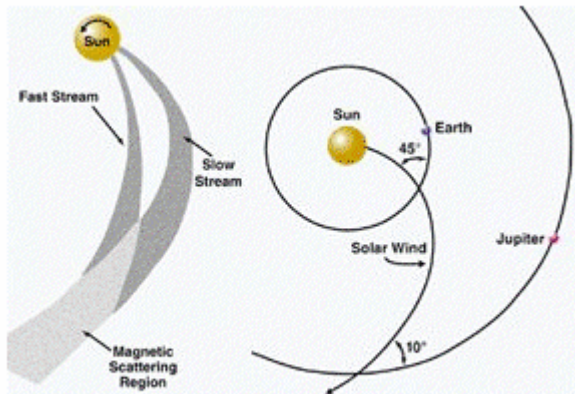


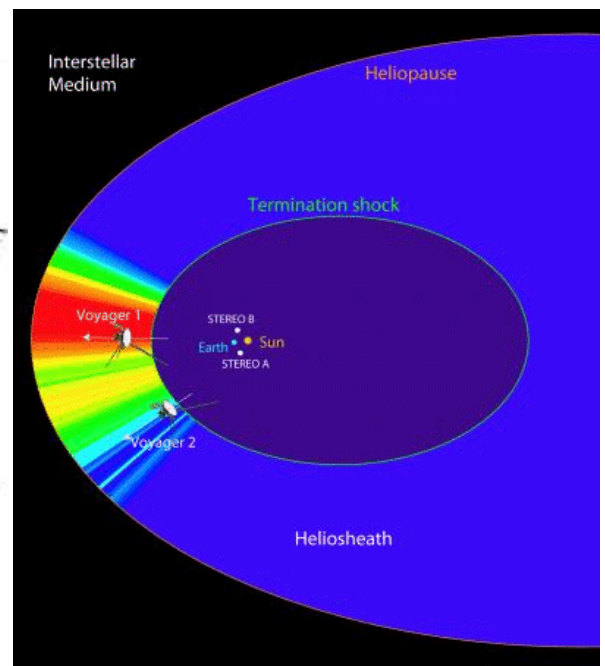
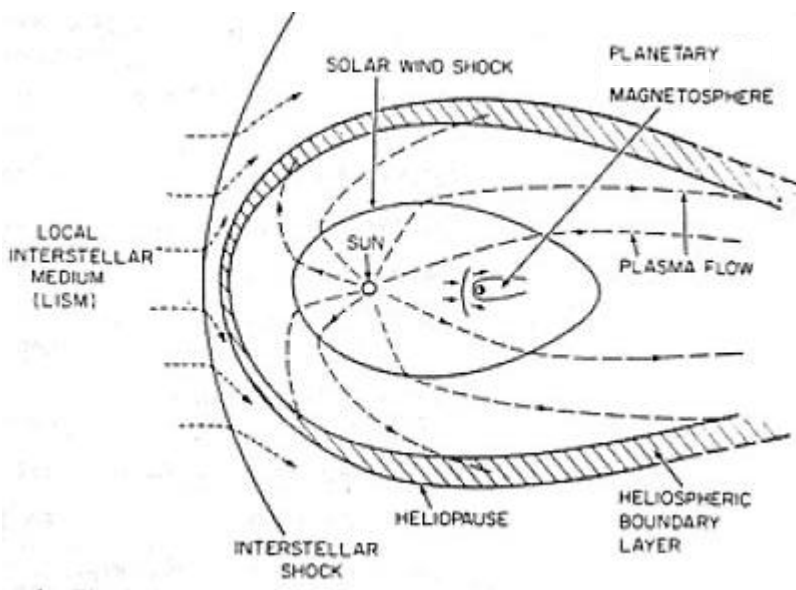
Evidence of a sub-cycle within the existing solar cycles

The Solar Current article considers a possible link between solar periodic activity and orbital properties of the major planets i.e. Jupiter and Saturn, which might be achieved via a feedback as a result of energy exchange between heliospheric current and planetary magnetospheres. If the above is valid for the Jupiter / Saturn than the Earth's magnetosphere should exert similar effect.



The heliospheric current sheet propagates along a spiral shape. The amount of energy extracted out from the heliospheric current by a particular magnetosphere may not vary greatly along its orbital path (if heliosphere was homogenous in all directions), except in the case when two planets line up producing 'magnetospheric eclipse'. In such case heliospheric current will change, hence modulation.

