

A high-order flow-band ice dynamics model for the Belcher Glacier system

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As part of the Canadian contribution to IPY GLACIODYN addressing the dynamic response of Arctic tidewater glaciers to climate, we are developing a new model of Belcher Glacier dynamics. Belcher Glacier is a large, fast-flowing, tidewater outlet of the Devon Island ice cap, Nunavut. A goal of the study is to develop and validate a high-resolution coupled mass balance-hydrology-dynamics model to investigate the glacier under current conditions and to explore its possible response to future climate change. To this end a flow-band model is presented that properly accounts for high-order stress gradients, arising from longitudinal and transverse stresses. These stresses can play a significant role at high sliding speeds, in icefalls and at the calving terminus of a tidewater glacier such as the Belcher. The numerical model can be thermo-mechanically coupled and various options for modelling basal sliding and iceberg calving at the terminus are incorporated. The model will eventually be coupled to a multi-component model of glacier hydrology, where supraglacially-stored water can propagate into the ice through fractures.