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# Semi-permanent continuous monitoring of the CO2 sequestration zone using Seismic ACROSS and multi-geophones Part II

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Carbon dioxide is one of the strong candidates of greenhouse effect which causes the climate change. The geological storage of $CO_2$ is aimed reduce the emission of $CO_2$. For secure storage, it is necessary to monitor the physical state of the $CO_2$-dissolved water stored underground. The monitoring systems using seismic wave are required to be stable for a long term. In seismic reflection processing such as PSDM, 3D effect is extremely important. We propose monitoring the temporal change of reservoirs using the seismic ACROSS, which has high stability to suitable for such monitoring. In this presentation, we report the result of the 3D simulation aiming to examine the effect of source-receiver arrangement and the other measurement setting.

We used the 700m x 700m x 350m geological model and attempted to detect the velocity reduction in 10m cube at 110m depth. A single-force source and ˜40 receivers were placed at the surface. We calculated the wave field for the two cases: with and without the low velocity cube, by means of the finite difference method (Larsen and Schultz, 1995). Then the difference of the waveforms at the receiver points were transformed into the displacements, and back-propagated as the source waveform. The temporal maximums or root mean squares of the amplitude of the wave fields was used to image the place the temporal change occurred.

We used time reversal method (back propagation.) The resultant back-propagation image shows the dependency of the receiver distribution. The presence of a sedimentary layer seems to reduce the resolution, possibly because of the short wavelength in the sedimentary layer. Careful evaluation of the optimal receiver arrangement is required in practice. Another factor affecting the detectability of the objective temporal change is the relation of S/N in the measurement and the magnitude of the temporal change, which concerns the spatial extent and the depth of the target, the change in the physical properties. More detailed investigation for each factor is demanded for the quantitative evaluation of the practical applicability.

Keywords: CCS, CO2 sequestration, time lapse, ACROSS, back propagation, time reversal