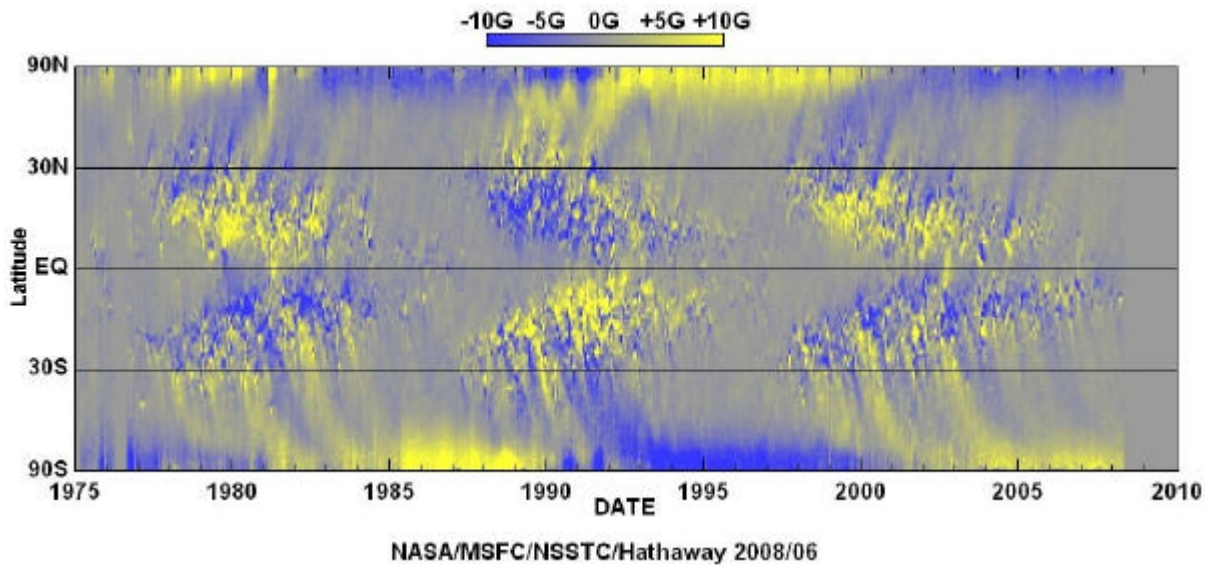
The heliosphere is not homogenous in all directions, it is distorted by galactic magnetic field created by the presence of cosmic rays. The strength of solar magnetic field varies considerably at the head side. As individual magnetospheres enter this particular area then their contribution to the overall feedback (mainly provided by Jupiter) will vary. The effect will be strongest with



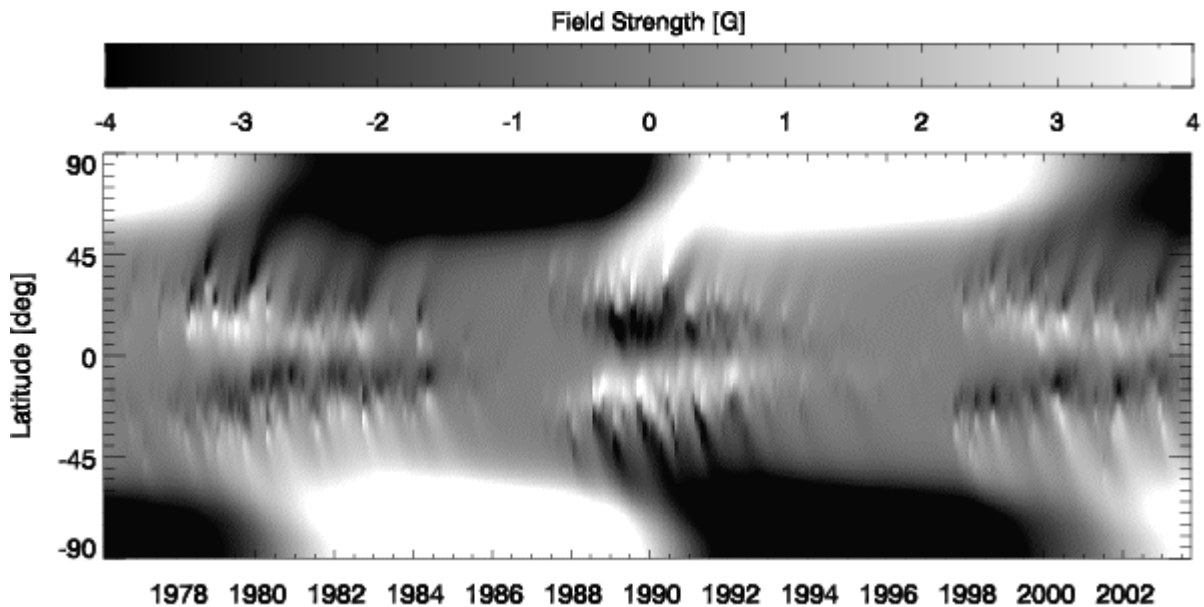
the outer planets (Jupiter onwards), while it is likely by the time effect reaches 1AU (Earth), possibly drops to negligible values. It is also obvious that the outer regions of the Jupiter's magnetosphere (which extends up to 10 AU, as far as Saturn's orbit) may have significant effect on the contribution to its own feedback.

