CODE Contribution to IGS Repro3 Campaign

Scheduling of Stochastic Pulses

CODE orbits are generated by extracting the middle part of a long-arc solution covering 3 days. In order to compensate for potential deficiencies in the orbit modeling, empirical, instantaneous velocity changes – so-called stochastic pulses – are added every 12 hours (Beutler et al. 1994). In Figure 2a there are some planes with bigger, others with lower magnitude of the orbit misclosures during the eclipse season. For those with the lower values the eclipse period was close to noon. For that reason another solution was computed where the pulses are scheduled at the biggest distance of the satellite from the Sun (orbit midnight, Figure 2b). As Figure 2c shows, this results in a reduction of the orbit misclosures by about 10%.

Earth Rotation Parameters

The Earth rotation parameters (daily offset and rates for X- and Y-component as well as Length of day, LOD) are estimated in a global solution individually per GNSS (GPS, GLONASS, Galileo; as proposed by Scaramuzza et al. 2018). The differences with respect to the C04-series is computed and the related spectra are shown in Figure 3. In repro3 solution series (right hand plots) a new high-frequency pole model (Dosai and Sibisi 2016) is used. In the operational final solution (as for all other space geodetic techniques where the C04-series is based on) still the IERS2010 model (left hand plots) is applied. For that reason the direct interpretation of these differences is difficult. As Abrahao et al. (2017) have shown, deficiencies in tidal effect models can be discussed in detail when adding a third solution.

Some important model updates are planned to be introduced with the current reprocessing effort. These new models are:
- IERS-convention related: new mean pole (R. Ray) and high frequency pole model (Dosai and Sibisi 2016);
- Inclusion of Galileo as the third GNSS constellation: requires an update of receiver and satellite antenna corrections as well as Galileo-specific orbit models;
- Orbit modelling: shift pulses from noon to orbit midnight; requires long-arc solution (72 hours)

The full dataset of results (Sušnik et al. 2016) is available at

The inclusion of Galileo requires updated receiver and antenna corrections that have extensively been improved with the repro3-style solution.

Station Coordinate Series

The definition of the daily solutions have been realized by the International GNSS Service (IGS) with the currently used IGS04 reference frame. A verified list of reference frame sites has been used for the datum definition.

The stations coordinates from the daily three-day long-arc solutions are more consistent to the reference frame because of the related smoothing effects (see Figure 4). When the different models are enabled step by step, the consistency of the three-day solution with the IGS04 reference frame is improved by the updated antenna corrections (see Figure 5).

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