

Supplementary Figures and Tables

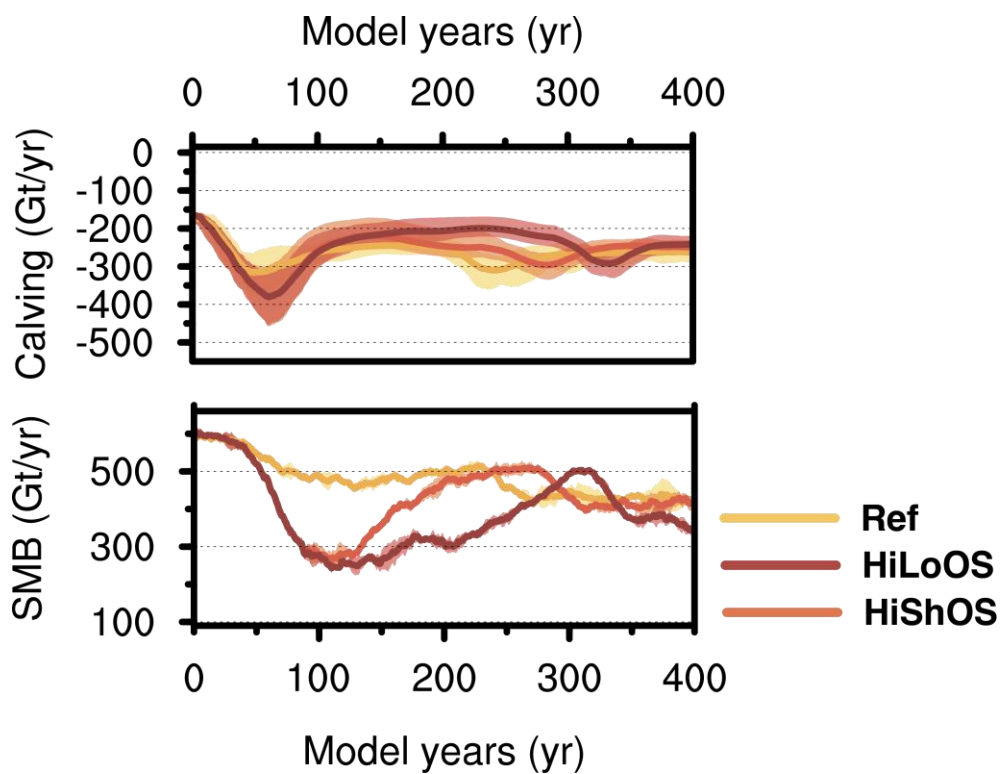


Fig. S1: Timeseries of GrIS integrated calving (top panel) and SMB (bottom panel) for the reference (Ref, yellow), high-short overshoot (HiShOs, orange) and high-long overshoot (HiLoOs, red). Solid line shows ensemble mean, shading shows ensemble min/max.

