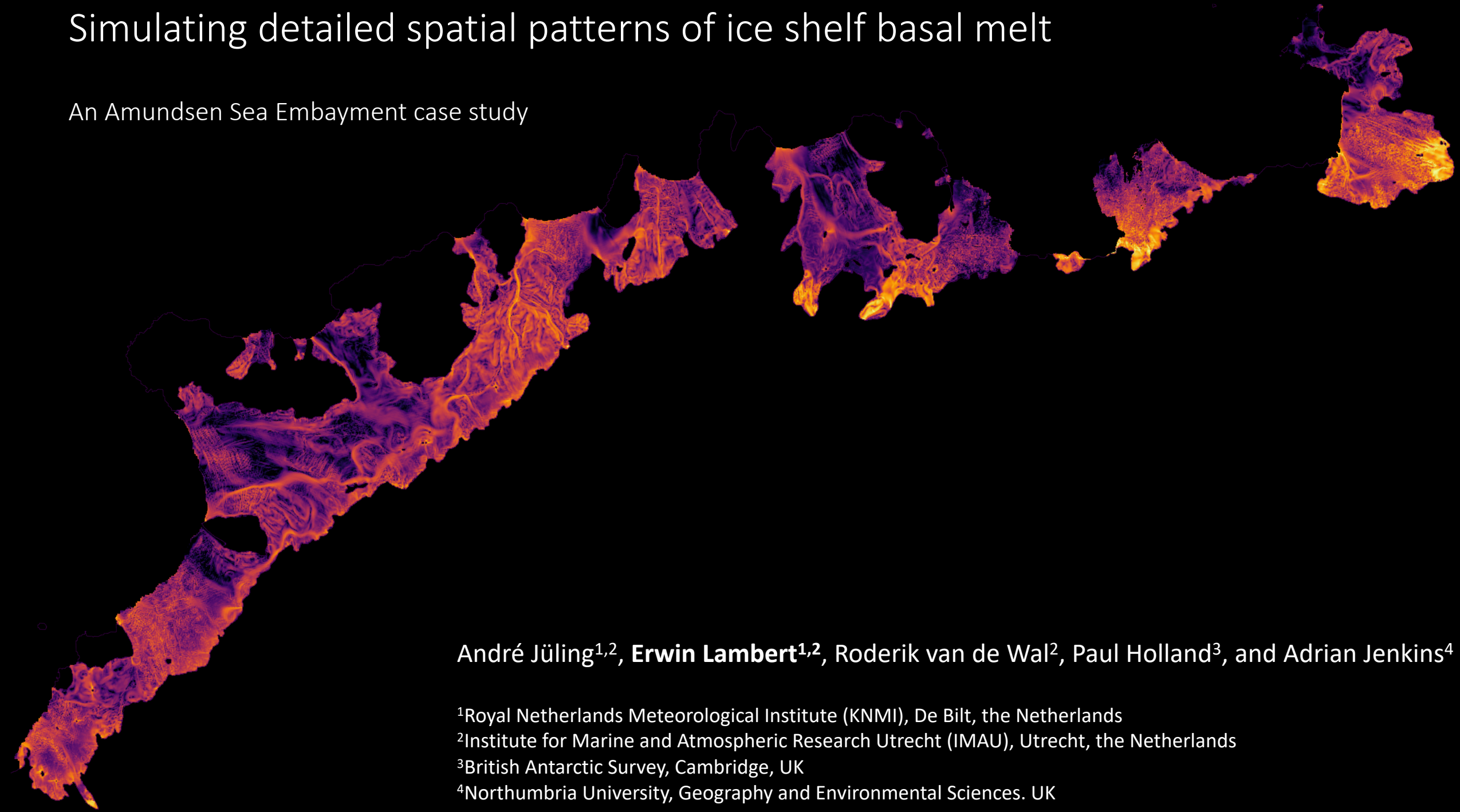


Simulating detailed spatial patterns of ice shelf basal melt

An Amundsen Sea Embayment case study



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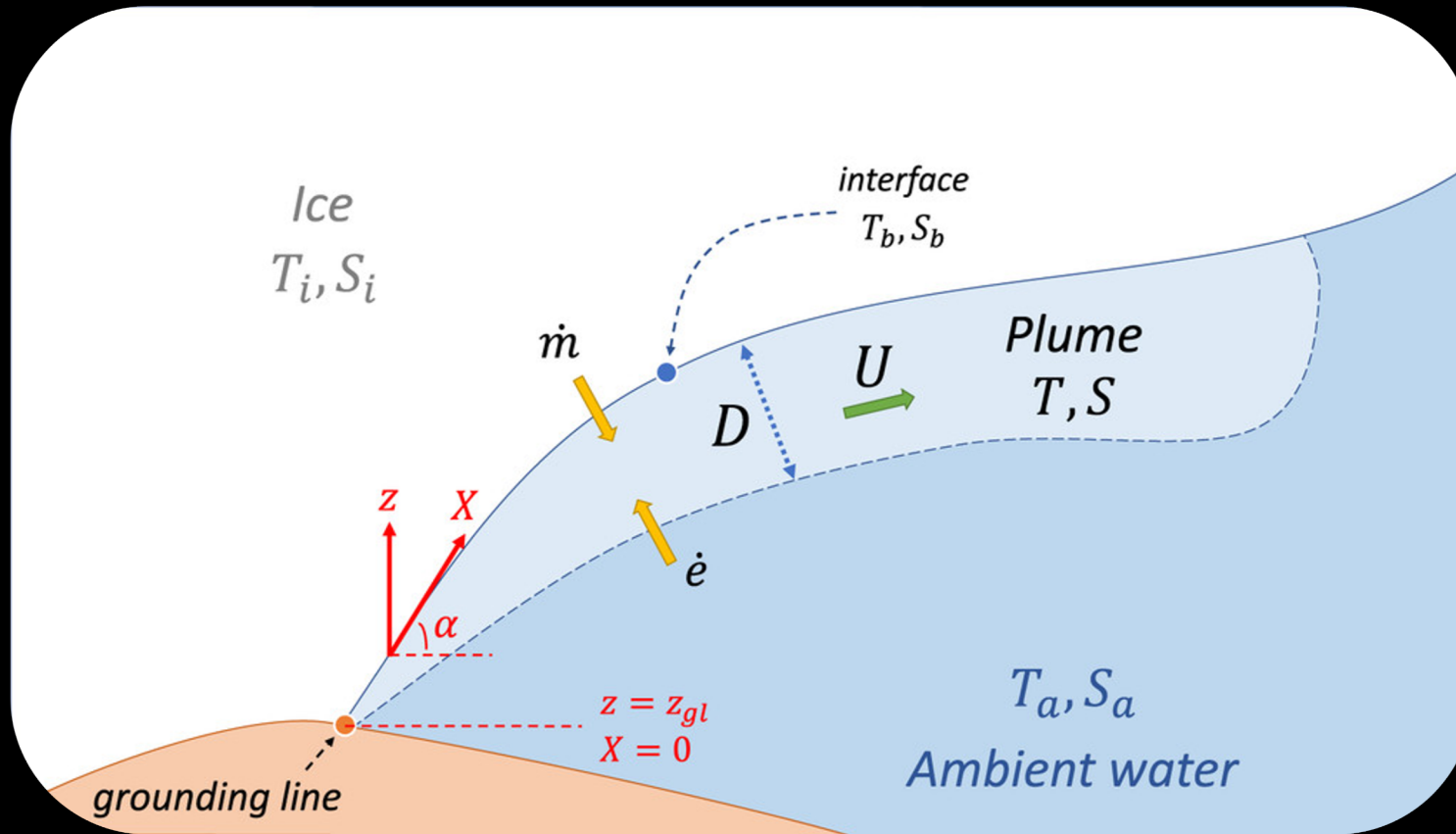
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Melt plume concept



Jenkins (1991), Lazeroms et al. (2019)

Below an ice shelf, a boundary layer of low salinity water is maintained by a balance of melt ($\dot{m}$) and entrainment ($\dot{e}$).

