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Detecting the sea level fingerprint of accelerated Greenland mass loss

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The tide-gauge record from the North American east coast reveals significant accelerations in sea level starting in the late 20th century. We analyze the tide-gauge data using a model in which the accelerations are assumed to be zero prior to 1990. The estimated accelerations range from near zero to $\sim$0.3 mm yr-2 and exhibit a systematic spatial variability. We model this variability using several processes: ongoing mass change in Greenland and Antarctica as measured by the GRACE satellites; ocean dynamic and steric variability provided by the GECCO$_2$ ocean synthesis; and the inverted barometer effect. Because we are using accelerations over several decades, the contribution from glacial isostatic adjustment is negligible, a substantial benefit of this approach. This approach also enables us to estimate admittances for any of these processes. By including an admittance for the Greenland mass loss, we test the hypothesis that the self-attraction and loading sea level fingerprint associated with accelerated mass loss is real and observable in the sea level data. An admittance of zero indicates a rejection of this process. Our estimated admittance is 0.75 ± 0.16, a clear positive detection at the level of 4–5 standard deviations.