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Normal-faulting seismic sequences in Ibaraki and Fukushima Prefectures triggered by the Mw9.0 Tohoku-oki Earthquake

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The 2011 M9.0 Tohoku-Oki Earthquake triggered widespread seismicity throughout the Japanese island arc including Hokkaido and Kyushu regions. In particular, a significant increase in the shallow seismicity was observed in the minutes following the main-shock along the Pacific coast of NE Japan, notably the northern part of Ibaraki Prefecture and the southern part of Fukushima Prefecture. The most striking feature of the induced seismicity is that the focal mechanisms reveal normal faulting with a T-axis orientated in a roughly E-W direction. Several large magnitude events including the maximum 7.0 earthquake have occurred during the sequence. It is very important to understand why such intensive earthquake swarm activity associated with large mag-nitude events was triggered therein.

We have, therefore, conducted a series of temporary seismic observations through a dense deployment of about 60 portable stations after outbreak of the intensive seismic swarm. We manually picked P- and S-wave arrival times of earthquakes using waveforms retrieved from the dense seismic network. We determined high-resolution three dimensional velocity structures ap-plying the double-difference tomography method [Zhang and Thurber, 2003] to the datasets.

At the northern part of the Ibaraki prefecture, depth-sections of hypocenters show an earthquake alignment dipping westwards at 40 to 50-degree at depths shallower than 10 km. On the other hand, hypocenters at the south-east part of the Fukushima pre-fecture show diffused pattern, consisting of many small seismic clusters. Most of hypocenters appear to be located along velocity boundaries between high- and low- velocity bodies. Note that a low velocity body is clearly imaged beneath the hypocenter of the largest M7.0 event (2011/04/11) in this seismic sequence.

Keywords: triggered seismicity, velocity structure, earthquake