

Widespread changes in deep intraslab seismicity along the Tonga trench

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At subduction zones, the relation between shallow earthquakes and deep intra-slab earthquakes has attracted attention (e.g., Lay et al., 1989, Delbridge et al., 2017). In this study, we focus on the subduction zone along the Tonga trench where the deep earthquakes are extremely active. We investigate seismicity from January 1, 1998 to December 31, 2016 for 19 years, with earthquakes larger than M4.5. We found three notable changes in the seismicity rate deeper than 400km. All of them occurred over 500km in north-south direction. Since the first occurred during the period when precision of hypocenter location was not good, we pay attention to the second and third. The second event was a sudden drop of the seismicity rate from early 2009. In particular, reverse-type earthquakes decreased in a range of 450-500km in depth. The beginning of the seismicity drop might correspond to a shallow earthquake (in the slab) of M7.6 of March 19, 2009, but explanation by static stress shadow due to the shallow earthquake is rather difficult. Thus the causation is unclear. In addition, acceleration more than 1cm/yr in south direction was observed by GNSS around the same time. The third event was re-activation of the seismicity from middle 2013. This did not correspond to occurrence of a large earthquake more than M7. We can see spatial difference between the starting time of the re-activation. Apparent propagation speed in the north-south direction was about 10km/day. A slow mechanism to trigger the seismicity may exist in the slab.

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