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## Assessing causes of recent sea level budget misclosure

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Three decades of satellite radar altimetry have provided an important global mean sea level change record. Validation of that record against other independent data is critical. Sea level rise has two primary causes: steric expansion of the oceans due to temperature and salinity changes, observed globally since 2005 by the Argo float network, and ocean mass change, uniquely and critically observed by GRACE and GRACE-FO since 2002. The globally averaged sum of Argo steric expansion and GRACE(-FO) ocean mass can be compared directly to the radar altimetry record, a comparison that is widely referred to as the Sea Level Budget, and numerous groups have assessed this comparison for over a decade. Recent improvements to Jason-3 wet troposphere modelling has helped show closure of the budget through around 2020, but growing misclosure of the two records in the years since remains unexplained. Our most recent estimates of the 2005-2024 trend in global mean sea level, presented at the 30 Years of Progress in Radar Altimetry Symposium in September 2024, show sea level rise of 3.80 mm/year from altimetry and 3.56 mm/year from GRACE+Argo. In this work, we more deeply investigate this recent misclosure. After first establishing a new unified ocean mask for all three datasets, we examine the budget over subsets of the global ocean and show that the disagreement cannot be explained by differences in any one small portion of the ocean. We then investigate and compare ocean mass changes in Earth's gravity from GRACE(-FO) and Altimetry-minus-Argo and show that disagreements between these records at long spherical wavelengths can explain differences in the recovered trends in global mean sea level.