

Review response for *High-precision 1'×1' bathymetric model of Philippine Sea inverted from marine gravity anomalies*

Dear Reviewer,

Thanks for your useful suggestions and comments. Your opinions are significant, greatly helping me improve my article. We have carefully revised the manuscript according to the comments and hope that the correction will meet with approval. The response to the reviewer's comments is as follows:

General comments

It is a good work; however, I think it is a repetition of the authors' work in the South China Sea (An et al. 2022). The IGGM was introduced for the first time in that paper, and was tested in the South China Sea. So, basically the regional capability of IGGM has already been proved in that work. With such considerable number of contributing authors, this study could (or should) have been a global test of the IGGM by merging a suite of regionally predicted depths. If not, then the only difference between this paper and the authors' previous paper is just the change in study area. And since each study area will yield different results, then any subsequent regional application of IGGM will just be a repetition.

Response: Thank you for recognizing our research and providing valuable suggestions. We highly value your comments on our work and would like to use this response to express our research motivation and methodology more clearly. Our original intention in writing this paper was not to replicate our previous work, as you rightly pointed out, we aimed to apply the method globally. Before its global application, we conducted experiments in the representative Philippine Sea with the goal of optimizing the selection strategy for relevant parameters and releasing a reliable bathymetry model. Additionally, we need to verify the method's universality, not just its applicability to a specific region. Currently, uncertainties persist regarding the inversion accuracy on a global scale. We noted the importance and uniqueness of the Philippine Sea, a region that is clearly characterized by shipboard bathymetric data and the distribution of seafloor topography. Therefore, in this phase we focus on showing the potential global applicability of the method through experiments in the Philippine Sea. We would like to discover more interesting aspects, such as how the inversion strategy and result from the Philippine Sea can be utilized globally. All co-authors and contributors aspire to expand this work globally in the future, and we are diligently working towards that goal. Moreover, numerous new issues need addressing in the global seafloor topography modeling effort. Consequently, we are making our algorithmic program available to the public, hoping to receive suggestions and corrections from experts and scholars to enhance our research. Thank you again for your valuable comments, and we will fully consider your suggestions.

Authors should check the units of measurements used. Some readers will argue that g/cm³ is not the generally accepted S.I. unit of density. Similar statement can be said of the unit of the gravitational constant.

Response: Thanks for your suggestions, we have corrected the relevant units by replacing g/cm³ with kg/m³, and the gravitation constant $6.672 \times 10^{-11} \text{ m}^3/\text{kg} \cdot \text{s}^2$.

Specific comments

Line 52: *The S&S method is also a frequency domain method*

Response: Noted. Thanks for your comments.

Line 87: *What do you mean by 'certain parameters'?*

Response: Thanks for your comments. The expression here is slightly ambiguous, and 'certain parameters' represent the density constant $\Delta\rho$, the calculated radius, and the weight parameter k .

Figure 1: *The color palette used causes the empty grid cells (continent) to blend in as part of the gravity anomaly. Anomalies close to or greater than 80 mGal are showing as white, which is not far from gray. So, I suggest you consider changing this color palette.*

Response: Thanks for your comments. We have changed this color palette.

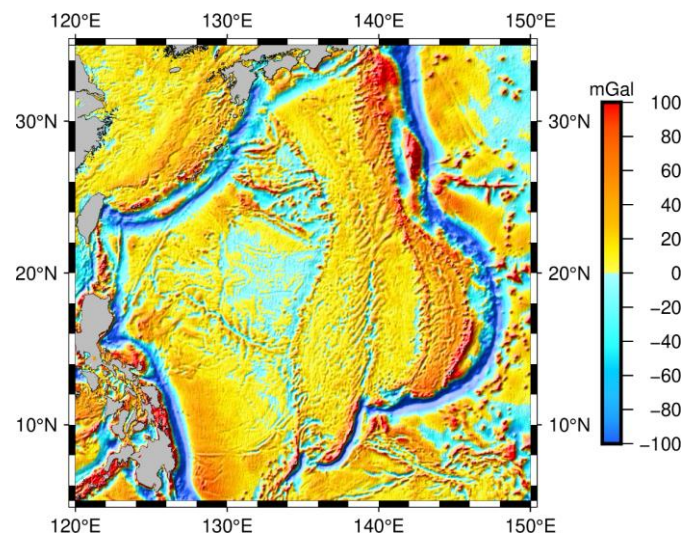


Figure 1. SIO V32.1 gravity anomaly model in the study area.

You did not define θ and k in Eqs. (3) and (4). How do you compute the value of θ ? You should state it in the manuscript.

Response: Thank you for your suggestions, we have added the appropriate explanations. "where θ is calculated by the arctangent value based on the depth of the control point and the horizontal distance between the control point and the surrounding sea surface points. And k is an unknown parameter determined by the iterative algorithm and is used in conjunction with $\cos\theta_m$ as a weighting parameter to quantify short-wavelength gravity effects caused by the surrounding points."

