Solid Earth Discussions

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Comment on se-2021-145

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Referee comment on "Benchmark forward gravity schemes: the gravity field of a realistic lithosphere model WINTERC-G" by Barend Cornelis Root et al., Solid Earth Discuss., https://doi.org/10.5194/se-2021-145-RC1, 2022

The gravity modeling (i.e. construction of density models of the Earth based on the gravity field) becomes more and more popular after appearance of the new data based on satellite determinations (e.g. GRACE and GOCE). These data, for the first time, provided a possibility to construct consistent gravity field models based on a combination of the satellite, terrestrial and air-born determinations. Direct gravity calculations remain one the main tools for interpretation of these data. So far, researched employ various methods for such calculations. Therefore, it is very important to compare these methods in terms of accuracy and effectiveness. This is done in a very convincing way in the present manuscript. The authors compared a global spherical harmonic solution (GSH) code (Root et al., 2016), a tesseroid based code (Uieda et al., 2016), an integration on triangle volume elements (Sebera et al., 2018), and a hexacon-based code inside the open-source software ASPECT. The authors thoroughly analyze all the codes for different density configurations and formulate recommendations for their applicability. Although, all codes can provide similar results in most cases, clear preferences can be given to the GSH and tesseroid codes.

To my point, this is a very important methodological paper, which will be cited in many following studies of the gravity field. It is very clearly written and each, even small, detail is explained and documented by numerical examples. Therefore, I recommend publication of the manuscript in its present form. I have the only recommendation to perform a similar analysis for calculation of the gravity gradients, which are often used after appearance of the direct GOCE data, however, this could be a topic for the next paper.

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