

Effects to the crustal movements of the Tokai region by 2011 Tohoku Earthquake

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On March 11, 2011, a massive earthquake of Mw9.0 occurred along the plate boundary off the Tohoku region, Eastern Japan. This was the largest earthquake in the recent Japanese history. Its co-seismic and after-seismic crustal deformation affected the crust of all over Japan and also triggered active seismicities.

Tokai region, central Japan, is located at the plate boundary zone between subducting Philippines Sea Plate and Amurian Plate. In this region, Tokai Earthquake has been expected to occur in the near future along the plate boundary. Some of the induced earthquakes of the Tohoku Earthquake occurred in the Tokai region. Therefore, this massive earthquake might change the conditions of the crust in this area. We estimated the effects of the Tohoku Earthquake which was appeared in the crustal deformation in the Tokai region.

Very dense observation network has been expanded in the Tokai region. We obtained GPS station coordinates by analyzing observation data of 84 stations in Shizuoka, Aichi, Nagano and Yamanashi Prefectures. These GPS stations included GEONET (GPS Earth Observation Network System) and JUNCO (Japanese University Consortium for GPS Research). We processed their data during the period of 200 days from February to September 2011. We used GAMIT ver.10.4 software for analyzing observation data. Reference frame was ITRF2008. At first, we estimated co-seismic displacements of each stations from the obtained coordinates. Then, we calculated after-seismic velocity field and dilatation velocities, and compared them with the ones calculated in the previous study (Hashimoto et al., 2011) from GPS observation during the period before the Tohoku Earthquake, August 2005 to December 2006.

Our results showed clear dilatation velocity distribution change before and after the Tohoku Earthquake on March 11, 2011. The effect of the afterslip was quite significant, and also the coupling condition between Philippine Sea plate and Amurian Plate may be changed, although the Tohoku Earthquake was the event which occurred in subducting zone of the different pair of plates from the Tokai region.

Keywords: GPS, crustal movements, Tokai region, Tohoku Earthquake, strain velocity, temporal change