It has been recently discovered that this particular area is prone to incursion by strong of cosmic rays and does not abruptly stop at the termination shock but most likely extend much closer to the centre of the solar system, which again may significant effect on the possible feedback as the major magnetospheres enter the area.

Existence of this inhomogeneous area of the heliosphere, may be reason for inability to precisely define SSN extremities to spatial Jupiter- Saturn relationship.



The sub-cycle patterns are also visible on (NASA)sunspot diagrams



The Earth – Jupiter synodic period (398.88 days = 1.092822 years) therefore its effect should be detectable within the familiar 11-year solar cycles. Numerical analysis for all of the 23 solar cycles appears to show presence of a short-term sub-cycle (see the Appendix pages). Most of the normal cycles, contain 3-4 (some even 5) sub-cycles, mainly evident during time of the more intense part of the normal cycle.

Detected subcycle appears not to be an actual cycle made of sunspot groups, it is a modulating cycle. This means that if there is an ordinary 11 year cycle in its progress then subcycle may modulate its amplitude. When subcycle is ‘negative’ it suppress amplitude of the main cycle, while when subcycle is high it has no effect. It follows that subcycle is most obvious when 11 year cycle is strong while if main cycle is at its minimum then subcycle may not be detectable.





The analysis of the individual cycles is done in the following manner:

Available monthly data is filtered to eliminate long term (11-year cycle) but preserving the short-term variability. This is achieved by deducting a long-term moving average (over period of 23 months centered on the actual monthly value) from the monthly value itself. Obtained values are used to calculate short-term average by employing a moving average (from filtered monthly data) over period of 5 months.

The analysis shows that the period short-term average has a period of 1.092 years.

