

Determining radio telescope reference points with GNSS

Background

During 2015–2017 the Onsala twin telescopes (OTT) were installed. The new radio telescopes have been commissioned and taken into operation in 2018/2019. Together with the Onsala 20 m and 25 m antenna they now form the Onsala telescope cluster. The new telescopes are of azimuth/elevation type. For this kind of telescopes, the so-called geodetic reference point, or invariant point, is the intersection of the azimuth and elevation axes. According to specification and information provided by the manufacturer, the two axes shall intersect within ± 0.3 mm, so that the invariant point is well defined. However, this needs to be checked, as well as the location of the reference points, and their relation to reference points of other space geodetic equipment, needs to be determined. In the end it is necessary to have independently derived locations of these reference points, directly expressed in the international terrestrial reference frame (ITRF). To achieve this, GNSS campaigns shall be performed and analysed. The idea is to mount two GNSS antennas with a dedicated gimbal mount on each side of the telescopes' main reflectors, and then to move the telescopes step-by-step in a predefined az/el pattern, while taking GNSS data. The recorded GNSS data shall then be analysed and the radio telescope reference point shall be determined. Similar campaigns were performed on the Onsala 20 m telescope several years ago, and might be repeated as well in connection to this project.

Task description

You will take care of collecting GNSS data with gimbal-mounted GNSS antennas and corresponding receivers on both OTT. You shall plan suitable observing schedules, e.g. plans to move the telescopes in a predefined az/el pattern. For redundancy purpose and robustness, several of these sessions shall be performed. The data shall be analysed so that in the end the telescope's reference points can be determined. Several different GNSS software packages are available (Gipsy, c5++, RTKLIB) to perform the GNSS analysis. The postprocessing of the derived point cloud can be done with MatLab or Python.

Required education and potential course requirements

You should have interest and a solid background in GNSS and corresponding data analysis, as well in general signal processing and data analysis. Programming in MatLab and/or python and experience in Linux computer environment is of advantage.

Do you want to know more?

Ning T, Haas R, Elgered G (2015) Determination of the local tie vector between the VLBI and GNSS reference points at Onsala using GPS measurements. *Journal of Geodesy*, DOI 10.1007/s00190-015-0809-1

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