Subsurface monitoring using seismic interferometry for the large-scale CCS Demonstration Project at the Tomakomai Area

*Ryuji Niiro[1], Motonori Higashinaka[1], Susumu Abe[1], Makoto Tsuchiya[2], Hideo Saito[2], Ziqiu Xue[3], Tetsuma Toshioka[3]

1.JGI, inc., 2.Japan CCS Co., Ltd., 3.RITE

JCCS, commissioned from METI, deployed the permanent OBC (Ocean Bottom Cable), and seismic signal has been continuously recorded since July, 2014. The cable length of the OBC is 3.6km and the receiver interval is 50m, respectively.
The main purposes of this observation are the earthquake monitoring and the time-lapse seismic survey, what is more, subsurface imaging by seismic interferometry can be implemented by using the continuously observed data in the arbitrary spans of the 6 years monitoring period.
As the baseline survey, 3D seismic survey was already conducted in 2009 and 2D in 2013. Furthermore, periodic monitoring seismic surveys will be conducted after the start of CO_2 injection. Seismic surveys in which active sources are used provide reliable subsurface images, but those expensive costs make it difficult to conduct monitoring surveys frequently. As an alternative approach, passive seismic survey methods have a potential to delineate the temporal change of CO_2 plume distributions in the reservoir in a shorter period, because the seismic interferometry can be applied to any period of the continuous observation data.
In this study, we applied the seismic interferometry to local earthquake seismograms recorded by the permanent OBC. We begin with synthesizing the pseudo shot gathers by applying seismic interferometry to the P-wave and P-coda of 158 earthquakes which have occurred from January 1, 2015 to November 21, 2015. Note that the selected earthquakes are larger than magnitude of 2.0 and those hypocentral distances are longer than 48 km. Processing the pseudo shot gathers, we obtained the seismic images through the CMP stacking method. As a result, we can clearly image the reflector at the depth of the reservoir.
It is necessary to examine the repeatability, the relation between the number of seismic events and S/N of the passive seismic section to confirm its applicability in CO_2 monitoring.

Keywords: Seismic Interferometry, CO2, CCS, monitoring