Check Eq. (5) again. The output of Eq. (4) is $\Delta g_{res}^{j_n}$, and not $\Delta g_{short}^{j_n}$.

Response: Noted. Thank you for your comments and careful review.

Line 171: *Change 'objects, analysing and determining' to 'subregions for analysing and determining'.*

Response: Noted. Thank you for your comments.

Line 171 – 172: *The optimal parameters are chosen after determining the unknown parameters; am I right? If yes, then change 'in advance' to 'afterwards'.*

Response: Yes, you're right. We've changed it.

Table 1: Change the column title 'Removing points' to 'No. of removed points'.

Response: Noted. Thank you for your comments.

Figure 4: The geographic extents of Area A ($6^{\circ} \times 7^{\circ}$) and Area D ($6^{\circ} \times 8^{\circ}$) are almost similar; so, I think you could have plotted Area A to have slightly similar size as Area D. Apart from Area C, Areas A, B and D contain more depth data, but because you have plotted them too small in size, they look quite clumsy. The same applies to the subsequent related figures. Since you used GMT for the plots, you can even increase the plot size of Area B too. Use a different projection (-J option) for the plot module for each map.

Response: Thank you for your comments and suggestion. We completely agree with you and have redrawn the relevant figures to make them more appropriate.

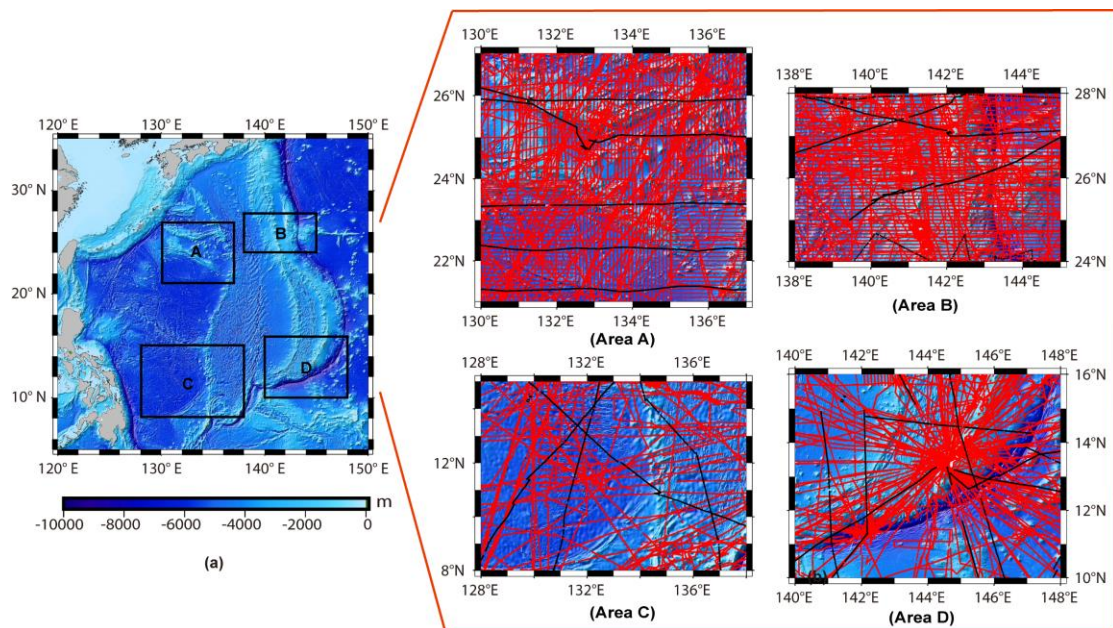


Figure 4. Distribution of four local areas and shipborne bathymetric data (red points are control points, black points are checkpoints, and the basemap is the GEBCO model).

