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Multi-century impacts of ice sheet retreat on sea level and tides in Hudson Bay

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In Hudson Bay, sea level changes associated with ice loss from the Greenland and Antarctic ice sheets will differ in both sign and magnitude due to gravitational effects. Changing water depths give rise to changes in ocean tides, for which tidal energy dissipation and tidal amplitudes are directly linked to ocean bathymetry (Green, 2010). In the present study, we investigate the impact of sea level changes on tides in Hudson Bay, Canada a region where tidal energy dissipation is strongly sensitive to bathymetry (e.g. Egbert and Ray, 2000), and the bathymetry is in turn highly uncertain in some parts of the bay. Recent work by Wilmes et al. (2017) indicates that regional variability in future sea level changes as a consequence of ice sheet collapse will impact tides globally, in particular in Hudson Bay. As the magnitude of globally averaged sea level change due to Greenland and Antarctic ice loss remains highly uncertain (e.g. Church et al., 2013; DeConto and Pollard, 2016; Golledge et al., 2015), we present simulations of multi-century sea level changes associated with a suite of Greenland and Antarctic ice loss scenarios using a gravitationally self consistent sea level model (Gomez et al., 2010). To fully quantify the sea level changes in Hudson Bay, we incorporate the contributions of glacial isostatic adjustment associated with the last deglaciation in our projections. We then consider the impact of these sea level changes on tides in Hudson Bay using the OTIS tidal model. Our results aid in constraining the response of Hudson Bay tidal dynamics to projected sea level changes, elucidating the feedbacks between energy dissipation and shoreline migration, and assessing the impact of climate change on coastal regions in the Hudson Bay.