

Study on usage of GNSS observations from Polish GBAS stations in seismological research

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The subject of this research is the usability analysis of ASG-EUPOS (Active Geodetic Network – EUPOS) derived Global Navigation Satellite System (GNSS) observations in the context of seismological research. This study was carried out based on the examination of selected stations movement during earthquakes that took place on 26 and 30 October 2016 in the central part of Italy.

ASG-EUPOS is acting as a main Polish GNSS Ground Based Augmentation System (GBAS). Its key advantage is the uniform points distribution throughout the country. This quality has enabled a choice of 25 stations localized in the specified azimuth range in reference to the line connecting epicenter and station near Warsaw. Such method of points selection (from the south-west to the north-east of the Polish area) affords the opportunity to analyse the values of stations displacement and vertical fluctuation depending on the distance to the earthquake source.

The considered earthquake in the regions of Marche, Umbria and Lazio, was one of the strongest and the most tragic geodynamic phenomena in Europe in recent times. Three subsequent events (measuring 5.5, 6.1 and 6.6 on the moment magnitude scale) were taken into account. The GNSS data sets were processed using Bernese GNSS Software Version 5.2 and applying Precise Point Positioning (PPP) kinematic method which provides an epoch-wise solution for each station independently (that means without the impact of network or other stations errors). Further steps of data processing, including coordinate transformation to local reference frame and signal processing using Savitzky–Golay filter, brought forward the time series illustrating changes in station velocity as well as the observation noise as a function of distance from the earthquake epicenter. Furthermore, data from Polish seismological stations were used in order to verify obtained results.

A possibility of the seismic waves arrival moment determination and their velocity calculation as well, renders a GNSS technique very helpful and valuable for seismological studies. Of crucial importance is that this technique supplies relatively large amount of data from numerous stations and at low cost. A proper GNSS data processing can provide information which is useful for research concerning earthquakes and the associated seismic waves propagation.