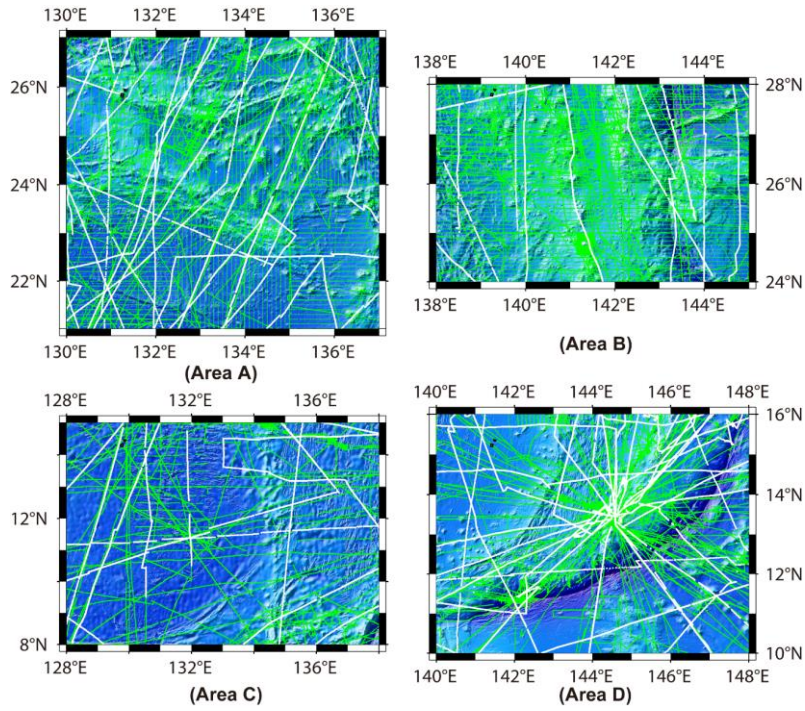


Figure 6. Selection based on the distribution of shipborne cruises in IGGM (The green control points are used to calculate bathymetric models corresponding to different unknown parameter values, and the white control points were employed for iteratively selecting the optimal parameter values of $\Delta\rho$, R and k).

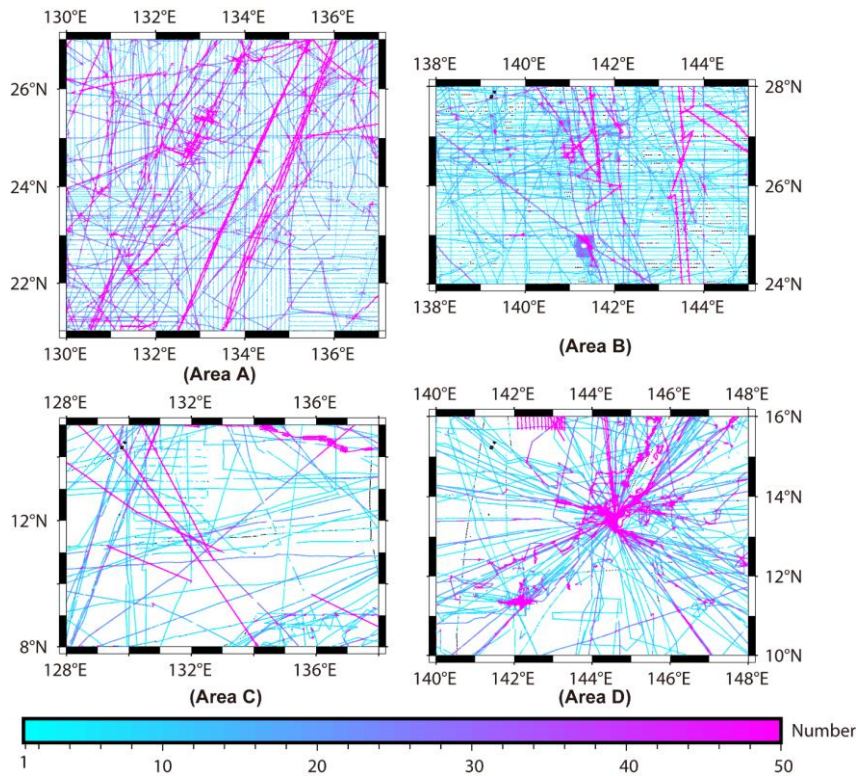


Figure 7. Total number of surrounding points within 2' of each shipborne point as the center (black points represent no other single-beam shipborne points within a 2' radius)

Line 216 – 217: “and the density contrast $\Delta\rho$ calculated by IGGM is closer to the theoretical value (1.67 g/cm³)”. In reference to Table 2, this statement is very misleading. Because, apart from IGGM's 1.4 g/cm³ in Area B, the other values are far from 1.67 g/cm³, especially if you express the unit of density as kg/m³.

Response: Thank you for your comments. We completely agree with you and we have removed this statement.

Figure 7: It would be better to change the color palette; it has made the figure kind of too flashy. I can hardly see the black points you are talking about, simply because of use of wrong color palette. Moreover, there has been research commenting on the weaknesses of the rainbow color palette. You can look it up at <https://doi.org/10.1016/j.isprsjprs.2022.10.002>. Also, increase the sizes of the plots like I have commented in the preceding comment, so that they can be more readable.

Response: Thank you for your comments and suggestion. We have changed this color palette.

Line 238: Change ‘reason’ to ‘factor’.

Response: Noted. Thank you for your comments.

Line 269 – 270: Change ‘the sea area lacking of’ to ‘marine regions that lack’

Response: Noted. Thank you for your comments.

You need to rephrase the first sentence of Line 310 – 312; it is not clear to understand.

Response: Thank you for your comments. We have rephrased the sentence to make it clearer.

“In the second checks the topo_25.1 model has excluded poor-quality points, with both the STD and RMS showing better performance compared to the DTU18 model. However, it is noteworthy that the MAPE of topo_25.1 is worse.”

Line 399: Check the spelling of the first author’s name.

Response: Noted. Thank you for your comments and careful review.