

Travel time changes of the ACROSS signal detected by the TRIES borehole network associated with the Tohoku Earthquake

KUNITOMO, Takahiro¹ ; ASAI, Yasuhiro^{1*} ; OKUBO, Makoto¹

¹Tono Research Institute of Earthquake Science, ADEP

The 2011 off the Pacific coast of Tohoku Earthquake (M9.0, March 11, 2011) caused large change of observed data, such as groundwater level, strain and stress, in Tono Research Institute of Earth Science (TRIES), which located approximately 600km away from the epicenter. In addition, significant changes in travel time of the seismic ACROSS signal transmitted from the TOKI station (JAEA Tono Geoscience Center) were detected at many Hi-net stations (Kunitomo et al., 2014a). In this study, we analyzed the ACROSS signal observed by the borehole network of TRIES distributed in the range of about 9 km from the Toki station, and discuss the seismic velocity change caused by the Tohoku Earthquake. The observation stations, SBS110, JRJ, TRIES, TGR165, TGR350, TOS, BYB, are distributed in the range about 1 - 9 km apart from the seismic ACROSS station (TOKI). Analysis period is two years, from April 2010 to March 2012. We calculated the Green's functions from the transfer functions every day by the data processing of ACROSS (Kunitomo et al., 2014b), and estimated temporal change in the travel time of S-wave by the cross spectral method. S-wave travel time showed a step-like delay at the all observation stations at the time of the 2011 off the Pacific coast of Tohoku Earthquake. The delay times which depend on the observation station, are 1 to 7 ms at SV wave and 1 to 3 ms at SH wave. Travel time delay can be divided into two types, short-term delay and long-term delay. The short-term delay recovers exponentially in about 2 to 3 weeks, on the other hand, the long-term delay remains even after one year. The short-term delay is different by observation station, and it is estimated to represent the change in the vicinity of the observation station. The delay times of SH waves are large in the stations, TRIES, TGR165, TGR350 near Mizunami Underground Research Laboratory (MIU). The long-term delay, except the stations near MIU, has generally become larger with increasing distance from the ACROSS station, and it is estimated to represent the change in broad area.

Keywords: seismic velocity change, crustal movement, seismic ACROSS, the 2011 off the Pacific coast of Tohoku Earthquake