Improved estimates of non-tidal environmental loading contribution into Zenith Total Delay series over Europe

Janusz Bogusz¹, Anna Klos¹, Rosa Pacione², Vincent Humprey³, and Henryk Dobslaw⁴

¹Military University of Technology, Warsaw, Poland
²e-GEOS S.p.A, ASI/CGS, Matera, Italy
³California Institute of Technology, Pasadena CA, USA
⁴GFZ German Research Centre for Geosciences, Potsdam, Germany

The motivation of this study is to assess the spatio-temporal patterns in the Zenith Total Delay (ZTD) time series estimated within the second re-processing campaign (1996-2014) of the EUREF Permanent GNSS Network (EPN, http://www.epncb.oma.be) for a set of European stations. In particular we used AS0 solution provided by the EPN analysis center ASI (Agenzia Spaziale Italiana Centro di Geodesia Spaziale, Italy), and GO1 and GO4 solutions provided by the EPN analysis center GOP (Geodetic Observatory Pecny, Czech Republic) along with the combined EPN Repro-2 products. Solutions differ by processing options and number of stations processed. We find that all individual ZTD solutions are characterized by pure autoregressive noise, which is reduced during the combination, meaning that some part of information is lost in the combination procedure. Combination procedure does not however affect spatial patterns of ZTD residuals (trend and seasonal signals are removed beforehand). They are almost the same for both individual and EPN Repro-2 combined solutions. This means that regional ZTD estimates reflect tropospheric dynamics even at very high-frequency signals of small variance. Therefore, we compute ZTD differences from the two GOP solutions GO1 and GO4, which only differ by unmodelled non-tidal atmospheric loading. We find that there is a similarity between the ZTD differences and non-tidal atmospheric loading which is strongly demonstrated in terms of unusual loading events, as significant non-linear trends or large seasonal peaks. As these similarities are only observed for GO1 and GO4 differences, this indicates that unmodelled vertical loading effects contribute 50% of the ZTD noise, affecting errors of trends.