Generation Process of the 2004 Niigata-Chuetsu Earthquake and its Major Aftershocks Inferred from Aftershock Distributions

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The 2004 Niigata-Chuetsu earthquake (Mjma 6.8) occurred in a concentrated deformation zone along the Japan Sea coast (NKTZ: Niigata-Kobe Tectonic Zone), which was identified from strain patterns determined by the dense GPS network. The observed difference in deformation rate between the NKTZ and the surrounding region, is almost one order of magnitude (Sagiya et al., 2000). It was, however, controversial whether or not this large deformation rate reflects stress concentration. This is because larger inland earthquakes occurred outside of the NKTZ, while active folds are observed within the NKTZ. It is inferred from deformation rate profiles and the estimated stress field in and around the NKTZ that a weak zone with low viscosity exists in the lower crust beneath the NKTZ (Iio et al., 2002). The large deformation rate may result from aseismic slip of many ductile fault zones in the lower crust that constitutes the weak zone. The complicated fault plane distributions of the mainshock and large aftershock sequences are possibly produced by a number of the ductile fault zones in the lower crust. Further, rupture processes of major earthquakes, estimated from aftershock distributions, suggest that the weak zone beneath the Niigata-Chuetsu region is weaker than in the surrounding areas.