



Continuous source system and distributed acoustic sensing for reservoir to crust monitoring

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We have developed a permanent seismic monitoring system using a continuous seismic source and distributed acoustic sensing (DAS). The active seismic source system continuously generates waveforms with wide frequency range. By stacking the continuous waveforms, our monitoring system improves signal-to-noise ratio of the seismic signal. Thus, less-energy vibration using small-size source could be utilized for the exploration of deeper geological targets. Presently, we have deployed the small-size monitoring source system in the Kuju geothermal field in the northeast Kyushu Island, Japan. Although our monitoring source system is small and generates high frequency vibrations (10-20Hz), the signal propagated >80 km distance using two-month continuous source data. Our field experiments demonstrate that variation of seismic velocity of the crust could be identified with high accuracy (~0.01 %). To record the monitoring signal from continuous source system, we need to deploy seismometers. Deployment of many seismometers increase spatial resolution of the monitoring results. Recently, we have deployed the DAS system close to the continuous seismic source system. Using DAS, dense and long seismometer network can be realized, and we succeeded to identify the temporal variation of seismic velocity. By using both continuous source and DAS, we are able to monitor wide area with lower cost. Our monitoring system could accurately monitor the larger-scale crust and smaller-scale reservoir in high temporal resolution.