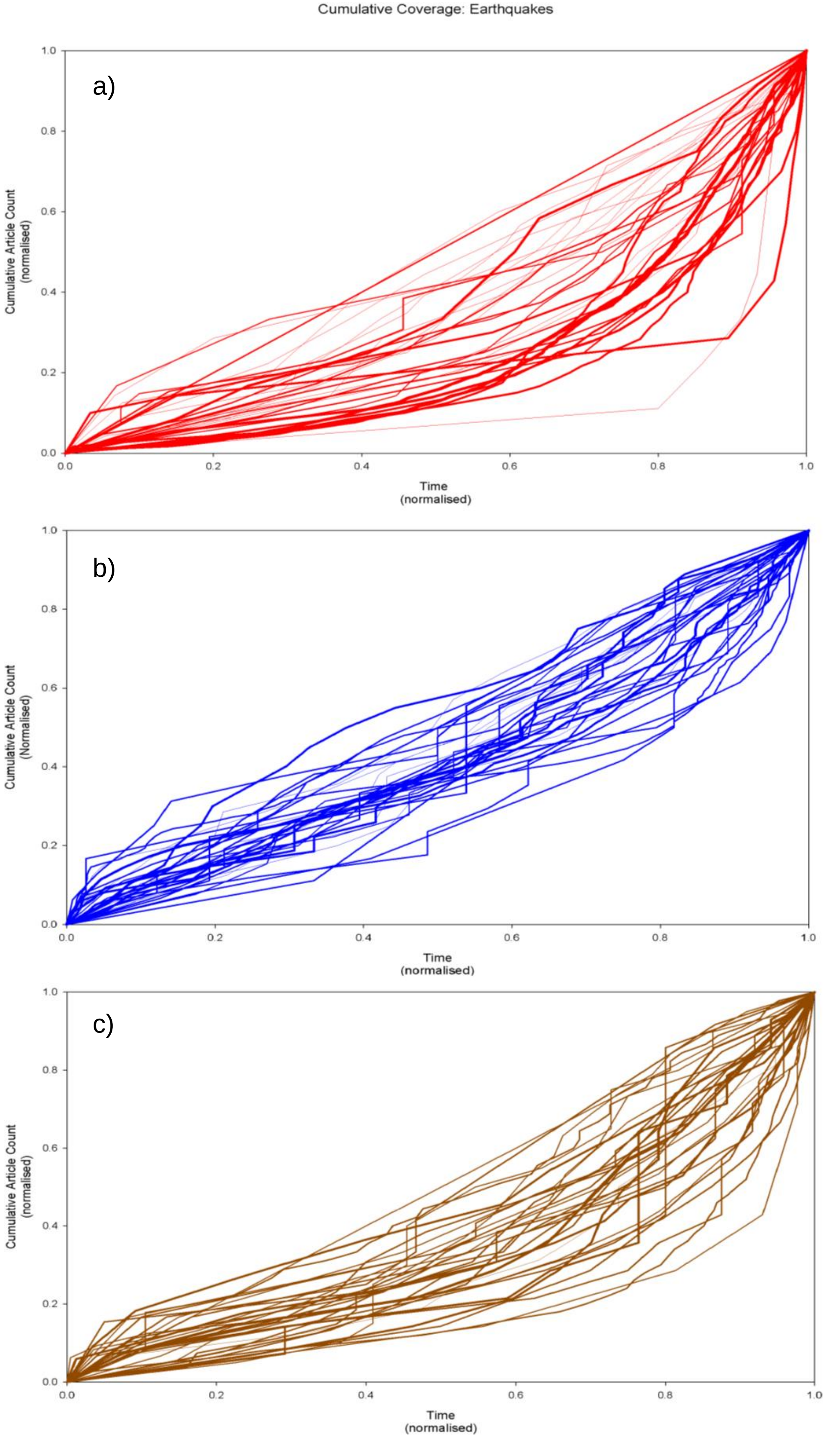

Figure 7.5. GNAT-Db event type cumulative coverage graphs

a) earthquake b) flood c) landslide

The standard deviation calculated for earthquake and landslide hypsometric integrals is similar, at 0.082719 and 0.075781 respectively. This confirms the variation in cumulative build-up for each event type displayed in figures 7.5.a to 7.5.c.

The integral value varies between 0 and 1, with a value of 0.5 representing a uniformly concavo-convex or linear slope, and values tending towards 0 representing increasingly concave slopes and values tending towards 1 representing increasingly convex slopes. Concave events show a delayed media response, with little initial interest. Convex events show a high instant media reaction, and then little subsequent interest, and linear or concavo-convex coverage represents a steady or gradual level of interest during the duration of the event. Within the zero to one value range, a number of subdivisions are identified. Significantly concave profiles are represented by a hypsometric value less than 0.425 and concave profiles are those with a value greater than 0.575 (Allison and Higgitt, 1998). Values between 0.425 and 0.575 signify symmetrically concavo-convex patterns of media interest.

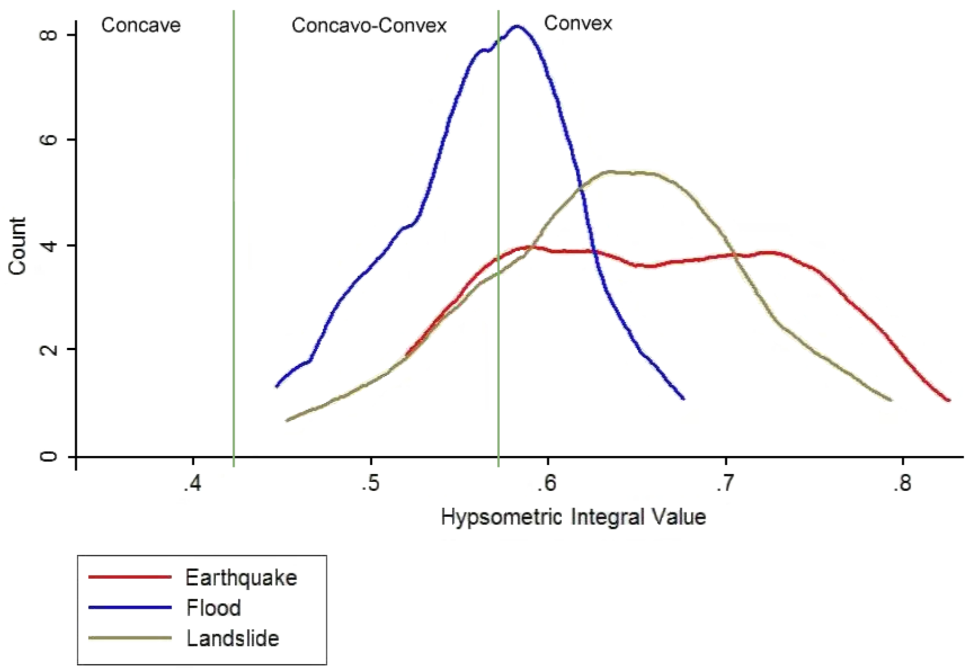

Figure 7.6: GNAT-Db event type hypsometric integral value graph

The hypsometric integral values for each of the 33 events within each GNAT-Db event type dataset were plotted on a kernel density, or k-density, graph (see figure 7.6). I employed kernel density estimation due to its ability to accurately smooth data, thus allowing for extrapolation of information from the entire dataset, and avoiding the arbitrary binning of an equivalent histogram plot. Once each event type dataset was plotted, statistical summary data was extrapolated (see table 7.1) and trends within event type coverage were made evident.

	Earthquake	Flood	Landslide
Mean	0.6601939	0.564597	0.6368545
Standard Deviation	0.0827144	0.0509582	0.0757712
Variance	0.0068417	0.025967	0.0057413
Skewness	0.0815922	-0.2318695	-0.1732991
Kurtosis	1.920701	2.904363	2.940046

Table 7.1: Table showing summary information of GNAT-Db event type hypsometric integral value data

Figure 7.6 demonstrates how the majority of recorded events exhibit a trend towards convex profile slopes. 70 of the 99 recorded events exhibit convex profiles, with the remaining 29 events exhibiting concavo-convex profiles. Of these 29 concavo-convex profiles, 16 are flood events, seven are landslides, and six are earthquakes. Given the intrinsic nature of natural hazard events – that they are often unpredictable, episodic, and rapid in their onset – coupled with the assertion that the media can (and will) only cover an event once it has happened (Ploughman, 1995), that is to say when the event is 'newsworthy,' means that a trend towards convex coverage is expected.

It was expected that each hazard event type in question would display very different coverage profiles. Landslides and earthquakes were expected to exhibit increasingly convex profiles, with an increasingly positive skew, due to the rapid onset of such events. The physical processes involved in each event mean that there is often little warning that such an event will occur, but soon after the event has occurred the extent of the impact is evident. It is possible that landslide events may be 'expected,' perhaps due to heavy rains and/or a history of such events in an area, but it is unlikely that coverage will begin until the event has occurred. A few events are removed from this pattern in instances such that the impact only becomes evident days after the actual occurrence. This might include for example, an earthquake occurring in a remote location in which communications and locations are limited, and the true spatial extent and intensity of impact only develops days or weeks after. The situation in the remote Himalaya Neelum and Jeelum Valleys affected by the 2005 Kashmir Earthquake is a good example of this phenomenon. In landslides, a similar behaviour may also be observed when settlements are engulfed, and only after several days can the missing be attributed to the disaster as fatalities, perhaps then triggering more sustained media interest.

By comparison, floods were expected to show a slower, more concave cumulative build up in coverage due to the more prolonged physical processes inherent in such events. Floods are known to follow predictable seasonal climatic changes and thus people in areas prone to flooding often know when and where to expect flood events and, as such, news media coverage may predate the actual event. Floods also need several days of rain, which, due to ever-improving weather system tracking and monsoon variability forecasting, is often predictable in its onset, even in areas where flooding is rare. Due to the more predictable nature of floods, compared to landslides and earthquakes, it is likely that news media coverage will increase over time as the likelihood and extent of the event becomes apparent.

Despite the general trend towards a convex nature of coverage, it is clear that each event type demonstrates a very different cumulative coverage profile. These patterns can be related to the physical processes inherent within each hazard type and the expected news media coverage models for each event type in question.

7.5.1. Earthquakes

All 33 of the recorded earthquake events tend more towards a hypsometric value of one. However, six of the 33 events exhibit a symmetrically concavo-convex profile with values ranging from 0.52 – 0.575. Of the six concavo-convex events, five are non-fatal events and one resulted in 10 fatalities. This would suggest low fatality events exhibit more concavo-convex profiles. However, the remaining non/low-fatality events (nine of which were non-fatal and one resulted in seven deaths) exhibit convex profiles with hypsometric values ranging from 0.579 to 0.825. The event with the highest hypsometric value, 0.825, is the Afghanistan earthquake, which was a non-fatal event. No discernable relationship was found between hypsometric value and event coverage parameters (total coverage, duration, peak coverage, fatalities, start-to-peak duration, and peak-to-end), most likely to be attributed to the limited number and diversity of events within this database.

Recorded earthquakes display a bimodal platykurtic kurtosis distribution, with a kurtosis value of 1.920. This value is much lower than both flood and landslide kurtosis, 2.904 and 2.940 respectively. A lower kurtosis value denotes a lower, wider peak around the mean and thinner profile ‘tails.’ This, in turn, denotes that earthquake coverage is more varied in its cumulative build up with a large range in cumulative profiles. On average, recorded earthquake lead-in duration (the time from the start of coverage to the peak of coverage) is two days. This is followed by a much slower tail-off period (the time from peak coverage to the end of coverage), which is, on average, 14 days.

Earthquakes are sudden, unexpected events. This geo-physical characteristic is displayed clearly by the positive skewness of the resultant k-density curve (0.081), denoting a rapid build-up to peak, followed by a longer tail-off. This is a characteristic found within all recorded earthquake events.

Due to the unexpected nature of earthquakes, coverage cannot predate the event in question. The only instance where this could be argued to occur is when significant aftershocks to a large event are considered to be an event themselves. The magnitude and location of an earthquake event is readily established, and as such, it is possible to make quick casualty and damage estimates. The relatively high news media coverage for high magnitude earthquakes may therefore be more related to a 'worst case' scenario from past experience. For example, it is apparent that almost all earthquakes with a magnitude greater than seven will be found on the UK BBC News website, for example, yet only infrequently do such events affect society creating a disaster. In this instance, it could be argued that the media is more attuned to the potential impact of such an event magnitude, rather than the actual impact, which in itself shows an implicit and perhaps precautionary scientific awareness in media response.

These phenomena may explain the bimodal nature of the distribution – in that almost all earthquakes register in the media, yet only some result in damage and fatalities – resulting in either a rapid uptake and then a cessation of coverage, or a rapid uptake and continued coverage dependent upon the unfolding situation in the field. Accordingly, peak coverage is likely to occur within days, if not hours, of the event occurring as more detailed information emerges. It is also the shock of the event that makes it 'newsworthy,' an issue discussed in more depth in Chapter Nine. Event decay coverage will also persist as the extent of the event becomes apparent. Large events over wide, often inaccessible areas, with high fatality numbers, are expected to have longer decay coverage periods as the recovery of bodies and cleanup will take longer.

The mean hypsometric value for all earthquake events, which describes the focal value of the distribution, is 0.66. However, this figure is skewed upwards by the very large Sichuan and Kashmir earthquakes. When these two events are omitted, the mean drops to 0.654 and the skewness increases to 0.217.

18 of the 33 recorded earthquakes are 'small' events, with total coverage less than 100 articles and an average of 43 articles. This is in comparison to the remaining 15 'large' events, which average 2,486 articles in total (561 articles when the Sichuan and

Kashmir events are excluded). It is this extreme range in average article total that may have also contributed to the bimodal distribution of earthquake hypsometric values. It could be argued that within the timeframe of the data considered here, two types of earthquake event are captured – the extreme fatality event (Sichuan and Kashmir) and the more frequent smaller scale earthquake.

The standard deviation for earthquake hypsometric values is 0.082. This value represents the relatively large variability or dispersion of the dataset. Of the three event types, earthquakes have the highest standard deviation, followed by landslides (0.075) and floods (0.050). This indicates that cumulative earthquake coverage is more variable in nature, with a greater range from the mean, again as a function of the shear variety of event under consideration here.

7.5.2. Landslides

Seven of the 33 recorded landslide events demonstrate concavo-convex profiles, with hypsometric integral values ranging from 0.452 to 0.575. This infers a gradual increase in coverage, with either a small tendency for accelerated coverage at the outset, or an accelerated cessation of coverage at the end of the event. The remaining 26 events are represented by convex profiles, ranging from a hypsometric value of 0.578 to 0.792. It was hypothesised that landslides would demonstrate coverage profiles similar to flood profiles. That is to say, the lead-in duration would be, on average, longer than earthquakes but shorter than floods and that the decay period duration, irrespective of event magnitude, would be similar to that of flood events. This may be due to a combination of the effectively instantaneous impact of the physical processes involved in landslide events – such that extent and impact are relatively easy to ascertain and the order of magnitude of the ensuing recovery processes. Again, it is key to note that, beyond the large magnitude earthquakes discussed above, the dominant trigger in fatal landslide events is precipitation, notably the monsoon rains in South and South East Asia. As such the sensitivity of the media – or the expectation for such events – may be more attuned and hence responsive to their occurrence. This is certainly the case in news agencies such as Nepal's Kantipur Online, which regularly features landslide events during the summer monsoon period.

As with recorded earthquake events, landslides demonstrate a platykurtic kurtosis distribution. With a kurtosis value of 2.940, landslides record the highest kurtosis value of the three event types. This signifies that the variance within the dataset is due to infrequent extreme deviations, mirrored by the common small-scale event types in the dataset. No relationship was found to be present between landslide hypsometric value and event parameters (total coverage, duration, peak coverage, fatalities, start-to-peak and peak-to-end duration), possibly as a function of the variability of event types (perhaps failure types, locations, outcomes, dynamics), encompassed within the dataset. I would argue that more significant trends may become apparent with a wider sample that considers this variability more adequately.

The majority of events record a similar cumulative coverage profile: a low first day article count, often followed quickly by a peak article count only slightly higher than initial coverage, in turn followed by the shortest coverage decay duration of the three event types (on average 13 days). However, there are nine events that demonstrate slightly different coverage profiles: peak coverage is attained on the first day of coverage, thus the ratio between lead-in time and decay time is much lower than the average (1:14 compared to the dataset average of 1:6). Both of these coverage profile types result in a convex profile slope.

By comparison, six of the seven events recording concavo-convex profiles are characterised by more gradual cumulative coverage build-up, with lead-in times similar to decay coverage periods. On analysis, these are relatively large events located in relatively poorly reported areas, such that the extent and magnitude of the event only becomes apparent after several days.

As noted elsewhere (see Petley *et al*., 2005), the majority of recorded landslides were rainfall-triggered events. Like floods, a certain level of lead-in coverage is expected due to the relative predictability of high intensity rainfall and meso-scale climatic systems. This ability has been greatly enhanced during the study period with the introduction of satellite systems such as TRMM (Tropical Rainfall Monitoring Mission) which effectively gives global real-time rainfall monitoring data, with an inherent predictive capability. Despite these advances in observations, it remains unlikely that the extent of the event will be made apparent for several days, particularly in large events.

Landslide lead-in coverage is (time to peak reporting), on average, slightly longer than earthquake coverage (three days compared to two days) and coverage decay duration is slightly shorter (13 days compared to 14 days). This is demonstrated by a negative skewness value of -0.173. In the case of rainfall induced landslides, the slightly longer lead-in time is perhaps due to increased reports of heavy rains in the days leading up to a landslide event, highlighting the possibility of landslides in any given area. It is also possible that, due to the magnitude and/or location of the event, the extent of the damage/number of fatalities, and thus peak coverage, is not made apparent for several days as it takes time to assess the situation and for information to filter into the media realm. The nature of landslides is such that heavy machinery, and significant man-power is needed to excavate the area affected by a failure, only after which can a full assessment of fatalities be made. If the situation worsens during excavation, coverage may rise, but if it becomes apparent that the landslide impact is not as severe, then coverage may tail off.

Decay coverage duration may continue due to the difficulties inherent within landslide fatality recovery and cleanup. It is also apparent from case study analysis that follow-up reporting of a landslide event focuses on whom to blame – government, climate change, illegal logging, shoddy workmanship etc. – which is often a lengthy and protracted process. For example, decay coverage of the two recorded landslides in Bukit Antarabangsa, Malaysia focused almost solely on the issue of blame – and reporting continues in December 2009, with the Malaysian Cabinet decision to declassify the report on the event only one year later.

The mean hypsometric integral value for landslide events is 0.636, similar to recorded earthquake mean, 0.66. However, as shown by the k-density graph, a larger number of landslide events are recorded around the mean compared to the bimodal distribution of earthquake events either side of the earthquake mean. Hence landslides are more self-similar in character, and therefore the media response – and by implication the nature of landslides - is more predictable. The range between landslide hypsometric values is the largest of the three event types in question, 0.34. Coupled with a standard deviation of 0.757, this signifies that the coverage of landslide events is highly variable.

The variation in landslide coverage is difficult to quantify and cannot be attributed to one dominant factor. 28 of the 33 recorded landslides are classed as ‘low’ coverage events, with fewer than 100 individual recorded articles. The remaining five recorded events have total coverage counts ranging from 124 to 533, and are classed as ‘high’ coverage events. However, only one of the five ‘high’ coverage events is classed as a ‘high’ fatality event, the Southern Leyte, Philippines landslide. The remaining four ‘high’ fatality events fall within the ‘low’ coverage category, with total article counts of 17, 67, 85 and 88. Thus, no discernable trend is apparent between fatality numbers and total article count. What is clear however in the case of landslides is that reporting is more sensitive to the smallest events, those which only result in single figure fatalities, as compared to earthquakes or floods. This may be a reflection of the actual physical distribution of fatalities as a result of landslides, but may also be a measure of the relative media interest in one fatality due to flooding.

7.5.3. Floods

17 of the 33 recorded flood events demonstrate convex profiles, with hypsometric integral values tending towards one. The remaining 16 events have concavo-convex profiles, with hypsometric values between 0.446 and 0.574. It was expected that flood events would exhibit more concave coverage profiles, with longer lead-in and decay times and less prominent peaks. However, only four of the events tended towards a hypsometric value of zero. Flood events demonstrate a leptokurtic kurtosis distribution, with a kurtosis value of 2.904. That is to say, the peak distribution of events is more acute around the mean value, 0.564, and that there is a higher probability than a normally distributed variable of extreme values. This distribution is also referred to as a 'Laplace' distribution or a 'double exponential' distribution due to its steep angled growth and decay curves.

The range in the hypsometric integral values for recorded flood events is 0.23, compared to 0.3 and 0.34 for earthquakes and landslides respectively. Coupled with the kurtosis distribution, centred closely on the mean, and the low standard deviation of 0.050, this indicates that recorded flood events demonstrate little variance and that event coverage tends towards the mean value. This trend in overall flood reporting is demonstrated well by the close grouping of events in the cumulative coverage graph (figures 7.5.a to 7.5.c). What is striking is that the cumulative graphs of flood coverage are visibly, and statistically, different to both earthquakes and landslides (which themselves although more similar, show some marked differences).

Floods are, and can be, anticipated and/or predicted in both timing and location. This is demonstrated by the high negative skew value of -0.231. The average flood event lead-in duration is six days, twice that of landslides lead-in duration (three days) and three times the average lead-in time for recorded earthquake events (two days). Only 10 of the 33 events had lead-in times longer than six days. One of these 10 events was the Haiti floods, which had a lead-in duration of 37 days. This lengthy period of coverage build-up was due to a series of tropical storms affecting the area over a period of three weeks, which continuously exasperated the complex socio-political situation and led to an increasing number of fatalities nationwide. The Haiti floods will be discussed at length in Chapter Eight.

Longer lead-in times were expected for recorded flood events due to slower physical processes involved. As the likelihood of a flood event increases because heavy rains persist or a tropical storm heads landward, the coverage will progressively increase as the scope of the event becomes apparent. Analysis of the recorded flood events suggests that peak coverage is likely to occur at the time, or just after, flooding reaches its high stage, which is in turn the time of greatest risk and often coincides with a peak in fatality numbers.

Floods also have the longest average event decay period (when the Kashmir and Sichuan earthquakes are omitted from the earthquake dataset), 18 days. This is in comparison to an average decay duration of 14 days for both landslides and earthquakes (27 days when the Kashmir and Sichuan earthquakes are included). It can take some time to establish the extent of the damage caused by a large flood, both in terms of casualties and economic damage. The duration of the period of retreat of flood waters also hoods significant control over relief efforts, access, and the onset of subsequent disease. Analysis of event coverage suggests that, after peak coverage is reached, which usually coincides with a peak in fatality numbers, calculations of economic damage and recovery cost are likely to dominate the decline in coverage.

The statistical analysis presented here suggests that all the recorded flood events were reported in a similar way, regardless of fatality numbers, event magnitude and location. A range of events was chosen, demonstrating fatality counts ranging from zero to 2,400. Although a positive linear relationship between fatality numbers and total article count is evident (r-squared = 0.625), this improves in significance (r-squared = 0.701) once the outlier event (the Indiana, USA floods) is omitted. However, once event data is normalised, there is no significant difference between the cumulative coverage profile of a low-fatality event and a high-fatality event. This is surprising, as at the outset news media coverage appeared flashy, indiscriminate, and highly sensitive to the coincidence of local and global geography and concurrent news, whereas this result demonstrates consistent, predictable media behaviour.

