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Uncertainties originating from GCM downscaling and bias correction with application to the MIS-11c Greenland Ice Sheet

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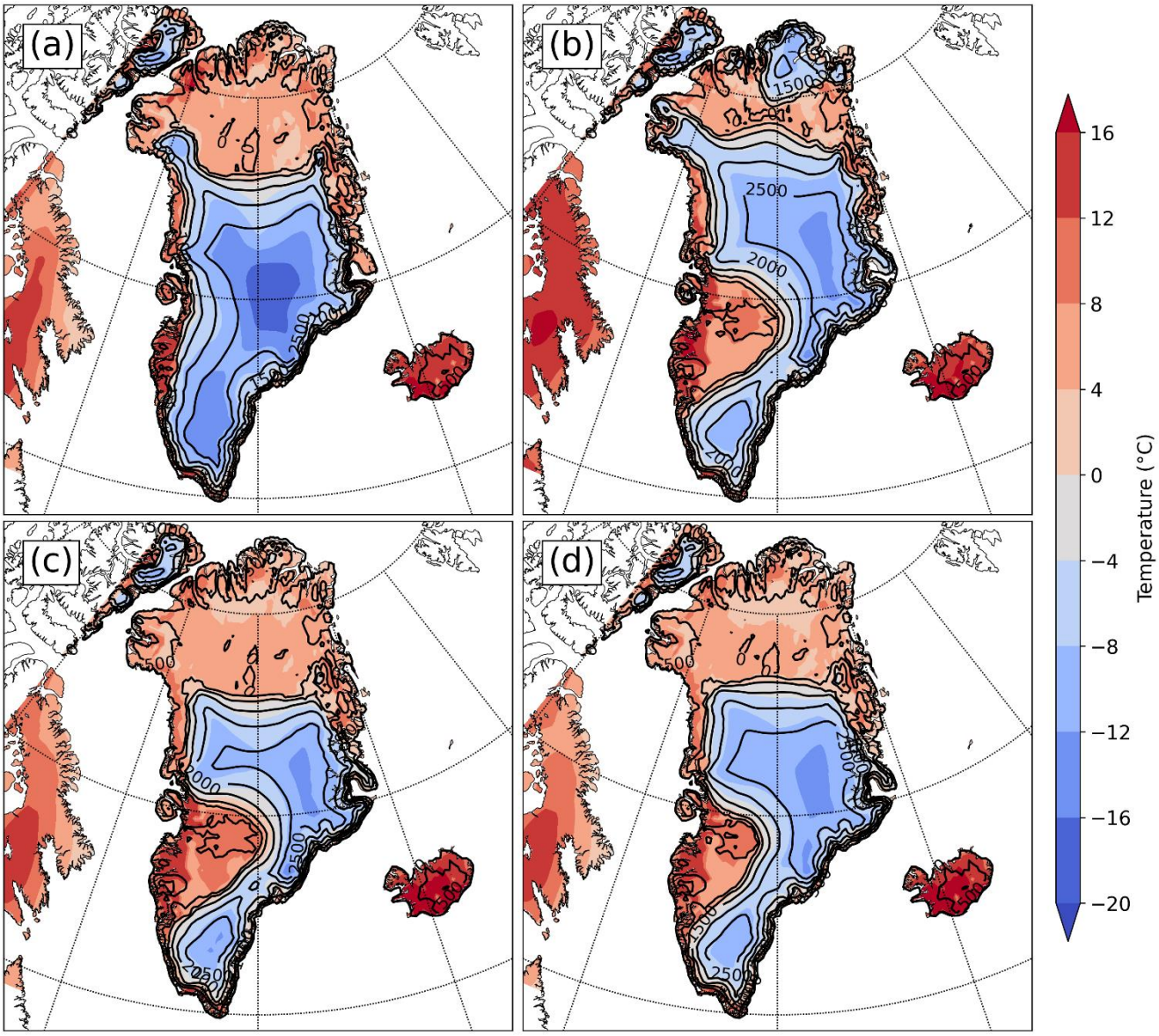

Figure S1. Comparison of 2-meter JJA mean air temperatures at 413 ka for four different GSM simulations with the RACMO temperature baseline. The simulations utilize identical parameters and forcing, except for the choice of surface slope-lapse rate technique. Methodologies utilized are as follows: (a) fully spatially and temporally varying (STV), (b) seasonally varying but spatially fixed, (c) spatially smoothed STV, and (d) daytime-only STV. Surface elevation (bed elevation plus ice surface height) in 500-meter increments is shown in black contours.

