

1 Supplementary Information

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3 Development of ECCO-downscaled Amundsen-Bellingshausen Sea regional simulation using

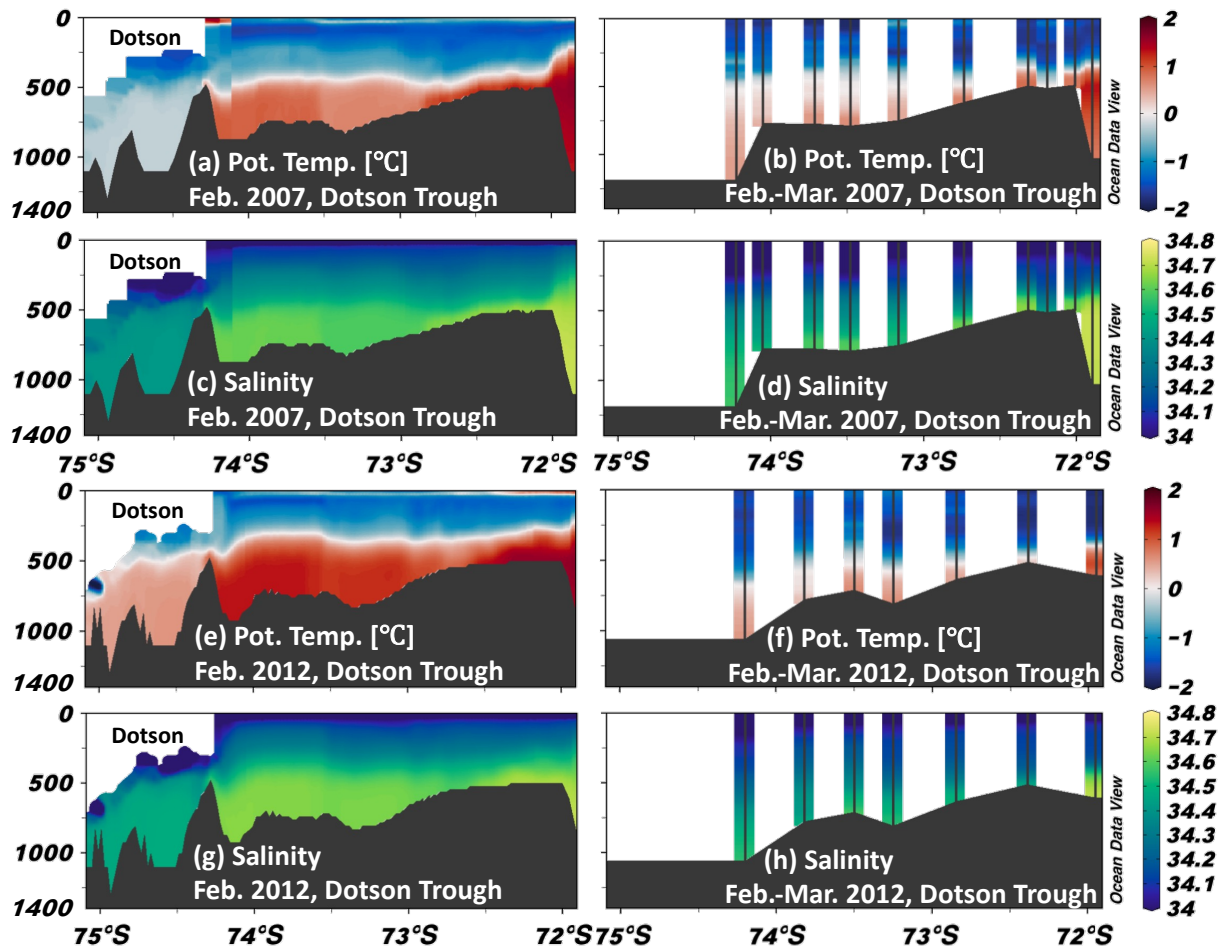
4 MITgcm(66j)

