



Supplement of

Sensitivity of the current Antarctic surface mass balance to sea surface conditions using MAR

C. Kittel et al.

Correspondence to: Christoph Kittel (ckittel@uliege.be)

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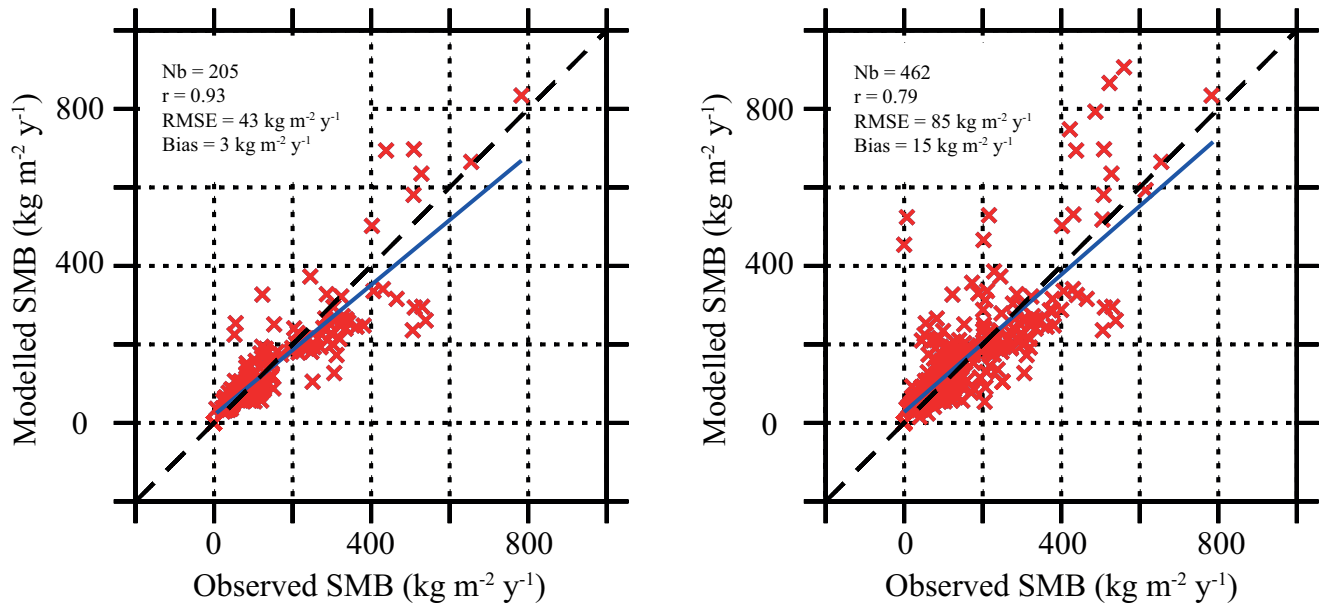
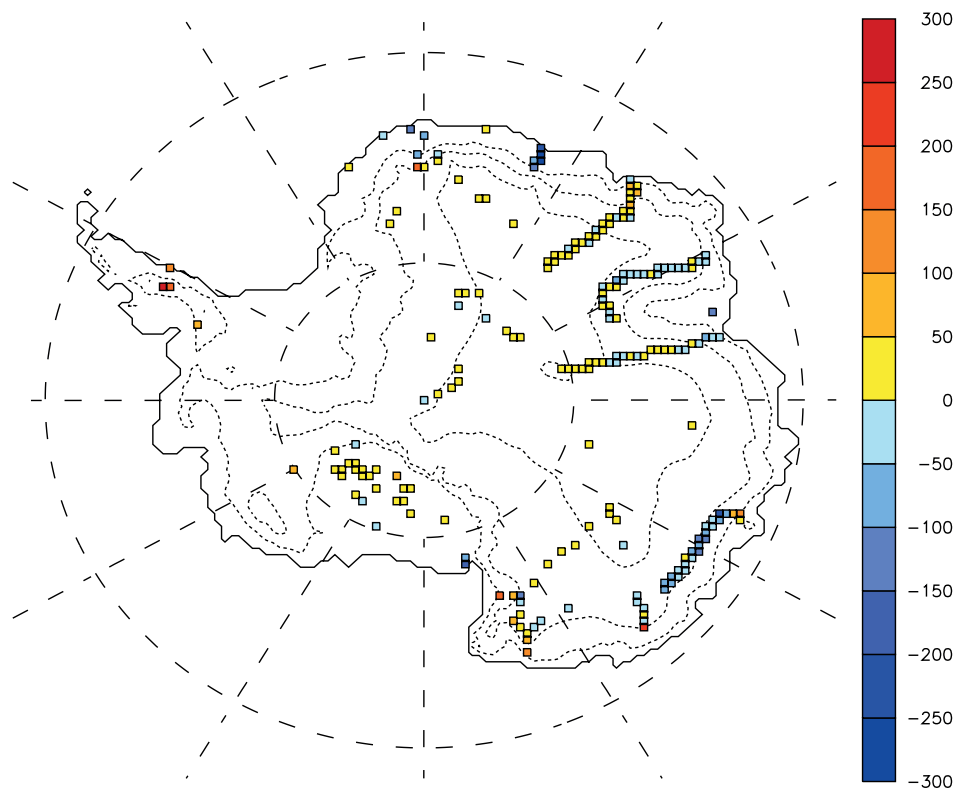


Figure S1. Comparison with SMB from the GLACIOCLIM-SAMBA database over 1950–2015. a) Only grid cells containing more than one observation are conserved for the comparison. b) All grid cells containing at least one observation are used. Bias and RMSE units are kg m⁻² yr⁻¹.



