Evaluation of GNSS reprocessing tropospheric products using GOP-TropDB

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Abstract
The IGS Troposphere Working Group (TWG) aims at improving the accuracy and usability of GNSS-derived troposphere estimates. For this reason, an evaluation database and web-based exploring system is under development for performing continuous monitoring and automated comparisons of troposphere estimates obtained from independent observation techniques such as GNSS, VLBI, DORIS, radiosondes, WVR and other products such as Numerical Weather Models (NWM) or other specific tropospheric models, e.g. blind or augmented.

Recently, the second reprocessing of observations from space geodetic techniques were completed mainly in order to improve global terrestrial reference frame, but the solutions also provided homogeneous time-series of coordinates and tropospheric parameters. Although they are suitable for various scientific applications, they serve primarily as a feedback for assessing models and strategies applied in the reprocessing.

The poster shows recent developments of the TWG service foreground - the web-based monitoring and exploring system and it demonstrates the background of the TWG service - the GOP-TropDB database system - by evaluating several global GNSS reprocessing tropospheric products, namely estimated zenith total delays and linear horizontal gradients, with respect to a global NWM reanalysis products serving as a good reference in this case.

The Table summarizes solution strategies of three IGS Repro2 tropospheric solutions - CO2 and CF2 (CODE), GFZ and IGS Repro1 final tropospheric product. ZTDs and horizontal gradients for all IGS stations and period of 1996-2013 (2014) were compared to results obtained from ERA-Interim. (Zus et al, 2014).

The Figures below show a summary geographical maps for all solutions. From left to right: CO2, GFZ, IGS w.r.t ERA-Interim. From top to bottom: ZTD, E-/N-gradients.

AC Solution strategy ZTD bias sdev rms [mm] N-GRD bias sdev rms [mm] E-GRD bias sdev rms [mm] mean pair count

| CO2 3-day, DD, 3 deg, VMP, ZTD(2h), GRD(24h) pw-linear | 1.01 8.37 9.10 | 0.03 0.32 0.30 | 0.00 0.35 0.37 | 17450 |
| CO2 3-day, DD, 3 deg, VMP, ZTD(2h), GRD(24h) pw-linear | 0.40 8.02 9.10 | 0.03 0.32 0.30 | 0.00 0.35 0.37 | 17450 |
| CF2 3-day, DD, 3 deg, VMP, ZTD(2h), GRD(24h) pw-linear | -2.04 8.37 9.33 | 0.03 0.32 0.30 | 0.00 0.35 0.37 | 17450 |
| GF2 1-day, DD, 3 deg, VMP, ZTD(2h), GRD(24h) pw-linear | -1.44 10.17 10.73 | 0.06 0.56 0.61 | 0.35 0.64 0.78 | 9364 |
| IGS 1-day, DD, 3 deg, GMF, ZTD(5min), GRD(5min) | -2.28 9.19 9.94 | 0.01 0.44 0.44 | 0.00 0.51 0.52 | 13238 |

An example of other GOP’s TropDB functionality is a new online Web service which enables request extraction of selected meteorological or tropospheric parameters from the ERA-Interim data fields (1990-today, Dee et al, 2007).

IGS repro troposphere products were compared to ERA-Interim in GOP-TropDB. Results were initially studied and interactive web GUI was developed for a detailed study of individual results from all sources and sites.

Statistical differences between CODE’s 3-day and 1-day solutions showed a significant impact on tropospheric parameters at some global stations (right plots).

Particular check of midnight parameters as well as summary statistics (table), showed that the 3-day solution is in better agreement with ERA-Interim than the 1-day solution.

Gradient comparison revealed an opposed sign in GFZ’s TroSINEX (later confirmed). Results for 2014 with reversed values showed good agreement with other solutions (left plots).

Higher values (and higher variability) for tropospheric gradients were observed (not shown) in IGS 5-min high-resolution product. CODE’s solutions suggests a reasonable compromise for gradient modelling with a 24h piece-wise linear parameterization, while GFZ’s gradients seems to be significantly smoothed when using 24h piece-wise constant model.

IGS final product shows a slow degradation for all parameters during the last years (left plots).


Acknowledgements: Development of GOP-TropDB was supported by Czech-US bilateral project (LH14089). We acknowledge ECMWF for providing ERA-Interim.