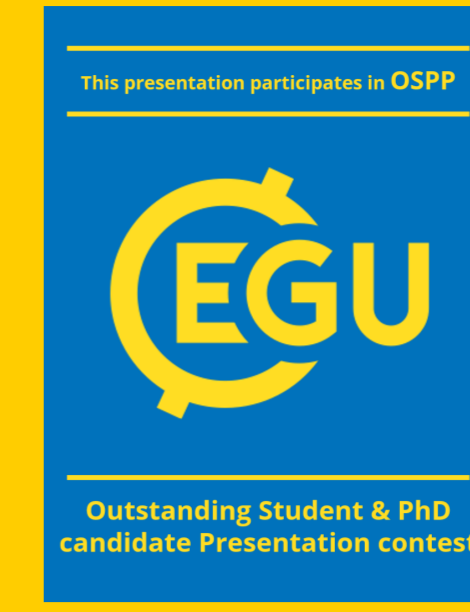


Temperature Trends and Surface Melt on the Antarctic Peninsula between 1979-2024 using RACMO2.4p1



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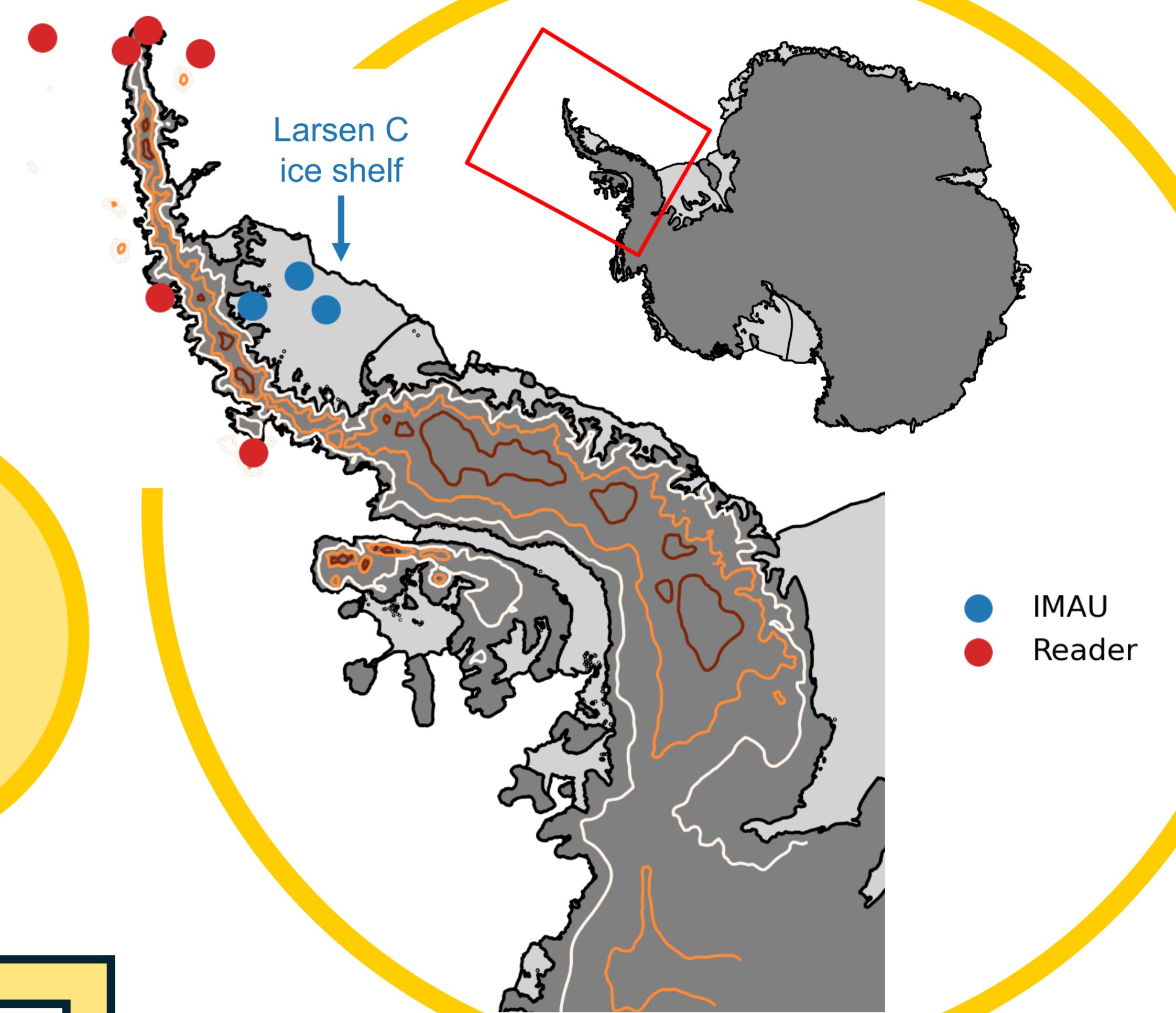
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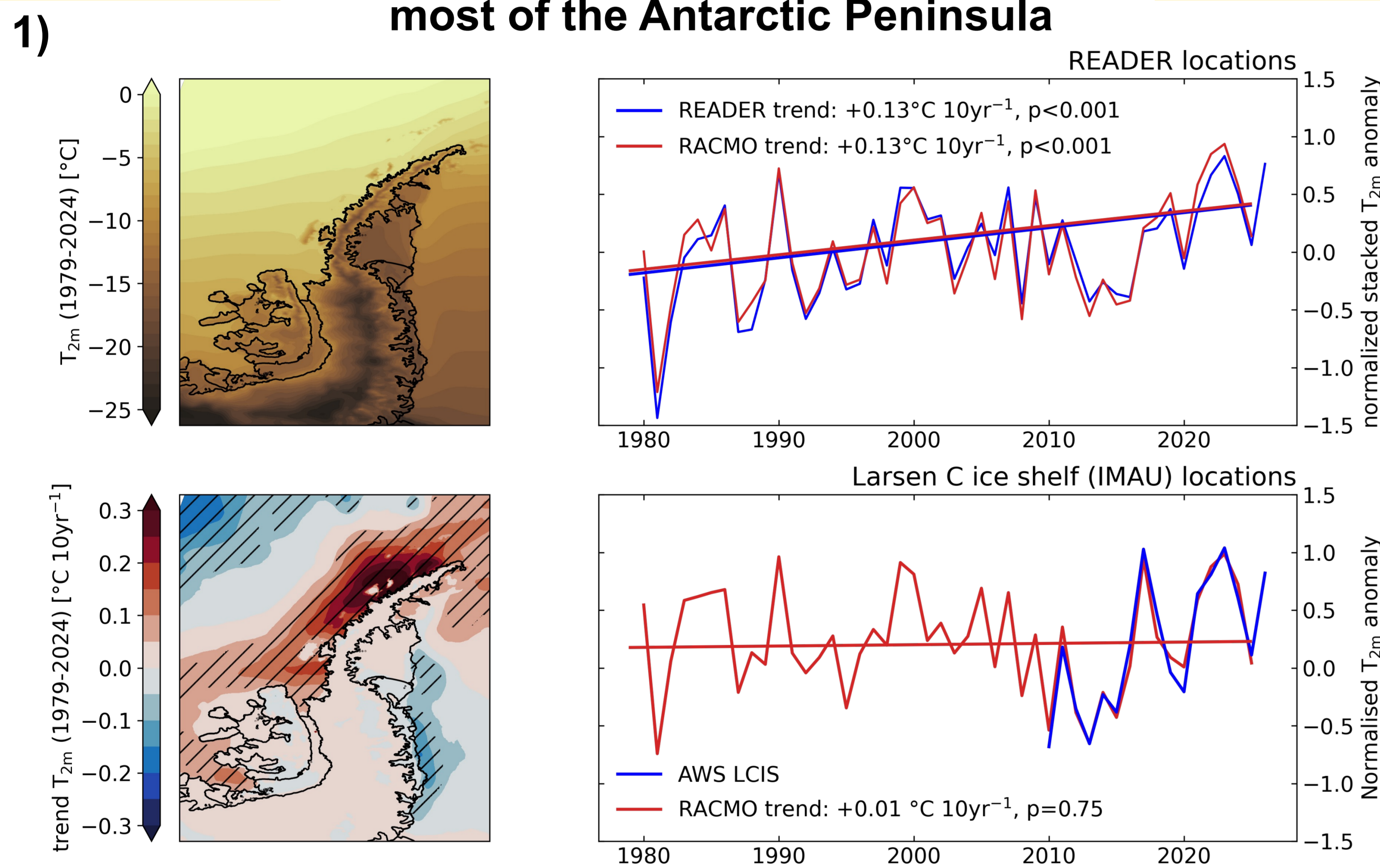
Utrecht University

The Antarctic Peninsula is the warmest region of Antarctica, with ice shelves vulnerable to atmospheric warming fringing its east coast. Accurate surface energy balance (SEB) and surface mass balance (SMB) estimates are essential to study processes such as ice shelf collapse and ice mass loss. We therefore present a novel simulation with RACMO2.4p1¹ of the Antarctic Peninsula at 5.5 km grid resolution for the period 1979-2024. Our objectives for this study are twofold:

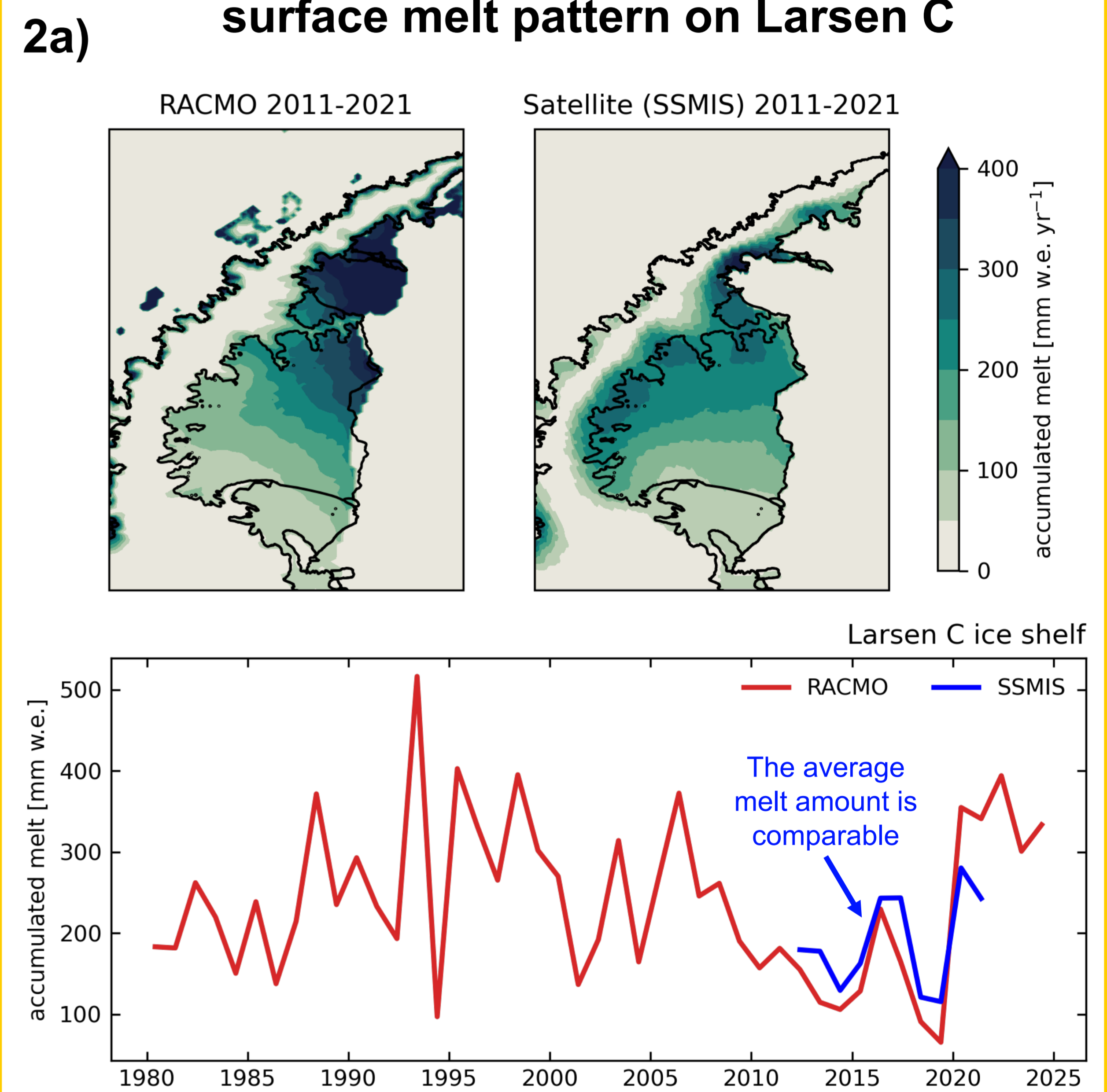
- 1) Evaluate the modeled temperature trends using observations (READER dataset² and IMAU automatic weather stations³) and study their spatial heterogeneity.
- 2) Explain the mismatch between the modeled and observed spatial pattern of surface melt (IMAU AWS and SSMIS data⁴) on the Larsen C ice shelf.



