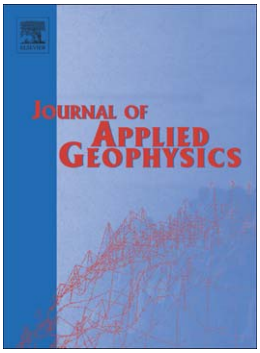

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PII: S0926-9851(17)30175-1
DOI: doi:10.1016/j.jappgeo.2018.01.002
Reference: APPGEO 3401

To appear in: *Journal of Applied Geophysics*

Received date: 17 February 2017
Revised date: 12 September 2017
Accepted date: 6 January 2018

Please cite this article as: Zhao, Guangdong, Chen, Bo, Chen, Longwei, Liu, Jianxin, Ren, Zhengyong, High-accuracy 2D and 3D Fourier forward modeling of gravity field based on the Gauss-FFT method, *Journal of Applied Geophysics* (2018), doi:10.1016/j.jappgeo.2018.01.002

High-accuracy 2D and 3D Fourier forward modeling of gravity field based on the Gauss-FFT method

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Abstract This paper derives a set of analytical expressions through employing the 2D and 3D Fourier transforms for calculating the gravity anomalies of a 3D density source approximated by right rectangular prisms. To reduce the errors due to aliasing and imposed periodicity as well as edge effects in the Fourier domain modeling, we use the Gauss-FFT technique in the standard Fourier forward methods, and extend the Gauss-FFT algorithm from 2D to 3D. The capabilities of these schemes are tested by simple synthetic models. The results show that the precision of the Fourier forward methods using the Gauss-FFT with 4 Gauss-nodes (or more) is comparable to that of the spatial modeling. In addition, the "ghost" source effects in the 3D Fourier forward gravity fields due to imposed periodicity of the standard FFT algorithm are remarkably depressed by the application of the Gauss-FFT algorithm. Furthermore, the execution times of the 4 nodes Gauss-FFT modeling are reduced by two orders of magnitude compared with the spatial forward method. It demonstrates that the improved Fourier methods are efficient and accurate forward modeling tools for gravity anomalies.

Keywords Gravity field, Forward modeling, Spectral method, Gauss-FFT

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