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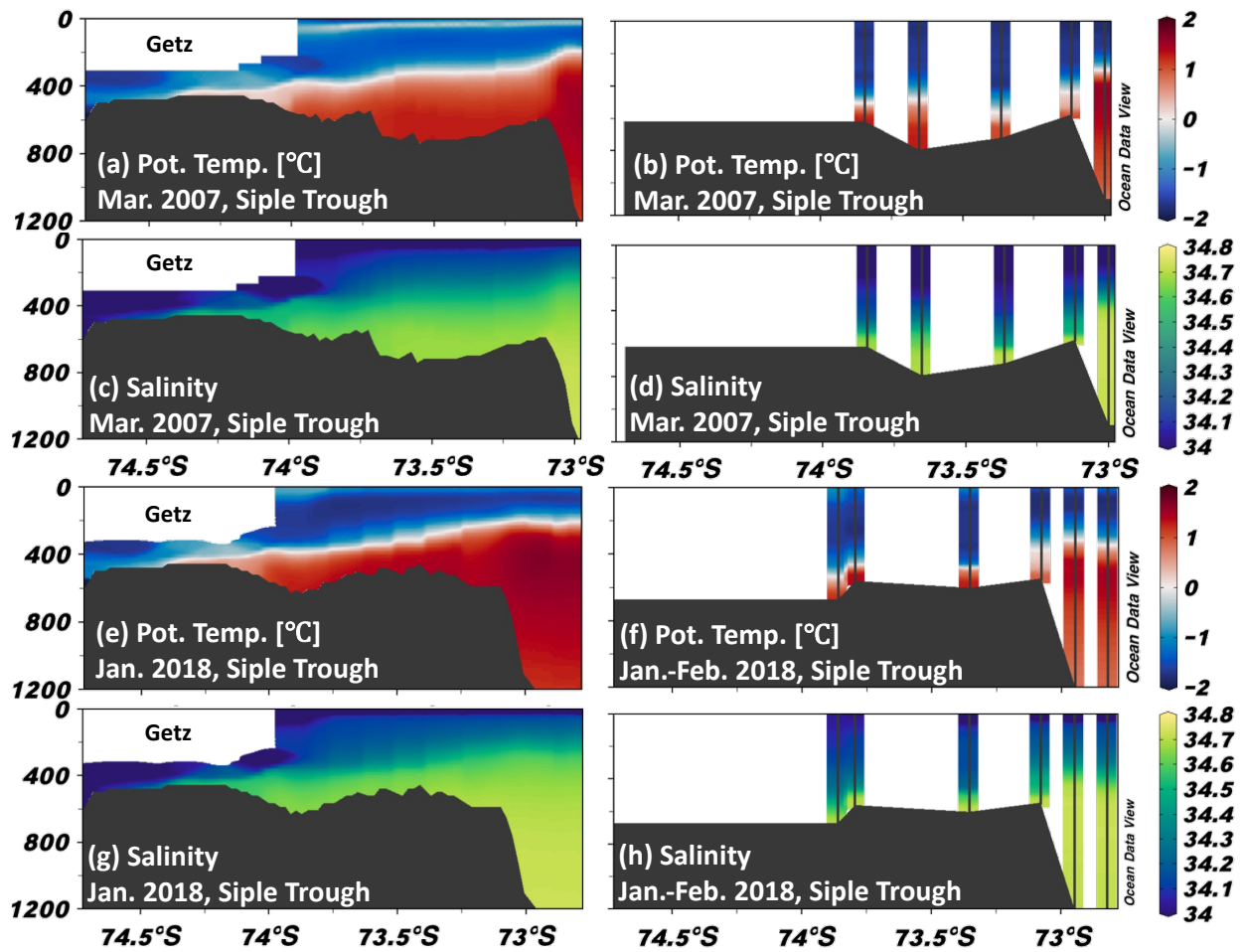
6 Nakayama et al.

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Supplementary Figure 1. Dotson Trough sections for February and March 2007 (a, b, c, d) and February to March 2012 (e, f, g, h). The model sections are extended further south to illustrate the hydrographic features within the ice-shelf cavities.



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22 **Supplementary Figure 2.** Similar to Fig. S1 but Siple Trough sections for March 2007 (a, b, c,

23 d) and January to February 2018 (e, f, g, h).

