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Crustal deformation around southern part of Yamagata-Bonti fault zone derived by GPS observation

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1. Introduction

The Yamagata-Bonti fault zone runs along the western margin of the Yamagata basin. In order to investigate crustal deformation around southern part of this fault zone with higher spatial resolution than GEONET, we installed a temporal GPS observation station at Yamagata University.

2. Observation and analysis

We used 400SSE Geodetic Surveyor and L1/L2 Geodetic antenna with ground plane (Trimble Navigation Ltd.) . Sampling interval is 30s, and elevation mask is set to be 15degree. The data acquisition period was from April to December of 2008-2010. We retrieved the antenna during snow season because we did not use a radome. (We continue observation this winter with a radome.)

The data was analyzed by GAMIT/GLOBK. We downloaded rinex files of 5 GEONE stations surrounding the temporal station (Yamanobe, Shirataka, Kaminoyama, Tendo, and Miyagikawasaki) from GSI, and determined locations of 6 stations. The data of 21 IGS stations in and around Japan were also used.

3. Result

Displacement rate obtained was 2 ± 0.2 mm/yr eastward and 14 ± 0.2 mm/yr southward on the average of 6 stations. Subtracting these averages, we examined relative movement. We found that the stations in the west of the fault move toward northeast and those in the east toward southwest. The rate of relative movement was about 3mm/yr. This direction shifts from that of the crustal shortening (E-W ~NW-SE direction) predominant in northeastern Honshu.

Seismicity is active near the surface trace of the southern part of the Yamagata-bonti fault since 1997. P-axis of this earthquake mechanism solution is oriented in NE-SW direction, that is consistent with the crustal displacement obtained in the present study.

We checked the influence due to the difference of the analysis software and adding a temporal station by comparing our result with GEONET F3 solution from 2008 to 2009. The differences of displacement rate and a direction were found to be very small between our result and F3 solution.

4. Future plan

Recent studies indicate that the Yamagata-bonti fault zone is divided into northern and southern segments that generate earthquakes separately. Therefore it is important to compare crustal deformation between the segments. This study showed that the data from a temporal station was very effective to grasp the crustal movement around the southern segment. We plan to set temporal GPS stations near the northern segment to investigate crustal movement in detail.

Keywords: GPS, crustal deformation, active fault, Yamagata-Bonti fault zone