Supplementary Material to

Meteorological drivers of melt at two nearby glaciers in the McMurdo Dry Valleys of Antarctica

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1 AWS sensors

Table S1: Sensor specifications at the AWS's based on Gooseff and others (2022). The last column indicates which station data were used and stations in brackets indicate those used only for gap-filling, in which TARM indicates the AWS at Taylor Glacier, COHM at Commonwealth Glacier, BOYM at Lake Bonney, EXEM and Explorers Cove and HOEM at Lake Hoare.

Variable	**Instrument**	**Accuracy**	**Stations**
Air temperature	CSI CS 107	± 0.2 °C at 20 °C	TARM (BOYM), COHM (EXEM)
Relative humidity	CSI 207 Phys-Chem	5% (RH 12–100%) at 25 °C	TARM (BOYM), COHM (EXEM)
Wind speed	R.M. Young 05103	1.5%	TARM (BOYM, HOEM), COHM (EXEM)
Wind direction	R.M. Young 05103	4%	TARM (BOYM, HOEM), COHM (EXEM)
Shortwave radiation	Eppley SPP pyranometer	10 Wm^{-2}	TARM (BOYM), COHM (EXEM)
Longwave radiation	Eppley PIR pyrgeometer	5 Wm^{-2}	BOYM, COHM
Surface height	CSI SR50	0.01 m	TARM, COHM

2 Main findings for different parameter choices

Table S2: Overview of the parameter settings used in the base run and 3 additional runs. Here z_{rad} impacts the solar penetration (small value results in more solar penetration into the subsurface) and z_{0m} is the roughness length of momentum for ice. Bold values show the parameter value that is adjusted compared to the base run.

run	z_{rad}	z_{0m}
base	0.005 m	1e-3 m
z0-rough	0.005 m	**1e-2 m**
less-pen	**0.015 m**	1e-3 m
more-pen	**0.001 m**	1e-3 m

Table S3: Slope and p-value of trend in melt season energy for melt, surface melt, internal melt and total melt at COHM for the model runs presented in Table S2.

	Q_M (Wm^{-1})		**Surface melt** (mm w.e.)		**Internal melt** (mm w.e.)		**Total melt** (mm w.e.)	
run	slope	p-value	slope	p-value	slope	p-value	slope	p-value
base	0.05	0.042	0.72	0.039	4.47	0.113	3.88	0.113
z0-rough	0.04	0.023	0.66	0.020	4.91	0.057	4.27	0.057
less-pen	0.14	0.017	2.21	0.015	4.46	0.126	2.24	0.139
more-pen	0.00	0.039	0.02	0.057	6.54	0.126	6.54	0.126

Table S4: Correlations as in Table 2, but with 3 additional runs with parameter settings given in Table S2.

	TARM				COHM			
	base	z0-rough	less-pen	more-pen	base	z0-rough	less-pen	more-pen
RH (%)	-0.07	-0.12	-0.29	-0.14	-0.09	-0.09	-0.09	-0.12
WS (ms^{-1})	0.28	0.27	0.31	0.13	-0.00	-0.03	0.02	-0.09
T_a (°C)	**0.59**	**0.52**	**0.62**	0.21	**0.57**	**0.50**	**0.55**	**0.60**
S_{in} (Wm^{-2})	-0.30	-0.05	0.18	-0.22	-0.08	-0.07	-0.02	-0.05
Albedo (-)	-0.36	-0.33	**-0.51**	-0.24	**-0.80**	**-0.81**	**-0.84**	**-0.59**
Minimum albedo (-)	**-0.44**	**-0.43**	**-0.63**	-0.21	**-0.61**	**-0.59**	**-0.65**	-0.37
L_{in} (Wm^{-2})	**0.41**	0.21	0.02	0.19	0.04	0.03	-0.02	0.13
DDAF (°C)	**0.48**	0.47	**0.50**	0.19	**0.48**	0.39	**0.44**	**0.76**
Daily N_{ep} (-)	0.06	0.09	-0.03	0.22	-0.23	-0.22	-0.28	-0.17
Daily N_{eff} (-)	0.25	0.07	-0.16	0.27	0.05	0.04	0.00	0.01
Precipitation (mm w.e.)	-0.13	-0.20	-0.35	0.10	0.06	0.09	0.05	-0.04
Foehn hours (h)	**0.45**	**0.43**	**0.60**	0.08	**0.45**	0.40	**0.45**	**0.55**
S_{net} (Wm^{-2})	0.23	0.25	**0.50**	0.09	**0.76**	**0.77**	**0.81**	**0.57**
L_{net} (Wm^{-2})	0.17	-0.01	-0.27	0.11	**-0.45**	**-0.47**	**-0.54**	-0.25
Q_G (Wm^{-2})	-0.37	-0.26	-0.01	-0.10	0.01	0.18	0.21	-0.09
Q_P (Wm^{-2})	0.20	0.24	**0.48**	0.08	**0.72**	**0.74**	**0.75**	**0.55**
SH (Wm^{-2})	0.28	0.28	0.25	0.04	-0.34	-0.43	**-0.46**	-0.03
LH (Wm^{-2})	-0.19	-0.16	**-0.40**	-0.09	**-0.63**	**-0.57**	**-0.70**	**-0.43**

3 Surface temperature performance

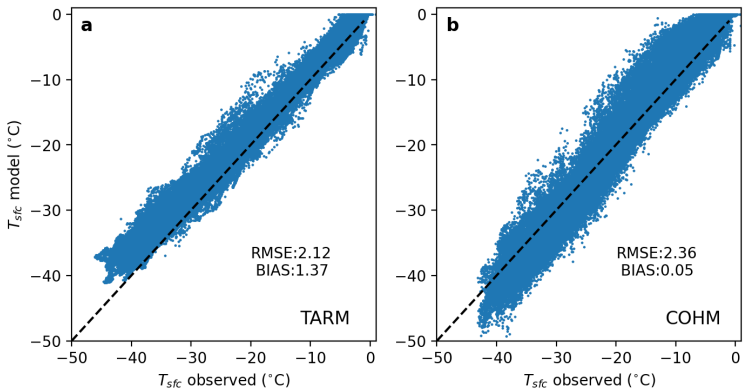

Figure S1: Modelled vs observed surface temperature at TARM (a) and COHM (b) between 2013-2018 when thermal infrared surface temperature observations were available.

4 Minimum albedo and winter foehn

Figure S2: Summer minimum albedo (orange) and the preceding winter foehn wind occurence (black) at COHM.