Modeling of Ocean Dynamics in Ice-Shelf Rifts

Ir. Mattia Poinelli[1,2,3]

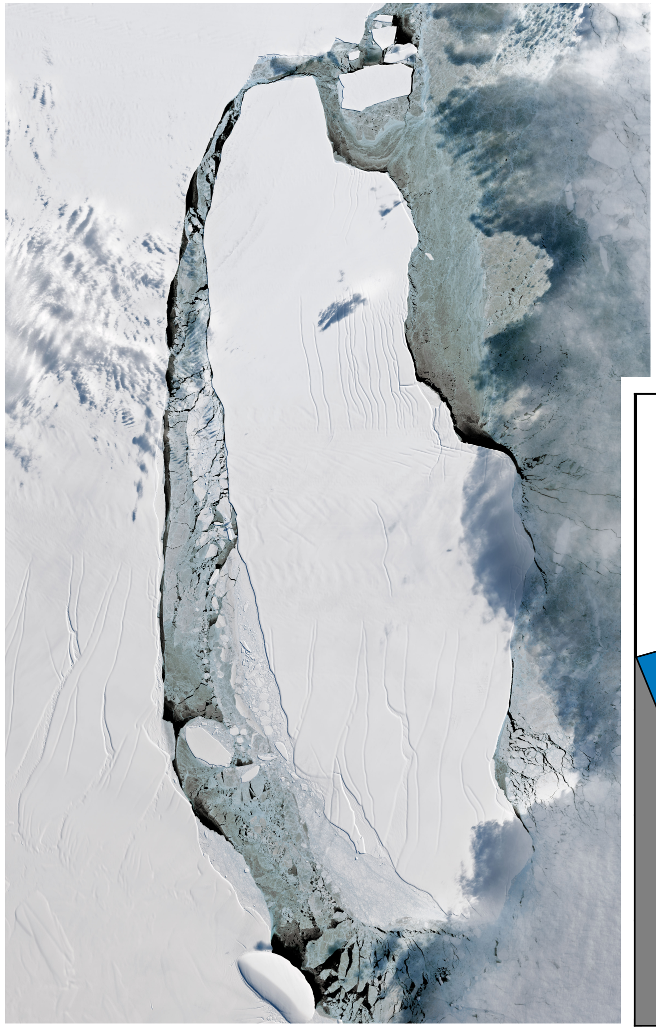
Dr. Michael Schodlok[3]

Dr. Eric Larour[3]

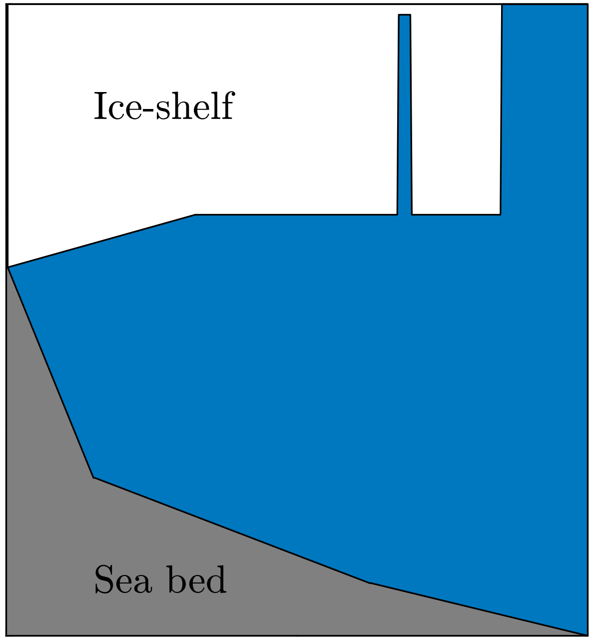
[1] Delft University of Technology, Netherlands