MAR SMB biases ($\text{kg m}^{-2} \text{yr}^{-1}$)

Figure S2. Comparison between MAR SMB and observed SMB from the GLACIOCLIM-SAMBA database (Favier et al., 2013) for 1950 – 2015. Units are $\text{kg m}^{-2} \text{yr}^{-1}$.

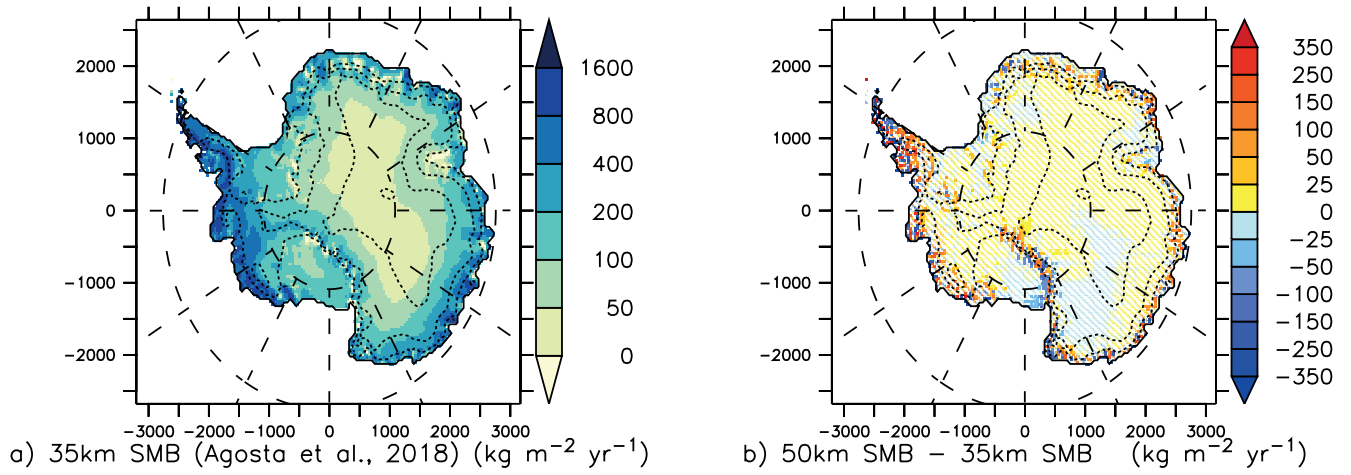


Figure S3. a: Mean SMB simulated by MAR over 1979 – 2015 from Agosta et al. (2018). b: Comparison between the MAR SMB at a 35 km resolution from Agosta et al. (2018) and the MAR SMB at a 50 km resolution (this study). Units are $\text{kg m}^{-2} \text{yr}^{-1}$. Non-significant anomalies (i.e., lower than the interannual variability) are dashed.

