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Sea-level Fingerprinting, Vertical Crustal Motion from GIA, and Projections of Relative Sea-level Change in the Canadian Arctic

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We present projections of relative sea-level rise in the 21st century for communities in the Canadian Arctic. First, for selected communities, we determine the sea-level fingerprinting response from Antarctica, Greenland, and mountain glaciers and ice caps. Then, for various published projections of global sea-level change in the 21st century, we determine the local amount of "absolute" sea-level change. We next determine the vertical land motion arising from glacial isostatic adjustment (GIA) and incorporate this into the estimates of absolute sea-level change to obtain projections of relative sea-level change. The sea-level fingerprinting effect is especially important in the Canadian Arctic owing to proximity to Arctic ice caps and especially to the Greenland ice sheet. Its effect is to reduce the range of projected relative sea-level change compared to the range of global sea-level projections. Vertical crustal motion is assessed through empirically derived regional isobases, the Earth's predicted response to ice-sheet loading and unloading by the ICE-5G ice sheet reconstruction, and Global Positioning System vertical velocities. Owing to the large rates of crustal uplift from glacial isostatic adjustment across a large region of central Arctic Canada, many communities are projected to experience relative sea-level fall despite projections of global sea-level rise. Where uplift rates are smaller, such as eastern Baffin Island and the western Canadian Arctic, sea-level is projected to rise.