Should the colored noise be introduced to the analysis of GPS campaign time series?

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GPS techniques have been widely used to determine geophysical phenomena which is estimated from time series using linear regression. Mis- or non-modeled error sources (i.e. atmospheric propagation etc.) and monument types lead to noise in the time series. The noise in the series is described as white plus flicker noise combinations. Estimation of unbiased trend and its realistic uncertainties are the primary duty for a reliable conclusions. Should the noise in the series from GPS campaign measurements be introduced, while it is possible to analyze for a continuous stations' data?

To find an answer to the question, we simulated time series using Hector v1.6. The length of the series is 10 years, its standard deviations of driving noise are between the range of 1.3 and 4.0 mm with the increments of 0.1 mm; moreover, white and flicker noise fractions have been selected as 0.50. Firstly, the noise amplitudes accepted as the truth were calculated from simulated series including no gaps via variance component estimation. 3, 7, and 10 days campaign set-ups were created. For instance, first 3 consecutive days (January 1st through 3rd) from each year in the series were selected and analyzed. Then, the second group (January 4th through the 6th) were analyzed by shifting the previous 3 consecutive days, and so on. This set-up were applied for 7, and 10 days campaigns. After that noise amplitudes were estimated from 121, 52, and 36 time series from set-up campaigns for 3, 7, and 10 days campaigns, respectively. It is hard to estimate noise amplitude for the series from campaigns due to the small number of measurements. When we compare the results of GPS campaigns with those of the truth, we conclude that the correlations between campaigns need to be taken into account even though there is a bias between the true values and the amplitudes of GPS campaign time series.

Keywords: Time series, noise analysis, GPS campaign