State and fate of Antarctica's gatekeepers

Stef Lhermitte

When meets

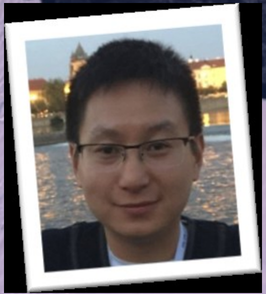
TU Delft
KU LEUVEN
Utrecht University
Koninklijk Nederlands Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat
NIOZ
ULB
NWO

Sophie
de Roda Husman

Maaike
Izeboud

Ann-Sophie
Priergaard Zinck

Bert
Wouters



Zhongyang
Hu

Erwin
Lambert

Marijn
van der Meer

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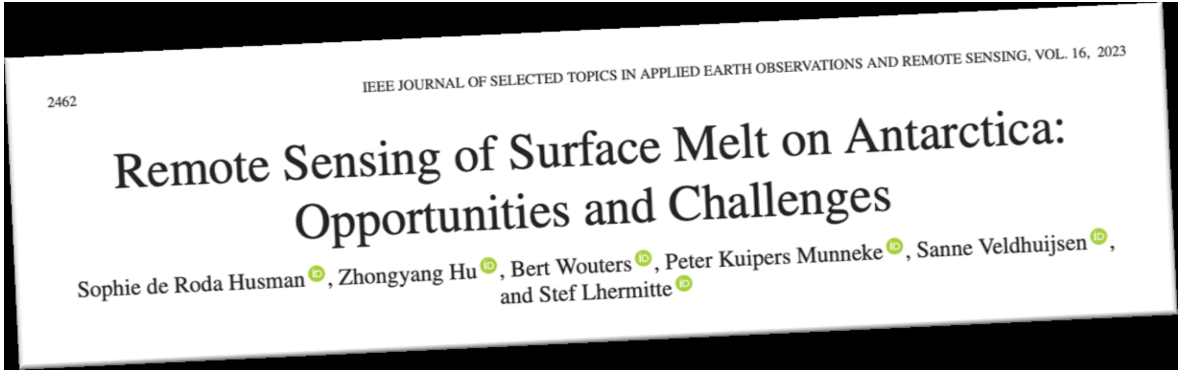
Ice shelf EO products

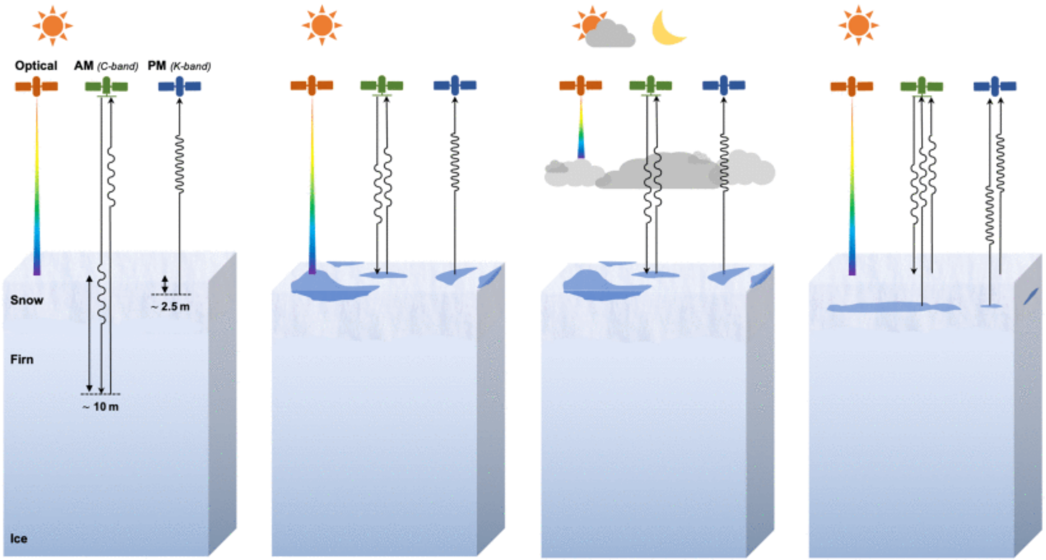
Surface melt



2462 IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING, VOL. 16, 2023

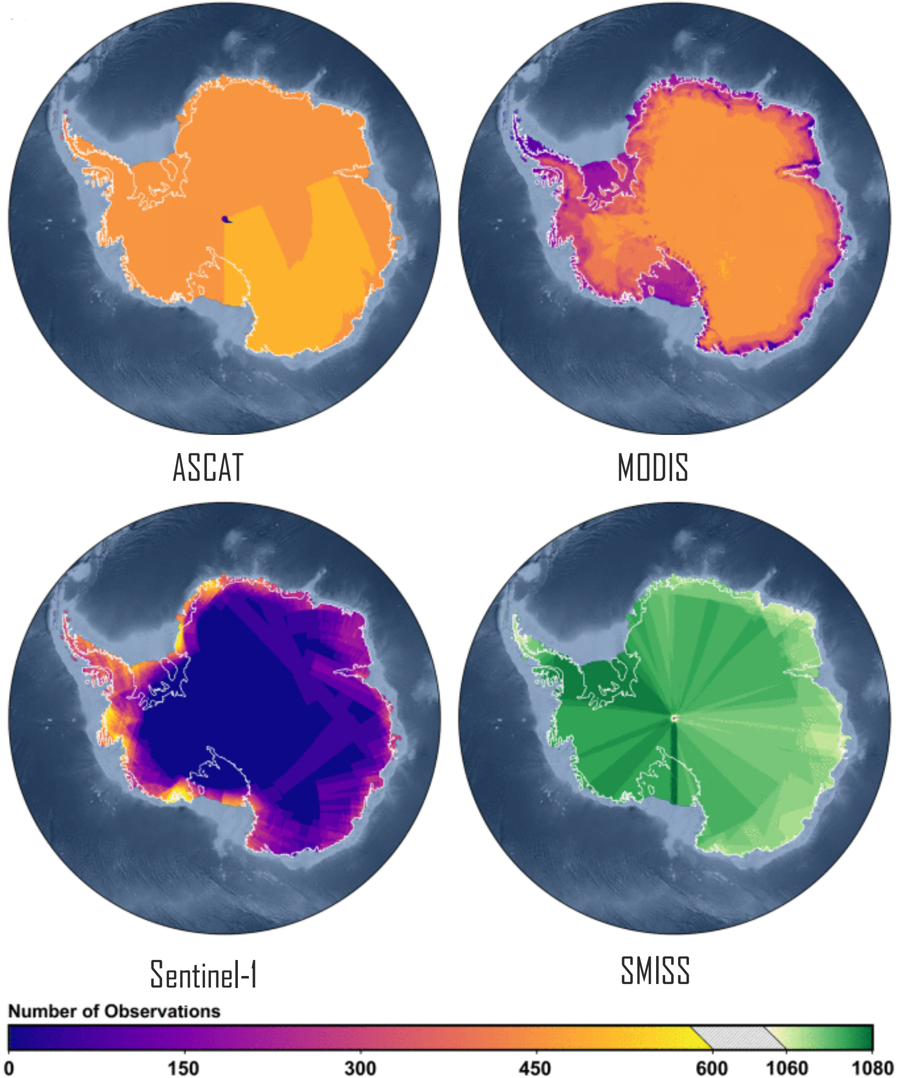
Remote Sensing of Surface Melt on Antarctica: Opportunities and Challenges

Sophie de Roda Husman, Zhongyang Hu, Bert Wouters, Peter Kuipers Munneke, Sanne Veldhuijsen, and Stef Lhermitte



(a) (b) (c) (d)

Surface melt differs among ducts



De Roda Husman, 2023

Surface melt differs among [redacted]ducts

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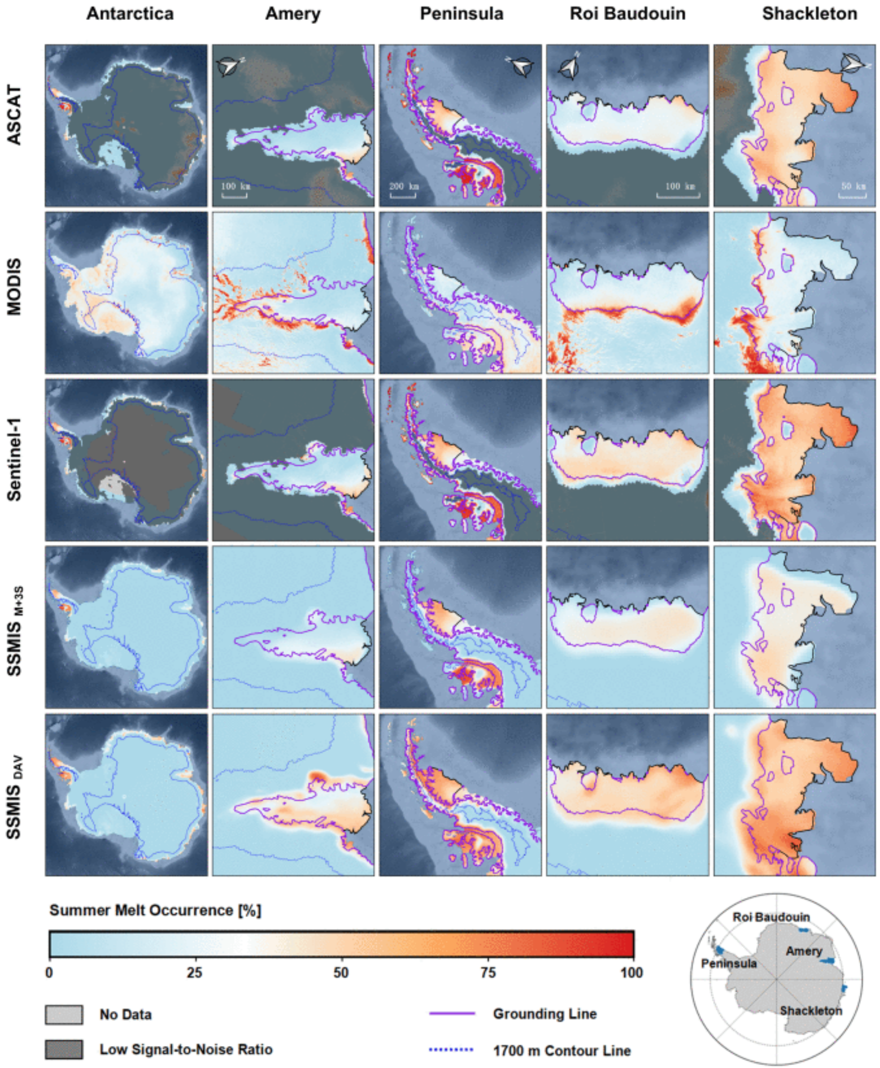
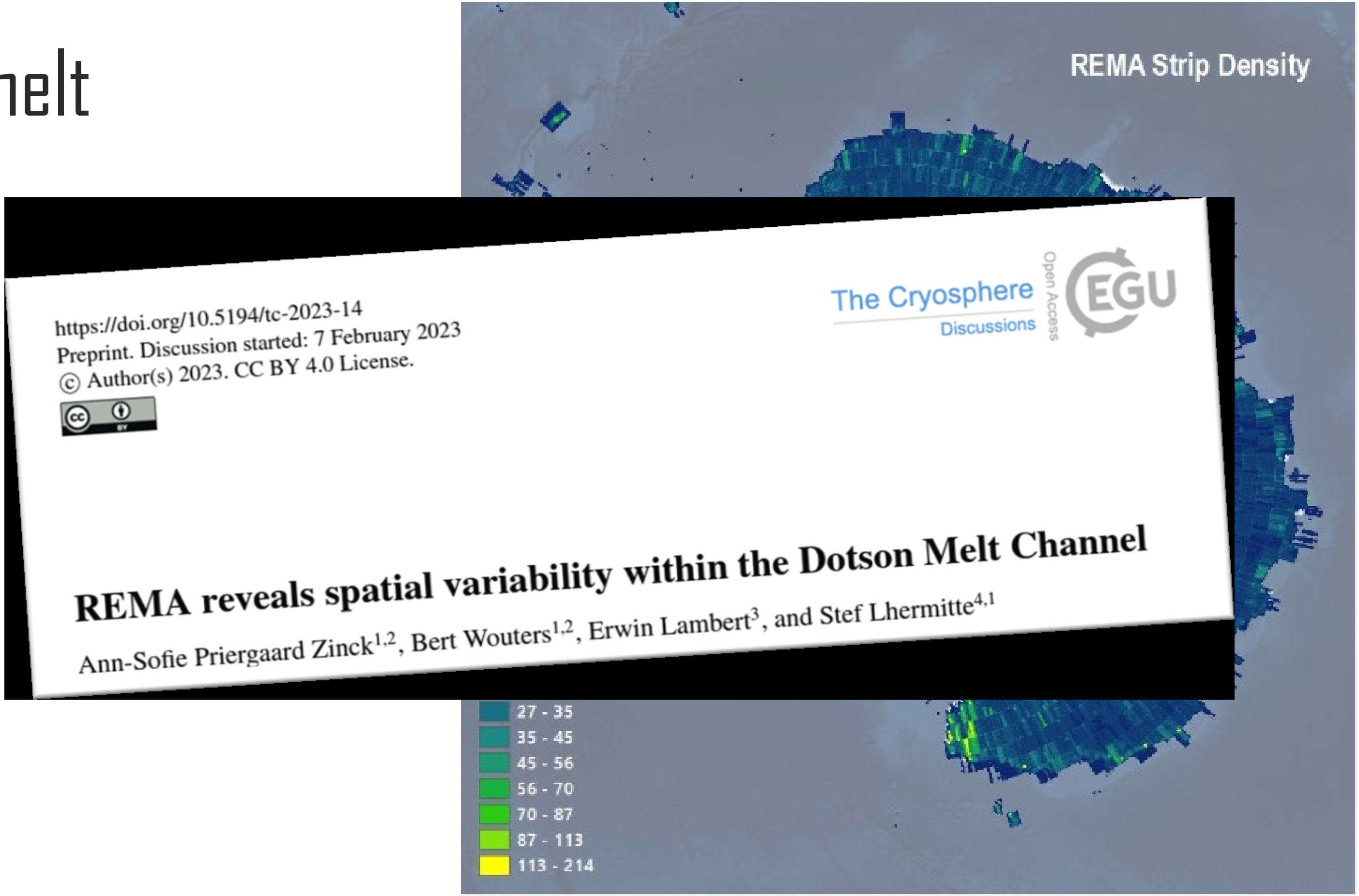


