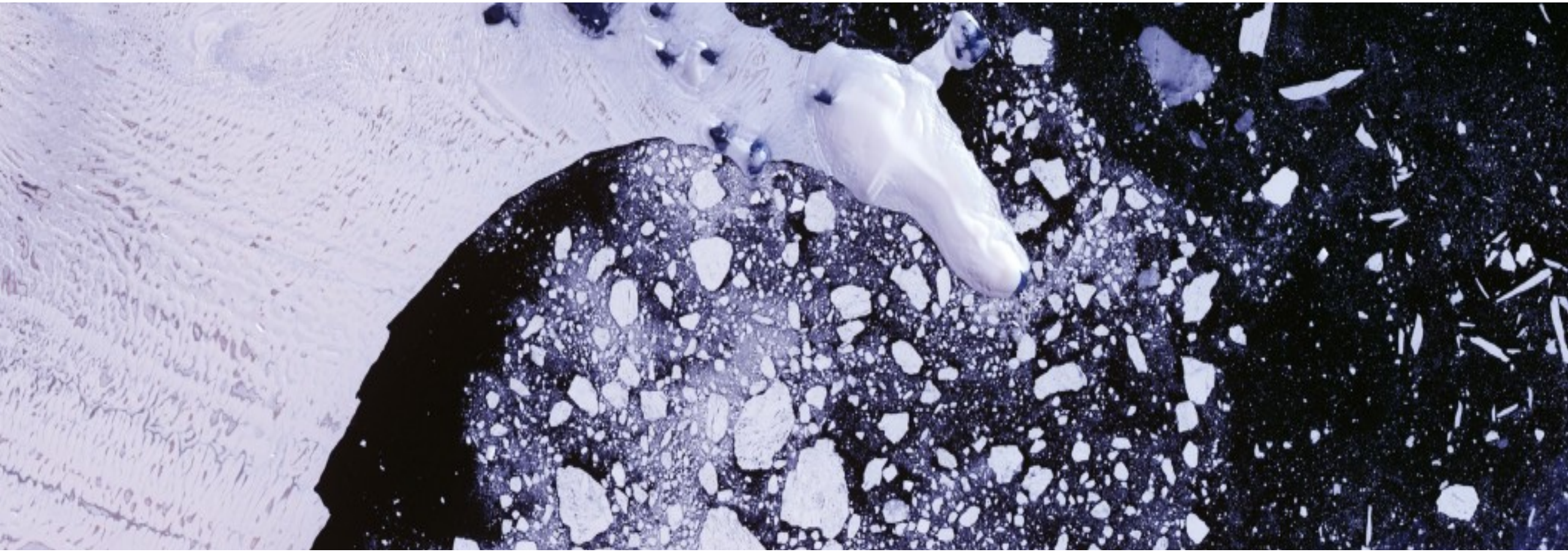
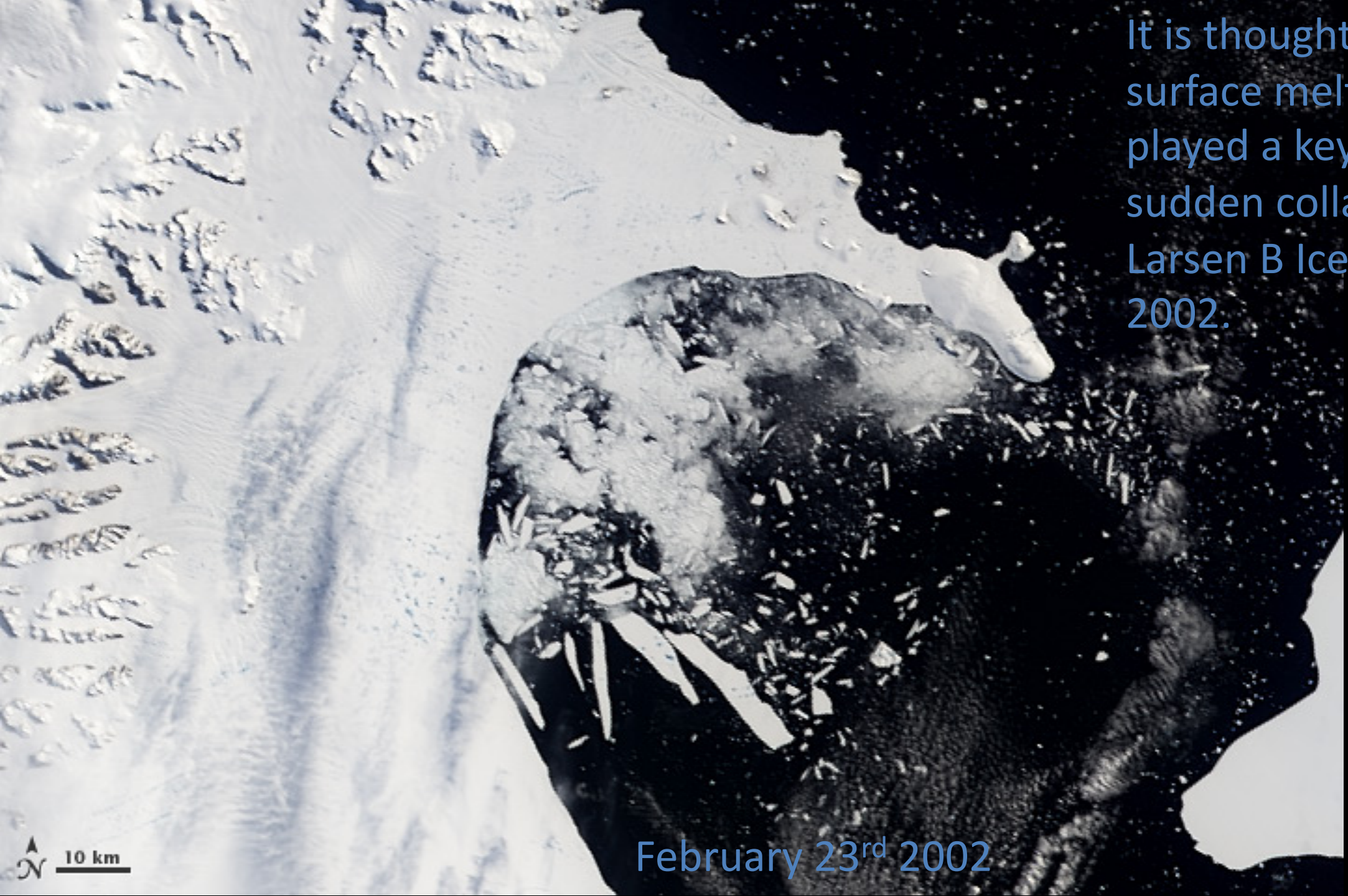
A 3D MODEL OF ANTARCTIC ICE SHELF SURFACE HYDROLOGY



