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A Statistical Study of the Solar Eclipses
recorded in Chinese and Korean History
during the Pre-telescopic era

Neasa Foley

October 1989

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A thesis submitted to the University of Durham for the
degree of Master of Science

11 MAY 1990

Abstract

**A Statistical Study of the Solar Eclipses Recorded in Chinese and Korean
History during the Pre-telescopic Era**

by Neasa Foley

**A thesis submitted to the University of Durham for
the degree of Master of Science.**

October 1989

The Chinese and Korean solar eclipse records were translated from the Dynastic Histories, for the period 205 B.C. to 1621 A.D., the pre-telescopic era. The translated records were investigated for seasonal and temporal variations, as well as variations by magnitude and altitude. The Chinese and Korean sunspots records were also examined and comparisons were also made between the eclipse efficiencies and the sunspots. Comparisons were also made between the long-term solar variations shown by tree-ring ^{14}C and northern hemisphere aurorae, and the sunspots, revealing a similar trend in the records. Where the sunspot records deviate from ^{14}C and aurorae data, the deviation can be explained using the eclipse efficiency as a measure of the thoroughness of the ancient astronomers.

Table of Contents

Abstract		(i)
Table of Contents		(ii)
Chapter 1	Introduction	1
	1.1 Previous Investigations	2
	1.2 Dynastic Histories	3
	1.3 Transliterations	6
	1.4 Computations	6
	1.5 Delta T	10
	1.6 Examinations	11
Chapter 2		12
	2.1 Observation of eclipses by magnitude	17
	2.2 Efficiency of observation	22
	2.3 Variations with time	25
	2.4 Variations with the altitude of the sun	33
	2.5 Seasonal variations of sunspots and eclipses	38
	2.6 Correlation between sunspots and eclipse efficiency	44
	2.7 Long term variations of sunspot observation	47
Chapter 3		50
Chapter 4	Conclusions	61
Appendix I	Computer Programs	(iii)
Appendix II	Catalogue of Chinese and Korean solar eclipse records	(iv)
Bibliography		64
Acknowledgements		(v)

Chapter 1

Introduction

From 204 B.C. until well into the telescopic era (1620 A.D.) the rulers of China employed astronomers to maintain a constant watch on the sky both day and night. The Chinese equated parts of the sky with parts of the Empire or high-placed people and believed that an astronomical event in a certain area of the sky heralded a significant occurrence (such as a death, a war or a disaster) on the Earth. Thus a fairly regular record of major astronomical events, such as novæ, supernovæ, solar & lunar eclipses, comets, meteors & meteor showers, auroræ, sunspots and occultations of the stars and planets, was made. The Imperial Astronomers were charged with recording these events and interpreting their meaning. Most of these records still exist today in the form of Astronomical Treatises in the official histories of the ruling Dynasties.

Prior to 204 B.C. records were also kept, some dating as far back as ~1500 B.C. have been found on 'oracle bones' (animal bones with carved



records on them), some of which may have been astronomical records. However there are no continuous records until 204 B.C. mainly due to the fact that Ch'in Shih Huang Ti ordered the burning of all books in 213 B.C. and the capital Hsien-yang was plundered in 206 B.C.

Previous Investigations

The solar eclipse records are found under the 'Day-time events' section of most of the Astronomical Treatises in the Dynastic Histories, usually in their own section.

Alexander Wylie, a Scottish missionary and astronomer in China, in 1897 translated most of the Dynastic Histories eclipse records, and also many of the local gazettes, (*Fang-chih*, local histories which sometimes contain events such as eclipses). He did not convert the dates fully, quoting the year in the Gregorian calendar and the month and date in the Chinese calendar.

Pierre Hoang, a Chinese missionary, in 1929 compiled the eclipse records from the Dynastic Histories and some of the (un-named) local gazettes into a table in French. He only included a record from the Southern ruling dynasty when it ran concurrently with a Northern dynasty and on occasion denoted an eclipse as having occurred at the wrong capital. Also, he ignored many of the accompanying comments.

Homer H. Dubs translated a section of the "History of the Former Han Dynasty by Pan Hu" between 1938 and 1952. In this he included the eclipse

records for the Former Han dynasty only, and calculated the magnitudes of the eclipses if they were visible from the Earth's surface. He also calculated the Right Ascension of the Sun where it was recorded for comparison purposes. However he speculated that where there was no eclipse occurring on a recorded date that this was due to scribal error and he often changed the day, month and year of the eclipse record so that it would fit an eclipse that actually occurred. In some cases this was justified but in most it was not.

I have translated the solar eclipse records for all the Dynastic Histories, from 204 B.C. to 1621 A.D., and calculated the magnitude, local time of eclipse maximum and altitude, at the appropriate capital. I have also translated the Korean solar eclipse records from 1009 A.D. to 1621 A.D. These were also in classical Chinese. I ignored the *Fang-chih* since they are in the main, unreliable. Using this information I have made further investigations and compared the efficiency of eclipse observation with sunspot recordings.

Dynastic Histories

The 26 Chinese Dynastic Histories are shown in Table 1.1 (from Han 1955).

Excluding the *Shih-chi* (Historical Record), the *Ch'ing-shih-kao* (Drafted History of the Ch'ing Dynasty) and the *Liao-shih* (History of the Liao Dynasty), all the Astronomical Treatises were consulted.

Table 1.1: The 26 Chinese Dynastic Histories.

Book Title	Translated Title	Chief Editor	Date of Compilation
Shih-chi	Historical Records	Ssuma Ch'ien	104 – 87 B.C.
Han-shu	History of the Former Han Dynasty	Pan Ku & Pan Chao	58 – 76 A.D.
Hou-han-shu	History of the Later Han Dynasty	Fan Yeh	398 – 445 A.D.
San-kuo-chih	History of the Three Kingdoms	Ch'en Shou	285 – 297 A.D.
Chin-shu	History of the Chin	Fang Hsuan-ling	635 A.D.
Sung-shu	History of the (Liu) Sung Dynasty	Shen Yueh	492 – 493 A.D.
Nan-ch'i-shu	History of the Southern Ch'i Dynasty	Hsiao Tzu-hsien	489 – 537 A.D.
Liang-shu	History of the Liang Dynasty	Yao Ssu-lien	629 – 636 A.D.
Ch'en-shu	History of the Ch'en Dynasty	Yao Ssu-lien	629 – 636 A.D.
Wei-shu	History of the Northern Wei Dynasty	Wei Shou	551 – 554 A.D.
Pei-ch'i-shu	History of the Northern Ch'i Dynasty	Li Te-lin	627 – 636 A.D.
Chou-shu	History of the Northern Chou Dynasty	Ling-hu Te-fen	636 A.D.
Nan-shih	History of the Southern Dynasties	Li Yen-shou	630 – 650 A.D.
Pei-shi	History of the Northern Dynasties	Li Yen-shou	630 – 650 A.D.
Sui-shi	History of the Sui Dynasty	Wei Cheng	629 – 636 A.D.
Chiu-t'ang-shu	Old History of the T'ang Dynasty	Liu Hsu	940 – 945 A.D.
Hsin-t'ang-shu	New History of the T'ang Dynasty	Ou-yang Hsiu & Sung Ch'i	1060 A.D.

Book Title	Translated Title	Chief Editor	Date of Compilation
Chiu-wu-tai-shih	Old History of the Five Dynasties	Hsueh Chu-cheng	973 - 974 A.D.
Hsin-wu-tai-shih	New History of the Five Dynasties	Ou-yang Hsiu	1036 - 1053 A.D.
Sung-shih	History of the Sung Dynasty	T'o-t'o & Ou-yang Hsuan	1343 - 1345 A.D.
Liao-shih	History of the Liao Dynasty	T'o-t'o & Ou-yang Hsuan	1343 - 1345 A.D.
Kin-shih	History of the Kin Dynasty	T'o-t'o & Ou-yang Hsuan	1343 - 1345 A.D.
Yuan-shih	History of the Yuan Dynasty	Sung Lien	1369 - 1370 A.D.
Hsin-yuan-shih	New History of the Yuan Dynasty	K'o Shao-min	1890 - 1920 A.D.
Ming-shih	History of the Ming Dynasty	Chang & T'ing-yu	1672 - 1755 A.D.
Ch'ing-shih-kao	Drafted History of the Ch'ing Dynasty	K'o Shao-min	1914 - 1927 A.D.

Transliterations

Chinese words were transliterated using the Wade-Giles system (however employing Peking and Nanking, since these are the most common names for these capitals.) The Korean transliterations followed the Reischauer system.

Computations

In this investigation, the following computer programs (designed by Dr. F.R. Stephenson) were used:

1. Date conversion from the Chinese and Korean calendar to the Western (Julian or Gregorian) equivalent. This program, called CHINDATE followed the rules set out by Hsueh and Ou-yang (1956). Input required was the year (A.D. or B.C.), lunar month, and the day of the sexagenary (Chinese Cyclical Day) – the last item using a menu display, i.e. the 10 stems (*chia, i, etc.*) followed by the 12 branches (*tzu, ch'ou, etc.*). For details of the kan-chih see Table 1.2. The output was the corresponding Western date unless the recorded lunar month and cyclical day did not agree, in which case, an error message was printed.

2. Calculation of the magnitude, local time of maximum phase and solar altitude for a solar eclipse on a selected date. This extensive program, called CENT, was based on the solar theory of Newcomb (1895) and the lunar theory of Brown (1919) – the latter as set out in the Improved Lunar Ephemeris (1954). Small amendments to the lunar mean longitude were in-

	TZU	CH'OU	YIN	MAO	CH'EN	SZU	WU	WEI	SHEN	YU	HSU	MAI
CHIA	CHIA-TZU 1		CHIA-YIN 51		CHIA-CH'EN 41		CHIA-WU 31		CHIA-SHEN 21		CHIA-HSU 11	
I		I-CH'OU 2		I-MAO 52		I-SZU 42		I-WEI 32		I-YU 22		I-MAI 12
PING	PING-TZU 13		PING-YIN 3		PING-CH'EN 53		PING-WU 43		PING-SHEN 33		PING-HSU 23	
TING		TING-CH'OU 14		TING-MAO 4		TING-SZU 54		TING-WEI 44		TING-YU 34		TING-MAI 24
WU	WU-TZU 25		WU-YIN 15		WU-CH'EN 5		WU-WU 55		WU-SHEN 45		WU-HSU 35	
CHI		CHI-CH'OU 26		CHI-MAO 16		CHI-SZU 6		CHI-WEI 56		CHI-YU 46		CHI-MAI 36
KENG	KENG-TZU 37		KENG-YIN 27		KENG-CH'EN 17		KENG-WU 7		KENG-SHEN 57		KENG-HSU 47	
HSIN		HSIN-CH'OU 38		HSIN-MAO 28		HSIN-SZU 18		HSIN-WEI 8		HSIN-YU 58		HSIN-MAI 48
JEN	JEN-TZU 49		JEN-YIN 39		JEN-CH'EN 29		JEN-WU 19		JEN-SHEN 9		JEN-HSU 59	
KUEI		KUEI-CH'OU 50		KUEI-MAO 40		KUEI-SZU 30		KUEI-WEI 20		KUEI-YU 10		KUEI-MAI 60

Table 1.2: The Chinese Cyclical Days. The cyclic numbers are formed from the combination of two series of elements. The first series of elements, known as the celestial stem, consists of 10 elements. The second, known as the earthly branches, consists of 12 elements.

compared in order to adopt the lunar acceleration of $-26''/\text{cy}^2$ deduced by Morrison and Ward (1975) – see Morrison (1979) for details. This program required the input of the Julian Day Number JDN (*e.g.* from an eclipse catalogue such as von Oppolzer (1887)), and the latitude and longitude of the (assumed) place of observation. An expression for ΔT derived by Stephenson and Morrison (1984) was used. Using an iterative procedure, the required details were obtained, magnitude being expressed as a fraction of the solar disc obscured. For total eclipses, magnitude was alternatively expressed as the ratio of the apparent lunar and solar diameters.

Frequently, an eclipse can reach greatest phase before sunrise or after sunset at the required place. If the computed altitude of the Sun at greatest phase was above -15 degrees, the appropriate details were output, in case the end or beginning of the eclipse might still have been visible. Otherwise a statement to the effect that no eclipse was observable was printed. The program, although employing several subroutines, operated as a single unit. It has been extensively tested against the eclipse predictions in the *Astronomical Ephemeris*, *Astronomical Almanac*, *etc.* and found to be extremely accurate (*e.g.* timing errors of a fraction of a second, *etc.*)

3. Calculation of the approximate local circumstances of all eclipses visible at a fixed place over a selected period of time. This program, called SUN, which was an abbreviated version of CENT required the input of a suitable starting and finishing JDN, usually many years apart, and the

place co-ordinates. For convenience, the selected starting date was that of some eclipse near the beginning of the required time interval which was known to be visible on the Earth's surface (e.g. as listed by von Oppolzer), although any New Moon date would have done just as well. Taking this starting JDN, the program would check whether an eclipse was visible at the chosen place, printing details as in CENT, and then add 29.53059 days, (the mean synodic month) to the JDN and repeat, continuing until the finishing day number was reached. A distinction between visible and invisible eclipse was made as before.

4. Alternative calculation similar to SUN. This short program, called XXX, was identical to SUN except it employed eclipse cycles based on the tables of Neugebauer (1929) and von Oppolzer to deduce the dates of all likely eclipses visible on the Earth's surface in a selected interval of time for a specific place. Once again, suitable starting and finishing JDN were required. It was found that there were only very minor differences between the results obtained from this program and SUN above.

5. Calculation of the Right Ascension (R.A.) of the Sun. This program, called RASUN, calculated the R.A. of the Sun using Newcombs theory, 1895, for comparison with the values given in the eclipse records. The program required the input of a date and a latitude and longitude for each eclipse record.

Delta T (ΔT)

Changes in the length of day (LOD) have an important effect on the visibility of solar eclipses and for accurate computation of the local circumstances of such an event in the past, a reliable expression for the Earth's rotational 'clock error' (ΔT) must be used. It is well established that on account of lunar and solar tides in the oceans, atmosphere and solid body of the Earth, the length of the mean solar day is increasing by some 2.5 milliseconds per century (see Lambeck, 1980). Other long term causes of non-tidal origin have been proposed such as global changes in sea-level (which would appear to alter the moment of inertia of the Earth) or core-mantle coupling (which would link variations in the speed of rotation of the core with the lower mantle and hence the surface of the Earth). However, non-tidal variations in the LOD are difficult to quantify theoretically and in practice long term changes in the Earth's rate of rotation are best deduced using historical observations of eclipses. The most recent extensive investigation of such data is that of Stephenson and Morrison (1984). They analysed recorded timings of lunar and solar eclipses from ancient Babylon and the Arab lands in medieval times, as well as some untimed Chinese and European observations of total solar eclipses. As a result, they showed that there were significant non-tidal variations in the LOD of amplitude some 10 milliseconds and periodicity of the order of a millennium.

The formulae for computing ΔT in the historical past, derived by Steph-

enson and Morrison were as follows:

- since 950 A.D.: $\Delta T = 25.5t^2$ (where t is time in centuries since 1800 A.D.);
- before 950 A.D.: $\Delta T = 1360 + 320t + 44.3t^2$ (t is in the same units)

These two expressions have been incorporated in all the programs used in my dissertation.

Examinations

Chapter 2 contains a detailed analysis of the eclipse records and examines them by magnitude, season, altitude, year etc. It compares them with sunspot records from 187 B.C. to 1621 A.D. and examines for a relation between eclipse efficiency and the sunspot cycle as shown by the Chinese and Korean sunspot records.

Chapter 3 is an investigation of all the eclipse records with additional details. I have examined these details and verified, in most cases, whether these details are true or false.

Chapter 2

There exists a large quantity of Chinese historical records dating back to 200 B.C. The primary source of this material is the Dynastic Histories, usually compiled by a team of official historians. Most of these histories contain a special section on Astronomy known as the Astronomical Treatise. This Astronomy section records phenomena such as solar and lunar eclipses, comets, occultations of the stars and planets by the moon, auroræ, sunspots, novae and meteor showers. The bulk of these records have not been translated, or at best only partially so. The present project involved the search for and translation of all the solar eclipse records in the Astronomical Treatises of the Dynastic Histories, about 1000 records in all. Some translations of the solar eclipse records have already been made, e.g. by Wylie (1897), Hoang (1925), and Dubs (1938 – 1955), but these are not complete, and in some cases contain errors.

A typical solar eclipse record contains the following details: the Emperor's name, the Reign Period (where appropriate), the year of the Reign, the lunar month, the Chinese Cyclical Day Number (a 60-day cycle, solar-

and lunar-independent), the day of the month (this is usually the first day or last day since the days of the month were labelled by the age of the moon, and eclipses always occur at the New Moon.) The date is followed by a brief statement saying "The Sun was eclipsed", sometimes with additional details. In certain dynasties, especially Han and T'ang, the Right Ascension (R.A.) of the Sun during the eclipse is also given. This is expressed in terms of the number of degrees within one of the 28 lunar mansions. Where the lunar mansion is given, I have calculated the R.A. for comparison purposes. On account of the precession of the equinoxes, the R.A. of a star increases at a rate of about 1 degree every 71 years. Thus the R.A. corresponding to the boundaries of the Lunar Mansions as recorded in the Histories have shifted over the centuries. However, this can be easily taken into account (e.g. using the tables of star co-ordinates in the *Astronomische Chronologie* of Neugebauer, 1929).

Certain eclipse records give extra information, such as the eclipse was total, or crescent shaped ("like a hook"), or very rarely, annular ("like a golden ring"), or on the other hand, not observed due to cloud or rain. These records are examined in Chapter 3.

Korean eclipse records

Astronomical records were also kept on a regular basis in Korea. The "Astronomical Treatise" in the *Koryo-sa* ("The history of the Koryo Dynasty"), contains an accurate record, especially after about 1000 A.D., of

solar eclipses and other astronomical events. This history runs from 1009 A.D. to 1392 A.D. and deals with the Wang Dynasty. The subsequent Yi Dynasty (1392 A.D. – 1910 A.D) is covered by a series of chronicles known as the *Wangjo Sillok*, collected records from which are found in the *Chungbo Muuhun Pigo*. However this project only dealt with observations in the pre-telescopic era, so translations were made up until 1621 A.D., where a natural cutoff point occurred, near the end of the Ming Dynasty in China, after which there are no further astronomical records until the subsequent Ch'ing Dynasty in 1644 A.D. The Korean records had the same format as the Chinese records (and were recorded in classical Chinese), except there were no Reign Periods in Korea, and no records of Lunar Mansions were made.

Date Conversion

The Chinese date was converted using a computer program (CHIN-DATE), into a Julian Calendar Date and a Julian Day Number (JDN) (see Appendix 1, JULIAN). A JDN is counted as the number of days which have passed since Jan 1st 4713 B.C., hence each JDN accounts for a unique date and there is no confusion between Julian and Gregorian calendars. The transition between these two calendars originally occurred in 1582 Oct 5/15th hence the translated records are given in Julian Calendar dates before Oct 5th 1582, and in Gregorian calendar dates after Oct 15th 1582. However, when examining the seasonal variations of the eclipse records, it

was necessary to convert the Julian dates into Gregorian dates so as to maintain the alignment of the seasons between the two calendars.

Using another computer program (see Appendix 1, CENT), calculations were made to see whether or not an eclipse occurred on a recorded date, and whether it would have been visible at the observing centre (usually taken to be the capital city of the reigning dynasty). If the eclipse was visible, then the magnitude of the eclipse, the local time of maximum phase and the altitude of the sun (in degrees above the horizon) at maximum phase were calculated. These details are given in a catalogue (Appendix 2).

Location

Unlike sunspots, or some supernovae or comets, eclipses are highly specific events, being visible for only short periods at certain locations and at certain times. Eclipses occur in a cycle called the Saros which lasts for 6585.32 days (18.03 years), and after three Saroi there is a similarity in the the area/sequence of eclipse occurrence. In any one year, the greatest number of eclipses that can occur is 7, of which 4 are solar and 3 are lunar, or 5 solar and 2 lunar, while the smallest number of eclipses that may occur is 2, both solar. (W. M. Smart, 1960). A solar eclipse occurs when the Moon passes in front of the Sun, obscuring part or all of it from the Earth. Since the Moon's diameter is much smaller than that of the Sun and the Earth, the shadow cast by the Moon only covers part of the Earth's surface. Within the umbra of the Moon's shadow, the eclipse is total, while within

the penumbra the eclipse is partial. Because the Moon's orbit around the Earth is slightly eccentric, sometimes it more than covers the Sun's disc, and on other occasions it does not cover it completely, leaving a ring of the Sun visible round the edge of the Moon. This type of eclipse is known as annular and occurs when the Moon is in apogee and the Sun in perigee, where apogee means the point in a celestial body's orbit when it is most distant from the Earth, and perigee means the point when it is nearest.

From the moment of first contact, (the instant when the discs of the Sun and Moon first appear to touch), until the moment of last contact, some three to four hours can elapse. However totality never exceeds 7 mins 40 secs, and annularity 12.5 mins, although both are usually much less. The width of the zone of totality averages less than 200 km, but when the Sun's altitude is low and the shadow falls in an oblique angle on the Earth, the zone of totality can be much larger (up to 350 km in width).

The Chinese Astronomical recordings were compiled at the Imperial Observatory which was usually located at the capital. The site of the capital varied from dynasty to dynasty, and often 2 or 3 dynasties reigned concurrently in North and South China. As a result there frequently exist two or more records of the same eclipse, but with different magnitudes, local times etc. as a result of being recorded at different locations. The positions of the Chinese capitals between 205 B.C. and 1621 A.D. are shown in Table A. The Koreans made their eclipse observations at the Korean

capital, also shown in Table A. Many of their eclipses recorded in Korea were also independently recorded in China. The capitals were located with the aid of Herrman (1966) and The Times Atlas of the World (1981).

Investigations

The eclipse records were translated and catalogued. Then a study of the information available in the eclipse records was undertaken. Using a computer program [see Appendix 1, XXX], a list of all the eclipses which could have been observed in China and Korea at the relevant capitals was generated. This gave information on the magnitude, local time and altitude of the eclipses. Using this information, a number of examinations could be made.

2.1 Observation of eclipses by magnitude

For this investigation, the eclipses recorded in each dynasty were divided into 13 groups or bins; 11 of these were for magnitudes: 1-10% , 11-20% *etc.*, and one for magnitudes > 100%, and the number of eclipses falling into each category was counted. The bin for eclipses which were computed as having a magnitude of more than 100% was called "Total". Since magnitude is measured as a percentage of the Sun's diameter covered by the Moon, eclipses can have magnitudes of up to 107% (when the Moon is in perigee and the Sun is in apogee.) In addition, there were separate bins for eclipses which

Capital	latitude	longtitude
Ch'ang-an	34° 17'	-108° 58'
Lo-yang	34° 43'	-112° 28'
Peking	39° 57'	-116° 29'
Moukden	41° 51'	-123° 38'
Chang-yeh	39° 01'	-100° 56'
Chiu-ch'uan	39° 46'	-99° 07'
Yong-chou	26° 08'	-111° 35'
Kuei-chi	29° 06'	-120° 39'
Hsin-yang	34° 06'	-114° 00'
Nanking	32° 05'	-118° 47'
Ta-tung	40° 06'	-113° 13'
K'ai-feng	34° 52'	-114° 33'
Lin-an	30° 12'	-120° 12'
Kaesong(Songdo)	37° 58'	-126° 34'
Kangwha	37° 44'	-126° 39'
Seoul	37° 33'	-126° 58'

Table A: Sites of Chinese and Korean capitals

1. were recorded but did not occur, i.e. were not visible on the Earth's surface (NEVOES), and
2. which occurred somewhere on the Earth but were not visible at the Chinese (or Korean) capital, or occurred before the Sun had risen or after the Sun had set there (NEVIC or NEVIK).

Although certain eclipses, which were described as "...obscured by rain or cloud", actually occurred, they were not physically observed by the astronomers and are therefore not included in any of the calculations or examinations carried out in this chapter.

Former Han Dynasty: 204 B.C. to 24 A.D. (Fig 2.1.1)

This was the first dynasty for which virtually complete records exist, since Ch'in Shih Huang Ti ordered the destruction of nearly all previous records in 213 B.C. There was a very high number of incorrect predictions, and very few predictions that were even close to being correct. A small number of low magnitude eclipses were observed, with a large number of eclipses over 50% magnitude being seen, and two total eclipses, one of which was recorded as total in 197 B.C. and was annular and the other which was recorded as total in 181 B.C.

Later Han Dynasty: 25 A.D. to 220 A.D. (Fig 2.1.2)

There is a drop in the number of eclipses recorded that did not occur, and a slight increase in the number of almost correct predictions. There is also a slight increase in the number of eclipses < 50% magnitude observed,

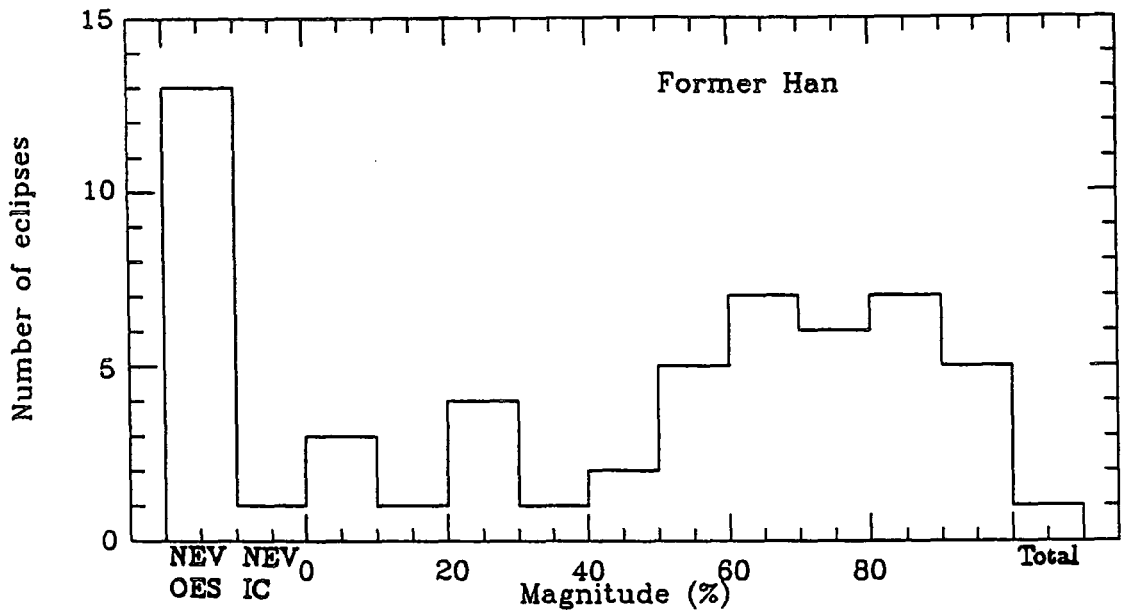


Figure 2.1.1: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the Former Han dynasty.

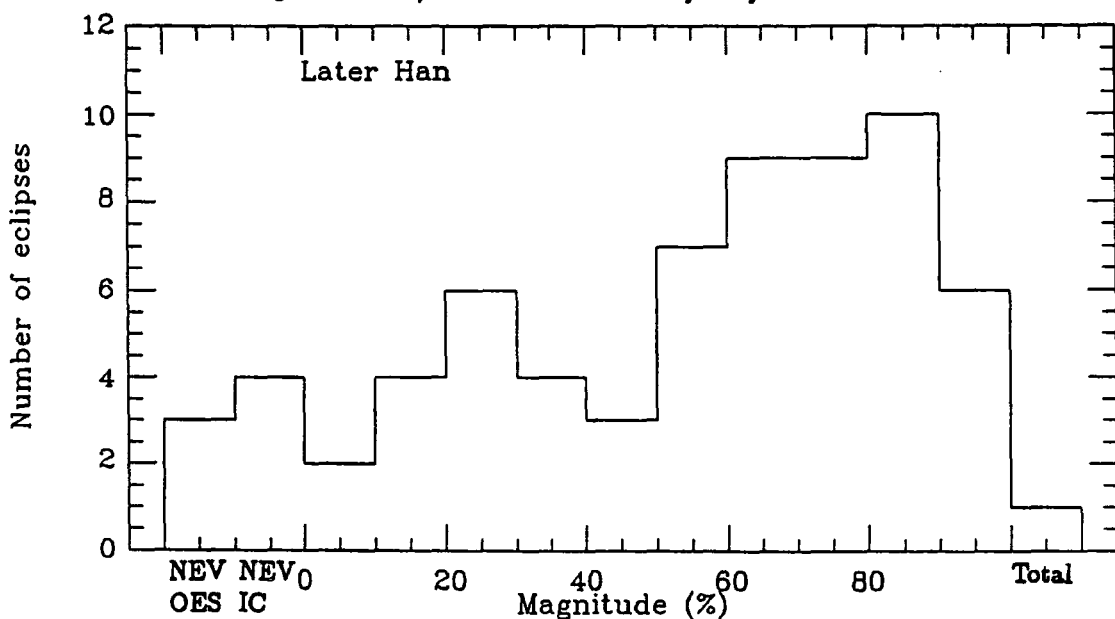


Figure 2.1.2: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the Later Han dynasty.

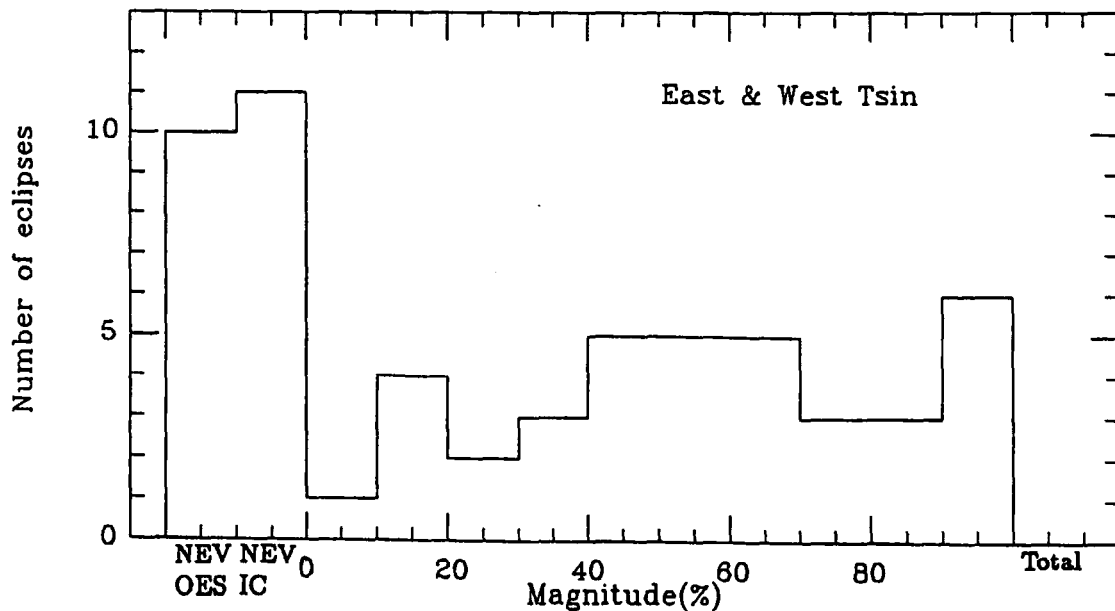


Figure 2.1.3: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the East and West Tsin dynasties.

and there is a high number of eclipses $> 50\%$ magnitude observed. Also two total eclipses were recorded (in 65 A.D. and 120 A.D.) although only one (120 A.D.) occurred and was total, the eclipse in 65 A.D. reaching a calculated magnitude of 0.98 at the capital.

Tsin Dynasty: 265 A.D. to 420 A.D. (Fig 2.1.3)

This includes both Western and Eastern Tsin. There are a large number of predictions that were both vastly (NEVOES) and slightly (NEVIC) incorrect and the number of observations increases at magnitudes higher than 40%.

The Wei Dynasty (220 A.D. to 264 A.D.), the many short-lived dynasties between 420 and 618 A.D., and the 5 Dynasty Period (906 A.D. to 960 A.D.) were not considered suitable data for this examination. This was due to the fact that very few eclipses were recorded in these unstable dynasties, certainly not enough for valid results. The dynasties from 420 A.D. to 618 A.D. ran concurrently and frequently recorded the same eclipse from different places. The Kin Dynasty records were also ignored because they were almost identical to those of the Southern Sung Dynasty.

T'ang Dynasty: 618 A.D. to 906 A.D. (Fig 2.1.4)

The T'ang astronomers made many predictions that were almost correct, mainly occurring when the Sun was below the horizon with respect to the capital. They also predicted several eclipses which did not occur at all. Many observable eclipses were recorded, most being over 40% magnitude.

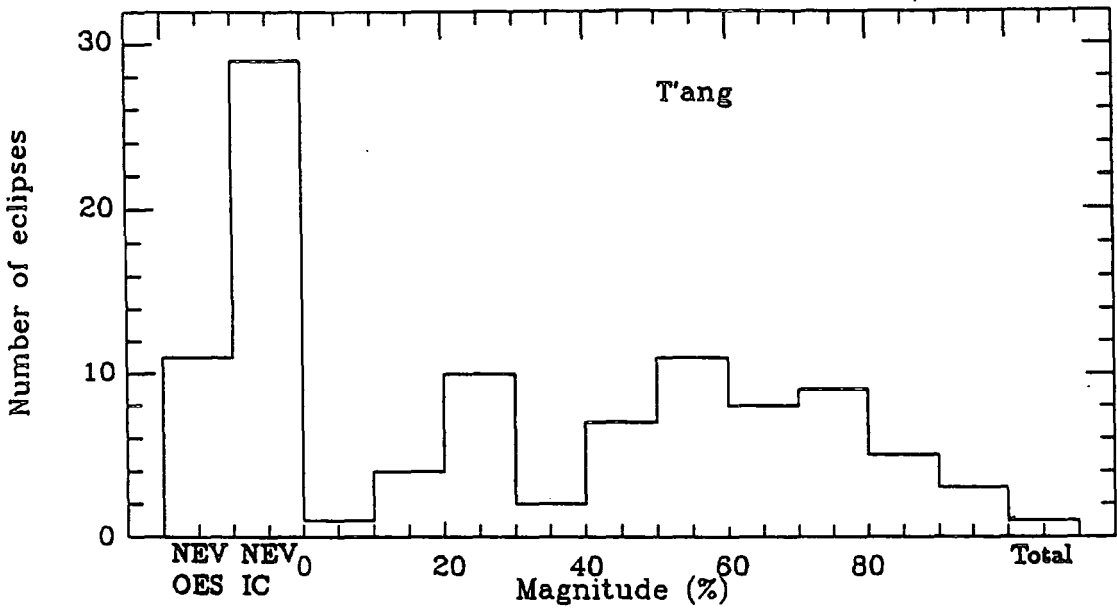


Figure 2.1.4: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the T'ang dynasty.

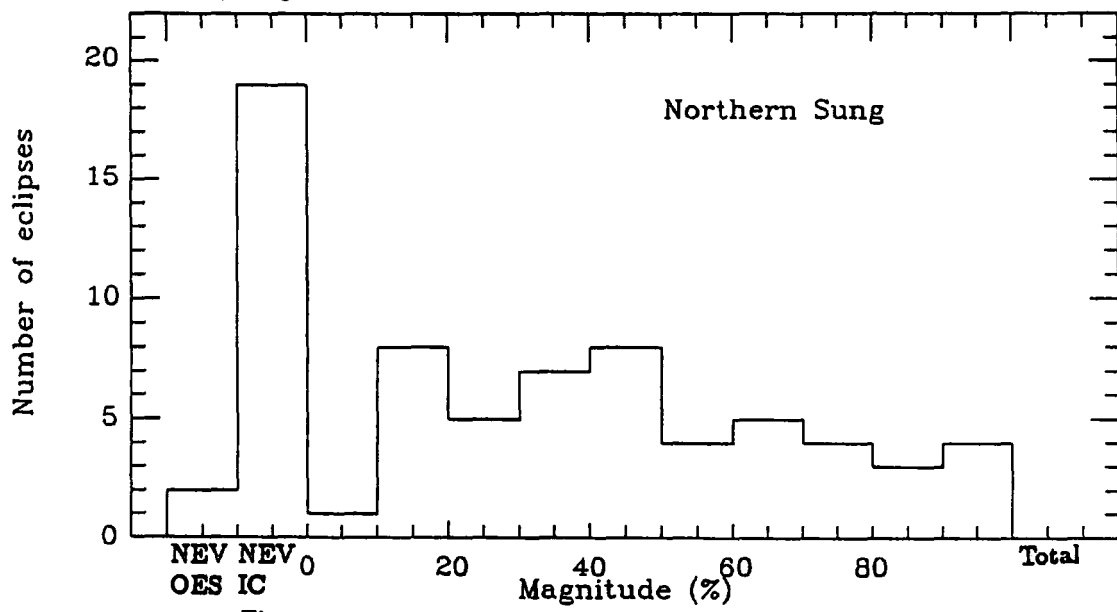


Figure 2.1.5: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the Northern Sung dynasty.

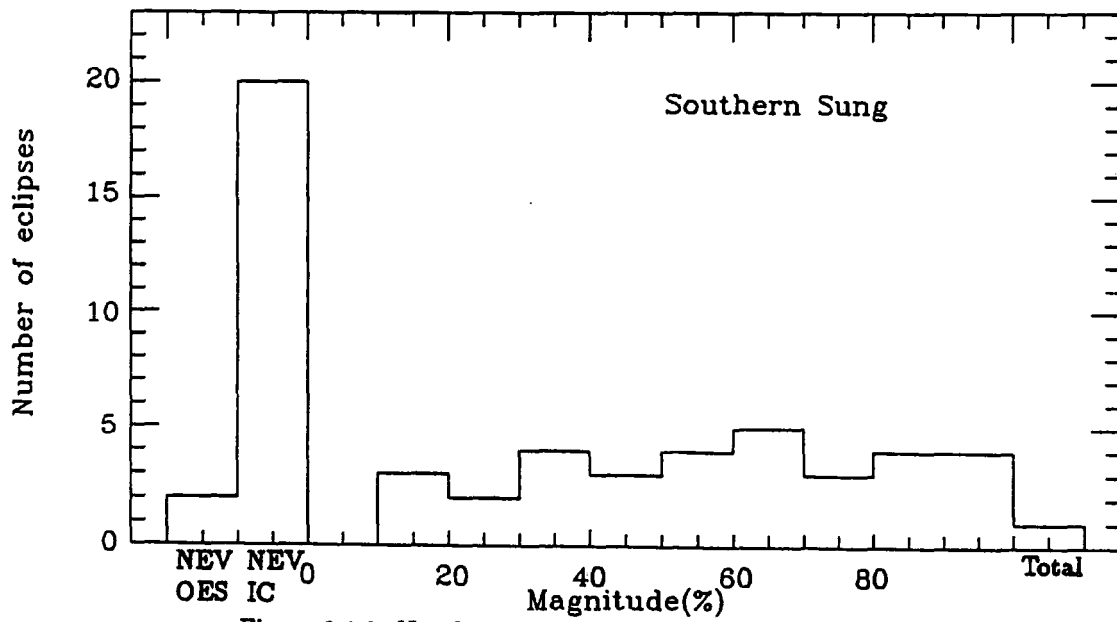


Figure 2.1.6: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the Southern Sung dynasty.

One total eclipse was correctly recorded in 761 A.D.

Northern Sung Dynasty: 960 A.D. to 1127 A.D. (Fig 2.1.5)

Very few totally incorrect predictions were recorded, although a lot of slightly incorrect predictions were. Most of the eclipses recorded were between 10% and 50% magnitude.

Southern Sung Dynasty: 1127 A.D. to 1279 A.D. (Fig 2.1.6)

This pattern of eclipse records was similar to the Northern Sung, although no eclipses with a magnitude less than 10% were seen, and the eclipses observed were fairly evenly distributed over the range of magnitudes. One total eclipse was recorded in 1275 A.D.

Yuan Dynasty: 1260 A.D. to 1367 A.D. (Fig 2.1.7)

Few totally incorrect eclipses, and several slightly incorrect eclipses were recorded. The eclipses that occurred were fairly evenly distributed from magnitudes of 10% upwards. One annular eclipse was recorded in 1292 A.D.

Ming Dynasty: 1367 A.D. to 1621 A.D. (Fig 2.1.8)

Only a few completely wrong predictions were made. The observed eclipses fall into two main groups, those between 10% and 40% magnitude and those between 70% and 100% magnitude, there being significantly less eclipses recorded between 40% and 70% magnitude. No total eclipse was observed.

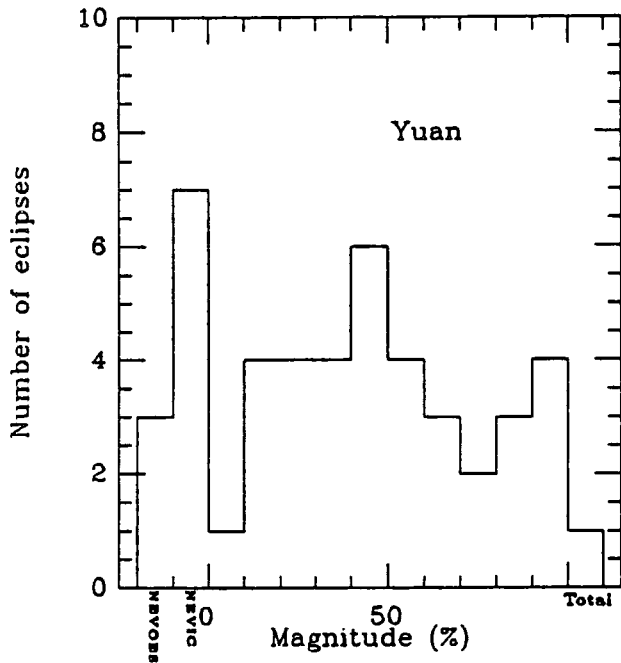


Figure 2.1.7: Number of eclipses observed versus magnitude in 10% magnitude bins, for the Yuan dynasty.

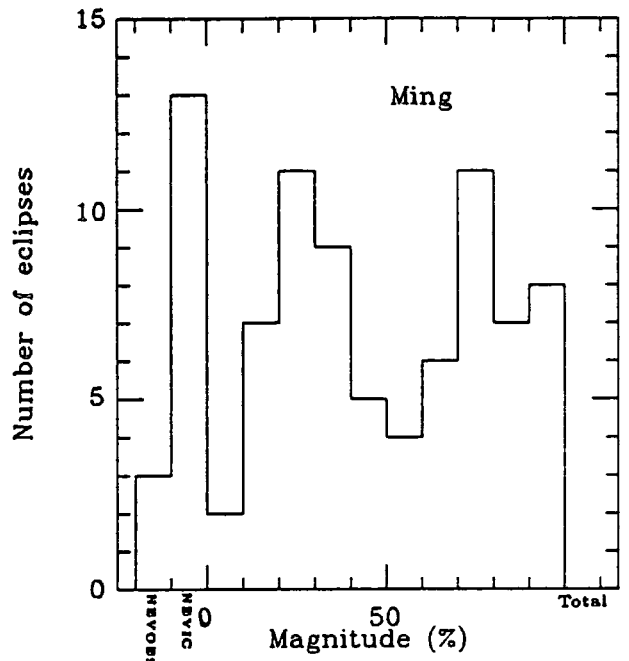


Figure 2.1.8: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the Ming dynasty.

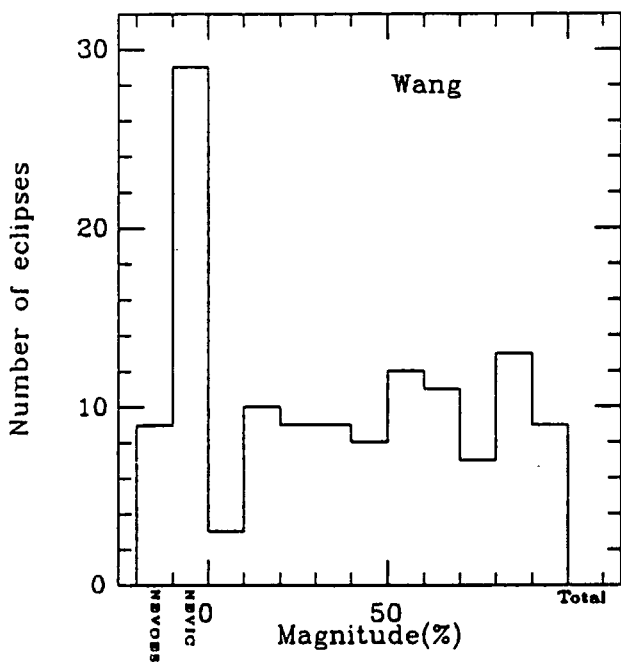


Figure 2.1.9: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the Wang dynasty.

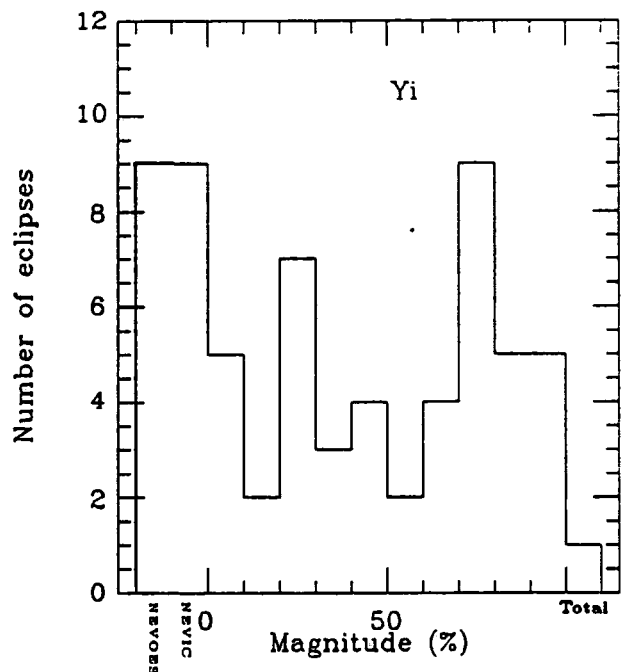


Figure 2.1.10: Number of eclipses observed versus magnitude, in 10% magnitude bins, for the Yi dynasty.

Dynasty	No. of years	NEVOES	NEVIC
F.Han	230	13	1
L. Han	195	3	4
Tsin	155	10	11
T'ang	285	11	29
N. Sung	170	2	19
S. Sung	150	2	20
Yuan	100	3	7
Ming	250	3	13

Table 2.1: Number of wrongly recorded eclipses per dynasty

Korea

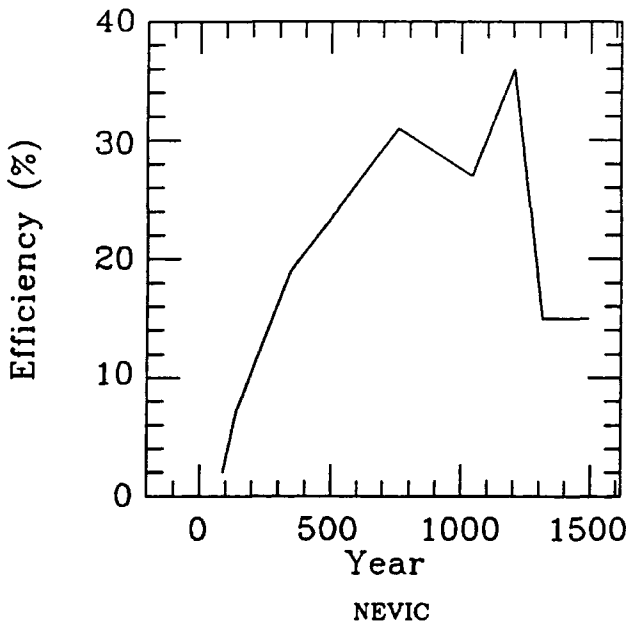
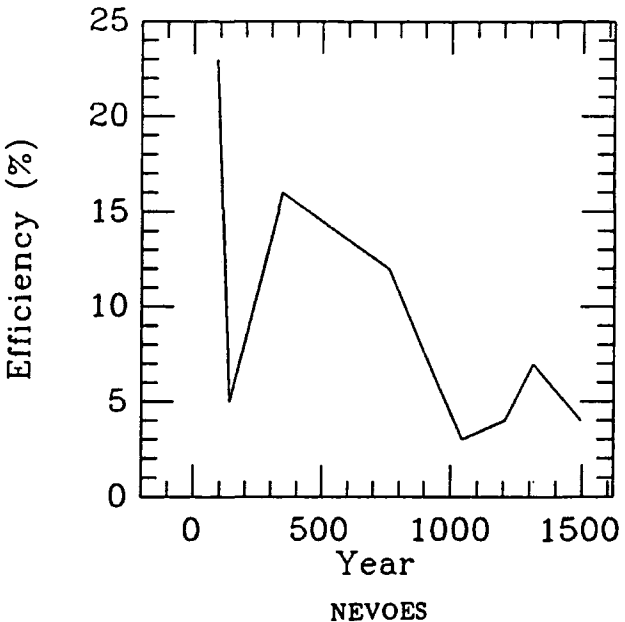
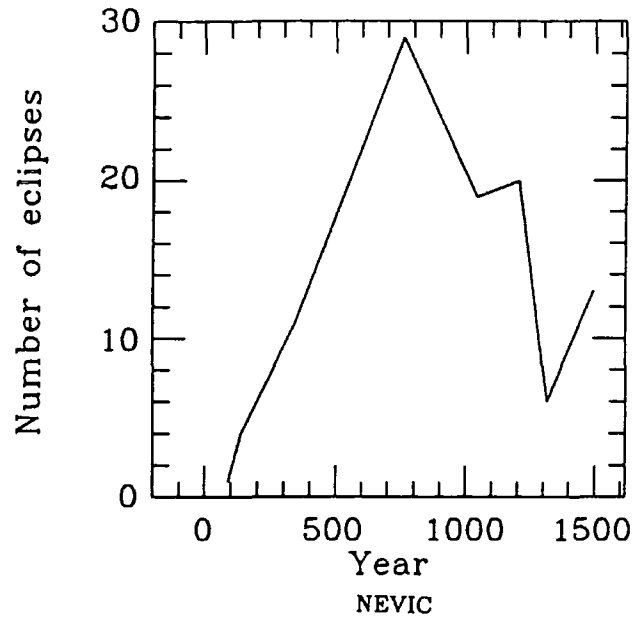
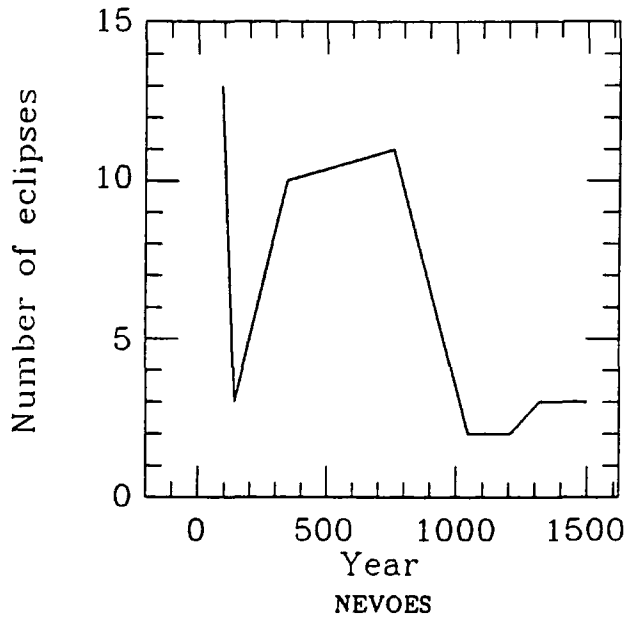
Koryo (Wang) Dynasty: 1009 A.D. to 1392 A.D. (Fig 2.1.9)

There were a large number of totally wrong predictions and a very large number of incorrect predictions. The eclipses observed were fairly evenly distributed in magnitude. No total eclipse was observable although several were recorded. These were presumably predictions.

Yi Dynasty: 1392 A.D. to 1621 A.D. (Fig 2.1.10)

An almost equally large number of totally wrong and slightly incorrect predictions were made. Most of the eclipse records were at greater than 70% magnitude. One total eclipse was recorded (in 1460 A.D.)

Table 2.1 shows the number of wrongly recorded eclipses per dynasty. One would assume that over the centuries the Chinese would have improved and refined their method of predicting eclipses. One would expect to see a decrease in the number of totally wrong predictions (NEVOES) with time



Efficiency is the number of eclipses occurring at this time as a % of those that occurred in total.

Figure 2.1.11: Number of eclipses not visible on the Earth's surface (NEVOES) and not visible in China (NEVIC) that were recorded per dynasty, with respect to time.

and an increase, possibly followed by a decrease in the number of eclipses that occurred but were not visible in China (NEVIC) with time, as their methods became better.

Figure 2.1.11 shows the number of eclipses recorded that did not touch the Earth. These do show a general declining trend over the 1800 years of the records. When the numbers are adjusted to be a percentage of the total number of eclipses for the dynasty, the decrease becomes more apparent. Similarly for the eclipses that occurred but were not visible in China (predictions) we see an increase from a minimum to a peak, then a decrease and levelling off.

2.2 Efficiency of observation.

The efficiency of eclipse recordings is defined to be the ratio (expressed as a percentage) of the number of eclipses actually recorded, to the number of eclipses actually observable according to calculations (i.e. the number observed to the number that occurred). The eclipses which could have been observed were calculated by a computer program (Appendix 1, XXX). This program, based on orbital calculations, was discussed earlier in Chapter 1. For each location, a list of eclipses was produced over the appropriate time span, giving the date, magnitude, local time and altitude of each eclipse. A comparison was then made between the observed and the occurred eclipses. In particular, dates were found to be consistently accurate. In Fig 2.2.1

the efficiency of the Chinese observers as a whole is shown. One would expect a sharp increase in efficiency as the magnitude rises, with the larger magnitudes (91–107%) being very high, since it is very difficult to miss a total eclipse, and the smaller eclipses (1–20%) being very low, because they are much harder to notice. This was indeed found to be the case, although the difference in efficiencies is not as large as one would expect. The 1–9% bin has a low efficiency of 27%, but all the other bins efficiencies occur between 64% and 96% which is not a particularly large range. The average efficiency for eclipses with magnitude between 1% & 50% is 63.6%, while the average efficiency for eclipses with magnitude between 51% & total is 84.2% which is sufficiently large to be consistent with my expectations for large eclipse efficiencies. The overall average is 74.5%.

Variations in efficiency introduced by weather must be taken into consideration. Assuming that climatic conditions have not suffered dramatic long term changes over the past 2000 years, the average cloud cover per year over all China is 4.4 oktas (eighths) (55%). From place to place there is a slight variation, shown in Table 2.2. All climatic data was obtained from the Meteorological Office Archives and is an average of data obtained between 1901 and 1964 A.D. The rainfall and cloudcover information for certain Chinese and Korean capitals is displayed in Table B.

Thus while the sun is above the horizon it is visible for (on average) only 45% of the time, thus we would expect only 45% of the eclipses to be

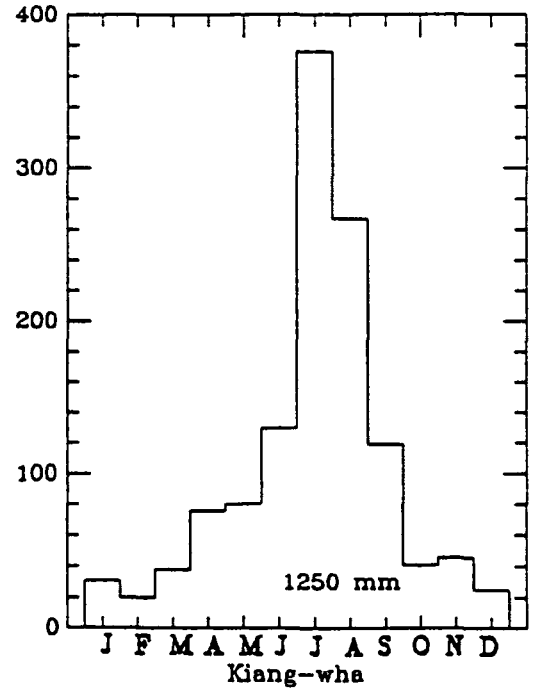
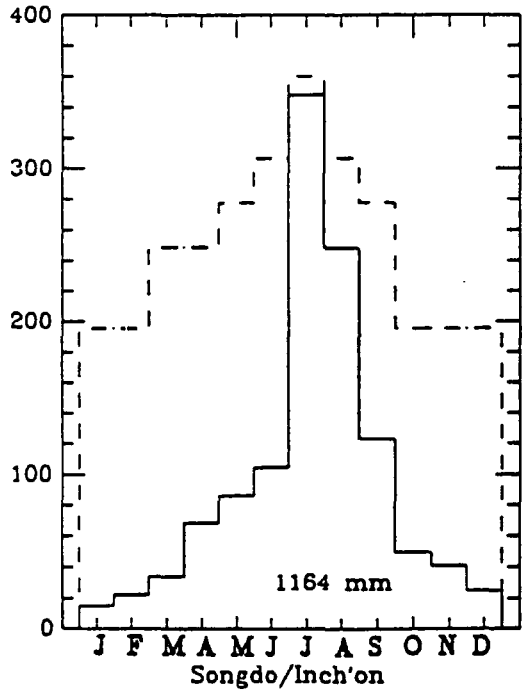
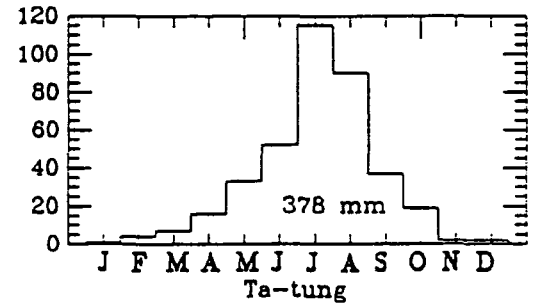
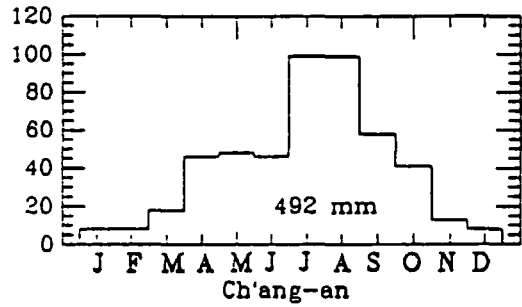
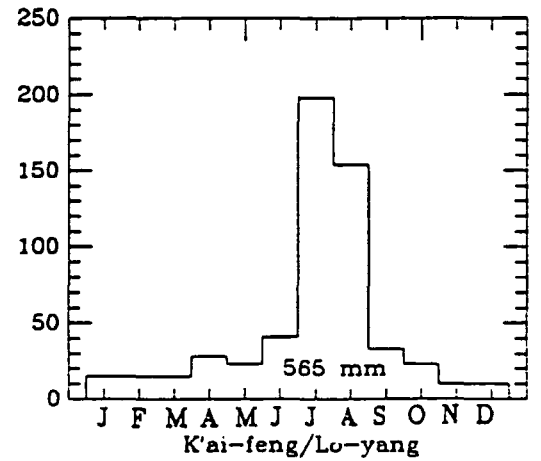
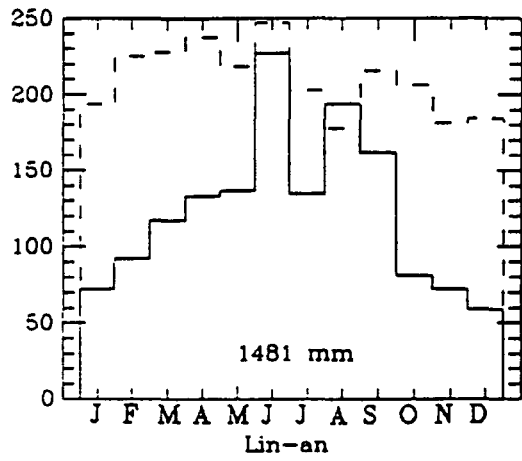
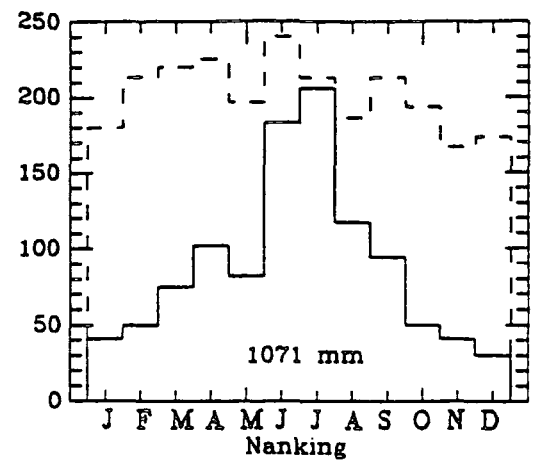
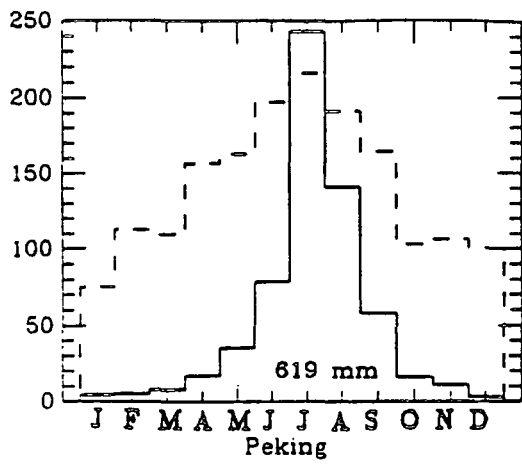


Table B: Weather statistics for Chinese and Korean capitals. The continuous line indicates rainfall and the broken line indicates cloudcover in %

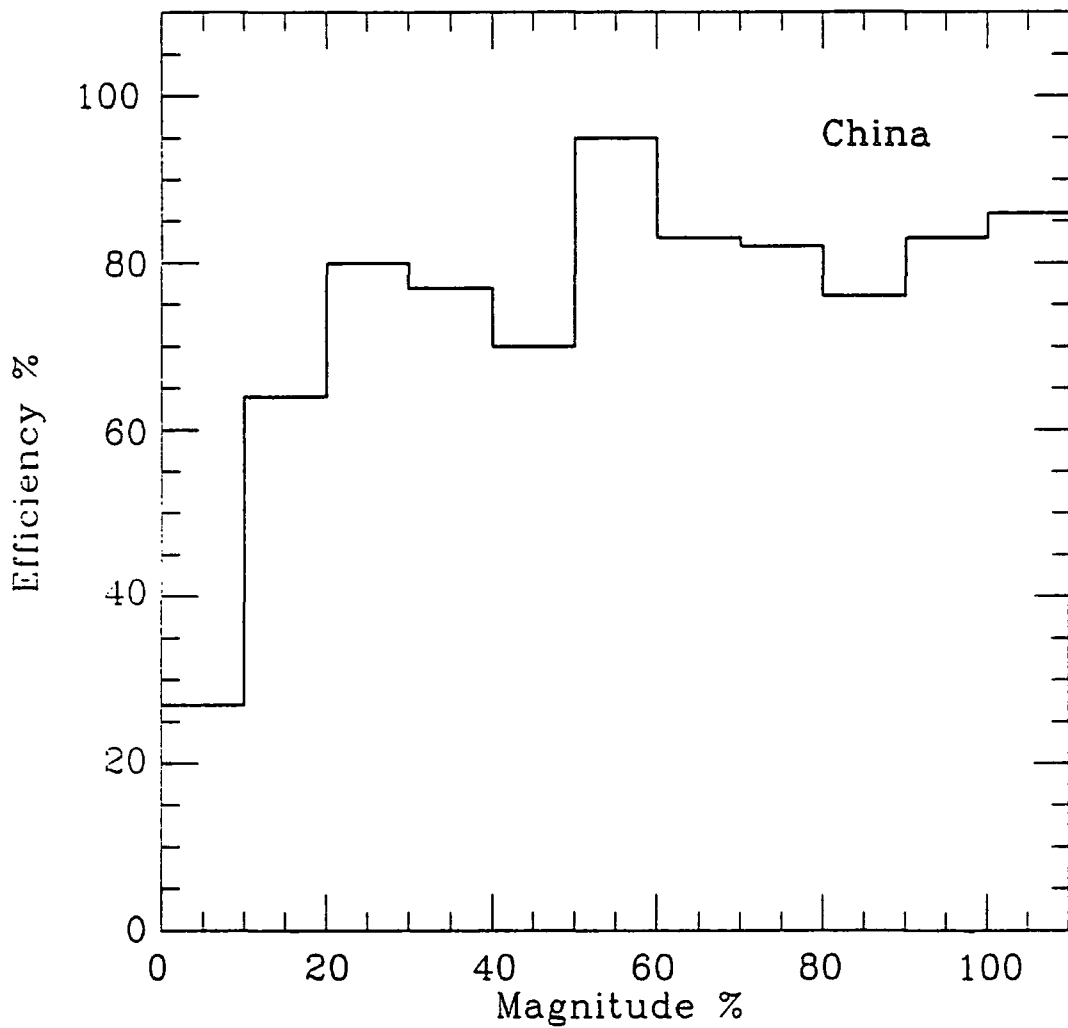


Figure 2.2.1: Efficiency of eclipse records as a function of magnitude for China.

Capital	Cloud Cover	
	<i>Oktas</i>	<i>Percentage</i>
Peking	3.6	45 %
Nanking	4.8	60 %
Lin-an	5.4	67.5 %
Tientsin	3.1	38 %
Shanghai	5.1	64 %
Hankow	4.9	61 %

Table 2.2: Cloud cover at various Chinese cities

visible and hence an average efficiency of $\sim 45\%$ (perhaps a little more if we include the fact that many of the larger eclipses would be observable even if the sky was quite cloudy. This can be compared with the average efficiency for all eclipses of 68.4%, and the average efficiency for eclipses $< 50\%$ magnitude, 29.4%. I think it can be safely said that these figures agree well with the cloud cover data. Since many of the small eclipses can be easily missed, the figure of 29.4% is less than that of 45% by a factor which is believable. For Korea, cloud cover information is available only for Inch'on, a city in between Songdo and Kangwha, so the figures for Inch'on may be used as an average for the values for the two Korean capitals. The average cloud cover is 4.5 oktas (56%). The average eclipse efficiency for all Korean eclipses is 62% and for eclipses of magnitude $< 50\%$ is 26.8%. Again, these figures are acceptable. However, dealing with cloud cover is complex and these relationships are only conjecture.

