

Origin of the characteristic gravity anomaly around active faults - accumulated volumetric strain v.s. subsurface displacement

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Peculiar gravity anomaly often arises around active faults, reflecting their past fault motions. For example, the local gravity anomaly around the Northern-Izu Fault System (NIFS) reveals a quadrant pattern with amplitude of 10mgal.

It is not yet known whether the density anomaly responsible for the gravity is primarily due to volumetric strain or to subsurface topography of the density discontinuity surfaces. Koyama (1988) interpreted the NIFS gravity anomaly in terms of the horizontal variation of the depth of the Atami group/Shirahama group boundary. On the other hand, the same data can be explained in terms of accumulation of volumetric strain caused by repeated fault motion in a homogeneous half-space.

Tanaka and Okubo (2001) applied the dislocation theory to a spherically symmetric, non-rotating, viscoelastic and isotropic (SNRVEI) earth. They found the fault motions repeated on a same fault every 1000 yr over 500,000 yr could explain the observed gravity anomaly. To our regret, however, they did not present vertical displacement of the interfaces where subsurface density contrast exists.

We develop their theory to compute vertical displacement and volumetric strain 'within' the earth. To be more specific, the reciprocity theorem (Okubo 1993) enables us to compute them easily with a linear combination of forced deformation (Tide/Load/Shear deformation). The result will be given during the presentation.