

Interactive comment on “Uncertainty in Satellite estimate of Global Mean Sea Level changes, trend and acceleration” by Michaël Ablain et al.

Anonymous Referee #1

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This paper provides the first estimate of an error variance-covariance matrix for altimeter measurements of global mean sea level rise. The authors then derive a 90% confidence interval of GMSL on a 10-day basis and estimate the trend and acceleration of GMSL over 5 year or longer intervals.

Overall the paper is easy to understand and could potentially provide a useful quantification of uncertainty. However, my primary concern is with the treatment of GIA uncertainty and the authors must address this.

The authors note that they use the Spada 2017 estimate of 0.05 mm/year for GIA uncertainty. This uncertainty estimate is for the GIA component due to the ongoing changes in the Earth's crust since the last glacial maximum (LGM) but does not include modern day melt contributions to GIA. As the authors are aware, the LGM-GIA

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response is typically accounted for in altimeter-based estimates of GMSL by adding 0.3 mm/yr to the altimeter-derived estimate of GMSL. However, this estimate does not account for deformations of the ocean bottom due to modern melt, which can introduce biases in both the mean trend and acceleration term. See, for example, Frederikse et al. 2017 and Lickley et al. 2018. This correction need not be included if the authors wish to use altimeter measurements to estimate changes in sea surface height instead of sea level. However, the authors explicitly reference estimates of changes in sea level (lines 117- 120) where they compare altimeter estimates of GMSL to changes in ocean volume as measured by tide gauges, or the sum of the contributions to changes in ocean volume. To be consistent, I believe this additional source of GIA uncertainty should be accounted for. Alternatively, they could remove the GIA estimate altogether and state upfront that this is an estimate of the uncertainty in sea surface height and cannot be compared to volumetric changes in sea level.

Frederikse, T., Riva, R. E., & King, M. A. (2017). Ocean bottom deformation due to present-day mass redistribution and its impact on sea level observations. *Geophysical Research Letters*, 44(24).

Lickley, M. J., Hay, C. C., Tamisiea, M. E., & Mitrovica, J. X. (2018). Bias in estimates of global mean sea level change inferred from satellite altimetry. *Journal of Climate*, 31(13), 5263-5271.

Specific Comments:

There are a number of grammatical errors and issues with vocabulary choice throughout. Please check!

Here are a few examples: Line 41: add an s to “altimeter” Replace “confidence envelope” with “confidence interval” throughout Line 86: replace “the GMSL” with “GMSL”. Line 96: Add “us” after “enables” and remove the “s” on “metrics”

Other issues: Line 307, should be ‘~’ not ‘=’ Please label axes on Figure 5 and 9.

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