

## **22-year Dominant Cyclicity in Solar/Heliospheric Activity during the Maunder Minimum**

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The question of the temporal behaviour of solar magnetic activity and related heliospheric and magnetospheric activity during the period of greatly suppressed activity, the Maunder minimum, is important for understanding of the underlying processes. In particular, it is very important to know whether the 11-year cycle was still present during the Maunder minimum and whether its length and phase were kept. Here we review all available data, both direct and indirect, to reveal the cyclic pattern of activity during the Maunder minimum. Although directly observed sunspot activity was extremely low during the deep phase of the minimum, it was shown to tend appearing with roughly 22-year period. A sub-dominant 11-year cycle also can be recognized. More information about the solar activity can be found using indirect proxy data. Cosmogenic isotope abundance in terrestrial archives is a proxy for cosmic ray flux which is modulated by solar magnetic activity and solar wind. The content of <sup>14</sup>C in tree-rings shows the dominant 22-year cyclicity during the Maunder minimum as well as during the Spörer minimum. On the other hand, <sup>10</sup>Be in polar ice shows a clear 11-year cycle which is, however, in phase with solar activity. The available records of aurorae observed at middle latitude, which serve as a proxy for transient interplanetary phenomena, also depict a dominant 22-year periodicity during the Maunder minimum as well as the nitrate concentration in polar ice, which keeps record of strong solar particle events. Accordingly, most of the available data sets suggest that solar activity varied regularly with the dominant roughly 22-year cyclicity during the Maunder minimum. A weak sub-dominant 11-year cycle emerged towards the end of the period. The phase of the solar cycle was kept throughout the Maunder minimum implying that the operation of dynamo was not interrupted or disordered. We also discuss the possible origin of the behavior of the <sup>10</sup>Be data which is different from all other parameters during the Maunder minimum.