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The role of ocean circulation in the propagation of rifts on ice shelves.

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The break-up of large ice shelves and the associated loss of ice are thought to play a destabilizing role in the ice sheet dynamics. Although ice shelves are a substantial buttressing source in the stability of continental ice sheets, the propagation of large rifts eventually leads to the break-up of icebergs into the ocean. As consequence, this loss of ice would trigger further glacier acceleration and ice sheets retreat, destabilizing the ice cap. Retreat and collapse of ice sheets are also thought to be related to regional climate warming. Indeed, satellite observations suggest that a warming surrounding would induce the ice sheet to progressive thinning and weakening.

The prolongation of un-grounded ice into the ocean is often interrupted by the propagation of fractures that eventually separates large icebergs from the ice shelf. These fractures are called rifts and range from dimensions of 10 to 100 km. A recent example of such phenomena is the massive break-up of the Larsen C in July, 2017 which followed the disintegration of Larsen A in 1995 and the partial break-up of Larsen B in 2002. The tabular iceberg formed by Larsen C was limited by the propagation of a large rift that began in summer 2016, although the ice shelf had already been thinning since 1992.

Rift initiation and propagation are thought to be the result of glaciological and oceanographic sources that trigger ice to break. Nonetheless, exact mechanisms remain elusive. The on-going project focuses on ice-ocean interactions in ice shelves that accommodate rifts by using oceanographic models. The goal is to couple rift propagation and ocean circulation underneath ice cavities in order to infer how basal melting affects the development of rifts. The numerical framework is developed within the capabilities of the MITgcm. We aim to identify the sensitivity of propagation rate and opening rate of rifts to variations in the ocean circulation that have occurred during the separation of part of the ice shelf.

On a larger scale, we are interested in the role of rifting in the stability of Antarctic shelves. Therefore, we work toward a better understanding of which processes are involved in the triggering of rift propagation.

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