

Crustal deformation in the Mid-Niigata area and its implication for strain concentration

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The Mid-Niigata area is located within the concentrated strain belt along the eastern margin of the Japan Sea. This area suffered from two large earthquakes, the 2004 Chuetsu and the 2007 Chuetsu-oki earthquakes. Based on GPS velocity data calculated from daily coordinate time series of GEONET, we identified significant time dependence of the interseismic crustal deformation patterns before, between, and after these two earthquakes. Modeling results of the deformation pattern changes are summarized as follows. 1) Contraction before 2004 occurred between the source regions of the two earthquakes and it was attributed to aseismic faulting across almost the whole elastic layer, implying that the observed strain was largely inelastic. This interpretation is also supported from a fact that the historical seismic energy release in this area is much smaller than that expected from geodetic strain accumulation. 2) After two earthquakes, aseismic faulting seems to have continued without explicit time decay. The aseismic faulting is estimated close the source fault of the main shocks, implying that postseismic strength recovery did not occur on the main shock fault or a nearby parallel fault was activated to accommodate regional contraction. This is consistent with an idea that the upper crust in this area is segmented to smaller blocks and the mechanical behavior is very sensitive to external stress changes.

Keywords: Strain concentration, Niigata-Kobe Tectonic Zone, 2004 Chuetsu earthquake, 2007 Chuetsu-oki earthquake, aseismic faulting, inelastic deformation