Basal melt



https://doi.org/10.5194/tc-2023-14
Preprint. Discussion started: 7 February 2023

The Cryosphere Discussions
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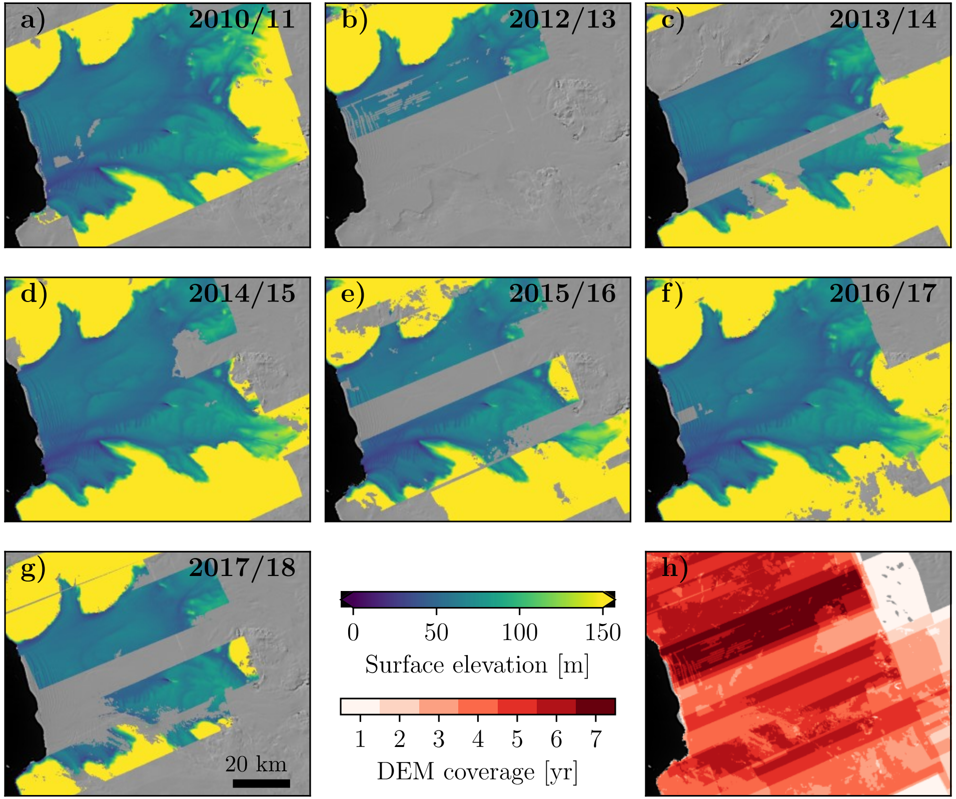
REMA reveals spatial variability within the Dotson Melt Channel

Ann-Sofie Priergaard Zinck[1,2], Bert Wouters[1,2], Erwin Lambert[3], and Stef Lhermitte[4,1]