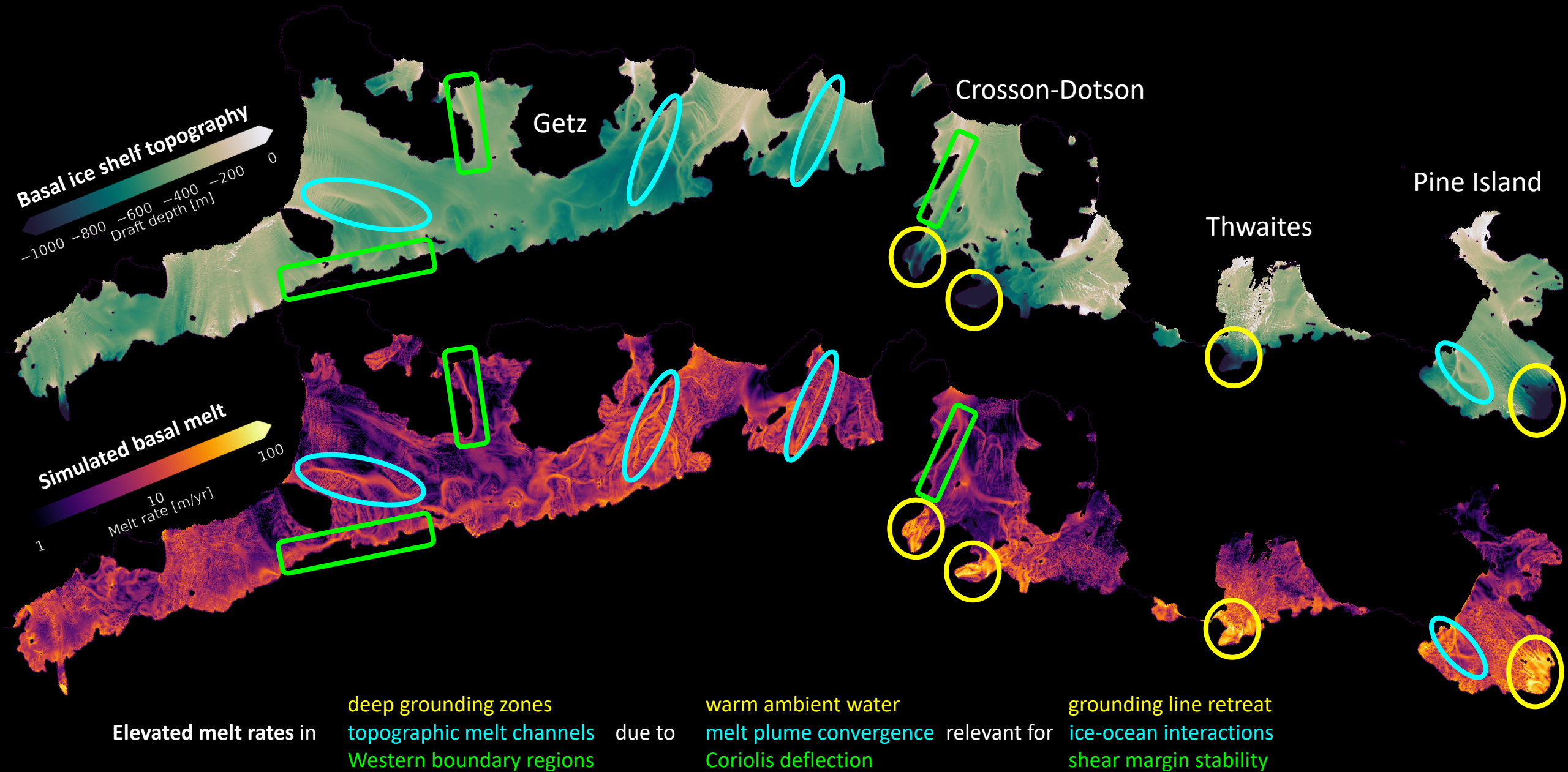
As a consequence of buoyancy, this water rises along the ice shelf base, forming a melt plume.

Here, we adopt a 2D version of this model*, resolving the horizontal flow.

The model is forced with horizontally uniform ambient conditions, mimicking observed T and S .

* based on Holland et al. (2006)

Amundsen Sea basal melt pattern



A qualitative model intercomparison

deep grounding zones
topographic melt channels
Western boundary regions

1 10 100
Melt rate [m/yr]

a) T-dependent param.
(Favier et al., 2019)



b) Plume model
(Lazeroms et al., 2019)



c) PICO model
(Reese et al., 2018)