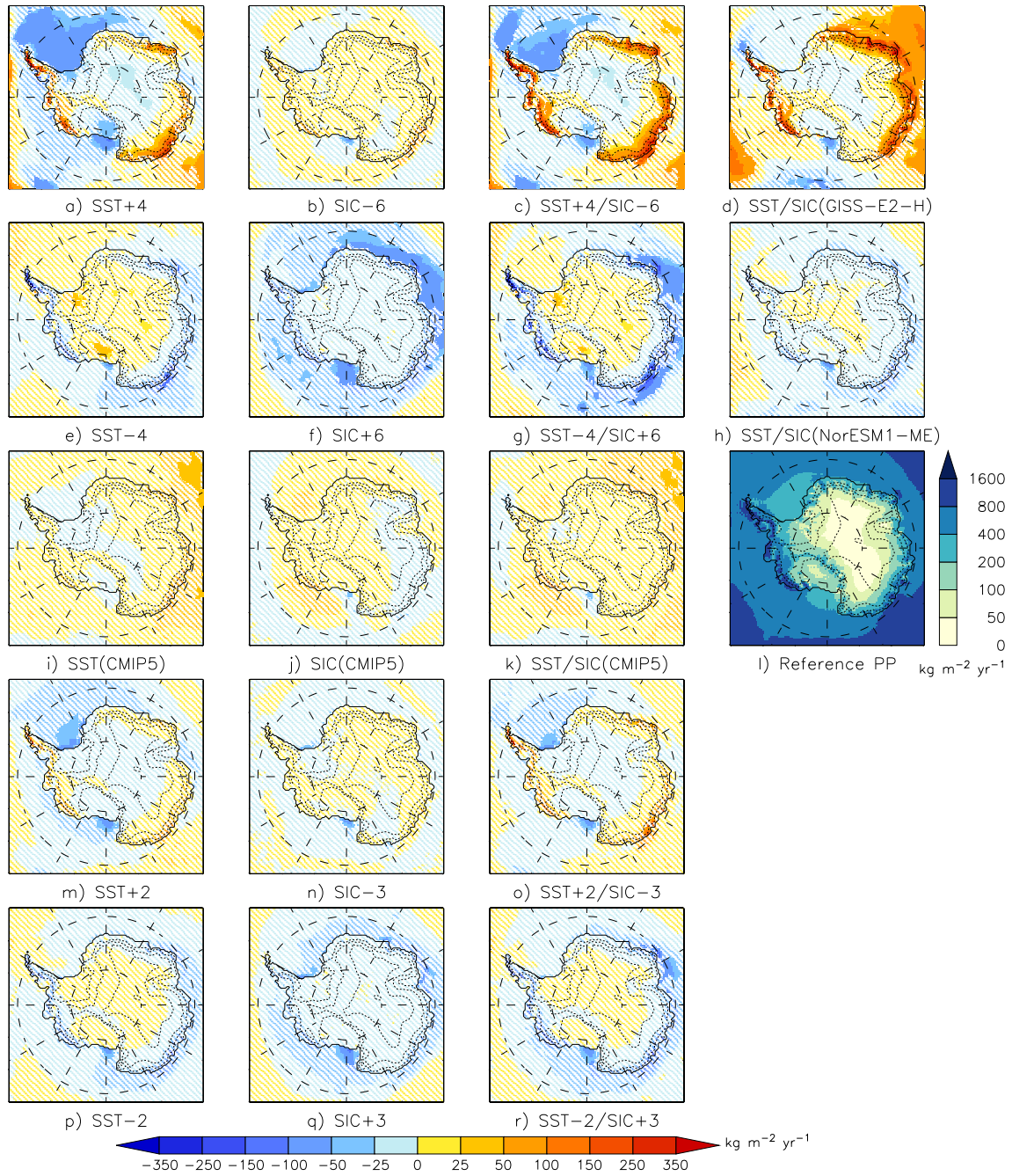


Figure S4. Difference in mean annual total precipitation (rainfall + snowfall) ($\text{kg m}^{-2} \text{yr}^{-1}$) between the reference simulation and (a) SST+4, (b) SIC-6, (c) SST+4/SIC-6, (d) SST/SIC(GISS-E2-H), (e) SST-4, (f) SIC+6, (g) SST-4/SIC+6, (h) SST/SIC(NorESM1-ME), (i) SST(CMIP5), (j) SIC(CMIP5), (k) SST/SIC(CMIP5), (m) SST+2, (n) SIC-3, (o) SST+2/SIC-3, (p) SST-2, (q) SIC+3, (r) SST-2/SIC+3 experiments. Differences less than the interannual variability are considered as non-significant and are dashed. l) Mean annual SMB ($\text{kg m}^{-2} \text{yr}^{-1}$) simulated by MAR forced by ERA-Interim over 1979 – 2015.