[2] University of California, Irvine, CA

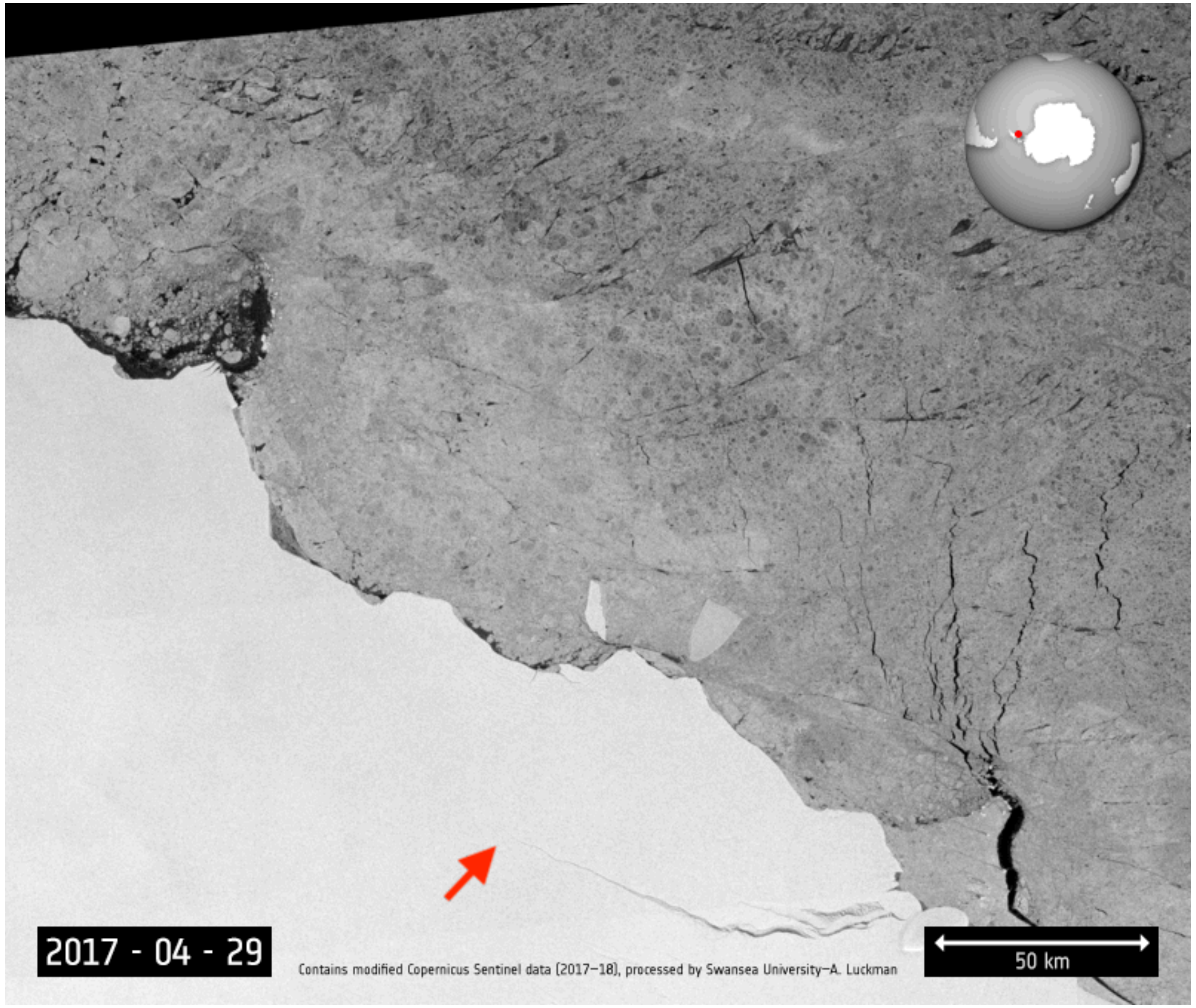
[3] Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA



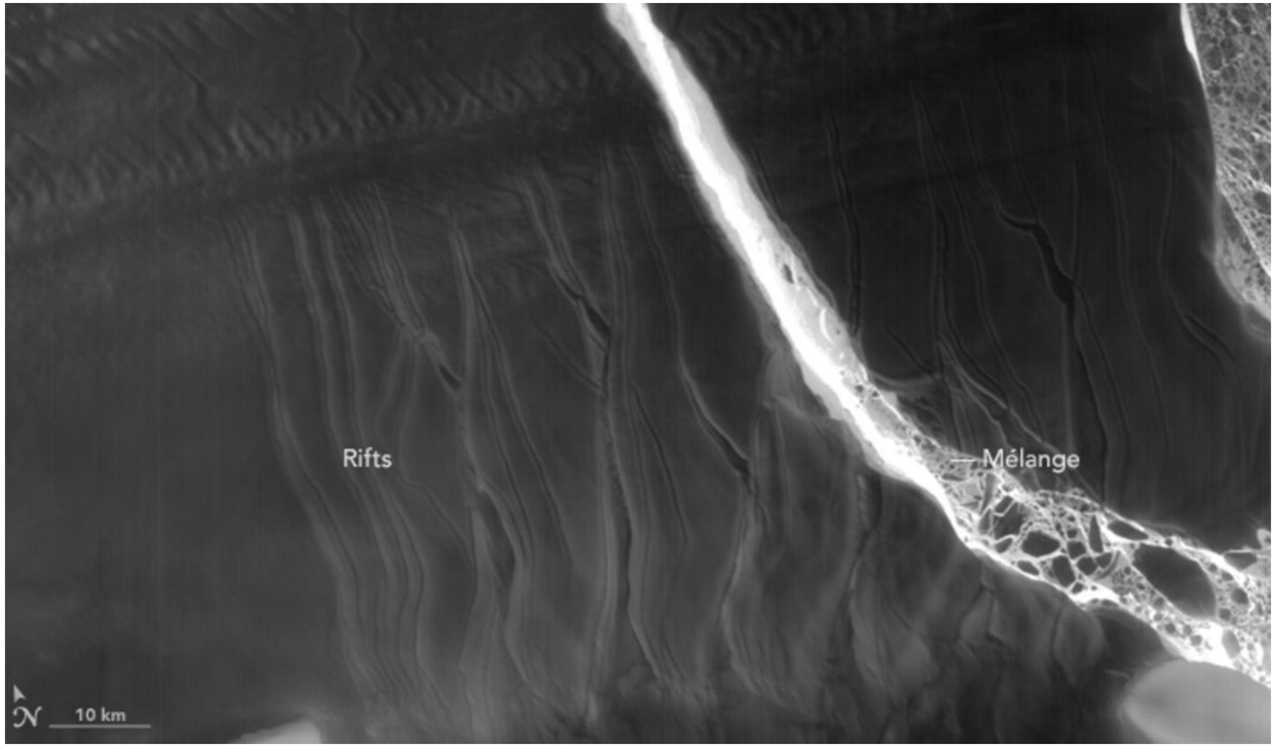
LANDSAT data processed by Stevens, J.