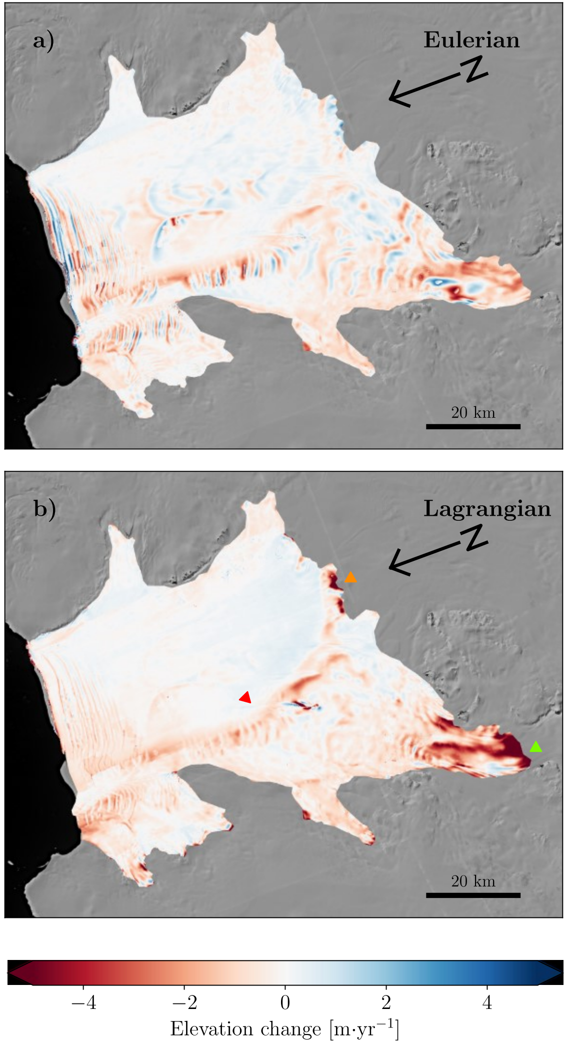
https://www.pgc.umn.edu/data/rema/

Yearly summer elevation mosaics



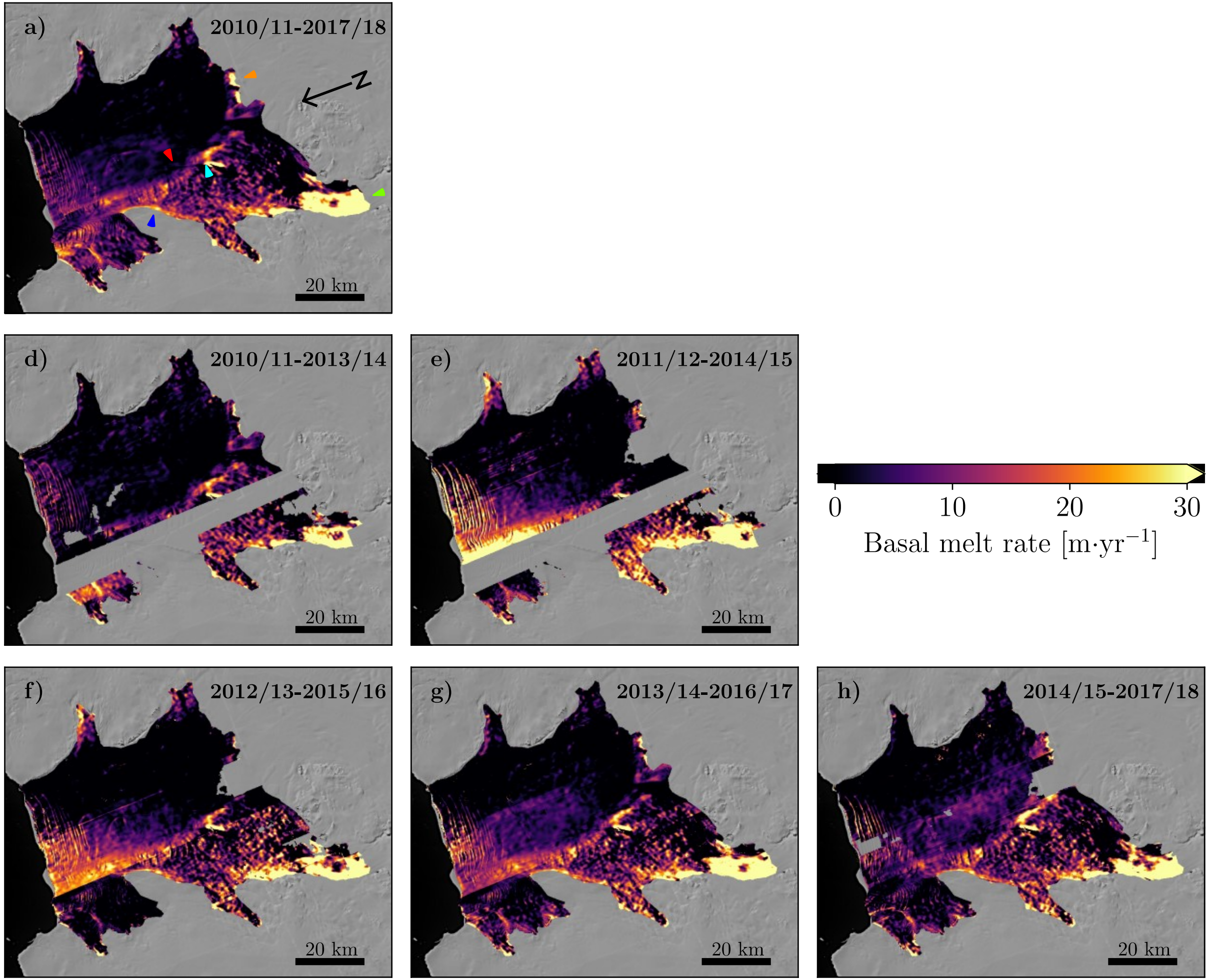
Priergaard Zinck, 2023

Surface elevation trends



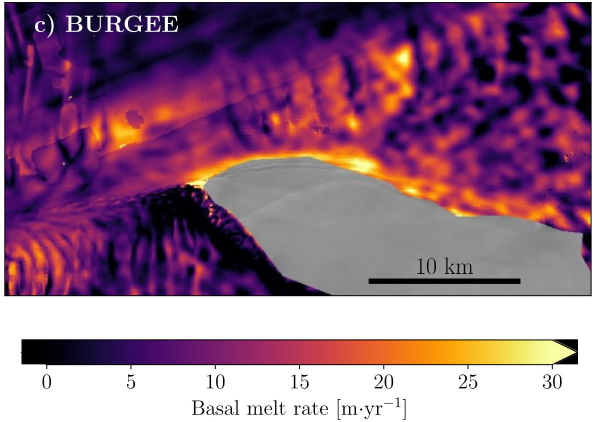
Priergaard Zinck, 2023

Basal MB



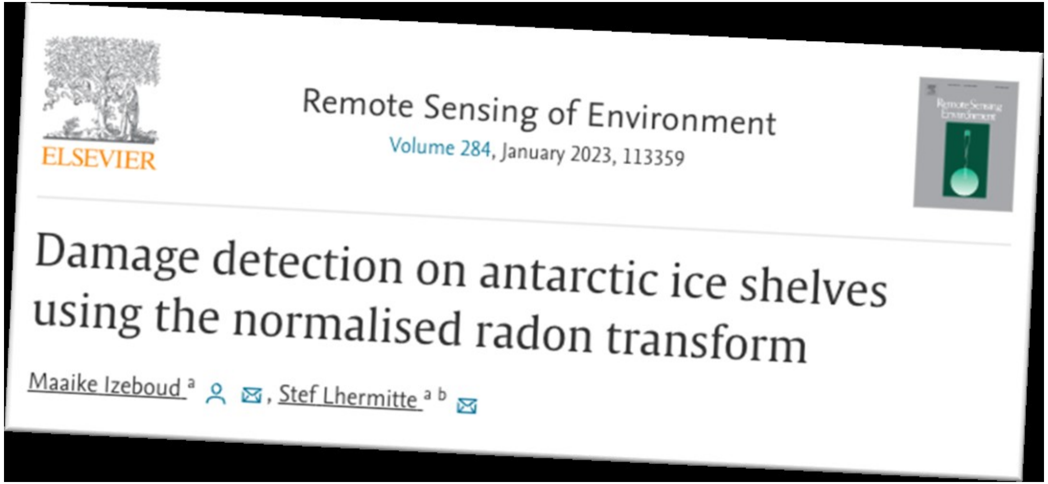
Priergaard Zinck, 2023

Basal MB



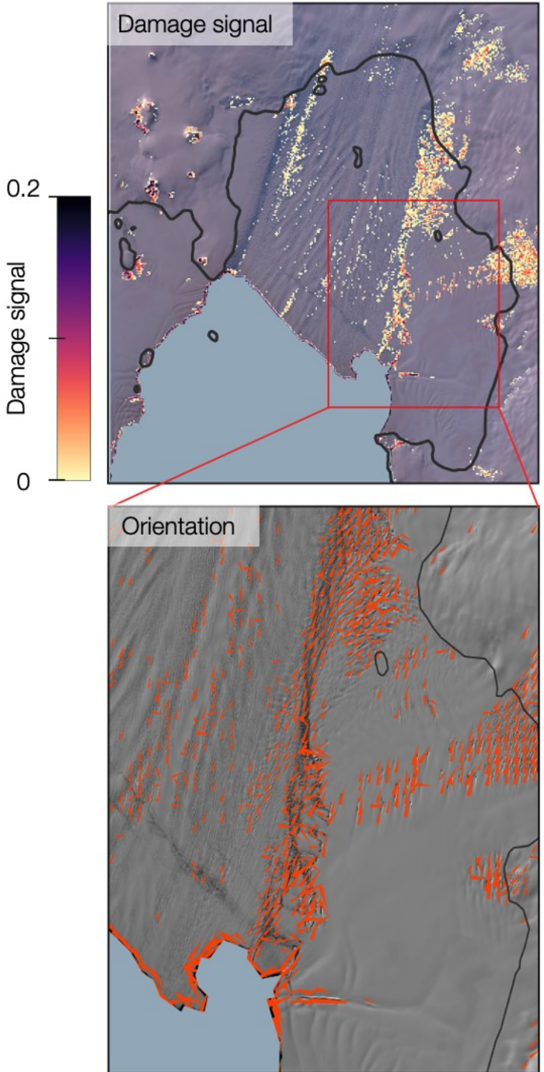
Priergaard Zinck, 2023

Damage


Remote Sensing of Environment
Volume 284, January 2023, 113359

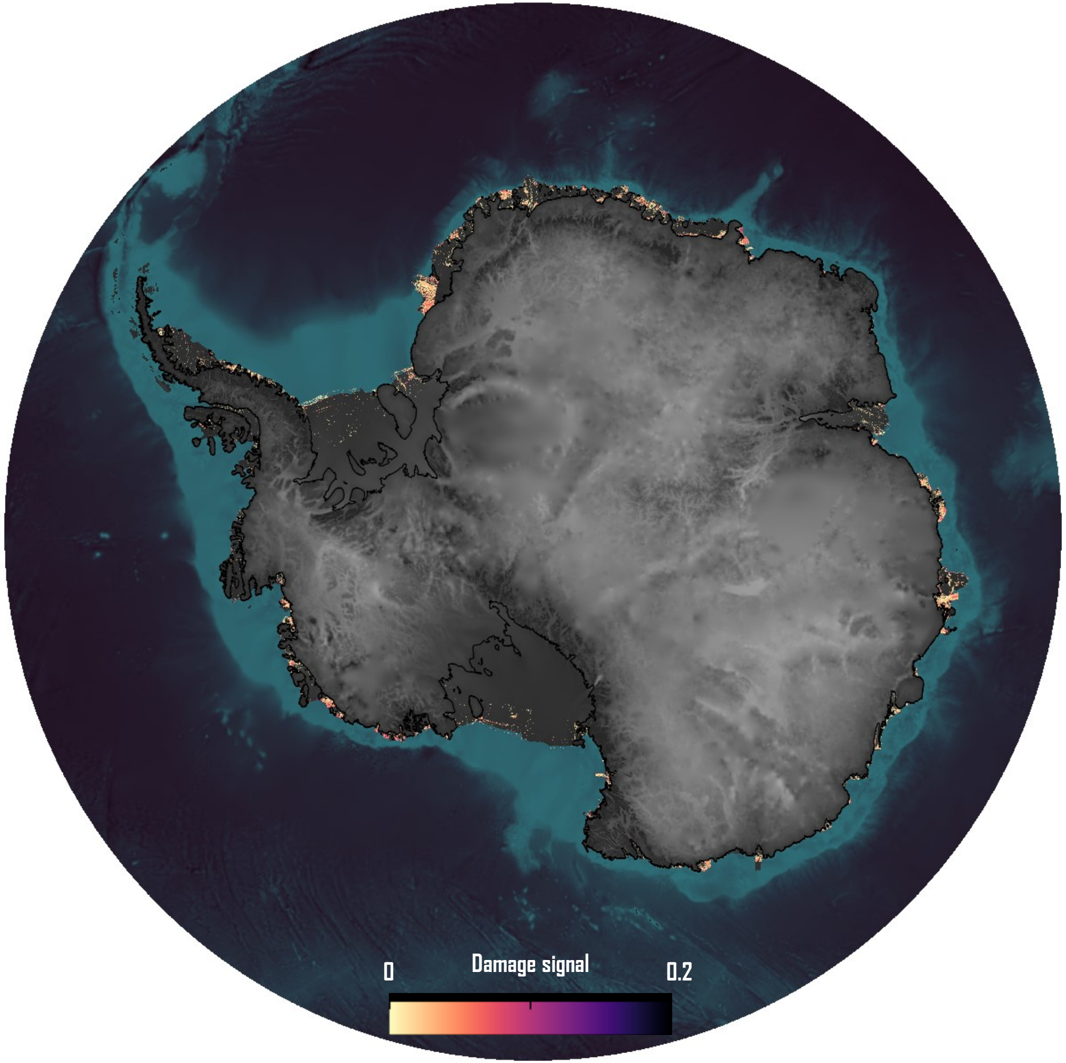
Damage detection on antarctic ice shelves using the normalised radon transform

Maaike Izeboud [a], Stef Lhermitte [a b]

