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# Determination of multi-GNSS pseudo-absolute code biases and verification of receiver tracking technology

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It is common to handle code biases in the Global Navigation Satellite System (GNSS) data analysis as conventional differential code biases (DCBs): P1-C1, P1-P2, and P2-C2. Due to the increasing number of signals and systems in conjunction with various tracking modes for the different signals (as defined in RINEX3 format), the number of DCBs would increase drastically and the bookkeeping becomes almost unbearable.
The Center for Orbit Determination in Europe (CODE) has thus changed its processing scheme to observable-specific signal biases (OSB). This means that for each observation involved all related satellite and receiver biases are considered. The OSB contributions from various ionosphere analyses (geometry-free linear combination) using different observables and frequencies and from clock analyses (ionosphere-free linear combination) are then combined on normal equation level. By this, one consistent set of OSB values per satellite and receiver can be obtained that contains all information needed for GNSS-related processing. This advanced procedure of code bias handling is now also applied to the IGS (International GNSS Service) MGEX (Multi-GNSS Experiment) procedure at CODE. Results for the biases from the legacy IGS solution as well as the CODE MGEX processing (considering GPS, GLONASS, Galileo, BeiDou, and QZSS) are presented. The consistency with the traditional method is confirmed and the new results are discussed regarding the long-term stability.

When processing code data, it is essential to know the true observable types in order to correct for the associated biases. CODE has been verifying the receiver tracking technologies for GPS based on estimated DCB multipliers (for the RINEX 2 case). With the change to OSB, the original verification approach was extended to search for the best fitting observable types based on known OSB values. In essence, a multiplier parameter is estimated for each involved GNSS observable type. This implies that we could recover, for receivers tracking a combination of signals, even the factors of these combinations. The verification of the observable types is crucial to identify the correct observable types of RINEX 2 data (which does not contain the signal modulation in comparison to RINEX 3). The correct information of the used observable types is essential for precise point positioning (PPP) applications and GNSS ambiguity resolution. Multi-GNSS OSBs and verified receiver tracking modes are essential to get best possible multi-GNSS solutions for geodynamic purposes and other applications.