

Surface motions prior to mega earthquakes by using GPS data

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Measurements of surface deformation can be used to understand complex stress changes underground. Stress gradually accumulates on strata until it exceeds thresholds that strata can withstand, at which point abrupt tectonic motions occur, causing earthquakes, rupture and intense vibration. The elastic deformation caused by force accumulation in strata during seismogenic processes may also be observable. In this study, we try to find out any unusual behaviors of surface motion prior to mega earthquakes by using GPS data provided by The Geospatial Information Authority of Japan (GSI).

First, we have investigated short-term deformations prior to the 2003 M8.0 Hokkaido earthquake and the 2011 M9.0 Tohoku earthquake. GPS data near the epicenters has been checked. It is found that one day before the M8.0 Hokkaido earthquake, some pre-slip may have occurred at the stations near the epicenter. As for the M9.0 mega event, two days before there have been significant deformation in the region close to the focal area. However, because of the M7.3 foreshock two days before, the deformation results may possible affect by the co-seismic slip and the afterslip.

Then, we have monitored long term motion of GPS stations associated with the M9.0 event. GPS data of three stations on the Pacific coast and three stations on Japan Sea coast in the Tohoku region have been selected to analyze. It is found that about one year before the mega earthquake, the direction of motions of Japan Sea region began to change from east to west. And around 40 days before, the whole Tohoku region began to move to east. The details of the phenomena and possible mechanism will be discussed in our presentation.