

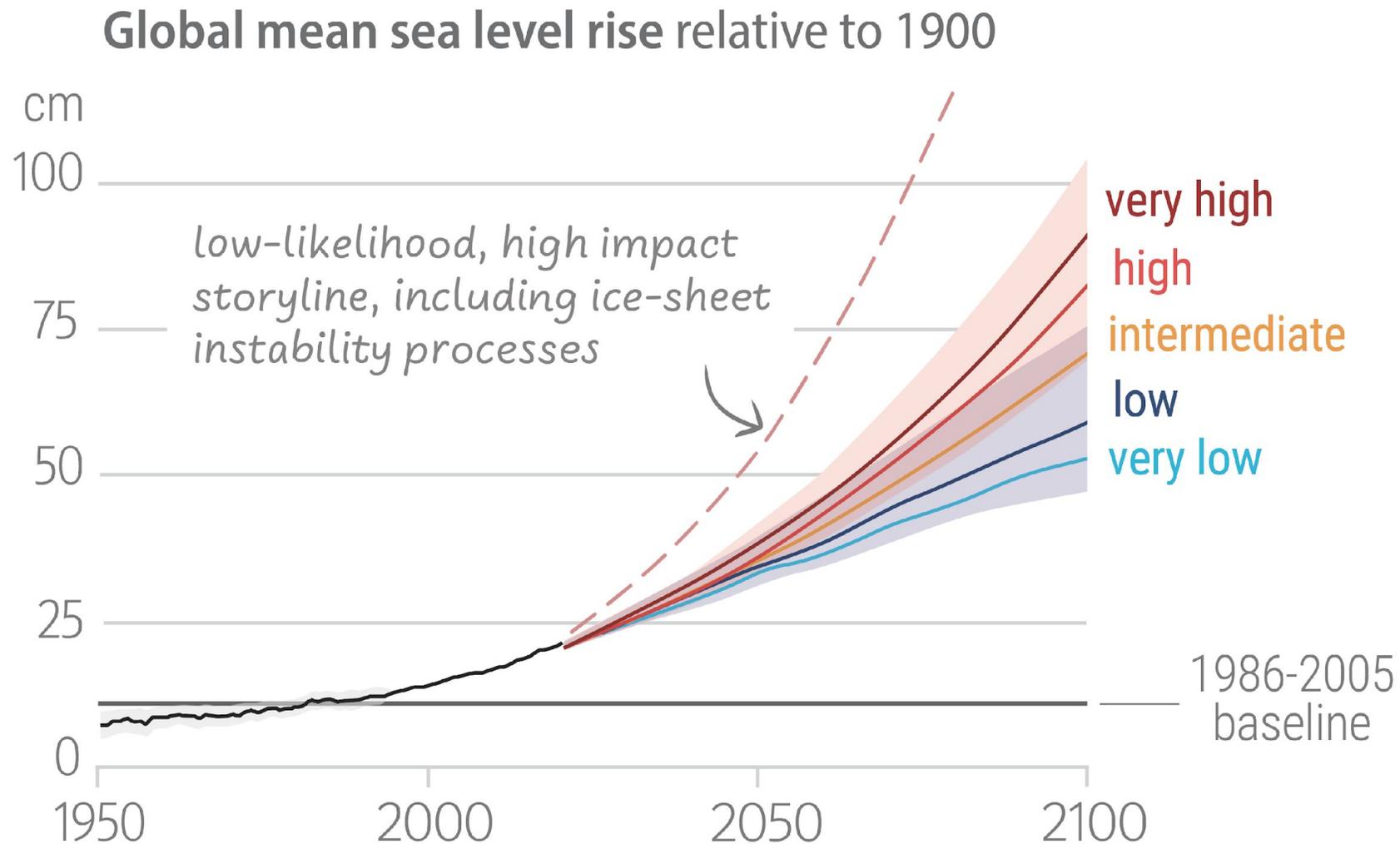
An aerial photograph of a vast, white ice shelf. A prominent, narrow channel of clear, turquoise meltwater flows through the center of the ice, creating a stark contrast with the surrounding white snow and ice. The channel is flanked by smaller, irregular ice floes and patches of snow. The overall scene is bright and cold, with a clear blue sky visible in the upper right corner.

# Channelized melt beneath Antarctic ice shelves previously underestimated

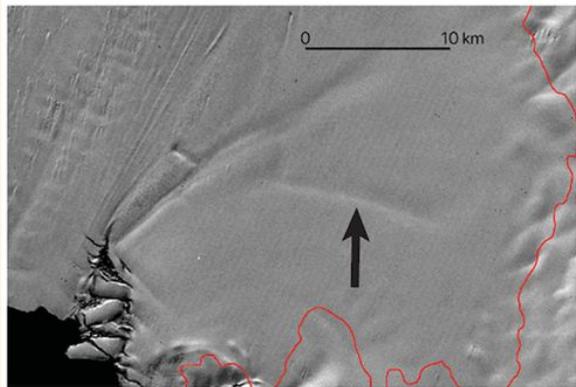
Ann-Sofie P. Zinck,

*Stef Lhermitte, Martin G. Wearing and Bert Wouters*

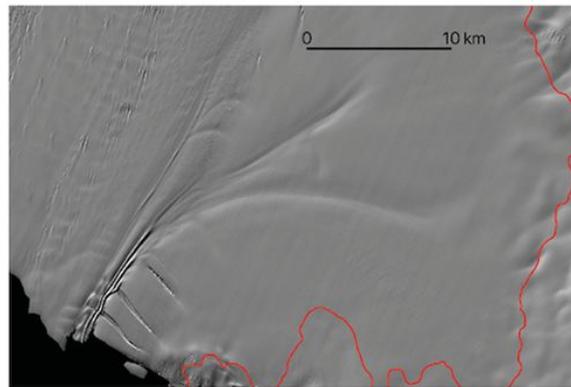
# Ice-sheet instability processes, such as ice shelf basal melting, are the main contributors to uncertainties in sea level rise projections



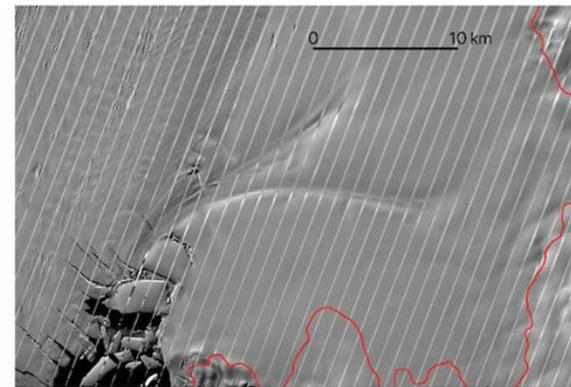
# Basal channels represent potential weak zones on ice shelves



