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学 位 論 文 内 容 の 要 旨

博士の専攻分野の名称 博士（理 学） 氏 名 TU TAOLIN YOKO

学 位 論 文 題 名

Geodetic and seismological study of slow earthquakes and inter-plate coupling in the Ryukyu subduction zone

(琉球沈み込み帯におけるスロー地震およびプレート間カップリングに関する測地学
的および地震学的研究)

Slow earthquakes are important phenomena in discussing how plates converge in subduction zones. Here I detected slow slip events (SSEs) and very low-frequency earthquakes (VLFES) in the Ryukyu Trench using GEONET (GNSS Earth Observation Network) GNSS (Global Navigation Satellite System) data and board-band seismic data of F-net and BATS (Broadband Array in Taiwan for Seismology) in order to investigate interplate coupling in this subduction zone.

From 1997 to 2016, I identified 38 SSEs beneath the Iriomote Island, southwestern Ryukyu Arc. These events occurred biannually on the same fault patch at a depth of ~30 km on the subducting Philippine Sea Plate slab with average moment magnitudes (M_w) of ~6.6. Their slip accumulation rate varies in time and increases in 2002 and 2013, coinciding with the activation of the back-arc spreading as indicated by the earthquakes swarms in the Okinawa Trough. It suggests that episodic activations of the back-arc spreading at the Okinawa Trough caused extra southward movement of the block south of the trough and accelerated convergence at the Ryukyu Trench.

From 2005 to 2012, a total of 29,841 VLFES were detected in the Ryukyu area also. These events are distributed near the Ryukyu Trench axis and have shallow thrust-faulting mechanisms, which indicates that they probably occur in the accretional prism or on the shallow plate interface of the Ryukyu subduction zone. Moreover, these VLFES are characteristic of high b -values (2.3-5.0), and nearby SSEs often influence their activities. For example, in the Sakishima, Okinawa, and Amami areas, VLFES are activated in 5-30 days, 0-15 days, and 0-5 days,

respectively, after the start of SSEs.

Among these VLFs, 97 events south of the Miyako Island showed notable similarities in waveforms, amplitudes, magnitudes, and source mechanisms. These events recurred in the same area with an average interval of ~50 days. This new type of VLFs, named as repeating very low frequency earthquakes (RVLFs), are similar to small repeating earthquakes in the creeping zone of the plate boundaries. Seismic slip released by the RVLFs is about 3-42 % of the average plate convergence in this segment of the subduction zone, significantly smaller than that of 72% released by the repeating SSEs.

From the locations of SSEs and VLFs detected in this study, and two suspect megathrust earthquakes ($M_w > 8$) in the Ryukyu area, slow and ordinary earthquakes in the Ryukyu Trench are found to occur in following depths, Sakishima: megathrusts (locked zone, ~10 km), VLFs (~20 km), and SSEs (~30 km), and Okinawa: VLFs (~20 km) and SSEs (~30 km). However, the situation in the Amami area is not well understood due to the complex tectonic setting and inaccurate hypocenters of large earthquakes and VLFs.