Event coverage decay is more variable and is not wholly dependent upon fatality numbers, as first hypothesised. A number of high fatality events can be seen to have decay coverage periods far shorter than the average, namely the August, 2008 Lao Cai, Vietnam floods and the November 24, 2008 Brazil floods. Several low-fatality events are also shown to have decay periods much longer than would be expected, namely August 5, 2008, Pakistan floods and June 2008 Indiana, USA floods. It is likely that a combination of factors control the level and extent of flood coverage.

Examination of lead-in articles for the recorded flood events reveals that articles become increasingly preoccupied with fatality numbers. However, when fatality numbers have peaked, event decay coverage is more concerned with economic damage and cleanup.

6.5.4. Summary

It was expected that event magnitude, fatality numbers and/or event location would be the controlling factors over cumulative event coverage build-up. However, analysis of each event type dataset has showed that there is little to no discernable trend between individual event characteristics (fatality numbers, total event coverage, location) and cumulative coverage build-up. It is therefore likely that a combination of event characteristics (namely fatality numbers, location and time of event occurrence) directs event coverage build-up. Despite the lack of direct correlations, the analysis of the magnitude frequency of events extracted from these databases, and the scale-free comparison of the event coverage using the hypsometric analysis, shows consistent, predictable behaviour between events reported worldwide. I suggest that this consistency in coverage is a function of both the physical nature of the hazard, as evidenced by the systematic differences between flood, earthquake and landslide coverage, and the contextual conditioning of news media coverage of these. What is perhaps most surprising is that in an apparently erratic, and highly selective media that such recurrent behaviour occurs. I argue that this reaffirms my initial assertion that the media is a valuable tool for studying natural hazards, because coverage holds valuable information on location and timing, as well as potential event dynamics, timing and impact on a timeframe that is of use to disaster relief planning and management. I argue that to understand this apparent media sensitivity, it is therefore necessary to examine recorded events on an individual basis and assess their subsequent coverage. As such, a selection of case study events has been chosen and will be examined in detail to ascertain why news media coverage for that event developed as it did. Such detailed individual examination may provide information as to the controlling factors of natural hazard news media coverage.

Chapter Eight: Results: Case Study Analysis

Twelve case study events, four of each event type under examination, were chosen for further analysis. Events were chosen to illustrate the variability and inter-linked nature of the factors that control natural hazard media coverage. Events were chosen to demonstrate a wide spatial distribution, with a selection of 'Western' and 'Eastern' events. My focus will be on the similarities and differences in news media coverage of events of similar magnitudes (fatality numbers) and coverage profiles from varying locations. For example, how and why is a 'high' fatality 'Eastern' event reported by the media compared to a 'low' fatality 'Western' hazard event?

Event	Event Type	Fatalities	Total Event Article Count	Peak Event Article Count	Event Duration (Days)
L'Aquila, Italy	EQ	299	873	139	30
Sichuan, China	EQ	68,712	11,187	343	245
Kashmir, Pakistan Administered Kashmir	EQ	74,698	18,806	1,110	218
Niigata Chuetsu Oki, Japan	EQ	7	925	102	35
Southern Leyte, Philippines	LS	1,126	533	59	50
Bukit Antarabangsa, Malaysia	LS	5	221	33	31
Chittagong, Bangladesh	LS	128	17	5	14
La Conchita, California	LS	14	151	36	12
Indiana, USA	FL	3	510	29	48
Haiti	FL	600	908	49	103
Lao Cai, Vietnam	FL	119	26	9	9
Queensland, Australia (Nov 2008) Queensland, Australia (Feb 2009)	FL	0 21	240 44	20 10	21 12

Table 8.1: Table showing GNAT-Db case study summary information

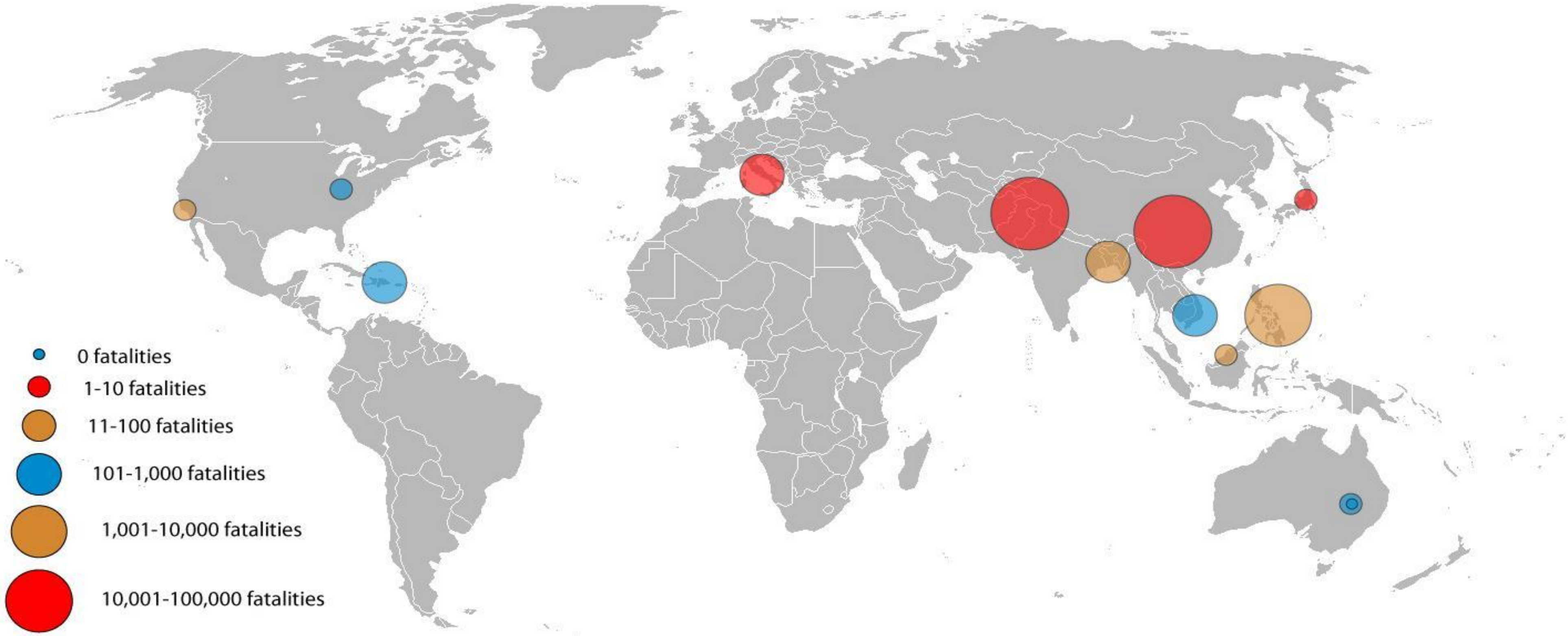

Figure 8.1: GNAT-Db case study location map

8.1. L'Aquila, Italy Earthquake

8.1.1. Background to the Event

The L'Aquila, Italy earthquake represents the only Western earthquake recorded within the GNAT-Db that caused major fatality numbers. It is also the most recent earthquake event recorded within the GNAT-Db and the coverage pattern is particularly noteworthy because of the inconsistent pattern in the reporting of fatalities. In terms of total coverage, the L'Aquila, Italy earthquake ranks as the seventh largest recorded event within the entire GNAT-Db.

At 01:32 local time on April 6, 2009, a 6.3 Mw earthquake struck L'Aquila Italy. Early media reports described the "death toll at 16, with 30 people missing[6]." However, by morning the next day, reports began to emerge that suggested the event was a lot worse than initially suspected. L'Aquila Mayor Massimo Cialente confirmed 90 deaths and announced that 10,000 people were homeless and around 10,000 to 15,000 buildings had either been damaged or destroyed.

Earthquakes in Italy are common. Figure 8.2 shows all the earthquakes recorded by the USGS throughout Italy over the past 19 years. The star represents the location of the L'Aquila earthquake.

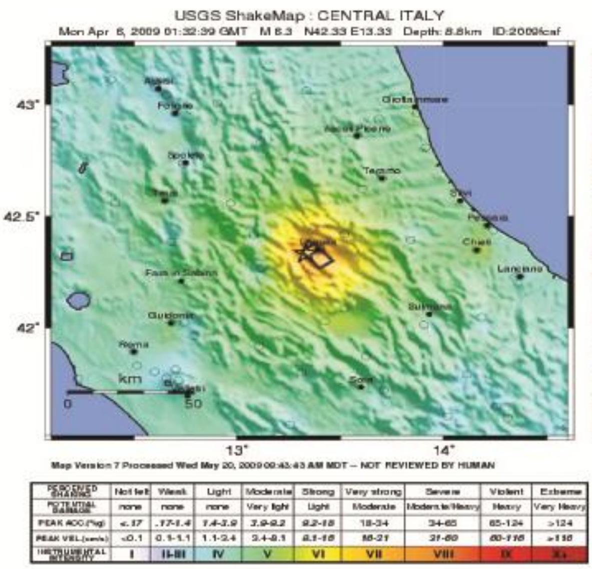

Figure 8.2: L'Aquila, Italy earthquake USGS ShakeMap showing location and intensity.

Source: USGS. 2008

Aerial photograph of the damage caused by the earthquake.

Source: Macleans.Ca, 2009

[6] http://www.telegraph.co.uk/news/worldnews/europe/italy/5112771/Italian-earthquake-At-least-16-dead-and-thousands-displaced.html

Italy experiences frequent small shallow earthquakes, with most having a depth no greater than 35km and a magnitude no greater than 5. Fatal earthquakes in Italy are rare. The last major fatal earthquake was the 6.9Mw November 23, 1980 Campania earthquake, which killed 2,570 people.

Seismic activity in Italy is the result of the ongoing tectonic collision between the African and Eurasian plates. This collision, and subsequent uplift, resulted in the uplift of the Alps. However, regional scale seismic activity was not responsible for the L'Aquila earthquake; local level movement on a NW-SE trending fault was. The local level back-arc spreading within the Tyrrhenian Sea, which is opening faster than the African and Eurasian Plates are colliding, is a major driving force behind local level tectonic activity (Kahle and Mueller, 1998). Also, L'Aquila is built upon the bed of an ancient lake, which provides a soil structure that amplifies seismic waves.

At a local level, the city of L'Aquila has a lengthy history of earthquakes. The city was struck by earthquakes in 1315, 1349, 1452, 1501, 1646, 1703, and 1706. The last major deadly earthquake to affect the city was the February 1703 event, which caused devastation across much of central Italy and destroyed large swathes of the L'Aquila city and killed over 5,000 people.

8.1.2. Media Coverage of the Event

The news media coverage of the L'Aquila earthquake is a prime example of how news media coverage and knowledge of a natural hazard event can develop over time; from "two killed in Italy quake[7]" to "quake: death toll at 281[8]."

It was expected that the L'Aquila, Italy earthquake would demonstrate a coverage profile similar to the predicted earthquake model; rapid coverage growth to a high peak, followed by a steady decline in coverage. It was also expected that, because it was a high casualty Western European event, total article count, peak article count and coverage duration would be high and last for a long time. Equally, it was expected that the L'Aquila earthquake would record high coverage statistics due to its status as the only major Western earthquake event.

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[7] http://www.thaindian.com/newsportal/world-news/two-killed-in-italy-quake-second-lead_100175960.html

[8] http://query.nytimes.com/gst/fullpage.html?res=9507E5D91130F933A25757C0A96F9C8B63

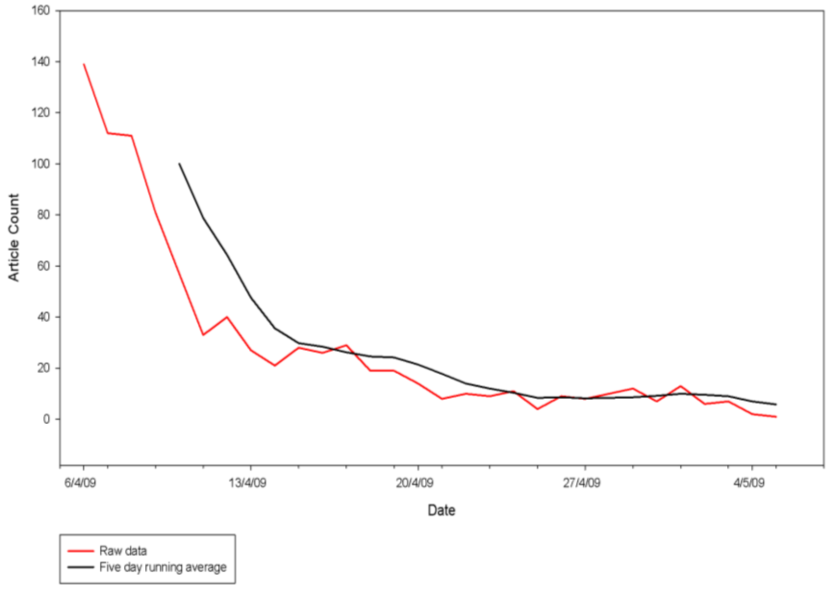

Figure 8.3: L'Aquila, Italy Earthquake GNAT-Db Coverage graph

The news media coverage profile for the L'Aquila, Italy earthquake is made up entirely by a coverage decay curve. Peak article count occurred on the first day of coverage and decreased over the following 29 days. The average peak-to-end duration for recorded earthquake events is 14 days (22 days including the Sichuan and Kashmir earthquakes) and so post-peak coverage of the L'Aquila earthquake persisted for twice the average earthquake event length.

In total, 873 articles were recorded, 573 of which were recorded within the first seven days. In terms of fatalities, the Italy earthquake ranks as the seventh largest earthquake event and the twelfth largest event in total in terms of recorded fatality numbers. In comparison, it ranks as the sixth largest earthquake event and the eighth largest recorded event within the entire GNAT-Db database.

Peak article count was 139 articles and occurred on April 6, the day of the event. The earthquake struck at 01.32am, which meant that initial reports could be distributed and circulated in time to reach morning press deadlines around the world. For example, '*Strong earthquake hits Central Italy – Huffington Post*'[9] was published in New York six hours after the event occurred and '*Strong earthquake hits Italy; 50 dead – Express India*'[10] was published four hours after the event.

[9] http://www.huffingtonpost.com/2009/04/05/strong-earthquake-hits-ce_n_183343.html

[10] http://www.expressindia.com/latest-news/Strong-earthquake-hits-Italy-50-dead/443681/

The first report recorded within the L'Aquila earthquake GNAT-Db dataset was published in Rome within four hours of the event occurring and reported 16 fatalities – "*At least 16 dead as strong quake strikes Italy – AFP*."[11] The next recorded article, published by Xinhua in Beijing, China eight hours after the event occurred, reported only two fatalities – "*Two killed in Italy quake – Xinhua*."[12] Some reports refrained from giving specific casualty estimates within the headline and instead reported wide ranging figures of those injured or killed. For example, "*Powerful Italian quake kills many – BBC News*" reported "*at least 90 killed...about 1,500 injured...[and] between 30,000 and 40,000 people are believed to have lost their homes*"[13].

Within 12 hours of the event occurring fatality figures had risen steadily – "Powerful earthquake in central Italy kills 20 – AP;"[14] "Death toll climbs to 30 in Italian quakes – Focus News Agency;"[15] "Italian earthquake: 40 dead – Telegraph."[16] However, between 24 hours and 48 hours after the event occurred, fatality figures began to increase in large steps – "Italy earthquake survivors face up to aftermath as death toll rises to 179 – Guardian;"[17] "Aftershock hits Italy: Quake death toll now over 200 – Toronto Sun;"[18] "Death toll of Italy earthquake rises to 260 – Associated Press;"[19] "Italy earthquake death toll rises to 275 – AP;"[20] and "Death toll from quake in central Italy reaches 293 – Xinhua."[21]

The reporting of fatality numbers within the coverage of the L'Aquila earthquake shows how fatality figures in a hazard situation can develop over time and can differ geographically.

Casualty numbers are inherently difficult to obtain in a disaster zone and the L'Aquila earthquake case study demonstrates how casualty estimates in a large hazard event can evolve over time. A large area of the Abruzzo region was affected by the

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[11] http://www.google.com/hostednews/afp/article/ALeqM5gPvbr5qNxY_er40Zvp8-k-9ICpVQ

[12] http://news.xinhuanet.com/english/2009-04/07/content_11142151.htm

[13] http://news.bbc.co.uk/1/hi/7984867.stm

[14] http://www.breitbart.com/article.php?id=D97CSLRO0&show_article=1

[15] http://67.225.139.201/network/strong-earthquake-hits-central-italy-20-dead-410-pm

[16] http://www.telegraph.co.uk/news/worldnews/europe/italy/5113762/Italian-earthquake-40-dead-and-50000-homeless.html

[17] http://www.guardian.co.uk/world/2009/apr/07/italy-earthquake-onna-abruzzo

[18] http://www.torontosun.com/news/world/2009/04/07/9039401.html

[19] http://www.nydailynews.com/news/national/2009/04/08/2009-04-08_death_toll_of_italy_earthqua ke_rises_to_260_as_aftershocks_tent_camps_rescue_eff.html

[20] http://news.brunei.fm/2009/04/09/italy-earthquake-death-toll-rises-to-275/

[21] http://news.xinhuanet.com/english/2009-04/12/content_11172319.htm

earthquake, with a number of remote towns and villages suffering severe damage and fatalities. Only when all affected areas were identified and local authorities, rescue teams and local citizens had had the time to liaise, could accurate casualty estimates be published. This led to delays in the publication of accurate fatality data. To remain at the forefront of their industry, and until reliable information was made available, the news media disseminated all available information as quickly as possible, which, as with all large disaster situations, meant information was often fragmented and quickly outdated.

A number of post-peak articles were not focused upon the earthquake event. A few articles consisted of follow up reports and a few discussed the continuing struggles of those affected. There are a number of secondary peaks within the raw data decay coverage. For example, on April 4, 2009, anti-government protests occurred in Rome, Italy and, although the articles picked up by the GNAT-Db were not primarily focused on the earthquake, which took place on April 6, Silvio Berlusconi's recent handling of the earthquake was briefly discussed in a number of articles. Another peak can be seen between April 14 and April 17 when it was announced Pope Benedict XVI would visit the most damaged parts of L'Aquila. The issue of including articles not primarily focused on the event under examination will be discussed in Chapter Ten.

An increase in coverage within the first week of May 2009, coinciding with the one month anniversary of the event, was also noted. Analysis of a number of events within both the NHRSS-Db and GNAT-Db has shown that such increases in coverage during anniversary periods, namely the first week, month and year anniversary, are common. Small events are often remembered in local press, whilst large events, such as the Sumatra-Andaman earthquake and the 2005 Kashmir earthquake, are often remembered for many years, with anniversary reports repeated several years later.

8.2. Sichuan, China Earthquake

8.2.1. Background to the Event

The Sichuan, China earthquake was chosen for further examination due to its prominence within the dataset. The event accounts for 45% of the recorded fatalities and 29% of the total recorded articles within the earthquake dataset. Coverage of the Sichuan earthquake lasted for 245 days, making it the longest recorded event within the entire GNAT-Db. It also ranked as the second largest event in terms of total coverage, with over 11,000 individual articles recorded.

On May 12, 2008, at 14:28 local time, a 7.9Mw earthquake struck the Sichuan province of China. The earthquake epicentre was 80km west-northwest of the Sichuan capital, Chengdu, and had a depth of 19km. According to the China Earthquake Administration, the earthquake occurred along the Longmenshan fault, along the border of the Indo-Australian Plate and Eurasian Plate (Burchfiel *et al*., 2008).

The high magnitude of the event, coupled with its location in a developing region with a high population density, meant casualty numbers were expected to be high. 15 million people lived within the affected area and initial reports suggested that over half of them were left homeless. Within hours reports began to emerge as to the full extent of the earthquake and casualty numbers began to be revised upwards on an almost hourly rate.

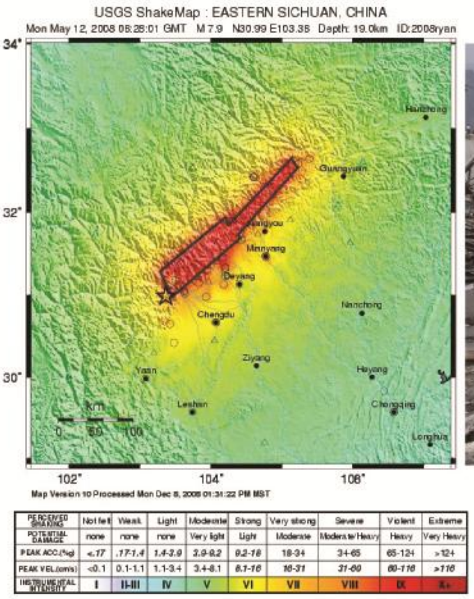

Figure 8.4: Sichuan, China earthquake USGS ShakeMap showing location and intensity.

Source: USGS. 2008

Photograph of the damage caused by the earthquake in Beichuan, Sichuan Province, China

Source: The Asia Foundation, 2008

The Sichuan earthquake was the deadliest earthquake to hit China since the 1976 Tangshan earthquake, which killed 242,419 people (Spignesi, 2005). Within 24 hours over 15,000 troops and a 184 member rescue team had reached the affected zone (China.org, 2008) and rescue teams from South Korea, Japan, Singapore, Russia and Taiwan arrived within four days. Despite this, it was felt that international rescue crews and media groups should have been allowed into the worst hit places earlier to aid rescue attempts and the flow of information (*The Economist*, 2008).

8.2.2. Media Coverage of the Event

It was expected that the Sichuan, China earthquake would demonstrate a 'typical' earthquake coverage profile, that is to say, one similar to the predicted earthquake model outlined in Chapter Four, for example, rapid coverage growth, high peak, and long decay period. The geophysical and socio-economic magnitude of the event: 7.9Mw; 68,712 fatalities; and US$150 billion damage, suggested that the event would be one of the largest recorded events within the GNAT-Db in terms of total coverage, peak coverage and event duration. Total recorded coverage of the Sichuan, China earthquake was 11,877 individual articles. This was the second highest total coverage recorded; only the Kashmir earthquake recorded higher, with a total of 18,806 articles.

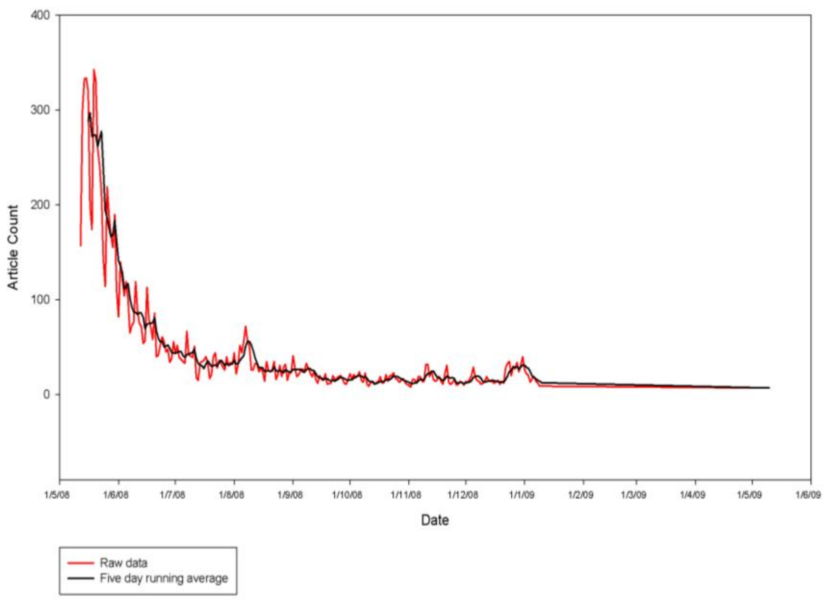

Figure 8.5: Sichuan, China Earthquake GNAT-Db coverage graph

On the first day of coverage 157 individual articles were recorded. Within seven days, this figure had increased and peak coverage of 343 articles was reached on May 19. The average start-to-peak coverage duration within the GNAT-Db earthquake dataset is three days. The sheer magnitude of the Sichuan earthquake, combined with the vast area affected, the remote location of some of the worst hit areas, and the austere Chinese media, meant that it took several days for the extent of the damage and accurate fatality numbers to be established. This is demonstrated by the longer than average start-to-peak duration: eight days.

