

Poster

Abstract Title

Solar signatures in climate time series of the instrumental record

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Study Group

Abstract Text

Time series of the Earth's climate are nonstationary, complex aggregates which bear evolving modal structures. To disentangle the system's dynamic complexity and identify the status of synchronous motions in terms of a network of dominating component modes, sparse approximations have first been applied two decades ago in a broad study across the 128-year instrumental period 1870-1997 in annual resolution. To this end, a waveform analysis termed Matching Pursuit (MP), i.e., a technique of functional disaggregation in a multi-dimensional signal space, had been equipped with a dictionary of frequency-modulated (FM), flexible test signals. As could have been expected, the non-terrestrial data of reconstructed insolation show the least complex composition: more than 96% of the time series' variance are captured by the five leading MP-FM modes. The analysis has been extended in the meantime in various directions, but the initial 'mother' decomposition continues to pose conceptual questions about the dynamical status both of the climate system and of its solar drive. When the idea of stable frequencies in free oscillators of the system had been abandoned (initially as a response to the detection of conceptually important frequency drifts in a GCM study on the boreal summer monsoon), more and more complex synchronous motions came to the fore (thus reducing the effective dimensionality of the real-world climate system, by the way). In an effort to define benchmarks of qualitatively correct climate simulation, all those different types of internal synchronization under participation of leading solar modes are recapitulated here and further scrutinized.

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No conflict of interest

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