Automatic estimation of fault type in two dimension using gravity gradient tensor

*Shigekazu Kusumoto[1]

1. Graduate School of Science and Engineering for Research, University of Toyama

Dip of structural boundaries such as faults and caldera walls plays an important role in discussing their formation mechanism. In particular, since the dip of the fault plays an important role in calculation of strong vibration prediction, it is an important parameter in the creation of a hazard map. Consequently, in addition to the geological survey, geophysical explorations such as seismic and gravity survey have been carried out to know the dip of the structural boundaries. Since gravity survey can be carried out at relatively low cost, there are many opportunities to be implemented. In recent years, gravity gradiometry survey, which is defined by spatial second order differential of gravity potential, has also been carried out.

Beiki and Pedersen (2010) showed that the maximum eigenvector of the gravity gradient tensor indicates a high density causative body of gravity anomalies. Kusumoto (2015) considers that basement would be a assembly of high density material and applied their ideas to estimation of fault dip. It was shown that this method gives harmonic results to the actual dip. Since this method utilizes the property that the maximum eigenvector of the tensor indicates the direction of the high density causative body, it is suitable for estimating the dip of a dike and normal fault. On the other hand, Kusumoto (2017) shows that the minimum eigenvector of the tensor is suitable for estimating the dip of low density bodies and reverse faults. Consequently, when using this method, preliminary information on the type of fault is required.

When the fault is exposed to the surface or the fault type is known by seismic survey and other methods, we can estimate the fault dip by using the eigenvector corresponding to the observed fault type. However, in the buried fault, it is necessary to know the fault type by some method. In this study, we propose a method to distinguish fault type from the relationship between horizontal gravity gradient and the maximum eigenvector of the tensor.

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[References]

Beiki M, Pedersen LB (2010) Eigenvector analysis of gravity gradient tensor to locate geologic bodies. Geophysics 75: I37–I49.

Kusumoto S (2017) Eigenvector of gravity gradient tensor for estimating fault dips considering fault type. Progress in Earth and Planetary Science. 4:15

Kusumoto S (2015) Estimation of dip angle of fault or structural boundary by eigenvectors of gravity gradient tensors. Butsuri-Tansa 68: 277-287. (in Japanese with English abstract)

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