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Focal mechanisms for small to intermediate earthquakes in the northern part of the Alps and their seismotectonic interpretation

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In the framework of the AlpArray project more than 600 broadband stations have been installed and operated in the Alps and the surroundings. Together with the permanent stations in the area it is one of the most densely spaced seismic networks worldwide. Thereby, it offers an excellent opportunity to investigate the seismicity and seismotectonics of the Alpine chain. Due to the huge number of stations focal mechanisms can be calculated even for small magnitude earthquakes with high accuracy. The focal mechanisms are one important key to reveal the contemporary stress field and thus contribute to a better understanding of the geodynamic processes of the Alps.

In our study we focus on small to intermediate earthquakes in the Northern Alps, namely on four distinct sub-regions. These are from West to East the Lake Constance, the Arlberg region, the area of Garmisch-Partenkirchen and the broader region of Innsbruck. In order to calculate the focal mechanisms, we apply the FOCMEC program (Snoke, 2003), which inverts for a pure double-couple source. P-polarities as well as amplitude ratios of SH to P are used as input parameters for the inversion. Thanks to the dense network a good coverage of the focal sphere is achieved in most cases.

Altogether, we calculated focal mechanisms for 25 earthquakes in the magnitude range between 2.5 and 3.5 from the time period 2016 to 2019. Most of the focal mechanisms represent reverse or strike-slip faulting, normal faulting events are rather rare. The mechanisms are analysed with respect to lateral changes along the Northern Alpine. On one hand we compare the mechanisms with mechanisms of older studies as well as with moment tensors of events of slightly larger magnitudes. Those events are the scope of another subproject in the framework of the AlpArray (Petersen et al., 2019). On the other hand, we compare our mechanisms with geological indicators, namely orientation of faults. Finally, the focal mechanisms are used as input to invert for the stress field.

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