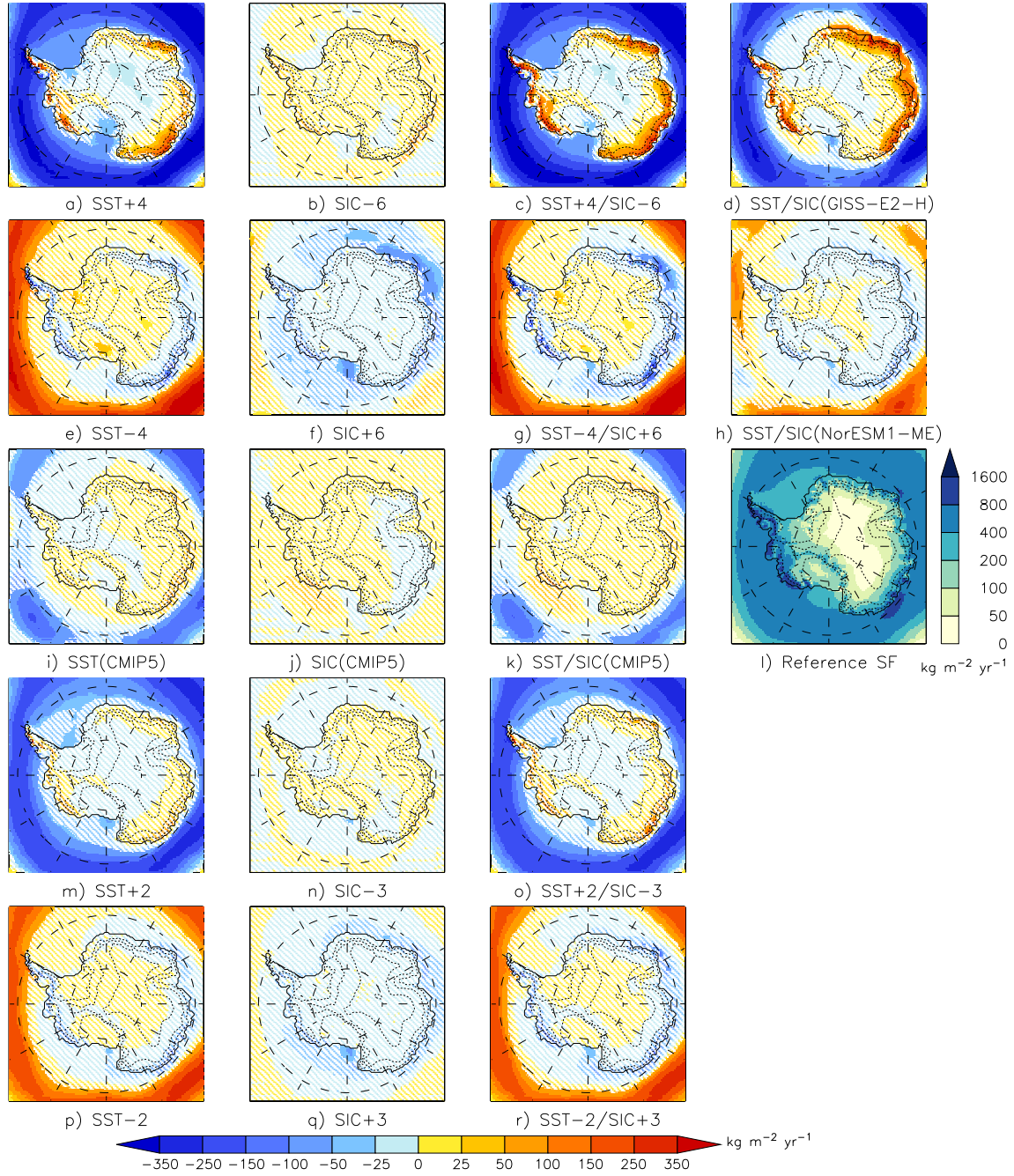


Figure S5. Same as Fig. S4 but for snowfall over the ice sheet and the surrounding ocean.

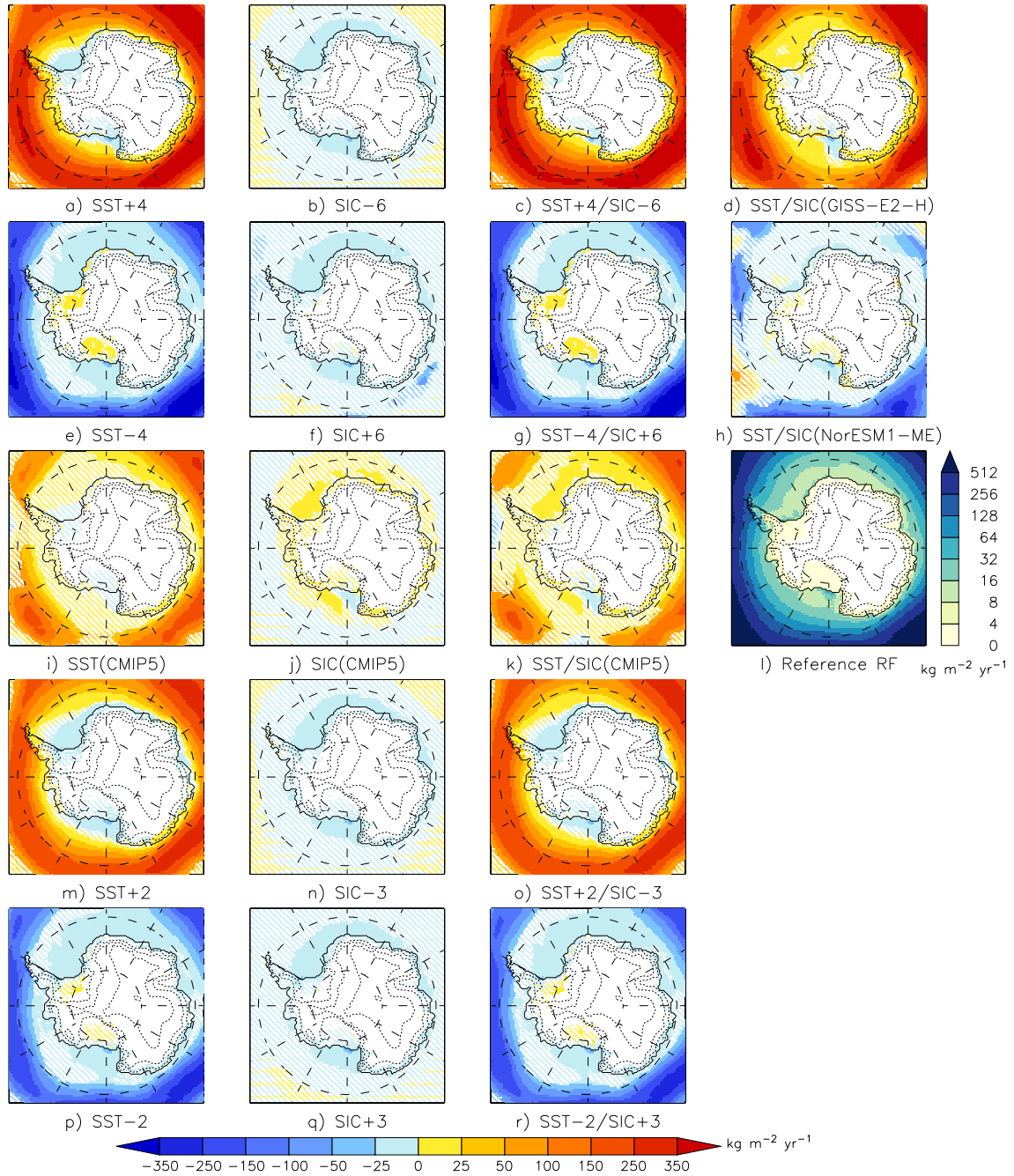


Figure S6. Same as Fig. S4 but for rainfall over the ice sheet and the surrounding ocean. White areas over the ice sheet indicate that there is no rainfall.

