

Repeating Slow Slip Events in the Bonin/Ogasawara Islands Observed by the Continuous Global Navigation Satellite System (GNSS)

*Deasy Arisa¹, Kosuke Heki¹

1.Department of Natural History Sciences, Faculty of Science, Hokkaido University

Slow slip events (SSEs) are the episodic movement across a fault, characterized as a slow fault deformation that releases energy on timescales of hours, to weeks or even years, which is much longer than seconds to minutes timescales of regular earthquakes. Numbers of SSEs has been recognized from various subduction zones around the world. The character of SSE was first recognized in Cascadia subduction zone in the Northwestern of United States and Canada. These studies were followed by some reports of similar event including Japan.

The dense geodetic observation by Continuous Global Navigation Satellite System (GNSS) station operated by Geospatial Information Authority of Japan (GSI), also widely known as GPS, contribute a big impact on observing such events in Japan. It has been used as a way to measure the motion of Earth's crustal plates. In Japan, from the starting of their installation in 1996, various SSEs have been recorded to have occurred.

We have been conducting the same study of this event and reporting the possibility of this occurrence in other part of Japan which is never reported before. The area of this newly found SSE is in the remote islands of Japan, Bonin (Ogasawara) islands, which lies along the convergent boundary where the Pacific Plate subducts beneath the Philippine Sea Plate. These islands are located at the southern part of Japan, very close to the edge of Mariana arcs.

The events are detected by using GNSS data from GSI together with additional supporting data from National Astronomical Observatory of Japan (NAO) to confirm the occurrence of these events. GNSS stations on Bonin Islands recorded the plate deformation and reveals the possible existence of Slow Slip Events (SSEs) near the boundary between the Philippine Sea plate and Pacific plate. The Slow Slip Events (SSEs) together with other crustal deformation in this area has been observed since the beginning of GNSS installation in two islands, Chichijima and Hahajima from 1996 until now. This ~20 years of observation contribute the result of finding of repeating SSEs.

Using data from this dense geodetic network, we focus our study on the repeating SSEs in the latest decade, reporting that there are at least 5 SSEs have occurred within 10 years with the recurrence interval of ~2 years, detected by stations in Hahajima and Chichijima islands. These 5 SSEs have uniform characters in the time constants as well as the recurrence interval, and we modeled the rupturing due to these SSEs by using rectangular fault plane model. This study is giving the result of slip approximately 8-10 cm for each event or 4-5 cm/yr. These events have magnitude from 6.8 to 6.98, varies especially from the size of the fault rupture, with the seismic moment of 2×10^{19} Nm - 3.75×10^{19} Nm.

Keywords: Bonin Islands Arc, Fault Rupture, GNSS, GPS, Ogasawara, Slow slip event (SSE)