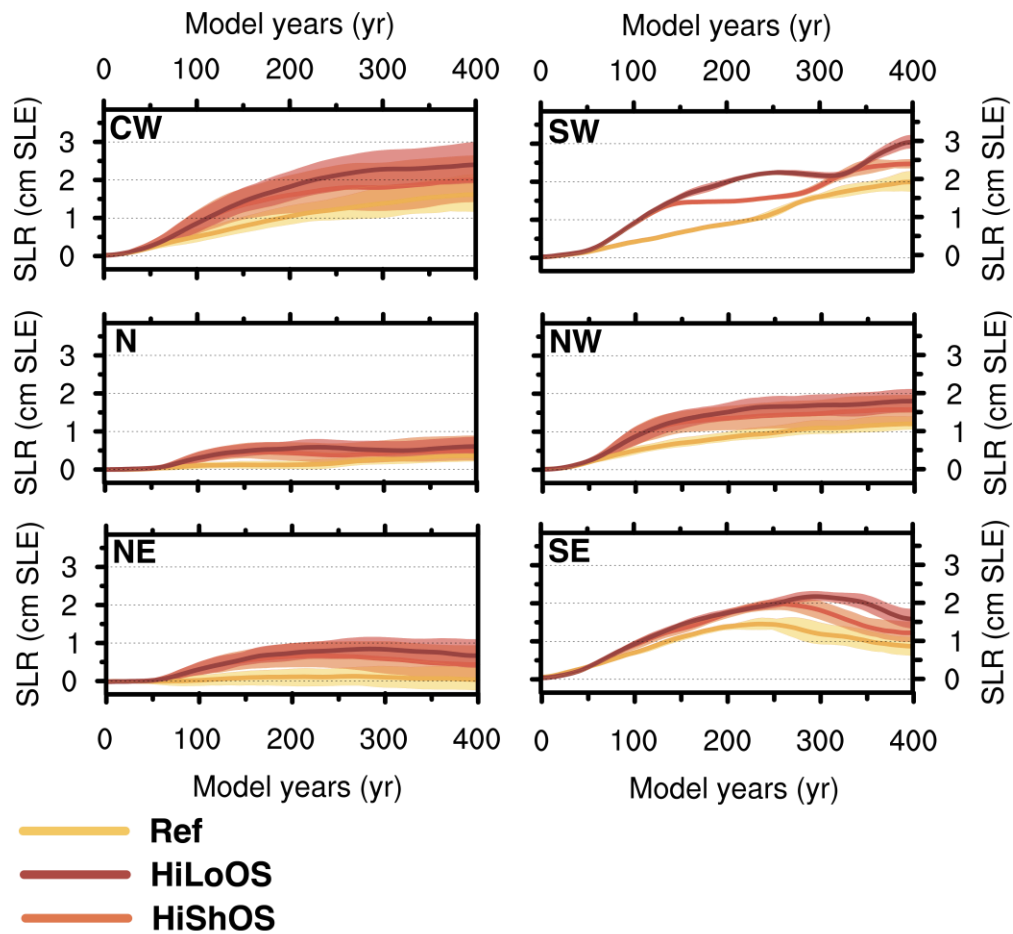


Fig. S2: Timeseries of GrIS mass loss (cm SLE) for each Greenland basin in the reference (Ref, yellow), high-short overshoot (HiShOs, orange) and high-long overshoot (HiLoOs, red). Solid line shows ensemble mean, shading shows ensemble min/max.