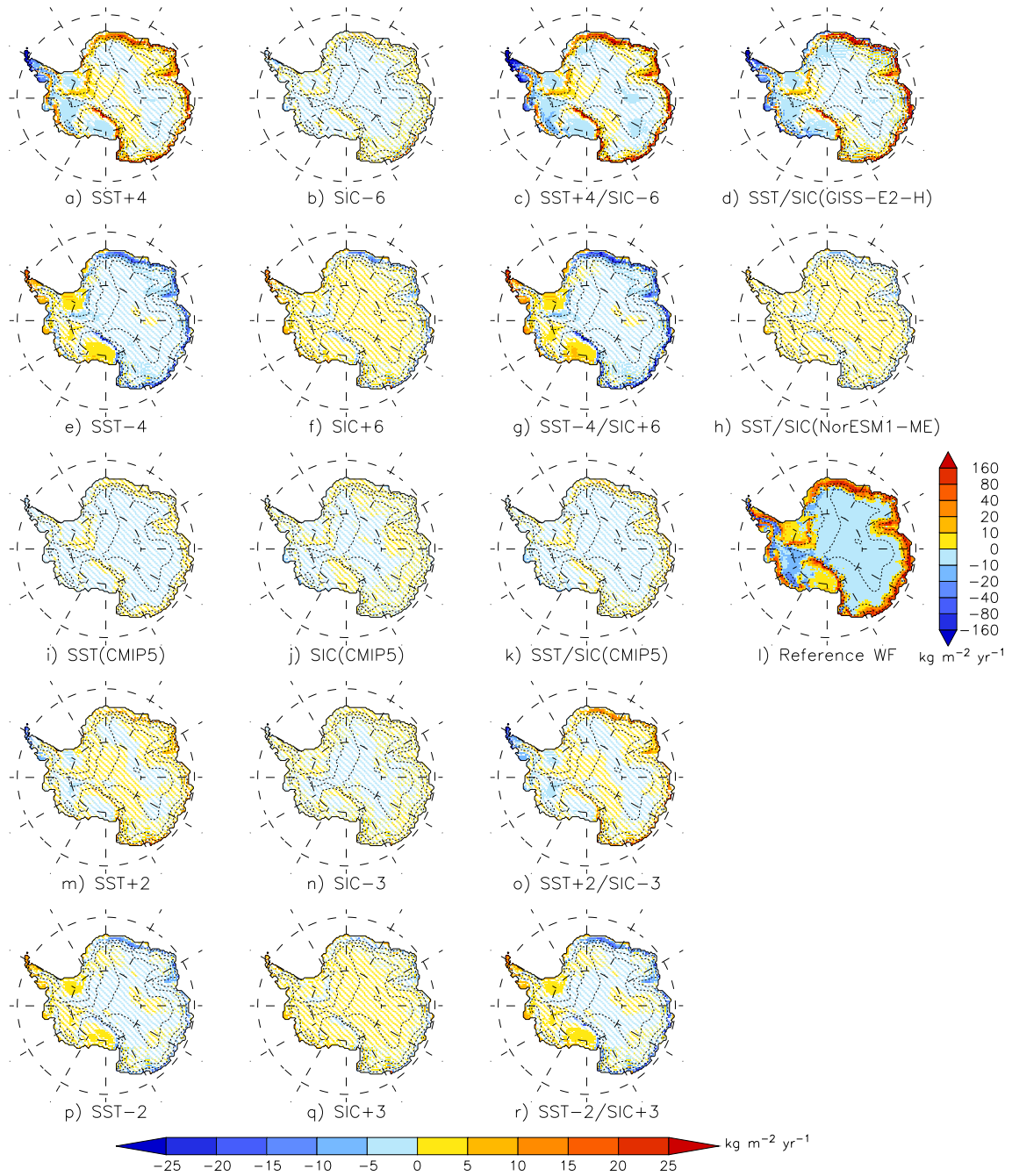


Figure S7. Same as Fig. S4 but for water fluxes (sublimation minus deposition) at the ice sheet surface. Positive fluxes indicate sublimation while negative fluxes are representative of deposition processes.

