

## ***Interactive comment on “Crustal Density Model of the Sea of Marmara: Geophysical Data Integration and 3D Gravity Modelling” by Ershad Gholamrezaie et al.***

### **Anonymous Referee #2**

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In my initial review, I recommended rejection because of concerns regarding the datasets (gravity and bathymetry) used by the authors in the submarine domain of the Sea of Marmara. This issue

Ershad Gholamrezaie and his co-authors claim that they have used the only publicly available data set EIGEN-6C4 (Förste et al., 2014) that covers the onshore and offshore parts of the study area, as the shipboard gravity data is supposedly not available. Pierre Henry (Reviewer #3) mentioned that he will be happy to make this data available.

Hence, my new recommendation is that the authors should be given a chance to revise

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their paper, using all the marine geophysical data (shipboard gravity and bathymetry) that were collected over the last years in the offshore domain.

In his reply, Ershad Gholamrezaie mentions out a number of points that he takes for granted, as listed below:

1. “Anyway, the “improved” data set of Kende et al. (2017) differs only by max a few mGals in the offshore domain from the satellite data (Sandwell et al., 2014), but has the same general characteristics. So the problem raised by the reviewer relates to the difference in two different versions of satellite gravity data published in the same year by two different well-known and experienced teams. “

I am not convinced, Ershad Gholamrezaie must prove this allegation. The profile shown by Kende et al (Profile XX', shown in Figure 2) strikes in the E-W direction, along the central part of the Sea of Marmara, where the altimetry-derived gravity grid is likely to be optimum. The problem arises along N-S profiles, particularly in the western part of the Tekirdag Basin, where only a few satellite data points are available in the N-S direction.

2. “As the scope of our paper is not to quality check satellite gravity data, but to make use of it together with other observations, we decided for the EIGEN-6C4 free-air gravity anomaly data set”.

I do not agree, by no means, with this approach. The very first, most important thing the authors should do, is to make sure that the dataset they use is appropriate. EIGEN-6C4 is a global dataset, it is undoubtedly the best one for global studies. For local studies, however, there may be significant discrepancies leading to unwanted artefacts. The “local” vs “global” grids is a well known problem in geophysics and the authors should carefully go into it.

3. “We have carried out a sensitivity analysis to test which difference we obtain between our model adjusted for the EIGEN-6C4 and a model adjusted to the data set

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of Sandwell et al. (2014). The results of this sensitivity analysis are enclosed to this response as a supplement file (Figure. 1). Accordingly, the two different satellite gravity data sets are almost identical over the onshore domains where the absolute difference is less than 10 mGal. Offshore, a notable difference of 30 to 50 mGal is evident along the bending segments of the Main Marmara Fault, the regions below which we have modelled the high-density bodies in the lower crust.”

This is well expected, of course, because the two models are based on space observations. Comparison should be made between satellite altimetry-based and shipboard gravity-based data. Here again, the authors must prove thoroughly their allegations. The authors suggest to include this comparison in the paper in the revised version and thus document the related uncertainties, including seismic data: this is very good idea, that should be encouraged.

4. “The reviewer claims that not properly considering the steep slopes resolved in the high-resolution bathymetry may question our general results concerning the deep crustal structure. This is simply impossible [...] and] can be demonstrated easily with a comparison of the gravity response of respective models.”

The authors should be invited to demonstrate their claims, by comparing the gravity response of the different models using different datasets, including shipboard datasets.

In conclusion : the use of global vs local grids for local studies is an issue of critical importance. The authors must demonstrate that they can successfully address this issue in the specific case of the Sea of Marmara.

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Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2018-113>, 2018.