Supplementary information

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Temporal constraints on future accumulation-area loss of a major Arctic ice cap due to climate change (Vestfonna, Svalbard)

This supplement contains detailed information on the parameters of air temperature and precipitation downscaling procedures and on the accuracy of downscaling results, on the linear regressions used for extrapolation of modeled equilibrium line altitude time series into the future as well as on calculations of global radiation and surface albedo in the study area. Detailed information regarding the global circulation models used in the study and additional figures illustrating the uncertainty assessment are also provided.

Downscaling parameters and accuracy

Table S1a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-23.1	-1.03	0.66	1.30	-1.13
2	-17.5	-0.89	0.54	1.33	-0.99
3	-21.1	-0.65	0.05	1.43	-0.89
4	-10.9	3.71	-3.12	-2.41	2.20
5	-3.7	-3.36	3.54	1.60	-1.10
6	-0.4	1.73	-1.55	-1.79	2.47
7	0.6	-4.56	4.12	2.67	-2.44
8	0.8	2.34	-2.85	4.00	-2.60
9	-2.5	0.91	-0.49	-0.44	0.51
10	-7.4	0.84	-0.13	-0.08	-0.46
11	-12.2	-1.67	1.48	1.10	-0.90
12	-17.8	-0.15	0.02	1.47	-1.47

Table S1b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-18.9	4.54	-4.50	-4.06	3.96
2	-13.8	-0.07	0.38	-1.80	1.55
3	-21.4	0.49	-0.18	-0.62	0.19
4	-15.4	5.52	-4.74	-2.31	1.64
5	-5.1	0.24	0.38	-1.15	1.03
6	-0.4	2.66	-1.80	-0.15	0.54
7	0.7	0.86	-1.20	1.35	-1.14
8	0.6	-5.73	3.94	3.62	-2.61
9	-4.3	10.28	-9.70	0.85	-0.46
10	-6.4	0.92	-0.17	0.20	-0.55
11	-12.5	1.05	-0.98	-0.53	0.44
12	-12.0	1.26	-1.07	-0.63	0.53

Table S1c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-18.8	-0.26	0.43	-1.61	1.36
2	-11.9	-0.15	-0.29	0.08	0.54
3	-18.6	1.57	-1.43	-0.37	0.24
4	-8.6	-1.62	1.73	1.12	-0.81
5	-4.9	1.03	-0.82	1.14	-0.83
6	-0.5	-1.29	0.93	3.32	-2.24
7	1.2	2.32	-2.25	0.66	-0.34
8	-0.9	-4.27	2.68	1.95	-1.06
9	-4.1	3.50	-3.35	0.43	-0.40
10	-7.2	-1.70	1.53	0.56	-0.18
11	-9.0	2.68	-2.66	0.06	0.12
12	-9.9	0.95	-1.11	-0.36	0.69

Table S1d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-13.9	1.79	-1.40	-1.64	1.38
2	-13.8	0.66	-0.41	-0.67	0.49
3	-20.7	-1.15	0.75	2.55	-2.19
4	-14.1	5.10	-4.31	-4.49	3.86
5	-4.1	3.47	-2.87	-1.23	1.30
6	-0.8	-6.70	6.07	-0.07	1.24
7	1.6	6.39	-5.03	-4.07	3.50
8	-0.8	9.03	-9.15	-5.99	5.79
9	-2.4	2.86	-2.40	0.70	-0.48
10	-7.6	2.17	-1.95	0.26	-0.30
11	-8.4	0.63	-0.24	-0.12	-0.07
12	-17.9	0.68	-0.72	-0.14	0.02

Table S2a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-17.2	0.82	-0.98	-1.76	1.92
2	-15.3	-0.46	0.35	0.28	-0.14
3	-16.1	-0.91	1.14	0.54	-0.72
4	-13.1	-2.51	2.56	2.34	-2.18
5	-7.5	-0.53	0.58	1.04	-0.96
6	-1.5	3.84	-4.75	-2.60	4.14
7	0.8	-1.53	1.55	3.67	-3.48
8	0.2	-0.33	0.93	2.50	-2.83
9	-1.9	-1.00	1.18	0.46	-0.33
10	-7.9	0.95	-0.95	-0.60	0.68
11	-13.3	-0.05	-0.08	0.35	-0.27
12	-10.5	2.53	-2.55	-1.12	1.25

Table S2b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-14.4	-2.05	1.94	0.26	-0.07
2	-16.0	0.61	-0.60	-0.97	0.97
3	-20.9	-2.69	2.42	2.39	-2.20
4	-12.6	-2.31	2.35	2.13	-1.91
5	-6.8	-1.35	1.73	-0.69	0.50
6	-1.3	3.08	-2.13	-2.56	2.79
7	0.7	3.15	-2.78	-0.30	0.47
8	0.1	-0.23	0.21	-1.87	2.59
9	-2.8	-1.05	0.78	1.77	-1.30
10	-6.9	0.32	-0.13	-0.45	0.46
11	-16.2	-2.65	2.72	0.60	-0.88
12	-11.8	-2.53	2.59	0.26	-0.26

Table S2c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-22.3	-3.05	2.89	2.01	-1.97
2	-18.0	1.40	-1.34	0.04	-0.14
3	-28.7	0.27	-0.69	-0.37	0.48
4	-14.6	-1.25	1.56	0.38	-0.57
5	-6.8	2.06	-1.95	-0.79	0.94
6	-1.8	2.53	-2.75	-1.17	1.92
7	0.6	-4.01	3.21	3.00	-2.76
8	-0.4	-0.27	-0.40	-1.13	1.82
9	-2.8	0.16	-0.25	-0.86	1.06
10	-8.0	0.97	-0.66	-0.71	0.54
11	-12.4	3.00	-2.74	-1.29	1.09
12	-15.7	-1.39	1.15	1.33	-1.15

Table S2d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-22.0	1.12	-1.18	-0.77	0.69
2	-10.9	0.27	-0.28	-0.35	0.52
3	-16.6	1.53	-1.58	-0.34	0.47
4	-13.8	-0.20	0.20	-2.25	2.38
5	-6.0	1.59	-1.46	-2.84	2.98
6	-1.4	-0.09	0.19	-0.88	1.86
7	1.2	-1.39	1.75	-1.07	0.78
8	0.0	1.18	-1.03	4.36	-3.81
9	-4.5	0.21	-0.41	1.99	-1.83
10	-7.6	-2.09	2.17	0.69	-0.69
11	-13.0	0.80	-0.50	-0.07	-0.22
12	-9.5	-0.03	0.20	-0.12	0.09

Table S3a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-21.1	0.14	0.05	-0.50	0.18
2	-14.7	-0.05	-0.12	-0.07	0.32
3	-19.0	1.79	-1.82	-1.47	1.47
4	-12.8	1.72	-1.51	-2.02	2.01
5	-6.0	-1.54	1.38	1.05	-0.59
6	-1.3	-2.37	3.74	2.92	-3.36
7	0.6	-0.18	-0.91	2.99	-2.16
8	0.5	-3.93	4.59	1.75	-1.60
9	-2.6	1.48	-1.00	0.34	-0.56
10	-7.2	1.20	-1.15	-1.22	1.30
11	-9.8	1.01	-0.94	0.34	-0.29
12	-13.4	-0.84	0.71	0.70	-0.52

Table S3b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-14.7	-1.95	2.13	0.79	-0.88
2	-15.0	0.72	-0.79	-0.49	0.61
3	-15.3	0.05	0.16	-2.02	1.91
4	-14.9	0.06	0.56	-0.67	0.15
5	-6.1	-0.51	0.90	-1.11	0.98
6	-0.9	-0.04	0.57	0.35	0.24
7	0.8	-1.95	1.75	3.02	-2.75
8	0.5	-2.87	3.24	1.76	-1.60
9	-3.7	1.08	-0.96	0.30	-0.38
10	-7.5	0.63	-0.36	-2.17	2.01
11	-6.7	1.90	-1.77	-1.69	1.84
12	-14.9	1.23	-1.38	-0.70	0.82

Table S3c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-16.2	2.57	-2.59	-2.47	2.54
2	-14.2	-0.33	0.51	-1.05	0.93
3	-22.3	0.40	-0.09	-1.45	0.98
4	-11.2	0.96	-0.73	-2.19	2.17
5	-6.3	-0.22	0.46	-0.22	0.19
6	-1.3	1.00	-0.67	0.69	-0.43
7	0.6	-1.15	0.09	0.09	0.34
8	0.2	3.05	-2.76	-0.79	0.83
9	-2.4	1.15	-0.77	-0.99	0.84
10	-6.4	0.14	0.25	-1.81	1.54
11	-10.7	-0.13	-0.11	-0.70	1.01
12	-13.0	0.01	0.45	-0.51	0.07

Table S3d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-16.4	-3.99	4.28	2.59	-2.83
2	-16.4	1.63	-1.71	0.53	-0.44
3	-17.4	2.52	-2.33	-1.77	1.60
4	-10.4	1.78	-1.69	-0.43	0.65
5	-6.1	-0.35	0.61	0.86	-0.88
6	-1.4	-0.39	0.53	0.60	-0.30
7	0.5	2.68	-3.48	0.48	-0.76
8	0.5	4.52	-4.46	-2.48	3.00
9	-2.2	0.53	-0.32	0.66	-0.54
10	-5.8	0.43	-0.11	-1.29	1.20
11	-10.4	-0.08	-0.03	1.84	-1.60
12	-15.7	-1.02	1.61	-0.15	-0.55

Table S4a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-15.7	-0.93	0.65	-0.18	0.25
2	-14.3	-0.04	0.09	-0.39	0.42
3	-25.2	-0.03	0.00	-0.66	0.41
4	-14.3	0.41	0.20	-2.39	2.01
5	-7.5	0.12	-0.52	0.85	-0.15
6	-3.0	-0.56	0.16	0.11	-0.08
7	1.7	0.12	0.08	-0.41	0.20
8	-0.9	-0.13	-0.20	0.58	-0.20
9	-3.6	-0.26	0.27	0.53	-0.06
10	-8.6	-0.05	0.23	0.10	-0.24
11	-13.2	0.72	-0.63	-0.48	0.60
12	-15.5	0.28	-0.56	0.32	-0.01

Table S4b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-12.3	0.44	-0.15	0.05	0.05
2	-15.8	-0.01	0.14	-0.38	0.28
3	-17.6	0.47	-0.25	-0.06	0.05
4	-13.5	0.03	-0.18	0.47	0.02
5	-8.1	0.40	0.14	1.30	-1.45
6	-2.3	0.38	0.06	0.22	-0.01
7	-0.1	0.07	-0.16	0.43	-0.16
8	-1.8	-0.47	0.19	1.15	-0.89
9	-3.7	-0.16	-0.13	-0.19	0.92
10	-8.4	-0.67	0.92	0.14	-0.62
11	-12.7	0.48	-0.44	-0.33	0.48
12	-11.4	0.09	-0.27	-0.52	0.90

