



Modeling of highly stable GNSS ground and space clocks using piece-wise linear representations

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Global Navigation Satellite Systems (GNSS) are based on measurements of signal propagation time, so that clock information is required for both the transmitting satellite and the receiving ground station. In undifferenced GNSS network analyses, synchronization errors of the satellite and station clocks are usually estimated by epoch-wise biases. If, as is common in practice, white noise is assumed as stochastic behavior for the clocks, there are high correlations between the clock estimates and other geodetic parameters. While the satellite clock is correlated with the radial orbit component and geocenter parameters, the station clock shows high correlations with the station height coordinate and the tropospheric zenith delay. These effects can be reduced by introducing proper models for describing the clock characteristics. Especially for global network solutions, deterministic clock modeling is suitable to reduce a substantial number of clock estimates. However, adequate modeling requires a high degree of stability for the corresponding clocks.

In this contribution, we show preliminary results of modeling highly stable GNSS ground and space clocks using piece-wise linear representations. For the satellites, we select the rubidium clocks of the GPS IIF and IIIA blocks as well as the passive hydrogen maser clocks of the Galileo FOC spacecraft for modeling. In addition, a selection of hydrogen maser stations of the International GNSS Service (IGS) is also modeled. Over a period of several weeks, daily network solutions with and without piece-wise linear clock modeling are processed and then compared. We discuss different strategies and show the effects of various modeling options (length of split interval, parameter weighting) on the correlations of the estimated parameters.