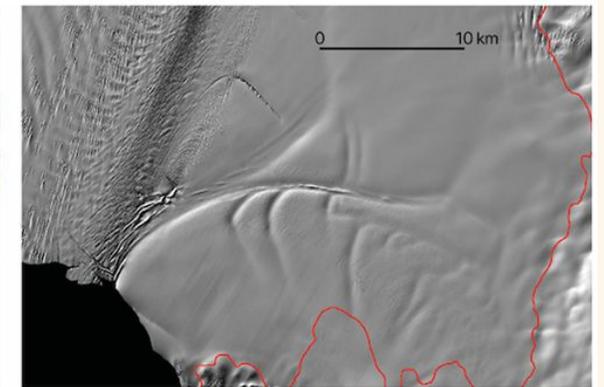
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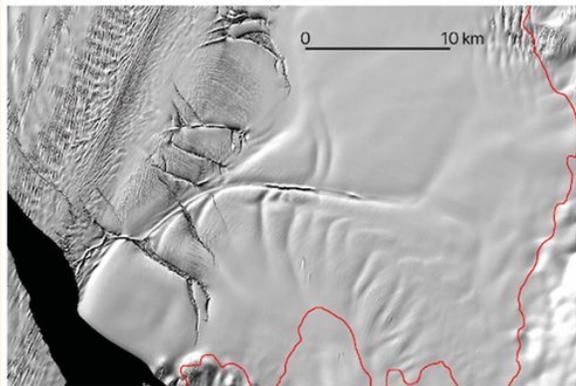
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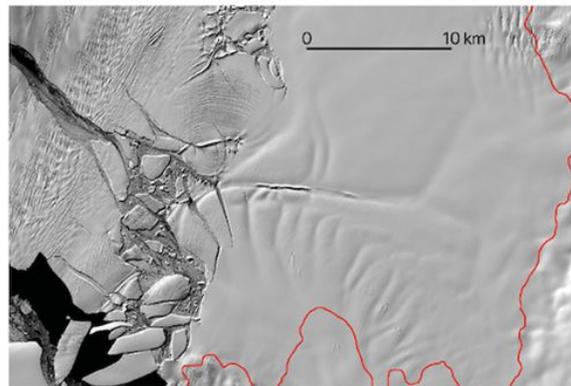
2005-02-16



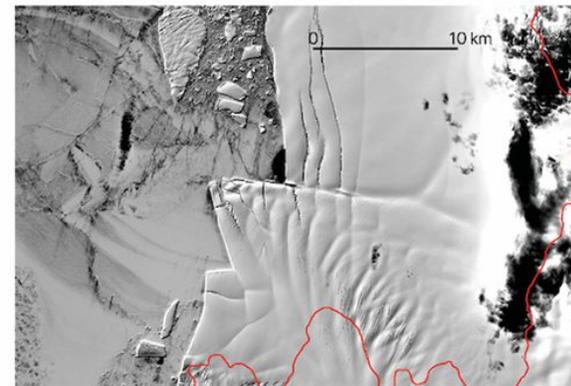
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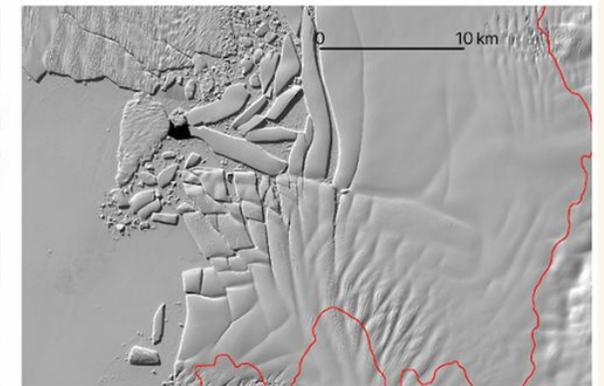
2017-12-26



2018-12-13



2020-12-11



2022-03-13

# BURGEE: Basal melt rates Using REMA and Google Earth Engine

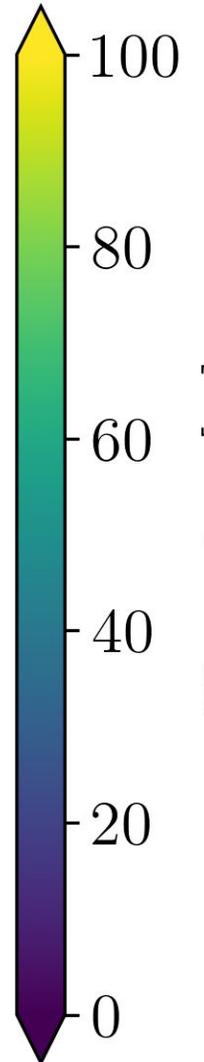
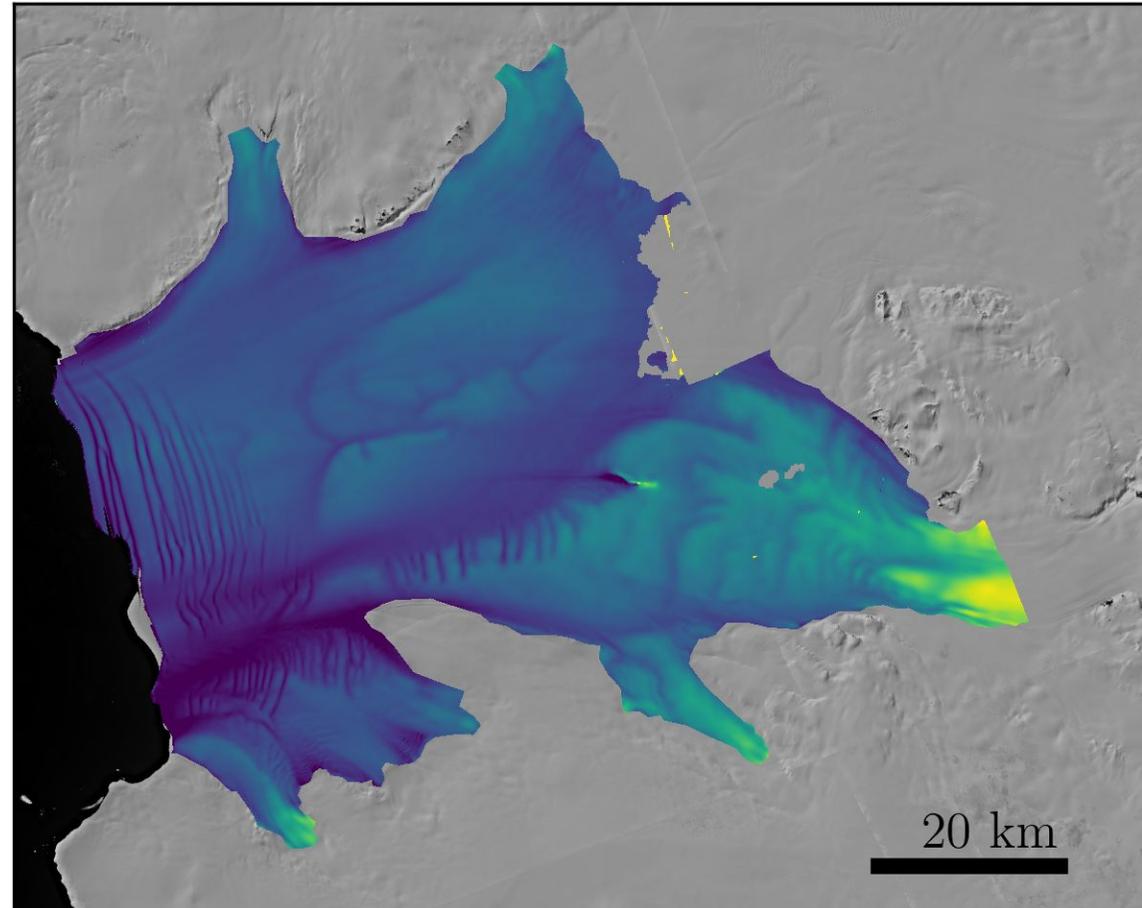
Ice thickness  
change

Surface mass  
balance

$$\frac{DH}{Dt} = -H(\nabla \cdot \bar{u}) + \dot{M}_s - \dot{M}_b$$

Ice flux  
divergence

Basal melt  
rate



Elevation [m]

