

Reviewer # 2

Suggestions for revision or reasons for rejection

Most of the revisions are satisfactory, and I appreciate the authors' efforts to clarify the GIA/VLM treatment. The manuscript has improved, but two minor issues still require clarification before publication.

First, the authors' response states that the altimetry GIA correction was incorrectly applied in the original manuscript and that the analysis was redone. Please clarify whether all related sea-level time-series figures and statistics were regenerated using the corrected GIA treatment. For example, Figure 4 appears to show no track change; please double-check.

We can confirm that all related sea-level time-series figures and statistics were regenerated using the corrected GIA. We have provided a comparison between Figure 4, from the revised and the original manuscript. The trend in our EOF Reconstructions were the same in both figures but there is a subtle difference in their uncertainties, see the two figures below. Thank you.

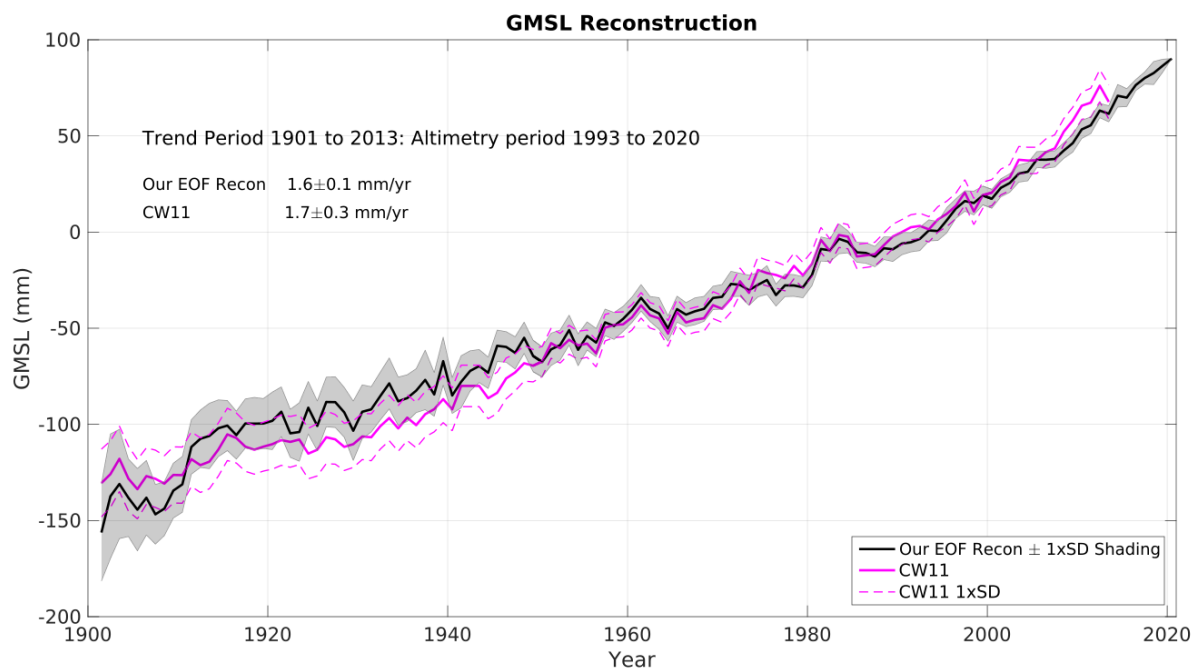


Figure 4 The GIA applied has been correctly applied (revised manuscript)

