



EGUsphere, referee comment RC1  
<https://doi.org/10.5194/egusphere-2022-330-RC1>, 2022  
© Author(s) 2022. This work is distributed under  
the Creative Commons Attribution 4.0 License.

## **Comment on egusphere-2022-330**

Thomas Frederikse (Referee)

---

Referee comment on "Current observed global mean sea level rise and acceleration estimated from satellite altimetry and the associated measurement uncertainty" by Adrien Guérou et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-330-RC1>, 2022

---

### **Review of "Current observed global mean sea level rise and acceleration estimated from satellite altimetry and the associated uncertainty"**

This manuscript describes an updated version of the global-mean sea-level record distributed by CNES/AVISO and provides an update of the uncertainty assessment from Ablain et al. (2019). The paper is complete, well-written, and shows the progress in estimating GMSL from altimetry over the past few years. I didn't see any major issue with the current manuscript and I recommend it for publication in Ocean Science. I do have some minor points, which I have listed below.

Thomas Frederikse

General:

There are currently a few different altimetry GMSL curves available from various processing groups (For example NASA GSFC: [https://podaac-tools.jpl.nasa.gov/drive/files/allData/merged\\_alt/L2/TP\\_J1\\_OSTM/global\\_mean\\_sea\\_level/GMSL\\_TPJAOS\\_5.1\\_199209\\_202203.txt](https://podaac-tools.jpl.nasa.gov/drive/files/allData/merged_alt/L2/TP_J1_OSTM/global_mean_sea_level/GMSL_TPJAOS_5.1_199209_202203.txt) or NOAA STAR: [https://www.star.nesdis.noaa.gov/socd/lisa/SeaLevelRise/LSA\\_SLR\\_timeseries\\_global.php](https://www.star.nesdis.noaa.gov/socd/lisa/SeaLevelRise/LSA_SLR_timeseries_global.php)). It would be nice to compare the new GMSL curve against these products: do they all agree within the uncertainty estimates, and are there differences in the trends/accelerations over various periods?

Line-by-line

L3 and throughout the whole manuscript: I wonder about the double dots/trema on Poseidon. The trema should not be there: when transcribing the ancient Greek name Ποσειδάων into the Latin alphabet, the ι (iota) should not get a trema as the iota does not start a new syllable: it's Po-sei-don and not Po-se-i-don.

L22-23: The accuracy numbers, where do they come from? I think this statement needs a source. Also, the daily ¼ by ¼ degree resolution, that is just the resolution at which the along-track data has been interpolated. The spatio-temporal resolution at which features can be extracted will be much lower.

L72 and L79: To avoid confusion with the +/- 82 degree spatial coverage mentioned in line 22, state explicitly here (or at L22/23) that the TOPEX/Jason missions only cover +/- 66 degree latitude.

L134: The ocean bottom deformation correction mentioned here is not just a correction needed to match altimetry with Argo/GRACE: GMSL changes are defined as global-mean relative sea-level changes (See equation 42 in Gregory et al. 2019 and the discussion in the same section), while satellite altimetry provides global-mean geocentric sea-level change (GMGSL). Both GIA and contemporary mass redistribution cause the ocean bottom to subside on average, which leads to a difference between GMSL and GMGSL that is corrected by adding 0.3 mm/yr (GIA) and 0.1 mm/yr (Contemporary) to the GMGSL trend. Hence to estimate GMSL from altimetry, both corrections serve the same purpose. One could argue that the GIA correction is larger and thus more important. However, due to the increasing rate of barystatic sea-level rise, the contemporary mass change-induced ocean bottom correction is about 0.2 mm/yr since 2005, which is on the same order as the GIA correction, see the supplement of Hakuba et al., 2021.

L178: why apply a low-pass filter before estimating the trend? That does not make the estimated trend any more accurate, and in the worst case even degrades the estimate because of edge effects at the beginning and end of the time series. I suggest to estimate the trend/acceleration without low-pass filtering.

Figure 5 and Figure 6: the trends and accelerations for the longest periods in this figure don't match with the numbers in Figure 3. In Figure 5, the trend for the longest period is 3.5 mm/yr and the acceleration  $< 0.1 \text{ mm/yr}^2$ , while in Figure 3, there's a trend of 3.3 mm/yr and acceleration of  $0.12 \text{ mm/yr}^2$ . The only possible difference could be the different period: the caption notes here that these figures only show data until October 2021 and Figure 3 notes December 2021. However, since the mean seasonal cycle has been removed, the difference cannot be this big. So there must be something wrong with either Figure 5/6 or Figure 3. I also recommend using a single record length for both.

L294: I'd be cautious with stating that the ITRF uncertainty is fully linear. It is an assumption made here, which is fine, but in reality, the error probably is non-linear. That is because ITRF frames refer to the center of mass (CM), while most observations that go

into ITRF are in the center-of-figure frame (CF). The difference between the two, geocenter motion, is to a large extent driven by ice mass loss, which is rapidly accelerating, while in ITRF frames, geocenter motion is approximated by a linear trend, which induces a non-linear error. Fully quantifying this error is way out of scope for the current manuscript, but it might be good to notice here.

I assume in this paper, ITRF2014 has been used. ITRF2020 has recently been released. Could the authors provide any information on whether this updated reference frame can help with reducing the reference-frame uncertainties?

L409: I encourage the authors to share the scripts used to calculate the uncertainties on a public repository.

#### References:

Gregory, J. M., Griffies, S. M., Hughes, C. W., Lowe, J. A., Church, J. A., Fukimori, I., Gomez, N., Kopp, R. E., Landerer, F., Cozannet, G. L., Ponte, R. M., Stammer, D., Tamisiea, M. E., & van de Wal, R. S. W. (2019). Concepts and Terminology for Sea Level: Mean, Variability and Change, Both Local and Global. *Surveys in Geophysics*.  
<https://doi.org/10.1007/s10712-019-09525-z>

Hakuba, M. Z., Frederikse, T., & Landerer, F. (2021). Earth's Energy Imbalance from the ocean perspective (2005 – 2019). *Geophysical Research Letters*.  
<https://doi.org/10.1029/2021GL093624>