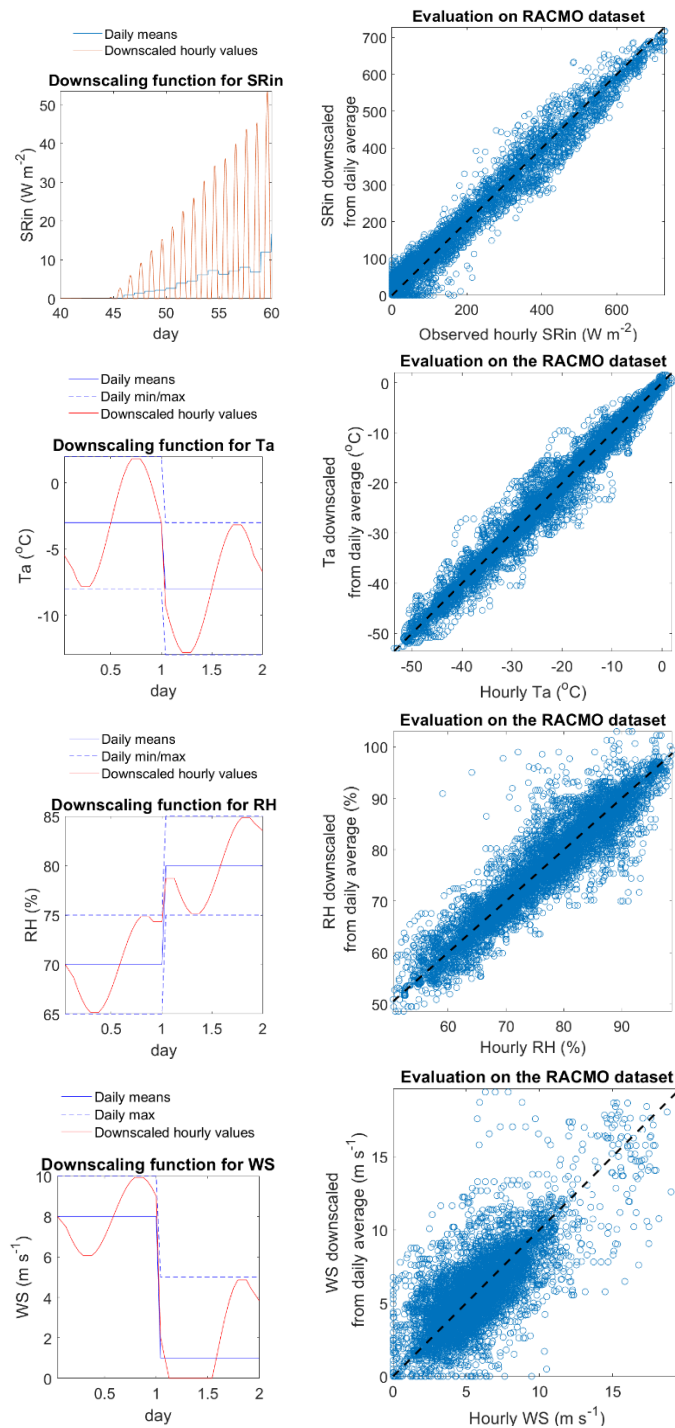
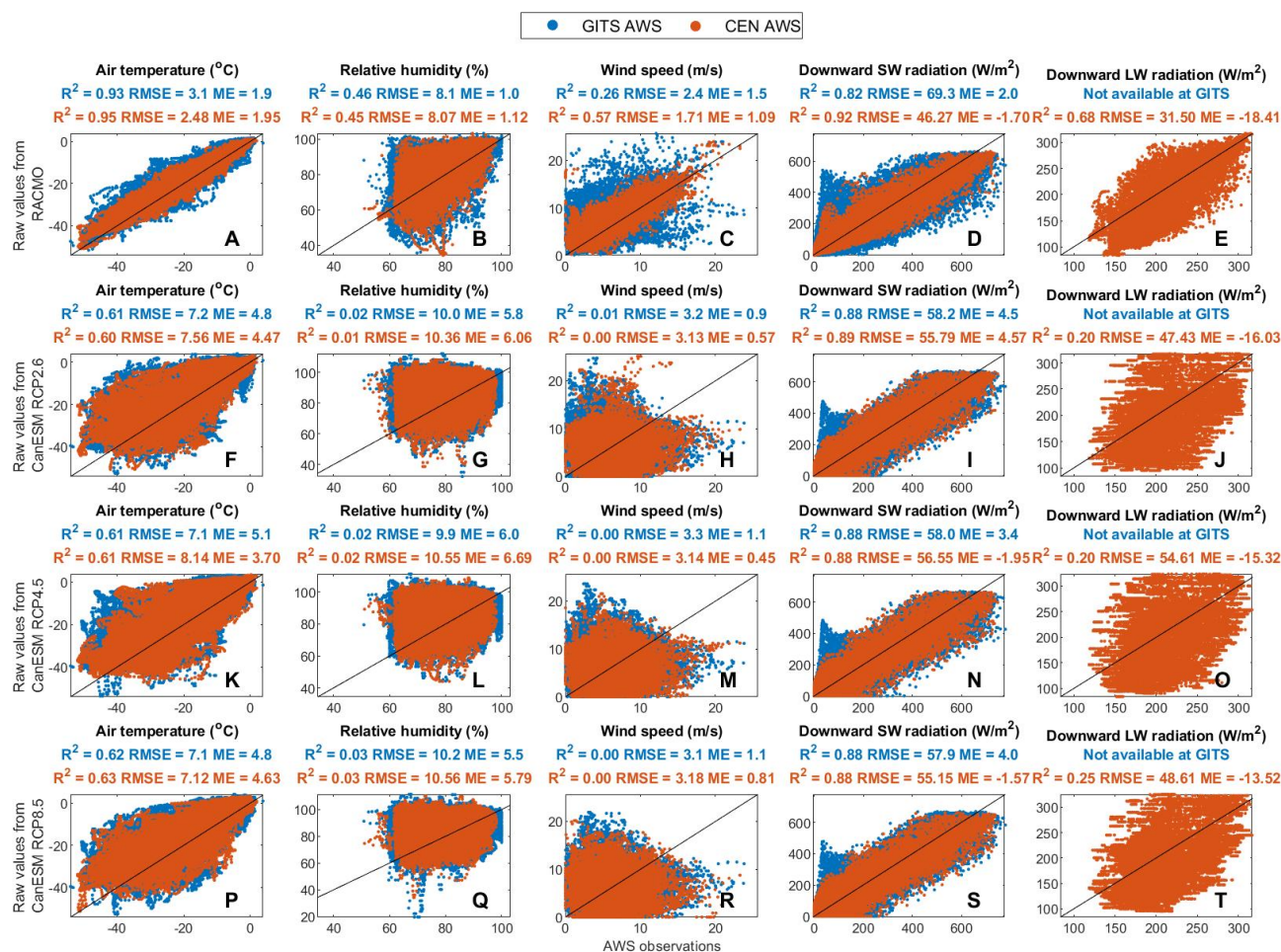