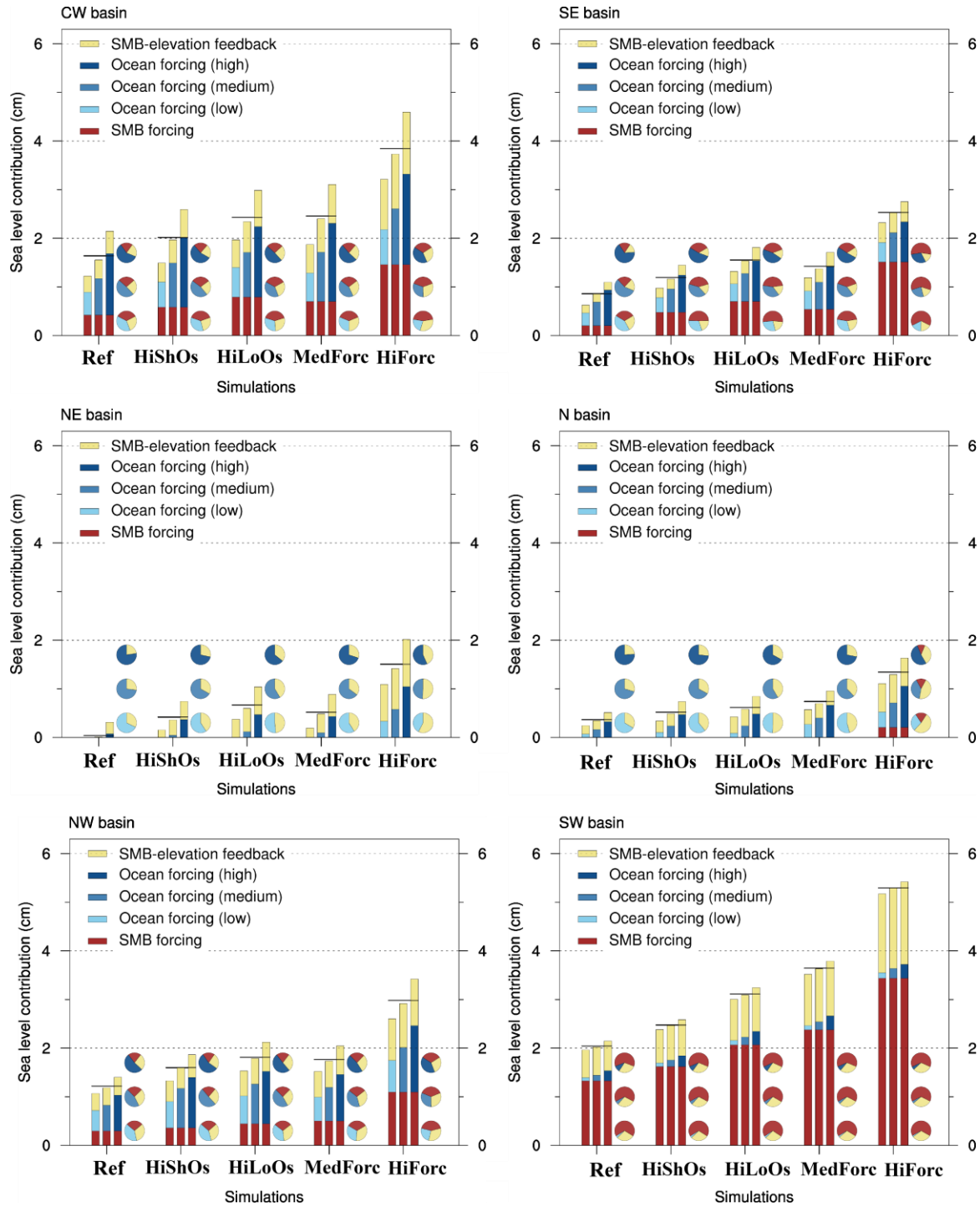


Fig. S3: Bar chart of ice loss for each Greeland basin at the end of our 400 years long simulations under the reference (Ref), high overshoot (HiShOs and HiLoOs), and high forcing (HiForc) simulations. Total mass loss is partitioned between SMB forcing, ocean forcing, and SMB-elevation feedback based on the simulations described in the ‘Partitioning mass loss’ subsection of Material and methods.

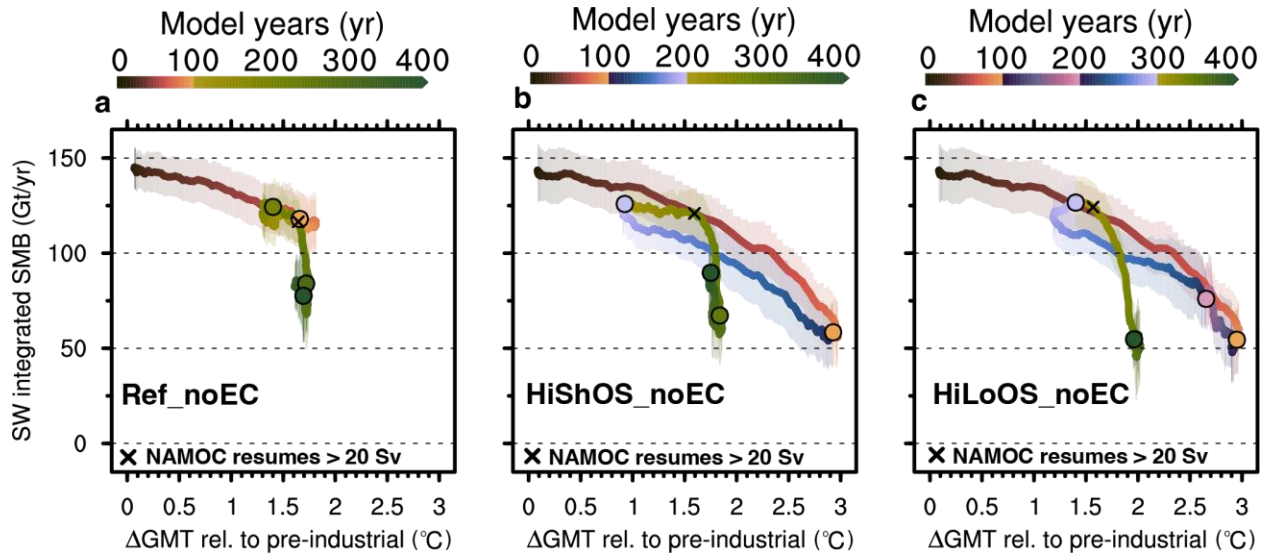


Fig. S4: Same plot as in Fig. 4 (a-c), but for simulations with melt-elevation feedback turned off (fixed-elevation SMB forcing, see Material and Methods section ‘Partitioning mass loss’). (a–c) Southwest Greenland SMB as a function of global mean warming for the (a) reference (Ref_noEC), (b) high-short (HiShOs_noEC) and (c) high-long (HiLoOs_noEC) overshoot simulations. Solid lines show the ensemble mean, shading indicates the ensemble min/max. Colours indicate the temporal evolution of the simulations, progressing through the emission ramp-up phase (red), stable-high phase (purple, only in (c)), ramp-down phase (blue, in (b,c)), and stable-low phase (green). Circles show years 100, 200, 300 and 400 of each simulation, while crosses mark the timing of AMOC recovery.

