# Supplementary to Exposure to Underestimated Channelized Melt in Antarctic Ice Shelves

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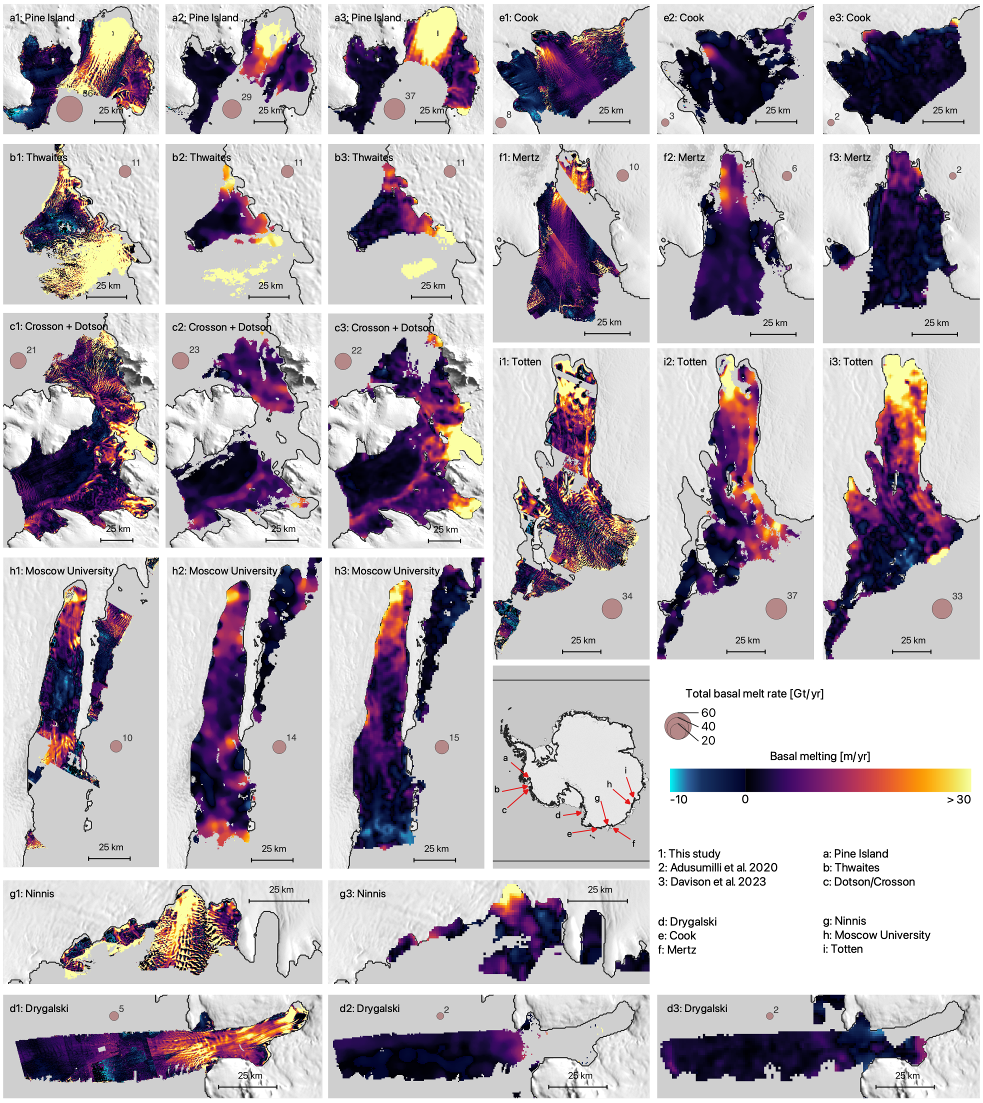
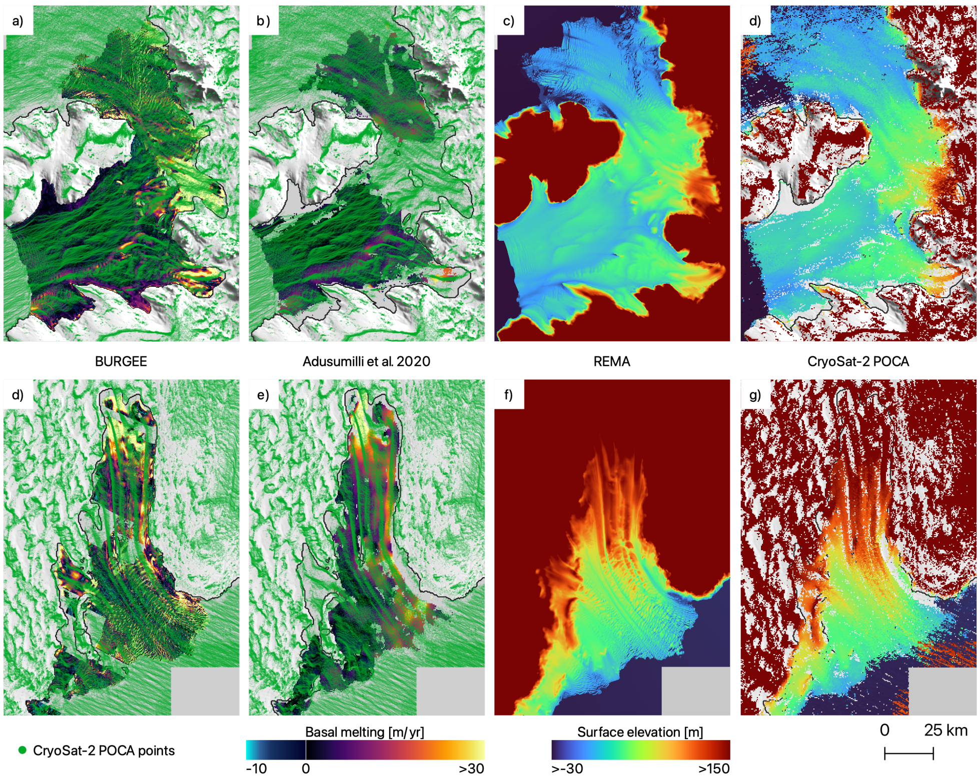
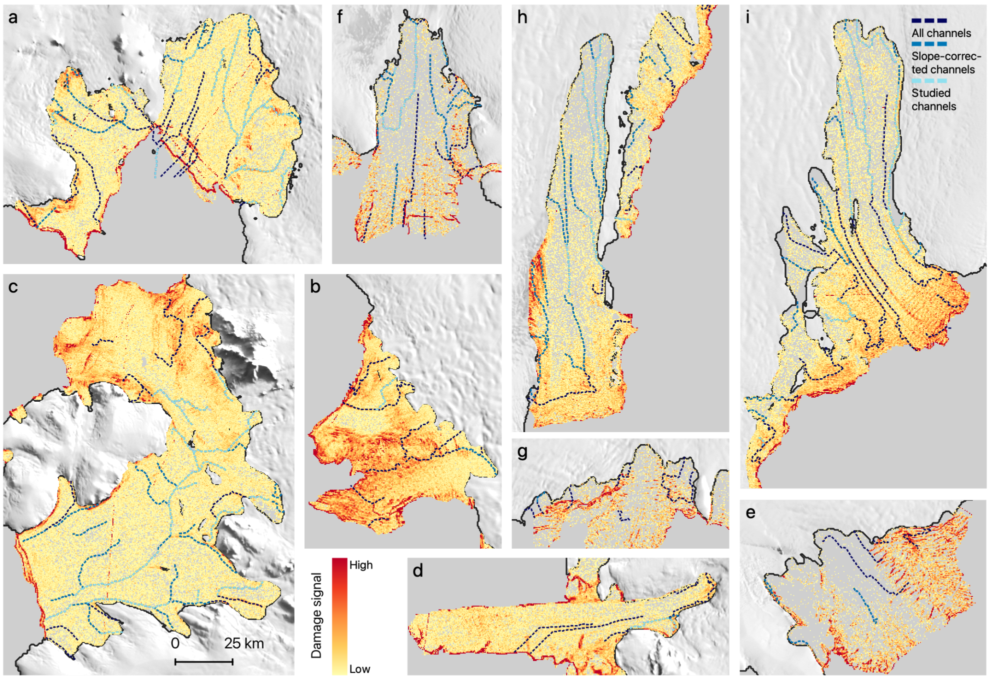


