Review of Global Marine Gravity Gradient Tensor Inverted from Altimetry derived Deflection of the Vertical: CUGB2023GRAD

The authors computed components of gravity gradient tensor using altimetry derived deflections of vertical. They combined different altimetry satellite data assigning weights to them. Applying remove-compute-restore technique they developed CUGB2023GRAD grid which is publicly available.

The paper does not explain the strength of the method applied nor the potential benefit of their product for use which I think is very important. On the one hand, the methodology needs to be expanded in general. But on the other hand, there are various equations which I think is very lengthy. Some adjustment is needed therefore in balancing the content. I am not sure if an Appendix can be added.

I can imagine readers being interested in learning more about the benefits and applications of the outcome of this work. The authors could be more convincing and provide some details also w.r.t. the literature. This is not provided in the current version. I also think that some of the figures can be explained better.

The use of EGM2008 needs to be justified in general. For marine related gravity field, I can imagine GOCE data also should be included in the GGM used. I wonder whether GEBCO grid is the best option to compare with. Would there be any case one compares the outcome of this work for instance w.r.t shipborne measurements directly, maybe along track measurements of bathymetry?

Some detailed comments:

Line 101: Please use the ESSD reference for the ICGEM service.

Line 111: Please explain why the weights are calculated based on EGM2008? What would be an alternative to this?

Line 133: Preference for using EGM2008 needs to be justified.

Last sentence on Page 6 is confusing.

Line 171: Why somewhat? Was it unexpected?

Again, some sections are unnecessarily lengthy and some sections are not explained as much needed.

Line 193: No parenthesis for deflections of vertical

Line 301: GEBCO_2021 or 2022? I believe the two are used in the paper. Please explain why? Would there be any in-situ data available for this purpose? Would it be more reliable to do comparisons w.r.t shipborne or other in-situ measurements?

Eq 1: Not pi but tao in the dividend. Please double check the equation.

Some well-known formulations have been repeated. I think this is not needed.

Please explain why you have larger differences in the East direction, please explain the differences between Figures 4c-d and 4g-h

Please explain the coordinate systems used when needed in the text and in which the Txx and the other 5 are given.

Figure 8b: Differences w.r.t SIO31.1VGG look larger in the map. Are they consistent with the histogram? Please double check.

Could you please explain the outcome and benefit of the representation of Fig. 9?

Please use the GMT reference when needed.