

Review for: “**North Atlantic sea level budget revisited**” by Zhe Song, Anny Cazenave<sup>1</sup>, William Llovel, Andrea Storto and Marie Bouih (<https://doi.org/10.5194/egusphere-2026-802>).

This study examines the North Atlantic sea level budget from 2004-2022, comparing satellite altimetry data with estimates of steric and manometric contributions from various sources (ARGO floats, ocean reanalyses, and GRACE). While a complete sea level budget (altimetry balanced by steric and manometric components) was not achieved using GRACE data and any ARGO/reanalysis combinations, it was closed when using full-depth steric data from the CIGAR and ORA5S reanalyses with the CIGAR manometric component. The authors found that the deep steric component of CIGAR significantly contributed to this closure, and highlight potential issues with GRACE measurements, particularly in the Northeastern Atlantic. Even when the overall budget is balanced, significant regional anomalies in sea level trends persist.

The paper is generally well-written and the figures are clear. However, the altimetry and GRACE data sets are not sufficiently cited. The numerous analyses presented can make it challenging to discern the main points. A table detailing the mean contributions from each component (altimetry, steric, deep steric, manometric) would improve clarity and facilitate comparison. The conclusions would be strengthened by more robust substantiation. A key concern is the reliance of the manometric component conclusions on the validity of the CIGAR deep steric data, given the considerable differences observed between CIGAR and ORA5S estimates – potentially indicating differing underlying physical processes. The observed warming and salinization in the deep western North Atlantic within CIGAR since 2004 should be validated using in-situ data, such as from existing moorings (e.g., see <https://www.nature.com/articles/s43247-025-02170-y>). Additionally, considering the potential impact of the derived changes in the manometric component on the Atlantic Meridional Overturning Circulation (AMOC) would enhance the paper's discussion.

Given the importance of this topic, I recommend publication after major revisions.

#### **Specific points:**

Page 5, line 117: the mascon solution is probably not from GFZ, but rather from GSFC?

Page 5, line 128: in the following no individual mascon solutions but only ensemble means are shown and discussed

Page 8, line 201-203: how do the global mean values compare between the datasets?

Figure 1: what would be the corresponding ORA5S component?

Figures 1, 2, and 3: what is the confidence level for the corresponding trends?

Page 9/10, lines 224-228: phrasing potentially misleading: larger trends => GRACE show positive trends while CIGAR trends are negative? Most significant differences seem to be rather in the North East Atlantic than near Greenland.

Page 13, lines 271-276: Why is it necessary for the deep steric component to align with the upper steric component?

Page 14, lines 292-294: If the reliability of that dataset is questionable, consider excluding it from the study.

Figure 4: might be an option to add the corresponding manometric curves

Figure 6, caption: scatter plots of sea level trends in mm/year?, what does the normalization of the data include?

Figure 7/8, caption: map of residual SL trends ... in mm/year ?

Tables 1/2/3: The reported uncertainty may be unrealistically low, considering the uncertainties inherent in the contributing data sources.

Figures 9-13: very similar, hard to distinguish

Page 31, line 575: steric sea level **trends**?

Page 31, line 583: decreasing trend -> negative trend