Solid Earth Discussions

Solid Earth Discuss., referee comment RC2
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Specific comments on se-2021-117

Anonymous Referee #1

Referee comment on "Interpolation of magnetic anomalies over an oceanic ridge region using an equivalent source technique and crust age model constraint" by Duan Li et al., Solid Earth Discuss., https://doi.org/10.5194/se-2021-117-RC2, 2021

Specific comments

I have also some specific comments/recommendations:

- It seems that the method uses a topocentric Cartesian system with x pointing to North, y to East, and z pointing down, but I could not find this information in the manuscript.
- On page 6 is written that "Regularization and precondition techniques were utilized to stabilize the inversion process and balance the decay of the potential field". I understand that a preconditioning technique, in this case, does not introduce a priori information about the parameter vector m (eq. 1), but only controls the convergence. So, could you please explain what is the a priori information introduced by matrix P (eq. 1) and how it contributes to stabilizing the inversion?
- I think that the elements forming matrices G and P (eq. 1) must be clearly defined in the manuscript. Note that, without specifying the elements of matrix G, the reader cannot know what type of equivalent sources (prisms, dipoles, etc) form the equivalent layer.
- I recommend using a tool model to illustrate how matrices Wx and Wy (eq. 3) are defined.
- According to page 7, matrices Wx and Wy (eq. 3) impose smoothness only on the physical property distribution of the shallow layer. Why they are not used to also impose smoothness on the deep layer?
- What are the criteria to define the depth/geometry of shallow and deep layers?
- On page 7, it is written that "A layer with larger ES cell sizes at larger depth was utilized to simulate the background magnetic field.". I understand that "changing cell sizes" is possible only if the layer is formed by 3D sources. How to change the cell sizes of a layer formed, for example, by dipoles?
- Apparently, the weights wx and wy (elements of matrices Wx and Wy, eq. 3) do not have any normalization. In this case, it is expected that their numerical values depend on the particular characteristics of the study area and the interpretation model. As a consequence, it is not possible to use a fixed 10^-4 in all situations. I recommend including some discussion about this.
- What is the "geophysical meaning" of the synthetic magnetic interface presented in Section 3? Could it be related to the Curie isotherm? In this case, I think it should be smooth. It seems that this simulated magnetic interface is a purely mathematical way of generating long-wavelength data.
- The simulated main geomagnetic field presented in Section 3 is constant, with

intensity, inclination, and declination of 35000 nT, 40°, and 3°, respectively. The crust model, however, covers an area of approximately 5° x 5°. Is it reasonable to consider that the main field is constant throughout this area?

- In my opinion, a detailed description of the parameters used to generate the results shown in Figure 2 with all methods must be included in the manuscript. Otherwise, it is not possible to obtain a proper comparison.
- The study area in Section 4 covers an approximately 5° x 5° area. Is it reasonable to consider that the main geomagnetic field is constant throughout this area? How the variability of the main field affects the results?
- I think that Figure 3 should be improved. I could not understand the relationship between the axes "Northing" and "Distance" in panel (b). Apparently, panel (e) shows the two layers, their equivalent sources, and the weights wx and wy (elements of matrices Wx and Wy in eq. 3) associated with them, but it is not clear for me.