Stress distribution in northeast Japan estimated from active faults and comparison of it to results from a model simulation

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Introduction

It is well known that active faults in the inland Japan have generated earthquakes every few thousand- few tens of thousand years during last 1 million years. This activity results from accumulation of tectonic stresses in the intraplate due to the relative plate motion. We have been developing a model which can simulate crustal activity in Japan. Hashimoto and Matsu'ura (2004) have simulated stress accumulation in northeast Japan using a concept of partial collision at the plate boundary between the Pacific and North American plates. To reveal a real distribution of tectonic stress accumulation, this presentation shows strain rates and stress accumulation distribution in northeast Japan estimated from quaternary active fault data and comparison of them to results from the model simulation.

Estimation of starins and stresses

Wesnousky et al. (1982) showed strain rates estimated from active faults data. We refined their estimation by means of adding new knowledge such that the dip of active faults becomes smaller with depth. We also estimate distribution of the stress accumulation from an assumption that the moment released by each fault distributes around the fault with the 2D normal distribution.

Results

The estimated crustal shortening rates in the Tohoku area are about 3-6% of the plate convergence rate between the Pacific and North American plates. These values are very large in comparison with the values estimated by Wesnousky et al. (1982) which were about 1% of the plate convergence rate. The spacial distribution of stress accumulation shows E-W compression in the Tohoku and the western Hokkaido. The compression axis inclines gradually toward NW-SE from the inland to eastern Hokkaido. We compare this result with the simulated stress fields with various collision rates. The stress fields with 0 and 5% collision rates do not match with the observed fields, but the stress fields with 10% collision rate is similar to the observed fields. The estimated crustal shortening rates from active faults are the lower limits because of the existence of folds and unrecognized faults. Thus the 10% collision rate is consistent with the observed results. This value is also supported by the results from fluvial terrace data that the crustal shortening rates is estimated 8-10% of the plate convergence rate using uplift rates of fluvial terraces (Tajikara, 2004).