

The objective of this study is to construct a high-resolution global marine gravity change rate (MGCR) model using multi-satellite altimetry data. Many academic institutions have constructed global static marine gravity fields based on altimetry data, but there are few studies of time-varying marine gravity and no high-resolution model products. Nowadays, time-varying marine gravity studies using GRACE satellite gravity data have some problems: the spatial resolution is low, and the true geophysical signal is affected by strip noise, signal leakage error and their residuals. Therefore, the study of high-resolution time-varying marine gravity based on altimetry data is a very meaningful work. It is worth saying that the SWOT altimetry mission has been implemented in December 2022, and the SWOT wide-swath mode can obtain the sea surface height covering global in a short period, and when SWOT accumulates many years of data, more time-varying marine gravity studies will appear in the future. In general, I think the manuscript is valuable to be published. My suggestion is for minor revision, and there are some points that can be improved to make the work presentation better:

1、 Check the presentation to make the content clearer:

① In the data introduction section, the purpose of using the data should be clearly indicated (for example, L2P product data and AVISO monthly sea level anomaly data are both altimetry data, while in the flowchart of Fig. 3, the authors did not indicate which altimetry data was used to construct the SDUST2020MGCR model), which makes the paper more reader-friendly. ② In studies related to ocean and climate change, the GIA effect is usually deducted. While the purpose of this paper is to study marine gravity field change, the author needs to explain the reasons for subtracting the GIA effect. ③ The spherical harmonic coefficient degree of GIA model is fully expanded to 256, while the degree of altimetry model is expanded to 2160, and the GRACE model is expanded to 60, the degree of models are inconsistent, and the author need to describe clearly the calculation here. ④ The English language is sometimes not so fluent, and some English words are not specialized vocabulary, and this doesn't help the readability of the paper (at least in my remember, the expression "seawater volume change" is rarely used).

2、 Add explanations to improve the reliability of the results:

Investigating global time-varying gravity field mainly depends on GRACE/GRACE-FO gravity data, but strip noise, leakage errors and their processed residuals, which affect the true physical signal, and this is a major problem in the study of time-varying marine gravity using GRACE. In the results and analysis section, I would ask the author to give some explanations/comments after describing the results of altimetry and GRACE (for example, highlighting the advantages of altimetry and introducing the problems of GRACE). ① The lines 426 and 463 of manuscript both mention that the STD of the altimetry result is less than the GRACE result, I think that a discussion about uncertainties, in the GRACE MGCR and altimetry MGCR, could improve the paper by giving more reliability to the results. ② Author needs to read the manuscript carefully and consider the appropriate references that could be added (for example, the lines 423 and 449).

3、 Standardize the display of figures and formulas:

① In mathematical formulas, the use of the division sign, multiplication sign, and brackets should be consistent. ② Please check equation 7, I think the bracket can be removed. ③ In my version, formulas 3, 5, and 9 look strange, Please check and correct if needed. ④ Please check the font size of the formula symbols in the sentence on line 312. ⑤ The statistical histogram of Figure 8, the histogram can be plotted densely and continuously if needed. ⑥ The figures (1, 4, 5, 6, 7) in the manuscript are blurry, please increase the resolution.