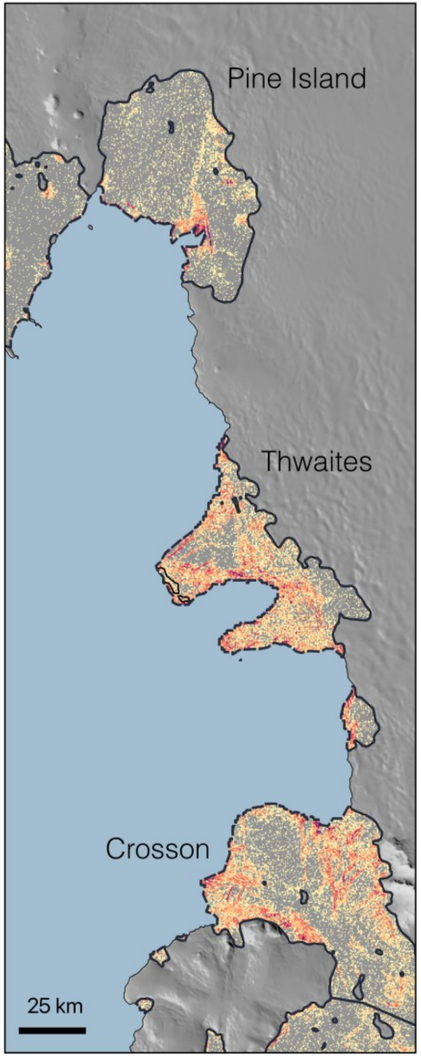


Antarctic damage

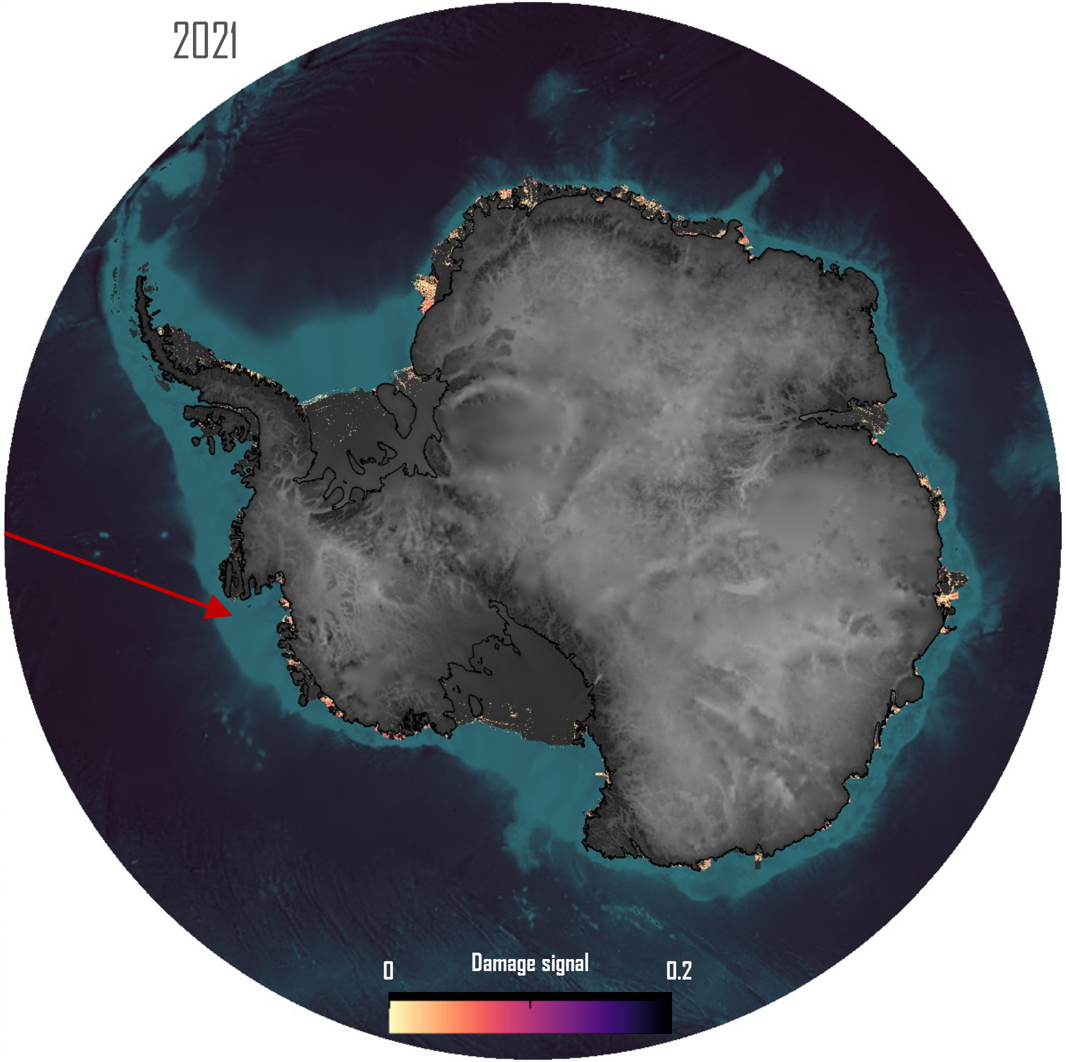
2021



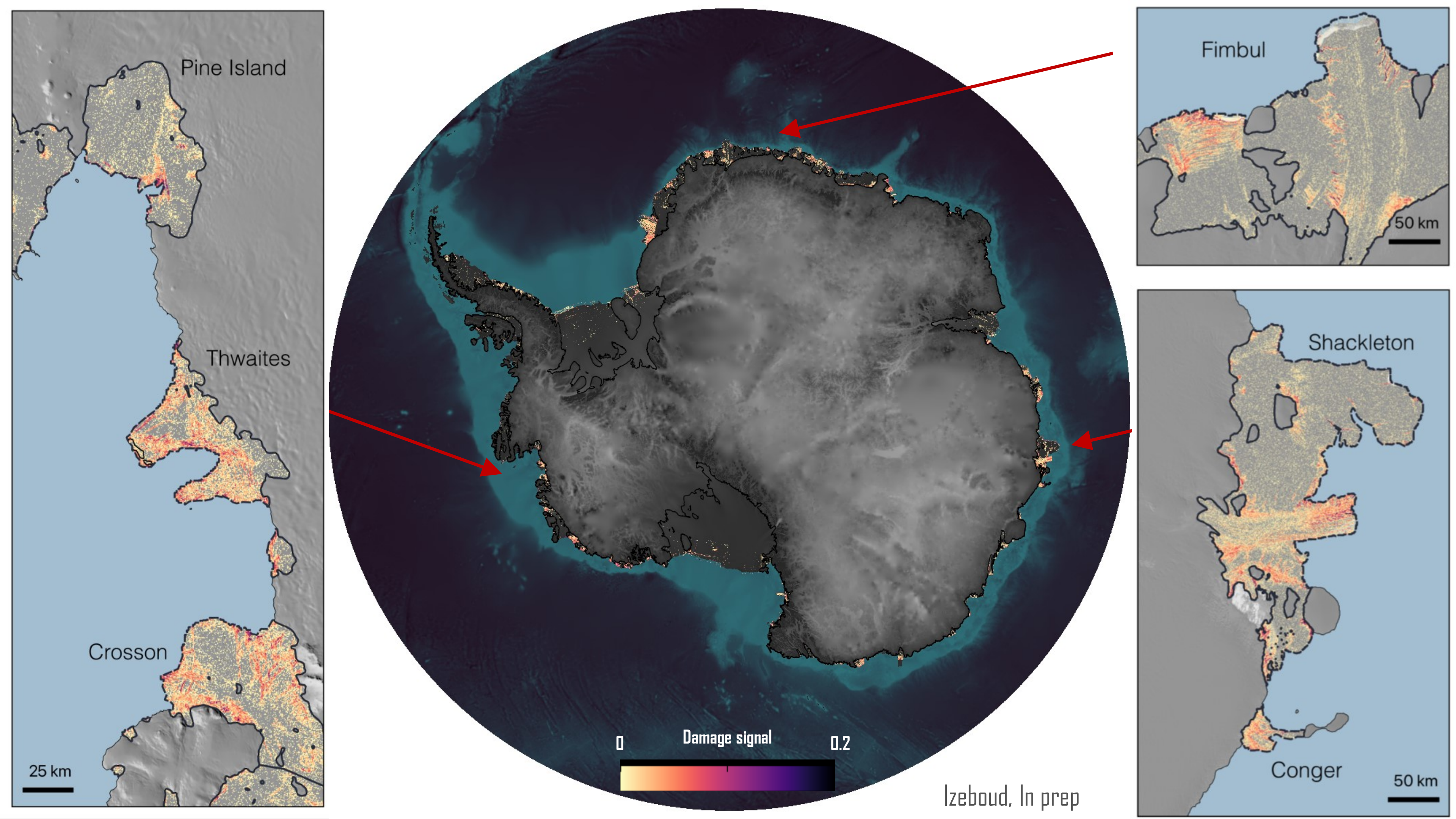
Izeboud, In prep



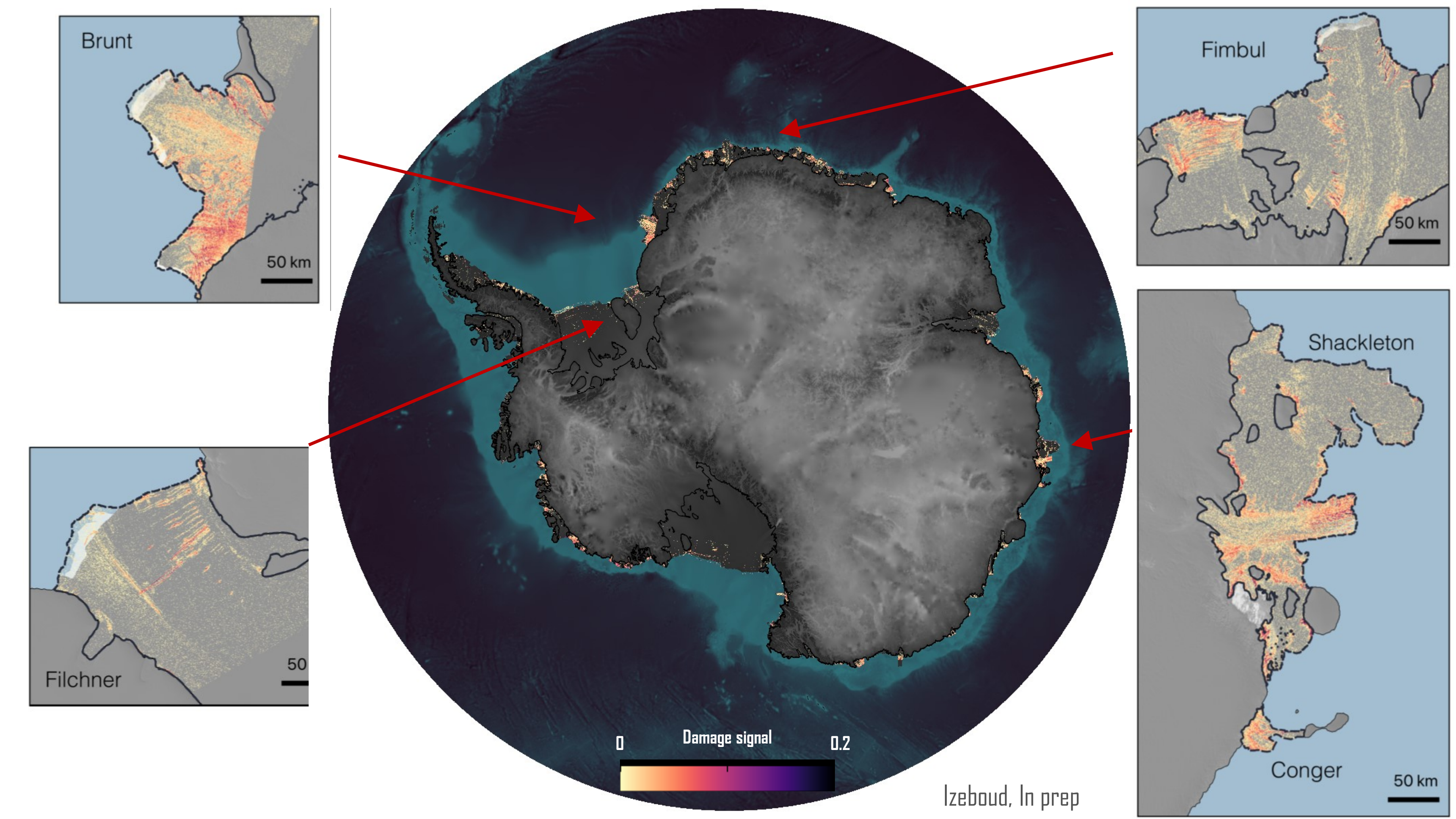
2021



Izeboud, In prep



Pine Island
Thwaites
Crosson
25 km
Fimbul
50 km
Shackleton
Conger
50 km
Damage signal
0
0.2
Izeboud, In prep

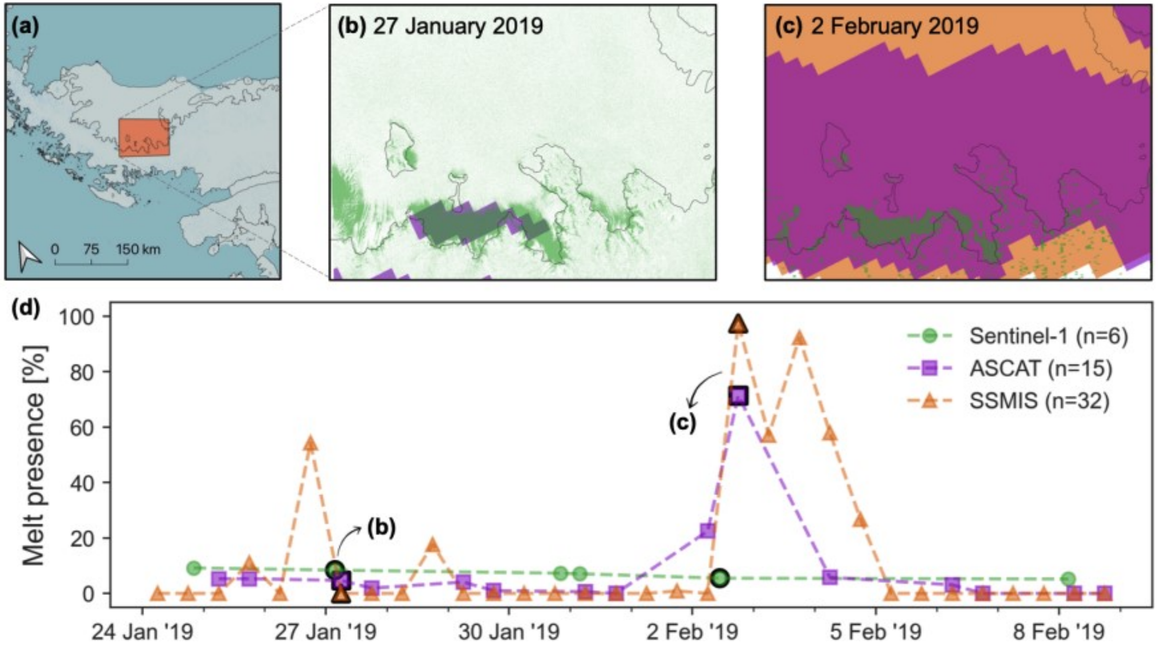

Brunt
50 km
Fimbul
50 km
Shackleton
Conger
50 km
Filchner
50
Damage signal
0
0.2
Izeboud, In prep

Added value of machine learning?