Figure 2.2.2 shows that for Korea, a similar consistency is found, with

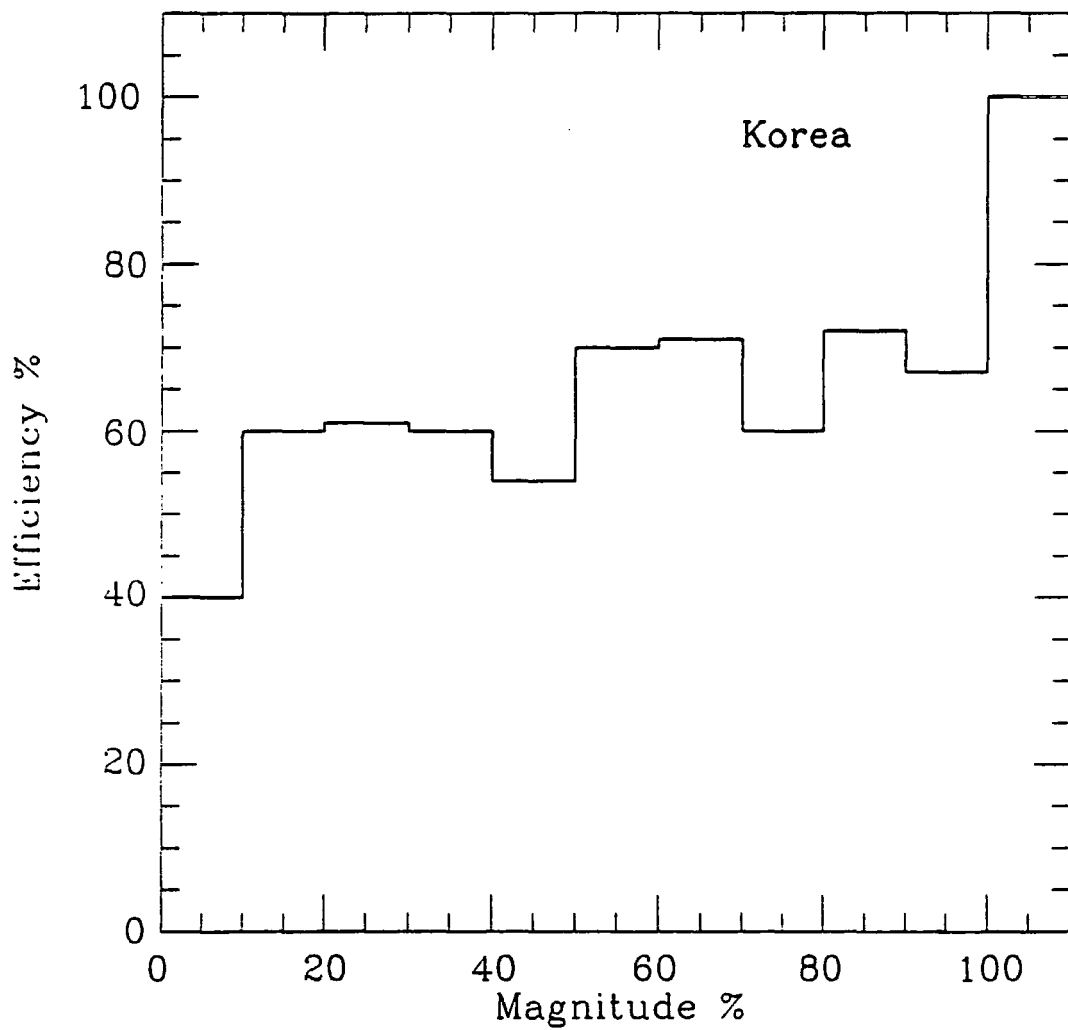


Figure 2.2.2: Efficiency of eclipse records as a function of magnitude for Korea.

a small efficiency for eclipses with very small magnitude (1–10%) = 40.0%, and a fairly narrow range of values for all other magnitudes (54% to 72% for efficiency, excluding the 100% for total eclipses). The average efficiency for eclipses between 1–50% magnitude is 55.2% and the average efficiency for eclipses between 51%–total is 73.3%.

For total eclipses the Korean efficiency is 100% (one out of one), while for China it is 86%, but when we look at the actual numbers involved, we find that the Chinese astronomers missed only one total eclipse out of seven. Further examination shows that this eclipse occurred on June 7th 894 A.D. during the T'ang Dynasty; the capital location at the time was Ch'ang-an. The eclipse achieved a magnitude of 1.06% at 19.45h (7:27 p.m.), while its altitude was 3 degrees above the horizon. Thus the sun was setting by the time it had reached its maximum. Presumably, the astronomers thought the sun was merely setting (especially if the eclipse started from the lower limb of the sun) and did not recognise the eclipse when it occurred. This eclipse was not recorded at all.

2.3 Variations with Time.

Examination of the changes in efficiency of eclipse observation over the 1800 years of pre-telescopic dynastic eclipse records, one expects to find an increase in efficiency, and then a levelling off once their prediction techniques were perfected within the limits attainable with very poor theory,

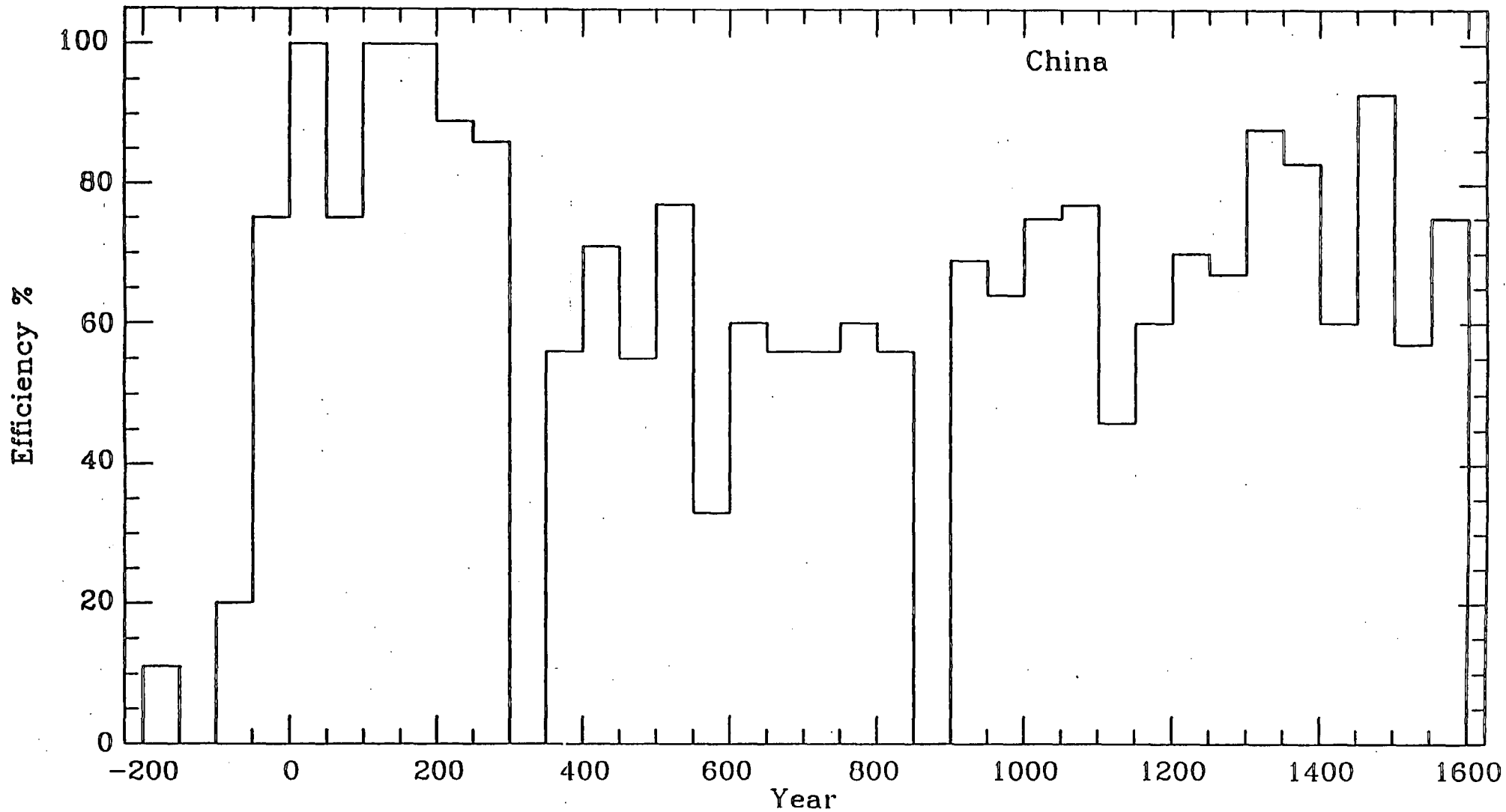


Figure 2.3.3: Efficiency of small eclipses observed as a function of small eclipses occurred for China, by year, in 50 year bins.

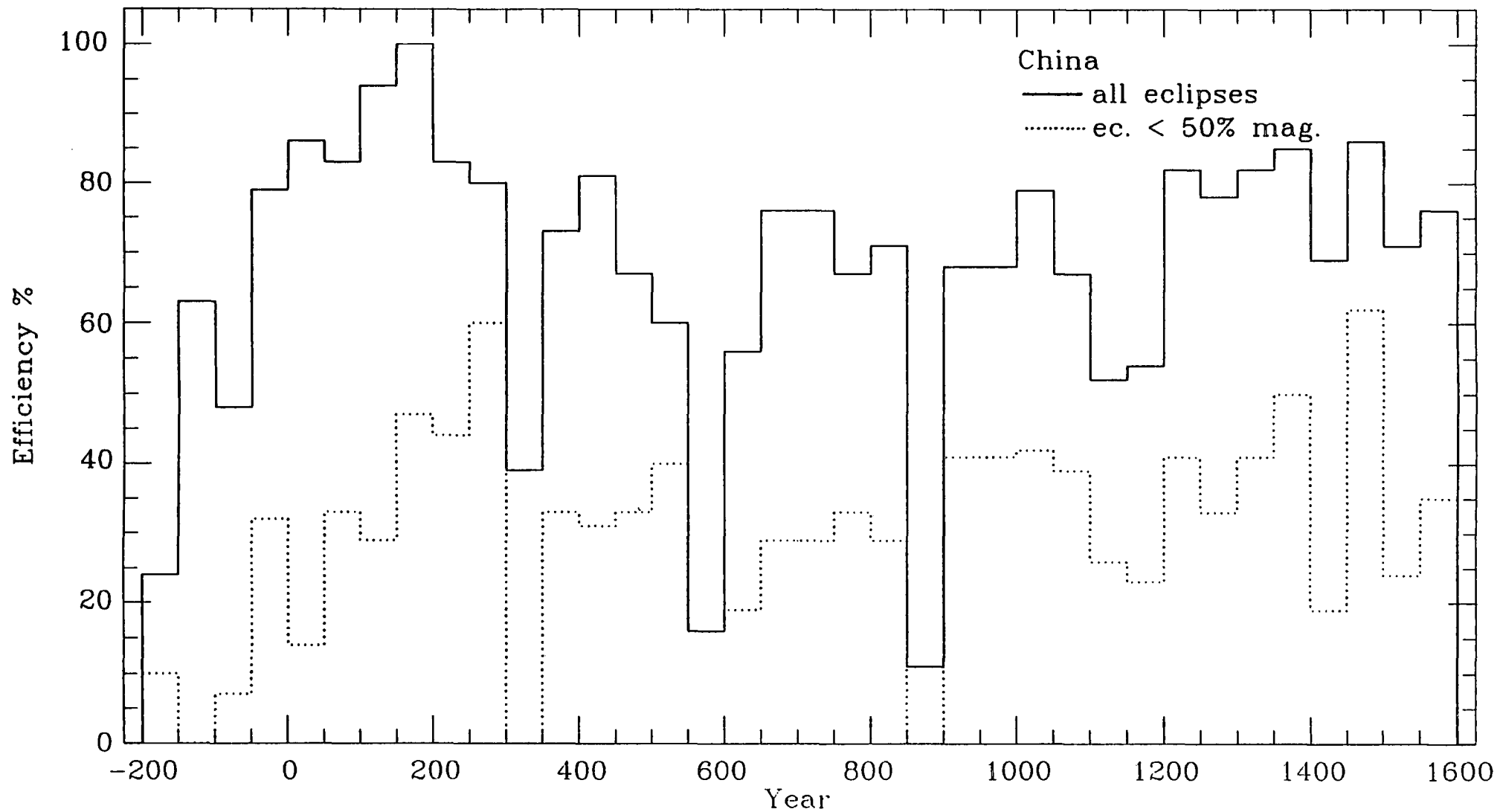


Figure 2.3.2: Efficiency of eclipses recorded in China, by year, in 50 year bins.

(perhaps until some long term change in cloud cover or effect of movement of capital). Fig 2.3.1 shows the number of eclipses that occurred and the number of eclipses observed over the 1800 years, in 50-year bins. There is a variation in the frequency of eclipses occurring. This variation is due to irregularities introduced by the Saros cycles, and by the movement of the capitals from which the observations and eclipse calculations were made. In larger bins, this variation would be smoothed, but as it is, the scatter is less than the root mean.

Mean = 18.19, Root Mean = 4.26 and $\sigma = 2.5$

The efficiency is shown in Fig 2.3.2.

The efficiency is very low initially, and then rises to a very high maximum over 500 years. Then at 300 A.D. the efficiency drops to almost zero (in the case of small eclipses the efficiency falls to zero). Between 350 A.D. and 550 A.D. the efficiency is quite high although it does not recover to what it was before the drop at 300 A.D. Then at 550 A.D. there is another lapse, although not quite as dramatic, with the overall efficiency falling from 60% to 16%, and the small eclipse efficiency falling from 40% to 11%. Again, there is another rise and a levelling off for 600 A.D. to 850 A.D. (the T'ang Dynasty) until at 850 A.D. the efficiency drops to almost zero (overall eclipse efficiency 11%, small eclipse efficiency 0%). After this, the efficiency of eclipse recording continues steadily at a moderately high rate, $\sim 70\%$ for all eclipses and $\sim 40\%$ for small eclipses. There is a slight dip of

~ 20% between 1100 A.D. to 1200 A.D. and then a jump to a still higher rate (~ 80% for all eclipses and ~ 40% for small eclipses) until 1400 A.D. Then there was a slight fluctuation in efficiencies until 1680 A.D. although the average efficiency remains the same.

Historical Causes of Temporal Efficiency Variations

The drop at 850 A.D. – 900 A.D.

The T'ang Dynasty ruled China from 618 A.D. to 906 A.D. For most of that period, a good efficiency of eclipse observation was maintained, but during the last 50 years, this dropped to almost zero. Between 850 A.D. and 900 A.D., 19 eclipses occurred, but only 6 eclipses were recorded. Four of these were incorrect predictions, so only 2 eclipses were observed (both > 50% in magnitude). One can surmise that there was considerable internal turmoil within China towards the end of the T'ang Dynasty to account for such a low number of eclipse recordings and this is confirmed by the history of the time.

“... from 820 to 860 a growing pattern of disorder and local banditry emerged; from 860 to 875, broadly supported garrison insurrections broke out, coupled with a serious attempt to form an independent regional state in the lower Yangtze valley; from 875 to 884 a popular rebellion of immense proportions arose. The rebels captured the T'ang capital and held it for more than 2 years. The dynasty was ... (now)... virtually destroyed and

from 884 to 907 an array of regional states were established, one of which provided the coup de grace to the T'ang Dynasty."

(The Cambridge History of China, Vol. 3, p. 682)

In 880 A.D., the emperor fled the capital Ch'ang-an to take refuge in Szechwan from the triumphant rebel army. The capital was totally looted. Panic-stricken officials and court members (and so presumably astronomers) fled the capital in all directions. The rebels withdrew from the capital in 883 A.D. having finally been defeated by

"...the undisciplined provincial troops who looted and destroyed the remains of Ch'ang-an, reducing to ashes those palaces which were still standing."

(Ditto p.760)

From this we have a ready explanation for the poor efficiencies in the 850 – 900 A.D. bin. Presumably, when the court officials fled in panic they did not bother to stop for much of their paperwork and thus when the city was sacked in 880 A.D. and razed to the ground in 883 A.D., the astronomical records for the period were destroyed. Of the 2 recorded eclipses which occurred, one was reported in 888 A.D., third lunar month, (magnitude 0.68). By then the capital was reoccupied by the Emperor, and we find

"...the Emperor died in the third month of 888 A.D."

(Ditto p. 773)

The eclipse may have been seen as an omen of the Emperor's death, as in previous periods.

The four other records were all of faulty eclipse predictions. Those recorded in 854 A.D. and 877 A.D. were eclipses which were not visible at the capital but did occur somewhere on the Earth. Those recorded in 876 A.D. and 879 A.D. were not visible on the Earth's surface. These few records were made before the city was raided and probably escaped the destruction by chance.

950 to 1300 A.D. The Divided Empire.

Between 1115 A.D. and 1278 A.D., China was ruled by two overlapping dynasties, one in North China, the other in South China, both keeping their own Astronomical records. The Northern Sung ruled from 960 – 1127 A.D., capital K'ai-feng. The Southern Sung ruled from 1127 – 1279 A.D. with the capital at Lin-an. The Kin ruled from 1115 – 1234 A.D., capital Peking. And the Yuan ruled from 1260 – 1367 A.D. also from Peking, beginning in Mongolia and conquering the North, and then the South of China. Thus the beginning of the Kin Dynasty overlaps the end of the Northern Sung and the start of the Southern Sung, and the beginning of the Yuan Dynasty overlaps the end of the Southern Sung.

Between 951 – 1100 A.D. (solely Northern Sung), the average efficiencies over 50-year intervals are 71%^a , 41%^b , and 72%^c. The 1101 – 1150 A.D.

^aall eclipses

^bsmall eclipses (< 50% magnitude)

^c% of observed small eclipses to actual small eclipses

Dynasty	% all	% small	% small/small
N. Sung	72	43	71
S. Sung	73	30	68
Kin	86	44	80
Yuan	85	44	82

Table 2.3: Dynastic Efficiencies

bin contains the Northern Sung, Southern Sung and the Kin Dynasties. The numbers for each dynasty are displayed below.

The actual efficiencies for 1101 – 1150 A.D. are 52^a , 26^b and 46^c and for 1151 - 1200 A.D. are 54^a , 23^b and 60^c.

		Ec. occ.	Small ec. occ.	Ec. obs.	Small ec. obs.
For the	N. Sung	12	8	7	5
	S. Sung	7	4	3	1
	Kin ^d	4	1	2	0
	Total	23	13	12	6

giving us 52%, 26% and 46%, in agreement with above. Most of the eclipses recorded by the Kin have already been taken into account by the Northern and Southern Sung, so only 4 eclipses occurred (2 observed) are unique to the Kin.

Because of the overlapping nature of the Kin & Southern Sung dynasties, and the moderately low efficiency at the beginning of the Southern

^aall eclipses

^bsmall eclipses (< 50% magnitude)

^c% of observed small eclipses to actual small eclipses

^dunique to

Sung, which is due to the many eclipses which were predicted but not observed due to being obscured by clouds or rain, and since usually there are low efficiencies at the start and end of dynasties, we can account for the drop in efficiencies.

From 1201 A.D. to 1350 A.D., the Yuan and the Kin dynasties have a high level of efficiency, there being much less reported obscuration by cloud from the north-lying capitals.

Figure 2.3.3. This graph shows the efficiency of the small eclipses i.e. the number of eclipses $< 50\%$ magnitude which were observed, over the number of eclipses $< 50\%$ magnitude that occurred. This gives a true account of the efficiencies of observation since it is relatively easy to see large eclipses. Again, the Former Han has a very very low efficiency which increases for the 'Wang Mang' period, and the Later Han has the best efficiency for any dynasty. Then at 300 A.D. the efficiency drops to zero. During this period 18 eclipses occurred, 6 of which were less than 50% magnitude. None of these small eclipses were recorded. Of the 12 large eclipses which occurred, 7 were observed although some very large ones were missed. Between 328 A.D. & 355 A.D. only one eclipse was recorded (magnitude 0.92). Historically the ruling dynasty were in fact invading nomadic tribesmen who defeated the Wei in ~ 312 A.D. Possibly they were not as interested in Astronomy as the Chinese although later they became sinified. It is most likely that it was merely insufficient observing than

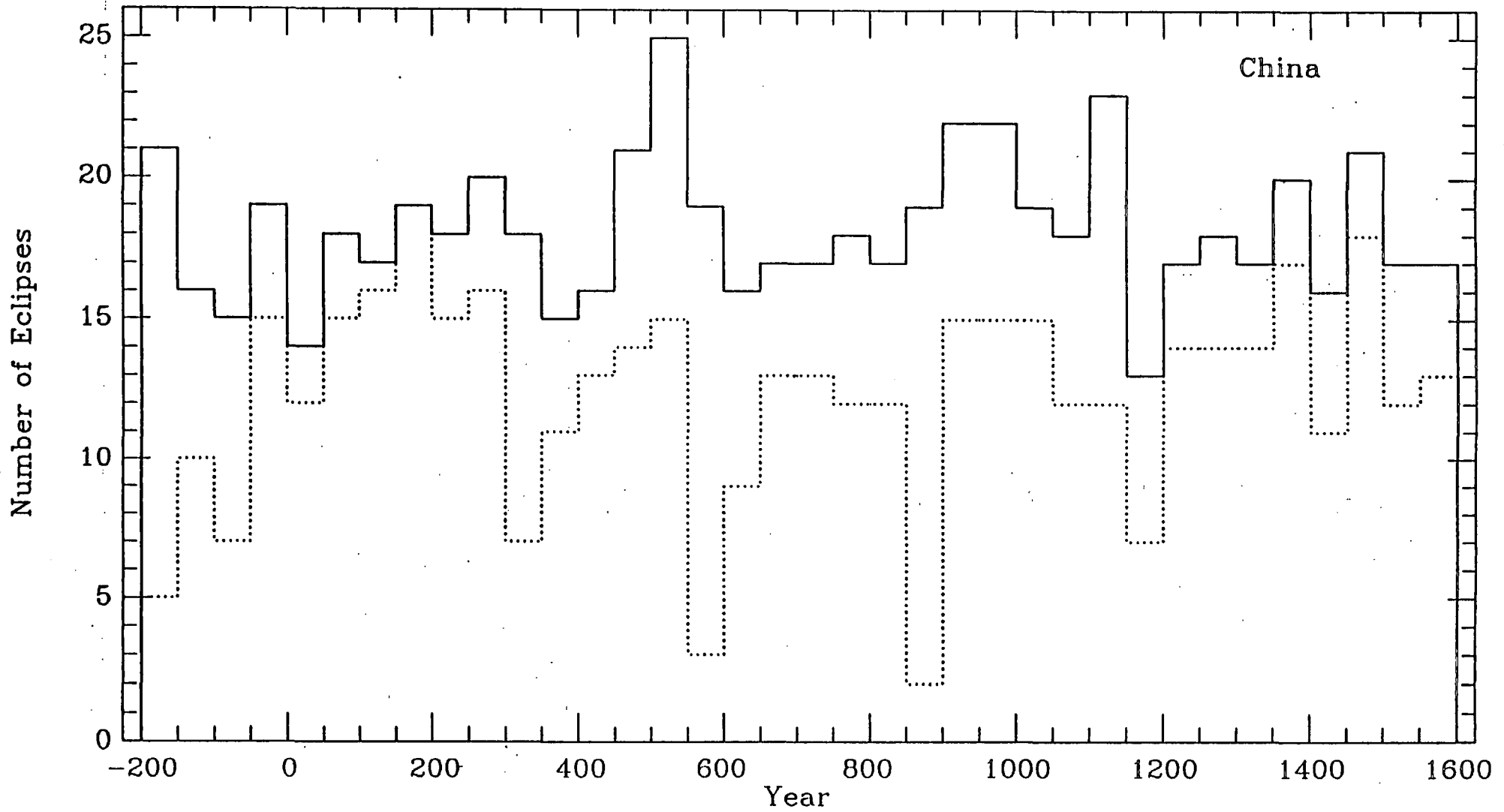


Figure 2.3.1: Number of eclipses occurred and the number of eclipses observed by year, in 50 year bins, for China.

any other factor that caused this minimum. From 386 A.D. to 588 A.D. there was a series of overlapping dynasties in the North, South and East of China, none of whom was particularly efficient, but between them they managed to cover quite a lot of the eclipses. There is a slight dip at 550 A.D. to 600 A.D. (Cheng, Northern Chi, Northern Chou and Sui dynasties.) No observed eclipses were recorded for the Cheng and Sui dynasties, one for the Northern Chi and three for the Northern Chou, out of a total of 19 ($9 < 50\%$ magnitude). It was a bad time for eclipse recording, many eclipses greater than 50% were missed. The T'ang dynasty maintained a steady efficiency although once again there is the drop at 850-900 A.D. due to the chaos at the end of the T'ang dynasty, as already mentioned. The Northern Sung Dynasty has a slightly increased efficiency although there is again a drop in efficiency at the crossover between the Northern and Southern dynasties. The Yuan reached very high efficiencies and although there are fluctuations, the Ming was also very efficient.

Figure 2.3.4. This shows the number of eclipses occurring and the number of eclipses observed in Korea, including the eclipses with magnitude $< 50\%$. Figure 2.3.5 shows the efficiencies for Korea. The Korean records are not very consistent, sometimes there are high, and sometimes low efficiencies for no obvious reason. Park (1977) suggests that this is due to varying degrees of interest in the heavens by the Korean ruling authorities. His examination of the Korean records from 1392 – 1519 A.D. finds

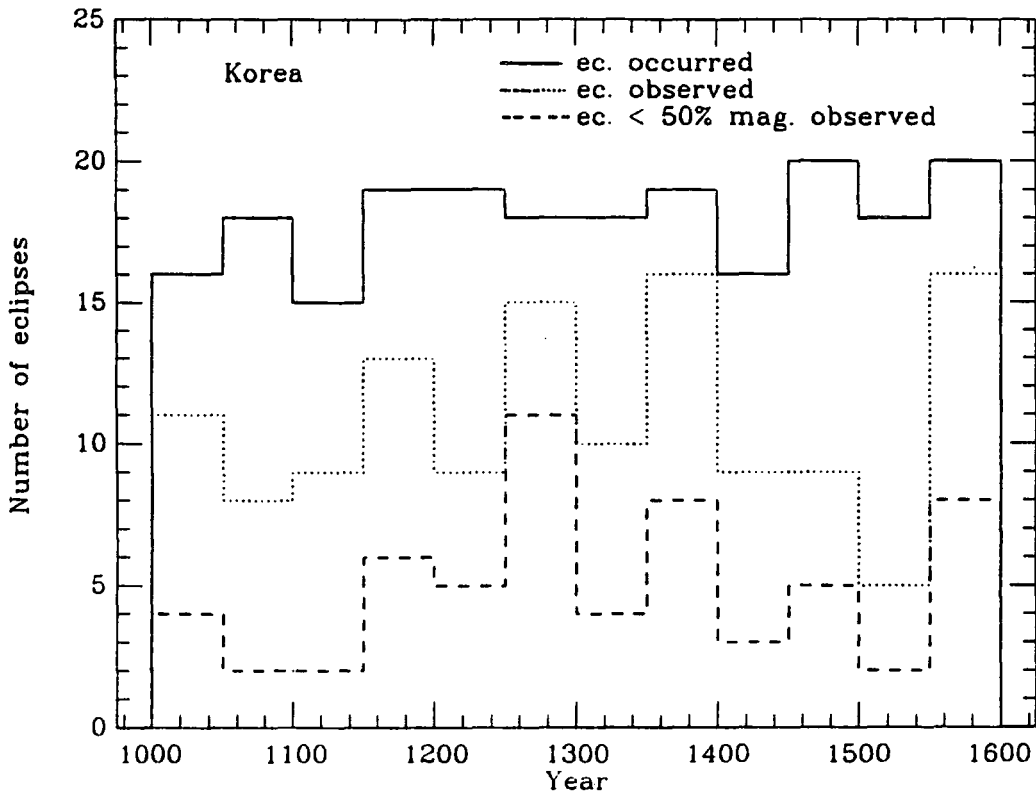


Figure 2.3.4: Number of eclipses occurred and the number of eclipses observed by year, in 50 year bins for Korea.

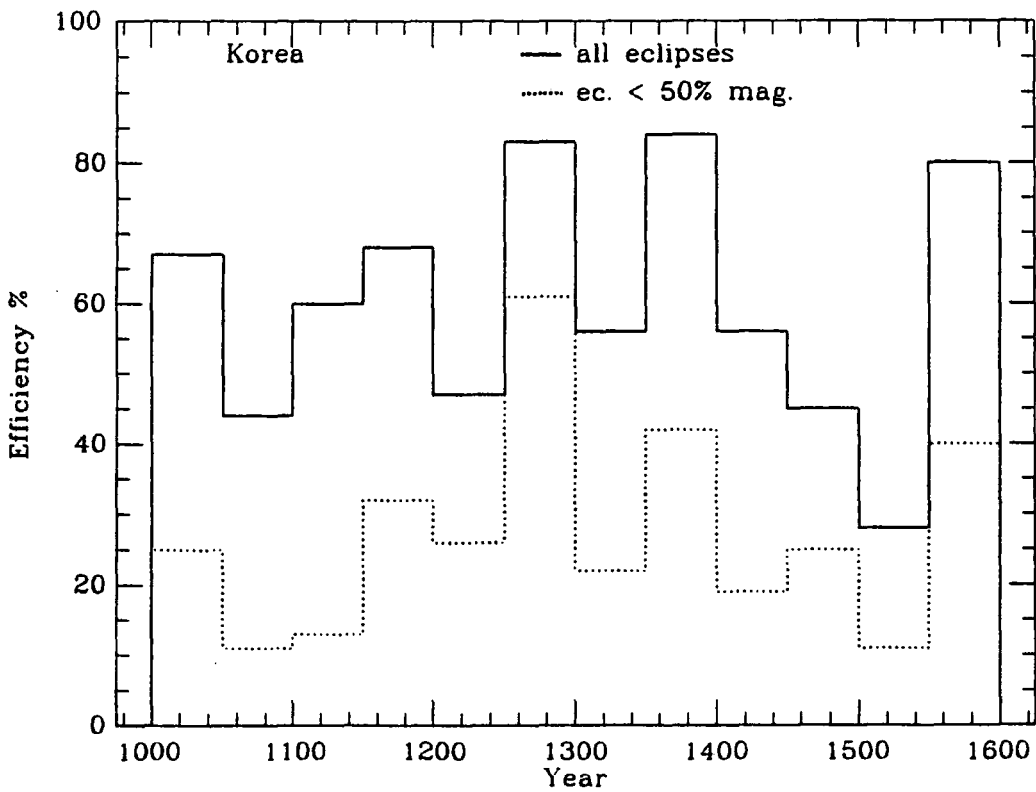


Figure 2.3.5: Efficiency of eclipses recorded in Korea, by year, in 50 year bins.

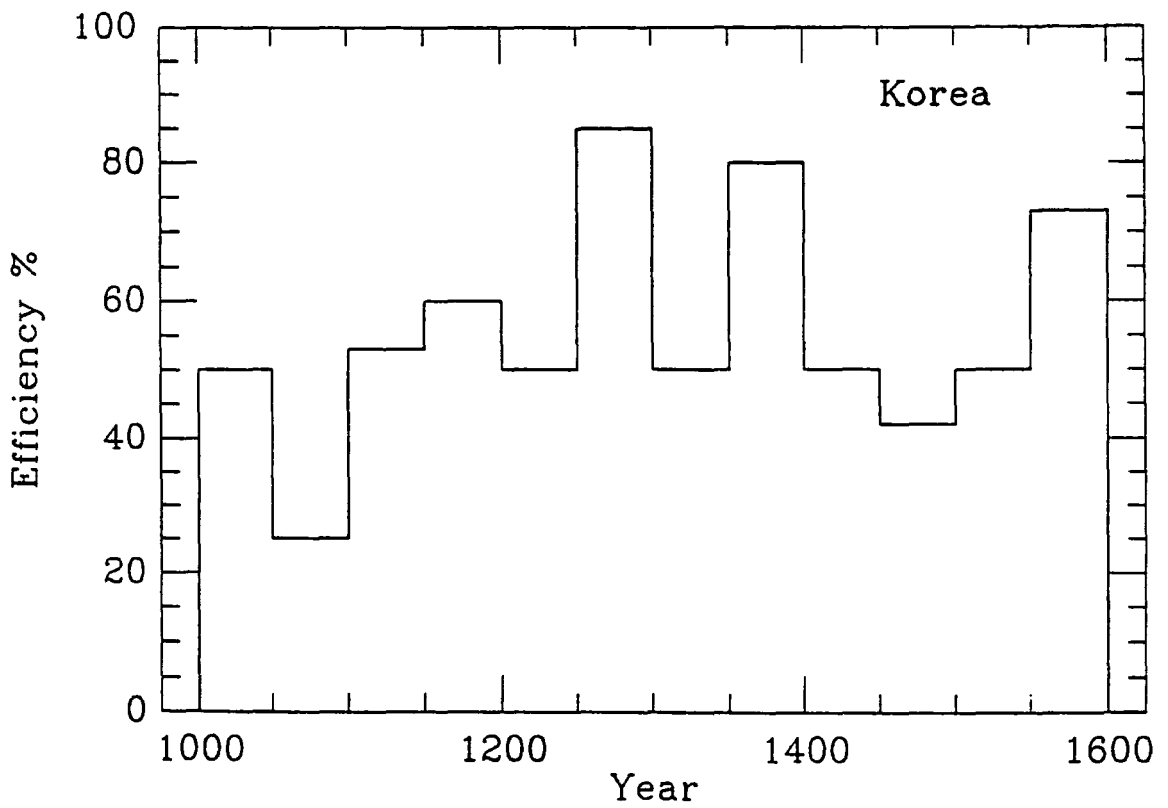


Figure 2.3.6: Efficiency of small eclipses observed as a function of small eclipses occurred for Korea, by year, in 50 year bins.

a fluctuation in the astronomical or unusual natural phenomena recorded that has nothing to do with historical factors, and may be related to the religious, political and ethnocentric attitudes of the reigning Emperor and his court. There is a significant low from 1400 A.D. to 1550 A.D. for no explicable reason historically. The small eclipse efficiency (as a function of small eclipses) shown in Figure 2.3.6, also fluctuates. There is no steady efficiency.

2.4 Variations with the Altitude of the Sun

Examination of the eclipse records as a function of the sun's altitude above the horizon should yield information about the observing efficiency, and some reasons pertaining to it. All the Chinese capitals are between 32 and 40 degrees latitude (mean 36). Summer maximum altitude of the Sun at latitude 36° is $77 \pm 3^\circ$, winter maximum is $30 \pm 3^\circ$. Therefore one expects the number of eclipses observed/occurred to have a maximum between 0 and 30 degrees above the horizon, and a sharp minimum at 70 – 80 degrees, with zero eclipses being observed at 90 degrees. Thus, there is a much higher chance of an eclipse occurring at lower altitudes. However, this factor is eliminated when we examine the efficiencies since we are looking at the percentage observed as a total of the whole. When the sun is high in the sky, one would expect there to be a strong glare so that small eclipses would not be easily visible to the naked eye. When the sun is at low altitudes e.g.

when it is sunrise or sunset, the light will have to shine further through the atmosphere, and consequently the glare will be blocked by the larger amount of dust and other small particles contained in the atmosphere. Also the interactions will partially polarize the light thus further reducing the glare and making solar phenomenon more obvious. Therefore one would expect the efficiencies to have a minimum/zero around $80^\circ - 90^\circ$, and to be significantly high at sunrise and sunset.

Figure 2.4.1 shows the number of eclipses occurring and the number of eclipses observed, by altitude for China and Figure 2.4.2 shows the efficiency. Figures 2.4.3 and 2.4.4 show the eclipses occurring and observed with magnitudes less than 50%, and the efficiencies thereof.

Figure 2.4.1. As we expect, the number of eclipses occurring decreases with increasing altitude. This appears to be a fairly linear rate, with only one eclipse occurring between 80° and 90° (this eclipse is of magnitude 0.22 at 12:10 p.m.) Also, the number of eclipses observed decreases with increasing altitude, although there is a slight dip at sunrise and sunset. This may be due to

1. mistaken sunsets and sunrises i.e. the sun rises or sets eclipsed but is not noticed as being eclipsed because the sun is assumed to be darker due to the rise or set.
2. obscured horizons e.g. mountain ranges to the east or west
3. climatic conditions, it is often cloudier at sunrise than at any other

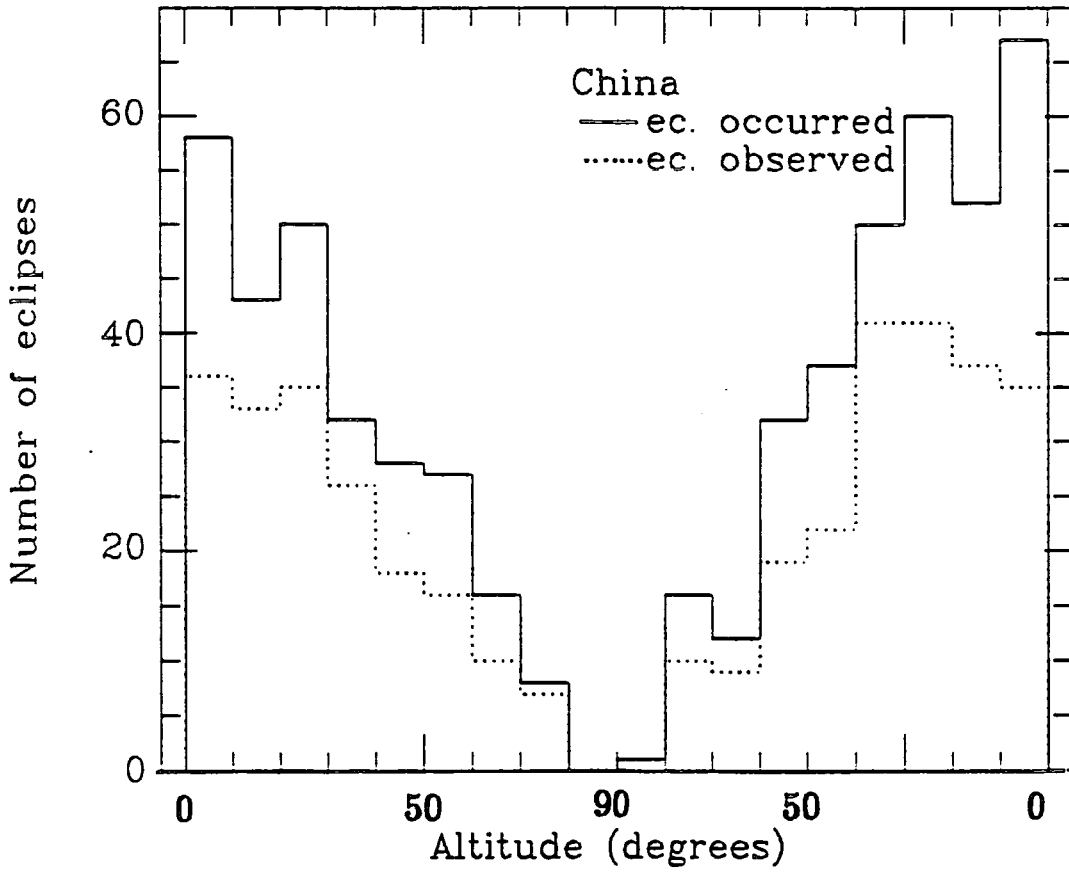


Figure 2.4.1: Number of eclipses occurring and the number of eclipses observed by altitude for China

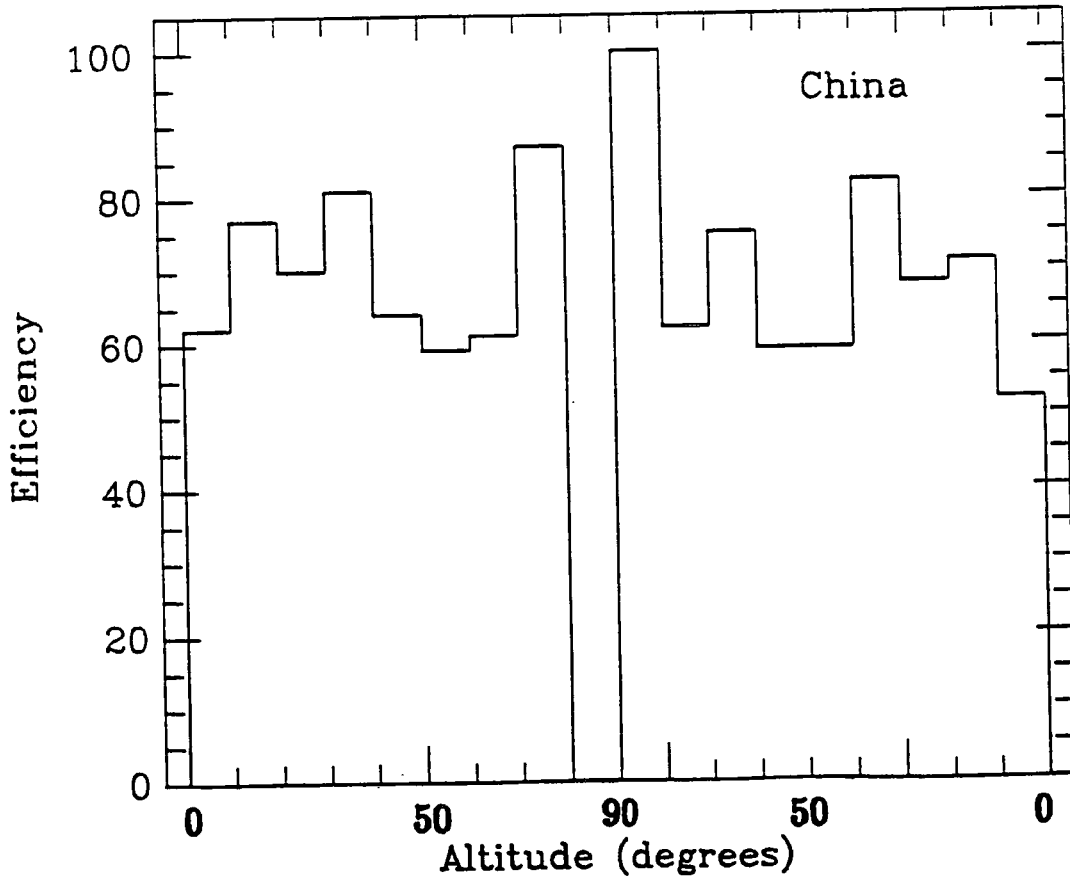


Figure 2.4.2: Efficiency of eclipse observations by altitude for China.

time of the day. (This fact is supported by Chinese and Korean climatic data provided by the Met. Office Archives.)

Figure 2.4.2. The efficiency starts at a medium value ($\sim 60\%$), rises to a slight maximum between 10° and 40° , then levels off before a peak at $70^\circ - 80^\circ$ before noon. (Closer inspection of these peaks shows that the $70^\circ - 80^\circ$ peak is made mainly from eclipses whose magnitude is greater than 70% , while the $80^\circ - 90^\circ$ peak is one eclipse out of one). Inspection of the efficiency of observed eclipses with magnitudes less than 50% would probably yield more valid results.

Figure 2.4.3. This graph shows the number of eclipses with magnitude less than 50% that were observed. These all show the decreasing trend with increasing altitude. The efficiency of the small eclipses with respect to the total number of eclipses that occurred (Figure 2.4.4) does not show the expected decrease in much detail, although we observe the slight dip at sunrise and sunset and the expected dip at high altitudes (excluding the $80^\circ - 90^\circ$ peak). On average the efficiency between 10% & 40% magnitude is higher than that between 40% and 70% magnitude. The efficiency of eclipses $< 50\%$ magnitude observed with respect to eclipses $< 50\%$ magnitude occurred shows the characteristics we expected, with only a slight aberration on the after noon side.

For Korea, (Figure 2.4.5) the numbers involved are much smaller so the variations from the expected trends will be much larger than for China.

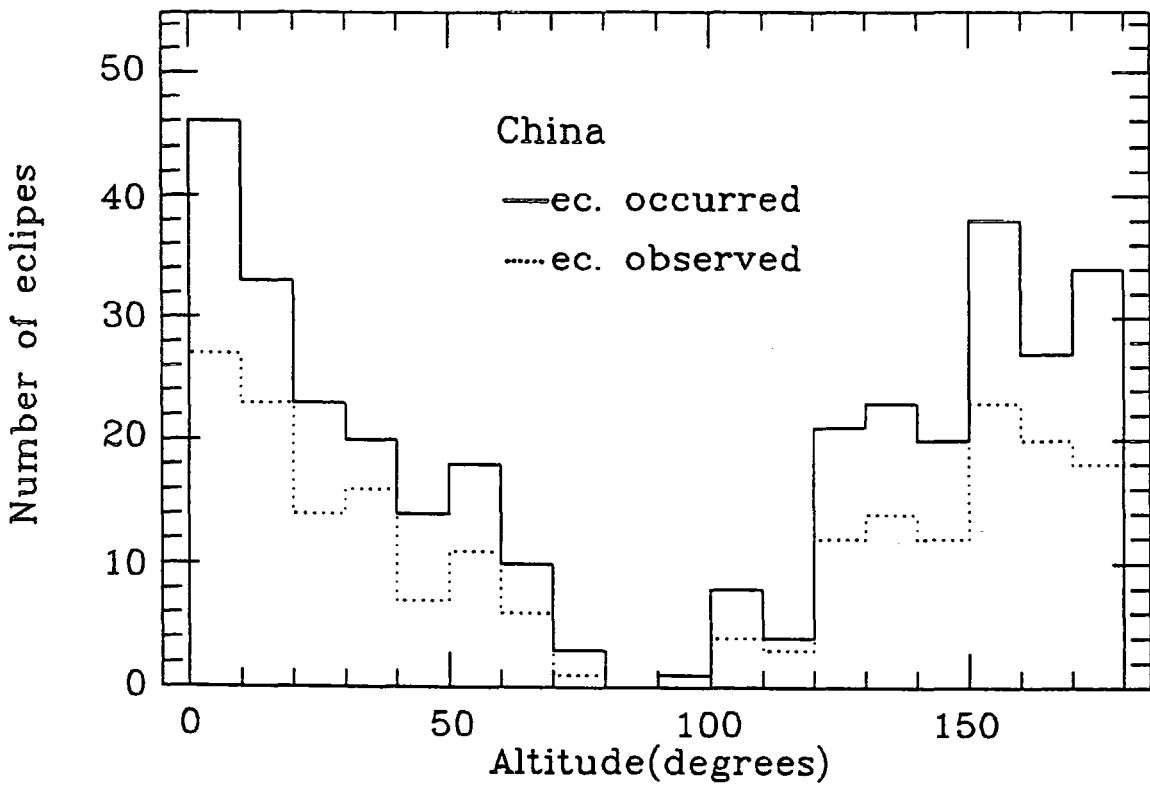


Figure 2.4.3: Number of eclipses occurring less than 50% in magnitude and number of eclipses observed less than 50% in magnitude by altitude for China

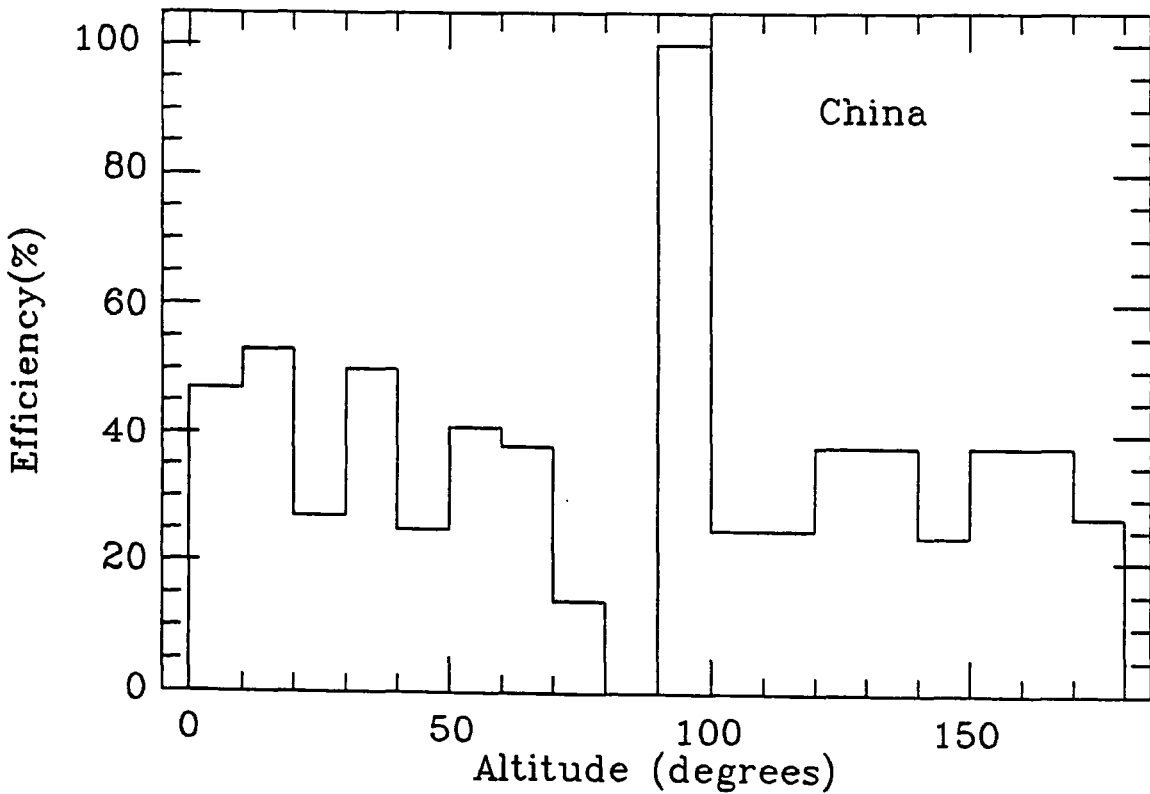


Figure 2.4.4: Efficiency of observations of eclipses less than 50% in magnitude by altitude for China

There is a decrease in the number of eclipses occurring with increasing altitude but there is a peak at the $20^\circ - 40^\circ$ mark. The efficiency (Figure 2.4.6) increases as altitude increases for before noon (reaching 100% for the $70^\circ - 80^\circ$ bin, but this is again 1 eclipse out of one), and the efficiency increases with decreasing altitude after noon, behaving as we would expect it to.

Figure 2.4.7, showing the number of eclipses that occurred with magnitude $< 50\%$ and the number of eclipses observed with magnitude $< 50\%$ for Korea, displays the same trend i.e. the decrease in eclipses occurring with increasing altitude etc., and the efficiency (Figure 2.4.8) also follows the previous pattern, although the $60^\circ - 80^\circ$ efficiency of 100% is three eclipses out of three.

Figures 2.4.9 and 2.4.10 show the same previous information about the Korean eclipse variations with altitude, except in 15° bins, in an attempt to smooth out the rough variations, especially in the efficiency plots. Figure 2.4.9 shows the number of eclipses $< 50\%$ magnitude occurring and observed (also $< 50\%$ magnitude) in Korea in 15° bins, again displaying the decrease in the number of eclipses with increasing altitude. The efficiency, Figure 2.4.10, shows the expected variation after noon although the pre-noon efficiency is not quite so obvious. The 100% efficiency peak at $60^\circ - 70^\circ$ is still three eclipses out of three.

The number of eclipses occurring before noon in China is 262 while

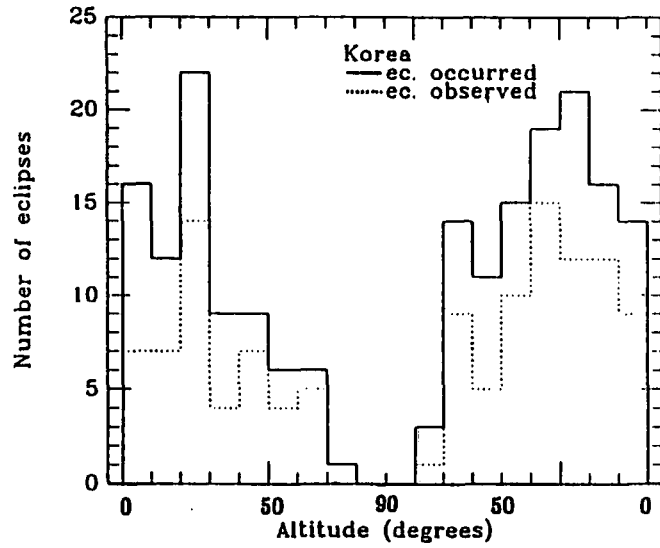


Figure 2.4.5

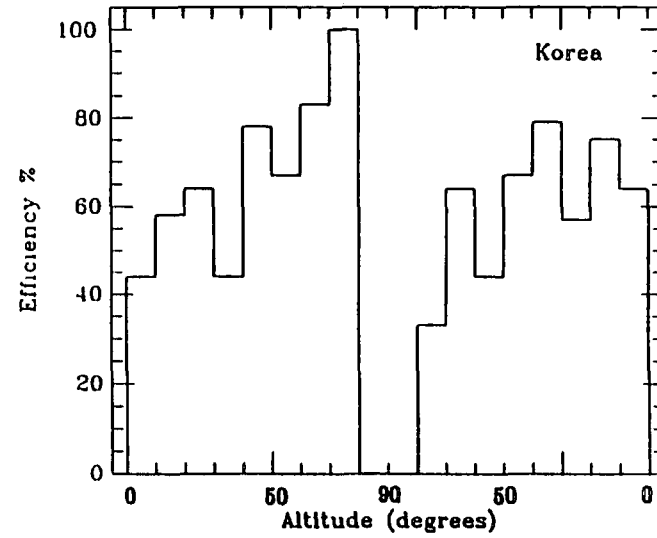


Figure 2.4.6

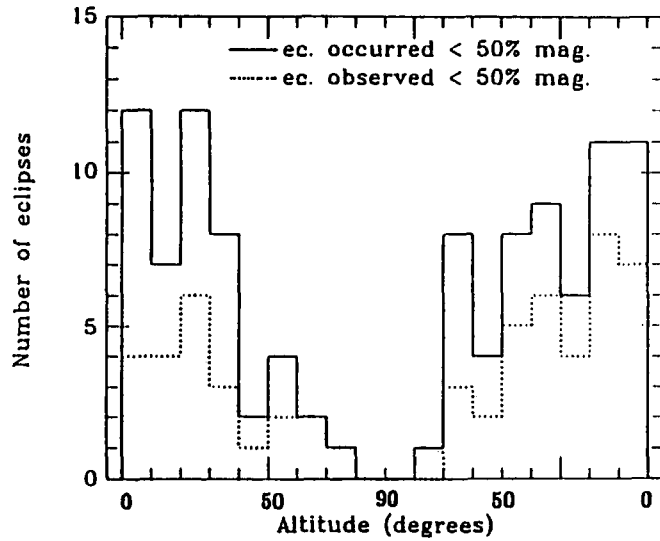


Figure 2.4.7

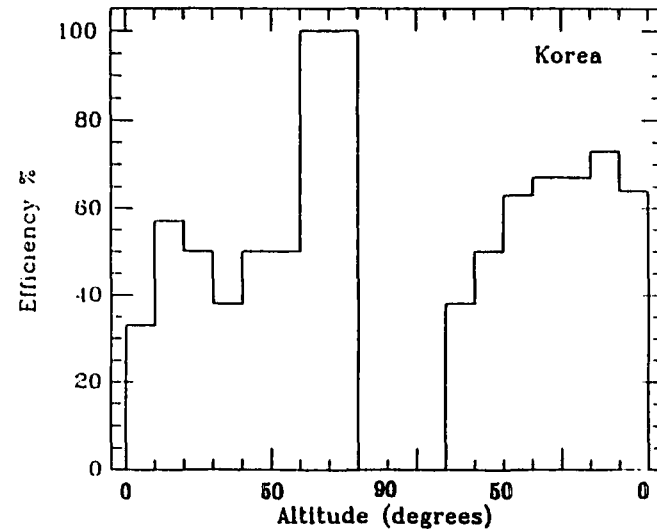


Figure 2.4.8

Figures 2.4.5 to 2.4.8 show the number of eclipses occurring and observed in Korea by altitude and the number of eclipses < 50% in magnitude occurring and observed in Korea, and their efficiencies

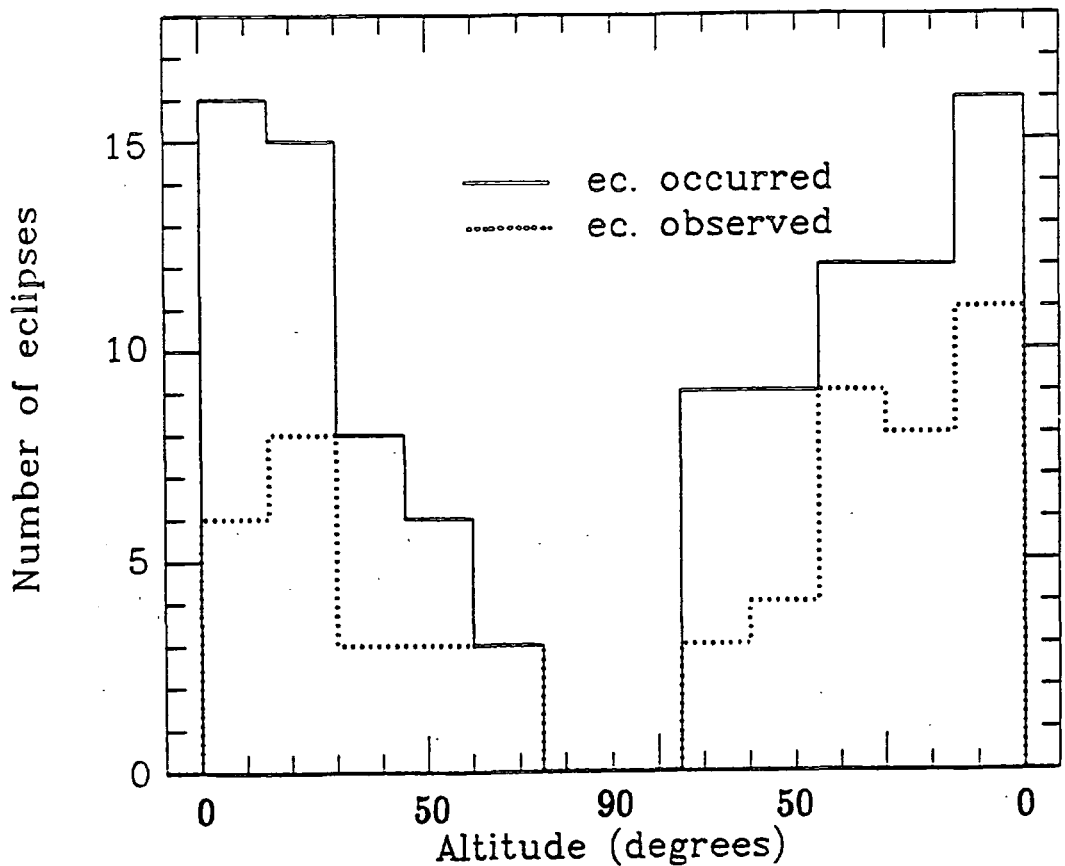


Figure 2.4.9: Number of eclipses observed and occurred by altitude for Korea in 15 bins.

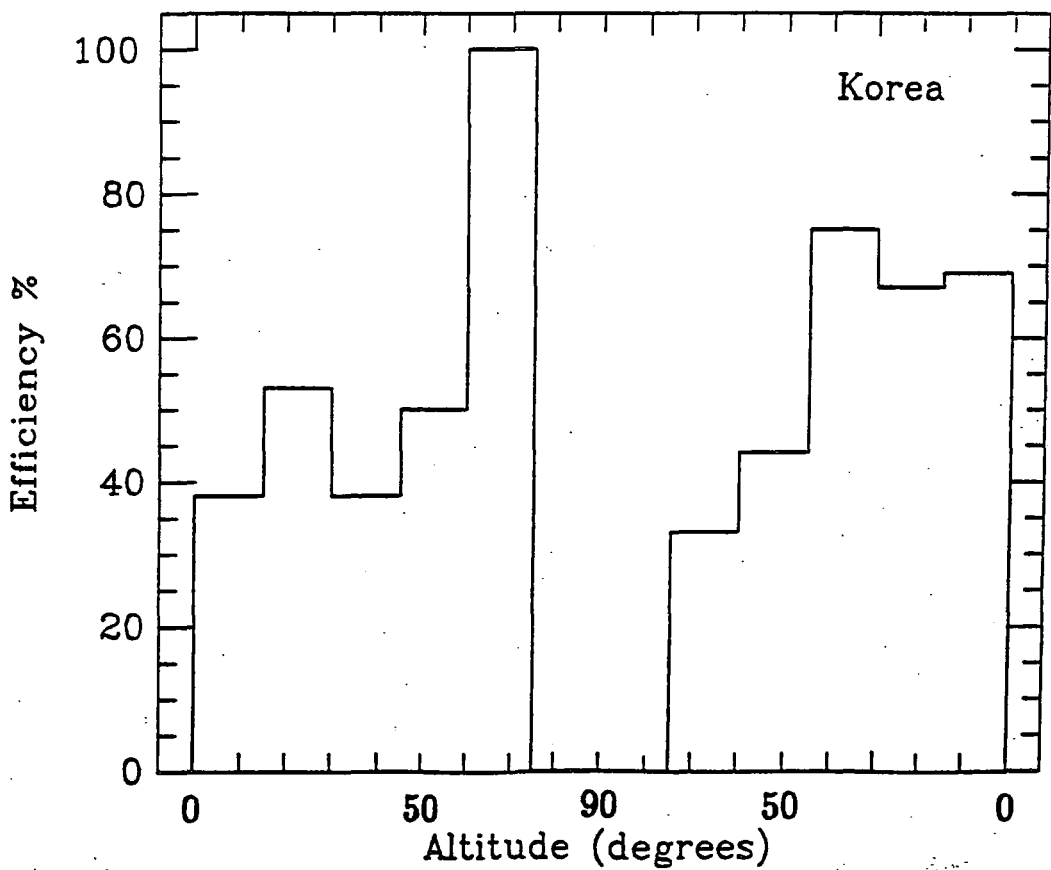


Figure 2.4.10: Efficiency of eclipse observation of eclipses less than 50% magnitude by altitude for Korea in 15° bins

Time	Korea eclipse mag. %	Total	Prob. visible
12:01–12:15 p.m.	96 93 82 76 70 66 13 11	9	7
12:16–12:30 p.m.	93 79 49 16 6 1	6	2
12:31–12:45 p.m.	79 77 39	3	2
		18	11

Table 2.4: Eclipse occurrences around noon, Korea

Time	China eclipse mag. %	Total	Prob. visible
12:01–12:15 p.m.	93 92 88 82 82 65 52 51 48 37 22 18 16 1	15	10
12:16–12:30 p.m.	95 90 85 62 61 59 59 50 50 35 27 19 12 2	14	9
12:31–12:45 p.m.	94 92 74 66 48 16 16 4	9	4
12:50 p.m.	94	1	1
		39	24

Table 2.5: Eclipse occurrences around noon, China

the number occurring after noon is 327. For Korea, the number occurring before noon is 81 and the number occurring after noon is 113. In both cases, this is a variation of $\sim 10\%$, or 1σ from an average. This may be due to the fact that eclipses whose maxima are reached after (but around) the noon hour should usually be observable before noon. Hence, although we record them as occurring after noon, they were probably visible before noon, thus evening out the variation.

Looking at the Korean eclipses we find that there are at least 11 eclipses whose maxima occurred after noon but who should have been visible before

noon. For China we find 24 eclipses with a similar characteristic. Thus the variation becomes: Korea, 92 before noon, 102 after noon, and China, 286 before noon and 295 after noon. These are much smaller variations, $\sim 2\%$, and well within acceptable statistical variations.

2.5 Seasonal variation of sunspots and eclipses.

Examination of Chinese and Korean sunspot records [Yau & Stephenson (1988), Willis *et al* (1980) and Willis *et al* (1988)] provides evidence that there is a seasonal variation in the sunspot records. Since over the long term, sunspots should occur with an even distribution throughout the year, this implies the seasonal variation is due to the observers and the observing conditions. It was proposed in Willis *et al* (1980) and Willis *et al* (1988) that this is due to climatic conditions. In Spring a haze is produced by loess dust thrown up into the atmosphere by winter storms. This reduces the glare of the sun, making more visible small features on the sun's surface which would not otherwise be seen. In Summer, the rainy season causes the sky to be often filled with clouds, thus reducing the number of opportunities when the sun is visible, and also washing the dust particles out of the atmosphere, and so increasing the glare of the sun. The result is a spring maximum and a summer minimum in sunspot observation, shown in Figure 2.5.1.

Seasonal variation of eclipses.

Small eclipses have some of the characteristics of sunspots. They are

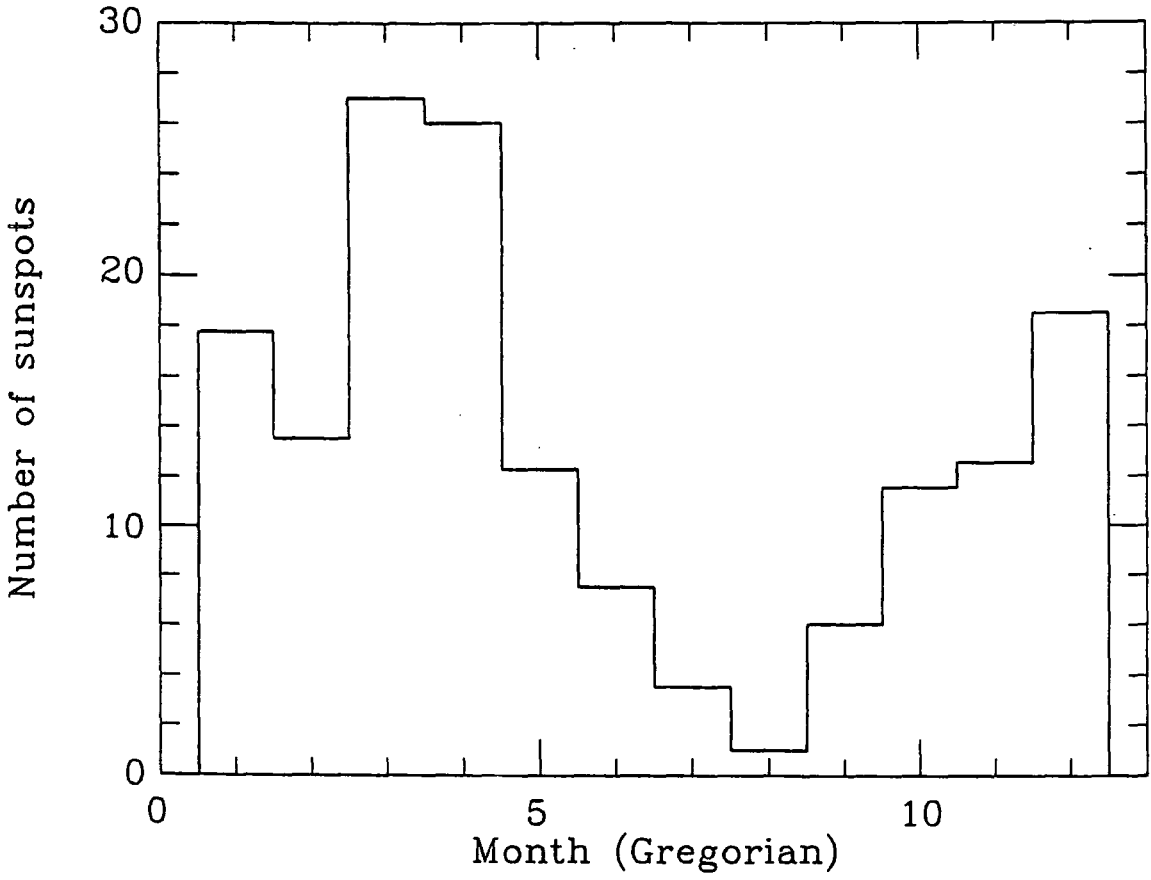


Figure 2.5.1: Seasonal variation of sunspots for China and Korea.

slight disturbances in the sun's luminosity and do not affect the brightness of the sun as seen from the Earth. Eclipses of up to about 50% magnitude may mimic sunspot behaviour in this way. Being small, they are not readily visible to the naked eye, but they may become more obvious under the same climatic conditions as the sunspots. Hence we shall examine the eclipse records for a similar seasonal variation.