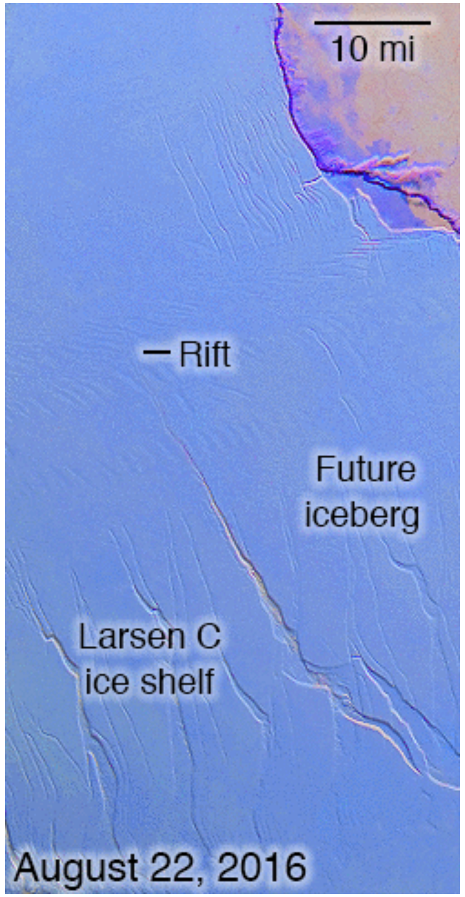
Larsen C calved the large iceberg A68 in July 2017.



Ice mélange is thought to control rift propagation.

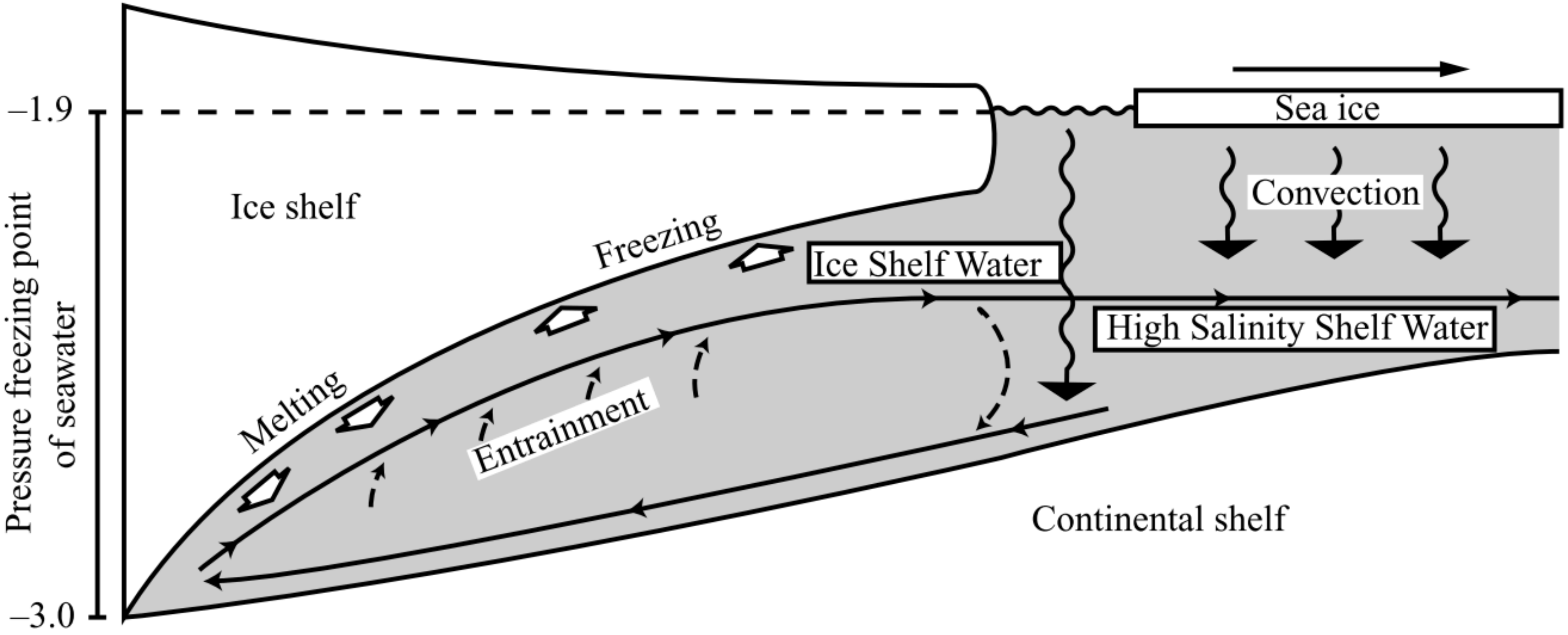


LANDSAT data processed by Allen, J.



