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Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

Evidence for significant solar signatures in some 20th century geophysical and climatological time series

J.-L. Le Mouël and V. Courtillot

Institut de Physique du Globe de Paris, 1 rue Jussieu, 75005 Paris, France

Over the past five years, we have had the opportunity to analyze a number of geophysical and climatological data using both conventional and less conventional methods of time series analysis, including non linear ones such as inter-annual quadratic variation and analysis of lifetime (see references). Most data series cover the 20^{th} century and we are particularly interested in signals with periods from a decade to several decades. We will briefly review some of our findings, which include what we believe is strong evidence for solar signals in these data, at the $\sim$11yr and multi-decadal scales (with a particularly telling multi-decadal signature over the 20^{th} century). We find for instance that there is a clear solar component in (1) the annual variation of temperature in the longest time series (such as Prague, Uccle or Bologna where two to three centuries of daily data are accessible), (2) in the lifetime of mean temperatures in Europe or (3) in the western USA, (4) in the spectral content of the Madden-Julian oscillation or (5) in the six-month spectral line of the length of day. All these point to a current under-estimation of the solar forcing factor in driving at least in (significant) part evolutions of climate (there may be a link to the ongoing debate on the value of climate sensitivity). Possible mechanisms imply a significant role for clouds and their micro-physics, either through cosmic rays ("*à la Svensmark*") or atmospheric electricity ("*à la Tinsley*"). We have recently found additional evidence for the unusual character of the most recent solar cycle 23, which may suggest that ongoing cycle 24 (and maybe 25) will also be unusual, possibly reminiscent of the sequence that started with cycle 4 in 1785 and led to the so-called Dalton minimum. We concur with other authors that we may be headed towards a similar period of moderate (reduced) solar activity and a Dalton-like cooler climate period.

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