# BURGEE: Basal melt rates Using REMA and Google Earth Engine

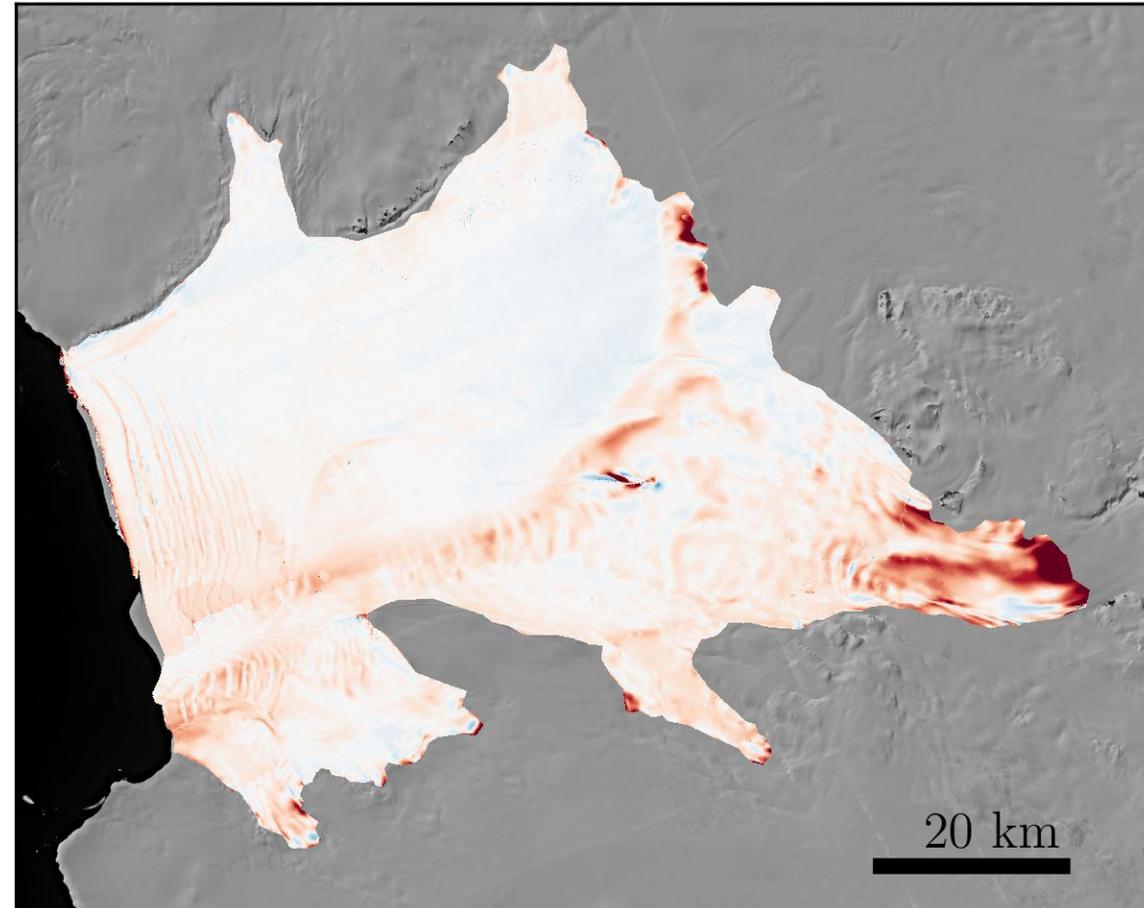
Ice thickness  
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Surface mass  
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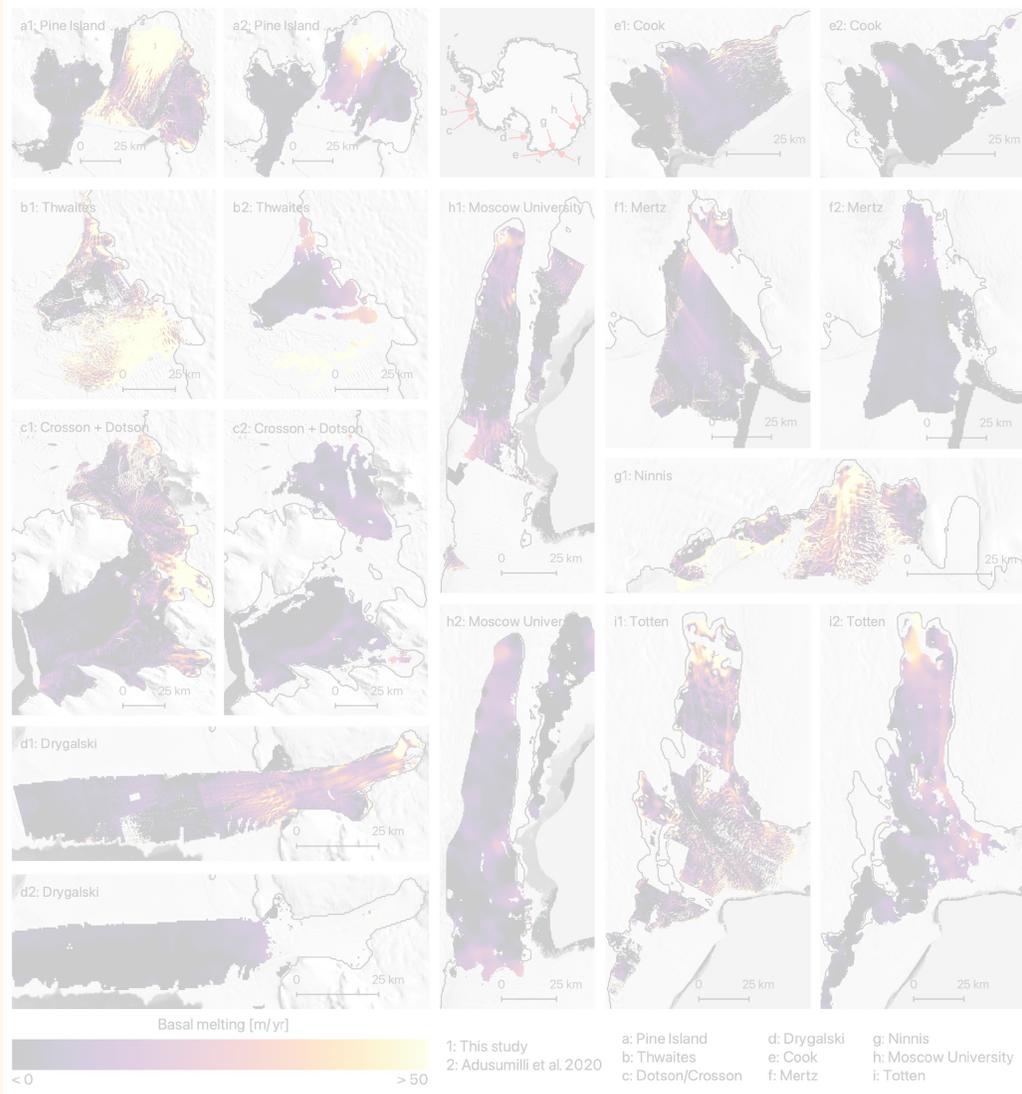
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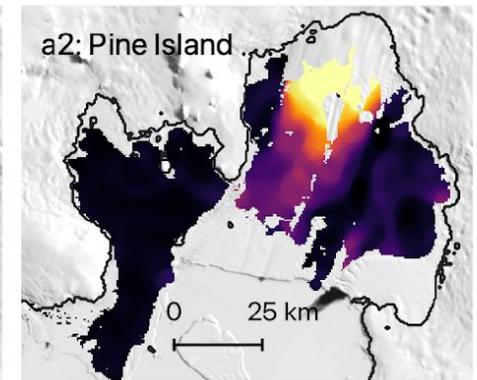
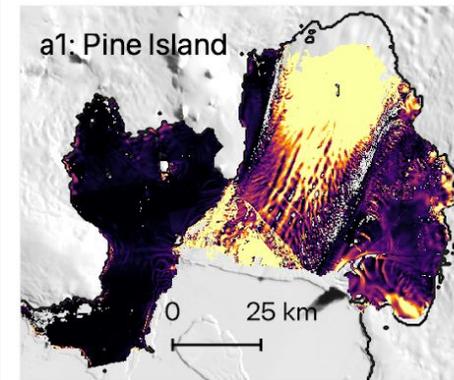
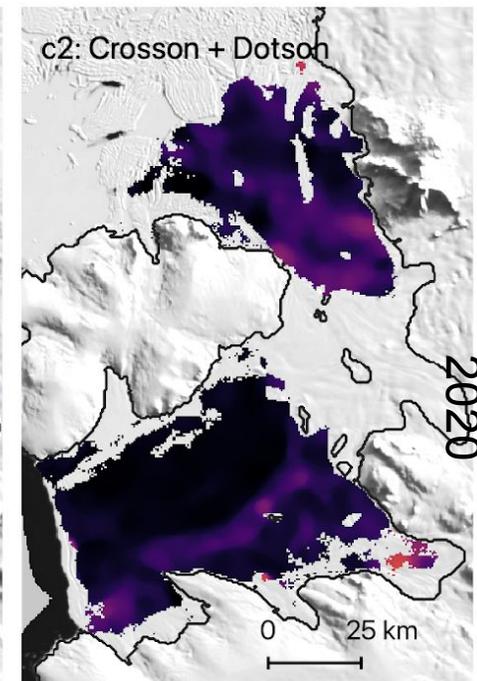
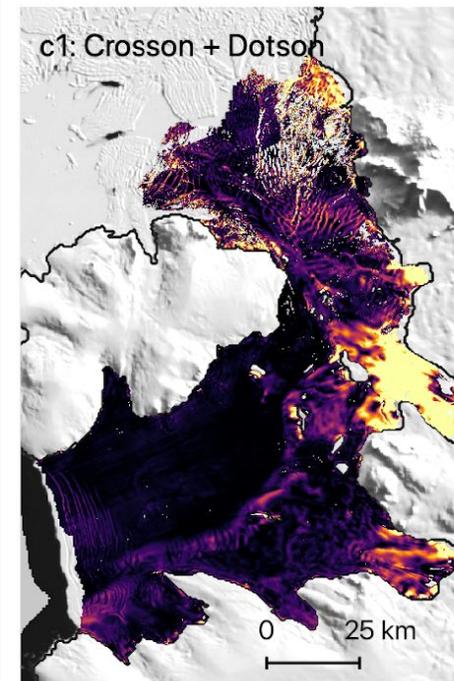
Basal melt  
rate