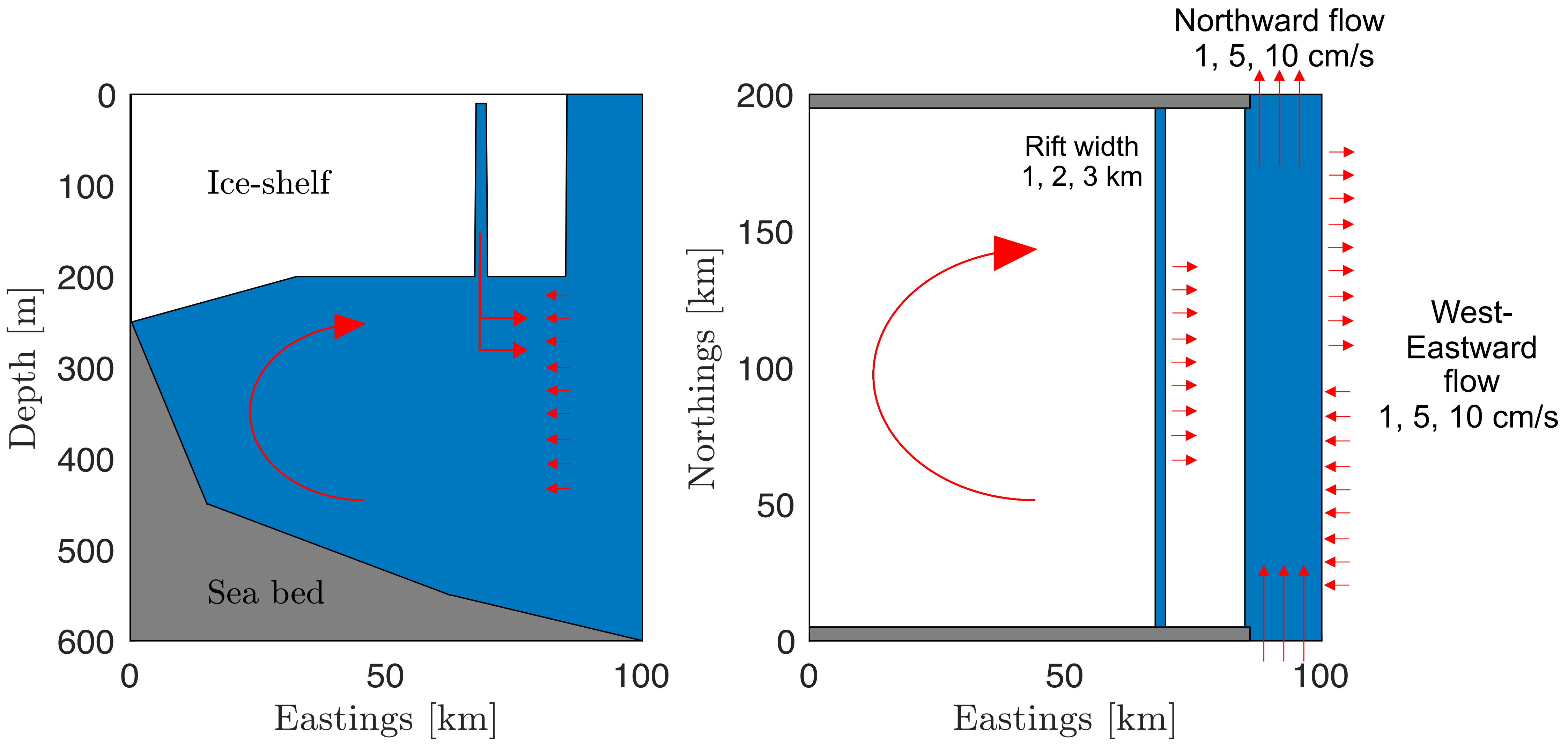
NASA Terra

Meltwater formed at depth raises along the cavity topography, accreting as frazil ice at shallower depths.

