Vertical velocity profile and possible velocity changes in SW Japan from GNSS data over the last 20 years

*Yutaro Iwasa[1], Kosuke Heki[2]

1. Space Geodesy Laboratory, Earth and Planetary Dynamics, Natural History Sciences, Graduate School of Science, Hokkaido University, 2. Earth and Planetary Science, Graduate School of Science, Hokkaido University

GNSS (Global Navigation Satellite System) observations have been playing a major role in studying crustal deformation near plate boundaries. Such observations provide valuable information on, e.g. fault mechanisms of earthquakes, and also contribute to mitigation of volcanic disasters. In addition to them, inter-seismic crustal deformation reflect strain accumulation in the plate interface, and enables us to study mechanical coupling between the plates. So far, most of these results are based on horizontal components of the 3-D crustal deformation, and the vertical components has not been well utilized. This would be due to the lower signal-to-noise ratio of the vertical crustal movements. On the other hand, in the plate boundary region, the horizontal components include both rigid plate motion and interplate coupling. On the other hand, the vertical components only contain the latter, and directly reflect inter-plate coupling. Aoki and Scholz (2003) analyzed the vertical crustal movement of the Japanese Islands using the data over three-year period 1996-1999. We already have 20 years of crustal movement data from the Japanese dense GNSS array GEONET (GNSS Earth Observation Network), and much more accurate vertical velocity data are available. In this study, we estimated vertical velocity using the time seris 1996-2016. In particular, we analyzed the interplate coupling in Southwest Japan using the vertical velocity profile spanning from the Muroto Cape to the Oki Islands. The interplate coupling in the Japan Trench is reported to have gradually weakened over the years before the 2011 Tohoku-Oki earthquake. Classical studies of viscous flow contribution in subduction zones have also suggested that crustal deformation rate may change within an earthquake cycle. The Nankai Trough is the plate boundary where the Philippine Sea plate subducts, and the next inter-plate earthquake is anticipated to occur within the coming years or decades. With the long-term data spanning ~20 years, we could study the temporal change of the vertical velocities. Here we modeled them using quadratic functions of time, and discusss the significance of the quadratic terms. GNSS stations close to the Nankai Trough subside while those a little farther apart show uplift. Then, the temporal change in the coupling would appear in various polarities and amounts for these stations. On the other hand, if the acceleration is simply due to some unknown movement of the reference point, the quadratic term would appear as a uniform value in all the station. In this study, I compared the linear trend and the quadratic components of stations with various distances from the trench, and found that the quadratic term might be a leakage from the movement of the reference point.

Keywords: Vertical Velocity

©2017. Japan Geoscience Union. All Right Reserved.