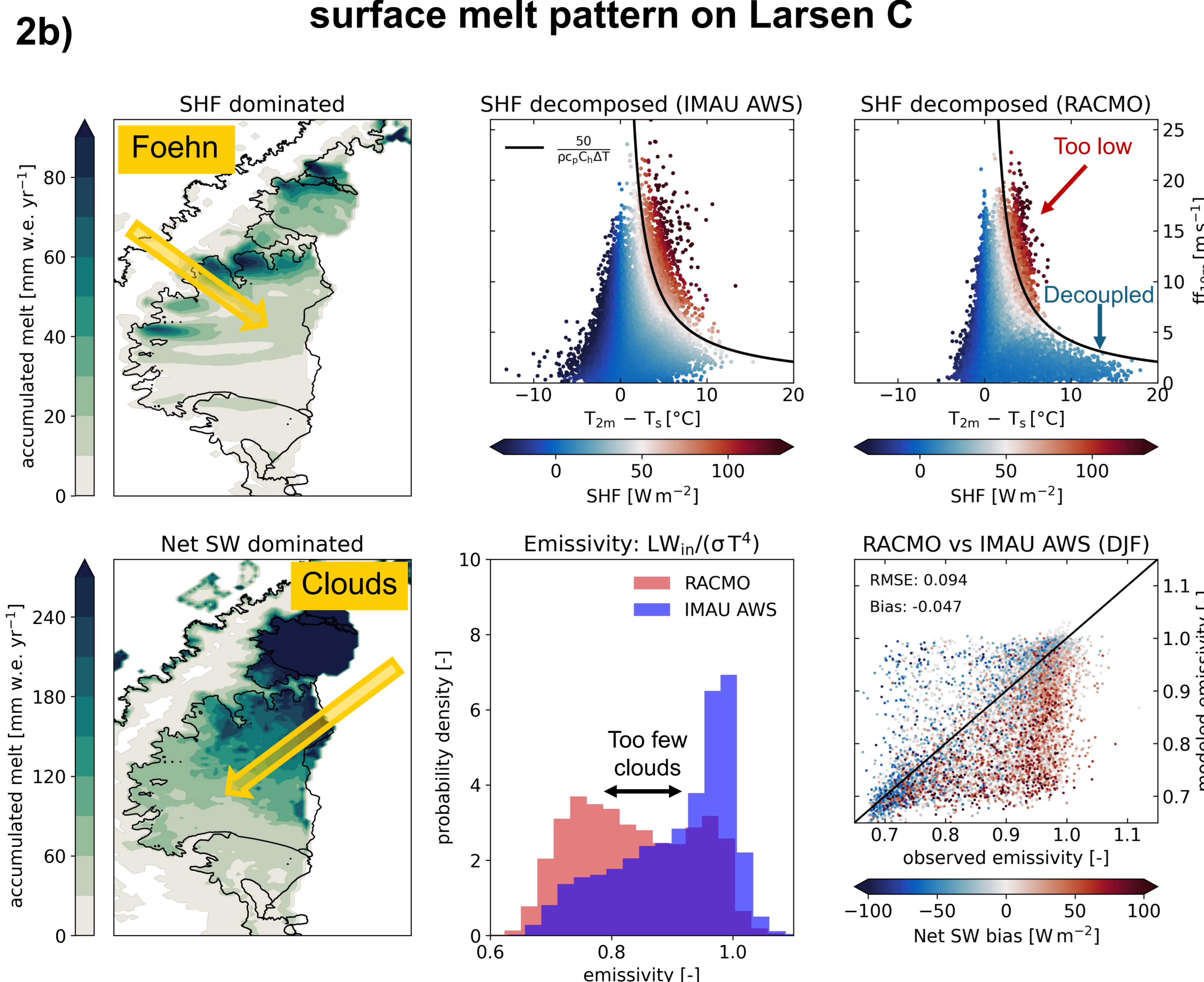
No significant air temperature trend on most of the Antarctic Peninsula



Mismatch in modeled and observed surface melt pattern on Larsen C



Foehn winds and clouds dominate the surface melt pattern on Larsen C



Key points

- ▶ RACMO captures the observed temperature trends well and shows that **most of the Antarctic Peninsula has not warmed significantly between 1979-2024** due to substantial interannual variability.
- ▶ **Foehn induced melt is not strong enough in RACMO**, which causes too little melt along the mountain ridge and is related to underestimated sensible heat flux.
- ▶ **Melt induced by variational cloud cover is too strong in RACMO**, which causes too much melt in the northeast and is related to an overall underestimated cloud cover.

Presentation page:



¹We use the same model version as presented and evaluated in van Dalum, C. T. et al.: *The surface mass balance and near-surface climate of the Antarctic ice sheet in RACMO2.4p1*, *The Cryosphere*, 19, 4061–4090, 2025

²See Turner, J. et al.: *The SCAR READER Project: Toward a High-Quality Database of Mean Antarctic Meteorological Observations*. *Journal of Climate*, 17(14), 2890–2898, 2004

³See van Tiggelen, M. et al.: *Institute for Marine and Atmospheric Research Utrecht (IMAU) Antarctic automatic weather station data, including surface radiation balance (1995–2022)*, *Earth Syst. Sci. Data*, 17, 4933–4955, 2025.

⁴19 GHz Special Sensor Microwave Imager/Sounder (SSMIS) data from Di Biase, V. et al.: *Estimating Antarctic surface melt rates using passive microwave data calibrated with weather station observations*, *The Cryosphere*, 20, 87–96, 2026

