

## Earthquake clusters with similar earthquakes around the Sakishima Islands

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Small repeating earthquakes relate with the interplate coupling and are probably a kind of 'slip sensor' to detect the aseismic slip in the area surrounding them. They are not affected by spatial density of the seismic network if we can detect them. Utilizing this advantage, we have already estimated the spatio-temporal change of slip distribution in the subducting Pacific plate boundary. However, we obtained that the temporal resolution of slip rates depended on time interval of earthquakes. Estimated slip rates also have some uncertainty for variation between physical and source properties by region.

In this study, we investigate spatio-temporal characteristics of earthquake clusters with similar earthquakes as goal of estimating interplate coupling with high-precision and high temporal resolution. We researched the repeating earthquakes which occurred around the Sakishima Islands. Large interplate earthquake are not occurred around this area, but seismic activities are high. On the other hand, relative plate convergence rate of about 12.5 cm/yr is very fast for the effect both southward movement by back-arc opening from Okinawa trough and the subducting Philippine Sea plate toward northwest. Furthermore, about 20 slow-slip events, which have constant recurrence interval of about 0.5 year and average slip of 5-6 cm, are discovered in this area by Heki and Kataoka [2008].

We investigated similarities of seismograms and extracted earthquake clusters. JMA hypocenter catalogue are used for selecting hypocenter information. We analyzed waveform records operated by the NIED and JMA for the periods of about 7 years after 2002. Earthquake clusters were extracted from hypocenter location, hypocentral error, and distance between events as parameters. On the other hand, we basically applied the procedure for investigating similar earthquakes and small repeating earthquakes, and estimating slip rates of small repeating earthquake by Igarashi et al. [2003].

As a result, we detected repeating earthquake sequences which have long-term duration and repeated constantly, around the Sakishima Islands. The focal mechanisms of their events are the low-angle thrust fault type. The depth of their clusters is also consistent with the oceanic crust and mantle in the subducting Philippine Sea plate interpreted from receiver functions. Therefore, they are located in the upper boundary of the Philippine Sea plate. Their estimated slip rates are consistent with the slip velocity of the subducting plates.

Some earthquake clusters are located around the source region of slow slip events. In particular, we investigated seismic activities of an earthquake cluster with similar earthquakes located in the west of the Hateruma Island and about 30 km deep. From relations between magnitude and time series, we can see that the seismic activities of the cluster have been changing with recurrence time of half a year to a year. M4 class earthquakes with high waveform similarities occur in the cluster as seismic activities are active. They seem to have synchronized with the generation of slow slip events. However, the timing of generation might be not completely corresponding, and the seismic activities not be sometimes occurred. We suggest that the place of slow slip event changed in each case, the earthquake cluster are surrounded by more stable sliding area, or a slip amount earthquakes of M4 class events is larger than the that of a slow slip event. It is expected that earthquake clusters and small repeating earthquakes give the state of slip and stress in the place. We should investigate the relation between inter-plate coupling and the seismic activities for the units of earthquake clusters in detail in the future.