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Studying local seismic events in the Fennoscandian postglacial fault province using the data of the POLENET/LAPNET project

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In our study we analysed about 30 local events originating from the Fennoscandian postglacial fault province and recorded by the POLENET/LAPNET temporary seismic array during the International Polar Year 2007-2009. The study area is cut by numerous faults, stretching both from NNE to SSE and from N to S. Particularly interesting was a group of earthquakes originating from the area around the Tornio river, where these two fault systems cross each other. The events were relocated using first arrivals of P-and S-waves at stations with the distance less than 200 km from the epicentre. Program HYPOELLIPS (Lahr, 1980) was applied for initial location and more precise location was then performed using the VELEST program (Kissling et al., 1994) and also the grid search method (Nelson, Vidale, 1990). We used master events (blasts from the Hukkavaara hill in northern Finland, for which the coordinates are known with high precision) to test accuracy of location procedures and to compare results of different location methods. Estimation of location accuracy was performed for dataset including permanent stations only and for dataset including also temporary stations of the POLENET/LAPNET array. Number of stations used for relocation was in the range from 5 to 33 and RMS error after relocation was about 0.2 s.

Epicentres of relocated events show good coincidence with the known faults in the area, which proves that most of these faults were reactivated. Generally, the relocated events can be separated into two groups according to the hypocentre depth. The first group includes events originating from the depths of 0-15 km, which is a typical depth of earthquakes in intraplate, stable continental regions. The second group includes events originating from the depths of 15-30 km, which is rather exceptional for such intraplate areas.

Our result demonstrates that some ofthe reactivated post-glacial faults are of large size and can be potentially hazardous for such critical facilities as nuclear power plants, nuclear waste depositories and recently opened mines in the Fennoscandian Shield.