EGU23-4554, updated on 30 Nov 2023
https://doi.org/10.5194/egusphere-egu23-4554
EGU General Assembly 2023

A Detection of the Sea Level Fingerprint of Greenland Ice Sheet Melt

Sophie Coulson[1], Sonke Dangendorf[2], Jerry X. Mitrovica[3], Mark Tamisiea[4], Linda Pan[3], and David Sandwell[5]

[1]Fluid Dynamics and Solid Mechanics Group, Los Alamos National Laboratory, Los Alamos, NM, USA
[2]Department of River-Coastal Science and Engineering, Tulane University, New Orleans, LA, USA
[3]Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA, USA
[4]Center for Space Research, University of Texas, Austin, TX, USA
[5]Institute of Geophysics and Planetary Physics, University of California, San Diego, CA, USA

Rapid melting of ice sheets and glaciers drives a unique geometry, or fingerprint, of sea-level change, including a sea-level fall in the vicinity of the ice sheet that is an order of magnitude greater than the associated global mean sea-level rise of the melt event. The detection of individual fingerprints has been challenging due to sparse sea surface height measurements at high latitudes and the difficulty of disentangling ocean dynamic variability from the signal. Efforts to date have analyzed sea level records outside the zone of major sea-level fall, where the gradients and amplitudes of the fingerprint signal are significantly lower. We predict the fingerprint of Greenland Ice Sheet (GrIS) melt using new ice mass loss estimates from radar altimetry data and model reconstructions of nearby glaciers, and compare this prediction to an independent, altimetry-derived sea surface height trend corrected for ocean dynamic variability in the region adjacent to the ice sheet. The two fields show consistent gradients across the region, with the expected strong drawdown of the sea surface toward GrIS. A statistically significant correlation between the two fields ($p < 0.001$) provides the first unambiguous observational detection of the near-field sea level fingerprint of recent GrIS melting in our warming world. This detection provides a robust map of the impact of ice mass flux on global oceans since the early 1990s, and validates theoretical and numerical developments in the sea level modelling community.