Relations Between Solar Activity and Solar Tides Caused by the Planets Defined

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Summary

The database established by Martin (1) is analysed. The database has monthly values for the alignment index representing the tidal influence of the planets Venus, Earth and Jupiter on the sun. The index values are plotted over long and short time scales. A pattern of five separate repeating long waves is discovered, each wave having a period of 55.1533 years. The long wave (LW) peaks and troughs are found to occur in a repeating series of intervals in the sequence: 10.3818-12.0039-10.3818-12.0039-10.3818 years. The peaks of these waves are found to have a long term average period of 11.0307 years. Each LW is found to be formed by the connection of 34 shorter periods (SP), each 1.6222 years long. The interlacing of the five LWs results in five smaller intervals within each SP, each with a period of 0.3244 years. It is found that the timing of the features observed within sunspot cycles correspond very closely with the SPs and 0.3244 year intervals within each SP. This includes the times of minima and maxima, and significant features of the shape of each cycle. The significance of these several findings is discussed, and it is concluded that they show convincingly that the combined tidal influence of the planets Venus, Earth and Jupiter is a primary factor in the formation of many observed solar events.

Observations from long term plots.

The alignment index calculated by Martin (1) was plotted for two periods: from 1750 to 1900, Figure 1., and 1900 to 2050, Figure 2. The cutoff level of 1.88 used by Martin is shown. These plots are included mainly to show that, on this time scale, the crests of waves appear at intervals of approximately eleven years, coinciding with the peaks of the planetary tidal influence curves calculated by both Hung and Martin. In these plots the form of many waves is not at all clear. Some are just visible down to an index level of about 2.2, but the lower part of the plot appears to be quite random.

The analysis done by Hung and Martin has extracted information from only the upper part of this alignment index data, but, as pointed out by Martin, that does not show a very convincing case for a cause and effect relationship with solar activity because the phase difference is sometimes lagging. The alignment index data must therefore be analysed in some other way before it can be fully accepted that tidal influences of the planets cause variations in solar activity.

Construction of shorter term plots.

Plots were made of the data with the time scale reduced to twenty five years each, covering the periods from 1800 to 1825, and 1900 to 2050. Averaged monthly sunspot data is also plotted. The plots are reproduced in Appendix A. The peaks of the waves seen in the long term plots are clearly visible, and between each of those peaks a series of high points at regular intervals with a period of ~1.62 years. These are referred to as short period markers (SPM). The elegantly simple procedure of joining-the-dots was used to first draw the shape of each LW peak, and then track the occurrence of successive SPM down to between the 2.0 and 1.5 index levels. It was found that below an index level of 1.5 the SPMs relate to low rather than high points within the pattern of SPs.

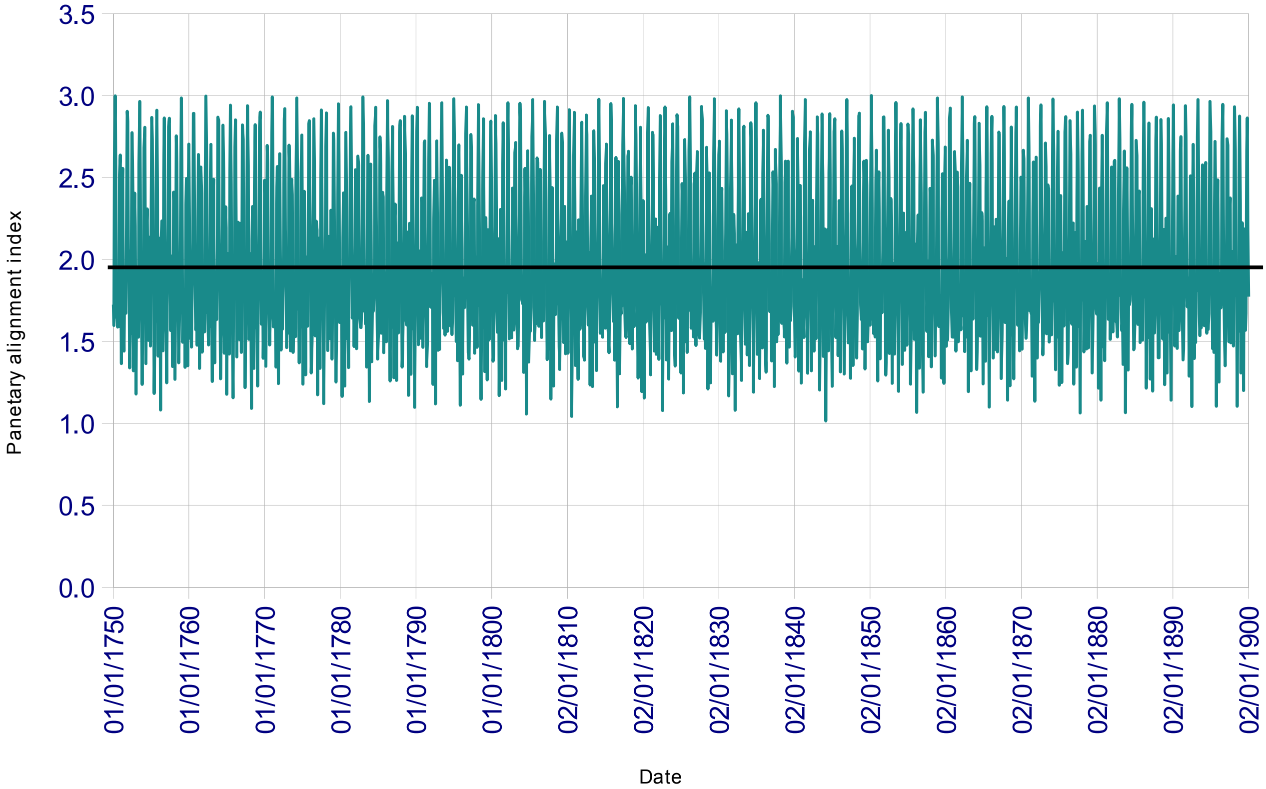


Figure 1. Planetary tidal index from 1750 to 1900.

