Supplementary information for

Investigating the impacts of ice shelf thickness variations on grounding zone change at Thwaites Glacier

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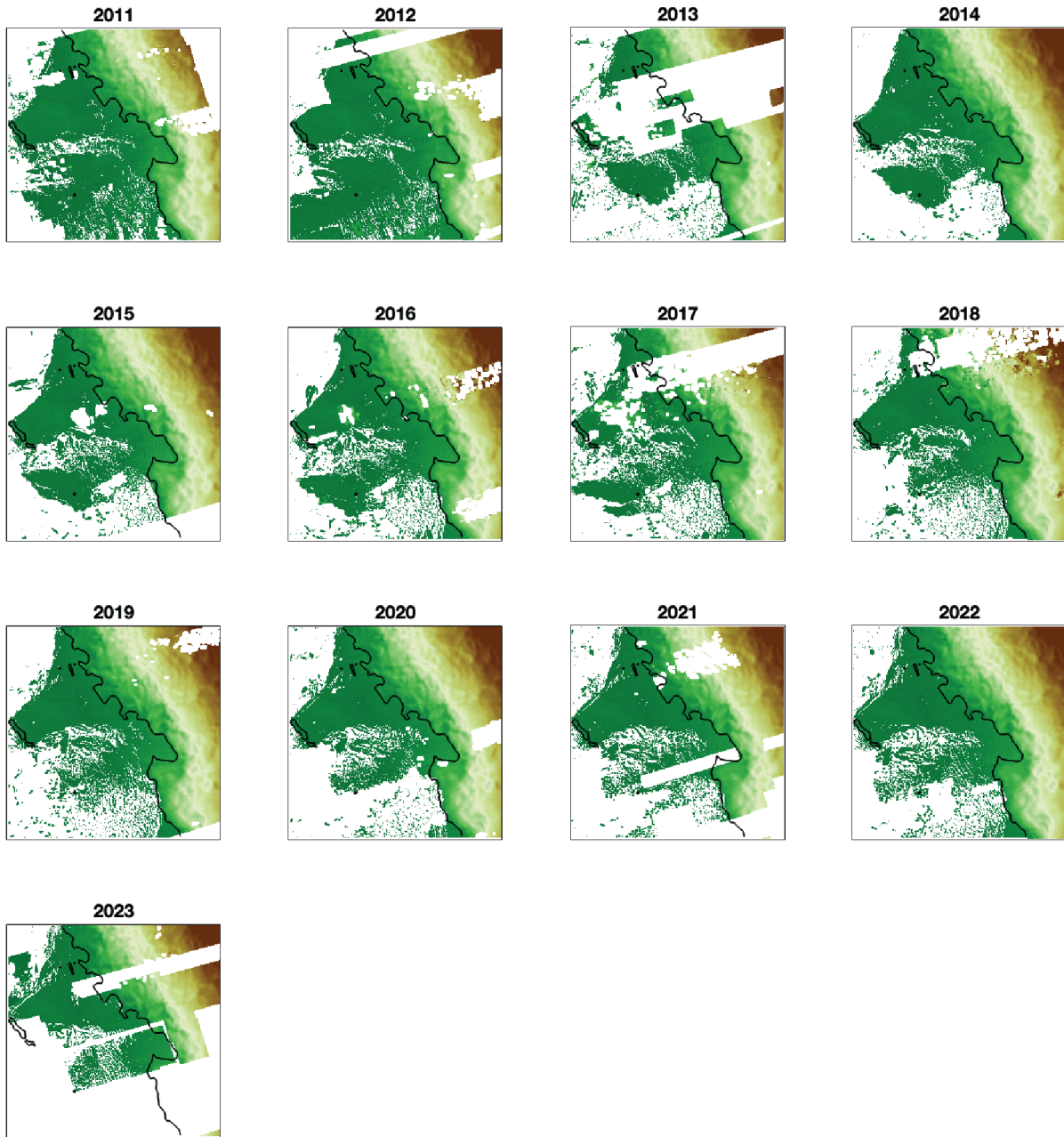
Supplemental Figures
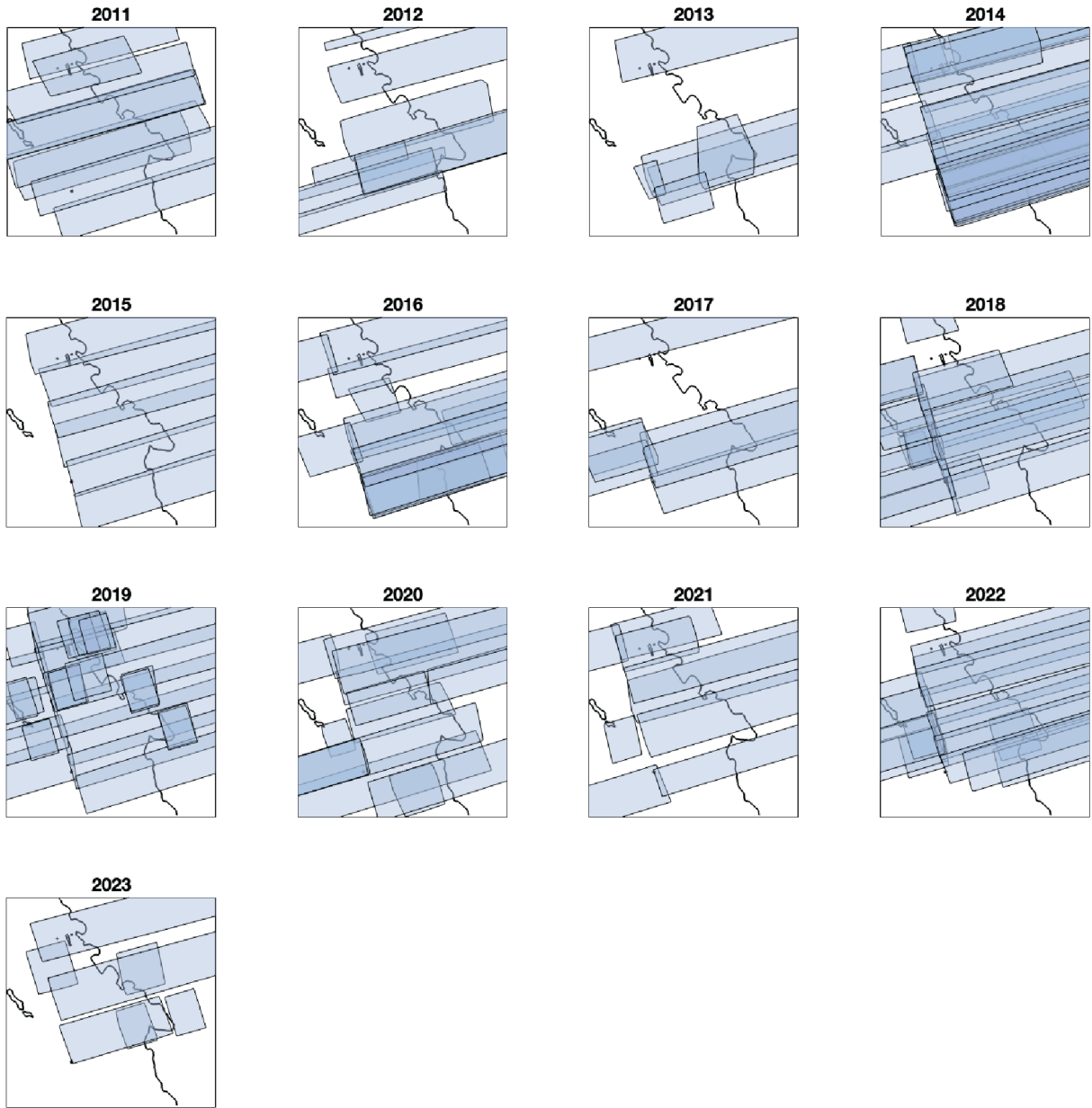
Fig. S1. Annual Mosaic Coverage.

