

Observing Ocean Loading with GNSS

Background

Ocean tide loading is the deformation of the Earth due to the weight of the ocean tides. The water in the ocean tides moves back and forth and these mass redistributions cause periodic loading of the ocean bottom. Since the Earth is not completely rigid, it deforms under this load and this is called ocean tide loading. As a consequence, vertical and horizontal displacements are caused. The ocean tides are produced by the gravitational pull of the Moon and Sun and since their orbits have more than one periodicities due to the eccentricity, evection, etc., the ocean tides can be described as a sum of several ocean tides with each having their own period. Models exist to predict the 3D displacements due to ocean loading, and these models use as input ocean models and earth models. On the other hand, highly accurate geodetic measurements and their analysis, e.g. using Global Navigation Satellite System (GNSS) data, can be used to observe vertical and horizontal displacements directly. Thus, a comparison of theoretical predictions and observed effects is possible.

Task description

You will analyse GPS data from a set of about 50 globally distributed GNSS reference stations that have uninterrupted, several year-long data recordings. The scientific Gipsy-Oasis II software will be used in the so-called Precise-Point-Positioning (PPP) strategy. In order to be able to monitor the ocean loading induced station displacements, the 3D station positions will be determined with high temporal resolution. To achieve highest precision, the analysis needs to be done with integer ambiguity resolution. The resulting time series of 3D station displacements shall be analysed with a harmonic analysis and ocean loading amplitudes and phases shall be derived that can be compared to theoretical models.

Required education and potential course requirements

You should have interest and a solid background in GNSS data analysis and general signal processing and data analysis. Programming in MatLab and/or python for the post-processing stage is required. Experience in Linux computer environment is of advantage.

Do you want to know more?

Scherneck, H.-G. (1991) A parametrized solid Earth tide mode and ocean loading effects for global geodetic base-line measurements. *Geophys. J. Int.*, 106(3):677–694.

The free ocean tide loading provider: <http://holt.oso.chalmers.se/loading/>

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