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On the optimum choices of estimation of regularization parameter for downward continuation problem of geoid computation without applying Stokes formula

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There are various methods for regularization of ill-posed problems. The central part of all regularization methods is estimation of optimum regularization parameter. Estimation of the regularization parameter is so important that the accuracy and reliability of the results of an ill-posed problem is mainly driven by the selected regularization parameter. Every estimation method of regularization parameter has its own assumptions and criteria. Therefore, it is important to find the most suitable method of estimation of regularization parameter for each ill-posed problem specifically. In this paper we are going to present the most suitable method for estimation of regularization parameter for the downward continuation problem, which is, involved in the geoid computation without applying Stokes formula. This downward continuation is performed by ellipsoidal Able-Poisson integral. To find the optimum method for estimation of regularization parameter the aforementioned problem we have studied following choices: (i) Discrepancy Principle (DP), (ii) Generalized Cross-Validation (GCV), (iii) L-Curve (LC), and (iv) Flattest Slope (FS). To be able to compare the efficiency of the aforementioned methods for estimation of regularization parameter applied to the downward continuation problem based on Abel-Poisson method we have conducted a simulation study, and based on the results of the study we have concluded that LC method gives the best results for the ill-posed problem. Next the LC method is applied to the real data for geoid computation in geographical region of Iran in our method, which is based on remove, downward continuation (inverse application of ellipsoidal Abel-Poisson integral), restore, and application of ellipsoidal Bruns formula.