Georgia Tech

Sammie Buzzard[1], Alex Robel[1]

1. Ice and Climate Group, School of Earth and Atmospheric Sciences, Georgia Tech

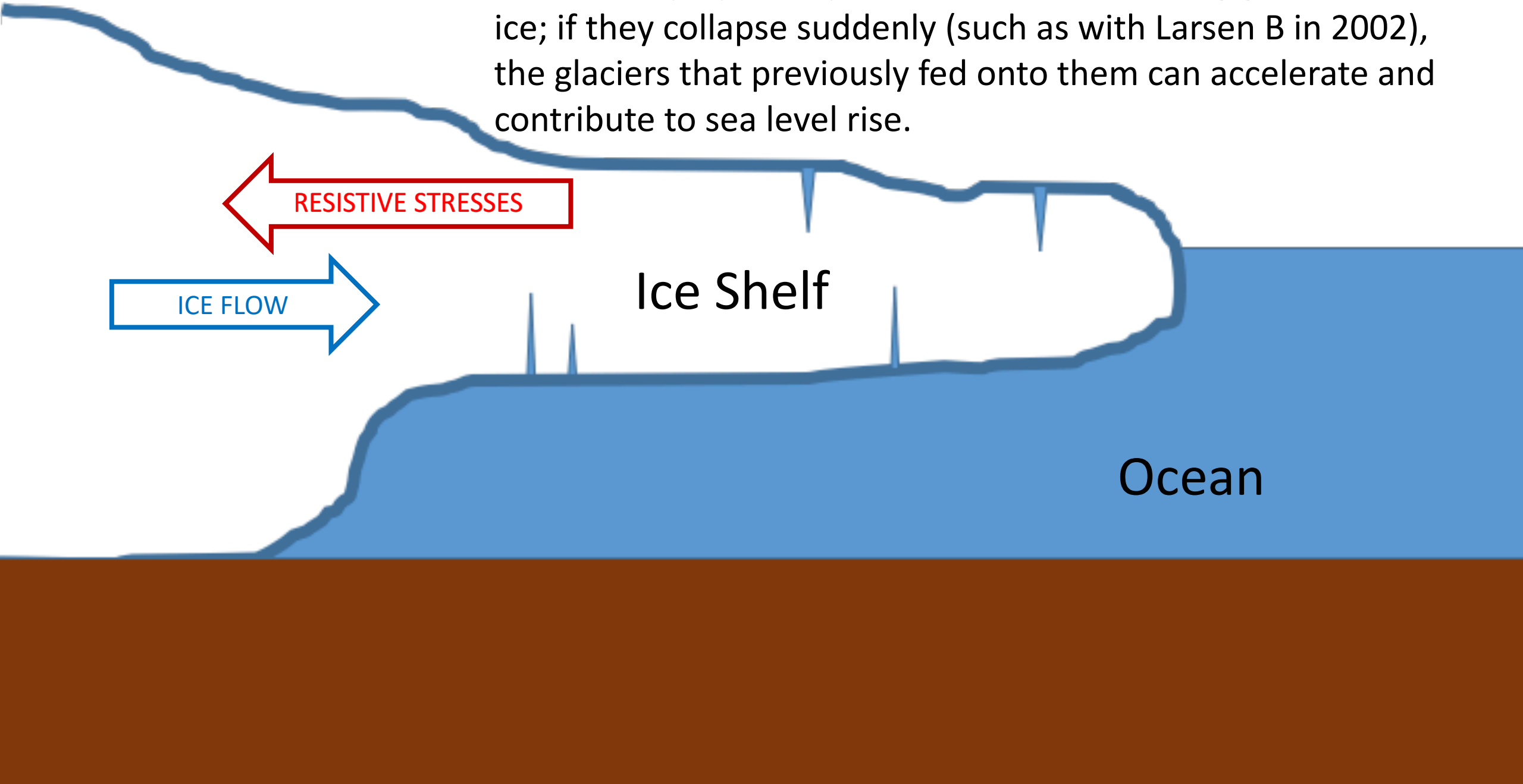


It is thought that surface melt lakes played a key role in the sudden collapse of the Larsen B Ice Shelf in 2002.

