Geophysical Research Abstracts,
Vol. 11, EGU2009-4847, 2009
EGU General Assembly 2009

Analysing the impact of data smoothing procedures on temporal correlations using examples of GPS residual time series

X. Luo, M. Mayer, and B. Heck
University of Karlsruhe (TH), Geodetic Institute, Karlsruhe, Germany (luo@gik.uni-karlsruhe.de)

The understanding of dynamical processes in the complex Earth system requires not only a large amount of observation data in form of time series but also appropriate analysis procedures to decompose the time series into deterministic signals and stochastic noise. The signals can be extracted by data smoothing to create an approximating function which attempts to capture important patterns in the data while the noise component can be fitted by means of stationary probabilistic models, e.g. autoregressive (integrated) moving average (AR(I)MA) processes. Obviously, the data smoothing algorithm applied in signal processing affects the selection of an appropriate stationary time series model for the noise.

In this paper several data smoothing methods (finite moving average, robust weighted local regression, exponential smoothing, finite impulse response filter) are analysed and their influences on temporal correlations in the obtained noise sequences are investigated by means of various hypothesis tests based on empirical autocorrelation function and empirical spectral density respectively as well as non-parametric tests. The analysed database consists of 285 GPS double difference residual time series resulting from 1-Hz data processing and 191 simulated time series using first order autoregressive AR(1) resp. moving average MA(1) processes. Each time series has the same length of 3600 values and the GPS data are processed applying an improved observation weighting model based on signal-to-noise ratio measures using the Bernese GPS software version 5.0. The presented test results are largely consistent and show significant mitigation in temporal correlations after exponential smoothing. Additionally, a higher local regression degree results in stronger temporal correlations in the noise sequences. The presented data smoothing methods and hypothesis tests can be applied analogously to other similar research works.