Geophysical Research Abstracts
Vol. 13, EGU2011-3132, 2011
EGU General Assembly 2011

Self-Similarity, Long-Range Dependence and Paradigmatic Models for Natural Time Series

Christian Franzke (1), Tim Graves (2), Nicholas W. Watkins (1), Robert B. Gramacy (2), and Cecilia Hughes (1)

(1) British Antarctic Survey, Science Programmes, Cambridge, United Kingdom (chan1@bas.ac.uk), (2) Statistical Laboratory, University of Cambridge, Cambridge, UK

Long-range dependence and non-Gaussianity are ubiquitous in many natural systems like ecosystems, biological systems and climate. However, it is little appreciated that both phenomena usually occur together in natural systems and that the superposition of both phenomena constitute the self-similarity of a system. These features, which are common in complex systems, make them more predictable and impact the occurrence and clustering of extremes. The risk assessment of systems with these properties will lead to different outcomes (e.g. return periods) than the more common assumption of independence of extremes.

Two paradigmatic models are introduced which can simultaneously account for long-range dependence and non-Gaussianity: Autoregressive Fractional Integrated Moving Average and Linear Fractional Stable Motion. Statistical properties of estimators for long-range dependence and self-similarity are critically assessed. It is found that the most popular estimators are not robust. In particular, they can be biased in the presence of important features of many natural systems like annual cycles, trends and multiplicative noise. Paradigmatic models suitable for natural time series are discussed.