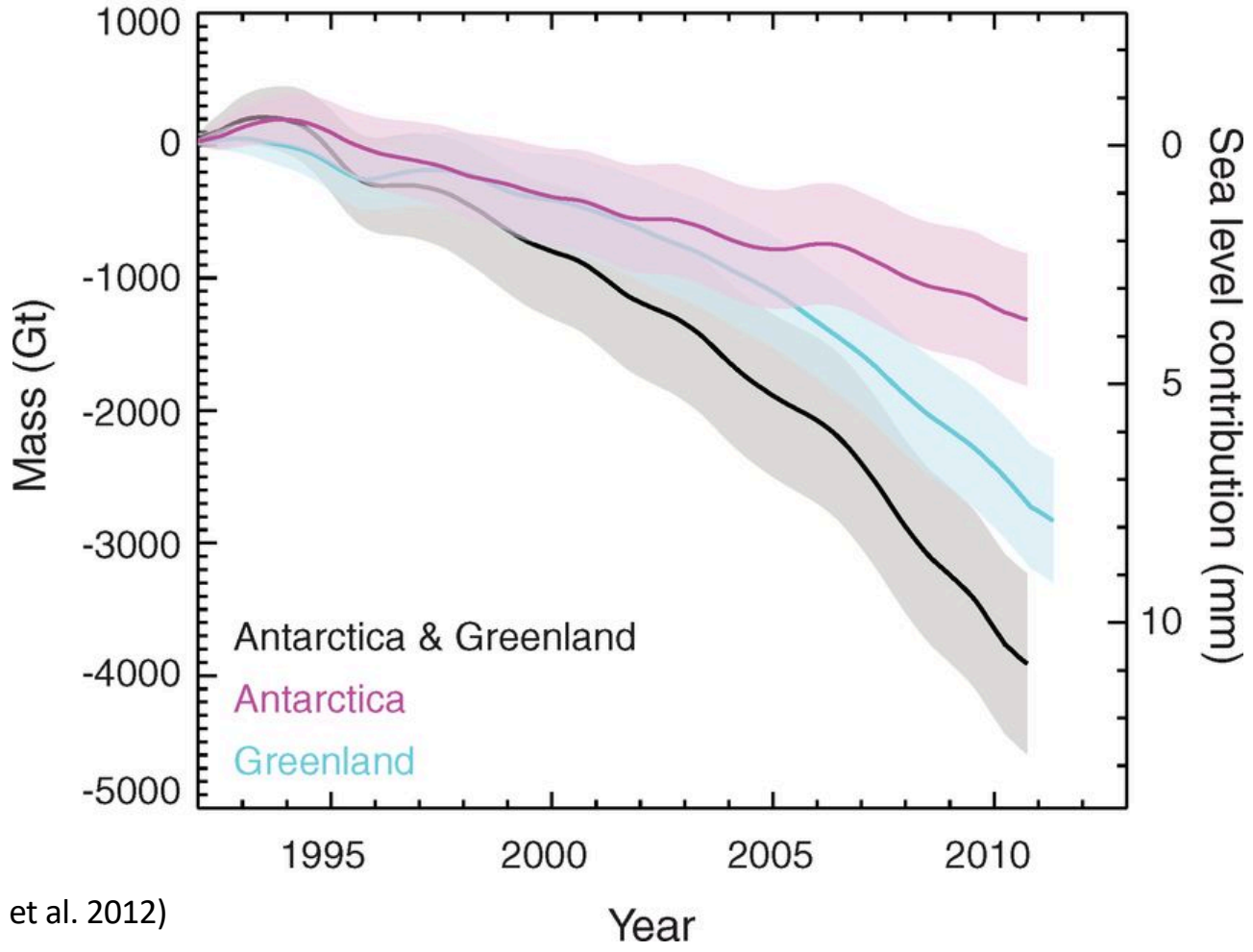
February 23rd 2002

Image: NASA

Ice shelves play an important role in buttressing grounded ice; if they collapse suddenly (such as with Larsen B in 2002), the glaciers that previously fed onto them can accelerate and contribute to sea level rise.

