Geophysical Research Abstracts
Vol. 14, EGU2012-2364-1, 2012
EGU General Assembly 2012

Independent Component Analysis (ICA) as a tool for exploring geodetic time series

E. Forootan and J. Kusche

University of Bonn, Institute of geodesy and Geo-information, Astronomical Physical Mathematical Geodesy, Bonn, Germany (forootan@geod.uni-bonn.de) and (kusche@geod.uni-bonn.de)

Long-term geodetic and geophysical observations offer the possibility of studying the behaviour of geophysical or climatic phenomena embedded in the observed time series. These observations, however, usually exhibit non-linear and complex physical interactions with many inherent time scales. Therefore, simple time series approaches inefficient for exploring the source of variabilities from those observed mixture of signals. Independent Component Analysis (ICA) is a higher-order statistical technique that allows to separate a mixture of random non-Gaussian signals into their statistically independence sources. Its benefit is that it only relies on the information contained in the observations, no a-priori models are prescribed to extract source signals. However, justifications of ICA are usually rooted in the theory of random signals. This study discusses the possibility of using ICA to separate a mixture of stochastic random signals and deterministic sinusoidal signals in the presence of a trend. Theoretical as well as numerical investigations are presented. As a specific application, the performance of ICA on a synthetic example based on the hydrological signals detected by the Gravity Recovery and Climate Experiment (GRACE) satellite gravimetry mission is presented. We also present the results of ICA when it was applied to separate the real GRACE-derived water storage signals over the landmass of Australia from the surrounding oceans. Our results show that the ICA is a reliable analysis tool which can be used for exploring geodetic signals.
Keywords: ICA; geodetic time series; GRACE-derived water storage