Within the eight days between coverage start and coverage peak, fatality figures rose sharply from an initial estimate of only five fatalities to figures ranging between 30,000 and 40,000. One of the first articles recorded within the Sichuan earthquake dataset was recorded four hours and thirty-eight minutes after the event occurred and reported that five people had died in the event – '*5 confirmed dead in Sichuan earthquake – CCTV*.'[22] However, within 12 hours, reports began to emerge of over 5,000 students dying in schools within the Sichuan Province – '*China: 5,535 students died in '08 earthquake – MSNBC*'[23] and up to 10,000 people dying in Chengdu Province alone – '*10,000 Dead After Magnitude 7.9 Earthquake Rocks Central China – FOX*.'[24]

Casualty numbers continued to rise and were continuously revised over the next two months. It was not until July 21, 2008, that the final 'official' figure of 68,712 was released by the Chinese government. This figure was henceforth referenced by the majority of recorded articles (New York Times, 2008).

The Sichuan earthquake resulted in fatality numbers several orders of magnitude higher than 31 of the other recorded events. Only the Kashmir earthquake recorded more fatalities: approximately 74,698. Analysis of the entire GNAT-Db earthquake dataset suggested that there is a positive linear relationship between fatality numbers and event duration. Thus, it was expected that the Sichuan earthquake would record the second highest event duration. However, the Sichuan earthquake recorded 245 consecutive days of coverage, 27 days longer than the Kashmir earthquake.

Analysis of the articles concerned with the Sichuan earthquake found that, for the first 14 days, coverage was primarily concerned with escalating fatality numbers and the ensuing recovery process; an understandable situation following such a large-scale event. However, much of the coverage after this was concerned with political aspects of the event and secondary issues related to the earthquake. As with coverage of the L'Aquila, Italy earthquake, many of the recorded articles were not primarily concerned with the earthquake, but instead discussed secondary issues related to the event. For example, controversy surrounding substandard school buildings, the breaking of dams, the affects of the event on preparations for the 2008 Beijing Olympics, and the re-housing of several rare pandas after their zoo was destroyed during the earthquake, all recorded high levels of coverage.

It is believed that such extraneous issues were the reason coverage of the event persisted for longer than expected. For example, a peak in coverage is visible on August 7, 2008. Analysis of recorded articles on this date reveals that coverage is

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22 http://www.cctv.com/video/worldwidewatch/2008/05/worldwidewatch_300_20080512_15.shtml

23 http://www.msnbc.msn.com/id/30611523

24 http://www.foxnews.com/story/0,2933,355036,00.html

primarily focused on the 2008 Beijing Olympics and each time the earthquake is only briefly referenced. A second prominent peak is recorded on December 31, 2008. Recorded articles on this day were primarily concerned with reviewing major events over the past year, and thus the Sichuan earthquake was referenced each time.

8.3. Kashmir, Pakistan Occupied Kashmir Earthquake

8.3.1. Background to the Event

The Kashmir earthquake ranks as the largest recorded event within the entire GNAT-Db, both in terms of total coverage and fatality numbers. In total, the Kashmir earthquake accounts for over 49% of total recorded articles and 48% of total recorded fatalities.

On October 8, 2005 Pakistan Occupied Kashmir and the North West Frontier Province was struck by a 7.6 Mw earthquake. The earthquake occurred at 08:52 local time, and caused extensive damage throughout the region and ultimately led to the deaths of 74,698 people and the displacement of 3.3 million people (GSP, 2006).

The earthquakes epicentre was 19 kilometres North East of Muzaffarabad. The affected region lies within the highly tectonic region whereby the Eurasian and Indian plates are colliding, causing the uplift of the Himalayan mountains. The direct source of the earthquake was the Northwest-striking Balakot-Bagh (B-B) fault. The B-B fault had previously been mapped by the Geological Survey of Pakistan but had not been recognized as active (Kaneda *et al.*, 2008).

Over 1,000 hospitals were damaged or destroyed, causing serious short-term logistical problems for recovery teams as thousands of injured people had to be transported several kilometres to the nearest available hospital (MSF, 2006). Long-term recovery was also a major issue. Housing and feeding the 3.3 million who were left homeless after the earthquake became an international operation, particularly with regards to the impending Himalayan winter (*The Economist*, 2005).

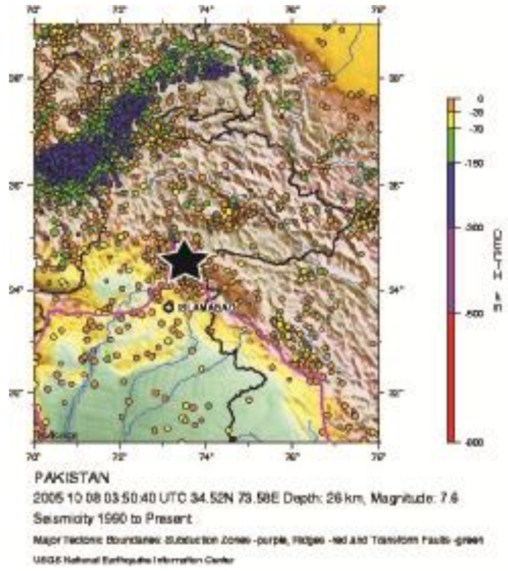

Figure 8.6: Kashmir earthquake location map including all earthquakes recorded by USGS throughout Italy over the past 19 years. The star marks the location of the 2005 event.

Source: USGS, 2005

Photograph of the damage caused by the Kashmir earthquake in the town of Ziarat.

Source: *Washington Post*, 2005

8.3.2. Media Coverage of the Event

A total of 18,806 individual articles were recorded within the 218 consecutive days following the event. Although this represents the highest total article count, the Kashmir earthquake was not the longest event in terms of consecutive day's coverage: the previously discussed Sichuan earthquake recorded 27 more day's coverage.

The Kashmir earthquake did record the highest first day article count, 215 articles, and the highest peak article count for any of the 99 events recorded within the GNAT-Db: 1,110 individual articles. This is over three times as many articles recorded at peak coverage for the Sichuan earthquake.

Peak coverage occurred on October 11, 2005, four days after the event took place. Analysis of the first four days of coverage suggests that it was not until the real magnitude of the event was established that coverage began to increase sharply. On October 8, the day of the event, reports detailed 256 fatalities: '*Pakistan earthquake, 256 dead – CNN*[25]'. This figure proceeded to increase over the next four days as more towns and regions were found to have been affected by the earthquake. For example, on October 10, 850 casualties were reported – '*Death toll tops 850, rescue work gears in India-controlled Kashmir – Xinhua*[26].' On October 11, the day of peak coverage,

[25] http://www.cnn.com/2005/WORLD/asiapcf/10/08/quake.pakistan/index.html
[26] http://english.people.com.cn/200510/11/eng20051011_213708.html

casualty estimates increased dramatically as it became apparent that a huge number of towns throughout the Jammu and North West Frontier Province area had been completely destroyed - ‘*Disaster Death Toll could Hit 40,000 – The Mirror*.’[27]

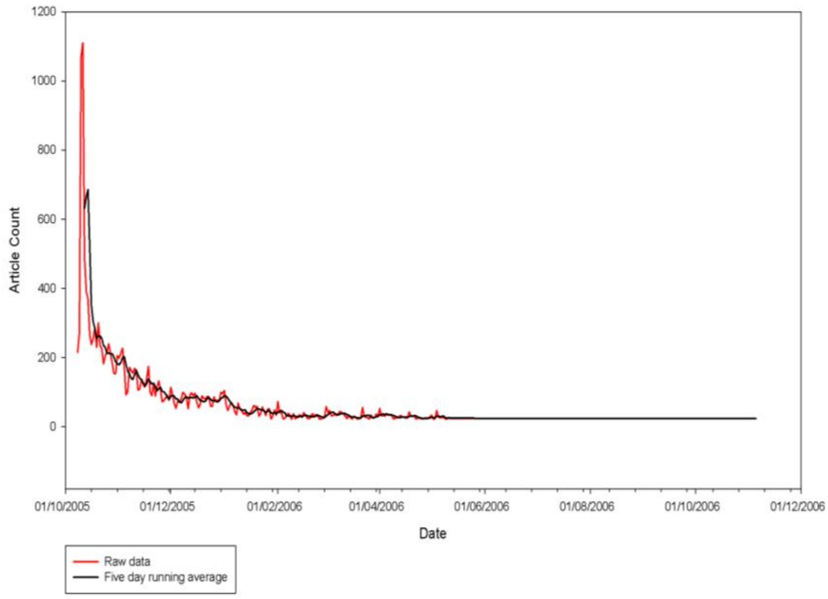

Figure 8.7: Kashmir, Kashmir Administered Pakistan Earthquake GNAT-Db coverage graph

Once peak article count was reached, coverage reduced rapidly, falling to below half peak rate within 24 hours. This rapid decrease in coverage is likely due to the publication of such a high casualty estimate. Once such a possible high number of fatalities is reported, subsequent changes in fatality numbers below this point may not be considered ‘newsworthy.’ It is also possible that, once an event reaches a certain magnitude, somewhere in the order of tens of thousands of fatalities, all further increases in fatality figures become inconsequential: the event has become so large that such numbers become immeasurable and it becomes difficult for the audience/readers to relate. The issue of fatality numbers controlling event coverage will be discussed further in Chapter Nine.

In the week following peak coverage, fatality figures nearly doubled but total article counts continued to fall. It was not until October 19 and 20 that fatality figures reached maximum – ‘*New casualty figures push quake death toll to 79,000 – USA Today*.’[28] A

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[27] http://www.mirror.co.uk/news/top-stories/2005/10/11/south-asian-earthquake-60-of-my-family-are-dead-115875-16233686/

[28] http://www.usatoday.com/news/world/2005-10-19-pakistan-quake_x.htm

slight increase in total press coverage is recorded during these two days - from 230 articles to 301 - but figures quickly decrease again.

8.4. Niigata Chuetsu Oki, Japan Earthquake

8.4.1. Background to the Event

The Niigata Chuetsu Oki, Japan earthquake was chosen due to its, seemingly abnormal, high level of total coverage for such a 'low' fatality event. Total coverage of the Niigata Chuetsu Oki earthquake ranked as the sixth largest event within the entire database, despite recording the seventh lowest fatality count.

The 6.6Mw Niigata Chuetsu Oki offshore earthquake occurred at 10:13 local time on July 16, 2007, killing seven people. The main shock event was followed by a sequence of aftershocks that were felt throughout the region. The earthquake was located 65km Southwest of Niigata city, a major metropolis on the west coast of Honshu. USGS and Tokyo University Earthquake Research Institute analysis found the source of the earthquake to be a thrust fault with a northeast trend 10km below the Japanese Sea.

The earthquake caused ground failures as far as the Unouma Hills, 50km from the shore and several small tsunami waves were recorded with run-up heights of 20cm along the shoreline of southern Niigata region.

The Kashiwazaki Nuclear Power Plant, which is the biggest nuclear power facility in the world, was damaged during the earthquake causing a fire to rage for over two hours. Officials also reported that radioactive water, used for cooling, leaked into the sea. Officials at the plant stated that the water would cause no damage to the surrounding environment.

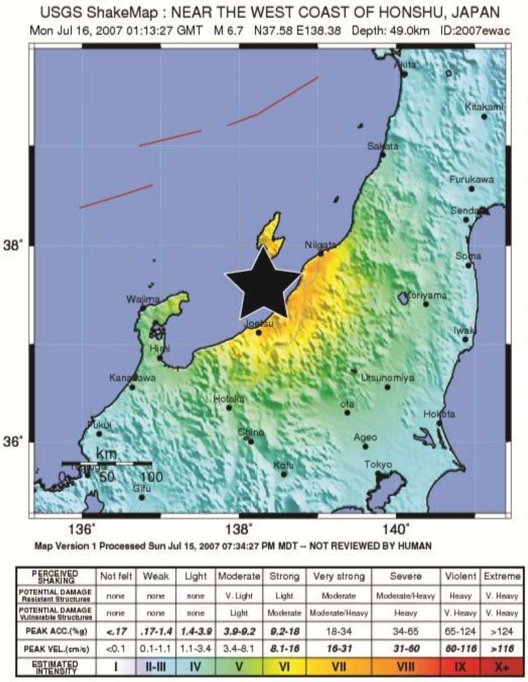

Figure 8.8: Niigata Chuetsu Oki, Japan earthquake USGS ShakeMap showing location and intensity.

Source: USGS, 2009

Photograph of a ground failure triggered by the earthquake in Unuomo Hills, Japan.

Source: USGS, 2009

8.4.2. Media Coverage of the Event

The Niigata Chuetsu Oki earthquake recorded a total of 925 individual media articles, the fifth highest article count for an earthquake and the sixth highest article count within the entire GNAT-Db. However, the earthquake only caused seven fatalities, the lowest recorded number for a non-fatal earthquake, that which caused no fatalities, in the GNAT-Db earthquake dataset. This is contrary to what is expected from a ‘low’ fatality event. In comparison, the L’Aquila earthquake, categorised as a ‘medium’ fatality event, caused 299 fatalities and recorded 873 articles, 52 fewer than the Niigata Chuetsu Oki earthquake.

After the event occurred, peak coverage, 102 individual articles, is reached within two days. In terms of peak coverage and start-to-peak duration, the Niigata Chuetsu Oki earthquake ranks seventh and fifth within the GNAT-Db earthquake dataset and seventh and twelfth within the entire GNAT-Db respectively. Following peak coverage, recorded article count drops rapidly. However, the profile of the raw data shows three prominent secondary peaks within one month of the primary peak in recorded coverage. The majority of earthquake events analysed displayed only one secondary peak, coinciding with either the week or month anniversary of the event.

The first recorded secondary peak, on July 23, 2007, followed news that the United Nations International Atomic Energy Agency would visit the Kashiwazaki Nuclear Power Plant to inspect damage caused by the earthquake – '*Japan to allow UN inspection of damaged nuclear plant – The New York Times*[29]. The second peak, July 30, 2007 coincided with news that most of the damage caused by the earthquake was not insured – '*Earthquake is biggest risk but is mostly uninsured – Business Insurance*'[30]. The final peak, on August 6, 2007, was the result of a second earthquake occurring in the region and the Niigata Chuetsu Oki earthquake being referenced in a number of articles covering the more recent earthquake – '*Large offshore quake hits southern Japan – Forbes*.'[31]

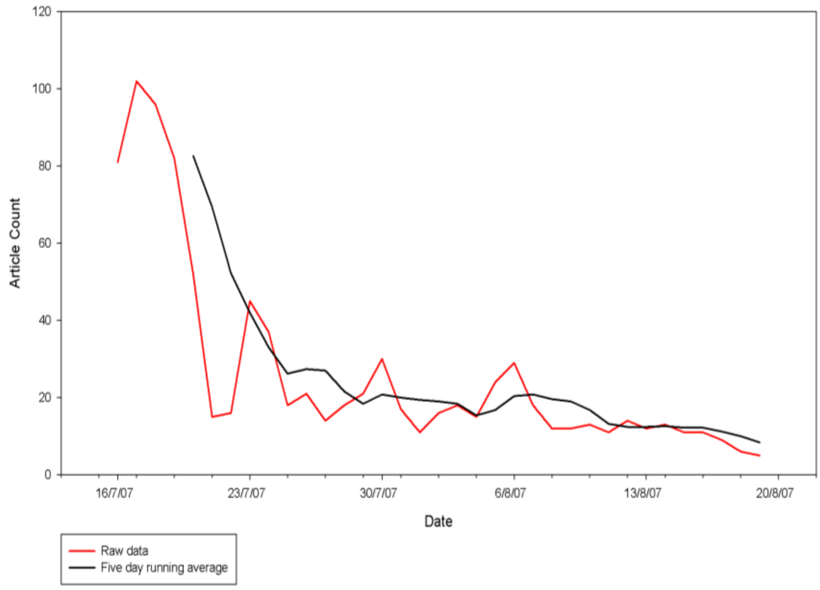

Figure 8.9: Niigata Chuetsu Oki, Japan Earthquake GNAT-Db coverage graph

Analysis of article content found that a number of articles were predominantly focused upon the damage sustained by the Kashiwazaki Nuclear Power Plant following the earthquake and the ensuing industrial and financial implications. For example, several recorded articles were predominantly concerned with automobile production in Japan –

[29] http://www.nytimes.com/2007/07/23/world/asia/23iht-japan.2.6783410.html

[30] http://www.businessinsurance.com/article/20020414/ISSUE01/10009391

[31] http://www.forbes.com/feeds/afx/2007/08/06/afx3992771.html

'*Toyota resumes Japanese output – BBC News*'[32] – and the earthquake is only referenced briefly as a cause of disruption to a Rikon piston plant and several Toyota assembly plants.

In conjunction with the high level of recorded news media coverage, coverage of the Niigata Chuetsu Oki earthquake lasted 35 days, making it the sixth longest earthquake event and the eleventh longest event recorded within the entire GNAT-Db. Coverage of the Niigata Chuetsu Oki earthquake persisted for five days longer than the L'Aquila, Italy earthquake. This demonstrates how the magnitude and extent of news media coverage for an event is not necessarily controlled by fatality figures.

8.5. Earthquake Conclusion

In-depth analysis of the four earthquake case studies presented has shown how earthquakes of varying magnitudes follow similar coverage profiles, both in terms of fatality counts and geo-physical intensity.

Both the Kashmir and Sichuan earthquakes are prominent events within the earthquake dataset due to their magnitude and the subsequent intensity of news media coverage. However, analysis has shown that even events of greatly differing magnitudes and coverage intensity, such as the difference between the Kashmir and Niigata Chuetsu Oki earthquakes, display similar coverage profiles and reporting patterns.

Analysis of the article content for each of the four events showed that distinct patterns in media priorities are apparent within earthquake coverage. Initial media focus is often on fatality number estimation. However, individual analysis of articles related to the L'Aquila Italy earthquake demonstrated how reports of fatality numbers are often full of uncertainty and guesswork. Early reports of the L'Aquila earthquake listed only 10 fatalities and figures changed on an almost hourly basis. Thus, accurate fatality data may not become available until several days after the event and often coincides with when peak coverage has been reached. Location and extent of the event is often a key variable concerning the speed at which accurate fatality data can be obtained. In certain situations, it can take several days for valuable and coherent information to propagate from the affected zone and circulate throughout the news media. For example, the Kashmir earthquake occurred in a mountainous region whereby the difficult terrain made it difficult to reach a number of the small towns and villages that had been affected by the event.

[32] http://news.bbc.co.uk/1/hi/business/6911310.stm

Once final fatality figures are reported, which often coincides with peak event coverage and the conclusion of search and rescue operations, the focus of media interest often moves towards more socio-political and economic issues surrounding the event. Post-peak reports are frequently concerned with the business and financial implications surrounding the earthquake. The closure of a factory or the damage to a power station, for example, often increases coverage and prolongs it. Earthquake events with prominent financial or business aspects appear to be reported to a greater extent and for a longer duration, compared to events of similar magnitudes with no wider economic implications.

Despite the prominence of the L'Aquila, Italy earthquake within the GNAT-Db in terms of fatality numbers and total article count (having recorded the twelfth highest fatality count and the seventh highest total article count) it was expected to display greater prominence due to its status as the only major fatal 'Western' earthquake. In comparison to the coverage of a number of low magnitude 'Western' events, such as the 2008 California, USA earthquake, and the 'Eastern' 2007 Sumatra earthquake, the coverage statistics of the L'Aquila earthquake appear to be lower than expected. This analysis raises questions over the assumptions made about the prominence of 'Western' events and apparent 'Western' media bias. It also questions the expected controlling influence of fatality numbers on overall coverage statistics.

8.6. Southern Leyte, Philippines Landslide

8.6.1. Background to the Event

In terms of total fatality and total coverage, the Southern Leyte landslide ranks as the largest recorded event within the landslide dataset. It also ranks as the tenth largest event in terms of total coverage and the sixth largest recorded event in terms of fatality numbers.

At approximately 10:30 local time, on February 17, 2006, a large section of cliff-face above the Philippine Fault collapsed causing rockslides, debris avalanches and mudslides. The village of Guinsaugon in the town of Saint Bernard was almost completely destroyed.

Heavy rains in the 10 days prior to the landslide coupled with a minor earthquake of magnitude 2.6 were believed to be the trigger mechanisms. 10 smaller landslides had occurred within the region in the seven days before the event of February 17, 2006, but Guinsaugon was the worst hit with 1,126 deaths, 246 of which were children.

Rescue teams and relief efforts began quickly. However, work was hampered by persistent heavy rains, the destruction of local infrastructure, and the instability of the surrounding ground due to recent seismic activity. Areas surrounding the landslide zone were also affected by chest-deep mud, which severely disrupted relief efforts.

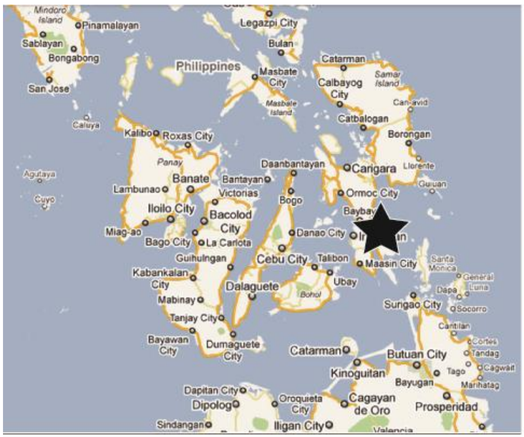

Figure 8.10 Map showing the location of the Southern Leyte, Philippines landslide

Photograph of the Southern Leyte landslide covering the village of Guinsaugon

Source: The Times, 2006

8.6.2. Media Coverage of the Event

The Southern Leyte, Philippines landslide is the largest landslide event recorded in the GNAT-Db in terms of fatalities and total news media coverage.

In total, 533 articles were recorded by the GNAT-Db. This is more than double the number of articles recorded for the next largest event: the December 2008 Bukit Antarabangsa, Malaysia landslide, which recorded 221 articles in total.

Coverage began on the day of the event and only three articles were recorded. This figure is much lower than expected for an event of this magnitude. However, the size and location of the Leyte landslide may have meant that accurate information was not quickly filtering from the event site to media organisations and, thus, there was a lag in reporting. As shown in figure 8.10, coverage dipped on the fourth day, February 19.