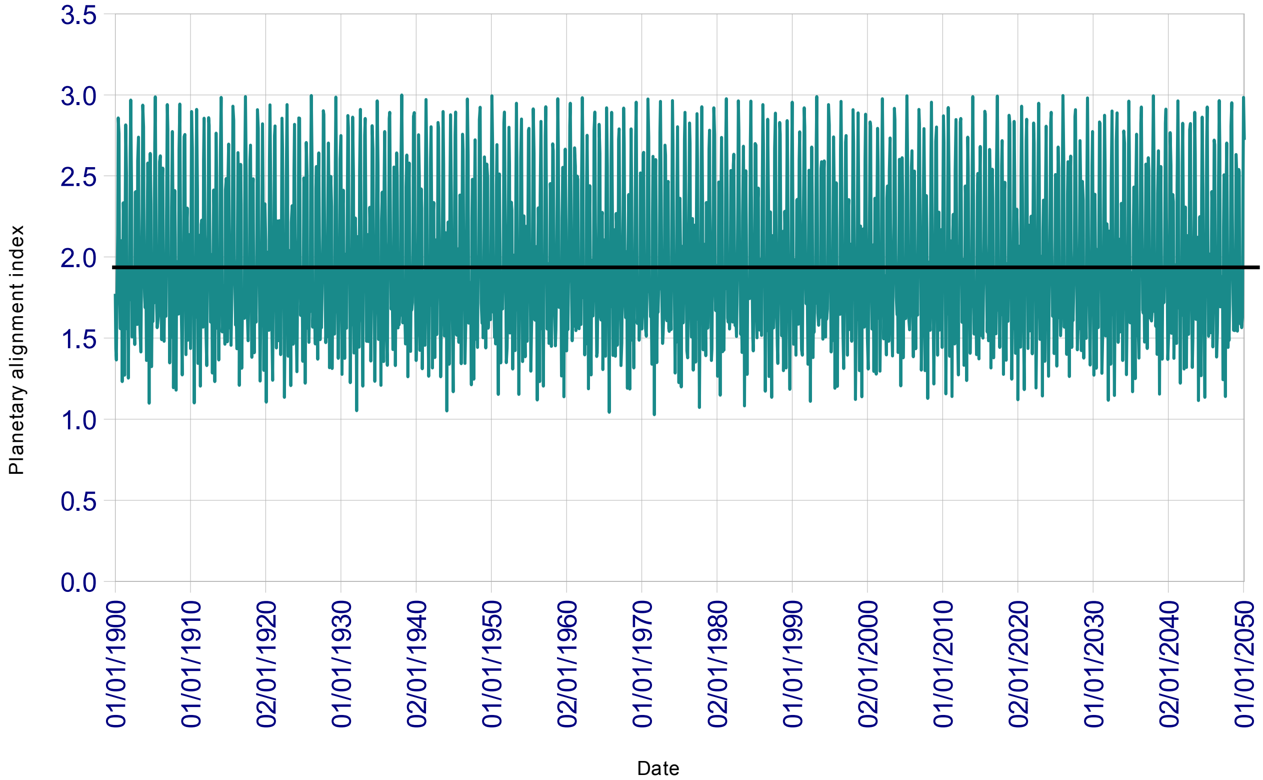


Figure 2. Planetary alignment index from 1900 to 2050.

Completion of the emerging pattern in this manner revealed a sequence of five interlacing long waves (LW). It is noted that there are intermediate low points in the lower part of the plots, mostly below the 2.0 index level, that also occur at the SP interval. These have not been systematically examined, but after an initial assessment it was concluded that they were unlikely to have much bearing on the analysis and conclusions that follow. Because the SPM points, and thus the LWs derived from them, arise from the precisely predictable regular orbits of the planets Venus, Earth and Jupiter, it must be assumed that they have existed back into the distant past, and will continue into the indefinite future. The LWs are numbered from one to five, with number one starting in January 1900, at the midway low point (MLP) between the peaks on either side. A shallow ripple is evident in the shape of the LWs during some periods. This is an artifact of the monthly intervals between dates in the data set. True high and low points sometimes fall in between the plotted points, and the method of smoothing used can result in turning points on the plots being a little too high or too low, particularly at the low points.

Because there are five waves, it is seen that between each SPM point, intermediate waves (IW) occur at intervals of 1.62÷5 = 0.325 years. This period helps to define the phase intervals between the waves. The 1.62 year value for the SP referred to so far is a first approximation. Progressive refinement of the analysis from those starting points enabled the following precise set of values and relationships to be established...

The period of all LWs is 55.1533 ± 0.005 years. This basic number was arrived at by measurement of cycles 1 and 5 over three full cycles from peak-to-peak. Accurate peak times were obtained by interpolation on an enlarged graphical plot. Wave peaks are shown on the charts with the wave number beside a triangle.

On the assumption that the peaks of the long waves are related to the sunspot cycle, the long term average length of the cycle is 55.1533÷5=11.03067 ± 0.00133 years.

There are thirty four SPs in each LW. The true SP length is thus: 55.1533÷34 = 1.6222 years. The period of the IWs is then: 1.6222÷5 = 0.3244 years. The mid points on the LWs are identified with the wave number beside a downward facing triangle, aligned with a solid green line extending down to the sunspot curve. It is observed that the MLP of any LW may not be the lowest point. The lowest point can occur at the mid point, or at 1.6222 years before or after the mid point, and also there can sometimes be almost equal low points at 1.6222 years on both sides of the mid point.

It is observed that the intervals between successive LW MLPs and peaks (LWP) fall as follows:

1 to 2 (1.6222 x 7) – (0.3244 x 3) = 10.3818 years.

2 to 3 (1.6222 x 7) + (0.3244 x 2) = 12.0039 years

3 to 4 (1.6222 x 7) – (0.3244 x 3) = 10.3818 years

4 to 5 (1.6222 x 7) + (0.3244 x 2) = 12.0039 years

5 to 1 (1.6222 x 7) – (0.3244 x 3) = 10.3818 years

The average of which is 11.0306 years, as above. (Except for small error due to rounding.)

Relationships with R_{min} and R_{max} of observed sunspot cycles.

It has long been observed that the times of sunspot minima and maxima vary from cycle to cycle in relation to regularly spaced timing points derived by averaging observed cycle lengths over an extended period. Various mechanisms have been studied as possible causes. In this section of the current study we investigate possible correspondences between the observed dates of R_{min} and R_{max} with the nearest low and high points respectively of the planetary tidal influences. Dates of R_{min} and R_{max} used are as downloaded from the Solar Influences Data Centre (SIDC) of the Royal

Observatory of Belgium.

The timing of solar cycle R_{min} are analysed first: The nearest tidal influence dates (NTDs) in relation to the observed minima were first identified by inspection from the plots, then determined accurately from the database. These data are presented in Table 1, together with the times of the nearest LW MLPs, which are used as reference points. Times in years before or after the LW MLPs were calculated for both the NLPs selected and the dates of the observed solar minima, R_{min}. These two set of values exhibit a very close correspondence, as shown in Figure 3.. The Correlation Coefficient is 0.98. It is observed that R_{min} occurs at intervals close to 0.811, 1.622 and 3.244 years from the MLPs, i.e., multiples of the SP. From this it can already be stated with a very high level of confidence that solar activity is closely related to the combined tidal influence of the planets Venus, Earth and Jupiter. The factors that appear to cause the actual solar minima to occur before or after the MLP of the LWs are dealt with in the next section.

The timing of solar R_{max} are analysed in a similar manner. These data are presented in Table 2. The calculated NTDs and observed R_{max} times before and after the LWPs are shown plotted in Figure 3. The correlation coefficient is 0.99. It is observed that although R_{max} sometimes occurs close to one of the SPM points, they mostly occur close to one of the IW high points. It may be argued that the length of the IW period is so short that the apparently close association with the peaks could still occur by chance. However, the specific factors that appear to cause solar maxima to occur just when they do can be identified, and are dealt with in the next section.

Cycle no.	From observations			From calculated tidal influences						
	R_{min} Date	R_{max} Date	Cycle length Years	Midpoint low date	Nearest low date to obs.	Diff'ce from obs. Years	Cycle length Years	Mid.low to near low.	1.622 intervals (Rounded)	Mid.low to obs. low.
5	1798.3	1805.1	12.2	1800.207	1798.585	0.28	12.002	-1.622	1.0	-1.91
6	1810.5	1816.4	12.8	1812.209	1810.587	0.09	12.815	-1.622	1.0	-1.71
7	1823.3	1829.9	10.6	1822.591	1823.402	0.10		0.811	-0.5	0.71
8	1833.9	1837.2		1834.597						
14	1902.1	1906.1	11.4	1900.131	1901.753	-0.35	12.004	1.622	1.0	1.97
15	1913.5	1917.6	10.1	1910.513	1913.757	0.26	9.571	3.244	2.0	2.99
16	1923.6	1928.3	10.1	1922.517	1923.328	-0.27	10.382	0.811	0.5	1.08
17	1933.7	1937.3	10.4	1932.898	1933.710	0.01	10.382	0.811	0.5	0.80
18	1944.1	1947.4	10.2	1944.902	1944.091	-0.01	10.382	-0.811	-0.5	-0.80
19	1954.3	1958.2	10.5	1955.284	1954.473	0.17	10.382	-0.811	-0.5	-0.98
20	1964.8	1968.9	11.5	1965.666	1964.855	0.06	11.193	-0.811	-0.5	-0.87
21	1976.3	1980.0	10.4	1977.670	1976.048	-0.25	10.382	-1.622	-1.0	-1.37
22	1986.7	1989.5	9.7	1988.052	1986.430	-0.27	10.382	-1.622	-1.0	-1.35
23	1996.4	2000.3	12.1	2000.056	1996.812	0.41	12.004	-3.244	-2.0	-3.66
24	2008.5	2013.0	12.3	2010.438	2008.816	0.32	12.004	-1.622	-1.0	-1.94
25	2020.8	<= Estimate		2020.820	2020.820					

Table 1. Dates of solar cycle minima – Observed dates and correlation with dates of planetary tidal influence low points.

