EGU2020-9354
https://doi.org/10.5194/egusphere-egu2020-9354
EGU General Assembly 2020

Combined Precise Orbit Determination for BDS-2 and BDS-3 Satellites

Hanbing Peng[1,2], Maorong Ge[2,1], Yuanxi Yang[3,4], Harald Schuh[2,1], and Roman Galas[1]
[1]Institute of Geodesy and Geoinformation Science, Technische Universität Berlin, Berlin, Germany (hanbing.peng@gfz-potsdam.de)
[2]GFZ German Research Centre for Geosciences, Potsdam, Germany
[3]Xi'an Research Institute of Surveying and Mapping, Xi'an, China
[4]National Key Laboratory of Geo-information Engineering, Xi'an, China

Since November 2017, the 3rd generation BeiDou Navigation Satellite System (BDS-3) of China has stepped into an intensive build-up phase. Up to the end of 2019, there are 5 experimental and 28 operational BDS-3 satellites in the space. Besides that, 16 BDS-2 legacy satellites are still providing Positioning, Navigation and Timing (PNT) service for Asia-Pacific users. Unlike BDS-2 satellites, BDS-3 satellites will not transmit signal on frequency B2I which is one of the open service frequencies of BDS-2 and will be replaced by B2a of BDS-3. For legacy signals, only that on B1I and B3I will be transmitted by all BDS-3 satellites. Therefore, current routine scheme that generates precise orbit and clock products with B1I+B2I combination observations becomes infeasible for BDS-3. Observation combination used for product generation of BDS-2 could be switched to B1I+B3I combination as well. However, this might cause discontinuity in BDS-2 products as different hardware delays specific to signals are contained in them. In this study, combined processing of BDS-2 and BDS-3 satellites to generate consistent precise orbit and clock products is researched. To elaborate the impact of observation biases between BDS-2 and BDS-3, different combined Precise Orbit Determination (POD) processing schemes are examined. It shows that receiver biases between BDS-2 and BDS-3 should be considered in combined POD which is clear from the post-fit residuals of observations, especially from that of BDS-3 code observations. After estimating those biases between B1I+B2I of BDS-2 and B1I+B3I of BDS-3, Root-Mean-Square (RMS) of BDS-3 code observations decreases from 5.07 to 1.23 m. The results show that, biases of B1I+B3I between BDS-2 and BDS-3 are relatively small, less than 4 m for most receivers and around 1.2 m on average. But their estimates are stable with standard deviations (STDs) of 0.13 ~ 0.34 m depending on receiver types. Influences of these biases on the POD results are limited. However, biases between B1I+B2I of BDS-2 and B1I+B3I of BDS-3 are more significant, from -10 to 30 m for different receivers. Except for Septentrio receivers, quantities of those biases are basically related to the receiver types. Averages of biases from Trimble, JAVAD and Leica receivers are 18.5, 5.0 and 10.0 m, respectively. Those biases are also estimated with very small STDs, which ranges from 0.13 to 0.28 m. It is demonstrated that those receiver biases should be properly handle in combined POD processing of BDS-2 and BDS-3 satellites. As B1I+B2I is more appropriate for BDS-2, using different observation combinations for BDS-2 and BDS-3 in combined POD

processing is more preferred over the scheme in which B1I+B3I is used for both BDS-2 and BDS-3.