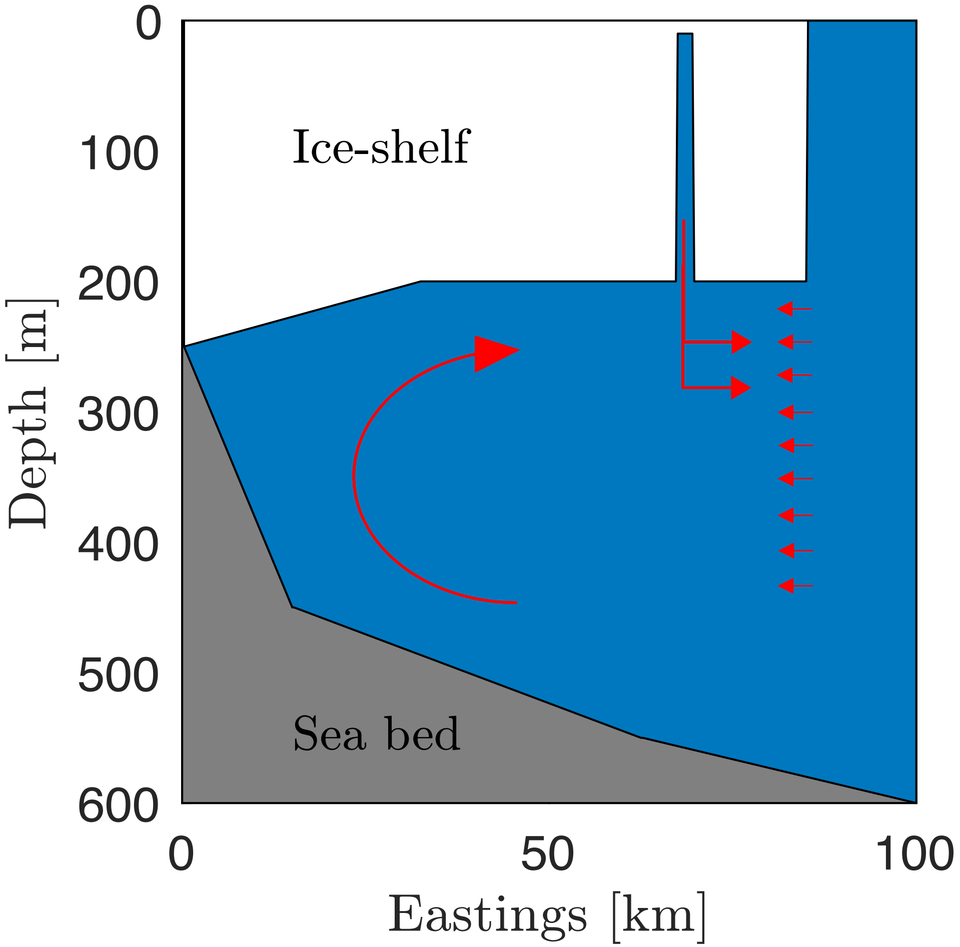


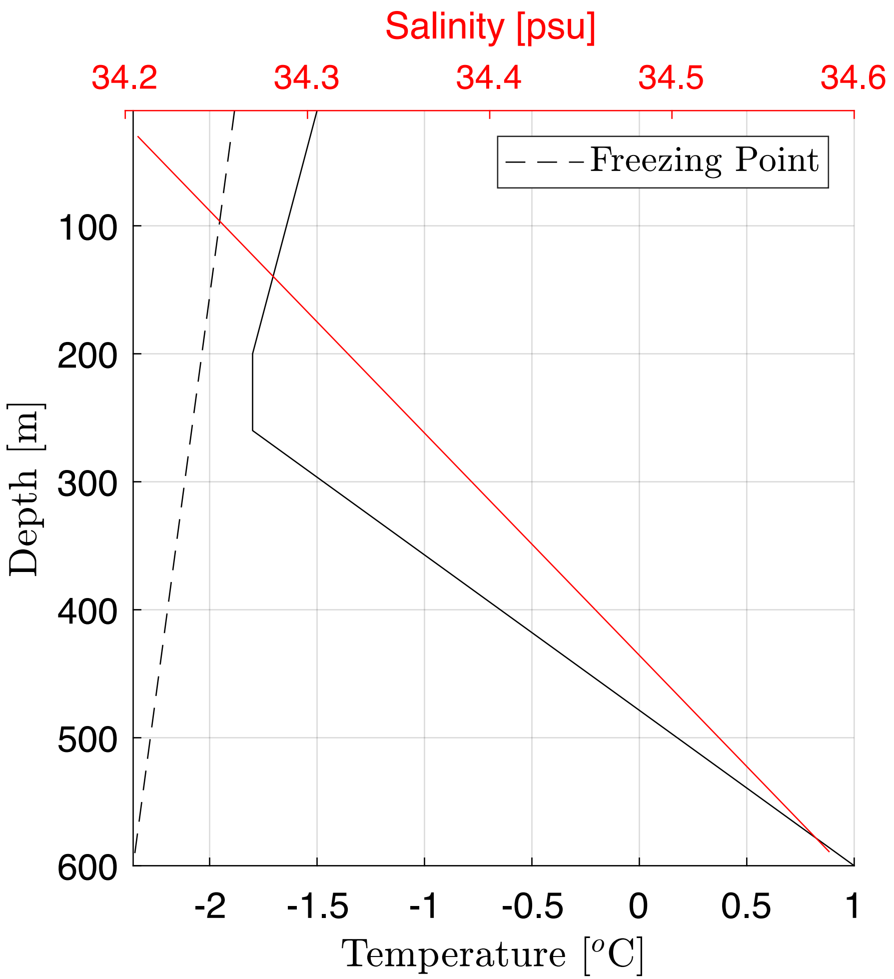
Holland & Feltham, *J. Fluid. Mech*. (2005)

We use MITgcm to study ocean dynamics below an idealized ice-shelf, tuning rift volume and current intensity.

