EPN Special Project on "Time Series Analysis": Results of the Retrospective Analysis of the EPN Time Series (1996-2001)[1]

A. KENYERES[2], C. BRUYNINX, G. CARPENTIER[3]

Extended abstract

Following the establishment of the EPN Special Project on Time Series Analysis in 2000 a retrospective work has been started aiming at the determination and elimination of jumps and outliers present in the EPN coordinate time series. All EPN stations from 31 December 2001 back to the installation date have been carefully investigated and the observed offsets, due to equipment change - indicated in the station logs - have been determined.. The offset information is collected to a station problem file, which will be available for the EUREF community. This information may be used at the future densification of EUREF, where EPN sites with offsets may be used as fiducial site.

The primary tool used at this study was the ADDNEQ program from the Bernese 4.2 software package. The code was slightly modified so that we could estimate and then introduce antenna eccentricities both for the vertical and horizontal components. Using the ADDNEQ program, the weekly EPN solutions have been combined into a single multi-year solution. The approach we used in ADDNEQ first removes the constraints from the weekly EPN solutions. Then, these free-network solutions are combined into a multi-year solution, which is tied to the ITRS. The advantage of the multi-year combination approach is that the weekly Helmert transformations absorb periodic signals common to the whole network, such as the annual periodicity.

In the course of the analysis the different disturbing factors (e.g. equipment change, antenna malfunctioning, annual periodicity) were also investigated.

Using the offset and outlier corrections velocities were also estimated for the EPN stations. About 10 % of the stations have been installed within the last year; they have been excluded from the current study to avoid biased velocity estimation due to the short observation series.

As the large outliers especially at the end of the time series, significantly bias the velocity estimation, all outliers larger than 1 cm in the horizontal component and larger than 2 cm for the height component have been eliminated. Altogether 76 outlier periods and additionally 13 stations with short observation history were excluded from the final combination. In order to measure the effect of the offset correction, the estimated velocities have been compared with the ones estimated previously without any correction. As we expected, the improvement in the horizontal velocities is in most cases below 2 mms. Only some stations exceed this level, where the observation history was relatively short. However, the changes in the height component velocities were dramatic; several cases they are above the 10 mm/year level.

The collected offset-correction table will be freely available and offered for use in geodesy and in geokinematics. The monitoring of the performance of each EPN site will be continued in the future and according to our expectations such investigations will be extended by other groups to the global (IGS) level.

[1] The full paper is published in the Physics and Chemistry of the Earth as: A. KENYERES, C. BRUYNINX, G. CARPENTIER: Im*proved Velocity Estimation Based on Consistency Analysis of the EPN Time Series* (in press)

[2] Carine Bruyninx, G. Carpentier, F. Roosbeek: EPN Central Bureau Royal Observatory of Belgium, Av. Circulaire 3, B-1180 Brussels, Belgium, e-mail: c.bruyninx@oma.be

[3] Ambrus Kenyeres, FÖMI Satellite Geodetic Observatory, P.O.B. 346, H - 1373 Budapest, Hungary, fax +36 - 27 - 37 49 82, tel. +36 - 27 - 37 49 80 / 37 48 44, e-mail: kenyeres@sgo.fomi.hu