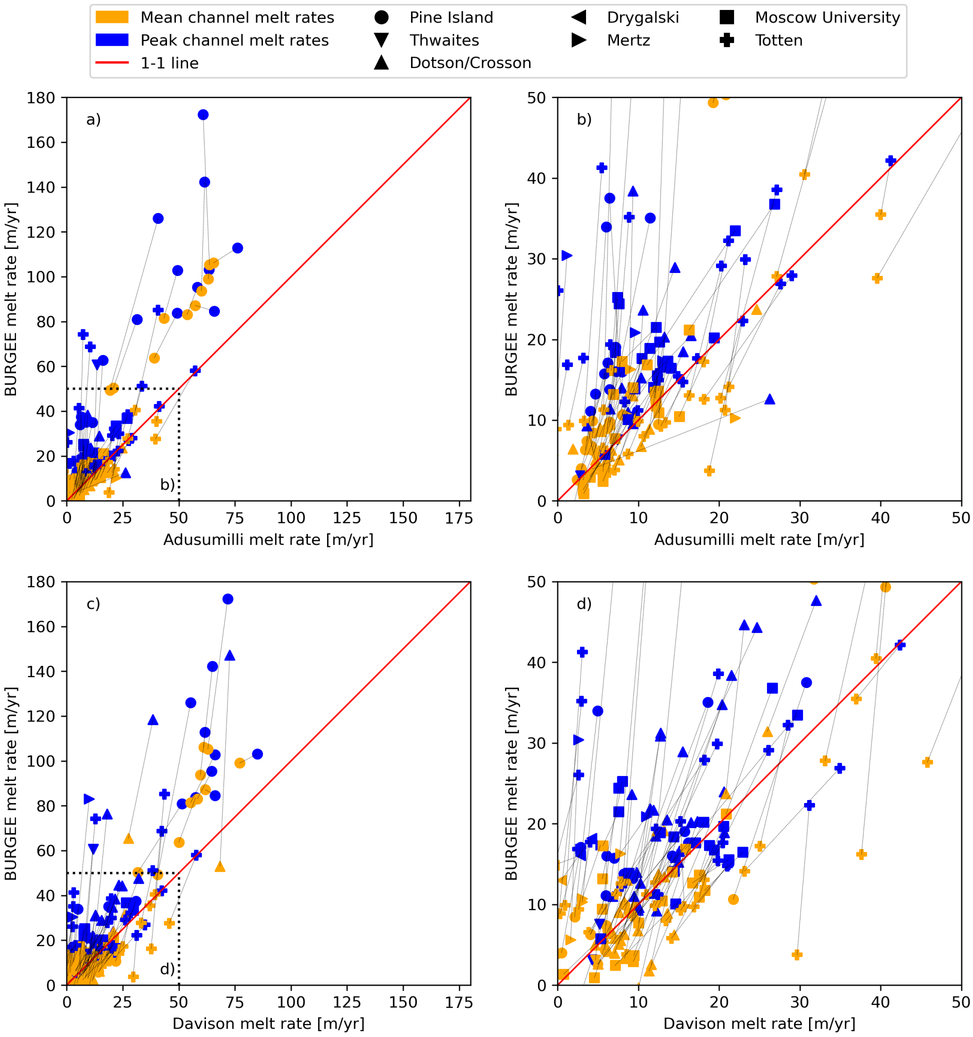

**Suppl. Fig. 1 Basal melt rate trend.** Basal melt rates from this study are marked with 1, from Adusumilli[1] with 2, and from Davison[2] with 3. The Ninnis ice shelf (g) is not covered by [1]. The black line denotes the BedMachine V3 grounding line[3]. The circles denote total ice-shelf wide basal melt rate in Gt/yr, only considering areas covered by both BURGEE, Adusumilli,[1] and Davison[2].



