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Ice front blocking of ocean heat transport to an Antarctic ice shelf

Anna Wåhlin[1], Nadine Steiger[2], Elin Darelius[2], Karen Assmann[1], Mirjam Glessmer[3], Ho Kyung Ha[4], Laura Herraiz-Borreguero[5], Celine Heuzé[6], Adrian Jenkins[7], Tae Wan Kim[8], Aleksandra Mazur[1], Joel Sommeria[9], and Samuel Viboud[9]

[1]Department of Marine Sciences, Univeresity of Gothenburg, Sweden (anna.wahlin@marine.gu.se)
[2]Geophysical Institute, University of Bergen, Norway
[3]Leibniz Institute of Science and Mathematics Education, Kiel, Germany
[4]Inha University, South Korea
[5]Commonwealth Scientific and Industrial Research Organisation (CSIRO), Hobart, Australia
[6]Department of Earth Sciences, Univeresity of Gothenburg, Sweden
[7]Northumbria University, Newcastle upon Tyne, UK
[8]Korea Polar Research Institute, South Korea
[9]Laboratoire des Ecoulements Geophysiques et Industriels Domaine Universitaire, Grenoble, France

Shoreward oceanic heat flux in deep channels on the continental shelf typically far exceeds that required to match observed ice shelf melt rates, suggesting other critical controls. IN the present study we study the depth-independent (barotropic) and the density-driven (baroclinic) components of the flow of warm ocean water towards an ice shelf. Using observations from the Getz Ice Shelf system as well as geophysical laboratory experiments on a rotating platform, it is shown that the dramatic step shape of the ice front blocks the barotropic component, and that only the baroclinic component, typically much smaller, can enter the sub-ice cavity. A similar blocking of the barotropic component may occur in other areas with comparable ice-bathymetry configurations, which may explain why changes in the density structure of the water column have been found to be a better indicator of basal melt rate variability than the heat transported onto the continental shelf. Representing the step topography of the ice front accurately in models is thus important for simulating the ocean heat fluxes and induced melt rates.