

Introduction to the special section for the 2005 M7.2 Miyagi-oki earthquake

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An $M=7.2$ earthquake occurred on the plate boundary off Miyagi Prefecture, northeastern Japan, at 11:46 a.m. Japanese Standard Time on 16 August 2005, when the number of people returning to their homes after the holidays was at a peak. This earthquake resulted in the Japanese bullet train of Tohoku/Akita/Yamagata/Shinkansen falling out of service for half a day, and it took a whole day for the service to get back to normal. A suspended ceiling also fell at a public facility in Sendai city, and many people were injured. Overall, this earthquake injured 79 people, and caused partial damage to 339 buildings.

Large earthquakes with a magnitude of ~ 7.5 have occurred repeatedly at a recurrence interval of ~ 37 years along the plate boundary off Miyagi Prefecture. When the $M=7.2$ event occurred in the source area of the anticipated Miyagi-oki earthquake, more than 27 years had passed since the last event, and the possibility of an earthquake occurrence within the next 10 years exceeded 50% according to the evaluation report by the Headquarters for Earthquake Research Promotion (2003) of the Japanese government. Among all of the anticipated earthquakes in Japan, this Miyagi-oki earthquake had the highest probability of occurrence.

Although the August 2005 Miyagi-oki earthquake occurred within the source area of the anticipated Miyagi-oki earthquake, the magnitude was slightly smaller than $M=7.5$ that had been anticipated. For this reason, the Headquarters for Earthquake Research Promotion predicted that this earthquake is not the anticipated Miyagi-oki earthquake. However, if this 2005 earthquake is not the one anticipated—subsequently denoted here as the “coming” earthquake—when are we to expect the Miyagi-oki earthquake? Moreover, what is happening within the source area of the coming Miyagi-oki earthquake at this moment? It is critical for us to provide answers to those questions in order to get a clear picture of the coming Miyagi-oki earthquake.

Dense nationwide seismic and GPS networks, which were recently constructed as the “Kiban” networks [in Japanese, this means the basic observation network (Okada *et al.*, 2004; Sagiya, 2004)], were successful in recording the mainshock rupture, aftershock activity and post-

seismic deformation in detail. In addition to these permanent observation networks on land, a temporary OBS network has been deployed right above the source area (Hino *et al.*, 2006), which enabled the mainshock and aftershock hypocenters to be precisely located. Many studies have been carried out based on data obtained by these observation networks. For example, in order to understand how this earthquake is related to the coming Miyagi-oki earthquake, comparative studies between this earthquake and the past large earthquakes off Miyagi Prefecture have been vigorously carried out.

A comparison of the aftershock distribution of the 2005 Miyagi-oki earthquake with that of the previous 1978 $M=7.4$ Miyagi-oki earthquake shows that the aftershock area of the 2005 event partly overlaps the southern/southeastern part of that of the 1978 event (Okada *et al.*, 2005). Waveform inversions of the two events show that the coseismic slip area of the 2005 event also partly overlaps the southeastern part of that of the 1978 event (Yaginuma *et al.*, 2006; Yamanaka and Kikuchi, 2004; Wu and Koketsu, 2005). These observations indicate that only a portion of the rupture area of the previous 1978 event ruptured during this 2005 earthquake.

The present special section is a collection of papers on the 2005 $M=7.2$ Miyagi-oki earthquake. I hope that these studies will contribute toward our developing a clear picture of the impending Miyagi-oki earthquake and to a deepening of our understanding of the mechanism of earthquake generation in general.

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