Figure S2. Annual coverage for Thwaites Glacier and the TGIS, showing strips that were registered and used to locate HB and surface depressions/basal channels.
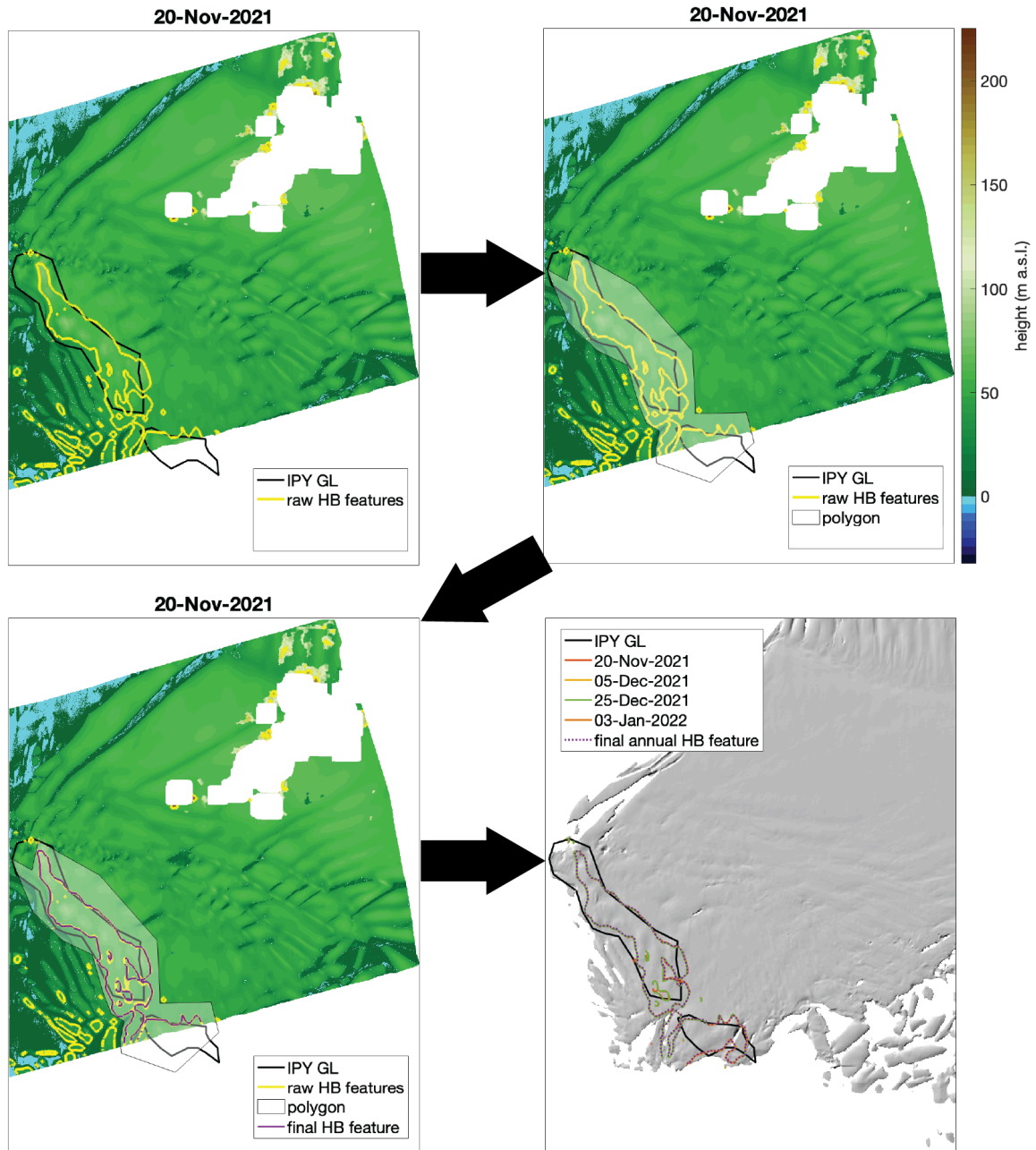
Figure S3. Workflow for manually delineating HB features (Section 3.1). (a) Step 1: plot all HB features automatically detected in the strip (yellow curve). (b) Step 2: manually draw a polygon around the features within the region of interest (here, Pinning