	From observations			From calculated tidal influences						
Cycle no.	R_{min} Date	R_{max} Date	Cycle length Years	Maximum date	Nearest high date to obs.	Diff'ce from obs. Years	Cycle length Years	Max. to near high	0.324432 intervals (Rounded)	Max. to Obs high
5	1798.3	1805.1	11.3	1807.020	1804.749	-0.35	11.6777	-2.271	-5.0	-1.92
6	1810.5	1816.4	13.5	1817.400	1816.427	0.03		-0.973	-3.0	-1.00
7	1823.3	1829.9	7.3	1827.782						
8	1833.9	1837.2								
14	1902.1	1906.1	11.5	1905.322	1905.971	-0.13	11.3551	0.649	2.0	0.78
15	1913.5	1917.6	10.7	1917.326	1917.326	-0.27	11.0307	0.000	0.0	0.27
16	1923.6	1928.3	9.0	1927.708	1928.357	0.06	9.0841	0.649	2.0	0.59
17	1933.7	1937.3	10.1	1938.090	1937.441	0.14	10.0574	-0.649	-2.0	-0.79
18	1944.1	1947.4	10.8	1950.094	1947.498	0.10	10.7062	-2.595	-8.0	-2.69
19	1954.3	1958.2	10.7	1960.475	1958.204	0.00	10.3817	-2.271	-7.0	-2.28
20	1964.8	1968.9	11.1	1972.479	1968.586	-0.31	11.3551	-3.893	-12.0	-3.58
21	1976.3	1980.0	9.5	1982.861	1979.941	-0.06	9.4085	-2.920	-9.0	-2.86
22	1986.7	1989.5	10.8	1993.243	1989.350	-0.15	11.0307	-3.893	-12.0	-3.74
23	1996.4	2000.3	12.7	2005.247	2000.380	0.08	12.3284	-4.866	-15.0	-4.95
24	2008.5	2013.0	11.1	2015.629	2012.709	-0.29		-2.920	-9.0	-2.63
25	2020.8	2024.1		2027.633						

Table 2. Dates of solar cycle maxima – Observed dates and correlation with dates of planetary tidal influence low points.

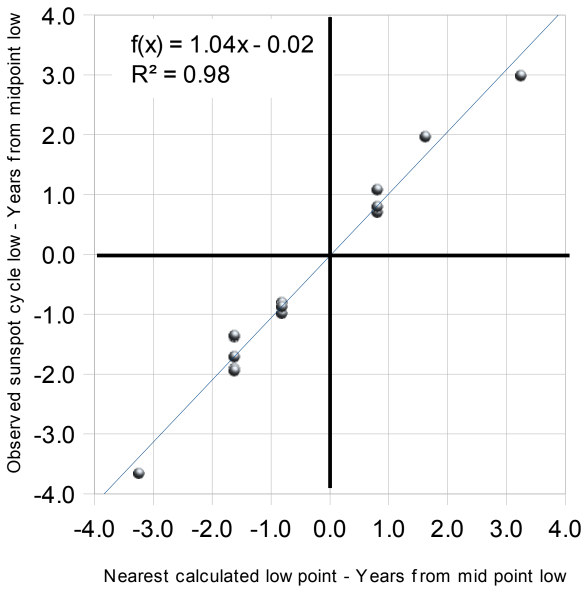


Figure 3. Years to R_{min} from MLP - Calculated vs observed.

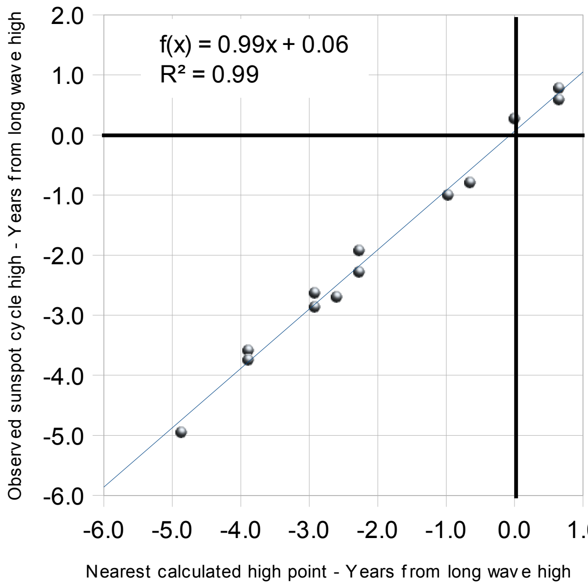


Figure 4. Years to R_{max} from LWP - Calculated vs observed.

Analysis of short term planetary tidal influence patterns

From a study of the graphs of planetary tidal influences and sunspot numbers, it is observed that there are two dominant types of short period waves. One is the IW previously referred to, with a period of 0.324 years. All of these IWs have a very similar form. They differ quite considerably in magnitude, some quite low. The second type has a period of approximately double 0.324, or about 0.648 years, thus can be called double tidal period (DTP) waves. The wave form can vary somewhat in shape, but because the high points are all above a tidal index value of about 2.8, all the

DTP waves are high in maximum magnitude. It is pointed out by Hung (1), in his Appendix B, that the effect of a tide producing planetary gravitational force is potentially proportional to the square of the time for which it acts. In the present context the mechanism involved in transferring the planetary gravitation forces into solar activity is as yet unknown, but it should follow that most DTP waves are likely to have somewhat more than four times the influence of the smaller IWs. This probability appears to be supported by the following analysis.

From a broader scan of the graphs we find a number of characteristic sequences of IW and DTP waves. These patterns appear to be consistently associated with epochs of increasing and decreasing solar activity respectively. They are defined as follows:-

Sequences associated with increasing solar activity. (Note: Acronyms used are also listed in Appendix B)

- Two adjacent DTP waves, (ADTP). This implies a long period of high tidal influence.
- A sequence of three IW highs rising in magnitude, (IWHR). In the most recognizable form of this pattern the three highs rise successively. In a slight variation the second high is a little lower than the first, but the combined effect appears to be similar.
- A sequence of three IW lows all clearly above the lowest LW, (IWLA). These normally occur concurrent with an IWHR sequence.

Sequences associated with decreasing solar activity:

- A sequence of three IW highs successively falling in magnitude, (IWHF).
- A sequence of three IW lows on or below the lowest LW, (IWLB) The centre low is usually noticeably lower than the ones on either side.
- A single high IW in the centre, with very low IW peaks on both sides, (IWC). This pattern usually overlaps with IWLB patterns on one or both sides. It implies a long period of low tidal influence, which may be seen as approximating the inverse of an ADTP.

