



Analysis of the impact range of geophysical deformations on changes in GNSS station coordinates

Adrian Kaczmarek and Bernard Kontny

Wroclaw University of Environmental and Life Sciences, Institute of Geodesy and Geoinformatics, The Faculty of Environmental Engineering and Geodesy, Wroclaw, Poland (adrian.kaczmarek@upwr.edu.pl)

The GNSS coordinate time series are still using for analysis and interpretation of tectonic phenomena occurring on the surface of the Earth's crust. Unfortunately, however, changes in GNSS station coordinates are also induced by various external factors, unrelated to the tectonics of the area. These factors include the deformations of the Earth's crust caused by Hydrology, Atmosphere Pressure Loading or Non-Tidal Ocean Loading. The present research focuses on the analysis of the extent of the significance of the impact of Earth's crust deformations, estimated on the basis of geophysical models, on changes in the coordinates of GNSS stations. For this purpose, the model of crust deformation provides by the BKG* center was used. This model, with a spatial resolution of $2.5^{\circ} \times 2.5^{\circ}$, contains deformations of the Earth's crust caused by Hydrology (monthly time resolution), Atmosphere Pressure Loading (time resolution 6h) and Non-Tidal Ocean Loading (time resolution 12h). For the analyzes in question, the above model was compacted to the $0.5^{\circ} \times 0.5^{\circ}$ grid (Europe area) using linear interpolation between grid nodes. The time span of models is about 25 years (from 1990 to 2015). Earlier analyzes carried out by the authors showed that in coordinate time series there is a phase shift [1] between the signals (coordinate changes and horizontal deformations*). The research has now been extended to analyze the extent of the impact of the Earth's crust deformation on the coordinates of the GNSS station, in order to verify whether the model* of deformation of the Earth's crust has a global or local range. For this purpose, the spatial correlation between the time series of deformations calculated in the grid nodes between coordinate time series and deformations for selected GNSS stations was examined.

*DFG Research Unit: Space-Time Reference Systems for Monitoring Global Change and for Precise Navigation in Space. Project 5: Consistent celestial and terrestrial reference frames by improved modeling and combination.

[1]Kaczmarek A., Kontny B., Estimates of seasonal signals in GNSS time series and environmental loading models with iterative Least-Squares Estimation (iLSE) approach, Acta Geodynamica et Geomaterialia, Vol. 15 No. 2 (190), Prague, Czech Republic 2018, pp. 131-141

Keywords: coordinate time series, geophysical deformation time series, spatial correlation, GNSS.