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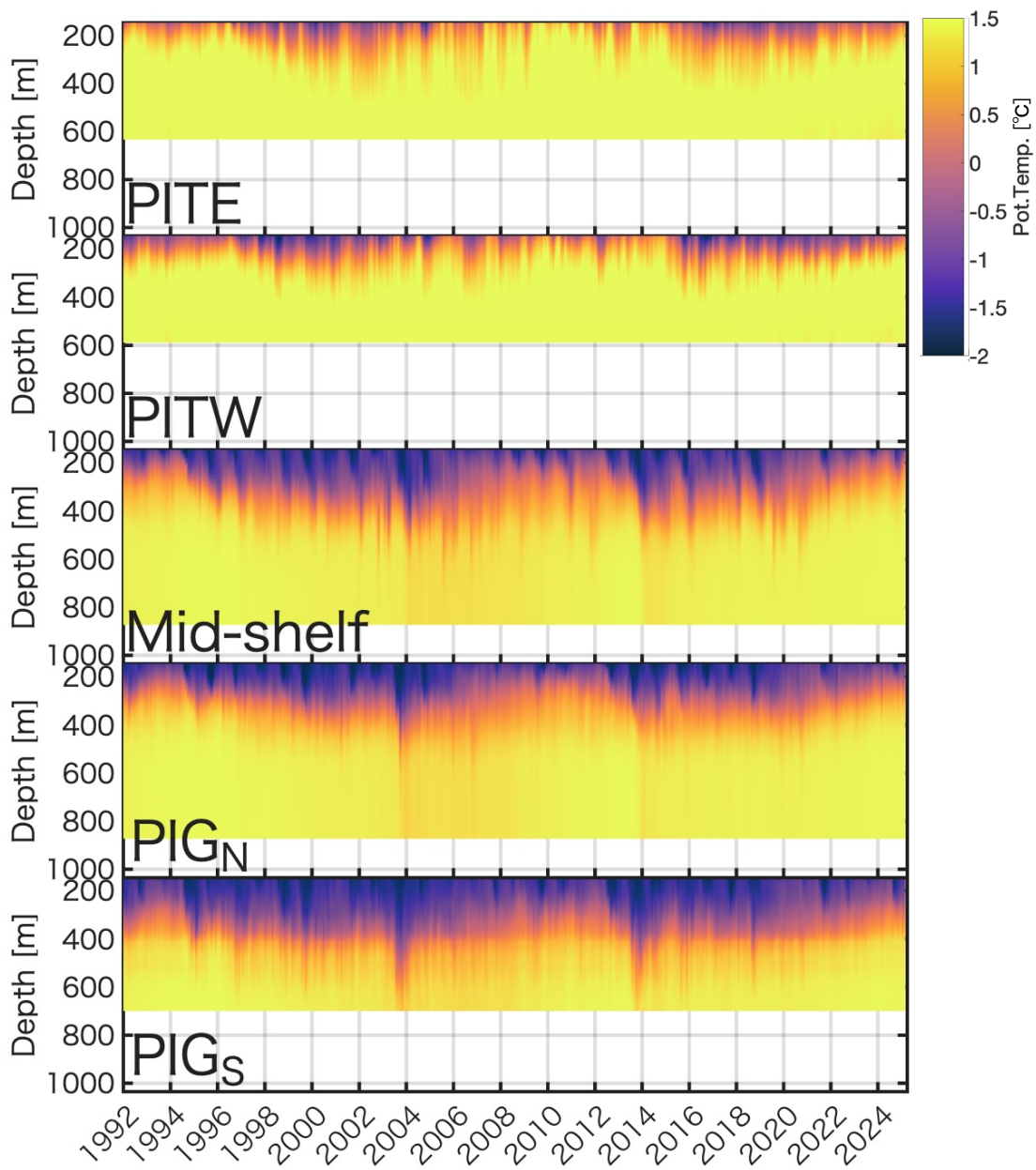
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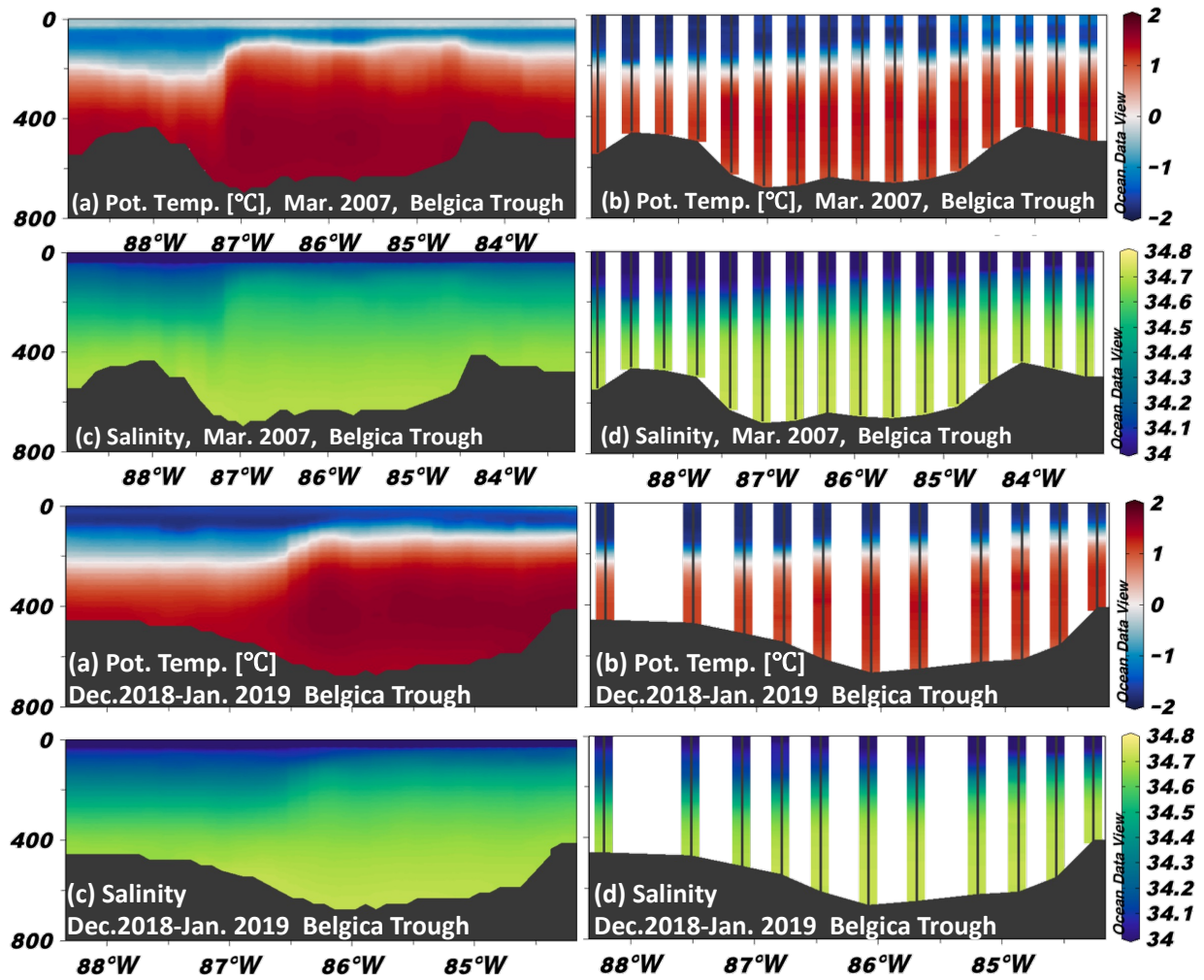
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Supplementary Figure 3. Same as Figure 12 but for the time period between January 1992 and March 2025.