Table S4c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-24.2	0.64	-0.96	0.02	0.21
2	-15.4	0.25	0.00	-0.39	0.31
3	-22.9	0.72	-0.73	0.72	-0.75
4	-13.2	0.94	-0.95	0.03	0.58
5	-7.1	0.06	-0.08	0.15	0.22
6	-2.6	0.30	0.03	0.04	0.24
7	1.4	0.39	-0.24	-0.09	0.14
8	-0.4	-0.60	0.70	0.12	-0.41
9	-3.6	-0.44	0.40	0.79	-0.50
10	-10.2	0.47	-0.46	-0.42	0.65
11	-18.7	0.19	-0.51	-0.48	0.31
12	-16.9	0.45	-0.25	-0.87	0.67

Table S4d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-14.3	0.20	0.16	-0.79	0.63
2	-13.2	0.48	-0.41	0.55	-0.26
3	-19.9	0.17	-0.24	-0.46	0.52
4	-16.5	-0.63	0.32	-0.32	0.47
5	-10.3	-3.00	2.48	-0.52	0.27
6	-1.9	0.09	0.35	-0.48	0.34
7	2.1	0.13	-0.17	0.14	-0.34
8	-1.5	-0.21	0.29	0.50	-0.44
9	-3.5	-0.06	0.28	1.07	-0.95
10	-7.2	-0.06	0.72	1.15	-1.84
11	-13.1	-0.63	0.31	-0.02	0.10
12	-18.7	-0.42	-0.21	-0.37	0.68

Table S5a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-15.0	1.18	-0.90	-0.43	0.31
2	-19.1	0.93	-0.89	-0.25	0.15
3	-22.1	-1.00	0.89	0.14	-0.21
4	-13.5	0.38	-0.72	0.40	0.11
5	-5.6	0.58	-0.51	-0.07	0.33
6	0.0	-0.67	1.24	0.10	0.26
7	0.8	-0.46	0.62	-0.24	0.32
8	0.9	-1.42	1.46	-0.57	1.08
9	-2.4	-0.34	0.32	-0.50	0.72
10	-8.2	0.07	-0.22	0.15	0.06
11	-7.9	0.53	-0.48	-0.27	0.45
12	-9.8	-1.32	1.12	0.50	-0.18

Table S5b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-18.2	-0.75	1.22	-1.40	0.97
2	-21.2	-0.06	0.07	-0.76	0.59
3	-28.7	-0.07	0.17	-0.67	0.22
4	-13.6	-0.26	0.32	-0.04	0.17
5	-4.3	0.16	-0.24	0.19	0.30
6	-1.9	-0.69	0.91	-0.98	1.39
7	-0.1	0.45	-0.17	-1.05	1.13
8	1.0	-0.76	1.12	-0.06	0.27
9	-2.5	0.64	-0.59	0.14	0.05
10	-8.8	-0.41	0.39	0.41	-0.40
11	-14.7	0.01	-0.05	0.53	-0.63
12	-13.5	0.54	-0.65	0.11	0.02

Table S5c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-24.6	0.01	0.05	-1.13	0.85
2	-11.6	-0.06	0.05	0.08	0.11
3	-25.1	0.26	0.17	0.11	-0.75
4	-12.7	0.10	-0.19	0.26	0.06
5	-6.5	-0.07	0.08	-0.21	0.45
6	-0.2	-0.17	0.00	-0.01	1.14
7	1.9	-1.69	0.09	1.28	-0.91
8	-0.3	1.13	-0.93	-1.15	1.52
9	-3.4	0.04	-0.08	-0.44	0.63
10	-9.2	0.42	-0.25	0.06	-0.22
11	-7.6	-0.92	0.72	0.96	-0.66
12	-12.7	-0.34	0.30	0.64	-0.59

Table S5d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-22.0	-0.16	0.07	0.35	-0.48
2	-19.5	-0.04	0.11	0.27	-0.46
3	-21.4	1.04	-0.87	0.63	-0.89
4	-9.9	-0.34	0.35	0.15	0.22
5	-4.8	0.04	0.09	0.22	0.04
6	0.1	-0.95	0.36	0.65	0.38
7	1.8	0.05	-1.12	0.95	-0.01
8	0.7	-0.42	0.33	-0.09	0.58
9	-2.6	-0.07	0.07	-0.15	0.34
10	-7.6	0.29	-0.20	-0.03	0.06
11	-13.5	1.25	-1.08	-0.31	0.12
12	-16.5	-0.10	-0.07	-0.06	0.13

Table S6a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-18.3	-0.29	-0.60	4.99	-3.93
2	-16.7	-3.18	3.65	2.05	-2.51
3	-18.0	-1.31	1.36	-0.60	0.54
4	-10.7	2.10	-1.80	-1.63	1.60
5	-7.1	2.95	-2.82	-1.87	1.81
6	-1.9	-4.84	4.45	2.74	-1.81
7	-0.1	-3.77	3.12	1.06	-0.59
8	0.1	-7.49	8.10	3.96	-4.16
9	-4.8	-2.07	1.53	0.70	-0.11
10	-7.5	-1.03	1.39	0.57	-0.81
11	-14.7	2.41	-2.65	0.01	0.17
12	-14.9	-1.62	1.36	2.11	-1.80

Table S6b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-15.9	-2.30	2.47	0.97	-1.06
2	-17.2	-1.84	1.56	1.76	-1.46
3	-24.2	2.65	-3.02	-0.09	0.27
4	-10.8	-4.16	4.49	3.11	-3.08
5	-6.0	-0.66	1.39	1.05	-1.61
6	-2.0	-3.07	2.97	2.79	-2.48
7	0.1	0.20	0.00	0.55	-0.19
8	-0.4	-1.40	1.97	-1.76	2.40
9	-5.4	0.26	-0.91	1.80	-0.99
10	-8.3	0.76	-0.98	0.03	0.37
11	-14.0	-1.51	1.16	3.33	-2.90
12	-15.3	1.51	-1.94	-1.38	1.75

Table S6c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-19.7	-1.89	2.24	2.65	-3.01
2	-16.1	-0.22	0.07	-1.67	1.75
3	-20.3	-3.39	3.84	0.94	-1.46
4	-15.1	0.68	-0.62	0.01	0.07
5	-5.3	3.10	-2.83	-3.56	3.51
6	-1.4	-3.41	3.96	1.75	-1.77
7	0.2	2.94	-4.52	-0.69	1.37
8	0.2	8.27	-8.52	-5.04	5.32
9	-3.2	-0.73	0.85	0.80	-0.58
10	-7.1	0.94	-0.73	-1.77	1.65
11	-11.5	2.94	-2.95	-0.56	0.64
12	-12.4	-3.17	3.43	2.70	-2.85

Table S6d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-18.4	2.94	-2.41	-3.05	2.38
2	-13.6	-0.16	0.28	-0.60	0.58
3	-16.4	-3.04	3.28	2.92	-3.01
4	-16.5	-4.07	3.93	-0.21	0.36
5	-7.5	2.12	-2.09	-2.16	2.19
6	-2.0	-5.30	5.52	2.75	-1.90
7	-0.8	-2.87	2.13	1.52	-0.93
8	-1.9	-3.20	2.42	0.10	0.71
9	-3.2	1.74	-2.27	-2.73	3.69
10	-8.1	-0.68	0.67	0.56	-0.31
11	-9.8	-1.96	2.35	-1.80	1.43
12	-10.4	-1.06	1.36	0.37	-0.53

Table S7a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-13.9	0.68	-0.33	-1.80	1.45
2	-20.8	-0.90	0.60	-0.20	0.23
3	-22.8	-2.43	1.97	1.70	-1.22
4	-12.3	2.31	-1.68	-3.12	2.43
5	-8.0	-1.35	1.35	1.09	-0.95
6	-1.9	14.25	-14.10	-4.27	5.71
7	0.4	-1.40	1.26	1.14	-0.90
8	2.6	-12.36	14.62	9.48	-10.79
9	-1.3	3.29	-2.62	-0.78	0.20
10	-9.2	0.82	-1.12	-2.27	3.23
11	-17.9	-5.44	4.21	6.88	-4.85
12	-13.0	2.23	-1.88	-6.53	5.46

Table S7b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-14.0	5.47	-5.39	-6.21	5.99
2	-20.5	1.19	-1.91	-2.82	3.43
3	-24.1	-4.70	4.38	3.06	-2.79
4	-12.8	1.35	-0.68	-2.66	1.90
5	-6.9	-4.32	4.33	1.32	-0.93
6	-2.2	6.21	-7.36	-4.45	5.91
7	0.5	10.11	-9.70	-3.64	3.80
8	4.2	-2.21	4.63	0.75	-2.51
9	-1.3	5.73	-5.25	-3.16	3.10
10	-5.7	5.78	-5.71	-7.63	8.05
11	-5.9	-4.92	5.50	2.01	-2.21
12	-13.0	-3.06	3.14	-0.44	0.30

Table S7c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-27.3	0.44	-0.98	1.75	-1.52
2	-16.7	4.35	-4.24	-2.67	2.24
3	-20.5	-1.62	2.27	2.73	-3.85
4	-14.8	3.34	-3.26	-2.86	2.79
5	-5.5	1.56	-1.18	-2.07	1.85
6	-0.7	2.88	-2.64	-6.12	6.80
7	0.7	7.05	-7.97	-4.04	4.33
8	1.9	-11.63	12.27	4.16	-4.88
9	-3.1	0.51	-0.16	1.13	-0.98
10	-7.0	3.90	-3.70	-3.59	3.43
11	-18.1	-4.69	3.69	2.34	-1.07
12	-14.4	-4.05	3.98	1.43	-1.26

Table S7d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-14.9	-6.61	7.48	5.72	-6.44
2	-13.4	1.09	-0.98	-2.32	2.20
3	-15.1	-1.11	1.72	-1.81	0.98
4	-10.3	1.84	-1.34	-4.48	4.10
5	-6.6	2.08	-1.15	0.17	-1.25
6	-1.5	-7.91	9.58	6.21	-5.93
7	0.6	0.16	-0.75	-0.23	0.38
8	3.7	2.48	-0.46	2.19	-4.16
9	-0.8	3.33	-2.76	-4.17	3.39
10	-7.8	-1.23	1.17	-1.81	2.26
11	-10.8	0.62	-0.28	0.55	-0.98
12	-13.8	-0.45	0.21	-1.23	1.55

Table S8a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-24.3	-4.07	4.04	0.09	-0.72
2	-15.0	-1.68	1.79	0.45	-0.47
3	-19.8	-0.35	0.06	-2.50	2.73
4	-17.2	-0.04	0.10	-0.57	0.47
5	-7.5	1.51	-1.62	-0.22	0.69
6	-0.9	-2.40	2.96	-4.46	5.03
7	0.8	0.67	-1.03	-1.75	1.90
8	1.6	-7.19	8.78	1.03	-1.61
9	-2.3	-4.26	4.75	5.47	-5.48
10	-8.9	-1.44	1.39	0.36	-0.08
11	-12.2	-1.50	1.61	0.32	-0.51
12	-18.9	-2.73	2.08	2.11	-1.35

