

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on **essd-2021-137**

Anonymous Referee #1

Referee comment on "Global sea-level budget and ocean-mass budget, with a focus on advanced data products and uncertainty characterisation" by Martin Horwath et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-137-RC1>, 2021

I enclose my critical comments to the manuscript "Global sea-level budget and ocean-mass budget, with focus on advanced data products and uncertainty characterisation" by Martin Horwath et al., MS No.: **essd-2021-137**

General comments

This manuscript is delivering a comprehensive analysis of the global sea level budget and the global ocean-mass budget using data sets developed in the framework of ESA's Climate Change Initiative. Study presents four strong points: 1) the methodological framework of the budget assessments, 2) with descriptions of the data sets used, 3) the summaries of the methods of their generation and 4) details on their uncertainty characterisation.

Study is addressing the important scientific question about the closure/misclosure of the sea-level budget for the period since 1993, with discussion about the observed changes of global mean sea level equal the sum of observed (or otherwise assessed) contributions, and the role of uncertainty estimates for the budget assessment.

Manuscript provides detailed assessment of the observed individual sea level components (e.g. steric sea level, from ice mass loss from Greenland and Antarctica ice sheets), specifically focused on the assessment of their uncertainties. Outputs from global glacier model is utilised to provide global glacier mass changes; and WaterGAP global hydrological model is used for the estimate of the land water storage contributor to sea level budget.

Manuscript is well written, with an adequate number of figures and reasonable discussion. Detailed description of data availability is an important contribution to the quality of the paper.

Outlook for future possible studies is an unavoidable point of the paper, providing a direction for the further improvement of the sea level and its components observations.

However, there are some critical specific comments.

1) Part 9.2 line 1312. Suggestions regarding " a SLB misclosure in the early years

of Argo 2003–2006 is likely due to an underestimation of the steric sea-level rise". I would suggest to include the reference to support the statement regarding the underestimation of the steric sea-level rise, or add a sentence to clarify this statement.

2) Part 3.2.3 Deep ocean steric contribution

This part needs some comment (just a comment) regarding the estimate... 0.1 ± 0.1 mm/yr based on Purkey and Johnson (2010), to address the optimistic uncertainties in this estimate, suggesting that some very limited data sets are available to calculate this estimate, mainly to bring the issue of the need for observations in the deep ocean.

3) It would be good to see some statement, providing a clear message (maybe in abstract), that availability of the data (e.g. results from P1 vs P2) is important to improve our understanding about sea level components, and to understand the source of uncertainties.... Something like that. However, I do not inflict any specific statement, I just would like to suggest a message about the importance of observations for sea level components. It is a very minor suggestion.