The occurrence of these patterns in the tidal influences graph and their relationship to the concurrent solar activity is illustrated by reference to the graphs for the period from 1975 to 2000, covering cycle numbers 21 and 22, and part of 23. Cycle no.21 is annotated to identify the patterns defined above. All cycles differ somewhat in detail, but as a guide, cycle 21 is described in detail. Apparent minor anomalies are qualified.

To the left of cycle 21 R_{min} an IWHF + IWLB sequence occurs at the end of cycle 20.

1. Cycle 21 is initiated by the impulse from an ADTP pattern centred 0.25 years before R_{min}, which occurs at 1976.3.
2. The rising epoch is caused by the sequence: IWHR+IWLA; ADTP; IWHR+IWLA;ADTP.
3. The peak in solar activity occurs at a low IW at 1975.9.
4. The falling epoch is caused by the sequence: IWHR#+IWLB; IWC; IWLB; IWC; IWHF+IWLB; IWHF+IWLA*. #Although this is a rising pattern, the peaks are lower than those in the similar patterns during the rising epoch, and it is concurrent with an IWLB. *This appears to be a precurser to the start of cycle 22.

The following cycle 22 begins with an ADTP pattern centred at 1986.43, 0.27 years before R_{min} at 1986.7.

It is observed that, in most cycles within this study, the patterns are fairly consistently associated with the epochs in which they are defined above. However, some crossover does occur, such as noted at # and *. It is tentatively assumed that quantifying the tidal forces by integrating over the duration of the pattern would show that the resultant level of tidal influence would be consistent

with the position within the epoch in which an apparently inconsistent pattern occurs.

Looking at the patterns associated with R_{min} dates, it is observed that in all those cases when R_{min} coincides with an SPM point an ADTP is close to centred on that date, and in all those cases when R_{min} occurs midway between SPM points, there are ADTP patterns at each of those SPM points. It should be particularly noted that the tidal influence patterns that indicate when R_{min} occur do not usually coincide with MLPs, but over the time scale studied, they occur in a balanced distribution about the MLPs. The characteristics sequences appear so consistent that it should be possible to accurately predict the dates of future R_{min}.

The dates at which R_{max} occur appear rather less predictable. In very general terms they are observed to occur at or shortly after the last IWHR pattern within the cycle, or just before the first occurrence of an IWLB pattern in the cycle. Solar activity is observed to be very volatile at around the peak of the cycle, and it would appear that quite small differences in the level and/or sequencing of the tidal influence waves can cause the level of solar activity to more or less abruptly cease to increase and begin falling. As in the case of R_{min} dates, it is noted that those features of the tidal patterns that can be associated with R_{max} do not necessarily coincide with LWPs. The mean date of the distribution of R_{max} is about 2.0 years before the LWPs.

An important question is whether the characteristics defined can help to explain particularly low cycles of solar activity, such as no.s 5, 6 and 14. We do not intend to describe these in detail in the present study, but examination does indicate that the sequence of events during the rising epochs includes patterns that usually occur during the falling epochs, suggesting that they may be responsible for suppressing the rate of increase of solar activity in these cycles.

Results and discussion.

It was suspected that previous studies by Hung (1) and Martin (2) had yielded an incomplete analysis of the tidal influences of the planets Venus, Earth and Jupiter on solar activity. This study has confirmed that the database contained substantially more useful information which, when analysed, has provided much more detailed insights into the proposition that planetary tidal forces influence the solar activity that becomes manifest as visible sunspots and solar storms. In particular, the data not included in the earlier studies appears to define the dates of R_{min} with a fairly high degree of accuracy, and the dates of R_{max} to a lesser degree of accuracy.

The analysis has defined a cycle with an average period of 11.0307 years persisting over an indefinitely long period. This is within the range of the estimated average length of the sunspot cycle as determined in studies by many investigators over a long period of time. These estimates are quite numerous, so no attempt is made here to reconcile with any of them, but it is recognized that the accuracy of all estimates based on observed data can be adversely affected by variations in early dates of R_{min}. It is noted that a difference of only one year in an early date will, over twenty three cycles and about 250 years, mean a difference in estimated average length of about 0.04 years. e.g., if all the cycles from ~1600 are taken, including -12 to 23, the average cycle length is 11.056 years, but if -12 and -11 are disregarded, the average cycle length is 11.024 years. Recent R_{min} dates are of course accurate to within a small fraction of a year. A figure of 11.0307 years is therefore consistent with observations and appears highly credible as a fundamental parameter.

The average period above is derived from the sequence of 10.382 and 12.004 year periods within the 55.15 year LW. These occur in the ratio of three to two over time. From a statistical study of observed periods presented by Niroma. (3), in section 1.1.1., Table 3, there is strong evidence for the predominance of sunspot cycles with periods very close to 10.382 and 12.004, in nearly the same ratio. The presence of the 0.811 and 1.622 year increments is also clearly evident in that data. Thus the results of the current analysis are in close agreement with observed sunspot cycles.

One of the important findings of this study is that the dates of observed R_{min} and R_{max} are related to clearly definable temporal patterns of effectively greater or lesser tidal force arising from the

alignments of the planets Venus, Earth and Jupiter. One-to-one relationships are observed consistently over a two hundred year period. As noted by Hung, such an observation is quite at variance with the majority of long held opinion: that the planetary tidal forces are too small to have any effect on solar activity. Rigorous statistical checks have not been conducted, but there is such close agreement between observed and calculated solar cycle dates and activity that there must be a high level of confidence that the inferred relationships are real.

No attempt has been made in this study to systematically investigate the possibility that characteristics of the patterns could yield a reliable formula for estimating either the level of R at any point in the cycle, or the maximum value. One of the characteristic features of the sunspot cycle is the difference in the rate of rise of solar activity. Assuming that the basic findings of the current investigation are independently verified, it should be feasible to make a more detailed analysis of the cumulative effect of the tidal forces acting during the epoch of increase, perhaps leading to an estimate of the rate of rise in solar activity. That, coupled with an estimate of the date of R_{max} from the methods suggested by the current analysis, could provide a means of more accurately predicting the probable level of R_{max}.

Of the numerous methods purported to predict the level of sunspot activity, R_{max}, that using solar polar fields in the preceding cycle, as proposed by Svalgaard and Schatten (4), currently appears to offer the best fit with both observations and theoretically sound fundamentals. For the proposal that planetary tidal effects influence solar activity to be proved valid, it would then follow that we will also have to find a linkage between the tidal forces and changes in solar magnetic fields during the solar cycle.

Hung (1) has suggested that resonance in the Sun's, atmosphere may be a factor in amplifying the apparently small tidal influence of the planets. We understand that Hung, and apparently earlier investigators, have considered the sunspot cycle of eleven years as the candidate tidal resonance period. If resonance is involved, it seems that more likely candidates could be one or more of the repeated shorter periods of 1.622, 0.648, 0.324, and even 0.811 years in the tidal gravitational forces during the epoch of increasing activity. From our observations regarding the patterns associated with increasing and decreasing solar activity, the 0.648 year period could be the most likely candidate for a major natural frequency amplifying the effect of the planetary tidal forces, with 0.324 years as a second harmonic. On the other hand, resonance may not be a factor at all, the effect of tidal gravitation being simply a function of it's magnitude and the time for which it acts.

The principal objective of the work by Hung (1) was to examine the role of planetary alignments in relation to the timing of episodes of major solar flares and related phenomena. Planetary tidal forces were proposed as at least part of the mechanism involved in activating these events. No attempt has been made to correlate the results of the current investigation with the incidence of these phenomena, but it is reasonable to assume that a detailed scan through the patterns revealed in the current work could provide further insight into likely connections, possibly leading to more accurate predictions.

