Geophysical Research Abstracts
Vol. 15, EGU2013-8957, 2013
EGU General Assembly 2013

Detecting oscillatory patterns and time lags from proxy records with non-uniform sampling: Some pitfalls and possible solutions

Reik Donner

Potsdam Institute for Climate Impact Research, Research Domain IV - Transdisciplinary Concepts & Methods, Potsdam, Germany (reik.donner@pik-potsdam.de)

Time series analysis offers a rich toolbox for deciphering information from high-resolution geological and geomorphological archives and linking the thus obtained results to distinct climate and environmental processes. Specifically, on various time-scales from inter-annual to multi-millenial, underlying driving forces exhibit more or less periodic oscillations, the detection of which in proxy records often allows linking them to specific mechanisms by which the corresponding drivers may have affected the archive under study.

A persistent problem in geomorphology is that available records do not present a clear signal of the variability of environmental conditions, but exhibit considerable uncertainties of both the measured proxy variables and the associated age model. Particularly, time-scale uncertainty as well as the heterogeneity of sampling in the time domain are source of severe conceptual problems that may lead to false conclusions about the presence or absence of oscillatory patterns and their mutual phasing in different archives.

In my presentation, I will discuss how one can cope with non-uniformly sampled proxy records to detect and quantify oscillatory patterns in one or more data sets. For this purpose, correlation analysis is reformulated using kernel estimates which are found superior to classical estimators based on interpolation or Fourier transform techniques. In order to characterize non-stationary or noisy periodicities and their relative phasing between different records, an extension of continuous wavelet transform is utilized. The performance of both methods is illustrated for different case studies. An extension to explicitly considering time-scale uncertainties by means of Bayesian techniques is briefly outlined.