-1

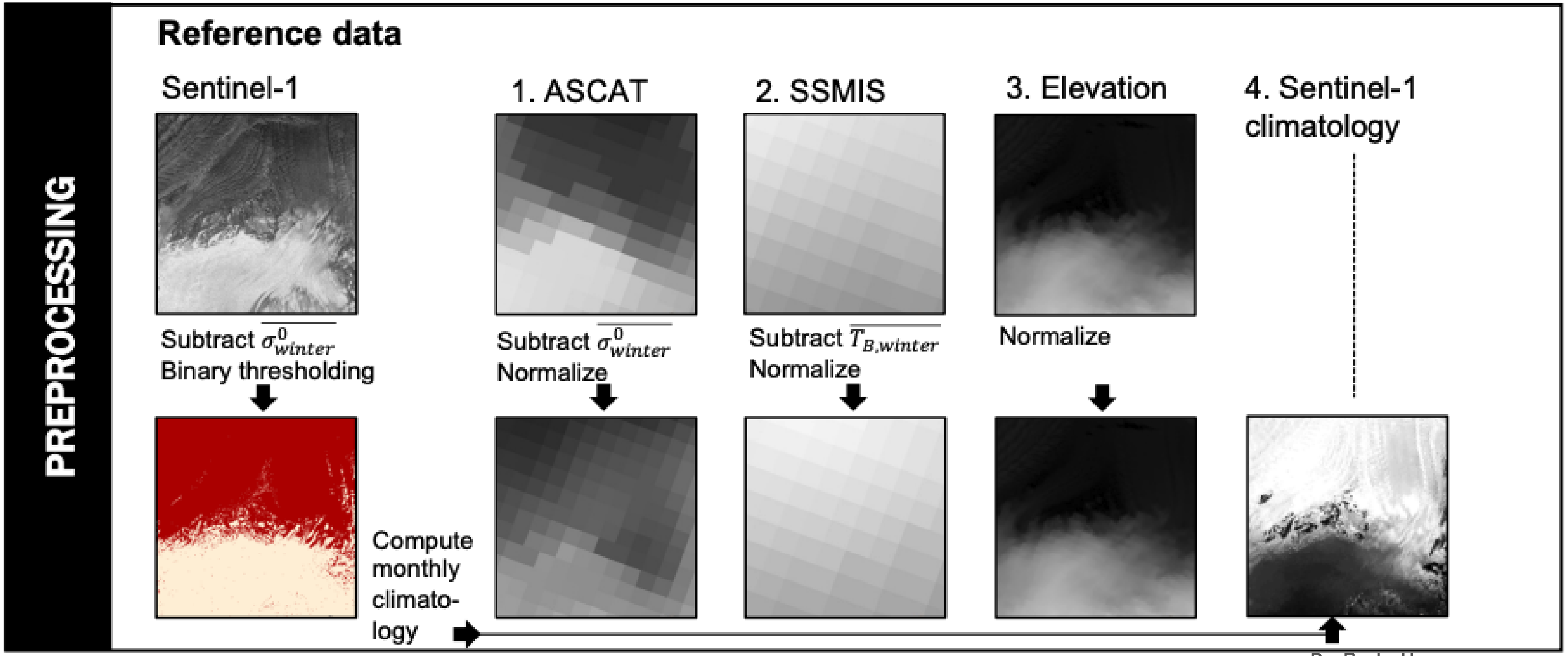
Combining EO datasets

ML for combining EO dataset



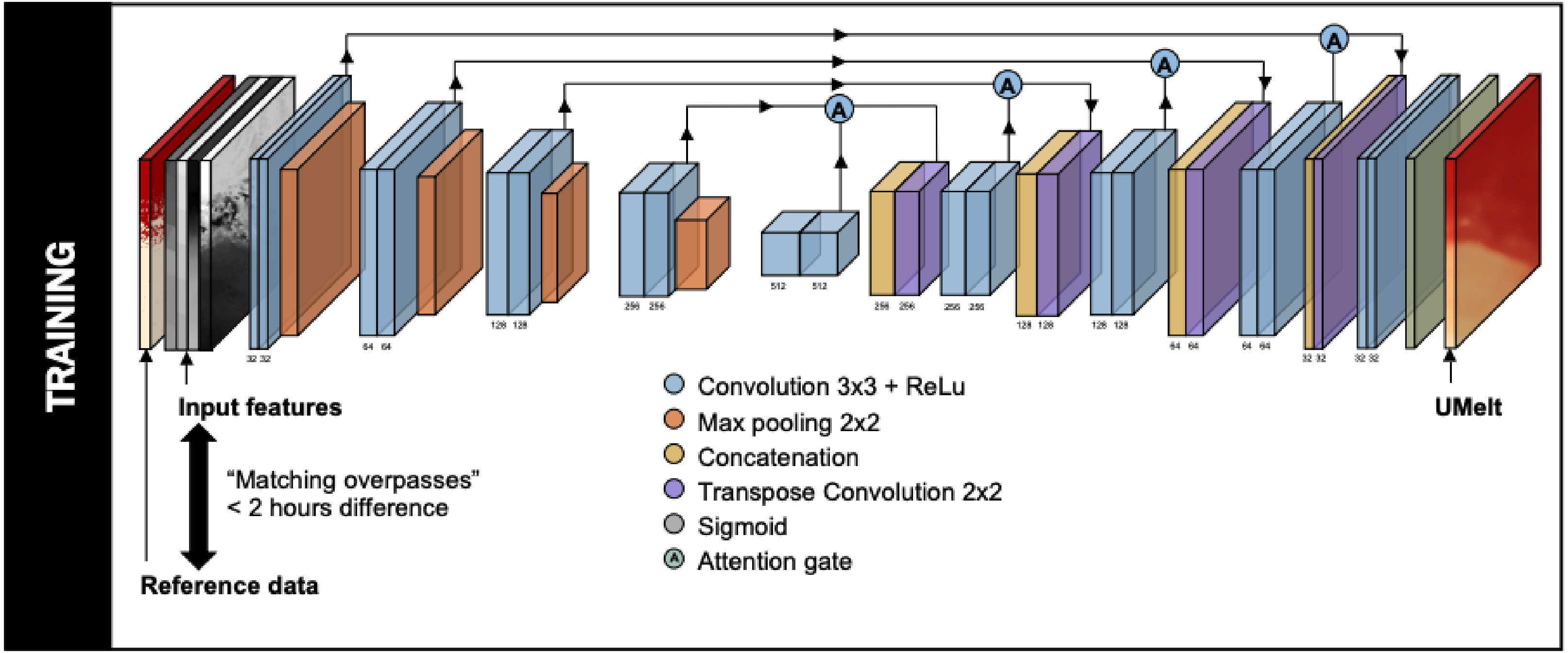
De Roda Husman, In prep

ML approach for high-resolution melt product



De Roda Husman, in prep

ML approach for high-resolution melt product



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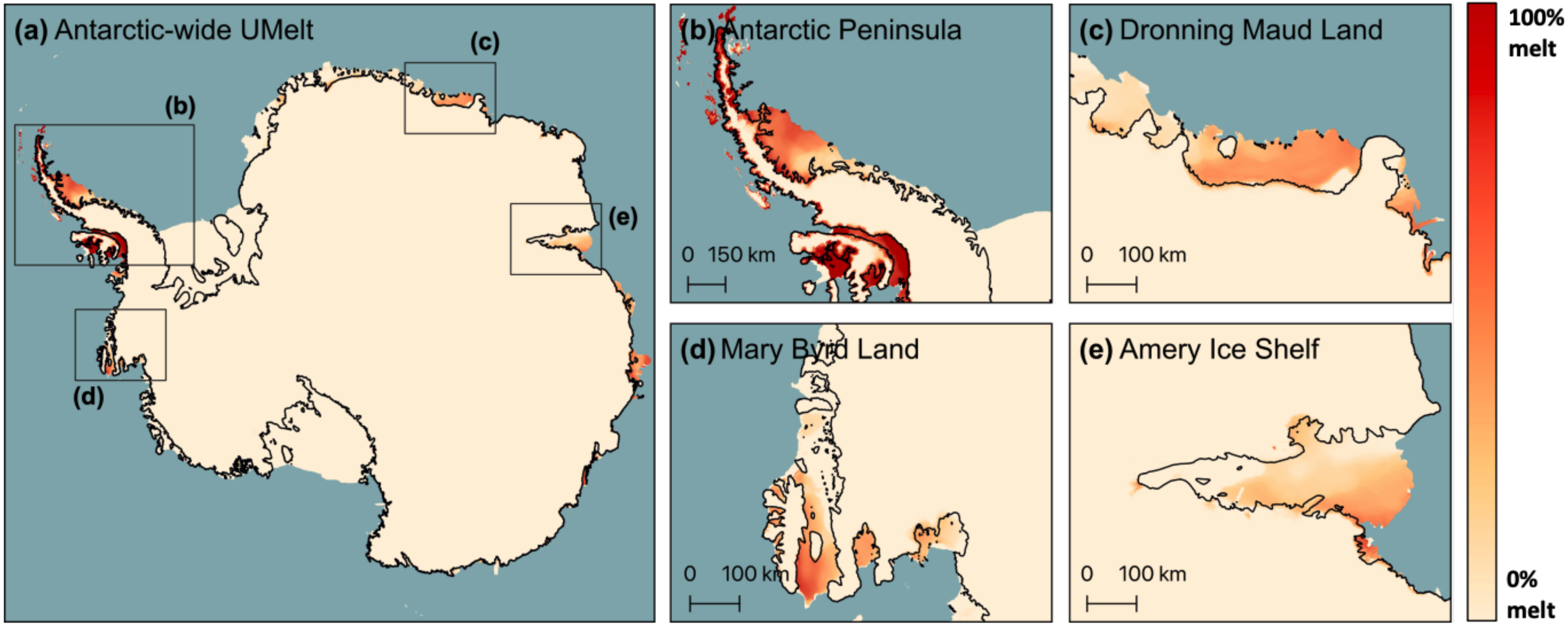
Antarctic wide high resolution melt product