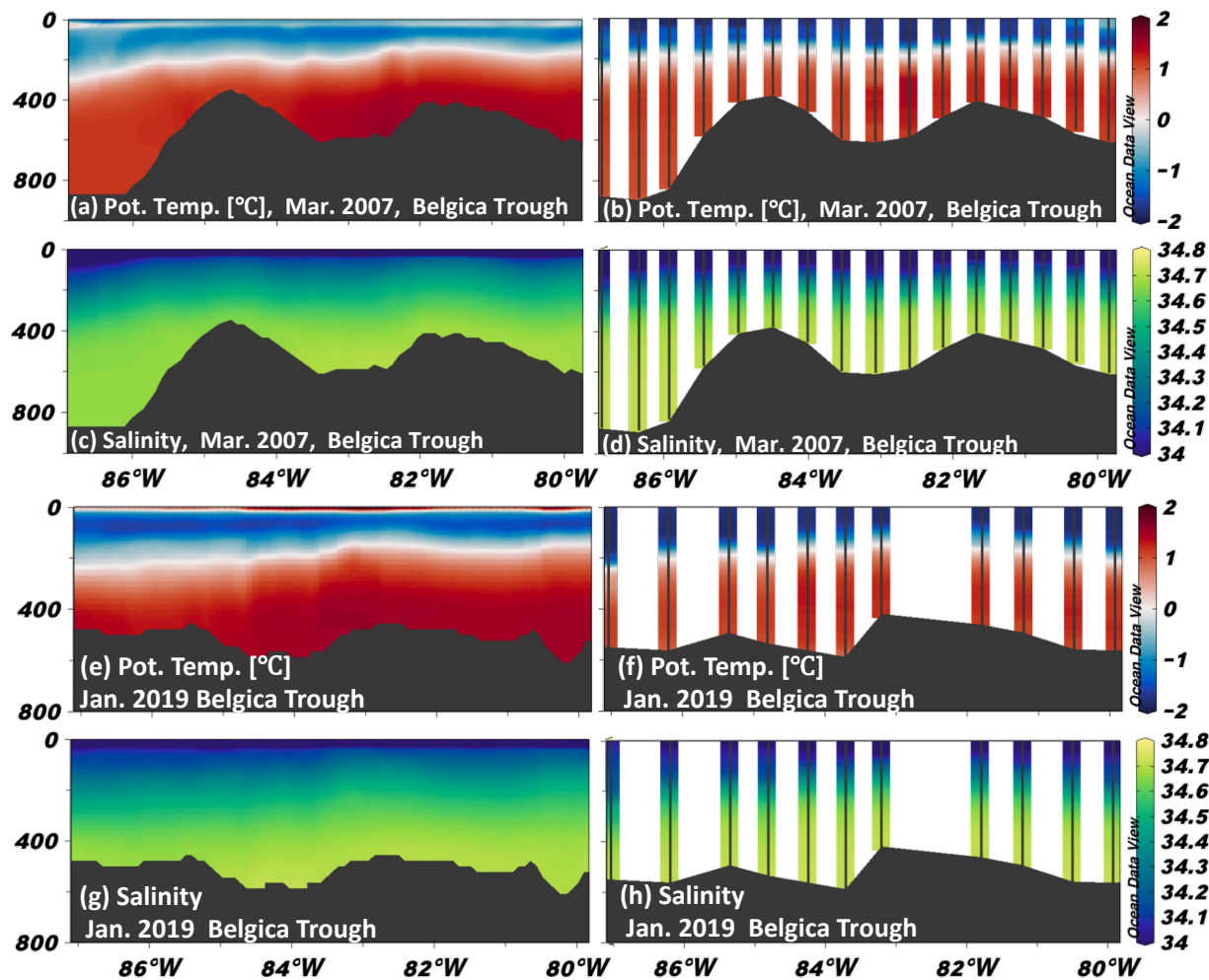
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