Seismic interferometry using ghost reflections applied to laboratory measurements for monitoring supercritical CO2 sequestration

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S51B-2771: Seismic interferometry using ghost reflections applied to laboratory measurements for monitoring supercritical CO2 sequestration

Friday, 16 December 2016
08:00 - 12:20
Moscone South - Poster Hall

The seismic method with active sources has proven to be a very valuable tool for CO2 sequestration monitoring. The seismic method can be used for extraction of reservoir quantities like saturation and pore pressure. But nonrepeatability in the positioning of the source and receiver during base and monitoring surveys can deteriorate the accuracy of the estimated changes in the reservoir parameters. Application of seismic interferometry (SI) to reflection recordings on permanent networks of seismic stations could help eliminate the monitoring errors due to the non-repeatability errors. Retrieving virtual sources at the positions of the stations eliminates the non-repeatability in the source positioning. SI is traditionally applied using crosscorrelation. We show results from application of SI to ultrasonic data of sequestration of supercritical CO2. The data are recorded on a two-layer sample consisting of epoxy (caprock) and Bentheimer sandstone (reservoir). We apply SI by crosscoherence, which has the potential to retrieve results with higher temporal resolution than SI by crosscorrelation. Our aim is to monitor layer-specific changes inside the reservoir during the displacement of brine by supercritical CO2 and during the displacement of supercritical CO2 by brine. To achieve layer-specific monitoring, we retrieve with SI non-physical reflections from the bottom of the sandstone as if source and receiver were placed at the top of the sandstone. The velocities we estimate from the non-physical reflections during injection of brine aiming to displace supercritical CO2 and during injection of supercritical CO2 aiming to displace brine indicate rather similar saturation for both injection cases. We confirm the latter by transmission measurements, but with lower resolution.

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