

**Reviewer query:** black

**Answer:** Blue

**Added/revised text to the main manuscript:** Blue, *italics*

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## Reviewer 1#

### General Comments

My review focuses on the changes to the manuscript made in response to my original review. The authors have largely addressed my queries through edits made to the manuscript and rebuttals in their response letter. I recommend publication of this article following some minor changes.

We thank the reviewer for his earlier comments and suggestions.

### Specific Points

Section 2.4: Original review comment adequately addressed.

### Thanks

Calculation of sea-level fingerprints: Adequately addressed in response letter.

### Thanks

Glaciers: The authors produced a new figure to show the breakdown of the contribution to global mean sea level from glaciers in 18 different regions (with the 19th region being excluded from analysis with justification provided). The new presentation of results is included as supplemental figure 3 and it is exactly the type of result I had hoped to see. However:

(1) I encourage the authors to promote this important figure to the main manuscript given the key role of glaciers (if the number of figures is limited, figures 2 and 3 could be combined to make space).

We thank the reviewer for this suggestion and his earlier comments on glacier contribution. We added supplementary figure S3 to the main text (now Figure 6) as the reviewer suggested.

(2) I suspect some readers may not be familiar with the regions by number in the Randolph Glacier Inventory. Please include a map panel, or at least supplement the panel legends with a name to go with the number.

We agree. Glacier region names corresponding to the RGI numbers are given in the caption of figure 6.

(3) Please could the authors standardize the y-axes among panels (the sea level axes currently vary by more than two orders of magnitude). The key result shown in the new figure is that the main contribution to pre-industrial Common Era global mean sea-level change is not glaciers generally, but rather glaciers in a handful of regions (e.g., regions 3, 5, and 9; while regions 10-12 effectively make no contribution). Standardizing the temperature axes would also give a more intuitive sense of how glacier mass balance and temperature correlations are variable/consistent among regions. Use of LMR temperature appears reasonable.

Thanks. The new figure 6 uses a standardized scale to highlight these points. We also added a few lines in the discussion to convey that the glacier contribution is not uniform across regions but largely comes from a handful of regions, as:

*As evident from Fig. 6, not all glacier regions contributed equally to the GMSL, but a few areas (e.g. Greenland periphery, Russian Arctic) dominate the others (e.g. North Asia, Low latitudes). The distribution of glacier sea-level contribution in the CE seems to relate to the glacier initial volume distribution (which is the twentieth-century glacier volume distribution as given in Farinotti et al., 2019).*

The revised discussion text (e.g., line 520) about spatial and temporal variability in the glacier contribution is very helpful and addresses the points raised in my review (or at least notes some of the queries, even if answers are not easy to come by).

Thanks. In fact, the points raised by the reviewer opened the discussion more widely and improved the quality of the discussion.

#### Technical Corrections

Each of the technical corrections I originally proposed were addressed by the authors. Below I list some very minor editorial points that I noticed.

Line 79: A comma following “terrestrial water storage” would be helpful.

Corrected

Line 192: Should read “we therefore use ~2000 CE”.

Corrected

## Reviewer 2#

### General Comments

I appreciate the authors' efforts in addressing my previous comments and find that the manuscript has been greatly improved through the revision process and therefore recommend it for publication. Below are a number of minor, mostly technical, comments that I would suggest for the final version of the manuscript.

We thank the reviewer for his earlier comments and suggestions.

Ln 220 add 'the' in "not employed in 'the' Walker et al..."

Corrected

Ln 220-221 and Ln 421-422 While the difference between the two reconstruction curves is likely due in part to the removal of the constraint, it should also be noted in the text that the database was updated with additional proxy records from the Kemp curve to the Walker curve, so that could also be having an influence on the difference between the two curves.

Thanks. We added a sentence to indicate this in the text (ln 216)

Ln 233 add reference to tide gauge-based 20th century GMSL

Hay, C. C., Morrow, E., Kopp, R. E. & Mitrovica, J. X. Probabilistic reanalysis of twentieth-century sea-level rise. *Nature* 517, 481–484 (2015).

Thanks. We provide reference for Hay et al. (2015) to indicate the twentieth-century sea-level reconstruction.

Ln 277-279 this wording doesn't seem quite right if I'm reading it correctly... would suggest rewording to "Note that this method does not include any additional specific processes that are missing in our modelling experiments but acknowledges the remaining uncertainty (e.g. uncertainty arising from model initialization, different input data, or differences in model physics)"

Changed as suggested.

Ln 330 could you add a reference about this 1257 eruption? Or any more details?

Thanks. It is the strongest eruption in the last millennium (Mt Samalas in Indonesia). We have provided the reference for this in the text.

Sigl, M., Winstrup, M., McConnell, J. et al.: Timing and climate forcing of volcanic eruptions for the past 2,500 years, *Nature*, 523, 543–549, 2015

Ln 425 add ‘the’ in “However, ‘the’ Walker et al...”

Okay

Ln 453 should ‘contributed by’ be ‘attributed to’?

Yes, corrected.

Ln 529 “contribution from Antarctica” rather than “contribution of Antarctic”

Corrected.

Ln 588 would suggest rewording to describe what “it” is in this sentence

We rewrote this sentence as, “*Those centennial-scale changes during the PCE indicates that the twentieth-century GMSL rise may also include a response to such natural variations*”

Ln 591 do not need to say ‘sources’ twice

Corrected

Ln 607 should reference Walker et al 2022, not 2021

Walker et al. (2022) is also included

### Reviewer 3#

#### General Comments

A second review of "Process-based Estimate of Global-mean Sea-level Changes in the Common Era" by Gangadharan and coauthors.

I thank the authors for addressing my earlier comments. This study should be published after very minor revisions. I don't need to see another iteration. I'd like to congratulate the authors on a nice study and a valuable contribution to the community.

Kind regards,

Christopher Piecuch, Woods Hole Oceanographic Institution

We thank Christopher Piecuch for his valuable comments during the revision. We do acknowledge him in the paper along with the two anonymous reviewers as:

*“We thank Christopher Piecuch and the two anonymous reviewers for providing critical comments and suggestions during the revision of this paper”*

#### Minor points

1. On line 214, the authors say that Kemp et al. (2018) impose a constraint of no net GMSL change between ~0 and ~1700 CE to avoid a spurious regional trend. This isn't exactly true. Those authors (as well as Kopp et al. 2016) impose that constraint to avoid large uncertainties on the global trend, not regional trends.

Thanks. This sentence has been rewritten as: “Also, in Kemp et al. (2018), the GMSL during -100 – 100 CE is made equal to GMSL over 1600 – 1800 CE to avoid a spurious global sea-level trend component originating from regional changes.

2. More generally, I suggest all of the authors to give a careful proof reading of the manuscript for grammar and syntax. I haven't taken the time to enumerate all such instances, but the authors should ensure there aren't any remaining typos or awkward phrasings.

Sure