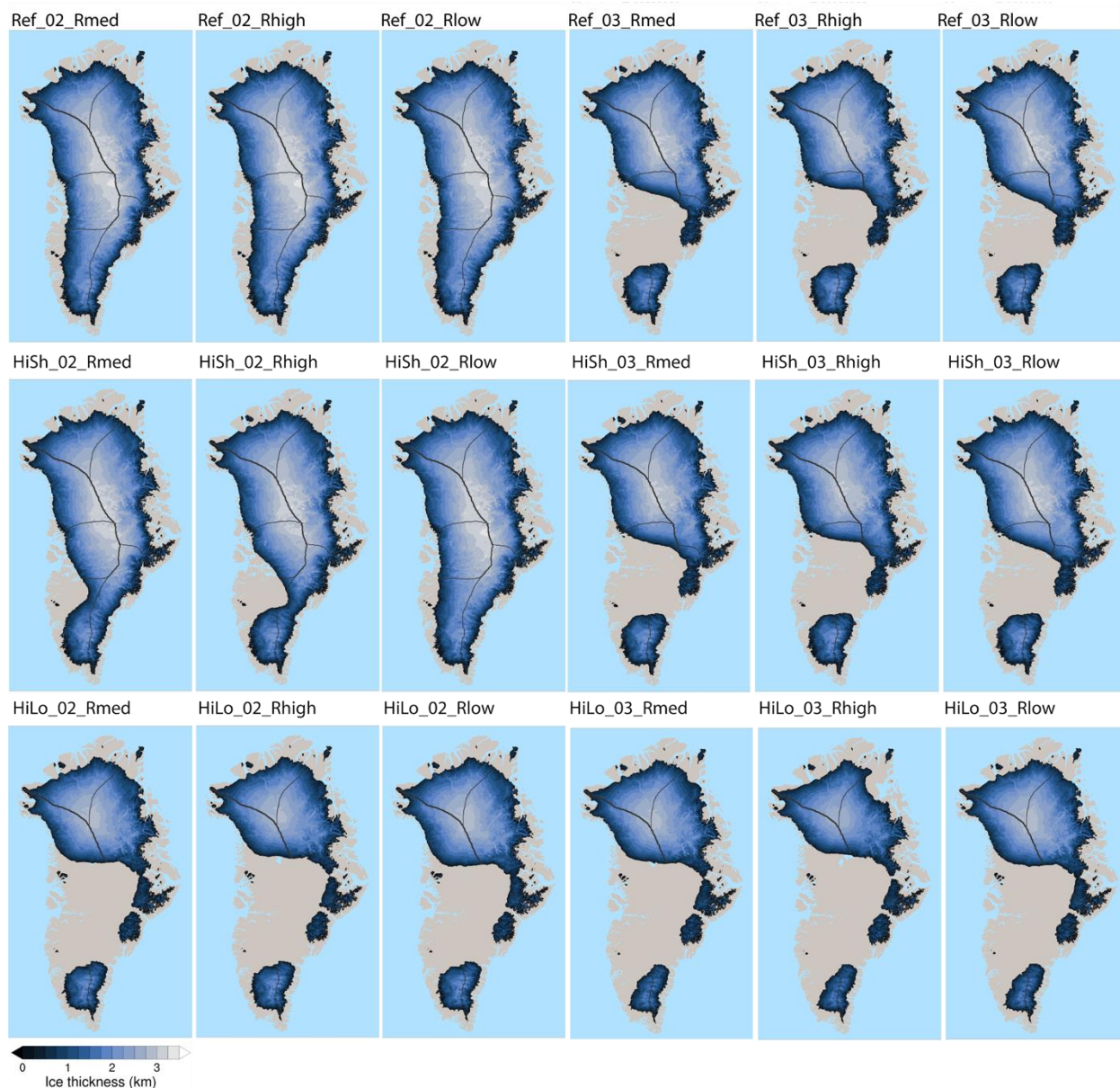


Fig. S5: GrIS thickness at the end of the extended simulations (simulation time = 10,000 years) under the reference (Ref, top row), high-short (HiSh, central row), and high long (HiLo, bottom row) overshoot scenarios. Every ensemble member is shown: 02/03 indicating the NorESM2-LM ensemble member used to force the ice sheet (see Material and Methods), Rlow/Rmed/Rhigh indicates the sensitivity of the GrIS to the ocean forcing (see Material and Methods).

