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Complex geometry of the fault system revealed by analysis of locations and focal mechanisms of micro-earthquakes occurring in the 2014 West Bohemia seismic activity

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The West Bohemia/Vogtland swarm area is located on the border between the Czech Republic and Germany. Seismic activity in this area typically occurs in the form of earthquake swarms with the maximum local magnitude not exceeding 4.5. The micro-earthquakes are monitored by the seismic local network WEBNET which consists of 22 seismic stations (9 online and 13 offline) densely covering the seismoactive area. The records are sampled with 250 Hz and are usually of high quality with good signal-to-noise ratio.

We process more than 500 micro-earthquakes with the local magnitude higher than 0.5 which occurred in the 2014 seismic activity for their accurate locations, focal mechanisms and moment tensors. The locations are calculated using the double-difference method, and the focal mechanisms and moment tensors are inverted using the principal component analysis (PCA). The Green's functions needed in the moment tensor inversion were computed using ray tracing in a gradient crustal model developed for the West Bohemia region.

The results reveal that the analyzed micro-earthquakes cluster according to their foci and focal mechanisms. The foci clusters indicate activation of several fault segments, which are parallel as well as mutually crossing. A variety in orientations of foci clusters is projected into the detection of several types of focal mechanisms covering strike-slip, normal as well as reverse mechanisms. A rather complex foci clustering and a high variety of focal mechanisms indicate a complex geometry of the focal zone. This complexity points to strong lateral variations of the geological structure as well as of the tectonic stress field.