# BURGEE reveals basal melt rates of much greater detail than studies relying on radar altimetry only

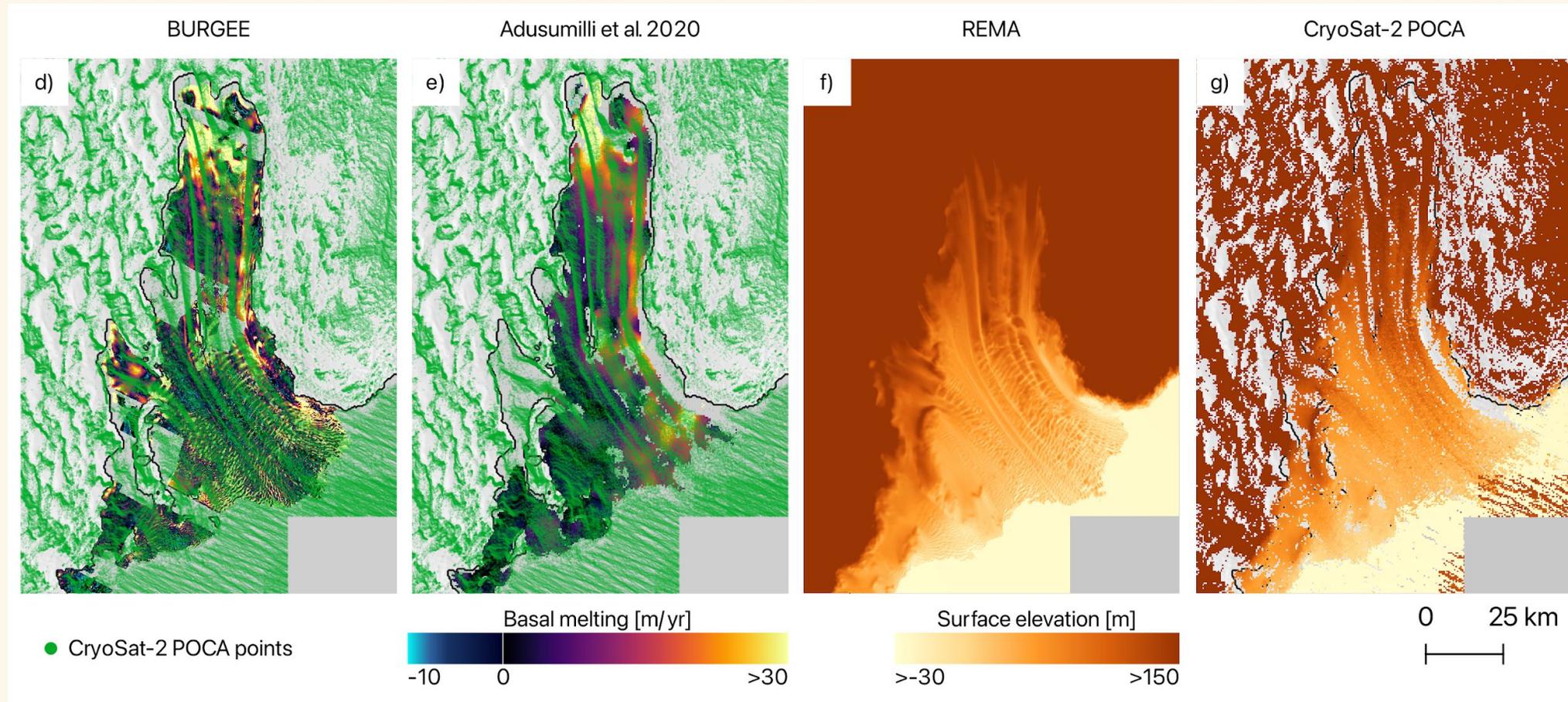


BURGEE, Zinck et al. 2026