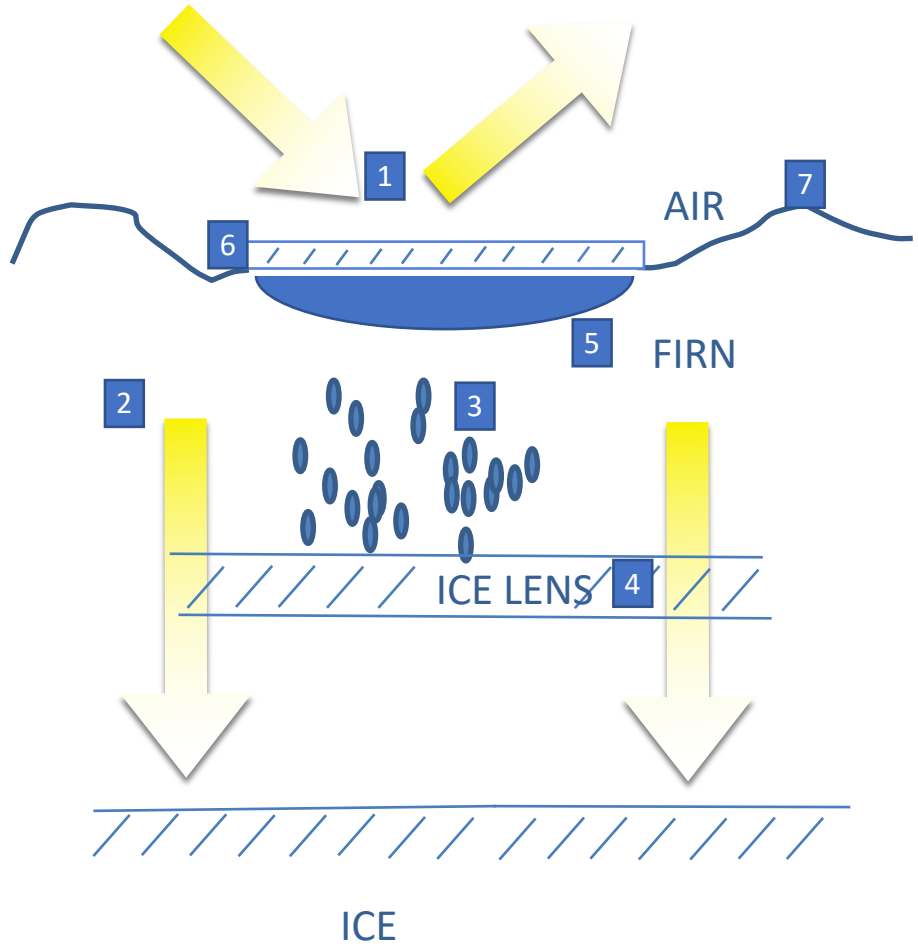


The contribution of ice sheets to sea level rise is accelerating. In order to understand how this will change in the future we need to know more about the future stability of ice shelves, and to understand this we need to know more about their surface hydrology.



