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Inversion of gravity data using compactness and smoothness constraints

Hojjat Kabirzadeh, Ricky Kao, Michael Sideris, and Jeong Woo Kim
Dept. of Geomatics Engineering, University of Calgary, AB, CANADA

Linear inverse problems in gravity field modeling include the problems in which we measure surface gravity and are seeking the density of the source body assuming a predefined geometry. Various approaches have been proposed to perform the gravity inversion in geophysical surveys. In this study, a Lagrangian method and a group of constraints, including minimum distance, smoothness, and compactness have been applied to predict the density distribution of the causative bodies.
The method has been tested on synthetic data as well as real data. The results of the synthetic data show that, in the case of noiseless data, the model is fully recovered while in presence of noisy data we have an acceptable estimation of the original model. The method works well to recover the density and location of the models. The inversion procedure is stable and converges fast even in the presence of large noise in the data.
The investigations using real data show that the inversion method works the best for models with high density contrast, as well as the compact real models like dikes or seals. The method could be tested on other cases, such as, e.g., aquifer water content changes, to show the applicability of the method in cases of less compact density distributions.