Characteristic spatial distribution for moment tensor solutions of aftershocks in the 2003 Tokachi-oki earthquake area

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The 2003 Tokachi-oki earthquake with Mw7.9 is the largest interplate earthquake occurred ever since the high dense broadband seismometer network, the National Research Institute for Earth Science and Disaster Prevention (NIED) F-net, has been established over Japan. We determine the spatial distribution of moment tensor solutions and centroid depths of the mainshock and aftershocks (Mw4.0-6.5). The focal mechanism of the main shock shows a thrust fault with nodal plane dipping toward northwest with dip angle of 16 degree while centroid depth is estimated at 29 km(strike, rake, and seismic moment are 246 degrees, 124 degree, 6.9 x 10^20 Nm, respectively). All aftershocks are divided to three groups: (1) the thrust fault type whose nodal plane is similar to the main shock; (2) the other thrust type with nodal plane different from the main shock; and (3) the normal fault type.

The type (1) shows a depth distribution inclined to NW gently, coincident to the upper boundary of descending Pacific Plate. The active area of the type (1) does not overlap with the co-seismic slip area of the main shock obtained by Yagi (2003) at all. This suggests that the way to release the stress concentrated on plate boundary in the aftershocks area is different with that in the co-seismic area: the stress in the aftershock area is released on some small asperities surrounded by the aseismic site, while that in the co-seismic area of the main shock is released on a larger asperity.

On the other hand, the type (2) shows no characteristic depth distribution with centroid depth scattered above and beneath the upper plate boundary. P axes of some aftershocks occurred above the plate boundary show the direction from ENE-WSW to ESE-WNW. According to Kimura (1986), thrust faults of Hidaka collision zone has developed in this area. DeMets (1992) also concluded that the Kuril Island arc is moving toward the southwest with a speed of 6-11 mm/year. Our result about these P axes suggests that the compressional stress is dominated by this collision after the main shock.

The type (3) events are distributed, mainly, at about 40 km depth above the upper plate boundary.