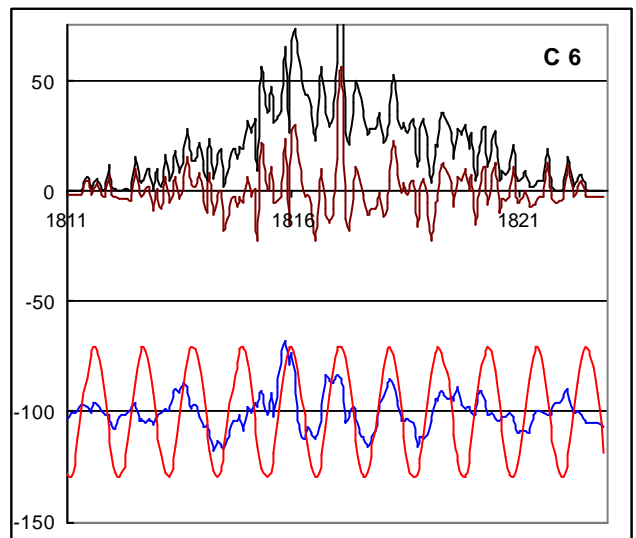
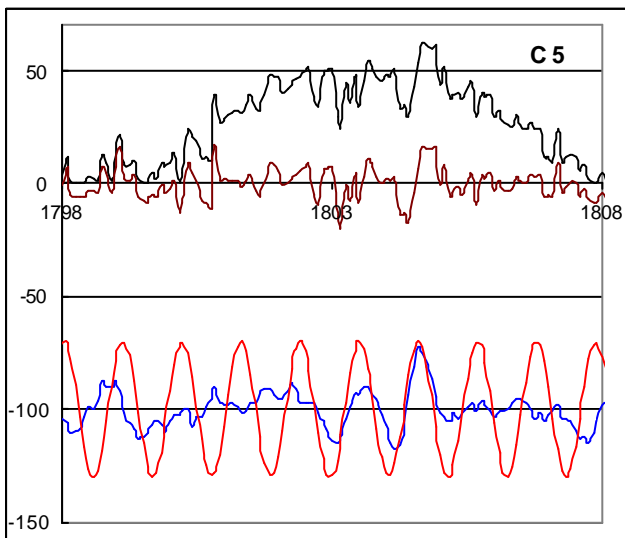
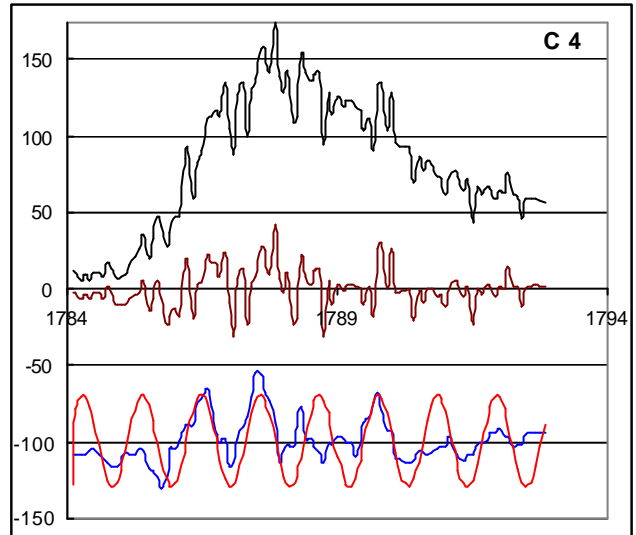
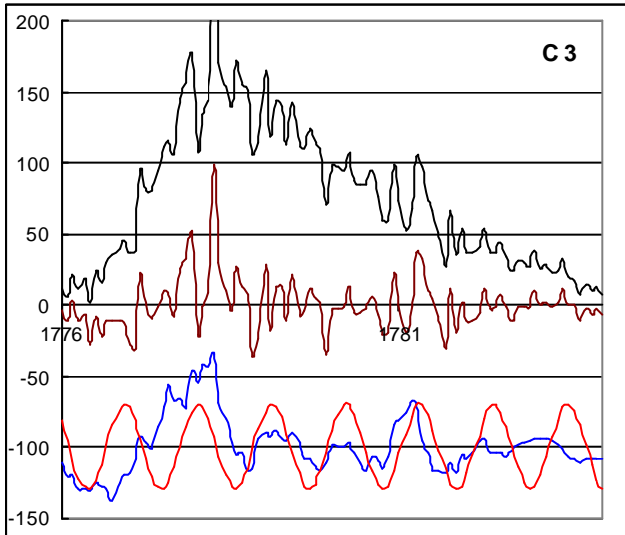
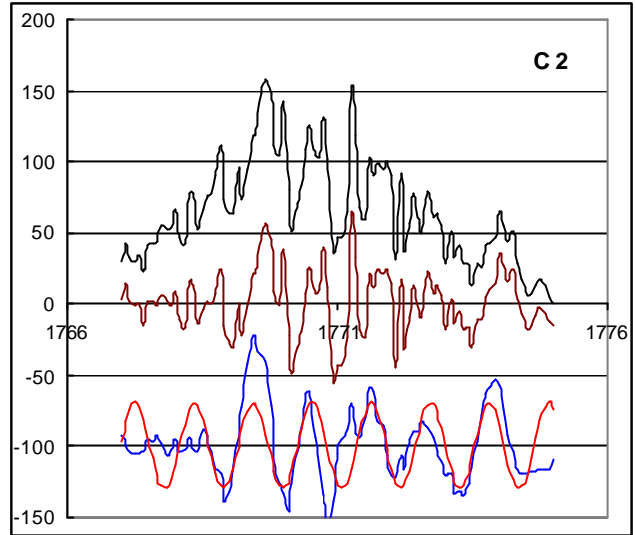
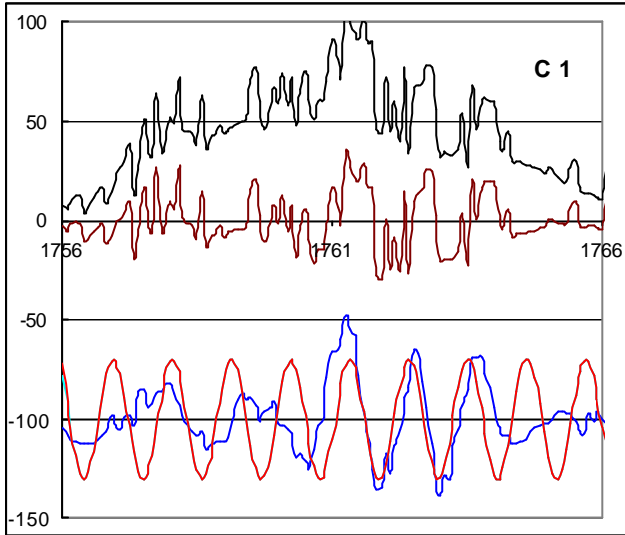
Note: For the base of the moving average calculations, in order to avoid appearance of a false periodicity, prime numbers (5 and 23) are used. The long-term moving average is calculated over period for at least 24 months preceding and following the cycle under the consideration. If the complete historic period for all of the 23 cycles is considered than oscillating phase shift can be observed.

Graphical representation for each of the 23 solar cycles (in the appendix) contains:

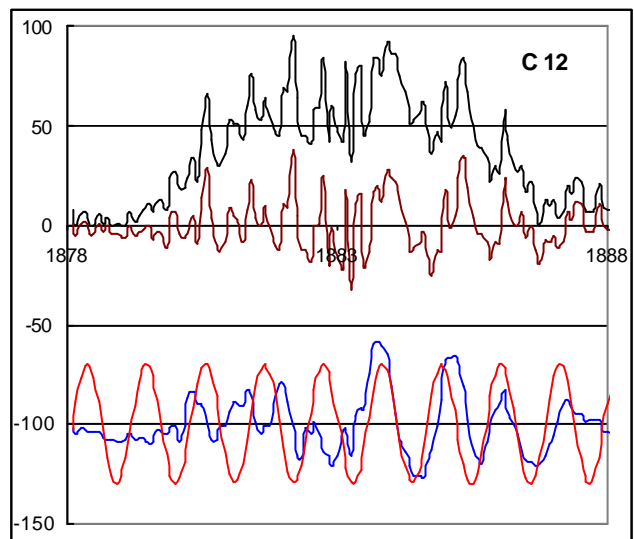
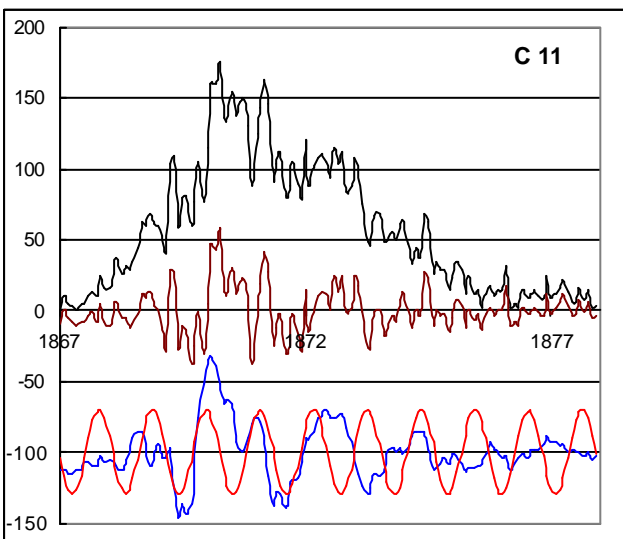
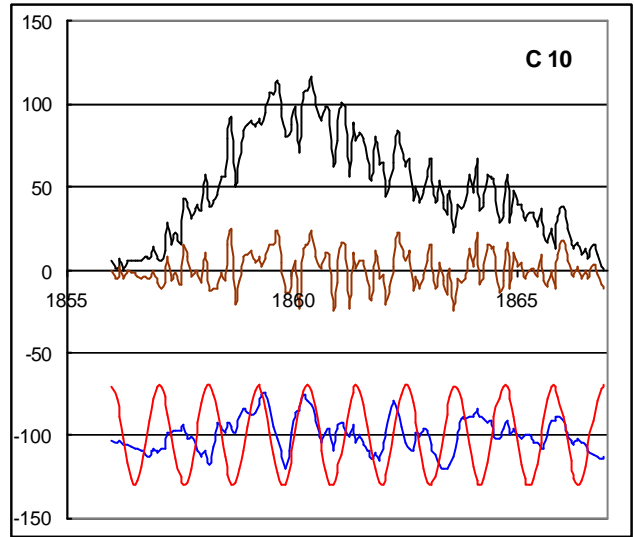
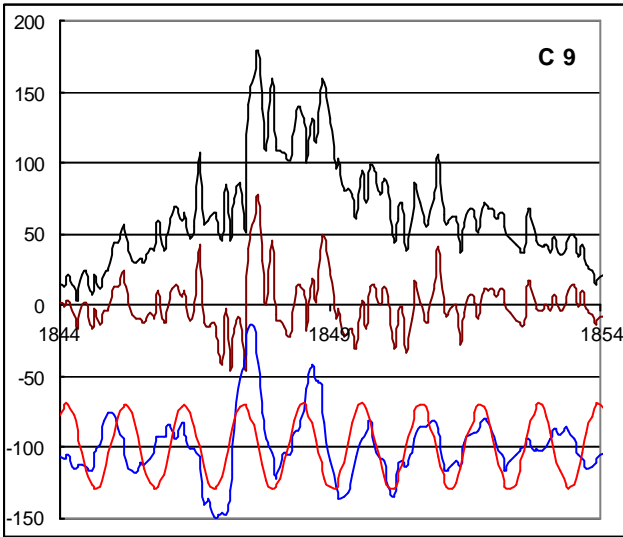
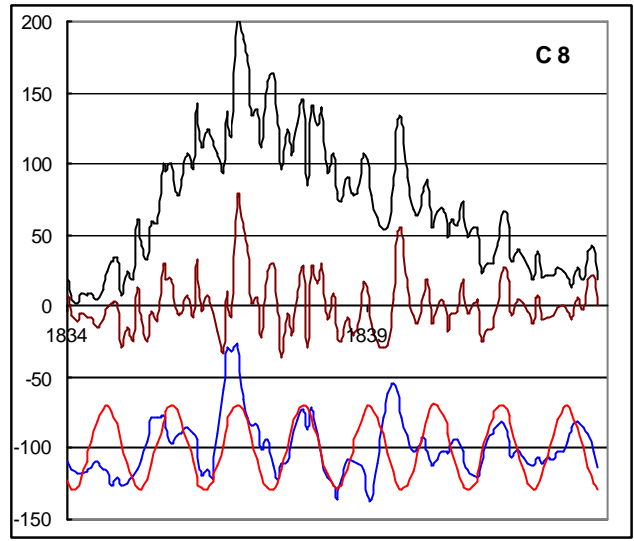
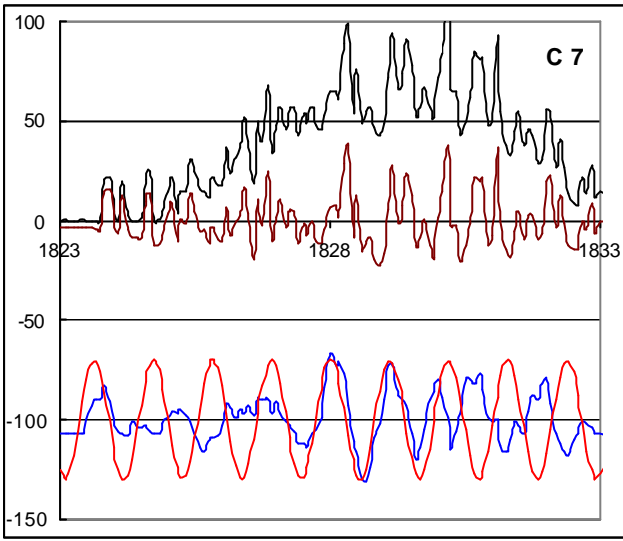
- monthly sunspot data – top(black) line 
- filtered monthly data – middle (brown) line 
- short term average - bottom irregular (blue) line 
- 1.092 years periodicity- bottom regular (red) line 