(Shepherd et al. 2012)

The Buzzard et al. (2018) model was the first to model the full life cycle of lakes on Antarctic ice shelves over multiple years. It includes the following processes:

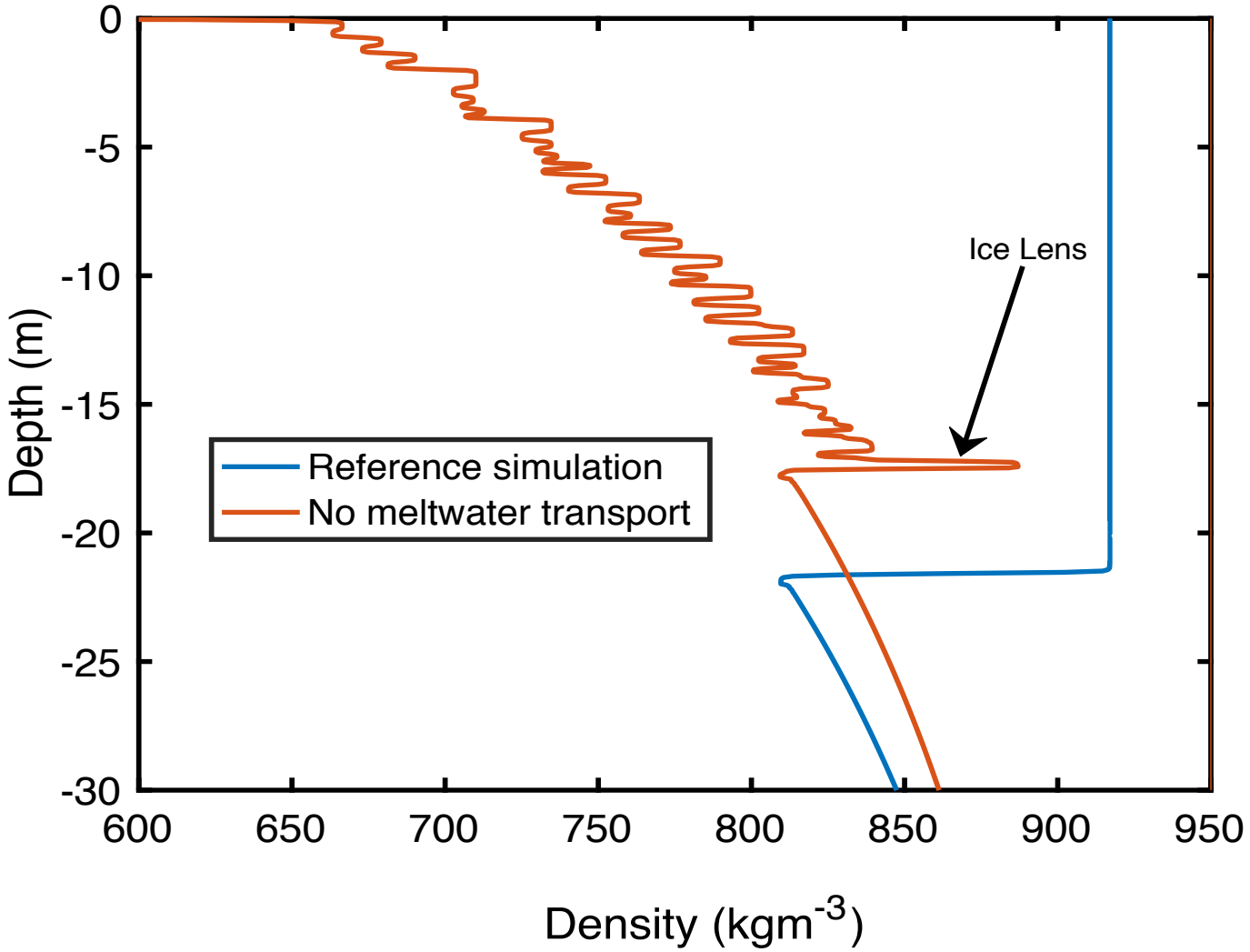


1. Surface energy balance
2. Heat transfer through ice shelf
3. Meltwater percolation into firn
4. Ice lens formation
5. Surface lake formation
6. Surface lake refreezing
7. Surface albedo variation