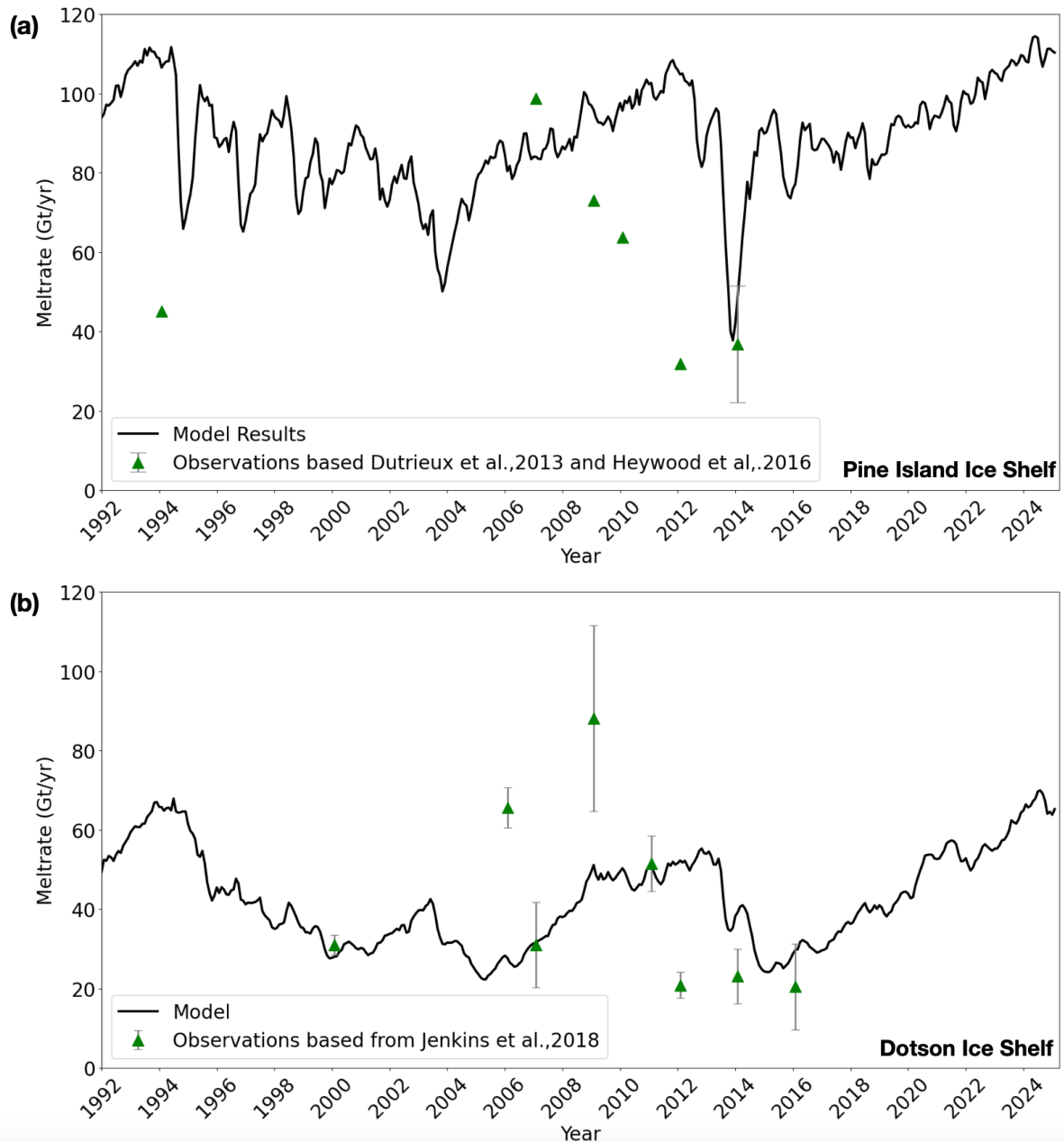
Supplementary Figure 4. Similar to Fig. S1 Belgica Trough sections closer to the shelf break