The number of eclipses which were observed in China were counted and split into Gregorian monthly bins. The number of eclipses which actually occurred were similarly counted and the efficiency for each month was calculated. The number of eclipses with magnitude $< 50\%$ which were observed were counted and the efficiency for small eclipses was calculated. The results are shown in Figures 2.5.2 and 2.5.3.

Climatic variations at capital locations in China.

Nanking & Lin-an	Hot summer with a marked summer maximum of rainfall.
Ch'ang-an	A region known for humidity and mistiness
Peking	Summer rains are torrential. The biting north and north-west winds descend in winter onto the plain from the loess region and are often heavily dust laden.
Lo-yang & K'ai-feng	Heavy dust storms. There is a marked summer maximum of rainfall but it is sparse and very variable and prone to cloudburst. In years of drought the dust storms in summer are worse even than those in winter.

(From "A Geography of China" by T.R.Treagar)

As expected there is a maximum in the number of eclipses occurring during the summer and a minimum in the number of eclipses occurring

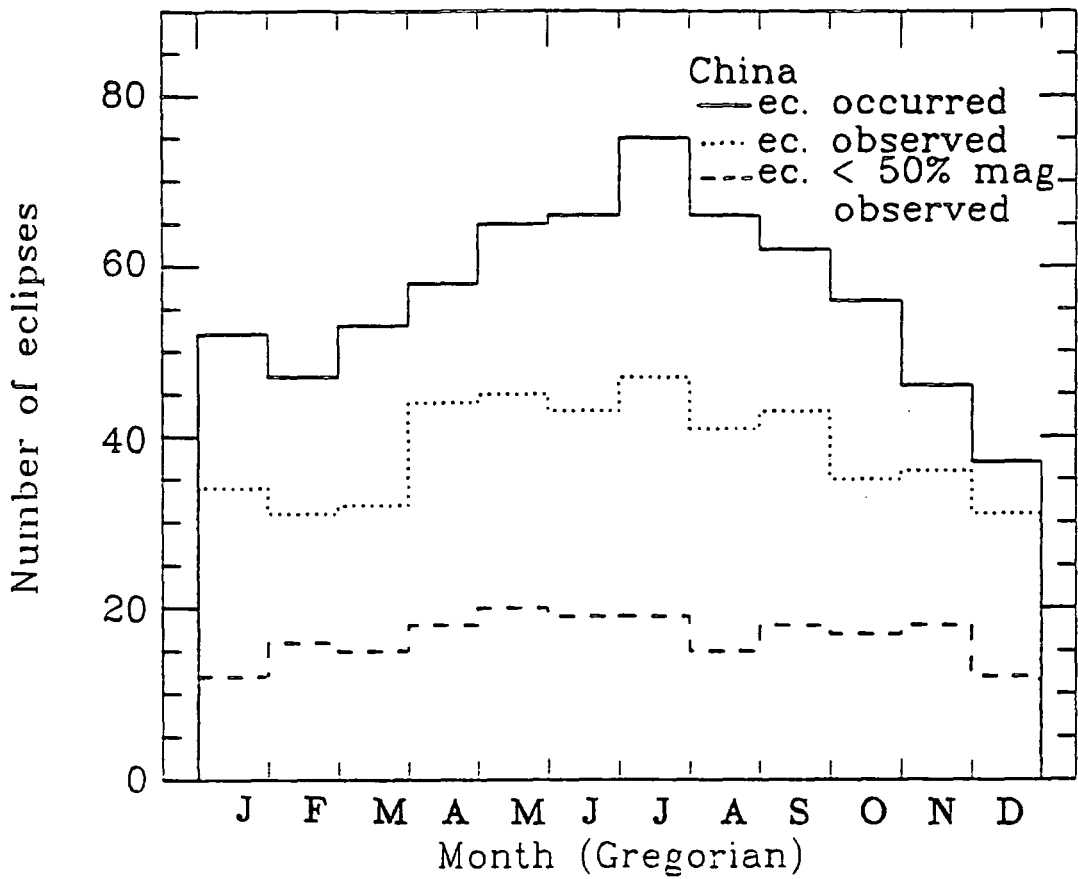


Figure 2.5.2: Seasonal variations (by Gregorian month) of eclipses which occurred, eclipses which were observed, and eclipses < 50% magnitude which were observed, for China.

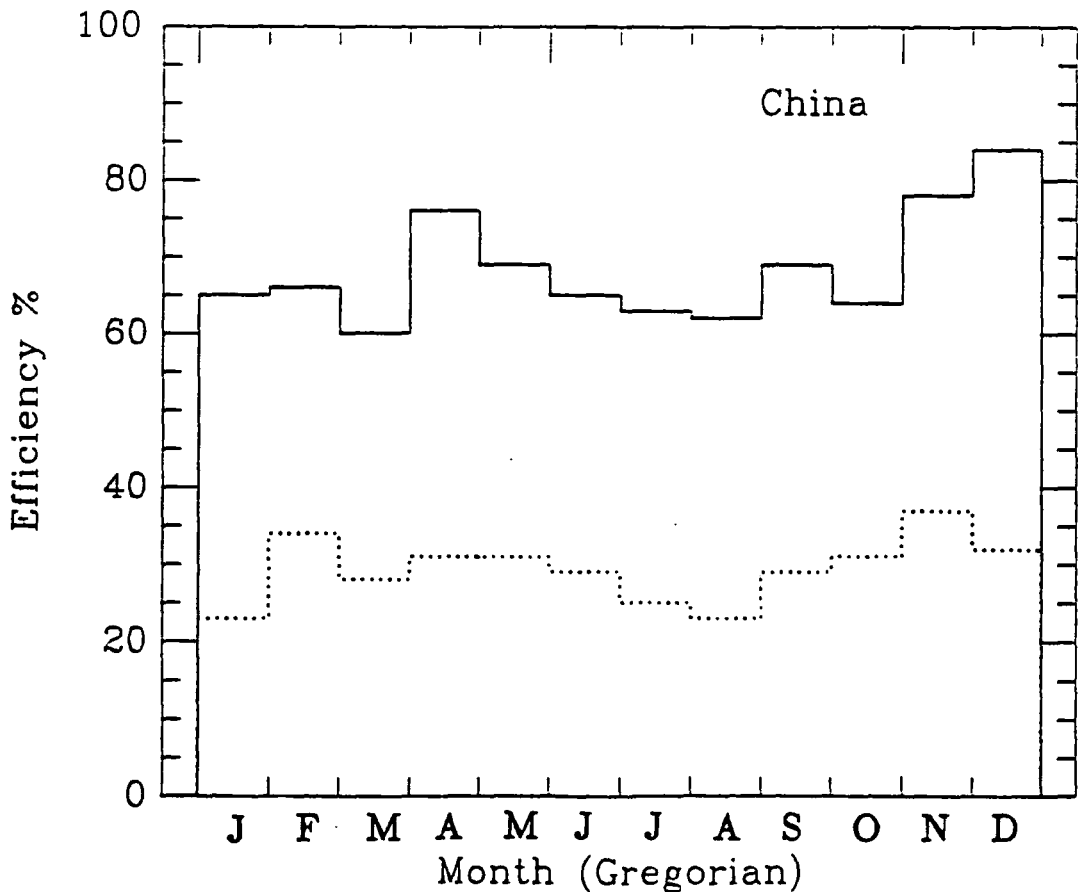


Figure 2.5.3: Efficiency of observation (by Gregorian month) of eclipses. The continuous line indicates all eclipses and the dotted line indicates eclipses < 50% magnitude, for China.

during the winter. This can be attributed solely to the number of daylight hours available for the sun to be eclipsed in. (When we normalise the figures to a standard 12 hours of daylight all year round, we find that the maximum and minimum disappear from the number of eclipses occurring). We might expect to see a spring maximum and a summer minimum in the efficiencies but this is not evident. There is no obvious trend in the data for either all eclipses or just the eclipses $< 50\%$ in magnitude. Using the χ -squared test, no statistical significance for the data was found.

For Korea, the number of eclipses observed is much lower: 149 for Korea and 500 for China. Also the timespan over which these eclipses were recorded is much smaller. Hence we do not expect to see a very obvious summer maximum/winter minimum for the number of eclipses occurring, however the figures are statistically acceptable. Examination of the efficiency of all the eclipses again (Figures 2.5.4 and 2.5.5), does not give any statistical significance although there does appear to be a late spring/early summer maximum and an autumn minimum. The small eclipse efficiency does display a significant (using the χ -squared test) late spring maximum and autumn minimum.

The Chinese records are from many capitals and hence from different regions of China. The climate of China varies appreciably from region to region, thus the different climates tend to obscure any information which may be obtained from the graph. It becomes necessary to subdivide the

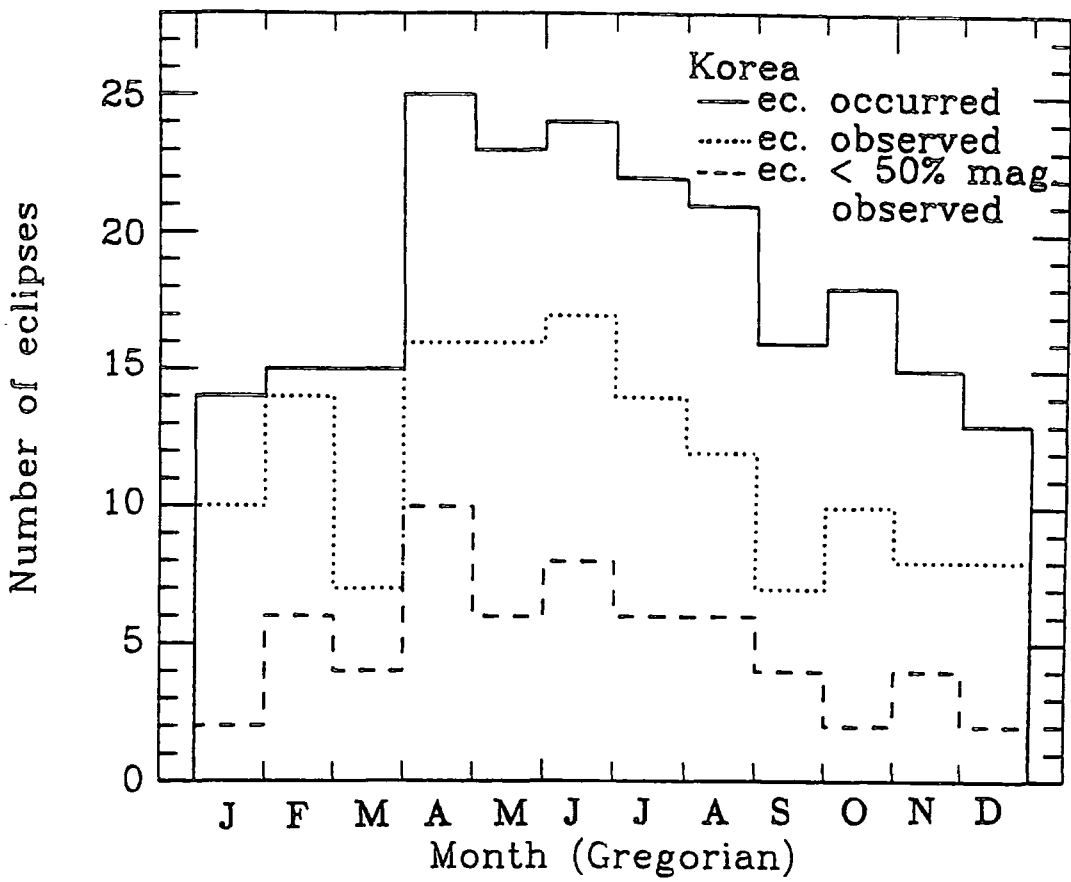


Figure 2.5.4: Seasonal variations (by Gregorian month) of eclipses which occurred, eclipses which were observed, and eclipses < 50% magnitude which were observed, for Korea.

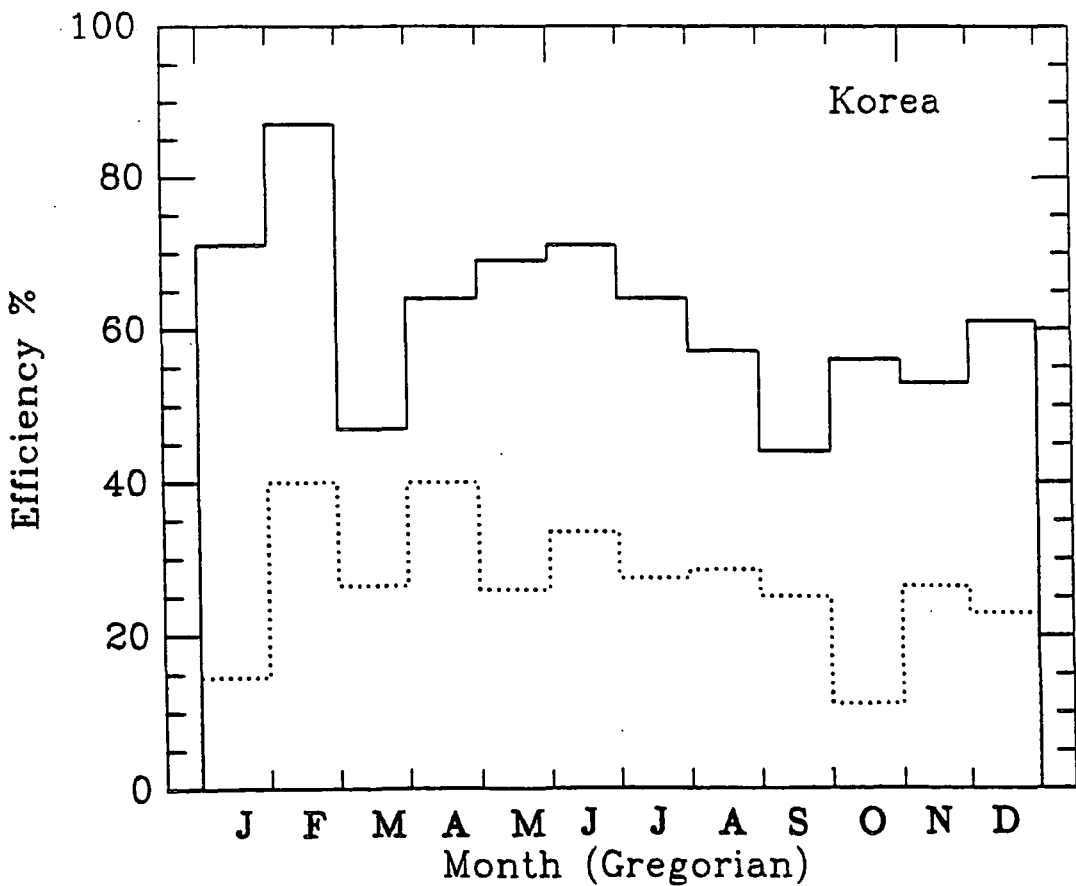


Figure 2.5.5: Efficiency of observation (by Gregorian month) of eclipses. The continuous line indicates all eclipses and the dotted line indicates eclipses < 50% magnitude, for Korea.

Chinese records by dynasty and capital. The Korean records however, are all from the same location (to within a few degrees) and from a fairly short timespan (with regard to climatic changes). The significance of the Korean small eclipse variation is 99% i.e. the likelihood that the variation is due to chance is 1%.

By the same token, the sunspot records can be split up by capital for further examination. The records were written at the same places as the eclipse records, but there are fewer, and there are also more gaps in the records (from 580 A.D. to 826 A.D.) owing to their possible destruction during An Lu-shan's rebellion in 760 A.D. Consequently, there are only enough sunspots recorded at Nanking, Lin-an and Peking to yield any valid information to inspection.

Examination of seasonal variation in eclipse records by capital.

Figure 2.5.6: There is no significant seasonal variation in efficiencies for Ch'ang-an. However, this data is for two dynasties, separated by ~ 1000 years, so this was split up into the Former Han only (Figure 2.5.7) and the T'ang only (Figure 2.5.8). There is still no significance in the T'ang efficiencies but the efficiencies for the Former Han appear to have a spring maximum/summer minimum for eclipses less than 50% magnitude. However at this subdivision there is insufficient data for a full statistical analysis.

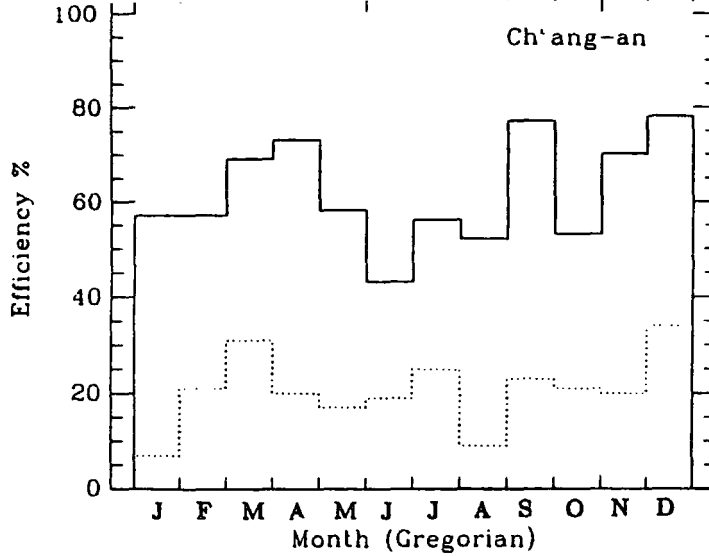


Figure 2.5.6: Capital: Ch'ang-an
From 204 B.C. to 24 A.D.: Former Han Dynasty
and 618 A.D. to 906 A.D.:T'ang Dynasty.

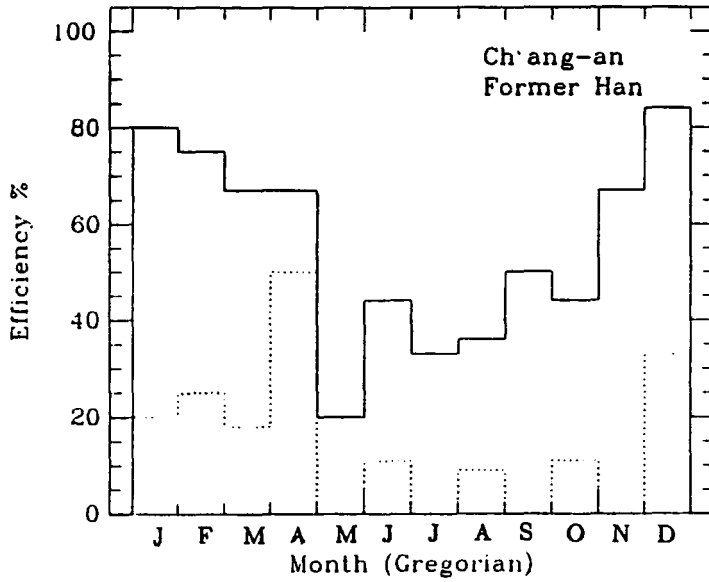


Figure 2.5.7: Capital: Ch'ang-an
From 204 B.C. to 24 A.D.: Former Han Dynasty only.

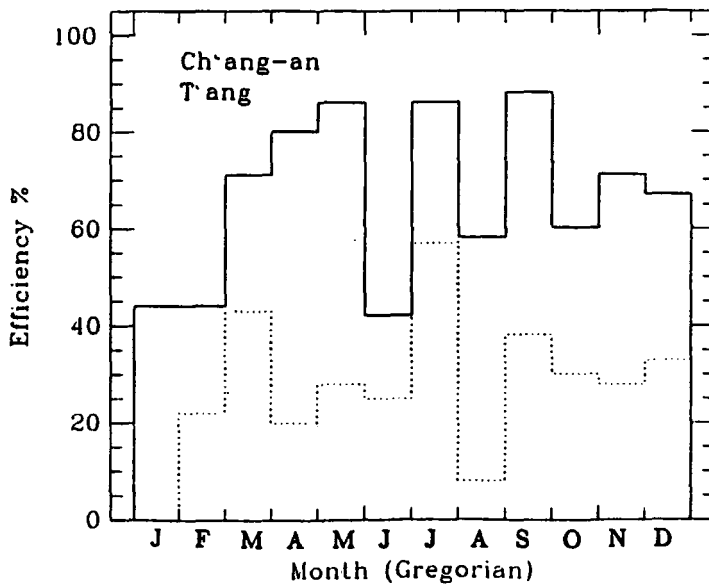


Figure 2.5.8: Capital: Ch'ang-an
From 618 A.D. to 906 A.D.: T'ang Dynasty only.

Figures 2.5.6 - 2.5.8: Efficiency of observation by Gregorian month. The continuous line indicates all eclipses and the dotted line indicates eclipses < 50% in magnitude for Ch'ang-an at different epochs.

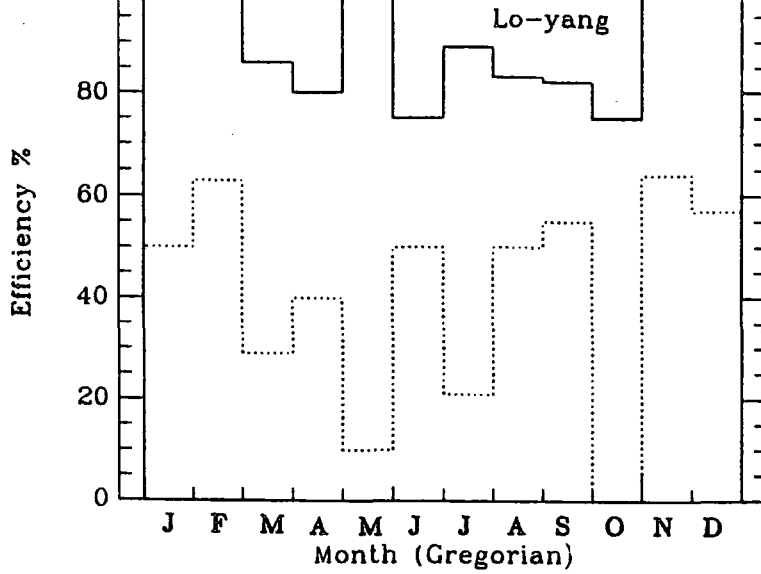


Figure 2.5.9: Capital: Lo-yang From 24 A.D. to 309 A.D.: Later Han Dynasty and 925 A.D. to 957 A.D.: Five Dynasties period.

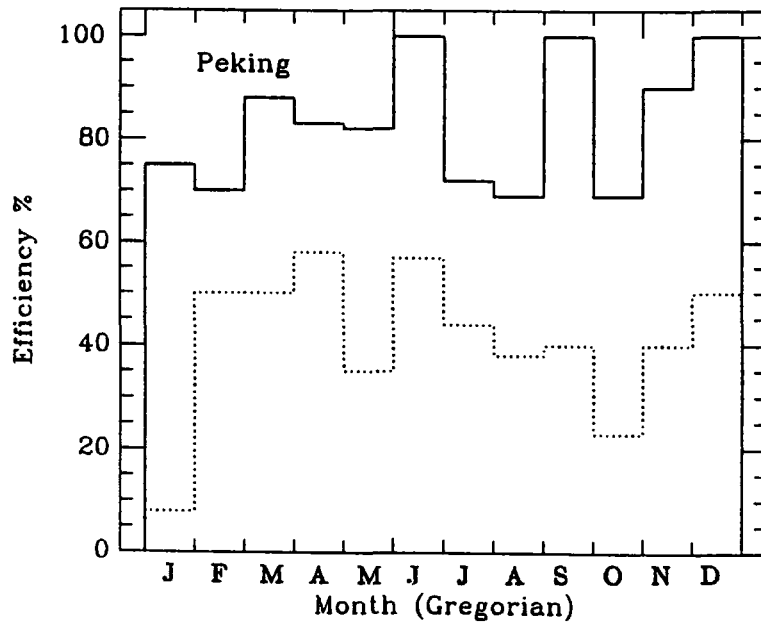


Figure 2.5.10: Capital: Peking From 1087 A.D. to 1367 A.D.: Kin and Yuan Dynasties and 1421 A.D. to 1621 A.D.: Ming Dynasty.

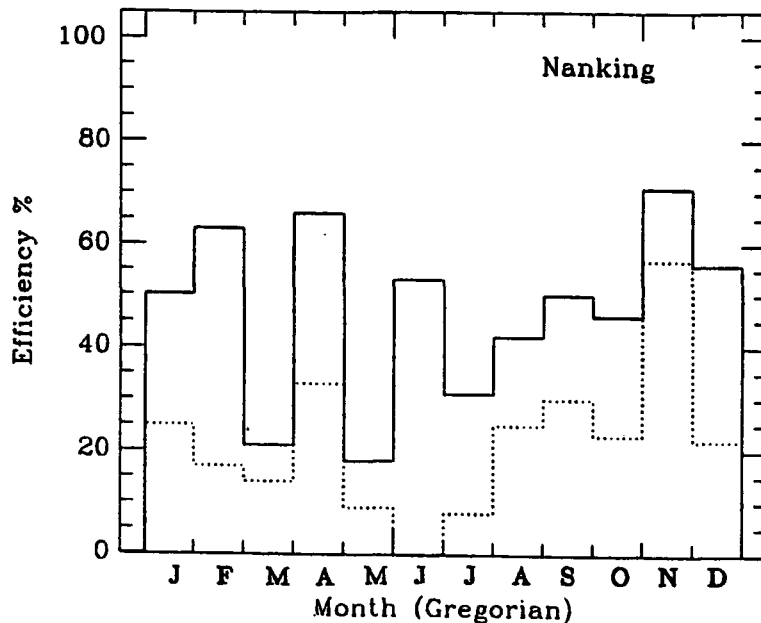


Figure 2.5.11: Capital: Nanking From 309 A.D. to 588 A.D.: Eastern Tsin, Northern Wei, Eastern Wei, Liang, Cheng, Northern Chi and Sui Dynasties and 1367 A.D. to 1421 A.D.: Yuan Dynasty.

Figures 2.5.9 to 2.5.11 show the seasonal variations (by Gregorian month) of the eclipse efficiencies for specific Chinese capitals. The continuous line represents all eclipses and the dotted line represents eclipses with magnitudes < 50%

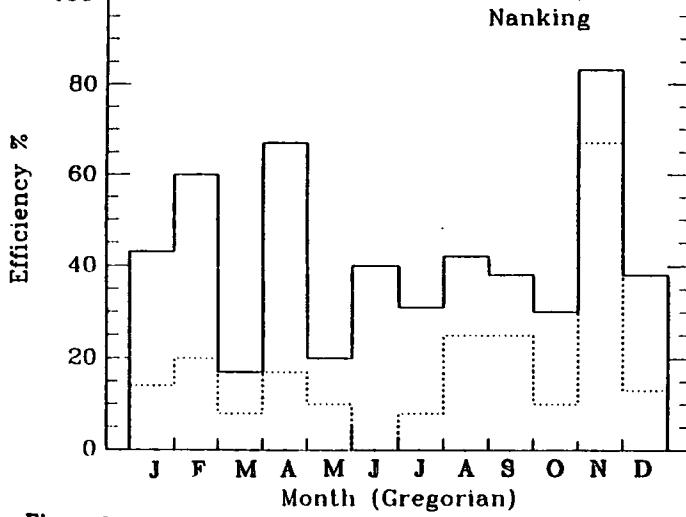


Figure 2.5.12: Capital: Nanking From 309 A.D. to 588 A.D.: Eastern Tsin, Northern Wei, Eastern Wei, Liang, Cheng, Northern Chi and Sui Dynasties only.

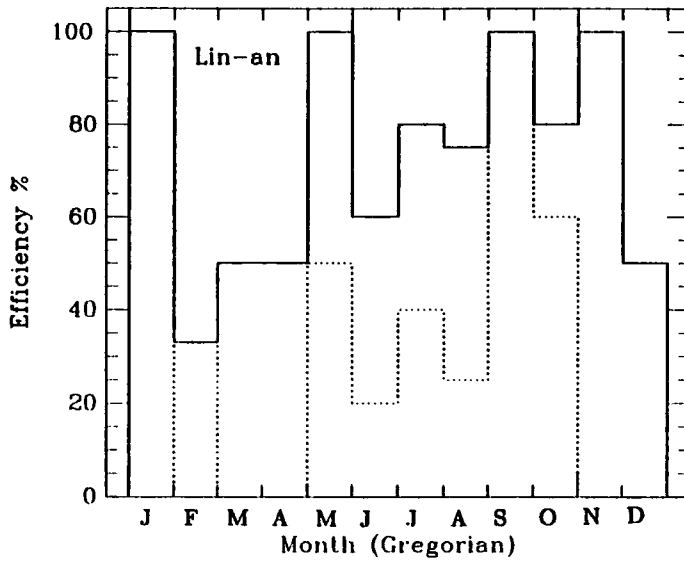


Figure 2.5.13: Capital: Lin-an From 1129 A.D. to 1279 A.D.: Southern Sung Dynasty.

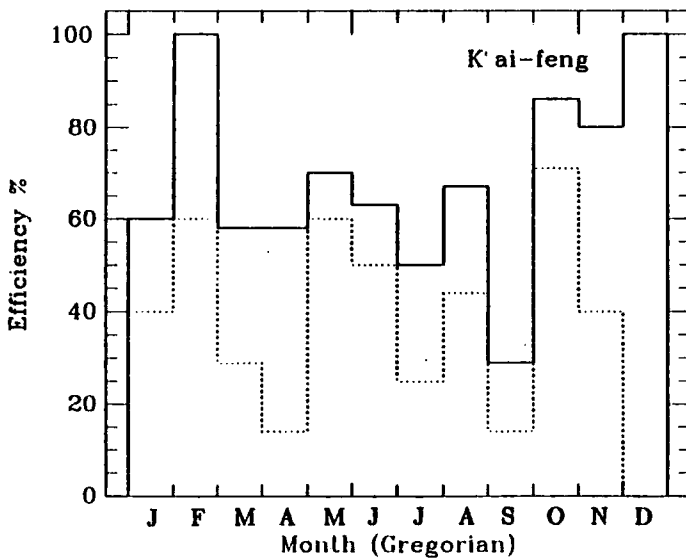


Figure 2.5.14: Capital: K'ai-feng From 904 A.D. to 1127 A.D.: Five Dynasties and Northern Sung Dynasties.

Figures 2.5.12 to 2.5.14 show the seasonal variations (by Gregorian month) of the eclipse efficiencies for specific Chinese capitals. The continuous line represents all eclipses and the dotted line represents eclipses with magnitudes < 50%

For Lo-yang (Figure 2.5.9), there is no significance in the variations of the efficiencies, nor for the efficiencies for all eclipses in Peking, Nanking, Lin-an or K'ai-feng, shown in Figures 2.5.10, 11, 12, 13 and 14. For the small eclipses, there is a very slight variation in Peking, but nothing of significance. For Nanking, the small eclipse variation has a spring maximum, a summer minimum and a winter maximum. The figures for Nanking come from a period of turbulence spanning the 4th to 7th century and the Ming dynasty from 1367 A.D. to 1421 A.D. If we examine the records for Nanking excluding those from the later Ming dynasty (Figure 2.5.12), we again find an apparent summer minimum, slight spring maximum and a winter maximum (which is mainly concentrated around a peak in November. Unfortunately there are insufficient numbers for a statistical test. There is no evident seasonal variation in the efficiency of all eclipses for this section of Nankings records. There is also no variation in the efficiency of eclipses < 50% magnitude for Lin-an and K'ai-feng.

Figure 2.5.15 shows a further subdivision of the seasonal variation of eclipse records for Korea. The number of eclipses which occurred with

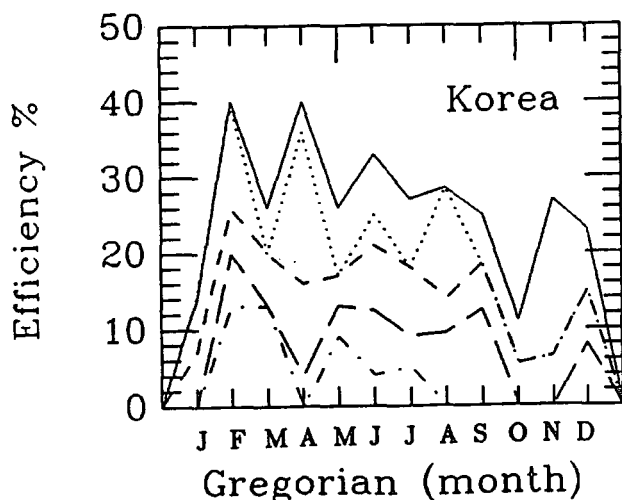


Figure 2.5.15: Number of eclipses observed in Korea per Gregorian month for magnitudes less than 50%, 40%, 30%, 20%, and 10%. The continuous line indicates eclipses < 50%, the dotted line indicates eclipses < 40%, the shorted dashed line < 30%, the long dashed line < 20% and the dashed and dotted line < 10%.

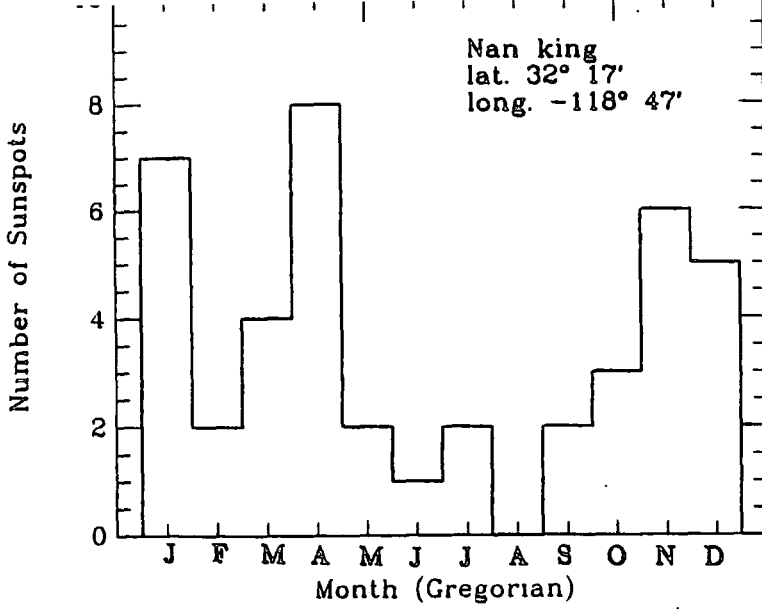


Figure 2.5.16: Seasonal sunspot variations (by Gregorian month) for Nanking

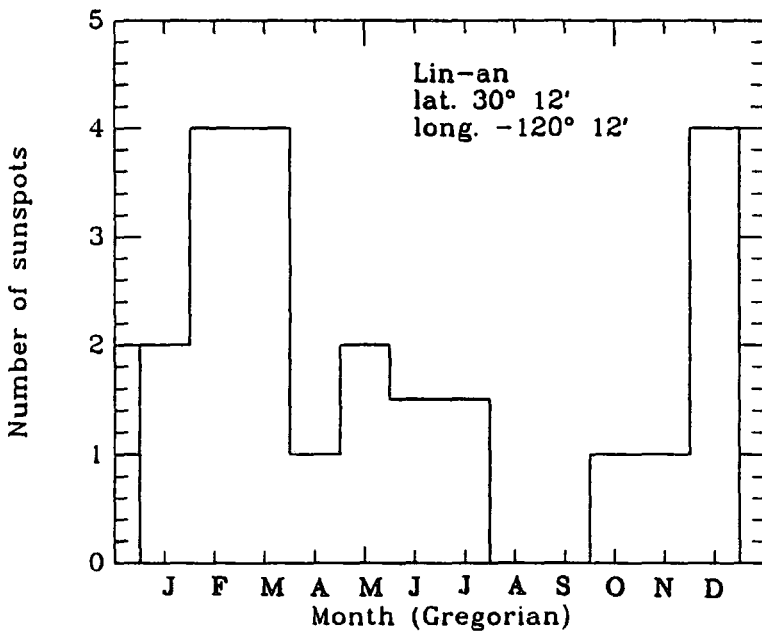


Figure 2.5.17: Seasonal sunspot variations (by Gregorian month) for Lin-an

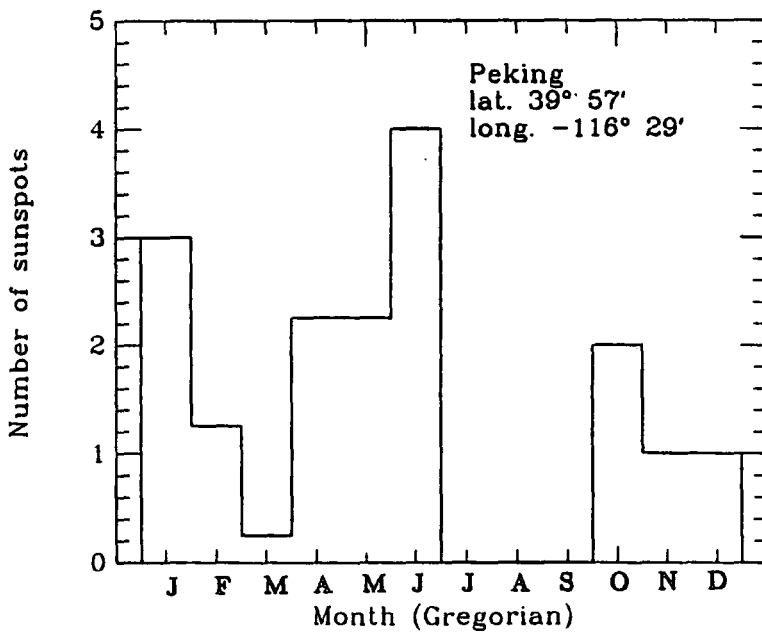


Figure 2.5.18: Seasonal sunspot variations (by Gregorian month) for Peking

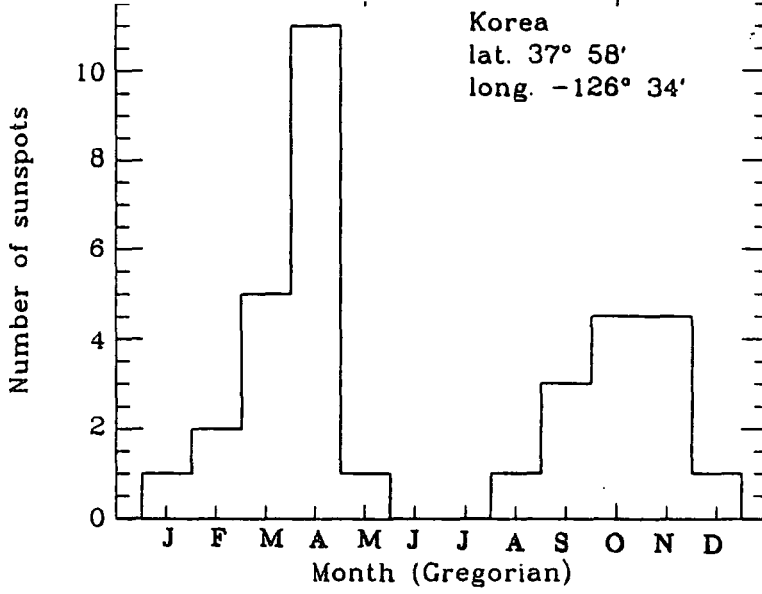


Figure 2.5.19: Seasonal sunspot variations (by Gregorian month) for Korea

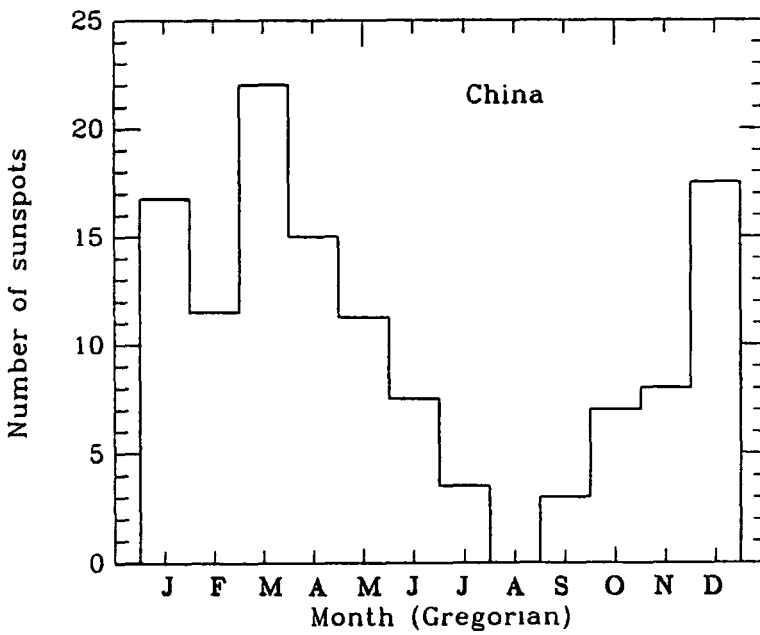


Figure 2.5.20: Seasonal sunspot variations (by Gregorian month) for China

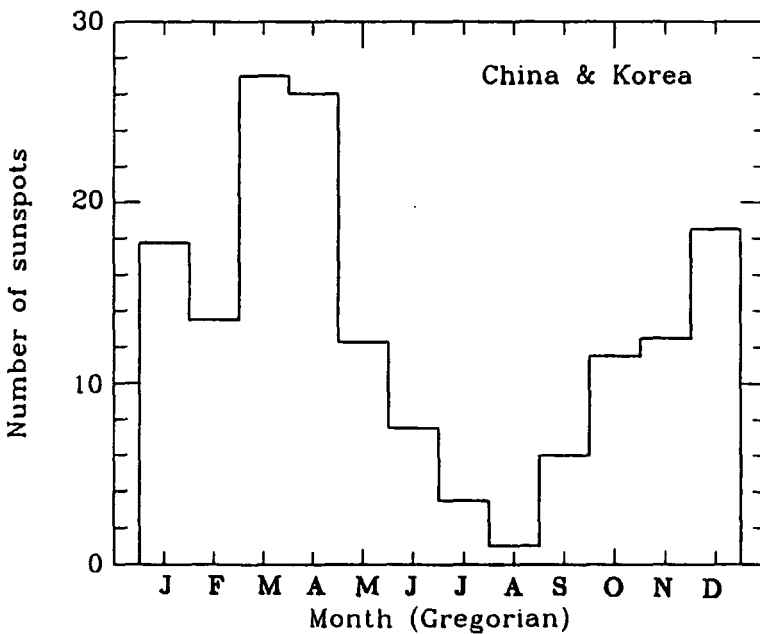


Figure 2.5.21: Seasonal sunspot variations (by Gregorian month) for China and Korea

magnitudes less than 50%, 40%, 30%, 20% and 10% are shown. There does appear to be a maximum towards spring, but again the number of eclipses is too small to be used in a statistical test. This maximum disappears as the number of eclipses sampled gets smaller.

Seasonal variation in sunspot records by capital.

Figure 2.5.16 shows all the sunspot records for Nanking (removing the Ming dynasty leaves very few sunspot records). There is a definite spring maximum and summer minimum, although the minimum does not coincide directly with that of the eclipse records. For Lin-an, Figure 2.5.17 shows a spring maximum and an autumn minimum, and for Peking, Figure 2.5.18 shows a late spring maximum and an autumn minimum.

The sunspots recorded in Korea are shown in Figure 2.5.19. There is a very definite spring maximum and summer minimum. However the minimum in the records ^{of} the small eclipses does not correspond to this minimum, the sunspot minimum being located at June/July and the eclipse minimum being located at August/September.

For all of China, the sunspot records are shown in Figure 2.5.20. The combined capitals give a spring maximum and a summer minimum. When the Chinese and Korean records are combined, as in Figure 2.5.21, we once again observe the spring maximum and the summer minimum. This is significant to 0.5% using the χ -squared test (i.e. it is 0.5% likely due to chance.)

2.6 Correlation between sunspots and eclipse efficiency

We wish to examine the variations in efficiencies of eclipse recording over time and compare them with the number of sunspots recorded over the same period of time, to discover whether there is any correlation between them. If there is a high number of sunspots when there is a high eclipse efficiency, and a low number of sunspots when there is a low efficiency, we can surmise that the two groups of observations are related, and hence conclude that when there is a high efficiency of eclipse observation there will also be a high efficiency of sunspot observation. We do not know the actual number of sunspots that occurred and can only guess that the peaks indicate increases in solar activity. However these peaks may in fact indicate an increase in the efficiency of observing techniques, or a particularly diligent astronomer, and may not be due to any solar activity cycle at all.

Figure 2.6.1. Korea 1000 A.D. to 1600 A.D. The data was divided into 50-year bins and the number of eclipses occurred and the number of eclipses observed in each 50-year bin was counted and the efficiency calculated. The number of sunspot recordings for each 50-year period were counted and marked as dots on the graph. At first glance, one could believe that there is a definite relationship, especially between the small eclipse efficiency and the sunspots. We have a peak in small eclipse efficiency at 1150 – 1200 A.D., 1250 – 1300 A.D., 1350 – 1400 A.D. and 1550 – 1600 A.D. and in

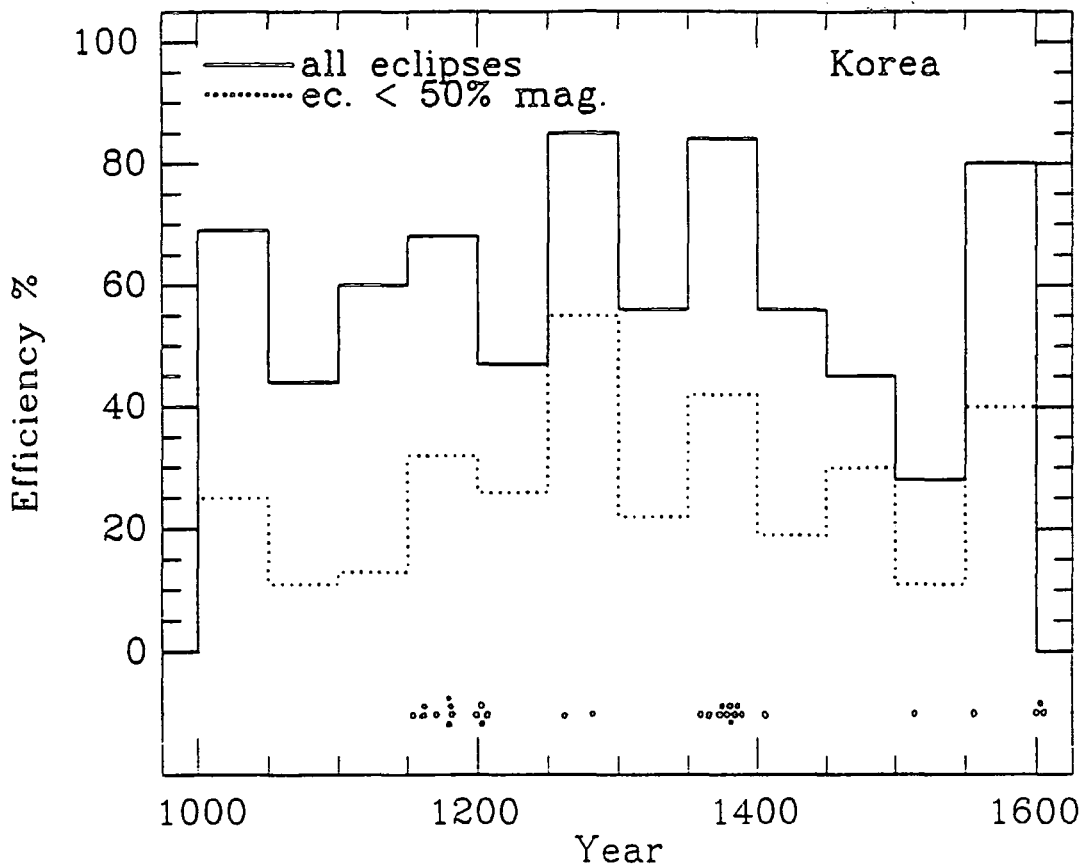


Figure 2.6.1: Efficiency of eclipse observation in Korea by year, from 1001 A.D to 1600 A.D. in 50 year bins. Sunspot records are marked at the appropriate year.

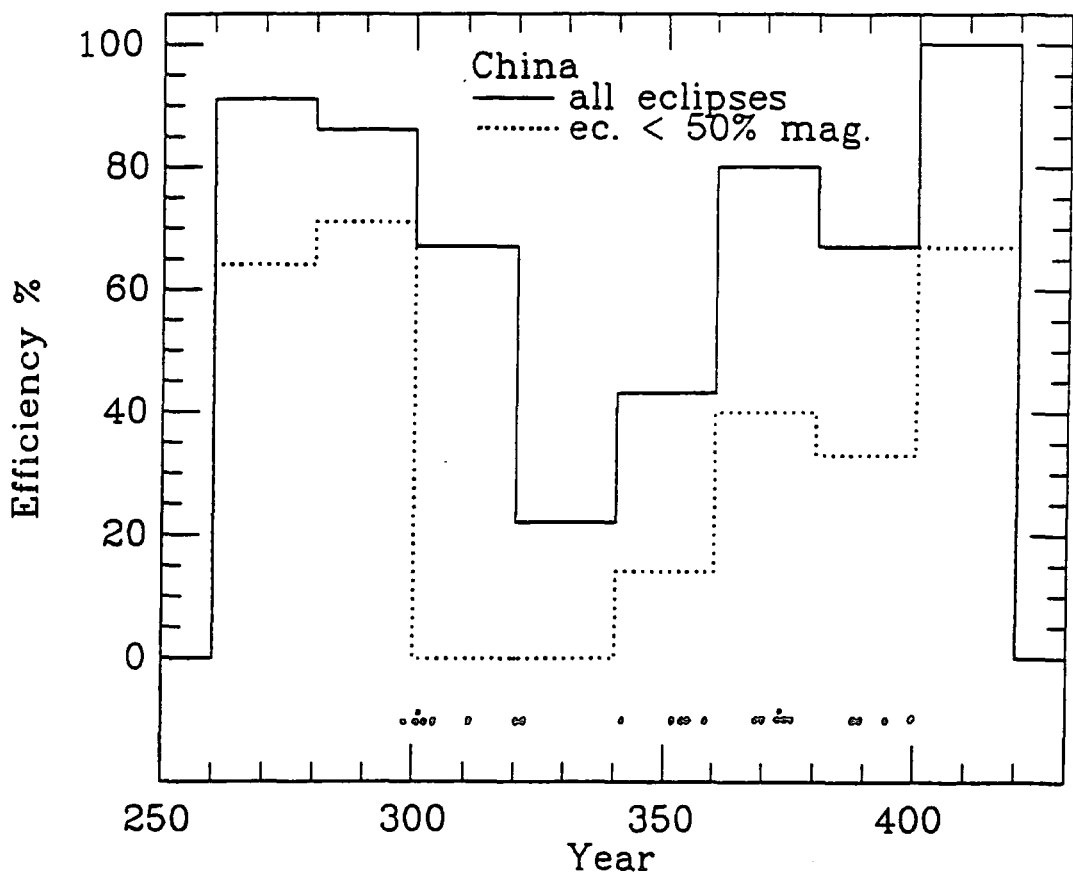


Figure 2.6.2: Efficiency of eclipse observation in China by year, from 260 A.D to 420 A.D. in 20 year bins. Sunspot records are marked at the appropriate year.

sunspot recordings at 1150 – 1200 A.D., 1250 – 1300 A.D., 1350 – 1400 A.D., 1400 – 1450 A.D., 1500 – 1550 A.D. and 1550 – 1600 A.D.

The Chinese sunspot records do not run continuously, there being no records between 580 A.D. and 825 A.D.; presumably they were destroyed in the *An Lu-shan* rebellion of 760 A.D. and the fall of Ch'ang-an in 880 A.D. There are also very few sunspot records before 299 A.D. (only 9 sunspot observations between 165 B.C. & 240 A.D.) and no sunspot observations between 400 A.D. and 499 A.D. Therefore it was decided to split the Chinese records into two groups for examination; one covering the Western and Eastern Tsin dynasties (265 A.D. – 420 A.D.), and the other covering the Northern Sung to Ming^a (950 A.D. to 1450 A.D.)

Figure 2.6.2 shows 260 A.D. – 420 A.D. in China, in 20-year bins. There is a dip in efficiencies from very high for both all and small eclipses at 260 A.D. – 300 A.D., to an efficiency of zero from 300 A.D. – 340 A.D. for small eclipses, and an average efficiency of ~ 30% for all eclipses. This rises to quite high efficiencies from 360 A.D. – 420 A.D. for both all and small eclipses. These variations correspond to those found in Figure 2.3.3. There is no apparent direct correlation between eclipse efficiency and sunspot observation.

Figure 2.6.3 shows 950 A.D. – 1450 A.D. in China, in 50-year bins. There is a slightly better correlation between the small eclipse efficiency and

^auntil 1421 A.D. when the Ming capital moved from K'ai-feng to Peking, there being no Chinese sunspot records between 1384 A.D. & 1562 A.D.

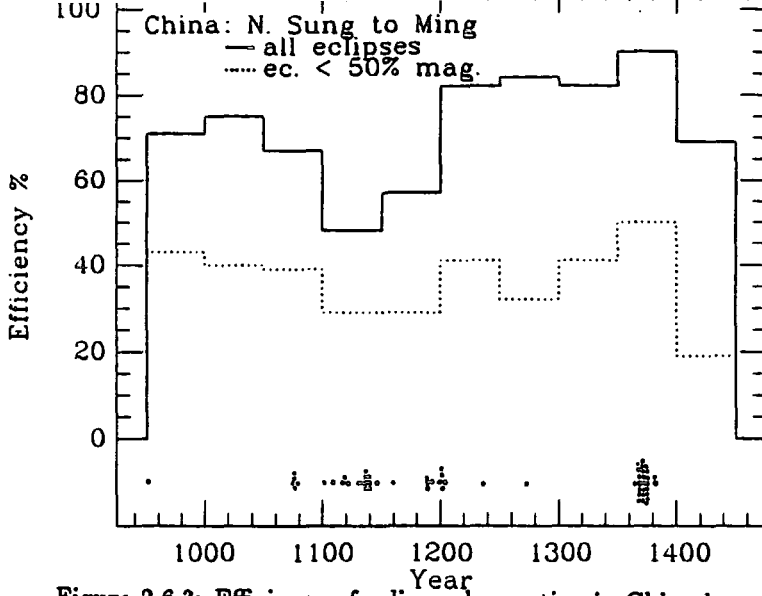


Figure 2.6.3: Efficiency of eclipse observation in China by year, from 1051 A.D to 1450 A.D. in 50 year bins. Sunspot records are marked at the appropriate year.

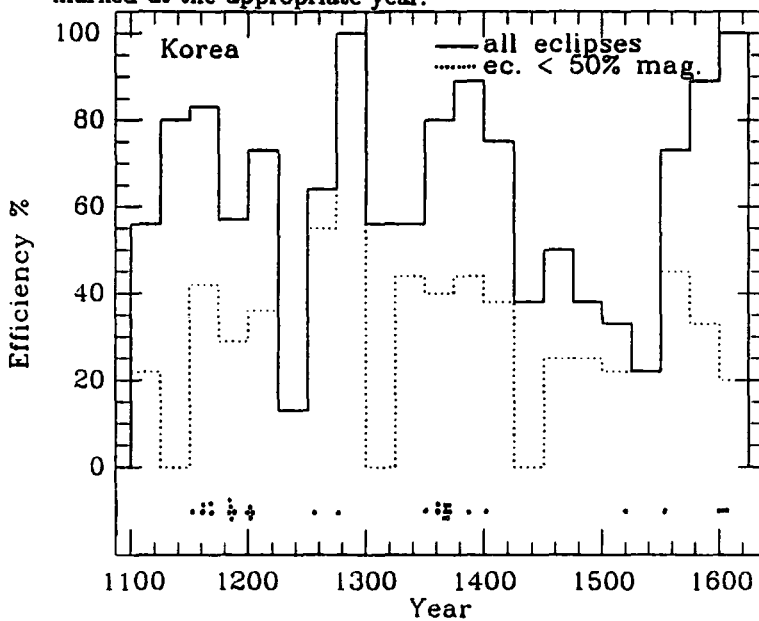


Figure 2.6.4: Efficiency of eclipse observation in Korea by year, from 1051 A.D to 1450 A.D. in 25 year bins. Sunspot records are marked at the appropriate year.

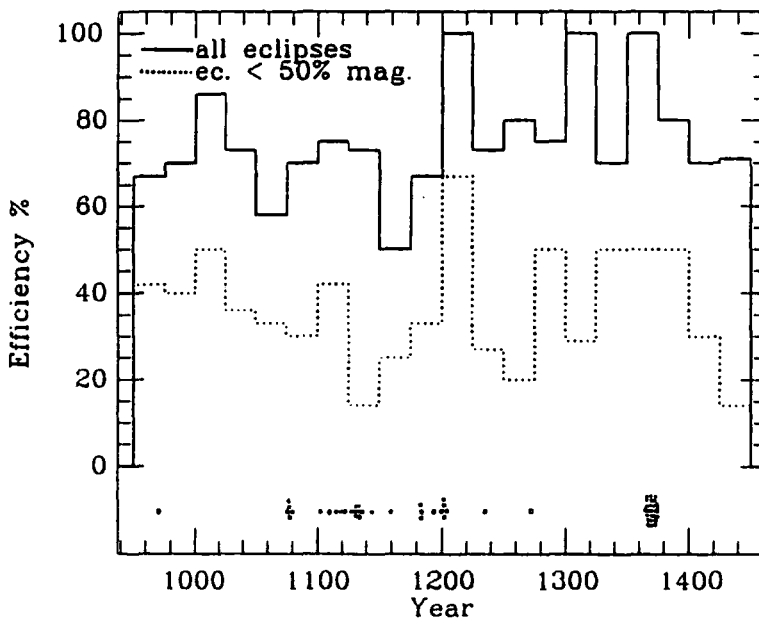


Figure 2.6.5: Efficiency of eclipse observation in China by year, from 1100 A.D to 1625 A.D. in 25 year bins. Sunspot records are marked at the appropriate year.

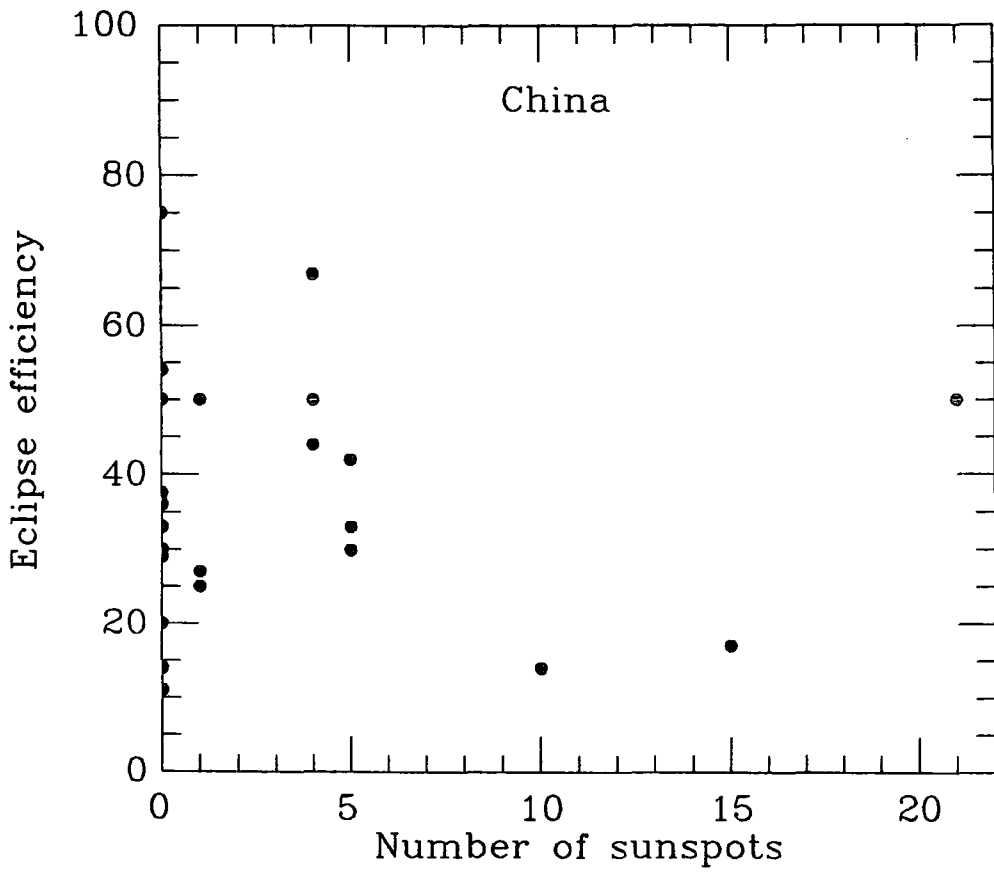


Figure 6.6: Eclipse efficiency versus sunspot number.

sunspot observation. Figure 2.6.4 shows 950 A.D. – 1425 A.D. in China, in 25-year bins. There is nothing statistically significant in the correlations between eclipse efficiency and sunspot observation.

Applying the χ -squared test to the number of sunspots corresponding to the efficiency in each 25 or 50 year bin does not reveal anything of significance for the above situations. Plotting the eclipse efficiency versus the sunspot in each case gives a scattered plot with no obvious direct relationship. A typical scatter plot is shown in Figure 2.6.6, for China. Although there does appear to be a general increasing trend there is no significance whatsoever in this graph.

Figure 2.6.5: This shows 1100 A.D. to 1625 A.D. in Korea, in 25 year bins. There does appear to be some correlation between sunspots and eclipse efficiency, but when one plots these against each other there is still a scatter.

However, if one splits the eclipse efficiencies into two groups, those which exist for a 25 year bin containing zero sunspot records and those which exist for a 25 year bin containing at least one sunspot observation, and examines the average efficiency for each of these two groups, one finds that the average efficiency for the 25 year bins for which sunspots are recorded is much higher than the average efficiency for the 25 year bins for which no sunspots are recorded.

Table 2.6 shows that one is more likely to find a sunspot when there

Average efficiency for	Zero sunspots	At least one sunspot
All eclipses	44.2 %	75.2 %
Eclipses < 50% mag.	18.4 %	42.8 %
Small ec./small ec.	31.5 %	73.3 %

Table 2.6: Eclipse efficiency variations with sunspot number

is a high eclipse efficiency. Examination of the figures for China reveal a similar trend but not to such a dramatic degree.

2.7 Long term variations of sunspot observation

The Korean eclipse records begin in 1009 A.D., therefore we need only consider Korean sunspots from this date onwards. Examination of the sunspot number index derived from precision measurement of tree-ring ^{14}C (Stuiver and Quay, 1980) and occurrence of northern hemisphere auroræ is shown in Figure 2.7.1 (adapted from Eddy, 1988). This has the following features:

	^{14}C	Auroræ
A minimum at	1020 – 1080 A.D.	1020 – 1070 A.D.
	1285 – 1335 A.D.	1210 – 1335 A.D.
	1420 – 1530 A.D.	1338 – 1510 A.D.
A maximum at	1100 – 1170 A.D.	1100 – 1130 A.D.
		1180 A.D.
	1375 A.D.	1330 – 1375 A.D.
	1575 – 1630 A.D.	1575 A.D.

The Korean sunspot records show the following features:

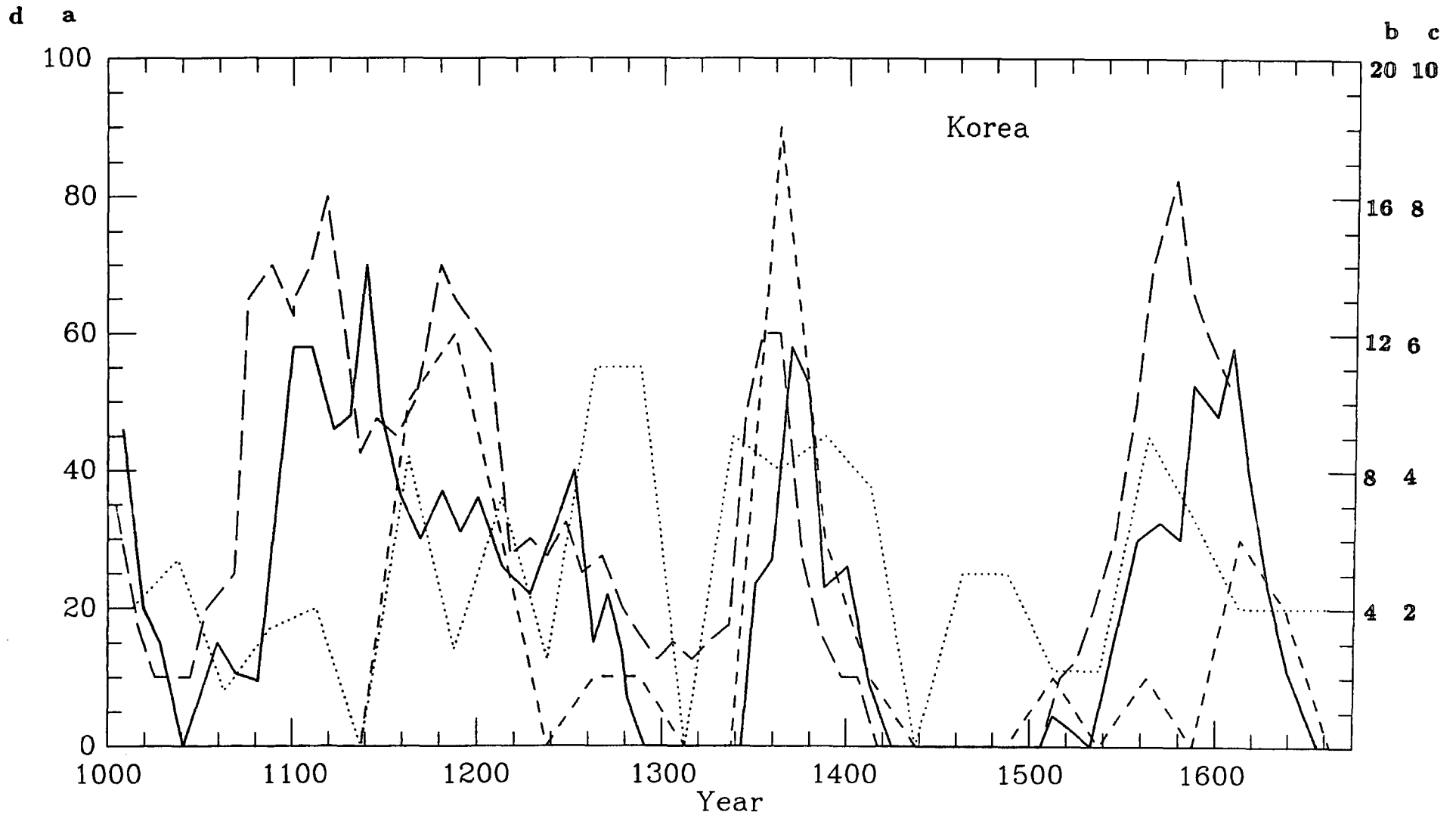


Figure 2.7.1: Comparison of indices of solar activity as a function of time from 1000 A.D. to 1650 A.D. The continuous line (scale a at left) is a sunspot number index (Stuiver and Quay, 1980) from tree-ring ^{14}C . The long dashes (scale b at right) are an index of the occurrence of northern hemisphere aurorae, another measure of solar activity. The short dashes (scale c at right) are the number of sunspots recorded in Korea and the dots (scale d on left, in%) represent the efficiency of small eclipse observation in Korea.

