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Estimating Basin-Scale Sea Level Budgets with Satellite Gravity

Ocean mass estimates from satellite gravimetry and steric-corrected altimetry often diverge, especially at the ocean-basin scale. We present a method to provide basin-scale ocean mass trends by using Slepian functions to spatially localise the mass density field obtained from the GRACE satellite better. A negative buffer kernel is conventionally applied around the coastline to reduce the land signal leakage, but it can affect the recovered signal by up to 50% in individual ocean basins. Through synthetic experiments, we determine the optimal kernel size for Slepian functions to be 1 degree, much smaller than the typically required 300–500 km. With this approach, we estimate that the global mean ocean mass between 2003 and 2022 is increasing at a rate equivalent to 2.07 ± 0.05 mm yr^{-1} of sea level rise, consistent with previous studies. Regionally, the South Atlantic Ocean has the largest mass increase rate of 2.95 ± 0.12 mm yr^{-1}, while the North Pacific Ocean has the smallest rate (1.20 ± 0.09 mm yr^{-1}). Our results suggest that the Slepian functions can be used to provide a more accurate estimate of the ocean mass trend at the basin scale, and the sea level change varies significantly across regions.

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