see appendix on the next pages

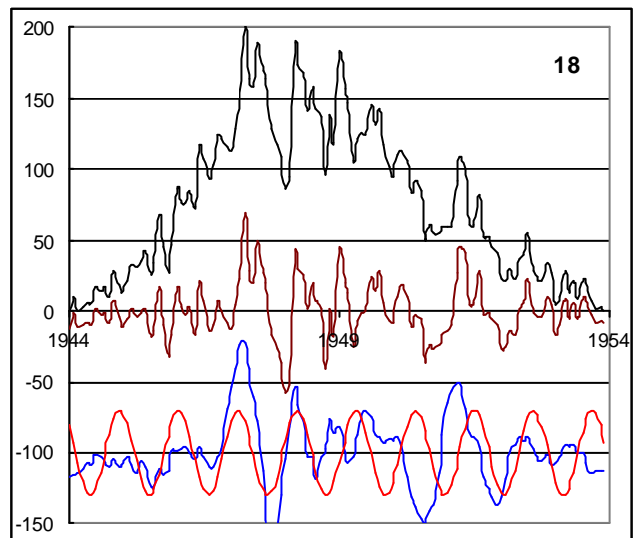
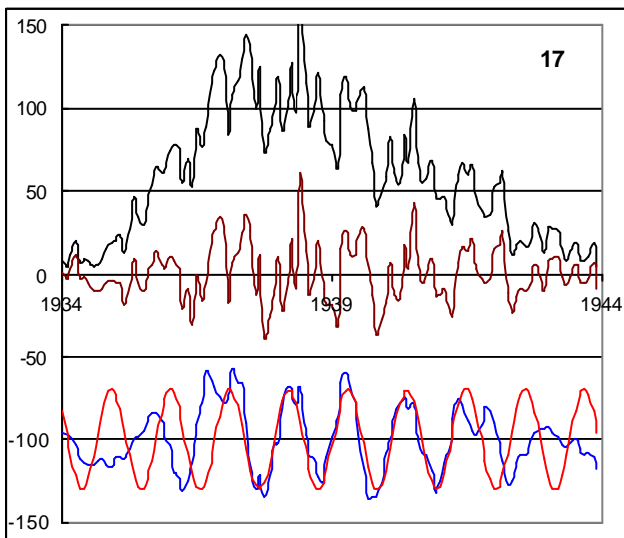
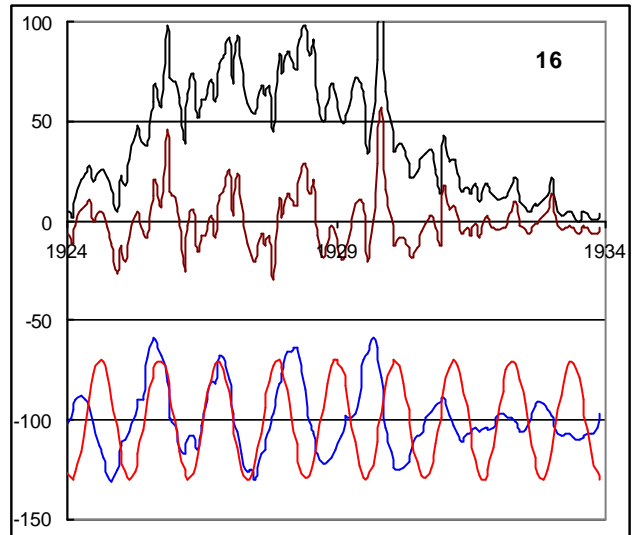
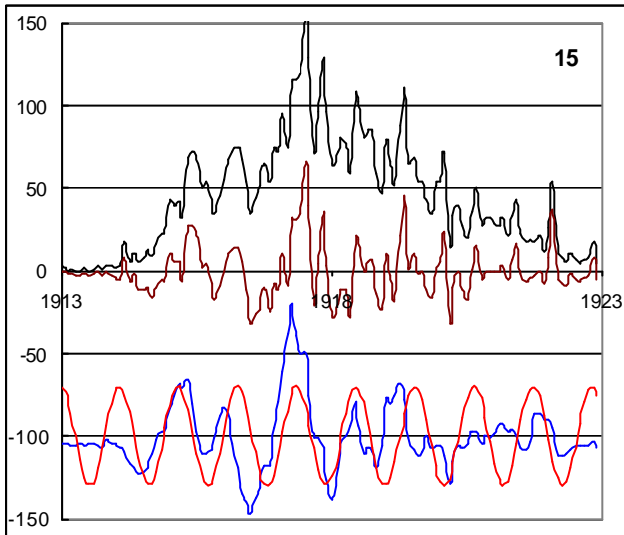
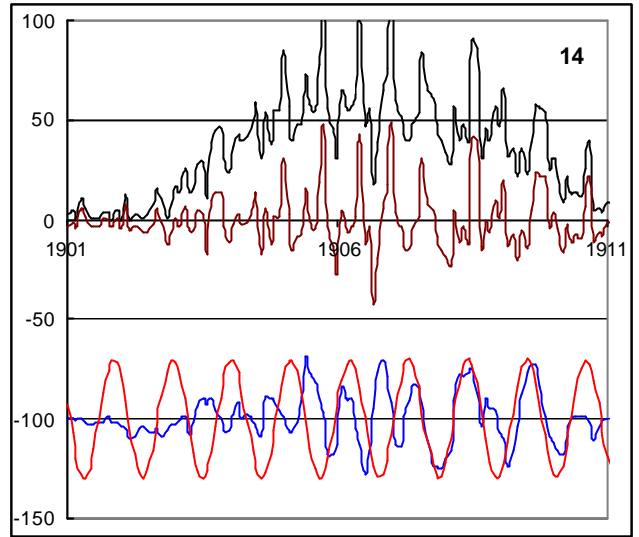
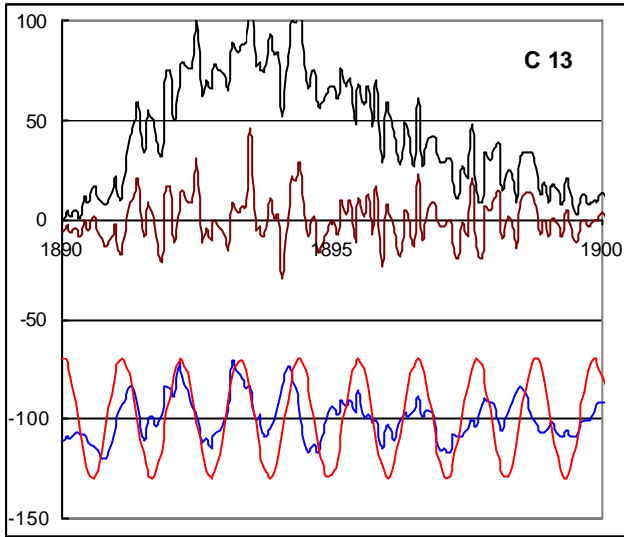
APPENDIX