Conclusions

This study appears to have established a strong connection between the tidal forces resulting from the alignments of Venus, Earth and Jupiter and concurrent levels of solar activity. An accurate temporal framework is defined for determining the dates of R_{min}. The factors governing the timing of R_{max} are not as definite, but in many cycles it should be possible to also determine the dates of R_{max} within a fairly small range of probable dates. The current study gives considerable support to the proposals by Hung, and earlier investigators he cites, that such connections are a reality.

The observations regarding the nature of the tidal influence at different epochs within the solar cycle are qualitative, depending on a visual interpretation of the graphs of the index of planetary

tidal forces. Even at that level the conclusions appear quite definitive, but in order to further consolidate the argument, it will probably be necessary to take the analysis to a higher order, by quantifying the tidal forces and summing them over appropriate time intervals within each epoch.

In a paper recently submitted for publication Brajša et.al. (5) (6), have made several observations in relation to the efforts to predict cycle no. 24 using a number of different methods. As regards predictions using dynamo models they conclude: “All this makes the fine tuning of various dynamo models controversial for predicting future solar activity.” Also, after reviewing the viability of methods employing empirical, precurser, statistical or combined procedures, they state: “In summary, the topic of solar cycle prediction is still inconclusive to a large extent, which represents additional motivation for further research.” The methods used in such studies range from the relatively simple to the highly complex and sophisticated, but the general inference is that there are fundamental difficulties still frustrating the making of accurate predictions employing any method based on the processing of historical data. The nature of the planetary tidal influences observed in the current study, particularly as regards the irregularity of temporal variations that appear to most influence solar activity, highlight the nature of some of those difficulties when trying to use either modelling or the statistical analysis of past observations to frame predictions of the future.

Based on our conclusions above, it is proposed that we have now defined the basis of a new and very direct method for predicting the timing of future solar activity, which is essentially stochastic in relation to the known tidal forces acting on the sun during short contemporary periods.

A forecast of forthcoming cycle 24 is made in Appendix C.

References:

1. Hung, Ching-Cheh: Apparent Relations Between Solar Activity and Solar Tides Caused by the Planets; NASA/TM—2007-21487.

2. Martin, H.R.: Relations Between Solar Activity and Solar Tides Caused by the Planets Apparently Defined; *In private correspondence March 23rd., 2009.*

3. Niroma T.: One Possible Explanation for the Cyclicity of the Sun; *Internet site* http://personal.inet.fi/tiede/tilmari/sunspots.html

4. L. Svalgaard, K. H. Schatten: Predicting Solar Cycle 24 (Using Solar Polar Fields); SH51A-1593: AGU Fall 2008.

5. R. Brajša, H. Wöhl, A. Hanslmeier, G. Verbanac, D.Ruždjak, E. Cliver, L. Svalgaard, and M. Roth: A Prediction for the 24th. Solar Cycle: *Cent. Eur. Astrophys. Bull. Vol (2009) 1.1*

6. R. Brajša, H. Wöhl, A. Hanslmeier, G. Verbanac, D.Ruždjak, E. Cliver, L. Svalgaard, and M. Roth: On Solar Cycle Predictions and Reconstructions: 2009, *Astron. Astrophysics.,* In press.

Appendix A-1

The following pages of this Appendix contain the twenty five year period charts referred to in the text:-

A-2 Planetary tidal index and sunspot numbers – 1800 to 1825

A-2 Planetary tidal index and sunspot numbers – 1900 to 1925

A-3 Planetary tidal index and sunspot numbers – 1925 to 1950

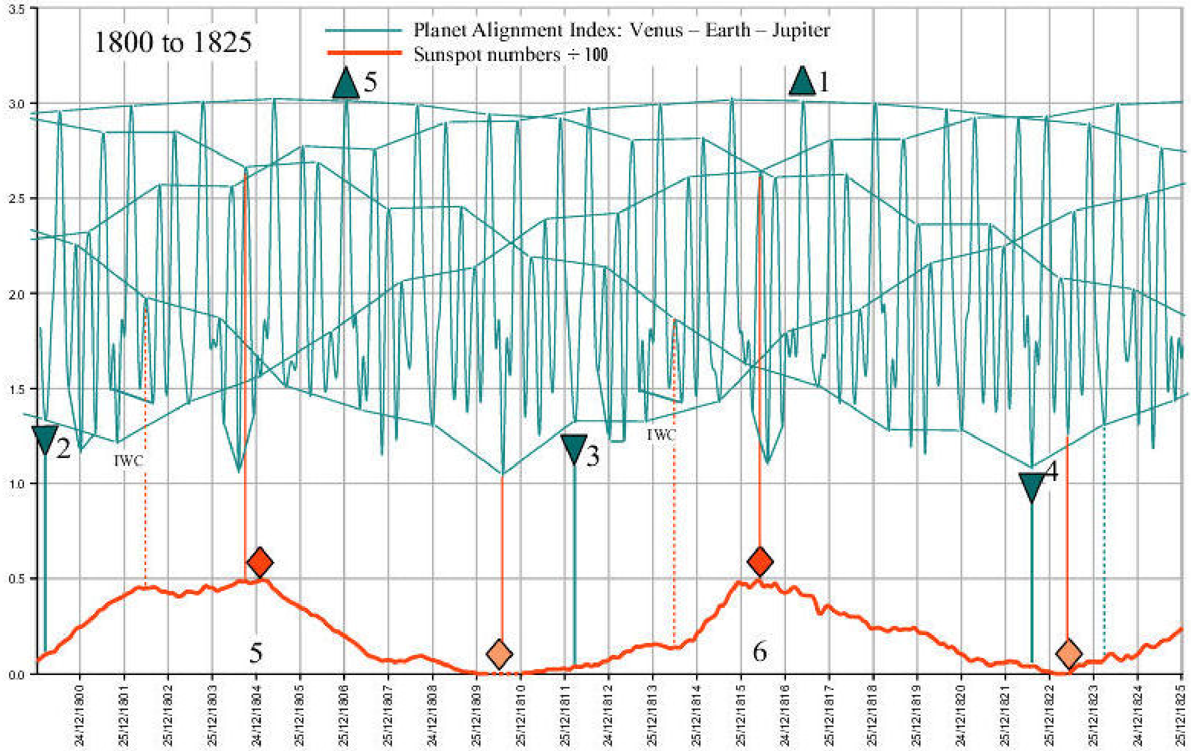
A-3 Planetary tidal index and sunspot numbers – 1950 to 1975

