

Crustal deformation and fault model of Chuetsu Earthquake(23 October, 2004)

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GSI observed notable crustal deformation caused by Chuetsu Earthquake (23, October, 2004) by GEONET and leveling survey.

GEONET detected eastward movement in Izumozaki, Kashiwazaki and Niigata-Mishima, those are the observation sites locating west of the epicenter. On the other hand, westward movement was detected at Sumon and Niigata-Yamato, those are locating on the east side of the epicenter. The 21cm movement in Sumon site is the largest horizontal movement in GEONET sites caused by this earthquake. Tochio site, which is locating at the north of epicenter, moved toward Northwest by north. Ojiya site, which is the nearest observation point to the epicenter moved toward west and upward. The 27cm uplift in Ojiya site is the largest vertical movement.

Using these displacement data by GEONET, we made a fault model of Chuetsu Earthquake. Though Chuetsu Earthquake had many aftershock following the mainshock, we chose one rectangular fault represent the whole movement. We used inversion program based on the formula of Okada(1992). We chose starting strike, dip, and rake parameters from F-net (NIED), as well as the fault size(22km x 10km) and slip (1.2m) representing the moment magnitude (Mw)6.5. The estimated parameters are: the position of northeast corner of the fault=N37.40(deg), E138.96(deg), strike=N210(deg), dip=53(deg)(west down), rake=92(deg), slip= 1.82(m). Resulting moment magnitude(Mw) is 6.7, which is larger than the magnitude given by the F-net for the mainshock. However, as our model is including the movement caused by aftershock, the parameter is considered to be reasonable.

GSI carried out a leveling survey around along the first order leveling routes around the epicentric area. The route starts from Nagaoka city and goes to the junction point in Ojiya city. One route goes to Tokamachi city and another one goes to Minami Uonuma city from the junction. The leveling route crosses the fault zone and its total length is 75.5km. Leveling route connected to the Niigata-Yamato GEONET site in Minami-Uonuma city. We can calculate the vertical crustal movement referring to this GEONET sites as the co-seismic crustal deformation. The largest vertical movement observed by this leveling survey is, 71.5cm uplift in BM3598 in Ojiya city, which is just on the fault zone. The result of leveling survey coincide to the calculated vertical motion by the fault model from GEONET observation. It is very interesting that such simple rectangular model can represent complicated faults of Chuetsu Earthquake and its aftershocks.