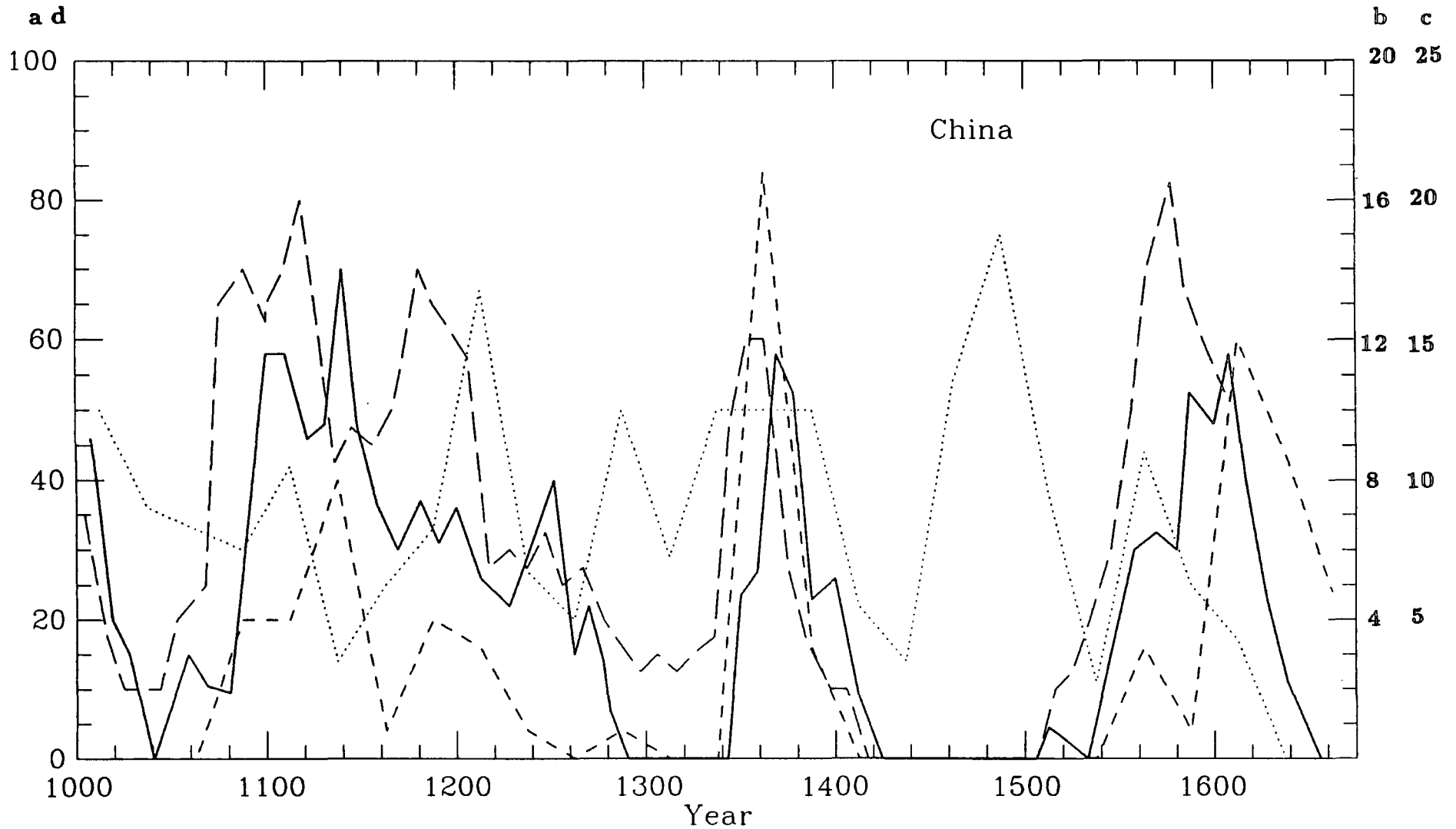


Figure 2.7.2: Comparison of indices of solar activity as a function of time from 1000 A.D. to 1650 A.D. The continuous line (scale a at left) is a sunspot number index (Stuiver and Quay, 1980) from tree-ring ^{14}C . The long dashes (scale b at right) are an index of the occurrence of northern hemisphere aurorae, another measure of solar activity. The short dashes (scale c at right) are the number of sunspots recorded in China and the dots (scale d on left, in%) represent the efficiency of small eclipse observation in China.

A minimum at	1000 – 1150 A.D.
	1275 – 1350 A.D.
	1400 – 1500 A.D.
A maximum at	1130 – 1225 A.D.
	1350 – 1400 A.D.
	1525 A.D.
	1550 – 1625 A.D.

On the whole it can be said that the Korean sunspot records follow the pattern of solar activity shown by the ^{14}C and auroræ data. They deviate from them at certain points e.g. there is a minimum where we would expect a maximum at 1100 – 1150 A.D. and 1575 A.D., and there is a maximum at 1275 A.D. when we would expect a minimum. Using the efficiency of observation of small eclipses we can explain these deviations.

If we examine the Chinese sunspot records and compare them to the ^{14}C and auroræ data, Figure 2.7.2, we find a similar correspondence.

A minimum at	1250 – 1350 A.D.
	1400 – 1550 A.D.
	1590 A.D.
A maximum at	1125 – 1150 A.D.
	1200 – 1225 A.D.
	1350 – 1400 A.D.
	1550 – 1575 A.D.
	1600 – 1650 A.D.

By comparing these variations with eclipse efficiency we can explain why we do not get a good correlation in the scatter plots of sunspots versus efficiency. During the period 1100 A.D. to 1275 A.D. there is a continuous high activity shown in the ^{14}C and auroræ data. The fluctuations in the sunspot records reflect this activity, and where it varies from this e.g.

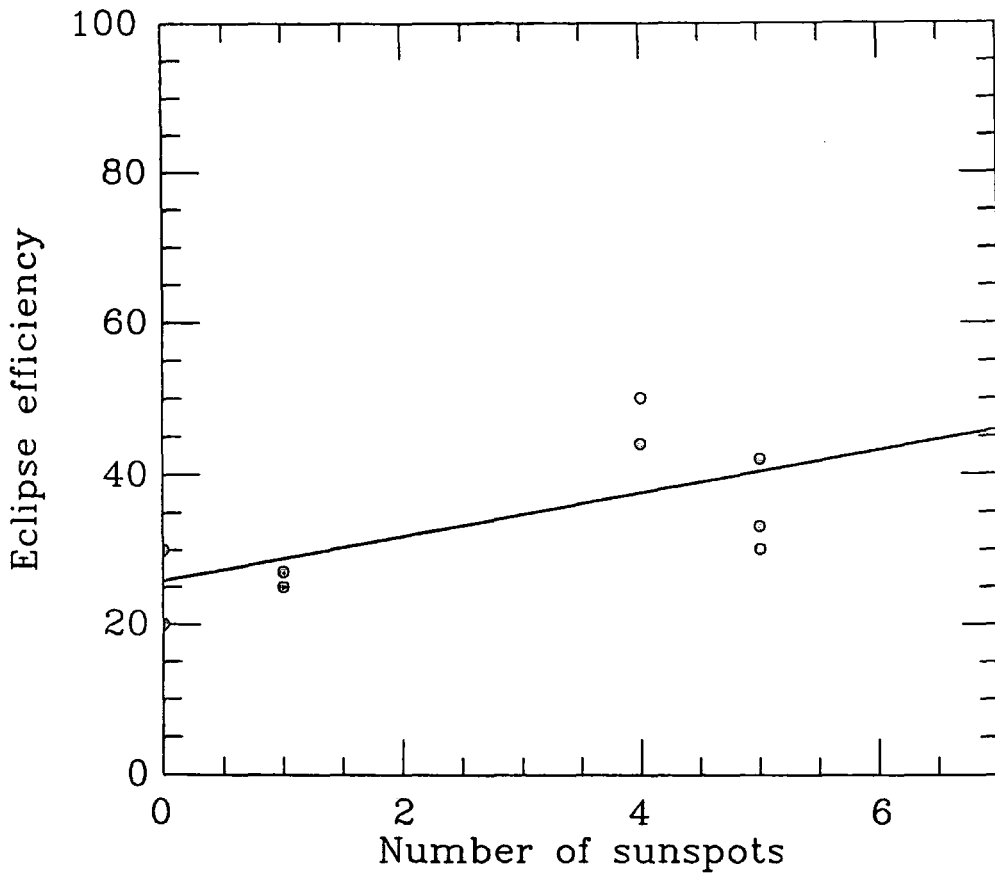


Figure 2.7.3: Eclipse efficiency versus sunspots, with data affected by the long term solar variations removed.

at 1250 A.D. there is a peak in ^{14}C and a trough in sunspot observation, there is a suitable drop in eclipse efficiency of observation to point toward a bad observing period overall. Between 1420 A.D. and 1500 A.D., despite there being a very high maximum in eclipse efficiency, there are no sunspots recorded. This is because there is a period of extremely low solar activity according to the ^{14}C data. If one plots the eclipse efficiency versus sunspots recorded (similar to Figure 2.6.6) but removes the data that is worst contaminated in this way, then a better correlation is obtained as displayed in Figure 2.7.3. Again one cannot describe this result as very significant but the spread of the scatter is a lot less. Using the F-distribution test one finds that the correlation in Figure 2.7.3 is just over 5% significant.

Chapter 3

In most of the Chinese and Korean eclipse records, there is merely a statement to the effect that the sun was eclipsed. However certain records give additional information such as that the eclipse was total, or alternatively, almost complete or not complete, for example: "like a hook". Occasionally comments on the visibility of stars were also mentioned.

For the Former Han, Later Han and T'ang dynasties, the Right Ascension of the sun, with respect to one of the 28 Lunar Mansions is regularly noted, usually to the nearest degree. I have found that this is nearly always accurate to within a few degrees. The Chinese associated a certain person, part of the city/palace or a region of the kingdom (Empire), with a certain part of the sky. If a significant event such as an eclipse occurred in a particular Lunar Mansion, this was taken as a warning from Heaven for the terrestrial equivalent.

Some of the records contain mistakes, mainly due to copyists errors which have occurred over the centuries, but usually these can be spotted e.g. Eclipse No. 40, where the extra information given helps ascertain

which eclipse is being referred to.

Notation: In the catalogue, (See Appendix 2), each eclipse record has been assigned a number. I will refer to an eclipse by this number.

Comments	Eclipse Number
Total: stars/planets seen	230 377 726
Total (no other details)	3 7 54 70 412 798 800 826 837 869
Almost total, stars all visible	90
Almost complete	5 17 34 189
Not complete/like a hook	32 42 51
Stars/planets seen	283 300 668
Reported from the provinces	60 99 103 106 274 279
Obscured by rain	181 423 477 478 511 622 686 736 751 834 850 945
Obscured by cloud	47 392 422 469 476 488 529 531 533 541 548 551 558 570 581 589 598 601 615 620 624 627 630 633 642 645 651 652 653 655 691 692 803 926
Not seen by official observers/ didn't eclipse (as expected)	91 95 96 101 452 492 494 495 502 509 526 536 540 582 603 607 659 665 693 765 789 862 874
Specified as a prediction	245 247
Further additional information (i.e. extra comments)	40 46 47 184 257 258 260 262 272 284 285 286 287 292 381 483 742 796 868 879 880 911 927 935 955 957 961

Table 3.1: Additional information in eclipse records

Table C: Additional comments in the eclipse records and their interpretation.

Remark	Eclipse No.	Results of calculation ^a and Interpretation	Place
Total ^b	230	Central annular at Nanking	C
	377	Total at Ch'ang-an	C
	726	Total at Lin-an	C
Total ^c	3	Annular total at Ch'ang-an	C
	7	Total at Ch'ang-an	C
	54	Total in east of Ch'ang-an	C
	70	Almost total at Ch'ang-an	C
	412	NEVOES	C
	434	NEVIC	C
	475	Total NNW of K'ai-feng	C
	798	Total SW of Korea	K
	800	Total NNE of Kaesong	K
	826	Annular total at Kaesong	K
	837	Total SE of Nanking	C
	869	Total NE of Korea/Seoul	K
Almost total ^d	90	Total at Lo-yang	C
Almost complete	5	Total SW of Ch'ang-an	C
	17	Total NE of Ch'ang-an	C
	34	Total E of Ch'ang-an	C
	189	Annular SW of Nanking	C
Like a hook	32	Total SSW of Ch'ang-an	C
	42	Total just SE of Ch'ang-an	C
	51	Total S of Ch'ang-an	C
Stars and planets seen	283	Not total in China ^e	
	300	NEVIC	C
	668	Total SW of Peking	C

^aplace named is the capital at the time

^bstars and planets visible

^cno other details

^dstars all visible

^ecalculation gives magnitude as 0.88 at Nanking

Remark	Eclipse No.	Result of calculation and Interpretation	Place
Reported from the provinces	60	Eclipse large, magnitude 0.62 therefore probably overcast at the capital	C
	99	NEVIC	C
	103	Magnitude at capital 0.02, therefore barely visible at the capital. Most likely seen at points SE of capital (at lat 30°, long -130°, magnitude of 0.30).	C
	106	Magnitude at capital 0.39 at altitude of -2 degrees. Probably overcast at capital. Most likely reported from NE of capital.	C
	274	Magnitude 0.10 at capital, reported from Hsia Chou. Magnitude = 0.11, local time = 7.0h, altitude = 25 degrees.	C
	279	NEVOES, reported from Hsia Chou.	C
Not seen by observers or didn't eclipse as predicted		NEVOES: 101 NEVIC or K: 91 492 494 495 502 509 536 547 582 603 607 659 665 693 789 874 With only a few exceptions most of these records come from the Northern, Sung, Southern Sung and Kin dynasties.	
	95	Mag.=0.25, LT=8.3h, Alt=31 deg. Possible, perhaps cloudy.	C
	96	Mag.=0.10, LT=15.5h, Alt=19 deg. Possible.	C
	452	Mag.=0.14, LT=11.4h, Alt=51 deg. Possible.	C
	526	Mag.=0.91, LT=14.5h, Alt=55 deg. Must have been very cloudy	C

765	Mag.=0.04, LT=10.0h, Alt=33 deg. Believable.	C
862	Mag.=0.68, LT=4.4h, Alt=-2 deg. Confused with sunrise or cloud	C

EXTRA

40. The record states that "The Sun was eclipsed, it was not complete, like a hook and then it set". The date for which this eclipse is recorded is -33 August 23rd. However, computer calculation gives no eclipse occurring on the earth's surface for that date. By examining other eclipses occurring around this time, it was found that on -34 November 1st, an eclipse of magnitude 0.84 (at Ch'ang-an) occurred, and the sun set while at its maximum. It is difficult to explain how such a serious date error arose.

46. "The Sun was eclipsed . . . the capital alone knew of it, the Kingdoms in the 4 (directions) did not see it." Computed magnitude at the capital (Ch'ang-an) was 0.06 at altitude of 10 degrees, local time = 16.5h. The eclipse was largest in the North West (mag. of 0.20 at lat. 40°, long. -90°).

47. "The Sun was eclipsed . . . the 4 quarters all saw it; at the capital it was cloudy and overcast". Although this eclipse was not seen at Ch'ang-an, it would have been very large (0.65 magnitude) if clear weather had prevailed.

148. "The Sun was eclipsed, the Emperor was displeased". This may have been because no eclipse in fact occurred, or because he was under the

impression that an eclipse had occurred and he had missed it.

258. "The Sun was eclipsed, it was one fifteenth covered at the hour 1 – 3 p.m. There was a mist." Another more literal translation of "There was a mist" is "cloud vapour spots intermingling/mixed colour". The eclipse observed was very small, calculated as 0.04 magnitude, with an altitude of 32 degrees at 15.0h, at Lo-yang. In a clear sky, this would be practically impossible for the naked eye to resolve. However the presence of a mist or thin cloud cover/vapour would reduce the sun's glare and greatly facilitate the observation of such a small eclipse. This eclipse occurred in March which leads one to believe that the cloud or vapour may well have been due to a duststorm ("yellow wind") which throws fine particles of sand and dust (from the loess regions as well as Inner Mongolia and Sinkiang/the Gobi Desert) into the atmosphere. These act as a filter and make small features of the sun such as sunspots and small eclipses more obvious.

257. "The Sun was eclipsed, it was eight fifteenths (i.e. 0.53) covered". Calculated magnitude is 0.60.

260. "The Sun was eclipsed, the eclipse began at early 1 – 3 p.m. It was four tenths in magnitude. The eclipse ended at 3 – 5 p.m. The eclipse began from the North West". Calculated magnitude is 0.62 and the maximum occurred at 2:48 p.m.

262. "The Sun was eclipsed, the eclipse began at 9 – 11 a.m. It was one third in magnitude. The eclipse ended at 11 a.m. – 1 p.m." Calculated

magnitude is 0.93 and the maximum occurred at 8:48 a.m.

273. "The Sun was eclipsed. It was nine fifteenths (i.e. 0.60) covered".
Calculated magnitude is 0.48.

The extra details for eclipses 257, 260 and 273 such as time, magnitude and direction of eclipse compare favourably with the values calculated but those for 262 do not agree.

284. "The Sun was eclipsed. It was seven fifteenths covered. The Sun rose already eclipsed from beneath the Earth. It eclipsed from the NorthWest horn" (i.e. the NorthWest limb). However, no eclipse was visible on the earth's surface and no eclipse was found to fit the information for several years on either side of the date. One must assume that this was a faulty prediction, or else perhaps a bank of heavy cloud caused the sun to appear later than expected, hence simulating an eclipse that began while the sun was below the horizon.

285. "The Sun rose eclipsed from the SouthWestern horn. The eclipse was not seen at the capital due to cloud but was observed in the provinces (at Ting Hsian)". The capital, Ta-tung, was located at lat. $40^{\circ} 06'$, long. $-113^{\circ} 13'$, while Ting Hsian was quite close at lat. 41° , long. -112° . Thus the eclipse which was obscured by cloud at Ta-tung had a magnitude of 0.23, while at Ting Hsian it was visible with a magnitude of 0.24. The record states that the Sun rose eclipsed when in fact it set eclipsed. This must be due to a copying error.

286. "The Sun rose from beneath the Earth, already eclipsed. The eclipse started from the South Western horn". The maximum magnitude of 0.37 was reached just as the sun rose.

287. "The Sun was eclipsed in the near South. The eclipse began from the true South".

381. There was no month given for this eclipse although the name of the Emperor, the Reign Period, year and Chinese Cyclical Day Number were given. However for all the months containing this day number, no eclipse would have been visible on the earth's surface, on that day number.

483. "The Sun was eclipsed but no waning was observed. It occurred in the night-time. It was predicted for daylight". An eclipse occurred on this date but it was not visible in China. The Chinese astronomer's prediction was incorrect by several hours and the sun had set on China. The eclipse would have been visible in South America.

742. "The Sun was eclipsed. A darkness invaded the Sun which was not totally covered. It was like a golden ring. There were vapours like golden earrings on the left and right, and a vapour like a halo completely surrounding it." This is a description of an annular eclipse, magnitude 0.94 (i.e. annular at Peking). The 'earrings' and 'vapour' presumably refer to some atmospheric effect.

796. "The Astronomer Royal predicted an eclipse which was not seen at the capital owing to clouds. He was to be punished. Reports from the

countryside confirmed the eclipse occurred and he was forgiven.” This is one of the few Korean records with additional information. It illustrates the danger to the astronomers of incorrectly predicting eclipses, giving them an incentive to get it right.

879. “The Sun was eclipsed”. The annals state that an eclipse was predicted to happen on the 4th month, 4th cyclical day (1473 May 3rd) but this coincided with another festival so ceremonies were held on the 3rd month, 41st cyclical day (1473 April 10th) instead, which was 23 days previous to the date that the eclipse was predicted for. In fact, no eclipse occurred on the 4th month, 4th cyclical day, but an eclipse was observed at the capital on the 4th month, 58th cyclical day (1473 April 27th), with magnitude 0.67 at 3:42 p.m.

This is an example of the manipulation of eclipse dates where it was considered expedient by the authorities. The eclipse was predicted by the Imperial Astronomers to be due on a date on which there was a festival or religious ceremony already arranged. There was an attendant religious ceremony that went with the observance of an eclipse and the two ceremonies would have coincided. In order that they could both be carried out the eclipse was recorded as having occurred prior to the date when it actually did, so that ceremonies for the eclipse could be completed, and not interfere with those already arranged. However, the eclipse prediction by the Astronomers was wrong and the eclipse did not in fact occur on the

day it was predicted. It was not recorded when it actually occurred.

911. "The Sun was eclipsed three tenths, this occurred while the sun was below the horizon". No eclipse occurred on the earth's surface, so this implies that the Chinese predicted the magnitudes of eclipses at this period.

927. "The Sun was one and a half tenths eclipsed". No eclipse was visible in China, but calculations show that an eclipse should have been visible in the mid-Pacific Ocean.

935. "The Sun was eclipsed. Between 1 and 3 p.m. the stars shone brightly. After 3 p.m. it became light." The eclipse was of magnitude 0.70 at the capital Peking, according to calculation. The stars only become visible at magnitude of over about 0.95, therefore the stars must have been reported from the countryside. The eclipse was total throughout much of Southern China, reaching a magnitude of 1.07. The time of maximum magnitude at Peking was 2:18 p.m. which agrees with the record and there was similar timing in Southern China.

955. "The Sun was eclipsed. At 10:15 – 10:30 a.m. the eclipse started. The Sun eclipsed nine-tenths. At 12:00 – 12:15 p.m. the eclipse ended." These values agree almost exactly with the calculations, maximum of 0.95 occurring at 11:11 a.m. at Peking.

957. "The Sun was eclipsed at 7 – 9 a.m., it returned to full brightness at 9 – 11 a.m. It was eclipsed eight point eight eight tenths." This was a central annular eclipse. It began at ~ 7 a.m., reached a maximum of 0.90

at 8:38 a.m. at Peking and finished at ~ 9:30 a.m.

961. "The Sun was eclipsed by more than seven tenths. The Sun was in Wei when it began to wane. The Sun began eclipsing at three k'o past the hour of Wei (1:45 - 2:00 p.m.) At half past the hour of Shen (4 p.m.) the Sun entered the shadow of the Moon totally. At the hour of Wei it recovered" This record is badly written and difficult to understand. The eclipse began at ~ 2 p.m. A maximum of 0.61 occurred at 4:06 p.m. in Peking. Presumably where the record says the sun recovered at the hour of Wei, they mean the hour of Shen. This must have been a copying error.

Chapter 4

Conclusion

The work presented in this dissertation involved the translation and investigation/analysis of the pre-telescopic solar eclipse records from the 26 Dynastic Histories of China, from 204 B.C. – 1621 A.D., and the Korean records from 1009 – 1621 A.D. The translations themselves are contained in Appendix 2 of this thesis.

Chapter 2 was divided into seven sections, each dealing with a particular feature of the eclipse records, and their relevant calculations. Section 2.1 examined the eclipse observations as a function of calculated magnitude for each dynasty. The number of eclipses which were predicted was noted, and it was found that these decreased with dynasty (chronologically). Section 2.2 looked at the efficiency of the Chinese and Korean observers as a function of calculated magnitude. As expected, eclipses of small magnitudes were less readily seen than eclipses of large magnitudes. The possible effect of weather conditions and climate were also taken into account when

considering the results. Section 2.3 dealt with the variations in eclipse recording with time. Most of the variations in the frequency of Chinese eclipses could be explained in terms of historical events, such (as the *An-lushan* rebellion of 756 A.D. and the fall of Ch'ang-an in 880 A.D.), but the Korean eclipses could not be explained in this manner. Instead they were presumed due to the waxing and waning interest in the heavens of the Korean monarchs. Section 2.4 examined the variations in eclipse observation with the Sun's altitude in the sky, noting the decreasing likelihood of an eclipse being observed with the increasing altitude. Section 2.5 looked at the seasonal variations of sunspots and eclipses, finding a marked seasonal variation in the frequency of recorded sunspots, but no obvious variation in the eclipse frequency. Splitting the records up by capital for a more intensive examination did not produce statistically significant variations. Section 2.6 compared the sunspots and the eclipse efficiency and looked to see if there was any correlation between them. Although no *direct* correlation was found there appeared to be a greater likelihood of sunspot recording when there was a high eclipse efficiency. Section 2.7 compared the sunspot records and eclipse efficiency with the sunspot number index derived by Stuiver and Quay (1980) from precision measurements of tree-ring ^{14}C , and the occurrence of northern hemisphere aurorae. It was found that there was a good correlation between the Chinese and Korean sunspot records and the long-term solar activity cycle, as shown by the ^{14}C and

aurorae data. The reason why there is not a good correlation between the eclipse efficiency and the sunspot number is due to the existence of this periodicity, since the eclipse efficiency is not related to this in any way. Upon removal of sunspot data which are affected this way (*i.e.* the solar activity minimum between $\sim 1275 - 1335$ A.D. when eclipse efficiency is very high, and the solar activity maximum at 1250 A.D. when eclipse efficiency is very low), there is a much better correlation, shown in Figure 7.3, suggesting that the sunspot records depend in some way on the observing efficiency.

Chapter 3 was an extensive investigation of the solar eclipse records, examining all the records with additional information. Individual eclipses with interesting comments were investigated in detail, and comparisons were made between the magnitudes, times etc. noted in the records and the values calculated.

The solar eclipse records are interesting and tell us a great deal about the Chinese and Korean approach to astronomy in the pre-telescopic era. The eclipse efficiency can act as a guide to the quality of their astronomical records as a whole. The variable efficiency leads one to believe that the variations in the Chinese and Korean sunspot records are due a combination of the long-term solar activity variations and the observing efficiency. The sunspot records are mainly affected by the solar activity variations but the observing efficiency plays a significant role when the solar activity variations are stable (neither at a maximum nor a minimum nor fluctuating wildly).

Appendix 1
Computer Programs

CENT

```

C     THIS PROGRAM COMPUTES THE VARIOUS ELEMENTS FOR THE MAXIMUM
C     PHASE OF AN ECLIPSE WITH HIGH ACCURACY WHEN LINKED WITH
C     A. NEWCOMB. DELTA IS GIVEN WITH AN ACCURACY OF ABOUT 0.00005.
C     DURATIONS OF TOTALITY OR ANNULARITY ARE ACCURATE TO ABOUT 0.3
C     SEC NEAR THE CENTRAL LINE AND Q AND V VALUES TO ABOUT 1 DEGREE.
C     HOWEVER, NEAR THE MARGINS THE ERRORS IN DURATION AND POSITION
C     ANGLES INCREASE RAPIDLY, LARGELY BECAUSE OF THE ERROR IN DELTA.
C     IMPLICIT REAL*8(A-H,O-Z)
C     REAL*8 JD,LULA,LULO,NUM,KK,LAT,LONG,LHA,LUPA,NUT,LRA,LD
C     REAL*8 LATSRT, LONGST
C     COMMON/MOON/LULA,LULO,LUPA,DLO,DPA,DLA,DM,DSS,LRA,LD
C     COMMON/SUN/SOLA,SOLO,RV,DSO,SVAR,ARV
C     COMMON/CONSTS/NUM,NUT,EPS,T
C     COMMON/LACC/ACC
C     PARAMETER OPU=2,IPU=1
C     DIMENSION IDATE(6)
C     DATA PI/3.1415927D0/
C     OPEN (UNIT=OPU,FILE='SYS$OUTPUT',STATUS='OLD')
C     OPEN (UNIT=IPU,FILE='SYS$INPUT',STATUS='OLD',READONLY)
C     IACCRY=2
C     WRITE (6,*) ' TYPE IN LUNAR ACCELERATION TERM (E.G. -26 FOR LVM) '
C     READ (5,*) ACC
C     ACC = -26
C     WRITE(6,*) ' TYPE IN T SQUARED COEFFICIENT IN DELTA T (E.G. 32.4) '
C     READ(5,*) TSQDT
C     TSQDT=32.5
C     WRITE(6,8814) TSQDT, ACC
8814  FORMAT(' VALUES OF TSQDT AND ACC USED=',2(F10.1,3X))
C     ACC=ACC+26
C     ACC=ACC/2
C     WRITE(6,*) ' TYPE IN LATITUDE, DEGREES(INT) , MINS(FLOAT) '
C     READ(5,*) IDEG,XMIN
C     WRITE(6,400) IDEG,XMIN
400  FORMAT(' LATITUDE AS TYPED IN =',I6,2X,F6.2)
C     LATSRT=IDEG+XMIN/60.
C     IF(IDEG.LT.0) LATSRT=IDEG-XMIN/60.
C     WRITE (6,*) ' TYPE IN LONGITUDE (SAME FORMAT), NEGATIVE TO EAST '
C     READ(5,*) IDEG,XMIN
401  FORMAT(' LONGITUDE AS TYPED IN = ',I6,2X,F6.2)
C     IF(IDEG.EQ.0) WRITE(6,*) ' CONFIRM THIS TO BE -0 ,TYPE YES OR
NO '
C     IF(IDEG.EQ.0) READ(5,8812) ANS

```

```

8812  FORMAT (A4)
      IF((ANS.EQ.'Y'.OR.ANS.EQ.'YES').AND.IDEG.EQ.0) XMIN=-XMIN
      WRITE(6,401) IDEG,XMIN
C     WRITE(6,*) ' TYPE IN HEIGHT IN METRES (FLOAT)'
C     READ(1,*) HEIGHT
C     HH=0.0000001568D0*HEIGHT
C     WRITE (6, 46) HEIGHT
46    FORMAT ('HEIGHT ABOVE SEA LEVEL IN METRES =',F10.0)
      HH=0.
      LONGST=IDEG+      (XMIN)/60.
      IF(IDEG.LT.0) LONGST=IDEG-XMIN/60.
      WRITE(6,*)' TYPE IN JULIAN DATE AT 12. HRS U.T. (INTEGER)'
      READ(5,*)JSTART
      ERROR=0.001
      START=JSTART
      WRITE(6,99)JSTART
99    FORMAT(' JULIAN DATE AT 12.0 HOURS  U.T. AS TYPED IN =',I10)
      TCORR=0.
      CALL CONJNC( ERROR,START,TCORR)
      TIME=0.
      ITRY=1
      JD=START+TCORR/24.
      CALL SUMMON(JD,2)
      IF (T.GT.-9.5) DELTAT = 25.5*(T+1)**2
      IF (T.LE.-9.5) DELTAT = 1360 + 320*(T+1) +44.3*(T+1)**2
C     NB T IS TIME IN CENTURIES FROM 1900.0
C     DELTAT=TSQDT*(T+1.0)**2
      WRITE(2,922) DELTAT
922   FORMAT(' CURRENT DELTA T =',F10.1,' SECONDS')
C     WRITE(6,*) ' TYPE YES IF YOU WANT THIS , NO TO TYPE YOUR OWN'
C     READ(5,923) ANS
      ANS = YES
923   FORMAT(A4)
      IF(ANS.EQ.'Y'.OR.ANS.EQ.'YES') GOTO 933
C     WRITE(6,*)' TYPE IN DELTA DT IN SECONDS (FLOAT)'
C     READ(5,*) DELTAT
933   CONTINUE
12    WRITE(6,500) DELTAT
500   FORMAT(' DELTAT USED IN THIS CALCULATION IS =',F10.1,' SECS')
      LONG=LONGST+1.002738*DELTAT*15/3600.
      LAT=LATSRT*PI/180
      LONG=LONG*PI/180
1     CONTINUE
      CALL SUMMON(JD,IACCRY)

```

```

C** LD IS LUNAR DEC IN RADIANS
C   CALL DEBUG('LUPA',LUPA)
      LUPA=NUH*LUPA
      SOLOR=NUH*SOLO
      SOLAR=NUH*SOLA
      DLO=NUH*DLO
      DSO=NUH*DSO
      DPA=NUH*DPA
      DLA=NUH*DLA
      H=DATAN(DSIN(EPS)*DCOS(SOLOR)/DCOS(EPS))
      DH=-0.437*DSIN(SOLOR)*DSO/(1+0.191*(DCOS(SOLOR))**2)
      SOPA=8.794/ARV
C   REF 1982 AA, L11.
      SOPA=NUH*SOPA
      PA=DSIN(LUPA-SOPA)
      X1=DCOS(LULA)*DSIN(LULO-SOLOR)/PA
      Y1=DSIN(LULA-SOLAR)/PA
      DX1=DCOS(LULA)*(PA*DCOS(LULO-SOLOR)*(DLO-DSO)
*      -DSIN(LULO-SOLOR)*DCOS(LUPA-SOPA)*DPA)/PA**2
      DY1=(PA*DCOS(LULA-SOLAR)*DLA-DSIN(LULA-SOLAR)
*      *DCOS(LUPA-SOPA)*DPA)/PA**2
      DX=DX1*DCOS(H)-DY1*DSIN(H)-DH*(X1*DSIN(H)+Y1*DCOS(H))
      DY=DX1*DSIN(H)+DY1*DCOS(H)+DH*(X1*DCOS(H)-Y1*DSIN(H))
      DHU=0.262516-0.888*DSO/(0.839+0.161*(DCOS(SOLOR))**2)
      SINS=DSIN(SOLOR)*DSIN(EPS)+SOLAR*DCOS(EPS)
      COSS=DSQRT(1-SINS**2)
      SD=DATAN2(SINS, COSS)
      DEC=JD-DINT(JD)
      COSSRA=DCOS(SOLOR)/COSS
      TANSRA=(DSIN(SOLOR)*DCOS(EPS)-SOLAR*DSIN(EPS))/DCOS(SOLOR)
      SRA=DATAN(TANSRA)+PI
      IF(COSSRA.GT.0.)SRA=SRA-PI
      IF(SRA.LT.0.)SRA=SRA+2*PI
      B=SOPA/DSIN(LUPA)
      A=SRA-(DCOS(LD)/DCOS(SD))*B*(LRA-SRA)/(1-B)
      SHD=SD-B*(LD-SD)/(1-B)
      SIND=DSIN(SHD)
      R=1/DSIN(LUPA)
      X=R*DCOS(LD)*DSIN(LRA-A)
      Y=R*(DSIN(LD)*DCOS(SHD)-DCOS(LD)*SIND*DCOS(LRA-A))
      Z=R*(DSIN(LD)*SIND*DCOS(LD)*DCOS(SHD)*DCOS(LRA-A))
      F1=0.004664026/(RV*(1-B))
      F2=0.004640776/(RV*(1-B))
C   THESE ARE EQUIVALENT TO KK = 0.2724807 (ESAE, 217). FOR KK =

```

```

C      0.272274 F1=0.004664016..., F2=0.004640784... NEGLIGIBLE DIFF.
      SSD=959.63/RV
C      THE ABOVE IS DUE TO AUWERS
C      SSD=960.00/RV
C      THIS IS DUE TO WITTMANN
      KK=0.2724880D0
C      THE ABOVE VALUE OF KK IS USED IN 1982 AA (L12). THE ESAE (    )
C      RECOMMENDS 0.2724807 FOR USE AFTER 1962. THE DIFFERENCE IS
C      TRIVIAL
      KK=0.272274
C      THE ABOVE KK IS USED IN PRE-1962 CALCULATIONS AND FOR COMPUTING
C      THE DURATIONS OF TOTALITY ON CENTRAL LINES
      U1=1.000011*(Z*F1+KK)
      U2=1.000011*(Z*F2-KK)
      ST=DEC*86400+67125.836D0+8640184.542D0*T+0.092*T**2
*      +NUT*DCOS(EPS)/15.0
      ST=ST-DINT(ST/86400.D0)*86400.0
      RAD=ST*15*NUM
      ANGLE=RAD-A
      DSHD=0.968*DCOS(SOLOR)*DSO*DSIN(EPS)/DCOS(SHD)
      SP=0.99497418D0-0.00167082D0*DCOS(2*LAT)+0.00000210D0*DCOS(4*LAT)
      RHOSIN=(SP+HH)*DSIN(LAT)
      CC=1.00167997D0-0.00168208D0*DCOS(2*LAT)+0.00000212D0*DCOS(4*LAT)
      RHOCOS=(CC+HH)*DCOS(LAT)
      XI=RHOCOS *DSIN(ANGLE-LONG)
      ETA=      DCOS(SHD)*RHOSIN -SIND*RHOCOS *DCOS(ANGLE-LONG)
      ZETA=      SIND*RHOSIN +DCOS(SHD)*RHOCOS *DCOS(ANGLE-LONG)
      DXI=DMU*RHOCOS *DCOS(ANGLE-LONG)
      DETA=DMU*XI* SIND-DSHD*ZETA
      XX=X -XI
      YY=Y -ETA
      DXX=DX-DXI
      DYY=DY-DETA
      DTT=-((XX*DXX+YY*DYY)/(DXX**2+DYY**2))
      RNN=DSQRT(DXX**2+DYY**2)
      DEL=(XX*DYY-YY*DXX)/RNN
      UM=U2-ZETA*1.000011*F2
      PEN=U1-ZETA*1.000011*F1
      IF (DABS(DEL).GT.PEN) WRITE (6,*) ' NO ECLIPSE'
      IF (DABS(DEL).GT.PEN) WRITE (6,17)
17     FORMAT (' ',/, 79 (1H=))
      IF (DABS(DEL).GT.PEN)      GO TO 3
      Q1=DSQRT((PEN**2-DEL**2)/(DXX**2+DYY**2))
      DIFF=DTT

```



```

TIME=TIME+DIFF
  JD=JD+DIFF/24.
  IF(DABS(DIFF).LT.0.00001) GOTO 2
  GOTO 1
2 CONTINUE
  PAR=LUPA/NUM
  RR=R-ZETA
  RB=RR**2
  RC=XI**2+ETA**2
  DM2=RB+RC
  DM=DSQRT(DM2)
  SDM=0.0799+0.272453*PAR
  ASDM=SDM*R/DM
  IF (DABS(DEL).GT.DABS(UM)) GO TO 27
  SINPSI=DABS(DEL/UM)
  COSPSI =DSQRT(1-SINPSI**2)
  SDUR=DABS(UM )*COSPSI/RNM
  XX1=XX-SDUR*DXX
  XX2=XX+SDUR*DXX
  YY1=YY-SDUR*DYY
  YY2=YY+SDUR*DYY
  SINQ1=XX1/UM
  SINQ2=XX2/UM
  COSQ1=YY1/UM
  COSQ2=YY2/UM
  TANQ1=SINQ1/COSQ1
  TANQ2=SINQ2/COSQ2
  AQ1=DATAN(TANQ1)*180/PI
  AQ2=DATAN(TANQ2)*180/PI
  IF (COSQ1.LT.0) AQ1=AQ1+180
  IF (COSQ2.LT.0) AQ2=AQ2+180
  DUR=SDUR*7200
  IF (AQ1.LT.0) AQ1=AQ1+360
  IF (AQ1.GT.360) AQ1=AQ1-360
  IF (AQ2.LT.0) AQ2=AQ2+360
  IF (AQ2.GT.360) AQ2=AQ2-360
  XI1=XI-DXI*SDUR
  XI2=XI+DXI*SDUR
  ETA1=ETA-DETA*SDUR
  ETA2=ETA+DETA*SDUR
  TANC1=XI1/ETA1
  TANC2=XI2/ETA2
  AC1=DATAN(TANC1)*180/PI
  AC2=DATAN(TANC2)*180/PI

```

```

IF (ETA1.LT.0) AC1=AC1+180
IF (ETA2.LT.0) AC2=AC2+180
AV1=AQ1-AC1
AV2=AQ2-AC2
IF (AV1.LT.0) AV1=AV1+360
IF (AV1.GT.360) AV1=AV1-360
IF (AV2.GT.360) AV2=AV2-360
IF (AV2.LT.0) AV2=AV2+360
GO TO 28
27  AV1=0
    AV2=0
    AQ1=0
    AQ2=0
    DUR=0
28  WRITE (6,55)
55  FORMAT(' RESULTS FOR MAXIMUM PHASE')
    LHA=(ANGLE-LONG)*12/PI
    IF(LHA.LT.12.0) LHA=LHA+12.
    IF(LHA.GT.12.0) LHA=LHA-12.
    IF(LHA.LT.0.) LHA=LHA+24.
    TANQQ=XX/YY
    QQ=DATAN(QQ)*57.29578DO
    IF (DSIGN(1.ODO,QQ).NE.DSIGN(1.ODO,XX)) QQ=QQ+180.
    PA=QQ+180.
    COSALT=DSQRT(1-ZETA**2)
    ALT=(180/PI)*DATAN(ZETA/ COSALT)
    EMAG=(PEN-(UM))/(UM+PEN)
    IF(DABS(DEL).GT.DABS(UM)) EMAG=(PEN-DABS(DEL))/(UM+PEN)
    FTIME=TIME+12.+TCORR
    ET=FTIME
    FTIME=FTIME-DELTAT/3600
    IF(FTIME.GT.24.0) FTIME=FTIME-24.0
    IF(FTIME.LT.0.0) FTIME=FTIME+24.0
    IF (ET.GT.24) ET=ET-24
    IF (ET.LT.0) ET=ET+24
    IHOURS=FTIME
    XMINS=(FTIME-IHOURS)*60.0
    WRITE(6,214) IHOURS, XMINS, EMAG
214  FORMAT(' ***** UT = ',I6,F10.2,' MAGNITUDE =',F10.4)
    WRITE (6,224) ET
224  FORMAT (' EPHEMERIS TIME (HOURS)=' ,F10.4)
    WRITE (6,217) LHA
217  FORMAT (' LOCAL APPARENT TIME IN HOURS=' ,F10.3)
    WRITE(6,210) DEL, UM

```

```

210  FORMAT(' DELTA, UMBRA RADIUS ON FP=',2(F10.5))
      WRITE (6,253) ALT, DUR
253  FORMAT (' ALTITUDE, DURATION=', 2(F10.2))
      WRITE (6, 254) SSD, ASDM
254  FORMAT (' APP SOLAR AND LUNAR SD=', 2(F10.2))
      WRITE (6,747) AQ1, AV1, AQ2, AV2
747  FORMAT (' P2, V2, P3, V3=',4(F10.0))
      CALL JDCAL(JD,IDATE)
      WRITE(6,601)(IDATE(JJ),JJ=1,3)
601  FORMAT (' CIVIL DATE OF SOLAR ECLIPSE =',I5,'/',I3,'/'I3)
      WRITE (6, 17)
      GOTO 3
      END

      SUBROUTINE CONJNC(ERROR,START,DELTT)
      IMPLICIT REAL*8(A-H,O-Z)
      REAL*8 J,M,K,NUM,NUT
C** ITERATE TO FIND CORRECTION , DELTT HOURS , TO STARTING JULIAN
C** DATE ' START' TO FIND CONJUNCTION FOR ECLIPSE. THE ACCURACY
C** REQUIRED IS 'ERROR' HOURS ( ABOUT 0.1 USUALLY )
      COMMON/ANGLES/G,S,D,F,P,V,J,GVT,OM,DD,DF,DG,DS,R,M,Q,A,Y,C,K
      COMMON/CONSTS/NUM,NUT,EPS,T
      DELTT=0.
1     CONTINUE
      DATE=START+DELTT/24.
      CALL SUNMON(DATE,2)
C** FIND DIFFERENTIAL CORRECTION TO TIME TO MAKE ELONGATION
C** OF MOON FROM SUN ( ANGLE D ) SMALLER
      DP=D/NUM +22640*DSIN(G)+769.*DSIN(2*G)+2370*DSIN(2*D)
      **4586.0*DSIN(2*D-G)-668.0*DSIN(S)-6910.0*DSIN(S)*(1.+K)+GVT
      * +206*DSIN(2*D-G-S)-125*DSIN(D)-212*DSIN(2*G-2*D)
C2345677
      IF(DP.GT.(270*3600) ) DP=DP-360*3600
      DDP=22640.0*DCOS(G)*DG+4536.0*DCOS(2*D-G)*(2*DD-DG)
      * +2370.0*DCOS(2*D)*2*DD+769*DCOS(2*G)*2*DG-412*DCOS(2*F)*2*DF
      * +192*DCOS(2*D+G)*(2*DD+DG)
      * + 206*DCOS(2*D-G-S)*(2*DD-DG)+165*DCOS(2*D-S)*2*DD
      * -125*DCOS(D)-110*DCOS(G+S)*DG+148*DCOS(G-S)*DG
      * +(12.190749D0/24.)*3600.0
200  FORMAT(' IN CONJNC , CORRECTION TO TIME THIS ITERATION
      * IS ',F10.5,' HOURS ')
C234567
      DT=-DP/DDP
C     WRITE(6,200) DT

```

```

        DELTT=DELTT+DT
        IF(DABS(DT).LT.ERROR) GOTO 2
        GOTO 1
2      CONTINUE
        DELTT=DELTT-DT
        RETURN
        END
SUBROUTINE JDCAL(JDATE,DATE)
INTEGER DATE(6)
REAL M(48) ,MM(48)
REAL*8 JD,JDATE
EQUIVALENCE (M(1),MM(1))
DATA M(1),M(3),M(4),M(5),M(6),M(7),M(8),M(9),M(10),M(11),M(12)/
1      31.0,31.0,30.0,31.0,30.0,31.0,31.0,30.0,31.0,30.0,31.0/
MM(2)=28.0
J = 1
JD=JDATE
DO 100 N=1,3
DO 100 L=1,12
K = 12*N+L
100 MM(K) = M(L)
MM(2) = M(2)+1.0
IF(JD-2299160.5)105,101,101
101 JD = JD+10.0
REM = JD-2342041.5
IF(REM)105,104,102
102 DO 103 J=1,100
REM = REM-FLOAT(36524+((J/4)-((J-1)/4)))
IF(REM)104,103,103
103 CONTINUE
104 JD = JD+FLOAT(J-(J/4))
105 JD = JD+0.5
IY = INT(JD/1461.0)
DIFF = JD-FLOAT(IY*1461)
DO 107 JM=1,48
DIFF = DIFF-M(JM)
IF(DIFF)108,107,107
107 CONTINUE
108 DATE(1) = IY*4 -4712+(JM-1)/12
DATE(2) = JM-((JM-1)/12)*12
DIFF = DIFF+M(JM)+1.0
DATE(3) = INT(DIFF)
TEMPA = (DIFF-FLOAT(DATE(3)))*24.0
DATE(4) = INT(TEMPA)

```

```
DATE(5) = INT((TEMPA-FLOAT(DATE(4)))*60.0)
DATE(6) = 0
RETURN
END
```

JULIAN

```
C   LAST USED OCTOBER 1982
C   THIS PROGRAM COMPUTE THE JULIAN DAY NUMBER AND CHINESE
C   CYCLICAL DATE NUMBER FOR ANY DATE BC OR AD. IT USES THE
C   JULIAN CALENDAR UP TO 1582 AND THE GREGORIAN CALENDAR
C   FROM 1582. NO DATES BETWEEN 1582 OCTOBER 5 AND 14 ARE ACCEPTED.
C   IMPLICIT REAL*8(A-H,O-Z)
C   REAL*8 JD
C   PARAMETER OPU=2,IPU=1
C   OPEN (UNIT=OPU,FILE='SYS$OUTPUT',STATUS='OLD')
C   OPEN (UNIT=IPU,FILE='SYS$INPUT',STATUS='OLD',READONLY)

5   CONTINUE
C   WRITE(6,*) 'TYPE IN CALENDAR DATE: YEAR, MONTH, DAY (ALL INTEGER)'
C   WRITE (6,*) '(JULIAN TO 1582 OCT 4; GREGORIAN FROM 1582 OCT 15)'
C   READ(5,*) IYEAR,MONTH,IDAY
C   CALL TOJD(IYEAR,MONTH,IDAY,JD)
C   IF (JD.GE.0) GO TO 7
C   WRITE (6,*) 'ERROR, NO SUCH DATE'
C   WRITE (6,17)
C   GO TO 5

7   DJD=JD
C   IJD=DJD
C   WRITE (6, 18) IJD
18  FORMAT (' JULIAN DAY NUMBER=',I10)
C   IJD=DJD/60
C   REM=DJD-IJD*60
C   IREM=REM-10
C   IF (IREM.LT.1) IREM=IREM+60
C   WRITE (6, 8) IREM
8   FORMAT (' CHINESE CYCLICAL DAY NUMBER=',I10)
C   WRITE (6, 17)
17  FORMAT (' ',/,79(1H=))
C   GO TO 5
C   END
C   SUBROUTINE TOJD(IYEAR,MONTH,IDAY,JDATE)
C   REAL*8 JDATE
C   INTEGER Y , D
C   Y=IYEAR
C   M=MONTH
C   D=IDAY
C   IF(IYEAR.GT.1582) GOTO 1
C   IF(IYEAR.EQ.1582.AND.MONTH.GT.10) GO TO 1
```

```

IF (IDAY.GT.4.AND.IDAY.LT.15.AND.IYEAR.EQ.1582.AND.MONTH.EQ.10)
*GO TO 2
IF(IDAY.GE.15.AND.IYEAR.EQ.1582.AND.MONTH.EQ.10)GO TO 1
JDATE=367*Y-7*(Y+5001+(M-9)/7)/4+275*M/9+D+1729777
RETURN
1  CONTINUE
JDATE=367*Y-7*(Y+(M+9)/12)/4-3*((Y+(M-9)/7)/100+1)/4
* +275*M/9+D+1721029
RETURN
2  CONTINUE
JDATE=-1
RETURN
END

```

RASUN

```

C   LAST USED OCTOBER 1982
      IMPLICIT REAL*8(A-H,O-Z)
      REAL*8 NUM, LET, JD, LAU, LONG, LAT, LOU, LHA ,LRA, LAMBDA
5   CONTINUE
      WRITE(6,*) ' TYPE IN CIVIL DATE, YEAR, MONTH, DAY ( ALL INTEGER) '
      READ(5,*) IYEAR,MONTH,IDAY
      WRITE(6,100) IYEAR,MONTH,IDAY
100  FORMAT(///' CIVIL DATE =',I5,','/,I4,','/,I4)
      CALL TOJD(IYEAR,MONTH,IDAY,12.0,JD)
C   WRITE(6,*)' TYPE IN LATITUDE, DEGREES ( INTEGER), MINS( DECIMAL) '
C   READ(5,*) IDEG,XMINS
C   WRITE(6,250) IDEG,XMINS
250  FORMAT(' LATITUDE =',I5,3X,F6.2)
C   LAT=IDEG+XMINS/60.
C   WRITE(6,*)' TYPE IN LONGITUDE , SAME FORMAT ,NEGATIVE TO EAST '
C1  READ(5,*) IDEG,XMIN
C   IF(IDEG.GT.0) LONG=IDEG+XMIN/60.
C   IF(IDEG.LT.0) LONG=IDEG-XMIN/60.
C   IF(IDEG.NE.0) GOTO 2
C   WRITE(6,*)' FOR ZERO DEGREES , TYPE IN AS + OR - 360 , WITH '
C   WRITE(6,*)' POSITIVE SIGN FOR MINUTES '
C   GOTO 1
2   CONTINUE
C   IF(IABS(IDEG).EQ.360) LONG=LONG-360.
C   WRITE(6,251) IDEG,XMIN
251  FORMAT(' LONGITUDE =',I5,3X,F6.2)
      LAT=35.0
      LONG=-115.0
C   WRITE(6,*) ' TYPE IN ET IN HOURS '
      H=7.5
      JD=JD+H/24.-0.5
      PI=3.141592653589D0
      NUM=PI/648000.
      CIR=1296000.
      E=(JD-2415020.D0)/36525.
      DELTAT=32.5*(E+1)**2
      LET=-8.72-26.74*E-11.22*E**2
      LET=LET-1.94+3.43*E-1.78*E**2
      GVT=14.27*DSIN(6.050+2.31884*E)
      RK=-0.002495D0*E-0.00000752D0*E**2
      OM=NUM*(933060.-6962911.*E+7.48*E**2+0.008*E**3)
      SV=LET+GVT+7.26*DSIN(OM)

```



```

VAR=SV-95.96*DSIN(OM)-15.58*DSIN(OM-0.0401*E+4.800)
SS=1290513.0D0+129596579.10D0*E-0.54*E**2-0.012*E**3
SS=CON(SS)
SS=SS*NUM
SL=1006908.04D0+129602768.13D0*E+1.089*E**2
S=SS
SOLIN=DSIN(S)*6910.*(1+RK)+72.*DSIN(2.*S)*(1.+2.*RK)
SOLIN=SOLIN-20.5
SSOL=SOLIN+SL
SOL=CON(SSOL)
SOL=NUM*SOL
SUN=SOL*180/PI
EPS=NUM*(23.*3600.+1628.26-46.845*E-0.0059*E**2+0.00181*E**3)
LONG=LONG+1.002738*DELTAT/240.
LOU=LONG*PI/180
LAU=LAT*PI/180
ST=(H+12)*3600.+67126.+8640184.542D0*E+0.0929*E**2
ST=ST-DINT(ST/86400.D0)*86400.
ST=ST*15.*NUM
SIND=DSIN(SOL)*DSIN(EPS)
COSD=DSQRT(1.-SIND**2)
TAND=SIND/COSD
SUND=DATAN(TAND)*180/PI
TANA=DSIN(SOL)*DCOS(EPS)/DCOS(SOL)
COSA=DCOS(SOL)/COSD
SRA=DATAN(TANA)
IF (COSA.LT.0) SRA=SRA+PI
IF (SRA.LT.0) SRA=SRA+2*PI
SUNRA=SRA*180/PI
SHA=ST-SRA-LOU
SINHT=SIND*DSIN(LAU)+COSD*DCOS(LAU)*DCOS(SHA)
COSHT=DSQRT(1.-SINHT**2)
HT=DATAN2(SINHT,COSHT)*180./PI
TANSAZ=COSD*DSIN(SHA)/(COSD*DCOS(SHA)*DSIN(LAU)-SIND*DCOS(LAU))
COSSAZ=(SIND*DCOS(LAU)-COSD*DCOS(SHA)*DSIN(LAU))/COSHT
SUNAZ=DATAN(TANSAZ)
IF (COSSAZ.LT.0) SUNAZ=SUNAZ+PI
IF (SUNAZ.LT.0) SUNAZ=SUNAZ+2*PI
SUNAZ=SUNAZ*180/PI
TPI=2.*PI
SHA=SHA-2.*PI*aint(SHA/TPI)
IF (SHA.LT.0.) SHA=SHA+2.*PI
TIME=SHA*12./PI+12.
IF (TIME.GT.24.) TIME=TIME-24.

```

```

ISHR=TIME
SHR=ISHR
SHIN=60.*(TIME-SHR)
FF=40511.92+1739527317.29D0*E-0.34*E**2-0.0012*E**3+VAR
C FF=FF-2.02-4.39*E
F=CON(FF)
F=NUM*F
RL=973571.71D0+1732564406.06D0*E+7.14*E**2+0.0068*E**3+SV
DA=RL-SL
D=CON(DA)
D=NUM*D
GG=1065985.3D0+1717915883.54D0*E+44.31*E**2+0.0518*E**3+SV
G=CON(GG)
G=NUM*G
RLUN=(1.+RK)*(18.02*DSIN(S+D)+165.15*DSIN(2.*D-S)
*-24.42*DSIN(2.*D+S)-109.67*DSIN(G+S)+147.69*DSIN(G-S)
**+205.96*DSIN(2.*D-G-S)+14.58*DSIN(2.*D+G-S)-28.48*DSIN(2.*D+S-G)
*-668.11*DSIN(S))+18.61*DSIN(G-D)-13.19*DSIN(3.*G-2.*D)
**+22639.55*DSIN(G)+769.02*DSIN(2.*G)+36.12*DSIN(3.*G)
**+2369.90*DSIN(2.*D)+4586.43*DSIN(2.*D-G)
*-124.99*DSIN(D)+13.90*DSIN(4.*D)
*-211.66*DSIN(2.*G-2.*D)+191.95*DSIN(2.*D+G)
**+30.77*DSIN(4.*D-2.*G)+38.43*DSIN(4.*D-G)+14.39*DSIN(2.*D+2.*G)
*-411.61*DSIN(2.*F)-55.17*DSIN(2.*F-2.*D)-39.53*DSIN(2.*F-G)
*-45.10*DSIN(2.*F+G)
RLUN=RLUN-17.*DSIN(OM)
DRLO=RL+RLUN
RLO=CON(DRLO)
SA=(1+RK)*(-126.98*DSIN(S)-165.06*DSIN(S-2.*D)
*-115.18*DSIN(S+G)-182.36*DSIN(S+G-2.*D)-138.76*DSIN(S-G))
*-112.79*DSIN(D)+2373.36*DSIN(2.*D)+192.72*DSIN(G+2.*D)
**+22609.07*DSIN(G)-4578.13*DSIN(G-2.*D)+767.96*DSIN(2.*G)
*-152.53*DSIN(2.*G-2.*D)+50.64*DSIN(3.*G)-52.14*DSIN(2.*F-2.*D)
*-85.13*DSIN(2.*F-G)
RM=-526.069*DSIN(F-2.*D)+44.297*DSIN(F+G-2.*D)
*-24.649*DSIN(F-2.*G)-22.571*DSIN(F+S-2.*D)*(1.+RK)
**+10.985*DSIN(F-S-2.*D)*(1.+RK)-6.000*DSIN(F+G-4.*D)
**+20.599*DSIN(F-G)-30.598*DSIN(F-G-2.*D)
SA=F+NUM*SA
RLA=DSIN(SA)*18519.70-6.24*DSIN(3.*SA)+RM
DLO=RLO/3600
DLA=RLA/3600
RLO=NUM*RLO
RLA=NUM*RLA

```

```

SINLD=DCOS(RLA)*DSIN(RLO)*DSIN(EPS)+DSIN(RLA)*DCOS(EPS)
COSLD=DSQRT(1.-SINLD**2)
TANLD=SINLD/COSLD
RLD=DATAN(TANLD)
QD=RLD/(NUM*3600)
TANLR=(DCOS(RLA)*DSIN(RLO)*DCOS(EPS)-DSIN(RLA)*DSIN(EPS))
*/(DCOS(RLA)*DCOS(RLO))
LRA=DATAN(TANLR)
IF (DCOS(RLO).LT.0.) LRA=LRA+PI
IF (LRA.LT.0) LRA=LRA+2.*PI
QRA=LRA/(NUM*3600)
LHA=ST-LRA-LOU
API=28.2*DCOS(2.*D)+186.5*DCOS(G)+34.3*DCOS(G-2.*D)
**+10.2*DCOS(2.*G)+3422.5
API=NUM*API
RHO=0.99832+0.00168*DCOS(2.*LAU)
PHI=696.*DSIN(2.*LAU)
GLA=LAU-PHI*NUM
A=COSLD*DSIN(LHA)
B=COSLD*DCOS(LHA)-RHO*DCOS(GLA)*DSIN(API)
C=SINLD-RHO*DSIN(GLA)*DSIN(API)
Q=DSQRT(A**2+B**2+C**2)
R=Q/DSIN(API)
SD=0.2725/R*180/PI
XA=DSQRT(A**2+B**2)
DEC=DATAN2(C,XA)
PD=DEC/(NUM*3600)
COSH=B/XA
SINH=A/XA
TANH=A/B
HH=DATAN(TANH)
IF (COSH.LT.0.) HH=HH+PI
IF (HH.LT.0) HH=HH+2*PI
RA=LRA+LHA-HH
PRA=RA/NUM
PRA=CON(PRA)
PRA=PRA/3600
SINB=-DCOS(DEC)*DSIN(RA)*DSIN(EPS)+DSIN(DEC)*DCOS(EPS)
COSB=DSQRT(1-SINB**2)
TANB=SINB/COSB
BETA=DATAN(TANB)*180/PI
COSL=DCOS(DEC)*DCOS(RA)/COSB
TANL=(DCOS(DEC)*DSIN(RA)*DCOS(EPS)+DSIN(DEC)*DSIN(EPS))/
*(DCOS(DEC)*DCOS(RA))

```

```

RLAM=DATAN (TANL)
IF (COSL.LT.0) RLAM=RLAM+PI
LAMBDA=RLAM*180/PI
IF (LAMBDA.LT.0) LAMBDA =LAMBDA+360.
SINAL=DSIN(DEC)*DSIN(LAU)+DCOS(DEC)*DCOS(LAU)*COSH
COSAL=DSQRT(1.-SINAL**2)
ALT=DATAN2(SINAL,COSAL)*180./PI
TANAZ=DCOS(DEC)*SINH/(DCOS(DEC)*COSH*DSIN(LAU)
*-DSIN(DEC)*DCOS(LAU))
COSAZ=(DSIN(DEC)*DCOS(LAU)-DCOS(DEC)*COSH*DSIN(LAU))/COSAL
AZ=DATAN(TANAZ)
IF (COSAZ.LT.0) AZ=AZ+PI
IF (AZ.LT.0) AZ=AZ+2*PI
AZ=AZ*180/PI
WRITE (6,746) H, TIME
746 FORMAT (' ET, LOCAL TIME=', 2(F10.3))
WRITE (6, 99) SUNRA, SUND, SUN
99 FORMAT (' SOLAR RA, DEC, LONG=', 3(F10.2))
WRITE (6, 98) PRA, PD
98 FORMAT (' TOPOCENTRIC LUNAR RA AND DEC=', 2(F10.2))
WRITE (6, 87) DLO, DLA
87 FORMAT (' GEOCENTRIC LONGITUDE AND LATITUDE=', 2(F10.3))
WRITE (6, 49) LAMBDA, BETA
49 FORMAT (' TOPOCENTRIC LUNAR LONG AND LAT=', 2(F10.2))
WRITE (6, 97) SD
97 FORMAT (' LUNAR SEMI-DIAMETER=', F10.2)
WRITE(6,110) SUNAZ, HT
110 FORMAT (' SOLAR AZIMUTH AND ALTITUDE=', 2(F10.3))
WRITE (6, 111) AZ, ALT
111 FORMAT(' LUNAR AZIMUTH AND ALTITUDE=', 2(F10.2), //, 79(1H=))
GO TO 5
END
SUBROUTINE TOJD(IYEAR,MONTH,IDAY,HOURL,JDATE)
REAL*8 JDATE
INTEGER Y , D
C** CONVERTS YEAR/MONTH/DAY/HOUR TO JULIAN DATE
C** ALGORITHM OF PAUL MULLER 1975 THESIS
Y=IYEAR
M=MONTH
D=IDAY
IF(IYEAR.GT.1582) GOTO 1
IF(IYEAR.EQ.1582.AND.MONTH.GT.9) GOTO 1
IF(IDAY.GT.5.AND.IYEAR.EQ.1582.AND.MONTH.EQ.9) GOTO 1
C** DATE BEFORE 1582 SEPT 15.... GREGORIAN CALENDAR

```

```

JDATE=367*Y-7*(Y+5001+(M-9)/7)/4+275*M/9+D+1729777
JDATE=JDATE+(HOUR-12.0)/24.0
RETURN
1  CONTINUE
JDATE=367*Y-7*(Y+(M+9)/12)/4-3*((Y+(M-9)/7)/100+1)/4
* +275*M/9+D+1721029
JDATE=JDATE+(HOUR-12.0)/24.0
RETURN
END
FUNCTION CON(A)
REAL*8 CON,A
N=A/1296000.DO
CON=A-N*1296000.DO
IF(CON.LT.0.ODO) CON=CON+1296000.DO
RETURN
END
SUBROUTINE DEBUG(ANAME,RVAL)
IMPLICIT REAL*8(A-H,O-Z)
DATA BLANK,XMINUS/1H ,1H-/
VAL=DABS(RVAL)
C** ANGLE , NAME ANAME , IS IN SECS OF ARC
IVAL=VAL
SEC=VAL-IVAL
IDEG=VAL/3600.
XMIN=(VAL-3600.*IDEG)/60.
MIN=XMIN
ISEC=(VAL-3600.*IDEG-60.*MIN)
SEC=SEC+ISEC
IF(RVAL.GT.0) SIGN=BLANK
IF(RVAL.LT.0) SIGN=XMINUS
WRITE(6,100) ANAME,RVAL,SIGN,IDEG,MIN, SEC
100  FORMAT(' ANGLE NAME = ',A4,' VALUE = ',F15.3,' DEG/MIN/SEC
= ',
* A1,2(I5,2X),F6.3)
RETURN
END

```

SUN

```

C This version of SONNEN.FOR has been modified and works, 7 Apr 89
C USES ONLY A STARTING DATE FROM NEUGEBAUER OR OPPOLZER AND ADDS
C MULTIPLES OF 29.53059 DAYS UNTIL FINAL DATE IS REACHED
C INVISIBLE ECLIPSES REJECTED.
C ASSUMES N = -26, S/M DELTAT.
  IMPLICIT REAL*8(A-H,O-Z)
  REAL*8 LUPA,M,LA,NUM,LT,JD,LULO,LULA,LHA,LET,K,  LAT,LONG,LUNIN,
*LRA,KK, LONGST,LATST,LD
  REAL*4 LOG
  DIMENSION IDATE(6)
  PI=3.141592653589D0
  NUM=PI/648000.0D0
  CF=PI/180.0
  CIR=1296000.0D0
  WRITE (*,*) 'SOLAR ECLIPSE CALCULATIONS FOR SINGLE PLACE'
  WRITE (*,*) 'DELTAT FROM STEPHENSON AND MORRISON (1984)'
211 WRITE (*,*) 'TYPE IN LAT AND LONG (DEGREES AND DECIMALS)'
  READ (5,*) LATST, LONGST
C   WRITE (6,151) LATST, LONGST
151 FORMAT (' LAT AND LONG=', 2(F10.2),//,79(1H=))
5   WRITE(*,*) 'TYPE IN STARTING JDN FROM PVN OR OPPOLZER LIST'
  READ(5,*) SJD
  WRITE (*,*) 'TYPE IN FINAL DATE FROM PVN OR OPPOLZER LIST'
  READ (5,*) FJD
  DAYS=29.530588D0
  RJD=SJD
9   CJD=RJD
  NJD=CJD
  JD=NJD
  E=(JD-2415020.D0)/36525.D0
  IF (E.GT.-9.5) DELTAT = 25.5 * (E+1)**2
  IF (E.LE.-9.5) DELTAT = 1360 + 320 * (E+1) + 44.3 * (E+1)**2
C   WRITE (6,417) DELTAT
417 FORMAT (' DELTAT=', F10.0)
C   WRITE (6,463) JD
463 FORMAT (' JD=', F10.0)
C   DELTAT=32.5 *(E+1)**2
C   DELTAT=25.5 *(E+1)**2
  ACC=0.
  LET=-8.72-26.74*E-11.22*E**2-1.94+3.43*E-1.78*E**2+ACC*E**2
  GVT=14.27*DSIN(6.050+2.31884*E)
  K=-0.002495*E-0.00000752*E**2