Analysis of news events on February 19 revealed that a large explosion at the Pasta de Conchos coalmine in Mexico caused the deaths of 65 mineworkers. It is likely that this event temporarily reduced the interest/prominence of the Leyte landslide within the media. However, on February 20, reports began to emerge regarding the extent of the death toll involved in the Leyte landslide: "*Military estimates 1,800 dead from Philippines landslide – USA Today*"[33] and that survivors had been found: "*Signs of life*

[33] http://www.usatoday.com/news/world/2006-02-17-landslide_x.htm

detected at landslide site – FOXNews"[34] This revived public interest and coverage peaked on February 20, the fifth day of coverage.

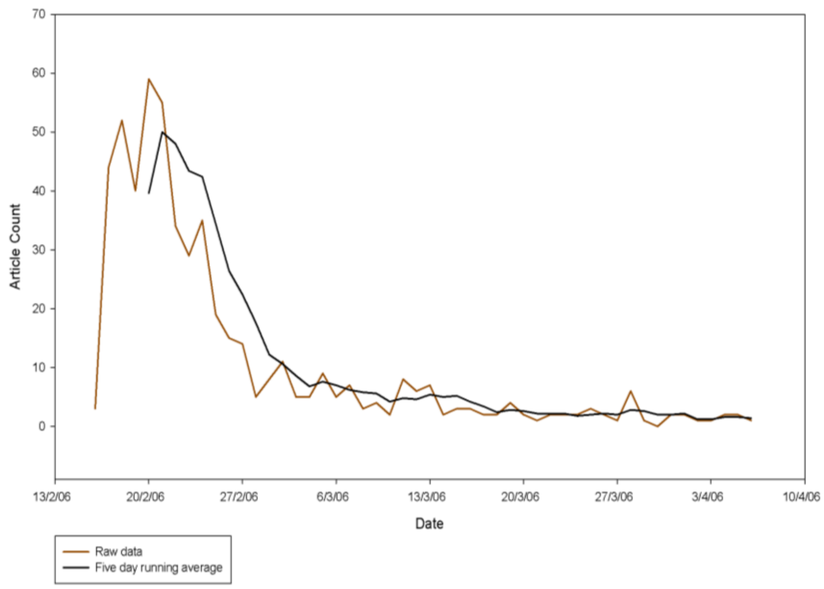

Figure 8.11: Southern Leyte, Philippines landslide GNAT-Db coverage graph

In total, continuous news media coverage of the Leyte landslide persisted for 50 days, making it the longest event recorded within the landslide dataset. This was expected due to the sheer magnitude of the event. However, the second longest event was the September 2008 China landslide, which recorded 45 days continuous coverage, just five fewer than the Leyte landslide. The China landslide caused 40 deaths, substantially fewer than would be expected for an event with such a long duration.

8.7. Bukit Antarabangsa, Malaysia Landslide

8.7.1. Background to the Event

In comparison to the expected high levels of coverage for the Southern Leyte, Philippines landslide, the Bukit Antarabangsa, Malaysia landslide was chosen for further evaluation due to its ranking as the second largest landslide event in terms of total recorded article count, despite ranking as the second lowest event in terms of reported fatality numbers (excluding non-fatal events).

On December 6, 2008 a landslide occurred in the Ampang hillside area, killing five people and seriously injuring 15. This event was the twelfth major landslide since the

[34] http://www.foxnews.com/story/0,2933,185382,00.html

1993 ‘Highland Towers’ landslide that killed 48 people and prompted new planning and building regulations in the Ampang region.

The December 2008 landslide occurred at 04:00 local time and is thought to have been triggered by heavy rains. However, it is believed that the stability of the slope was seriously weakened prior to the heavy rains due to substandard retaining walls surrounding the Bukit Antarabangsa township (Kuppusamy, 2008). In total, 14 bungalows were destroyed and over 2,000 people were evacuated.

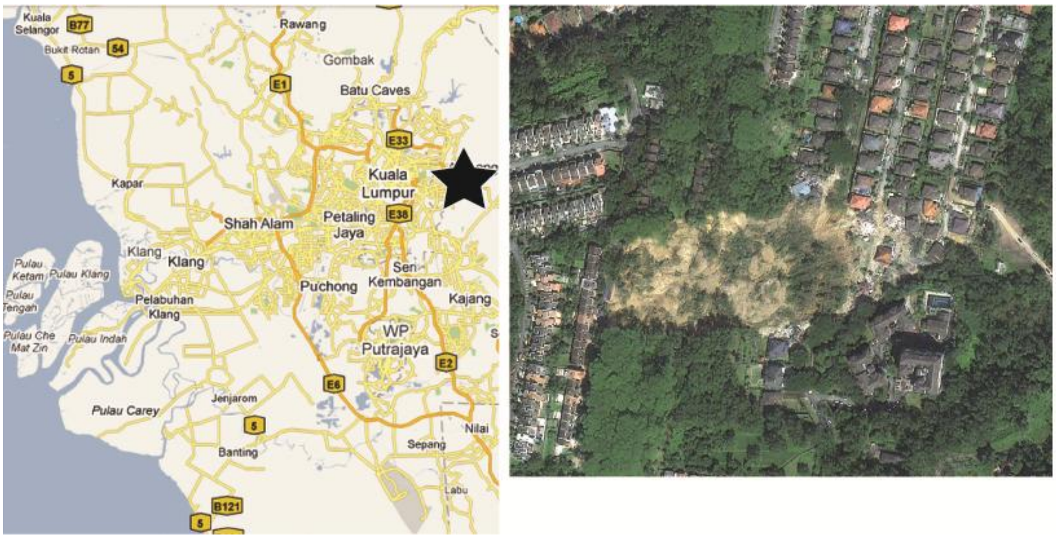

Figure 8.12: Map showing the location of the Bukit Antarabangsa landslide

Arial photograph of the Bukit Antarabangsa landslide

Source: National University of Singapore, 2008

8.7.2. Media Coverage of the Event

The news media coverage profile recorded for the Bukit Antarabangsa landslide is ‘typical’ for a landslide event in that coverage peaks within four days of event onset, one day longer than average for the GNAT-Db landslide dataset, and declines steadily thereafter, with a peak in coverage around the month anniversary of the event.

Total coverage for the Bukit Antarabangsa landslide was 221 individual articles. It is likely that the high level of coverage recorded for such a ‘low’ magnitude event is due to this event being the culmination of a series of events in the area occurring in the previous months. On October 4, October 17 and November 14 landslides occurred in the Bukit Antarabangsa township. The December 6 event was by far the largest in terms of destruction and death toll.

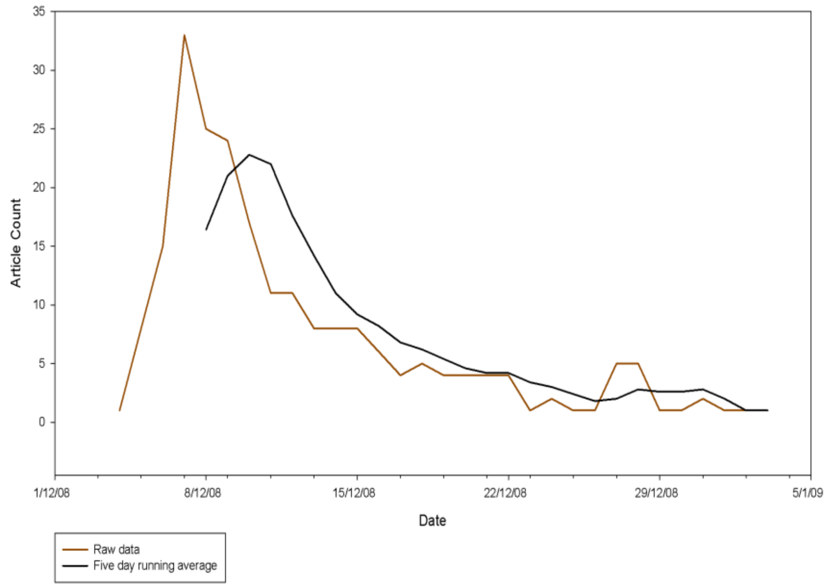

Figure 8.13: Bukit Antarabangsa, Malaysia landslide GNAT-Db coverage graph

Peak article count, 33 articles, was reached on the fourth day of coverage, December 7, 2008. This coincided with the recovery of the final body from the landslide site and the announcement that the Deputy Prime Minister of Malaysia, Datuk Seri Najib Tun Razak, would call for a complete assessment of all ongoing hillslope projects – '*Political Will Needed For Safety Of Hillslope Development, Says Razaka – MYSinchew*[35].' In terms of peak article count, the Bukit landslide ranks as the third largest recorded landslide event. Only the La Conchita, California landslide and Southern Leyte, Philippines landslide, with 36 and 59 articles respectively, rank higher.

The total duration of the event was 31 days, making it the third longest landslide event recorded and the 15 longest event within the entire GNAT-Db. Analysis of the coverage found that much of the news media coverage surrounding the December 6, 2008 Bukit Antarabangsa landslide focused primarily on the controversy surrounding the cause of landslides in the area and the court rulings regarding building regulations and standards following the 1993 'Highland Towers' landslide.

A number of recorded articles were found to be concerned primarily with assigning blame for the event. On the second day of recorded coverage, six of the eight recorded articles reported headlines concerned with the cause of the landslide and not fatality numbers – '*Bukit Antarabangsa Tragedy: Blame placed on work at bungalow – New Straits Times*.'[36] Over the course of the 31 days of coverage, several explanations for

[35] http://www.mysinchew.com/node/19166
[36] http://www1.nst.com.my/Current_News/NST/Sunday/Frontpage/2421920/Article/index_html

the event are put forth, including abandoned building projects, poor planning regulations, hillslope deforestation and a major failure of the water retention and drainage system.

A secondary peak in coverage on December 27 and 28 is noted. Analysis of the coverage on these two days reveals that the articles are principally concerned with a government imposed blanket ban on hillslope developments throughout Malaysia, and the opposition to the ban from landowners and developers.

Like coverage of the Niigata Chuetsu Oki earthquake, analysis of the Bukit Antarabangsa landslide coverage found that fatalities do not necessarily control overall magnitude and extent of news media coverage of a hazard event. Yet again, focus of the coverage was on the economic issues and matters surrounding appointing blame, and not on fatalities or the physical processes involved in the landslide.

8.8. Chittagong, Bangladesh Mudslide

8.8.1. Background to the Event

The Chittagong, Bangladesh mudslide of June 2007 was chosen for further analysis due to the notable disparity between the magnitude of the event, 128 fatalities, and the relative lack of coverage, only 17 articles. With a fatality count of 128, the event was expected to feature within the top twenty recorded events in terms of total recorded coverage. However, the Chittagong mudslide ranks eighty-seventh out of the 99 recorded GNAT-Db events.

The Chittagong mudslide occurred in the South Eastern port city of Chittagong, Bangladesh on June 11, 2007. Heavy monsoon rainfall caused flash flooding in the surrounding hills that led to a number of landslides and mudslides. The Chittagong mudslide occurred on the hill slopes above the shanty towns surrounding the Chittagong Cantonment and led to 128 fatalities, including 59 children.

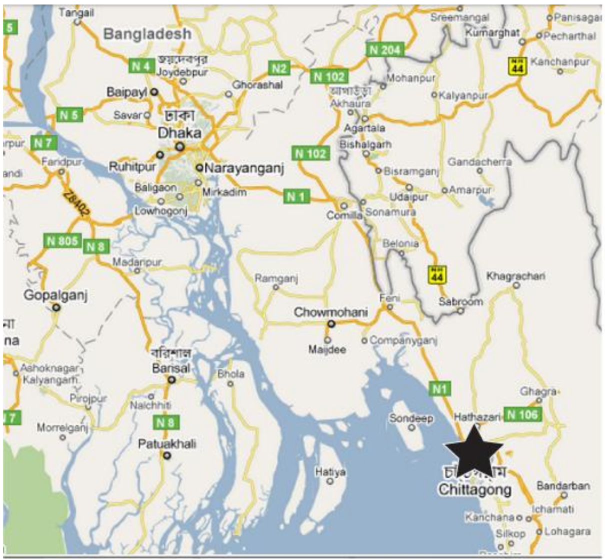

Figure 8.14: Map showing the location of the Chittagong, Bangladesh mudslide.

Photograph showing rescuers pulling a body from the mud.

Source: *National Geographic*, 2007

The 2007 annual Bangladesh Monsoon began with unusually heavy rains, which were intensified by a large tropical storm moving landward from the Bay of Bengal and subsequently caused flooding across one third of the coastal city of Chittagong (Madsen and Jacobsen, 2004). Over five million people were forced to evacuate and thousands, predominantly from the shanty towns, became homeless because the damage to homes and infrastructure was too severe. Over the course of the following three days, a series of large landslides and mudslides occurred throughout the Chittagong area destroying major communication and transport infrastructure, which severely hampered rescue efforts.

The intense monsoon rain also affected other areas of Bangladesh, flooding whole towns and causing landslides countrywide. 40,000 people were left homeless due to intense flooding in the nearby town of Comilla, and 400,000 people were left stranded when the district of Cox's Bazaar became flooded and roads and bridges were cut-off.

The extent of the flooding and landslides was so great that vast swathes of crops were destroyed, leading to a major food shortage and financial problems for millions of Bangladeshis. In addition, the Chittagong Port, which serves 90% of the country's foreign trade, was closed for several days, resulting in US$ millions in lost revenue.

Controversy surrounded the cause of the Chittagong mudslide, as well as the Bangladesh Government's initial denial and inaction towards widespread hill cutting, the likely cause of the mudslide. Dr. Shahidul Islam, Geography professor of

Chittagong University was quoted as saying “The only reason for Monday’s mud slide in the Cantonment area is the indiscriminate cutting of hills...we warned several times that the places where landslides occurred had become vulnerable due to hill cutting. But proper measures were never taken to stop the practice[37].”

Hill cutting in the Chittagong area has been performed for several decades and several assessments and reports (see Islam, 2008) had discovered that a slope of 20-30° represents the maximum angle where a slope remains stable, hills in the area were being cut with a slope of 70-80°, drastically increasing the likelihood of slope failure during heavy rains. It was also reported that the hill cutting business in the area was being run by ‘influential persons[38]’ and safety regulations were frequently being ignored.

8.8.2. Media Coverage of the Event

Total recorded coverage of the Chittagong mudslide is much lower than would have been expected for an event of this magnitude. If a positive linear relationship were to exist between fatality numbers and total coverage, as expected, an event causing 128 fatalities should record a total coverage in the region of 200 articles. However, only 17 articles in total were recorded within the GNAT-Db.

Coverage of the Chittagong mudslide lasted for just 14 days. On six of these days, only one related article was recorded and peak article count was five, reached on the third day of coverage.

It was expected that, due to the magnitude of the event coupled with the controversy surrounding the government’s inaction towards illegal hill cutting and the forewarning of such an event by local experts, the Chittagong mudslide would be one of the largest events recorded. However, although the overall coverage profile resembles a ‘typical’ landslide event profile, the figures involved are much lower than would be expected.

[37] http://www.thedailystar.net/newDesign/topic/shahidul-islam?page=2
[38] http://www.newagebd.com/2009/jul/04/home.html

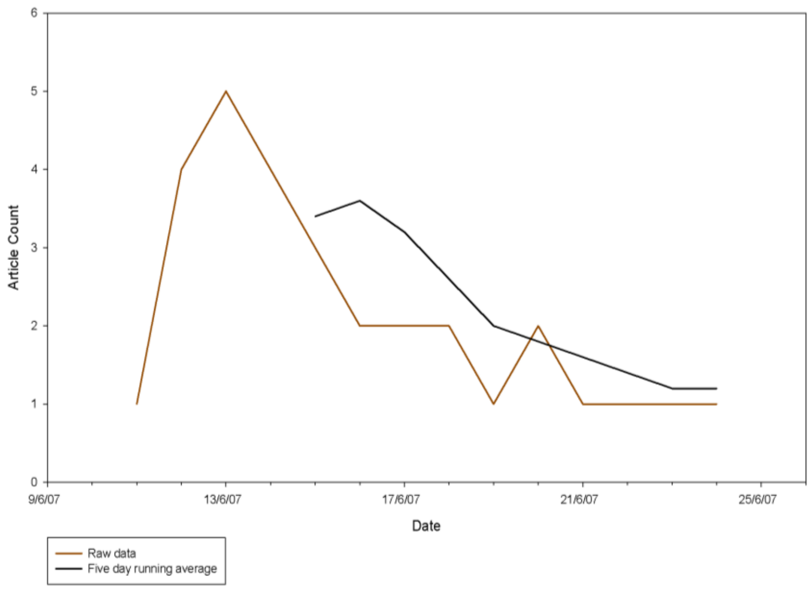

Figure 8.15: Chittagong, Bangladesh mudslide GNAT-Db coverage graph

Analysis of the recorded articles found that, in the first three days of coverage, reported casualty numbers varied greatly. Only one article was reported on the day of the event and it was reported that 67 people had died. By the second day three of the four recorded articles reported different casualty numbers; 80, 103, and 130. This uncertainty in fatality numbers persisted throughout the entire duration of the event.

After peak article count was reached on June 13, the third day of coverage, the focus of recorded articles moved from casualty numbers to the banning of ex-Bangladesh Prime Minister Sheikh Hasina from visiting Chittagong Port to the controversy surrounding illegal hill cutting and corruption in the area. However, coverage remained very low and ceased within 11 days.

Analysis of general news reports at the time found that no other major news events occurred at the same time of the Chittagong mudslide. Seven days before the mudslide occurred, Cyclone Gonu killed 12 people in Oman and the thirty-third G8 summit took place in Germany amid large protests. However, analysis of these events found that, coverage of these two events had reduced substantially by June 11, the day of the mudslide. Severe flooding affected large areas of North England on June 25 and may account for a reduction in British news media coverage of the Chittagong mudslide but this alone cannot account for the low level of coverage elsewhere.

8.9. La Conchita, California Landslide

8.9.1. Background to the Event

In terms of fatality numbers, the La Conchita, California landslide ranks as the eighteenth (of the 33) largest landslide event and the fifty-first largest event within the entire GNAT-Db. However, total recorded coverage of the event ranks it as the third most publicised landslide event and the twenty-seventh most publicised event within the entire GNAT-Db.

On January 10, 2005, at 00:30 local time, a landslide struck the community of La Conchita in Ventura County, California. 10 fatalities were reported and 36 houses were destroyed or severely damaged.

The community of La Conchita, lies between the California shoreline and a high bluff with a slope tending towards 35°. The bluff consists of poorly indurated marine sediment; interlayered siliceous shale, siltstone and sandstone in the upper section and siltstone, sandstone and mudstone in the lower section (O'Tousa, 1995).

The bluff above La Conchita has produced a number of notable landslides since the formation of the community in 1924, including the large, but non-fatal, March 4, 1995 landslide.

The 2005 La Conchita landslide occurred after 15 days of heavy rain saturated the surrounding land. Recorded rainfall levels for the period October 1, 2004 to January 10, 2005, the day of the landslide, were 493mm, much higher than the mean 122mm for that time period (USGS, 2006).

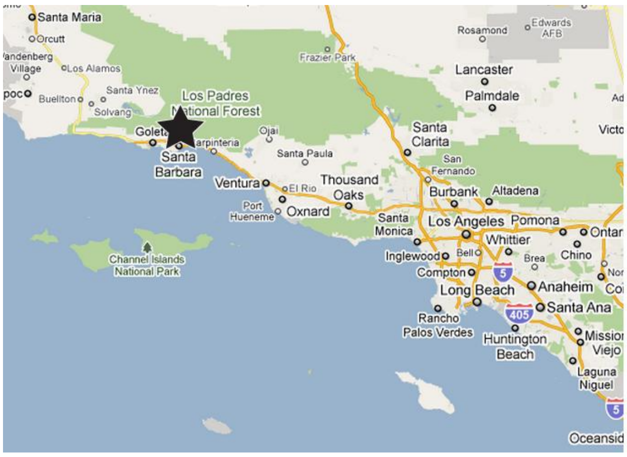

Figure 8.16: Map showing the location of the La Conchita, California landslide.

Photos displaying the size and impact of the 2005 La Conchita, California landslide.

Source: USGS, 2005

However, post-event analysis of the site found that much of the debris deposited by the 2005 La Conchita landslide consisted of fairly dry material (USGS, 2006). It was believed that the vast majority of the landslide mass was dry material that had mobilised on top of a lower saturated layer deposited by the 1995 event. Video coverage of the 2005 event supports this theory as the rapidly flowing mass are seen being carried on the lower, much more saturated, fluidised layer.

8.9.2. Media Coverage of the Event

It was expected that a fatal landslide in the USA would be a major news event and feature prominently within the GNAT-Db landslide dataset. Such events are rare in the USA, particularly in highly populated areas like California and so it was expected that coverage of such an event would be greater, in terms of total article count, duration and peak article count, than a comparable 'Eastern' landslide event.

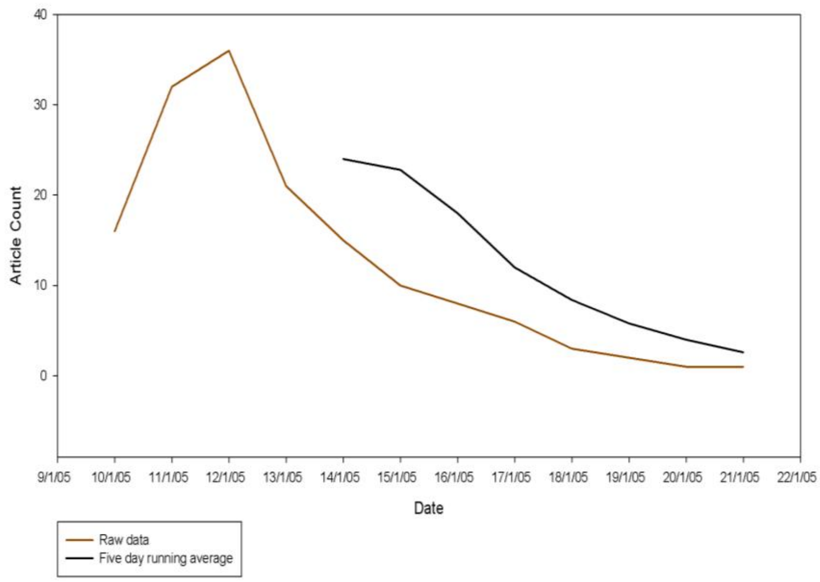

Figure 8.17: La Conchita, California landslide GNAT-Db coverage graph

The La Conchita landslide was the third largest event recorded within the GNAT-Db landslide dataset in terms of total event coverage and the second largest recorded event in terms of peak article count. In total, 151 individual articles were recorded, with peak coverage reaching 36 articles on January 12, three days after the event occurred. When compared to 'Eastern' events of a similar magnitude (fatality count), it is possible to see just how intense the coverage of the La Conchita landslide was; the July 7, 2008 Nepal landslide resulted in nine deaths but only 10 articles were recorded over seven days, the November 8, 2008 Kenya landslide caused 11 deaths but only 12 articles were recorded over six days, and the July 19 2008 Guatemala landslide caused 12 fatalities but only 15 articles were recorded over 12 days.

In terms of duration however, coverage of the La Conchita landslide was below average, 12 days compared to the dataset average of 16. Coverage of the event can therefore best be described as short and intense.