Table S8b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-29.7	0.35	-0.87	-0.84	0.59
2	-17.5	-0.70	0.94	-0.48	-0.03
3	-19.3	5.22	-5.61	-2.26	2.68
4	-12.0	4.55	-4.15	-4.77	4.43
5	-6.0	0.52	0.27	-0.22	-0.54
6	-0.9	-1.07	3.07	0.44	-0.67
7	0.9	0.36	0.26	0.08	-0.13
8	1.4	0.38	1.45	-3.98	3.62
9	-1.6	1.15	-0.62	0.13	-0.45
10	-6.9	-0.37	0.84	1.55	-2.10
11	-4.3	6.50	-5.75	-8.16	7.38
12	-20.0	2.54	-3.21	-2.58	2.98

Table S8c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-23.5	-3.89	3.41	3.27	-2.89
2	-10.5	2.46	-1.79	-1.57	0.97
3	-20.8	0.48	-0.59	-1.84	1.74
4	-12.9	-0.43	0.95	1.17	-1.46
5	-5.8	2.76	-1.69	-0.60	-0.42
6	-1.9	-4.47	4.51	3.95	-2.73
7	-1.0	-6.63	4.97	0.50	0.81
8	0.5	4.75	-3.04	0.13	-0.22
9	-2.7	0.30	0.06	2.79	-2.68
10	-10.4	5.39	-5.68	-5.28	5.52
11	-11.7	-3.22	3.48	4.99	-5.14
12	-14.0	-0.84	0.89	2.13	-2.11

Table S8d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-12.4	-0.44	1.63	0.48	-1.92
2	-16.3	2.74	-2.52	-2.21	1.77
3	-13.9	2.02	-1.11	-2.21	1.08
4	-14.5	1.57	-1.36	3.32	-3.10
5	-7.3	0.56	-0.61	1.25	-0.74
6	-2.5	8.55	-8.71	-0.50	1.59
7	0.0	-1.80	2.09	2.54	-2.12
8	2.5	1.09	0.91	-4.36	3.27
9	-2.4	-0.84	1.17	-0.09	0.20
10	-10.5	0.31	-0.79	1.04	-0.14
11	-10.9	-0.12	0.79	-1.63	0.41
12	-12.0	-2.58	3.12	1.53	-2.18

Table S9a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-16.8	0.20	-0.67	-0.83	1.32
2	-18.2	-1.20	1.13	1.49	-1.50
3	-18.4	-0.76	0.53	2.39	-2.17
4	-17.1	3.38	-3.14	-4.41	4.23
5	-5.7	-1.66	1.75	-0.90	1.04
6	-0.7	-2.26	2.24	2.54	-1.66
7	1.2	2.02	-2.57	2.64	-2.12
8	0.1	-0.72	0.59	1.38	-1.10
9	-2.4	0.24	0.38	0.20	-0.51
10	-8.4	-0.97	1.36	-0.30	-0.02
11	-15.2	1.19	-1.27	-1.02	0.99
12	-11.7	-0.55	1.09	0.89	-1.34

Table S9b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-27.6	3.54	-4.07	-1.99	2.21
2	-20.2	0.26	-0.48	-0.69	0.78
3	-20.9	-0.02	-0.66	1.73	-1.17
4	-15.0	2.01	-1.26	-0.64	0.02
5	-6.2	0.49	-0.07	0.73	-0.92
6	-1.6	-2.02	2.87	-0.17	0.00
7	0.9	0.39	-0.57	-0.16	0.47
8	-0.5	-3.62	3.64	0.22	-0.14
9	-2.3	0.78	-0.04	-0.61	0.32
10	-6.9	1.51	-1.12	0.11	-0.32
11	-17.2	-1.46	1.13	-0.41	0.53
12	-11.7	-0.43	0.60	0.30	-0.39

Table S9c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-21.5	-4.55	4.34	1.53	-1.48
2	-15.6	-0.27	0.17	-1.32	1.46
3	-20.7	1.74	-2.10	-1.16	1.45
4	-11.7	0.68	-0.40	-0.11	0.11
5	-5.3	-0.44	0.59	1.55	-1.39
6	-1.0	-1.14	1.24	-0.01	0.79
7	0.4	-3.92	4.40	0.07	-0.53
8	-0.4	-1.04	0.90	0.17	0.60
9	-2.1	2.28	-2.11	-0.05	0.23
10	-7.1	0.06	0.26	0.90	-1.02
11	-10.0	-3.80	3.95	0.57	-0.61
12	-11.0	0.52	-0.32	0.74	-0.82

Table S9d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-22.9	1.50	-2.23	-0.26	0.80
2	-19.9	0.99	-1.24	0.25	-0.12
3	-20.2	-1.68	1.62	2.69	-2.71
4	-17.7	-0.50	0.61	-0.28	0.16
5	-7.3	0.83	0.06	1.03	-1.79
6	-1.2	-0.13	0.51	2.76	-2.64
7	0.9	-0.20	0.04	1.74	-2.05
8	0.3	0.33	-1.23	0.73	0.29
9	-1.9	0.75	-0.09	-1.21	1.06
10	-5.6	0.07	0.58	-0.63	0.27
11	-11.7	0.78	-1.11	0.56	-0.22
12	-10.0	-1.08	1.94	-1.44	0.75

Table S10a: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 2.6 run of the NorESM1-M global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-13.9	-3.81	4.03	1.31	-1.49
2	-16.4	0.71	-1.05	-0.25	0.61
3	-17.6	1.92	-1.64	-0.35	0.26
4	-19.5	2.14	-2.97	-1.50	2.31
5	-6.3	-1.00	0.98	0.51	-0.14
6	-1.1	-1.16	1.53	-0.13	0.29
7	1.1	-1.38	1.57	1.27	-1.70
8	0.2	0.80	-0.42	-0.52	0.22
9	-3.9	-0.06	-0.16	0.55	-0.32
10	-8.6	0.18	-0.48	-0.84	1.37
11	-16.8	1.09	-1.16	0.59	-0.87
12	-14.9	-0.50	0.79	-0.41	0.04

Table S10b: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 4.5 run of the NorESM1-M global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-18.0	1.68	-1.24	-0.02	-0.36
2	-17.0	1.20	-1.49	-0.08	0.43
3	-16.3	0.17	-0.23	-0.31	0.54
4	-19.2	-2.10	1.72	1.71	-1.52
5	-5.4	0.89	-0.49	-0.77	0.72
6	-0.5	-1.61	1.34	1.22	-0.39
7	0.9	-0.09	-0.21	0.07	0.50
8	0.3	-0.63	1.22	0.03	-0.44
9	-3.0	-2.07	2.45	0.24	-0.64
10	-6.3	-0.26	0.55	-0.21	0.30
11	-9.7	1.65	-1.48	0.05	0.01
12	-15.4	-0.70	0.36	0.43	-0.22

Table S10c: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 6.0 run of the NorESM1-M global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-17.9	0.11	-0.20	0.46	-0.39
2	-16.2	-0.46	0.54	-0.21	0.13
3	-14.9	-1.42	1.25	0.37	-0.11
4	-20.2	-1.16	1.59	2.18	-2.81
5	-5.0	-0.43	0.86	-1.22	1.14
6	-0.8	-3.61	3.43	0.20	0.35
7	1.0	-0.75	0.91	0.99	-1.14
8	-0.3	-2.74	2.64	1.03	-1.13
9	-4.1	-1.53	1.08	-0.06	0.61
10	-7.6	-0.67	0.58	-0.23	0.52
11	-16.4	-0.48	0.25	0.79	-0.96
12	-13.6	-0.78	0.35	0.34	0.10

Table S10d: Parameters (a_i, $b_{j,i}$) of the multiple linear regression equation used during downscaling of air temperatures from the RCP 8.5 run of the NorESM1-M global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	a_i	$b_{NW,i}$	$b_{NE,i}$	$b_{SW,i}$	$b_{SE,i}$
1	-20.3	0.47	0.03	0.30	-1.01
2	-19.8	-0.11	-0.01	0.33	-0.41
3	-12.2	0.61	-0.87	-0.87	1.60
4	-16.0	-0.95	0.83	-0.23	0.39
5	-6.1	1.11	-0.83	-0.79	0.76
6	-0.4	0.94	-0.48	-1.39	1.67
7	0.7	-1.67	1.49	0.36	0.36
8	-0.2	-1.11	0.77	-0.29	1.30
9	-3.5	0.27	-0.23	1.11	-1.14
10	-8.0	-0.52	0.77	0.40	-0.60
11	-15.8	-1.18	1.36	0.14	-0.60
12	-20.5	-0.32	0.38	0.66	-1.10

Table S11: Accuracy of the downscaled GCM air temperatures expressed as monthly root mean square (RMS) errors between GCM and ERA-Interim data of the period September 2006 to August 2011. Unit is K. Given RMS errors refer to either months of the accumulation season (Sep–May), months of the ablation season (Jun–Aug) or all months of the entire year. The four RCP scenarios are indicated by 2.6, 4.5, 6.0 and 8.5 respectively.

GCM	Accumulation season				Ablation season				Year round			
	2.6	**4.5**	**6.0**	**8.5**	**2.6**	**4.5**	**6.0**	**8.5**	**2.6**	**4.5**	**6.0**	**8.5**
BCC-CSM1.1	2.60	2.51	2.51	2.64	0.59	0.66	0.58	0.45	2.27	2.20	2.20	2.30
CSIRO-Mk3.6.0	2.58	2.38	2.34	2.42	0.63	0.64	0.58	0.58	2.25	2.09	2.05	2.12
GFDL-ESM2G	2.54	2.48	2.54	2.40	0.70	0.60	0.71	0.52	2.23	2.17	2.23	2.10
HadGEM2-ES	2.30	2.47	2.20	2.67	0.53	0.62	0.64	0.62	2.01	2.16	1.94	2.34
IPSL-CM5A-LR	2.37	2.41	2.55	2.45	0.56	0.60	0.60	0.74	2.07	2.11	2.23	2.15
MIROC5	2.43	2.45	2.56	2.75	0.58	0.61	0.67	0.60	2.13	2.14	2.24	2.40
MIROC-ESM	2.42	2.36	2.23	2.29	0.54	0.62	0.50	0.64	2.11	2.07	1.94	2.01
MIROC-ESM-CHEM	2.49	2.26	2.26	2.25	0.62	0.62	0.78	0.49	2.18	1.98	2.00	1.97
MRI-CGCM3	2.59	2.51	2.53	2.48	0.65	0.62	0.38	0.57	2.27	2.19	2.20	2.17
NorESM1-M	2.43	2.41	2.33	2.20	0.72	0.54	0.59	0.57	2.14	2.10	2.04	1.93

Table S12a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.28	-0.73	0.80	0.24	-0.60
2	0.15	1.33	-1.24	-0.13	0.19
3	0.28	0.07	-0.27	-0.47	0.46
4	0.14	-0.06	-0.05	-0.08	0.09
5	0.10	0.21	-0.03	0.30	-0.39
6	0.14	-0.69	0.44	0.44	0.00
7	0.19	0.20	-0.34	0.15	-0.20
8	0.25	0.07	-0.16	-0.28	0.07
9	0.26	-0.66	0.79	0.89	-0.96
10	0.41	0.45	-0.41	-0.19	0.17
11	0.34	0.45	-0.43	0.13	-0.02
12	0.25	0.33	-0.40	0.15	-0.14

