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Croswell Seismic Waveform Tomography for Monitoring of CO2 Injection at the Ketzin site, Germany

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The CO2SINK project began in April 2004 with a focus on geological CO2 storage in a saline aquifer near the town of Ketzin, west of Berlin. The injection started on June 30th, 2008, and as of October 25th 2009, 23,936 tons of CO2 have been injected into the underground. In order to monitor the CO2 injection, time-lapse cross-well seismic measurements were done in 2008. The pre-injection baseline survey was performed in May 2008. Two repeats followed in July and August 2008, after the breakthrough of CO2 in one of the two observation wells.

CO2 injection usually results in small changes in the seismic velocity of the reservoir. To monitor this we need an accurate velocity model of the underground, waveform tomography is well suited to solve this problem. In this study, waveform tomography was applied to the baseline and 2 repeat crosshole datasets to reconstruct the underground velocity models. First, travel time tomography was applied to the baseline dataset. Then waveform tomography was applied to the baseline dataset using the travel time result as the starting model. After that the baseline waveform tomography result was used as the starting model for the first repeat, and then this result was used as the starting model for the second repeat. The results show good correlation with well log data and geological structure, and some observed velocity field changes may be caused by injection of CO2.