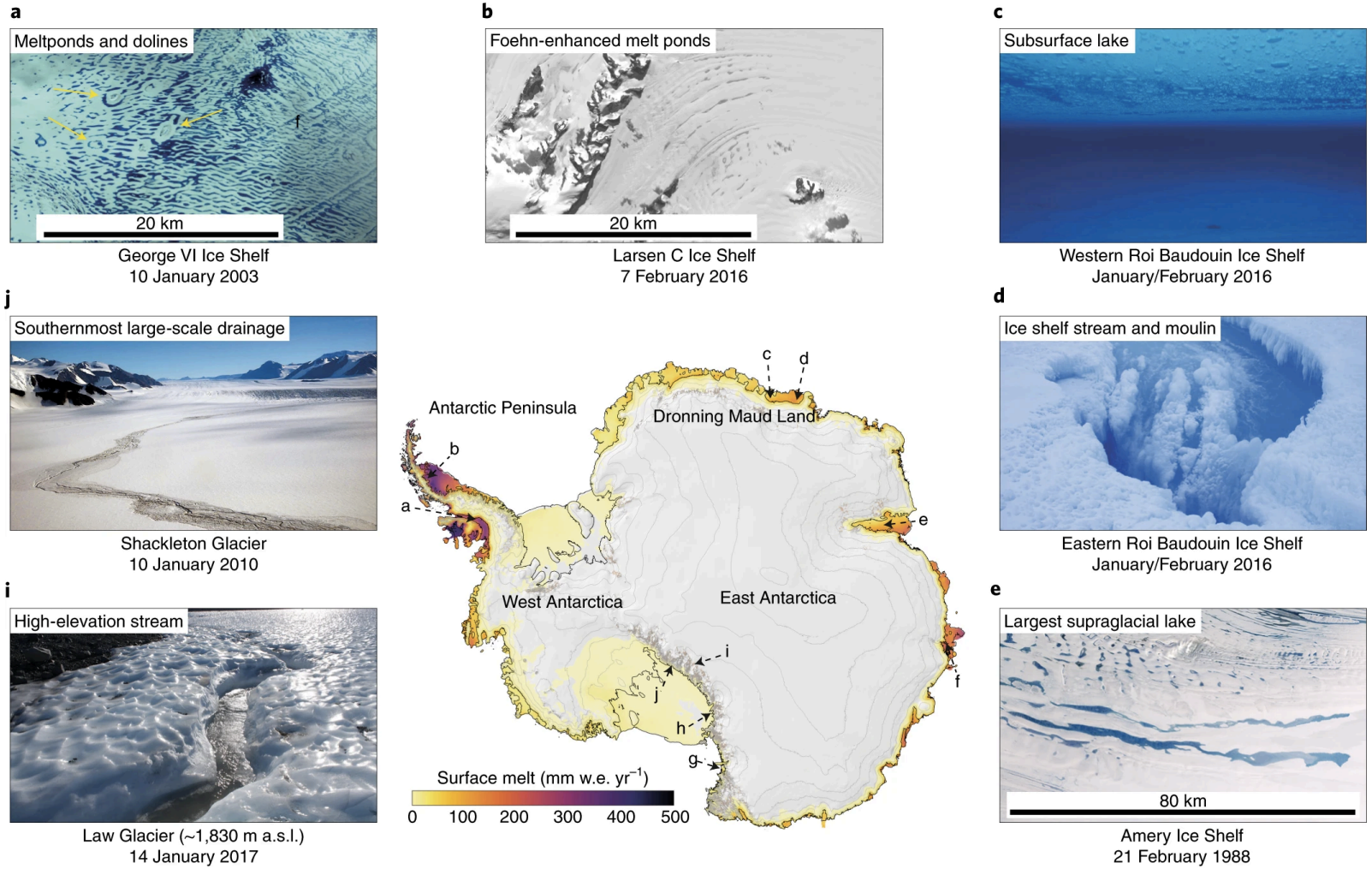
Buzzard et al. (2018a), JAMES

Open access model code: **doi.org/10.17864/1947.121**

One process that was found to be important for lake formation in a case study of the Larsen C Ice Shelf was the formation of ice lenses by the refreezing of surface meltwater.



Buzzard et al. (2018b), The Cryosphere



However, new surface hydrology features such as rivers and waterfalls are frequently being found on ice shelves, and in order to model these we need to go beyond a 1-D model. Therefore we are developing…