Points 4 and 5 as seen in the IPY GL (black curve)). (c) Eliminate features outside the polygon and any with fewer than 25 points to obtain a final HB feature for that strip (purple curve). (d) Step 4: plot all HB features from each year (colored curves) and manually delineate the most consistent, continuous HB (purple dashed curve) from the combination of all HBs from that year.
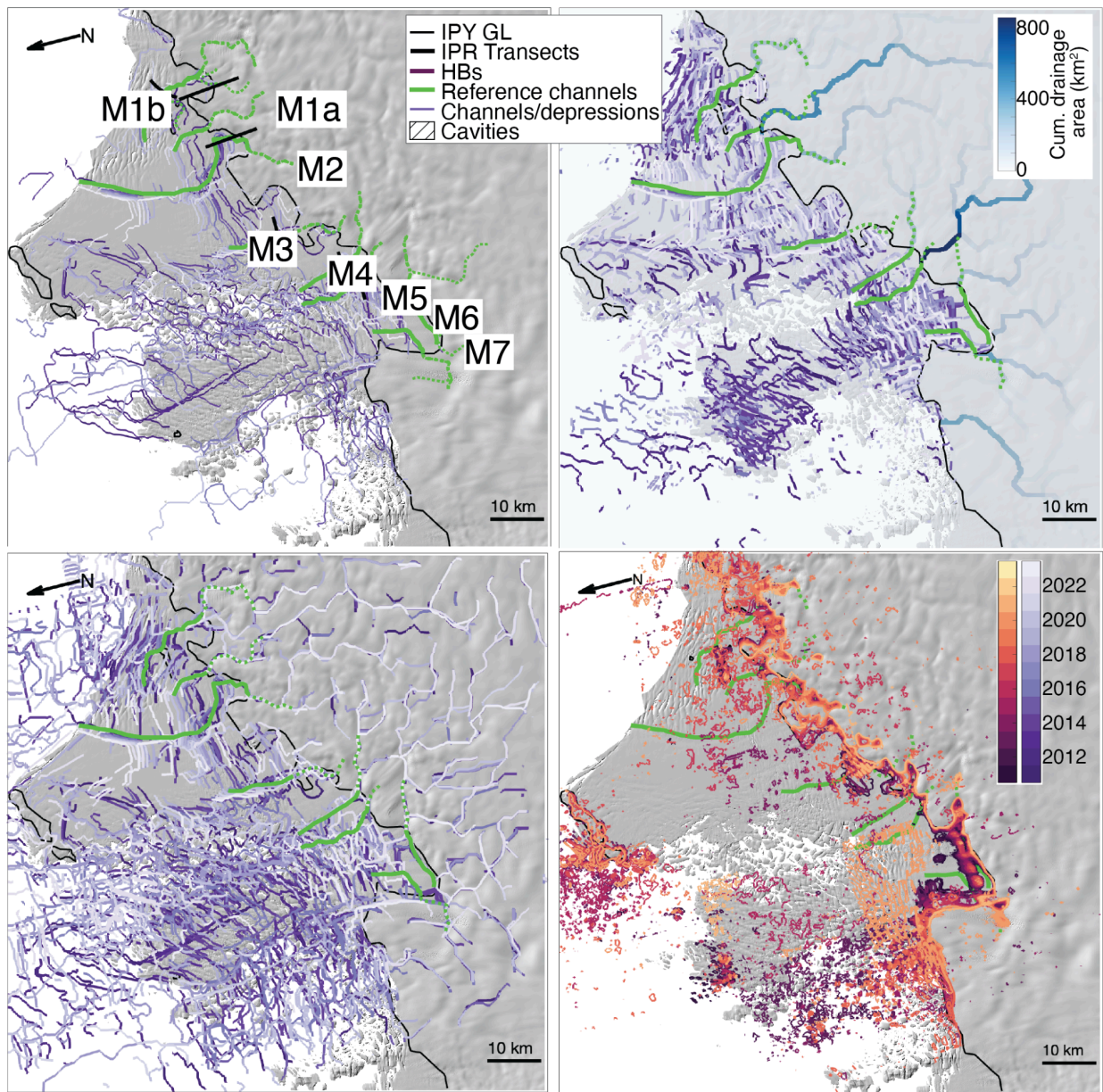
