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The network adjustment aimed for the campaigned gravity survey using a Bayesian approach: methodology and model test

Shi Chen, Xu Liao, Hongsheng Ma, Longquan Zhou, Xingzhou Wang, and Jiancang Zhuang
Institute of Geophysics, China Earthquake Administration(chenshi@cea-igp.ac.cn)

The relative gravimeter, which generally uses zero-length springs as the gravity senor, is still as the first choice in the field of terrestrial gravity measurement because of its efficiency and low-cost. Because the drift rate of instrument can be changed with the time and meter, it is necessary for estimating the drift rate to back to the base or known gravity value stations for repeated measurement at regular hour's interval during the practical survey. However, the campaigned gravity survey for the large-scale region, which the distance of stations is far away from serval or tens kilometers, the frequent back to close measurement will highly reduce the gravity survey efficiency and extremely time-consuming. In this paper, we proposed a new gravity data adjustment method for estimating the meter drift by means of Bayesian statistical interference. In our approach, we assumed the change of drift rate is a smooth function depend on the time-lapse. The trade-off parameters were be used to control the fitting residuals. We employed the Akaike's Bayesian Information Criterion (ABIC) for the estimated these trade-off parameters. The comparison and analysis of simulated data between the classical and Bayesian adjustment show that our method is robust and has self-adaptive ability for facing to the unregularly non-linear meter drift. At last, we used this novel approach to process the realistic campaigned gravity data at the North China. Our adjustment method is suitable to recover the time-varied drift rate function of each meter, and also to detect the meter abnormal drift during the gravity survey. We also defined an alternative error estimation for the inversed gravity value at the each station on the basis of the marginal distribution theory.

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