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Global mean and local sea level budget from updated observations and residual analysis

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The closure of the Sea Level Budget (SLB) is a key challenge for modern physical oceanography. First, it is essential that we ensure the proper identification and quantification of each significant contributor to sea level change through this closure. Second, it provides an efficient means to closely monitor and cross-validate the performance of intricate global observation systems, such as the satellite altimetry constellation, satellite gravimetry missions (GRACE/GRACE-FO), and the Argo in-situ network. Third, this closure reveals to be a beneficial approach for assessing how well the observed climate variables, such as sea level, barystatic sea level, temperature and salinity, land ice melt, and changes in land water storage, comply with conservation laws, in particular those related to mass and energy.

In this presentation, we will discuss the state of knowledge of global mean and regional sea level budget with up-to-date observations, encompassing 1) an up-to-date assessment of the budget components and residuals, along with their corresponding uncertainties, spanning from 1993 to 2023 in global mean and throughout the GRACE and Argo era for spatial variations; 2) the identification of the periods and areas where the budget is not closed, i.e. where the residuals are significant; 3) advancements in the analysis and understanding of the spatial patterns of the budget residuals. A focus will be made on the North Atlantic Ocean where the residuals are significantly high. We investigate the potential errors causing non-closure in each of the components (e.g., in situ data sampling for the thermosteric component, geocenter correction in the gravimetric data processing) as well as potential inconsistencies in their processing that may impact large-scale patterns (e.g., centre of reference and atmosphere corrections). Errors linked to the system observability (due to different sampling and resolution of the various observations) will be quantified with synthetic data extracted from ocean simulations.

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