Relationships between zones of long wavelength gravitational gradient and large strain rates revealed by GPS observations

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A large lateral density discontinuity in the deep crust or a steep gradient in Moho and/or Conrad discontinuities yield long wavelength gravity gradients. Since the stress is easily concentrated in and around a part with a sharp change in the structure, a region with such structures is expected to be a zone of a large strain rate in Japan, which is in the compressional field due to the subducting plates. Several regions of large strain rates are reported from the analyses of the dense GPS observation network (Sagiya et al., 2000). We investigate the relationships between zones of long wavelength gravitational gradients and the regions of the large strain rates.

We analyze the gravity anomaly data in a region of 130E-146E, 30N-46N. After the gravity effect of the slabs (Furuse et al., 2003) are subtracted from the gravity anomaly data and a low-pass filter with a cut-wavelength of 150 km is applied to them, the spatial distribution of the gradient is calculated.

Several zones with steep gradients are recognizable on the obtained gravitational gradient map. Some of them correspond to the zones with the reported zones of the large strain rates. In particular, there exists a steep gradient zone, which coincides to the Niigata-Kobe Tectonic Zone. The region corresponds to a boundary between a relatively weak gravity anomaly region in the Japan Sea area and a very large negative gravity anomaly region in the Cyubu mountainous region. The possible cause of the Niigata-Kobe Tectonic Zone is that the stress concentration takes place along the sharp structure boundary within the crust. Since the gravity gradient whose wavelength is longer than 150km the related structure boundary exists in the deep crust.