Spatio-temporal change in seismic velocity associated with the 2016 Kumamoto earthquake using cross-correlations of ambient noise records

*Tatsunori Ikeda[1], Hiro Nimiya[2], Takeshi Tsuji[1,2]

1. International Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Kyushu University, 2. Department of Earth Resources Engineering, Kyushu University

In recent years, seismic interferometry using ambient noise has been widely applied to extract information of the subsurface seismic structure. In particular, monitoring of seismic velocity using cross-correlations of ambient noise records is effective to continuously estimate temporal change in seismic velocity associated with earthquakes, volcanic activities and seasonal variation. In this study, we report spatio-temporal variation of seismic velocity change in Kyushu Island associated with the Mw7.0 Kumamoto earthquake occurred on April 16, 2016.

We used continuous seismic data recorded by Hi-net seismic stations (NIED) in Kyushu Island from 1 December 2015 to 30 November 2016. We computed cross-correlations of ambient noise records between two stations in the frequency range of 0.1 to 0.9 Hz. Daily variation of seismic velocity was estimated by applying the stretching interpolation technique to the coda of cross-correlations. By using the velocity changes measured between all pairs of stations with an interstation distance of < 40 km, we mapped spatial variation of seismic velocity change.

We observed clear velocity reduction during the Kumamoto earthquake near the rupture faults and Aso volcano. The velocity reduction near the fault zone (~0.4%) may have been cause by formation damage, a change in stress state and an increase in pore pressure. The largest seismic velocity reduction observed around Aso volcano (~0.8%) was likely caused by the presence of pressurized volcanic fluids. The velocity reduction gradually recovered to the pre-earthquake value, suggesting gradual healing of the damage caused by the earthquake. The velocity increase near Aso volcano observed after the earthquake might be a response to depressurization caused volcanic activities.

Acknowledgements:
We are grateful to the National Research Institute for Earth Science and Disaster Prevention (NIED) for providing us with the Hi-net data.

Keywords: seismic interferometry, Kumamoto earthquake, monitoring