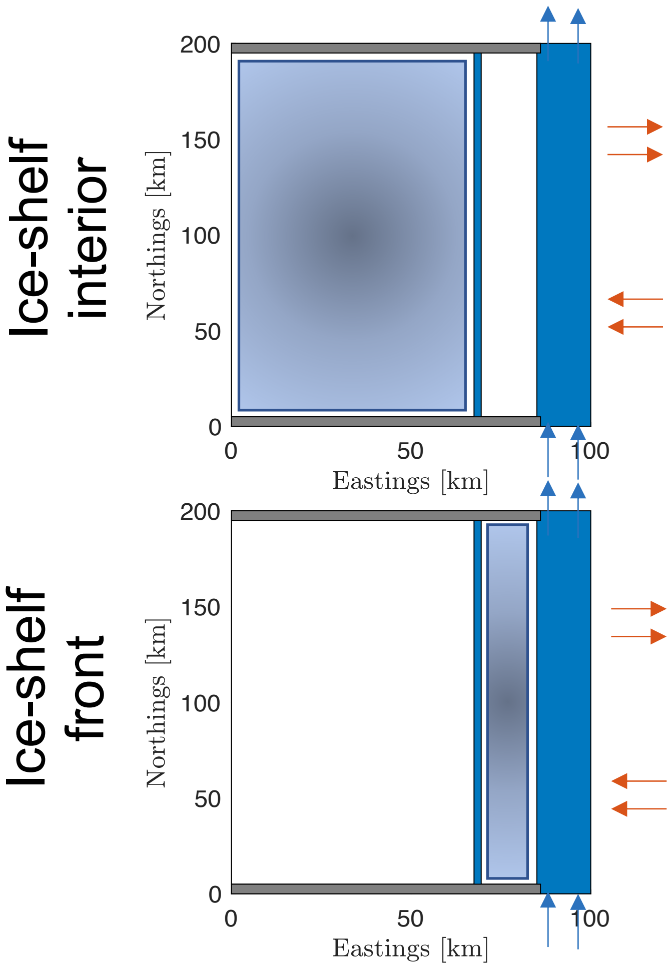


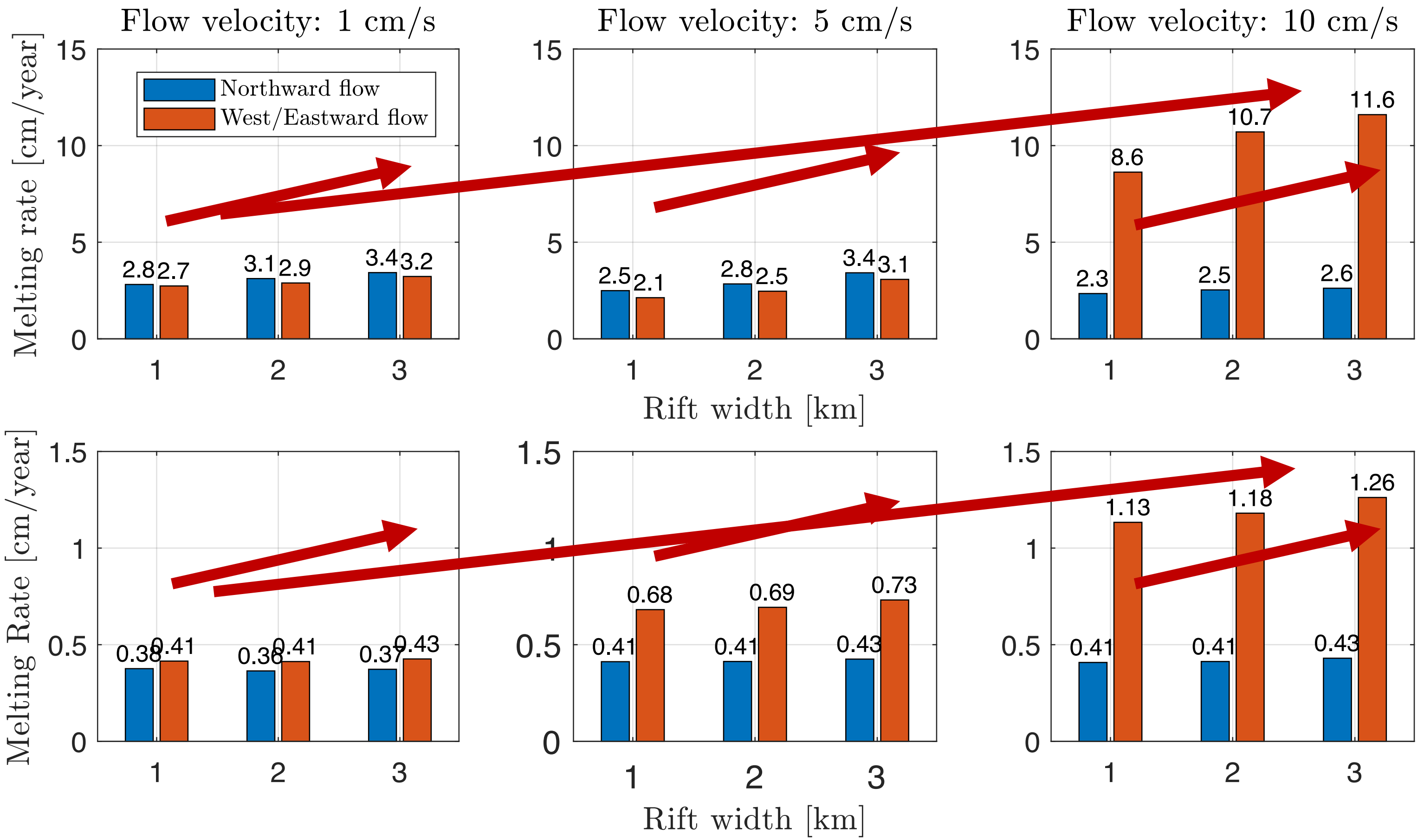
Boundary conditions represent a barotropic flow, characterized by a standard stratification vertical profile.





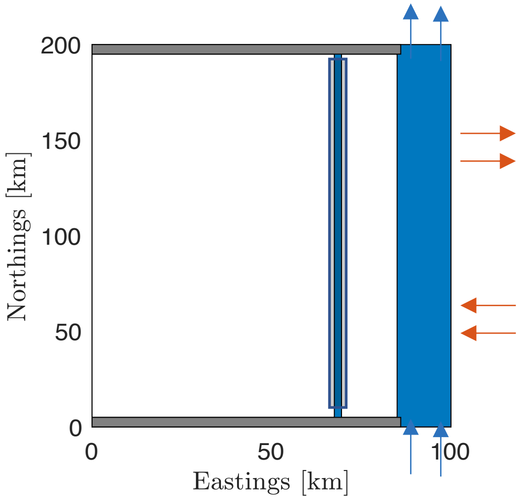
Average melting rate below the ice-shelf increases with rift widening.

