How Do Different Phase Center Correction Values Impact GNSS Reference Frame Stations?

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Abstract. For highly precise positioning with Global Navigation Satellite Systems (GNSS), it is mandatory to take Phase Center Corrections (PCC) into account. This holds especially true for data processing at reference stations contributing to regional or global reference frames as well as Precise Point Positioning (PPP).

Currently, the International GNSS Service (IGS) is updating the PCC values for several geodetic antennas mounted at reference stations contributing to the IGS20. When analysing the variations at the pattern level, differences at the centimeter level occur for the GPS ionosphere-free linear combination L0. However, for users and network providers it is of most interest to investigate the effect of different sets of PCC (dPCC) on geodetic parameters. This includes topocentric coordinate deviations, receiver clock errors and tropospheric parameters.

In this contribution, we describe our developed standardized simulation approach, which allows to assess the impact of multi-GNSS dPCC on geodetic parameters with changing processing parameters. This includes the selection of the frequency or linear combination, the elevation cut-off angle, the observation weighting scheme and the weighting with respect to the satellite coverage as well as the geographic location.

Using the simulation approach, we illustrate the impact of the PCC updated by the IGS on geodetic parameters on a global map. We study the effect for longer time series of 10 years showing the impact of variations in the GNSS constellations. For selected stations contributing to the IGS20, we compare the simulation results with PPP results from real observations. Here, we also analyse the role of the reference point for code observations, i.e. applying phase center offsets or full sets of PCC on the code observations or not.