Table S12b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.17	-0.25	0.44	-0.82	0.83
2	0.14	0.31	-0.06	-1.91	1.82
3	0.21	0.77	-0.60	-0.67	0.57
4	0.14	1.05	-1.58	0.97	-0.56
5	0.10	0.20	-0.10	-0.26	0.28
6	0.15	-0.14	0.36	0.17	-0.27
7	0.18	-0.03	0.01	-0.02	-0.09
8	0.20	-0.09	-0.03	-0.40	0.46
9	0.25	-0.56	0.48	0.69	-0.55
10	0.41	-0.57	0.50	0.27	-0.19
11	0.41	1.14	-1.15	0.04	-0.08
12	0.22	0.28	-0.35	0.01	0.11

Table S12c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	-1.09	1.33	0.31	-0.54
2	0.19	-1.29	1.25	-0.09	0.04
3	0.17	1.17	-0.80	-0.64	0.56
4	0.15	-2.77	3.07	0.66	-1.12
5	0.11	0.28	-0.48	-0.14	0.34
6	0.20	-0.37	0.26	0.34	-0.41
7	0.15	-0.10	-0.03	0.15	0.02
8	0.22	0.41	-0.54	-0.27	0.26
9	0.30	-0.94	0.79	-0.23	0.29
10	0.42	-0.58	0.49	0.26	-0.19
11	0.41	-0.40	0.58	-0.26	0.05
12	0.19	-0.05	0.20	0.16	-0.12

Table S12d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the BCC-CSM1.1 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.16	-0.68	0.91	-0.10	0.12
2	0.18	0.19	-0.15	-0.29	0.18
3	0.23	0.24	-0.16	-0.15	0.07
4	0.17	1.16	-1.20	-1.17	0.91
5	0.10	0.22	-0.13	-0.50	0.50
6	0.18	-0.09	0.00	0.41	-0.32
7	0.17	0.17	-0.04	-0.81	0.63
8	0.18	-0.05	0.15	0.12	-0.15
9	0.30	-1.11	0.99	-0.58	0.61
10	0.32	-0.40	0.53	-0.47	0.56
11	0.43	0.52	-0.55	-0.42	0.33
12	0.26	0.15	-0.38	0.40	-0.26

Table S13a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	0.12	0.00	-0.59	0.45
2	0.18	-0.19	0.30	-0.45	0.28
3	0.24	0.36	-0.27	0.09	-0.20
4	0.15	0.13	-0.34	0.04	0.04
5	0.12	-0.56	0.40	0.89	-0.80
6	0.18	-1.60	1.62	0.51	-0.59
7	0.14	1.29	-1.20	-0.97	1.00
8	0.19	-0.01	0.02	0.07	-0.08
9	0.26	0.13	-0.09	-0.88	0.89
10	0.38	-0.16	0.21	-0.83	0.87
11	0.33	-0.37	0.60	0.58	-0.66
12	0.24	0.03	-0.01	0.62	-0.66

Table S13b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.18	-2.04	2.31	0.94	-1.03
2	0.16	-0.25	0.30	0.24	-0.25
3	0.25	-0.29	0.12	0.07	0.03
4	0.13	-0.21	0.11	-0.85	0.97
5	0.11	0.43	-0.48	0.30	-0.24
6	0.16	-1.51	2.31	-0.32	-0.37
7	0.19	0.14	-0.24	0.04	-0.14
8	0.17	-0.44	0.14	1.40	-0.98
9	0.25	0.20	-0.28	-0.67	0.81
10	0.39	-0.48	0.44	-0.18	0.28
11	0.34	0.21	0.10	0.93	-1.11
12	0.23	-0.60	0.71	0.26	-0.35

Table S13c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.20	-0.64	0.75	0.14	-0.20
2	0.20	2.88	-3.00	-1.67	1.63
3	0.25	0.10	-0.13	-0.44	0.39
4	0.13	0.22	0.02	0.03	-0.27
5	0.12	-0.73	0.49	1.48	-1.27
6	0.17	0.53	-0.58	0.15	-0.07
7	0.17	-0.32	0.38	-0.27	0.12
8	0.24	0.39	-0.49	-1.10	0.97
9	0.26	-0.24	0.34	-0.39	0.34
10	0.43	-0.50	0.42	0.04	-0.01
11	0.42	0.04	0.09	-0.27	0.05
12	0.26	-0.91	0.95	0.78	-0.91

Table S13d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the CSIRO-Mk3.6.0 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.24	0.74	-0.90	-0.28	0.33
2	0.18	0.25	-0.48	-0.24	0.45
3	0.22	0.29	-0.32	-0.07	0.14
4	0.13	0.19	-0.05	-0.56	0.42
5	0.12	-0.15	0.18	0.21	-0.25
6	0.20	-0.85	0.80	-0.18	0.07
7	0.13	-0.63	0.44	0.55	-0.17
8	0.19	0.24	-0.26	-0.35	0.38
9	0.24	-0.20	0.32	0.14	-0.14
10	0.47	-0.11	0.01	0.08	-0.12
11	0.38	-0.80	0.92	0.20	-0.28
12	0.23	0.02	0.00	0.73	-0.71

Table S14a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.23	-0.03	0.10	0.34	-0.46
2	0.18	-0.04	0.12	0.46	-0.60
3	0.26	-0.05	-0.04	-0.35	0.33
4	0.15	-0.10	-0.04	-0.11	0.11
5	0.09	-0.58	0.53	0.17	0.09
6	0.10	0.01	-0.16	-0.39	0.98
7	0.17	-0.47	0.40	0.47	-0.45
8	0.21	-0.36	0.28	0.54	-0.53
9	0.28	-0.33	0.39	-0.14	0.05
10	0.45	0.14	-0.04	-0.67	0.49
11	0.31	0.60	-0.23	-0.36	0.19
12	0.19	0.69	-0.83	-0.63	0.95

Table S14b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.21	0.02	-0.31	0.86	-0.52
2	0.17	0.16	0.04	-0.27	0.06
3	0.23	-0.70	0.79	-0.39	0.30
4	0.12	-0.29	0.51	-0.42	0.25
5	0.12	0.68	-0.65	-0.32	0.25
6	0.17	0.80	-0.80	-0.53	0.58
7	0.16	-2.05	1.94	0.89	-0.80
8	0.18	0.93	-0.89	-0.64	0.68
9	0.19	-0.28	0.17	0.92	-0.51
10	0.38	-0.08	0.17	-0.27	0.27
11	0.40	-0.39	0.25	0.16	-0.05
12	0.25	-0.27	0.13	0.70	-0.58

Table S14c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.25	-0.03	-0.12	0.01	-0.01
2	0.17	1.87	-1.82	-0.20	0.18
3	0.27	-0.04	-0.01	0.03	-0.13
4	0.14	0.68	-0.51	-1.35	1.13
5	0.09	0.39	-0.02	-0.06	-0.14
6	0.21	0.52	-0.53	-0.32	0.11
7	0.17	0.37	-0.40	0.03	-0.11
8	0.19	-0.89	0.82	-0.12	0.21
9	0.31	0.29	-0.26	-0.53	0.36
10	0.40	-1.03	1.08	0.30	-0.33
11	0.45	0.09	-0.07	0.02	-0.19
12	0.22	0.11	-0.25	0.66	-0.46

Table S14d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the GFDL-ESM2G global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.24	0.08	-0.18	-0.21	0.22
2	0.20	-0.22	0.00	0.50	-0.48
3	0.20	0.27	-0.12	-0.40	0.37
4	0.13	0.26	-0.26	-0.30	0.25
5	0.11	-0.82	0.73	0.66	-0.57
6	0.18	0.02	0.04	-0.24	0.10
7	0.18	-0.23	0.09	-0.06	0.08
8	0.17	0.59	-0.31	-0.33	0.14
9	0.23	-0.32	0.23	0.44	-0.21
10	0.40	0.47	-0.36	-0.15	0.08
11	0.41	0.29	-0.29	-0.67	0.64
12	0.23	1.37	-1.19	-1.08	0.95

Table S15a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.25	-0.36	0.24	0.20	-0.25
2	0.17	0.21	0.02	-0.44	0.22
3	0.28	0.14	-0.18	-0.36	0.19
4	0.11	0.90	-0.71	0.14	-0.19
5	0.11	0.81	-0.71	-0.31	0.28
6	0.23	0.07	-0.34	-0.24	0.19
7	0.19	0.01	-0.26	-0.11	0.15
8	0.17	0.02	0.15	0.11	-0.14
9	0.30	-0.05	0.10	-0.06	-0.12
10	0.39	-0.37	0.42	0.37	-0.36
11	0.44	0.34	-0.45	-0.49	0.48
12	0.19	0.32	-0.19	0.27	-0.19

Table S15b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.21	-0.18	0.31	-0.15	0.02
2	0.17	0.17	-0.15	-0.59	0.57
3	0.20	0.21	-0.33	0.21	0.03
4	0.15	-0.84	0.85	0.60	-0.79
5	0.12	-0.59	0.41	0.65	-0.52
6	0.22	0.08	-0.26	-0.22	0.11
7	0.18	0.07	-0.19	-0.02	0.00
8	0.20	-0.04	-0.03	-0.02	0.06
9	0.22	-0.01	-0.03	0.03	0.19
10	0.40	0.37	-0.23	-0.14	0.04
11	0.36	0.73	-0.74	0.09	-0.01
12	0.21	0.94	-0.91	0.41	-0.31

Table S15c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	0.36	-0.41	0.07	-0.02
2	0.09	0.61	-0.63	1.49	-1.01
3	0.28	-0.22	0.13	-0.13	0.01
4	0.15	-0.70	0.47	0.46	-0.40
5	0.10	0.54	-0.57	-0.25	0.37
6	0.18	-0.75	0.34	-0.06	0.43
7	0.17	0.00	0.03	-0.08	0.01
8	0.17	-0.06	-0.09	-0.25	0.53
9	0.22	0.51	-0.52	0.25	-0.06
10	0.45	-0.10	0.01	-0.21	0.21
11	0.44	-0.21	0.18	-0.31	0.20
12	0.21	0.06	0.14	-0.17	0.08

Table S15d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the HadGEM2-ES global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.23	0.06	0.09	-0.30	0.08
2	0.13	-0.27	-0.02	-0.88	1.41
3	0.29	-0.73	0.85	-0.02	-0.36
4	0.12	0.66	-0.61	-2.18	2.18
5	0.13	0.26	-0.34	-0.59	0.56
6	0.11	0.62	-0.14	0.46	-0.60
7	0.19	0.05	0.08	-0.20	-0.11
8	0.19	-0.04	0.09	-0.07	0.06
9	0.24	-0.20	0.55	-0.41	0.16
10	0.44	0.37	-0.35	-0.09	0.02
11	0.37	0.05	-0.24	-0.13	0.36
12	0.26	-0.58	0.69	-0.58	0.38