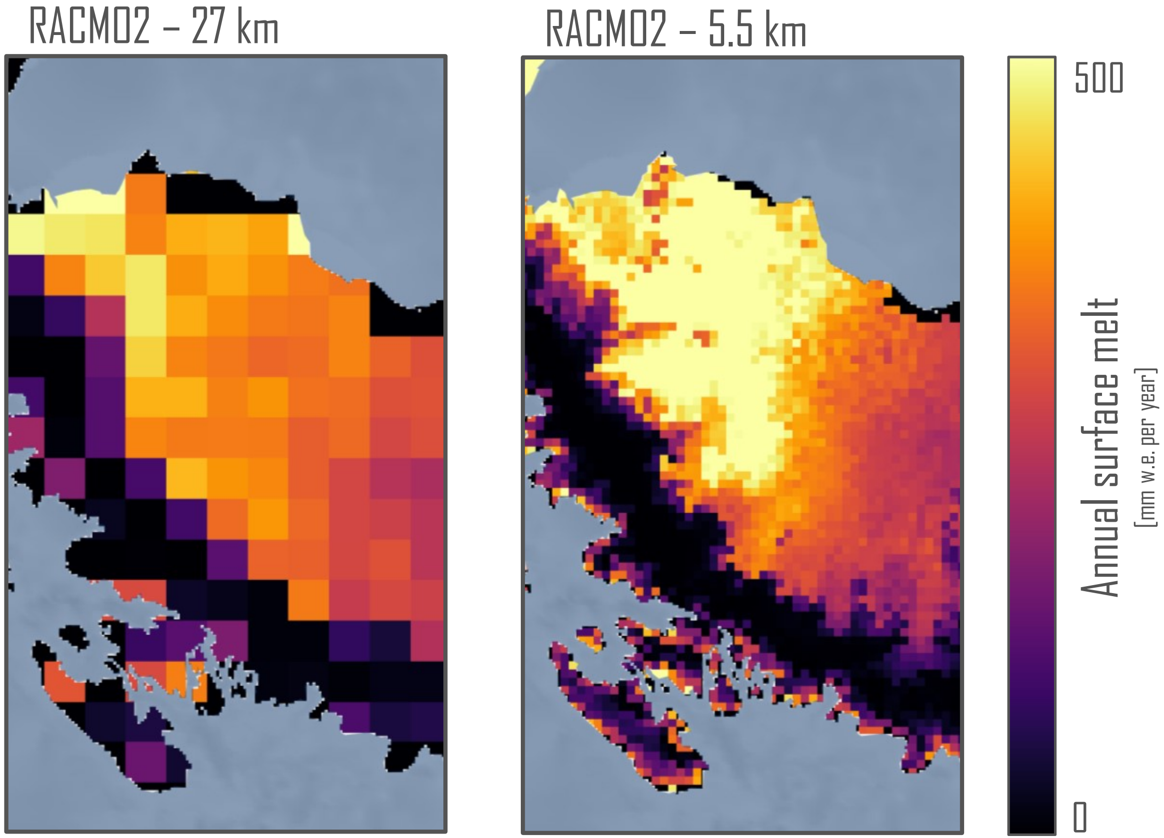


De Roda Husman, in prep

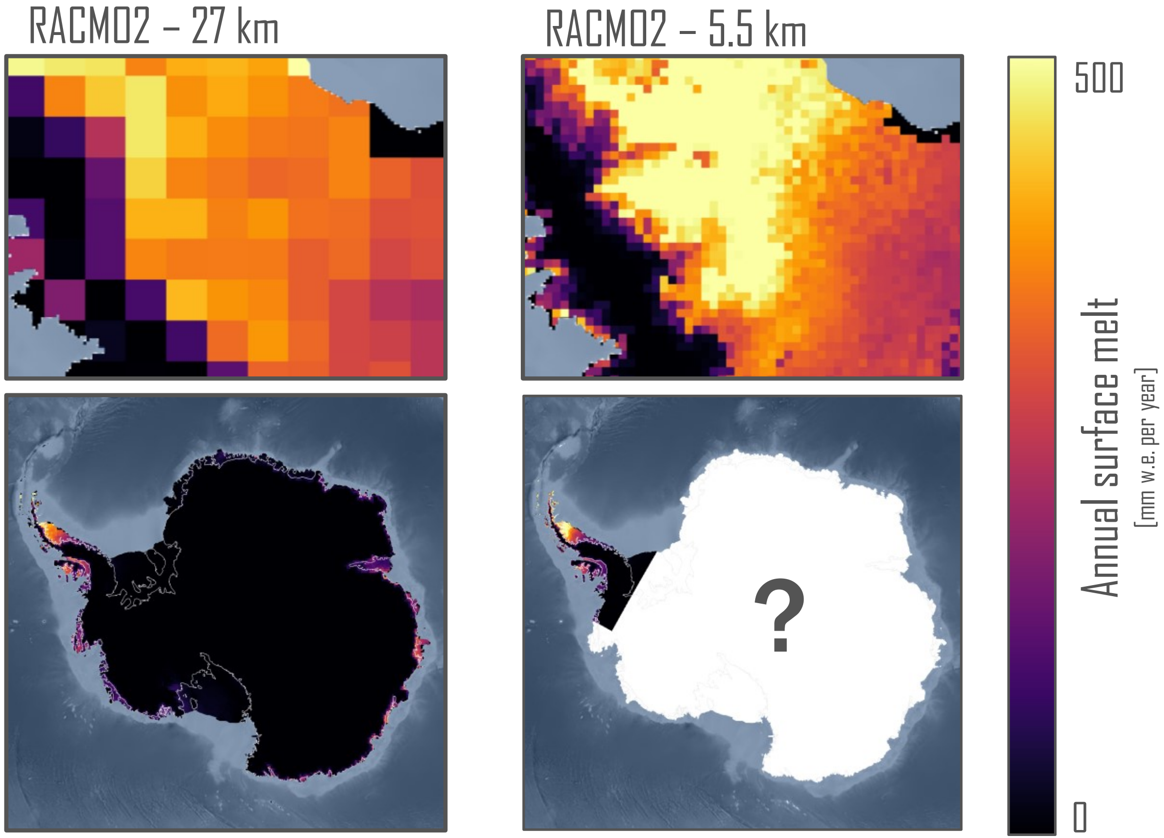
-2

Downscaling model products

High-resolution surface melt

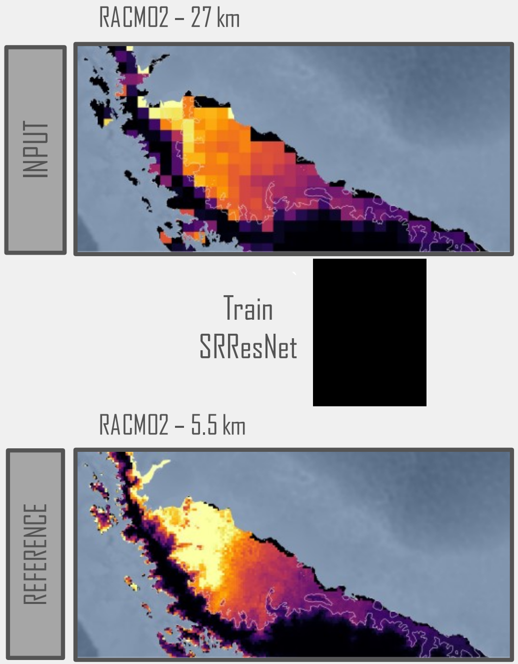


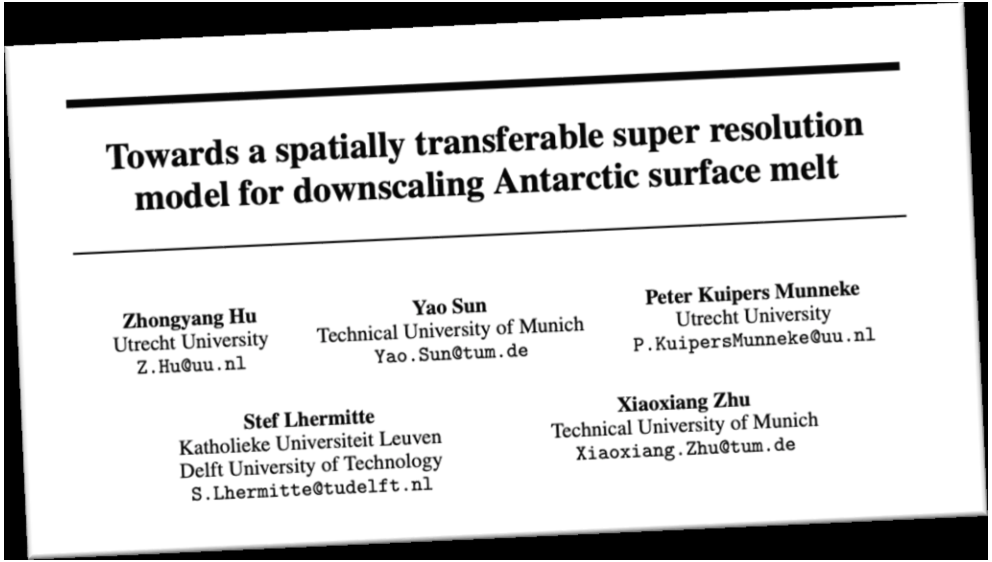
High-resolution surface melt



Super-resolution to "fill the gaps" in RACMO2 5.5 km

Single-image super-resolution
SRResNet





Towards a spatially transferable super resolution model for downscaling Antarctic surface melt

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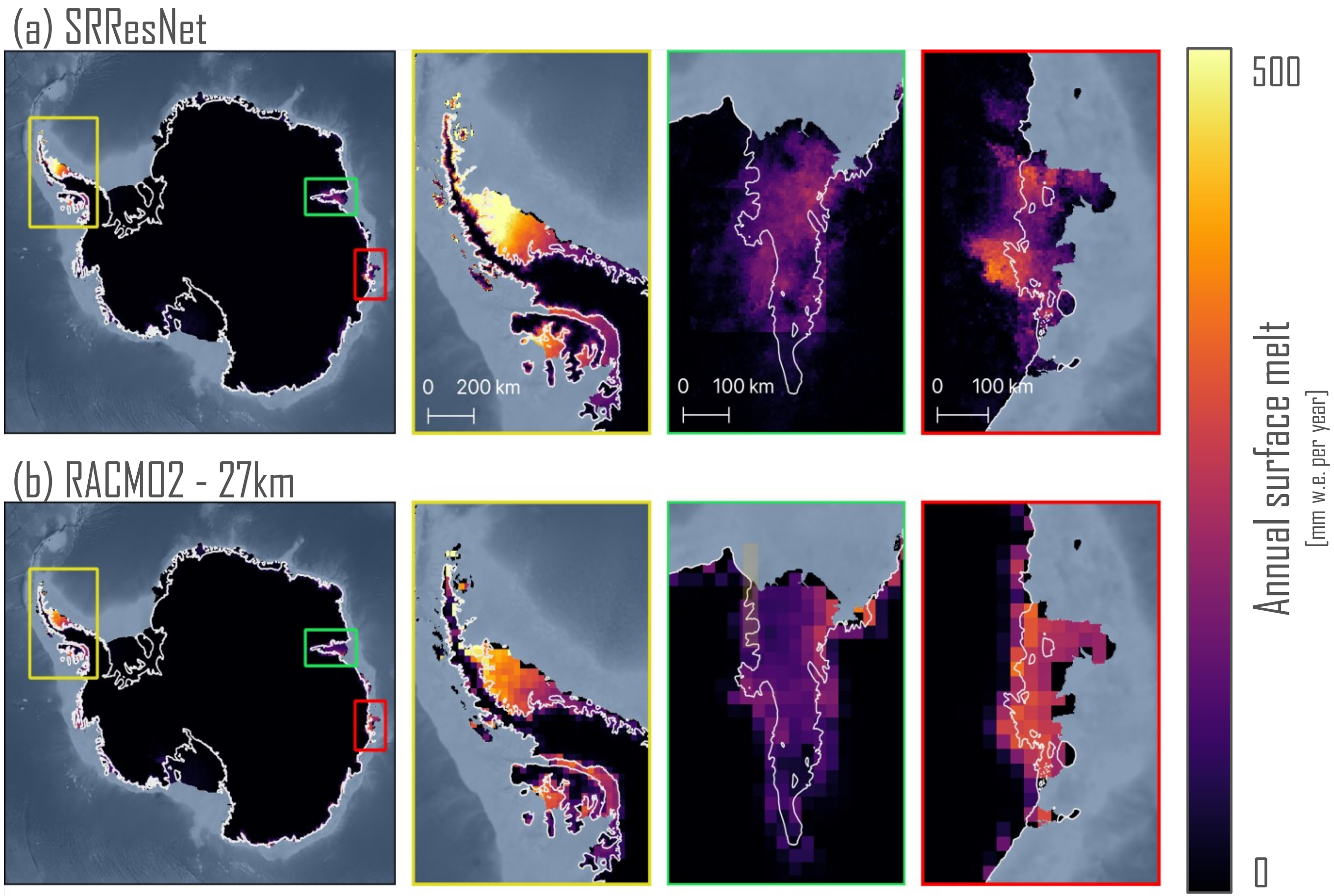
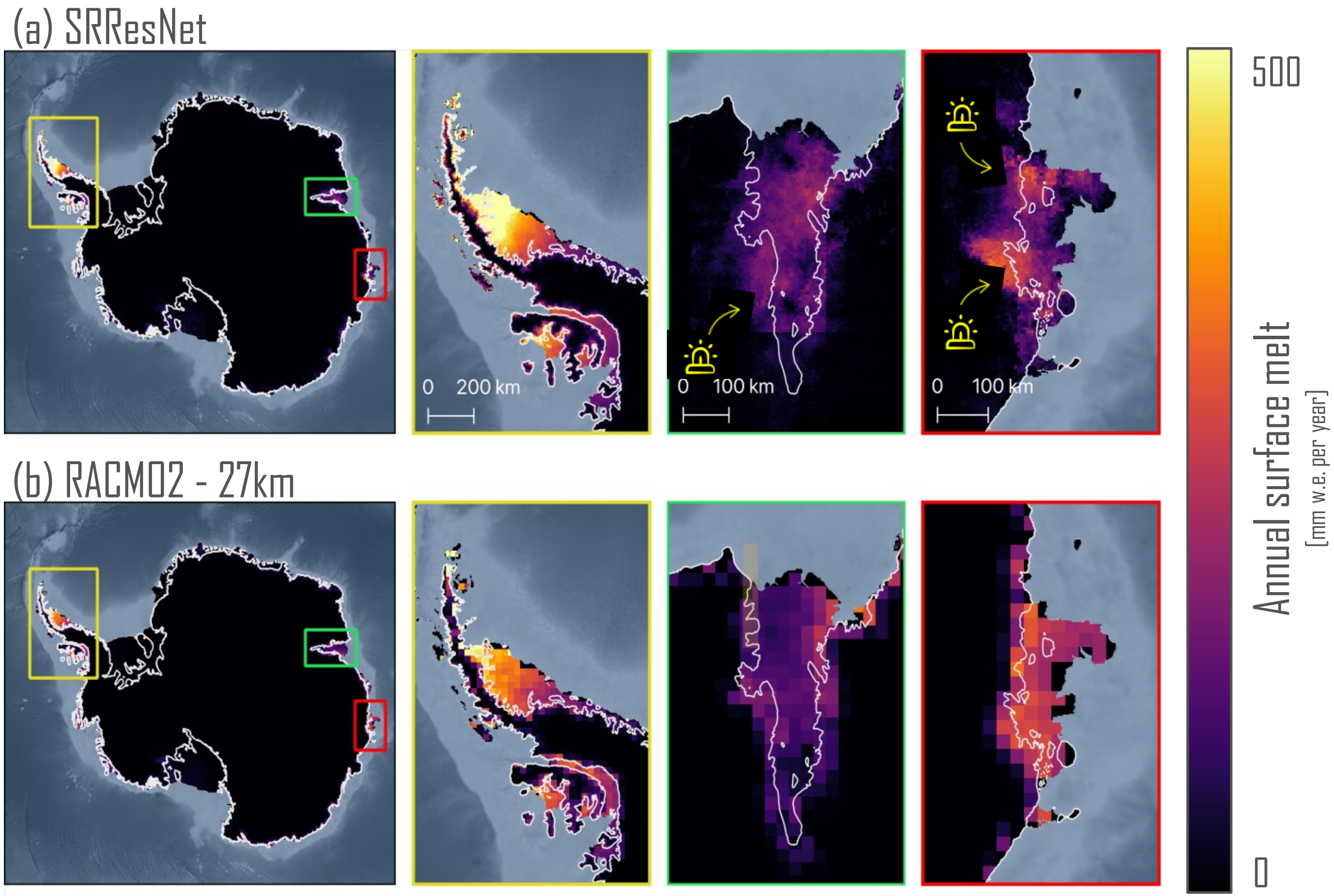
But… the SRResNet model is not transferable