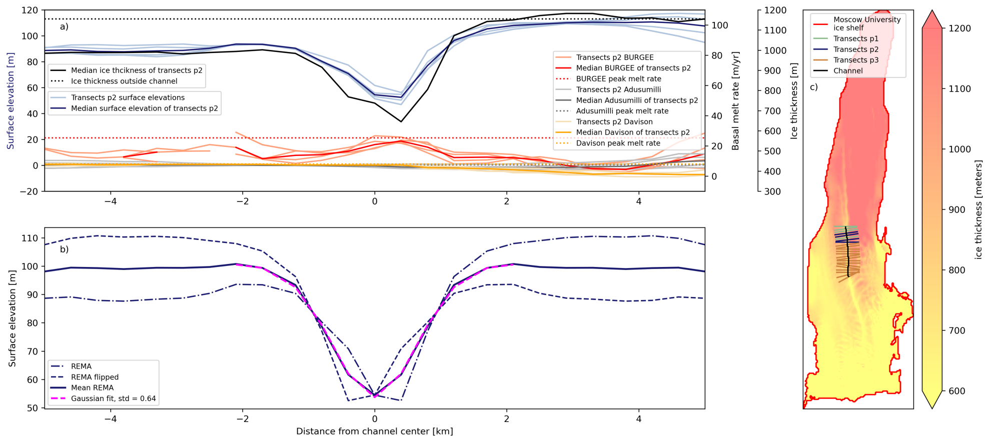

**Suppl. Fig. 2 CryoSat-2 point-of-closest-approach and REMA coverage.** a) and d) Dotson and Totten ice shelves, respectively, with BURGEE melt rates and CryoSat-2 points. b) and e) Dotson and Totten ice shelves, respectively, with Adusumilli[1] melt rates and CryoSat-2 points. c) and f) REMA mosaic surface elevation of Dotson and Totten, respectively. d) and g) CryoSat-2 point-of-closest-approach elevations of Dotson and Totten, respectively.




**Suppl. Fig. 3** **Damage.** Ice shelf average damage map from 2015-2018[4] overlaid with detected channels.




**Suppl. Fig. 4 Mean and peak channel melt rates.** Mean and peak channel melt rates comparing BURGEE to Adusumilli[1] (a and zoom-in in b) and Davison[2] (c and zoom-in in d).




**Suppl. Fig. 5 Channel transects and Gaussian fitting.** a) Ice thickness, surface elevation and basal melt rates of transects p2 as shown in c) The peak melt rates are the 90 percentiles of all the transect p2 melt rates within $\pm 2$ km of the channel center. The mean melt rate is the mean of the median melt rate profile. The ice thickness outside of the channel is defined as the 80 percentile of the median ice thickness profile. b) Example of Gaussian fitting of the transect p2 parts of the channel shown in c) using the mean elevation profile of the surface elevation and its' flipped version. The channel width is defined as one standard deviation. c) Example of a channel, its' transects and transact division based on ice thicknesses on Moscow University ice shelf with BedMachineV3 ice thicknesses below. The channel thickness difference of this channel is between 200-300 m, and then channel transects are therefore grouped into three different groups. Group p1: channels with a channel ice thickness in between $H_{max}$ and $H_{max} - \frac{H_{max}-H_{min}}{3}$, where $H_{max}$ is the maximum channel thickness and $H_{min}$ is the minimum channel thickness. Group p2: channels with a channel ice thickness in between $H_{max} - \frac{H_{max}-H_{min}}{3}$ and $H_{max} - \frac{H_{max}-H_{min}}{2}$. Group p3: channels with a channel ice thickness in between $H_{max} - \frac{H_{max}-H_{min}}{2}$ and $H_{min}$.

**Table 1** Updates made to BURGEE v2.

| Component | BURGEE v1 | BURGEE v2 |
|---|---|---|
| REMA tides | 6-hourly basis | Using sourceImage1 timestamp |
| CryoSat-2 latitudinal and longitudinal criteria | CryoSat-2 points furthest apart from each other in the latitudinal and longitudinal directions are required to be separated by at least 60 km and 10 km | CryoSat-2 coverage in both the latitudinal and longitudinal directions of at least 75% of the distance of the REMA strip in both directions |
| CryoSat-2 coverage criteria | Minimum 80 CryoSat-2 points per REMA strip | Minimum 80 CryoSat-2 points per REMA strip or a percental coverage of at least 5% |
| Reference image for feature tracking | Median of the DEMs from the last year | Median of the 2015-07-01 – 2017-07-01 DEMs |
| Lagrangian displacement | Of the yearly median elevation maps | Strip-per-strip basis |

# References


[1] Adusumilli, S., Fricker, H. A., Medley, B., Padman, L. & Siegfried, M. R. Interannual variations in meltwater input to the Southern Ocean from Antarctic ice shelves. *Nature Geoscience* **13**, 616–620 (2020). URL http://dx.doi.org/10.1038/s41561-020-0616-zhttps://www.nature.com/articles/s41561-020-0616-z.

[2] Davison, B. J. *et al.* Annual mass budget of Antarctic ice shelves from 1997 to 2021. *Science Advances* **9** (2023). URL https://www.science.org/doi/10.1126/sciadv.adi0186.

[3] Morlighem, M. MEaSUREs BedMachine Antarctica, Version 3 [Data Set]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. (2022). URL https://nsidc.org/data/NSIDC-0756/versions/3.

[4] Izeboud, M., Lhermitte, S., de Roda Husman, S. & Wouters, B. Antarctic ice shelves vulnerable to damage in future climate warming. *Nature Climate Change [in review], NCLIM-24010280-T* (2024).