Table S16a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.19	-0.06	-0.14	0.32	-0.01
2	0.16	-0.30	0.56	-0.08	-0.09
3	0.25	-0.39	0.46	-0.15	0.00
4	0.07	-0.51	0.80	-0.58	0.74
5	0.12	-0.34	0.13	-0.26	0.41
6	0.17	-0.14	-0.09	0.33	-0.07
7	0.14	0.11	-0.05	0.18	-0.14
8	0.16	-0.25	0.60	0.04	-0.21
9	0.27	0.33	-0.42	-0.12	0.20
10	0.44	-0.29	0.24	0.09	-0.11
11	0.43	0.09	-0.05	-0.06	-0.10
12	0.22	-0.03	0.13	0.30	-0.33

Table S16b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.21	0.50	-0.25	-0.60	0.40
2	0.24	-0.08	-0.32	-0.10	0.11
3	0.24	-0.04	-0.05	-0.01	0.09
4	0.16	-0.14	0.09	0.14	-0.35
5	0.09	-0.08	0.37	-0.21	0.15
6	0.20	-0.04	-0.04	-0.04	-0.03
7	0.05	0.40	-0.15	0.08	0.36
8	0.18	-0.25	0.16	0.13	0.01
9	0.27	0.08	-0.46	0.07	0.32
10	0.38	0.34	-0.42	0.26	-0.09
11	0.43	0.10	-0.24	-0.04	0.08
12	0.22	0.30	-0.33	0.23	-0.11

Table S16c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.23	-0.05	-0.03	-0.20	0.22
2	0.18	-0.01	-0.04	0.15	-0.17
3	0.22	-0.12	0.27	-0.15	0.06
4	0.12	-0.23	0.29	-0.22	0.25
5	0.08	0.04	0.07	-0.25	0.40
6	0.15	0.29	-0.16	-0.13	0.10
7	0.15	0.17	-0.18	0.09	-0.01
8	0.17	-0.24	0.04	0.30	0.00
9	0.29	-0.04	0.13	-0.22	0.05
10	0.46	-0.14	0.10	-0.12	0.06
11	0.36	-0.24	0.29	0.29	-0.25
12	0.29	-0.11	-0.04	0.01	-0.07

Table S16d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the IPSL-CM5A-LR global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.23	-0.58	0.99	0.12	-0.61
2	0.20	0.90	-1.36	-0.51	0.80
3	0.25	0.36	-0.50	0.06	-0.01
4	0.12	-0.15	0.03	0.25	-0.06
5	0.10	-0.36	0.54	-0.28	0.20
6	0.11	0.02	-1.32	2.31	-0.65
7	0.19	-0.07	0.07	-0.31	0.12
8	0.14	0.00	0.20	0.30	-0.24
9	0.28	-0.20	0.02	0.36	-0.20
10	0.49	-0.19	0.11	-0.05	-0.04
11	0.37	-0.24	0.44	0.40	-0.55
12	0.22	0.05	-0.12	-0.23	0.38

Table S17a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.18	-0.21	0.29	-0.17	0.26
2	0.20	-1.44	1.24	2.91	-2.88
3	0.23	-0.99	1.17	0.50	-0.69
4	0.12	-0.73	0.53	0.46	-0.21
5	0.11	-0.73	0.71	0.14	-0.08
6	0.18	-2.07	1.69	2.87	-2.54
7	0.17	0.01	-0.02	0.05	-0.10
8	0.11	-0.15	0.34	-3.62	3.86
9	0.31	-0.03	-0.13	-0.36	0.38
10	0.42	0.16	-0.29	-0.54	0.64
11	0.37	1.65	-1.75	-0.90	1.05
12	0.25	-0.02	0.08	-0.53	0.43

Table S17b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	0.29	-0.33	0.63	-0.59
2	0.18	-1.60	1.78	1.56	-1.79
3	0.25	0.80	-0.85	-0.41	0.38
4	0.11	0.32	-0.01	-0.05	-0.11
5	0.13	0.20	-0.34	-0.39	0.42
6	0.18	-2.75	2.77	1.65	-1.73
7	0.17	0.59	-0.69	-1.11	1.14
8	0.19	0.23	-0.13	-0.76	0.66
9	0.26	-0.97	0.93	1.16	-1.09
10	0.42	1.22	-0.98	-0.57	0.32
11	0.36	0.14	-0.11	-0.54	0.58
12	0.24	-0.74	0.54	0.97	-0.76

Table S17c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	-0.42	0.35	-0.67	0.71
2	0.17	1.80	-1.72	0.08	-0.18
3	0.27	-1.27	1.15	0.36	-0.42
4	0.14	-0.85	0.63	1.33	-1.17
5	0.10	-0.36	0.60	-0.51	0.41
6	0.18	1.29	-1.39	-1.09	1.17
7	0.17	-2.78	3.09	1.33	-1.70
8	0.17	1.65	-1.70	-0.25	0.41
9	0.24	-0.92	1.07	0.75	-0.80
10	0.44	0.29	-0.31	-0.47	0.43
11	0.44	0.97	-1.00	-1.82	1.73
12	0.22	0.02	-0.16	0.58	-0.38

Table S17d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the MIROC5 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	-0.85	0.85	0.41	-0.41
2	0.17	0.41	-0.37	0.34	-0.38
3	0.23	1.33	-1.38	-0.59	0.66
4	0.13	0.51	-0.54	-0.63	0.62
5	0.12	-0.05	-0.18	0.37	-0.20
6	0.19	-3.96	3.61	-0.01	0.24
7	0.16	-0.09	0.11	0.29	-0.34
8	0.21	-0.56	0.54	0.89	-0.96
9	0.30	0.14	-0.17	0.15	-0.22
10	0.34	-0.07	0.13	0.95	-0.82
11	0.41	-0.04	0.10	-0.77	0.66
12	0.24	-0.07	0.21	0.25	-0.41

Table S18a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	-0.09	0.03	0.03	0.02
2	0.14	-0.43	0.36	0.63	-0.36
3	0.19	-0.93	0.87	0.02	0.23
4	0.08	-1.61	2.10	-0.28	0.18
5	0.13	-0.38	0.26	0.27	-0.29
6	0.03	-2.88	3.08	-0.04	0.65
7	0.16	0.28	-0.14	-0.35	0.22
8	0.22	-0.12	-0.07	0.09	-0.05
9	0.29	0.40	-0.32	-0.26	0.12
10	0.42	-0.65	0.62	0.19	-0.17
11	0.35	-0.34	0.26	0.17	0.00
12	0.25	-0.33	0.39	-0.23	0.09

Table S18b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.25	0.01	-0.08	0.14	-0.23
2	0.16	0.41	-0.28	0.46	-0.55
3	0.17	-0.67	0.79	0.33	-0.16
4	0.15	0.05	-0.10	-0.24	0.11
5	0.11	0.47	-0.45	-0.08	0.13
6	0.17	-0.73	0.93	0.19	-0.38
7	0.18	0.15	-0.18	-0.32	0.19
8	0.16	-0.38	0.47	0.07	0.00
9	0.30	-0.15	0.06	0.18	-0.20
10	0.42	0.91	-1.01	-0.14	0.22
11	0.41	0.06	0.03	0.05	-0.20
12	0.18	-0.68	0.86	0.79	-0.74

Table S18c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.23	-0.05	-0.07	0.11	-0.03
2	0.14	-0.41	0.42	0.28	-0.12
3	0.26	0.03	-0.07	0.06	-0.14
4	0.13	0.17	-0.25	-0.04	0.15
5	0.12	0.42	-0.46	-0.01	-0.02
6	0.19	-0.09	-0.20	0.99	-0.82
7	0.14	0.60	-0.38	-0.14	0.04
8	0.20	-0.15	0.19	-0.51	0.42
9	0.26	-0.31	0.13	0.10	0.11
10	0.50	0.04	-0.12	0.06	-0.19
11	0.34	0.00	0.05	-0.01	0.10
12	0.23	0.02	-0.05	-0.02	0.06

Table S18d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the MIROC-ESM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.19	0.72	-0.58	0.09	-0.12
2	0.18	-0.32	0.14	0.57	-0.41
3	0.17	-0.34	0.57	0.01	0.03
4	0.13	-0.10	0.01	0.52	-0.41
5	0.13	0.29	-0.30	0.00	-0.12
6	0.17	-0.29	0.22	-0.68	0.76
7	0.16	-0.84	0.85	0.61	-0.65
8	0.18	-0.33	0.51	0.00	-0.11
9	0.32	-0.02	-0.19	-0.11	0.14
10	0.35	-0.06	0.09	-0.37	0.48
11	0.46	0.19	0.02	-0.65	0.27
12	0.24	-0.19	0.04	-0.75	0.90

Table S19a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	-0.80	0.86	-0.08	-0.01
2	0.16	-0.34	0.45	-0.13	0.09
3	0.22	-0.71	0.74	0.95	-0.93
4	0.13	-0.74	0.95	-0.05	-0.21
5	0.11	0.04	0.01	0.77	-0.79
6	0.22	-0.27	0.06	0.03	-0.07
7	0.11	-0.86	1.01	-0.35	0.53
8	0.20	0.35	-0.47	0.52	-0.45
9	0.26	0.17	-0.22	0.25	-0.16
10	0.42	-0.19	0.13	0.00	0.05
11	0.31	0.18	0.01	0.39	-0.38
12	0.22	-0.65	0.73	0.80	-0.81

Table S19b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.27	-0.12	0.10	-0.39	0.19
2	0.19	0.51	-0.54	-0.19	0.08
3	0.25	-0.01	-0.10	-0.06	0.07
4	0.13	-0.50	0.50	0.03	-0.02
5	0.10	-0.17	0.28	0.18	-0.15
6	0.22	0.10	-0.18	-0.01	-0.16
7	0.20	-0.12	-0.01	-0.14	0.02
8	0.18	-0.50	0.49	-0.13	0.19
9	0.26	-0.12	0.05	0.79	-0.68
10	0.43	0.85	-0.86	-0.09	0.06
11	0.34	-0.37	0.52	-0.70	0.67
12	0.18	0.23	-0.26	0.91	-0.65

Table S19c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.23	-0.03	-0.07	0.19	-0.14
2	0.18	-0.40	0.45	0.32	-0.41
3	0.24	-0.12	0.05	0.00	0.01
4	0.14	-0.13	0.17	0.19	-0.30
5	0.10	0.33	-0.02	-0.29	0.13
6	0.18	-0.92	0.97	-0.01	-0.08
7	0.15	-0.06	0.16	0.03	-0.07
8	0.18	-0.48	0.59	-0.91	0.87
9	0.23	-0.56	0.65	-0.04	0.10
10	0.37	-0.01	0.27	0.38	-0.53
11	0.37	-0.01	0.05	0.15	-0.14
12	0.23	0.68	-0.68	-0.24	0.26

