Time correlated noise vs. transient in GPS time series

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Satellite based geodetic measurements like GPS provide an outstanding tool to measure crustal motions. They are widely used to derive geodetic velocity models that are applied in geodynamics to determine rotations of tectonic blocks, to localize active geological features, and to estimate rheological properties of the crust and the underlying asthenosphere.

However, the measurements are subject to (time correlated) noise, caused by different effects that can hardly be quantified properly. So in general pure statistical approaches are used to assess noise characteristics by looking at deviations from the a priori velocity model. This implies that it is not possible to solve for time variable velocities and time correlated noise at the same time, since time correlated noise and transients can result in similar patterns in the time series.

We developed a tool based on the Allan variance to analyse noise characteristics of time series quite efficiently compared to spectral analyses and MLE. This tool allows to analyse large data sets and to look for noise characteristics that are common e.g. in the PBO data set. The results can then be used to identify sites with possible time variable velocities and to solve for time dependent velocities.