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Investigating a deep geothermal reservoir using ambient noise correlation

Maximilien Lehujeur, Jérôme Vergne, Jean Schmittbuhl, and Alessia Maggi

Institut de Physique du Globe de Strasbourg IPGS (CNRS, Université. de Strasbourg I), 5 rue René Descartes, 67084 Strasbourg Cedex, Franc

Knowledge of the geological structures and their evolution in time is necessary to understand and predict the behavior of geothermal reservoirs. In this study, we focus on the site of Rittershoffen (North East of France), next to the site of Soultz-sous-Forêts (GEIE-EMC), where a geothermal plant is about to be installed (ECOGI project). An Enhanced Geothermal System (EGS) will be established at ∼3000m depth using a combination of 2 wells. Our objective is to characterize the reservoir (∼10 km2 large / 3 km deep) through the estimation of the seismic velocities as a function of space and time in order to follow the reservoir life during the exploitation period. Several studies over the past 10 years have shown that correlation of seismic noise between seismic receivers can be used to infer the medium properties and follow their evolution in time. Conversely to the use of individual micro seismic events, ambient noise provides continuous information, and does not require knowledge of seismic source locations. The analyzed data come from a permanent network of short period velocimeters extending on a radius of 15 km around the two geothermal sites. Additionally, two temporary small-aperture arrays have been deployed in the area. Within the frequency range used in this study (0.2 to 5 Hz), the ambient noise has a composite origin. A careful analysis of this noise is performed in order to measure dispersion characteristics of surface waves between each pair of receivers. The inversion of these dispersion curves provides a preliminary velocity model which is in good agreement with the sonic measurements performed in the borehole. Some preliminary results will be shown about temporal variability of the coda of the correlation functions and the ability to monitor temporal variations in the reservoir.