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Crustal deformation of the strain concentration zone along the eastern Japan Sea margin based on dense GPS observation

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We have been conducting dense GPS observation in the Joetsu-Chuetsu region, Niigata Prefecture, to investigate deformation and tectonic loading process in the strain concentration zone along the eastern Japan Sea margin. As our GPS campaign, we occupy about 50 GPS sites for 1-2 months every year. We have three campaign measurements since 2008 and obtained an initial result of horizontal displacement rate field.

Our GPS network covers a 90 km-long area extending E-W direction between Itoigawa and Minami-Uonuma cities. We detected about 15mm/year contraction over the whole area. Precision of each velocity estimate is about 2mm/year, but the estimate velocity pattern is consistent with that from the continuous GPS measurement using GEONET.

In the western half of the network, from Itoigawa to Takada plain, there is no significant contraction. Although the Western Takada Plain Fault is considered to be the source fault of a M7 earthquake in 1751, we do not see any deformation signal associated with this fault. On the other hand, a large amount of shortening (10mm/year contraction over 30km-wide area) is accommodated within the Eastern Kubiki Hills east of the Takada Plain. Average E-W strain rate is as large as 0.3 ppm/year. The deformation pattern in the Eastern Kubiki Hills is not a simple 2-dimensional one. We find a step-wise offset around the city border between Joetsu and Tokamachi cities, and lateral variation may exist in the N-S direction. Also the crustal deformation may have short wavelength features.

In addition to the presentation of the observed result, we also present a preliminary deformation model based on it to discuss deformation process of the strain concentration zone.

Keywords: Strain concentration zone, GPS, crustal deformation, active faults, active folding