Upper plane seismicity of the double seismic zone beneath the NE Japan arc and M7.0 2003 Off Miyagi earthquake

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A large (M7.0) intra-slab earthquake occurred on May 26, 2003 on the upper plane of the double seismic zone off Miyagi Prefecture. No intraslab earthquakes with magnitudes greater than 7 have occurred since 1926 under the land area of Tohoku.

In this study, we relocated the mainshock and aftershocks of 2003 off Miyagi earthquake and compare the background seismicity in the period from 1997 to 2003 in and around the focal area. We obtained relative earthquake locations based on the Double-Difference method (Waldhauser and Ellsworth, 2000) using the relative earthquake arrival times by waveform cross spectrum.

Relocated aftershocks are distributed along a plane steeply dipping to WWN, which coincide with one of nodal plane of moment tensor solution. Its dip angle changes near the Moho and aftershocks both to the crust and to the mantle of the slab. The hypocenter of the mainshock seems to be located near the Moho.

Many earthquakes before the 2003 event occurred near the hypocenter of the main shock. These events are distributed near the Moho and/or within the mantle of the slab. High background upper-plane seismicity within the mantle may correspond to the area to which the rupture within the crust is easier to extend, causing large intraslab events. There exist few areas where background upper plane seismicity extends to the mantle of the slab such as the focal area of the 2003 off Miyagi earthquake.