```

```

OM=NUM*(933060-6962911*E+7.48*E**2+0.008*E**3)
SV=LET+GVT+7.26*DSIN(OM)+0.84*DSIN(0.35255*E+0.894)
SVAR=(1.88-0.016*E)*DSIN(0.999+2.6227*E)
**+6.40*DSIN(4.035+0.35255*E)
S=NUM*(1290513.0D0+129596579.10D0*E-0.54*E**2-0.012*E**3+SVAR)
F=      40511.92+1739527317.29D0*E-0.34*E**2-0.0012*E**3+SV
*-95.96*DSIN(OM)-15.58*DSIN(OM-0.0401*E+4.800)
*-1.86*DSIN(OM-0.0157*E+5.06)
F=F+1.52-5.81*E+0.049*E**2
F=NUM*CON(F)
D=1262663.67D0+1602961637.93D0*E+6.05*E**2+0.0068*E**3+SV-SVAR
D=NUM*CON(D)
G=NUM*(1065985.3D0+1717915883.54D0*E+44.31*E**2+0.0518*E**3+SV)
DD=12.190749D0*CF/24
DF=13.229350D0*CF/24
DG=13.064992D0*CF/24
DS=0.985600*CF/24
LAT=LATST*CF
LONG=(LONGST+1.002738*DELTAT*15/3600)*CF
TA=0
11 SOLIN=DSIN(S)*6910.057*(1+K)+DSIN(2*S)*72.338*(1+2*K)
LUNIN=(1+K)*(18.02*DSIN(S+D)+165.15*DSIN(2*D-S)
*-24.42*DSIN(2*D+S)-109.67*DSIN(G+S)+147.69*DSIN(G-S)
**+205.96*DSIN(2*D-G-S)+14.58*DSIN(2*D+G-S)
*-28.48*DSIN(2*D+S-G)-668.11*DSIN(S))
**+18.61*DSIN(G-D)-13.19*DSIN(3*G-2*D)+22639.55*DSIN(G)
**+769.02*DSIN(2*G)+36.12*DSIN(3*G)+2369.90*DSIN(2*D)
**+4586.43*DSIN(2*D-G)-124.99*DSIN(D)+13.90*DSIN(4*D)
*-211.66*DSIN(2*G-2*D)+191.95*DSIN(2*D+G)+30.77*DSIN(4*D-2*G)
**+38.43*DSIN(4*D-G)+14.39*DSIN(2*D+2*G)-411.61*DSIN(2*F)
*-55.17*DSIN(2*F-2*D)-39.53*DSIN(2*F-G)-45.10*DSIN(2*F+G)
DLO=22639.55*DCOS(G)*DG+4586.43*DCOS(2*D-G)*(2*DD-DG)
**+2369.90*DCOS(2*D)*2*DD+769.02*DCOS(2*G)*2*DG
*-411.61*DCOS(2*F)*2*DF+191.95*DCOS(2*D+G)*(2*DD+DG)
DSQ=6910.057*DCOS(S)*DS*(1+K)
CD=D/NUM+LUNIN-SOLIN-20.5
IF (CD.GT. 648000.) CD=CD-1296000.
CDD=DD/NUM+DLO-DSQ
DTA=-CD/CDD
IF (DABS(DTA).LT.0.01) GO TO 12
TA=TA+DTA
G=G+DG*DTA
D=D+DD*DTA
F=F+DF*DTA

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```

S=S+DS*DTA
GO TO 11
12 E=E +TA/(36525*24)
EPS=NUM*(23*3600+1628.26-46.845*E-0.0059*E**2+0.00181*E**3
**+9*DCOS(OM))
LOG=0.00003057D0-0.00000015D0*E+DCOS(S)*(-0.00727412D0
**+0.00001814D0*E+0.00000005D0*E**2)+DCOS(2*S)*(-0.00009138D0
**+0.00000046D0*E)+0.000000001D0*(13360*DCOS(D))
RV=10.**LOG
SOL=1006908.04D0+129602768.13D0*E+1.089*E**2+SVAR-17*DSIN(OM)
DSOL=0.985647*3600/24
SOLIN=SOLIN-20.47/RV
SOLO=NUM*CON(SOL+SOLIN)
PPI=0.261*DCOS(4*D)+28.233*DCOS(2*D)+3.086*DCOS(G+2*D)
**+186.540*DCOS(G)+34.312*DCOS(G-2*D)+0.601*DCOS(G-4*D)
**+0.978*DCOS(D)+0.283*DCOS(2*G+2*D)+10.166*DCOS(2*G)
PPI=3422.451+PPI*(1-0.000048)
P=NUM*PPI
LUPA=PPI*(1+0.1667*P**2)
ST=23925.836+8640184.542D0*E+0.0929*E**2+3600*(TA+12.)
ST=ST-86400*DINT(ST/86400)
IF (ST.LE.0.) ST=ST+86400
RAD=15*NUM*ST-17*DSIN(OM)*NUM
SS=(1+K)*(-25.10*DSIN(S+2*D) -126.98*DSIN(S)
**+165.05*DSIN(S-2*D)
* -115.18*DSIN(S+G)-182.36*DSIN(S+G-2*D)
* -138.76*DSIN(S-G)
**+31.70*DSIN(S-G-2*D))
**+112.79*DSIN(D)+2373.36*DSIN(2*D)
* +192.72*DSIN(G+2*D)
* +22609.07*DSIN(G)-4578.13*DSIN(G-2*D)
* -38.64*DSIN(G-4*D)
**+767.96*DSIN(2*G)-152.53*DSIN(2*G-2*D)-34.07*DSIN(2*G-4*D)
**+50.64*DSIN(3*G) -52.14*DSIN(2*F-2*D)
* -85.13*DSIN(2*F-G)
M=-526.069*DSIN(F-2*D)-3.352*DSIN(F-4*D)+44.297*DSIN(F+G-2*D)
**+6.000*DSIN(F+G-4*D)+20.599*DSIN(F-G)-30.598*DSIN(F-G-2*D)
**+24.649*DSIN(F-2*G)-2.000*DSIN(F-2*G-2*D)
**+22.571*DSIN(F+S-2*D)*(1+K)+10.985*DSIN(F-S-2*D)*(1+K)
SS=F+NUM*SS
LA=DSIN(SS)* 18519.70 -6.24*DSIN(3*SS)+M-0.60
DLO=DLO+(1+K)*(-109.7*DCOS(G+S)*(DG+DS)+147.7*DCOS(G-S)*(DG-DS)
**+206.0*DCOS(2*D-G-S)*(2*DD-DG-DS)+165.2*DCOS(2*D-S)*(2*DD-DS))
**+36.1*DCOS(3*G)*3*DG-125.2*DCOS(D)*DD+38.4*DCOS(4*D-G)*(4*DD-DG)

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*-45.1*DCOS(2*F+G)*(2*DF+DG)
  DM=-526.1*DCOS(F-2*D)*(DF-2*DD) -30.6*DCOS(F-G-2*DD)*(DF-DG-2*DD)
  DSS=DF+NUM*(2373.4*DCOS(2*D)*2*DD+192.7*DCOS(G+2*D)*(DG+2*DD)
**+22609.1*DCOS(G)*DG-4578.1*DCOS(G-2*D)*(DG-2*DD)
**+768.0*DCOS(2*G)*2*DG)
  DLA= 18519.70 *DCOS(SS)*DSS-6.24*DCOS(3*SS)*3*DSS+DM
  LUPA=NUM*LUPA
  LULA=LA*NUM
  DLO=NUM*(DLO+13.176396D0*3600./24.)
  DSO=NUM*(DSO+DSOL)
  DLA=NUM*DLA
  LULO=973571.71D0+1732564406.06D0*E+7.14*E**2+0.0068*E**3+SV+LUNIN
  LULO=NUM*CON(LULO)
  H=DATAN(DSIN(EPS)*DCOS(SOLO)/DCOS(EPS))
  COSSO=DCOS(SOLO)
  DH=-0.437*DSIN(SOLO)*DSO/(1+0.191*COSSO**2)
  SOPA=8.80*NUM
  PA=DSIN(LUPA-SOPA)
  DPA=-28.2*DSIN(2*D)*2*DD-186.5*DSIN(G)*DG
*-34.3*DSIN(G-2*D)*(DG-2*DD)
  DPA=NUM*DPA
  X1=DCOS(LULA)*DSIN(LULO-SOLO)/PA
  Y1=DSIN(LULA)/PA
  DX1=DCOS(LULA)*(PA*DCOS(LULO-SOLO)*(DLO-DSO)
*-DSIN(LULO-SOLO)*DCOS(LUPA-SOPA)*DPA)/PA**2
  DY1=(PA*DCOS(LULA)*DLA-DSIN(LULA)*DCOS(LUPA-SOPA)*DPA)/PA**2
  DX=DX1*DCOS(H)-DY1*DSIN(H)-DH*(X1*DSIN(H)+Y1*DCOS(H))
  DY=DX1*DSIN(H)+DY1*DCOS(H)+DH*(X1*DCOS(H)-Y1*DSIN(H))
  DMU=0.262516-0.888*DSO/(0.839+0.161*COSSO**2)
  SINS=DSIN(SOLO)*DSIN(EPS)
  COSSD=DSQRT(1-SINS**2)
  SD=DATAN2(SINS, COSSD)
  COSSRA=DCOS(SOLO)/COSSD
  TANSRA= DSIN(SOLO)*DCOS(EPS)/DCOS(SOLO)
  SRA=DATAN(TANSRA)+PI
  IF (COSSRA.GT.0.) SRA=SRA-PI
  IF (SRA.LT.0.) SRA=SRA+2*PI
  B=SOPA/DSIN(LUPA)
  SINLD=DCOS(LULA)*DSIN(LULO)*DSIN(EPS)+DSIN(LULA)*DCOS(EPS)
  COSLD =DSQRT(1.-SINLD**2)
  LD=DATAN2(SINLD, COSLD)
  TANLRA=(DCOS(LULA)*DSIN(LULO)*DCOS(EPS)-DSIN(LULA)*DSIN(EPS))/
*(DCOS(LULA)*DCOS(LULO))
  LRA=DATAN(TANLRA)

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IF (DCOS(LULO).LT.0.) LRA=LRA+PI
IF (LRA.LT.0.) LRA=LRA+2*PI
AA=SRA-(DCOS(LD)/DCOS(SD))*B*(LRA-SRA)/(1-B)
SHD=SD-B*(LD-SD)/(1-B)
SIND=DSIN(SHD)
R=1/DSIN(LUPA)
X=R*DCOS(LD)*DSIN(LRA-AA)
Y=R*(DSIN(LD)*DCOS(SHD)-DCOS(LD)*SIND+DCOS(LRA-AA))
Z=R*(DSIN(LD)*SIND+DCOS(LD)*DCOS(SHD)*DCOS(LRA-AA))
F1=962.03*NUM/(RV*(1-B))
F2=957.23*NUM/(RV*(1-B))
KK=0.272488D0
U1=1.000011*(Z*F1+KK)
U2=1.000011*(Z*F2-KK)
ANGLE=RAD-AA
DSHD=0.968*DCOS(SOLO)*DSO*DSIN(EPS)/DCOS(SHD)
SP=0.99497418D0-0.00167082D0*DCOS(2*LAT)+0.0000021D0*DCOS(4*LAT)
RHOSIN=SP*DSIN(LAT)
CC=1.0016799D0-0.00168208D0*DCOS(2*LAT)+0.00000212D0*DCOS(4*LAT)
RHOCOS=CC*DCOS(LAT)
DTT = 0.
NN = 0
EMAG = 0.
13 XI=RHOCOS*DSIN(ANGLE-LONG)
ETA=DCOS(SHD)*RHOSIN-SIND*RHOCOS+DCOS(ANGLE-LONG)
ZETA=SIND*RHOSIN+DCOS(SHD)*RHOCOS+DCOS(ANGLE-LONG)
DXI=DMU*RHOCOS+DCOS(ANGLE-LONG)
DETA=DMU*XI*SIND-DSHD*ZETA
XX=X-XI
YY=Y-ETA
DXX=DX-DXI
DYY=DY-DETA
DTT=-((XX*DXX+YY*DYY)/(DXX**2+DYY**2))
NN = NN + 1
IF (DABS(DTT).LT. 0.0001) GO TO 14
IF (NN.GT.9) EMAG =-1
IF (NN.GT.9) GO TO 43
TA=TA+DTT
X=X+DX*DTT
Y=Y+DY*DTT
SHD=SHD+DSHD*DTT
SIND=DSIN(SHD)
ANGLE=ANGLE+DMU*DTT
GO TO 13

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```

14  GMT=TA+12-24*DINT((TA+12)/24)
    DLONG=LONG/CF
    DJD=JD    +TA/24-DLONG/360
    MJD=DJD+0.5
    IJD=DINT(DJD)/60
    REM=DJD-IJD*60
    REM=REM+0.5
    IREM=REM-10
    IF (IREM.LT.1) IREM=IREM+60
    CALL JDCAL(DJD, IDATE)
    LHA=(ANGLE-LONG)/(CF*15)+12
    LT=LHA-24*DINT(LHA/24)
    IF (GMT.LT.0.) GMT=GMT+24
    IF (LT.LT.0.) LT=LT +24
    DEL=(XX*DYY-YY*DXX)/DSQRT(DXX**2+DYY**2)
    UM=U2-ZETA*1.000011*F2
    PEN=U1-ZETA*1.000011*F1
    EMAG=(PEN-DABS(DEL))/(UM+PEN)
C   IF (EMAG.LT. -0.20) GO TO 43
    IF (EMAG.LT.0.) GO TO 43
    IF (DABS(DEL).LT.DABS(UM)) EMAG=(PEN-UM)/(UM+PEN)
    RN=DSQRT(DXX**2+DYY**2)
    IF (DABS(DEL).LT.PEN) SDUR=PEN*DSQRT(1-(DEL/PEN)**2)/RN
    IF (DABS(DEL).GE.PEN) SDUR=0.
    COSALT=DSQRT(1-ZETA**2)
    ALT=(180/PI)*DATAN(ZETA/COSALT)
    IF (ALT .LT. -25.) GO TO 43
C   IF (ALT.LT.-15.) GO TO 43
    JDN=JD
    WRITE (6,779) JDN
779  FORMAT(I10)
    WRITE (6,305) JDN, IREM
305  FORMAT (' JDN, CHINESE CYCL DN =',2(I10))
C   WRITE (6,777) IDATE(1), IDATE(2), IDATE(3)
777  FORMAT (' Y' ,3(I9))
C   WRITE (6,778) UM, DEL, SDUR
778  FORMAT (' UMBRA, DELTA, SDUR=',3(F10.3))
    WRITE (6,304) EMAG, LT, ALT
304  FORMAT (' M',3(F10.2),//,79(1H=))
43   RJD=RJD+DAYS
    IF (RJD.GT.FJD) GO TO 211
    GO TO 9
    END
    FUNCTION CON(A)

```

```

REAL*8 CON,A,F
DATA F/1296000.0D0/
N=A/F
CON=A-N*F
IF(CON.LT.0.) CON=CON+F
RETURN
END
SUBROUTINE JDCAL(JDATE,DATE)
INTEGER DATE(6)
REAL M(48) ,MM(48)
REAL*8 JD,JDATE
EQUIVALENCE (M(1),MM(1))
DATA M(1),M(3),M(4),M(5),M(6),M(7),M(8),M(9),M(10),M(11),M(12)/
1 31.0,31.0,30.0,31.0,30.0,31.0,31.0,30.0,31.0,30.0,31.0,30.0,31.0/
MM(2)=28.0
J = 1
JD=JDATE
DO 100 N=1,3
DO 100 L=1,12
K = 12*N+L
100 MM(K) = M(L)
MM(2) = M(2)+1.0
IF(JD-2299160.5)105,101,101
101 JD = JD+10.0
REM = JD-2342041.5
IF(REM)105,104,102
102 DO 103 J=1,100
REM = REM-FLOAT(36524+((J/4)-((J-1)/4)))
IF(REM)104,103,103
103 CONTINUE
104 JD = JD+FLOAT(J-(J/4))
105 JD = JD+0.5
IY = INT(JD/1461.0)
DIFF = JD-FLOAT(IY*1461)
DO 107 JM=1,48
DIFF = DIFF-M(JM)
IF(DIFF)108,107,107
107 CONTINUE
108 DATE(1) = IY*4 -4712+(JM-1)/12
DATE(2) = JM-((JM-1)/12)*12
DIFF = DIFF+M(JM)+1.0
DATE(3) = INT(DIFF)
TEMPA = (DIFF-FLOAT(DATE(3)))*24.0
DATE(4) = INT(TEMPA)

```

```
DATE(5) = INT((TEMPA-FLOAT(DATE(4)))*60.0)
DATE(6) = 0
RETURN
END
```

XXX

```

C SOLAR ECLIPSE CALCULATIONS FOR A SPECIFIED LOCATION.
C USES ONLY A STARTING DATE FROM NEUGEBAUER AND EMPLOYS CYCLES.
C INVISIBLE ECLIPSES REJECTED. ASSUMES -26 AND 32.5
  IMPLICIT REAL*8(A-H,O-Z)
  REAL*8 LUPA,M,LA,NUM,LT,JD,LULO,LULA,LHA,LET,K,  LAT,LONG,LUNIN,
  *LRA,KK, LONGST,LATST,LD
  REAL*4 LOG
  DIMENSION IDATE(6)
  PARAMETER OPU=2,IPU=1
  OPEN (UNIT=OPU,FILE='SYS$OUTPUT',STATUS='OLD')
  OPEN (UNIT=IPU,FILE='SYS$INPUT',STATUS='OLD',READONLY)
  PI=3.141592653589D0
  NUM=PI/648000.0D0
  CF=PI/180.0
  CIR=1296000.0D0
  WRITE (*,*) ' TYPE IN LAT AND LONG (DEGREES AND DECIMALS)'
  READ (5,*) LATST, LONGST
  WRITE (6,151) LATST, LONGST
151 FORMAT ('LAT AND LONG=', 2(F10.2), '//,79(1H=)')
5  WRITE (*,*) ' TYPE IN STARTING JDN FROM PVN LIST (3 DEC PL)'
  READ (5,*) SJD
  WRITE (*,*) ' TYPE IN NUMBER OF MONTHS IN CYCLE (358, 223, ETC)'
  READ (5,*) MON
  MON=MON-1
  RJD=SJD
  DAYS=29.530588D0
  NN=1
  NNUM=0
9  CJD=RJD+0.5
  NJD=CJD
  JD=NJD
  E=(JD-2415020.D0)/36525.D0
c  DELTAT=32.4 *(E+1)**2
  IF (E.GT.-9.5) DELTAT = 25.5*(E+1)**2
  IF (E.LE.-9.5) DELTAT = 1360 +320*(E+1) + 44.3*(E+1)**2
C  WRITE (6,431) DELTAT
431 FORMAT (' DELTAT =', F10.1)
  ACC=0.
  LET=-8.72-26.74*E-11.22*E**2-1.94+3.43*E-1.78*E**2+ACC*E**2
  GVT=14.27*DSIN(6.050+2.31884*E)
  K=-0.002495*E-0.00000752*E**2
  OM=NUM*(933060-6962911*E+7.48*E**2+0.008*E**3)

```

```

SV=LET+GVT+7.26*DSIN(OM)+0.84*DSIN(0.35255*E+0.894)
SVAR=(1.88-0.016*E)*DSIN(0.999+2.6227*E)
**+6.40*DSIN(4.035+0.35255*E)
S=NUM*(1290513.0D0+129596579.10D0*E-0.54*E**2-0.012*E**3+SVAR)
F=      40511.92+1739527317.29D0*E-0.34*E**2-0.0012*E**3+SV
*-95.96*DSIN(OM)-15.58*DSIN(OM-0.0401*E+4.800)
*-1.86*DSIN(OM-0.0157*E+5.06)
F=F+1.52-5.81*E+0.049*E**2
F=NUM*CON(F)
D=1262663.67D0+1602961637.93D0*E+6.05*E**2+0.0068*E**3+SV-SVAR
D=NUM*CON(D)
G=NUM*(1065985.3D0+1717915883.54D0*E+44.31*E**2+0.0518*E**3+SV)
DD=12.190749D0*CF/24
DF=13.229350D0*CF/24
DG=13.064992D0*CF/24
DS=0.985600*CF/24
LAT=LATST*CF
LONG=(LONGST+1.002738*DELTAT*15/3600)*CF
TA=0
11 SOLIN=DSIN(S)*6910.057*(1+K)+DSIN(2*S)*72.338*(1+2*K)
LUNIN=(1+K)*(18.02*DSIN(S+D)+165.15*DSIN(2*D-S)
*-24.42*DSIN(2*D+S)-109.67*DSIN(G+S)+147.69*DSIN(G-S)
**+205.96*DSIN(2*D-G-S)+14.58*DSIN(2*D+G-S)
*-28.48*DSIN(2*D+S-G)-668.11*DSIN(S))
**+18.61*DSIN(G-D)-13.19*DSIN(3*G-2*D)+22639.55*DSIN(G)
**+769.02*DSIN(2*G)+36.12*DSIN(3*G)+2369.90*DSIN(2*D)
**+4586.43*DSIN(2*D-G)-124.99*DSIN(D)+13.90*DSIN(4*D)
*-211.66*DSIN(2*G-2*D)+191.95*DSIN(2*D+G)+30.77*DSIN(4*D-2*G)
**+38.43*DSIN(4*D-G)+14.39*DSIN(2*D+2*G)-411.61*DSIN(2*F)
*-55.17*DSIN(2*F-2*D)-39.53*DSIN(2*F-G)-45.10*DSIN(2*F+G)
DLO=22639.55*DCOS(G)*DG+4586.43*DCOS(2*D-G)*(2*DD-DG)
**+2369.90*DCOS(2*D)*2*DD+769.02*DCOS(2*G)*2*DG
*-411.61*DCOS(2*F)*2*DF+191.95*DCOS(2*D+G)*(2*DD+DG)
DSO=6910.057*DCOS(S)*DS*(1+K)
CD=D/NUM+LUNIN-SOLIN-20.5
IF (CD.GT. 648000.) CD=CD-1296000.
CDD=DD/NUM+DLO-DSO
DTA=-CD/CDD
IF (DABS(DTA).LT.0.01) GO TO 12
TA=TA+DTA
G=G+DG*DTA
D=D+DD*DTA
F=F+DF*DTA
S=S+DS*DTA

```

```

GO TO 11
12  E=E +TA/(36525*24)
    EPS=NUM*(23*3600+1628.26-46.845*E-0.0059*E**2+0.00181*E**3
**+9*DCOS(OM))
    LOG=0.00003057D0-0.00000015D0*E+DCOS(S)*(-0.00727412D0
**+0.00001814D0*E+0.00000005D0*E**2)+DCOS(2*S)*(-0.00009138D0
**+0.00000046D0*E)+0.000000001D0*(13360*DCOS(D))
    RV=10.**LOG
    SOL=1006908.04D0+129602768.13D0*E+1.089*E**2+SVAR-17*DSIN(OM)
    DSOL=0.985647*3600/24
    SOLIN=SOLIN-20.47/RV
    SOLO=NUM*CON(SOL+SOLIN)
    PPI=0.261*DCOS(4*D)+28.233*DCOS(2*D)+3.086*DCOS(G+2*D)
**+186.540*DCOS(G)+34.312*DCOS(G-2*D)+0.601*DCOS(G-4*D)
**+0.978*DCOS(D)+0.283*DCOS(2*G+2*D)+10.166*DCOS(2*G)
    PPI=3422.451+PPI*(1-0.000048)
    P=NUM*PPI
    LUPA=PPI*(1+0.1667*P**2)
    ST=23925.836+8640184.542D0*E+0.0929*E**2+3600*(TA+12.)
    ST=ST-86400*DINT(ST/86400)
    IF (ST.LE.0.) ST=ST+86400
    RAD=15*NUM*ST-17*DSIN(OM)*NUM
    SS=(1+K)*(-25.10*DSIN(S+2*D) -126.98*DSIN(S)
**+165.05*DSIN(S-2*D)
* -115.18*DSIN(S+G)-182.36*DSIN(S+G-2*D)
* -138.76*DSIN(S-G)
**+192.72*DSIN(S-G-2*D))
**+112.79*DSIN(D)+2373.36*DSIN(2*D)
* +192.72*DSIN(G+2*D)
* +22609.07*DSIN(G)-4578.13*DSIN(G-2*D)
* -38.64*DSIN(G-4*D)
**+767.96*DSIN(2*G)-152.53*DSIN(2*G-2*D)-34.07*DSIN(2*G-4*D)
**+50.64*DSIN(3*G) -52.14*DSIN(2*F-2*D)
* -85.13*DSIN(2*F-G)
    M=-526.069*DSIN(F-2*D)-3.352*DSIN(F-4*D)+44.297*DSIN(F+G-2*D)
**+6.000*DSIN(F+G-4*D)+20.599*DSIN(F-G)-30.598*DSIN(F-G-2*D)
**+24.649*DSIN(F-2*G)-2.000*DSIN(F-2*G-2*D)
**+22.571*DSIN(F+S-2*D)*(1+K)+10.985*DSIN(F-S-2*D)*(1+K)
    SS=F+NUM*SS
    LA=DSIN(SS)* 18519.70 -6.24*DSIN(3*SS)+M-0.60
    DLO=DLO+(1+K)*(-109.7*DCOS(G+S)*(DG+DS)+147.7*DCOS(G-S)*(DG-DS)
**+206.0*DCOS(2*D-G-S)*(2*DD-DG-DS)+165.2*DCOS(2*D-S)*(2*DD-DS))
**+36.1*DCOS(3*G)*3*DG-125.2*DCOS(D)*DD+38.4*DCOS(4*D-G)*(4*DD-DG)
**+45.1*DCOS(2*F+G)*(2*DF+DG)

```



```

DM=-526.1*DCOS(F-2*D)*(DF-2*DD) -30.6*DCOS(F-G-2*DD)*(DF-DG-2*DD)
DSS=DF+NUM*(2373.4*DCOS(2*D)*2*DD+192.7*DCOS(G+2*D)*(DG+2*DD)
**+22609.1*DCOS(G)*DG-4578.1*DCOS(G-2*D)*(DG-2*DD)
**+768.0*DCOS(2*G)*2*DG)
DLA= 18519.70 *DCOS(SS)*DSS-6.24*DCOS(3*SS)*3*DSS+DM
LUPA=NUM*LUPA
LULA=LA*NUM
DLO=NUM*(DLO+13.176396D0*3600./24.)
DSO=NUM*(DSO+DSOL)
DLA=NUM*DLA
LULO=973571.71D0+1732564406.06D0*E+7.14*E**2+0.0068*E**3+SV+LUNIN
LULO=NUM*CON(LULO)
H=DATAN(DSIN(EPS)*DCOS(SOLO)/DCOS(EPS))
COSSO=DCOS(SOLO)
DH=-0.437*DSIN(SOLO)*DSO/(1+0.191*COSSO**2)
SOPA=8.80*NUM
PA=DSIN(LUPA-SOPA)
DPA=-28.2*DSIN(2*D)*2*DD-186.5*DSIN(G)*DG
*-34.3*DSIN(G-2*D)*(DG-2*DD)
DPA=NUM*DPA
X1=DCOS(LULA)*DSIN(LULO-SOLO)/PA
Y1=DSIN(LULA)/PA
DX1=DCOS(LULA)*(PA*DCOS(LULO-SOLO)*(DLO-DSO)
*-DSIN(LULO-SOLO)*DCOS(LUPA-SOPA)*DPA)/PA**2
DY1=(PA*DCOS(LULA)*DLA-DSIN(LULA)*DCOS(LUPA-SOPA)*DPA)/PA**2
DX=DX1*DCOS(H)-DY1*DSIN(H)-DH*(X1*DSIN(H)+Y1*DCOS(H))
DY=DX1*DSIN(H)+DY1*DCOS(H)+DH*(X1*DCOS(H)-Y1*DSIN(H))
DMU=0.262516-0.888*DSO/(0.839+0.161*COSSO**2)
SINSD=DSIN(SOLO)*DSIN(EPS)
COSSD=DSQRT(1-SINSD**2)
SD=DATAN2(SINSD, COSSD)
COSSRA=DCOS(SOLO)/COSSD
TANSRA= DSIN(SOLO)*DCOS(EPS)/DCOS(SOLO)
SRA=DATAN(TANSRA)+PI
IF (COSSRA.GT.0.) SRA=SRA-PI
IF (SRA.LT.0.) SRA=SRA+2*PI
B=SOPA/DSIN(LUPA)
SINLD=DCOS(LULA)*DSIN(LULO)*DSIN(EPS)+DSIN(LULA)*DCOS(EPS)
COSLD =DSQRT(1.-SINLD**2)
LD=DATAN2(SINLD, COSLD)
TANLRA=(DCOS(LULA)*DSIN(LULO)*DCOS(EPS)-DSIN(LULA)*DSIN(EPS))/
*(DCOS(LULA)*DCOS(LULO))
LRA=DATAN(TANLRA)
IF (DCOS(LULO).LT.0.) LRA=LRA+PI

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```

IF (LRA.LT.0.) LRA=LRA+2*PI
AA=SRA-(DCOS(LD)/DCOS(SD))*B*(LRA-SRA)/(1-B)
SHD=SD-B*(LD-SD)/(1-B)
SIND=DSIN(SHD)
R=1/DSIN(LUPA)
X=R*DCOS(LD)*DSIN(LRA-AA)
Y=R*(DSIN(LD)*DCOS(SHD)-DCOS(LD)*SIND*DCOS(LRA-AA))
Z=R*(DSIN(LD)*SIND+DCOS(LD)*DCOS(SHD)*DCOS(LRA-AA))
F1=962.03*NUM/(RV*(1-B))
F2=957.23*NUM/(RV*(1-B))
KK=0.272488D0
U1=1.000011*(Z*F1+KK)
U2=1.000011*(Z*F2-KK)
ANGLE=RAD-AA
DSHD=0.968*DCOS(SOLO)*DSO*DSIN(EPS)/DCOS(SHD)
SP=0.99497418D0-0.00167082D0*DCOS(2*LAT)+0.0000021D0*DCOS(4*LAT)
RHOSIN=SP*DSIN(LAT)
CC=1.0016799D0-0.00168208D0*DCOS(2*LAT)+0.0000021D0*DCOS(4*LAT)
RHOCOS=CC*DCOS(LAT)
13 XI=RHOCOS*DSIN(ANGLE-LONG)
ETA=DCOS(SHD)*RHOSIN-SIND*RHOCOS*DCOS(ANGLE-LONG)
ZETA=SIND*RHOSIN+DCOS(SHD)*RHOCOS*DCOS(ANGLE-LONG)
DXI=DMU*RHOCOS*DCOS(ANGLE-LONG)
DETA=DMU*XI*SIND-DSHD*ZETA
XX=X-XI
YY=Y-ETA
DXX=DX-DXI
DYY=DY-DETA
DTT=-((XX*DXX+YY*DYY)/(DXX**2+DYY**2))
IF (DABS(DTT).LT. 0.0001) GO TO 14
TA=TA+DTT
X=X+DX*DTT
Y=Y+DY*DTT
SHD=SHD+DSHD*DTT
SIND=DSIN(SHD)
ANGLE=ANGLE+DMU*DTT
GO TO 13
14 GMT=TA+12-24*DINT((TA+12)/24)
DLONG=LONG/CF
DJD=JD +TA/24-DLONG/360
MJD=DJD+0.5
IJD=DINT(DJD)/60
REM=DJD-IJD*60
REM=REM+0.5

```

```

IREM=REM-10
IF (IREM.LT.1) IREM=IREM+60
CALL JDCAL(DJD,IDATE)
LHA=(ANGLE-LONG)/(CF*15)+12
LT=LHA-24*DINT(LHA/24)
IF (GHT.LT.0.) GHT=GHT+24
IF (LT.LT.0.) LT=LT +24
DEL=(XX*DYY-YY*DXX)/DSQRT(DXX**2+DYY**2)
UH=U2-ZETA*1.000011*F2
PEN=U1-ZETA*1.000011*F1
EMAG=(PEN-DABS(DEL))/(UH+PEN)
C IF (EMAG.LT. -0.20) GO TO 43
IF (EMAG.LT.0.) GO TO 43
IF (DABS(DEL).LT.DABS(UH)) EMAG=(PEN-UH)/(UH+PEN)
RN=DSQRT(DXX**2+DYY**2)
IF (DABS(DEL).LT.PEN) SDUR=PEN*DSQRT(1-(DEL/PEN)**2)/RN
IF (DABS(DEL).GE.PEN) SDUR=0.
COSALT=DSQRT(1-ZETA**2)
ALT=(180/PI)*DATAN(ZETA/COSALT)
IF (ALT .LT. -25.) GO TO 43
C IF (ALT.LT.-15.) GO TO 43
JDN=JD
C WRITE (6,779) JDN
779 FORMAT(I10)
WRITE (6,305) JDN, IREM
305 FORMAT (' JDN, CHINESE CYCL DN =',2(I10))
WRITE (6,777) IDATE(1), IDATE(2), IDATE(3)
777 FORMAT (' YEAR, MONTH, DAY=', 3(I9))
C WRITE (6,778) UM, DEL, SDUR
778 FORMAT (' UMBRA, DELTA, SDUR=',3(F10.3))
WRITE (6,304) EMAG, LT, ALT
304 FORMAT (' MAGNITUDE, LOCAL TIME, ALTITUDE=',3(F10.2),//,79(1H=))
43 REV=6
IF (NN.EQ.1) REV=0
IF (NN.EQ.5) REV=5
IF (NN.EQ.6) REV=1
IF (NN.EQ.7) REV=5
IF (NN.EQ.13) REV=5
IF (NN.EQ.14) REV=1
IF (NN.EQ.15) REV=5
IF (NN.EQ.16) REV=1
IF (NN.EQ.17) REV=5
IF (NN.EQ.23) REV=5
IF (NN.EQ.25) REV=1

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```

IF (NN.EQ.26) REV=5
IF (NN.EQ.32) REV=5
IF (NN.EQ.33) REV=1
IF (NN.EQ.34) REV=5
IF (NN.EQ.40) REV=5
IF (NN.EQ.41) REV=1
IF (NN.EQ.42) REV=5
IF (NN.EQ.43) REV=1
IF (NN.EQ.44) REV=5
IF (NN.EQ.50) REV=5
IF (NN.EQ.51) REV=1
IF (NN.EQ.52) REV=5
IF (NN.EQ.58) REV=5
IF (NN.EQ.59) REV=1
IF (NN.EQ.60) REV=5
IF (NN.EQ.61) REV=1
IF (NN.EQ.62) REV=5
IF (NN.EQ.68) REV=5
IF (NN.EQ.70) REV=1
IF (NN.EQ.71) REV=5
NNUM=NNUM+REV
IF (NNUM.GT.MON) GO TO 5
RJD=RJD+DAYS*REV
NN=NN+1
GO TO 9
END
FUNCTION CON(A)
REAL*8 CON,A,F
DATA F/1296000.0DO/
N=A/F
CON=A-N*F
IF(CON.LT.0.) CON=CON+F
RETURN
END
SUBROUTINE JDCAL(JDATE,DATE)
INTEGER DATE(6)
REAL M(48) ,MM(48)
REAL*8 JD,JDATE
EQUIVALENCE (M(1),MM(1))
DATA M(1),M(3),M(4),M(5),M(6),M(7),M(8),M(9),M(10),M(11),M(12)/
1 31.0,31.0,30.0,31.0,30.0,31.0,31.0,30.0,31.0,30.0,31.0/
MM(2)=28.0
J = 1
JD=JDATE

```

```

DO 100 N=1,3
DO 100 L=1,12
K = 12*N+L
100 MM(K) = M(L)
MM(2) = M(2)+1.0
IF(JD-2299160.5)105,101,101
101 JD = JD+10.0
REM = JD-2342041.5
IF(REM)105,104,102
102 DO 103 J=1,100
REM = REM-FLOAT(36524+((J/4)-((J-1)/4)))
IF(REM)104,103,103
103 CONTINUE
104 JD = JD+FLOAT(J-(J/4))
105 JD = JD+0.5
IY = INT(JD/1461.0)
DIFF = JD-FLOAT(IY*1461)
DO 107 JM=1,48
DIFF = DIFF-M(JM)
IF(DIFF)108,107,107
107 CONTINUE
108 DATE(1) = IY*4 -4712+(JM-1)/12
DATE(2) = JM-((JM-1)/12)*12
DIFF = DIFF+M(JM)+1.0
DATE(3) = INT(DIFF)
TEMPA = (DIFF-FLOAT(DATE(3)))*24.0
DATE(4) = INT(TEMPA)
DATE(5) = INT((TEMPA-FLOAT(DATE(4)))*60.0)
DATE(6) = 0
RETURN
END

```

Appendix 2
Catalogue of Chinese and Korean
Solar Eclipse Records

ECLIPSE CATALOGUE

1. -204 Dec 20, China. Emperor Kao-tzu, 3rd year, 10th month, (day) *chia-hsu* (11), last day. "The Sun was eclipsed; it was 20 deg in *Tou* (R.A. 267.2 deg)". Computed details: R.A. of Sun = 265.5 deg; magnitude at Ch'ang-an = 0.59, local time of maximum = 10.6 h, altitude at maximum phase = 29 deg. Delta T = 12723.6
2. -203 Jan 18, China. Emperor Kao-tzu, 3rd year, 11th month, (day) *kuei-mao* (40), last day. "The Sun was eclipsed; it was 3 deg in *Hsu* (R.A. 296.2 deg)". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. at conjunction on Jan 18, R.A. of Sun = 297.3 deg). Delta T = 12722.4
3. -197 Aug 7, China. Emperor Kao-tzu, 9th year, 6th month, (day) *i-wei* (32), last day. "The Sun was eclipsed; it was total; it was 13 deg in *Chang* (R.A. 134.4 deg)". Computed details: R.A. of Sun = 132.2 deg; magnitude at Ch'ang-an = 0.95 (i.e. central annular), local time of maximum = 8.7 h, altitude at maximum phase = 43 deg. Delta T = 12627.3
4. -187 Feb 21, China. Emperor Hui, 7th year, 1st month, (day) *hsin-ch'ou* (38), first day. "The Sun was eclipsed; it was 13 deg in *Wei* (R.A. 315.8 deg)". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. at conjunction on Feb 21, R.A. of Sun = 323.9 deg). Delta T = 12489.5
5. -187 Jul 17, China. Emperor Hui, 7th year, 5th month, (day) *ting-mao* (4), penultimate day. "The Sun was eclipsed; it was almost complete; it was at the beginning of *Liu-hsing* (R.A. 114.8 deg)". Computed details: R.A. of Sun = 111.8 deg; magnitude at Ch'ang-an = 0.91, local time of maximum = 15.2 h, altitude at maximum phase = 47 deg. Delta T = 12483.7
6. -185 Jul 26, China. Empress Kao, 2nd year, 6th month, (day) *ping-hsu* (23), last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 12454.6
7. -180 Mar 4, China. Empress Kao, 7th year, 1st month, (day) *chi-ch'ou* (26), last day. "The Sun was eclipsed; it was total; it was 9 deg in *Wu-nu* (R.A. 282.7 deg)". Computed details: R.A. of Sun = 341.8 deg; magnitude at Ch'ang-an = 1.04 (total), local time of maximum = 14.7 h, altitude at maximum phase = 33 deg. Delta T = 12388.4
8. -177 Jan 2, China. Emperor Wen, 2nd year, 11th month, (day) *kuei-mao* (40), last day. "The Sun was eclipsed; it was 1 deg in *Wu-nu* (R.A. 282.7 deg)". Computed details: R.A. of Sun = 279.7; magnitude at Ch'ang-an



- = 0.29, local time of maximum = 14.7 h, altitude at maximum phase = 21 deg. Delta T = 12347.9
9. -177 Dec 22, China Emperor Wen, 3rd year, 10th month, (day) *ting-yu* (34), last day. "The Sun was eclipsed; it was 23 deg in *Tou* (R.A. 270.5 deg)". Computed details: R.A. of Sun = 267.2 deg; magnitude at Ch'angan = 0.39, local time of maximum = 14.1 h, altitude at maximum phase = 25 deg. Delta T = 12334.0
 10. -176 Jan 20, China. Emperor Wen, 3rd year 11th month, (day) *ting-mao* (4), last day. "The Sun was eclipsed; it was 8 deg in *Hsu* (R.A. 301.5 deg)". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. at conjunction on Jan 21, R.A. of Sun = 298.8 deg). Delta T = 12332.8
 11. -159 Jun 9, China. Emperor Wen, Reign *Hou*, 4th year, 4th month, (day) *ping-ch'en* (53), last day. "The Sun was eclipsed; it was 13 deg in *Tung-ching* (R.A. 76.5 deg)".
Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. at conjunction on Jun 9, R.A. of Sun = 72.4 deg). Delta T = 12085.4
 12. -156 Feb 9, China. Emperor Wen, Reign *Hou*, 7th year, 1st month, (day) *hsin-wei* (8), first day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 12047.7
 13. -153 April 5, China. Emperor Ching, 3rd year, 2nd month, (day) *jen-wu* (19), last day. "The Sun was eclipsed; it was 2 deg in *Wei* (R.A. 13.2 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 10.6 deg). Delta T = 12003.2
 14. -149 Jan 22, China. Emperor Ching, 7th year, 11th month, (day) *keng-yin* (27), last day. "The Sun was eclipsed; it was 9 deg in *Hsu* (R.A. 302.9 deg)". Computed details: R.A. of Sun = 301.8 deg; magnitude at Ch'angan = 0.68, local time of maximum = 10.3 h, altitude at maximum phase = 30 deg. Delta T = 11949.4
 15. -148 Feb 10, China. Emperor Ching, Reign *Chung*, 1st year, 12th month, (day) *chia-yin* (51), last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 11934.9
 16. -147 Oct 22, China. Emperor Ching, Reign *Chung*, 2nd year, 9th month, (day) *chia-hsu* (11), last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 11911.1
 17. -146 Nov 10, China. Emperor Ching, Reign *Chung*, 3rd year, 9th month, (day) *wu-hsu* (35), last day. "The Sun was eclipsed; it was almost complete; it was 9 deg in *Wei* (R.A. 227.6 deg)". Computed details: R.A. of

- Sun = 226.6 deg; magnitude at Ch'ang-an = 0.78, local time at maximum = 11.1 h, altitude at maximum phase = 38 deg. Delta T = 11896.3
18. -143 Sept 8, China. Emperor Ching, Reign *Chung*, 6th year, 7th month, (day) *hsin-hai* (48), last day. "The Sun was eclipsed; it was 7 deg in *Chen* (R.A. 164.0 deg)". Computed details: R.A. of Sun = 163.6 deg; magnitude at Ch'ang-an = 0.62, local time of maximum = 6.1 h, altitude at maximum phase = 5 deg. Delta T = 11856.6
 19. -142 Aug 28, China. Emperor Ching, Reign *Hou*, 1st year, 7th month, *i-szu* (42), penultimate day. "The Sun was eclipsed; it was 17 deg in *I* (R.A. 156.1 deg)". Computed details: R.A. of Sun = 153.0; magnitude at Ch'ang-an = 0.63, local time of maximum = 15.5 h, altitude at maximum phase = 37 deg. Delta T = 11843.1
 20. -138 Mar 21, China. Emperor Wu, Reign *Chien-yuan*, 2nd year, 2nd month, (day) *ping-hsu* (23), first day. "The Sun was eclipsed; it was 14 deg in *K'uei* (R.A. 358.7 deg)". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. at conjunction on Mar 21, R.A. of Sun = 357.3 deg). Delta T = 11793.3
 21. -137 Nov 1, China Reign *Chien-yuan*, 3rd year, 9th month, (day) *ping-tzu* (13), last day. "The Sun was eclipsed; it was 2 deg in *Wei* (R.A. 220.9 deg)". Computed details: R.A. of Sun = 213.0 deg; magnitude at Ch'ang-an = 0.58, local time of maximum = 8.6 h, altitude at maximum phase = 22 deg. Delta T = 11770.7
 22. -135 Feb 16, China. Reign *Chien-yuan*, 5th year, 1st month, (day) *chi-szu* (6), first day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 11752.7
 23. -133 Mar 25, China. Reign *Yuan-kuang*, 1st year, 2nd month, (day) *ping-ch'en* (53), last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 11723.4
 24. -133 Aug 19, China. Reign *Yuan-kuang*, 1st year, 7th month, (day) *kuei-wei* (20), penultimate day. "The Sun was eclipsed; it was 8 deg in *I* (R.A. 147.2 deg)". Computed details: R.A. of Sun = 144.3 deg; magnitude at Chang'an = 0.72, local time of maximum = 13.2 h, altitude at maximum phase = 64 deg. Delta T = 11717.8
 25. -126 Apr 6, China. Reign *Yuan-so*, 2nd year, 2nd month, (day) *i-szu* (42), last day. "The Sun was eclipsed; it was 3 deg in *Wei* (R.A. 14.6 deg)". Computed details: R.A. of Sun = 11.7 deg; magnitude at Ch'ang-an = 0.50, local time of maximum = 14.4 h, altitude at maximum phase = 46 deg. Delta T = 11625.7

26. -122 Jan 23, China. Reign *Yuan-so*, 6th year, 11th month, (day) *kuei-ch'ou* (50), last day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.66, local time of maximum = 13.9 h, altitude at maximum phase = 29. (N.B. Date should be 12th lunar month). Delta T = 11573.1
27. -121 Jul 9, China. Reign *Yuan-shou*, 1st year, 5th month, (day) *i-szu* (42), last day. "The Sun was eclipsed; it was 6 deg in *Liu* (R.A. 106.8 deg)". Computed details: R.A. of Sun = 103.5 deg; magnitude at Ch'ang-an = 0.98, local time of maximum = 8.0 h, altitude at maximum phase = 37 deg. Delta T = 11553.0
28. -111 Jun 18, China. Reign *Yuan-ting*, 5th year, 4th month, (day) *ting-ch'ou* (14), last day. "The Sun was eclipsed; it was 23 deg in *Tung-ching* (R.A. 87.2 deg)". Computed details: R.A. of Sun = 82.2 deg; magnitude at Ch'ang-an = 0.79, local time of maximum = 10.2 h, altitude at maximum phase = 64 deg. Delta T = 11416.0
29. -106 Jun 24, China. Reign *Yuan-feng*, 4th year, 6th month, (day) *chi-yu* (46), first day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 11347.3
30. -95 Feb 23, China. Reign *T'ai-shih*, 1st year, 1st month, (day) *i-szu* (42), last day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.87, local time of maximum = 8.6 h, altitude at maximum phase = 23 deg. Delta T = 11201.8
31. -92 Dec 12, China. Reign *T'ai-shih*, 4th year, 10th month, (day) *chia-yin* (51), last day. "The Sun was eclipsed; it was 19 deg in *Tou* (R.A. 267.9 deg)". Computed details: R.A. of Sun = 257.7 deg; magnitude at Ch'ang-an = 0.82, local time of maximum = 15.0 h, altitude at maximum phase = 19 deg. Delta T = 11150.2
32. -88 Sept 29, China. Reign *Cheng-ho*, 4th year, 8th month, (day) *hsin-yu* (58), last day. "The Sun was eclipsed; it was not complete and like a hook; it was 2 deg in *K'ang* (R.A. 188.2)". Computed details: R.A. of Sun = 183.3 deg; magnitude at Ch'ang-an = 0.91 (i.e. central annular), local time of maximum = 15.7 h, altitude at maximum phase = 27 deg. Delta T = 11098.8
33. -83 Dec 3, China. Emperor Chao, Reign *Shih-yuan*, 3rd year, 11th month, (day) *jen-ch'en* (29), first day. "The Sun was eclipsed; it was 9 deg in *Tou* (R.A. 258.0 deg)". Computed details: R.A. of Sun = 247.5 deg; magnitude at Ch'ang-an = 0.62, local time of maximum = 11.5 h, altitude of maximum phase = 33 deg. Delta T = 11028.9

34. -79 Sept 20, China. Reign *Yuan-feng*, 1st year, 7th month, (day) *chi-hai* (36), last day. "The Sun was eclipsed; it was almost complete; it was 12 deg in *Chang* (R.A. 134.9 deg)". Computed details: R.A. of Sun = 174.8 deg; magnitude at Ch'ang-an = 0.82, local time of maximum = 13.2 h, altitude at maximum phase = 54 deg. Delta T = 10977.8
35. -67 Feb 13, China. Emperor Hsuan, Reign *Ti-chieh*, 1st year, 12th month, (day) *kuei-hai* (60), last day. "The Sun was eclipsed, it was 15 deg in *Ying-shih* (R.A. 335.8 deg)". Computed details: R.A. of Sun = 325.0; magnitude at Ch'ang-an = 0.09, local time of maximum = 16.9 h, altitude at maximum phase = 5 deg. Delta T = 10825.1
36. -55 Jan 3, China. Reign *Wu-feng*, 1st year, 12th month, (day) *i-yu* (22), first day. "The Sun was eclipsed; it was 10 deg in *Wu-nu* (R.A. 293.4 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 282.4 deg) Delta T = 10667.2
37. -53 May 9, China. Reign *Wu-feng*, 4th year, 4th month, (day) *hsin-ch'ou* (38), first day. "The Sun was eclipsed; it was 19 deg in *Pi* (R.A. 57.3 deg)". Computed details: R.A. of Sun = 42.2 deg; magnitude at Ch'ang-an = 0.82, local time of maximum = 13.9 h, altitude of maximum phase = 59 deg. Delta T = 10636.2
38. -41 Mar 28, China. Emperor Yuan, Reign *Yung-kuang*, 2nd year, 3rd month, (day) *jen-hsu* (59), first day. "The Sun was eclipsed; it was 8 deg in *Lou* (R.A. 9.6 deg)". Computed details: R.A. of Sun = 4.0 deg; magnitude at Ch'ang-an = 0.73, local time of maximum = 5.7 h, altitude at maximum phase = -3 deg. Delta T = 10479.8
39. -39 Jul 31, China. Reign *Yung-kuang*, 4th year, 6th month, (day) *wu-yin* (15), last day. "The Sun was eclipsed; it was 7 deg in *Chang* (R.A. 130.2 deg)". Computed details: R.A. of Sun = 126.9 deg; magnitude at Ch'ang-an = 0.56, local time of maximum = 13.9 h, altitude of maximum phase = 61 deg. Delta T = 10449.1
40. -33 Aug 23, China. Reign *Chien-chao*, 5th year, 6th month, (day) *jen-shen* (9), last day. "The Sun was eclipsed; it was not complete and like a hook; then it set". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. There was a large partial eclipse visible near sunset on -34 Nov 01, i.e. Reign *Chien-chao*, 4th year, 9th month, (day) *ting-ch'ou*. Computed details: Magnitude at Ch'ang-an = 0.84, local time of maximum = 17.6, altitude of maximum phase = -3 deg. Despite the chronological difficulties, it seems very likely that this is the eclipse to which the text refers). Delta T = 10380.4
41. -28 Jan 5, China. Emperor Ch'eng, Reign *Chien-shih*, 3rd year, 12th month, (day) *wu-shen* (45), first day. "The Sun was eclipsed; it was 9 deg

- in *Wu-nu* (R.A. 292.9 deg)". Computed details: R.A. of Sun = 283.8 deg; magnitude at Ch'ang-an = 0.68, local time of maximum = 14.9 h, altitude at maximum phase = 19 deg. Delta T = 10313.0
42. -27 Jun 19, China. Reign *Ho-p'ing*, 1st year, 4th month, (day) *chi-hai* (36), last day. "The Sun was eclipsed; it was not complete and like a hook; it was 6 deg in *Tung-ching* (R.A. 71.5 deg)". Computed details: R.A. of Sun = 83.9 deg; magnitude at Ch'ang-an = 0.96, local time of maximum = 9.6 h, altitude at maximum phase = 57 deg. Delta T = 10294.1
43. -25 Oct 23, China. Reign *Ho-p'ing*, 3rd year, 8th month, (day) *i-mao* (52), last day. "The Sun was eclipsed; it was in *Fang* (R.A. 210.7 to 216.0)". Computed details: R.A. of Sun = 205.3 deg; magnitude at Ch'ang-an = 0.77, local time of maximum = 15.2 h, altitude at maximum phase = 26 deg. Delta T = 10263.7
44. -24 Apr 18, China. Reign *Ho-p'ing*, 4th year, 3rd month, (day) *kuei-ch'ou* (50), first day. "The Sun was eclipsed; it was in *Mao* (R.A. 27.6 to 38.7)". Computed details: R.A. of Sun = 23.7 deg; magnitude at Ch'ang-an = 0.58, local time of maximum = 14.5 h, altitude at maximum phase = 48 deg. Delta T = 10257.4
45. -23 Apr 7, China. Reign *Yang-so*, 1st year, 2nd month, (day) *ting-wei* (44), last day. "The Sun was eclipsed; it was in *Wei* (R.A. 12.9 to 27.6)". Computed details: R.A. of Sun = 13.6 deg; magnitude at Ch'ang-an = 0.08, local time of maximum = 14.6 h, altitude at maximum phase = 44 deg. Delta T = 10244.9
46. -15 Nov 1, China. Reign *Yung-shih*, 1st year, 9th month, (day) *ting-szu* (54), last day. "The Sun was eclipsed.....the capital alone knew of it; the kingdoms in the four (directions) did not see it". Computed details: Magnitude at Ch'ang-an = 0.06, local time of maximum = 16.5 h, altitude at maximum phase = 10 deg. Delta T = 10134.2
47. -14 Mar 29, China. Reign *Yung-shih*, 2nd year, 2nd month, (day) *i-yu* (22), last day. "The Sun was eclipsed....the four quarters all saw it; in the capital it was cloudy and overcast". Computed details: Magnitude at Ch'ang-an = 0.85, local time of maximum = 8.2 h, altitude at maximum phase = 28 deg. (N.B. Although this eclipse was not seen at Ch'ang-an, it would have been very large there if clear weather had prevailed). Delta T = 10129.0
48. -13 Mar 18, China. Reign *Yung-shih*, 3rd year, 1st month, (day) *chi-mao* (16), last day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.44, local time of maximum = 15.9 h, altitude at maximum phase = 24 deg. Delta T = 10110.3

49. -12 Aug 31, China. Reign *Yung-shih*, 4th year, 7th month, (day) *hsin-wei* (8), last day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.21, local time of maximum = 6.0 h, altitude at maximum phase = 5 deg. Delta T = 10097.8
50. -11 Jan 26, China. Reign *Yuan-yen*, 1st year, 1st month, (day) *chi-hai* (36), first day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.12, local time of maximum = 8.2 h, altitude at maximum phase = 14 deg. Delta T = 10092.6
51. -1 Feb 5, China. Emperor Ai, Reign *Yuan-shou*, 1st year, 1st month, (day) *hsin-ch'ou* (38), first day. "The Sun was eclipsed; it was not complete and like a hook; it was 10 deg in *Ying-shih* (R.A. 331.5 deg); (it occurred) in the same month and day as that in the 7th year of Emperor Hui (i.e. -187)". Computed details: R.A. of Sun = 317.3 deg; magnitude at Ch'ang-an = 0.85, local time of maximum = 7.8 h, altitude at maximum phase = 11 deg. Delta T = 9964.3
52. 0 Jun 20, China. Reign *Yuan-shou*, 2nd year, 3rd month, (day) *jen-ch'en* (29), last day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.27, local time of maximum = 19.6 h, altitude of maximum phase = -5 deg. (N.B. Date should be 4th month, *jen-hsu* (59).) Delta T = 9946.8
53. 1 Jun 10, China. Emperor P'ing, Reign *Yuan-shih*, 1st year, 5th month, (day) *ting-szu* (54), first day. "The Sun was eclipsed; it was in *Tung-ching* (R.A. 65.8 to 98.6 deg)". Computed details: R.A. of Sun = 74.8 deg; magnitude at Ch'ang-an = 0.73, local time of maximum = 10.9 h, altitude of maximum phase = 72 deg. Delta T = 9934.4
54. 2 Nov 23, China. Reign *Yuan-shih*, 2nd year, 9th month, (day) *wu-shen* (45), last day. "The Sun was eclipsed totally". Computed details: Magnitude at Ch'ang-an = 0.93, local time of maximum = 8.5 h, altitude at maximum phase = 16 deg. Delta T = 9915.9
55. 10 Sep 11, China. Emperor Wang Mang, Reign *Chu-she*, 1st year, 10th month, (day) *ping-ch'en* (13), first day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. Date should be 7th month, not 10th month). Delta T = 9817.4
56. 14 Apr 18, China. Reign *T'ien-feng*, 1st year, 3rd month, (day) *jen-shen* (9), last day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.27, local time of maximum = 6.3 h, altitude at maximum phase = 10 deg. Delta T = 9771.5
57. 16 Aug 21, China. Reign *T'ien-feng*, 3rd year, 7th month, (day) *wu-tzu* (25), last day. "The Sun was eclipsed". Computed details: Magnitude at

- Ch'ang-an = 0.80, local time of maximum = 10.1 h, altitude at maximum phase = 56 deg. Delta T = 9741.9
58. 26 Feb 6, China. Emperor Kuang Wu, Reign *Chien-wu*, 2nd year, 1st month, (day) *chia-tzu* (1), first day. "The Sun was eclipsed; it was 8 deg in *Wei*, (R.A. 313.3 deg)". Computed details: R.A. of Sun = 318.7 deg; magnitude at Lo-yang = 0.67, local time of maximum = 16.6 h, altitude at maximum phase = 8 deg. Delta T = 9623.1
 59. 27 Jul 22, China. Reign *Chien-wu*, 3rd year, 5th month, (day) *i-mao* (52), last day. "The Sun was eclipsed; it was 14 deg in *Liu* (R.A. 116.5 deg)". Computed details: R.A. of Sun = 117.9 deg; magnitude at Lo-yang = 0.54, local time of maximum = 8.1 h, altitude at maximum phase = 37 deg. Delta T = 9604.9
 60. 30 Nov 14, China. Reign *Chien-wu*, 6th year, 9th month, (day) *ping-yin* (3), last day. "The Sun was eclipsed; it was not seen by the Astronomer Royal but was reported from the provinces; it was 8 deg in *Wei* (R.A. 228.9 deg)". Computed details: R.A. of Sun = 228.1 deg; magnitude at Lo-yang = 0.62, local time of maximum = 7.0 h, altitude at maximum phase = 2 deg. (N.B. Since this eclipse should have been large at the capital at sunrise, the weather may possibly have been overcast there). Delta T = 9563.5
 61. 31 May 10, China. Reign *Chien-wu*, 7th year, 3rd month, (day) *kuei-hai* (60), last day. "The Sun was eclipsed; it was 5 deg in *Pi* (R.A. 44.0 deg)". Computed details: R.A. of Sun = 43.9 deg; magnitude at Lo-yang = 0.76, local time of maximum = 9.0 h, altitude at maximum phase = 46 deg. Delta T = 9557.4
 62. 40 Apr 30, China. Reign *Chien-wu*, 16th year, 3rd month, (day) *hsin-chou* (38), last day. "The Sun was eclipsed; it was 7 deg in *Mao* (R.A. 34.9 deg)". Computed details: R.A. of Sun = 35.3 deg; magnitude at Lo-yang = 0.57, local time of maximum = 4.8 h, altitude at maximum phase = -6 deg. Delta T = 9445.9
 63. 41 Apr 19, China. Reign *Chien-wu*, 17th year, 2nd month, (day) *i-wei* (32), last day. "The Sun was eclipsed; it was 9 deg in *Wei* (R.A. 22.2 deg)". Computed details: R.A. of Sun = 24.7 deg; magnitude at Lo-yang = 0.81; local time of maximum = 13.7 h; altitude at maximum phase = 56 deg. Delta T = 9433.9
 64. 46 Aug 22, China. Reign *Chien-wu*, 22nd year, 5th month, (day) *i-wei* (32), last day. "The Sun was eclipsed; it was 7 deg in *Liu* (R.A. 109.5 deg)". Computed details: R.A. of Sun = 118.3 deg; magnitude at Lo-yang = 0.15; local time of maximum = 8.6 h; altitude at maximum phase = 43 deg. Delta T = 9368.9

65. 49 May 20, China. Reign *Chien-wu*, 25th year, 3rd month, (day) *wu-shen* (45), last day. "The Sun was eclipsed; it was 15 deg in *Pi* (R.A. 54.0 deg)". Computed details: R.A. of Sun = 54.4 deg; magnitude at Lo-yang = 0.77; local time of maximum = 18.2 h; altitude at maximum phase = 9 deg. Delta T = 9334.0
66. 53 Mar 9, China. Reign *Chien-wu*, 29th year, 2nd month, (day) *ting-szu* (54), first day. "The Sun was eclipsed; it was 5 deg in *Tung-pi* (R.A. 343.1 deg)". Computed details: R.A. of Sun = 348.0 deg; magnitude at Lo-yang = 0.74; local time of maximum = 8.6 h; altitude at maximum phase = 28 deg. Delta T = 9287.4
67. 55 Jul 13, China. Reign *Chien-wu*, 31st year, 5th month, (day) *kuei-yu* (10), last day. "The Sun was eclipsed; it was 5 deg in *Liu* (R.A. 107.5 deg)". Computed details: R.A. of Sun = 109.0 deg; magnitude at Lo-yang = 0.25; local time of maximum = 8.3 h; altitude at maximum phase = 41 deg. Delta T = 9258.6
68. 56 Dec 25, China. Reign *Chung-yuan*, 1st year, 11th month, (day) *chia-tzu* (1), last day. "The Sun was eclipsed; it was 20 deg in *Tou* (R.A. 270.3 deg)". Computed details: R.A. of Sun = 273.1 deg; magnitude at Lo-yang = 0.66; local time of maximum = 12.6 h; altitude at maximum phase = 31 deg. Delta T = 9240.8
69. 60 Oct 13, China. Emperor Ming, Reign *Yung-p'ing*, 3rd year, 8th month, (day) *jen-shen* (9), last day. "The Sun was eclipsed; it was 2 deg in *Ti* (R.A. 198.2 deg)". Computed details: R.A. of Sun = 197.3 deg; magnitude at Lo-yang = 0.68; local time of maximum = 15.0 h; altitude at maximum phase = 30 deg. Delta T = 9194.3
70. 65 Dec 16, China. Reign *Yung-p'ing*, 8th year, 10th month, (day) *jen-yin* (39), last day. "The Sun was totally eclipsed; it was 11 deg in *Tou* (R.A. 261.3 deg)". Computed details: R.A. of Sun = 262.9 deg; magnitude at Lo-yang = 0.98 (i.e. partial); local time of maximum = 9.9 h; altitude at maximum phase = 25 deg. Delta T = 9131.2
71. 70 Sep 23, China. Reign *Yung-p'ing*, 13th year, 10th month, (day) *chia-chen* (41), last day. "The Sun was eclipsed; it was 17 deg in *Wei* (R.A. 237.9 deg)". Computed details: R.A. of Sun = 178.1 deg; magnitude at Lo-yang = 0.92; local time of maximum = 8.5 h; altitude at maximum phase = 30 deg. Delta T = 9073.3
72. 73 Jul 23, China. Reign *Yung-p'ing*, 16th year, 5th month (day) *wu-wu* (55), last day. "The Sun was eclipsed; it was 15 deg in *Liu* (R.A. 117.5 deg)". Computed details: R.A. of Sun = 120.1 deg; magnitude at Lo-yang = 0.80; local time of maximum = 18.2 h; altitude at maximum phase = 9 deg. Delta T = 9039.1

73. 75 Dec 26, China. Reign *Yung-p'ing*, 18th year, 11th month, (day) *chia-chen* (41), last day. "The Sun was eclipsed; it was 21 deg in *Tou* (R.A. 271.3 deg)". Computed details: R.A. of Sun = 273.6 deg; magnitude at Lo-yang = 0.18; local time of maximum = 12.2 h; altitude at maximum phase = 32 deg. Delta T = 9009.7
74. 80 Mar 10, China. Emperor Chang, Reign *Chien Ch'u*, 5th year, 2nd month, (day) *keng-chen* (17). Last day. "The Sun was eclipsed; it was 8 deg in *Pi* (R.A. 346.1 deg)". Computed details: R.A. of Sun = 349.4 deg; magnitude at Lo-yang = 0.25; local time of maximum = 16.4 h; altitude at maximum phase = 17 deg. Delta T = 8959.0
75. 81 Aug 23, China. Emperor Chang, Reign *Chien Ch'u*, 6th year, 6th month, (day) *hsin-wei* (8). Last day. "The Sun was eclipsed; it was 6 deg in *I* (R.A. 146.9 deg)". Computed details: R.A. of Sun = 150.1 deg; magnitude at Lo-yang = 0.29; local time of maximum = 7.5 h; altitude at maximum phase = 25 deg. Delta T = 8941.6
76. 87 Oct 15, China. Emperor Chang, Reign *Chang Ho*, 1st year, 8th month, (day) *i-wei* (32). Last day. "The Sun was eclipsed; it was 4 deg in *Ti* (R.A. 200.2 deg)". Computed detail: R.A. of Sun = 198.7 deg; magnitude at Lo-yang = 0.86; local time of maximum = 17.5 h; altitude at maximum phase = 2 deg. Delta T = 8867.8
77. 90 Mar 20, China. Emperor Ho, Reign *Yung Yuan*, 2nd year, 2nd month, (day) *jen-wu* (19). Second day. "The Sun was eclipsed; it was 8 deg in *K'uei* (R.A. 352.4 deg)". Computed details: R.A. of Sun = 357.6 deg; magnitude at Peking = 0.16; local time of maximum = 6.7 h; altitude at maximum phase = 7 deg. Delta T = 8838.8
78. 92 Jul 23, China. Emperor Ho, Reign *Yung Yuan*, 4th year, 6th month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed; it was 2 deg in *Hsing* (R.A. 119.1 deg)". Computed details: R.A. of Sun = 120.3 deg; magnitude at Lo-yang = 0.63; local time of maximum = 10.7 h; altitude at maximum phase = 68 deg. Delta T = 8810.8
79. 95 May 22, China. Emperor Ho, Reign *Yung Yuan*, 7th year, 4th month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.89; local time of maximum = 9.7 h; altitude at maximum phase = 56 deg. Delta T = 8777.1
80. 100 Aug 23, China. Emperor Ho, Reign *Yung Yuan*, 12th year, 7th month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed; it was 8 deg in *I* (R.A. 150.1 deg)". Computed details: R.A. of Sun = 150.3 deg; magnitude at Lo-yang = 0.45; local time of maximum = 7.7 h; altitude at maximum phase = 27 deg. Delta T = 8714.7

81. 103 Jun 22, China. Emperor Ho, Reign *Yung Yuan*, 15th year, 4th month, (day) *chia-tsu* (1). Last day. "The Sun was eclipsed; it was 22 deg in *Ching* (R.A. 89.3 deg)". Computed details: R.A. of Sun = 87.6 deg; magnitude at Lo-yang = 0.82; local time of maximum = 11.8 h; altitude at maximum phase = 79 deg. Delta T = 8681.1
82. 107 Apr 11, China. Emperor An, Reign *Yung Ch'u*, 1st year, 3rd month, (day) *kuei-yu* (10). Second day. "The Sun was eclipsed; it was 2 deg in *Wei* (R.A. 16.5 deg)". Computed details: R.A. of Sun 17.3 = deg; magnitude at Lo-yang = 0.46; local time of maximum = 7.2 h; altitude at amximum phase = 19 deg. Delta T = 8636.3
83. 111 Jan 27, China. Emperor An, Reign *Yung Ch'u*, 5th year, 1st month, (day) *keng-chen* (17). First day. "The Sun was eclipsed; it was 8 deg in *Hsu* (R.A. 305.3 deg)". Computed details: R.A. of Sun = 308.7 deg; magnitude at Lo-yang = 0.72; local time of maximum = 15.3 h; altitude at maximum phase = 19 deg. Delta T = 8591.5
84. 113 Jun 1, China. Emperor An, Reign *Yung Ch'u*, 7th year, 4th month, (day) *ping-shen* (33). Last day. "The Sun was eclipsed; it was 1 deg in *Ching* (R.A. 68.3 deg)". Computed details: R.A. of Sun = 66.8 deg; magnitude at Lo-yang = 0.88; local time of maximum = 19.1 h; altitude at maximum phase = 0 deg. Delta T = 8563.9
85. 114 Nov 15, China. Emperor An, Reign *Yuan Ch'u*, 1st year, 10th month, (day) *wu-tsu* (25). First day. "The Sun was eclipsed; it was 10 deg in *Wei* (R.A. 232.4 deg)". Computed details: R.A. of Sun = 229.6 deg; magnitude at Lo-yang = 0.57; local time of maximum = 15.0 h; altitude at maximum phase = 22 deg. Delta T = 8546.9
86. 115 Nov 4, China. Emperor An, Reign *Yuan Ch'u*, 2nd year, 9th month, (day) *jen-wu* (19). Last day. "The Sun was eclipsed; it was 4 deg in *Hsin* (R.A. 221.7 deg)". Computed details: R.A. of Sun = 218.6 deg; magnitude at Lo-yang = 0.24; local time of maximum = 15.1 h; altitude at maximum phase = 23 deg. Delta T = 8535.5
87. 116 Apr 1, China. Emperor An, Reign *Yuan Ch'u*, 3rd year, 3rd month, (day) *hsin-hai* (48). Second day. "The Sun was eclipsed; it was 5 deg in *Lou* (R.A. 8.5 deg)". Computed details: R.A. of Sun = 9.0 deg; magnitude at Liao-hsi = 0.98; local time of maximum = 5.7 h; altitude at maximum phase = -1 deg. Delta T = 8530.8
88. 117 Mar 21, China. Emperor An, Reign *Yuan Ch'u*, 4th year, 2nd month, (day) *i-szu* (42). First day. "The Sun was eclipsed; it was 9 deg in *Kuei* (R.A. 356.6 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 359.3 deg). Delta T = 8519.4