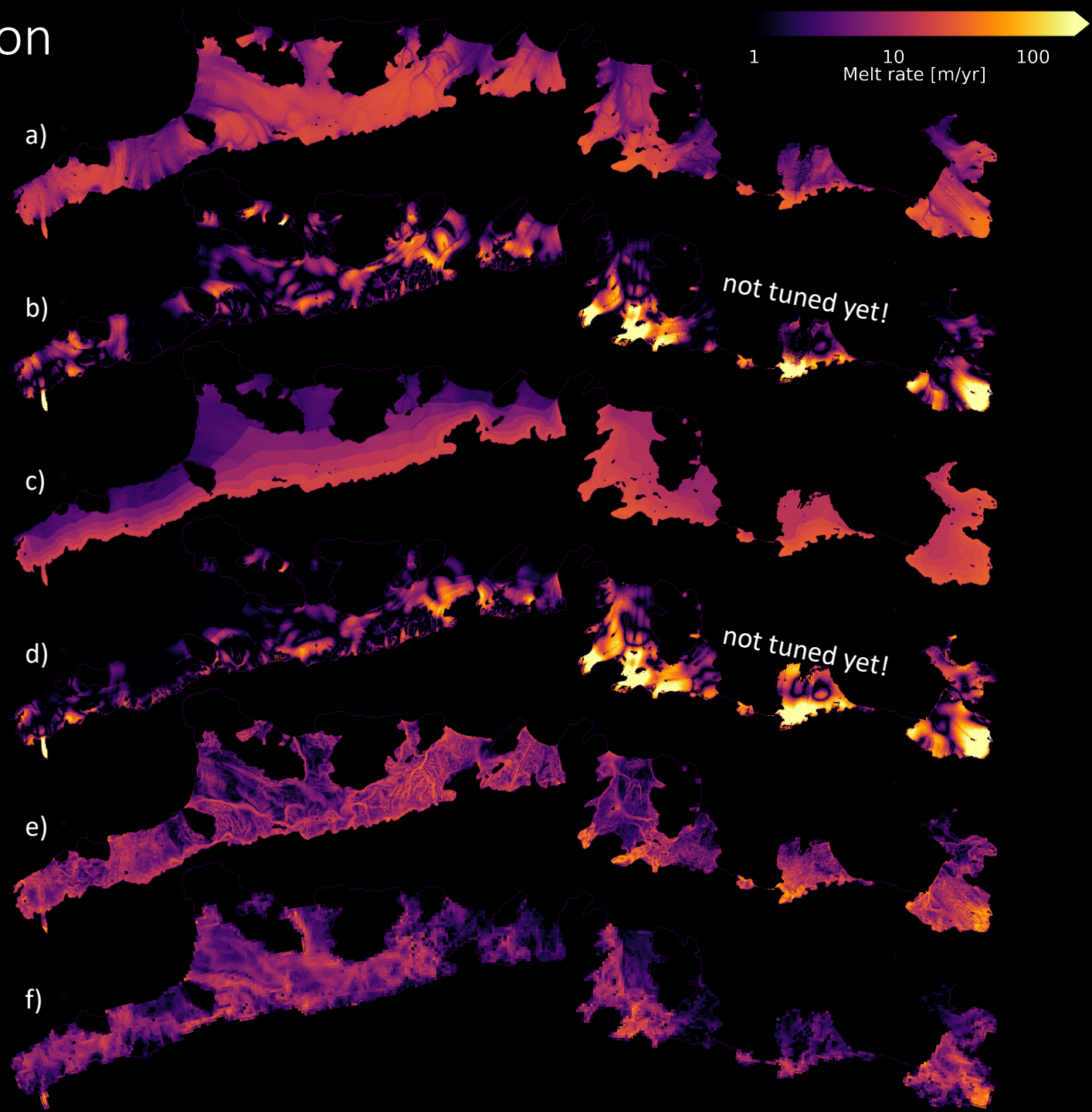
d) PICOP model
(Pelle et al., 2019)



e) 2D Layer model
(this study)



f) MITgcm model



Conclusions

All melt models have issues. Choosing the right one depends on a balance between realism and computational cost.

The **2D Layer model** may prove a useful model for ice-ocean coupling: relatively fast, yet spatially detailed.

Also, it can be used for downscaling of coarse 3D model output.

Yet, the model still needs modification and validation for cold, large ice shelves (Ross, Filchner-Ronne).

Also, the model does not resolve bathymetric control of ocean-cavity exchange.

A draft paper is in preparation, so keep an eye out for that!

In the meantime, all code is available on <https://github.com/AJueling/melt/>

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