CSEM as a complement to reflexion seismic in de-risking deep geothermal projects in sedimentary basins – What can we bring today?

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SUMMARY

Resistivity imaging, in particular with MT, is widely used for geothermal exploration in volcanic environnement. In sedimentary basins and urbanized areas, reflexion seismic is always the technique deployed, for its ability to map very detailed structural geology, and in particular, to locate faults that can control the fluid flows. With the increasing needs for green energy, more and more 2D and 3D seismic surveys had been shot all over Europe those last years (France, Switzerland, Germany, etc). However, although the structural information obtained is essential, it is now quite clear that locating faults with seismic, even in 3D, is not enough to guarantee their permeability and then productivity of the wells.

Those last years we have developed and assessed the use of MT and CSEM on such areas as a complement to seismic in identifying through resistivity the most permeable areas and indices of fluids flows. Over the year, the CSEM technique in land has achieved significant improvements. Instruments, productivity and processing improvements allowed recent surveys to reach 100 of synchronous stations and dozens of long powerful galvanic transmitters operated with very small teams and in populated areas, while keeping reasonable prices for the geothermal industry. On the other hand, parallel processing and 3D inversion became the standard tools. Those last improvements made the land-CSEM mature enough to image resistivity contrasts up to 3km depth and provide useful services for commercial purpose. We want to give here a feedback from recent both research and commercial projects, on where we are technically speaking, how reliable the process became, what kind of added information it can provide to geothermal companies, and discuss where lies the necessary efforts.

Keywords: Geothermal prospection, sedimentary basins, CSEM