Review of the manuscript: SDUST2021GRA: Global marine gravity anomaly model recovered from Ka-band and Ku-band satellite altimeter data, by Zhu et al.

Summary
The paper focuses on the determination of a global marine gravity anomaly model based on multi-satellite altimetry data. The content of the manuscript is interesting. Although the method used is well-established in geodetic literature, the advantage of the paper is that the noise variances of along-track geoid gradients in Ka band and Ku band are determined by an iterative method and crossover discrepancies in the processing of gravity anomaly recovery. Meanwhile, HY-2A data are used to establish the global marine gravity model of SDUST2021GRA, unlike the recognized marine gravity models (DTU17 and SIO V30.1).

The resulting SDUST2021GRA model is validated with the existing marine gravity survey data, including the recognized marine gravity anomaly models and ship-borne gravity data. The validation results confirm that accuracy of SDUST2021GRA is comparable to contemporary marine gravity data by the applied method and the combination of multi-satellite altimetry data. Especially over the offshore area, SDUST2021GRA has higher accuracy. This model may beneficial for marine gravity field recovery and mean dynamic topography refinement as well as other researches like the study of ocean state and ocean circulation.

Detailed comments
Some minor comments are listed as below:

2.1 Study area

(1) Please add more information for the figure caption of Figure 1 on page 3, for instance, what are these colors represent? Although we know from the text that red/green displays XGM2019e/ EGM2008, and blue shows shipborne gravity data. However, it may be more clear by adding these captions, and readers can directly catch the meanings of this figure without finding materials from the text in different locations.

3.2.3 Noise variances of Ka-band and Ku-band geoid gradients

(2) The iterative method for determining the noise variances are presented by a long text. It is better to add a flowchart and shorten the text.

4 Gravity anomaly results

(3) As the authors stated in introduction on page 2 line 40 "HY-2A-measured altimeter data are rarely used for published global models of gravity anomalies", while the development of SDUST2021GRA included HY-2A data. To quantify the effects of HY-2A data on global gravity anomalies inversion, the authors may consider additionally computing one solution without HY-2A, the difference between this solution and SDUST2021GRA can study the contribution of HY-2A data. This model can also be validated against shipborne gravity data to assess its quality, and compared with SDUST2021GRA.

4.1 Comparison with SIO V30.1 and DTU17

(4) In this study, SDUST2021GRA was compared with DTU17 and SIO V30.1 for cross validation, and concluded that the former has better quality over offshore areas. It is noticeable that the SAR altimeter data from Sentinel-3A/B had been used in the computation of SIO V30.1, and it is well known that these SAR data has great advantages over traditional radar altimeter over coasts. While, these SAR altimeter data were not used in developing SDUST2021GRA (as shown in Table 1 on page 4 line 85), the authors may consider using SAR altimeter data to further improve the marine gravity anomaly model.

(5) Figure 5 shows the differences between SDUST2021GRA and the two recognized marine gravity anomaly models (DTU17 and SIO V30.1). The differences between DTU17 and SIO V30.1 should be also calculated to illustrate the differences of gravity anomaly models. Please also give the error information (the formal errors) of these three models if it is possible.

(6) There is no data in some areas in Figure 8 on page 15. Please explain it in more details in the manuscript.

(7) Please plot a global picture of formal error of SDUST2021GRA via the law of error propagation, as the same did by the authors on page 16, line 345. This picture contains the error information of SDUST2021GRA over different areas, which are useful for the potential users. Moreover, the authors may consider comparing the difference against shipborne gravity data of SDUST2021GRA and its formal errors over different areas, to see if the formal error of SDUST2021GRA is reliable.