WP10-DDSS-018 - Products.EUREF.ReferenceFrame

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Document assessing the validation procedures / quality checks performed at ROB

Input files

- 1996/001 - 2013/362: EPN-repro2 daily combined SINEX files using IGb08/epn_08.atx with position offsets applied to be consistent with IGS14/epn_14.atx
- 2013/363 - 2017/028: EPN routine daily combined SINEX files using IGb08/epn_08.atx with position offsets applied to be consistent with IGS14/epn_14.atx
- 2013/362 – now: EPN routine daily combined SINEX files using IGS14/epn_14.atx

Metadata checks

The metadata contained in the SINEX (antenna/radome type, antenna serial number, antenna offset) have been compared to the station metadata and the antenna calibrations.
Days with hardware of firmware changes are rejected from the multi-year solution.
When the antenna/radome and receiver information are not available for a period in the sitelog of the station, the period is excluded.
(redundant with EUREF.Combined.Positions checks for the routine files)

Internal checks

Several indicators assess the validity and the quality of a multi-year solution computed with the CATREF software:

1. Time series of the weighted root mean square of the residual position time series
2. Time series of the Helmert transformation parameters
3. Station Position Time Series : outliers are iteratively removed when they exceed a threshold of 10 mm for the horizontal components and 20 mm for the vertical component (except for ~10 stations which are noisier)
4. Correlations of outliers in position time series with degradations in long-term tracking performance of the stations evidenced by G-nut/Anubis software (Vaclavovic and Dousa, 2016) have been investigated. The following data quality metrics were checked:
    a. the ratio of the number of observations with at least two frequencies in the daily RINEX file with respect to the number of expected observations.
    b. the elevation cut off angle as set in the station log file as well as the lowest elevation cut off actually observed in the RINEX data.
    c. the number of identified phase cycle slips for each constellation

d. the code multipath for each constellation on each frequency

The time series of the quality check metrics have been compared with the position time series with a special focus on stations having unexplained behaviour, position jumps or velocity changes for unknown reason.

Both position changes and tracking performances are monitored at each release of the multi-year solution, station owners are contacted when a degradation of the tracking is observed.

5. Impact of position discontinuities and velocity changes on position and velocity estimates, comparison with external solution (former EPN discontinuity list, ITRF2014 or IGS14 discontinuity list,…)
6. Agreement of the estimated position/velocities of the reference stations with the reference coordinates (pos/vel): The multi-year solution is expressed in IGS14 under minimal constraints using 14 transformations parameters. Only IGS14 stations whose IGS14 reference pos/vel agree better than 3 mm on the horizontal and 5 mm on the vertical positions and 0.2mm/yr on the horizontal and 0.4 mm/yr on the vertical velocities wrt their estimated pos/vel, are selected as reference stations. IGS14 reference stations computed in the EPN with individual antenna calibrations are removed first in case of disagreements.

Comparison with external solutions

The multi-year solution is compared with the IGS multi-year (IGSYYPWW.snx) solution going up to the same GPS week. Several elements are compared: the discontinuity list, the residual position time series, the period of observations and the estimated positions and velocities. Differences are analyzed in order to understand them and to make the EPN solution as consistent as possible with the IGS solution.

Comparison with Hector estimation and EPN Classes

In order to assess the quality of the stations and to derive realistic error estimates, the Hector software (Bos et al., 2013) has been used to estimate a linear trend, an annual and a semi-annual signals assuming a power-law stochastic model and white noise.

Based on the velocity error estimates derived with the Hector software and the velocity differences between CATREF and Hector estimates, the EPN stations are categorized into 2 classes A and B. Only class A stations are suitable as reference stations.