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Effects of Hudson Strait Ice Loss on the RSL Fit Quality of the ICE-7G_NA (VM7) Model: New Observational Evidence for Heinrich Event H1

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The ICE-xG (VMy) series of GIA-based reconstructions have, over the course of many years, been empirically fit to an expanding array of relative sea level (RSL) and other observations through the refinement of hypothetical ice thickness histories (increasing x) and radial mantle viscosity profiles (increasing y). Progressive refinements along these lines do not account for possible horizontal mantle viscosity variations and are not formally guaranteed to converge towards some unique optimal fit, but the basic scientific approach has in practice yielded observationally and ice-dynamically consistent reference solutions that became stable bases for further study and refinement. Our latest work examines the effects of refining the ice history component of the ICE-7G_NA (VM7) model (or, I7G model) in such a way as to introduce representations of Heinrich Event H1 in the $\sim$16.8-16.2 kyr BP date range. When grounded ice is removed from the channel that currently underlies Hudson Strait, the resulting perturbation of GIA-based RSL predictions markedly and consistently improves upon the quality of I7G fits to near-field observations. Considering all sea level index points from the extensive University of Toronto RSL observation database, the RMS misfits of model predictions are reduced by more than 20% for clusters of observations at 18 sites, including all but one site on the northern and southern shorelines and interior islands of Hudson Strait. Understandably modest (<20%) changes in RMS misfit occur at a comparable number of sites that lie farther afield, while some degradation of I7G fit quality is also observed at a handful of sites close to the Atlantic outlet of Hudson Strait.

Noting that the unmodified I7G model already produces very good overall fit quality with respect to the global University of Toronto RSL database, our results suggest that a reference model of even higher value would result from the incorporation of Heinrich Event H1 into the ice thickness history component. Working towards the definition of such a model, ongoing, related studies are aiming to understand the physical basis and optimal structure of the imposed ice thickness perturbation. One possible explanation invokes the effects of tidal shear on ice grounding lines, and some tidal simulations have already been carried out in preparation for a broader programme of tidal and ice dynamical modeling.