

Interpretation of crustal deformation in Hokkaido since the occurrence of 2003 Tokachi-Oki earthquake

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The continuous GPS observation network (GEONET) of the Geographical Survey Institute (GSI) detected a significant crustal deformation caused by the Tokachi-Oki earthquake (M8.0) of September 26th, 2003. A large postseismic deformation was also observed just after the earthquake in whole Hokkaido. While monitoring the postseismic deformation, large earthquakes occurred on November 29th and December 6th, 2004 at off Kushiro region. The GEONET also detected a coseismic and postseismic deformation caused by these earthquakes. These postseismic deformations still continue in the Tokachi region, but almost subside in the Kushiro and the Nemuro regions.

Since the GPS analysis results include annual and linear trend components, we remove them from the raw time series by fitting a polynomial function and trigonometric functions to the data for the period between 1998 and 2000, when there were no abnormal events. By extrapolating the estimated linear and annual components to entire period, we estimate the transient crustal deformation. We also remove a coseismic offset due to four earthquakes (November 29th and December 6th, 2004 Kushiro-Oki earthquakes, August 16th, 2005 MiyagiKen-Oki earthquake and November 15th, 2006 Kurile earthquake) which occurred in the analysis period. We applied Kalman filtering following the time dependent inversion technique for the period since September 2003 to estimate spatio-time evolution of the aseismic interplate slip. A few cm/2month slip was estimated in Tokachi-Oki region at present. On the other hand, a several cm/2month slip was estimated in Kushiro-Oki and Nemuro-Oki region just after the occurrence of two earthquakes in 2004. There is almost no slip in this region at the beginning of 2006. The estimated total moment surpasses Mw7.9 in 2007.

We also estimated the viscoelastic effect caused by the 2003 Tokachi-Oki earthquake, using 3-D FEM (Finite Element Method). Qualitatively, a part of observed postseismic deformation can be explained by the viscoelastic deformation in horizontal component. However, the observed postseismic vertical deformation can not be explained by the viscoelastic deformation. Because predicted vertical deformation caused by viscoelastic effect is subsidence and observed one is uplift.