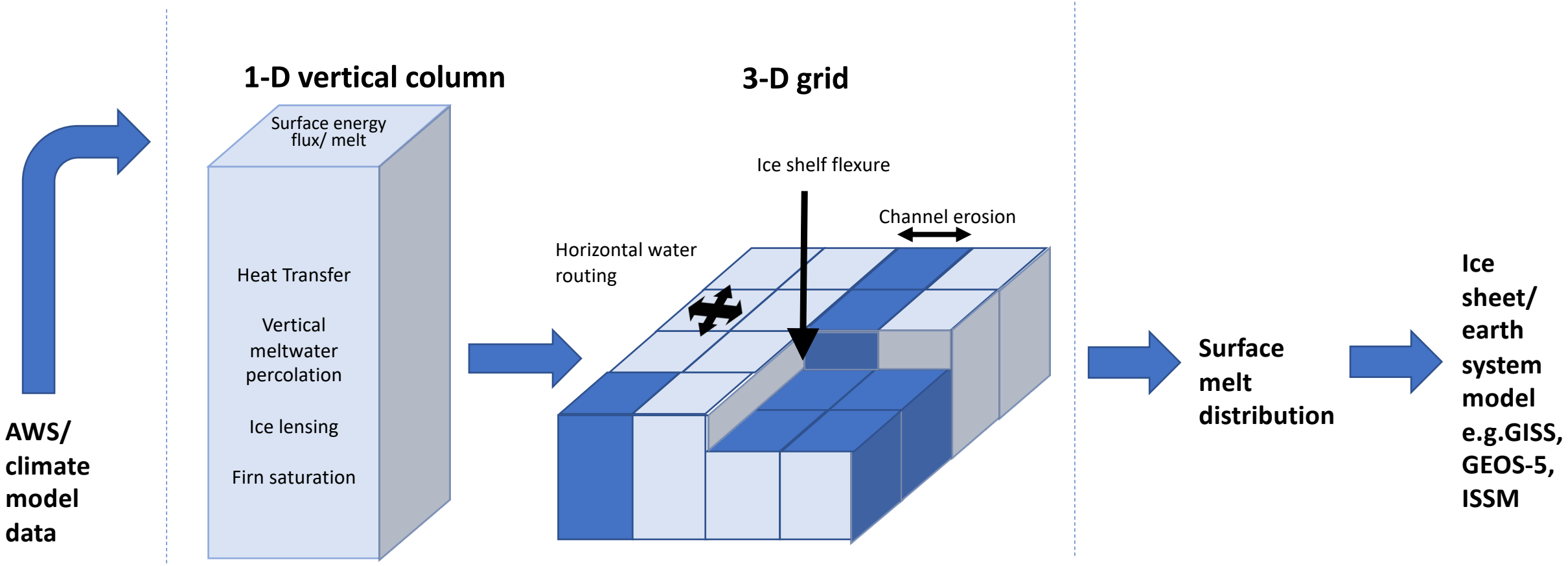
Bell et al. 2018 (Nature Climate Change)

MONARCHS

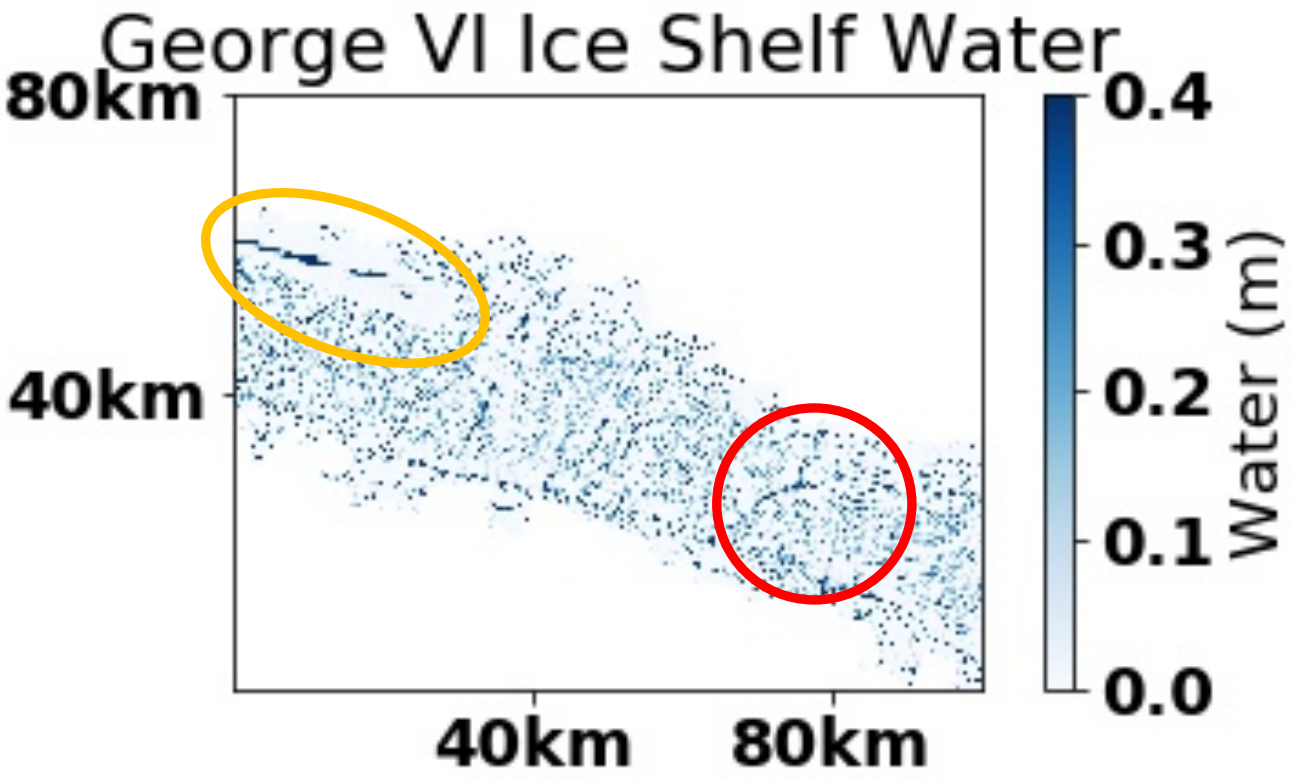
MOdel of a**N**t**AR**ctic i**C**e shelf

surface **H**ydrology and **S**tability

MONARCHS takes the 1-D column model of Buzzard et al. (2018) and creates a 3-D grid of these columns, allowing water to move laterally between them. This allows us to model features such as rivers, and ultimately to provide a surface melt distribution for any ice shelf. MONARCHS has the potential to be coupled to larger ice sheet and earth system models.



