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# GNSS time-series analysis: a three-dimensional approach for automated outlier rejection.

Luca Tavasci, Stefano Gandolfi, and Luca Poluzzi
Università di Bologna, School of engineering and architecture, DICAM, Bologna, Italy

Time-series derived from GNSS permanent stations are among the most important datasets for many geophysical applications. Therefore, they should be properly analyzed in order to take full advantage of continuously operating systems. Due to the nature of the GNSS systems, the coordinate components of each position solution are correlated. Moreover, also the three-dimensional time-series usually contain several correlations between their spatial components. The literature provides several algorithms for time series analysis, each focusing on a particular aspect depending upon the purpose of the analysis. Nevertheless, these algorithms consider one-dimensional time-series and consequently the three coordinate components the GNSS position solutions have to be previously split, depending on the reference system adopted. In this work, we propose a method that allows taking into account the correlations within the three spatial components of the GNSS solutions, therefore considering them as single three-dimensional stochastic variables. For any three dimensional time-series the method provides a local reference system in which the three components become uncorrelated and a proper one-dimensional analysis can be performed. In addition, an iterative approach for the analysis and rejection of outliers is proposed, based on the multi-dimensional chi-square distribution.