Table S19d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the MIROC-ESM-CHEM global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.21	-0.40	0.39	0.53	-0.47
2	0.15	1.81	-1.91	0.44	-0.24
3	0.23	0.39	-0.31	-0.22	0.17
4	0.13	-0.22	0.19	-0.46	0.46
5	0.12	-0.19	0.07	0.15	-0.06
6	0.17	0.39	-0.57	-0.02	0.19
7	0.18	-0.54	0.49	0.33	-0.42
8	0.18	-0.01	0.03	0.10	-0.04
9	0.25	-0.14	0.13	0.72	-0.63
10	0.45	0.12	-0.15	0.04	-0.10
11	0.37	-0.05	0.15	0.02	-0.07
12	0.19	0.15	0.02	-0.10	0.12

Table S20a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.27	0.59	-0.86	-0.49	0.53
2	0.20	0.16	-0.12	0.15	-0.34
3	0.18	0.60	-0.45	-0.91	0.97
4	0.08	-3.43	3.46	2.08	-1.70
5	0.12	-1.70	1.54	0.22	-0.10
6	0.16	-0.16	0.20	1.49	-1.47
7	0.18	1.32	-1.12	-2.01	1.65
8	0.18	1.08	-1.07	-0.92	0.97
9	0.32	0.76	-0.79	-1.05	0.90
10	0.48	0.73	-0.67	-1.68	1.46
11	0.43	0.76	-0.84	0.01	-0.03
12	0.21	0.55	-0.21	-1.13	0.89

Table S20b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.18	-2.04	2.12	0.02	0.06
2	0.19	-0.71	0.48	0.90	-0.77
3	0.26	0.92	-1.35	0.11	0.17
4	0.09	0.99	-0.95	-0.06	0.35
5	0.11	-0.23	0.36	1.56	-1.68
6	0.17	-0.91	1.24	0.09	-0.40
7	0.14	0.47	-0.76	0.42	-0.01
8	0.18	1.21	-0.92	-1.16	0.91
9	0.26	-2.04	2.38	-0.33	0.02
10	0.45	-0.12	-0.08	0.08	0.03
11	0.38	-0.11	0.19	0.50	-0.57
12	0.23	0.45	-0.75	1.18	-0.86

Table S20c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	-0.83	0.55	1.12	-0.88
2	0.20	-0.72	0.74	0.09	-0.29
3	0.25	-1.16	1.13	0.57	-0.62
4	0.10	1.18	-0.71	0.12	-0.34
5	0.10	0.49	-0.28	-0.21	0.09
6	0.18	0.15	-0.13	-0.24	0.18
7	0.14	-2.56	2.35	1.32	-1.01
8	0.20	-0.72	0.74	0.15	-0.19
9	0.28	-0.07	0.28	-0.51	0.27
10	0.43	0.76	-0.56	-0.84	0.61
11	0.39	-0.16	0.06	-0.40	0.49
12	0.24	-0.36	0.37	1.04	-1.08

Table S20d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the MRI-CGCM3 global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	-0.40	0.45	0.86	-0.92
2	0.17	-0.24	0.23	0.40	-0.37
3	0.26	0.17	-0.24	-0.52	0.45
4	0.15	-0.98	0.85	0.33	-0.36
5	0.11	1.37	-1.34	-0.56	0.54
6	0.11	0.03	-0.09	0.12	0.30
7	0.19	0.29	-0.58	2.54	-2.48
8	0.19	-0.44	0.01	0.16	0.28
9	0.26	-0.63	0.72	-0.53	0.47
10	0.41	0.16	-0.24	0.29	-0.20
11	0.37	-0.46	0.57	-0.12	0.06
12	0.22	1.72	-1.51	-2.61	2.48

Table S21a: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 2.6 run of the NorESM1-M global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.22	1.23	-1.10	-0.36	0.20
2	0.18	-1.40	1.22	1.17	-1.01
3	0.25	0.05	-0.04	-0.01	-0.05
4	0.11	-0.75	0.23	-0.33	0.96
5	0.12	0.40	-0.37	0.19	-0.29
6	0.12	-0.32	0.64	0.17	-0.20
7	0.17	-0.05	0.01	0.01	-0.07
8	0.15	0.23	-0.34	-0.15	0.47
9	0.30	0.18	-0.21	-0.22	0.12
10	0.38	-0.56	0.59	-0.11	0.17
11	0.44	-0.80	0.71	0.16	-0.20
12	0.25	0.07	0.08	0.02	-0.24

Table S21b: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 4.5 run of the NorESM1-M global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.25	-0.32	0.25	0.59	-0.68
2	0.18	0.85	-0.77	-0.55	0.42
3	0.24	-0.40	0.59	0.39	-0.60
4	0.09	0.90	-0.81	-1.10	1.30
5	0.11	0.04	-0.12	0.59	-0.51
6	0.11	-0.31	0.98	-1.02	0.74
7	0.13	-0.75	0.57	-0.57	0.91
8	0.16	1.95	-1.66	-2.48	2.35
9	0.26	-0.51	0.44	0.15	-0.03
10	0.38	0.19	-0.29	0.26	-0.08
11	0.39	0.18	-0.07	0.04	-0.15
12	0.17	1.57	-1.29	-0.83	0.83

Table S21c: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 6.0 run of the NorESM1-M global circulation model. The subscript *j* (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (*i*)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.17	0.64	-0.75	-0.21	0.55
2	0.21	-0.20	0.17	0.12	-0.30
3	0.20	0.49	-0.54	-0.09	0.29
4	0.15	-0.41	0.37	0.42	-0.57
5	0.13	-0.76	0.59	0.49	-0.44
6	0.23	-0.28	-0.11	-0.10	0.16
7	0.16	-0.17	0.12	-0.52	0.59
8	0.18	0.06	-0.10	-0.62	0.74
9	0.26	0.10	-0.28	-0.25	0.47
10	0.43	-0.34	0.22	0.16	-0.08
11	0.43	-0.07	-0.14	-0.06	0.17
12	0.21	0.28	-0.21	0.33	-0.26

Table S21d: Parameters (c_i, $d_{j,i}$) of the multiple linear regression equation used during downscaling of precipitation from the RCP 8.5 run of the NorESM1-M global circulation model. The subscript j (NW, NE, SW, SE) indicates the location of the respective grid points relative to Vestfonna.

Month (i)	c_i	$d_{NW,i}$	$d_{NE,i}$	$d_{SW,i}$	$d_{SE,i}$
1	0.24	-0.87	0.78	0.54	-0.54
2	0.12	0.72	-0.89	-0.22	0.70
3	0.23	-1.15	1.19	0.87	-0.90
4	0.16	0.07	-0.07	-0.58	0.30
5	0.11	0.13	-0.14	-0.17	0.20
6	0.17	-0.43	0.39	0.69	-0.64
7	0.15	0.82	-0.56	0.26	-0.50
8	0.20	-0.10	-0.14	0.13	0.08
9	0.26	0.19	-0.22	0.11	-0.04
10	0.42	-0.35	0.42	0.22	-0.30
11	0.38	0.82	-0.66	0.13	-0.28
12	0.26	-0.93	0.82	0.21	-0.18

Table S22: Accuracy of downscaled GCM precipitation expressed as monthly root mean square (RMS) errors between GCM and ERA-Interim data of the period September 2006 to August 2011. Unit is mm. Given RMS errors refer to either months of the accumulation season (Sep–May), months of the ablation season (Jun–Aug) or all months of the entire year. The four RCP scenarios are indicated by 2.6, 4.5, 6.0 and 8.5 respectively.

GCM	Accumulation season				Ablation season				Year round			
	2.6	**4.5**	**6.0**	**8.5**	**2.6**	**4.5**	**6.0**	**8.5**	**2.6**	**4.5**	**6.0**	**8.5**
BCC-CSM1.1	2.6	2.4	2.4	2.5	2.1	2.0	2.2	2.3	2.5	2.3	2.3	2.4
CSIRO-Mk3.6.0	2.4	2.6	2.5	2.5	2.2	2.1	2.2	2.3	2.4	2.5	2.5	2.5
GFDL-ESM2G	2.4	2.4	2.5	2.6	2.0	2.2	2.2	2.3	2.3	2.4	2.4	2.5
HadGEM2-ES	2.3	2.4	2.2	2.7	1.9	2.2	2.0	1.9	2.2	2.3	2.2	2.5
IPSL-CM5A-LR	2.6	2.4	2.4	2.2	2.2	2.0	2.0	2.2	2.5	2.3	2.3	2.2
MIROC5	2.3	2.6	2.5	2.5	2.1	2.3	2.2	2.2	2.3	2.5	2.4	2.4
MIROC-ESM	2.4	2.5	2.5	2.4	1.8	2.0	2.1	2.3	2.3	2.4	2.4	2.3
MIROC-ESM-CHEM	2.5	2.3	2.3	2.5	2.4	2.2	2.1	2.1	2.5	2.3	2.3	2.4
MRI-CGCM3	2.3	2.4	2.4	2.5	2.3	2.3	2.2	2.2	2.3	2.3	2.4	2.4
NorESM1-M	2.4	2.6	2.5	2.7	2.3	2.0	2.1	2.2	2.4	2.4	2.4	2.6

Equilibrium line altitude extrapolation

Table S23a: Parameters and coefficients of determination of the linear fits of the modeled equilibrium line altitude time series (cf. Fig. 5). Parameters correspond to the equation ELA=*a*·YEAR+*b* and are given in m.

GCM	RCP 2.6			RCP 4.5		
	a	***b***	**R^2**	***a***	***b***	**R^2**
BCC-CSM1.1	0.5	-723	0.20	2.4	-4517	0.83
CSIRO-Mk3.6.0	1.2	-2064	0.75	2.5	-4716	0.93
GFDL-ESM2G	-0.5	1380	0.32	1.2	-2021	0.74
HadGEM2-ES	2.8	-5330	0.89	4.2	-8133	0.78
IPSL-CM5A-LR	0.6	-864	0.29	1.7	-3049	0.79
MIROC5	2.2	-4121	0.83	4.9	-9498	0.89
MIROC-ESM	4.2	-8012	0.83	5.5	-10696	0.94
MIROC-ESM-CHEM	3.1	-5788	0.90	6.1	-11990	0.95
MRI-CGCM3	1.8	-3365	0.85	3.2	-6149	0.92
NorESM1-M	2.4	-4427	0.90	3.4	-6572	0.93
Mean	1.8	-3352	0.98	3.6	-6806	0.99

Table S23b: Parameters and coefficients of determination of the linear fits of the modeled equilibrium line altitude time series (cf. Fig. 5). Parameters correspond to the equation ELA=*a*·YEAR+*b* and are given in m.

