Inversion of GNSS and GPS/Acoustic data for afterslip and viscoelastic relaxation following the 2011 Tohoku earthquake

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We simlutaneously estimate coseismic slip, afterslip and viscoelastic relaxation following the 2011 Tohoku earthquake by inverting GNSS and GPS/Acoustic data. The Green function is calculated from analytical expression given by Fukahata and Matsu'ura [2006], which is expressed by a heriditary integral of slip rates. We employ a model consists of an elastic layer over a Newtonian viscoelastic substrate. The elastic thickness is 50 km and the viscosity of the Maxwell body is $9.0 \times 10^{18} Pa \cdot$s. As a Pacific Plate configuration we use Nakajima and Hasegawa [2006] and take an area of 400km long and 300 km wide zone. Temporal and spatial smoothing is implemented and their strength is optimized by minimizing Akaike's Bayesian Information Criteria.

The result shows that the afterslip is almost over by the end of September 2013. Afterslip is significant in the deeper extension of the main rupture, but less significant in the area of previously ruptured area, including the 1978 Miyagi-oki earthquake rupture area. Aferslip is also inferred in the shallower part of the off-Fukushima area. The inferred viscoelastic flow leads trenchward movement in Tohoku area, while landward movement at some GPS/Acoustic stations. The results also show that afterslip causes uplift of about 20–30cm at inland stations above the downdip extension of the large slip area, while viscoelastic relaxation causes subsidence of about a few centimeters there.