

Analysis and Special Projects within the EPN

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Introduction

In 2001 the 3rd Local Analysis Center (LAC) Workshop took place in Warsaw, Poland. It was settled at that workshop to change some processing options with the beginning of GPS week 1130 to improve the EPN products. The LAC's solutions are fixed to the current ITRF since the same week in order to support the EPN Troposphere Special Project, and a coordinate re-substitution is applied in the final estimation of the hourly troposphere parameters. The ITRF2000 reference frame is used in the EPN analysis since week 1143 according to the changes within the IGS.

Analysis and Combination Scheme

There are currently 15 LACs which each of them analyses a sub-network of the EPN. The LACs submit weekly SINEX files of station coordinate solutions and daily SINEX files of station troposphere parameter solutions to the EUREF Data Center at the Bundesamt fuer Kartographie und Geodäsie (BKG). There is an agreement to use common processing options by all LACs in the analysis of the EPN observations. These options will be changed to new selections or models if obviously the results will improve. Changes of the processing options have simultaneously to be introduced by all LACs to identify the corresponding changes in the results. Such changes took place in the year 2001 and are outlined in the next section.

EPN Processing Changes

All remarkable changes since the EUREF 2001 symposium concerning the analysis of the EPN observations are summarized in Table 1. A very fruitful LAC Workshop had been hold at the Warsaw University of Technology in May/June 2001. Representatives of the LACs reported about their activities and the status of the EPN Special Projects had been presented too. Details about that workshop may be found in the proceedings [Sledzinski, 2001]. It was agreed upon to commonly change some processing options in the EPN analysis with the beginning of GPS week 1130. These new options are given in the minutes of the LAC workshop which are available on the web-page of the EPN Central Bureau [Bruyninx, 2002] and summarized in Table 2. The observation elevation cut-off angle was lowered to 10° in order to better de-correlate the station height and troposphere parameters, and the elevation dependent weighting of observations was introduced to account for the increased noise of observations on low elevations. The LACs now use the Niell mapping function to more realistically map the tropospheric delay into zenith direction.

16 – 19 May 2001	<ul style="list-style-type: none"> • EUREF 2001 Symposium, Dubrovnik, Croatia
31 May – 01 June 2001	<ul style="list-style-type: none"> • 3rd Local Analysis Center Workshop, Warsaw, Poland
2 Sep 2001 (week 1130)	<ul style="list-style-type: none"> • Introduction of new processing options, following the minutes of the 3rd LAC Workshop, Warsaw • SINEX files submitted by the LACs are fixed to the ITRFxx (contribution to Troposphere Special Project) • New analysis center IGE introduced into the combined solution
November 2001	<ul style="list-style-type: none"> • Proceedings of the 3rd Local Analysis Center Workshop published in the Reports on Geodesy No3 (58), 2001, Warsaw University of Technology
2 Dec 2001 (week 1143)	<ul style="list-style-type: none"> • Change from ITRF97 to ITRF2000 in reference frame realization • New analysis center SGO introduced into the combined solution
5 – 8 June 2002	<ul style="list-style-type: none"> • EUREF 2002 Symposium, Ponta Delgada, Portugal

Table 1: EPN Processing History 2001/2002

Time Series Special Project

Within the EPN a dedicated Special Project (SP) has been established in 2000 with the specific task to monitor the EPN time series and site performance [Kenyeres et al., 2002]. In the frame of the SP, a retrospective analysis of the weekly combined EPN SINEX solutions, from 1996 to 2001, has been performed [Kenyeres, Bruyninx, Carpentier., 2002]. The analysis targeted the identification and elimination of the offsets and outliers present in the EPN coordinate time series. The general and strict rule was, that only offsets with clear indication of equipment change, according to the station log files, are treated. The analysis is continued in the future on a routine basis.

The final product of the computations is a file containing all offset and outlier information. The first version of this file is in the Bernese-specific ASCII “STACRUX” format. However, the collected information should also be stored and distributed in a more general format. For this reason, EUREF joined to the discussion started within the IGS community to select and offer a worldwide solution for the archiving of this type of station events. Based on the collected offset and outlier database, improved velocities have been estimated. The velocity improvement for the horizontal components is generally below 2 mm/year, however for the height component it may exceed the 10 mm/year.

Troposphere Special Project

The objective of the EPN Special Project “Generation of an EUREF troposphere product” is to compute a weekly combined troposphere solution for all sites included in the EUREF Permanent Network which can be used for post-processing GPS analysis as well as for climate research [van der Marel, Weber, 2002].

The Special Project started in June 2001. While in GPS week 1110 four Local Analysis Centers had delivered daily troposphere solution files, it is since GPS week 1143 that all 15 Local Analysis Centers are participating to the Special Project. In GPS week 1130 the processing options were changed for the individual analysis at the Local Analysis Centers to improve results and to standardize the analyses. For the troposphere parameter estimation two additional changes have been introduced concerning the constraining of the weekly coordinate solution to ITRF and the fixing of the weekly coordinate

Guidelines	Recommendations
<ul style="list-style-type: none"> • Usage of IGS Orbits • Introduction of Ocean Loading Corrections • 10° elevation cut off angle and elevation dependent weighting of observations • Usage of Niell mapping function for troposphere parameters 	<ul style="list-style-type: none"> • Estimation of hourly troposphere parameters • Save troposphere parameters in daily normal equation files, generate weekly SNX solution, re-generate TRP files with fixing on SNX coordinates • Ambiguity fixing • Include RMS of unit weight in SNX files (Bernese Software only)

Table 2: Summarized minutes of the 3rd LAC Workshop in Warsaw, May/June 2001

solution during the final estimation of the daily troposphere parameters. These steps have yielded to a visible reduction of the weekly mean biases between the combined solution and the individual solutions which are now below 3-4 mm in Zenith Total Delay.

At present two institutions are performing the combination of the single solutions, the GeoForschungsZentrum, Potsdam (GFZ) and BKG. The differences between the two solutions are below 0.2 mm in Zenith Total Delay for the mean bias with a standard deviation of $\pm 0.5-0.6$ mm. More about the combination procedure and detailed results are presented in [Soehne, Weber, 2002].

Outlook

As shown in this report the EPN has implemented state of the art processing options and will go on in the future to realize the highest level of accuracy. The close cooperation between IGS and EUREF provides benefit for IGS from EUREF and vice versa. The EPN products are the achievement of the continuous effort of the station operations, data centers and analysis centers among others.

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