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Evaluation of newly installed SWEPOS mast stations, individual vs. type PCV antenna models and comparison with pillar stations

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For about two decades, SWEPOS (the Swedish Permanent GNSS network) pillar stations have been used in different geodetic and geodynamic studies. To keep continuous measurements of these long lived pillar stations and at the same time modernizing the SWEPOS network, it has been decided to install new truss mast stations, equipped with modern and individually calibrated antennas and radomes, capable of tracking all new GNSS satellites. Installation of mast stations started in 2011. Today, each pillar station in the SWEPOS permanent GNSS network has a close-by truss mast station, mostly in 10 meters distance with individual calibrated Leica choke ring antenna and its attachment (LEIAR25.R3, LEIT). Due to their closeness to pillars, the modern mast stations may provide additional information for the analysis of ground movements in Sweden e.g. to distinguish between tectonic and geodynamic processes (e.g. land uplift in Sweden).

In this study, we have used two datasets from two different seasons for 21 pillars and 21 mast stations and formed different networks. The mast network has been processed using both IGS standard (type) and individually calibrated PCV (Phase Center Variation) models and therefore the effect of these two different PCV models on height components has been investigated. In a combined network, we processed all 42 stations (21 pillars+21 mast) to see how this multi-baseline network (861 baselines) combination differs from independent mast or pillar networks with much less baselines (210 baselines). For our analysis, we used the GAMIT-GLOBK software and compared different networks. Ambiguity resolutions, daily coordinate repeatability and differences between height components in different solutions are presented. Moreover, the GAMIT and BERNESE solutions for combined mast and pillar networks are compared.

Our results suggest that the SWEPOS truss mast stations can reliably be used for crustal deformation studies. The comparison between pillar and mast stations shows similar time series for different horizontal and vertical components and their Normalized rms (nrms) and weighted rms (wmrs) are almost equal.

Comparison of standard and calibrated PCV models for mast stations show notable differences in height components and reach up to $\pm$14 mm. These differences are antenna-dependent and are not systematic offsets. Therefore, whenever available, individual calibrated antenna models have to be used instead of standard (type) calibrated models.

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