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Deterministic and Stochastic Receiver Clock Modeling in Precise Point Positioning

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The traditional GNSS (Global Navigation Satellite System) data analysis assumes an independent set of clock corrections for each epoch. This introduces a huge number of parameters that are highly correlated with station height and troposphere parameters. If the number of clock parameters can be reduced, the GNSS processing procedure may be stabilized. Experiments with kinematic solutions for stations equipped with H-Maser clocks have confirmed this. On the other hand, static coordinates do not significantly benefit from changing the strategy in handling the clock parameter.
In the current GNSS constellation only GIOVE-B and the GPS Block IIF satellite clocks seem to be good enough to be modeled instead of freely estimated for each epoch without losing accuracy at the level of phase measurements. With the Galileo constellation this will change in future. In this context, ESA (European Space Agency) funded a project on "Satellite and Station Clock Modelling for GNSS". In the frame of this project, various deterministic and stochastic clock models have been evaluated, implemented and assessed for both, station and satellite clocks.
In this paper we focus on the impact of modeling the receiver clock in the processing of GNSS data in static and kinematic precise point positioning (PPP) modes. Initial results show that for stations connected to an H-Maser clock the stability of the vertical position for kinematic PPP could be improved by up to 60%. The impact of clock modeling on the estimation of troposphere parameters is also investigated, along with the role of the tropospheric modeling itself, by testing various sampling rates and relative constraints for the troposphere parameters. Finally, we investigate the convergence time of PPP when deterministic or stochastic clock modeling is applied to the receiver clock.