Figure S4. Strip-derived instances of surface depressions (a, b) and basal channels (c). (a) shows filtered surface depressions and the locations of OIB transects M1a – M7 along which MCoRDS radar measurements were used to verify the presence of basal channels (Fig. S4). (b) and (c) show unfiltered instances of surface depressions and basal channels, respectively, and (d) shows unfiltered instances of the HBs.
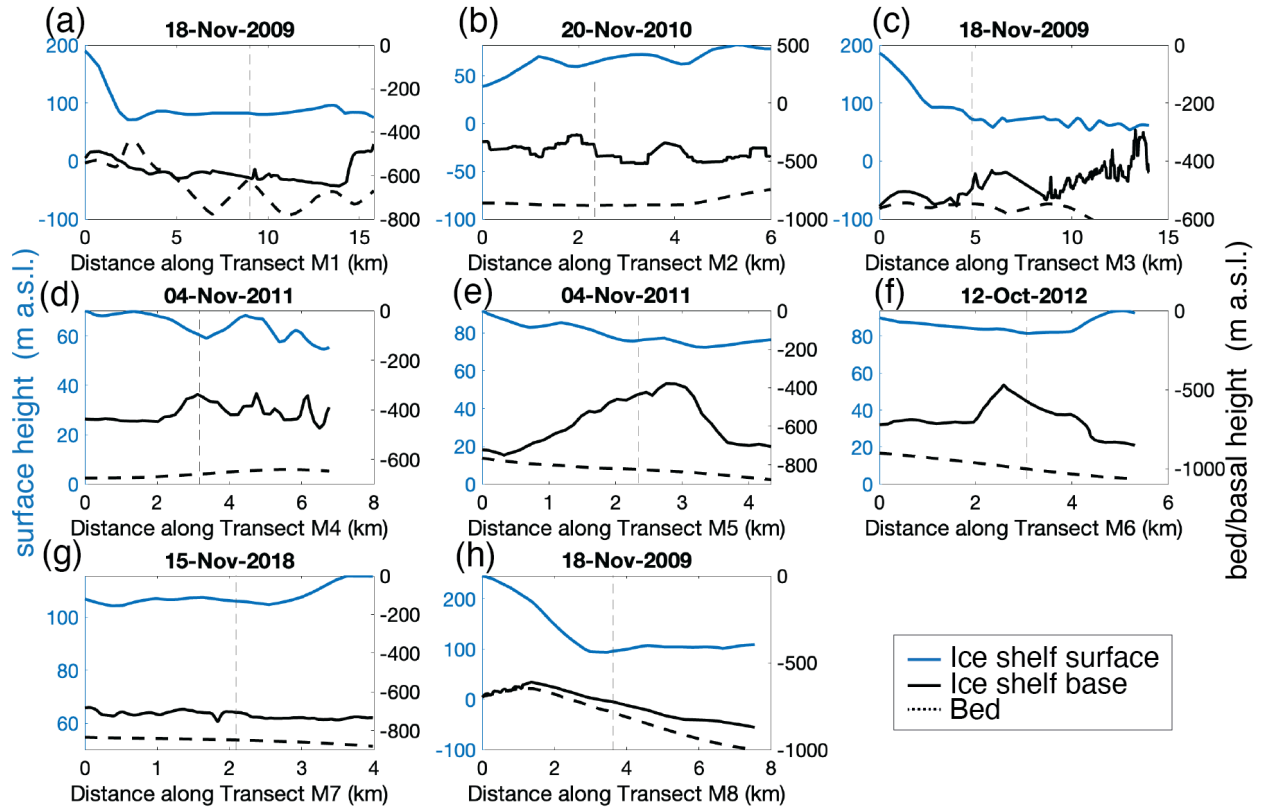
