EGU22-8682
https://doi.org/10.5194/egusphere-egu22-8682
EGU General Assembly 2022

Investigating the sources of surface mass loading signals in coastal GNSS permanent stations

Jagat Dwipendra Ray[1], Walyeldeen Godah[2], Balaji Devaraju[1,3], and M Sithartha Muthu Vijayan[4]
[1]National Centre for Geodesy, Indian Institute of Technology Kanpur, India (jogot123@gmail.com)
[2]Centre of Geodesy and Geodynamics, Institute of Geodesy and Cartography, Warsaw, Poland (walyeldeen.godah@igik.edu.pl)
[3]Department of Civil Engineering, Indian Institute of Technology Kanpur, India (dbalaji@iitk.ac.in)
[4]Multi-Scale Modelling Programme, CSIR-Fourth Paradigm Institute, Bangalore, India (vijayan@csir4pi.in)

The GNSS (Global Navigation Satellite Systems) position time series contains various geophysical signals which can be grouped into tectonic and non-tectonic signals. The tectonic signals include the signals of crustal deformation, volcanic deformation, transient signals of the earthquake and even landslide. On the other hand, the non-tectonic signal contains contributions of various surface mass loadings induced by temporal mass variations within the Earth's system. The effects of the tidal components of these temporal mass variations are generally get removed during routine GNSS data processing. However, the effects of non-tidal mass loading are typically removed in the post GNSS data processing stage. Therefore, a raw GNSS position time series provides an opportunity to study the sensitivity of a GNSS station towards various non-tidal mass loadings. The understanding of the effect of non-tidal mass loadings in coastal GNSS stations is very important as these coastal GNSS stations are generally used to constrain vertical land motions of Tide gauge stations.

The objective of this study is to investigate the effects of various non-tidal mass loadings, such as non-tidal ocean loading, non-tidal atmospheric loading, hydrological loading and sea level loading, in a few coastal GNSS permanent stations. The vertical GNSS position time series of these stations are obtained from the Nevada Geodetic Laboratory (NGL) and analysed using the seasonal decomposition method. The seasonal components of the GNSS position time series resulting from this analysis are assessed through surface deformations due to various surface mass loading effects provided by the German Research Centre for Geosciences (GFZ). Furthermore, the resulted seasonal components of the GNSS position time series are also compared with the corresponding ones obtained from Gravity Recovery and Climate Experiment/GRACE Follow-On (GRACE/GRACE-FO) satellite missions data. The results of these assessments and comparisons are analysed and discussed from the perspective of surface deformations induced by non-tidal mass loadings at coastal GNSS stations.