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Sea-level rise from the Greenland Ice Sheet in response to observed change

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The Greenland Ice Sheet (GrIS) has been out-of-balance since the early 1990s, contributing to sea level at a rate of ∼0.4 mm/yr. This mass loss can be partitioned between surface (and basal) mass balance, and discharge due to ice dynamics through outlet glaciers. While there is an instantaneous response in outlet glacier velocity to a perturbation at the terminus (e.g. a large calving event), the diffusive response – due to the evolution of ice thickness over time – means that the total effect of a perturbation can take decades to be fully realized. Here we model the committed sea level response of GrIS. That is, overlooking any future perturbations, we find the sea level contribution from GrIS that is locked in due to the slow dynamical response of the ice to past changes. We use the ice flow model ISSM, along with various input datasets, to find an initial state representing the ice sheet in the early 2000s, from which we run forward simulations, holding the climate constant. We apply perturbations to the outlet glacier termini that represent recent observed changes, and model the ice sheet's committed sea level contribution over the 21st century.