

Possible repeating slow slip events beneath the Bonin Islands

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Continuous global navigation satellite system (GNSS) data including the global positioning system (GPS) is one of the most powerful tools available for observation of Earth's surface deformation. In particular, coseismic, postseismic, slow transient, and interseismic deformation have all been observed globally by GPS over the past two decades, especially in subduction zones.

Here, we are using the deformation data from GPS observations to understand the deformation due to the earthquakes, afterslip and slow slip events in subduction zones around Japan, where geodetic data coverage is particularly dense. We are focusing on Bonin (Ogasawara) Islands Arc to understand its characteristic, especially the possibility of repeating Slow Slip Events (SSE). Global positioning system (GPS) time series in Bonin Islands Arc reveal the possible existence of slow slip events (SSEs) at the boundary between the Philippine Sea plate and Pacific plate.

Using data from this dense geodetic network operated by GSI, there are several possible events look like SSE that have one-year recurrence, detected by stations in Hahajima and Chichijima islands. These SSEs were identified from January 1996 to October 2014 by GNSS time series offset monitoring and rupture modeling with a rectangular fault located on the subducting Philippine Sea Plate. The detected SSEs were found to have a variety of characteristic recurrence intervals, magnitudes, durations, and coincide or relate with other seismic activities.

Time-decaying constant of these slow slips are first estimated to obtain the northward, eastward and vertical components of the ground deformation. Several methods are used to estimate the fault parameter including depth, dip, slip, strike, and width to understand its consistency with the fault boundary geometry. This process is followed by modeling the rupture area during the events and calculating the magnitude of these events based on geodetic approach.

These results lead us to further understanding about sequence of slow slip events in Bonin Islands Arc as a part of Philippine Sea plate.

Keywords: Slow Slip Event (SSE), Bonin Islands Arc, Ogasawara, GNSS, GPS