Creep rates along the Philippine fault, Leyte Island, and possible repeating of Mw~6.5 earthquakes on an isolated locked patch

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Shallow active faults commonly repeat cycles of sudden rupture and subsequent silence of hundreds to tens of thousands of years, but some parts of well-developed faults exhibit continuous creep accompanied by many small earthquakes. Discovery and detailed examination of such fault creeps on land have been in a rapid progress with the advent of synthetic aperture radar interferometry applied to satellite data.

In this study, we measured the spatial variation of the creep rate along the Philippine fault on Leyte Island using ALOS/PALSAR data acquired between October 2006 and January 2011. Prominent creep of 27±10 mm/year was estimated in northern and central parts of the island except for a locked portion in the middle. We compared the creep rate distribution along the fault with the slip distribution of the 2017 Mw 6.5 Ormoc earthquake that occurred in northern Leyte, estimated from the displacements mapped by ALOS-2/PALSAR-2 interferometric data. The estimated slip of the 2017 earthquake amounted up to 2.5 meters and to moment magnitude of 6.51, with the dominant rupture area coinciding with the locked portion identified from the creep analysis. Teleseismic waveforms of the 2017 earthquake and another event that occurred in 1947 (Ms 7.0) exhibit close resemblance, indicating the same locked portion ruptured repeatedly with a time interval of 70 years.