Co- and Post-seismic crustal deformation due to the M6.8 earthquake off Fukushima prefecture on October 31, 2003 observed by GPS

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One of the typical interplate earthquake with magnitude 6.8 occurred at 10:06 (LT) on October 31, 2003 off Miyagi and Fukushima prefectures, northeastern Japan, accompanied by a small tsunami with amplitude of about 0.3 m at Ayukawa, Miyagi pref. Yamanaka (2003, http://wwweic.eri.u-tokyo.ac.jp/) performed a seismic waveform inversion to reveal slip distribution on a model fault dipping westward with strike directing NNE-SSW. Shanta et al. (2004, this meeting) investigated sP depth-phases in seismographs of the main shock and aftershocks to obtain their precise focal depths. This result supports that the main shock is a typical interplate event.

Seismicity around the area off Miyagi and Fukushima prefectures seems to be activated since 2002, including earthquakes with magnitude larger than 6 and various types such as Mj6.2 interplate earthquake on November 3, 2002, Mj7.0 intra-slab earthquake on May 26, 2003, and Mj6.2 shallow inland earthquake on July 26, 2003. Large earthquakes with magnitudes of about 7.5 have repeatedly occurred on the plate boundary east off Miyagi prefecture (e.g. Seno et al., 1980). The most recent one took place in 1978, i.e., Mj7.4 Miyagi-oki earthquake. It is located just the western adjacent of the source area of the October 31, 2003 earthquake. Based on the record of the repeated occurrence of earthquakes with magnitudes of about 7.5, the Headquarters of Earthquake Research Promotion of Japan evaluated that the next Miyagi-oki earthquake will occur with the probability of about 40 % in the next 10 years. Thus the recent seismic activity should be discussed in terms of a cycle of the M7.5 forthcoming earthquake.

Since the hypocenter of the Mj6.8 earthquake is located at more than 100 km far from the Pacific coast, there was no distinctive crustal deformation observed by the continuous GPS network. However, two GPS stations, Kinkazan (KNK) and Enoshima (EN3) in Miyagi pref., located at about 100 km northwest of the hypocenter, show coseismic displacements accompanied by postseismic ones with as small amplitudes as about 5 mm. These amplitudes are comparable with observation errors of GPS, but may be caused by actual faulting process in and around the source area of the earthquake because no displacement was observed at farther stations such as Akita (AKT) at the Japan Sea coast. Another continuous GPS station, OIP, established on a natural gas platform located at about 40 km off Fukushima pref. and about 100 km southwest of the hypocenter, also demonstrates no coseismic but postseismic signal with an amplitude of about half of those observed at KNK and EN3. This suggests that the postseismic source may exist at the southern part of the coseismic one.

Uchida et al. (2004) found that the active area of aftershocks moved toward southeast about 14 hours after the main shock and that an aseismic faulting with magnitude of about 0.1m occurred there using the analyses of repeating earthquakes. These phenomena are consistent with the land deformation observed by GPS. We will also present models for the co- and post-seismic sources.