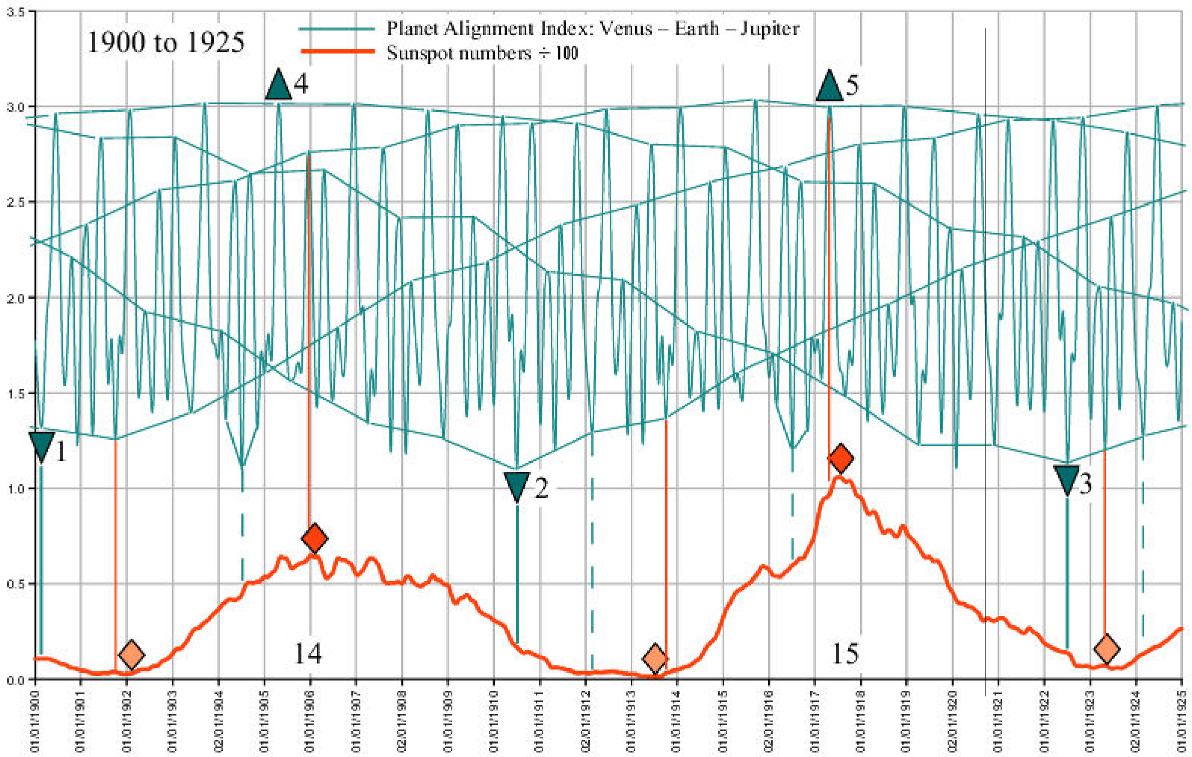
A-4 Planetary tidal index and sunspot numbers – 1975 to 2000

A-4 Planetary tidal index and sunspot numbers – 2000 to 2025

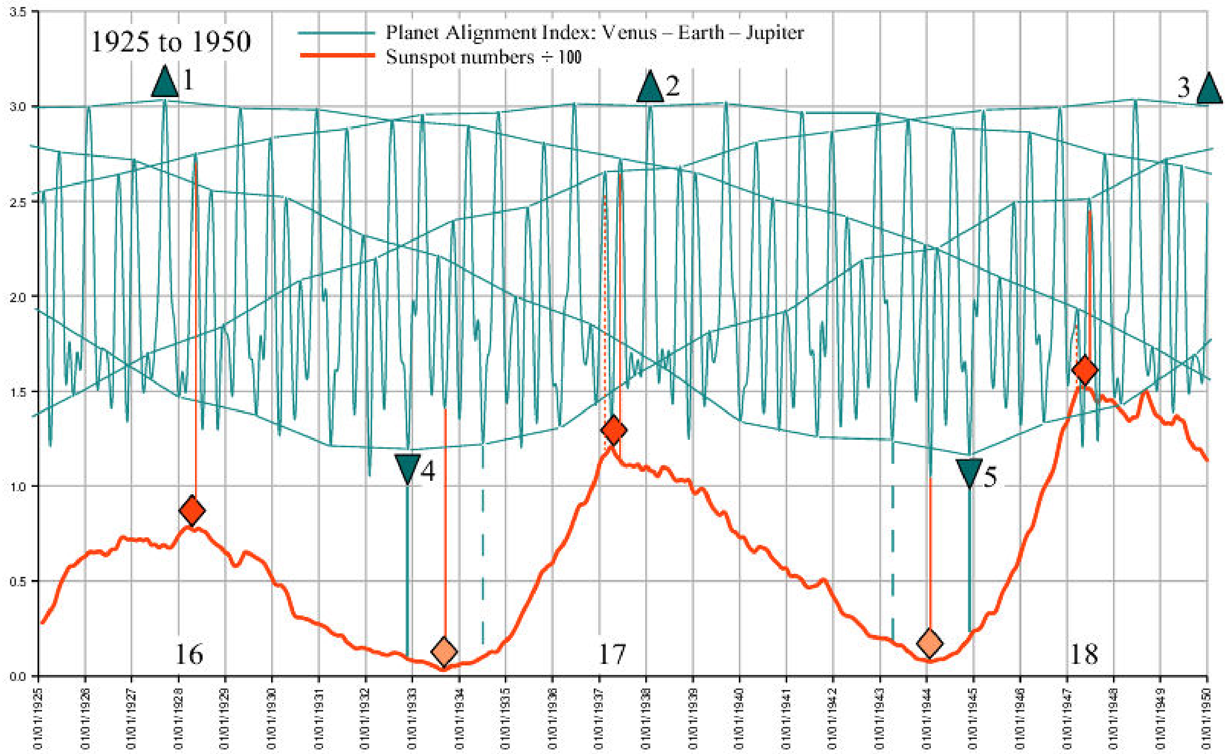
It is suggested that the full pattern of the interlinking long waves can best be appreciated by printing the charts and joining them together to form a continuous plot.

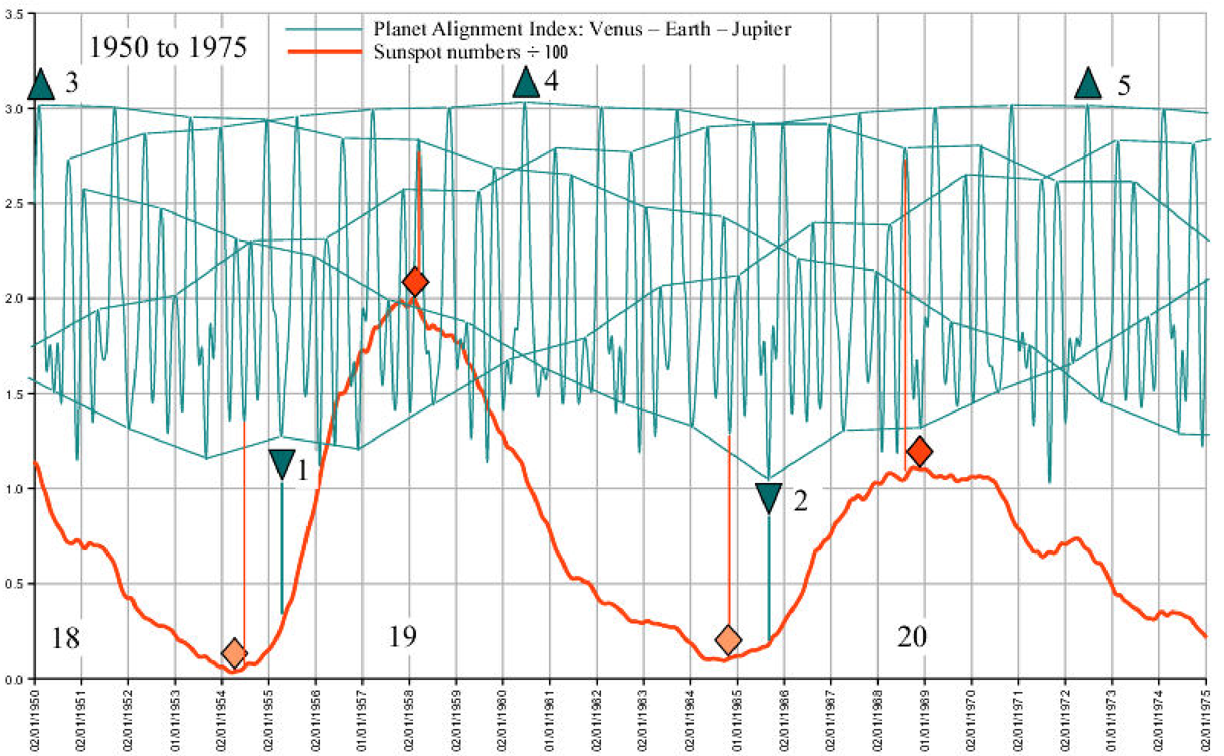
Appendix A-2


1800 to 1825
Planet Alignment Index: Venus – Earth – Jupiter
Sunspot numbers ÷ 100
IWC
IWC
5
6