Analysis of the recorded articles reveals that coverage build-up focused chiefly on estimating fatality figures and discussing past events, namely the 1995 event. At peak coverage, articles were wholly concerned with the rescue attempts underway – '*Rescue Crews Searching for Life Beneath the Slide – New York Times*[39].' However, on January 13, four days after the event occurred, the search for survivors was called off – '*Search Ends for Calif. Mudslide Victims – AP Online*'[40] - and coverage began to decline rapidly, halving by the next day. Decay coverage consisted primarily of reports of the decisions by some residents to move back to their homes – '*Slide Survivors Divided on Future – Fairfax Free Library*[41]' – and reports of damage costs – '*Damage tops US$90 million – Ventura County Star*.'[42]

Like the Bukit Antarabangsa landslide, coverage of the La Conchita landslide followed a fatalities-orientated pattern in news media concern. Focus was initially on fatality numbers and, when all reported victims were accounted for, coverage peaked and began to steadily decline thereafter. This was found to be a common trend amongst recorded landslide events.

8.10. Landslide Conclusion

Analysis of the four landslide case studies has shown that, like earthquake coverage, coverage profiles and overall reporting patterns of landslides are very similar, regardless of the physical extent of the event, recorded fatalities or event location. However, although the overall coverage profiles remain similar, the landslide case studies analysed demonstrate how the magnitude and extent of the coverage statistics can differ greatly and are dependent upon a number of inter-linked factors, not simply fatality numbers or location.

The four landslide case study events demonstrate very similar coverage profiles and reporting patterns. Peak coverage of landslide events, which are much lower in

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[39] http://query.nytimes.com/gst/fullpage.html?res=9E04E0D91638F931A25752C0A9639C8B63&s ec=&spon=&pagewanted=all
[40] http://ro-a.redorbit.com/news/general/118171/searchers_dig_for_calif_mudslide_victims/index.html
[41] http://www.thefreelibrary.com/SLIDE+SURVIVORS+DIVIDED+ON+FUTURE.-a0127229839
[42] http://www.vcstar.com/news/2005/Jan/14/damage-tops-90-million/

comparison to both earthquake and flood events, is likely to occur when the official fatality figure is announced, which often coincides with the conclusion of search and rescue operations once such efforts become futile or once all missing persons have been accounted for. After this point, coverage usually declines steadily, taking, on average, six times longer to decay compared to build-up duration. Over time, as final fatality figures are announced and the extent of the disruption caused becomes apparent, the event becomes less ‘newsworthy.’ However, like the socio-political and economic issues that have been shown to prolong earthquake coverage, landslide coverage often persists due to matters surrounding the cause of the event and those held responsible.

News media coverage of a number of the recorded landslide events was found to point towards a certain level of contention and controversy with regards to the cause of the event. Like the previously discussed earthquake case studies that demonstrated higher levels of coverage due to socio-political and economic issues, these events recorded higher coverage levels and often longer event durations than would be expected for events recording such fatality numbers.

As demonstrated by the La Conchita landslide, the Chittagong mudslide and the Bukit Antarabangsa landslide, fatality figures are not the controlling factor with regards to coverage of a landslide event. The high coverage levels of the La Conchita landslide and Bukit Antarabangsa landslide were as expected. Both events occurred in affluent areas with recent histories of large landslides. The La Conchita earthquake also represented the only major fatal ‘Western’ landslide and so was expected to feature prominently within the GNAT-Db landslide dataset. However, it was expected that, due to the ‘high’ fatality count involved in the Chittagong mudslide, coupled with the controversy surrounding the possible causes of the event and the recent news media interest in Bangladesh following Cyclone Sidr, a much higher total article count would be recorded.

Analysis of the wider news media interests at the time of the Chittagong mudslide found that no other major international media events occurred at the same time that may have shifted news media interest away from the mudslide. Thus, it was expected that coverage of the Chittagong landslide would have been far greater.

It is possible that the Chittagong mudslide demonstrates the archetypal ‘Eastern’ hazard event. Despite the high death toll and the controversy surrounding the cause of the event, no socio-political or economic issues of major Western interest were involved and so the event seems to have been overlooked by Western news media.

This is possibly due to the apparent ‘Western’ media bias in coverage of such events and will be discussed further in Chapter Nine.

8.11. Indiana, USA Floods

8.11.1. Background to the Event

The 2008 Indiana, USA floods represent the only major ‘Western’ flood event recorded. In terms of total coverage, the event ranks as the third largest within the flood dataset and the twelfth largest within the GNAT-Db database as a whole, despite recording the second lowest fatality count (excluding non-fatal events).

Throughout the month of June, six US states experienced flooding due to severe storms related to El Niño. Illinois, Indiana, Iowa, Kansas, Missouri and Wisconsin were all affected, with 13 fatalities reported and US$6 billion in reported damages nationwide (FEMA, 2008).

Central and Southwestern Indiana were affected worse of all. Flooding along the Ohio River and its tributaries occurred in the first two weeks of June 2008. On June 4, 2008, rain soaked parts of South-central Indiana began to flood as persistent strong rain storms soaked the already saturated land. Early damage was focused around the town of Bloomington. On June 7, additional rain caused large areas of South-central and Western Indiana to flood. The town of Edinburgh recorded the highest rainfall level, 278 mm in seven hours and 90% of the town was left underwater (FEMA, 2008). Many low-lying areas of Central and Northern Indiana were also affected, with area-wide evacuations carried out due to persistent rainfall and rising floodwaters.

Despite the widespread flooding, casualty and injury numbers were very low. One man drowned in the town of Remington and two people died in the town of Columbus on June 8 and 9 respectively. All three individuals were swept away by rising floodwaters.

Damages across the state of Indiana were expected to make the flooding the costliest disaster in Indiana history. Initial reports estimated total damages to reach over US$1 billion, with US$800 million of agricultural damage and US$45 million of infrastructure damage.

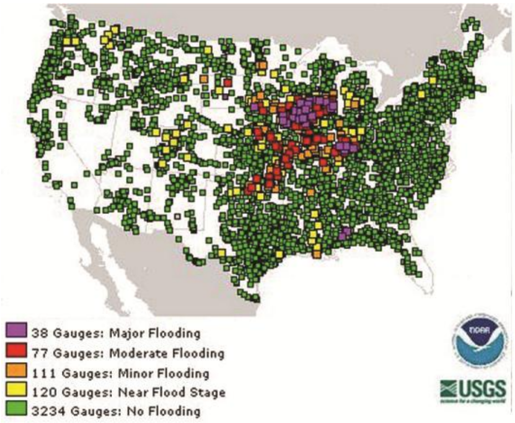

Figure 8.18: Map displaying the intensity of flooding throughout the USA. The location of the most intense flooding is Indiana, USA

Photograph showing the extent of flooding throughout Indiana.

Source: *The Washington Post*, 2008

8.11.2. Media Coverage of the Event

It was expected that, despite the low death toll, the Indiana floods would be one of the largest recorded flood events, in terms of total article count, peak coverage, and duration, due to the prominence of American events within global media. In total, 510 individual articles were recorded, making the Indiana floods the third largest recorded flood event and the twelfth largest event within the entire 99 event GNAT-Db database.

The raw coverage profile of the Indiana, USA floods is highly variable, with distinct peaks and troughs within the coverage profile throughout the entire duration of event coverage. Analysis of wider media trends at the time found that a number of high profile events occurred at various points during the coverage of the Indiana floods. Events such as the June 2 Danish embassy car bombing in Pakistan that killed five people, the June 8 Tokyo stabbing incident whereby seven people were killed and 10 seriously injured, and the June 10 Sudan Airways tragedy that killed 44 people, all correspond to dips in coverage of the Indiana floods.

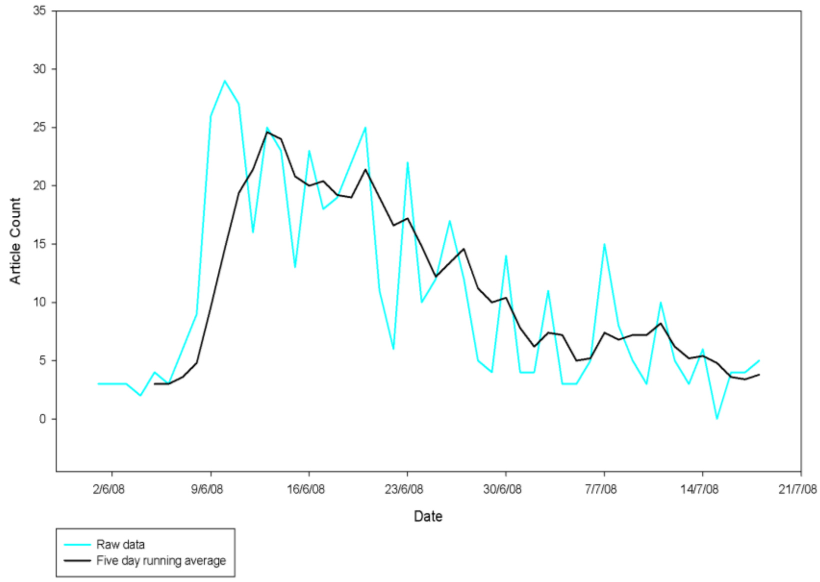

Figure 8.19: Indiana, USA Floods GNAT-Db coverage graph

Peak coverage, 29 articles, was reached 10 days after coverage began, four days longer than average start-to-peak duration for a recorded GNAT-Db flood event. Average flood event peak coverage is 17 articles. Thus, the Indiana floods recorded a substantially higher number of articles at peak. Peak coverage coincided with the reporting of the three afore mentioned fatalities and the peak in rainfall intensity. After this time, rains began to lessen, floodwaters began to subside, and news media coverage began to decay.

Overall coverage of the event lasted 48 days, making it the fourth longest flood event recorded. The period from coverage start to peak coverage was 10 days and decay coverage was 38 days, both of which are much longer than the average (six and 18 days respectively). When the Indiana flood data is smoothed, a running five-day average provides us with a more recognisable flood event decay profile: a steady decrease in coverage with fewer prominent peaks and troughs. However, the decay coverage of the Indiana floods remains at a relatively high level and does not decrease as rapidly as expected.

Like coverage of the Niigata Chuetsu Oki earthquake, the ensuing economic implications of the event became the focus of much of the news media attention once fatalities peaked. Analysis of the recorded articles found that much of the decay coverage focused on the economic costs of the floods. The extent of the agricultural damage caused by the flooding caused unprecedented knock-on effects throughout the world. Oil and petrol prices rose sharply and stock prices of corn and ethanol reached record levels within days of the onset of flooding (Mattoon, 2008). Estimates as to the economic impact of the floods began on June 10, the day peak coverage was reached; '*Flooding Damage Estimate at US$126 Million – Inside Indiana Business,*'[43] and continued throughout much of the decay coverage period, with the final estimate being published on July 7: '*Weather damaged crop costs top US$8 billion – High Plains Journal*.'[44]

8.12. 2008 Haiti Floods

8.12.1. Background to the Event

Although the 2008 Haiti floods do not represent the largest recorded flood event in terms of fatality numbers or total article count, the series of hurricanes that affected the nation over a period of several weeks and the steady escalation in the flooding, made the coverage profile of the event notably different to any other recorded flood event.

Decades of instability brought on by violence, military coups, and dictatorships have left Haiti the poorest nation in the Western Hemisphere (Heinl and Heinl, 2005). In 2008 violence broke out throughout the nation in response to rising food prices. Thousands of Haitians were starving and armed gangs seized control of the state capital, Port-au-Prince. The situation was exacerbated throughout the summer of 2008 as a series of hurricanes battered the small Caribbean state. Hurricanes Fay, Gustav and Hanna struck Haiti throughout August 2008, flooding nine of the 10 regions within Haiti and causing 500+ deaths (NOAA, 2008). Gonaives, the third largest city in Haiti, was submerged under two metres of flood waters and over 300,000 people were affected (Reuters, 2009).

Figure 8.20. Map showing the location of the Haiti floods. The star locates Gonaives, the worst hit area.

Arial photograph showing the extent of flooding throughout Gonaives.

Source: NAHHD, 2008

[43] http://www.insideindianabusiness.com/newsitem.asp?ID=29796

[44] http://www.hpj.com/archives/2008/jul08/jul7/AFBF-Weatherdamagedcropcost.cfm

On September 7, 2008 Hurricane Ike, the tenth largest Atlantic hurricane on record (NOAA, 2008), hit Haiti. Haiti was still in the process of recovery following hurricanes Fay, Gustav and Hanna and, as such, the humanitarian crisis worsened. In total, 74 deaths were reported and over one million people were left homeless. The one remaining bridge in Gonaives was washed away, seriously hindering rescue efforts, and large swathes of the city were severely damaged.

8.12.2. Media Coverage of the Event

Coverage of the Haiti floods lasted 103 days, making it the longest recorded flood event by 43 days and the third longest event recorded within the entire GNAT-Db. In total, 908 articles were recorded, making the 2008 Haiti floods the second largest flood event within the GNAT-Db flood dataset and the seventh largest event recorded within the entire GNAT-Db. Due to the nature of the events in the run up to the floods in Haiti, pre-peak coverage is characterised by a series of peaks, each coinciding with the onset and landfall of the four summer hurricanes: Fay – 15-18 August; Gustav – 26 August; Hanna – 28 August; and hurricane Ike – 1-13 September. It took 37 days for coverage of the Haiti floods to peak, the longest recorded start-to-peak time recorded within the entire GNAT-Db. This is undoubtedly due to the continuous escalation of the flooding throughout August as a result of the close proximity of the separate hurricane events, each of which will have rejuvenated interest in the event and made it appear more 'newsworthy.'

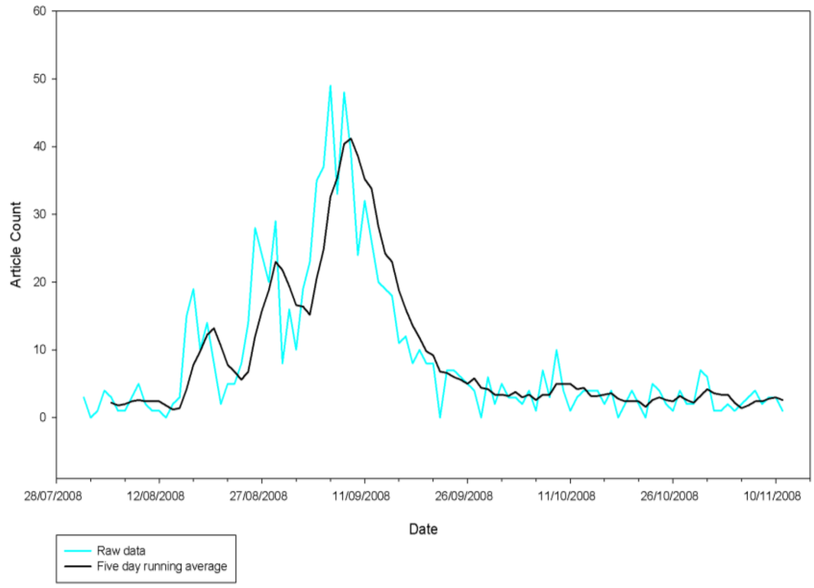

Figure 8.21: Haiti Floods GNAT-Db coverage graph

At the time of the Haiti floods, severe flooding was affecting large areas of India's Maharashtra state, Andhra Pradesh and Northern Bihar. Total coverage of both events is very similar, 908 articles for the Haiti floods and 1,000 articles for the India floods. Peak coverage for both events occurred within six days of each other, though India recorded 73 articles compared to Haiti's 49. However, the major anomaly between the two events is that coverage of the India floods only lasted 35 days, despite the death toll being four times greater, at least 2,400 recorded fatalities. It is likely that the hurricanes, combined with the political aspects of Haiti's escalating governmental and humanitarian troubles, made the event more interesting and more captivating as a story.

Excluding the Kashmir and Sichuan earthquakes, the Haiti floods recorded the longest decay coverage period within the entire GNAT-Db: 67 days. Analysis of the articles recorded within the decay period found that much of the post-peak coverage focuses on the increasing fatality numbers, the worsening humanitarian situation, and the ongoing relief efforts throughout Haiti. It was also noted that, when a hurricane or tropical storm developed throughout the Caribbean Sea or Southern Atlantic Ocean within the following months, such as Hurricane Omar on October 13 or Tropical Storm Paloma on November 6, the recent hurricane events and flooding in Haiti were referenced. This increased the overall total and duration of the Haiti floods, despite the articles not being exclusively concerned with the Haiti floods.

An increase in coverage is noticeable on October 9, whereby coverage more than doubled from that of the previous week. Analysis of the reports on this day found that it was the announcement that the United States would rebuild the Ennery Bridge, a vital route to the hard-hit city of Gonaives.

Throughout the entire coverage of the Haiti floods, fatality estimates varied greatly. Fatality data for the Haiti floods is difficult to quantify from the recorded media articles alone. Due to the complexity of the events in Haiti, fatality figures often differ greatly. For example, on September 6, the date peak coverage was reached, one article reported '*Hurricane Hanna leaves 137 dead in Haiti – CCTV*'[45] and 48 minutes later another reported '*500 dead in Haiti from TS Hanna – United Press*.'[46]

[45] http://v.cctv.com/html/worldwidewatch/2008/09/worldwidewatch_300_20080906_18.shtml

[46] http://www.upi.com/Top_News/2008/09/06/500-dead-in-Haiti-from-TS-Hanna/UPI-68901220716533/

8.13. Lao Cai, Vietnam Floods

8.13.1. Background to the Event

In terms of fatality numbers, the Lao Cai, Vietnam floods ranked as the fifth largest flood event and the eighteenth largest event recorded within the entire GNAT-Db, with 119 deaths recorded. However, coverage of the event was much lower than would be expected and the event ranked as the third lowest flood event and the twenty-third lowest event within the entire GNAT-Db in terms of total coverage.

On August 4 2008, a tropical depression developed off the north coast of the island of Luzon, Philippines. By the next day the depression had intensified and had developed into a tropical storm. The intense storm, then named ‘severe Tropical Storm Kammuri,’ moved towards the South coast of China and made landfall in the Western Guangdong Province at 12pm local time on August 6, 2009.

Figure 8.22. Map showing the location of the Lao Cai, Vietnam and the track of Tropical Storm Kammuri.

Photograph showing the extent of flooding in Lao Cai.

Source: BBC News, 2008

After the severe tropical storm made landfall it began to weaken and was downgraded to a tropical storm. However, on August 7, Tropical Storm Kammuri emerged into the Gulf of Tonkin and regained some of its intensity. It was at this point that it struck Vietnam, bringing continuous heavy rains for several hours. Massive flash floods and landslides were reported throughout the Northern provinces, particularly Lao Cai, Yen bai and Phu Tho. In total, 119 fatalities were reported in Vietnam and dozens remain missing, presumed dead. Entire villages were cut off in Lao Cai, the worst-affected province, stranding tens of thousands of people. Large landslides in Yen bai occurred in the early hours of the morning, taking many residents by surprise and killing up to 40 people as they slept. Thousands of buildings across the Northern provinces were damaged or destroyed and vast areas of crops were destroyed.

A major rescue effort was led by the Vietnamese army but was severely hampered by continued bad weather and the destruction of a number of roads and tracks. Red Cross workers provided shelter and food for thousands, but again work was hampered by the bad weather and the lack of access. Hundreds of foreign tourists were also left stranded throughout Vietnam as major landslides stopped all trains between Lao Cai and Hanoi. No foreign casualties were reported and up to one hundred were flown out of harm's way by the Northern Aviation Service Authority.

The overall coverage profile for the Vietnam floods is atypical to what would be expected of an event of this magnitude. In total, only 26 individual articles were recorded over a duration of nine days. This is much lower than expected for an event of this magnitude. Based on a positive linear relationship between fatalities and total event coverage and fatalities and duration, an event causing 119 fatalities would be expected to record a total coverage of approximately 90 articles and persist for approximately 20 days.

Both the South Ossetia War between Georgia and Russia and the 2008 Beijing Olympics began on August 8, the same day as the onset of the Lao Cai floods. Analysis of the news media coverage of both the War and the Olympics found that it is likely that they took precedence over the floods in Vietnam. For example, on August 8, 1,450 articles were recorded on August 8 with regards to the South Ossetia War and 4,450 articles were recorded on the same day regarding the Beijing Olympics. It is likely that, due to the shock and debate surrounding the South Ossetia War and the hype and controversy surrounding the Beijing Olympics, that any hazard event (excluding 'very high' profile/magnitude events) occurring at this time would have recorded much lower coverage statistics than expected.

8.13.2. Media Coverage of the Event

Peak coverage, nine articles, was recorded on the third day of coverage, two days after Tropical Storm Kammuri made landfall in Vietnam. Peak coverage coincided with the peak in reported fatalities and, following this, coverage dropped rapidly for the next two days, with only one article being recorded on each day. A secondary peak in coverage, five articles on August 15, coincided with the evacuation of hundreds of foreign tourists out of Lao Cai province.

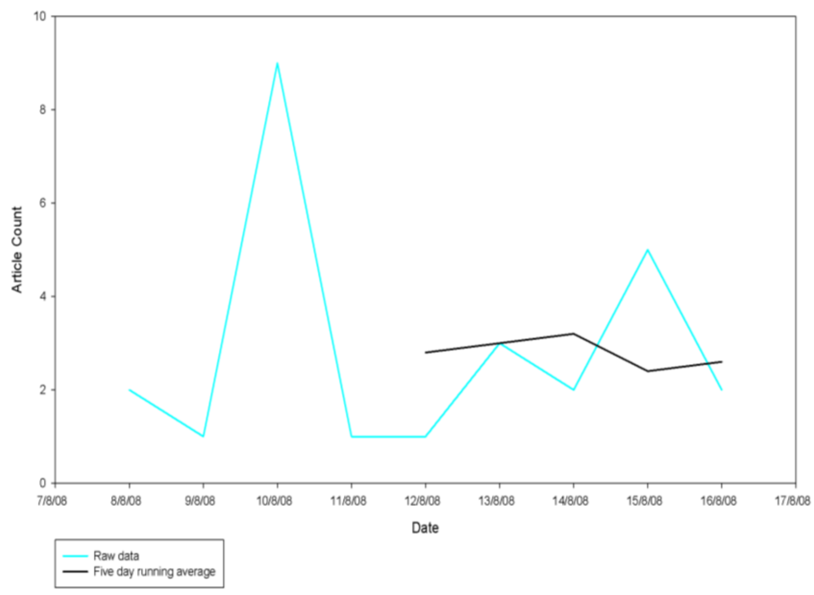

Figure 8.23: Lao Cai, Vietnam Floods GNAT-Db coverage graph

Overall, 21 of the recorded 26 articles focus on the death toll of the event. This is a much higher proportion than any other event examined. The remaining five articles reference the floods but the focus of the individual articles is on a range of other topics; a bomb explosion in China, a political march in Venezuela, and the disruption to a 'terror cell' in Italy.

Like several of the events under examination, the reporting of fatality numbers was often inconsistent. On the first day of coverage, fatality estimates ranged from 73 – '*Flash floods kill 73, leave 34 missing in Vietnam - Xinhua*'[47] – to 140 – '*At least 140 dead or missing in Vietnam floods – USA Today*.'[48] This inconsistency in fatality estimates continues throughout the duration of coverage. Examination of other events has shown that when an official fatality count is issued, usually coinciding with the peak in coverage, this figure is then referenced throughout the duration of the event. However, no such official figure was released for the Lao Cai floods during the timeframe under analysis.

