

The 2005 M7.2 Miyagi-oki earthquake and its relation to the anticipated Miyagi-oki earthquake

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According to the evaluation report by the Headquarters for Earthquake Research Promotion of Japanese government, large earthquakes with magnitude of about 7.5 have occurred repeatedly at a recurrence interval of about 37 yrs along the plate boundary off Miyagi prefecture, NE Japan. It has passed more than 27 yrs since the last event occurred, and so the possibility of earthquake occurrence within the next 10 yrs exceeds 50%. An M7.2 event occurred on 16 August 2005 in the source area of this anticipated Miyagi-oki earthquake.

Comparison of aftershock distribution of the 2005 Miyagi-oki earthquake with that of the previous 1978 M7.4 Miyagi-oki earthquake shows that the aftershock area of the 2005 event is partly overlapped with the southern/southeastern part of that of the 1978 event (Okada et al., 2005). Comparison of coseismic slip areas between the two shows that the coseismic slip area of the 2005 event is also partly overlapped with the southeastern part of that of the 1978 event (Yaginuma et al., 2005; Yamanaka & Kikuchi, 2004).

GPS data on land detected postseismic slip after the 2005 event. Estimated postseismic slip area is located to the south of the rupture area of the 2005 event (Miura et al., 2005), which seems to support the idea that locked areas are left unruptured to the north and to the west of the presently ruptured area.

The event before the last 1978 event is thought to be 1936 M7.4 Miyagi-oki earthquake. However, reexamination of magnitude of this event shows that its magnitude is not so large and is about M7.2 (Tanioka & Hasegawa, 2005). Moreover, two large earthquakes with M7.1 occurred near the source area of the anticipated Miyagi-oki earthquake in 1933 and in 1937. Hypocenter relocations of aftershocks of these three large earthquakes in 1930s show that the aftershock areas of these 1933, 1936 and 1937 events partly overlapped with the eastern, southern and western parts of that of the 1978 event, respectively (Umino et al., 2005).

These observations show that a series of these Miyagi-oki earthquakes does not have the feature of characteristic earthquake and suggest the existence of plural asperities in the source area of the anticipated Miyagi-oki earthquake.