Detection of transients in GPS time series based on covariance analyses of the rate

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GPS position time series provide an outstanding tool to measure crustal motion and deformation. The availability of longer time series and the enhanced data quality allow more and more to analyse time dependent effects in continental deforming zones. These analyses may provide insights to seismic cycle processes and allow to drawing conclusions on the rheology of the crust and the underlying asthenosphere.

However, the time series are subject to many different kind of (time correlated) noise, whose various sources like clock and orbit errors, ionospheric and tropospheric effects can hardly be quantified properly. The effect of time correlated noise on the time series can be similar to the one caused by transients posing the problem of separating the signal from the noise.

We developed an algorithm based on the Allan Variance that is capable of classifying time correlated noise and used it to calculate the covariance of the rate along with the spectral indices for many different azimuth directions. Unlike noise, transient signals usually occur in some preferred direction. Based on this assumption, we are able to identify sites in North-western America and Costa Rica that are affected by transients and to estimate the quality of models accounting for transients.