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Extracting white noise statistics in GPS coordinate time series

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The noise in GPS coordinate time series is known to follow a power-law noise model with different components (white noise, flicker noise, random-walk). This work proposes an algorithm to estimate the white noise statistics, through the decomposition of the GPS coordinate time series into a sequence of sub-time series using the Empirical Mode Decomposition algorithm. The proposed algorithm estimates the Hurst parameter for each sub time series, then selects the sub time series related to the white noise based on the Hurst parameter threshold. The algorithm is applied to simulated GPS time series and real data.

Both simulated GPS coordinate time series and real data are employed to test this new method, results are compared to the standard (CATS software) Maximum Likelihood (ML) estimator approach.

For a comparison with the Maximum Likelihood approach (CATS software), the number of epochs for the selected GPS time series is varied between 3 and 8 years. The results are promising when compared to CATS, but suffer from a larger standard deviation. The results demonstrate that this proposed algorithm has very low computational complexity and can be more than one hundred times faster than the CATS ML method, at the cost of a moderate increase of the uncertainty ($\sim 5\%$) of the white noise amplitude. Reliable white noise statistics are useful for a range of applications including improving the filtering of GPS time series, checking the validity of estimated coseismic offsets and estimating unbiased uncertainties of site velocities. The low complexity and computational efficiency of the algorithm can greatly speed up the processing of geodetic time series.