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Closing the global mean sea level budget from altimetry, GRACE/GRACE Follow-On and Argo data (2005-present)

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Change in the global mean sea level (GMSL) is the sum of changes in the global mean steric sea level and global mean ocean mass. Over the 1993-2016 period, the GMSL budget was found to be closed, as shown by many independent studies. However, non-closure of the sea level budget after 2016 has been recently reported when using altimetry, Argo and GRACE/GRACE Follow-On data (Chen et al., GRL, 2020). This non-closure may result from errors in one or more components of the sea level budget (altimetry-based GMSL, Argo-based steric sea level or GRACE-based ocean mass). In this study, we investigated possible sources of errors affecting altimetry and Argo data used to assess closure of the GMSL budget. Concerning altimetry data, we compared the wet tropospheric correction (WTC) applied to Jason-3 data (the reference satellite mission used for the GMSL computation since 2016) with that from the SARAL/AltiKa mission, and found no systematic bias between the radiometer measurements from these two missions. Besides, preliminary comparisons of GMSL trends (using the WTC ECMWF model) between different missions do not suggest discrepancies larger than 0.4 mm/yr over 2016-present. While further analyses are still needed, we find unlikely that non-closure of the sea level budget results from errors of the altimetry system. Concerning Argo data, since 2016, salinity data from different processing groups display strong discrepancies, likely due to instrumental problems and data editing issues. Good agreement is found between all available Argo-based thermosteric products. Given that the halosteric component should be negligible in global average, we re-examined the sea level budget since 2016 using only the thermosteric component and found significant improvement in the budget closure, although it is not yet fully closed. This suggests that the observed discrepancies in the Argo-based halosteric component largely contribute to the non-closure of the GMSL budget in the recent years.