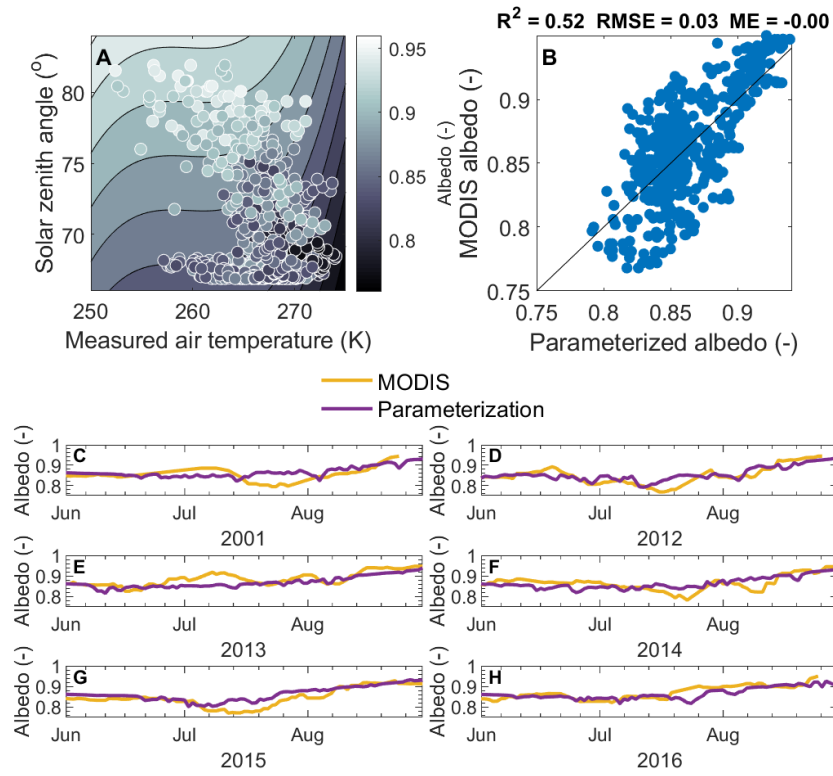
Supplementary Material



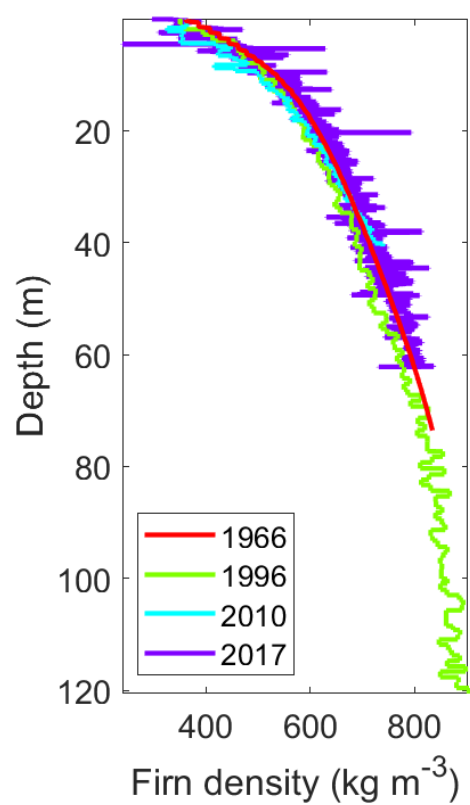
Supplementary Figure 1. Temporal downscaling of daily CanESM output. The left panels show the sinusoidal function that was used to reproduce the diurnal variation while the right panels show an evaluation of these functions when applied on daily-averaged RACMO data for which the hourly values are known.



Supplementary Figure 2. Comparison of RCM/ESM raw values to Automatic Weather Station (AWS) observations.



Supplementary Figure 3. Albedo parameterization. A: MODIS-observed albedo (shaded dots) as a function of the AWS-measured air temperature and concurrent solar zenith angle. Shaded background illustrates the parametrized albedo. B: MODIS-measured albedo versus parameterized albedo. C-H: MODIS observations and parameterized albedo during the summers where both MODIS and AWS observations are available.



Supplementary Figure 4. Comparison of firn density measured in four firn cores.

Supplementary Table 1. Comparison of fire density measured in four fire cores.

Model	RACMO2.3p2	CanESM2 RCP2.6	CanESM2 RCP4.5	CanESM2 RCP8.5				
	1966-2019				2020-2100			
Variable	Mean	Standard deviation	Decadal trend	p-value	Mean	Standard deviation	Decadal trend	p-value
2 m air temperature (°C)	-23.46	1.14	0.38	0.00	-	-	-	-
	-24.21	1.14	0.46	0.00	-21.44	0.93	0.17	0.00
	-23.93	1.19	0.54	0.00	-20.58	1.15	0.33	0.00
	-24.13	1.22	0.54	0.00	-19.53	1.93	0.76	0.00
