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## SUMMARY

The transition zone between the basement and the sedimentary cover is becoming an increasingly attractive target for the development of geothermal energy in deep sedimentary basin as encountered in the Upper Rhine Graben. Several geothermal power plants already exploit this target but the transition zone is however still poorly known with the presence of large heterogeneities. Studies need to be carried out in order to develop conceptual models on how it is formed and how it can be exploited to produce heat. In this study, we evaluate the ability of resistivity imaging by Controlled-Source Electromagnetic (CSEM) method, to identify favorable areas for the development of Enhanced Geothermal System (EGS) heat exchangers. We performed a land-CSEM survey on an analogue of the transition zone in a well-known catchment basin at Ringelbach, Vosges to assess the relevance of such data. Gathered data consist in a 3D-grid of 48 reception sites uniformly distributed over the whole basin, using a single transmitter.
We performed 2.5D inversions of this dataset with the parallel adaptive finite-element code MARE2DEM to image the resistivity structure through a profile of interest and compared the result to a former Electrical Resistivity Tomography (ERT) inversion. CSEM inversion extends the shallow ERT image in depth and allowed to obtain a resistivity image of the transition zone. The integration of these results with existing geological and geophysical knowledge allowed identifying and mapping a fault zone as well as the fractured zone at the top of the unaltered granite basement. Results of this study demonstrate the importance of acquiring resistivity data at the target depth before drilling to maximize the success rate of a deep EGS project and point out the interest of pursuing the study with the 3D inversion of the whole set of data.

**Keywords:** Geothermal energy, Land-CSEM, 2.5-D inversion