Geophysical Research Abstracts
Vol. 20, EGU2018-15143, 2018
EGU General Assembly 2018

Reservoir imaging using ambient noise correlation from a dense seismic network

Maximilien Lehujeur (1), Jérôme Vergne (1), Jean Schmittbuhl (1), Dimitri Zigone (1), Adrien LeChenadec (1), EstOF Team (1,2,3)

(1) EOST, Université de Strasbourg/CNRS, Institut de Physique du Globe de Strasbourg, Strasbourg, France (jean.schmittbuhl@unistra.fr), (2) ES-Géothermie, Haguenau, France, (3) GEIE-EMC, Kutzenhausen, France

In September 2014, a dense temporary seismic network (EstOF) including 288 vertical component geophones was deployed during one month in the Outre-Foreˆts region of the Upper Rhine Graben (France), where two deep geothermal projects (Soultz-sous-Foreˆts and Rittershoffen) are currently in operation. We apply ambient seismic noise correlation to estimate the empirical Green's function of the medium between the ∼41200 station pairs of the network. The noise correlation functions obtained are comparable to those from previous studies based on the sparse long-term networks settled in the area mostly to monitor the induced seismic activity. However, the dense spatial coverage of the EstOF network improves our ability to identify the main phases of the Green's function. Both the fundamental mode and the first overtone of the Rayleigh waves are identified between most station pairs and P waves are also observed. We analyze the statistical distribution of the Rayleigh wave group velocity between station pairs as a function of the period (between 0.8 and 5 seconds), the station pair orientation, the distance over wavelength ratio and the signal to noise ratio. We build a three-dimensional S-wave velocity model of the upper crust (down to 3 km deep) around the regional deep geothermal reservoirs with unprecedented resolution. This model is consistent with some local geological structures but also evidences non-lithological variations especially at depth. These variations are interpreted as large scale temperature anomalies related to deep hydro-thermal circulations.