The Alland earthquake series: Location, source mechanism and implications for the regional stress regime

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The Vienna Basin is one of the seismically most active regions in Austria. Because of population density and sensitive infrastructure, seismic hazard assessment in the area is of critical importance. In probabilistic seismic hazard assessments, the region is classified with low to moderate seismic hazard and the maximum credible magnitude was estimated to be around 6. Paleoseismological studies suggest that the region may have suffered earthquakes of magnitude ~7 in pre-historical times.

In 2015, an earthquake occurred ~20km west of Vienna (ML 4.2), near the town of Alland, in an area that has been relatively quiet seismically throughout the last centuries. According to the Austrian Earthquake Catalogue, there have only been 14 earthquakes within a radius of 15 km around the epicentre since 1200 before this event. Of the 11 instrumentally-recorded events, none have exceeded magnitude 2.5. While the economic impact of the Alland earthquake was small, it is a notable event in the regional context, due to its larger magnitude, and to its probable thrust-faulting type. It may thus shed light on the tectonic regime in the area, e.g. on the question which faults are active at present. Thrust faulting has been a prime feature throughout the Alpine orogeny, but so far it has seemed to not leave a strong mark in instrumental seismicity and ongoing deformation in the Alps.

In this study, we present main- and aftershock locations, the source mechanism of the main-shock from moment-tensor inversion, and to which degree it aligns with known geological features in the area. We will also discuss the implications for stress field and regional tectonics, and briefly touch the assessment of the regional seismic hazard.