89. 118 Sept 3, China. Emperor An, Reign *Yuan Ch'u*, 5th year, 8th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed; it was 18 deg in *I* (R.A. 160.1 deg)". Computed details: R.A. of Sun = 160.4 deg; magnitude at Chang-yeh = 0.51; local time of maximum = 17.4 h; altitude at maximum phase = 12 deg. Delta T = 8502.4
90. 120 Jan 18, China. Emperor An, Reign *Yuan Ch'u*, 6th year, 12th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed; it was almost total; the stars were all visible; it was 11 deg in *Nu* (R.A. 296.7 deg)". Computed details: R.A. of Sun = 299.1 deg; magnitude at Lo-yang = 1.03; local time of maximum = 13.7 h; altitude at maximum phase = 30 deg. Delta T = 8486.3
91. 120 Aug 12, China. Emperor An, Reign *Yung Ning*, 1st year, 7th month, (day) *i-yu* (22). First day. "The Sun was eclipsed; it was not seen by the official astronomers". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 8479.7
92. 124 Oct 25, China. Emperor An, Reign *Yen Kuang*, 3rd year, 9th month, (day) *keng-shen* (57). Last day. "The Sun was eclipsed; it was 15 deg in *Ti* (R.A. 212.4 deg)". Computed details: R.A. of Sun = 209.2 deg; magnitude at Lo-yang = 0.88; local time of maximum = 8.7 h; altitude at maximum phase = 23 deg. Delta T = 8430.6
93. 125 Apr 21, China. Emperor An, Reign *Yen Kuang*, 4th year, 3rd month, (day) *wu-wu* (55). First day. "The Sun was eclipsed; it was 12 deg in *Wei* (R.A. 26.5 deg)". Computed details: R.A. of Sun = 27.3 deg; magnitude at Lo-yang = 0.32; local time of maximum = 17.1 h; altitude at maximum phase = 18 deg. Delta T = 8425.0
94. 127 Aug 25, China. Emperor Shun, Reign *Yung Chien*, 2nd year, 7th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed; it was 9 deg in *I* (R.A. 151.1 deg)". Computed details: R.A. of Sun = 151.8 deg; magnitude at Lo-yang = 0.99; local time of maximum = 17.1 h; altitude at maximum phase = 18 deg. Delta T = 8397.8
95. 135 Sept 25, China. Emperor Shun, Reign *Yang Chia*, 4th year, 8th month (intercalary), (day) *ting-hai* (24). First day. "The Sun was eclipsed; it was not seen by official astronomers; it was 5 deg in *Chueh* (R.A. 181.9 deg)". Computed details: R.A. of Sun = 180.1 deg; magnitude at Ling-ling = 0.25; local time of maximum = 8.3 h; altitude at maximum phase = 31 deg. Delta T = 8309.7
96. 139 Jan 18, China. Emperor Shun, Reign *Yung Ho*, 3rd year, 12th month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed; it was not seen by the official astronomers; it was 11 deg in *Nu* (R.A. 296.7 deg)". Computed

- details: R.A. of Sun = 299.5 deg; magnitude at Kuei-chi = 0.10; local time of maximum = 15.5 h; altitude at maximum phase = 19 deg. Delta T = 8265.9
97. 140 Jul 2, China. Emperor Shun, Reign *Yung Ho*, 5th year, 5th month, (day) *chi-chou* (26). Last day. "The Sun was eclipsed; it was 33 deg in *Ching* (R.A. 100.3 deg)". Computed details: R.A. of Sun = 99.3 deg; magnitude at Lo-yang = 0.50; local time of maximum = 7.4 h; altitude at maximum phase = 30 deg. Delta T = 8249.1
 98. 141 Nov 16, China. Emperor Shun, Reign *Yung Ho*, 6th year, 9th month, (day) *hsin-hai* (48). Last day. "The Sun was eclipsed; it was 11 deg in *Wei* (R.A. 233.4 deg). Computed details: R.A. of Sun = 231.2 deg; magnitude at Lo-yang = 0.67; local time of maximum = 17.5 h; altitude at maximum phase = -5 deg. Delta T = 8233.3
 99. 147 Feb 18, China. Emperor Huan, Reign *Chien Ho*, 1st year, 1st month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed; it was not seen by the official astronomers but reported from the provinces; it was 3 deg in *Shih* (R.A. 325.7 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 330.4 deg). Delta T = 8173.1
 100. 149 Jun 23, China. Emperor Huan, Reign *Chien Ho*, 3rd year, 4th month, (day) *ting-mao* (4). Last day. "The Sun was eclipsed; it was 23 deg in *Ching* (R.A. 90.3 deg)". Computed details: R.A. of Sun = 89.4 deg; magnitude at Lo-yang = 0.55; local time of maximum = 6.4 h; altitude at maximum phase = 18. Delta T = 8146.3
 101. 152 Aug 19, China. Emperor Huan, Reign *Yuan Chia*, 2nd year, 7th month, (day) *keng-chen* (17). Second day. "The Sun was eclipsed; not seen by official astronomers". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 8110.3
 102. 154 Sept 25, China. Emperor Huan, Reign *Yung Hsing*, 2nd year, 9th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed; it was 5 deg in *Chueh* (R.A. 181.9 deg)". Computed details: R.A. of Sun = 180.7 deg; magnitude at Lo-yang = 0.75; local time of maximum = 8.2 h; altitude at maximum phase = 26 deg. Delta T = 8086.4
 103. 157 Jul 24, China. Emperor Huan, Reign *Yung Shou*, 3rd year, 5th month (intercalary), (day) *keng-chen* (17). Last day. "The Sun was eclipsed; it was not seen by the official astronomers but it was reported from the provinces; it was 2 deg in *Hsing* (R.A. 120.4 deg)". Computed details: R.A. of Sun = 121.5 deg; magnitude at Lo-yang = 0.02; local time of maximum = 6.5 h, altitude at maximum phase = 17 deg. Delta T = 8054.2

104. 158 Jul 13, China. Emperor Huan, Reign *Yen Hsi*, 1st year, 5th month, (day) *chia-hsu* (11). Last day. "The Sun was eclipsed; it was 7 deg in *Liu* (R.A. 110.9 deg)". Computed details : R.A. of Sun = 110.3 deg; magnitude at Lo-yang = 0.81; local time of maximum = 17.6 h; altitude at maximum phase = 18 deg. Delta T = 8043.2
105. 165 Feb 28, China. Emperor Huan, Reign *Yen Hsi*, 8th year, 1st year, (day) *ping-shen* (33). Last day. "The Sun was eclipsed; it was 13 deg in *Shih* (R.A. 335.7 deg)". Computed details: R.A. of Sun = 340.8 deg; magnitude at Lo-yang = 0.36; local time = 16.5 h; altitude at maximum phase = 13 deg. Delta T = 7968.2
106. 166 Feb 18, China. Emperor Huan, Reign *Yen Hsi*, 9th year, 1st month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed; it was not observed by the official astronomers but was reported from the provinces; it was 3 deg in *Shih* (R.A. 325.7 deg)". Computed details: R.A. of Sun = 330.8 deg; magnitude at Lo-yang = 0.39; local time of maximum = 6.4 h; altitude at maximum phase = -2 deg. Delta T = 7957.2
107. 167 Jul 4, China. Emperor Huan, Reign *Yung K'ang*, 1st year, 5th month, (day) *jen-tsu* (49). Last day. "The Sun was eclipsed; it was 1 deg in *Kuei* (R.A. 100.1 deg)". Computed details: R.A. of Sun = 100.7 deg; magnitude at Lo-yang = 0.64; local time of maximum = 16.6 h; altitude at maximum phase = 30 deg. Delta T = 7941.7
108. 168 Jun 23, China. Emperor Ling, Reign *Chien Ning*, 1st year, 5th month, (day) *ting-wei* (44). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.05; local time of maximum = 5.8 h; altitude at maximum phase = 11 deg. Delta T = 7930.8
109. 168 Dec 17, China. Emperor Ling, Reign *Chien Ning*, 1st year, 10th month, (day) *chia-chen* (41). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.76; local time of maximum = 15.5 h; altitude at maximum phase = 13 deg. Delta T = 7925.4
110. 169 Dec 6, China. Emperor Ling, Reign *Chien Ning*, 2nd year, 10th month, (day) *wu-hsu* (35). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.02; local time of maximum = 16.4 h; altitude at maximum phase = 5 deg. Delta T = 7914.5
111. 170 May 3, China. Emperor Ling, Reign *Chien Ning*, 3rd year, 3rd month, (day) *ping-yin* (3). Last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 7909.9
112. 171 Apr 23, China. Emperor Ling, Reign *Chien Ning*, 4th year, 3rd month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details:

- Magnitude at Lo-yang = 0.23; local time of maximum = 5.5 h; altitude at maximum phase = 1 deg. Delta T = 7899.0
113. 174 Feb 18, China. Emperor Ling, Reign *Hsi P'ing*, 2nd year, 12th month, (day) *kuei-yu* (10). Last day. "The Sun was eclipsed; it was 2 deg in *Hsu* (R.A. 299.3 deg)". Computed details: R.A. of Sun = 331.1 deg; magnitude at Lo-yang = 0.30; local time of maximum = 15.8 h; altitude at maximum phase = 19 deg. Delta T = 7867.3
 114. 177 Nov 9, China. Reign *Hsi P'ing*, 6th year, 10th month, (day) *kuei-ch'ou* (50). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 7824.7
 115. 178 Mar 7, China. Reign *Kuang Ho*, 1st year, 2nd month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 7819.3
 116. 178 Nov 27, China. Reign *Kuang Ho*, 1st year, 10th month, (day) *ping-tzu* (13). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.32; local time of maximum = 10.1 h; altitude at maximum phase = 28 deg. Delta T = 7813.9
 117. 179 May 24, China. Reign *Kuang Ho*, 2nd year, 4th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.86, local time of maximum = 13.1 h, altitude at maximum phase = 70 deg. Delta T = 7808.5
 118. 181 Sep 26, China. Reign *Kuang Ho*, 4th year, 9th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed; it was 6 deg in *Chueh* (R.A. 182.9 deg)". Computed details: R.A. of Sun 182.3 deg, magnitude at Lo-yang = 0.90, local time of maximum = 17.2 h, altitude at maximum phase = 10 deg. Delta T = 7782.4
 119. 186 Jul 4, China. Reign *Ching P'ing*, 3rd year, 5th month, (day) *jen-ch'en* (29). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.22, local time of maximum = 15.6 h, altitude at maximum phase = 42 deg. Delta T = 7729.3
 120. 189 May 3, China. Reign *Ching P'ing*, 6th year, 4th month (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.70, local time of maximum = 14.4 h, altitude at maximum phase = 52 deg. Delta T = 7698.0
 121. 193 Feb 19, China. Reign *Ch'u P'ing*, 4th year, 1st month (day) *chia-yin* (51). First day. "The Sun was eclipsed; it was 4 deg in *Shih* (326.7 deg)". Computed details: R.A. of Sun = 332.5 deg, magnitude at Ch'ang-an = 0.56, local time of maximum = 16.5 h, altitude at maximum phase = 12 deg. Delta T = 7656.0

122. 194 Aug 8, China. Reign *Hsing P'ing*, 1st year, 6th month, (day) *i-szu* (42). Last day. "The Sun was eclipsed". Computed details: Magnitude at Ch'ang-an = 0.92, local time of maximum = 5.1 h, altitude at maximum phase = -1 deg. Delta T = 7639.9
123. 200 Sep 26, China. Reign *Chien An*, 5th year, 9th month, (day) *keng-wu* (7). First day. "The Sun was eclipsed". Computed details: Magnitude at Chen-liu = 0.63, local time of maximum = 6.1 h, altitude at maximum phase = 1 deg. Delta T = 7577.7
124. 201 Mar 22, China. Reign *Chien An*, 6th year, 2nd month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details: Magnitude at Chen-liu = 0.15, local time of maximum = 6.5 h, altitude at maximum phase = 6 deg. Delta T = 7567.0
125. 208 Oct 29, China. Reign *Chien An*, 13th year, 10th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed. It was 12 deg in *Wei* (R.A. 235.9 deg)". Computed details: R.A. of Sun = 211.5 deg, magnitude at Chen-liu = 0.69, local time of maximum = 10.1 h, altitude at maximum phase = 36 deg. Delta T = 7484.0
126. 210 Mar 13, China. Reign *Chien An*, 15th year, 2nd month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details: Magnitude at Chen-liu = 0.82, local time of maximum = 6.0 h, altitude at maximum phase = -2 deg. Delta T = 7469.0
127. 212 Aug 14, China. Reign *Chien An*, 17th year, 6th month, (day) *keng-yin* (27). Last day. "The Sun was eclipsed". Computed details: Magnitude at Chen-liu = 0.78, local time of maximum = 15.6 h, altitude at maximum phase = 38 deg. Delta T = 7442.6
128. 216 Jun 3, China. Reign *Chien An*, 21st year, 5th month, (day) *chi-hai* (36). First day. "The Sun was eclipsed". Computed details: Magnitude at Chen-liu = 0.76, local time of maximum = 5.2 h, altitude at maximum phase = 3 deg. Delta T = 7401.4
129. 219 Apr 2, China. Reign *Chien An*, 24th year, 2nd month, (day) *jen-tzu* (49). Last day. "The Sun was eclipsed". Computed details: Magnitude at Chen-liu = 0.47, local time of maximum = 16.8 h, altitude at maximum phase = 18 deg. Delta T = 7370.8
130. 221 Aug 5, China. Emperor Wen, Reign *Huang Ch'u*, 2nd year, 6th month, (day) *wu-chen* (5). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.23; local time of maximum = 14.5 h; altitude at maximum phase = 53 deg. Delta T = 7345.5.

131. 222 Jan 30, China. Reign *Huang Ch'u*, 3rd year, 1st month, (day) *ping-yin* (3). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.11; local time of maximum = 16.4 h; altitude at maximum phase = 9 deg. Delta T = 7340.2
132. 223 Jan 19, China. Reign *Huang Ch'u*, 3rd year, 11th month, (day) *keng-shen* (57). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.90; local time of maximum = 15.3 h; altitude at maximum phase = 17 deg. Delta T = 7329.8
133. 224 Dec 27, China. Reign *Huang Ch'u*, 5th year, 11th month, (day) *wu-shen* (45). Last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SUFACE. Delta T = 7308.9
134. 232 Jan 10, China. Emperor Ming, Reign *T'ai Ho*, 5th year, 11th month, (day) *wu-hsu* (35). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.35; local time of maximum = 7.2 h; altitude at maximum phase = 1 deg. Delta T = 7233.5
135. 232 Feb 9, China. Reign *T'ai Ho*, 6th year, 1st month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 7232.6
136. 233 Jun 25, China. Reign *Ch'ing Lung*, 1st year, 5th month (intercalary), (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.24; local time of maximum = 7.9 h; altitude at maximum phase = 36 deg. Delta T = 7217.9
137. 240 Aug 5, China. Emperor Fei, Reign *Cheng Shih*, 1st year, 7th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.55; local time of maximum = 14.1 h; altitude at maximum phase = 57 deg. Delta T = 7142.2
138. 242 May 17, China. Reign *Cheng Shih*, 3rd year, 4th month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 7123.3
139. 244 May 24, China. Reign *Cheng Shih*, 5th year, 4th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.11; local time of maximum = 8.9 h; altitude at maximum phase = 47 deg. Delta T = 7101.9
140. 245 May 15, China. Reign *Cheng Shih*, 6th year, 4th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 7091.6

141. 245 Nov 7, China. Reign *Cheng Shih*, 6th year, 10th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.28; local time of maximum = 12.0 h; altitude at maximum phase = 39 deg. Delta T = 7086.5
142. 247 Mar 24, China. Reign *Cheng Shih*, 8th year, 2nd month, (day) *keng-wu* (7). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 1.04; local time of maximum = 17.2 h; altitude at maximum phase = 10 deg. Delta T = 7072.0
143. 248 Feb 12, China. Reign *Cheng Shih*, 9th year, 1st month, (day) *i-wei* (32). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 7062.6
144. 249 Mar 2, China. Reign *Chia P'ing*, 1st year, 2nd month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 7051.5
145. 259 Aug 6, China. Emperor Shao, Reign *Kan Lu*, 4th year, 7th month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6942.1
146. 260 Jan 30, China. Reign *Kan Lu*, 5th year, 1st month. (day) *i-yu* (22). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.47; local time of maximum = 7.3 h; altitude at maximum phase = 5 deg. Delta T = 6937.0
147. 261 Jun 15, China. Emperor Yuan, Reign *Ching Yuan*, 2nd year, 5th month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.40; local time of maximum = 16.6 h; altitude at maximum phase = 30 deg. Delta T = 6922.7
148. 262 Nov 29, China. Reign *Ching Yuan*, 3rd year, 11th month, (day) *chi-hai* (36). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.24; local time of maximum 13.4 h; altitude at maximum phase = 30 deg. Delta T = 6907.5
149. 266 Sept 16, China. Emperor Wu, Reign *T'ai Shih*, 2nd year, 7th month, (day) *ping-wu* (43). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.27; local time of maximum = 15.1 h; altitude at maximum phase = 36 deg. Delta T = 6868.0
150. 266 Nov 15, China. Reign *T'ai Shih*, 2nd year, 10th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 6860.3

151. 271 Nov 20, China. Reign *T'ai Shih*, 7th year, 10th month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.11; local time of maximum = 9.4 h; altitude at maximum phase = 24 deg. Delta T = 6814.3
152. 272 Nov 8, China. Reign *T'ai Shih*, 8th year, 10th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.10; local time of maximum = 16.9 h; altitude at maximum phase = 3 deg. Delta T = 6804.3
153. 273 May 4, China. Reign *T'ai Shih*, 9th year, 4th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.91; local time of maximum = 15.6 h; altitude at maximum phase = 39 deg. Delta T = 6799.3
154. 273 Aug 1, China. Reign *T'ai Shih*, 9th year, 7th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 6795.8
155. 274 Jan 26, China. Reign *T'ai Shih*, 10th year, 1st month, (day) *i-wei* (32). "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 6791.8
156. 274 Apr 24, China. Reign *T'ai Shih*, 10th year, 3rd month, (day) *kuei-hai* (60). "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.87; local time of maximum = 6.4 h; altitude at maximum phase = 12 deg. Delta T = 6789.3
157. 275 Sept 7, China. Reign *Hsien Ning*, 1st year, 7th month, (day) *chia-shen* (21). Last day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.16; local time of maximum = 13.9 h; altitude at maximum phase = 52 deg. Delta T = 6775.1
158. 277 Feb 20, China. Reign *Hsien Ning*, 3rd year, 1st month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.93; local time of maximum = 14.0 h; altitude at maximum phase = 36 deg. Delta T = 6760.1
159. 278 Feb 9, China. Reign *Hsien Ning*, 4th year, 1st month, (day) *keng-wu* (7). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6747.5
160. 283 Apr 14, China. Reign *T'ai K'ang*, 4th year, 3rd month, (day) *hsin-chou* (38). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.32; local time of maximum = 6.1 h; altitude at maximum phase = 7 deg. (N.B. Given as Chinese day *jen-shen* (9) in the text). Delta T = 6697.1

161. 285 Sept 16, China. Reign *T'ai K'ang*, 6th year, 7th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.50; local time of maximum = 14.8 h; altitude at maximum phase = 40 deg. Delta T = 6672.3
162. 286 Feb 11, China. Reign *T'ai K'ang*, 7th year, 1st month, (day) *chia-yin* (51). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.44; local time of maximum = 6.8 h; altitude at maximum phase = 1 deg. Delta T = 6668.1
163. 287 Jan 31, China. Reign *T'ai K'ang*, 8th year, 1st month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.44; local time of maximum = 14.7 h; altitude at maximum phase = 25 deg. Delta T = 6658.2
164. 288 Feb 19, China. Reign *T'ai K'ang*, 9th year, 1st month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 6647.5
165. 288 Jul 16, China. Reign *T'ai K'ang*, 9th year, 6th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.78; local time of maximum = 6.4 h; altitude at maximum phase = 17 deg. Delta T = 6643.4
166. 299 Dec 10, China. Emperor Hui, Reign *Yuan K'ang*, 9th year, 11th month, (day) *chia-tzu* (1). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.40; local time of maximum = 13.4 h; altitude at maximum phase = 29 deg. Delta T = 6527.8
167. 300 Mar 6, China. Reign *Yung K'ang*, 1st year, 1st month, (day) *hsin-mao* (28). "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 6525.3
168. 300 May 5, China. Reign *Yung K'ang*, 1st year, 4th month, (day) *hsin-mao* (28). "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6523.7
169. 301 Apr 25, China. Reign *Yung Ning*, 1st year, 3rd month (intercalary), (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.67; local time of maximum = 16.3 h; altitude at maximum phase = 28 deg. Delta T = 6513.9
170. 306 Jan 31, China. Reign *Kuang Hsi*, 1st year, 1st month, (day) *wu-hsu* (25). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6465.9

171. 306 Jul 27, China. Reign *Kuang Hsi*, 1st year, 7th month, (day) *i-yu* (22). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.93; local time of maximum = 16.0 h; altitude at maximum phase = 35 deg. Delta T = 6461.1
172. 307 Jan 20, China. Reign *Kuang Hsi*, 1st year, 12th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6456.2
173. 307 Dec 12, China. Emperor Huai, Reign *Yung Chia*, 1st year, 11th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6447.3
174. 308 Feb 8, China. Reign *Yung Chia*, 2nd year, 1st month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 6445.7
175. 312 Mar 24, China. Reign *Yung Chia*, 6th year, 2nd month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6404.4
176. 316 Jul 6, China. Emperor Min, Reign *Chien Hsing*, 4th year, 6th month, (day) *ting-szu* (54). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.95; local time of maximum = 12.4 h; altitude at maximum phase = 77 deg. Delta T = 6361.7
177. 316 Dec 31, China. Reign *Chien Hsing*, 4th year, 12th month, (day) *i-mao* (52). "The sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.79; local time of maximum = 16.2 h; altitude at maximum phase = 6 deg. (N.B. Given as Chinese day *chia-shen* (21) in the Annals). Delta T = 6356.9
178. 318 May 17, China. Emperor Yuan, Reign *T'ai Hsing*, 1st year, 4th month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6343.3
179. 325 Dec 12, China. Reign *T'ai Ning*, 3rd year, 11th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.61; local time of maximum = 12.5 h; altitude at maximum phase = 34 deg. Delta T = 6268.1
180. 327 Jun 6, China. Emperor Ch'eng, Reign *Hsien Ho*, 2nd year, 5th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.75; local time of maximum = 13.9 h; altitude at maximum phase = 63 deg. Delta T = 6253.8

181. 331 Apr 24, China. Reign *Hsien Ho*, 6th year, 3rd month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed: there was heavy rain at the capital". Computed details: NO ECLIPSE VISIBLE ON THE EARTH'S SURFACE. Delta T = 6215.6
182. 335 Nov 2, China. Reign *Hsien K'ang*, 1st year, 10th month, (day) *i-wei* (32). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON THE EARTH'S SURFACE. Delta T = 6171.3
183. 341 Mar 4, China. Reign *Hsien K'ang*, 7th year, 2nd month, (day) *chia-tzu* (1). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.92; local time of maximum = 15.5 h; altitude at maximum phase = 28 deg. Delta T = 6119.2
184. 342 Feb 22, China. Reign *Hsien K'ang*, 8th year, 1st month, (day) *i-wei* (32). First day. "The Sun was eclipsed; the Emperor was displeased". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6109.8
185. 346 May 22, China. Emperor Mu, Reign *Yung Ho*, 2nd year, 4th month, (day) *chi-yu* (46). "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 6069.0
186. 351 Feb 13, China. Reign *Yung Ho*, 7th year, 1st month, (day) *ting-yu* (34). "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6023.0
187. 352 Feb 2, China. Reign *Yung Ho*, 8th year, 1st month, (day) *hsin-mao* (28). "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 6013.6
188. 356 Nov 9, China. Reign *Yung Ho*, 12th year, 10th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.50; local time of maximum = 8.0 h; altitude at maximum phase = 14 deg. Delta T = 5967.8
189. 360 Aug 28, China. Reign *Sheng P'ing*, 4th year, 7th month, (day) *hsin-chou* (38). First day. "The Sun was eclipsed; it was almost total". Computed details: Magnitude at Nanking = 0.89; local time of maximum = 11.3 h; altitude at maximum phase = 66 deg. Delta T = 5931.5
190. 362 May 3, China. Emperor An, Reign *Lung Ho*, 1st year, 3rd month, (day) *chia-yin* (51). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 5916.0
191. 363 Jan 2, China. Reign *Lung Ho*, 1st year, 12th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.65; local time of maximum = 7.0 h; altitude at maximum phase = 0 deg. Delta T = 5909.1

192. 368 Apr 4, China. Emperor Ti, Reign *T'ai Ho*, 3rd year, 3rd month, (day) *ting-szu* (54). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.94; local time of maximum = 6.3 h; altitude at maximum phase = 7 deg. Delta T = 5859.1
193. 370 Aug 8, China. Reign *T'ai Ho*, 5th year, 7th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.31; local time of maximum = 8.1 h; altitude at maximum phase = 35 deg. Delta T = 5836.9
194. 375 Nov 11, China. Emperor Hsiao Wu, Reign *Ning K'ang*, 3rd year, 10th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.36; local time of maximum = 8.0 h; altitude at maximum phase = 20 deg. Delta T = 5787.3
195. 380 Apr 24, China. Reign *T'an Yuan*, 4th year, 12th month (intercalary), (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 5745.5
196. 381 Jul 8, China. Reign *T'an Yuan*, 6th year, 6th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.20; local time of maximum = 11.4 h; altitude at maximum phase = 77 deg. Delta T = 5734.1
197. 384 Oct 30, China. Reign *T'an Yuan*, 9th year, 10th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.49; local time of maximum = 7.4 h; altitude at maximum phase = 10 deg. Delta T = 5703.1
198. 392 Jun 7, China. Reign *T'an Yuan*, 17th year, 5th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.62; local time of maximum = 15.5 h; altitude at maximum phase = 43 deg. Delta T = 5632.4
199. 395 Apr 6, China. Reign *T'an Yuan*, 20th year, 3rd month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.52; local time of maximum = 14.3 h; altitude at maximum phase = 49 deg. Delta T = 5606.2
200. 400 Jun 17, China (North). Emperor Tao Wu, Reign *T'ien Hsing*, 3rd year, 6th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 5558.5
201. 400 Jul 8, China. Emperor An, Reign *Lung An*, 4th year, 6th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.54; local time of maximum = 11.3 h; altitude at maximum phase = 77 deg. Delta T = 5557.7

202. 403 May 7, China (North). Emperor Tao Wu, Reign *T'ien Hsing*, 6th year, 4th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.60; local time of maximum = 15.7; altitude at maximum phase = 37 deg. Delta T = 5531.7
203. 403 May 7, China. Emperor An, Reign *Yuan Hsiang*, 2nd year, 4th month, (day) *kuei-szu* (30). "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.84; local time of maximum = 16.2 h; altitude at maximum phase = 32 deg. Delta T = 5531.7
204. 404 Sept 3, China (North). Emperor Tao Wu, Reign *T'ien T'zu*, 1st year, 7th month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 5519.9
205. 407 Aug 19, China. Emperor An, Reign *I Hsi*, 3rd year, 7th month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.40; local time of maximum = 9.8 h; altitude at maximum phase = 54 deg. Delta T = 5492.5
206. 414 Sept 30, China. Emperor An, Reign *I Hsi*, 10th year, 9th month, (day) *ting-szu* (54). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.68; local time of maximum = 8.2 h; altitude at maximum phase = 26 deg. Delta T = 5427.7
207. 415 Sept 19, China. Emperor An, Reign *I Hsi*, 11th year, 7th month, (day) *hsin-hai* (48). Last day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.17; local time of maximum = 10.7 h; altitude at maximum phase = 54 deg. Delta T = 5418.9
208. 415 Oct 18, China (North). Emperor Ming, Reign *Shen Ti*, 2nd year, 8th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 5418.2
209. 417 Feb 3, China. Emperor An, Reign *I Hsi*, 13th year, 1st month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.50; local time of maximum = 6.8 h; altitude at maximum phase = -1 deg. Delta T = 5406.5
210. 419 Dec 3, China. Emperor Kung, Reign *Yuan Hsi*, 1st year, 11th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details: Magnitude = 0.05; local time of maximum = 10.0 h; altitude at maximum phase = 28 deg. Delta T = 5380.9
211. 424 Mar 17, China. Emperor Shao, Reign *Ch'ing P'ing*, 2nd year, 2nd month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 5342.3

212. 427 Jul 10, China. Emperor Wen, Reign *Yuan Chia*, 4th year, 6th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.61; local time of maximum = 19.5 h; altitude at maximum phase = -6 deg. Delta T = 5312.6
213. 427 Jul 10, China (North). Emperor T'ai Wu, Reign *Shih Kuang*, 4th year, 6th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 5312.6
214. 428 Dec 23, China (North). Emperor T'ai Wu, Reign *Shen Chia*, 1st year, 11th month, (day) *i-wei* (32). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 5303.9
215. 429 Jun 18, China. Emperor Wen, Reign *Yuan Chia*, 6th year, 5th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 5295.2
216. 429 Dec 12, China. Emperor Wen, Reign *Yuan Chia*, 6th year, 11th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.92; local time of maximum = 12.6 h; altitude at maximum phase = 34 deg. Delta T = 5290.9
217. 435 Feb 14, China. Emperor Wen, Reign *Yuan Chia*, 12th year, 1st month, (day) *i-wei* (32). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.68; local time of maximum = 17.7 h; altitude at maximum phase = -3 deg. (N.B. Given as Chinese day (56) in the Annals). Delta T = 5244.7
218. 435 Feb 14, China (North). Emperor T'ai Wu, Reign *T'ai Yen*, 1st year, 1st month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.92; local time of maximum = 17.2 h; altitude at maximum phase = 1 deg. Delta T = 5244.7
219. 438 Dec 12, China (North). Emperor T'ai Wu, Reign *T'ai Yen*, 4th year, 11th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.56; local time of maximum = 10.0 h; altitude at maximum phase = 22 deg. Delta T = 5211.0
220. 440 May 7, China. Emperor Wen, Reign *Yuan Chia*, 17th year, 4th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.16; local time of maximum = 12.7; altitude at maximum phase = 75 deg. Delta T = 5198.1
221. 440 May 7, China (North). Emperor T'ai Wu, Reign *T'ai P'ing*, 1st year, 4th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.46; local time of maximum = 12.3 h; altitude at maximum phase = 69 deg. Delta T = 5198.1

222. 442 Sept 20, China. Emperor Wen, Reign *Yuan Chia*, 19th year, 7th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.62; local time of maximum = 16.7 h; altitude at maximum phase = 17 deg. Delta T = 5177.4
223. 442 Sept 20, China (North). Emperor T'ai Wu, Reign *T'ai P'ing*, 3rd year, 8th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.57; local time of maximum = 16.0 h; altitude at maximum phase = 24 deg. Delta T = 5177.4
224. 445 Jul 20, China (North). Emperor T'ai Wu, Reign *T'ai P'ing*, 6th year, 6th month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 5152.4
225. 446 Jul 10, China. Emperor Wen, Reign *Yuan Chia*, 23rd year, 6th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.60; local time of maximum = 9.4 h; altitude at maximum phase = 53 deg. Delta T = 5143.9
226. 446 Jul 10, China (North). Emperor T'ai Wu, Reign *T'ai P'ing*, 7th year, 6th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.86; local time of maximum = 8.9 h; altitude at maximum phase = 47 deg. Delta T = 5143.9
227. 450 May 3, China (North). Emperor T'ai Wu, Reign *T'ai P'ing*, 10th year, 4th month, Summer, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 5110.6
228. 450 June 26, China (North). Emperor T'ai Wu, Reign *T'ai P'ing*, 10th year, 6th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 5109.2
229. 453 Aug 10, China. Emperor Wen, Reign *Yuan Chia*, 30th year, 7th month, (day) *hsin-chou* (38). First day. "The Sun was eclipsed totally". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. On 453 Aug 20, there was a total eclipse, but it was probably not visible in China.) Delta T = 5081.6
230. 454 Aug 10, China. Emperor Hsiao Wu, Reign *Hsiao Chien*, 1st year, 7th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed totally; stars and planets were all observed". Computed details: Magnitude at Nanking = 0.99; local time of maximum 8.9 h; altitude at maximum phase = 44 deg. (N.B. Hoang has Chinese day *ping-shen* (33)). Delta T = 5073.1

231. 454 Aug 10, China (North). Emperor Wen Cheng, Reign *Hsing Kuang*, 1st year 7th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.78; local time of maximum = 8.5 h; altitude at maximum phase = 38 deg. Delta T = 5073.1
232. 460 Oct 1, China (North). Emperor Wen Cheng, Reign *Ho P'ing*, 1st year, 9th month, (day) *keng-shen* (57). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 5019.7
233. 461 Sept 20, China. Emperor Hsiao Wu, Reign *Ta Ming*, 5th year, 9th month, (day) *chia-yin* (51). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.43; local time of maximum = 9.8 h; altitude at maximum phase = 46 deg. Delta T = 5011.3
234. 462 Mar 17, China (North). Emperor Wen Cheng, Reign *Ho P'ing*, 3rd year, 2nd month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.41; local time of maximum = 11.3 h; altitude at maximum phase = 48 deg. Delta T = 5007.1
235. 467 Nov 13, China (North). Emperor Hsien Wen, Reign *Huang Hsing*, 1st year, 10th month, (day) *chi-mao* (16). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4958.3
236. 468 May 8, China (North). Emperor Hsien Wen, Reign *Huang Hsing*, 2nd year, 4th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.24; local time of maximum = 10.5 h; altitude at maximum phase = 60 deg. Delta T = 4954.1
237. 468 Sept 5, China. Emperor Ming, Reign *T'ai Shih*, 4th year, 8th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4951.3
238. 468 Nov 1, China. Emperor Ming, Reign *T'ai Shih*, 4th year, 10th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.42; local time of maximum = 7.4 h; altitude at maximum phase = 9 deg. Delta T = 4949.9
239. 468 Nov 1, China (North). Emperor Hsien Wen, Reign *Huang Hsing*, 2nd year, 10th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.26; local time of maximum = 7.1 h; altitude at maximum phase = 2 deg. Delta T = 4949.9
240. 469 Oct 21, China. Emperor Ming, Reign *T'ai Shih*, 5th year, 10th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.60; local time of maximum = 10.4 h; altitude at maximum phase = 41 deg. Delta T = 4941.6

241. 469 Nov 20, China (North). Emperor Hsien Wen, Reign *Huang Hsing*, 3rd year, 10th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4940.9
242. 472 Jan 15, China (North). Emperor Hsiao Wen, Reign *Yen Hsing*, 1st year, 12th month, (day) *kuei-mao* (40). "The Sun was eclipsed. This was a prediction". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4922.9
243. 474 Jan 4, China. Emperor Ts'ang Wu Wang, Reign *Yuan Hui*, 1st year, 12th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.27; local time of maximum = 13.9 h; altitude at maximum phase = 29 deg. Delta T = 4905.6
244. 474 Jan 4, China (North). Emperor Hsiao Wen, Reign *Yen Hsing*, 3rd year, 12th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.46; local time of maximum = 13.3 h; altitude at maximum phase = 25 deg. Delta T = 4905.6
245. 474 Feb 3, China (North). Emperor Hsiao Wen, Reign *Yen Hsing*, 4th year, 10th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed. This was a prediction". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4904.9
246. 477 Oct 23, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 1st year, 10th month, winter, (day) *hsin-hai* (48). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4873.2
247. 478 Mar 26, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 2nd year, 2nd month, (day) *i-yu* (22). Last day. "The Sun was eclipsed. This was a prediction". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4869.7
248. 478 Oct 12, China. Emperor Shun, Reign *Sheng Ming*, 2nd year, 9th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4864.9
249. 478 Oct 12, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 2nd year, 9th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4864.9
250. 479 Apr 8, China. Emperor Shun, Reign *Sheng Ming*, 3rd year, 3rd month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.87; local time of maximum = 16.7 h; altitude at maximum phase = 22 deg. Delta T = 4860.8

251. 479 Apr 8, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 3rd year, 3rd month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.85; local time of maximum = 16.1 h; altitude at maximum phase = 26 deg. Delta T = 4860.8
252. 480 Sept 20, China. Emperor Kao, Reign *Chien Yuan*, 2nd year, 9th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4848.2
253. 481 Aug 11, China. Emperor Kao, Reign *Chien Yuan*, 3rd year, 7th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.26; local time of maximum = 17.7 h; altitude at maximum phase = 12 deg. Delta T = 4840.9
254. 481 Aug 11, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 5th year, 7th month, (day) *keng-shen* (57). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.31; local time of maximum = 17.1 h; altitude at maximum phase = 20 deg. Delta T = 4840.9
255. 484 Jan 14, China. Emperor Wu, Reign *Yung Ming*, 1st year, 12th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details: Magnitude at Nanking = 0.17; local time of maximum = 16.0 h; altitude at maximum phase = 12 deg. Delta T = 4820.3
256. 484 Jan 14, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 7th year, 12th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details: Magnitude at Ta-tung = 0.48; local time of maximum = 15.6 h; altitude at maximum phase = 11 deg. Delta T = 4820.3
257. 489 Mar 18, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 13th year, 2nd month, (day) *i-hai* (12). First day. "The Sun was eclipsed; it was eight-fifteenths covered". Computed details: Magnitude at Lo-yang = 0.60; local time of maximum = 14.5 h; altitude at maximum phase = 41 deg. Delta T = 4776.7
258. 490 Mar 7, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 14th year, 2nd month, (day) *chi-szu* (6). First day. "The Sun was eclipsed. It was one-fifteenth covered at the hour (1-3p.m.). There was a mist". Computed details: Magnitude at Lo-yang = 0.04; local time of maximum = 15.0 h; altitude at maximum phase = 32 deg. Delta T = 4768.5
259. 491 Feb 24, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 15th year, 1st month, (day) *kuei-hai* (60). Last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4760.4

260. 493 Jan 4, China, Emperor Wu, Reign *Yung Ming*, 10th year, 12th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed. At early (1-3 p.m.), the Sun started to eclipse. Four tenths of the Sun were covered. At (3-5 p.m.) the Sun shone fully again. The eclipse started from the North-West part of the Sun". Computed details: Magnitude at Nanking = 0.62; local time of maximum = 14.8 h; altitude at maximum phase = 22 deg. Delta T = 4744.8.
261. 493 Jun 30, China (North), Emperor Hsiao Wen, Reign *T'ai Ho*, 17th year, 6th month, (day) *keg-chen* (17). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4744.1
262. 494 Jun 19, China, Emperor Yu-lin, Reign *Lung Chang*, 1st year, 5th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed. At (9-11 a.m.), the Sun became eclipsed. One third of the Sun was covered. At (11 a.m.-1 p.m.) the Sun regained its brightness". Computed details: Magnitude at Nanking = 0.93; local time of maximum = 8.8 h; altitude at maximum phase = 48 deg. Delta T = 4732.6.
263. 494 Jun 19, China (North), Emperor Hsiao Wen, Reign *T'ai Ho*, 18th year, 5th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details: Magnitude at Lo-yang = 0.84; local time of maximum = 8.6 h; altitude at maximum phase = 44 deg. Delta T = 4732.6.
264. 496 Oct 22, China (North). Emperor Hsiao Wen, Reign *T'ai Ho*, 20th year, 9th month, (day) *keng-yin* (27). Last day. "The Sun was eclipsed". Computed details for Ta-tung: Magnitude = 0.59, local time of maximum = 16.5 h, altitude at maximum phase = 9 deg. Delta T = 4713.0
265. 500 Feb 15, China (North). Emperor Hsuan Wu, Reign *Ching Ming*, 1st year, 1st month, (day) *hsin-chou* (38). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 4685.4
266. 500 Aug 11, China (North). Emperor Hsuan Wu, Reign *Ching Ming*, 1st year, 7th month, (day) *chia-hai* (36). First day. "The Sun was eclipsed". Computed details for Ta-tung: Magnitude = 0.57, local time of maximum = 4.9 h, altitude at maximum phase = -2 deg. Delta T = 4681.4
267. 501 Jul 31, China (North). Emperor Hsuan Wu, Reign *Ching Ming*, 2nd year, 7th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details for Ta-tung: Magnitude = 0.12, local time of maximum = 6.1 h, altitude at maximum phase = 13 deg. Delta T = 4673.3
268. 502 Aug 19, China (North). Emperor Hsuan Wu, Reign *Ching Ming*, 3rd year, 7th month, (day) *ting-szu* (54). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4664.6

269. 508 Sept 11, China (North). Emperor Hsuan Wu, Reign *Yung P'ing*, 1st year, 8th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.46, local time of maximum = 7.8 h, altitude at maximum phase = 22 deg. Delta T = 4614.4
270. 509 Aug 31, China (North). Emperor Hsuan Wu, Reign *Yung P'ing*, 2nd year, 8th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.95, local time of maximum = 18.6 h, altitude at maximum phase = -2 deg Delta T = 4606.5
271. 512 Jan 4, China (North). Emperor Hsuan Wu, Reign *Yung P'ing*, 4th year, 12th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4587.1
272. 512 Jan 4, China. Emperor Wu, Reign *T'ien Chien*, 10th year, 12th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed; it was 4 deg in *Niu* (R.A. 287.8 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 286.9 deg.) Delta T = 4587.1
273. 512 Jun 29, China (North). Emperor Hsuan Wu, Reign *Yen Chang*, 1st year, 5th month, (day) *chi-wei* (56). Last day. "The Sun was eclipsed; it was nine-fifteenths covered". Computed details for Ta-tung : Magnitude = 0.48, local time of maximum = 18.1 h, altitude at maximum phase = 14 deg. Delta T = 4583.2
274. 513 Jun 19, China (North). Emperor Hsuan Wu, Reign *Yen Chang*, 2nd year, 6th month, (day) *chia-yin* (51). First day. "The Sun was eclipsed; it was not visible at the capital but was reported from Hsia Chou". Computed details for Ta-tung : Magnitude = 0.10, local time of maximum = 7.5 h, altitude at maximum phase = 31 deg. Delta T = 4575.2
275. 516 Apr 18, China (North). Emperor Hsuan Wu, Reign *Hsi P'ing*, 1st year, 3rd month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.80, local time of maximum = 7.0 h, altitude at maximum phase = 18 deg. Delta T = 4552.1
276. 518 Feb 20, China (North). Emperor Hsuan Wu, Reign *Shen Kuei*, 2nd year, 1st month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4536.9
277. 520 Feb 5, China (North). Emperor Hsuan Wu, Reign *Cheng Kuang*, 1st year, 1st month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.87, local time of maximum = 6.7 h, altitude at maximum phase = -2 deg. Delta T = 4521.1

278. 520 Feb 5, China. Emperor Wu, Reign *P'u T'ung*, 1st year, spring, 1st month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details for Nang-king : Magnitude = 0.98; local time of maximum = 7.0 h; altitude at maximum phase = 3 deg. Delta T = 4521.1
279. 520 Jun 25, China (North). Emperor Hsuan Wu, Reign *Cheng Kuang*, 2nd year, 5th month, (day) *ting-yu* (34). "The Sun was eclipsed; reported from Hsia Chou". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4517.8
280. 521 Jun 20, China (North). Emperor Hsuan Wu, Reign *Cheng Kuang*, 3rd year, 5th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.29, local time of maximum = 17.8 h, altitude at maximum phase = 17 deg. Delta T = 4509.9
281. 522 Dec 4, China (North). Emperor Hsuan Wu, Reign *Cheng Kuang*, 3rd year, 11th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4498.1
282. 523 Nov 23, China (North). Emperor Hsuan Wu, Reign *Cheng Kuang*, 4th year, 11th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.77, local time of maximum = 11.4 h, altitude at maximum phase = 29 deg. Delta T = 4490.2
283. 523 Nov 23, China. Emperor Wu, Reign *P'u T'ung*, 4th year, 11th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed; Venus was visible during the day". Computed details for Nang-king : Magnitude = 0.88; local time of maximum = 12.1 h; altitude at maximum phase = 37 deg. Delta T = 4490.2
284. 529 Nov 11, China (North). Emperor Hsiao Chung, Reign *Hung An*, 2nd year, 10th month, (day) *chu-yu* (46). "The Sun was eclipsed, it was seven-fifteenths covered. The Sun rose already eclipsed from beneath the Earth. The Sun eclipsed from the North-Western horn". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (No eclipse was found to fit the data within several years before and after the given date.) Delta T = 4441.9
285. 531 Jun 30, China (North). Emperor Chieh Min, Reign *Tsin T'ai*, 1st year, 6th month, (day) *chi-hai* (36). First day. "The Sun rose eclipsed from the South-Western horn. The eclipse was not seen at the capital due to cloud but was observed in the provinces (at Ting Hsian)". Computed details for Ta-tung : Magnitude = 0.23, local time of maximum = 17.6 h, altitude at maximum phase = 19 deg. Delta T = 4428.8
286. 532 Nov 13, China (North). Emperor Hsiao Wu, Reign *T'ai Chang*, 1st year, 10th month, (day) *hsin-yu* (58). First day. "The Sun rose from

beneath the Earth, already eclipsed. The eclipse started from the South-Western horn". Computed details for Ta-tung : Magnitude = 0.37, local time of maximum = 7.1 h, altitude at maximum phase = 0 deg. Delta T = 4417.8

287. 533 May 10, China (North). Emperor Hsiao Wu, Reign *Yung Hsi*, 2nd year, 4th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed in the near South. The eclipse began from the true South". Computed details for Ta-tung : Magnitude = 0.20, local time of maximum = 12.2 h, altitude at maximum phase = 68 deg. Delta T = 4413.9
288. 534 Apr 29, China (North). Emperor Hsiao Wu, Reign *Yung Hsi*, 3rd year, 4th month, (day) *kuei-chou* (50). "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.14, local time of maximum = 16.3 h, altitude at maximum phase = 28 deg. Delta T = 4406.1
289. 538 Feb 15, China (East). Emperor Hsiao Ching, Reign *Yuan Hsiang*, 1st year, spring, 1st month, (day) *hsin-chou* (38). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4375.7
290. 540 Jun 20, China (East). Emperor Hsiao Ching, Reign *Hsing Ho*, 2nd year, 4th month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details for Nang-king : Magnitude = 0.53, local time of maximum = 18.4 h, altitude at maximum phase = 8 deg. Delta T = 4357.1
291. 543 Apr 20, China (East). Emperor Hsiao Ching, Reign *Wu Ting*, 5th year, 1st month, (day) *chi-hai* (36). First day. "The Sun was eclipsed". Computed details for Nang-king : Magnitude = 0.41, local time of maximum = 9.7 h, altitude at maximum phase = 52 deg. Delta T = 4334.6
292. 544 Aug 11, China (East). Emperor Hsiao Ching, Reign *Wu Ting*, 6th year, 8th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed, it began from the North-Western horn". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4324.3
293. 559 Jun 20, China. Emperor Wu, Reign *Yung Ting*, 3rd year, 5th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 4207.4
294. 561 Apr 30, China. Emperor Hsiao Chao, Reign *Huang CHien*, 2nd year, 4th month, (day) *ping-tzu* (13). "The Sun was eclipsed". Computed details for Ta-tung : Magnitude = 0.27, local time of maximum = 18.7 h, altitude at maximum phase = 2 deg. Delta T = 4193.0

295. 562 Oct 14, China. Emperor Wu, Reign *Pao Ting*, 2nd year, 9th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Nanking : Magnitude = 0.26, local time of maximum = 8.0 h, altitude at maximum phase = 19 deg. Delta T = 4181.7
296. 563 Apr 9, China. Reign *Pao Ting*, 3rd year, 3rd month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4177.9
297. 564 Feb 28, China. Reign *Pao Ting*, 4th year, 2nd month, (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details for Nang-king : Magnitude = 0.15, local time of maximum = 6.7 h, altitude at maximum phase = 4 deg. Delta T = 4171.0
298. 564 Aug 23, China. Reign *Pao Ting*, 4th year, 8th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4167.2
299. 565 Aug 12, China. Reign *Pao Ting*, 5th year, 7th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4159.7
300. 566 Feb 6, China. Reign *T'ien Ho*, 1st year, 1st month, (day) *chi-mao* (16). "The Sun was eclipsed; Venus was seen". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4156.0
301. 567 Jan 26, China. Reign *T'ien Ho*, 2nd year, 1st month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4148.5
302. 567 Dec 17, China. Reign *T'ien Ho*, 2nd year, 11th month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4141.6
303. 571 May 10, China. Reign *T'ien Ho*, 6th year, 4th month, (day) *wu-yin* (15). "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4115.5
304. 575 Feb 26, China. Emperor Kao Tsu, Reign *K'ai Huang*, 12th year, 5th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 4086.3
305. 618 Oct 24, China. Emperor Kao Tsu, Reign *Wu Te*, 1st year, 10th month, (day) *jen-shen* (9). First day. "The Sun was eclipsed; it was 5 deg in *Ti* (R.A. 209.3 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 211.1 deg). Delta T = 3760.7

306. 621 Aug 23, China. Reign *Wu Te*, 4th year, 8th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed; it was 4 deg in *I* (R.A. 152.9 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 154.1 deg.) Delta T = 3740.2
307. 623 Dec 27, China. Reign *Wu Te*, 6th year, 12th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed; it was 19 deg in *Tou* (R.A. 277.9 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 279.0 deg). Delta T = 3723.2
308. 626 Oct 26, China. Reign *Wu Te*, 9th year, 10th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed; it was 7 deg in *Ti* (R.A. 211.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 213.2 deg, Magnitude = 0.28, local time of maximum = 9.8 h, altitude at maximum phase = 33 deg. Delta T = 3702.8
309. 627 Apr 21, China. Emperor T'ai Tsung, Reign *Cheng Kuan*, 1st year, 3rd month, intercalary, (day) *kuei-chou* (50). First day. "The Sun was eclipsed; it was 9 deg in *Wei* (R.A. 30.4 deg)". Computed details for Ch'ang-an : R.A. of Sun = 30.5 deg, Magnitude = 0.54, local time of maximum = 17.2 h, altitude at maximum phase = 17 deg. Delta T = 3699.4
310. 627 Oct 15, China. Reign *Cheng Kuan*, 1st year, 9th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed; it was 5 deg in *K'ang* (R.A. 200.5 deg)". Computed details for Ch'ang-an : R.A. of Sun = 202.3 deg, Magnitude = 0.77, local time of maximum = 8.5 h, altitude at maximum phase = 24 deg. Delta T = 3695.9
311. 628 Apr 10, China. Reign *Cheng Kuan*, 2nd year, 3rd month, (day) *wu-shen* (45). First day. "The Sun was eclipsed; it was 11 deg in *Lou* (R.A. 21.4 deg)". Computed details for Ch'ang-an : R.A. of Sun = 21.1 deg, Magnitude = 0.61, local time of maximum = 7.4 h, altitude at maximum phase = 22 deg. Delta T = 3692.4
312. 629 Aug 24, China. Reign *Cheng Kuan*, 3rd year, 8th month, (day) *chi-szu* (6). First day. "The Sun was eclipsed; it was 5 deg in *I* (R.A. 153.9 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 155.0 deg). Delta T = 3682.5
313. 630 Feb 18, China. Reign *Cheng Kuan*, 4th year, 1st month, intercalary, (day) *ting-mao* (4). First day. "The Sun was eclipsed; it was 4 deg in *Shih* (R.A. 334.0 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 334.3 deg). Delta T = 3679.0
314. 630 Aug 14, China. Reign *Cheng Kuan*, 4th year, 7th month, (day) *chia-tzu* (1). First day. "The Sun was eclipsed; it was 14 deg in *Chang* (R.A.

- 139.2 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 145.5 deg.) Delta T = 3675.6
315. 632 Jan 27, China. Reign *Cheng Kuan*, 6th year, 1st month, (day) *i-mao* (52). First day. "The Sun was eclipsed; it was 9 deg in *Hsu* (R.A. 313.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 312.3 deg, Magnitude = 0.53, local time of maximum = 15.1 h, altitude at maximum phase = 24 deg. Delta T = 3665.1
316. 634 Jun 1, China. Reign *Cheng Kuan*, 8th year, 5th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed; it was 7 deg in *Shen* (R.A. 72.9 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 70.7 deg.) Delta T = 3648.7
317. 635 May 22, China. Reign *Cheng Kuan*, 9th year, 4th month, intercalary, (day) *ping-yin* (3). First day. "The Sun was eclipsed; it was 13 deg in *Pi* (R.A. 60.3 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 60.4 deg). Delta T = 3641.5
318. 637 Apr 1, China. Reign *Cheng Kuan*, 11th year, 3rd month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed; it was 2 deg in *Lou* (R.A. 11.4 deg)". Computed details for Ch'ang-an : R.A. of Sun = 12.8 deg, Magnitude = 0.97, local time of maximum = 6.5 h, altitude at maximum phase = 9 deg. Delta T = 3628.3
319. 638 Mar 21, China. Reign *Cheng Kuan*, 12th year, 2nd month, intercalary, (day) *keng-chen* (17). First day. "The Sun was eclipsed; it was 9 deg in *K'uei* (R.A. 3.5 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 2.7 deg.) Delta T = 3621.4
320. 639 Sept 3, China. Reign *Cheng Kuan*, 13th year, 8th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed; it was 14 deg in *I* (R.A. 162.9 deg)". Computed details for Ch'ang-an : R.A. of Sun = 163.4 deg, Magnitude = 0.89, local time of maximum = 15.4 h, altitude at maximum phase = 36 deg. Delta T = 3611.1
321. 643 Jun 22, China. Reign *Cheng Kuan*, 17th year, 6th month, (day) *chi-mao* (16). First day. "The Sun was eclipsed; it was 16 deg in *Ching* (R.A. 90.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 92.3 deg, Magnitude = 0.50, local time of maximum = 5.2 h, altitude at maximum phase = 3 deg. Delta T = 3584.2
322. 644 Nov 5, China. Reign *Cheng Kuan*, 18th year, 10th month, (day) *hsin-chou* (38). First day. "The Sun was eclipsed; it was 3 deg in *Fang* (R.A. 222.3 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 223.7 deg.) Delta T = 3574.6

323. 646 Apr 21, China. Reign *Cheng Kuan*, 20th year, 3rd month, intercalary, (day) *kuei-szu* (30). First day. "The Sun was eclipsed; it was 9 deg in *Wei* (R.A. 30.4 deg)". Computed details for Ch'ang-an : R.A. of Sun = 30.8 deg, Magnitude = 0.23, local time of maximum = 17.6 h, altitude at maximum phase = 12 deg. Delta T = 3564.3
324. 648 Aug 24, China. Reign *Cheng Kuan*, 22nd year, 8th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed; it was 5 deg in *I* (R.A. 153.9 deg)". Computed details for Ch'ang-an : R.A. of Sun = 155.4 deg, Magnitude = 0.91, local time of maximum = 15.0 h, altitude at maximum phase = 42 deg. Delta T = 3547.6
325. 660 Jul 13, China. Emperor Kao Tsung, Reign *Hsien Ch'ien*, 5th year, 6th month, (day) *keng-yu* (7). First day. "The Sun was eclipsed; it was 5 deg in *Liu* (R.A. 115.2 deg)". Computed details for Ch'ang-an : R.A. of Sun = 114.8 deg, Magnitude = 0.74, local time of maximum = 10.8 h, altitude at maximum phase = 69 deg. Delta T = 3465.3
326. 661 Jul 2, China. Reign *Lung So*, 1st year, 5th month, (day) *chia-tzu* (1). Last day. "The Sun was eclipsed; it was 27 deg in *Ching* (R.A. 101.3 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 103.3 deg). Delta T = 3458.6
327. 665 Apr 21, China. Reign *Lin Te*, 2nd year, 3rd month, intercalary, (day) *kuei-yu* (10). "The Sun was eclipsed; it was 9 deg in *Wei* (R.A. 30.4 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 31.2 deg). Delta T = 3432.5
328. 667 Aug 25, China. Reign *Chen Feng*, 2nd year, 8th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed; it was 6 deg in *I* (R.A. 154.9 deg)". Computed details for Ch'ang-an : R.A. of Sun = 155.7 deg, Magnitude = 0.35, local time of maximum = 12.4 h, altitude at maximum phase = 65 deg. (N.B. Given as Chinese Day *chi-chou* (26) in the Annals.) Delta T = 3416.5
329. 669 Jul 4, China. Reign *Tsung Chang*, 2nd year, 6th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed; it was 29 deg in *Ching* (R.A. 103.3 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 105.4 deg). Delta T 3403.8
330. 670 Jun 23, China. Reign *Hsien Heng*, 1st year, 6th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed; it was 18 deg in *Ching* (R.A. 92.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 93.7 deg, Magnitude = 0.26, local time of maximum = 9.8 h, altitude at maximum phase = 60 deg. Delta T = 3397.2

331. 671 Dec 7, China. Reign *Hsien Heng*, 2nd year, 11th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed; it was 9 deg in *Chi* (R.A. 257.6 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 257.1 deg.) Delta T = 3387.3
332. 672 Nov 25, China. Reign *Hsien Heng*, 3rd year, 11th month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed; it was 10 deg in *Wei* (R.A. 239.5 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 244.9 deg). Delta T = 3380.7
333. 674 Apr 12, China. Old T'ang. Reign *Hsien Heng*, 5th year, 3rd month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed; it was 13 deg in *Lou* (R.A. 22.8 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 22.8 deg). Delta T = 3371.4
334. 674 Apr 12, China. New T'ang Reign *Shang Yuan*, 1st year, 3rd month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed; it was 10 deg in *Wei* (R.A. 233.9 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 22.8 deg). Delta T = 3371.4
335. 675 Sept 25, China. Reign *Shang Yuan*, 2nd year, 9th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 3361.5
336. 680 Mar 5, China. Reign *T'ao Lu*, 1st year, 4th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 3331.6
337. 680 Nov 27, China. Reign *Yung Lung*, 1st year, 11th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed; it was 15 deg in *Wei* (R.A. 234.5 deg)". Computed details for Ch'ang-an : R.A. of Sun = 247.1 deg, Magnitude = 0.54, local time of maximum = 9.8 h, altitude at maximum phase = 25 deg. Delta T = 3326.7
338. 680 Nov 27, China. New T'ang Reign *T'ao Lu*, 1st year, 11th month, (day) *jen-yin* (39). First "The Sun was eclipsed; it was 16 deg in *Wei* (R.A. 235.5 deg)". Computed details for Ch'ang-an : R.A. of Sun = 247.1 deg, Magnitude = 0.54, local time of maximum = 9.8 h, altitude at maximum phase = 25 deg. (N.B. Given as *jen-shen* (9) in the Annals). Delta T = 3326.7
339. 681 Nov 16, China. Reign *K'ao Yao*, 1st year, 10th month, (day) *ping-yin* (3). First day. "The Sun was eclipsed; it was 4 deg in *Wei* (R.A. 233.5 deg)". Computed details for Ch'ang-an : R.A. of Sun = 235.0 deg, Magnitude = 0.58, local time of maximum = 8.2 h, altitude at maximum phase = 13 deg. Delta T = 3320.2

340. 682 May 13, China. Reign *Yung Shun*, 1st year, 4th month, (day) *chia-tzu* (1). First day. "The Sun was eclipsed; it was 5 deg in *Pi* (R.A. 52.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 52.1 deg, Magnitude = 0.27, local time of maximum = 5.9 h, altitude at maximum phase = 9 deg. Delta T = 3316.9
341. 682 Nov 15, China. Reign *Yung Shun*, 1st year, 10th month, (day) *keng-shen* (57). First day. "The Sun was eclipsed; it was 3 deg in *Fang* (R.A. 222.3 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 233.8 deg). Delta T = 3313.7
342. 686 Feb 28, China. Empress Wu Hou, Reign *Chiu Kung*, 2nd year, 2nd month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed; it was 15 deg in *Shih* (R.A. 344.6 deg)". Computed details for Ch'ang-an : R.A. of Sun = 344.0 deg, Magnitude = 0.29, local time of maximum = 15.6 h, altitude at maximum phase = 24 deg. Delta T = 3291.5
343. 688 Jul 3, China. Reign *Chiu Kung*, 4th year, 6th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed; it was 27 deg in *Ching* (R.A. 101.3 deg)". Computed details for Lo-yang: R.A. of Sun = 104.8 deg, Magnitude = 0.82, local time of maximum = 19.1 h, altitude at maximum phase = 0 deg. Delta T = 3275.9
344. 691 May 4, China. Reign *T'ien Shou*, 2nd year, 4th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed; it was 7 deg in *Mao* (R.A. 43.2 deg)". Computed details for Lo-yang: R.A. of Sun = 43.2 deg, Magnitude = 0.63, local time of maximum = 5.3 h, altitude at maximum phase = 1 deg. Delta T = 3257.1
345. 692 Apr 22, China. Reign *Ju I*, 1st year, 4th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed; it was 11 deg in *Wei* (R.A. 32.4 deg)". Computed details for Lo-yang: R.A. of Sun = 32.6 deg, Magnitude = 0.77, local time of maximum = 17.7 h, altitude at maximum phase = 12 deg. Delta T = 3250.7
346. 693 Oct 5, China. Reign *Chang Shou*, 2nd year, 9th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed; it was 10 deg in *Chueh* (R.A. 193.7 deg)". Computed details for Lo-yang: R.A. 193.8 deg, Magnitude = 0.44, local time of maximum = 16.9 h, altitude at maximum phase = 10 deg. Delta T = 3241.1
347. 694 Sept 25, China. Reign *Ch'ang Shou*, 3rd year, 9th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 3234.7
348. 694 Sept 25, China. Reign *Yen Tsai*, 1st year, 9th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed; it was 18 deg in *Chen* (R.A. 184.9

- deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 184.4 deg). Delta T = 3234.7
349. 695 Feb 19, China. Reign *Cheng Sheng*, 1st year, 2nd month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Lo-yang: Magnitude = 0.62, local time of maximum = 12 .5 h, altitude at maximum phase = 40 deg. Delta T = 3232.0
350. 700 May 23, China. Reign *Sheng Li*, 3rd year, 5th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Lo-yang: Magnitude = 0.71, local time of maximum = 15.8 h, altitude at maximum phase = 39 deg. (N.B. Given as Chinese day (22) in the Annals. There was no third year in the *Sheng Li* reign period, so this is identical to the following eclipse.) Delta T = 3197.5
351. 700 May 23, China. Reign *Chiu Shih*, 1st year, 5th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed; it was 15 deg in *Pi* (R.A. 63.7 deg)". Computed details for Ch'ang-an : R.A. of Sun = 62.6 deg, Magnitude = 0.68, local time of maximum = 15.5 h, altitude at maximum phase = 43 deg. Delta T = 3197.5
352. 702 Sept 26, China. Reign *Ch'ang An*, 2nd year, 9th month, (day) *i-chou* (2). First day. "The Sun was eclipsed; it was in *Chueh* (R.A. 185.1 deg)". Computed details for Ch'ang-an : R.A. of Sun = 185.4 deg, Magnitude = 0.99, local time of maximum = 15.6 h, altitude at maximum phase = 28 deg. Delta T = 3182.2
353. 703 Mar 22, China. Reign *Ch'ang An*, 3rd year, 3rd month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed; it was 9 deg in *I* (R.A. 159.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 3.8 deg, Magnitude = 0.46, local time of maximum = 16.3 h, altitude at maximum phase = 22 deg. (N.B. Old T'ang states "The Sun was eclipsed totally".) Delta T = 3179.0
354. 703 Oct 16, China. Reign *Ch'ang An*, 3rd year, 9th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed; it was 7 deg in *Kuei* (R.A. 115.6 deg)". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. R.A. of Sun at conjunction = 263.8 deg). Delta T = 3175.3
355. 707 Jul 4, China. Emperor Chung Tsung, Reign *Shen Lung*, 3rd year, 6th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed; it was 28 deg in *Ching* (R.A. 103.7 deg)". Computed details for Ch'ang-an : R.A. of Sun = 105.2 deg, Magnitude = 0.52, local time of maximum = 12.2 h, altitude at maximum phase = 78 deg. Delta T = 3151.2

356. 707 Dec 29, China. Reign *Ching Lung*, 1st year, 12th month, (day) *i-chou* (2). First day. "The Sun was eclipsed; it was 21 deg in *Tou* (R.A. 281.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 281.3 deg, Magnitude = 0.85, local time of maximum = 7.0 h, altitude at maximum phase = -2 deg. Delta T = 3148.1
357. 712 Apr 8, China. Emperor Jui, Reign *T'ai Chi*, 1st year, 2nd month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 3120.4
358. 712 Oct 5, China. Emperor Hsuan Tsung, Reign *Hsien T'ien*, 1st year, 9th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed; it was 10 deg in *Cheuh* (R.A. 195.1 deg)". Computed details for Ch'ang-an : R.A. of Sun = 194.2 deg, Magnitude = 0.21, local time of maximum = 15.2 h, altitude at maximum phase = 29 deg. Delta T = 3117.3
359. 715 Feb 20, China. Reign *K'ai Yuan*, 3rd year, 7th month, (day) *keng-chen* (17). "The Sun was eclipsed; it was 4 deg in *Chang* (R.A. 137.2 deg)". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. R.A. of Sun at conjunction = 336.6 deg). Delta T = 3102.2
360. 718 Jul 4, China, Reign *K'ai Yuan*, 6th year, 5th month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. Given as Chinese day (32) in the Annals). Delta T = 3080.5
361. 719 May 24, China. Reign *K'ai Yuan*, 7th year, 5th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed; it was 15 deg in *Pi* (R.A. 67.7 deg)". Computed details for Ch'ang-an : R.A. of Sun = 63.0 deg, Magnitude = 0.27, local time of maximum = 6.8 h, altitude at maximum phase = 21 deg. Delta T = 3074.8
362. 721 Sept 26, China. Reign *K'ai Yuan*, 9th year, 9th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details for Ch'ang-an : Magnitude = 0.43, local time of maximum = 11.6 h, altitude at maximum phase = 53 deg. (N.B. The month is given as the 9th month in the Old T'ang, and as the 5th month in the New T'ang.) Delta T = 3059.9
363. 725 Jan 19, China. Reign *K'ai Yuan*, 12th year, 12th month, intercalary, (day) *ping-chen* (53). First day. "The Sun was eclipsed; it was in *Hsu* (R.A. 305.7 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 305.5 deg. The New T'ang has Chinese day *jen-chen* (29) which is probably a copying error.) Delta T = 3038.9

364. 729 Oct 27, China. Reign *K'ai Yuan*, 17th year, 10th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed; it was 9 deg in *Ti* (R.A. 205.7 deg)". Computed details for Ch'ang-an: R.A. of Sun = 215.0 deg, magnitude = 0.93 (Annular), local time of maximum = 7.4 h, altitude at maximum phase = 8 deg. (N.B. The New T'ang has Chinese Day *ping-wu* (43). Delta T = 3008.8.
365. 732 Mar 1, China. Reign *K'ai Yuan*, 20th year, 2nd month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed; it was 10 deg in *Shih* (R.A. 341.0 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 345.7 deg. The New T'ang has Chinese Day *kuei-yu* (10)). Delta T = 2994.1.
366. 732 Jul 1, China. Reign *K'ai Yuan*, 20th year, 8th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed; it was 7 deg in *I* (R.A. 157.3 deg)". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. R.A. of Sun at conjunctio = 103.1 deg). Delta T = 2992.1
367. 733 Aug 14, China. Reign *K'ai Yuan*, 21st year, 7th month, (day) *i-chou* (22). First day. "The Sun was eclipsed; it was 15 deg in *Chang* (R.A. 148.2 deg)". Computed details for Ch'ang-an : R.A. of Sun = 146.5 deg, Magnitude = 0.61, local time of maximum = 18.5 h, altitude at maximum phase = 1 deg. Delta T = 2985.0
368. 734 Dec 30, China. Reign *K'ai Yuan*, 22nd year, 12th month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed; it was 11 deg in *Tou* (R.A. 271.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 283.4 deg, Magnitude = 0.79, local time of maximum = 10.1 h, altitude at maximum phase = 26 deg. Delta T = 2976.4
369. 735 Dec 19, China. Reign *K'ai Yuan*, 23rd year, 11th month, intercalary, (day) *jen-wu* (19). First day. "The Sun was eclipsed; it was 11 deg in *Tou* (R.A. 271.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 271.0 deg, Magnitude = 0.18, local time of maximum = 8.7 h, altitude at maximum phase = 15 deg. Delta T = 2970.4
370. 738 Oct 18, China. Reign *K'ai Yuan*, 26 year, 9th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed. Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 2952.8
371. 740 Apr 1, China. Reign *K'ai Yuan*, 28th year, 3rd month, (day) *ting-hai* (24). First day. "The Sun was eclipsed; it was 3 deg in *Pi* (R.A. 51.7 deg)". Computed details : R.A. of Sun = 13.8 deg, magnitude at Ch'ang-an = 0.45, local time of maximum = 14.9 h, altitude at maximum phase = 41 deg. Delta T = 2943.8

372. 742 Aug 5, China. Reign *T'ien Pao*, 1st year, 7th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed; it was 5 deg in *Chang* (R.A. 138.2 deg)". Computed details for Ch'ang-an : R.A. of Sun = 137.7 deg, Magnitude = 0.59, local time of maximum = 15.8 h, altitude at maximum phase = 36 deg. Delta T = 2929.3
373. 746 May 25, China. Reign *T'ien Pao*, 5th year, 5th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed; it was 16 deg in *Pi* (R.A. 64.7 deg)". Computed details for Ch'ang-an: R.A. of Sun = 64.5 deg, Magnitude = 0.59, local time of maximum = 12.3 h, altitude at maximum phase = 77 deg. Delta T = 2905.9
374. 754 Jun 25, China. Reign *T'ien Pao*, 13th year, 6th month, (day) *i-chou* (32). First day. "The Sun was eclipsed; it was 19 deg in *Ching* (R.A. 96.6 deg)". Computed details for Ch'ang-an : R.A. of Sun = 96.6 deg, Magnitude = 0.84, local time of maximum = 11.8 h, altitude at maximum phase = 79 deg. Delta T = 2856.6
375. 756 May 5, China. Emperor Su Tsung, Reign *Chih Te*, 1st year, 3rd month, (day) *i-yu* (22). Last day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 2845.4
376. 756 Oct 28, China. Reign *Chih Te*, 1st year, 10th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed; it was 10 deg in *Ti* (R.A. 215.7 deg)". Computed details for Ch'ang-an : R.A. of Sun = 216.5 deg, Magnitude = 0.90, local time of maximum = 17.5 h, altitude at maximum phase = -3 deg. Delta T = 2842.4
377. 761 Aug 5, China. Emperor Su Tsung, Reign *Shang Yuan*, 2nd year, 7th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed; it was total; large stars were all visible; it was 4 deg in *Chang* (R.A. 137.2 deg)". Computed details for Ch'ang-an: R.A. of Sun = 138.1 deg, Magnitude = 1.05, local time of maximum = 9.8 h, altitude at maximum phase = 55 deg. Delta T = 2813.7
378. 768 Mar 23, China. Emperor Tai Tsung, Reign *Ta Li*, 3rd year, 3rd month, (day) *i-szu* (42). First day. "The Sun was eclipsed; it was 11 deg in *K'uei* (R.A. 6.9 deg)". Computed details for Ch'ang-an: R.A. of Sun = 5.9 deg, magnitude = 0.58, local time of maximum = 13.0 h, altitude at maximum phase = 55 deg. Delta T = 2774.1
379. 769 Mar 7, China. Reign *Ta Li*, 4th year, 1st month, (day) *chia-wu* (31). 15th day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 2768.3
380. 775 Oct 29, China. Reign *Ta Li*, 10th year, 10th month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed; it was 11 deg in *Ti* (R.A.

