Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

STT07-11 Room:421 Time:April 29 12:05-12:25

2D simulation of seismic wave propagation for time lapse monitoring of heterogeneous structure and near-surface effects

KAMIMURA, Aya[1*] ; KASAHARA, Junzo[1] ; MURASE, Kei[1] ; TAZAWA, Oshie[1] ; NISHIYAMA, Eiichiro[1] ; KUBOTA, Ryuji[1] ; FUJIMOTO, Osamu[1] ; OHMURA, Takeshi[1] ; NOGUCHI, Shizuo[1] ; OHNUMA, Hiroshi[1]

[1]Kawasaki Geological Engineering Co.,Ltd.

For the time lapse study in CCS and EOR, we have proposed the method using the seismic ACROSS (Accurately Controlled and Routinely Operated Signal System) and geophone array. However, it is considered that the near-surface effects and their temporal changes caused by water content changes, temperature and surface wave generation, might have very large effects for time lapse estimation, and we would like to evaluate and reduce the near-surface effects by the comparison of surface and borehole geophone records. We have carried out simulation studies to evaluate the effects of near-surface and heterogeneities such as the man-made cavities in the green tuff layers (Vp ˜2.5 km/s). We also evaluate the near-surface effects by changing geophone depths. The results of the simulations are as follows.

At the simulation of surface hypocenters, seismic waves passed through the man-made cavities attenuated and seismic waves scattered at the man-made cavities. This shows that there will be a heterogeneous structure like man-made cavities when observed seismic waves were attenuated, and the man-made cavities will become a secondary hypocenter.

As the results of simulation of surface hypocenters, the amplitude of scattered waves observed by borehole geophones were larger than that of surface geophones. This means that the borehole geophones are suitable for time lapse monitoring of heterogeneous structures. The amplitude of scattered waves observed by horizontal components of geophones was larger than that of vertical components of geophones. This means that the horizontal components of geophones are suitable for time lapse monitoring of heterogeneous structures.

At the simulations of deep hypocenters (15Hz, 2Hz) as assumed natural earthquakes, seismic waves scattered by the man-made cavities. Observation of natural earthquakes will be helpful to look at the wide seismic structure.