8.14. Queensland, Australia Floods

8.14.1. Background to the Event

The final flood case study to be examined is the February 2009 Queensland, Australia floods. This event will be compared to another recorded Australian flood event, the

[47] http://news.xinhuanet.com/english/2008-08/10/content_9119630.htm

[48] http://www.usatoday.com/weather/floods/2008-08-10-vietnam-floods_N.htm

November 2008 Queensland floods. These two events were chosen for comparative analysis due to the obvious similarities in location, but also the unexpected coverage profiles of both.

Throughout January and February 2009, an active monsoon trough extending across Northern Queensland, coupled with a series of low pressure systems and Tropical Cyclones Charlotte and Ellie, combined to produce above average rainfall. In total, 1233mm of rainfall were recorded throughout the first two months of 2009, compared to the 344mm recorded in the same period in 2008 (AGBM, 2009). This rainfall led to major river flooding in the Gulf of Carpentaria and Western River Catchments as well as along the North and Central Queensland coast. The heavy January rainfall coincided with king tides along the Queensland coast further exacerbating coastal flooding.

Although the low pressure system over the Gulf of Carpentaria weakened in late January, the system later strengthened, forming Tropical Cyclone Ellie on February 1 2009. Both Tropical Cyclones Charlotte and Ellie tracked along the Queensland coast, causing severe floods in the town of Ingham where over 3,000 inhabitants were affected. By February 6, further heavy rains caused additional flooding throughout much of Queensland. Ingham in particular received 236mm of rain, raising the floodwaters to over 12.5 metres (Bureau of Meteorology, Queensland, 2009). One week later, a rain depression caused by ex-Tropical Cyclone Charlotte exacerbated flooding on January 12 and isolated several Queensland communities for several days as major road and rail links were disrupted by floodwaters.

Figure 8.24. Map showing the location of Brisbane, Queensland, the worst hit area of the November 2008 floods.

Photograph showing the extent of the floods in Brisbane, Queensland Australia

Source: *Brisbane Times*, 2008

Despite the intense flooding and the number of those affected, no casualties were reported and damage was limited to farmland and small communal areas.

In comparison, the November 2008 Queensland floods lasted only four days but resulted in 21 deaths and affected over 3,000 people. On November 16, three days of heavy rain saturated much of the land throughout the Southeast Queensland catchment. On November 19 there was intense rainfall overnight, causing severe flash flooding in major built-up areas throughout Southeast Queensland and major riverine flooding along the Bremer River.

Major infrastructure routes were damaged or destroyed due to rising flood waters and mudslips. Thousands of residents were left stranded when the Brisbane Inner City Bypass and rail links were closed due to flooding.

8.14.2. Media Coverage of the Event

The recorded coverage statistics and profile displayed for the November 2008 Queensland floods are not what were expected for a fatal 'Western'[49] flood event. 21 fatalities were reported but, in total, only 44 individual articles were recorded. This figure is much lower than would be expected for an event of this magnitude, particularly when compared to the 240 articles reported for the non-fatal 2009 Queensland floods.

Peak coverage was reached within two days, and decay coverage lasted five times as long as start-to-peak coverage, a total of 10 days.

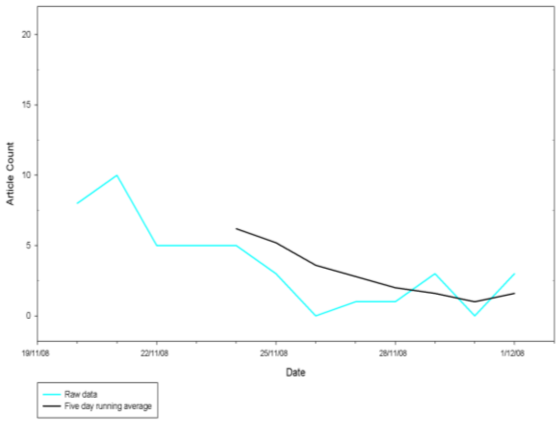

Figure 8.25.a: 2008 Queensland, Australia Floods GNAT-Db coverage

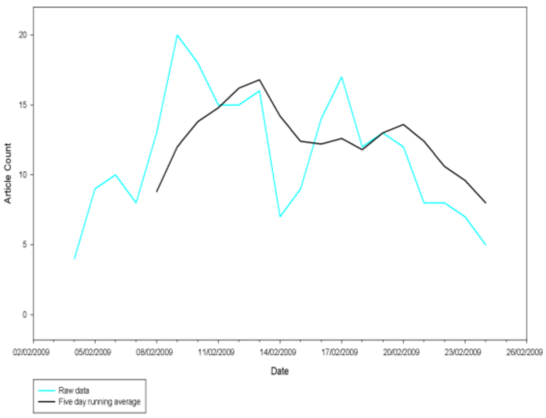

Figure 8.25.b: 2009 Queensland, Australia Floods GNAT-Db coverage

[49] The term 'Western' is used here to denote the development of a nation, not the location of an event.

It was first thought that the Santa Catarina, Brazil floods, which occurred at the same time as the November 2008 floods and resulted in 99 fatalities, may be the reason for the low coverage levels. However, coverage of this event was also much lower than would be expected.

Further analysis of overall media trends at the time of the November Queensland floods found that a number of political events took precedence at this time, namely the political crisis in Thailand that persisted for several weeks; the Mumbai terrorist attacks of November 26 that killed 195 people; and the Jos, Nigeria riots of November 29 that led to the deaths 381 people. Each of these events recorded high coverage rates and are likely to have 'overshadowed' coverage of the Queensland floods. Ongoing coverage of the recent election of Barack Obama also recorded extremely high coverage rates around the time of the Queensland floods; over 3,000 separate articles were reported referencing "Barack Obama" on the day the floods reached their worst in Queensland.

In comparison to the fatal Queensland floods of November 2008, the non-fatal floods throughout January and February 2009 recorded much higher coverage rates. In total, 240 separate articles were recorded over a period of 21 days. The five-day average profile for the January-February floods displays a coverage profile that resembles the predicted flood event model; elongated lead in time followed by a steady decline in coverage throughout the decay period with a momentary peak seven to 10 days after the overall peak.

The duration of the 2009 flood events, 21 days, and peak coverage, 20 articles, were both higher than the 2008 floods, 12 days and 10 articles respectively. Due to the non-fatal nature of the 2009 flood events, such coverage statistics were unexpected.

Analysis of the wider news media trends at the time of the 2009 flood event found that no major international events had occurred, which may have drawn attention from the event. However, at the same time, Australia was on the brink of one of its hottest heat waves, with temperatures consistently above 40°C in many parts of the South East and reported 374 deaths. In conjunction with the heat wave, severe bushfires had spread across large swathes of the state of Victoria, killing a further 173 people.

Analysis of the recorded 2009 flood articles found that very few of the articles reported solely on the flood events, most focused on a combination of the three event types, referencing the floods, bushfires and heat wave in the same article; '*Fires to follow floods as wild weather hits Australia – AFP*'[50]

In comparison, whereas the November 2008 floods were rapid onset events, the January-February 2009 floods were predictable in their onset due to the development of the storms and Tropical Cyclones. The heavy rains that caused the November floods were out of season and above average for their intensity and total rainfall. It is therefore felt that the recorded 'over reporting' of the non-fatal 2009 Queensland floods is likely due to the combination reporting of the fatal heat wave and bush fires with only brief references being made to the floods in articles focused on the heat wave and bushfires.

This 'over reporting' of events due to references in articles not primarily concerned with the event in question, and its affects upon the dataset, will be discussed in Chapter Ten.

8.15. Flood Conclusion

As found with earthquake and landslide coverage, fatality numbers do not seem to be the controlling factor of flood coverage as expected. The chosen case study events demonstrate how coverage of flood hazard events, and perhaps media events in general, can be greatly affected by exogenous events occurring at the same time. For example, coverage of the Lao Cai, Vietnam floods was expected to be much higher than the 26 recorded articles due to the high fatality count. However, the event occurred at the same time as several major socio-political events, namely the South Ossetia War and the Beijing Olympics, and, thus, the event was almost entirely overshadowed.

As with the La Conchita, California landslide, the Indiana, USA floods represented the only major 'Western' event recorded within the GNAT-Db flood dataset. It was expected that, despite the low fatality count, the Indiana floods would record a notable level of news media coverage due to the extent and economic cost of the damage and the dominance of US events within the global media.

Out of the three event types studied, flood event coverage seems to be the most variable in terms of content and overall coverage profiles. Earthquakes, and to a lesser extent landslides, demonstrate very similar coverage profiles and patterns in reporting. However, based upon the case studies presented, overall flood coverage profiles are often unpredictable due to the changeability in climatic factors, which largely govern the intensity and magnitude of the flooding.

[50] http://www.google.com/hostednews/afp/article/ALeqM5gyUztdckUqzd_SFg9jClfRmHlWEg

Although trends in reporting of flood events were uncovered regarding general news media ‘interests,’ no universal trend in event coverage was reported. Peak coverage of each event coincided with the peak in fatalities and build-up coverage often focused on the escalating fatality numbers. However, the four flood case studies represent four very different events and the focus of content of post-peak coverage of each is varied. Reports of the Indiana floods after peak coverage were primarily concerned with the financial implications of the event, whereas post-peak coverage of the Haiti floods focuses on the humanitarian issues inherent within such a large event.

8.16. Case Study Analysis Conclusion

As has been shown, fatality figures are not necessarily the controlling factor with regards to coverage magnitude and extent: a high fatality event will not automatically receive a high level of coverage. A number of high fatality events were shown to record low levels of coverage and a number of low fatality events recorded very high levels of coverage.

Overall, the apparent over- and under-reporting of recorded events may be more related to extraneous events, or lack thereof, and not fatality figures, as first thought. The high fatality/low coverage events all occurred at times when other stories within the media were taking precedence, the South Ossetia War, the election of Barack Obama and the 2008 Beijing Olympics.

Location of the event does not seem to be a key factor with regards to the extent of coverage either. Although ‘Western’ events seem to record higher levels of coverage, regardless of fatality figures, and are more prominent within the dataset, some low fatality ‘Eastern’ events, such as the Niigata Chuetsu Oki, Japan earthquake, also record very high coverage statistics. However, analysis of high fatality low coverage events has shown that ‘Eastern’ events are more likely to be ‘under’ reported if other extraneous events occur.

Events with political and/or economic issues surrounding them often record higher coverage statistics, namely total coverage and coverage duration. For example, the Niigata Chuetsu Oki, Japan earthquake recorded a much higher total coverage and persisted for a longer period than would have been expected from an event that caused the deaths of seven people. Analysis of the media reports recorded for all 12 case studies found that political and/or economic issues were the focus of much of the post-peak reporting. In events where political or economic issues were the focus, event duration seems to be longer than would be expected from an event of such magnitude. Political aspects or economic implications surrounding the event appear to control the longevity of event coverage.

Analysis also found that, if controversy surrounded the event (substandard planning or workmanship for example) then it is also likely that coverage of the event would persist for a longer period than expected.

Chapter Nine: Socio-Political Context & Reasoning - Patterns in Reporting

'The world does not have an appetite for more than one crisis at a time.'

~ Livingston, 1996:14

This chapter will focus upon social and political explanations for the temporal and spatial trends identified throughout previous chapters. Identified themes within the reporting of natural hazards, namely the location and timing of an event, the geophysical characteristics of an event, the focus on fatality figures, and the affects of external events, will be examined.

9.1. Event Characteristics

9.1.1. Fatality Numbers

Hazard events are often measured in a variety of ways – geophysical magnitude (e.g. earthquakes) and area affected (e.g. floods and landslides). For this study, fatality numbers were used as a 'universal currency[51]' when discussing events of varying types. This allowed for the comparison of floods, earthquakes and landslides of similar 'magnitudes.' It was predicted that fatality figures would be the controlling factor with regards to the level and magnitude of an events media coverage. As shown in Chapter Seven, a strong relationship was found between fatality numbers and total coverage for all three event types, which was taken to be a robust indicator of public interest in an event. However, throughout both databases, several high fatality events recorded total coverage statistics much lower than a number of low fatality events and several non-fatal events recorded total coverage statistics much higher than several high fatality events. Thus, there must be something beyond a death toll to compel news media coverage and, with regards to the databases presented, fatality numbers may not represent the controlling factor with regards to the level and extent of media coverage any given event receives.

9.1.2. 'Rare' vs. 'Common'

Earthquakes are common and several thousand occur throughout the world each year (USGS, 2009a). However, fatal earthquakes are rare: of the 29,685 earthquakes recorded by the USGS in 2007, only 19 were fatal, and only five of these resulted in more than 10 fatalities (USGS, 2009b). Thus, we understand why fatal earthquakes represent some of the largest events recorded within both databases. In acknowledgement of this, it was assumed that the rarity of an event may, in part, define

[51] See Jonkman, 2005; Adler, 2006 and Birkman, 2008 for a discussion of using fatality figures as a 'universal currency.'

the level and intensity of media coverage an event receives. For example, 'great' earthquakes, those recording ≥8Mw, occur, on average, once a year (USGS, 2009a). Consequently, it was assumed that such events would hold a certain 'novelty' value that is likely to add to the level of press interest in the event.

Only five ≥8.0Mw non-fatal earthquakes have been recorded by the USGS during the twenty-first century (USGS, 2009b). GNAT was used to record the media coverage of these five events and details are presented in table 9.1. Four of the five events occurred on, or close to, small island states with small populations: a maximum of 40 researchers inhabit the World Heritage Site of the Macquarie Islands; 16,800 people inhabit the Kuril Islands; and The Kingdom of Tonga has a population of only 104,000. In comparison, Hokkaido is Japan's second largest island and is home to over five million inhabitants.

Event	Date	Magnitude (Mw)	Total (articles)	Peak (articles)	Duration (days)
Hokkaido, Japan	25/09/2003	8.3	203	87	5
Macquarie Island	23/12/2004	8.1	16	16	1
Tonga	03/05/2006	8.0	36	36	1
Kuril Islands	15/11/2006	8.3	36	36	1
Kuril Islands	13/01/2007	8.1	25	25	1

Table 9.1: Table showing summary news media information for non-fatal 'great' earthquakes events within the twenty-first century

Despite the rarity and 'great' magnitude of the events in question, most recorded very low levels of coverage, both in terms of total recorded articles and event duration. Only the Hokkaido earthquake recorded a relatively high number of articles and a coverage duration longer than one day. Conversely, analysis found that small to moderate events (≤6.0Mw) and non-fatal events, including nine non-fatal Japanese events of much lower magnitudes, recorded much higher coverage parameters, despite their common occurrence and familiarity within societies the world over.

It was assumed that the unpredictable nature of earthquakes was the reason that such events are well-represented throughout both databases and the reason behind their often high coverage parameters. However, the low levels of recorded coverage for rare 'great' earthquakes suggests that the rarity of an event, particularly with regards to earthquakes, may not be a defining factor with regards to the level and magnitude of media coverage.

In comparison to the spatially constricted and unpredictable nature of earthquakes, floods regularly occur across the globe and often follow predictable seasonal patterns (Few, 2003). Thus, coverage of such events was expected to be relatively lower in comparison to earthquake coverage. However, floods also represent some of the deadliest natural hazard events on record, accounting for 6.2 million deaths throughout the twentieth century (MunichRe, 2009). In 2007 alone, DFO recorded 243 separate flood events, 206 of which were fatal events causing a total of 12,242 fatalities (DFO, 2008). Thus, the global occurrence and high fatality rate means that the cumulative impact of floods is much greater and, as a result, total recorded flood coverage in both databases is, on average, higher than both earthquake and landslide coverage.

Conversely, analysis found that individual flood events often recorded coverage parameters much lower than earthquakes. In fact, flood events displayed very different media coverage profiles to earthquake events. Whereas total coverage of an earthquake is often large, with a rapid increase to a high peak, followed by a relatively slow decay period; total flood coverage is often lower, with a lower peak in coverage but a longer duration. It is likely that the common occurrence of flood events means that such events are not necessarily seen as 'newsworthy' as earthquakes and that the physical processes inherent within floods (namely a more predictable and longer event duration) result in lower individual event coverage parameters.

Fatal landslides occur throughout the world but recent studies by Petely *et al.* (2005) have found that the majority of fatal landslides occur throughout Asia, namely South and Southeast Asia. This is echoed within the data presented throughout this study, whereby 45% of fatal landslides recorded within NHRSS-Db and 36% of events within GNAT-Db occurred in South and Southeast Asia. Thus, the regular occurrence of such events may result in them being classed as 'un-newsworthy,' unless an event stands out due to high fatality figures or a particular socio-economic aspect. This premise is supported by the fact that a number of fatal Asian landslides within both databases recorded coverage statistics much lower than expected for events of such magnitude and that prominent events (in terms of total coverage) were those with an accompanying socio-economic element.

9.2. Temporal Trends in Natural Hazard News Media Coverage

9.2.1. Long-Term

As noted in Chapter Six, a downward trend in overall earthquake coverage was recorded following a large or extreme fatality event, such as the 2005 Kashmir and 2008 Sichuan earthquakes. It is likely that, following an extreme fatality event or a well-publicised event, earthquakes of a smaller magnitude will be seen as less 'newsworthy.' Thus, it is believed that this recorded downward trend in coverage represents an overall decrease in interest in earthquakes. Due to the inherent shock of earthquake events, later events still record prominent peaks in coverage (as shown by the peak in coverage of the Nias earthquake during the decay coverage of the Sumatra-Andaman earthquake in figure 6.2) but it is likely that such coverage is lower and/or shorter than expected. It appears that overall coverage does not increase again until another extreme fatality event occurs.

Despite earthquakes representing the most 'popular' event type, in terms of total and peak coverage, floods represent the event type with the longest, on average, coverage duration. Analysis found that flood coverage is often great in terms of total number of articles recorded, but coverage often spans a much greater length of time compared to earthquake and landslide events.

Undoubtedly, the physical processes involved in each event type affect the level and duration of coverage. An earthquake, and much of the destruction caused, can be over in a matter of seconds and a landslide can engulf a town in a matter of minutes. In comparison, floods are often caused by several hours, or even days or weeks, of persistent rainfall, with the extent of the flooding worsening over this timeframe. Thus, coverage of flood events persists longer because there is more 'news' to report.

Analysis found that secondary peaks in event coverage often coincided with the weekly, monthly or yearly anniversary of the event. Headlines such as '*Italy earthquake: L'Aquila one month on – Telegraph*[52]' were found to be common. Although no events recorded within either database persisted for one year, a GNAT search was performed on the yearly anniversary of a number of events. It became apparent that large events are often remembered, with a resurgence in coverage of around 20% of initial peak coverage. For example, on May 12 2009, the one year anniversary of the Sichuan earthquake, 70 articles were recorded (20% of initial peak coverage – 343 articles). Recorded articles briefly reviewed the event in question but

[52] http://www.telegraph.co.uk/news/worldnews/europe/italy/5262449/Italy-earthquake-LAquila-one-month-on.html

focus was often on nationwide mourning ceremonies and stories of those still affected by the events one year on: '*Sichuan earthquake remembered – Euronews.net*[53]' and '*Revisiting Sichuan: One Year On – AsiaOne*[54].' The same analysis was performed for the 2005 Kashmir earthquake. It was found that, even three years after the event occurred, reports on the anniversary of the event were common. For example, on the third anniversary of the Kashmir earthquake a number of articles, such as '*Scars still linger after 2005 quake – Reuters AlertNet,*'[55] were recorded.

Analysis of the 2005 Kashmir earthquake also found that it is common in media coverage of natural hazards to relate events to similar events in recent history. For example, following the October 29, 2008 Pakistan earthquake, a peak in coverage relating to the 2005 Kashmir earthquake was noted. A number of articles referenced the 2005 Kashmir earthquake in comparison to the 2008 event despite the two events differing greatly; the 2005 event measured 7.8Mw on the Richter Scale compared to the 6.4Mw of the 2008 event; the 2005 event killed 74,698 people whereas the 2005 event killed 215; and the events occurred 1,671 kilometres apart. It is believed that such comparisons are made to invoke memories of past events, therefore giving the audience a reference point and improving the appeal of the story.

9.2.2. Short-Term

Analysis found that considerable daily fluctuations in media coverage of hazard events is common, with coverage demonstrating considerable short-term variation and not recording a steady accumulation or decay in coverage. As shown in the coverage profiles and the cumulative coverage graphs presented throughout the results chapters, recorded fluctuations in coverage are displayed as rapid, daily, peaks and troughs and steps in coverage respectively.

The 'breaking news' mentality of today's news media, as outlined by Duffield (2002) and Gerhardt (2006), means that a new event will often take precedence over another. Analysis has shown that several events recorded reductions in coverage, often total reductions, when another event occurred. For example, NHRSS-Db coverage of the 2008 Bihar, India floods fell from 2,061 articles on September 5, 2008 to zero articles on September 6, coinciding with the occurrence of the September 6, 2008 Cairo, Egypt Rockfall, which recorded 1,395 articles on the same day. Recorded news media attention appears to have entirely swapped from the floods to the rockfall. However, on September 7, 2008 coverage of the two events reversed and coverage of the rockfall

[53] http://www.euronews.net/2009/05/12/sichuan-earthquake-remembered/

[54] http://www.asiaone.com/static/multimedia/gallery/090512_quake/

[55] http://www.alertnet.org/thenews/newsdesk/LA18124.htm

decreased to 350 articles and coverage of the floods increased from zero to 2,136 articles. In addition, on September 8, coverage of the floods fell to 22 articles and coverage of the rockfall fell to one article, when a large landslide in Northern China occurred, killing 254 people, and recorded 1,059 articles.

This example of media coverage changeability suggests that online news publications are working to strict confines and are choosing which events to report on, despite publishing on a medium with near-infinite levels of online space. It therefore appears that, as Moore (1958) and later Galtung and Ruge (1965) and Livingston (1996) inferred, the news media have a brief attention span regarding natural hazards and can only handle one event at a time. Once the initial shock of the event is over, attention is likely to move on to a new event or return to a major ongoing issue.

It was also noted that the timing of an event could affect its coverage. For example, work and print deadlines mean that an event that occurs late in the day may not be reported until the next working day. Analysis found that this was the case for several landslide events. Coverage of the event on the day of the event would either be very low or non-existent and it was not until the next day that the expected level of first day coverage was recorded. It was also noted that events that occurred on weekends often recorded longer periods of time to peak coverage. It was felt that this was due to the event not featuring prominently in the weekend news due to limited website updates over weekends, and it taking until Monday for coverage to initiate and escalate. In contradiction, increases in event coverage were often found to occur on Sundays. It was felt that these increases were due to a re-capping of events that had occurred earlier in the week by Sunday editions.

9.3. Spatial Trends in Natural Hazard News Media Coverage

9.3.1. Location

It is likely that regions of the world show preferences towards certain event types and certain other regions. For example, previous work by Petley *et al.* (2005) found that the vast majority of landslide events occur in South and Southeast Asia. Thus, it is likely that such events will be reported highly within these regions, and those surrounding regions with social and political ties. For example, of the 615 articles regarding the nine Nepalese landslides recorded within NHRSS-Db, only 34 (5%) originated from news agencies outside of Asia. Of these, 20 (58%) were published within the USA and 14 (41%) were published in the UK. Conversely, NHRSS-Db coverage of the January 8, 2009 San Jose, Costa Rica earthquake, which recorded 20,092 individual articles in total, was predominantly sourced from the US, with no articles recorded by South American news agencies. In total, 14,328 articles (71%) were published by US news

Agencies: 5,315 articles (26%) were from UK news agencies, 1,614 (8%) were reported by Xinhua of China, and 198 articles (0.9%) were reported by *The Times of India*. Further analysis found that this lack of 'home' coverage is likely due to the majority of South American articles being reported in either Spanish or Portuguese and a number of major US publications being reproduced within South America. It was found that coverage of events from USA and UK press, coupled with local press interest, was a near-permanent element of event coverage recorded within NHRSS-Db. This is likely due to the size and global reach of major USA and UK news agencies, such as Associated Press and Reuters, and the subsequent re-publishing of articles from these agencies by other news outlets. Smaller news agencies often rely upon large news agencies to provide global-level information that they cannot secure themselves. In doing so, articles are often reproduced in part or in whole and it is likely that this reproduction of major news agency articles is the reason for the near-constant, and often high-level, of USA and UK press coverage recorded within NHRSS-Db.