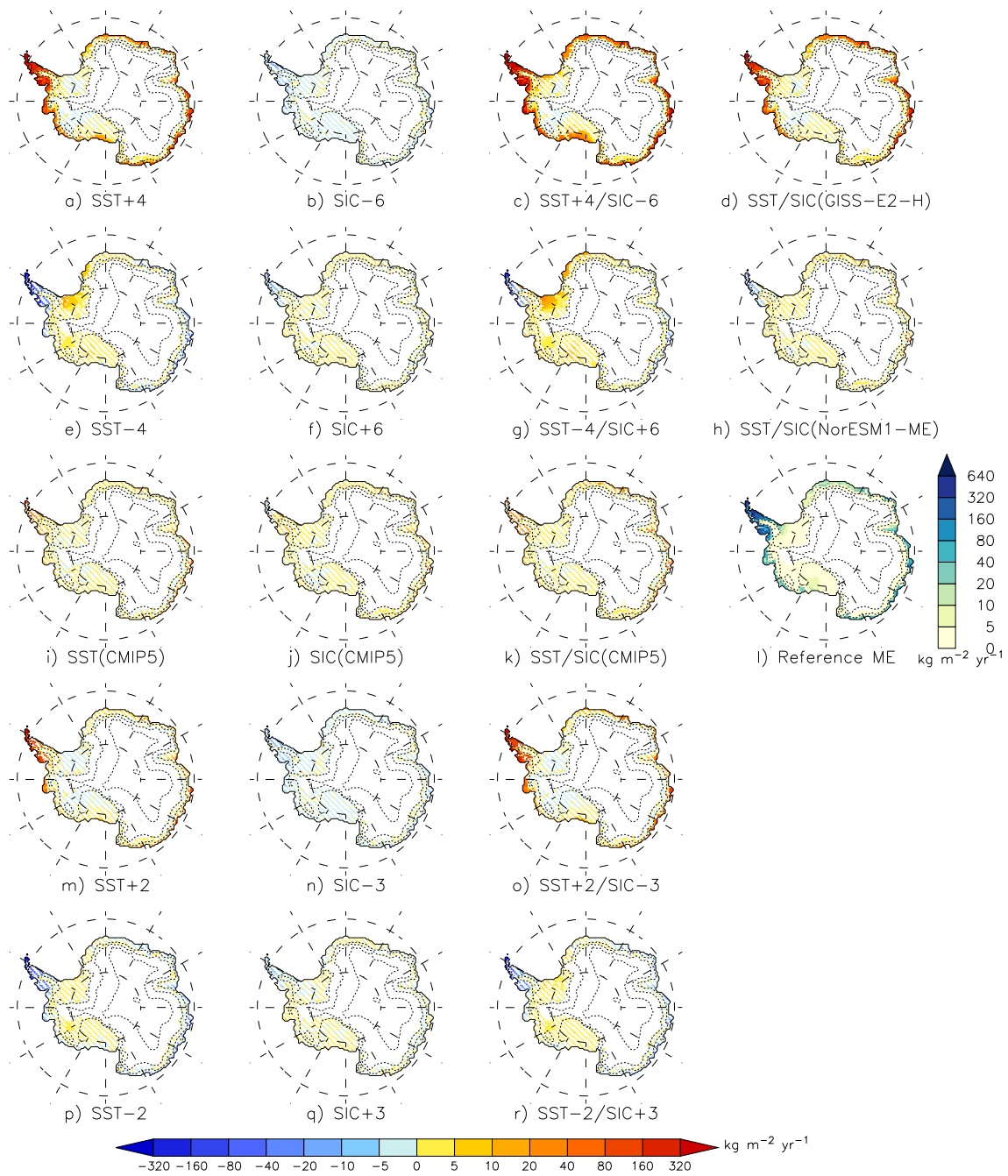


Figure S8. Same as Fig. S4 but for meltwater production at the surface. White areas over the ice sheet indicate that melt never occurs.

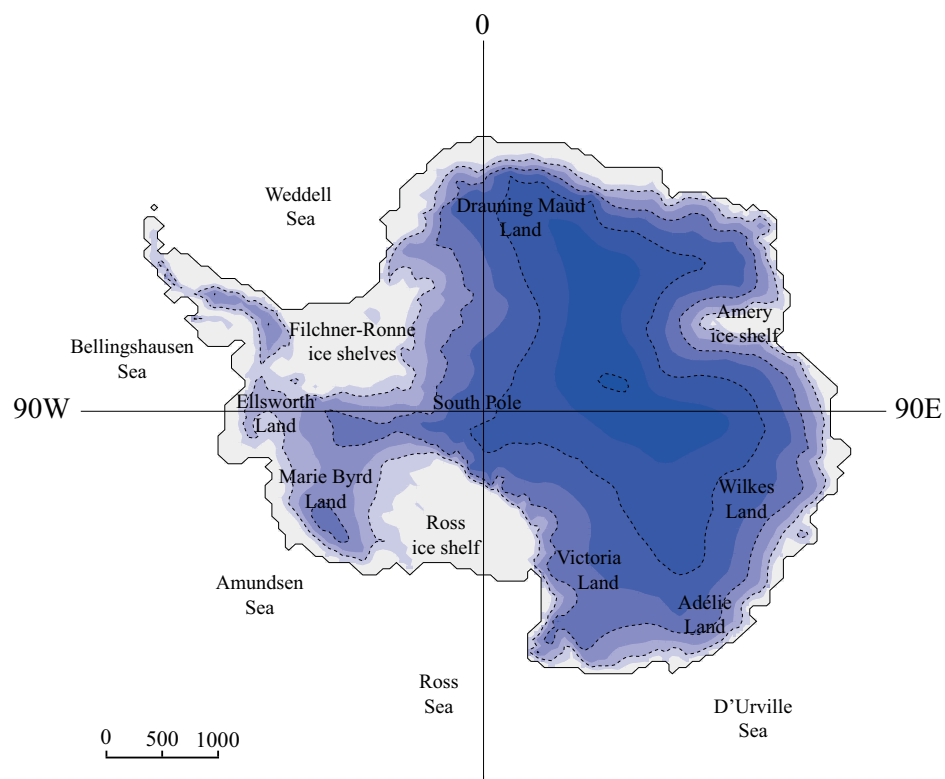


Figure S9. The Antarctic ice sheet and surrounding seas. Elevation contours are shown every 1000 m.

