REFAG 2022 THESSALONIKI - GREECE 17-20 October 2022

Assessment of thermal deformation modelling for the geodetic VLBI telescopes at Onsala Space Observatory

Rebekka Handirk (Chalmers University of Technology), Periklis Diamantidis (Chalmers University of Technology), Karine Le Bail (Chalmers University of Technology), Tobias Nilsson (Lantmäteriet) and Rüdiger Haas (Chalmers University of Technology)

Abstract. Thermal and gravitational deformation are among the most important telescope-specific error sources to be considered in geodetic Very Long Baseline Interferometry (VLBI), for both the legacy S/X and the VLBI Global Observing System (VGOS) networks. Correcting for these effects is important in order to achieve mm- accuracy for station coordinates, in particular in the context of the International Terrestrial Reference Frame (ITRF). Thermal deformation concerns the expansion of the telescope mount as a function of environmental temperature.

We focus on the thermal deformation of the geodetic VLBI telescopes at the Onsala Space Observatory (OSO), namely ONSALA60 (On) and the Onsala twin telescopes (OTT), that are regularly involved in the observations coordinated by the International VLBI Service for Geodesy and Astrometry (IVS).

We assess the topic by using the geodetic VLBI software packages ASCoT (Artz et al., 2016) and c5++ (Hobiger et al., 2010) using different analysis approaches. These include using the IVS-recommended thermal deformation model by Nothnagel (2009), in-situ temperature sensor data, as well as using in-situ height measurements with an invar rod system (Johansson et al., 1996). The height measurements for On clearly show the presence of an annual signature and a trend. We also investigate the time lag between environmental temperature and in-situ temperature in the concrete telescope mounts.

For On, our study covers several years of IVS R1-sessions, and for the OTT weekly IVS-VGOS sessions since June 2021. Furthermore, we also investigate sessions referred to as ONTIE, which are usually 24 hours long and include only On and the OTT. The latter are specifically designed to determine local tie vectors between the legacy S/X antenna On and the new VGOS antennas.