iag-comm4-2022-2
https://doi.org/10.5194/iag-comm4-2022-2
2nd Symposium of IAG Commission 4 "Positioning and Applications"

Estimation of absolute group delay variations of GNSS satellite antennas

Susanne Beer, Lambert Wanninger, and Anja Heßelbarth
TU Dresden, Geodetic institute, Geodesy (foundations), Germany (susanne.beer@tu-dresden.de)

Group delay variations (GDV) of GNSS satellite and receiver antennas affect GNSS code pseudoranges. GDV are frequency-dependent and vary with signal transmission and receiving direction due to direction-dependent properties of the satellite and receiver antennas. Since GNSS code measurements contain both the GDV of the satellite and that of the receiver antenna, the exact separation of both parts is a special challenge. It only becomes possible if absolute GDV are available for one of the antennas. Based on absolute GDV of four receiver antenna types (Wübbena et al. 2019), observations of terrestrial reference stations, and the code-minus-carrier linear combination, we estimated GDV for a large part of the satellite antennas of GPS, GLONASS, Galileo, BeiDou, and QZSS (Beer et al. 2021). Aside from the BeiDou□2 satellites, whose GDV are known to amount to 1.5 m, GPS satellites show the largest variations of several decimeters on frequencies L1 und L5, and also the largest satellite-to-satellite variations within a constellation. The GDV at frequency bands L2, E1, and B2a/B2b of GPS IIIA, Galileo, and BeiDou-3 satellite antennas, respectively, stay below 10 cm and are the least affected. It is shown that terrestrial observations of one orbit period are sufficient to estimate the GDV of each satellite antenna for its entire nadir angle range, and that orbit periods of several sidereal days significantly facilitate data acquisition.

Wübbena G, Schmitz M, Warneke A (2019) Geo++ absolute multifrequency GNSS antenna calibration. EUREF AC workshop, Warsaw, Poland. http://www.geopp.com/pdf/gpp_cal125_euref19_p.pdf

Beer S, Wanninger L, Heßelbarth A (2021) Estimation of absolute GNSS satellite antenna group delay variations based on those of absolute receiver antenna group delays. GPS Solut 25, 110 (2021). https://doi.org/10.1007/s10291-021-01137-8