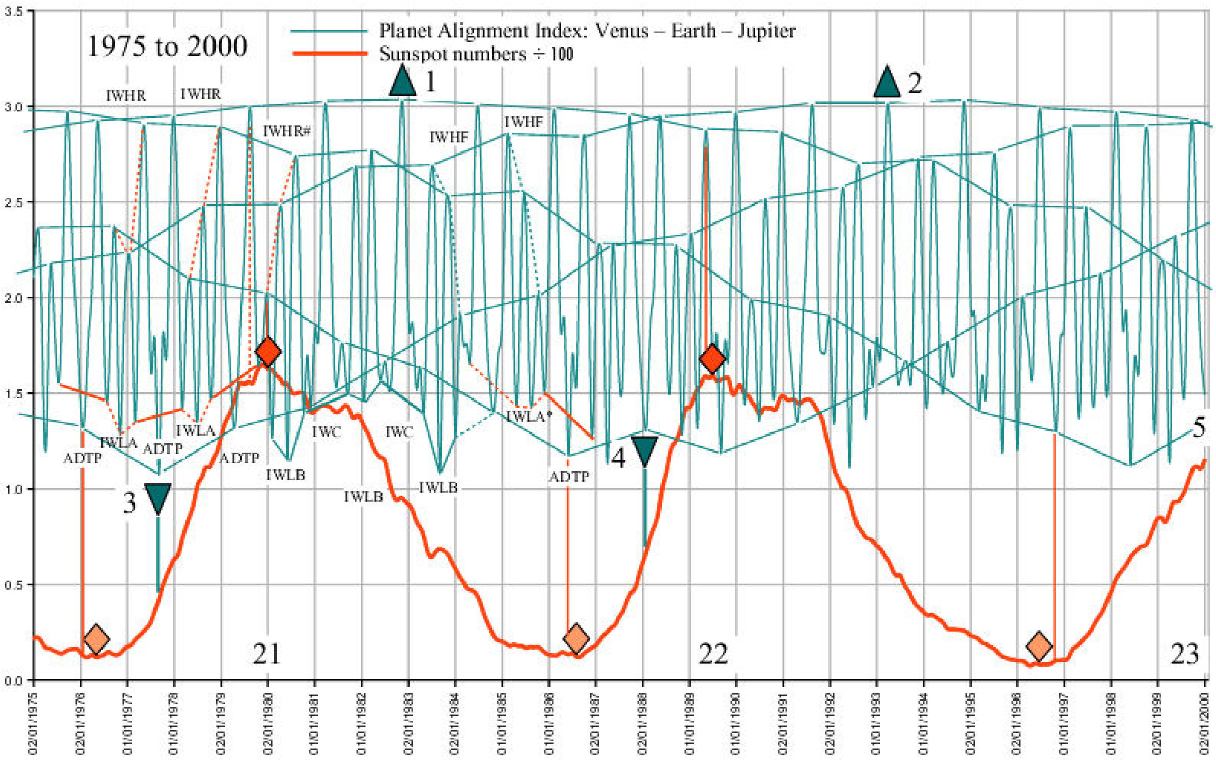

1900 to 1925
Planet Alignment Index: Venus – Earth – Jupiter
Sunspot numbers ÷ 100
14
15

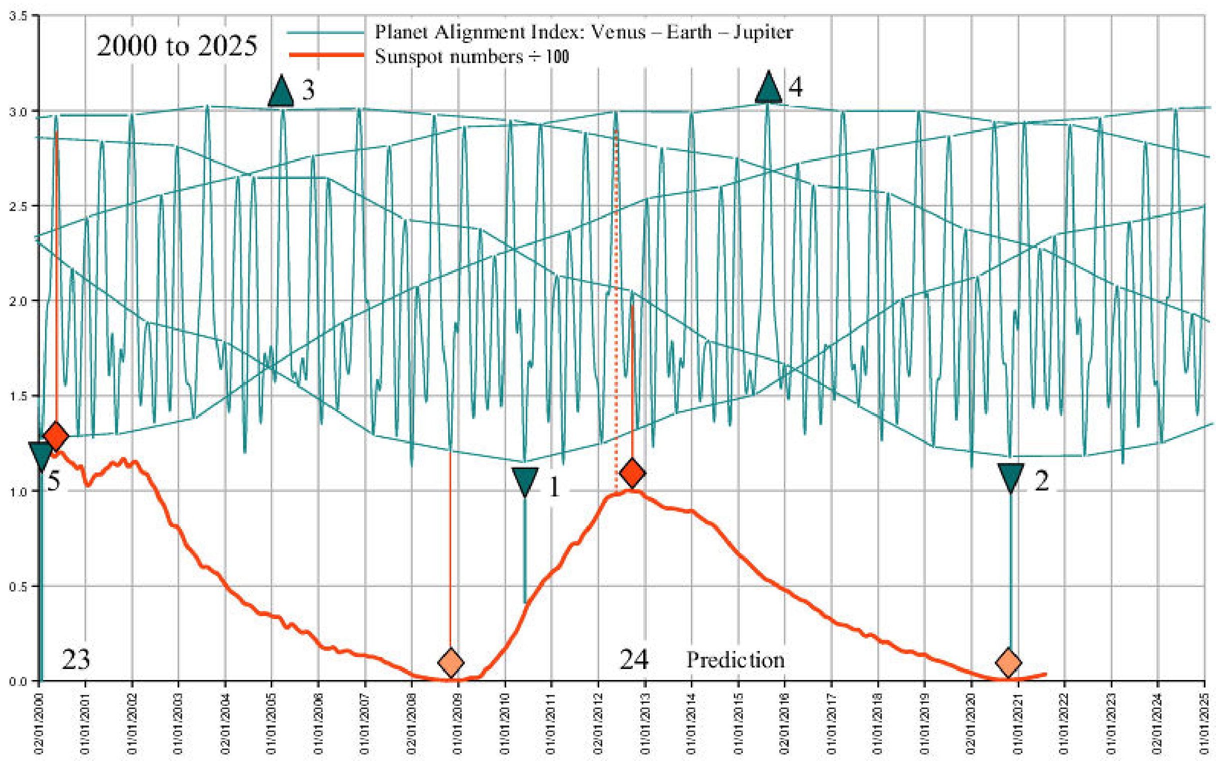
Appendix A-3


1925 to 1950
Planet Alignment Index: Venus – Earth – Jupiter
Sunspot numbers ÷ 100
16
17
18


1950 to 1975
Planet Alignment Index: Venus – Earth – Jupiter
Sunspot numbers ÷ 100
18
19
20

Appendix A-4


1975 to 2000
Planet Alignment Index: Venus – Earth – Jupiter
Sunspot numbers ÷ 100
IWHR
IWHR
IWHR#
IWHF
IWHF
IWLA
IWLA
IWLA*
ADTP
ADTP
ADTP
ADTP
IWC
IWC
IWLB
IWLB
IWLB
21
22
23
1
2
3
4
5


2000 to 2025
Planet Alignment Index: Venus – Earth – Jupiter
Sunspot numbers ÷ 100
3
4
5
1
2
23
24
Prediction

Appendix B

List of acronyms describing characteristic sequences of tidal gravity influence.

