

Variation of the carbon-14 content in tree rings during the Maunder and the Spoerer Minima

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In this paper, the features of the eleven-year solar cycle during the Maunder Minimum (1415-1715 AD) and the Spoerer Minimum (1415-1534 AD) will be reported. We have investigated the variations of carbon-14 content in tree rings from these periods, which reflect the state of solar wind and the interplanetary magnetic field. The measurements have been completed for the periods 1413-1554 and 1631-1739 AD with annual time resolution. The data were analyzed for periodicity using the S-transform together with the carbon-14 record obtained by Stuiver et al. (1998) and the beryllium-10 record obtained using ice cores from Greenland (Beer et al., 1998). The spectra of the S-transform have shown the signal of the eleven-year and the twenty-two year solar cycle for both of the periods, suggesting that cyclic solar magnetic activity had maintained through the periods investigated. The signal of the eleven-year cycle, however, seems to have been modulated around the period of 1455-1510 AD during the Spoerer Minimum. There is a possibility that the length of the eleven-year cycle had been stretched to about 13-14 years around 1455-1475 AD. On the other hand, any significant signal was detected for the period around 1495-1505 AD, suggesting that the amplitude of the eleven-year cycle was strongly suppressed during this period. This suppression might be due to the modulation of galactic cosmic rays depending on solar magnetic polarity (Jokipii 1981, Kota and Jokipii, 1983), which will be clues to determine the transition of polarities during the prolonged sunspot minimum. While, the average length of the eleven-year cycle during the Maunder Minimum seems to have been around 14 years. The spectrum of the S-transform obtained from the beryllium-10 record has also shown the signal of slightly longer "eleven-year" cycle for the periods corresponding to the Spoerer, Maunder and Dalton minima.

References

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