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Dynamics of a barotropic current at an ice shelf front

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Ice shelves in West Antarctica are melting at an increasing rate due to the flow of relatively warm Circumpolar Deep Water into the ice shelf cavities. The current that brings heat southward along the
eastern side of a trough towards an ice shelf front is found to have a barotropic and a baroclinic component. Mooring observations in front of Getz Ice Shelf suggest that 90% (roughly 0.6 Sv) of the
volume transport and 65% of the temperature transport is linked to the barotropic component of the
current towards the ice shelf. It is unknown whether and how much of a barotropic current can penetrate under the ice shelf across the about 300 m deep ice shelf front, where lines of constant water
column thickness discontinue.
We conduct idealized modelling with MITgcm to investigate the dynamics of a barotropic current at the
ice shelf front. Friction and strong vertical velocities at the ice shelf front break the potential vorticity
constraint and allow the flow to partly enter the ice shelf cavity. Only a small fraction of the current penetrates deep into the cavity, while a strong current flows parallel to the ice shelf front, where basal
melt is largely enhanced. How much of the current enters the cavity and how far it reaches depends on
the ice shelf- and bedrock topography.