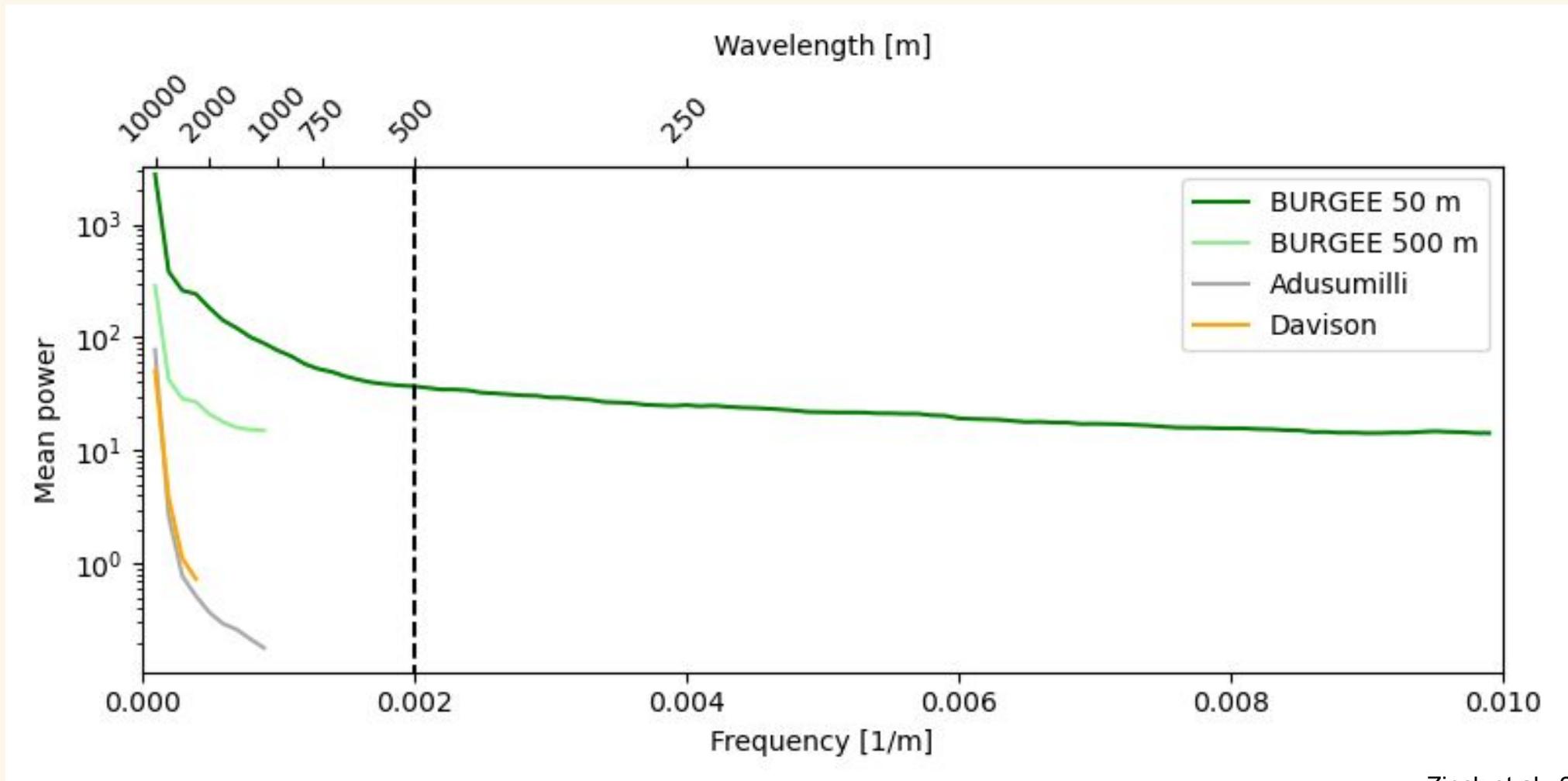


Adusumilli et al.

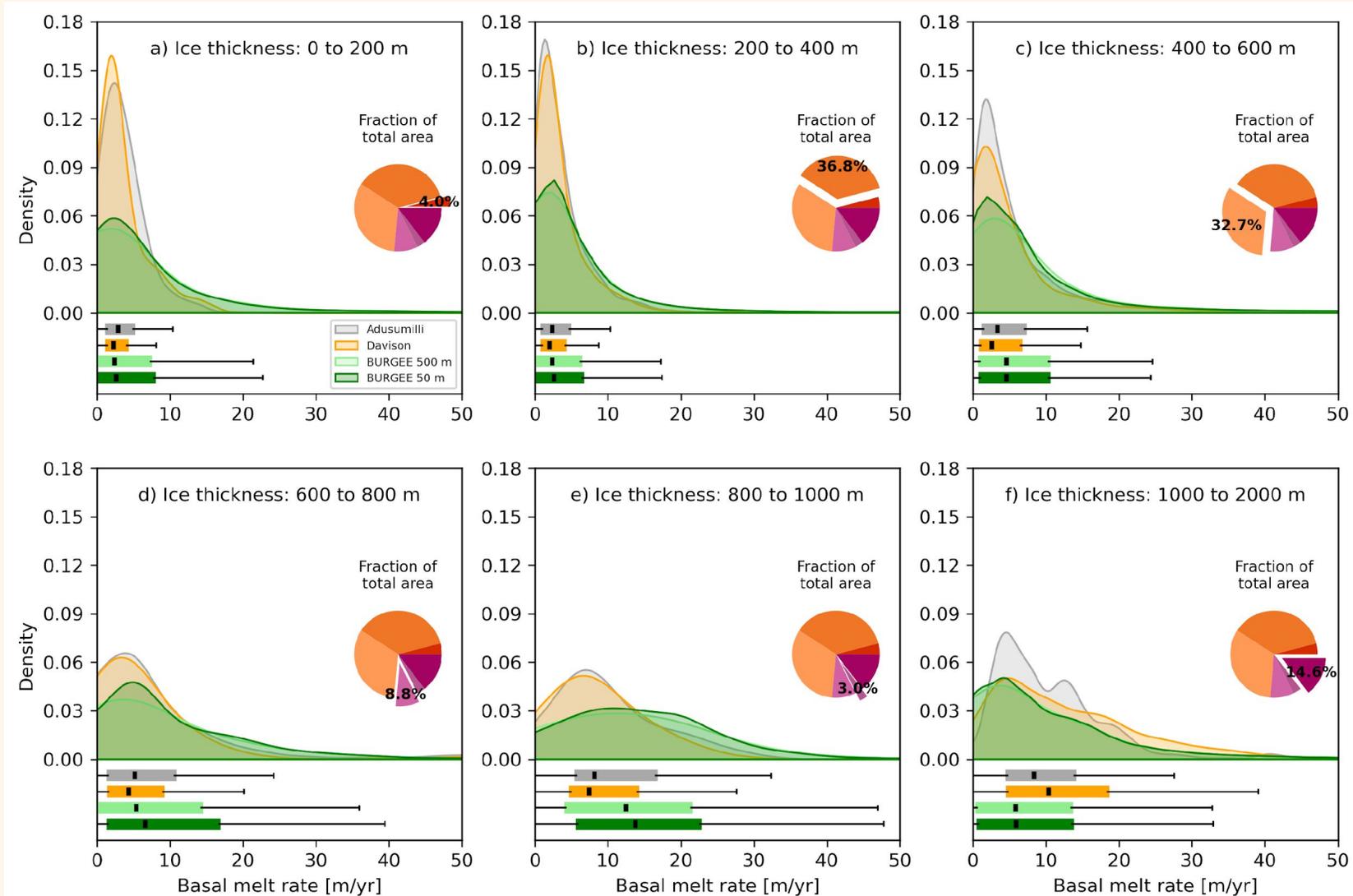
# The elevation product used determines the detail en resolution of the final melt product



