Tectonic implication of the 2003 Tokachi-Oki Earthquake and its Consequences

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Aftershock distribution of the great earthquake of Tokachi-Oki on September 26 is characterized by onset of an eastward extension of seismic events. Although seismicity is comparatively sparse, the greatest aftershock of magnitude 7.3 (Mw) occurred in the western part of the aftershock area about one hour after the main shock. To compute the state of stress immediately after the main shock in this region, a stress tensor inversion was carried out using a method developed by Horiuchi et. al.; 1995. Altogether 78 aftershock events along with more than 2500 polarity data of P wave in the period Sep. 26 ~ Oct. 18 were inverted. These aftershocks occurred in the region bounded in latitude 41.25o ~ 43oN and longitude 143.5o ~ 144.5oE.

The inversion revealed a steep, southward dipping the maximum principal stress axis and the intermediate and minimum principal stress axes dipping gently towards north and west respectively. The stress shape ratio was calculated to be 0.5. Under this stress environment the maximum shear stress was found to be posed on eastward dipping planes suggesting that one of the nodal planes in the focal mechanism solution should dip eastward which is the most probable fault plane. This result is consistent with the observed focal mechanism solutions of the aftershocks in the eastern region.

Assuming a horizontal maximum tectonic stress in this region prior to the main shock, the result indicates a drastic change immediately after the Tokachi-Oki main shock. It may be implying that the vertical lithostatic load became the maximum, as the tectonic stress was relieved by the main shock, which might be the reason for the complex consequences of the aftershock distribution in the eastern part of the aftershock region. The largest aftershock which is deeper than the main shock may be a consequence of the mechanical interaction between the two colliding arcs in this region.