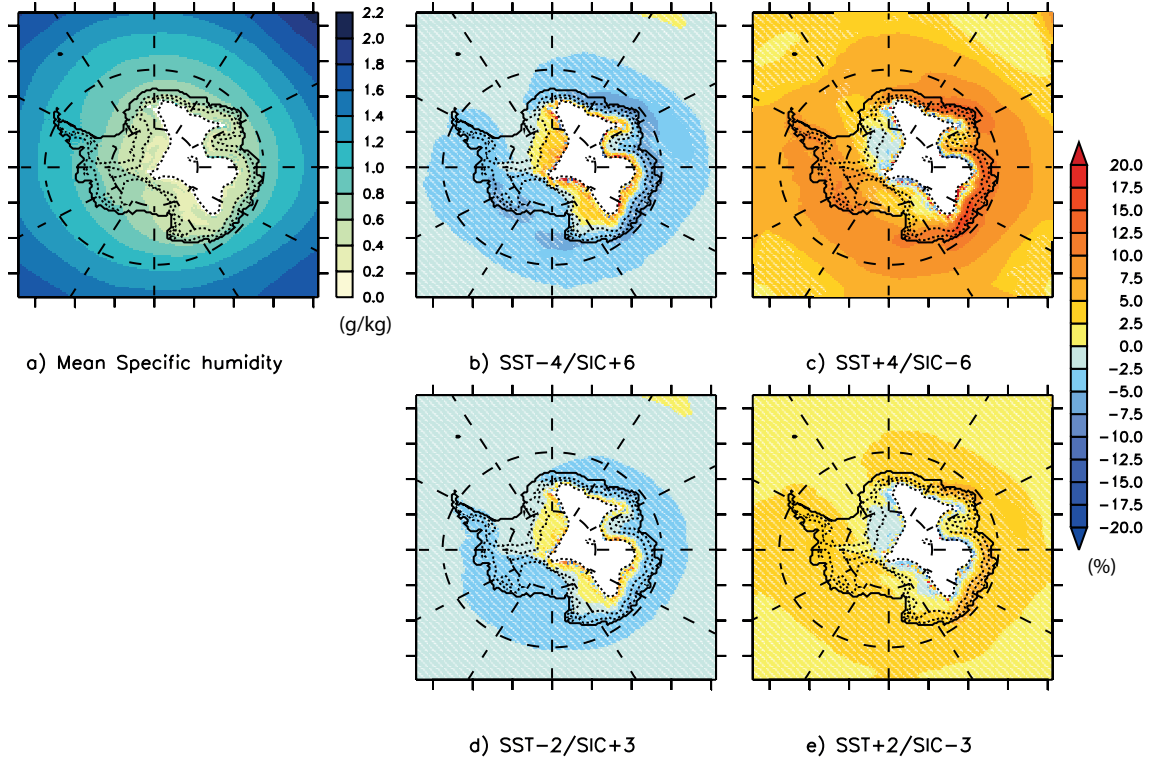


Figure S10. a: Mean specific humidity modelled by MAR over 1979–2015 at 700 hPa (Units: g/kg). Difference in mean specific humidity (%) between the reference simulation and (b) SST-4/SIC+6, (c) SST+4/SIC-6, (d) SST-2/SIC+3, (e) SST+2/SIC-3 experiments. Differences lower than the interannual variability are considered as non-significant and are dashed.

