

EGU22-3409

<https://doi.org/10.5194/egusphere-egu22-3409>

EGU General Assembly 2022

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Short-wavelength Bouguer anomaly and folding with disclination in the northeastern Japan

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In the northeastern Japan arc with the active compressive stress field since ~ 3 Ma, it is reported that a characteristic relationship between crustal deformation including faulting and short-wavelength (< 160 km) Bouguer anomalies. According to previous studies, active faults tend to be located in negative regions, which are caused by cracks and volumetric strain due to accumulated fault dislocation. Especially, it is shown that in strain concentration zones with active faults and multi folding, the effect of accumulated fault dislocation forms the negative zones of gravity anomaly along the northeastern Japan arc, impacting the pattern of short-wavelength Bouguer anomalies throughout the entire arc. In this presentation, we extend this concept further and discuss the positive and negative zones of gravity zones along the entire northeastern Japan arc from the geometrical viewpoint of folding with one of the defect, disclination. Folding is described by Euler-Schouten curvature tensor, which defines the protrusion of included space (e.g., two-dimensional Riemannian space) from enveloping space (e.g., three-dimensional Euclid space). Based on previous studies, the density of earthquake occurrence is proportional to the curvature of the plastic folding deformation of the crust, which is related to Euler-Schouten curvature, and fault dislocation also accumulates at the regions with its high curvature. The row (accumulation) of fault dislocation can be replaced by the disclination, and Riemann-Christoffel curvature, derived from Euler-Schouten curvature tensor, also expresses disclination density. In particular, angular folding with local curvature accompanied by a pair of disclination is called Kink folding, forming the mass-loss or mass-excess regions around disclination. Since Kink folding can approximately be the same as the undulating region bounded by several faults (fault block) in strain concentration zones, it is expected that the northeastern Japan arc has not only negative zones of gravity anomaly but also positive zones along the arc due to the mass-loss or mass-excess regions around disclination. Therefore, we conclude that the positive and negative zones of gravity anomaly along the northeastern Japan arc reflect the geometric condition of the crust with disclination.