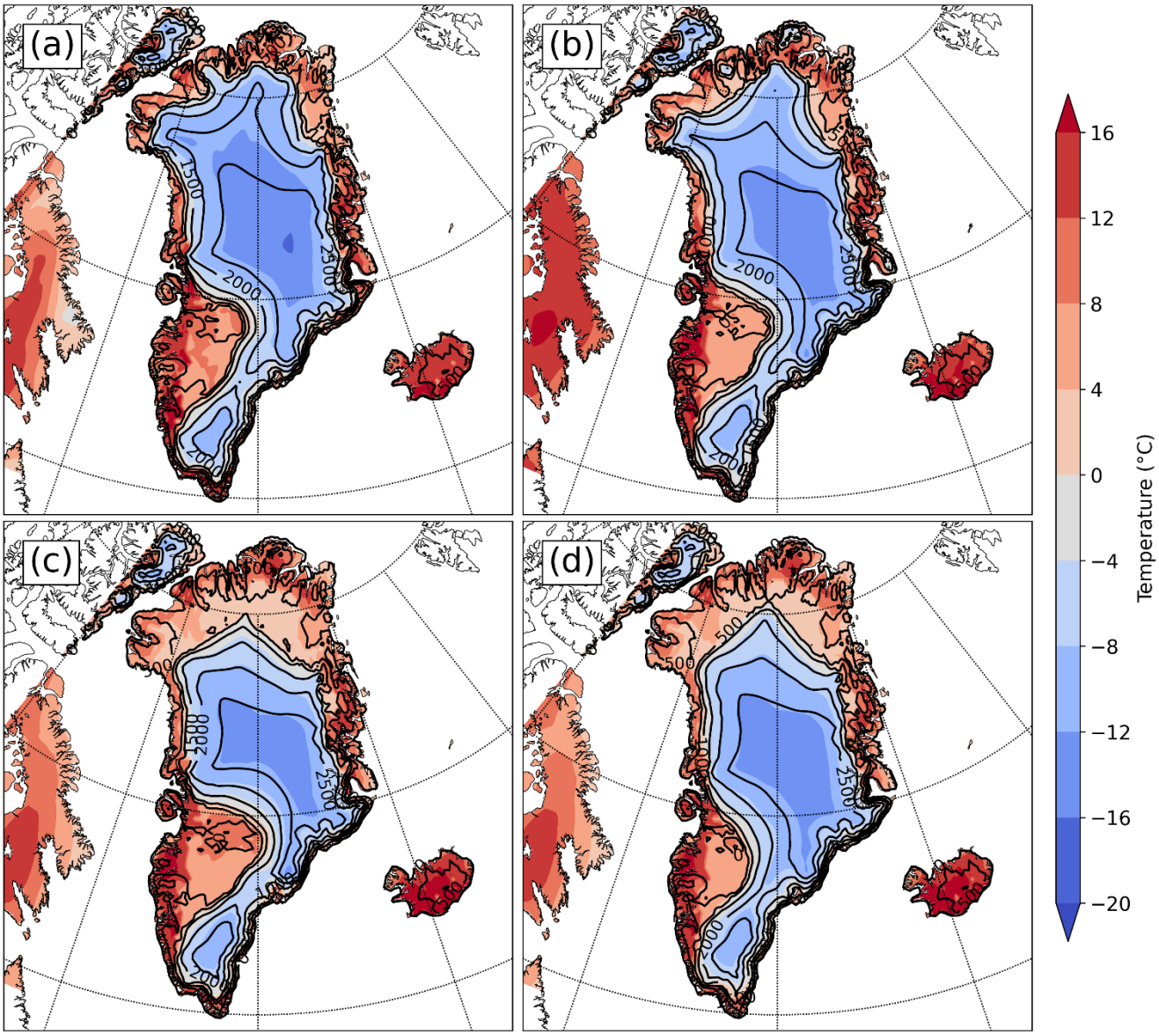

Figure S2. As in Figure S1, but utilizing four different simulations utilizing temperatures based on the MAR dataset.

The supplementary figures here serve to illustrate how strongly dependent our GSM simulations were on the choice of lapse rate methodology. Each set of simulations shown in Figures S1 and S2 utilize identical GSM parameter sets and precipitation data with bias corrections. However, each of the four displayed simulations uses one of the different lapse rate methodologies defined in the main manuscript. Each lapse rate has an effect on the outcome in two ways: firstly, it is used for the calculation of temperature biases between CESM and the choice of present-day baseline (RACMO or MAR), as both datasets are converted to sea level for a one-to-one comparison. Secondly, the same lapse rate is used to correct the input temperature field to the height of the land/ice surface as it appears in the GSM. The choice of lapse rate alone leads to amplifications in the simulated melt pattern of the Greenland ice sheet and can even affect which regions become completely ice-free.