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Initial assessment of BDS-3 Signal-In-Space Range Errors

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By the end of 2018, Beidou global satellite navigation system (BDS-3) preliminary system, including 18 Medium Earth Orbit (MEO) satellites and 1 GEostationary Orbit (GEO) satellite, has been successfully completed and began to provide preliminary services to global users. Thanks to the unique Inter-Satellite Link (ISL) and high-precision atomic clock on BDS-3 satellite, now we can obtain high-precision orbit and clock offsets with fewer stations. An initial assessment of BDS-3 broadcast orbit and clock accuracy based on 71 days navigation data (from October 25, 2018, to January 3, 2019) is presented to provide users with reliable broadcast accuracy. Satellites position and clock offsets derived from broadcast ephemeris are compared with Precise Orbit Determination (POD) orbit and clock offsets. Furthermore, the corresponding Signal-In-Space Range Errors (SISRE), most concerned by Standard Point Positioning (SPP) users, is computed according to multi-GNSS SISRE definition. Experimental results show that the average Root-Mean-Square (RMS) of 3D orbit errors is superior to 55 cm for overall constellation while the average RMS of the broadcast clock based on B3 signal is reduced to 1.8 ns. Besides, the radial errors of broadcast orbit were checked by Satellite Laser Ranging (SLR) measurement with RMS values of 10-12 cm. BDS-3 SISRE values are approximately 0.4-0.5 m, which benefits from the improved accuracy of orbit and clock where orbit errors, by itself, account for 0.12 m.