

## Orbit determination of BDS-3 satellites using inter-satellite link measurements

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Following the operation of the BeiDou regional navigation satellite system (BDS-2) at the end of 2012, China has been in the progress of deploying BeiDou global navigation satellite system (BDS-3). With the successful launch of 18 Medium altitude Earth Orbit (MEO) satellites and 1 Geostationary Earth Orbit (GEO) satellite, the BDS-3 has been able to provide preliminary position, navigation, and timing services for global users since 27 December 2018. These BDS-3 satellites are equipped with Ka-band inter-satellite link (ISL) payloads to realize inter-satellite ranging and communication. Using only ISL measurements, BDS-3 satellites is capable of autonomous orbit determination. The addition of ISL measurements can also improve the orbit accuracy compared with using only ground-tracking observations, especially for BDS whose ground stations are limited in regions. The BDS-3 ISL utilizes a dual one-way observation mode that follows a time division multiple access (TDMA) scheme. We present the precise orbit determination (POD) for current 18 BDS-3 MEO satellites with only ISL observations. The status of the BDS-3 is introduced, and ISL technique and data availability are described. The ISL POD processing strategy of BDS-3 satellites is presented. The obtained orbits are evaluated by analysis of post-fit residuals, orbit overlap comparison and SLR (satellite laser ranging) validation. The RMS (root mean square) values of post-fit residuals for ISL measurements are smaller than 15 cm. The 3D RMS of orbit overlap differences is smaller than 50 cm. The orbit accuracy is also confirmed by SLR residuals.