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Deficiencies of Phase Centre Models: Assessing the impact on geodetic parameters

Tobias Kersten, Johannes Kröger, Yannick Breva, and Steffen Schön
Leibniz University Hannover, Institut für Erdmessung, Hannover, Germany (kersten@ife.uni-hannover.de)

Precise GNSS applications like positioning, navigation and timing (PNT) as well as troposphere studies require consistent and accurate calibration values of receiver antennas. Nowadays, they are available by several calibration institutions based on robot or anechoic chamber concepts. The impact of phase centre model of receiver antennas on geodetic parameters like position, troposphere and receiver clock estimates is quite challenging as several estimation concepts, implementation philosophies and different phase centre models exist. Their interaction with the estimates is complex, their individual impact not easily identifiable and a concept to forecast the impact on associated geodetic parameters not available at present.

To integrate new satellite systems in the operational service, station operators of global (IGS) regional (EPN) and national (e.g. SAPOS, Germany or similar) networks require calibration values of these new signals in space (i.e. GPS L5, Galileo, etc). They are currently provided by chamber calibrations. However, the most of operational networks are mainly equipped with robot calibrations for GPS/GLONASS L1/L2. Although deficiencies exist for individual antennas between chamber and robot, a mixture of calibration values is applied to overcome the issue of required and available phase centre corrections. Nevertheless, differences will introduce systematic discrepancies in the parameters. At present, a rule of thumb for phase centre corrections to compare chamber and robot calibrations applies, which does not directly take into account the impact on the associated geodetic parameters. In addition, discrepancies between type mean and individual calibrations of up to 6-8 mm are reported in regional and global networks, which lead up to 10 mm in the height and up to 4 mm in the horizontal component.

This contribution will present a methodology to clarify this issue and will provide a concept to verify parameters, e.g. position, receiver clock and troposphere estimates. In previous publications, the authors focus on generic patterns to determine characteristics between chamber and robot calibrations. In this contribution, we verify the impact and apply stations of the EPN network, which provide equipment with calibrations of both types. Hence, a quantification of the impact is required to answer the following question: Is the 1 mm-rule of thumb is justified, or are there better thresholds available to assist station operators in the near future?