2 m relative humidity (%)	75.37	1.22	0.31	0.50	-	-	-	-
	75.05	0.99	0.27	0.19	77.02	0.84	0.11	0.00
	75.14	1.06	0.35	0.72	77.43	1.12	0.26	0.01
	75.23	1.04	0.30	0.37	78.51	1.26	0.45	0.06
10 m wind speed (m s ⁻¹)	5.77	0.20	0.02	0.55	-	-	-	-
	6.00	0.23	0.00	0.81	6.03	0.23	0.03	0.85
	6.07	0.23	0.01	0.47	6.12	0.21	0.03	0.91
	5.83	0.22	0.01	0.51	5.89	0.25	0.04	0.40
Downwelling shortwave radiation (W m ⁻²)	124.59	2.97	-0.34	0.20	-	-	-	-
	121.62	3.57	0.14	0.67	120.34	3.25	-0.38	0.01
	124.06	3.44	-0.14	0.64	122.22	3.92	-0.29	0.13
	123.66	3.63	0.11	0.74	119.17	4.04	-0.71	0.00
Surface albedo (-)	0.86	0.00	0.00	-	-	-	-	-
	0.86	0.00	0.00	-	0.86	0.00	0.00	-
	0.86	0.00	0.00	-	0.85	0.00	0.00	-
	0.86	0.00	0.00	-	0.85	0.01	0.00	-
Downwelling longwave radiation (W m ⁻²)	202.31	5.21	1.04	0.95	-	-	-	-
	202.24	5.34	1.64	0.15	213.14	4.50	0.61	0.04
	203.79	5.69	2.04	0.02	217.18	6.14	1.48	0.08
	200.12	5.62	1.86	0.06	219.77	8.19	3.06	0.00
Sensible heat flux (W m-2)	2.19	1.47	0.17	0.24	-	-	-	-
	2.05	1.44	-0.06	0.62	1.36	1.61	0.03	0.72
	0.48	1.40	-0.09	0.50	-0.36	1.65	-0.15	0.06
	2.59	1.35	-0.03	0.79	0.89	1.39	-0.05	0.49
Latent heat flux (W m-2)	-1.08	0.32	-0.04	0.27	-	-	-	-
	-1.77	0.42	-0.07	0.08	-2.29	0.40	-0.05	0.07
	-1.38	0.41	-0.11	0.00	-2.05	0.46	-0.09	0.00
	-1.05	0.38	-0.09	0.01	-2.10	0.60	-0.20	0.00
Conductive heat flux from subsurface (W m-2)	0.85	0.67	0.05	0.43	-	-	-	-
	0.96	0.77	-0.06	0.39	0.64	0.63	0.02	0.64
	0.94	0.64	-0.04	0.50	0.48	0.53	-0.02	0.47
	0.96	0.57	-0.06	0.26	0.46	0.72	-0.08	0.02

