EPOS GNSS - Description of the Products

1 Details of processing options for time series solutions

1.a WUT-EUREF daily combined solutions

EUROPEAN PLATE OBSERVING SYSTEM – GNSS products WUT-EUREF Analysis Center Strategy Summary (combined product based on EPN AC solutions)	
Analysis center	WUT-EUREF Warsaw University of Technology Pl. Politechniki 1, 00-661 Warsaw, Poland
Contact person(s)	Tomasz Liwosz e-mail: epnacc@pw.edu.pl
Software used	Bernese GNSS Software 5.4 – 15 EPN ACs, GAMIT/GLOBK 10.71 – 1 EPN AC, GipsyX – 1 EPN AC, EPOS.P8 – 1 AC. The details of the processing strategy correspond to options and models used in Bernese GNSS Software 5.4. The processing strategy is also consistent with the Guidelines for EPN Analysis Centers (http://www.epncb.eu/_documentation/guidelines/guidelines_analysis_centres.pdf).
Preparation date	30-01-2023
Version number	1
DOI	10.17388/WUT-EUREF-CMBPOS
Modification dates	
Date last complete data analysis	
Automatic updates of the time series	
MEASUREMENT MODELS	
Observable	Double differences, ionosphere free linear combination of L1 and L2 phase pseudoranges. Code observations used for receiver clock synchronization and for ambiguity resolution using Melbourne-Wubbena linear combination. The data sampling rate is 30 seconds for preprocessing and 180 seconds for final solution.
Data weighting	Elevation weighting
Data Editing	Phase preprocessing using triple differences. Cycle slips are detected and fixed.
RHC phase rotation corr.	Phase polarization effects applied
Ground antenna phase center cal.	Elevation- and azimuth-dependent phase center corrections are applied according to the IGS model (igs20.atx). In addition individual calibrations are used for some EPN stations according to EUREF model (epnc_20.atx).
Troposphere	Atmospheric mapping functions and hydrostatic zenith delays from VMF1/VMF3 numerical model (Boehm et al., 2006; Landskron and Böhm 2018).
Ionosphere	First order term is eliminated using ionosphere-free linear combination of L1 and L2. Higher order corrections (second, third and bending effect) are modeled (using CODE ionosphere global model and International Geomagnetic Reference Field model). CODE global model is also used to improve ambiguity resolution strategies.

Plate motions	IGS20 velocities
Tidal	Solid earth tidal displacement: IERS2010 (Petit and Luzum, 2010)
	Earth pole tide and ocean pole tide: IERS2010 (Petit and Luzum, 2010)
	Ocean loading: FES2014b (Lyard et al., 2021)
Non-tidal loading	Atmospheric Pressure: Not applied Ocean Bottom Pressure: Not applied Surface Hydrology: Not applied Other Effects: None applied
Earth Orientation Parameter (EOP) Model	IGS products
Satellite phase center calibration	IGS antenna model (igs20.atx)
Relativity corrections	Shapiro effect
GPS attitude model	Nominal attitude
ORBIT MODELS	
Geopotential	EGM2008 (up to degree 12)
Third-body	Positions of Moon, Sun, and planets according to DE421 JPL model.
Solar radiation pressure	Parameters of the new Empirical CODE model estimated (Arnold, 2015).
Tidal forces	Solid Earth: IERS2000, Ocean tides: FES2014b (up to degree 8)
Relativity	Schwarzschild effect
Numerical Integration	Collocation method of 10^{th} order.
ESTIMATED PARAMETERS (APRIORI VALUES & SIGMAS)	
Adjustment	Weighted least squares
Stations coordinates	Minimum constraints (no net translation) applied on usable IGS20 reference stations.
Satellite clocks bias	Not estimated
Receiver clock bias	Estimated using code pseudo-ranges
Orbital parameters	Not estimated
Troposphere	Troposphere zenith delays estimated as piece-wise linear functions in 1-hour intervals. Tropospheric horizontal gradients in north and east directions estimated in 24-hour intervals as piece wise linear function.
Ionosphere	Not estimated
Ambiguity	Ambiguities resolved in a baseline by baseline mode using different strategies according to baseline length (Dach et al., 2015)
Earth Orientation Parameters (EOP)	Not estimated
GPS attitude model	Not estimated
REFERENCE FRAMES	
Inertial	J2000 geocentric
Terrestrial	IGS20
Interconnection	Transformation between celestial and terrestrial systems according to IERS2010 convention (Petit and Luzum, 2010)
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