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Surface and body waves ambient noise tomography near Soultz-sous-forêts (France) using the dense EstOF seismic array

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In September 2014, a dense temporary network (EstOf) including 288 vertical component geophones was deployed during 30 days in the Outre-Forêt region of the Upper Rhine Graben (France), where two deep geothermal projects - Soultz-sous-Forêts (GEIE-EMC) and Rittershoffen (ECOGI) - are currently in operation. We applied ambient seismic noise correlation to determine the empirical Green's functions between the $\sim$41200 station pairs. This network significantly improved the spatial and azimuthal coverage relative to the sparse long-term networks settled in the area mostly to monitor the induced seismic activity. Both the fundamental mode and the first overtone of the Rayleigh waves could be identified between most station pairs in a period range between 1 and 5 seconds. These waves were analyzed to build dispersion maps at various periods which are then inverted to depth to build a 3 dimensional S-wave velocity model. Although less prominent, P waves have also been identified in the correlations at periods around 1s and were used to build a preliminary 3 dimensional P-wave velocity model of the area. Due to the increase in P wave velocity at the transition from the sedimentary pile to the crystalline basement, where lie the geothermal reservoirs, the resolution peaks at that depths. The main geological structures emerge from the tomographic models, which reflects their validity and supports the use of such techniques for the exploration and the characterization of deep geothermal reservoirs. The presentation will focus on the specificities of the seismic data recorded and the techniques used to build the tomographic models.