Preliminary Study on the Crustal Deformation along Sagaing Fault in Myanmar by using GNSS data

*Tha Zin Htet Tin[1,2], Takuya NISHIMURA[3], Manabu Hashimoto[3], Eric Lindsey[4], Myo Thant[2,5]

1. Graduate School of Science, Kyoto University, 2. Department of Geology, University of Yangon, Myanmar, 3. Disaster Prevention Research Institute, Kyoto University, 4. Earth Observatory of Singapore, Nanyang Technological University, Singapore, 5. Myanmar Earthquake Committee

Background

The plate tectonic motion between India, Eurasia, Sunda and Burma plates is responsible for the major geological processes in Myanmar. Among them, earthquakes are important mechanism responsible for geohazards in Myanmar. Currently, relative motion between the India and Sunda plates is about 35 mm/yr (Socquet et al,2006) and the rate of subduction of Indian plate beneath the Burma plate is about 12 - 24 mm/yr (Mallick et al.,2019). Due to this subduction and convergence between the India-Eurasia and Burma plates, fold and thrust belts are developed in the western part of Myanmar. Another major active geological structure in Myanmar is the 1200km long Sagaing Fault, a right-lateral strike slip fault, north-south trending along central Myanmar with slip rate of 18 –20 mm/yr. Most of the major cities in Myanmar, including Yangon, Mandalay, Nay Pyi Taw, Bago, Sagaing, Taungoo, Meiktila, etc., lie near-by and along the Sagaing Fault. Many large earthquakes have struck along this fault, resulting in many hundreds of casualties and significant damages in Myanmar over the past century.

GPS Measurement and Data Processing

A GPS network was constructed under the collaboration between Earth Observatory of Singapore (EOS), Myanmar Earthquake Committee (MEC) and Department of Meteorology and Hydrology, Myanmar (DMH) in Myanmar since 2012. 17 continuous GPS stations were instslled along 3 transect perpendicular to the Sagaing Fault from upper to lower Myanmar. To improve coverage in the Indo- Myanmar (Burma) Ranges in the west and Eastern Highland in the east, additional campaign measurements have been conducted since 2016. We possessed more than 113 campaign stations and 17 continuous stations to enable an estimate of crustal deformation across Myanmar. We estimated site velocities for the 17 permanent stations since 2012 and 41 campaign stations since 2016. We included RINEX data from nearby permanent IGS network stations in our processing to improve the accuracy of site positions and define a consistent reference frame in our research area. Daily coordinate positions for permanent and campaign stations in the International Terrestrial Reference Frame 2014 (ITRF2014) were computed using GIPSY-OASIS ver 6.4 software from Jet Propulsion Laboratory (JPL). Ocean tide loading was calculated using FES2014b model by the Onsala Space Observatory (http://holt.oso.chalmers.se/loading/) with respect to the joint mass center of solid Earth and ocean combined.

Result

We confirmed that the present-day relative motion and the direction of movement between the GNSS stations are consistent with the dextral strike slip of this fault system. The stations on the eastern side of the Sagaing Fault show smaller velocities with respect to the Sunda plate than those on the western side of the Sagaing Fault. The western stations still have significant motion with respect to the India plate. This result implies that the eastern part of Myanmar is generally experiencing less internal deformation than

the western side. The velocities in the Mandalay area show an additional WSW-ward movement due to the effect of clockwise rotation of the Eastern Himalayan Syntaxis from the north.

Keywords: GNSS, Sagaing Fault, Burma plate, Indo-Myanmar Ranges, Eastern Himalayan Syntaxis

