Abstract

The primary goal of this doctoral dissertation was to gain knowledge about the relative vertical movements of the Earth's crust in Poland. The study explored the potential use of various geodetic datasets (satellite and ground-based) and their integration for monitoring vertical crustal movements in Poland, an area of low dynamics. Data from ASG-EUPOS permanent GNSS stations, precise leveling measurements performed on double-leveled lines covering Poland from the 3rd and 4th measurement campaigns, Sentinel-1A and 1B satellite data, and radar interferometry data from the European Ground Motion Service (EGMS) product were used.

New or modified integration approaches were employed, including transformation as a means of combining absolute and relative movements, scale-free network theory for selecting adjustment points, and analysis of the influence of geological, tectonic, and hydrological factors on the obtained vertical velocities. Absolute vertical movements were determined for 100 ASG-EUPOS stations using the PPP technique, and micro-areas around the stations were identified to assess consistency with InSAR data.

It was demonstrated that the use of transformations allows for the transition from absolute reference level to relative level, which is one of the main challenges when combining leveling and GNSS data to determine vertical crustal movements. It was demonstrated that scale-free network theory is suitable for determining junction points in a hybrid network. Classifying points using scale-free network theory allows for the identification of junction points of greatest importance in the network. These same junction points can be used in the hybrid network alignment as well as in the transformation. It was demonstrated that it is possible to derive relative vertical crustal movements based on the integration of leveling, GNSS, and PSInSAR data with an accuracy of no worse than 0.2 mm/year.

Keywords: VCM, InSAR, GNSS, precision leveling, hybrid models, micro-areas