Model year 400

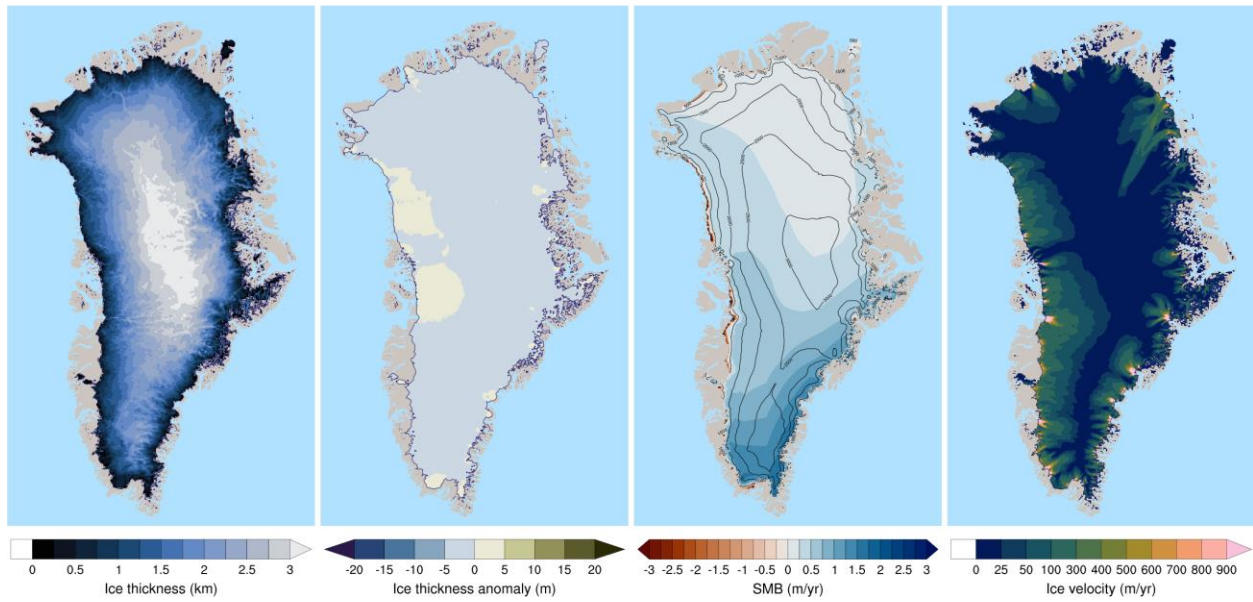


Fig. S6: GrIS ice thickness, ice thickness anomaly with respect to the present-day observed ice sheet, SMB, and ice velocity at the end of the initialisation procedure.

	Ref.	HiShOs	HiLoOs	HiForc
Final global warming (K)	1.7	1.8	2	3.4
Final GrIS warming (K)	3.9	3.5	4.7	7.7
Peak global warming (K)	1.8	2.9	2.9	3.4
Peak GrIS warming (K)	4.7	5.3	5.8	7.7
Mass loss (cm SLE)	6.2 (4.8-7.7)	8.2 (6.3-10.4)	10.2 (8.6-12.2)	17.5 (15.5-20.1)
Peak mass loss rate (mm/yr SLE)	0.3 (0.3-0.4)	0.8 (0.6-1.0)	0.8 (0.7-0.9)	1 (1.0-1.2)
Long-term GrIS loss (m SLE)	1.24 (0.04-2.67)	1.52 (0.12-2.59)	4.02 (3.64-4.67)	7.33 (7.32-7.33)
Final GrIS SMB (Gt/yr)	422 (417-427)	421 (398-443)	349 (326-372)	-40 (-61 - -20)
Final GrIS calving (Gt/yr)	263 (239-290)	249 (231-267)	242 (220-269)	220 (187-266)

Table T1: Key metrics for the reference (Ref), high-short overshoot (HiShOs), high-long overshoot (HiLoOs) and high emission (HiForc) simulations. Bold text indicates ensemble average, while numbers in parenthesis indicate min/max values across the ensemble.

