

Comparison of two Miyagi-oki earthquakes in 1978 and 2005 based on geodetic data

Satoshi Miura[1]; Takeshi Iinuma[1]; Yusaku Ohta[1]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.

On August 16, 2005, there occurred an interplate earthquake with magnitude 7.2, hereafter referred to as the 2005 Miyagi-Oki earthquake. Okada et al. (2005) carried out the relocation of aftershocks of the 1978 and 2005 events to reveal that the aftershock area of the 2005 event is overlapped only with the southeastern part of that of the 1978 event. In addition, they performed the seismic waveform inversion for the 2005 event to estimate the coseismic slip distribution and found that it also overlapped with the southeastern part of the 1978 rupture area.

It is important to compare co- and post-seismic deformations by means of geodetic data before and after these two events to examine the possibility of future earthquakes. In this study we investigate leveling and tide gauge data, which are available for the comparison with almost the same resolution in space and time for the two events.

Ueda et al. (2001) found a significant postseismic crustal deformation following the 1978 Miyagi-Oki earthquake (M7.4) using the tide gauge records and precise leveling data. Tide records show that postseismic deformation lasted at least four years. On the assumption that the deformation was caused by an afterslip on the subducting plate boundary, they estimated the area and amount of the afterslip by inversion analysis and concluded that the afterslip was restricted to the main shock fault and its vicinity for about two years after the main shock. In the following years, the afterslip migrated to the down-dip extension of the main shock fault on the plate boundary. We examine vertical crustal movement along the leveling route from Rifu to Ayukawa, Miyagi Prefecture, which was partly used by Ueda et al. (2001) to find some characteristics as below:

Coseismic deformations obtained for the two events show the similar feature, namely, subsidence around Ishinomaki and Oshika Peninsula, which is expected from fault models of the main shock. Spatial distribution of the subsidence looks wider for the 1978 event than the 2005 event and may suggest that the difference in the coseismic moment release between the two events. Postseismic movement for the periods 1978-1980 and 1980-2002 demonstrate that uplifting around Oshika Peninsula with almost the same amount. This means that the uplifting rate in the former period is ten times faster than the latter and indicates the significant afterslip occurred in the former period as concluded by Ueda et al. (2001). On the contrary, Postseismic elevation change after the 2005 event obtained for the period 2005-2006 indicates gradual subsidence to the east, which is similar tendency with the coseismic movement as mentioned above but different from the postseismic deformation after the 1978 event. It might be possible that the spatial distributions of the afterslip are different from each other for the two events.