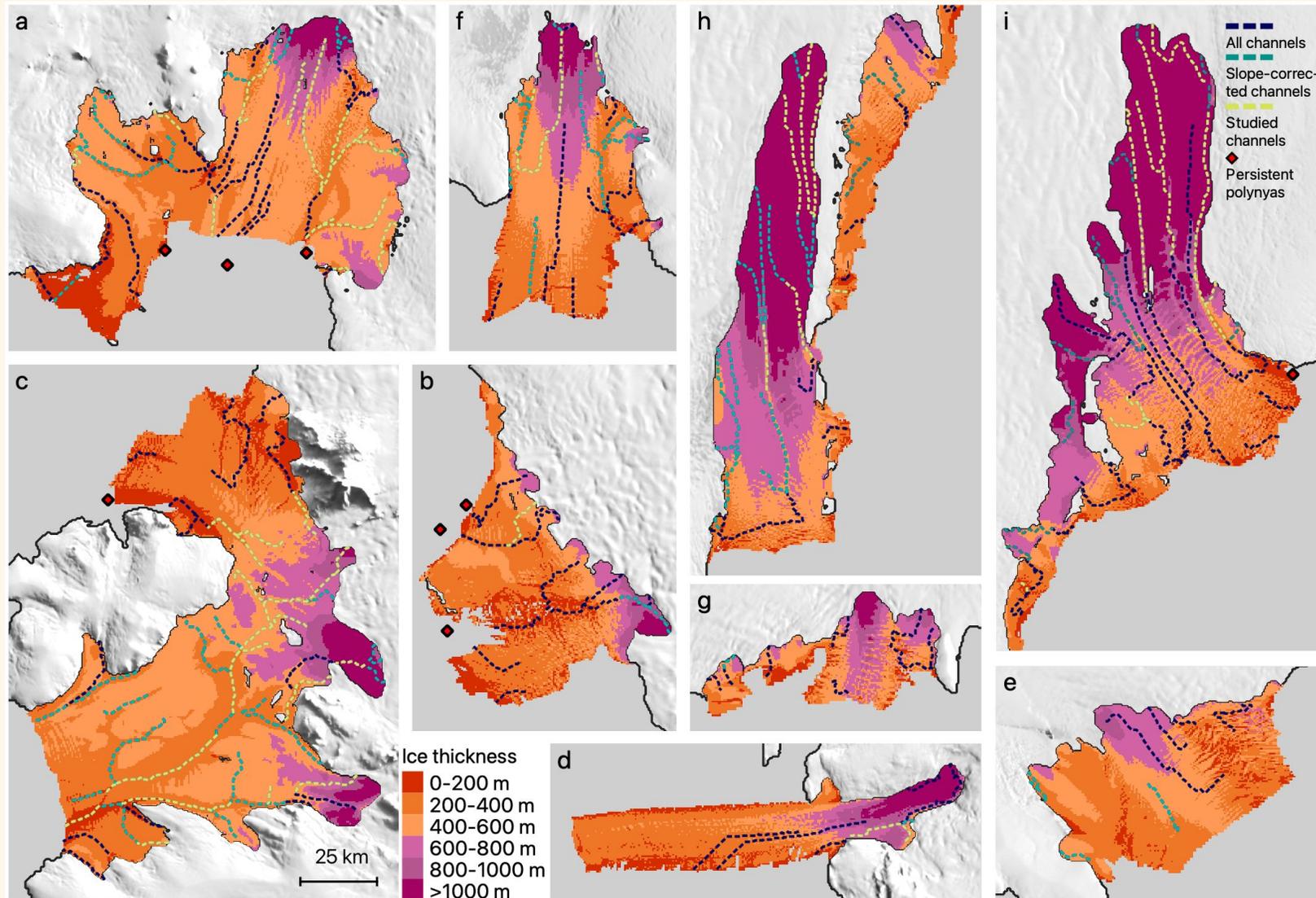
**A Fourier analysis of the melt maps reveals a characteristic wavelength of 500 m at which basal melting (or its impact) should be resolved in models**



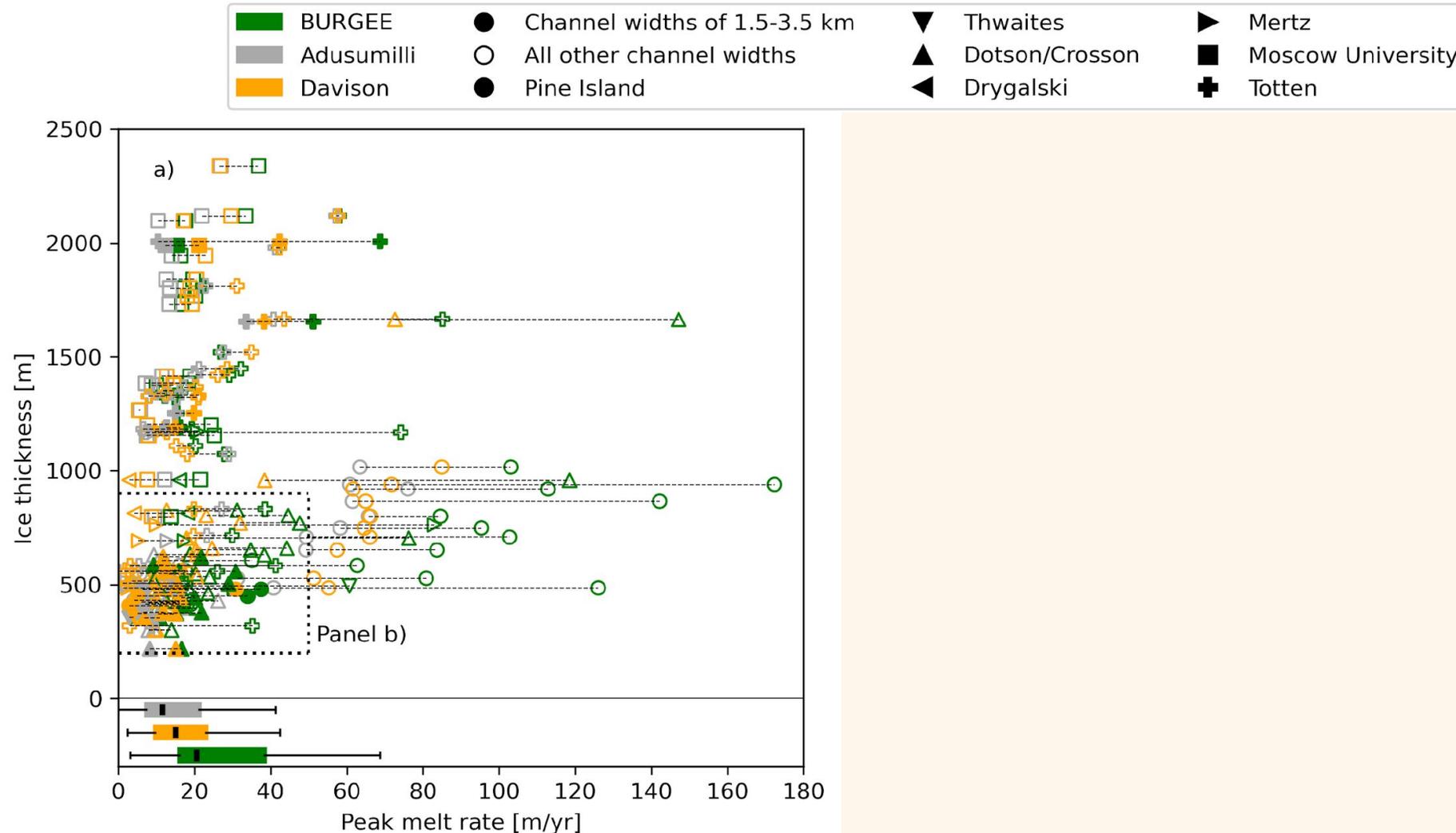
# BURGEE reveals higher median melt rates and larger spread in melt rates for ice thinner than 1000 m



