

## Parameters of Troposphere and Ionosphere Obtained from Processing GNSS Observations

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**Abstract:** Permanent GNSS (Global Navigation Satellite Systems) stations distributed all over the Europe and continually processed with suitable software allow monitoring of position as well as determining certain parameters of troposphere and ionosphere above the monitoring stations. More than 50 permanent GNSS stations are processed continually using Bernese GPS Software 5.0 within the Central European Permanent Network.

Zenith Total Delay (ZTD), one of the processing outputs, reflects delay of the GNSS signal caused by troposphere. Precipitable Water Vapour (PWV) is calculated if ground meteorological observations and ZTDs are available. Time series of ZTD and PWV are available since year 1996. Model of PWV over the Slovakia and its vicinity is produced considering height correction using digital elevation model data. More realistic variation of PWV over the area shows model of normalized PWV (nPWV) which is created from PWV values reduced by theoretical PWV value corresponding to altitude and latitude of the station.

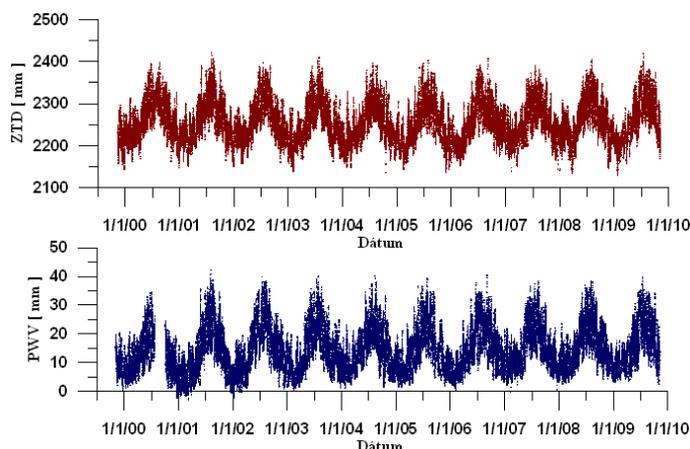


Fig. 1 Time series of ZTD and PWV for station GOPE

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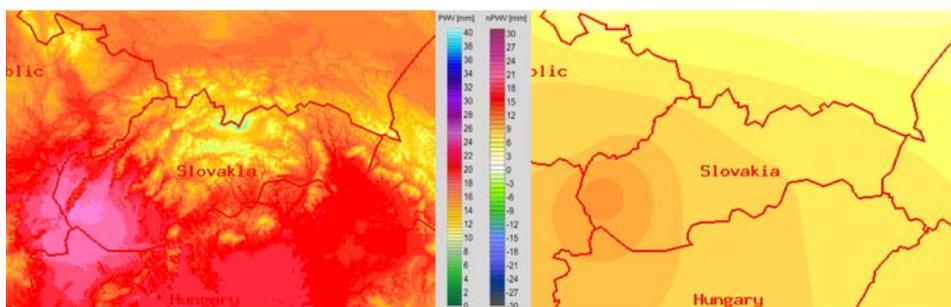


Fig. 2 Model of PWV and nPWV over Slovakia

Time series of ZTD and PWV and models of PWV and nPWV are published on the web page <http://147.175.80.68>, using Web Map Service and other web technologies. Data are continually updated and can be downloaded for scientific use.

Effect of ionosphere on GNSS observations is determined in the form of Global or Regional ionosphere models containing information on Total Electron Content (TEC) over the monitored area.

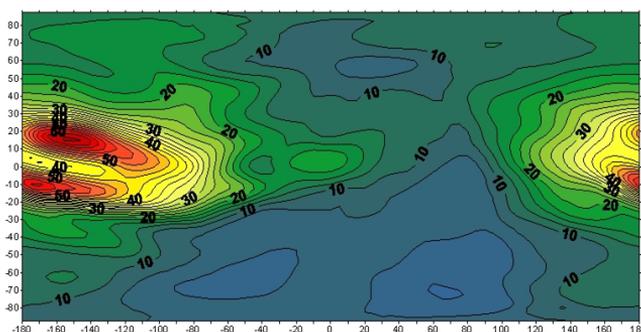


Fig. 3. Global ionosphere model

Troposphere and ionosphere models and time series are available with one hour resolution in

- postprocessed solution – time delay 2 to 3 weeks,
- NRT (Near Real Time) solution – time delay 1 to 2 hours.

**Key words:** Processing of permanent GNSS stations, Zenith Total Delay, Precipitable Water Wapour, Total Electron Content

## References

- Bevis M., Businger S., Herring T. A., Rocken CH., Anthes R. A., Ware R. H., 1992: GPS Meteorology: Remote Sensing of Atmospheric Water Vapor Using the Global Positioning System. *Journal of Geophysical Research*, Vol. **97**, No. D14, pp 15,787 – 15,801.
- Gao Y., Liu Z., 2004: Ionospheric TEC predictions over a local area GPS reference network. *GPS Solutions*, Vol. **8**, No. 1.
- Igondová M., Cibulka D., 2010: Precipitable Water Vapour and Zenith Total Delay time series and models over Slovakia and vicinity. *Contributions to Geophysics and Geodesy*, **40**, 299-312.