Rain heat flux (W m ⁻²)	0.00	0.00	0.00	-	-	-	-	-
	0.00	0.00	0.00	-	0.00	0.00	0.00	0.87
	0.00	0.00	0.00	-	0.00	0.00	0.00	0.32
	0.00	0.00	0.00	-	0.00	0.00	0.00	0.07
Net shortwave radiation (W m ⁻²)	17.71	0.55	0.12	0.56	-	-	-	-
	17.63	0.48	0.17	0.04	18.25	0.48	0.00	0.87
	17.95	0.45	0.13	0.34	18.71	0.60	0.04	0.21
	17.89	0.48	0.16	0.06	18.64	0.71	0.14	0.09
Net longwave radiation (W m ⁻²)	-19.53	1.97	-0.26	0.37	-	-	-	-
	-18.71	1.92	0.07	0.70	-17.62	1.94	0.01	0.91
	-17.87	1.92	0.13	0.45	-16.37	2.34	0.25	0.03
	-20.30	1.87	0.04	0.81	-17.41	2.16	0.29	0.00
Surface temperature (°C)	-23.84	1.19	0.37	0.00	-	-	-	-
	-24.20	1.17	0.45	0.00	-21.37	0.98	0.17	0.00
	-23.90	1.26	0.54	0.00	-20.50	1.23	0.34	0.00
	-24.30	1.28	0.53	0.00	-19.57	1.96	0.77	0.00
Surface melt (mm w.e.)	13.17	17.37	3.82	0.01	-	-	-	-
	15.38	10.97	3.26	0.00	33.57	17.70	1.93	0.03
	11.33	9.63	2.30	0.01	38.82	18.54	2.94	0.00
	7.84	9.30	1.73	0.04	45.00	35.64	10.62	0.00
Snowfall (mm w.e.)	321.88	53.33	2.40	0.87	-	-	-	-
	318.20	81.32	-9.85	0.18	326.53	89.82	4.58	0.48
	331.14	82.13	5.22	0.63	311.46	93.95	9.25	0.08
	321.98	78.20	-2.83	0.69	286.91	67.78	-6.27	0.05
Sublimation (mm w.e.)	-12.03	3.53	-0.41	0.27	-	-	-	-
	-19.73	4.65	-0.82	0.08	-25.51	4.43	-0.50	0.07
	-15.33	4.57	-1.22	0.00	-22.82	5.08	-0.96	0.00
	-11.72	4.26	-1.05	0.01	-23.36	6.69	-2.20	0.00
Rainfall (mm w.e.)	0.00	0.00	0.00	-	-	-	-	-
	0.00	0.00	0.00	-	0.00	0.01	0.00	0.88
	0.00	0.00	0.00	-	0.03	0.18	0.01	0.34
	0.00	0.00	0.00	-	0.22	1.65	0.14	0.07
Surface mass balance (mm w.e.)	309.85	51.37	1.98	0.93	-	-	-	-
	298.47	78.92	-10.67	0.13	301.02	88.09	4.08	0.53
	315.80	79.37	4.01	0.74	288.67	91.49	8.29	0.11
	310.26	76.09	-3.88	0.58	263.76	67.71	-8.34	0.01