High strain zone around the Nagamachi-Rifu fault detected by GPS observation

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1. Introduction

We have started continuous GPS observation across the Nagamachi-Rifu fault in Sendai under the research project named 'Comprehensive research on slip and Flow processes in and below the seismogenic region' since 2000 (Nishimura et al., 2001). We are estimating daily coordinates of 44 GPS stations including eight new stations and exiting stations operated by GSI and Tohoku Univ. Here, we present high strain zone detected by an analysis of site velocity of each GPS station.

2. Site Velocity and Strain field

We estimated linear, annual and semiannual components from daily coordinate of each GPS station, relative to 940035 (Tendou) to get the site velocity. We calculated principle strain in Delaunay triangles whose apes are GPS stations. Characters of strain distribution are summarized as below.

(1) East-west(EW) contraction is widely observed in Miyagi and Yamagata prefectures. In particular, rate of EW contraction between Awa-shima and the western coast of northeastern Japan is high. These can be explained by interplate coupling of northeastern Japan with the Pacific and Amurian plates.

(2) There is a high strain zone whose width is 25km, west of the Nagamachi-Rifu fault (hanging-wall side). In this zone, strain rate of EW or ESE-WNW contraction reaches 0.4 microstrain/yr and is higher than that in the surrounding region. This strain concentration cannot be simply explained by interplate coupling with the subducting Pacific plate.

(3) The high strain zone extends to the south around an adjacent active fault (the Shiroishi fault).

(4) Strain rate is low in the Ou backbone range west of the high strain zones of 2 and 3.

(5) The NS extension is observed in the region southwest of the Kagitori-Okukuji line located in the extension of the Futaba fault.

3. High strain zone and slip in the deep region of the Nagamachi-Rifu fault

Assuming aseismic creep in the deep region of the Nagamachi-Rifu fault causes strain concentration on the hanging-wall side of the fault, we estimate creep rate by inversion analysis. We removed the synthetic velocity due to the interplate coupling between the Pacific plate and northeastern Japan (Nishimura, 2000) to correct the inversion data. Taking the seismological studies on the deep structure around the Nagamachi-Rifu fault into consideration, we assumed creep on a simplified listric fault surface (Kato, personal communication) including the hypocenter of the M5.0 earthquake occurred on September 15, 1998. Preliminary inversion results suggest reverse slip with right-lateral strike component on a 10km*10km patch which locates 20-30km northwest of the surface trace of the Nagamachi-Rifu fault. The slip rate is estimated to be a couple of centimeters.