Fig. S5. Selected IceBridge transects intersecting each basal channel, showing ATM ice surface height (blue), ice basal height (orange; equal to ATM surface height minus MCoRDS thickness), and BedMachine bed height (black). The start of each transect is labeled on Fig. S3a.
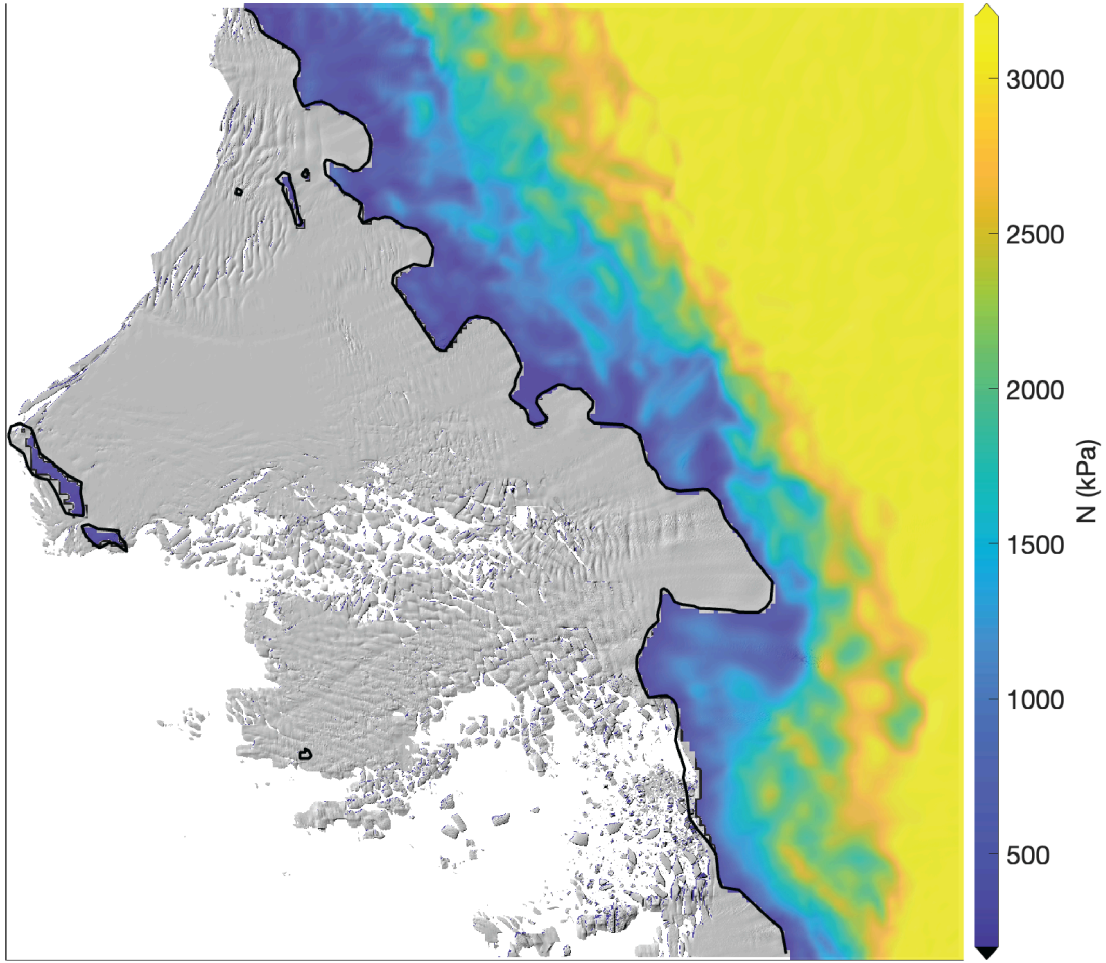
Fig. S6. Grounded ice shows subglacial hydraulic potential; floating ice shows hillshade.
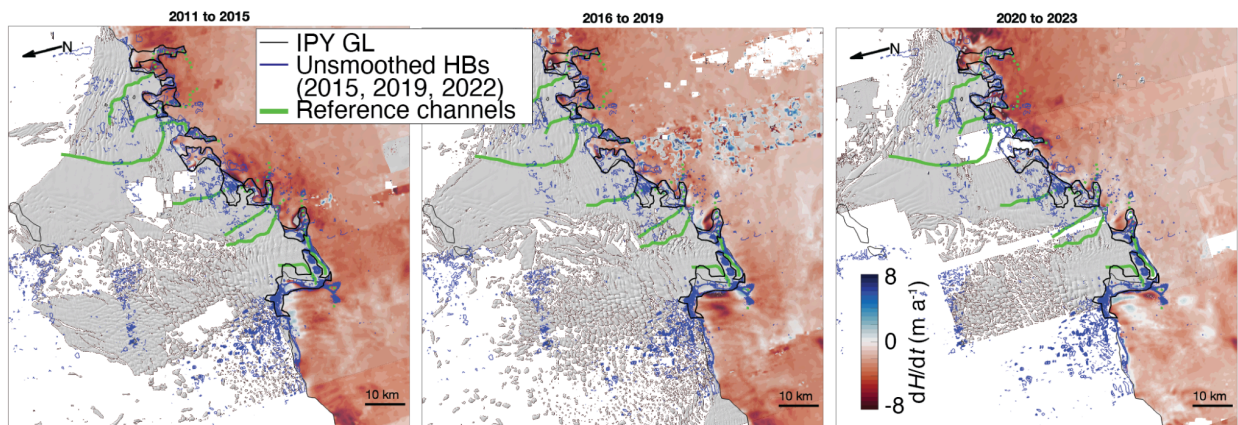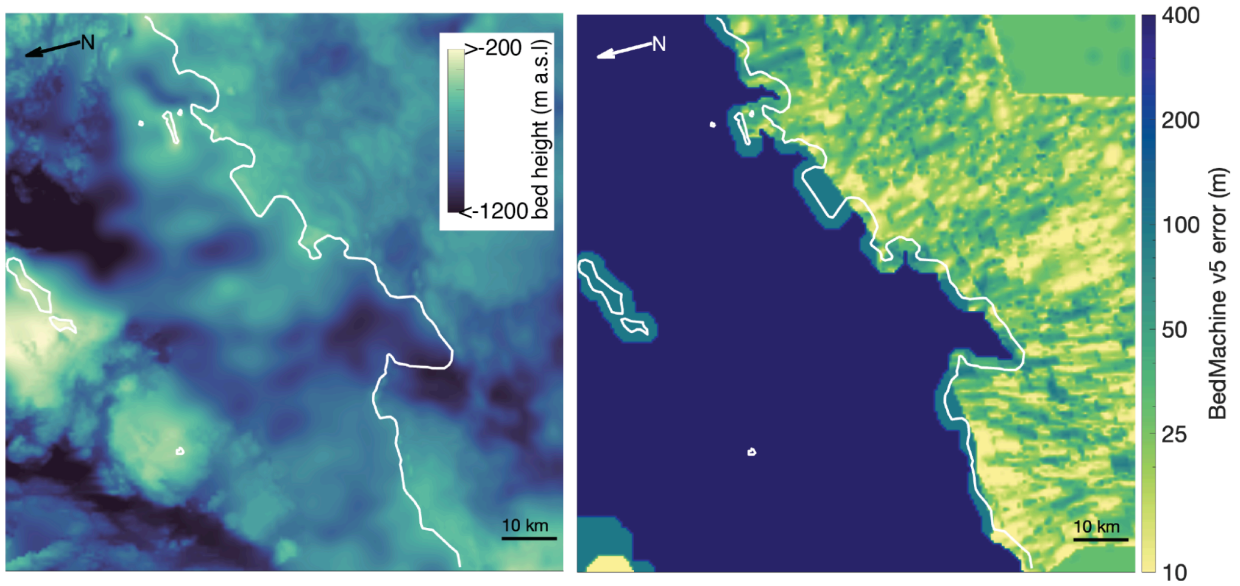

