Quasi-static slip before and after the M6.8 earthquake off Fukushima prefecture, on October 31, 2003

Naoki Uchida[1]; Toru Matsuzawa[2]; Toshihiro Igarashi[2]; Takashi Nakayama[1]; Akira Hasegawa[1]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.; [2] ERI, Univ. Tokyo

http://aob-new.aob.geophys.tohoku.ac.jp/

1. Introduction

Temporal changes of quasi-static slip before and after M6.8 off-Fukushima prefecture earthquake on October 31, 2003 were examined by using small repeating earthquake data. The M6.8 event was a low-angle thrust type earthquake on the plate boundary and a small crustal deformation following the event was observed by GPS data. We estimated the quasi-static slip from the activities of repeating earthquakes, which was thought to correspond to repeated ruptures of a small isolated asperity surrounded by a quasi-statically slipping area (Ellsworth, 1995; Nadeau and McEvilly, 1999).

2. Repeating earthquake data analysis

Repeating earthquakes were selected on the basis of waveform similarity. The process employed was the same as Igarashi et al. (2003) and Uchida et al. (2003). We selected earthquake pairs with epicenter separations of less than 30km and calculated cross-correlation coefficients for a 40s window containing both P and S waves. The criterion for selecting repeating earthquakes was set that the cross-correlation coefficient must be larger than 0.95 at two or more stations. A pair of repeaters was linked with another if the two pairs shared the same earthquake.

3. Results

Several repeaters were found to the south and to the west of the M6.8 asperity [Earthquake Information Center, ERI, University of Tokyo, 2003]. We calculated cumulative slip of the repeaters, which probably coincide with the cumulative quasi-static slip surrounding the repeaters. The analysis revealed that the slip rate was almost constant to be around 2cm/year through the period of these 20 years to the west of the asperity, while there were episodic slip-rate accelerations to the south of the asperity. In the periods just before and after the M6.8 event, we found no slip rate change to the west of the asperity. To the south of the asperity, however, we found a small but abrupt increase in the cumulative slip about 20 days before the earthquake and a large slip increase (around 10cm) after the event.

4. Conclusion

Quasi-static slip accelerations were identified before and after the M6.8 event to the south of the asperity. The latter one that was estimated about 30km south of the M6.8 asperity is considered to be the afterslip of the event. The slip started one day after the event, indicating the slip migrated from the asperity to the southern region. Considering that the quasi-static slip can migrate over the 30 km distance as estimated from the afterslip, there is a possibility that the small quasi-static slip before the M6.8 event had influenced the occurrence of the event.