Research report

During my stay at ERI from Oct. 16 to Nov.30, I worked with Prof. Akito Araya. We focused on the strain characteristics in Kamioka, Gifu Prefecture based on the observation data from GNSS and strainmeters. There are three strainmeters have been installed in Kamioka tunnels. Among them, the 1500-m laser strainmeter has more excellent resolution, dynamic range and bandwidth. After it was operated on August 2016 it has recorded the larger strain amplitude caused by the Mw6.9 Fukushima earthquake on 22, Nov. 2016. The Fukushima earthquake is the largest one during 2016.8.1-2019.11.9 when 16 (≥M5.0) earthquakes around 500km to Kamioka occurred. The strain changes from other earthquakes should be studied further. The strainmeter is about 0.5km from the Atotsugawa fault where occurred several earthquakes larger than Mw 7.0 in the history. Now, there are about 20 earthquakes less than M2.0 occurred each year.

Among the GEONET stations, J970 is about 8 km from Kamioka site which is the nearest station. The horizontal rates with the fixed station J970 in 5 years are studied. It shows the rates near Kamioka are smaller than other regions. And the velocity directions changed in the boundary of the Hida Mountain Range where the upliftings of the east stations are larger than 40cm while the upliftings in the west are less than 10cm after the 2011 Mw9.0 Tohoku Earthquake. So we deduce the deformation in Kamioka might be influenced by the eastward motion.

Both of the continuous GNSS stations and the strainmeter can attain the continuous strains in the region. Based on the horizontal velocities of GEONET stations, the strains within J250-J618-J252 and J249-J250-J618-J279 are calculated through interpolation of geodetically derived displacements and a least-squares solution method. The strain trends are about 6.8×10^{-8}/year. The residual strain is about $\pm5\times10^{-8}$/year after detrending. At the same time, the 116228 records attained by 1500-m laser strainmeter during 2016.12.1-2019.2.28 are studied. The strains are about $\pm5\times10^{-8}$ during 2016.9-2018.4. The peak strain in 2018 is larger than that in 2017.The data during 2016.9-2018.4 is nearly agree with seasonal change and the larger changes often appear after earthquakes. There are about 1800 records of strainmeter with the larger errors can't be used. The strainmeter is more sensitive to the rainfall and snow. Except the seasonal change and secular change, the records should also consist of the influences from the temperature,pressure, the ambient microseismic ocean noise, coseismic and postseismic changes. It becomes more complicated for understanding the different kinds of factors.

The above was our simple results when I stayed in the 45 days visiting time. There are still a lot questions will be deeply analyzed and studied in the future. This is an unforgettable time when I did the research at ERI. Thanks for ERI 's invitation and support. Thanks Prof. Akito Araya for giving me the careful and detail explanation in the principles, timely guidance and productive discussions. Thanks Ms. Yuko Yamada and other members who worked at the International office for their thoughtful helps during my preparation and other consequent steps of the visit. Thanks for the lovely people who contributed to my staying in Tokyo.ありがとうございます.