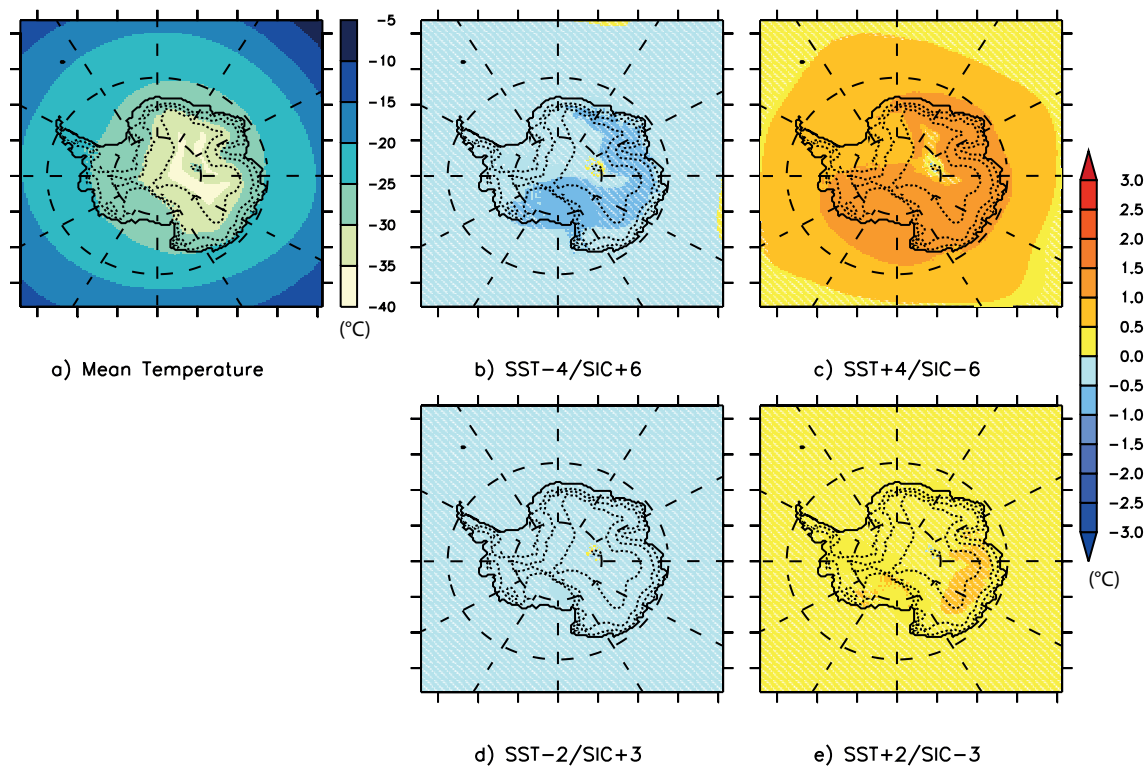


Figure S11. a: Mean air temperature modelled by MAR over 1979–2015 at 600 hPa (Units: °C). Difference in mean air temperature (°C) between the reference simulation and (b) SST-4/SIC+6, (c) SST+4/SIC-6, (d) SST-2/SIC+3, (e) SST+2/SIC-3 experiments. Differences lower than the interannual variability are considered as non-significant and are dashed.

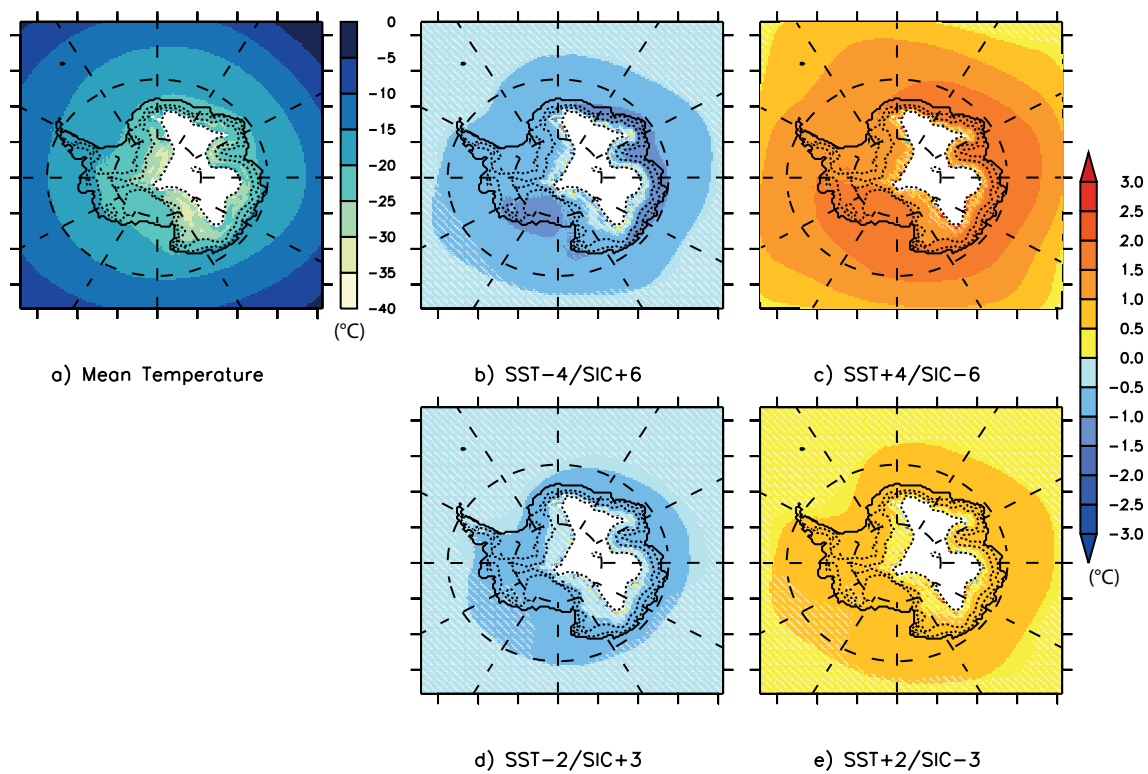


Figure S12. Same as Fig. S11 but at 700 hPa.

Table S1. Top: Annual mean integrated (Gt yr^{-1}) and standard deviation (Gt yr^{-1}) total precipitation (rainfall and snowfall), snowfall and rainfall ver the whole AIS (including grounded and not grounded ice) for the reference simulation (1979–2015). Bottom: Difference of annual mean total precipitation (rainfall and snowfall), snowfall and rainfall (Gt yr^{-1} and %) between each sensitivity test and the reference simulation (1979–2015). Anomalies larger than the inter-annual variability are considered as significant and are displayed in bold.

Mean (Gt y^{-1})	Total precipitation	Snowfall	Rainfall
Reference	2678 ± 110	2658 ± 109	20 ± 3
Anomaly (Gt y^{-1})	Total precipitation	Snowfall	Rainfall
SST-4	-64	-61	-3
SST-2	-89	-85	-4
SST+2	+50	+45	+5
SST+4	+162	+137	+25
SIC+6	-170	-166	-4
SIC+3	-107	-104	-3
SIC-3	+25	+28	-3
SIC-6	+91	+93	-2
SST-4/SIC+6	-136	-133	-3
SST-2/SIC+3	-129	-125	-4
SST+2/SIC-3	+133	+126	+7
SST+4/SIC-6	+344	+304	+40
SST/SIC(NorESM1-ME)	-105	-102	-3
SIC(CMIP5)	+36	+35	+1
SST(CMIP5)	+80	+79	+1
SST/SIC(CMIP5)	+105	+104	+1
SST/SIC(GISS-E2-H)	+368	+353	+15