Geophysical Research Abstracts
Vol. 16, EGU2014-175, 2014
EGU General Assembly 2014

INVESTIGATION OF NOISES IN GPS TIME SERIES: CASE STUDY ON EPN WEEKLY SOLUTIONS

Anna Klos (1), Janusz Bogusz (1), Mariusz Figurski (1), Wieslaw Kosek (2,3), and Maciej Gruszczynski (1)

(1) Military Univeristy of Technology, Warsaw, Poland (aklos@wat.edu.pl), (2) Polish Academy of Sciences, Space Research Centre, (3) University of Agriculture, Environmental Engineering and Land Surveying, Krakow, Poland

The noises in GPS time series are stated to be described the best by the combination of white (Gaussian) and power-law processes. They are mainly the effect of mismodelled satellite orbits, Earth orientation parameters, atmospheric effects, antennae phase centre effects, or of monument instability. Due to the fact, that velocities of permanent stations define the kinematic reference frame, they have to fulfil the requirement of being stable at 0.1 mm/yr. The previously performed researches showed, that the wrong assumption of noise model leads to the underestimation of velocities and their uncertainties from 2 up to even 11, especially in the Up direction. This presentation focuses on more than 200 EPN (EUREF Permanent Network) stations from the area of Europe with various monument types (concrete pillars, buildings, metal masts, with or without domes, placed on the ground or on the rock) and coordinates of weekly changes (GPS weeks 0834-1459). The topocentric components (North, East, Up) in ITRF2005 which come from the EPN Re-Processing made by the Military University of Technology Local Analysis Centre (MUT LAC) were processed with Maximum Likelihood Estimation (MLE) using CATS software. We have assumed the existence of few combinations of noise models (these are: white, flicker and random walk noise with integer spectral indices and power-law noise models with fractional spectral indices) and investigated which of them EPN weekly time series are likely to follow. The results show, that noises in GPS time series are described the best by the combination of white and flicker noise model. It is strictly related to the so-called common mode error (CME) that is spatially correlated error being one of the dominant error source in GPS solutions. We have assumed CME as spatially uniform, what was a good approximation for stations located hundreds of kilometres one to another. Its removal with spatial filtering reduces the amplitudes of white and flicker noise by a factor of 2 or 3. The assumption of white plus flicker plus random-walk noise (which is considered to be the effect of badly monumented stations) resulted in the random-walk amplitudes at the level of single millimetres for some of the stations, while for the majority of them no random-walk was detected, due to the fact that flicker noise prevails in GPS time series. The removal of CME caused the decrease in flicker noise amplitudes leading at the same time to greater random-walk amplitudes. The assumed combination of white plus power-law noise showed that the spectral indices for the best fitted noise model are unevenly distributed around -1 what also indicates the flicker noise existence in EPN weekly time series. The poster will present all of the assumed noise model combinations with the comparison of noise amplitudes before and after spatial filtering. Additionally, we will discuss over the latitude and longitude noise dependencies for the area of Europe to indicate any similarities between noise amplitudes and the location of stations. Finally, we will focus on the velocities with their uncertainties that were determined from EPN weekly solutions and show how the wrong assumption of noise model changes both of them.