On Long-Term Variability of Solar Activity

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Early studies of solar activity focused on the search for periodicities such as the 1 l-year cycle, the secular Gleissberg modulation and more long periods. Here we study the non-periodic continuum variations in the series of ^{14}C data for the time interval from about 6000 BC to 1950 AD. We use a simple analytical tool, the calculation of the Hurst exponent. This exponent describes the coherence or persistence in a long time series. We find a constant Hurst exponent, suggesting that solar activity in the frequency range of from 100 to 3000 years includes an important continuum component in addition to the well known periodic variations, The value we calculate, H ~ 0.8, is significantly larger than the value of 0,5 that would correspond to variations produced by a white-noise process. This value is in good agreement with the results for the, monthly sunspot data reported elsewhere, indicating that the physics that produces the continuum is a correlated random process and that it is the same type of process over a wide range of time interval lengths, As far as the effect of solar variability on climate is concerned, the solar irradiance has been found to change by a factor of 0,1% during the last solar cycle. A change of irradiance of about 0,5% is needed to produce an effect the Earth's climate, We have found that the time period over which such a change in solar activity can be expected to occur is significantly shorter than that which would be expected for variations produced by a white-noise random process.

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