Fig. S7. dH/dt on grounded ice.

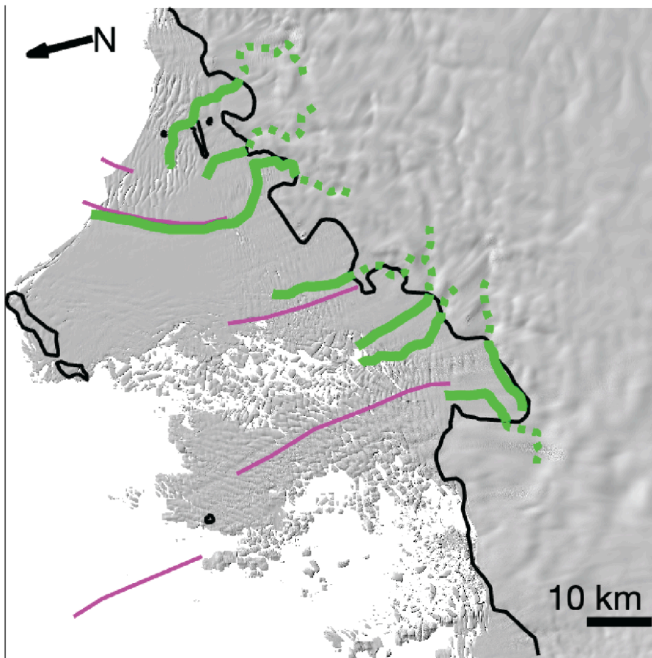Fig. S8. BedMachine v3 bed height (scale increases linearly) and error (scale increases logarithmically).
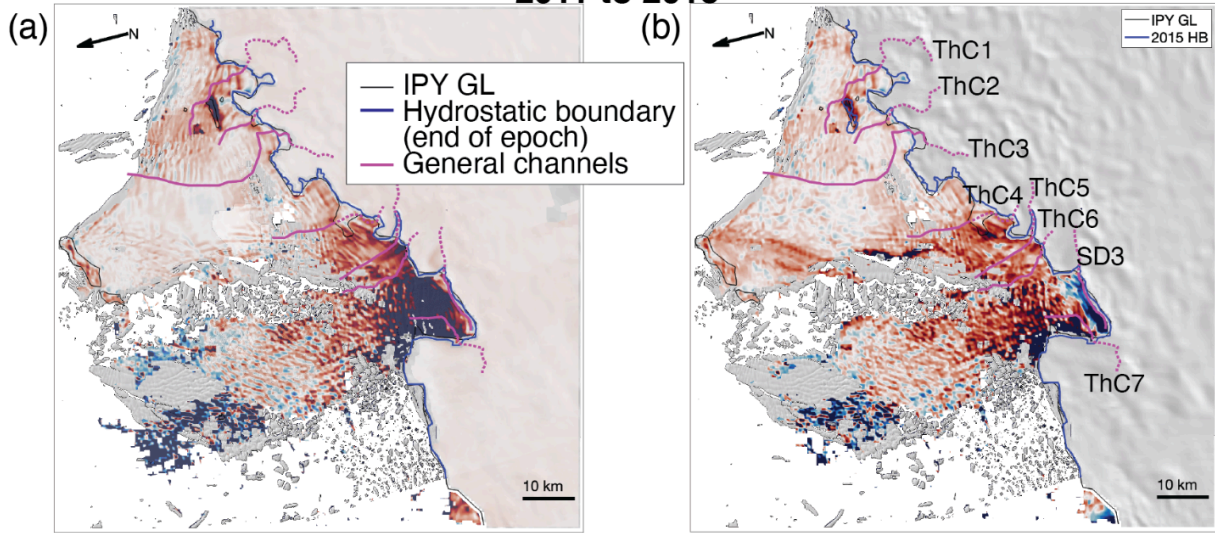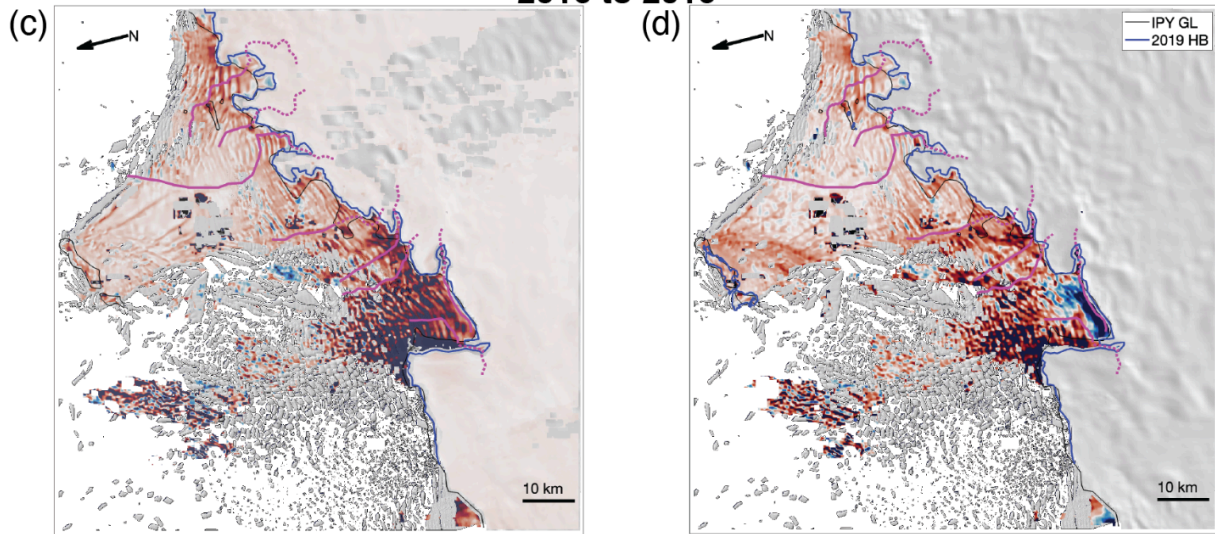