- 206.7 deg)". Computed details for Ch'ang-an: R.A. of Sun = 216.7 deg, Magnitude = 0.12, local time of maximum = 12.5, altitude at maximum phase = 41 deg. Delta T = 2729.2
381. 778 ? ?, China. Reign *Ta Li*, 13th year, ? month, (day) *chia-hsu* (11). "The Sun was eclipsed". Computed details: For all months, NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = ?
382. 779 Feb 25, China. Reign *Ta Li*, 14th year, 2nd month, (day) *ping-yin* (3). First day. "The Sun was eclipsed". Computed details for Ch'ang-an : Magnitude = 0.20, local time of maximum = 15.0 h, altitude at maximum phase = 29 deg. Delta T = 2709.8
383. 779 Aug 16, China. Reign *Ta Li*, 14th year, 7th month, (day) *wu-chen* (5). Last day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 2707.0
384. 787 Sept 16, China. Emperor Te Tsung, Reign *Cheng Yuan*, 3rd year, 8th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Ch'ang-an : Magnitude = 0.30, local time of maximum = 17.0 h, altitude at maximum phase = 13 deg. Delta T = 2660.0
385. 788 Sept 20, China. Reign *Cheng Yuan*, 4th year, 8th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 2654.4
386. 789 Jan 31, China. Reign *Cheng Yuan*, 5th year, 1st month, (day) *chia-chen* (41). First day. "The Sun was eclipsed; it was 6 deg in *Shih* (R.A. 337.0 deg)". Computed details for Ch'ang-an : R.A. of Sun = 318.2 deg, Magnitude = 0.73, local time of maximum = 9.7 h, altitude at maximum phase = 30 deg. Delta T = 2652.1
387. 790 Jan 20, China. Reign *Cheng Yuan*, 6th year, 1st month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 2646.5
388. 791 Jul 6, China. Reign *Cheng Yuan*, 7th year, 6th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details for Ch'ang-an : Magnitude = 0.05, local time of maximum = 10.3 h, altitude at maximum phase = 64 deg. Delta T = 2638.2
389. 792 Nov 19, China. Reign *Cheng Yuan*, 8th year, 11th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed; it was 6 deg in *Wei* (R.A. 236.9 deg)". Computed details for Ch'ang-an : R.A. of Sun = 239.4 deg, Magnitude = 0.18, local time of maximum = 8.8 h, altitude at maximum phase = 19 deg. Delta T = 2630.3

390. 794 May 4, China. Reign *Cheng Yuan*, 10th year, 4th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for Ch'ang-an : Magnitude = 0.94, local time of maximum = 12.6 h, altitude at maximum phase = 71 deg. Delta T = 2622.0
391. 796 Sept 6, China. Reign *Cheng Yuan*, 12th year, 8th month, (day) *chi-wei* (46). First day. "The Sun was eclipsed; it was 18 deg in *I* (R.A. 168.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 168.3 deg, Magnitude = 0.23, local time of maximum = 13.8 h, altitude at maximum phase = 51 deg. (N.B. Given as Chinese day (56) in the Annals). Delta T = 2608.6
392. 801 Jun 15, China. Reign *Cheng Yuan*, 17th year, 5th month, (day) *jen-hsu* (59). "The Sun was eclipsed; it was cloudy and not observed". Computed details for Ch'ang-an : Magnitude = 0.29, local time of maximum = 7.6 h, altitude at maximum phase = 32 deg. Delta T = 2581.6
393. 808 Jul 27, China. Emperor Hsien Tsung, Reign *Yuan Ho*, 3rd year, 7th month, (day) *kuei-szu* (30). "The Sun was eclipsed; it was 3 deg in *Hsing* (R.A. 131.0 deg)". Computed details for Ch'ang-an : R.A. of Sun = 130.0 deg, Magnitude = 0.28, local time of maximum = 8.3 h, altitude at maximum phase = 39 deg. Delta T = 2541.6
394. 815 Sept 7, China. Reign *Yuan Ho*, 10th year, 8th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed; it was 18 deg in *I* (R.A. 170.0 deg)". Computed details for Ch'ang-an : R.A. of Sun = 168.7 deg, Magnitude = 0.79, local time of maximum = 9.3 h, altitude at maximum phase = 42 deg. Delta T = 2502.1
395. 818 Jul 7, China. Reign *Yuan Ho*, 13th year, 6th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed; it was 1 deg in *K'uei* (R.A. 111.0 deg)". Computed details for Ch'ang-an : R.A. of Sun = 109.5 deg, Magnitude = 0.46, local time of maximum = 15.7 h, altitude at maximum phase = 40 deg. Delta T = 2486.6
396. 822 Apr 25, China. Emperor Mu, Reign *Ch'ang Ch'ing*, 2nd year, 4th month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed; it was 13 deg in *Wei* (R.A. 37.2 deg)". Computed details for Ch'ang-an : R.A. of Sun = 35.9 deg, Magnitude = 0.93, local time of maximum = 12.2 h, altitude at maximum phase = 70 deg. Delta T = 2465.7
397. 823 Oct 8, China. Reign *Ch'ang Ch'ing*, 3rd year, 9th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed; it was 12 deg in *Cheuh* (R.A. 198.5 deg)". Computed details for Ch'ang-an : R.A. of Sun = 197.0 deg, Magnitude = 0.94, local time of maximum = 6.1 h, altitude at maximum phase = -3 deg. Delta T = 2457.8

398. 830 Nov 19, China. Emperor Wen, Reign *Tai Ho*, 4th year, 11th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 2419.2
399. 834 Mar 14, China Reign *Tai Ho*, 8th year, 2nd month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed; it was 1 deg in *K'uei* (R.A. 358.3 deg)". Computed details for Ch'ang-an : R.A. of Sun = 357.8 deg, Magnitude = 0.44, local time of maximum = 15.5 h, altitude at maximum phase = 29 deg. Delta T = 2401.4
400. 836 Jan 22, China. Reign *Kai Cheng*, 1st year, 1st month, (day) *hsin-chou* (38). First day. "The Sun was eclipsed; it was 3 deg in *Hsu* (R.A. 310.1 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 308.6 deg). Delta T = 2391.5
401. 837 Dec 31, China. Reign *Kai Cheng*, 2nd year, 12th month, (day) *keng-yin* (27). "The Sun was eclipsed". Computed details for Ch'ang-an : Magnitude = 0.63, local time of maximum = 14.7 h, altitude at maximum phase = 22 deg. Delta T = 2381.1
402. 838 Nov 21, China. Reign *Kai Cheng*, 3rd year, 11th month, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 2376.4
403. 843 Mar 5, China. Emperor Wu Tsung, Reign *Hui Ch'ang*, 3rd year, 2nd month, (day) *keng-shen* (57). First day. "The Sun was eclipsed; it was 1 deg in *Pi* (R.A. 350.0 deg)". Computed details for Ch'ang-an : R.A. of Sun = 349.4 deg, Magnitude = 0.53, local time of maximum = 7.9 h, altitude at maximum phase = 20 deg. Delta T = 2353.7
404. 844 Feb 22, China. Reign *Hui Ch'ang*, 4th year, 2nd month, (day) *chia-yu* (51). First day. "The Sun was eclipsed; it was 7 deg in *Shih* (R.A. 339.4 deg)". Computed details for Ch'ang-an : R.A. of Sun = 339.1 deg, Magnitude = 0.16, local time of maximum = 9.3 h, altitude at maximum phase = 32 deg. Delta T = 2348.6
405. 845 Aug 7, China. Reign *Hui Ch'ang*, 5th year, 7th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed; it was 7 deg in *Chang* (R.A. 141.6 deg)". Computed details for Ch'ang-an : R.A. of Sun = 140.7 deg, Magnitude = 0.70, local time of maximum = 5.7 h, altitude at maximum phase = 5 deg. Delta T = 2340.9
406. 846 Dec 22, China. Reign *Hui Ch'ang*, 6th year, 12th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed, it was 14 deg in *Tou* (R.A. 295.7 deg)". Computed details for Ch'ang-an : R.A. of Sun = 275.5 deg, magnitude = 0.82, local time of maximum = 12.1 h; altitude at maximum phase = 32 deg. Delta T = 2333.7

407. 848 Jun 5, China. Emperor Hsuan Tsung, Reign *T'ai Chung*, 2nd year, 5th month, (day) *chi-wei* (32). First day. "The Sun was eclipsed; it was 9 deg in *Shen* (R.A. 296.9 deg)". Computed details for Ch'ang-an : R.A. of Sun = 77.1 deg, Magnitude = 0.42, local time of maximum = 9.5 h, altitude at maximum phase = 55 deg. Delta T = 2326.1
408. 854 Feb 1, China. Reign *T'ai Chung*, 8th year, 1st month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed; it was 2 deg in *Wei* (R.A. 318.4 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 319.4 deg). Delta T = 2296.6
409. 863 Aug 18, China. Emperor I Tsung, Reign *Hsien T'ung*, 4th year, 7th month, (day) *hsin-mao* (28). First day "The Sun was eclipsed; it was 17 deg in *Chang* (R.A. 151.6 deg)". Computed details for Ch'ang-an : R.A. of Sun = 150.7 deg, Magnitude = 0.74, local time of maximum = 15.5 h, altitude at maximum phase = 37 deg. Delta T = 2247.6
410. 876 Sept 22, China. Emperor Hsi Tsung, Reign *Ch'ien Fu*, 3rd year, 9th month, (day) *i-hai* (24). First day. "The Sun was eclipsed; it was 14 deg in *Chen* (R.A. 197.7 deg)". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. R.A. of Sun at conjunction = 183.4 deg). Delta T = 2180.8
411. 877 May 17, China. Reign *Ch'ien Fu*, 4th year, 4th month, (day) *jen-shen* (9). First day. "The Sun was eclipsed; it was 3 deg in *Pi* (R.A. 53.1 deg)". Computed details : NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 57.8 deg). Delta T = 2178.4
412. 879 Apr 25, China. Reign *Ch'ien Fu*, 6th year, 4th month, (day) *keng-shen* (57). First day. "The Sun was eclipsed totally; it was 8 deg in *Wei* (R.A. 32.2 deg)". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. R.A. of Sun at conjunction = 36.1 deg). Delta T = 2168.8
413. 888 Apr 15, China. Reign *Wen Te*, 1st year, 3rd month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed; it was 1 deg in *Wei* (R.A. 25.2 deg)". Computed details for Ch'ang-an : R.A. of Sun = 27.6 deg, Magnitude = 0.68, local time of maximum = 10.9 h, altitude at maximum phase = 63 deg. Delta T = 2124.7
414. 904 Nov 10, China. Emperor Chao Tsung, Reign *T'ien Yu*, 1st year, 10th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed; it was 2 deg in *Hsin* (R.A. 230.8 deg)". Computed details for Lo-yang : R.A. of Sun = 230.8 deg, Magnitude = 0.50, local time of maximum = 15.8 h, altitude at maximum phase = 14 deg. Delta T = 2045.0

415. 906 Apr 26, China. Reign *T'ien Yu*, 3rd year, 4th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed; it was 12 deg in *Wei* (R.A. 37.6 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun = 37.5 deg.) Delta T = 2038.2
416. 911 Jan 17, China. Old Emperor T'ai, Reign *K'ai P'ing*, 4th year, 12th month, (day) *keng-wu* (7). "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 2016.1
417. 911 Feb 2, China. New Reign *Ch'ien Hua*, 1st year, 1st month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for K'ai Feng : Magnitude = 0.24, local time of maximum = 11.6 h, altitude at maximum phase = 39 deg. Delta T = 2015.8
418. 923 Nov 11, China. Old Emperor Mo, Reign *Lung Te*, 3rd year, 10th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for K'ai Feng : Magnitude = 0.22, local time of maximum = 33.9 h, altitude at maximum phase = 30 deg Delta T = 1956.8
419. 923 Nov 11, China. New Emperor Chuang Tsung, Reign *T'ung Kuan*, 1st year, 10th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.23, local time of maximum = 13.7 h, altitude at maximum phase = 31 deg. Delta T = 1956.8
420. 925 Mar 30, China. New. Reign *T'ung Kuan*, 3rd year, 3rd month, (day) *ping-shen* (33). "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1950.3
421. 925 Apr 26, China. Old. Reign *T'ung Kuan*, 3rd year, 4th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 1950.1
422. 926 Jun 7, China. New. Emperor Ming, Reign *T'ien Ch'ien*, 1st year, 4th month, (day) *keng-hsu* (47). "The Sun was eclipsed; it was cloudy and not observed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1945.0
423. 926 Jul 22, China. New. Reign *T'ien Ch'ien*, 1st year, 6th month, (day) *i-wei* (32). "The Sun was eclipsed; it was cloudy and there was heavy rain. The eclipse was not observed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1944.6
424. 926 Sept 10, China. Old. Reign *T'ien Ch'ien*, 1st year, 8th month, (day) *i-yu* (22). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 1943.9

425. 927 Aug 30, China. Old Reign *T'ien Ch'ien*, 2nd year, 8th month, (day) *chi-mao* (16). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.36, local time of maximum = 5.8 h, altitude at maximum phase = 2 deg. Delta T = 1939.5
426. 928 Feb 24, China. Old. Reign *T'ien Ch'ien*, 3rd year, 2nd month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.03, local time of maximum = 7.8 h, altitude at maximum phase = 17 deg. Delta T = 1937.3
427. 928 Sept 17, China. New. Reign *T'ien Ch'ien*, 3rd year, 8th month, intercalary, (day) *kuei-mao* (40). "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1934.7
428. 929 Jan 14, China. New. Reign *T'ien Ch'ien*, 3rd year, 11th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1933.3
429. 929 Jul 24, China. New. Reign *T'ien Ch'ien*, 4th year, 6th month, (day) *kuei-chou* (50). "The Sun was eclipsed totally". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1931.1
430. 930 Jun 29, China. Old. Reign *Ch'ang Hsing*, 1st year, 6th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 1926.7
431. 930 Sept 25, China. New. Reign *Ch'ang Hsing*, 1st year, 9th month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1925.6
432. 931 Dec 12, China. Old. Reign *Ch'ang Hsing*, 2nd year, 11th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 1920.2
433. 933 Jul 25, China. New. Reign *Ch'eng Hsing*, 4th year, 7th month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1909.3
434. 937 Feb 14, China. Old. Emperor Kao Tsu, Reign *T'ien Fu*, 2nd year, 1st month, (day) *i-mao* (52). First day. "The Sun was eclipsed; it was almost total". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 1897.0
435. 937 Aug 24, China. New. Reign *T'ien Fu*, 2nd year, 7th month, (day) *ping-yin* (3). "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1894.4

436. 938 Feb 3, China. Old. Reign *T'ien Fu*, 3rd year, 1st month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.90, local time of maximum = 17.7 h, altitude at maximum phase = -5 deg. Delta T = 1892.7
437. 939 Jul 19, China. Old. Reign *T'ien Fu*, 4th year, 7th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.68, local time of maximum = 17.6 h, altitude at maximum phase = 16 deg. Delta T = 1886.3
438. 940 Dec 17, China. New. Reign *T'ien Fu*, 5th year, 11th month, (day) *ting-chou* (14). "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1880.2
439. 943 May 7, China. Old. Reign *T'ien Fu*, 8th year, 4th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.68, local time of maximum = 8.1 h, altitude at maximum phase = 35 deg. Delta T = 1869.5
440. 944 Sept 20, China. Old. Emperor Ch'i Wang, Reign *K'ai Yun*, 1st year, 9th month, (day) *keng-yu* (7). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.30, local time of maximum = 16.0 h, altitude at maximum phase = 23 deg. Delta T = 1863.5
441. 945 Aug 11, China. New. Reign *K'ai Yun*, 2nd year, 7th month, (day) *i-wei* (32). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1859.6
442. 945 Sept 9, China. Old. Reign *K'ai Yun*, 2nd year, 8th month, (day) *chia-tzu* (1). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.50, local time of maximum = 15.6 h, altitude at maximum phase = 32 deg. Delta T = 1859.3
443. 945 Dec 8, China. New. Reign *K'ai Yun*, 2nd year, 11th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1858.2
444. 946 Mar 6, China. Old. Reign *K'ai Yun*, 3rd year, 2nd month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.57, local time of maximum = 18.3 h, altitude at maximum phase = -6 deg. Delta T = 1857.2
445. 948 Jul 9, China. New. Emperor Yin, Reign *Chien Yu*, 1st year, 6th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Lo-yang : Magnitude = 0.69, local time of maximum = 17.9 h, altitude at maximum phase = 14 deg. Delta T = 1846.9

446. 949 Jun 29, China. New. Reign *Chien Yu*, 2nd year, 6th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details for Lo-yang: Magnitude = 0.57, local time of maximum = 5.8 h, altitude at maximum phase = 11 deg. Delta T = 1842.7
447. 950 Dec 12, China. Old. Reign *Chien Yu*, 3rd year, 11th month, (day) *chia-tzu* (1). First day. "The Sun was eclipsed". Computed details for Lo-yang: Magnitude = 0.50, local time of maximum = 6.9 h, altitude at maximum phase = -3 deg. Delta T = 1838.1
448. 952 Apr 27, China. Old. Emperor T'ai Tsu, Reign *Kuang Shun*, 2nd year, 4th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for Lo-yang: Magnitude = 0.75, local time of maximum = 5.2 h, altitude at maximum phase = -1 deg. Delta T = 1832.2
449. 957 Jan 18, China. New. Emperor Shih, Reign *Hsien Te*, 3rd year, 12th month, (day) *kuei-yu* (10). "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1812.0
450. 960 May 28, China. Emperor T'ai Tsung, Reign *Ch'ien Lung*, 1st year, 5th month, (day) *chia-hai* (36). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.64, local time of maximum = 14.6 h, altitude at maximum phase = 54 deg. Delta T = 1797.4
451. 961 May 17, China. Reign *Ch'ien Lung*, 2nd year, 4th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.14, local time of maximum = 18.0 h, altitude at maximum phase = 12 deg. Delta T = 1793.2
452. 965 Mar 6, China. Emperor T'ai Tsu, Reign *Ch'ien Te*, 3rd year, 2nd month, (day) *jen-yin* (39). First day. "The Sun should have eclipsed but didn't". Computed details for K'ai-feng: Magnitude = 0.13, local time of maximum = 11.4 h, altitude at maximum phase = 51 deg. Delta T = 1777.0
453. 967 Jul 10. China. Reign *Ch'ien Te*, 5th year, 6th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.46, local time of maximum = 15.6, altitude at maximum phase = 42 deg. Delta T = 1767.1
454. 968 Dec 12, China. Reign *K'ai Pao*, 1st year, 12th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1760.9
455. 970 May 8, China. Reign *K'ai Pao*, 3rd year, 4th month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.20, local time of maximum = 14.6 h, altitude at maximum phase = 51 deg. Delta T = 1755.1

456. 971 Oct 22, China. Reign *K'ai Pao*, 4th year, 10th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.25, local time of maximum = 10.6 h, altitude at maximum phase = 39 deg. Delta T = 1748.9
457. 972 Oct 10, China. Reign *K'ai Pao*, 5th year, 9th month, (day) *ting-szu* (54). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.30, local time of maximum = 10.0h, altitude at maximum phase = 38 deg. Delta T = 1744.8
458. 975 Aug 10, China. Reign *K'ai Pao*, 8th year, 7th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.94, local time of maximum = 6.3 h, altitude at maximum phase = 12 deg. Delta T = 1732.9
459. 977 Dec 3, China. Emperor T'ai Tsung, Reign *Hsing Kuoh*, 2nd year, 11th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.60, local time of maximum = 17.4 h, altitude at maximum phase = -6 deg. Delta T = 1723.1
460. 981 Oct 1, China. Reign *Hsing Kuoh*, 6th year, 9th month, (day) *i-wei* (32). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1707.2
461. 982 Mar 28, China. Reign *Hsing Kuoh*, 7th year, 3rd month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1705.1
462. 983 Mar 18, China. Reign *Hsing Kuoh*, 8th year, 2nd month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1701.1
463. 986 Jan 13, China. Reign *Yung Hsi*, 2nd year, 12th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.15, local time of maximum = 13.1 h, altitude at maximum phase = 32 deg. Delta T = 1689.3
464. 986 Jul 10, China. Reign *Yung Hsi*, 3rd year, 6th month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1687.3
465. 991 Mar 19, China. Reign *Shun Hua*, 2nd year, 2nd month, intercalary, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.39, local time of maximum = 6.4 h, altitude at maximum phase = 6 deg. Delta T = 1667.9

466. 992 Mar 7, China. Reign *Shun Hua*, 3rd year, 2nd month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.76, local time of maximum = 17.4 h, altitude at maximum phase = 6 deg. Delta T = 1663.9
467. 993 Feb 24, China. Reign *Shun Hua*, 4th year, 2nd month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1659.6
468. 993 Aug 20, China. Reign *Shun Hua*, 4th year, 8th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.13, local time of maximum = 16.7 h, altitude at maximum phase = 22 deg. Delta T = 1657.9
469. 995 Jan 4, China. Reign *Shun Hua*, 5th year, 12th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed; it was obscured by clouds". Computed details for K'ai-feng: Magnitude = 0.34, local time of maximum = 9.5 h, altitude at maximum phase = 23 deg. Delta T = 1652.3
470. 998 May 28, China. Emperor Chen, Reign *Hsien P'ing*, 1st year, 5th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1638.4
471. 998 Oct 23, China. Reign *Hsien P'ing*, 1st year, 10th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.15, local time of maximum = 14.6 h, altitude at maximum phase = 29 deg. Delta T = 1636.7
472. 999 Oct 12, China. Reign *Hsien P'ing*, 2nd year, 9th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.72, local time of maximum = 13.8 h, altitude at maximum phase = 39 deg. Delta T = 1632.8
473. 1000 Apr 7, China. Reign *Hsien P'ing*, 3rd year, 3rd month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.90, local time of maximum = 18.3 h, altitude at maximum phase = 1 deg. Delta T = 1630.8
474. 1002 Aug 11, China. Reign *Hsien P'ing*, 5th year, 7th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.40, local time of maximum = 16.6 h, altitude at maximum phase = 26 deg. Delta T = 1621.2
475. 1005 Jan 13, China. Reign *Ching Te*, 1st year, 12th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed totally". Computed details for K'ai-feng: Magnitude = 0.94, local time of maximum = 10.4 h, altitude at maximum phase = 30 deg. Delta T = 1611.4

476. 1006 May 30, China. Reign *Ching Te*, 3rd year, 5th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed, it was obscured by clouds". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1605.8
477. 1007 May 19, China. Reign *Ching Te*, 4th year, 5th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed, it was obscured by rain and clouds". Computed details for K'ai-feng: Magnitude = 0.36, local time of maximum = 17.1 h, altitude at maximum phase = 22 deg. Delta T = 1601.9
478. 1009 Mar 29, China. Reign *Ta Chung*, 2nd year, 3rd month, (day) *ping-chen* (53). First day. "The Sun was eclipsed; it was obscured by rain and clouds". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1594.4
479. 1012 Aug 20, China. Reign *Ta Chung*, 5th year, 8th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.33, local time of maximum = 14.9 h, altitude at maximum phase = 44 deg. Delta T = 1580.7
480. 1012 Aug 20, Korea. Emperor Hyonjong, 3rd year, 8th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.51, local time of maximum = 15.8 h, altitude at maximum phase = 33 deg. Delta T = 1580.7
481. 1014 Jan 4, China. Emperor Chen, Reign *Ta Chung*, 6th year, 12th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.44, local time of maximum = 8.7 h, altitude at maximum phase = 16 deg. Delta T = 1575.2
482. 1014 Jan 4, Korea. Emperor Hyonjong, 4th year, 12th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.29, local time of maximum = 9.9 h, altitude at maximum phase = 23 deg. Delta T = 1575.2
483. 1014 Dec 25, China. Emperor Chen, Reign *Ta Chung*, 7th year, 12th month, (day) *kuei-chou* (50). First day. "The Sun should have eclipsed, but no waning was observed. Occured in the night-time. It was predicted for daylight". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1571.3
484. 1015 Jun 9, China. Emperor Chen, Reign *Ta Chung*, 8th year, 6th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.47, local time of maximum = 12.6 h, altitude at maximum phase = 76 deg. Delta T = 1569.4

485. 1015 Jun 9, Korea Emperor Hyonjong, 6th year, 6th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.59, local time of maximum = 13.9 h, altitude at maximum phase = 62 deg. Delta T = 1569.4
486. 1019 Apr 8, China. Emperor Chen, Reign *T'ien Hsi*, 3rd year, 3rd month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.52, local time of maximum = 9.2 h, altitude at maximum phase = 44 deg. Delta T = 1554.2
487. 1019 May 2, Korea. Emperor Hyonjong, 10th year, 3rd month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1553.9
488. 1019 Oct 1, Korea. Emperor Hyonjong, 10th year, 9th month, (day) *chia-yin* (51). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1552.3
489. 1021 Aug 11, China. Emperor Chen, Reign *T'ien Hsi*, 5th year, 7th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details for Kai-feng: Magnitude = 0.85, local time of maximum = 12.3 h, altitude at maximum phase = 69 deg. Delta T = 1544.9
490. 1021 Aug 11, Korea. Emperor Hyonjong, 12th year, 7th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.88, local time of maximum = 13.3 h, altitude at maximum phase = 60 deg. Delta T = 1544.9
491. 1022 Aug 1, China. Emperor Chen, Reign *Ch'ien Hsing*, 1st year, 7th month, (day) *chia-tzu* (11). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1541.0
492. 1024 Jun 9, China. Emperor Jen, Reign *T'ien Sheng*, 2nd year, 5th month, (day) *ting-hai* (24). First day. "The Sun should have eclipsed but this was not observed according to prediction". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1533.7
493. 1024 Jun 9, Korea. Emperor Hyonjong, 15th year, 5th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1533.7
494. 1024 Dec 4, Korea. Emperor Hyonjong, 15th year, 11th month, (day) *i-yu* (22). First day. "The Sun should have eclipsed but didn't". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1531.8
495. 1025 Nov 23, Korea. Emperor Hyonjong, 16th year, 11th month, (day) *chi-mao* (16). First day. "The Sun should have eclipsed but didn't". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1527.9

496. 1026 Nov 13, China. Emperor Jen, Reign *T'ien Sheng*, 4th year, 10th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.64, local time of maximum = 9.4 h, altitude at maximum phase = 25 deg. Delta T = 1524.1
497. 1026 Nov 13, Korea. Emperor Hyonjong, 17th year, 10th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.82, local time of maximum = 10.6 h, altitude at maximum phase = 30 deg. Delta T = 1524.1
498. 1028 Mar 29, China. Emperor Jen, Reign *T'ien Sheng*, 6th year, 3rd month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.51, local time of maximum = 5.3 h, altitude at maximum phase = -6 deg. Delta T = 1518.7
499. 1029 Sept 11, China. Emperor Jen, Reign *T'ien Sheng*, 7th year, 8th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.74, local time of maximum = 6.2 h, altitude at maximum phase = 3 deg. Delta T = 1513.0
500. 1029 Sept 11, Korea. Emperor Hyonjong, 20th year, 8th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.64, local time of maximum = 7.0 h, altitude at maximum phase = 14 deg. Delta T = 1513.0
501. 1033 Jun 29, China. Emperor Jen, Reign *Ming Tao*, 2nd year, 6th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1498.1
502. 1036 Apr 29, China. Emperor Jen, Reign *Ch'ing Yu*, 3rd year, 4th month, (day) *chi-yu* (46). First day. "The Sun should have eclipsed but this was not observed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1487.1
503. 1038 Feb 7, China. Emperor Jen, Reign *Pao Yuan*, 1st year, 1st month, (day) *wu-hsu* (35). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1480.1
504. 1040 Feb 15, China. Emperor Jen, Reign *K'ang T'ing*, 1st year, 1st month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.69, local time of maximum = 14.7 h, altitude at maximum phase = 30 deg. Delta T = 1472.3
505. 1040 Feb 15, Korea. Emperor Chongjong, 6th year, 1st month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.77, local time of maximum = 15.7 h, altitude at maximum phase = 19 deg. Delta T = 1472.3

506. 1042 Jun 21, China. Emperor Jen, Reign *Ch'ing Li*, 2nd year, 6th month, (day) *kuei-yu* (10). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.42, local time of maximum = 18.8 h, altitude at maximum phase = 5 deg. Delta T = 1463.2
507. 1043 Jun 10, China. Emperor Jen, Reign *Ch'ing Li*, 3rd year, 5th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.30, local time of maximum = 5.0 h, altitude at maximum phase = 2 deg. Delta T = 1459.5
508. 1043 Jun 10, Korea. Emperor Chongjong, 9th year, 5th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.35, local time of maximum = 5.9 h, altitude at maximum phase = 12 deg. Delta T = 1459.5
509. 1044 Nov 22, China. Emperor Jen, Reign *Ch'ing Li*, 4th year, 11th month, (day) *wu-wu* (55). First day. "The Sun should have been eclipsed but this was not observed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1453.8
510. 1045 Apr 20, China. Emperor Jen, Reign *Ch'ing Li*, 5th year, 4th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details for K'ai-feng: Magnitude = 0.03, local time of maximum = 5.3 h, altitude at maximum phase = -1 deg. Delta T = 1452.3
511. 1045 Apr 20, Korea. Emperor Chongjong, 11th year, 4th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed; it was obscured by rain". Computed details for Kaesong : Magnitude = 0.03, local time of maximum = 6.1 h, altitude at maximum phase = 9 deg. Delta T = 1452.3
512. 1046 Apr 9, China. Emperor Jen, Reign *Ch'ing Li*, 6th year, 3rd month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.45, local time of maximum = 14.9 h, altitude at maximum phase = 44 deg. Delta T = 1448.6
513. 1046 Apr 9, Korea. Emperor Chongjong, 12th year, 3rd month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.52, local time of maximum = 16.0 h, altitude at maximum phase = 30 deg. Delta T = 1448.6
514. 1047 Mar 29, Korea. Emperor Munjong, 1st year, 3rd month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.14, local time of maximum = 17.0 h, altitude at maximum phase = 15 deg. Delta T = 1444.8

515. 1049 Feb 5, China. Emperor Jen, Reign *Huang Yu*, 1st year, 1st month, (day) *chia-yu* (31). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.16, local time of maximum = 12.1 h, altitude at maximum phase = 41 deg. Delta T = 1437.7
516. 1049 Feb 5, Korea. Emperor Munjong, 2nd year, 12th month, (day) *chia-wu* (31). Last day. "The Sun was eclipsed". Computed details for Kaesong : Magnitude = 0.10, local time of maximum = 13.3 h, altitude at maximum phase = 35 deg. Delta T = 1437.7
517. 1052 Nov 24, China. Emperor Jen, Reign *Huang Yu*, 4th year, 11th month, (day) *jen-yu* (39). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.11, local time of maximum = 14.2 h, altitude at maximum phase = 25 deg. Delta T = 1423.2
518. 1053 Nov 13, China. Emperor Jen, Reign *Huang Yu*, 5th year, 10th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.66, local time of maximum = 13.9 h, altitude at maximum phase = 30 deg. Delta T = 1419.5
519. 1053 Nov 13, Korea. Emperor Munjong, 7th year, 10th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for Kaesong : Magnitude = 0.59, local time of maximum = 15.0 h, altitude at maximum phase = 18 deg. Delta T = 1419.5
520. 1054 May 10, China. Emperor Jen, Reign *Chih Ho*, 1st year, 4th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.71, local time of maximum = 16.6 h, altitude at maximum phase = 28 deg. Delta T = 1417.6
521. 1056 Sept 12, China. Emperor Jen, Reign *Chia Yu*, 1st year, 8th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.26, local time of maximum = 16.1 h, altitude at maximum phase = 24 deg. Delta T = 1408.7
522. 1058 Aug 22, China. Emperor Jen, Reign *Chia Yu*, 3rd year, 8th month, (day) *chi-hai* (36). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.43, local time of maximum = 6.5 h, altitude at maximum phase = 12 deg. Delta T = 1401.4
523. 1059 Feb 15, China. Emperor Jen, Reign *Chia Yu*, 4th year, 1st month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.37, local time of maximum = 13.2 h, altitude at maximum phase = 42 deg. Delta T = 1399.6

524. 1059 Feb 15, Korea. Emperor Munjong, 12th year, 12th month, intercalary, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for Kaesong : Magnitude = 0.23, local time of maximum = 14.3 h, altitude at maximum phase = 32 deg. Delta T = 1399.6
525. 1060 Jan 6, Korea. Emperor Munjong, 13th year, 12th month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1396.2
526. 1061 Jun 20, China. Emperor Jen, Reign *Chia Yu*, 6th year, 6th month, (day) *jen-tzu* (49). First day. "The Sun should have eclipsed but didn't". Computed details for K'ai-feng: Magnitude = 0.91, local time of maximum = 14.5 h, altitude at maximum phase = 55 deg. Delta T = 1390.7
527. 1068 Feb 6, China. Emperor Shen, Reign *Hsi Ning*, 1st year, 1st month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.59, local time of maximum = 12.3 h, altitude at maximum phase = 41 deg. Delta T = 1365.9
528. 1068 Feb 6, Korea. Emperor Munjong, 22nd year, 1st month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.66, local time of maximum = 13.5 h altitude at maximum phase = 34 deg. Delta T = 1365.9
529. 1069 Jul 21, China. Emperor Shen, Reign *Hsi Ning*, 2nd year, 7th month, (day) *i-chou* (2). First day. "The Sun was eclipsed, it was cloudy and not observed". Computed details for K'ai-feng: Magnitude = 0.84, local time of maximum = 7.5 h, altitude at maximum phase = 28 deg. Delta T = 1360.4
530. 1069 Jul 21, Korea. Emperor Munjong, 23rd year, 7th month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details for Kaesong : Magnitude = 0.84, local time of maximum = 8.6 h, altitude at maximum phase = 42 deg. Delta T = 1360.4
531. 1073 May 10, China. Emperor Shen, Reign *Hsi Ning*, 6th year, 4th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed, it was obscured by cloud". Computed details for K'ai-feng: Magnitude = 0.84, local time of maximum = 5.8 h, altitude at maximum phase = 8 deg. Delta T = 1346.3
532. 1073 May 10, Korea. Emperor Munjong, 27th year, 4th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for Kaesong : Magnitude = 0.89, local time of maximum = 6.6 h, altitude at maximum phase = 19 deg. Delta T = 1346.3

533. 1075 Sept 13, China. Emperor Shen, Reign *Hsi Ning*, 8th year, 8th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed, it was obscured by cloud". Computed details for K'ai-feng: Magnitude = 0.41, local time of maximum = 10.0 h, altitude at maximum phase = 47 deg. Delta T = 1337.6
534. 1075 Sept 13, Korea Emperor Munjong, 29th year, 8th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details for Kaesong : Magnitude = 0.68, local time of maximum = 11.1 h, altitude at maximum phase = 52 deg. Delta T = 1337.6
535. 1076 Mar 8, Korea. Emperor Munjong, 30th year, 2nd month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1335.8
536. 1078 Jul 12, China. Emperor Shen, Reign *Yuan Feng*, 1st year, 6th month, (day) *kuei-mao* (40). First day. "The Sun should have eclipsed but didn't". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1327.2
537. 1079 Jul 1, Korea. Emperor Munjong, 33rd year, 6th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1323.6
538. 1080 Dec 14, China. Emperor Shen, Reign *Yuan Feng*, 3rd year, 11th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.92, local time of maximum = 10.0 h, altitude at maximum phase = 25 deg. Delta T = 1318.3
539. 1080 Dec 14, Korea. Emperor Munjong, 34th year, 11th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.88, local time of maximum = 11.4 h, altitude at maximum phase = 28 deg. Delta T = 1318.3
540. 1081 Dec 3, China. Emperor Shen, Reign *Yuan Feng*, 4th year, 12th month, (day) *kuei-wei* (20). First day. "The Sun should have eclipsed but didn't". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1314.1
541. 1082 May 1, China. Emperor Shen, Reign *Yuan Feng*, 5th year, 4th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed, it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1313.3
542. 1083 Oct 14, China. Emperor Shen, Reign *Yuan Feng*, 6th year, 9th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.41, local time of maximum = 7.2 h, altitude at maximum phase = 8 deg. Delta T = 1307.9

543. 1087 Aug 1, China. Emperor Che, Reign *Yuan Yu*, 2nd year, 7th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed; it was obscured by rain and cloud". Computed details for K'ai-feng: Magnitude = 0.11, local time of maximum = 17.3 h, altitude at maximum phase = 17 deg. Delta T = 1294.1
544. 1091 Jan 21, Korea. Emperor Sonjong, 8th year, 1st month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1281.5
545. 1091 May 21, China. Emperor Che, Reign *Yuan Yu*, 6th year, 5th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.11, local time of maximum = 14.8 h, altitude at maximum phase = 51 deg. Delta T = 1280.3
546. 1094 Mar 19, China. Emperor Che, Reign *Shao Sheng*, 1st year, 3rd month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.81, local time of maximum = 15.1 h, altitude at maximum phase = 36 deg. Delta T = 1270.1
547. 1095 Mar 9, China. Emperor Che, Reign *Shao Sheng*, 2nd year, 2nd month, (day) *ting-mao* (4). First day. "The Sun should have eclipsed but didn't". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1266.6
548. 1097 Jul 12, China. Emperor Che, Reign *Shao Sheng*, 4th year, 6th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1258.2
549. 1100 May 11, China. Emperor Che, Reign *Yuan Fu*, 3rd year, 4th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.28, local time of maximum = 9.0 h, altitude at maximum phase = 48 deg. Delta T = 1248.1
550. 1100 May 11, Korea. Emperor Sukchong, 5th year, 4th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.23, local time of maximum = 10.3 h, altitude at maximum phase = 61 deg. Delta T = 1248.1
551. 1101 Apr 30, China. Emperor Hui, Reign *Ch'ien Chung*, 1st year, 4th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details for K'ai-feng: Magnitude = 0.40, local time of maximum = 10.5 h, altitude at maximum phase = 63 deg. Delta T = 1244.6

552. 1101 Apr 30, Korea. Emperor Sukchong, 6th year, 4th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.44, local time of maximum = 11.8 h, altitude at maximum phase = 68 deg. Delta T = 1244.6
553. 1106 Dec 27, Korea. Emperor Yejong, 1st year, 12th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1224.6
554. 1107 Dec 16, China. Emperor Hui, Reign *Ta Kuan*, 1st year, 11th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.80, local time of maximum = 15.2 h, altitude at maximum phase = 16 deg. Delta T = 1221.1
555. 1108 Jun 11, China. Emperor Hui, Reign *Ta Kuan*, 2nd year, 5th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.24, local time of maximum = 12.9 h, altitude at maximum phase = 74 deg. Delta T = 1219.4
556. 1110 Oct 5, China. Emperor Hui, Reign *Ta Kuan*, 4th year, 9th month, (day) *ping-yin* (3). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.19, local time of maximum = 16.9 h, altitude at maximum phase = 7 deg. Delta T = 1211.2
557. 1113 Mar 19, China. Emperor Hui, Reign *Cheng Ho*, 3rd year, 3rd month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.03, local time of maximum = 14.4 h, altitude at maximum phase = 43 deg. Delta T = 1202.7
558. 1113 Mar 19, Korea. Emperor Yejong, 8th year, 3rd month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1202.7
559. 1115 Jul 23, China. Emperor Hui, Reign *Cheng Ho*, 5th year, 7th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.58, local time of maximum = 11.9 h, altitude at maximum phase = 74 deg. Delta T = 1194.5
560. 1115 Jul 23, Korea. Emperor Yejong, 10th year, 7th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.84, local time of maximum = 13.0 h, altitude at maximum phase = 69 deg. Delta T = 1194.5
561. 1118 May 22, China. Emperor Hui, Reign *Chung Ho*, 1st year, 5th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.30, local time of maximum = 18.5 h, altitude at maximum phase = 6 deg. Delta T = 1184.6

562. 1118 May 22, Korea. Emperor Yejong, 13th year, 5th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.47, local time of maximum = 19.2 h, altitude at maximum phase = 0 deg. Delta T = 1184.6
563. 1119 May 11, China. Emperor Hui, Reign *Hsuan Ho*, 1st year, 4th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details for K'ai-feng: Magnitude = 0.35, local time of maximum = 19.1 h, altitude at maximum phase = -1 deg. Delta T = 1181.2
564. 1119 May 11, China (North). Emperor T'ai Tsu, Reign *T'ien Fui*, 3rd year, 4th month, summer, *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.23, local time of maximum = 19.1 h, altitude at maximum phase = 1 deg. Delta T = 1181.2
565. 1120 Oct 24, China (North). Emperor T'ai Tsu, Reign *T'ien Fui*, 4th year, 10th month, winter, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.80, local time of maximum = 14.3 h, altitude at maximum phase = 28 deg. Delta T = 1176.2
566. 1120 Oct 24, Korea. Emperor Yejong, 15th year, 10th month, (day) *wu-chen* (5). First year. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.83, local time of maximum = 15.3 h, altitude at maximum phase = 20 deg. Delta T = 1176.2
567. 1122 Mar 10, China (North). Emperor T'ai Tsu, Reign *T'ien Fui*, 6th year, 2nd month, spring, (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.87, local time of maximum = 14.4 h, altitude at maximum phase = 38 deg. Delta T = 1171.4
568. 1122 Mar 10, Korea. Emperor Yejong, 17th year, 2nd month, (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.72, local time of maximum = 15.2 h, altitude at maximum phase = 30 deg. Delta T = 1171.4
569. 1123 Aug 23, China (North). Emperor T'ai Tsu, Reign *T'ien Fui*, 7th year, 8th month, autumn, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.31, local time of maximum = 5.4 h, altitude at maximum phase = -1 deg. Delta T = 1166.4
570. 1123 Aug 23, China. Reign *Hsuan Ho*, 5th year, 8th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed, it was obscured by cloud". Computed details for K'ai-feng: Magnitude = 0.44, local time of maximum = 5.2 h, altitude at maximum phase = -4 deg. Delta T = 1166.4

571. 1129 Mar 22, China (North). Emperor T'ai Tsung, Reign *T'ien Hui*, 7th year, 3rd month, (day) *chi-mao* (16). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1147.2
572. 1129 Oct 15, China. Emperor Kao, Reign *Ch'ien Yen*, 3rd year, 9th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed; it was in *K'ang* (R.A. 202.7 deg)". Computed details for Hang-chou: R.A. of Sun = 206.3 deg, Magnitude = 0.37, local time of maximum = 10.0 h, altitude at maximum phase = 40 deg. Delta T = 1145.3
573. 1129 Oct 15, Korea. Emperor Injong, 7th year, 9th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.65, local time of maximum = 10.5 h, altitude at maximum phase = 37 deg. Delta T = 1145.3
574. 1129 Oct 15, China (North). Emperor T'ai Tsung, Reign *T'ien Hui*, 7th year, 9th month, *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.54, local time of maximum = 9.5 h, altitude at maximum phase = 29 deg. Delta T = 1145.3
575. 1135 Jan 16, China. Emperor Kao Tsung, Reign *Shao Hsing*, 5th year, 1st month, (day) *i-szu* (42). "The Sun was eclipsed; it was in *Nu* (R.A. 299.7 deg)". Computed details for Hang-chou: R.A. of sun = 304.9 deg, Magnitude = 0.90, local time of maximum = 11.4 h, altitude at maximum phase = 40 deg. Delta T = 1127.4
576. 1135 Jan 16, Korea. Emperor Injong, 13th year, 1st month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.93, local time of maximum = 12.2 h, altitude at maximum phase = 32 deg. Delta T = 1127.4
577. 1135 Jan 16, China (North). Emperor T'ai Tsung, Reign *T'ien Hui*, 13th year, 1st month, *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.87, local time of maximum = 11.2 h, altitude at maximum phase = 29 deg. Delta T = 1127.4
578. 1136 Nov 2, China (North). Emperor Hsi Tsung, Reign *T'ien Hui*, 14th year, 11th month, (day) *ping-yin* (3). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1121.1
579. 1137 Feb 22, China. Emperor Kao Tsung, Reign *Shao Hsing*, 7th year, 2nd month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed; it was in *Shih* (R.A. 336.9 deg)". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. (N.B. R.A. of Sun = 341.8). Delta T = 1120.3

580. 1140 Aug 15, China (North). Emperor Hsi Tsung, Reign *T'ien Chuan*, 3rd year, 7th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1108.6
581. 1142 Jan 7, China. Emperor Kao Tsung, Reign *Shao Hsing*, 13th year, 12th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1104.0
582. 1143 Jan 17, Korea. Emperor Injong, 21st year, 12th month, (day) *kuei-wei* (20). First day. "The Sun should have eclipsed but didn't". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1100.4
583. 1144 Jan 7, China (North). Emperor Hsi Tsung, Reign *Huang T'ung*, 3rd year, 12th month, (day) *kuei-yu* (20). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1097.2
584. 1144 Jul 3, China (North). Emperor Hsi Tsung, Reign *Huang T'ung*, 4th year, 6th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1095.6
585. 1145 Jun 22, China. Emperor Kao Tsung, Reign *Shao Hsing*, 15th year, 6th month, (day) *i-hai* (12). First day. "The Sun was eclipsed; it was in *Ching* (R.A. 81.2 deg)". Computed details for Hang-chou: R.A. of Sun = 97.1 deg, Magnitude = 0.81, local time of maximum = 8.4 h, altitude at maximum phase = 41 deg. Delta T = 1092.6
586. 1145 Jun 22, Korea. Emperor Injong, 23rd year, 6th month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.93, local time of maximum = 9.2 h, altitude at maximum phase = 51 deg. Delta T = 1092.3
587. 1145 Jun 22, China (North). Emperor Hsi Tsung, Reign *Huang T'ung*, 5th year, 6th month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.88, local time of maximum = 8.3 h, altitude at maximum phase = 41 deg. Delta T = 1092.3
588. 1147 Oct 26, China. Emperor Kao Tsung, Reign *Shao Hsing*, 17th year, 10th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed; it was in *Ti* (R.A. 211.6 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. (N.B. R.A. of Sun at conjunction = 216.6 deg.) Delta T = 1084.5
589. 1148 Apr 20, China. Emperor Kao Tsung, Reign *Shao Hsing*, 18th year, 4th month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details for Hang-chou: Magnitude = 0.74,

- local time of maximum = 14.5 h, altitude at maximum phase = 51 deg.
Delta T = 1082.9
590. 1148 Apr 20, China (North). Emperor Hsi Tsung, Reign *Huang T'ung*, 8th year, 4th month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.41, local time of maximum = 14.3 h, altitude at maximum phase = 50 deg. Delta T = 1082.9
591. 1149 Apr 10, China. Emperor Kao Tsung, Reign *Shao Hsing*, 19th year, 3rd month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1079.7
592. 1149 Apr 10, Korea. Emperor Uijong, 3rd year, 3rd month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.53, local time of maximum = 5.5 h, altitude at maximum phase = 1 deg. Delta T = 1079.7
593. 1149 Apr 10, China (North). Emperor Hsi Tsung, Reign *Huang T'ung*, 9th year, 3rd month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.49, local time of maximum = 4.9 h, altitude at maximum phase = -5 deg. Delta T = 1079.7
594. 1150 Feb 25, China (North). Emperor Hai-Ling Wang, Reign *T'ien Te*, 2nd year, 1st month, (day) *chia-chen* (41). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1076.7
595. 1154 Jun 13, China. Emperor Kao Tsung, Reign *Shao Hsing*, 24th year, 5th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1062.6
596. 1154 Jun 13, Korea. Emperor Uijong, 8th year, 5th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.15, local time of maximum = 4.8 h, altitude at maximum phase = 1 deg. Delta T = 1062.6
597. 1154 Jun 13, China (North). Emperor Hai-Ling Wang, Reign *Cheng Yuan*, 2nd year, 5th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.27, local time of maximum = 4.3 h, altitude at maximum phase = -3 deg. Delta T = 1062.2
598. 1155 Jun 2, China. Emperor Kao Tsung, Reign *Shao Hsing*, 25th year, 5th month, (day) *ting-wei* (44). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details for Hang-chou: Magnitude = 0.57,

- local time of maximum = 5.1 h, altitude at maximum phase = 1 deg.
Delta T = 1059.4
599. 1155 Jun 2, Korea. Emperor Uijong, 9th year, 5th month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.48, local time of maximum = 5.7 h, altitude at maximum phase = 10 deg. Delta T = 1059.4
600. 1155 Jun 2, China (North). Emperor Hai-Ling Wang, Reign *Cheng Yuan*, 3rd year, 5th month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.36, local time of maximum = 5.1 h, altitude at maximum phase = 5 deg. Delta T = 1059.4
601. 1158 Apr 1, China. Emperor Kao Tsung, Reign *Shao Hsing*, 28th year, 3rd month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1050.1
602. 1158 Apr 1, Korea. Emperor Uijong, 12th year, 3rd month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.71, local time of maximum = 5.3 h, altitude at maximum phase = -4 deg. Delta T = 1050.1
603. 1158 Apr 1, China (North). Emperor Hai-Ling Wang, Reign *Cheng Lung*, 3rd year, 3rd month, (day) *hsin-yu* (58). First day. "The Astronomer Royal predicted an eclipse which was awaited but not seen". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 1050.1
604. 1160 Jul 4, Korea. Emperor Uijong, 14th year, 8th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 1042.7
605. 1160 Sept 2, China. Emperor Kao Tsung, Reign *Shao Hsing*, 30th year, 8th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed; it was in *I* (R.A. 157.5 deg)". Computed details for Hang-chou: R.A. of Sun = 167.3 deg, Magnitude = 0.46, local time of maximum = 11.6 h, altitude at maximum phase = 65 deg. Delta T = 1042.2
606. 1160 Sept 2, China (North). Emperor Hai-Ling Wang, Reign *Cheng Lung*, 5th year, 8th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.68, local time of maximum = 11.1 h, altitude at maximum phase = 54 deg. Delta T = 1042.2
607. 1161 Jan 28, China. Emperor Kao Tsung, Reign *Shao Hsing*, 31st year, 1st month, (day) *chia-hsu* (11). First day. "The Astronomer Royal predicted

- an eclipse, but it was not observed". Computed details: NO ECLIPSE
VISIBLE IN CHINA. Delta T = 1040.9
608. 1161 Jan 28, China (North). Emperor Hai-Ling Wang, Reign *Cheng Lung*,
6th year, 2nd month, (day) *chia-hsu* (11). First day. "The Sun was
eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta
T = 1040.9
609. 1162 Jan 17, Korea. Emperor Uijong, 16th year, 1st month, (day) *wu-chen*
(5). First day. "The Sun was eclipsed". Computed details for Kaesong:
Magnitude = 0.65, local time of maximum = 17.0 h, altitude at maximum
phase = -1 deg. Delta T = 1037.7
610. 1162 Jan 17, China (North). Emperor Shih, Reign *Ta Ting*, 2nd year, 1st
month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed
details for Peking: Magnitude = 0.79, local time of maximum = 16.2 h,
altitude at maximum phase = 7 deg. Delta T = 1037.7
611. 1162 Jan 17, China. Emperor Kao Tsung, Reign *Shao Hsing*, 32nd year,
1st month, (day) *wu-chen* (5). First day. "The Sun was eclipsed; it was in
Nu (R.A. 299.7 deg)". Computed details for Hang-chou: R.A. of Sun =
306.4 deg, Magnitude = 0.52, local time of maximum = 16.6 h, altitude
at maximum phase = 7 deg. Delta T = 1037.7
612. 1163 Jul 3, China. Emperor Hsiao, Reign *Lung Hsing*, 1st year, 6th month,
(day) *keng-shen* (57). First day. "The Sun was eclipsed; it was in *Ching*
(R.A. 81.2 deg)". Computed details for Hang-chou: R.A. of Sun = 108.1
deg, Magnitude = 0.68, local time of maximum = 17.9 h, altitude at
maximum phase = 13 deg. Delta T = 1033.0
613. 1163 Jul 3, Korea. Emperor Uijong, 17th year, 6th month, (day) *keng-shen*
(57). First day. "The Sun was eclipsed". Computed details for Kaesong:
Magnitude = 0.47, local time of maximum = 18.1 h, altitude at maximum
phase = 12 deg. Delta T = 1033.0
614. 1163 Jul 3, China (North). Emperor Shih, Reign *Ta Ting*, 3rd year,
6th month, (day) *keng-shen* (57). First day. "The Sun was eclipsed".
Computed details for Peking: Magnitude = 0.52, local time of maximum
= 17.4 h, altitude at maximum phase = 21 deg. Delta T = 1033.0
615. 1164 Jun 21, China. Emperor Hsiao, Reign *Lung Hsing*, 2nd year, 6th
month, (day) *chia-yin* (51). First day. "The Sun was eclipsed; it was ob-
scured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA.
Delta T = 1029.8
616. 1164 Jun 21, Korea. Emperor Uijong, 18th year, 6th month, (day) *chia-yui*
(51). First day. "The Sun was eclipsed". Computed details for Kaesong:

- Magnitude = 0.19, local time of maximum = 19.3 h, altitude at maximum phase = 0 deg. Delta T = 1029.8
617. 1164 Jun 21, China (North). Emperor Shih, Reign *Ta Ting*, 4th year, 6th month, (day) *chia-yu* (51). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.14, local time of maximum = 18.7 h, altitude at maximum phase = 7 deg. Delta T = 1029.7
618. 1167 Apr 21, Korea. Emperor Uijong, 21st year, 4th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.22, local time of maximum = 15.3 h, altitude at maximum phase = 40 deg. Delta T = 1020.7
619. 1167 Apr 21, China (North). Emperor Shih, Reign *Ta Ting*, 7th year, 4th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.35, local time of maximum = 14.3 h, altitude at maximum phase = 50 deg. Delta T = 1020.7
620. 1169 Aug 24, China. Emperor Hsiao, Reign *Ch'ien Tao*, 5th year, 8th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed; it was obscured by cloud, it was in *I* (R.A. 157.5 deg)". Computed details for Hang-chou: R.A. of Sun = 159.0 deg, Magnitude = 0.22, local time of maximum = 11.3 h, altitude at maximum phase = 67 deg. Delta T = 1013.1
621. 1169 Aug 24, Korea. Emperor Uijong, 23rd year, 8th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.53, local time of maximum = 11.7 h, altitude at maximum phase = 61 deg. Delta T = 1013.1
622. 1169 Aug 24, China (North). Emperor Shih, Reign *Ta Ting*, 9th year, 8th month, (day) *chia-shen* (21). First day. "The Astronomer Royal predicted an eclipse which was not observed due to rain". Computed details for Peking: Magnitude = 0.42, local time of maximum = 10.8 h, altitude at maximum phase = 55 deg. Delta T = 1013.1
623. 1170 Aug 14, Korea. Emperor Uijong, 24th year, 6th month, (day) *chi-mao* (16). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 1010.0
624. 1173 Jun 12, China. Emperor Hsiao, Reign *Ch'ien Tao*, 9th year, 5th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed; it was obscured by cloud, it was in *Ching* (R.A. 87.0 deg)". Computed details for Hang-chou: R.A. of Sun = 81.2 deg, Magnitude = 0.62, local time of maximum = 14.0 h, altitude at maximum phase = 62 deg. Delta T = 1000.9

625. 1173 Jun 12, Korea. Emperor Myongjong, 3rd year, 5th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.89, local time of maximum = 14.5 h, altitude at maximum phase = 55 deg. Delta T = 1000.9
626. 1173 Jun 12, China (North). Emperor Shih, Reign *Ta Ting*, 13th year, 5th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.85, local time of maximum = 13.4 h, altitude at maximum phase = 66 deg. Delta T = 1000.9
627. 1174 Nov 26, China. Emperor Hsiao, Reign *Shun Hsi*, 1st year, 11th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed; it was obscured by cloud, it was in *Wei* (R.A. 236.3 deg)". Computed details for Hang-chou: R.A. of Sun = 249.3 deg, Magnitude = 0.80, local time of maximum = 16.4 h, altitude at maximum phase = 8 deg. Delta T = 996.3
628. 1174 Nov 26, Korea. Emperor Myongjong, 4th year, 11th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.91, local time of maximum = 16.8 h, altitude at maximum phase = 0 deg. Delta T = 996.3
629. 1174 Nov 26, China (North). Emperor Shih, Reign *Ta Ting*, 14th year, 11th month, (day) *chia-shen* (21). First year. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.91, local time of maximum = 16.0 h, altitude at maximum phase = 7 deg. Delta T = 996.3
630. 1176 Apr 11, China. Emperor Hsiao, Reign *Shun Hsi*, 3rd year, 3rd month, (day) *ping-wu* (43). "The Sun was eclipsed; it was obscured by cloud". Computed details for Hang-chou: Magnitude = 0.03, local time of maximum = 14.9 h, altitude at maximum phase = 46 deg. Delta T = 991.9
631. 1176 Apr 11, Korea. Emperor Myongjong, 6th year, 3rd month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.28, local time of maximum = 15.4 h, altitude at maximum phase = 37 deg. Delta T = 991.9
632. 1176 Apr 11, China (North). Emperor Shih, Reign *Ta Ting*, 16th year, 3rd month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.36, local time of maximum = 14.5 h, altitude at maximum phase = 46 deg. Delta T = 991.9
633. 1177 Sept 24, China. Emperor Hsiao, Reign *Shun Hsi*, 4th year, 9th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 987.3

634. 1177 Sept 24, China (North). Emperor Shih, Reign *Ta Ting*, 17th year, 9th month, (day) *ting-tu* (34). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 987.3
635. 1183 Nov 17, China. Emperor Hsiao, Reign *Shun Hsi*, 10th year, 11th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed; it was in *Hsin* (R.A. 233.0 deg)". Computed details for Hang-chou: R.A. of Sun = 233.1 deg, Magnitude = 0.73, local time of maximum = 10.5 h, altitude at maximum phase = 35 deg. Delta T = 967.9
636. 1183 Nov 17, China (North). Emperor Shih, Reign *Ta Ting*, 23rd year, 11th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.86, local time of maximum = 10.1 h, altitude at maximum phase = 24 deg. Delta T = 967.9
637. 1184 May 12, Korea. Emperor Myongjong, 14th year, 4th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 966.4
638. 1185 Oct 25, Korea. Emperor Myongjong, 15th year, 10th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 961.8
639. 1187 Sept 4, Korea. Emperor Myongjong, 17th year, 7th month, (day) *chi-szu* (6). Last day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 956.0
640. 1188 Aug 24, China. Emperor Hsiao, Reign *Shun Hsi*, 15th year, 8th month, (day) *chia-tzu* (1). Last day. "The Sun was eclipsed; it was in *I* (R.A. 157.6 deg)". Computed details for Hang-chou: R.A. of Sun = 159.3 deg, Magnitude = 0.41, local time of maximum = 11.8 h, altitude at maximum phase = 68 deg. Delta T = 953.0
641. 1188 Aug 24, China (North). Emperor Shih, Reign *Ta Ting*, 28th year, 8th month, (day) *chia-tzu* (1). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.24, local time of maximum = 11.3 h, altitude at maximum phase = 57 deg. Delta T = 953.0
642. 1189 Feb 17, China. Emperor Hsiao, Reign *Shun Hsi*, 16th year, 2nd month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details for Hang-chou: Magnitude = 0.82, local time of maximum = 11.2 h, altitude at maximum phase = 49 deg. Delta T = 951.5
643. 1189 Feb 17, Korea. Emperor Myongjong, 19th year, 2nd month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.82, local time of maximum = 12.0 h, altitude at maximum phase = 43 deg. Delta T = 951.5

644. 1189 Feb 17, China (North). Emperor Shih, Reign *Ta Ting*, 29th year, 2nd month, (day) *hsin-yu* (58). "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.94, local time of maximum = 11.1 h, altitude at maximum phase = 39 deg. Delta T = 951.9
645. 1195 Feb 11, Korea. Emperor Myongjong, 25th year, 1st month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 932.9
646. 1195 Apr 12, China. Emperor Ning, Reign *Ch'ing Yuan*, 1st year, 3rd month, (day) *ping-hsu* (11). First day. "The Sun was eclipsed; it was in *Lou* (R.A. 19.0 deg)". Computed details for Hang-chou: R.A. of Sun = 26.4 deg, Magnitude = 0.61, local time of maximum = 13.0 h, altitude at maximum phase = 66 deg. Delta T = 932.4
647. 1195 Apr 12, China (North). Emperor Chang, Reign *Ming Ch'ang*, 6th year, 3rd month, *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.29, local time of maximum = 12.7 h, altitude at maximum phase = 59 deg. Delta T = 932.4
648. 1197 Feb 19, Korea. Emperor Myongjong, 27th year, 2nd month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 926.7
649. 1198 Feb 8, China. Emperor Ning, Reign *Ch'ing Yuan*, 4th year, 1st month, (day) *chi-hai* (36). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 923.7
650. 1198 Feb 8, Korea. Emperor Sinjong, 1st year, 1st month, (day) *chi-hai* (36). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.89, local time of maximum = 6.5 h, altitude at maximum phase = -2 deg. Delta T = 923.7
651. 1198 Feb 8, China (North). Emperor Chang, Reign *Ch'eng An*, 3rd year, 1st month, (day) *chi-hai* (36). First day. "The Sun was eclipsed, it was obscured by cloud". Computed details for Peking: Magnitude = 0.84, local time of maximum = 6.3 h, altitude at maximum phase = -5 deg. Delta T = 923.7
652. 1199 Jan 28, China. Emperor Ning, Reign *Ch'ing Yuan*, 5th year, 1st month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed; it was obscured by clouds". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 920.7
653. 1200 Jul 13, China. Emperor Ning, Reign *Ch'ing Yuan*, 6th year, 6th month, (day) *i-yu* (22). First day. "The Sun was eclipsed; it was obscured