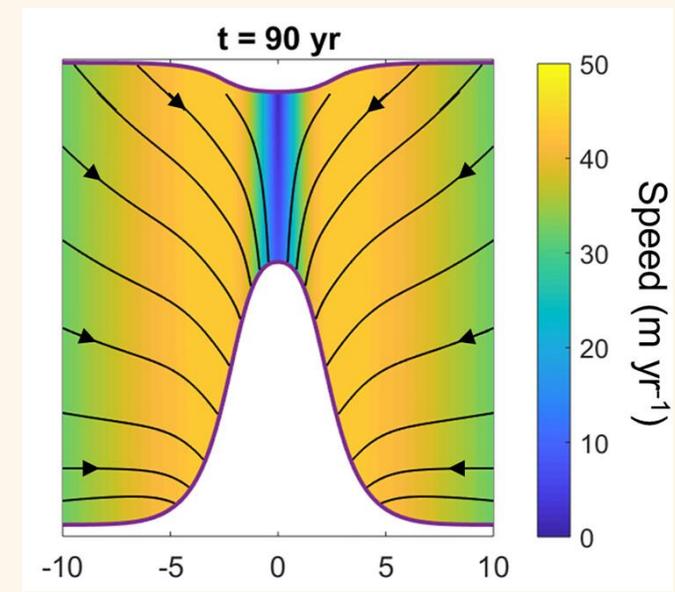
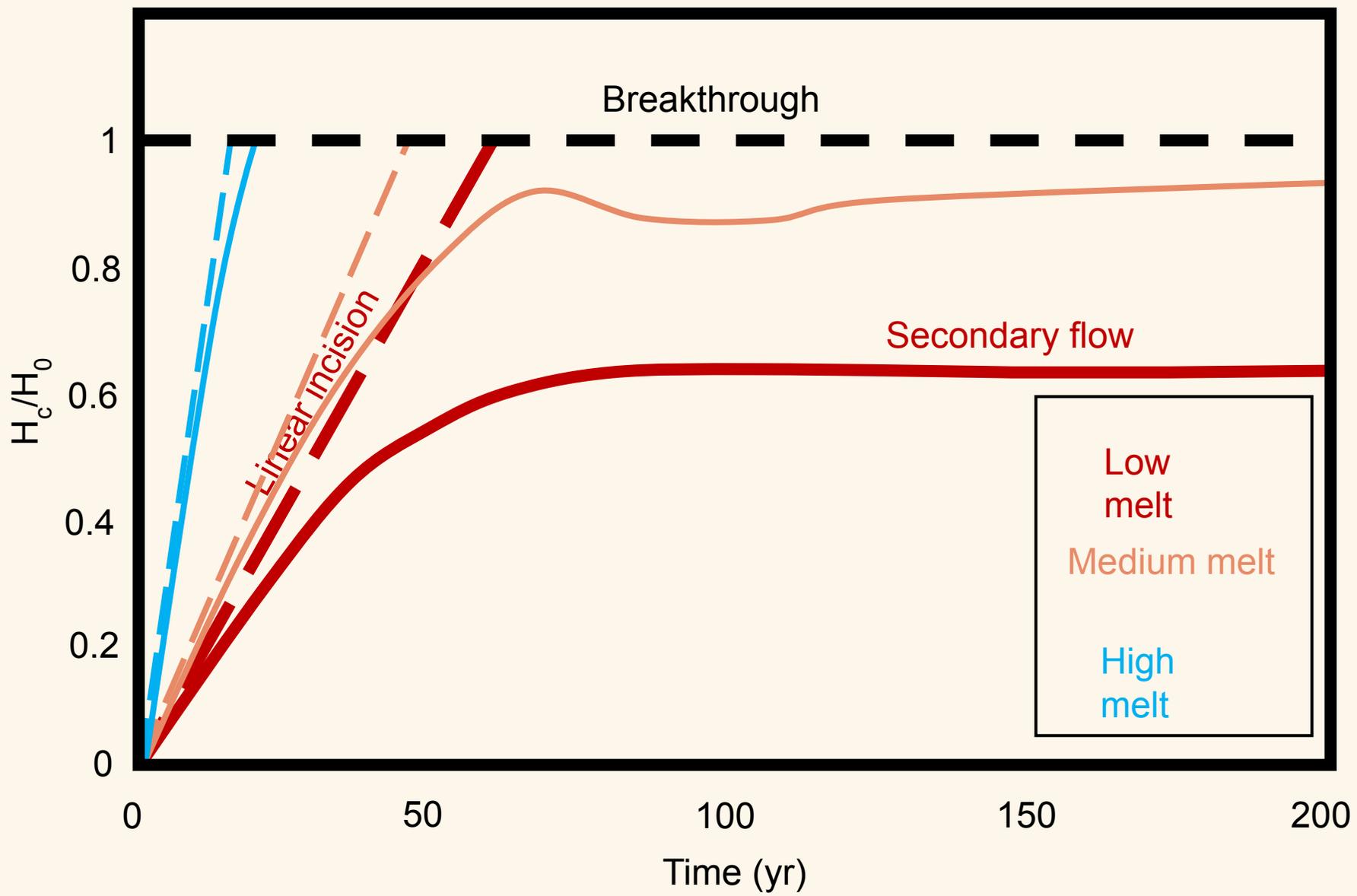
**Basal channels often represent thinner ice compared to their surroundings. We study those with the highest melt rates.**



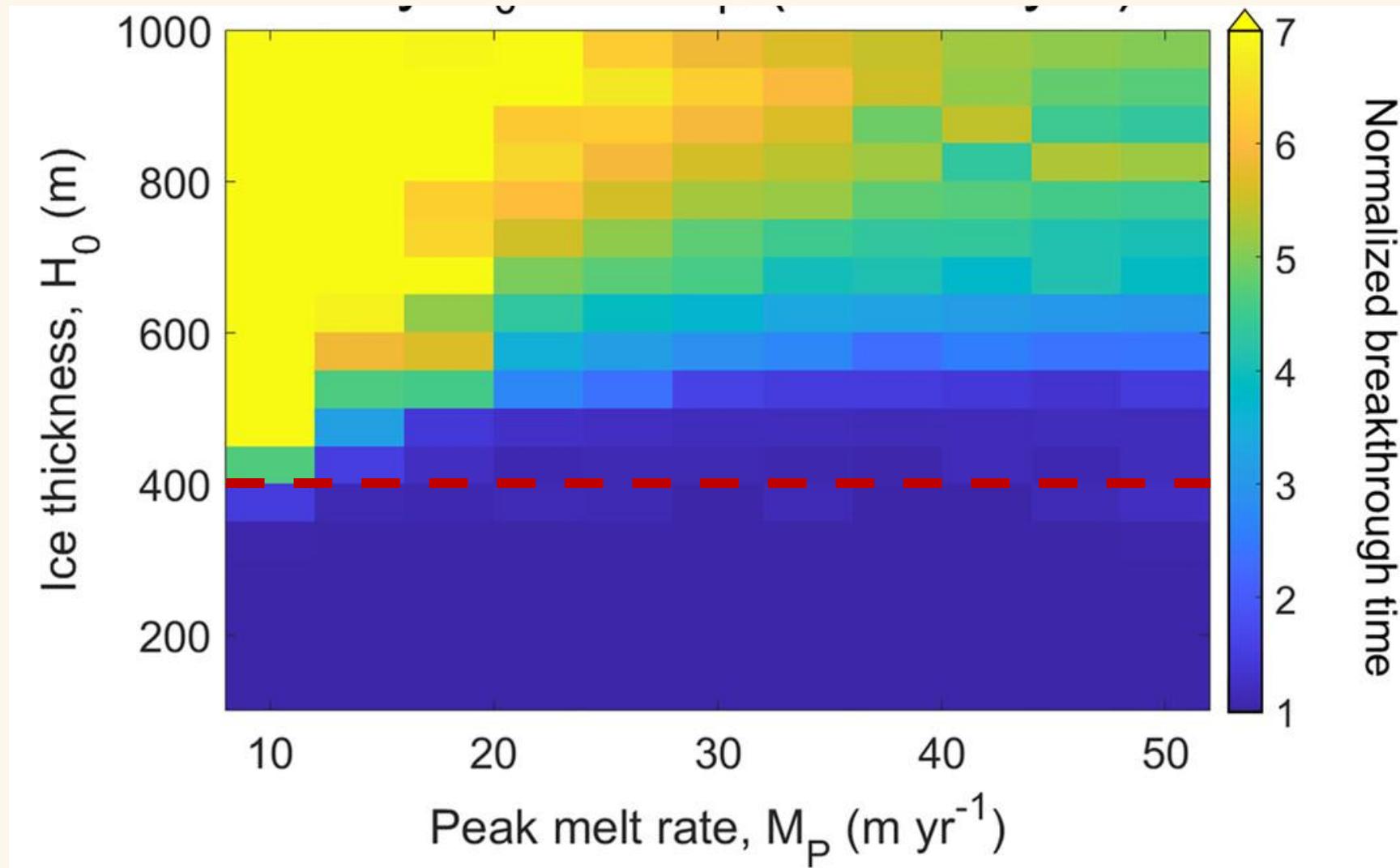
# BURGEE reveals up to 50% higher channel peak melt rates than altimetry-only studies



**We study channel breakthrough times to get an idea of what this underestimation implies in terms of channel (and ice shelf) vulnerability**

