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Determination of Uncalibrated Phase Delays for Real-Time PPP

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Today PPP is a well-known technique of GNSS based positioning used for a wide range of post-processing applications. Using observations of a single GNSS receiver and applying precise orbit and clock information derived from global GNSS networks highly precise positions can be obtained. The atmospheric delays are usually mitigated by linear combination (ionosphere) and parameter estimation (troposphere). Within the last years also the demand for real-time PPP increased. In 2012, the IGS real-time working group started a pilot project to broadcast real-time precise orbits and clock correction streams. Nevertheless, real-time PPP is in its starting phase and currently only few applications make use of the technique although SSR-Messages are already implemented in RTCM3.1. The problems of still limited accuracy compared to Network-RTK as well as long convergence times might be solved by almost instantaneous integer ambiguity resolution at zero-difference level which is a major topic of current scientific investigations.

Therefore a national consortium has carried out over the past 2 years the research project PPP-Serve (funded by the Austrian Research Promotion Agency – FFG), which aimed at the development of appropriate algorithms for real-time PPP with special emphasis on the ambiguity resolution of zero-difference observations. We have established a module which calculates based on GPS-reference station data-streams of a dense network (obtained from IGS via BKG) so-called wide-lane and narrow-lane satellite specific calibration phase delays. While the wide-lane phase delays are almost stable over longer periods, the estimation of narrow-lane phase delays has to be re-established every 24 hours. These phase-delays are submitted via a real-time module to the rover where they are used for point positioning via a PPP-model.

This presentation deals with the process and obstacles of calculating the wide-lane and narrow-lane phase-delays (based on SD –observations between two satellites) discussing the achieved standard deviation of the parameter estimation and their temporal stability. We continue with the topics of the quality of required a priori tropospheric delay information and how to pack these delays either within an proprietary data format or via an optional message of the RTCM-format. Finally we discuss the coordinate convergence period and coordinate quality achieved at the rover site.