Fig. S9. Hillshade showing our study's reference channels (green curves) and channels mapped by Alley et al. (2016) (magenta curves).

2011 to 2015

(a)

IPY GL
Hydrostatic boundary (end of epoch)
General channels

(b)

IPY GL
2015 HB

ThC1
ThC2
ThC3
ThC4 ThC5
ThC6
SD3

ThC7

10 km

2016 to 2019

(c)

(d)

IPY GL
2019 HB

10 km

2020 to 2023

(e)

(f)

IPY GL
2022 HB
2023 HB

DH/Dt (m a^{-1})

60
40
20
0
-20
-40
-60

M_b (m w.e. a^{-1})
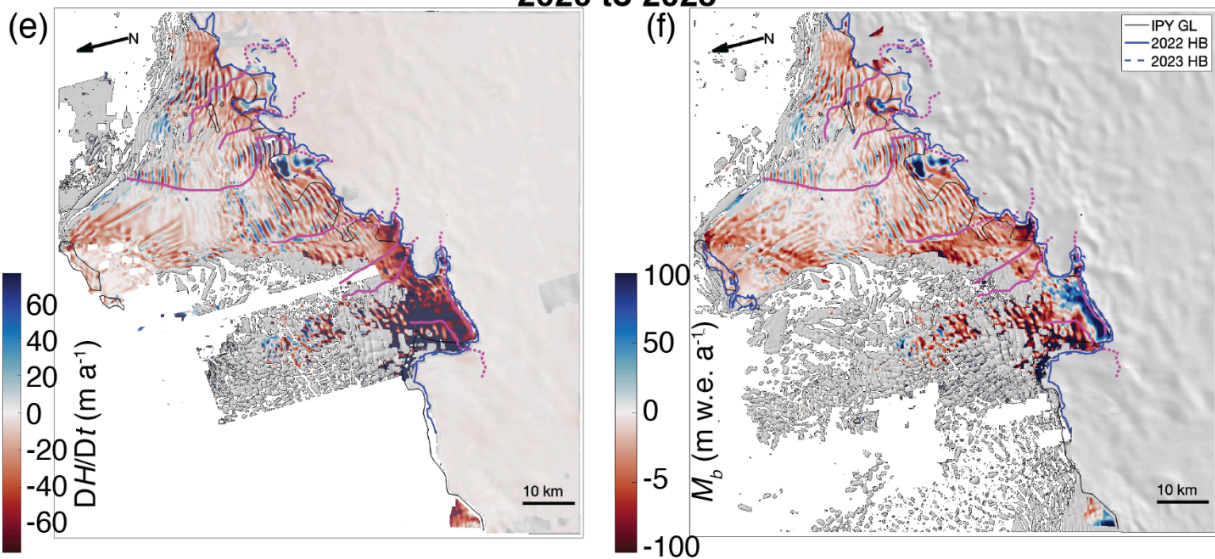
100
50
0
-5
-100

10 km

Fig. S10. Lagrangian change maps flow-shifted with velocity mosaic instead of annual velocity maps.