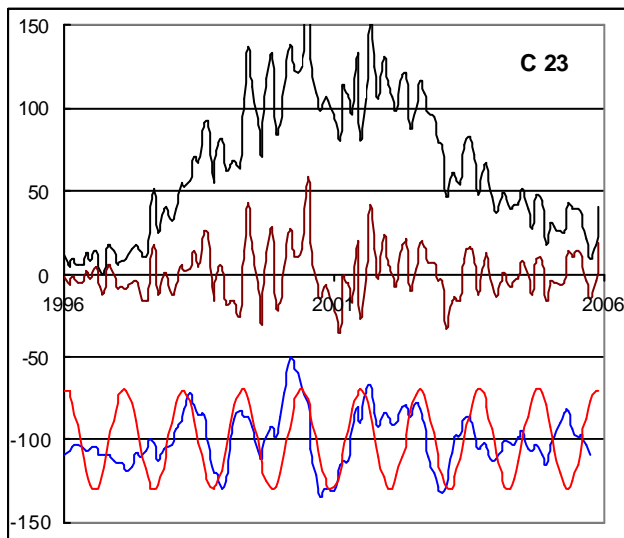
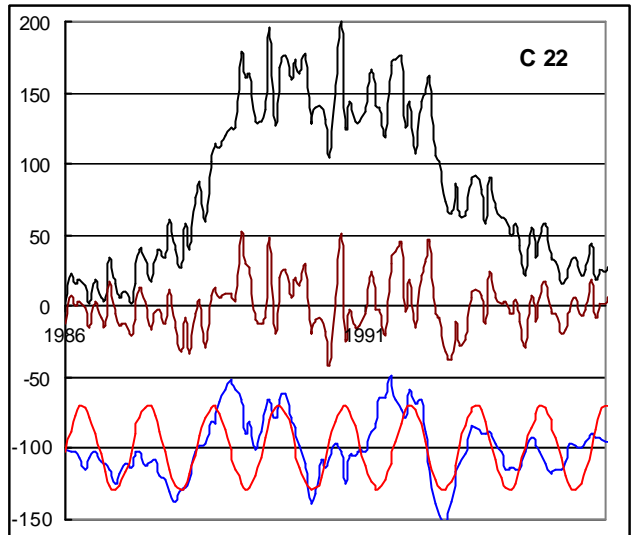
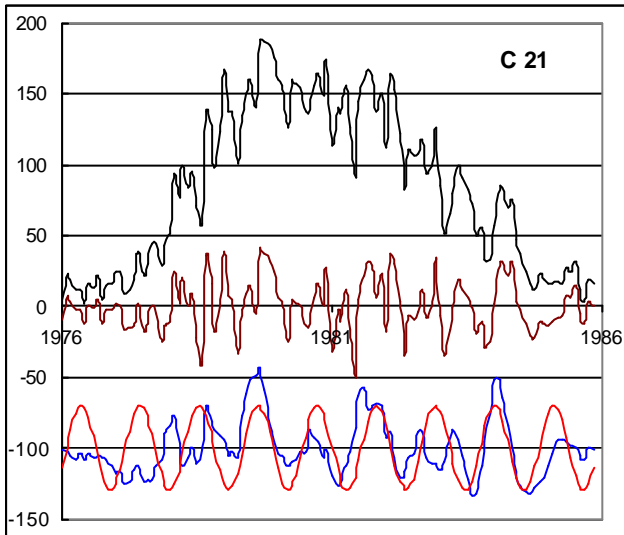
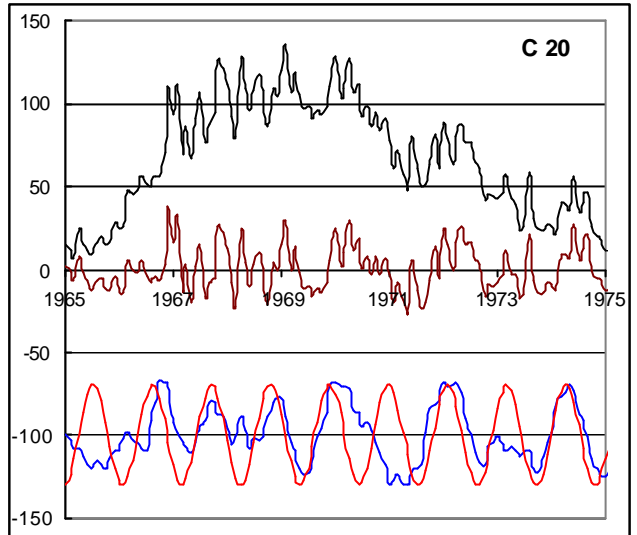
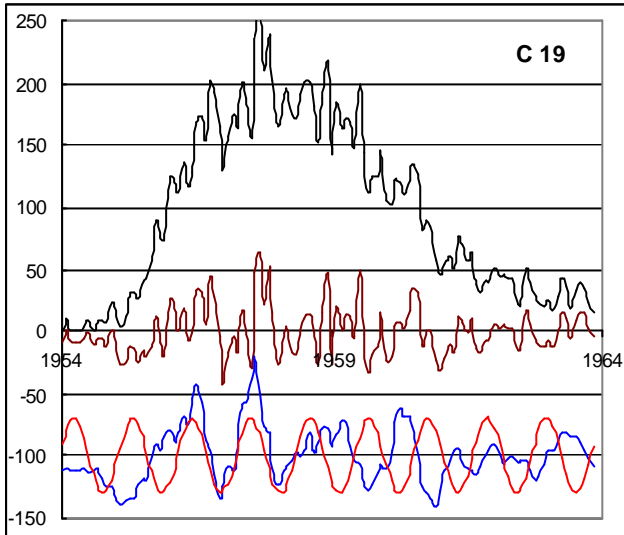
APPENDIX



APPENDIX



APPENDIX



- Legend:**
- monthly sunspot data
 - filtered monthly data
 - short term average
 - sub-cycle frequency