GCM	RCP 6.0			RCP 8.5		
	a	***b***	**R^2**	***a***	***b***	**R^2**
BCC-CSM1.1	3.2	-6103	0.90	6.1	-11945	0.92
CSIRO-Mk3.6.0	3.2	-6038	0.96	5.4	-10520	0.95
GFDL-ESM2G	3.3	-6217	0.95	6.6	-12963	0.94
HadGEM2-ES	5.4	-10534	0.73	8.2	-16143	0.79
IPSL-CM5A-LR	5.5	-10693	0.88	5.9	-11518	0.90
MIROC5	6.2	-12141	0.93	10.7	-21097	0.93
MIROC-ESM	7.7	-15052	0.91	7.8	-15194	0.93
MIROC-ESM-CHEM	6.9	-13503	0.79	8.5	-16733	0.94
MRI-CGCM3	3.9	-7494	0.90	6.9	-13524	0.93
NorESM1-M	5.1	-9861	0.93	8.8	-17300	0.91
Mean	5.2	-10083	0.99	7.3	-14406	0.99

Calculation of global radiation

Global radiation is modeled on a daily basis as a spatially distributed quantity by summing up direct solar radiation and multiple scattering and reflection between glacier and clouds. The reducing influence of cloud cover on direct solar radiation is taken into account. A detailed description of the modeling is given in Möller et al. (2011). The following outline reproduces the most important steps.

Direct solar radiation (R_D) is modeled on the basis of standard solar-geometry algorithms (Bernhardt & Philipps 1958, Corripio 2003, Iqbal 1984). The reduction due to cloud cover is realized by applying the Savinov-Ångström equation (Kondratyev 1969). Hence, the component of cloud cover-reduced direct solar radiation (R_S) is calculated according to:

$$R_S = R_D \cdot \left(1 - C_{gcm} \cdot \left(1 - \eta'\right)\right). \quad \text{(S1)}$$

Herein, C_{gcm} represents the daily cloud-cover fraction derived from data of the GCM grid point located closest to Vestfonna. It is taken as one single fixed number for the whole modeling domain in each time step. Table S25 gives an overview of the grid points for each of the ten GCMs. The parameter η' is a dimension-less empirical quantity. It is here set to 0.58 according to the value for locations at 80°N given in Budyko & Miller (1974).

Multiple scattering and reflection (R_M) is calculated from R_S according to surface albedo (α) and cloud-cover fraction following an empirical equation that was calibrated to fit local conditions on Vestfonna by Möller et al. (2011):

$$R_M = R_S \cdot \left(0.364 \cdot \alpha \cdot C_{gcm} \cdot \frac{F_{SV}}{0.88} \right). \tag{S2}$$

In this equation, F_{SV} is the spatially distributed sky-view factor that is divided by the local value of the sky-view factor at the reference location for which the calibration was done.

Table S24: Overview of GCM grid points from which daily data of cloud-cover fraction are used for solar radiation modeling (cf. Eq. S1). Locations (NW, NE, SW, SE) are given relative to Vestfonna (cf. Fig. 1).

GCM	Location
BCC-CSM1.1	SE
CSIRO-Mk3.6.0	SE
GFDL-ESM2G	SE
HadGEM2-ES	NE
IPSL-CM5A-LR	NW
MIROC5	NE
MIROC-ESM	SE
MIROC-ESM-CHEM	SE
MRI-CGCM3	NE
NorESM1-M	NE

Calculation of surface albedo

Surface albedo is modeled on a monthly basis as a function of terrain elevation using the minimal, statistical model presented by Möller (2012). Modeling of daily albedo fields is not feasible due to frequent snow-drift conditions (Sauter et al. 2013). The monthly mean surface albedo at terrain elevation z is calculated according to:

$$\alpha(z) = \Theta(z) - \Psi(z). \tag{S3}$$

S3 represents the difference between a function of rain/snow ratio ($\Theta(z)$) and a function of cumulative snowfall and cumulative positive degree days ($\Psi(z)$). $\Theta(z)$ is given as a sigmoid function according to:

$$\Theta(z) = \frac{\theta_1(z) - \theta_2(z)}{1 + \left(\frac{\Phi_{rsr}(z)}{\theta_3(z)} \right)^{\theta_4(z)}} + \theta_2(z). \tag{S4}$$

In S4, $\Phi_{rsr}(z)$ is the rain/snow ratio at terrain elevation z. The empirical parameters of the equation ($\theta_1(z)$-$\theta_4(z)$) are given as functions of terrain elevation (Table S25). $\Psi(z)$ is given as a linear function according to:

$$\Psi(z) = \psi_1(z) + \psi_2(z) \cdot \Phi_{csf}(z) + \psi_3(z) \cdot \Phi_{cpdd}(z). \tag{S5}$$

In S5, $\Phi_{csf}(z)$ represents cumulative snowfall at terrain elevation z and $\Phi_{cpdd}(z)$ represents cumulative positive degree days at terrain elevation z. The empirical parameters of this equation ($\psi_1(z)$-$\psi_3(z)$) are also given as functions of terrain elevation (Table S25).

Table S25: Functions of the empirical parameters of the surface-albedo model (cf. Eqs. S4 and S5) as calibrated by Möller (2012).

Parameter	Function
$\theta_1(z)$	$-0.343\cdot10^{-4}\cdot z+0.907$
$\theta_2(z)$	$0.030\cdot z^{0.436}+0.177$
$\theta_3(z)$	$0.298+0.300\cdot10^{-4}\cdot z-0.663\cdot10^{-7}\cdot z^2$
$\theta_4(z)$	$0.422+0.190\cdot10^{-2}\cdot z-0.623\cdot10^{-5}\cdot z^2+0.595\cdot10^{-8}\cdot z^3$
$\psi_1(z)$	$-0.118\cdot10^{-3}\cdot z+0.057$
$\psi_2(z)$	$0.334\cdot10^{-2}\cdot z^{0.098}-0.606\cdot10^{-2}$
$\psi_3(z)$	$0.337\cdot10^{-3}+0.931\cdot10^{-6}\cdot z-0.032\cdot10^{-7}\cdot z^2$

Global circulation models

Table S26: Characteristics of the ten global circulation models that form the ensembles representing the four RCP scenarios in this study.

GCM name	Institution	Country	Resolution (°)
BCC-CSM1.1	Beijing Climate Center, China Meteorological Administration	China	2.8125 × 2.8125
CSIRO-Mk3.6.0	Commonwealth Scientific and Industrial Research Organization in collaboration with Queensland Climate Change Centre of Excellence	Australia	1.875 × 1.875
GFDL-ESM2G	Geophysical Fluid Dynamics Laboratory	USA	2.0 × 2.5
HadGEM2-ES	Met Office Hadley Centre	United Kingdom	1.25 × 1.875
IPSL-CM5A-LR	Institut Pierre-Simon Laplace	France	1.9 × 3.75
MIROC5	Atmosphere and Ocean Research	Japan	1.4 × 1.4
MIROC-ESM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo) and National Institute for Environmental Studies	Japan	2.8125 × 2.8125
MIROC-ESM-CHEM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo) and National Institute for Environmental Studies	Japan	2.8125 × 2.8125
MRI-CGCM3	Meteorological Research Institute	Japan	1.125 × 1.125
NorESM1-M	Norwegian Climate Centre	Norway	1.9 × 2.5

Modeling uncertainties

Table S27: Accuracy of modeled climatic mass balances (CMB) expressed as RMS errors between modeling results of this study and of the study by Möller et al. (2013) that used the same model but with ERA-Interim instead of GCM data as forcing. Unit is m w.e. Given RMS errors refer to the mass-balance years 2006/2007–2010/2011 and to either months of the accumulation season (Sep–May), months of the ablation season (Jun–Aug) or all months of the entire year. The four RCP scenarios are indicated by 2.6, 4.5, 6.0 and 8.5 respectively.

GCM	Accumulation season				Ablation season				Year round			
	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
BCC-CSM1.1	0.08	0.06	0.07	0.08	0.05	0.09	0.08	0.17	0.09	0.09	0.10	0.18
CSIRO-Mk3.6.0	0.06	0.07	0.07	0.07	0.08	0.04	0.07	0.12	0.10	0.09	0.07	0.11
GFDL-ESM2G	0.07	0.07	0.07	0.08	0.05	0.13	0.12	0.16	0.10	0.15	0.13	0.19
HadGEM2-ES	0.06	0.07	0.07	0.07	0.11	0.15	0.19	0.16	0.10	0.16	0.18	0.15
IPSL-CM5A-LR	0.08	0.06	0.07	0.07	0.10	0.13	0.17	0.14	0.11	0.13	0.17	0.15
MIROC5	0.06	0.07	0.06	0.08	0.08	0.06	0.11	0.11	0.06	0.10	0.11	0.12
MIROC-ESM	0.07	0.07	0.07	0.07	0.12	0.12	0.10	0.18	0.15	0.15	0.14	0.19
MIROC-ESM-CHEM	0.07	0.06	0.06	0.07	0.07	0.09	0.20	0.15	0.10	0.12	0.22	0.12
MRI-CGCM3	0.06	0.07	0.07	0.08	0.17	0.15	0.17	0.18	0.14	0.16	0.15	0.20
NorESM1-M	0.06	0.07	0.07	0.07	0.10	0.11	0.13	0.21	0.10	0.09	0.14	0.21

Table S28: Accuracy of modeled CMB expressed as annual RMS errors between modeling results of this study and 20 individual stake-based point balance measurements on the northwestern slope of Vestfonna in the period 2008-2012. Unit is m w.e. The four RCP scenarios are indicated by 2.6, 4.5, 6.0 and 8.5 respectively.

GCM	2.6	4.5	6.0	8.5
BCC-CSM1.1	0.21	0.21	0.19	0.25
CSIRO-Mk3.6.0	0.21	0.18	0.23	0.22
GFDL-ESM2G	0.20	0.20	0.29	0.19
HadGEM2-ES	0.25	0.21	0.29	0.27
IPSL-CM5A-LR	0.24	0.21	0.27	0.24
MIROC5	0.28	0.20	0.22	0.21
MIROC-ESM	0.17	0.17	0.16	0.22
MIROC-ESM-CHEM	0.16	0.16	0.16	0.29
MRI-CGCM3	0.36	0.26	0.28	0.19
NorESM1-M	0.19	0.24	0.27	0.26

