Geophysical Research Abstracts, Vol. 9, 06328, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06328

Detection of climate induced long term oscillatory patterns in river discharge behaviour on regional scales

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Hydrological time-series are known to be highly correlated both in space and time. The characterization of climate-induced interannual variability on regional scales is crucial for the assessment of river discharge behaviour. This task requires a signal to noise enhancement and the separation of the relevant and significant long-term modes from seasonal, semi-annual and higher frequency components.

We applied Multichannel Singular System Analysis (M-SSA) to a set of river discharge time series. M-SSA is based on the time-lagged spatio-temporal correlation structure of multidimensional time series. The set of time series is linearly decomposed into orthogonal modes, and a subsequent mode selection allows accessing the respective relevant time scales explicitly at the gauges.

Seeking low frequency climate signals contained simultaneously in a set of more than 100 runoff time series from Southern Germany, we were able to show that these were dominated by a variety of low frequency modes in the second half of the last century. We found significant signals with periods of ~ 5, ~ 7, and ~ 10 years. These spatiotemporal patterns are discussed in the context of teleconnections and climate induced variability.