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for March 2007 (a, b, c, d) and December 2018 to January 2019 (c, d, g, h).



Supplementary Figure 5. Similar to Fig. S1 Belgica Trough sections closer to the continent for March 2007 (a, b, e, f) and January 2019 (c, d, g, h).



Supplementary Figure 6. Time series of simulated ice-shelf melt rates for (a) Pine Island Ice Shelf and (b) Dotson Ice Shelf. Observed estimates derived from ice-shelf melt budget calculations are shown as green triangles. Error bars are included where uncertainties are provided in the original publications.

52 **Supplementary Movie 1.** Same as Figure 5, but showing in GIF animation for the period
53 January 2024-December 2024 using 5-daily mean output.

54 **Supplementary Movie 2.** Same as Figure 15 a-b but showing in GIF animation.

55 **Supplementary Movie 3.** Same as Figure 17 but showing in GIF animation.

56 **Supplementary Movie 4.** (a, b) Animation corresponding to Figure 18, showing forward
57 particle-tracking results for meltwater released near the Dotson Ice Shelf front.

58 **Supplementary Movie 5.** (c, d) Same as panels (a, b), but for meltwater released near the
59 Thwaites Ice Shelf front.

60 **Supplementary Movie 6.** (e, f) Same as panels (a, b), but for meltwater released near the Pine
61 Island Ice Shelf front.

62 **Supplementary Movie 7.** (a, b) Animation corresponding to Figure 19, showing backward
63 particle-tracking experiment for mCDW entering the Dotson Trough.

64 **Supplementary Movie 8.** (c, d) Same as panels (a, b), but for mCDW entering the Pine Island
65 Bay Trough.