9.3.2. Cultural Ties

As well as being a geographical element, location is also a perception (Moore *et al*., 2008). The idea that somewhere is 'close' or 'far' is often based upon one's own perceptions of the world. In their study of Norwegian press coverage of crisis events in the Congo, Cuba and Cyprus, Galtung and Ruge (1965) found that events were more likely to become news if they involved 'elite' 'Western' nations or peoples. In a later study, Ploughman (1995:36) reaffirmed this argument and stated that 'foreign disasters must be more serious than equivalent domestic ones [and] the farther from America the country is geographically, politically, culturally, or racially, the larger the number of victims necessary for the story to receive attention.'

Adams (1986) found that the news media break the world up into a number cultural, societal and political 'blocks,' with the news media of these 'blocks' primarily focused upon events within their own 'block.' For example, the 'Western' world, or 'block,' shares many of the same religious, cultural and societal views and interests and, as such, ties between nations are often strong and events within the boundaries of the 'Western' 'block' are often heavily reported throughout. An event in Italy, for example, is likely to feature heavily throughout European and North American media, due to cultural and political similarities within both states. However, an event in Southeast Asia may not feature so heavily in European media but will undoubtedly record larger coverage statistics throughout the rest of the Asia 'block'.

However, a recent study by Giddens (2003) found that, due to increased air travel, ever-faster telecommunications and 24-hour news networks, the world is shrinking and people are becoming more familiar with one another. Globalization has, in essence, resulted in a ‘global identity’ whereby familiarity, and therefore social interest, in persons or events from across the globe has increased (*ibid*). For example, familiarity with regards to popular holiday destinations is likely to improve the news media coverage of an event in such a location: the audience can better relate to an event if they have been to the place in question. This is believed to be one of the reasons for the staggering interest and financial giving following the December 26, 2004 Sumatra-Andaman earthquake, and the relatively meagre initial allocation of financial assistance in response to the October 8, 2005 Kashmir earthquake (BBC, 2005). Indonesia and Thailand, two countries worst affected by the Sumatra-Andaman earthquake and subsequent tsunami, are major holiday destinations for Westerners. The vision of familiar beaches and fellow Westerners in trouble may have amplified the response to the disaster. In comparison, Kashmir, a mountainous, war-torn state nestled between a number of ‘rogue’ nations, does not feature sandy beaches or Western tourists and is less likely to invoke familiarity amongst most Westerners.

In addition, with regards to UK media coverage in particular, it is likely that any event, natural hazard or not, that occurs in an ex-colony state – Canada, Australia, India, Egypt, South Africa, Kenya etc. – will feature heavily in the media. Such states often represent a large number UK ex-patriots and, thus, cultural and societal ties between nations are strong. Large ex-pat communities often mean within that country are similar to the ‘home’ state.

9.3.3. Language

Language is a key component within global patterns of media coverage. It is likely that nations sharing similar languages, perhaps ex-colonies, or nations with large migrant communities will share interests in particular events. For example, it was noted that a common news source for South American events recorded within NHRSS-Db was the Los Angeles Times. This is likely due to 47.7% of the population of Los Angeles having Hispanic origins and 41.7% reporting Spanish as their first language (US Census Bureau, 2008). Thus, an interest in South American events is expected within the press of the area.

9.3.4. Access

Access to the site of a hazard event, or any ‘newsworthy’ event, is paramount for reporters. Access to the site of the event and those affected allows reporters to gain an understanding of the event and uncover the information needed for the publication of reports. However, access is not always easy, or possible. The nature of natural hazard events means that the site is often highly dangerous.

Analysis of media reports surrounding the October 8, 2005 Kashmir earthquake found that reports published in the first four days presented highly confused reports regarding the extent of the damage and the number of fatalities. The earthquake occurred in a mountainous region of a politically unstable state and so telecommunications and infrastructure within the area were not reliable. As such, it took several days for reporters and emergency response units to reach many of the affected areas and it was not until 12 days after the event occurred that accurate reports emerged within the media.

This difficulty in attaining accurate information in remote, dangerous, or politically unstable areas was also noted in seven other recorded events. Analysis of the four recorded Tibetan earthquakes throughout August to October 2008, the 2008 Sichuan, China earthquake, Cyclone Nargis, and the 2006 Yogyakarta, Java earthquake found that early coverage of each event demonstrated a level of uncertainty regarding the extent of damage and subsequent fatalities. Analysis found that fatality reports in particular were often highly contradictory and references to geographical and governmental limitations and restrictions of media access were often the reason. This, coupled with the size and complexity of some of the events, meant that the publication of accurate fatality figures and damage estimates often took much longer than expected.

For example, due to the subsequent widespread flooding across Burma[56], coverage of Cyclone Nargis was recorded within the NHRSS-Db flood dataset and demonstrates a perfect example of how difficult it can be to extract accurate event information from media coverage of a complex natural hazard. Burma is a country ruled by an evasive, paranoid and politically inward looking military Junta. As such, gaining access to the area and attaining accurate information was very difficult for media personnel, as well as relief agencies and military assistants. Subsequently, many news networks resorted to reporting from neighbouring countries and as such initial reports regarding the impact of the cyclone varied greatly, with reports of between 15,000 and 63,000 deaths published by major news agencies on the same day[57]. The lack of confidence

[56] Burma is used, and not Myanmar, because the UK Government, and myself, do not recognise the current ruling Junta or the subsequent 1989 name change as legitimate.
[57] '*Myanmar Cyclone Toll Rises to 15000; 30000 Missing - Bloomberg'* - http://www.bloomberg.com/apps/news?pid=20601087&sid=aHAw7bbQQHgs&refer=home
'*Burma cyclone death toll could hit 63000 – Telegraph'* - http://www.telegraph.co.uk/news/1932559/Burma-cyclone-death-toll-could-hit-63000.html

information emanating from within Burma led many news agencies to tend towards vague headlines – '*Burma cyclone: death toll 'could be 100,000' – Telegrap*h.[58]'

These examples show the difficulty in obtaining, fatality data from media reports. However, it became apparent that fatality figures presented late in the duration of an event were often accurate. This is likely due to a better understanding of the event and the publishing of official government information. Thus, media published fatality figures presented throughout this study are those from late in an event's duration and represent the most accurate media data available.

9.4. The Impact of External Events

As shown throughout the results chapters, several low coverage periods were recorded throughout both databases that coincided with major socio-political event. As shown in figure 5.3, the Iraq War was a prominent news feature throughout the timeframe under analysis and peaks in coverage, often relating to the deaths of soldiers, were found to coincide with a number of low natural hazard coverage periods. The run-up to the 2008 USA Presidential elections also featured prominently within the wider news media and is believed to have reduced recorded natural hazards coverage several times. For example, 'Super Tuesday[59]' (February 5, 2008), Election Day (November 4, 2008) and Inauguration Day (January 20, 2009) all dominated world press interest at the time and are likely to have overshadowed any natural hazard events at the time. For example, an earthquake in Rwanda on February 3, 2008 (two days before 'Super Tuesday),' which killed approximately 40 people, recorded a total of only 23 articles, much lower than would be expected for an event of this magnitude.

In addition, a number of global financial problems have also dominated the news media over the past 18 months. The liquidation of several large financial institutions and the subsequent governmental resolutions all received major press coverage and were found to have affected natural hazards media coverage. For example, on September 15, 2008 Lehman Brothers announced it would file for Chapter 11 bankruptcy[60], citing debts of US$768 billion. The subsequent public and press interest may be responsible for a number of hazard events recording lower than expected coverage parameters. For example, a landslide in Nepal on September 20, 2008, (five days after Lehman Brothers collapsed and was still receiving major press coverage) killed 64 people, but only recorded 19 articles in total, which was much lower than expected.

[58] http://www.telegraph.co.uk/news/worldnews/asia/burmamyanmar/1935795/Burma-cyclone-death-toll-could-be-100000.html

[59] 'Super Tuesday' was the day on which the largest simultaneous number of US presidential primary elections in the history of US primaries was held. In total, 24 of the 50 states voted.

[60] Chapter 11 is a chapter of the United States Bankruptcy Code, which permits reorganisation of a business when it is unable to service its debts or pay its creditors.

9.5. Redrawing the 'Issue Attention Cycle'

To address my overall research aim, the assessment of the variability in reporting of the global occurrence of natural hazards, I examined the differences in reporting of earthquakes, floods and landslides. In doing so, it became possible to address and redraw Downs' (1972) 'issue attention cycle' (figure 9.1) with regards to natural hazards and web-based news media (figure 9.2).

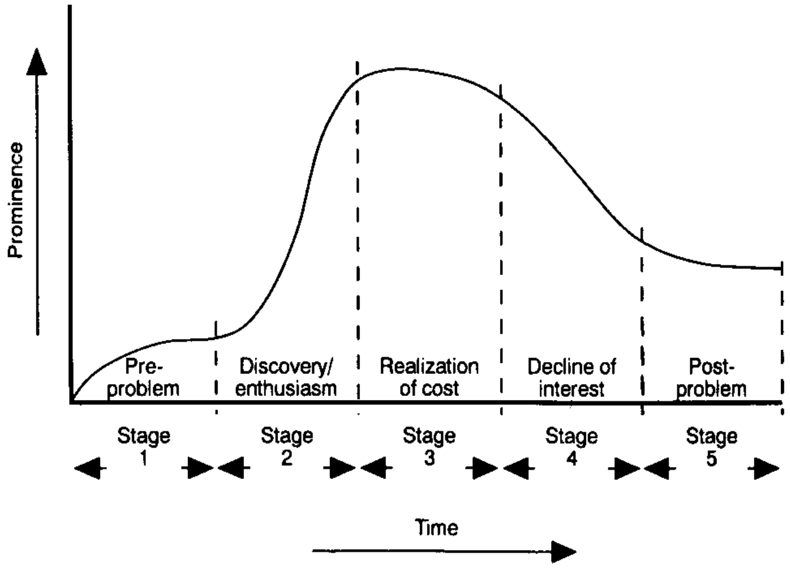

Figure 9.1: Schematic diagram representing Downs' (1972) 'issue attention cycle.'

Kirkwood (1994)

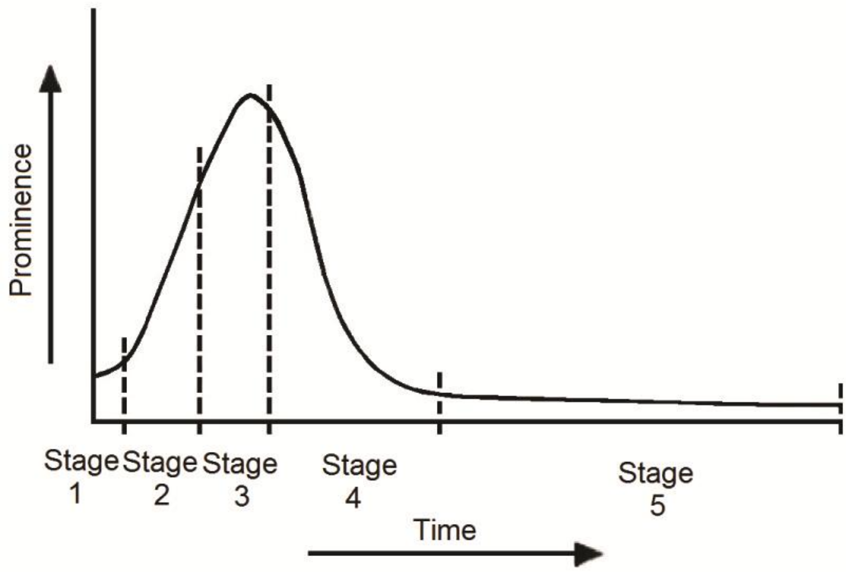

Figure 9.2: Schematic diagram representing hazard news attention cycle

In comparison to each stage in Downs' 'issue attention cycle,' the stages displayed in the natural hazard news attention cycle presented in figure 9.2 are much shorter. This is due to the increased speed with which news is transmitted in an increasingly connected world (Benthall, 1993) and the shorter periods of audience interest (Dayan and Katz, 1992; McCombs, 1997; Seiter, 1999). Each stage is outlined below.

Stage 1) Pre-event coverage

Due to the near-constant occurrence and reporting of natural hazards, a base level of reporting is always apparent within the media.

Stage 2) Event occurrence

When the natural hazard event occurs, it is picked up by the news media and interest in the event grows and reporting increases. The gradient of the event curve in the period prior to the peak denotes the rate of increase in interest for the specified event.

Stage 3) Increase to peak

Depending upon the magnitude, location and timing of the event, as well as wider news issues at the time, reporting continues to increase before reaching an overall peak in coverage. The peak of each event curve indicates the point at which media coverage reached its maximum.

Stage 4) Gradual decrease in coverage/interest

Following the peak in coverage, reporting/interest begins to decline. The decay of the event curve signifies the rate at which the interest in the specified event decreases over time. This often occurs once the impact of the event has been realised i.e. the number of fatalities, the extent of damage.

Stage 5) Post-event coverage

Coverage of the event continues to decrease until it reaches a point above zero and continues at this rate. This is due to references and comparisons to past events in future reports.

As has been shown throughout the results chapters, overall trends in news media coverage of different natural hazard event types are fundamentally different. The geophysical processes involved in each hazard, coupled with event characteristics and the identified trends within natural hazard news media coverage, control the subsequent news media coverage of an individual event.

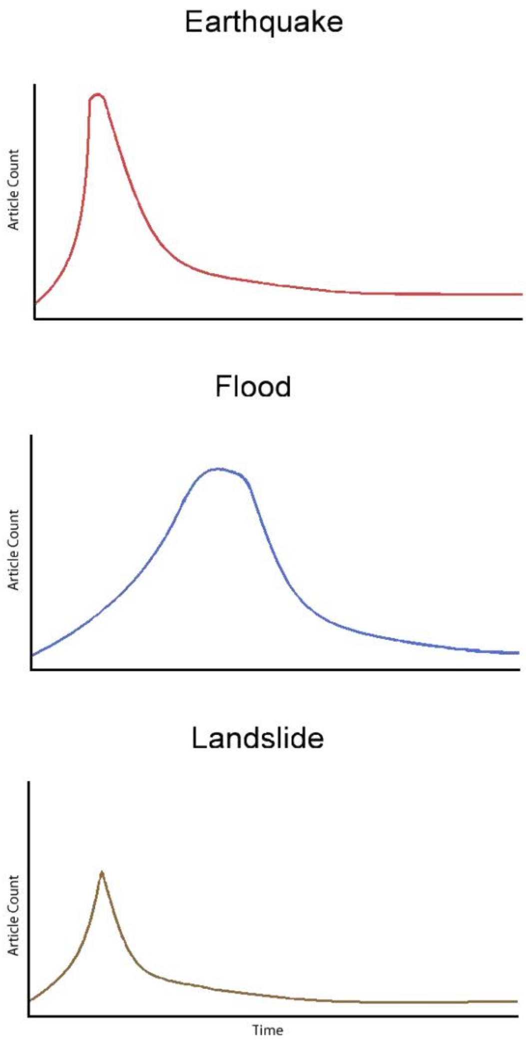

Figure 9.3 Individual event type hazard news media attention cycles

a) earthquake b) flood c) landslide

Figure 9.3 represents three natural hazard attention cycles, one for each of the event types studied, based upon the findings of this study.

It can be seen that each event type cycle differs greatly from the next. Earthquake coverage was found to record the highest peaks in coverage and the shortest period between event coverage onset and event peak. Thus, the earthquake hazard attention cycle displays a rapid and prominent peak. The shock and rapid onset of an earthquake means that coverage will increase rapidly. The timing of the peak is controlled largely by the magnitude of the event, with the length of time between event occurrence and peak increasing with magnitude. This is due to the lag time between event occurrence and the realisation of impact. The peak is followed by a steady decrease in coverage to a steady point just above zero. This constant low level of coverage is due to reports of future events being compared to the event in question.

In comparison to earthquakes, floods are often predictable slow onset events due to the climatic conditions involved and were found to record much slower periods between event onset and peak coverage. Thus, the flood hazard attention cycle displays a much slower growth to peak. Flood events were, on average, found to record longer durations in total event coverage and lower peaks in coverage. Thus, the peak and overall gradient of the flood hazard attention cycle curve is lower and wider than that for earthquakes.

Overall landslide coverage, including peak coverage, was found to be persistently lower than both earthquake and flood coverage. Accordingly, the overall landslide hazard cycle displays a much lower curve than both the earthquake and flood cycles. Like the earthquake cycle, the landslide peak is pointed and occurs relatively early in the cycle, compared to the more rounded flood cycle peak. Landslide coverage duration was also found to be, on average, the lowest out of the three event types. Thus, the overall duration of the landslide attention cycle (stages one to four) is shorter than that displayed for the earthquake and flood attention cycles.

9.6. Patterns in Reporting: Conclusion

It was predicted that fatality numbers would control the news media coverage of natural hazards. However, the analyses undertaken throughout this study have not conclusively revealed the control behind natural hazard event news media coverage. Many factors must be considered when discussing the possible reasons behind the level and extent of news media coverage surrounding natural hazard events. The events themselves are often complex, and the surrounding socio-political elements often complicate issues further. It is believed that, if a larger dataset were available, with a greater number of events distributed more evenly over a geographical area and a longer timeframe, a stronger relationship between fatality numbers and total coverage would be presented.

It has been clearly demonstrated throughout this study, and previous studies (see Petley *et al*., 2005), that the impact of hazard events is felt most throughout the East, namely South and Southeast Asia. However, it has also been shown that an imbalance exists between where hazard events occur and where the research is undertaken. This study has shown that a social interest in natural hazard event occurrence is apparent across the globe. However, until the imbalance in event occurrence and research is rectified, it is unlikely that accurate patterns in hazard occurrence and impact will be made available.

Chapter Ten: Conclusions: Findings, Limitations and Future Work

10.1 Findings

The aim of this study was the assessment of the variability in reporting of the global occurrence of natural hazards. To achieve this, three objectives were employed:

1) To collate a continuous database of web-based news media coverage relating to geophysical hazards for a period of five years.

Two separate geophysical hazard news media databases were created based upon Google News Alerts and GNA, NHRSS-Db and GNAT-Db respectively. It was found that both databases presented a number of challenges and often presented differing results.

Examination of NHRSS-Db found that several problems were evident with regards to using Google Alerts and RSS technology as a whole for accumulating a hazard news database. For example, it was found that the Google Alerts system used to produce NHRSS-Db had a number of limits and biases with regards to the articles recorded and the number of sources used. This raises issues regarding the selectivity and objectivity of the database. In light of this, a new system and database was created, GNAT and GNAT-Db respectively.

GNAT-Db sourced natural hazard news media information from GNA and allowed for extensive event type and individual event examination. This allowed for much detailed examination of temporal news media trends over a much greater timescale, 2005 to 2009 compared to 2008 to 2009 within NHRSS-Db. Although GNAT-Db offered a number of improvements on NHRSS-Db, several problems remained. For example, the foundation of GNAT-Db, GNA, is based upon a number of subjective selection criteria and algorithms regarding the inclusion of news sources and reports. In addition, the format of the database did not allow for direct examination of the spatial patterns within natural hazard news media coverage.

Although a number of problems occurred with regards to the collation of a web-based geophysical hazards news media database, the final database is an extensive and detailed long-term inventory of recent natural hazard events.

2) Assess the temporal and spatial dependence of news media coverage as a function of event type, timing, magnitude and location.

Following the collation of data, I statistically assessed the variations in coverage of natural hazard events of different types, magnitudes, timings and locations. Individual aggregate statistics, magnitude-frequency distribution and long-term time-series data was presented and systematically examined.

Analysis of total NHRSS-Db coverage found that RSS-based news media coverage is not sensitive to the magnitude and timing of an event on a short-term timescale and could not demonstrate any long-term trends due to the shorter timescale of the database. However, individual event type analysis of coverage parameters found that weak relationships were present between event fatality count and event total, peak and duration. In comparison, analysis of GNAT-Db found that archived news media databases, such as GNA used throughout this study, are sensitive to event parameters, such as magnitude, timing and location.

Hazard media coverage statistics recorded using GNAT show a clear sensitivity to individual event occurrence and longer-term seasonal trends related to seasonal climatic shifts. In addition, systematic differences within the media response to the hazard type – earthquake, flood or landslide – were recorded which appear to be linked to the physical processes involved within each hazard event and the present prediction and monitoring abilities. GNAT recorded media coverage also appears to be scale free, with large events recording similar coverage profiles to smaller events, albeit with different rates of coverage build-up and longer time periods involved.

3) Explore the characteristics of media response to natural hazards within the context of the socio-political climate.

I examined the possible socio-political reasons behind the variations and trends found within the recorded news media coverage of natural hazard events. Endogenous and exogenous factors related to event coverage were examined, including event characteristics, such as the number of recorded fatalities, temporal and spatial patterns, such as seasonal variations in event occurrence, and the effects of external socio-political events on the level and magnitude of natural hazard event coverage. In doing so, it became possible to produce a series of natural hazard news attention cycles that identify and define the trends in coverage of event type trends previously identified.

A geographical bias was hypothesised whereby the reporting of events would, in part, be controlled by the actual and/or perceived locale of the event, in terms of physical distance, or perceived distance due to differences in culture, religion and language. However, such a pattern remains unclear, yet the data presented throughout this study is the first step in understanding the value of using web-based news media to monitor and understand the occurrence, impact and understanding of natural hazards.

10.2 Original contribution and recommendations for future work

It is possible that this is a function of the technology used to collate the data and not a function of RSS technology as a whole. It is also possible that it is a function of GNA, whereby a greater volume of media information is archived in comparison to that which is made available through RSS feeds. A better understanding of the method and story selection process used by Google to disseminate information via its RSS feeds and archive media stories is needed to fully understand the temporal and spatial trends within hazard media coverage. In addition, it is believed that a longer RSS timeframe is needed to fully identify any possible long-term temporal trends within the recorded hazard media and accurately compare it to that recorded within GNA.

A regional pattern within hazard media coverage was also found, whereby those areas that are most affected by the natural hazards being studied were found to be the least well connected into the global media. To improve the scope of future work it would be necessary to increase the number of sources from the most affected areas.

Little academic work has examined the power and agility of the internet to examine the temporal and spatial occurrence of natural hazard events. What little work has been done has not comparatively assessed the coverage of different natural hazard events or event types. This study employed an extensive, long-term, global-scale news media archive to examine the temporal and spatial dependence of news media coverage as a function of event type, timing, magnitude and location.

