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Investigation on active faulting at the eastern border fault system of the Upper Rhine Graben using geophysical methods

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The Upper Rhine Graben (URG) belongs to the European Cenozoic Rift System (ECRIS) and is one of the most tectonically active regions in Europe. It is delimited by NNW-SSE striking Tertiary-age normal faults to both sides, which are supposed to be active especially at the eastern side. The main goal of this study is the analysis of the activity of this eastern boarder fault system and the characterization of seismotectonic parameters to improve the seismotectonic models, which use faults in the calculation of seismic hazard assessment and are based on a very sparse data set at the moment. In the frame of a pre-trenching survey, geophysical measurements with electrical resistivity tomography (ERT) and ground-penetrating radar (GPR) were conducted in the area south of Freiburg im Breisgau, in order to define an appropriate trenching site to determine key fault parameters, such as magnitude, age of last events, slip rate and return periods. In the frame of the study, several potentially fault-related structures were found in the GPR and ERT profiles. The ERT proofed very useful for the revision and verification of features found in GPR profiles. The GPR has limitations in case of high soil water content and there is a tradeoff between achievable spatial resolution and investigation depth. Several faults described in former studies (e.g. geological map of Baden-Württemberg, GeORG (LGRB, 2012) and Nivière et al., 2008) could be verified, but partially with deviations in the exact location, possibly related to accuracy and density of the data sets, as well as the geophysical methods and interpolation methods employed. The URG is a low-strain setting with high recurrence intervals of earthquakes and high erosional rates due to the moderate climate of the URG and the erosional power of the Rhine-River. In addition, the subsurface is modified by intensive agricultural use, which makes the analysis of the geophysical sections difficult and sometimes ambiguous. For the definition of a suitable trenching site for a detailed paleoseismic analysis, further investigations with percussion drilling are necessary to verify if the features found in the GPR and ERT profiles are indeed of tectonic erosional origin rather than being caused by erosion.