

Large tsunamis along a weakly coupled interface in the western Ryukyu trench

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A large tsunami struck the coasts of Ishigaki and surrounding islands along the western Ryukyu Trench on 24 April 1771. Several different earthquake phenomena were recently found along the western Ryukyu Trench: slow slips on the plate interface, very low frequency earthquakes, a tsunami earthquake and splay faults near the trench, which were similarly found in the Nankai trough. Moreover, it is pointed out based on GPS data on Taiwan that the westernmost Ryukyu subduction zone is fully coupled (Hsu et al., 2012). For all of these reasons, we purpose to investigate a plate coupling condition along the western Ryukyu subduction zone, based on tsunami deposits and GPS velocity data.

We analyze the data from the baseline of Iriomote and hateruma islands from 1997 to 2015. We exclude the data between Dec. 2001 and Mar. 2002 when Mw6.8 and Mw7.1 earthquakes occurred near the baseline during the time interval. This baseline is aligned perpendicular to the general trend of the western Ryukyu trench. The baseline length of 40 km between the two islands shows an extension of 1 mm/yr and strain rate ($+2.5 \times 10^{-8}$) over the period. The absolute strain rate along the western Ryukyu trench is smaller by one order of magnitude than those along the Nankai trough and Japan trench. As a matter of fact, the strain rate along the Nankai trough and Japan trench is negative (shortening). The long-term and constant rate extension of the baseline suggests that rifting of the Okinawa trough is caused by the retreat of the Ryukyu trench. This retreat is produced by a rollback of the Philippine Sea plate in the western Ryukyu trench.

Keywords: large earthquakes, Ryukyu trench, Interplate coupling, 1771 Yaeyama tsunami, tsunami deposits, GPS velocity