Offsets in the EPN station position components resulting from antenna/radome changes: PCC type-dependent model analyses

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Abstract

The EUREF Permanent Network (EPN) consists of more than 300 evenly distributed continuously operating Global Navigation Satellite System (GNSS) reference stations. As a result of the continuous modernization of GNSS systems, the equipment of reference stations is subject to changes and upgrades. Changes relating to GNSS receiver antenna replacement are considered as a main reason for coordinate shifts, and therefore, also for discontinuities in the station position time series. It is assumed that resulting offsets, reaching up to 4 cm in the height component, are primarily caused by changes in carrier phase multipath (MP) effects after antenna replacement. However, the observed position shifts may also indicate the deficiency in the antenna phase center corrections (PCC) models. In this paper, the authors identify and interpret the coordinate shifts caused by antenna/radome changes at selected EPN stations. The main objective is to investigate the correlation between the offset occurrence and PCC model type (type mean, individual robot-derived, individual chamber-derived) as well as MP changes after antenna replacement. For the study, GNSS data from 12 EPN stations covering the years 2017 – 2019 were analyzed. The results prove that the antenna replacement is critical in the context of station coordinates stability and, in most cases, results in visible shifts in the position component time series. Depending on solution type, MP changes, arisen as a result of antenna replacement, are responsible for 21%-42% of variations in the coordinates. In other cases, the imperfections in PCC models is the most probable reason for the observed shifts.