Slow slip events on the plate boundary off Miyagi and Fukushima detected by GPS and strain measurements

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In February 2001, earthquakes with M5.8 and 5.4 occurred along the plate boundary off Fukushima, NE Japan. Their focal areas are located at one of the most seismically active regions in Japan: there occurred a swarm activity including 3 major events with magnitude larger than 7 in 1938, and that including 5 events with magnitude larger than 6 in 1987. After the 1987 activity, however, no large earthquakes with magnitude larger than 6 have taken place in the region. A continuous GPS station (OIP) was installed on a gas platform 40km off Fukushima in 1995. OIP had been displaced toward southwest in the ITRF2000 coordinate system with about 2 cm/yr. all through the period until January 2001. The deviation from the trend of its steady-state displacement before 2001 amounts to about 25 mm in SE direction by the end of 2002. Permanent GPS stations on land operated by GSI, on the other hand, show no significant displacement larger than noise level in the same period. One possible model explaining the observed displacement rate is an aseismic slip event with a thrust type of mechanism occurring on the plate boundary, though the constraint on the model is weak. The model fault is 70 km by 45 km along its strike and dip, respectively, and includes the focal areas of the above two events around its upper edge. The aseismic slip from February to December 2001 amounts to about 17 cm, which is equivalent to Mw 6.8.

Postseismic displacements after the M6.1 event located off Miyagi on November 3, 2002 have been observed at the continuous GPS stations of GEONET operated by GSI [GSI, 2003] and of Tohoku University. The displacements directing the focal area of the M6.1 event observed at many sites suggest that the source of the postseismic deformation is located around the focal area. A 3-component strainmeter installed at Sanriku station, which is located closer to the focal area, also shows postseismic strain changes amounting to about 10 nano strain, together with coseismic ones of 15 nano strain. A possible source model for this event will be presented using GPS and strain data.