- by cloud". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 916.3
654. 1200 Dec 8, China (North). Emperor Chang, Reign *Ch'eng An*, 5th year, 11th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.02, local time of maximum = 11.0 h, altitude at maximum phase = 23 deg. Delta T = 915.0
655. 1201 Nov 28, Korea. Emperor Sinjong, 4th year, 11th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 912.1
656. 1202 May 23, China. Emperor Ning, Reign *Ch'ia T'ai*, 2nd year, 5th month, (day) *chia-chen* (41). First day. "The Sun was eclipsed; it was in *Pi* (R.A. 55.8 deg)". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 910.6
657. 1202 May 23, China (North). Emperor Chang, Reign *T'ai Ho*, 2nd year, 5th month, (day) *chia-chen* (41), First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.22, local time of maximum = 12.2. altitude at maximum phase = 81 deg. Delta T = 910.6
658. 1203 May 23, China. Emperor Ning, Reign *Ch'ia T'ai*, 3rd year, 4th month, (day) *chi-hai* (36). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 907.6
659. 1206 Mar 11, China. Emperor Ning, Reign *K'ai Hsi*, 2nd year, 2nd month, (day) *jen-tzu* (49). First day. "The Astronomer Royal predicted an eclipse but no waning if the Sun was observed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 899.0
660. 1206 Mar 11, China (North). Emperor Chang, Reign *T'ai Ho*, 6th year, 2nd month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed detail : NO ECLIPSE VISIBLE IN CHINA. Delta T = 899.0
661. 1209 Jul 4, Korea. Emperor Huijong, 5th year, 6th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 889.0
662. 1209 Dec 29, China (North). Emperor Wei-Shao Wang, Reign *Ta An*, 1st year, 12th month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 887.6
663. 1210 Jun 23, China. Emperor Ning, Reign *Chia Ting*, 3rd year, 6th month, (day) *ting-szu* (54). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 886.1

664. 1210 Dec 18, Korea. Emperor Huijong, 6th year, 12th month, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.95, local time of maximum = 6.9 h, altitude at maximum phase = -5 deg. Delta T = 884.7
665. 1211 Dec 7, China Emperor Ning, Reign *Chia Ting*, 4th year, 11th month, (day) *chi-yu* (46). First day. "The Astronomer Royal predicted an eclipse but no waning of the Sun was observed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 881.7
666. 1214 Oct 5, China. Emperor Ning, Reign *Chia Ting*, 7th year, 9th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.90, local time of maximum = 12.5 h, altitude at maximum phase = 52 deg. Delta T = 873.3
667. 1214 Oct 5, Korea. Emperor Kjong, 1st year, 9th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.67, local time of maximum = 13.0 h, altitude at maximum phase = 43 deg. Delta T = 873.3
668. 1214 Oct 5, China (North). Emperor Hsuan, Reign *Cheng Yu*, 2nd year, 9th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed; large stars were all visible". Computed details for Peking: Magnitude = 0.74, local time of maximum = 12.0 h, altitude at maximum phase = 43 deg. Delta T = 873.3
669. 1216 Feb 19, China. Emperor Ning, Reign *Chia Ting*, 9th year, 2nd month, (day) *chia-shen* (21). First day. "The Sun was eclipsed; it was in *Shih* (R.A. 338.3 deg)". Computed details for Hang-chou: R.A. of Sun = 338.9 deg, Magnitude = 0.12, local time of maximum = 16.9 h, altitude at maximum phase = 10 deg. Delta T = 869.2
670. 1216 Feb 19, Korea. Emperor Kjong, 3rd year, 2nd month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.31, local time of maximum = 17.3 h, altitude at maximum phase = 3 deg. Delta T = 869.2
671. 1216 Feb 19, China (North). Emperor Hsuan, Reign *Cheng Yu*, 4th year, 2nd month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.42, local time of maximum = 16.5 h, altitude at maximum phase = 11 deg. Delta T = 869.2
672. 1216 Aug 15, China (North). Emperor Hsuan, Reign *Cheng Yu*, 4th year, 7th month, intercalary, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 867.7

673. 1217 Aug 4, China. Emperor Ning, Reign *Chia Ting*, 10th year, 7th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed; it was in *Chang* (R.A. 140.6 deg)". Computed details for Hang-chou: R.A. of Sun = 140.7 deg, Magnitude = 0.65, local time of maximum = 12.1 h, altitude at maximum phase = 75 deg. Delta T = 864.9
674. 1217 Aug 4, Korea. Emperor Kjong, 4th year, 7th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.39, local time of maximum = 12.6 h, altitude at maximum phase = 66 deg. Delta T = 864.9
675. 1217 Aug 4, China (North). Emperor Hsuan, Reign *Hsing Ting*, 1st year, 7th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.33, local time of maximum = 12.2 h, altitude at maximum phase = 64 deg. Delta T = 864.9
676. 1218 Jul 24, China. Emperor Ning, Reign *Chia Ting*, 11th year, 7th month, (day) *keng-wu* (7). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 862.0
677. 1218 Jul 24, China (North). Emperor Hsuan, Reign *Hsing Ting*, 2nd year, 7th month, (day) *keng-wu* (7). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.20, local time of maximum = 12.6 h, altitude at maximum phase = 67 deg. Delta T = 862.0
678. 1218 Aug 23, Korea. Emperor Kjong, 5th year, 7th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.24, local time of maximum = 13.7 h, altitude at maximum phase = 60 deg. Delta T = 862.0
679. 1221 May 23, China. Emperor Ning, Reign *Chia Ting*, 14th year, 5th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed; it was in *Pi* (R.A. 55.8 deg)". Computed details for Hang-chou: R.A. of Sun = 66.8 deg, Magnitude = 0.47, local time of maximum = 12.8 h, altitude at maximum phase = 76 deg. Delta T = 853.6
680. 1221 May 23, Korea. Emperor Kjong, 8th year, 5th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.69, local time of maximum = 13.5 h, altitude at maximum phase = 64 deg. Delta T = 853.6
681. 1221 May 23, China (North). Emperor Hsuan, Reign *Hsing Ting*, 4th year, 5th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.81, local time of maximum = 12.5 h, altitude at maximum phase = 71 deg. Delta T = 853.6

682. 1223 Sept 26, China. Emperor Ning, Reign *Chia Ting*, 16th year, 9th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed; it was in *Chen* (R.A. 175.7 deg)". Computed details for Hang-chou: R.A. of Sun = 188.8 deg, Magnitude = 0.39, local time of maximum = 11.8 h, altitude at maximum phase = 56 deg. Delta T = 846.7
683. 1223 Sept 26, Korea. Emperor Kojong, 10th year, 9th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.66, local time of maximum = 12.2 h, altitude at maximum phase = 48 deg. Delta T = 846.7
684. 1223 Sept 26, China (North). Emperor Hsuan, Reign *Yuan Kuang*, 2nd year, 9th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.52, local time of maximum = 11.2 h, altitude at maximum phase = 45 deg. Delta T = 846.7
685. 1227 Jul 15, China. Emperor Li, Reign *Pao Ch'ing*, 3rd year, 6th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.10, local time of maximum = 6.6 h, altitude at maximum phase = 17 deg. Delta T = 835.6
686. 1227 Jul 15, Korea. Emperor Kojong, 14th year, 6th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed; it was obscured by rain". Computed details for Kaesong: Magnitude = 0.26, local time of maximum = 7.2 h, altitude at maximum phase = 27 deg. Delta T = 835.6
687. 1228 Jul 3, China. Emperor Li, Reign *Shao Ting*, 1st year, 6th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.11, local time of maximum = 14.7 h, altitude at maximum phase = 54 deg. Delta T = 832.7
688. 1228 Dec 28, Korea. Emperor Kojong, 15th year, 12th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 831.3
689. 1228 Dec 28, China (North). Emperor Ai, Reign *Cheng Ta*, 5th year, 12th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 831.3
690. 1230 Jun 13, Korea. Emperor Kojong, 17th year, 4th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 827.1
691. 1233 Oct 5, China. Emperor Li, Reign *Shao Ting*, 6th year, 9th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details for Hang-chou: Magnitude = 0.01, local time of maximum = 13.7 h, altitude at maximum phase = 45 deg. Delta T = 817.5

692. 1234 Aug 26, Korea. Emperor Kojong, 21st year, 8th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed; it was obscured by cloud". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 814.9
693. 1235 Feb 19, China. Emperor Li, Reign *Tuan P'ing*, 2nd year, 2nd month, (day) *chia-tzu* (1). "The Sun should have eclipsed but no waning was observed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 813.5
694. 1237 Dec 19, China. Emperor Li, Reign *Chia Hsi*, 1st year, 12th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.92, local time of maximum = 12.1 h, altitude at maximum phase = 36 deg. Delta T = 805.4
695. 1242 Sept 26, China. Emperor Li, Reign *Shun Yu*, 2nd year, 9th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.31, local time of maximum = 11.9 h, altitude at maximum phase = 56 deg. Delta T = 791.8
696. 1243 Mar 22, China. Emperor Li, Reign *Shun Yu*, 3rd year, 3rd month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.89, local time of maximum = 9.5 h, altitude at maximum phase = 45 deg. Delta T = 790.4
697. 1243 Apr 24, Korea. Emperor Kojong, 30th year, 3rd month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 790.2
698. 1245 Jul 25, China. Emperor Li, Reign *Shun Yu*, 5th year, 7th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.80, local time of maximum = 16.4 h, altitude at maximum phase = 29 deg. Delta T = 783.8
699. 1246 Jan 19, China. Emperor Li, Reign *Shun Yu*, 6th year, 1st month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.51, local time of maximum = 16.7 h, altitude at maximum phase = 7 deg. Delta T = 782.4
700. 1246 Jan 19, Korea. Emperor Kojong, 33rd year, 1st month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details for Kangwha: Magnitude = 0.36, local time of maximum = 17.1 h, altitude at maximum phase = -1 deg. Delta T = 782.4
701. 1248 Apr 25, Korea. Emperor Kojong, 35th year, 4th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 776.0

702. 1249 May 14, China. Emperor Li, Reign *Shun Yu*, 9th year, 4th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.96, local time of maximum = 9.8 h, altitude at maximum phase = 58 deg. Delta T = 773.1
703. 1252 Mar 12, China. Emperor Li, Reign *Shun Yu*, 12th year, 2nd month, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.82, local time of maximum = 5.6 h, altitude at maximum phase = -6 deg. Delta T = 765.1
704. 1252 Mar 12, Korea. Emperor Kojong, 39th year, 2nd month, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Kangwha: Magnitude = 0.97, local time of maximum = 6.2 h, altitude at maximum phase = 2 deg. Delta T = 765.1
705. 1253 Mar 1, China. Emperor Li, Reign *Pao Yu*, 1st year, 2nd month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 762.4
706. 1260 Apr 12, China. Emperor Li, Reign *Ching Ting*, 1st year, 3rd month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.60, local time of maximum = 16.5 h, altitude at maximum phase = 25 deg. Delta T = 742.7
707. 1260 Apr 12, Korea. Emperor Wonjong, 1st year, 3rd month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Kangwha: Magnitude = 0.37, local time of maximum = 16.9 h, altitude at maximum phase = 20 deg. Delta T = 742.7
708. 1261 Apr 1, China. Emperor Li, Reign *Ching Ting*, 2nd year, 3rd month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.24, local time of maximum = 18.8 h, altitude at maximum phase = 5 deg. Delta T = 740.0
709. 1261 Apr 1, China (North). Emperor Shih Tzu, Reign *Ch'ung Tung*, 2nd year, 3rd month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.40, local time of maximum = 18.9 h, altitude at maximum phase = -5 deg. Delta T = 740.0
710. 1265 Jan 19, China. Emperor Tu, Reign *Hsien Shen*, 1st year, 1st month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.78, local time of maximum = 7.5 h, altitude at maximum phase = 9 deg. Delta T = 729.6
711. 1265 Jan 19, China (North). Emperor Shih Tzu, Reign *Chih Yuan*, 2nd year, 1st month (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.64, local time of maximum = 7.4 h, altitude at maximum phase = 3 deg. Delta T = 729.6

712. 1267 May 25, China. Emperor Tu, Reign *Hsien Shun*, 3rd year, 5th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.62, local time of maximum = 19.2 h, altitude at maximum phase = -4 deg. Delta T = 723.3
713. 1267 May 25, China (North). Emperor Shih Tzu, Reign *Chih Yuan*, 4th year, 5th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.47, local time of maximum = 18.8 h, altitude at maximum phase = 6 deg. Delta T = 723.3
714. 1268 Nov 6, China. Emperor Tu, Reign *Hsien Shen*, 4th year, 10th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.54, local time of maximum = 15.4 h, altitude at maximum phase = 21 deg. Delta T = 719.3
715. 1268 Nov 6, Korea. Emperor Wonjong, 9th year, 10th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Kangwha: Magnitude = 0.41, local time of maximum = 15.8 h, altitude at maximum phase = 13 deg. Delta T = 719.3
716. 1268 Nov 6, China (North). Emperor Shih Tzu, Reign *Chih Yuan*, 5th year, 10th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.33, local time of maximum = 14.7 h, altitude at maximum phase = 21 deg. Delta T = 719.3
717. 1270 Mar 23, China. Emperor Tu, Reign *Hsien Shen*, 6th year, 3rd month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 715.6
718. 1270 Mar 23, Korea. Emperor Wonjong, 11th year, 3rd month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.04, local time of maximum = 16.5 h, altitude at maximum phase = 20 deg. Delta T = 715.6
719. 1270 Mar 23, China (North). Emperor Shih Tzu, Reign *Chih Yuan*, 7th year, 3rd month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.13, local time of maximum = 15.5 h, altitude at maximum phase = 30 deg. Delta T = 715.6
720. 1271 Sept 6, China. Emperor Tu, Reign *Hsien Shen*, 7th year, 8th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.39, local time of maximum = 7.3 h, altitude at maximum phase = 19 deg. Delta T = 711.7
721. 1271 Sept 6, Korea. Emperor Wonjong, 12th year, 8th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.16, local time of maximum = 7.8 h, altitude at maximum phase = 24 deg. Delta T = 711.7

722. 1271 Sept 6, China (North). Emperor Shih Tzu, Reign *Chih Yuan*, 8th year, 8th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.12, local time of maximum = 7.0 h, altitude at maximum phase = 14 deg. Delta T = 711.7
723. 1272 Aug 25, China. Emperor Tu, Reign *Hsien Shen*, 8th year, 8th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for Hang-chou: Magnitude = 0.28, local time of maximum = 7.3 h, altitude at maximum phase = 20 deg. Delta T = 709.1
724. 1272 Aug 25, Korea. Emperor Wonjong, 13th year, 8th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.50, local time of maximum = 7.9 h, altitude at maximum phase = 24 deg. Delta T = 709.1
725. 1272 Aug 25, China (North). Emperor Shih Tzu, Reign *Chih Yuan*, 9th year, 8th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.56, local time of maximum = 7.0 h, altitude at maximum phase = 17 deg. Delta T = 709.1
726. 1275 Jun 25, China. Emperor Kung, Reign *Te Yu*, 1st year, 6th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed totally. Stars were visible". Computed details for Hang-chou: Magnitude = 1.08, local time of maximum = 10.1 h, altitude at maximum phase = 63 deg. Delta T = 701.5
727. 1275 Jun 25, Korea. Emperor Ch'ungnyol Wang, 1st year, 4th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.83, local time of maximum = 10.8 h, altitude at maximum phase = 69 deg. Delta T = 701.5
728. 1275 Jun 25, China (North). Emperor Shih Tzu, Reign *Chih Yuan*, 12th year, 6th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.69, local time of maximum = 9.8 h, altitude at maximum phase = 58 deg. Delta T = 701.5
729. 1277 Oct 28, China. Emperor Shih Tzu, Reign *Chih Yuan*, 14th year, 10th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 1.04, local time of maximum = 13.3 h, altitude at maximum phase = 32 deg. Delta T = 695.2
730. 1277 Oct 28, Korea. Emperor Ch'ungnyol Wang, 3rd year, 10th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.97, local time of maximum = 14.3 h, altitude at maximum phase = 27 deg. Delta T = 695.2

731. 1282 Jul 7, China. Emperor Shih Tzu, Reign *Chih Yuan*, 19th year, 6th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 682.8
732. 1282 Aug 5, China. Emperor Shih Tzu, Reign *Chih Yuan*, 19th year, 7th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.67, local time of maximum = 10.2 h, altitude at maximum phase = 55 deg. Delta T = 682.6
733. 1282 Aug 5, Korea. Emperor Chungnyol Wang, 8th year, 7th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.62, local time of maximum = 11.1 h, altitude at maximum phase = 64 deg. Delta T = 682.6
734. 1283 Jan 30, Korea. Emperor Chungnyol Wang, 9th year, 1st month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 681.3
735. 1286 May 25, Korea. Emperor Chungnyol Wang, 12th year, 5th month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 672.6
736. 1287 Jul 10, Korea. Emperor Chungnyol Wang, 13th year, 5th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed, it was obscured by rain". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 669.6
737. 1287 Nov 7, China. Emperor Shih Tzu, Reign *Chih Yuan*, 24th year, 10th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.43, local time of maximum = 15.4 h, altitude at maximum phase = 15 deg. Delta T = 668.8
738. 1289 Mar 23, China. Emperor Shih Tsu, Reign *Chih Yuan*, 26th year, 3rd month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 665.2
739. 1289 Mar 23, Korea. Emperor Chungnyol Wang, 15th year, 3rd month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.05, local time of maximum = 10.1 h, altitude at maximum phase = 47 deg. Delta T = 665.2
740. 1290 Sept 5, China. Emperor Shih Tzu, Reign *Chih Yuan*, 27th year, 8th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.51, local time of maximum = 16.9 h, altitude at maximum phase = 15 deg. Delta T = 661.4

741. 1290 Sept 5, Korea. Emperor Chungnyol Wang, 16th year, 8th month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Kiangwha : Magnitude = 0.52, local time of maximum = 17.7 h, altitude at maximum phase = 6 deg. Delta T = 661.4
742. 1292 Jan 21, China. Emperor Shih Tsu, Reign *Chih Yuan*, 29th year, 1st month, (day) *chia-wu* (31). First day. "The Sun was eclipsed. A darkness invaded the Sun which was not totally covered. It was like a golden ring. There were vapours like golden earrings on the left and right and a vapour, like a halo, completely surrounding it". Computed details for Peking: Magnitude = 0.94, local time of maximum = 12.9 h, altitude at maximum phase = 31 deg. Delta T = 657.8
743. 1292 Jan 21, Korea. Emperor Chungnyol Wang, 18th year, 1st month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details for Kiangwha : Magnitude = 0.83, local time of maximum = 13.9 h, altitude at maximum phase = 28 deg. Delta T = 657.8
744. 1294 Jun 25, China. Emperor Shih Tzu, Reign *Chih Yuan*, 31st year, 6th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.30, local time of maximum = 7.3 h, altitude at maximum phase = 30 deg. Delta T = 651.6
745. 1294 Jun 25, Korea. Emperor Chungnyol Wang, 20th year, 6th month, (day) *keng-chen* (17). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.14, local time of maximum = 8.1 h, altitude at maximum phase = 38 deg. Delta T = 651.6
746. 1297 Apr 23, Korea. Emperor Chungnyol Wang, 23rd year, 4th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.36, local time of maximum = 7.4 h, altitude at maximum phase = 26 deg. Delta T = 644.3
747. 1299 Aug 27, China. Emperor Ch'eng, Reign *Ta Te*, 3rd year, 8th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.03, local time of maximum = 11.3 h, altitude at maximum phase = 56 deg. Delta T = 638.3
748. 1299 Aug 27, Korea. Emperor Chungnyol Wang, 25th year, 8th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.16, local time of maximum = 12.4 h, altitude at maximum phase = 59 deg. Delta T = 638.3
749. 1300 Feb 21, China. Emperor Ch'eng, Reign *Ta Te*, 4th year, 2nd month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.49, local time of maximum = 17.7 h, altitude at maximum phase = -2 deg. Delta T = 637.1

750. 1302 Jun 26, China. Emperor Ch'eng, Reign *Ta Te*, 6th year, 6th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.25, local time of maximum = 19.2 h, altitude at maximum phase = 1 deg. Delta T = 631.1
751. 1302 Jun 26, Korea. Emperor Chungnyol Wang, 28th year, 6th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed, it was obscured by rain and clouds". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 631.1
752. 1303 Jun 16, China. Emperor Ch'eng, Reign *Ta Te*, 7th year, 5th month, intercalary, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.97, local time of maximum = 6.0 h, altitude at maximum phase = 15 h, Delta T = 628.6
753. 1303 Jun 16, Korea. Emperor Chungnyol Wang, 29th year, 5th month, intercalary, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.89, local time of maximum = 6.6 h, altitude at maximum phase = 21 deg. Delta T = 628.6
754. 1304 Jun 4, China. Emperor Ch'eng, Reign *Ta Te*, 8th year, 5th month, (day) *dispute* (). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 626.2
755. 1304 Jun 4, Korea. Emperor Chungnyol Wang, 30th year, 5th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 626.2
756. 1306 Apr 26, Korea. Emperor Chungnyol Wang, 32nd year, 3rd month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 621.5
757. 1312 Jul 5, China. Emperor Jen, Reign *Huang Ching*, 1st year, 6th month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.58, local time of maximum = 17.2 h, altitude at maximum phase = 23 deg. Delta T = 605.9
758. 1312 Jul 5, Korea. Emperor Ch'ungson Wang, 4th year, 6th month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.64, local time of maximum = 17.9 h, altitude at maximum phase = 14 deg. Delta T = 605.9
759. 1315 May 4, China. Emperor Jen, Reign *Yen Yu*, 2nd year, 4th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.74, local time of maximum = 16.1 h, altitude at maximum phase = 33 deg. Delta T = 598.9

760. 1315 May 4, Korea. Emperor Ch'ungsuk Wang, 2nd year, 4th month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.72, local time of maximum = 17.0 h, altitude at maximum phase = 23 deg. Delta T = 598.9
761. 1318 Mar 4, China. Emperor Jen, Reign *Huang Ching*, 5th year, 2nd month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 591.9
762. 1319 Feb 21, China. Emperor Jen, Reign *Huang Ching*, 6th year, 2nd month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.51, local time of maximum = 7.9 h, altitude at maximum phase = 16 deg. Delta T = 589.5
763. 1319 Feb 21, Korea. Emperor Ch'ungsuk Wang, 6th year, 2nd month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.57, local time of maximum = 8.7 h, altitude at maximum phase = 25 deg. Delta T = 589.5
764. 1320 Feb 10, China. Emperor Jen, Reign *Huang Ching*, 7th year, 1st month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.14, local time of maximum = 9.2 h, altitude at maximum phase = 25 deg. Delta T = 589.5
765. 1320 Feb 10, Korea. Emperor Ch'ungsuk Wang, 7th year, 1st month, (day) *hsin-szu* (18). First day. "An eclipse was predicted but not observed". Computed details for Kaesong: Magnitude = 0.04, local time of maximum = 10.0 h, altitude at maximum phase = 33 deg. Delta T = 587.2
766. 1321 Jun 26, China. Emperor Ying, Reign *Chih Chih*, 1st year, 6th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.89, local time of maximum = 15.4 h, altitude at maximum phase = 44 deg. Delta T = 583.8
767. 1321 Jun 26, Korea. Emperor Ch'ungsuk Wang, 8th year, 6th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.98, local time of maximum = 16.3 h, altitude at maximum phase = 34 deg. Delta T = 583.8
768. 1322 Dec 9, China. Emperor Ying, Reign *Chih Chih*, 2nd year, 11th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 580.3
769. 1322 Dec 9, Korea. Emperor Ch'ungsuk Wang, 9th year, 11th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 580.3

770. 1327 Sept 16, China. Emperor T'ai Ting, Reign *T'ai Tung*, 4th year, 9th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 568.7
771. 1329 Jul 27, China. Emperor Wen, Reign *Tien Li*, 2nd year, 7th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.20, local time of maximum = 7.7 h, altitude at maximum phase = 30 deg. Delta T = 564.3
772. 1329 Jul 27, Korea. Emperor Ch'ungsuk Wang, 16th year, 7th month, (day) *ping-chen* (53). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.31, local time of maximum = 8.4 h, altitude at maximum phase = 39 deg. Delta T = 564.3
773. 1331 Sept 3, China. Emperor Wen, Reign *Chih Shun*, 2nd year, 8th month, (day) *chia-chen* (41). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 559.2
774. 1331 Nov 30, China. Emperor Wen, Reign *Chih Shun*, 2nd year, 11th month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.92, local time of maximum = 16.6 h, altitude at maximum phase = 1 deg. Delta T = 558.6
775. 1331 Nov 30, Korea. Emperor Ch'unghye Wang 1st, 1st year, 11th month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 558.6
776. 1334 May 4, China. Emperor Shun, Reign *Yuan T'ung*, 2nd year, 4th month, (day) *wu-wu* (55). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.31, local time of maximum = 8.5 h, altitude at maximum phase = 40 deg. Delta T = 552.9
777. 1336 Sept 6, China. Emperor Shun, Reign *Chih Yuan*, 2nd year, 8th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.96, local time of maximum = 8.3 h, altitude at maximum phase = 28 deg. Delta T = 547.3
778. 1337 Mar 3, China. Emperor Shun, Reign *Chih Yuan*, 3rd year, 2nd month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.23, local time of maximum = 18.0 h, altitude at maximum phase = -2 deg. Delta T = 546.2
779. 1343 Apr 25, China. Emperor Shun, Reign *Chih Cheng*, 3rd year, 4th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.41, local time of maximum = 8.3 h, altitude at maximum phase = 36 deg. Delta T = 531.8

780. 1343 Apr 25, Korea. Emperor Ch'unghye Wang 2nd, 4th year, 4th month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.56, local time of maximum = 9.1 h, altitude at maximum phase = 45 deg. Delta T = 531.8
781. 1344 Oct 7, China. Emperor Shun, Reign *Chih Cheng*, 4th year, 9th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.26, local time of maximum = 14.8 h, altitude at maximum phase = 28 deg. Delta T = 528.4
782. 1344 Oct 7, Korea. Emperor Ch'unghye Wang 2nd, 5th year, 9th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.27, local time of maximum = 15.9 h, altitude at maximum phase = 19 deg. Delta T = 528.4
783. 1346 Feb 22, Korea. Emperor Ch'ungmok Wang, 2nd year, 2nd month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.46, local time of maximum = 13.5 h, altitude at maximum phase = 41 deg. Delta T = 525.2
784. 1347 Feb 11, Korea. Emperor Ch'ungmok Wang, 3rd year, 1st month, (day) *chia-chen* (41). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.19, local time of maximum = 13.7 h, altitude at maximum phase = 35 deg. Delta T = 522.9
785. 1350 Nov 30, China. Emperor Shun. Reign *Chih Cheng*, 10th year, 1th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 514.2
786. 1350 Nov 30, Korea. Emperor Ch'ungiong Wang, 2nd year, 11th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 514.2
787. 1352 May 14, Korea. Emperor Kongmin Wang, 1st year, 4th month, (day) *kuei-mao* (40). First day. "An eclipse was predicted but not observed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 510.9
788. 1353 Sept 28, China. Emperor Shun, Reign *Chih Cheng*, 13th year, 9th month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 507.7
789. 1353 Sept 28, Korea. Emperor Kongmin Wang, 2nd year, 11th month, (day) *i-chou* (2). First day. "An eclipse was predicted but not observed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 507.7
790. 1354 Mar 25, China. Emperor Shun, Reign *Chih Ch'eng*, 14th year, 3rd month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed

- details for Peking: Magnitude = 0.32, local time of maximum = 17.8 h, altitude at maximum phase = 5 deg. Delta T = 506.6
791. 1354 Mar 25, Korea. Emperor Kongmin Wang, 3rd year, 3rd month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.36, local time of maximum = 18.5 h, altitude at maximum phase = -3 deg. Delta T = 506.6
792. 1357 Jul 18, Korea. Emperor Kongmin, 6th year, 6th month, (day) *chia-chen* (41). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 499.3
793. 1358 Jul 7, China. Emperor Shun, Reign *Chih Ch'eng*, 18th year, 6th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.43, local time of maximum = 7.8 h, altitude at maximum phase = 34 deg. Delta T = 496.9
794. 1358 Jul 7, Korea. Emperor Kongmin, 7th year, 6th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.54, local time of maximum = 8.6 h, altitude at maximum phase = 44 deg. Delta T = 496.9
795. 1358 Dec 31, China. Emperor Shun, Reign *Chih Ch'eng*, 18th year, 12th month, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.19, local time of maximum = 9.5 h, altitude at maximum phase = 19 deg. Delta T = 495.9
796. 1358 Dec 31, Korea. Emperor Kongmin, 7th year, 12th month, (day) *i-chou* (2). First day. "The Astronomer Royal predicted an eclipse which was not seen at the capital owing to clouds. He was to be punished. Reports from the countryside confirmed the eclipse occurred and he was forgiven". Computed details for Kaesong: Magnitude = 0.22, local time of maximum = 10.5 h, altitude at maximum phase = 26 deg. Delta T = 495.9
797. 1361 May 5, China. Emperor Shun, Reign *Chih Ch'eng*, 21st year, 4th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.80, local time of maximum = 18.2 h, altitude at maximum phase = 10 deg. Delta T = 490.6
798. 1361 May 5, Korea. Emperor Kongmin, 10th year, 4th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed totally". Computed details for Kaesong: Magnitude = 0.77, local time of maximum = 18.8 h, altitude at maximum phase = 2 deg. Delta T = 490.6
799. 1366 Aug 7, China. Emperor Shun, Reign *Chih Ch'eng*, 26th year, 7th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed

- details for Peking: Magnitude = 0.87, local time of maximum = 13.9 h, altitude at maximum phase = 54 deg. Delta T = 478.9
800. 1366 Aug 7, Korea. Emperor Kongmin, 15th year, 7th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed totally". Computed details for Kaesong: Magnitude = 0.94, local time of maximum = 14.8 h, altitude at maximum phase = 46 deg. Delta T = 478.9
801. 1367 Jun 28, China. Emperor T'ai Tsu, Reign *Hung Wu*, 1st year, 6th month, (day) *ping-wu* (32). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 476.8
802. 1367 Dec 22, China. Emperor Shun, Reign *Chih Ch'eng*, 27th year, 12th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.71, local time of maximum = 8.1 h, altitude at maximum phase = 7 deg. Delta T = 475.9
803. 1367 Dec 22, Korea. Emperor Kongmin, 16th year, 12th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed, it was obscured by cloud". Computed details for Kaesong: Magnitude = 0.77, local time of maximum = 8.9 h, altitude at maximum phase = 15 deg. Delta T = 475.9
804. 1367 Dec 22, China. Emperor T'ai Tsu, Reign *Hung Wu*, 1st year, 12th month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.55, local time of maximum = 8.2 h, altitude at maximum phase = 12 deg. Delta T = 475.9
805. 1369 Jun 5, China. Emperor T'ai Tsu, Reign *Hung Wu*, 2nd year, 5th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.91, local time of maximum = 11.5 h, altitude at maximum phase = 79 deg. Delta T = 472.7
806. 1369 Jun 5, Korea. Emperor Kongmin, 18th year, 5th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.79, local time of maximum = 12.4 h, altitude at maximum phase = 74 deg. Delta T = 472.7
807. 1371 Oct 9, China. Emperor T'ai Tsu, Reign *Hung Wu*, 4th year, 9th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 467.5
808. 1373 Mar 25, China. Emperor T'ai Tsu, Reign *Hung Wu*, 6th year, 3rd month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.40, local time of maximum = 6.4 h, altitude at maximum phase = 8 deg. Delta T = 464.4

809. 1373 Mar 25, Korea. Emperor Kongmin, 22nd year, 3rd month, (day) *kuei-mao* (40). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.37, local time of maximum = 7.2 h, altitude at maximum phase = 17 deg. Delta T = 464.4
810. 374 Mar 14, China. Emperor T'ai Tsu, Reign *Hung Wu*, 7th year, 2nd month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.25, local time of maximum = 7.2 h, altitude at maximum phase = 15 deg. Delta T = 462.3
811. 1374 Mar 14, Korea. Emperor Kongmin, 23rd year, 2nd month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.27, local time of maximum = 8.0 h, altitude at maximum phase = 23 deg. Delta T = 462.3
812. 1375 Jul 29, China. Emperor T'ai Tsu, Reign *Hung Wu*, 8th year, 7th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 459.3
813. 1375 Jul 29, Korea. Emperor Sinu, 1st year, 7th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.13, local time of maximum = 12.0 h, altitude at maximum phase = 69 deg. Delta T = 459.3
814. 1376 Jul 17, China. Emperor T'ai Tsu, Reign *Hung Wu*, 9th year, 7th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 457.2
815. 1377 Dec 31, China. Emperor T'ai Tsu, Reign *Hung Wu*, 10th year, 12th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.44, local time of maximum = 9.8 h, altitude at maximum phase = 27 deg. Delta T = 454.0
816. 1377 Dec 31, Korea. Emperor Sinu, 3rd year, 12th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.52, local time of maximum = 10.7 h, altitude at maximum phase = 27 deg. Delta T = 454.0
817. 1381 Oct 18, China. Emperor T'ai Tsu, Reign *Hung Wu*, 14th year, 10th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.29, local time of maximum = 11.8 h, altitude at maximum phase = 45 deg. Delta T = 445.9
818. 1381 Oct 18, Korea. Emperor Sinu, 7th year, 10th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.49, local time of maximum = 12.5 h, altitude at maximum phase = 39 deg. Delta T = 445.9

819. 1383 Aug 29, China. Emperor T'ai Tsu, Reign *Hung Wu*, 16th year, 8th month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.13, local time of maximum = 6.7 h, altitude at maximum phase = 12 deg. Delta T = 441.9
820. 1386 Dec 22, China. Emperor T'ai Tsu, Reign *Hung Wu*, 19th year, 12th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.59, local time of maximum = 7.2 h, altitude at maximum phase = 2 deg. Delta T = 434.9
821. 1386 Dec 22, Korea. Emperor Sinu, 12th year, 12th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.16, local time of maximum = 7.9 h, altitude at maximum phase = 6 deg. Delta T = 434.9
822. 1388 Jun 5, China. Emperor T'ai Tsu, Reign *Hung Wu*, 21st year, 5th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.62, local time of maximum = 6.3 h, altitude at maximum phase = 15 deg. Delta T = 431.9
823. 1388 Jun 5, Korea. Emperor Sinu, 14th year, 5th month, (day) *chia-hsu* (11). First day. "The Sun was eclipsed". Computed details for Kaesong: Magnitude = 0.65, local time of maximum = 6.9 h, altitude at maximum phase = 25 deg. Delta T = 431.9
824. 1389 Sept 20, China. Emperor T'ai Tsu, Reign *Hung Wu*, 22nd year, 9th month, (day) *ping-yin* (3). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 429.2
825. 1390 Oct 9, China. Emperor T'ai Tsu, Reign *Hung Wu*, 23rd year, 9th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.76, local time of maximum = 8.5 h, altitude at maximum phase = 25 deg. Delta T = 427.0
826. 1390 Oct 9, Korea. Emperor Kongyang Wang, 2nd year, 9th month, (day) *keng-yin* (27). First day. "The Sun was eclipsed totally". Computed details for Kaesong: Magnitude = 0.98, local time of maximum = 9.1 h, altitude at maximum phase = 28 deg. Delta T = 427.0
827. 1391 Apr 5, China. Emperor T'ai Tsu, Reign *Hung Wu*, 24th year, 3rd month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.25, local time of maximum = 16.3 h, altitude at maximum phase = 27 deg. Delta T = 426.0
828. 1391 Apr 5, Korea. Emperor Kongyang Wang, 3rd year, 3rd month, (day) *wu-tzu* (25). First day. "The Sun was eclipsed". Computed details for

Kaesong: Magnitude = 0.42, local time of maximum = 16.9 h, altitude at maximum phase = 18 deg. Delta T = 426.0

829. 1393 Aug 8, China. Emperor T'ai Tsu, Reign *Hung Wu*, 26th year, 7th month, (day) *chia-chen* (41). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 421.1
830. 1393 Aug 8, Korea. Emperor T'aejo, 2nd year, 7th month, (day) *chia-chen* (41). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 421.1
831. 1397 May 27, China. Emperor T'ai Tsu, Reign *Hung Wu*, 30th year, 5th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.97, local time of maximum = 6.4 h, altitude at maximum phase = 16 deg. Delta T = 413.2
832. 1397 May 27, Korea. Emperor T'aejo, 6th year, 5th month, (day) *jen-tzu* (49). First day. "The Sun was eclipsed totally". Computed details for Seoul: Magnitude = 1.06, local time of maximum = 7.1 h, altitude at maximum phase = 26 deg. Delta T = 413.2
833. 1400 Mar 26, Korea. Emperor Chongjong, 2nd year, 3rd month, (day) *ping-yin* (3). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.23, local time of maximum = 10.7 h, altitude at maximum phase = 53 deg. Delta T = 407.5
834. 1406 Jun 16, China. Emperor Ch'eng Tsu, Reign *Yung Lo*, 4th year, 6th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed, it was obscured by rain and cloud". Computed details for Nanking: Magnitude = 0.20, local time of maximum = 16.5 h, altitude at maximum phase = 30 deg. Delta T = 394.9
835. 1406 Jun 16, Korea. Emperor T'aejong, 6th year, 6th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.43, local time of maximum = 17.0 h, altitude at maximum phase = 25 deg. Delta T = 394.5
836. 1409 Oct 9, China. Emperor Ch'eng Tsu, Reign *Yung Lo*, 7th year, 9th month, (day) *keng-wu* (7). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.16, local time of maximum = 7.1 h, altitude at maximum phase = 9 deg. Delta T = 388.2
837. 1413 Feb 1, China. Emperor Ch'eng Tsu, Reign *Yung Lo*, 11th year, 1st month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed, it was almost total". Computed details for Nanking: Magnitude = 0.85, local time of maximum = 13.3 h, altitude at maximum phase = 40 deg. Delta T = 381.7

838. 1413 Feb 1, Korea. Emperor T'aejong, 13th year, 1st month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.87, local time of maximum = 14.1 h, altitude at maximum phase = 31 deg. Delta T = 381.7
839. 1415 Jun 7, China. Emperor Ch'eng, Reign *Yung Lo*, 13th year, 5th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.69, local time of maximum = 16.6 h, altitude at maximum phase = 29 deg. Delta T = 377.1
840. 1415 Jun 7, Korea. T'aejong, 15th year, 5th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.91, local time of maximum = 17.1 h, altitude at maximum phase = 25 deg. Delta T = 377.1
841. 1420 Sept 8, China. Emperor Ch'eng Tsu, Reign *Yung Lo*, 18th year, 8th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Nanking: Magnitude = 0.99, local time of maximum = 11.4 h, altitude at maximum phase = 59 deg. Delta T = 366.8
842. 1421 Aug 28, China. Emperor Ch'eng Tsu, Reign *Yung Lo*, 19th year, 8th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.29, local time of maximum = 17.4 h, altitude at maximum phase = 11 deg. Delta T = 364.9
843. 1421 Aug 28, Korea. Emperor Sejong, 3rd year, 8th month, (day) *hsin-mao* (18). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.29, local time of maximum = 18.2 h, altitude at maximum phase = 2 deg. Delta T = 364.9
844. 1422 Jan 23, China. Emperor Ch'eng Tzu, Reign *Yung Lo*, 20th year, 1st month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.89, local time of maximum = 11.6 h, altitude at maximum phase = 33 deg. Delta T = 364.2
845. 1422 Jan 23, Korea. Emperor Sejong, 4th year, 1st month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.77, local time of maximum = 12.7 h, altitude at maximum phase = 35 deg. Delta T = 364.2
846. 1423 Jul 8, China. Emperor Ch'eng Tsu, Reign *Yung Lo*, 21st year, 6th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 361.4
847. 1423 Jul 8, Korea. Emperor Sejong, 5th year, 6th month, (day) *keng-hsu* (47). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.09, local time of maximum = 7.9 h, altitude at maximum phase = 35 deg. Delta T = 361.4

848. 1428 Apr 15, Korea. Emperor Sejong, 10th year, 4th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.64, local time of maximum = 5.0 h, altitude at maximum phase = -4 deg. Delta T = 352.3
849. 1429 Aug 30, Korea. Emperor Sejong, 11th year, 8th month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 349.7
850. 1430 Aug 19, China. Emperor Hsuan, Reign *Hsuan Te*, 5th year, 8th month, (day) *chi-szu* (6). First day. "The Sun should have eclipsed but was obscured by rain and cloud". Computed details for Peking: Magnitude = 0.81, local time of maximum = 11.1 h, altitude at maximum phase = 58 deg. Delta T = 347.8
851. 1430 Aug 19, Korea. Emperor Sejong, 12th year, 8th month, (day) *chi-szu* (6). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.70, local time of maximum = 12.2 h, altitude at maximum phase = 62 deg. Delta T = 347.8
852. 1432 Feb 2, China. Emperor Hsuan, Reign *Hsuan Te*, 7th year, 1st month, (day) *hsin-yu* (58). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.16, local time of maximum = 12.6 h, altitude at maximum phase = 35 deg. Delta T = 345.1
853. 1433 Jun 17, Korea. Emperor Sejong, 15th year, 6th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 342.5
854. 1435 Nov 20, China. Emperor Hsuan, Reign *Hsuan Te*, 10th year, 11th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.77, local time of maximum = 13.4 h, altitude at maximum phase = 26 deg. Delta T = 338.0
855. 1435 Nov 20, Korea. Emperor Sejong, 17th year, 11th month, (day) *wu-chen* (5). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.69, local time of maximum = 14.5 h, altitude at maximum phase = 22 deg. Delta T = 338.0
856. 1436 Apr 17, Korea. Emperor Sejong, 18th year, 4th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 337.3
857. 1437 Apr 6, Korea. Emperor Sejong, 19th year, 3rd month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 335.3

858. 1444 Nov 11, China. Emperor Ying, Reign *Ch'eng T'ung*, 9th year, 10th month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.57, local time of maximum = 9.8 h, altitude at maximum phase = 23 deg. Delta T = 321.6
859. 1445 May 7, China, Emperor Ying, Reign *Ch'eng T'ung*, 10th year, 4th month, (day) *chia-chen* (41). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.76, local time of maximum = 11.3 h, altitude at maximum phase = 67 deg. Delta T = 320.7
860. 1447 Sept 10, China. Emperor Ying, Reign *Ch'eng T'ung*, 12th year, 8th month, (day) *keng-shen* (57). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.74, local time of maximum = 17.1 h, altitude at maximum phase = 11 deg. Delta T = 316.4
861. 1449 Feb 7, Korea. Emperor Sejong, 31st year, 1st month, (day) *ping-shen* (33). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 314.0
862. 1451 Jun 29, China. Emperor Ching, Reign *Ching T'ai*, 2nd year, 6th month, (day) *wu-chen* (5). First day. "The Sun should have eclipsed but didn't". Computed details for Peking: Magnitude = 0.68, local time of maximum = 4.4 h, altitude at maximum phase = -2 deg. Delta T = 309.7
863. 1452 Dec 11, China. Emperor Ching, Reign *Ching T'ai*, 3rd year, 11th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.32, local time of maximum = 15.7 h, altitude at maximum phase = 8 deg. Delta T = 307.1
864. 1452 Dec 11, Korea. Emperor Munjong, 2nd year, 11th month, (day) *chi-wei* (56). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.49, local time of maximum = 16.6 h, altitude at maximum phase = 1 deg. Delta T = 307.1
865. 1454 Apr 28, China. Emperor Ching, Reign *Ching T'ai*, 5th year, 4th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.20, local time of maximum = 5.9 h, altitude at maximum phase = 9 deg. Delta T = 304.7
866. 1454 Apr 28, Korea. Emperor Tanjong, 2nd year, 4th month, (day) *jen-wu* (19). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.09, local time of maximum = 6.5 h, altitude at maximum phase = 16 deg. Delta T = 304.7
867. 1455 Apr 17, Korea. Emperor Sejo, 1st year, 4th month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.54, local time of maximum = 7.0 h, altitude at maximum phase = 20 deg. Delta T = 302.9

868. 1460 Jul 18, China. Emperor Ying, Reign *T'ien Shun*, 4th year, 7th month, (day) *i-hai* (12). First day. "The Sun was eclipsed, court was suspended". Computed details for Peking: Magnitude = 0.86, local time of maximum = 13.5 h, altitude at maximum phase = 62 deg. Delta T = 293.8
869. 1460 Jul 18, Korea. Emperor Sejo, 6th year, 7th month, (day) *i-hai* (12). First day. "The Sun was eclipsed totally". Computed details for Seoul: Magnitude = 0.90, local time of maximum = 14.5 h, altitude at maximum phase = 52 deg. Delta T = 293.8
870. 1461 Dec 2, China. Emperor Ying, Reign *T'ien Shun*, 5th year, 11th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.16, local time of maximum = 9.2 h, altitude at maximum phase = 16 deg. Delta T = 291.4
871. 1462 Apr 1, Korea, Emperor Sejo, 8th year, 2nd month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 290.8
872. 1463 May 18, China. Emperor Ying, Reign *T'ien Shun*, 7th year, 5th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.46, local time of maximum = 19.5 h, altitude at maximum phase = -3 deg. Delta T = 288.9
873. 1463 May 18, Korea. Emperor Sejo, 9th year, 5th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 288.9
874. 1464 May 6, China. Emperor Ying, Reign *T'ien Shun*, 8th year, 4th month, (day) *kuei-wei* (20). First day. "The Sun was eclipsed, it was not observed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 287.2
875. 1467 Mar 6, China. Emperor Hsien, Reign *Ch'eng Hua*, 3rd year, 2nd month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.91, local time of maximum = 15.0 h, altitude at maximum phase = 31 deg. Delta T = 282.4
876. 1469 Jul 9, China. Emperor Hsien, Reign *Ch'eng Hua*, 5th year, 6th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.32, local time of maximum = 13.9 h, altitude at maximum phase = 59 deg. Delta T = 278.4
877. 1469 Jul 9, Korea. Emperor Yejong, 1st year, 6th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.42, local time of maximum = 14.9 h, altitude at maximum phase = 49 deg. Delta T = 278.4

878. 1470 Jun 29, China. Emperor Hsien, Reign *Ch'eng Hua*, 6th year, 6th month, (day) *wu-shen* (45). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.21, local time of maximum = 5.1 h, altitude at maximum phase = 5 deg. Delta T = 276.8
879. 1473 Apr 27, China. Emperor Hsien, Reign *Ch'eng Hua*, 9th year, 3rd month, (day) *hsin-yu* (41). "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.67, local time of maximum = 15.7 h, altitude at maximum phase = 37 deg. (N.B. On 4th month, 41st day, it is noted "Eclipse was predicted to happen on 4th month, 4th day, but this coincides with another festival so celebrations were held on this day (3rd month 41st day) instead". No eclipse occurred on the 4th month 4th day, but an eclipse occurred six days earlier on the 4th month 58th day.) Delta T = 272.1
880. 1474 Oct 11, China. Emperor Hsien, Reign *Ch'eng Hua*, 10th year, 9th month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed, court was suspended". Computed details for Peking: Magnitude = 0.46, local time of maximum = 9.9 h, altitude at maximum phase = 32 deg. Delta T = 269.7
881. 1475 Sept 30, China. Emperor Hsien, Reign *Ch'eng Hua*, 11th year, 9th month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.53, local time of maximum = 17.8 h, altitude at maximum phase = 30 deg. Delta T = 268.1
882. 1475 Sept 30, Korea. Emperor Songjong, 6th year, 9th month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.53, local time of maximum = 15.7 h, altitude at maximum phase = 22 deg. Delta T = 268.1
883. 1476 Feb 25, China. Emperor Hsien, Reign *Ch'eng Hua*, 12th year, 2nd month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.22, local time of maximum = 14.2 h, altitude at maximum phase = 35 deg. Delta T = 267.4
884. 1484 Sept 20, China. Emperor Hsien, Reign *Ch'eng Hua*, 20th year, 9th month, (day) *i-yu* (22). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.57, local time of maximum = 7.3 h, altitude at maximum phase = 14 deg. Delta T = 253.4
885. 1484 Oct 2, Korea. Emperor Songjong, 15th year, 9th month, (day) *ting-yu* (34). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 253.4
886. 1485 Sept 9, China Emperor Hsien, Reign *Ch'eng Hua*, 21st year, 8th month, (day) *chi-mao* (16). First day. "The Sun was eclipsed". Computed

- details for Peking: Magnitude = 0.13, local time of maximum = 7.5 h, altitude at maximum phase = 18 deg. Delta T = 251.9
887. 1488 Jul 9, China. Emperor Hsiao, Reign *Hung Chih*, 1st year, 6th month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.35, local time of maximum = 14.4 h, altitude at maximum phase = 54 deg. Delta T = 247.3
888. 1488 Jul 9, Korea. Emperor Songjong, 19th year, 6th month, (day) *keng-szu* (30). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.24, local time of maximum = 15.3 h, altitude at maximum phase = 44 deg. Delta T = 247.3
889. 1489 Dec 22, China. Emperor Hsiao, Reign *Hung Chih*, 2nd year, 12th month, (day) *chia-shen* (21). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.32, local time of maximum = 16.0 h, altitude at maximum phase = 6 deg. Delta T = 245.0
890. 1495 Feb 25, China. Emperor Hsiao, Reign *Hung Chih*, 8th year, 2nd month, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.29, local time of maximum = 11.8 h, altitude at maximum phase = 44 deg. Delta T = 236.9
891. 1495 Mar 9, Korea. Emperor Yonsan-gun, 1st year, 2nd month, (day) *ting-mao* (4). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 236.9
892. 1498 Dec 13, China. Emperor Hsiao, Reign *Hung Chih*, 11th year, 11th month, intercalary, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.14, local time of maximum = 13.2 h, altitude at maximum phase = 24 deg. Delta T = 231.1
893. 1498 Dec 13, Korea. Emperor Yonsan-gun, 4th year, 11th month, intercalary, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.21, local time of maximum = 14.4 h, altitude at maximum phase = 20 deg. Delta T = 231.1
894. 1500 Jun 28, China. Emperor Hsiao, Reign *Hung Chih*, 13th year, 5th month, (day) *chia-yin* (51). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.85, local time of maximum = 6.3 h, altitude at maximum phase = 17 deg. Delta T = 228.8
895. 1500 Jun 28, Korea. Emperor Yonsan-gun, 6th year, 5th month, (day) *chia-yin* (51). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.72, local time of maximum = 6.9 h, altitude at maximum phase = 24 deg. Delta T = 228.8

896. 1502 Oct 1, China. Emperor Hsiao, Reign *Hung Chih*, 15th year, 9th month, (day) *keng-wu* (7). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.22, local time of maximum = 17.2 h, altitude at maximum phase = 4 deg. Delta T = 225.3
897. 1502 Oct 13, Korea Emperor Yonsan-gun, 8th year, 9th month, (day) *keng-wu* (19). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 225.3
898. 1507 Jan 13, China. Emperor Wu, Reign *Ch'eng Te*, 2nd year, 1st month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.75, local time of maximum = 16.6 h, altitude at maximum phase = 3 deg. Delta T = 218.8
899. 1507 Jan 13, Korea. Emperor Chungjong, 2nd year, 1st month, (day) *i-hai* (12). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.92, local time of maximum = 17.3 h, altitude at maximum phase = -4 deg. Delta T = 218.8
900. 1514 Aug 20, China. Emperor Wu, Reign *Ch'eng Te*, 9th year, 8th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.70, local time of maximum = 11.8 h, altitude at maximum phase = 59 deg. Delta T = 207.6
901. 1514 Aug 20, Korea. Emperor Chungjong, 9th year, 8th month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.64, local time of maximum = 12.8 h, altitude at maximum phase = 60 deg. Delta T = 207.6
902. 1517 Jun 19, China. Emperor Wu, Reign *Ch'eng Te*, 12th year, 6th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.32, local time of maximum = 14.1 h, altitude at maximum phase = 59 deg. Delta T = 203.5
903. 1517 Jun 19, Korea. Emperor Chungjong, 12th year, 6th month, (day) *i-szu* (42). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.30, local time of maximum = 15.1 h, altitude at maximum phase = 48 deg. Delta T = 203.5
904. 1518 Jun 8, China. Emperor Wu, Reign *Ch'eng Te*, 13th year, 5th month, (day) *chi-hai* (36). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.29, local time of maximum = 15.3 h, altitude at maximum phase = 46 deg. Delta T = 202.1
905. 1521 Apr 7, China. Emperor Wu, Reign *Ch'eng Te*, 16th year, 3rd month, (day) *kuei-chou* (50). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.97, local time of maximum = 15.5 h, altitude at maximum phase = 35 deg. Delta T = 198.1

906. 1526 Jan 13, China. Emperor Shih, Reign *Chia Ching*, 4th year, 12th month, intercalary, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.83, local time of maximum = 7.0 h, altitude at maximum phase = -1 deg. Delta T = 191.3
907. 1526 Jan 13, Korea. Emperor Chungjong, 20th year, 12th month, intercalary, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.85, local time of maximum = 7.8 h, altitude at maximum phase = 8 deg. Delta T = 191.3
908. 1527 May 30, China. Emperor Shih, Reign *Chia Ching*, 6th year, 5th month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.29, local time of maximum = 9.0 h, altitude at maximum phase = 48 deg. Delta T = 189.4
909. 1527 May 30, Korea. Emperor Chungjong, 22nd year, 5th month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.14, local time of maximum = 9.9 h, altitude at maximum phase = 60 deg. Delta T = 189.4
910. 1529 Nov 1, China. Emperor Shih, Reign *Chia Ching*, 8th year, 10th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.74, local time of maximum = 13.3 h, altitude at maximum phase = 30 deg. Delta T = 186.1
911. 1539 Jun 14, China. Emperor Shih, Reign *Chia Ching*, 18th year, 5th month, (day) *i-wei* (32). "The Sun was eclipsed by three tenth's, this occurred while the Sun was still below the horizon". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 173.1
912. 1540 Apr 7, China. Emperor Shih, Reign *Chia Ching*, 19th year, 3rd month, (day) *kuei-szu* (30). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 172.0
913. 1542 Aug 11, China. Emperor Shih, Reign *Chia Ching*, 21st year, 7th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.86, local time of maximum = 12.2 h, altitude at maximum phase = 62 deg. Delta T = 168.9
914. 1543 Feb 4, China. Emperor Shih, Reign *Chia Ching*, 22nd year, 1st month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 168.3
915. 1543 Feb 4, Korea. Emperor Chungjong, 38th year, 1st month, (day) *ping-wu* (43). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN KOREA. Delta T = 168.3

916. 1545 Jun 9, China. Emperor Shih, Reign *Chia Ching*, 24th year, 5th month, (day) *jen-hsu* (59). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.63, local time of maximum = 18.1 h, altitude at maximum phase = 13 deg. Delta T = 165.2
917. 1548 Apr 8, China. Emperor Shih, Reign *Chia Ching*, 27th year, 3rd month, (day) *ping-tzu* (13). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 161.5
918. 1549 Mar 29, China. Emperor Shih, Reign *Chia Ching*, 28th year, 3rd month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.76, local time of maximum = 11.3 h, altitude at maximum phase = 56 deg. Delta T = 160.3
919. 1549 Apr 8, Korea. Emperor Myongjong, 4th year, 3rd month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 160.3
920. 1553 Jan 14, China. Emperor Shih, Reign *Chia Ching*, 32nd year, 1st month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.69, local time of maximum = 16.4 h, altitude at maximum phase = 5 deg. Delta T = 155.5
921. 1553 Jan 14, Korea. Emperor Myongjong, 8th year, 1st month, (day) *wu-yin* (15). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.86, local time of maximum = 17.2 h, altitude at maximum phase = -2 deg. Delta T = 155.5
922. 1555 Nov 14, China. Emperor Shih, Reign *Chia Ching*, 34th year, 11th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.37, local time of maximum = 16.0 h, altitude at maximum phase = 8 deg. Delta T = 151.9
923. 1555 Nov 14, Korea. Emperor Myongjong, 10th year, 11th month, (day) *jen-chen* (29). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.28, local time of maximum = 16.9 h, altitude at maximum phase = 0 deg. Delta T = 151.9
924. 1556 Nov 2, China. Emperor Shih, Reign *Chia Ching*, 35th year, 10th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.39, local time of maximum = 16.1 h, altitude at maximum phase = 9 deg. Delta T = 150.7
925. 1556 Nov 2, Korea. Emperor Myongjong, 11th year, 10th month, (day) *ping-hsu* (23). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.46, local time of maximum = 17.1 h, altitude at maximum phase = 0 deg. Delta T = 150.7

926. 1561 Feb 14, China. Emperor Shih, Reign *Chia Ching*, 40th year, 2nd month, (day) *hsin-mao* (28). First day. "The Sun was eclipsed, it was obscured by cloud". Computed details for Peking: Magnitude = 0.95, local time of maximum = 17.0 h, altitude at maximum phase = 5 deg. Delta T = 145.5
927. 1561 Aug 11, China. Emperor Shih, Reign *Chia Ching*, 40th year, 7th month, (day) *chi-chou* (26). "The Sun was one and a half tenth's eclipsed". Computed details: NO ECLIPSE VISIBLE IN CHINA. Delta T = 144.9
928. 1561 Aug 11, Korea. Emperor Myongjong, 16th year, 7th month, (day) *chi-chou* (26). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.06, local time of maximum = 7.1 h, altitude at maximum phase = 21 deg. Delta T = 144.9
929. 1564 Jun 9, China. Emperor Shih, Reign *Chia Ching*, 43rd year, 5th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.09, local time of maximum = 4.9 h, altitude at maximum phase = 3 deg. Delta T = 141.5
930. 1564 Jun 9, Korea. Emperor Myongjong, 19th year, 5th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.24, local time of maximum = 5.5 h, altitude at maximum phase = 8 deg. Delta T = 141.5
931. 1570 Feb 5, China. Emperor Mu Tsung, Reign *Lung Ch'ung*, 4th year, 1st month, (day) *chi-szu* (6). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.19, local time of maximum = 12.4 h, altitude at maximum phase = 37 deg. Delta T = 134.7
932. 1570 Feb 5, Korea. Emperor Sonjo, 3rd year, 1st month, (day) *chi-szu* (6). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.03, local time of maximum = 13.4 h, altitude at maximum phase = 36 deg. (N.B. Given as *i-szu* in the text.) Delta T = 134.7
933. 1572 Jul 10, China. Emperor Mu, Reign *Lung Ch'ung*, 6th year, 6th month, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Peking: Magnitude = 0.91, local time of maximum = 7.9 h, altitude at maximum phase = 35 deg. Delta T = 131.9
934. 1572 Jul 10, Korea. Emperor Sonjo, 5th year, 6th month, (day) *i-mao* (52). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.78, local time of maximum = 8.8 h, altitude at maximum phase = 45 deg. Delta T = 131.9

935. 1575 May 10, China. Emperor Shen, Reign *Wan Li*, 3rd year, 4th month, (day) *chi-szu* (6). First day. "The Sun was eclipsed. Between 1 p.m. and 3 p.m. the stars shone brightly. After 3 p.m. it became light". Computed details for Peking : Magnitude = 0.70, local time of maximum = 14.3 h, altitude at maximum phase = 54 deg. Delta T = 128.6
936. 1575 May 10, Korea Emperor Sonjo, 8th year, 4th month, (day) *chi-szu* (6). First day. "The Sun was eclipsed". Computed details for Seoul: Magnitude = 0.79, local time of maximum = 15.3 h, altitude at maximum phase = 44 deg Delta T = 128.6
937. 1577 Sept 2, China. Emperor Shen, Reign *Wan Li*, 5th year, 8th month, intercalary, (day) *i-yu* (22). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 126.0
938. 1577 Sept 2, Korea. Emperor Sonjo, 9th year, 8th month, intercalary, (day) *i-yu* (22). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 126.0
939. 1580 Feb 15, China. Emperor Shen, Reign *Wan Li*, 8th year, 2nd month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.94, local time of maximum = 9.1 h, altitude at maximum phase = 26 deg. Delta T = 123.2
940. 1580 Feb 15, Korea. Emperor Sonjo, 13th year, 2nd month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.82, local time of maximum = 10.0 h, altitude at maximum phase = 35 deg. Delta T = 123.2
941. 1582 Jun 20, China. Emperor Shen, Reign *Wan Li*, 10th year, 6th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.72, local time of maximum = 13.7 h, altitude at maximum phase = 63 deg. Delta T = 120.6
942. 1582 Jun 20, Korea. Emperor Sonjo, 15th year, 6th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.65, local time of maximum = 14.7 h, altitude at maximum phase = 53 deg. Delta T = 120.6
943. 1583 Dec 14, China. Emperor Shen, Reign *Wan Li*, 11th year, 11th month, (day) *chi-mao* (16). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.82, local time of maximum = 13.1 h, altitude at maximum phase = 25 deg. Delta T = 119.0
944. 1583 Dec 14, Korea. Emperor Sonjo, 16th year, 11th month, (day) *chi-mao* (16). First day. "The Sun was eclipsed". Computed details for Seoul :

Magnitude = 0.71, local time of maximum = 14.2 h, altitude at maximum phase = 22 deg. Delta T = 119.0

945. 1587 Oct 2, China. Emperor Shen, Reign *Wan Li*, 15th year, 9th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed, it was obscured by cloud and rain". Computed details for Peking : Magnitude = 0.74, local time of maximum = 12.7 h, altitude at maximum phase = 46 deg. Delta T = 114.9
946. 1587 Oct 2, Korea. Emperor Sonjo, 20th year, 9th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.80, local time of maximum = 13.7 h, altitude at maximum phase = 43 deg. Delta T = 114.9
947. 1589 Feb 15, Korea. Emperor Sonjo, 22nd year, 1st month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.31, local time of maximum = 8.0 h, altitude at maximum phase = 14 deg. Delta T = 113.4
948. 1589 Jul 13, Korea. Emperor Sonjo, 22nd year, 6th month, (day) *ting-chou* (14). First day. "The Sun was eclipsed". Computed details: NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 113.0
949. 1590 Jul 31, China. Emperor Shen, Reign *Wan Li*, 18th year, 7th month, (day) *keng-tzu* (37). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.43, local time of maximum = 17.1 h, altitude at maximum phase = 22 deg. Delta T = 111.8
950. 1590 Jul 31, Korea. Emperor Sonjo, 23rd year, 7th month, (day) *keng-tzu* (23). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.39, local time of maximum = 17.9 h, altitude at maximum phase = 12 deg. Delta T = 111.8
951. 1593 Nov 23, China. Emperor Shen, Reign *Wan Li*, 21st year, 11th month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 108.3
952. 1593 Nov 23, Korea. Emperor Sonjo, 25th year, 11th month, (day) *hsin-hai* (48). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.21, local time of maximum = 6.6 h, altitude at maximum phase = -5 deg. Delta T = 108.3
953. 1594 May 20, China. Emperor Shen, Reign *Wan Li*, 22nd year, 4th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.32, local time of maximum = 10.9 h, altitude at maximum phase = 65 deg. Delta T = 107.8

954. 1594 May 20, Korea. Emperor Sonjo, 27th year, 4th month, (day) *chi-yu* (46). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.11, local time of maximum = 11.9 h, altitude at maximum phase = 72 deg. Delta T = 107.8
955. 1596 Sept 22, China. Emperor Shen, Reign *Wan Li*, 24th year, 8th month, intercalary, (day) *i-chou* (2). "The Sun was eclipsed. At 10:15-10:30 a.m. the eclipse started. The Sun eclipsed nine tenth's. At 12:00-12:15 p.m. the eclipse finished". Computed details for Peking : Magnitude = 0.95, local time of maximum = 11.2 h, altitude at maximum phase = 49 deg. Delta T = 105.4
956. 1596 Sept 22, Korea. Emperor Sonjo, 29th year, 8th month, intercalary, (day) *i-chou* (2). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.95, local time of maximum = 12.2 h, altitude at maximum phase = 53 deg. Delta T = 105.4
957. 1603 May 11, China. Emperor Shen, Reign *Wan Li*, 31st year, 4th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed at 7-9 a.m., it returned to full brightness at 9-11 a.m. It was eclipsed eight point eight eight tenth's". Computed details for Peking : Magnitude = 0.90, local time of maximum = 8.6 h, altitude at maximum phase = 41 deg. (N.B. The wrong month and day are given in the annals: 3rd month, *jen-wu* (19)). Delta T = 98.6
958. 1603 May 11, Korea. Emperor Sonjo, 36th year, 4th month, (day) *ting-hai* (24). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.73, local time of maximum = 9.5 h, altitude at maximum phase = 51 deg Delta T = 98.6
959. 1604 Apr 29, China. Emperor Shen, Reign *Wan Li*, 32nd year, 4th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.08, local time of maximum = 16.4 h, altitude at maximum phase = 27 deg. Delta T = 97.6
960. 1604 Apr 29, Korea. Emperor Sonjo, 37th year, 4th month, (day) *hsin-szu* (18). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.09, local time of maximum = 17.3 h, altitude at maximum phase = 18 deg. Delta T = 97.6
961. 1610 Dec 15, China. Emperor Shen, Reign *Wan Li*, 38th year, 11th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed by more than seven tenth's. The Sun was in *Wei* (R.A. 236.3 deg) when it began to wane. The Sun began eclipsing at three *k'o* past the hour of *Wei* (13:45-14:00). At half past the hour of *Wei* the Sun entered the shadow of the Moon totally. At the hour of *Shen* it recovered". Computed details for Peking

- : R.A. of Sun = 251.7 deg, magnitude = 0.61, local time of maximum = 16.1 h, altitude at maximum phase = 5 deg. Delta T = 91.1
962. 1610 Dec 15, Korea. Emperor Kwanghal-gun, 2nd year, 11th month, (day) *jen-yin* (39). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.74, local time of maximum = 17.0 h, altitude at maximum phase = -3 deg. Delta T = 91.1
963. 1612 May 30, China. Emperor Shen, Reign *Wan Li*, 40th year, 5th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 89.7
964. 1612 May 30, Korea. Emperor Kwanghal-gun, 4th year, 5th month, (day) *chia-wu* (31). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN KOREA. Delta T = 89.7
965. 1615 Mar 29, China. Emperor Shen, Reign *Wan Li*, 43 rd year, 3rd month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.89, local time of maximum = 16.5 h, altitude at maximum phase = 20 deg. Delta T = 87.0
966. 1615 Mar 29, Korea. Emperor Kwanghal-gun, 7th year, 3rd month, (day) *ting-wei* (44). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.97, local time of maximum = 17.2 h, altitude at maximum phase = 11 deg. Delta T = 87.0
967. 1616 Apr 16, Korea. Emperor Kwanghal-gun, 8th year, 3rd month, (day) *hsin-wei* (8). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE ON EARTH'S SURFACE. Delta T = 86.1
968. 1617 Aug 1, China. Emperor Shen, Reign *Wan Li*, 45th year, 7th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN CHINA. Delta T = 84.8
969. 1617 Aug 1, Korea. Emperor Kwanghal-gun, 9th year, 7th month, (day) *kuei-hai* (60). First day. "The Sun was eclipsed". Computed details : NO ECLIPSE VISIBLE IN KOREA. Delta T = 84.8
970. 1621 May 21, China. Emperor Hsi, Reign *T-ien Ch'i*, 1st year, 4th month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details for Peking : Magnitude = 0.72, local time of maximum = 18.3 h, altitude at maximum phase = 9 deg. Delta T = 81.3
971. 1621 May 21, Korea. Emperor Kwanghal-gun, 13th year, 4th month, (day) *jen-shen* (9). First day. "The Sun was eclipsed". Computed details for Seoul : Magnitude = 0.75, local time of maximum = 19.0 h, altitude at maximum phase = 1 deg. Delta T = 81.3

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