



*The Solar System Large Planets influence on a new Maunder Minimum*

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In 1890's G. Spörer and E. W. Maunder (1890) reported that the solar activity stopped in a period of 70 years from 1645 to 1715. Later a reconstruction of the solar activity confirms the grand minima Maunder (1640-1720), Spörer (1390-1550), Wolf (1270-1340), and the minima Oort (1010-1070) and Dalton (1785-1810) since the year 1000 A.D. (Usoskin et al. 2007). These minimum periods have been associated with less irradiation from the Sun and cold climate periods on Earth. An identification of a three grand Maunder type periods and two Dalton type periods in a period thousand years, indicates that sooner or later there will be a colder climate on Earth from a new Maunder- or Dalton- type period. The cause of these minimum periods, are not well understood. An expected new Maunder-type period is based on the properties of solar variability. If the solar variability has a deterministic element, we can estimate better a new Maunder grand minimum. A random solar variability can only explain the past.

This investigation is based on the simple idea that if the solar variability has a deterministic property, it must have a deterministic source, as a first cause. If this deterministic source is known, we can compute better estimates the next expected Maunder grand minimum period. The study is based on a TSI ACRIM data series from 1700, a TSI ACRIM data series from 1000 A.D., sunspot data series from 1611 and a Solar Barycenter orbit data series from 1000. The analysis method is based on a wavelet spectrum analysis, to identify stationary periods, coincidence periods and their phase relations.

The result shows that the TSI variability and the sunspots variability have deterministic oscillations, controlled by the large planets Jupiter, Uranus and Neptune, as the first cause. A deterministic model of TSI variability and sunspot variability confirms the known minimum and grand minimum periods since 1000. From this deterministic model we may expect a new Maunder type sunspot minimum period from about 2018 to 2055. The deterministic model of a TSI ACRIM data series from 1700 computes a new Maunder type grand minimum period from 2015 to 2071. A model of the longer TSI ACRIM data series from 1000 computes a new Dalton to Maunder type minimum irradiation period from 2047 to 2068.