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Geodetic monitoring strategy at the geothermal sites of Soultz-sous-Forêts and Rittershoffen (Upper Rhine Graben, France)

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The European Cenozoic rift system, and in particular the Upper Rhine Graben offers a high potential of deep geothermal energy due to the well known geothermal anomaly and to the number of subsurface temperature data from oil exploration in the Upper Rhine Graben. One example is the Soultz-sous-Forêts Enhance Geothermal System (EGS) located in the French part of the Upper Rhine Graben. The Soultz-sous-Forêts EGS started in 1987 as a deep geothermal research site. The wells are drilled in naturally fractured and altered granites from 3200 to 5260 m depth located in the vicinity of quasi North-South faults. It is the first EGS site connected to the electric network, its electric production capacity is of 1.5MWe. A second EGS site, ECOGI, is in development near the village of Rittershoffen located at 7 km from Soultz-sous-Forêts. The objective of ECOGI is to produce 24MWth energy for an industrial use with a doublet configuration of wells at depths around 2500 and 3000 meters. Both EGS sites benefit of the natural circulation of geothermal water.
Some challenges in geothermal power plant are to understand the long-term behavior of the geothermal system and the induced seismicity. In the Soultz-sous-Forêts plant, borehole measures give evidences of aseismic slip (Bailleux et al., 2013). And previous geodetic monitoring studies of other deep geothermal plants show subsidence and horizontal displacements due to geothermal exploitation (e.g. Massonnet et al., 1997; Nishijima et al., 2005; Fialko and Simons, 2000). The ability of geodesy tools to provide information about dynamic behaviour and the change in the local stress field around the geothermal site make them a suitable method to meet these challenges.
Therefore, we establish a long-term geodetic monitoring system of the two geothermal sites. This work presents the monitoring strategy and the preliminary results. We install a network of continuous GNSS and INSAR data are in acquisition. Our aim is to monitor local surface displacement in natural, in stimulation and production states of the geothermal plants. GNSS and INSAR are two spatial geodetic methods with millimeter accuracy. The GNSS provides information about the absolute 3D displacement at some point location. And the INSAR method gives high spatial (meters) information of relative displacement.