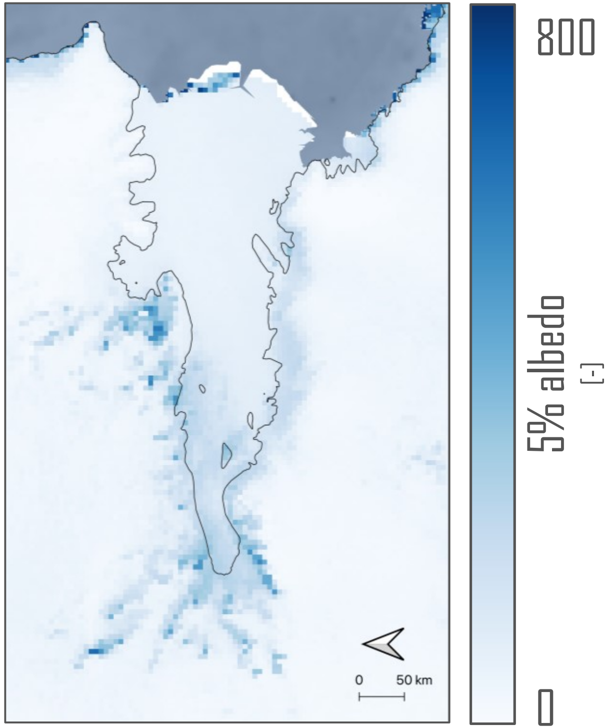


But… the SRResNet model is not transferable

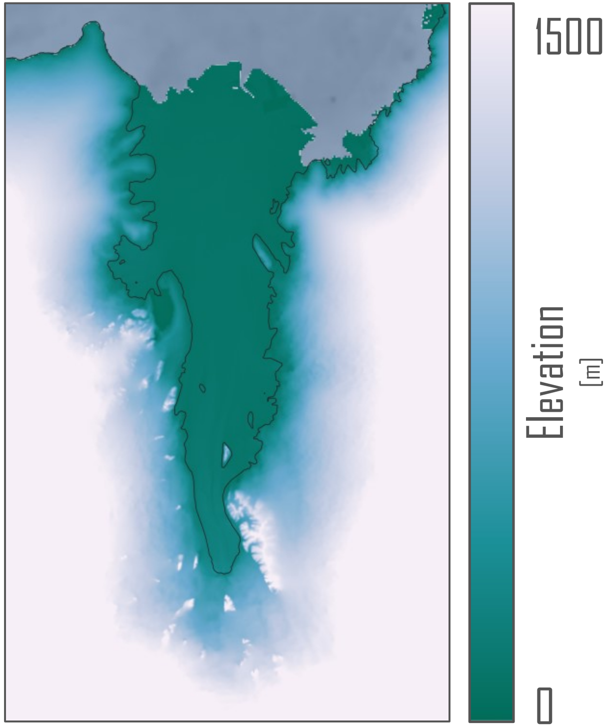


Remote sensing provides information about surface melt

Albedo → Radiation



Elevation → Temperature

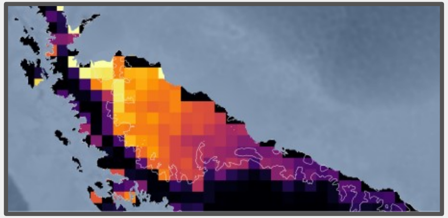


Remote sensing provides information about surface melt

Single-image super-resolution
SRResNet

RACMO2 – 27 km

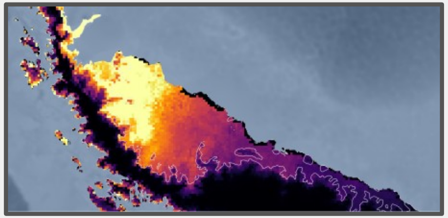
INPUT



Train
SRResNet

RACMO2 – 5.5 km

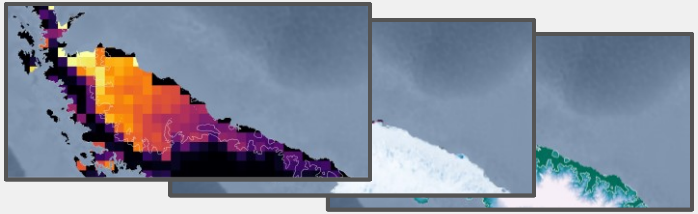
REFERENCE



Multi-image super-resolution
SUPREME

RACMO2 – 27 km + MODIS albedo + Elevation

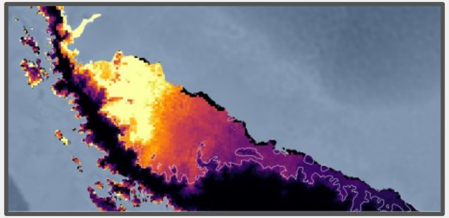
INPUT



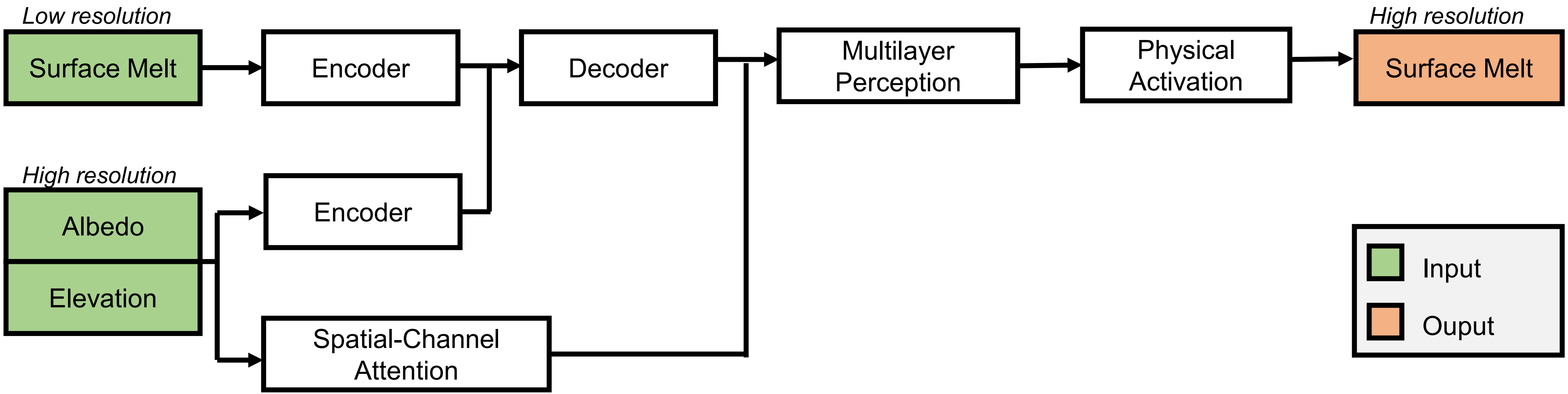
Train
SUPREME

RACMO2 – 5.5 km

REFERENCE



SUPREME model architecture



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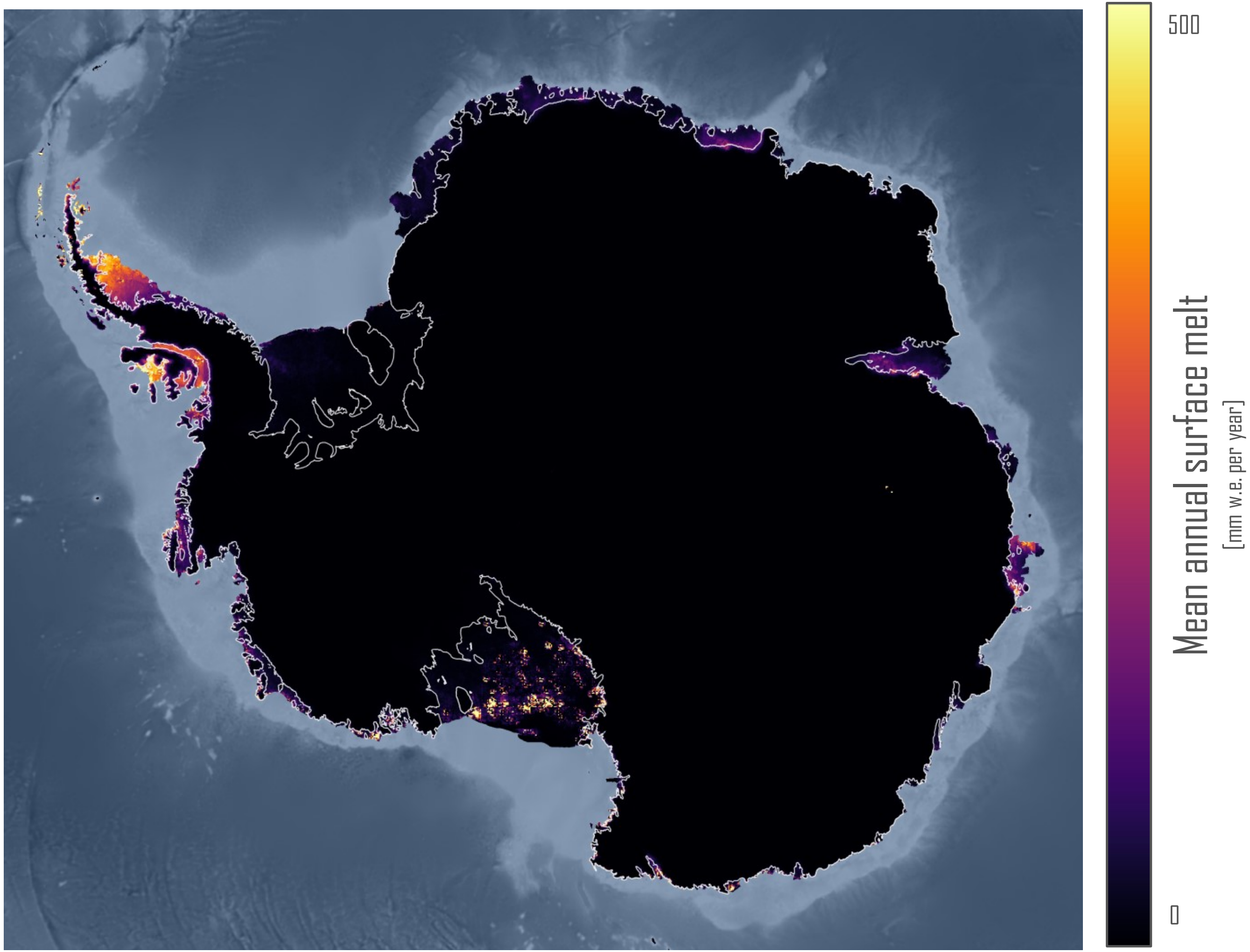
SUPREME
2001-2018