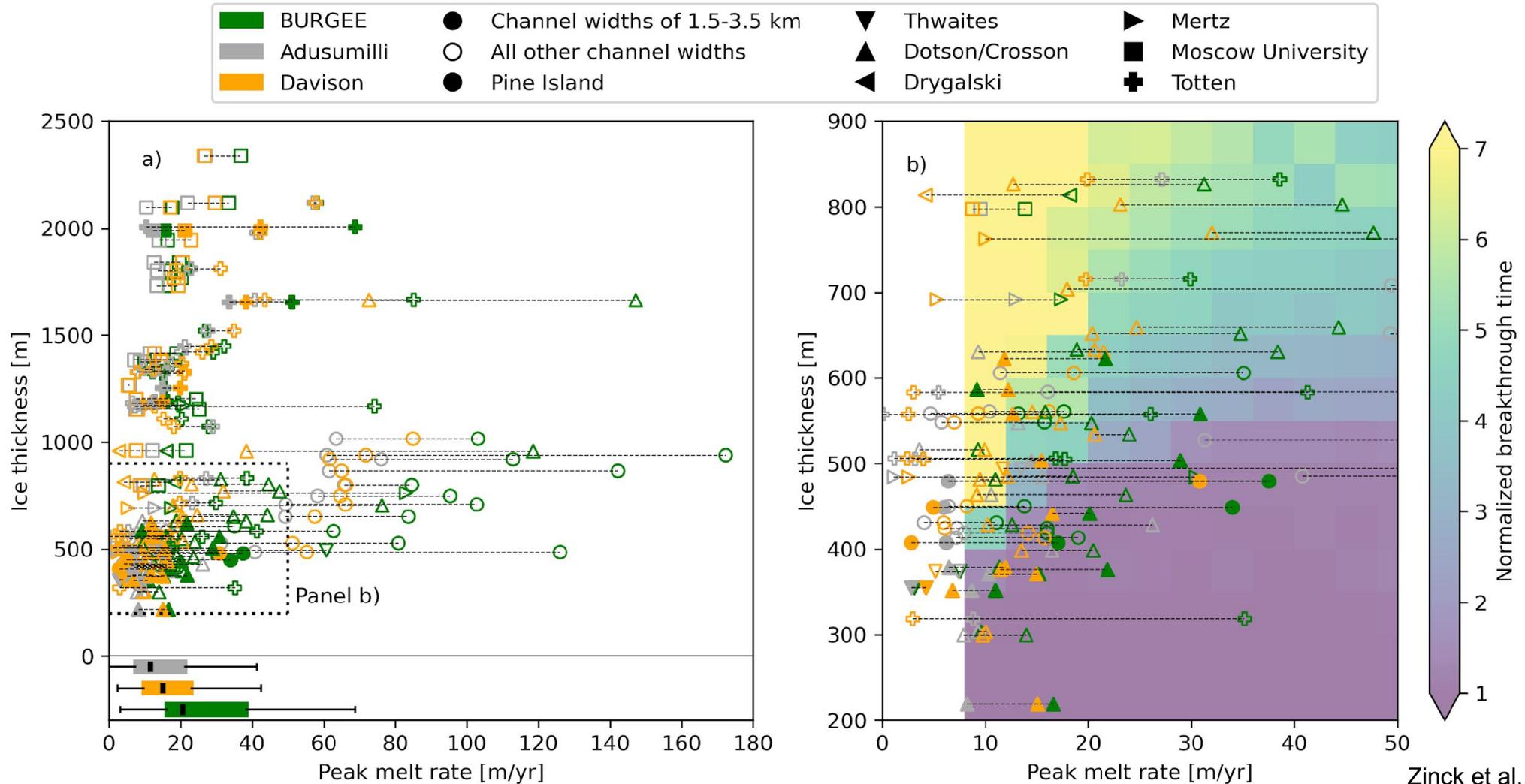


**High melt rates lead to faster channel breakthrough. For thin ice (<400 m) breakthrough time can assumed to be linear.**



Normalized breakthrough time:  
Secondary flow breakthrough times normalized by linear breakthrough times

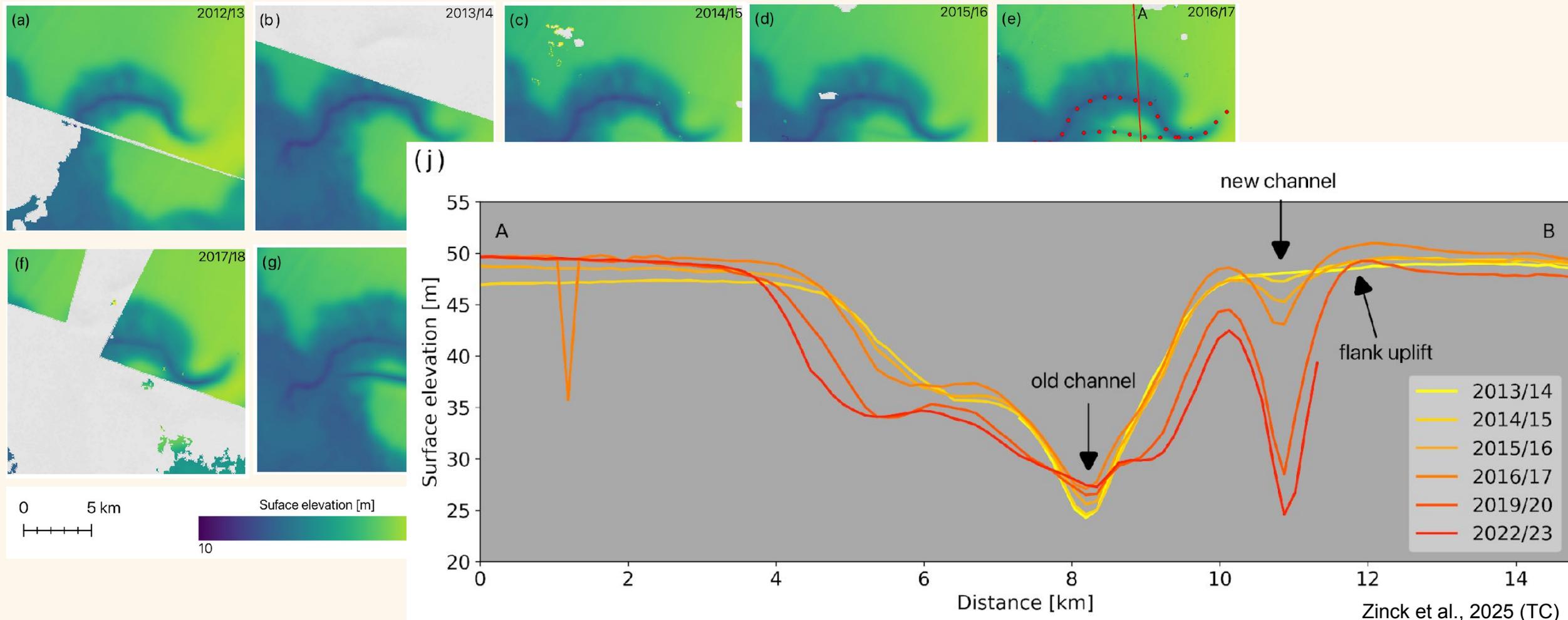
# BURGEE's higher peak melt rates lead to shorter breakthrough times potentially more vulnerable ice shelves!



# Selected conclusions

- BURGEE - a combination of stereo imagery (REMA) with radar altimetry - allows for basal melt mapping of high spatial resolution
  - Basal melt products relying solely on radar altimetry underestimate channel peak melt rates by up to 50%
  - IMPORTANT FOR MODELLERS: In order to capture channelized melting models need to resolve basal melting down to 500 m
- 
- BURGEE has also revealed the formation of new channels...

# BURGEE has also revealed the formation of a new channel on George VI Ice shelf □ The onset of this channel coincides with a strong El Nino event



# Selected conclusions – Thank you!

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  - Basal melt products relying solely on radar altimetry underestimate channel peak melt rates by up to 50%
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