EGUsphere, referee comment RC2
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Comment on egusphere-2022-876

Anonymous Referee #2

Referee comment on "Regionalizing the sea-level budget with machine learning techniques" by Carolina M. L. Camargo et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-876-RC2, 2022

In this manuscript Camargo and colleagues analyze the regional sea level budget (i.e., the sum of individually measured/modelled contributions) to satellite altimetry over the 1993 to 2016 period. They specifically focus on the effect of spatial averaging on the uncertainties in budget closure. For spatial averaging they incorporate an a priori pattern recognition (two different approaches) step, which identifies clusters of homogeneous regions that are then averaged for the budget analysis. They demonstrate that clustering generally improves the budget closure and works significantly better than just using larger blocks. They also demonstrate the importance of the inclusion of an ocean bottom pressure term to the sterodynamic component. Overall, this is a very well written paper using novel approaches with several interesting findings. I therefore have no major reservations regarding the publication of the paper in Ocean Science. Below I provide a couple of comments and suggestions:

General:

I hope I did not overlook anything, but it seems that the authors compare geocentric sea level from satellite altimetry to relative sea level from the budget components, as their budget components also seem to contain crustal components of GRD terms due to contemporary mass change!? To my understanding one must either add those components to satellite altimetry, or only consider the geoid variations in the budget. The term has a substantial contribution to regional sea level according to Frederikse et al. (2017a)

Specific

Line 20: The inverse barometer contribution is missing here

Line 32: or for individual coastline stretches characterized by coherent variability (Frederikse et al., 2016, 2017b; Dangendorf et al., 2021). It has also been closed at a tide gauge level by Wang et al. (2021).

Line 69: I was wondering how the authors treated missing data due to the presence of sea ice at higher latitudes? This might also affect some of the budget misclosures/uncertainties mentioned farther below in the manuscript.

Line 83: How does that compare the deep ocean contribution from Zanna et al. 2019?

Line 85 following: As mentioned as a general comment, the approach seems to be inconsistent with respect to geocentric sea level as measured by satellites.

Line 94: It might be good to provide a little more information here, given that this other paper is still under review. I was also wondering how the estimates differ from those in Frederikse et al. (2020)?

Line 174 following: I am wondering how sensitive the two approaches are to temporal filtering? Former assessments such as Thompson and Merrifield (2014) have focused on decadal scales (which is likely more relevant for trends). Did the authors test sensitivity to smoothing? Also, have the time series been deseasonalized before applying the clustering technique?

Line 207: Or atmospheric teleconnections. Not all of them are connected by coasts

Line 231: does this mean a positive bias?

Line 344: The authors might consider Calafat et al. (2013) & Dangendorf et al., (2014), who initially established that link

Line 349: Southern Hemisphere

References:

Calafat, F. M., Chambers, D. P., & Tsimplis, M. N. (2013). Interâ□□annual to decadal

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Dangendorf, S., Calafat, F. M., Arns, A., Wahl, T., Haigh, I. D., & Jensen, J. (2014). Mean sea level variability in the North Sea: Processes and implications. *Journal of Geophysical Research: Oceans*, *119*(10).

Frederikse, T., Riva, R., Kleinherenbrink, M., Wada, Y., van den Broeke, M., & Marzeion, B. (2016). Closing the sea level budget on a regional scale: Trends and variability on the Northwestern European continental shelf. *Geophysical research letters*, *43*(20), 10-864.

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Zanna, L., Khatiwala, S., Gregory, J. M., Ison, J., & Heimbach, P. (2019). Global reconstruction of historical ocean heat storage and transport. *Proceedings of the National Academy of Sciences*, *116*(4), 1126-1131.