While a number of natural hazard inventories exist, this study has highlighted the problems with previous studies and has shown how a new method, based upon web-based news media information, can help improve the scope and completeness of such inventories. As previously discussed by Petley *et al*. (2005), a large percentage of small-scale events go unreported due to the difficulties in collecting information on such events. This study has shown how the news media, particularly local-level news sources, can be used to expose the often overlooked non-fatal, small-magnitude, or remote natural hazard events and improve our understanding of the overall occurrence of hazard events.

This study is part of a larger project to examine natural hazard occurrence on a global scale and has generated many more questions than it has answered. For example, more work is needed to understand the endogenous and exogenous elements of event coverage. The length of the dataset used within this study was only five years. This raises important questions regarding data representivity, particularly when considering recurrence intervals of high magnitude events and long term spatial and temporal patterns in natural hazard event occurrence. To better understand the temporal and spatial occurrence of natural hazard events, it is essential to continue compiling this database and improve its timeframe and scope. Therefore, future work may involve the inclusion of more events and different event types over a longer timeframe.

A second aspect of the study that needs improving is the identification and examination of spatial trends within news media coverage. Therefore, future work may involve the inclusion of keywords in different languages within GNAT-Db, thus improving the geospatial scope of the database and helping to understand better the spatial impact of natural hazard events.

In addition to improving the temporal and spatial elements of the study, future work may involve the inclusion of humanitarian aid data for each event included within the database. This will allow for the examination of the relationship between news media coverage of an event and humanitarian funding. For example, does an increase in news media coverage of an event increase humanitarian funding? As discussed in Chapter Three, previous academic work on this issue is inconclusive and further study is needed.

A greater understanding of the impact of natural hazards can only be achieved through the creation of detailed and comprehensive national and global event inventories. This study has shown how web-based news media can be used to create such inventories and provide accurate information regarding natural hazard events.

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Appendix One: NHRSS-Db Summary Data

Key

- Earthquake (red)
- Flood (blue)
- Landslide (olive)

Event	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Article Count Last Day	Days to Peak	Peak to End	Ratio Peak:End
Pakistan 5	03/01/2008	0	2	137	135	135	2	1	2	0.04
Rwanda	03/02/2008	39	19	38	6	7	2	12	8	0.13
Colombia	23/05/2008	11	40	114	4	20	2	3	38	0.15
Japan 1	14/06/2008	12	7	3347	1568	1568	107	1	7	0.05
Japan 2	26/06/2008	0	1	2						
Japan 3	05/07/2008	0	1	116						
Japan 4	08/07/2008	0	2	130	129		1			
Indonesianesia 2	09/07/2008	0	1	1		1				
Pakistan 1	10/07/2008	0	2	124	123	123	1	1	2	0.04
Indonesianesia 3	17/07/2008	0	4	6	2	3	1	3	2	0.13
Japan 5	19/07/2008	0	1	425						
Japan 6	21/07/2008	0	1	599						
Japan 7	23/07/2008	0	3	2089	881	1062	146	1	1	0.04
Indonesianesia 4	28/07/2008	0	1	4		4				
Indonesianesia 5	06/08/2008	0	1	235		235				
Japan 8	20/08/2008	0	3	32	19		13	0	1	0.00

Event	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Article Count Last Day	Days to Peak	Peak to End	Ratio Peak:End
Indonesianesia 6	25/08/2008	0	1	348		348				
Japan 9	01/09/2008	0	1	27						
Indonesia 7	06/09/2008	0	1	1		1				
Afghanistan 1	06/09/2008	0	1	56		56				
Indonesia 8	10/09/2008	0	3	4728	931	2163	1634	2	2	0.04
Japan 10	11/09/2008	0	1	2278						
Indonesia 9	21/09/2008	0	6	142	1	141	141	6	1	0.25
Tibet 2	24/09/2008	0	1	470		470				
Tibet 3	02/10/2008	0	1	1		1				
Afghanistan 2	05/10/2008	0	1	84		84				
Kyrgyzstan	05/10/2008	75	3	4235	46	1016	1016	3	1	0.13
Indonesia 10	06/10/2008	0	1	1		1				
Tibet 4	06/10/2008	10	3	2248	1386	1386	862	1	3	0.04
Afghanistan 3	26/10/2008	0	1	33		33				
Indonesia 11	26/10/2008	0	1	46		46				
Pakistan 3	27/10/2008	300	51	15107	1	5832	1	4		0.04
Pakistan 6	28/10/2008	215	39	1038	5	134	24	3	37	0.15
Japan 12	29/10/2008	0	1	149						
Indonesia 12	07/11/2008	0	1	12		12				
Indonesia 13	16/11/2008	4	2	4232	950	3282	3282	2	1	0.08
Indonesia 14	22/11/2008	0	2	578	293	293	285	1	2	0.04
Indonesia 15	28/11/2008	0	2	100	48	52	52	2	1	0.08
Indonesia 16	03/12/2008	0	1	34		34				
Japan 13	04/12/2008	0	2	451	450		1			
Pakistan 7	08/12/2008	170	11	915	124	628	1	2	10	0.05

Event	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Article Count Last Day	Days to Peak	Peak to End	Ratio Peak:End
Indonesia 18	13/12/2008	0	1	1		1				
Pakistan 8	15/12/2008		10	2271	147	170	59	5	6	0.21
Indonesia 19	18/12/2008	0	1	5		5				
Indonesia 20	19/12/2008	0	1	1		1				
Indonesia 21	20/12/2008	0	1	16		16				
Pakistan 4	25/12/2008	0	1	146		146				
Pakistan 9	25/12/2008		16	1417	359	359	1	1	16	0.05
Indonesia 22	30/12/2008	0	1	25		25				
Afghanistan 4	03/01/2009	0	2	184	1	183	183	2	1	0.08
Indonesia 23	03/01/2009	0	1	2111		2111				
Indonesia 24	05/01/2009	0	3	1941	1	1878	62	2	2	0.04
Costa Rica	08/01/2009	40	9	13841	637	4365	1	2	8	0.04
Japan 15	01/02/2009	0	1	320						
Japan 16	16/02/2009	0	1	45						
Japan 17	28/02/2009	0	1	365						
Japan 11	21/09/2009	0	5	5	1		2			
Indiana 1	11/02/2008	0	12	27	13	13	13			
Bolivia	12/02/2008	0	4	142	49	64	29	3	2	0.13
Indonesia 1	16/02/2008	0	6	2	1	1	1			
Philippine 1	22/02/2008	45	7	82	72	72	1	1	7	0.05
Indiana 2	19/03/2008	0	1	45		45				
Tanzania	28/03/2008	75	2	370	1	369	369	2	1	0.08
Vietnam 1	12/05/2008	4	1	6		6				
Indiana 3	03/06/2008	0	4	9	1	8	8	4	1	0.17
Indiana 4	07/06/2008	0	82	915	9	691	1	2		0.04

Event	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Article Count Last Day	Days to Peak	Peak to End	Ratio Peak:End
Mexico	06/07/2008	12	10	46	10	10	1	1	10	0.05
India 2	12/07/2008	2400	227	14398	1	2136	3	57	169	57:169
Philippine 3	16/07/2008	0	19	3	1	1	1			
Haiti	01/08/2008	50	92	816	1	53	1	37	55	1.58
Pakistan	05/08/2008	30	36	49	48	48	1	1		0.04
Vietnam 2	09/08/2008	119	6	3288	237	1077	708	2	5	0.09
Florida	20/08/2008	12	12	115	8	16	10	3	10	0.13
Vietnam 3	29/08/2008	5	1	1		1				
Vietnam 4	27/09/2008	41	3	928	192	420	420	3	1	0.13
Algeria	01/10/2008	65	11	53	1	11	1	2	10	0.05
Vietnam 5	19/10/2008	11	2	143	66	77	77	2	1	0.08
Honduras	19/10/2008	110	19	26	8	8	1	1	19	0.05
Indonesia 2	26/10/2008	0	2	15	14	14	1	1	2	0.04
Vietnam 6	01/11/2008	92	5	2454	119	828	828	5	1	0.21
Philippine 4	03/11/2008	0	1	2		2				
Indonesia 3	08/11/2008	8	46	5	1	2	2			
Vietnam 7	18/11/2008	0	1	262		262				
Queensland	20/11/2008	21	11	105	34	34	1	1	11	0.05
Brazil 1	24/11/2008	99	10	9206	1325	2075	196	5		0.04
Philippine 5	02/01/2009	0	16	69	22	31	15	15	2	0.63
Vietnam 8	03/01/2009	5	1	36		36				
Indonesia 4	11/01/2009	6	1	1		1				
Brazil 2	30/01/2009	10	2	113	1	112	112	2	1	0.08
Indiana 6	08/02/2009	0	1	1		1				
Indonesia 6	16/02/2009	12	1	1		1				

Event	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1^{st} Day	Article Count Peak	Article Count Last Day	Days to Peak	Peak to End	Ratio Peak:End
Indonesia 8	02/03/2009	6	1	7		7				
Indonesia 9	11/03/2009	0	1	1		1				
Indiana 7	12/03/2009	0	6	77	71	71	5	1	6	0.05
Brazil F & 3	15/01/2008	5	1	1		1				
Peru	05/03/2008	7	1	5		5				
Philippine Mudslide	25/03/2008	0	1	1						
Norway 1	27/03/2008	0	1	3		3				
China (3 Gorges)	20/04/2008	200	1	72		72				
Kashmir 1	01/05/2008	12	2	196	92	104	104	2	1	0.08
Norway 2	02/05/2008	0	6	3	2	2	1	1	6	0.05
Papua New Guinea	07/05/2008	19	1	108		108				
Colombia Mudslide	31/05/2008	26	4	201	1		100			
Colombia	01/06/2008	27	3	1150	56	1035	59	2	2	0.04
Guatemala 1	20/06/2008	8	1	2		2				
Colombia 2	24/06/2008	10	1	56		56				
Nepal 1	25/06/2008	4	1	1		1				
Bangladesh 1	03/07/2008	10	22	284	106	177	1	4	19	0.18
Colombia 3	14/07/2008	8	5	3	1	2	2	5	1	0.21
Nepal 2	19/07/2008	11	2	2	1	1	1			
Guatemala 2	19/07/2008	12	2	20	19	19	1	2	1	0.08
Nepal 3	25/07/2008	0	1	2		2				
Nepal 4	30/07/2008	9	2	34	1	33	33	2	1	0.08
Nepal 5	06/08/2008	10	2	25	21	21	4	1	1	0.04
Nepal 2	07/08/2008	64	8	151	24	59	1	1	2	0.04

Event	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Article Count Last Day	Days to Peak	Peak to End	Ratio Peak:End
Nepal 6	16/08/2008	6	1	1		1				
Bangladesh 2	18/08/2008	11	1	85		85				
Nepal 7	24/08/2008	0	1	1		1				
Cairo Rockfall	06/09/2008	61	47	2235	1395	1395	1	1		0.04
Philippine Mudslide	07/09/2008	9	2	551	1		550			
China 1	08/09/2008	276	44	17575	1059	3706	7	5		0.04
Kashmir 2	14/09/2008	0	1	1		1				
China 2	18/09/2008	40	50	6189	18	3277	576		5	0.00
Nepal 1	20/09/2008	10	2	25	1	24	32			
Nepal 8	20/09/2008	64	8	142	1	118	23	2	7	0.09
Bukit Antarabangsa 1	04/10/2008	0	3	2	1	1	1			
Bukit Antarabangsa 2	17/10/2008	2	1	1		1				
Kashmir 3	25/10/2008	0	1	2		2				
China 3	07/11/2008	6	18	48	1	24	24	17	1	0.71
Bukit Antarabangsa 3	14/11/2008	2	18	17	1	13	13		1	0.00
Colombia 4	16/11/2008	3	1	1		1				
Philippine Mudslide	21/11/2008	14	1	223		223				
Colombia 5	21/11/2008	6	3	345	84	260	260	3	1	0.13
Brazil Mudslide	24/11/2008	109	3	2649	1		1324			
Brazil	24/11/2008	108	10	27	12	12	1	1	10	0.05
Brazil F & 1	29/11/2008	109	1	1324		1324				
Bukit Antarabangsa 4	04/12/2008	3	25	1442	4	358	1	8	18	0.17

Event	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Article Count Last Day	Days to Peak	Peak to End	Ratio Peak:End
Guatemala 3	15/12/2008	2	1	1		1				
Brazil F & 2	17/12/2008	130	1	5		5				
Kashmir 4	20/12/2008	0	1	1		1				
Nepal 9	25/12/2008	3	1	1		1				
Bukit Antarabangsa 5	30/12/2008	0	1	1		1				
Guatemala 4	04/01/2009	37	4	6235	676	2422	764	2	3	0.09
Bukit Antarabangsa 6	07/01/2009	0	10	7	1	6	6			
Norway 3	10/01/2009	0	1	1		1				
Papua New Guinea	07/02/2009	2	1	1		1				
Kashmir 5	25/02/2009	0	1	1		1				
Peru	02/03/2009	8	2	191	23	168	168	2	1	0.08
Norway 4	13/03/2009	0	5	290	288	288	1	1	5	0.05
Papua New Guinea	18/03/2009	4	1	10		10				

Appendix Two: GNAT-Db Summary Data

Key
- Earthquake
- Flood
- Landslide

Event	Region	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Peak Date	Article Count Last	Days to Peak	Peak to End	Ratio Peak:End
Iran 1	9	22/02/2005	602	10	354	12	99	24/02/2005	2	3	8.00	3:8
Kashmir	9	08/10/2005	74500	218	18806	215	1110	11/10/2005	24	4	215	4:215
Iran	9	31/03/2006	66	10	222	52	66	01/04/2006	2	2	9.00	2:9
Java	10	27/05/2006	5778	36	1310	83	177	30/05/2006	5	4	33	4:33
Chile	4	21/04/2007	10	6	29	2	13	23/04/2007	1	3	4	3:4
Japan New	8	16/07/2007	7	35	925	81	102	17/07/2007	5	2	34	1:17
Peru	4	15/08/2007	520	60	1115	12	159	17/08/2007	2	3	58	3:58
Sumatra	10	12/09/2007	23	11	249	47	74	13/09/2007	2	2	10.00	1:5
Pakistan 5	9	03/01/2008	0	10	65	7	11	04/01/2008	1	2	9	2:9
Rwanda	1	03/02/2008	39	17	23	5	6	03/02/2008	1	1	11	1:11
Sichuan	8	12/05/2008	68712	245	11187	157	343	19/05/2008	7	8	237	8:237
Colombia	4	23/05/2008	11	23	150	6	20	24/05/2008	2	2	22	1:11
Japan 1	8	14/06/2008	12	8	263	59	64	16/06/2008	13	3	6	1:2

Event	Region	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Peak Date	Article Count Last	Days to Peak	Peak to End	Ratio Peak:End
Indonesia 1	10	18/06/2008	1300	12	61	9	10	20/06/2008	4	3	10	3:10
Pakistan 1	9	10/07/2008	0	15	80	10	10	10/07/2008	3	1	15	1:15
Indonesia 3	10	17/07/2008	0	7	14	5	5	17/07/2008	1	1	7	1:7
Japan 7	8	23/07/2008	0	23	217	12	36	24/07/2008	7	2	22	1:11
California 1	2	29/07/2008	0.1	10	331	72	89	30/07/2008	13	2	9	2:9
Afghanistan 1	6	06/09/2008	0	7	26	8	8	06/09/2008	2	1	7	1:7
Indonesia 9	10	21/09/2008	0	6	9	3	3	21/09/2008	1	1	6	1:6
Tibet 2	8	24/09/2008	0	5	13	1	5	25/09/2008	1	2	7	2:7
Tibet 3	8	02/10/2008	0	27	80	3	12	07/10/2008	1	6	22	3:11
Afghanistan 2	6	05/10/2008	0	9	36	9	9	05/10/2008	2	1	9	1:9
Tibet 4	8	06/10/2008	10	8	39	10	12	07/10/2008	2	2	7	2:7
Kyrgyzstan	7	06/10/2008	75	8	70	26	26	06/10/2008	3	1	8	1:8
Pakistan 6	9	29/10/2008	215	40	529	68	72	30/10/2008	5	2	39	2:39
Indonesia 15	10	27/11/2008	0	7	15	1	5	29/11/2008	1	3	5	3:5
Pakistan 7	9	08/12/2008	170	7	758	114	564	09/12/2008	5	2	6	1:3
Afghanistan 4	6	03/01/2009	0	12	41	3	10	04/01/2009	1	2	11	2:11
Costa Rica	3	08/01/2009	40	13	57	4	12	10/01/2009	1	3	11	3:11
Italy	5	06/04/2009	299	30	873	139	139	06/04/2009	1	1	30	1:30
North Korea	8	13/07/2006	575	60	446	11	25	19/07/2006	2	7	54	7:54
Ethiopia	1	03/08/2006	364	49	330	4	20	07/08/2006	4	5	45	1:9
Turkey	5	27/10/2006	46	16	128	1	21	02/11/2006	3	7	10	7:10
Angola	1	18/01/2007	20	17	37	2	9	20/01/2007	1	3	15	1:5
Mozambique	1	01/03/2007	39	21	66	4	11	09/03/2007	2	9	13	9:13
Afghanistan	6	25/06/2007	113	32	114	1	11	29/06/2007	4	5	28	5:28

Event	Region	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Peak Date	Article Count Last	Days to Peak	Peak to End	Ratio Peak:End
Bulgaria	5	05/08/2007	8	18	39	1	7	08/08/2007	1	4	15	4:15
Indonesia 4	10	11/01/2008	6	13	63	11	11	11/01/2008	3	1	13	1:13
Philippine 1	10	22/02/2008	45	19	132	9	16	25/02/2008	6	4	16	1:4
Indonesia 7	10	24/02/2008	3	15	74	4	12	28/02/2008	2	5	11	5:11
Indonesia ?	10	10/03/2008	0	20	85	7	10	12/03/2008	1	3	18	1:6
Tanzania	1	28/03/2008	75	9	12	4	4	28/03/2008	1	1	9	1:9
Indiana ?	2	01/06/2008	3	48	510	3	29	10/06/2008	5	10	39	10:39
Mexico	3	06/07/2008	12	15	71	9	10	11/07/2008	2	6	10	3:5
Philippines	10	16/07/2008	0	25	198	10	20	28/07/2008	3	13	13	1:1
Pakistan	9	05/08/2008	30	29	202	7	17	11/08/2008	7	7	23	7:23
Vietnam 2	10	08/08/2008	119	9	26	2	9	10/08/2008	2	3	7	3:7
Florida	2	20/08/2008	12	19	196	11	15	22/08/2008	11	3	17	3:17
India (September)	9	25/08/2008	2400	35	1000	6	73	01/09/2008	6	8	28	2:7
Vietnam 4	10	27/09/2008	41	10	68	9	14	29/09/2008	3	3	8	3:8
Algeria	1	01/10/2008	65	12	39	1	11	06/10/2008	1	6	7	6:7
Honduras	3	19/10/2008	110	27	36	2	5	23/10/2008	2	5	23	5:23
Vietnam 6	10	01/11/2008	92	15	150	14	22	03/11/2008	4	3	13	3:13
Indonesia 3	10	08/11/2008	8	16	46	3	8	13/11/2008	2	6	11	6:11
Queensland	11	20/11/2008	21	12	44	8	10	21/11/2008	3	2	11	2:11
Brazil	4	24/11/2008	99	14	94	2	14	01/12/2008	3	8	7	8:7
Brazil 2	4	30/01/2009	10	10	16	1	4	31/10/2009	2	2	9	2:9
Vietnam	10	30/01/2009	74	20	61	3	7	10/02/2009	3	12	9	4:3
Indonesia 5	10	01/02/2009	0	14	71	2	11	05/02/2009	4	5	10	1:2
Australia	11	04/02/2009	0	21	240	4	20	09/02/2009	5	6	16	3:8

Event	Region	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Peak Date	Article Count Last	Days to Peak	Peak to End	Ratio Peak:End
Czech Republic	5	24/06/2009	13	13	196	4	35	28/06/2009	2	5	9	5:9
California	2	10/01/2005	14	12	151	16	36	12/01/2005	1	3	10.00	3:10
Leyte	10	16/02/2006	1126	50	533	3	59	20/02/2006	1	5	46	5:46
China	8	21/05/2007	60	27	75	12	12	21/05/2007	1	1	27	1:27
Bangladesh Mudslide	9	11/06/2007	128	14	17	1	5	13/06/2007	1	3	12	1:4
Vietnam 2	10	15/12/2007	18	24	51	1	5	26/12/2007	4	12	13	12:13
Peru 2	4	05/03/2008	7	13	26	2	5	06/03/2008	1	2	12	1:6
China (3 Gorges)	8	20/04/2008	200	17	85	1	16	23/04/2008	1	4	14	2:7
Papua New Guinea	11	07/05/2008	19	6	20	3	6	08/05/2008	2	2	5	2:5
Colombia Mudslide	4	31/05/2008	26	14	97	8	21	01/06/2008	2	2	13	2:13
Guatemala 1	3	20/06/2008	8	6	10	1	4	21/06/2008	1	2	5	2:5
Colombia 3	4	14/07/2008	8	12	28	1	6	15/07/2008	1	2	11	2:11
Guatemala 2	3	19/07/2008	12	12	15	1	4	21/07/2008	2	3	10	3:10
Nepal 2	9	07/08/2008	64	20	22	5	5	07/08/2008	2	1	20	1:20
Burkina Faso Mudslide	1	10/08/2008	31	13	24	5	5	10/08/2008	1	1	13	1:13
Bangladesh 2	9	18/08/2008	11	9	35	3	11	19/08/2008	1	2	8	1:4
Cairo Rockfall	1	06/09/2008	61	14	24	7	8	08/09/2008	1	3	12	1:4
China 1	8	08/09/2008	276	11	88	3	16	12/09/2008	2	5	7	5:7
China 2	8	18/09/2008	40	45	124	2	8	26/09/2008	6	9	37	9:37
Nepal 1	9	20/09/2008	10	6	12	1	5	21/09/2008	1	2	5	2:5
Nepal 8	9	20/09/2008	64	16	19	1	5	21/09/2008	1	2	15	2:15
China 3	8	02/11/2008	6	15	124	5	19	06/11/2008	2	5	11	5:11
China 4	8	07/11/2008	6	19	83	12	12	07/11/2008	3	1	19	1:19

Event	Region	Start Date	Fatalities	Event Duration	Total Coverage	Article Count 1st Day	Article Count Peak	Peak Date	Article Count Last	Days to Peak	Peak to End	Ratio Peak:End
Kenya Mudslide	1	08/11/2008	11	6	12	2	5	09/11/2008	1	2	5	2:5
Bukit Antarabangsa 3	10	17/11/2008	2	15	48	6	6	17/12/2008	1	1	15	1:15
Colombia 5	4	21/11/2008	6	13	25	2	5	22/11/2008	1	2	12	1:6
Philiipine Mudslide 3	10	21/11/2008	14	15	34	7	7	21/11/2008	1	1	15	1:15
Brazil F & 1	4	30/11/2008	109	15	67	8	14	01/12/2008	3	3	13	3:13
Bukit Antarabangsa 4	10	04/12/2008	3	31	221	1	33	07/12/2008	1	4	28	1:7
Guatemala 4	3	06/01/2009	37	7	43	24	24	06/01/2009	1	1	7	1:7
Norway 4	5	13/03/2009	0	8	15	5	5	13/03/2009	1	1	8	1:8
Kyrgyzstan	7	14/04/2009	16	14	28	2	7	16/04/2009	1	3	12	1:4