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Mechanical sea-ice strength parameterized as a function of ice temperature

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Mechanical sea-ice strength is key for a better simulation of the timing of landlock ice onset and break-up in the Canadian Arctic Archipelago (CAA). We estimate the mechanical strength of sea ice in the CAA by analyzing the position record measured by the several buoys deployed in the CAA between 2008 and 2013, and wind data from the Canadian Meteorological Centre's Global Deterministic Prediction System (CMC_GDPS) REforecasts (CGRF). First, we calculate the total force acting on the ice using the wind data. Next, we estimate upper (lower) bounds on the sea-ice strength by identifying cases when the sea ice deforms (does not deform) under the action of a given total force. Results from this analysis show that the ice strength of landlock sea ice in the CAA is approximately 40 kN/m on the landfast ice onset (in ice growth season). Additionally, it becomes approximately 10 kN/m on the landfast ice break-up (in melting season). The ice strength decreases with ice temperature increase, which is in accord with results from Johnston [2006]. We also include this new parametrization of sea-ice strength as a function of ice temperature in a coupled slab ocean sea ice model. The results from the model with and without the new parametrization are compared with the buoy data from the International Arctic Buoy Program (IABP).