LW	Long wave. Period of 55.1533 years.
SP	Short period. Period of 1.6222 years. (55.1533 ÷ 34)
SPM	Short period marker point. Indicating either the high or low point of the SPs constituting a long wave.
IW	Intermediate wave. Period of 0.3244 years. (1.6222÷ 5)
LWP	Date at which a long wave peaks.
MLP	Date of the midway low point between the peaks of a long wave.
DTP	A single high wave approximately double that of an IW. Period of approximately 0.628 years. The shape and period of these vary a little because they are formed as the sum of shorter waves. This implies a period of higher tidal influence, but the effect appears to be significantly modified depending on the magnitude of adjacent waves on one or both sides.
ADTP	Adjacent DTP waves, i.e., two in immediate succesion. Period of approximately 1.256 years. The same comments re: period & shape apply. This implies a period of significantly higher tidal influence causing increased solar activity.
IWHR	A sequence of three intermediate wave high points successively increasing in magnitude. A variant of this has the middle high point slightly lower that the outer two, but this appears to have a similar influence. Both imply high and increasing tidal influence.
IWHF	A sequence of three intermediate wave high points successively falling in magnitude. This implies a low and decreasing tidal influence.
IWC	A single relatively high IW with very low magnitude waves on either side. This implies a period of particularly low tidal influence, conceptionally the inverse of ADTP.
IWLA	A sequence of three IW low points, occurring above the lowest LW line in the plot. A sequence with the centre low on or slightly below the low LW line may sometimes be classified as this type of pattern. This sequence usually reinforces an IWHR sequence, the resultant high tidal influence causing increased solar activity.
IWLB	A sequence of three IW low points, occurring below the lowest LW line in the plot. It implies a period of lower tidal influence. If occurring concurrent with an IWLF pattern it further reduces the tidal influence. If occurring concurrent with an IWHR pattern it tends to reduce the tidal influence.

Appendix C

A prediction of Solar Cycle No. 24

This prediction is based on application of the observations made in the body of the note. It assumes a direct correlation between likely levels of solar activity and the concurrent patterns of planetary tidal influence as defined.

It is first necessary to note the features associated with the last phase of the preceding cycle no.23. The last sequence is IWHF+IWLB during late 2007 and into early 2008, which is consistent within an epoch of falling solar activity. However it is noted that an ADTP sequence occurs between the second last and last IWHF+IWLB sequences. This is similar to the end phase of some preceding cycles, typically nos.20 and 21, and appears to be associated with a relatively rapid rise in solar activity in each of the following cycles. We speculate that this may imply a 'memory' in the Sun's atmosphere persisting for at least 1.62 years.

The observed low point between cycles 23 and 24 is currently given by SIDC as 2008.5. An ADTP is centred at 2008.82 at a SWM point 1.622 years before the next low point of LW 1, which would thus identify it as the NLP to the tentative date of the observed R_{min}. SIDC data for March 2009 still records sunspot activity as effectively zero. If this status continues it leaves open the possibility that the actual low point may be later than 2008.5. It could even move to about the start of 2009 before falling outside the range of relationships between R_{min} and NLP illustrated in Figure 3. However, the nature of the sequences observed at the end of cycle no. 23, together with the forthcoming sequences of tidal influence described below, indicate that solar activity is most unlikely to remain near zero for much longer, but will most probably begin to increase significantly during the next few months. These observations lead us to the conclusion that even if the R_{min} moves to a later date, it is most unlikely to occur any later than early January 2009.

The prediction:

1. It is therefore considered that Cycle 24 will begin at 2008.8, initiated by the impulse from the ADTP pattern centred on that date.
2. The sequence: IWHR+IWLA; ADTP; IWHR+IWLA;ADTP, occurs in the rising epoch. This is observed to have the same sequence, with almost identical magnitudes, as during the corresponding period of cycle no. 23. It is therefore assumed that the rate of rise in solar activity during the rising epoch of cycle no. 24 will most likely be about the same as in cycle no.23. There is at the moment no valid reason for assuming it will be significantly higher or lower.
3. The peak in solar activity appears likely to occur at either the SPM point at 2012.39 or the low magnitude IW peak at 2012.71. Either of these could then be taken as the NHP. They are both close to the mean of the distribution of R_{max} in relation to the following LWP, in this case LW 4. The nature of the preceding and succeeding sequences infer with a high degree of probability that these dates represent the earliest and latest dates at which R_{max} will occur.
4. The sequence: IWHR#+IWLB; IWC; IWLB; IWC; IWHF+IWLB; IWC; IWHF+IWLB; ADTP*; IWHF+IWLB, occurs in the falling epoch. (#Although this is a rising pattern, the peaks are lower than those in the similar patterns during the rising epoch, and it is concurrent with an IWLB. This combination sequence is, in earlier cycles, associated with the first fall in solar activity after the peak.) (*This appears to be a precurser to the start of cycle no. 25.) The succession of IWLB sequences well below the lower LW cycle line, alternating with IWC sequences, is unprecedented in all of the former cycles plotted. This appears to imply that the fall in solar activity after the peak around 2012.4/2012.7 will initially be moderate, but followed by a more rapid decline into an extended period of low activity before R_{min}.

5. The most probable point for R_{min} is at 2020.82. The preceding sequences of IWLB and IWC patterns appear to preclude any possibility of an earlier date, and the series of sequences following suggest that cycle no. 25 will begin immediately.

The predicted nominal length of the cycle is 12.0 years.

The predicted form of the sunspot cycle is plotted on the graphs for the period 2000 to 2025. It is noted that by combining what appears to be a small range of dates for R_{max} together with an 'educated guess' for the rate of increase in solar activity, leads to a value for R_{max} of about 100. A semi quantitative and somewhat cursory comparison of the rates of rise in relation to concurrent patterns, as observed over a range of previous cycles, suggests that the spread of values could be around +10 to -20, i.e., from 80 to 110. This outcome is somewhere between the lower predictions based on long term cycles and higher predictions based on dynamo based models.

This prediction suggests average to lower solar activity during the period, particularly in the falling epoch. This could imply generally cooler conditions on earth but not, on the basis of present evidence, severe enough to be associated with the imminent onset of a 'little ice age', considered as a strong possibility by others.

Appendix D

Fibonacci numbers found in the pattern – nearly.

The actual ratio of the orbital periods of Earth and Venus is 1.62552. This is commonly thought of as being related to the ratio of two of the smaller Fibonacci numbers, i.e., 13:8, or 1.62500. This appears reasonable, since they differ by only 0.03%. It is noted that the ratio between the orbital periods of the planets is sometimes purported to be Φ, the Golden Mean, but the value of 1.61803 differs from the actual orbital ratio by 0.46%. The Fibonacci number ratio is therefore much more closely related to the reality.

In this study the short period is 1.6222 years, which appears correct to at least the third decimal place. This differs from the actual ratio of the orbital periods by 0.20%, and from the ratio of Fibonacci numbers by 0.17%. It might be supposed that the short period would be closer to 1.62552, but the difference appears to be real. These small differences are unimportant for the present study, and are merely mentioned as a factor that may require a closer understanding. The proximity of such events to both the 13:8 ratio and Φ is always intriguing.

The Fibonacci number, five, is implicated because there are five long waves, the spacings of which which are based on the five divisions of the short period.

For whatever reason, not obvious at first sight, there are thirty four short wave periods in all long waves, another Fibonacci number.

The duration of all long periods is 55.153 years, within 0.28% of the Fibonacci number 55. The small difference is of course due to the accumulated differences between the 1.6222 year short period and the actual ratio of 55:34, which is 1.6176. The latter is still only an approximation to Φ in the converging series.