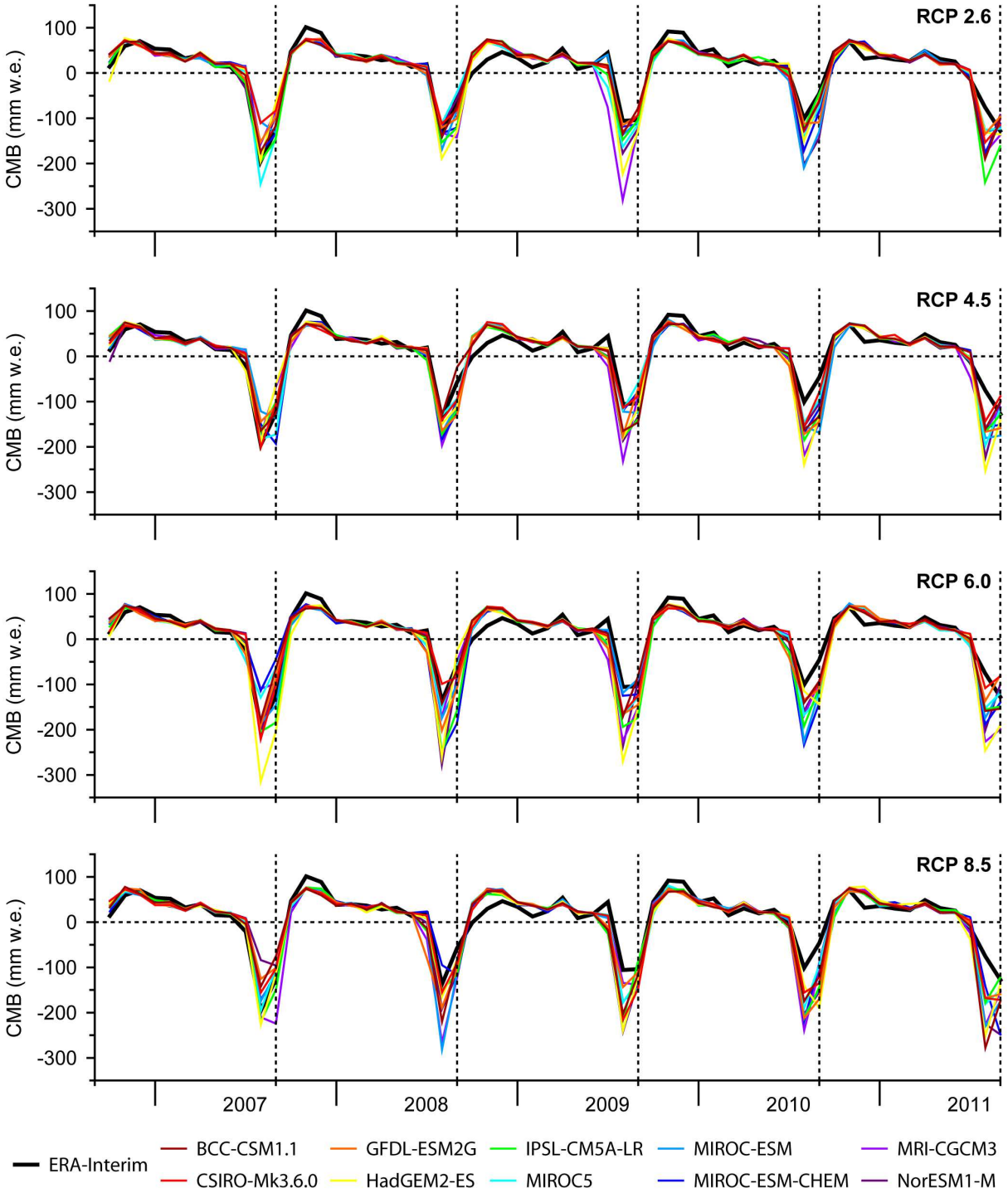

Figure S1: Glacier-wide monthly CMB of Vestfonna according to forcing by all ensemble members of the four RCPs for the mass-balance years 2006/2007 to 2010/2011. The ERA-Interim based time series (Möller et al. 2013) is shown for comparison.

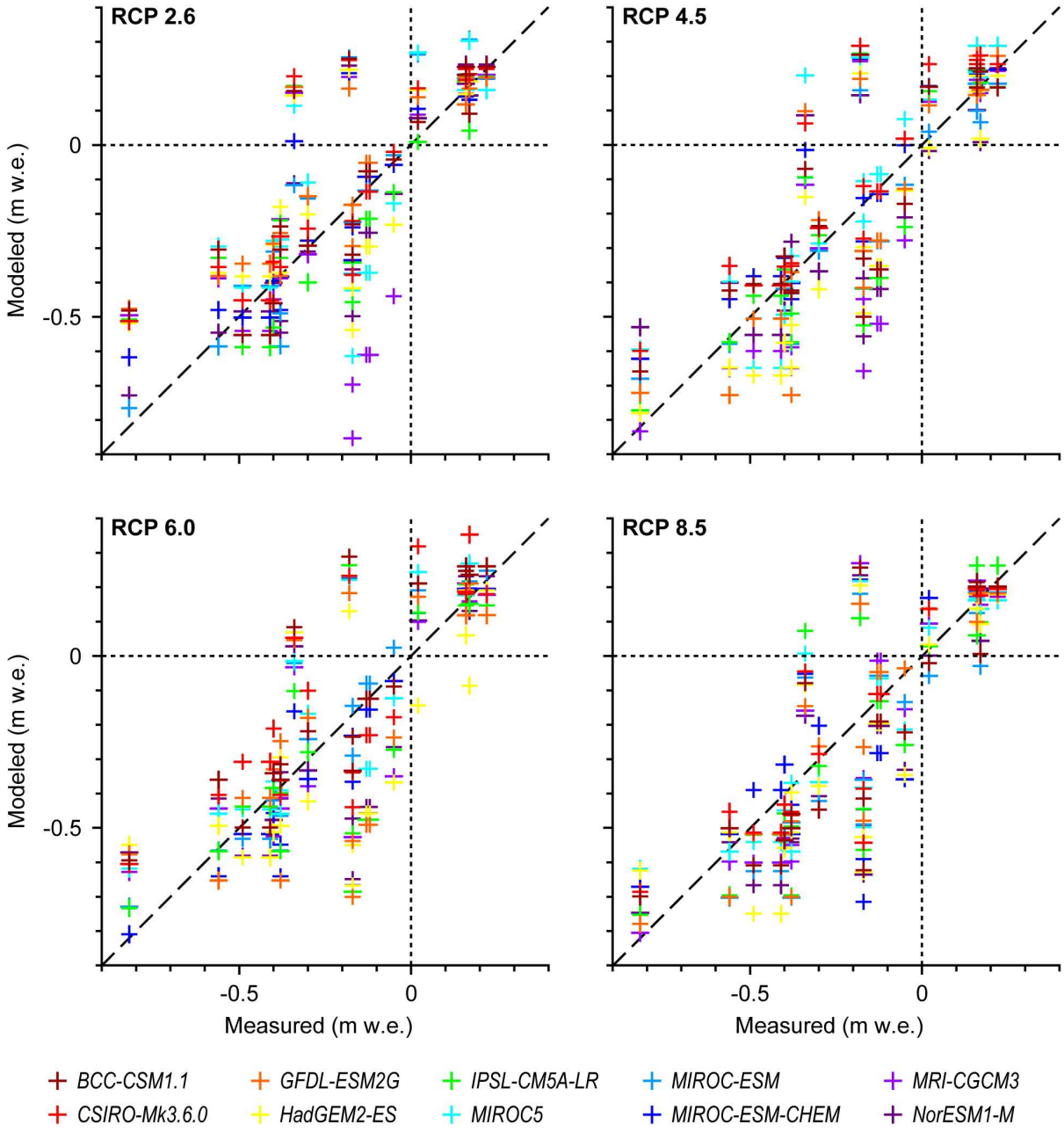

Figure S2: Modeled versus measured point CMB of Vestfonna according to forcing by all ensemble members of the four RCP scenario. In situ measurements are represented by 20 individual, stake-based point-balance measurements on the northwestern slope of Vestfonna in the period 2008-2012.

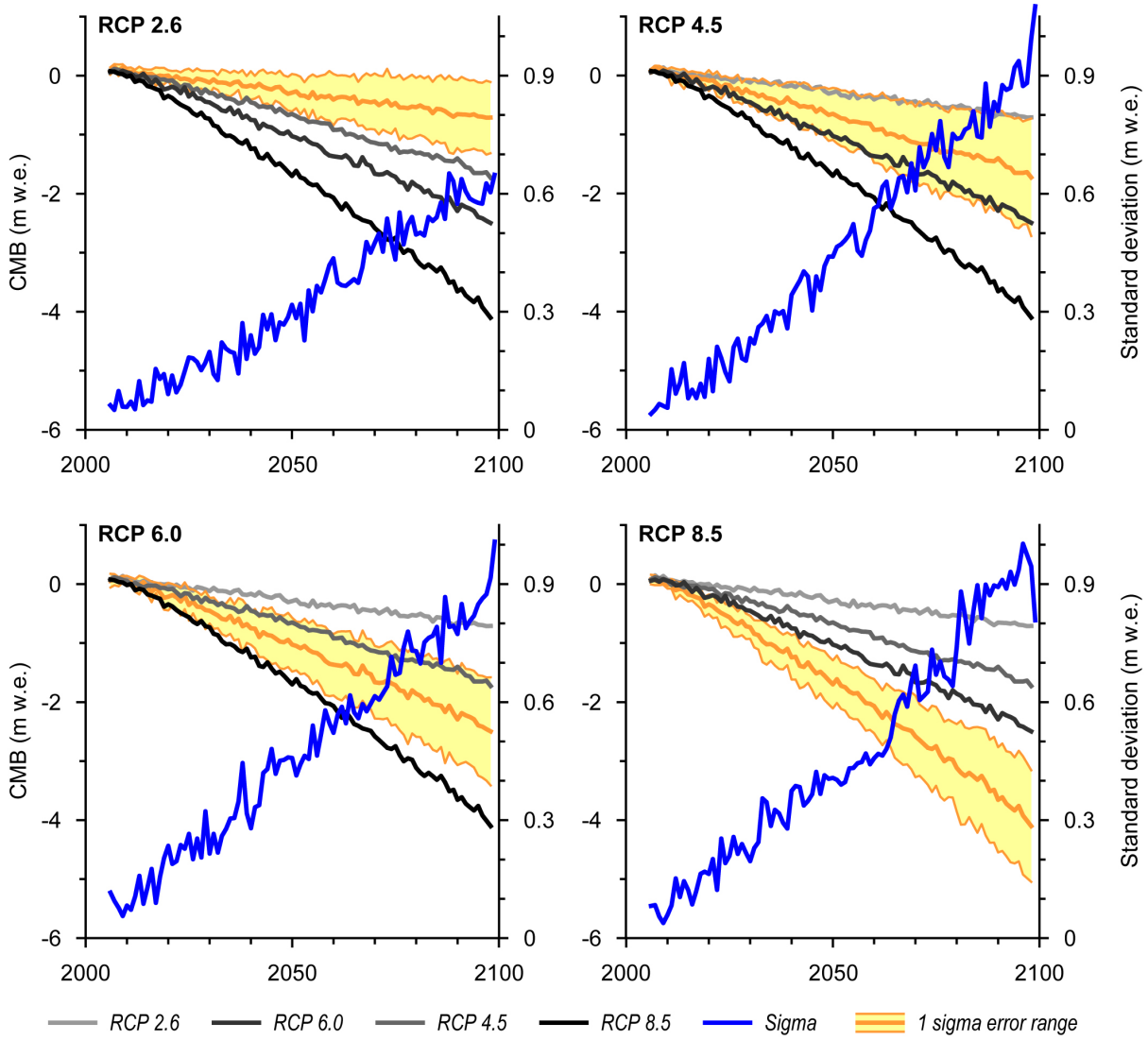

Figure S3: Model uncertainties of CMB evolution (yellow) of the four RCP ensembles expressed as a one standard deviation range (blue). In each panel the ensemble means of the respective remaining three RCPs are shown in grey.

References

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