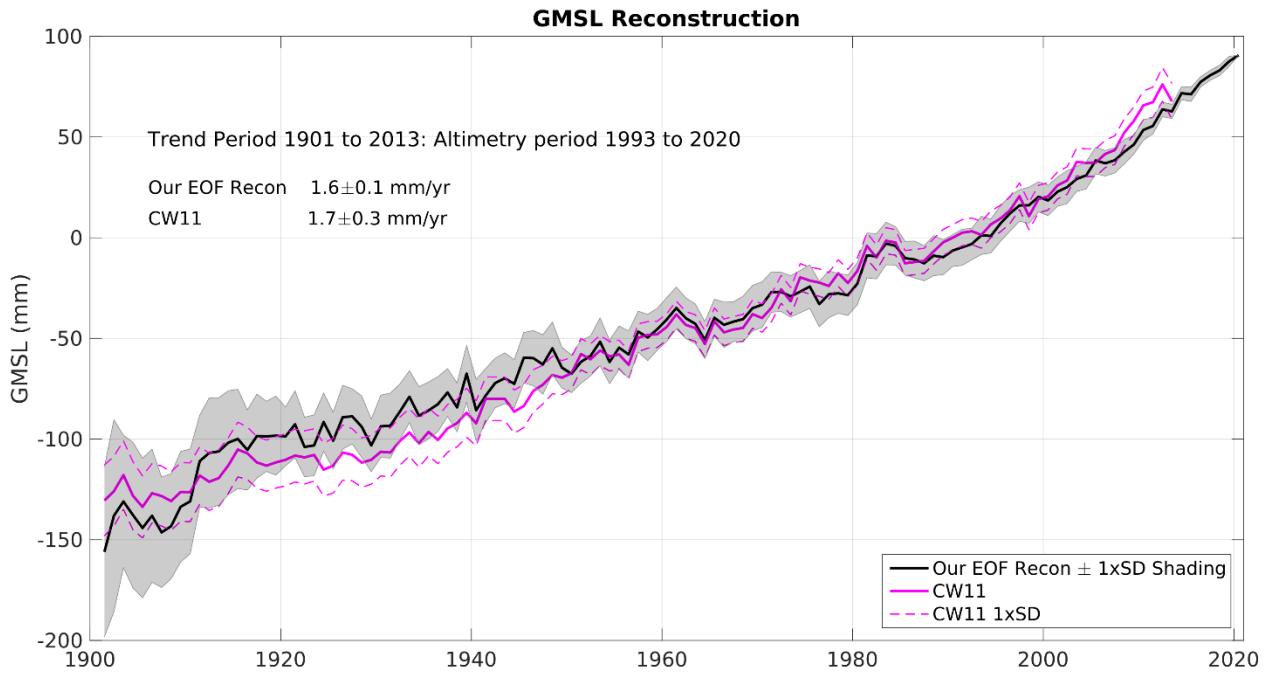


Figure 4 From the original manuscript where the GIA altimetry correction was applied incorrectly.

The revised text in lines 192–195 is still not sufficiently clear regarding how the reference frames of the altimetry and tide-gauge records are made consistent. I suggest adding a short equation to clarify. This would remove the remaining ambiguity and confirm that both datasets are placed in a consistent reference frame.

We have improved the description of the GIA applied and added two equations (see lines 190 to 198) to make it clearer, Thank you.

The text in the manuscript now reads:

We applied the geoid-only GIA correction, obtained as the sum of the GIA-induced relative sea level change and the vertical motion of the solid earth due to GIA ($d_{sea250.lgrid.ICE5Gv1.3_VM2_L90_2012} + d_{rad250.lgrid.ICE5Gv1.3_VM2_L90_2012}$ dataset). The altimetry data also had all the standard geophysical corrections applied, including the IB correction.

In summary, the GIA correction applied to tide gauge and altimetry are shown in Eq. 1.

$$\begin{aligned} \text{Tide Gauge}_{GIA_{corr}} &= \text{Tide Gauge Obs} - GIA_{corr}(d_{rsl250}).\Delta t \\ \text{Altimetry}_{GIA_{corr}} &= \text{Altimetry Obs} - GIA_{corr}(d_{sea250} + d_{rad250}).\Delta t \end{aligned} \quad (1)$$

Where t = time, please note that the Peltier's GIA correction is in mm/yr.

Second, the citation to Ding and Chao (2018) on line 668 should be revised for accurate. Ding and Chao (2018) support the existence of quasi-periodic, approximately 6-year surface displacement signals in GPS/GNSS observations, but it does not directly address VLM at tide-gauge sites or satellite-altimetry-minus-tide-gauge residuals. Wang et al. (2025) is directly relevant here because it analyzed SA–TG residuals at TG locations and fitted harmonic residual signals to improve the alignment between these two types of measurements, so the citation should be corrected.

Yes, we agree with reviewer #2 that Ding and Chao (2018) is not directly addressing VLM at tide-gauge sites or satellite-altimetry-minus-tide-gauge residuals where Wang et al., 2025 does. Thus, we removed the Ding and Chao (2018) reference and replaced it with Wang et al., 2025. Thank you.

The sentence now reads in the manuscript (see lines 661 to 663).

However, recent studies have shown that this assumption does not always hold, with both non-linear trends and higher-frequency variability present at some locations (Oelsmann et al., 2024; Wang et al., 2025).

Reference:

Ding, H., & Chao, B. F. (2018). A 6-year westward rotary motion in the Earth: Detection and possible MICG coupling mechanism. *Earth and Planetary Science Letters*, 495, 50–55.

<https://doi.org/10.1016/j.epsl.2018.05.009>

Wang, S., Shum, C. K., Bevis, M., He, X., Zhang, Y., Ding, Y., Zhang, C., & Montillet, J.-P. (2025). Sea level reconstruction reveals improved separation of regional climate and trend patterns over the last seven decades. *Earth System Science Data*, 17(12), 7055–7077.

<https://doi.org/10.5194/essd-17-7055-2025>