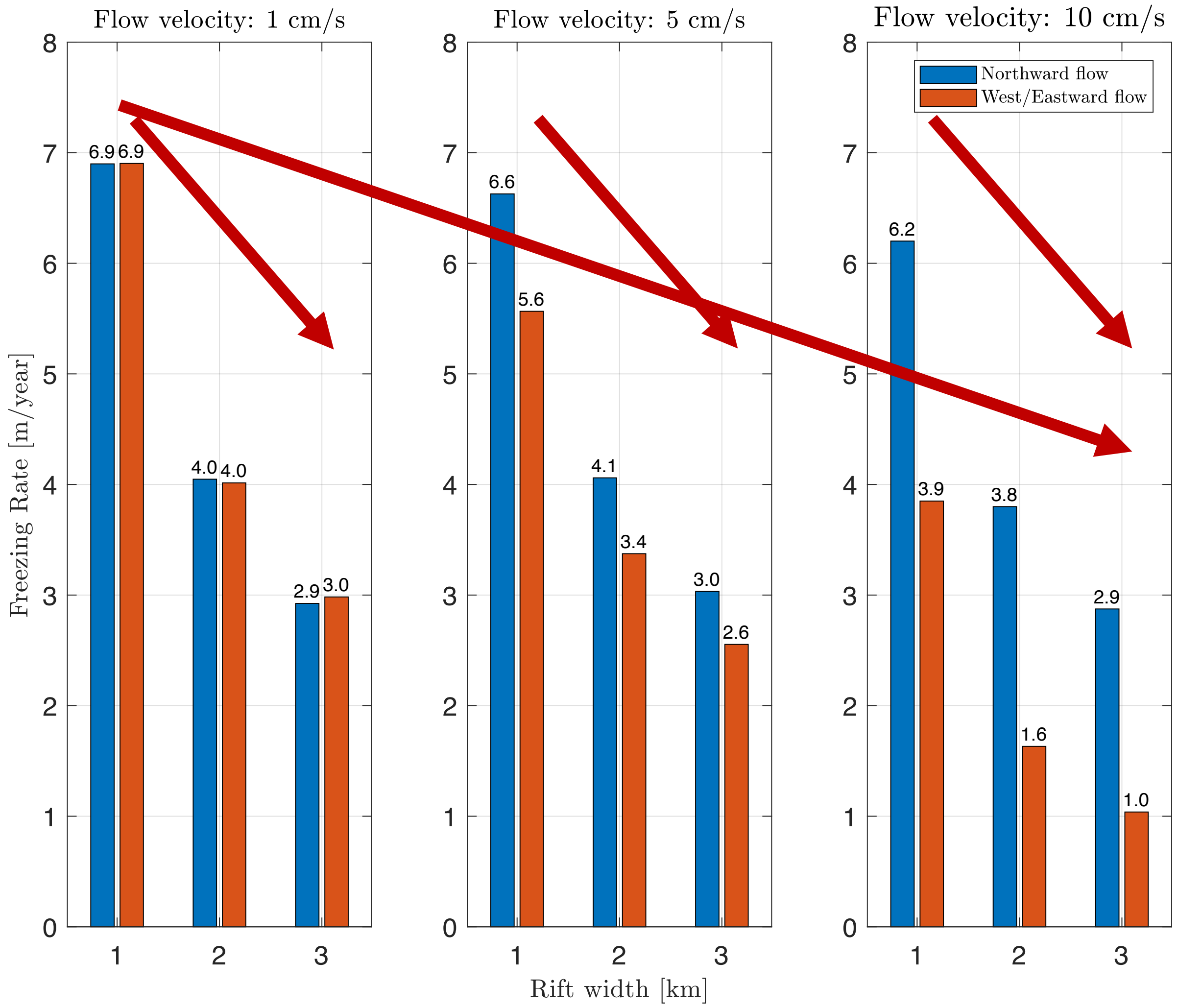




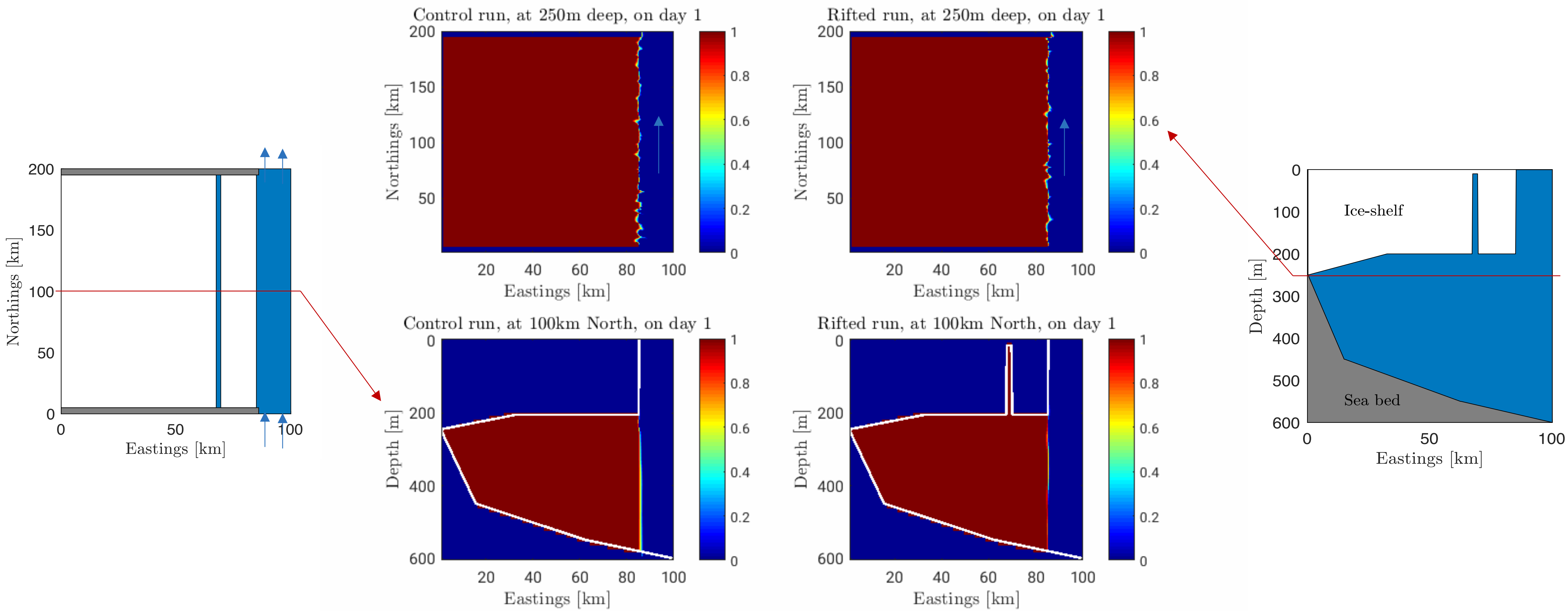
Average freezing rate inside the rift drops with rift widening.

