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The Alland earthquake series in Eastern Austria: Evidence for oblique basement reactivation

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We present our results on the fault geometry of the Alland earthquake series in Eastern Austria and discuss its implications for the regional stress regime, and active tectonics. The series contains 71 known events with local magnitudes $0.1 \leq M_L \leq 4.2$. We locate the sequence in a regional 3D velocity model to find absolute locations. These locations are then refined by relocating all events relative to each other using a double-difference approach, based on relative travel times measured from waveform cross-correlation and catalogue data. We also invert for the moment tensor of the $M_L = 4.2$ mainshock by fitting synthetic waveforms to the observed seismograms. For this, we grid-search the double-couple solution space and estimate the waveform-fit by a combination of the L1- and L2-norms of the waveform misfit. Direct comparison of waveforms of the largest events in this sequence suggests that all of them ruptured with very similar mechanisms. We find that the sequence ruptured a reverse-fault that is dipping towards NNE with $\sim 30^\circ$ at 6 - 7km depth, supported by both the hypocenters and the mainshock source mechanism. This fault orientation is somewhat unexpected, given that the main geological features in the area are striking roughly perpendicular to the strike of this fault. Therefore, our results suggest that the basement reactivated in an oblique direction to the main structures previously reported in the area. This provides new insight into the current regional stress field, and the active fault zones. We hypothesize that the stress regime may be dominated by buoyancy, challenging previously proposed ideas about the orientation of the maximum horizontal compressive stress σ_H in the Eastern Alps.