A case study of a recent extreme melt event on the George VI Ice Shelf showed that MONARCHS is able to recreate surface melt features (red), but also provided an argument for the inclusion of additional physics and the careful selection of the most accurate Digital Elevation Model (DEM) for each ice shelf (yellow).



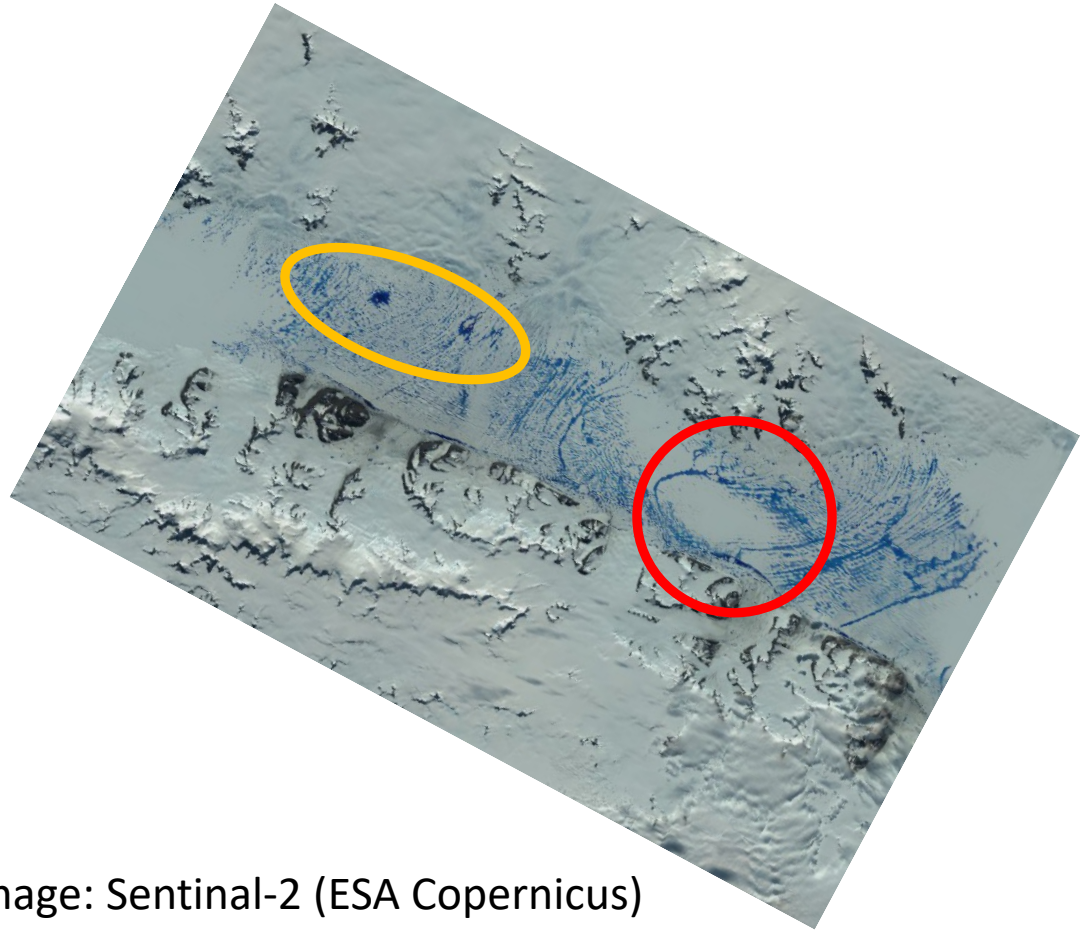


Image: Sentinal-2 (ESA Copernicus)

If you've read this far then thankyou! Our goal is for MONARCHS to be an open access model, driven by the needs of the community. I would have loved to have discussed this more with you in person, but until we can do that feel free to add in the comments/ email me with the following:

- What would you like to see incorporated into MONARCHS?
- What data do you have that we could use to calibrate or validate MONARCHS?

Questions?

sbuzzard3@gatech.edu
@treacherousbuzz

[Photo Credit: Frithjof Kuepper]