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Earthquake statistics, spatiotemporal distribution of foci and source mechanisms as a key to understanding of intraplate earthquake swarms in West Bohemia-Vogtland

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The origin of earthquake swarms is still unclear. West Bohemia-Vogtland represents one of the most active intraplate earthquake-swarm areas in Europe, besides this area also exhibiting very high activity of crustal fluids. There were swarms in 1997, 2000, 2008, and 2011 and 2017 with magnitudes ML $\leq$ 3.8, three unusual mainshock-aftershock activities (ML 3.5, 4.43.6), happened in 2014. The swarm events together with the mainshock- aftershock sequences form a belt of about 15 x 6 km in depths between 6 and 15 km. We analysed earthquake statistics, spatiotemporal distribution of the foci and source mechanisms of all the activities in the period 1997 – 2017. A notable finding is a significant acceleration of the seismic moment release in each subsequent activity starting from the 2000 swarm up to the 2014 sequence, which signifies an alteration from the swarm-like to the mainshocks-aftershock character of the seismicity. Despite the different character of the 2014 sequence and the earthquake swarms the magnitude-frequency distributions show the b-values $\approx$ 1 and PDFs of the inter-event times indicate similar event rate of the individual swarms and 2014 activity. Only a-value (event-productivity) in the MFD of the 2014 sequence is significantly lower than those of the swarms. The swarms are located close to each other except swarm of 2017 which is located several hundred meters apart, thus indicating an intact asperity. We found that the main focal zone NK consists of several differently oriented fault segments (five segments disclosed up to now), some of them had been reactivated.
Furthermore, we found that all the ML > 2.8 swarm events, which occurred in the given time span, are located in a few dense clusters. It implies that the most of seismic energy in the individual swarms has been released in step by step rupturing of one or a few asperities. The spatial distribution and focal mechanism patters of the individual swarms indicate their complexity. MTs of the most analysed events signify pure shears except for events the second phase of the 1997 swarm the MTs of which indicate significant amount of non-DC components.
We infer that the individual earthquake swarms in West Bohemia-Vogtland are mixture of the mainshock-aftershock sequences which correspond to step by step rupturing of one or a few asperities. The swarms occur on short fault segments with heterogeneous stress and strength, which may be affected by crustal fluids. Pressurized fluids may reduce normal component of the tectonic stress and lower friction. Thus, critically loaded and favourably oriented faults are brought to failure and the swarm activity is driven by the differential local stress.
We believe that these results could contribute sufficiently to understanding of some aspects of triggered seismic activities.