



## Development of real-time GNSS ZTD products

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Geodetic Observatory Pecný (GOP) has been routinely estimating near real-time zenith total delay (ZTD) parameters from GPS permanent stations since 2001. Currently, the GOP ZTDs are assimilated in several meteorological institutions. During last years new other tropospheric products were developed at GOP: 1) global hourly ZTD product, 2) multi-GNSS (GPS+GLONASS) regional ZTD product and 3) real-time ZTD product. All operationally running hourly updated ZTD solutions (stand-alone GPS, multi-GNSS and global) are based on the processing of batch data in a differential mode and using Bernese GNSS software and IGS ultra-rapid orbits. New real-time ZTD solution is implemented with completely different strategy – the Precise Point Positioning (PPP) and filtering technique - using real-time data streams and products and applying new developed software in GOP.

Firstly, the presentation gives a brief introduction into the in-house software library (G-Nut) development and into the specific end-user application Tefnut, which was implemented for PPP-based tropospheric estimates in post-processing, near real-time and real-time modes. Tefnut is ready for its first release, which will be available through [www.pecny.cz](http://www.pecny.cz). Secondly, ZTDs based on new software and strategy were evaluated with respect to the precise products from EUREF and IGS using a benchmark campaign over 40 days. Statistical evaluation included both post-processing and real-time (simulated) mode. Finally, an operational real-time performance of new product is demonstrated, which is aimed for the now-casting and severe weather monitoring applications. Statistical ZTD results (standard deviations of 5-8 mm) proved that PPP using IGS real-time orbit and clock products are already well suitable to fulfill the requirements of now-casting applications. Ongoing work is assessing an optimal balance between the timelines and the product quality.