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-3 Model emulation

ML for regional climate modelling

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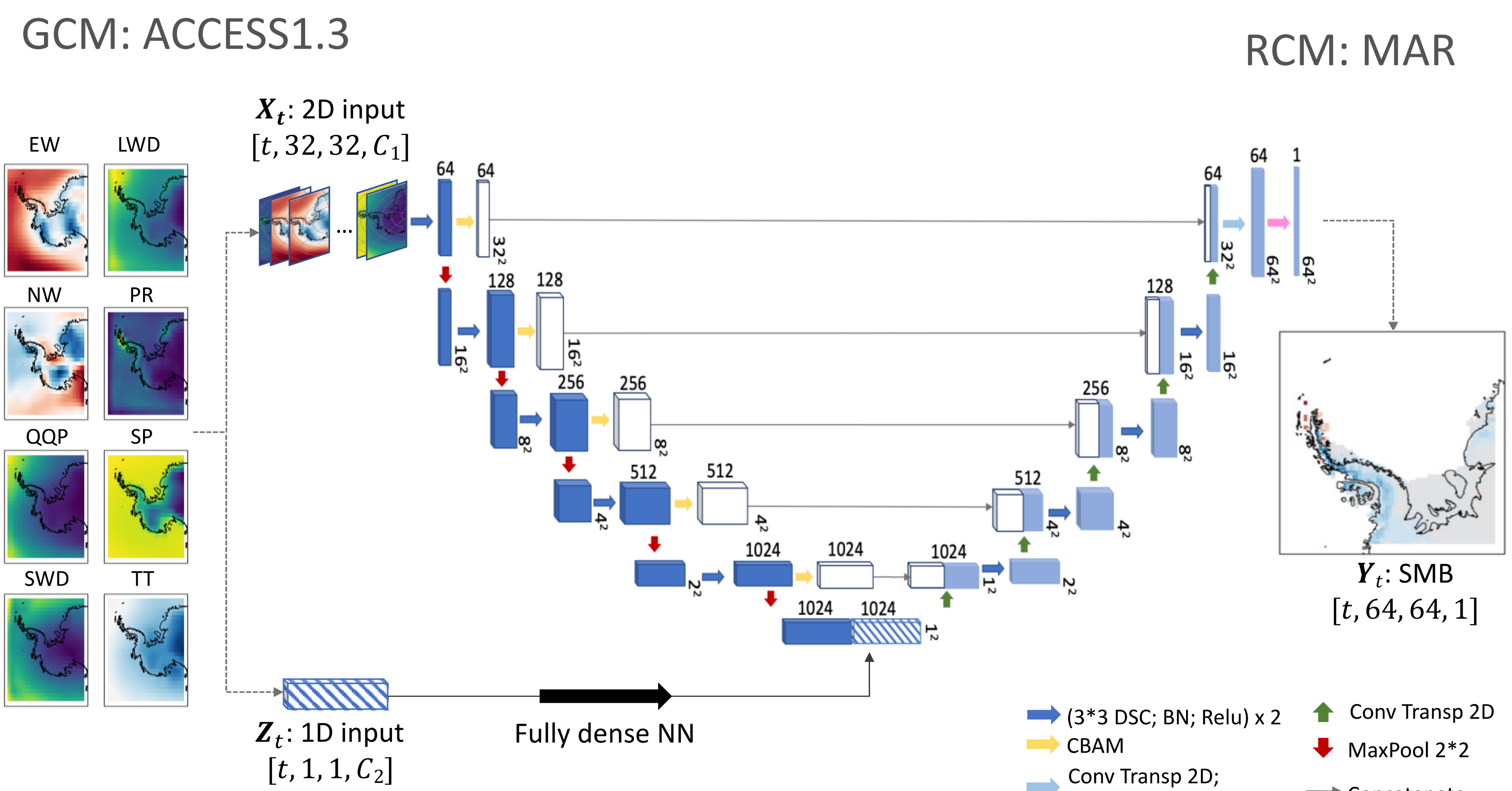
Deep Learning Regional Climate Model Emulators: A Comparison of Two Downscaling Training Frameworks

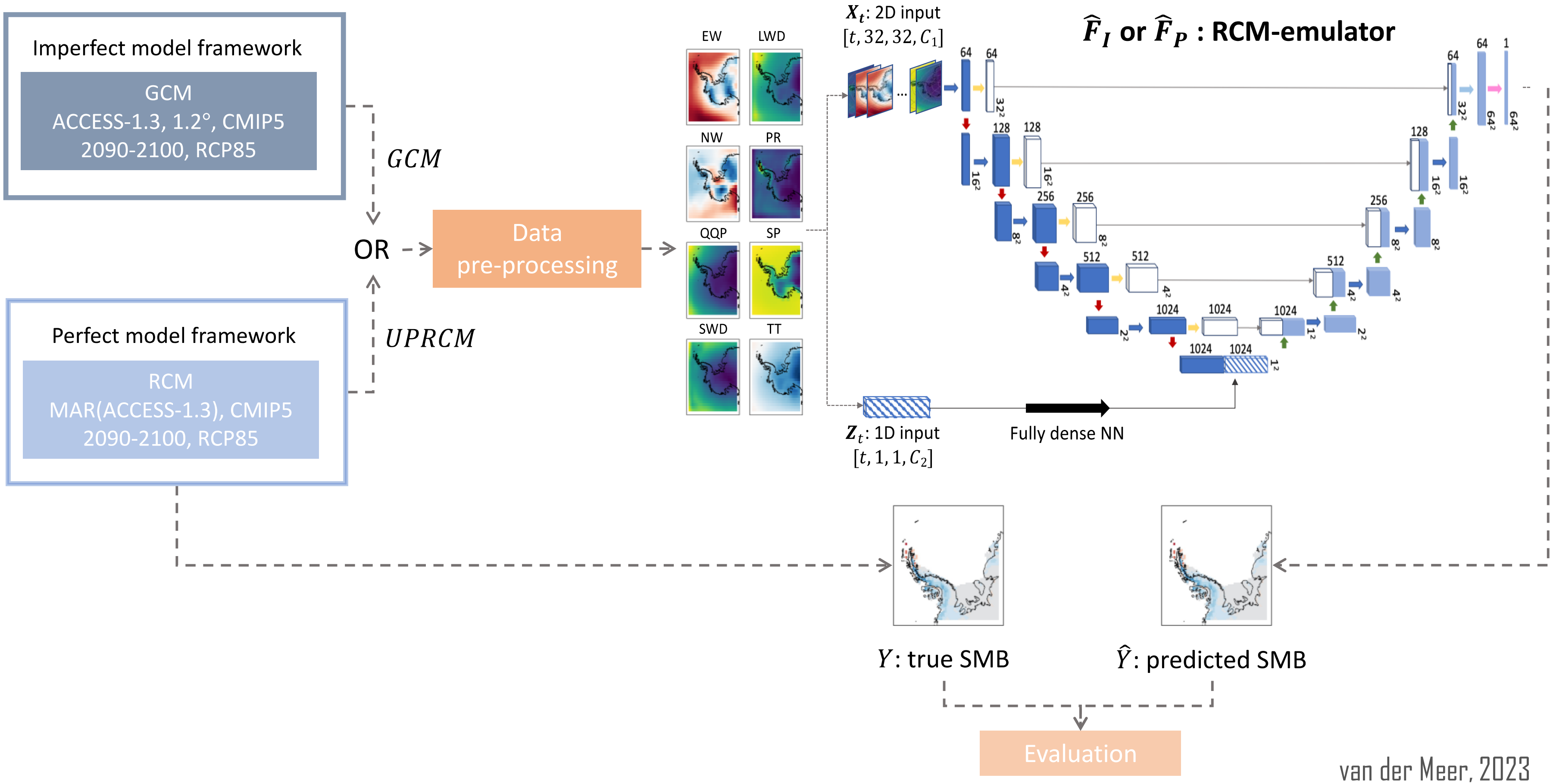
Marijn van der Meer, Sophie de Roda Husman, Stef Lhermitte

First published: 06 June 2023 | https://doi.org/10.1029/2022MS003593

https://doi.org/10.1029/2022MS003593



van der Meer, 2023

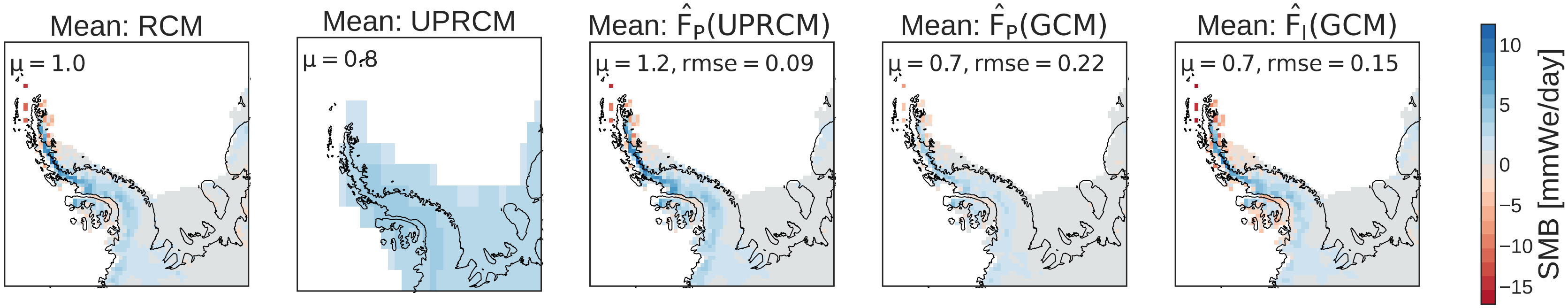


van der Meer, 2023

Emulator reproduces RCM well

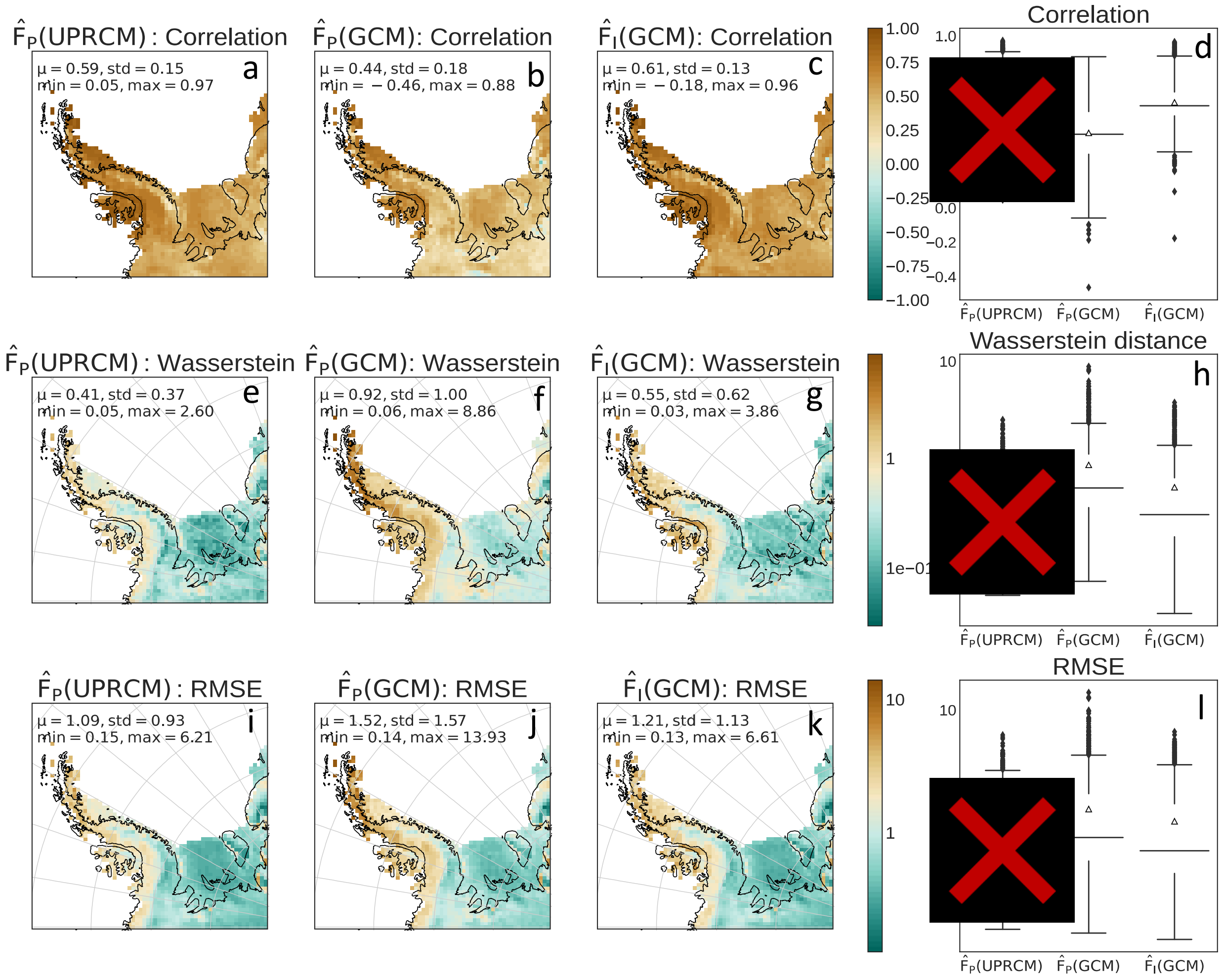
van der Meer, 2023

Emulator reproduces RCM well



van der Meer, 2023

Imperfect framewc wins



van der Meer, 2023

Conclusion

Booming EO products

ML can boost EO/model products even further