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On the comparison of different Radial Basis Functions in local gravity field modeling using Levenberg-Marquardt algorithm

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Abstract

In local-scale applications, Radial Basis Functions (RBFs) are appropriate tools for the purpose of high spatial/spectral resolution gravity field modeling. Due to the availability of different types of RBF kernels, different behaviors are expected in both spectral and spatial domains. While the spectral behavior of RBFs is dependent on the type of kernels, their spatial behavior significantly depends on the choice of their bandwidth. In this study, the functionality of various types of RBF kernels is addressed in coastal gravity field modeling. Four of the most well-known gravimetric RBF kernels including point-mass, radial multi-poles, Poisson wavelet and Poisson kernel are considered for the comparison aim. The area under consideration is the coastal region of the Persian Gulf which consists of 6244 terrestrial/marine gravity observations. The optimal RBF parameterization of the gravity field, i.e. specifying the optimal number of kernels and their 3D spatial configuration (their horizontal locations in the area of interest and their depth below the Bjerhammar sphere), is performed using the iterative Levenberg-Marquardt Algorithm (LMA). Our previous studies indicated that the LMA is a practical choice to deal with ill- conditioned problem of gravity field modeling. The stopping criterion is considered as the minimum L2-norm of the differences between the predicted and observed quantities at the independent control points. The numerical experiments reveal that the accuracy of gravity field and geoid models, regarding different types of RBF kernels, depends on the selection of RBF parameters; if RBF parameters are spatially optimized, they would lead to almost same results.