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Time-lapse seismic imaging of the Reykjanes geothermal reservoir

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We report on the results obtained from a dense seismic deployment over a geothermal reservoir. The reservoir has been producing continuously for almost a decade and is located on the tip of the Reykjanes peninsula, SW Iceland. The seismic stations on top of the reservoir have continuously recorded the ambient seismic wavefield between April 2014 and September 2015. The density of the seismic network makes the data well suited for time-lapse seismic imaging of the reservoir. To that end we compute time-lapse responses through the application of seismic interferometry. These interferometric lapse responses are obtained by simple crosscorrelation of the seismic noise recorded by the different seismic stations. We subsequently evaluate the temporal variation of the coda of these crosscorrelations. The term coda refers to the later arriving, multiple scattered waves. The multiple scattering implies that these waves have sampled the subsurface very densely and hence become highly sensitive to tiny mechanical and structural changes in that subsurface. This sensitivity allows one, in principle at least, to monitor the geothermal reservoir. Preliminary results indeed suggest a relation between the temporal variation of the coda waves and the reservoir. Ultimately, this method may lead to a means to monitor a geothermal reservoir in both space and time.