Rift

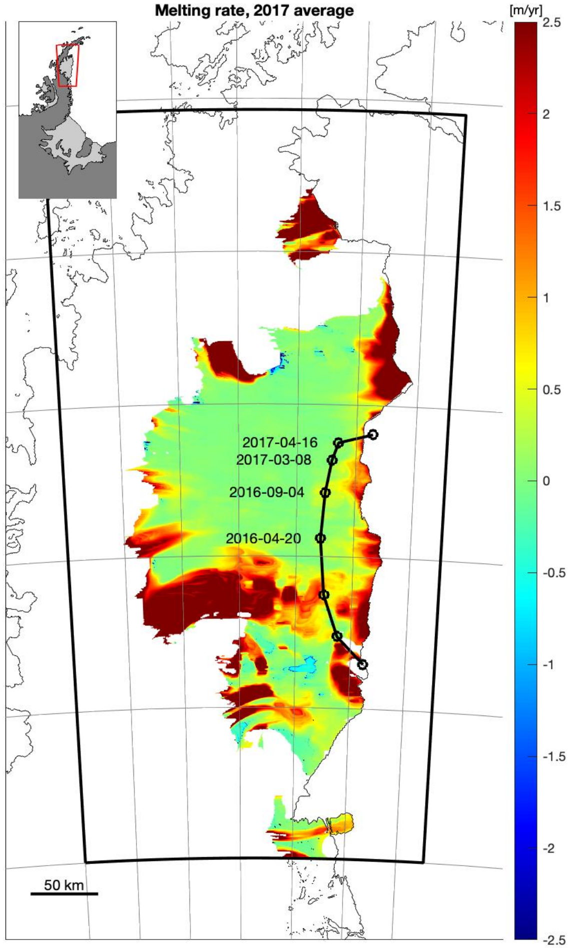


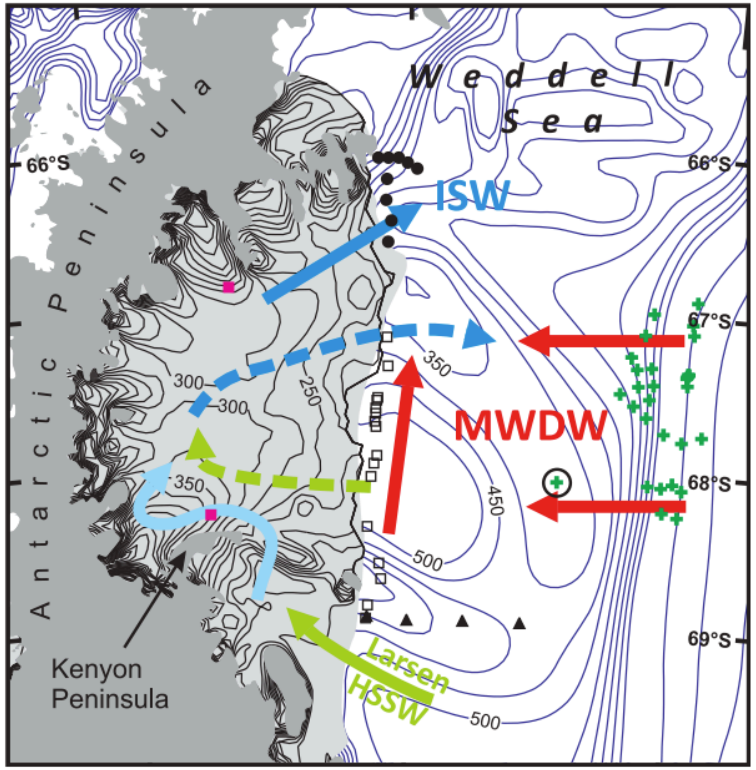


Compared to a fully intact shelf, rift presence dampens the intrusion of water masses from outside the cavity.



We aim to quantify the intrusion of water masses in the Larsen C ice-shelf during the propagation of A68 rift in 2016-2017.





After: Nicholls et al., *Geophys. Res. Lett.* (2012)

Conclusions

1. The larger the rift, the higher melting all over the ice-shelf.

2. A small volume rift, in combination with weak along-front currents imply enhanced freezing within rift flanks.

3. Freezing in between rift flanks rejects cold and salty water into the cavity, dampening the intrusion of water masses.

4. Currently, we are modeling ocean circulation on Larsen C, during the development of A68 berg, in order to quantify effects of the rift in the melting of the shelf.

Thank you!

Ir. Mattia Poinelli[1,2,3]
m.poinelli@tudelft.nl

[1] Delft University of Technology, Netherlands
[2] University of California, Irvine, CA
[3] Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA