Projected climate change in Finland during the 21st century calculated from CMIP6 model simulations

by

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An attachment file

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Table S1. Projected seasonal and annual mean changes in mean surface air temperature (in °C) relative to 1981–2010; spatial averages over Finland (DJF: December to February; MAM: March to May; JJA: June to August; SON: September to November; ANN: annual mean). Projections are given separately for three 30-year future periods and four SSP forcing scenarios. For each projection, three quantiles are given, with the median standing for the best estimate for the change and the 5. and 95. percentage points defining the 90 % probability interval. The quantiles are derived from a normal distribution fitted to the multi-model data (see section 2.3).

Period	Forcing	Quantile	DJF	MAM	JJA	SON	ANN
2020–2049	SSP1-2.6	5 %	0.1	0.2	0.6	0.4	0.6
2020–2049	SSP1-2.6	Median	2.1	1.7	1.7	1.9	1.8
2020–2049	SSP1-2.6	95 %	4.1	3.2	2.7	3.3	3.1
2020–2049	SSP2-4.5	5 %	0.7	0.6	0.8	0.5	0.8
2020–2049	SSP2-4.5	Median	2.4	1.9	1.7	1.9	2.0
2020–2049	SSP2-4.5	95 %	4.1	3.1	2.7	3.3	3.2
2020–2049	SSP3-7.0	5 %	0.7	0.4	0.7	0.4	0.7
2020–2049	SSP3-7.0	Median	2.4	1.8	1.7	1.9	1.9
2020–2049	SSP3-7.0	95 %	4.1	3.3	2.6	3.4	3.2
2020–2049	SSP5-8.5	5 %	0.7	0.6	0.7	0.6	0.8
2020–2049	SSP5-8.5	Median	2.7	2.1	2.0	2.2	2.2
2020–2049	SSP5-8.5	95 %	4.6	3.6	3.2	3.8	3.6
2040–2069	SSP1-2.6	5 %	0.6	0.5	0.7	0.6	0.8
2040–2069	SSP1-2.6	Median	2.6	2.2	2.1	2.3	2.3
2040–2069	SSP1-2.6	95 %	4.6	3.9	3.5	3.9	3.8
2040–2069	SSP2-4.5	5 %	1.2	1.1	1.0	0.8	1.2
2040–2069	SSP2-4.5	Median	3.3	2.6	2.4	2.6	2.7
2040–2069	SSP2-4.5	95 %	5.4	4.2	3.8	4.5	4.3
2040–2069	SSP3-7.0	5 %	1.9	1.2	1.2	1.0	1.5
2040–2069	SSP3-7.0	Median	3.8	3.0	2.7	2.9	3.1
2040–2069	SSP3-7.0	95 %	5.8	4.7	4.3	4.9	4.8
2040–2069	SSP5-8.5	5 %	2.3	1.6	1.4	1.4	1.9
2040–2069	SSP5-8.5	Median	4.3	3.4	3.2	3.5	3.6
2040–2069	SSP5-8.5	95 %	6.4	5.2	5.0	5.6	5.3
2070–2099	SSP1-2.6	5 %	0.3	0.6	0.5	0.6	0.7
2070–2099	SSP1-2.6	Median	2.6	2.3	2.2	2.4	2.4
2070–2099	SSP1-2.6	95 %	5.0	4.0	4.0	4.2	4.0
2070–2099	SSP2-4.5	5 %	1.9	1.7	1.2	1.4	1.7
2070–2099	SSP2-4.5	Median	4.3	3.5	3.3	3.6	3.7
2070–2099	SSP2-4.5	95 %	6.7	5.3	5.3	5.8	5.6
2070–2099	SSP3-7.0	5 %	3.4	2.6	2.1	2.2	2.8
2070–2099	SSP3-7.0	Median	6.1	4.7	4.4	4.7	5.0
2070–2099	SSP3-7.0	95 %	8.8	6.8	6.7	7.3	7.2
2070–2099	SSP5-8.5	5 %	4.1	3.1	2.3	2.7	3.3
2070–2099	SSP5-8.5	Median	7.1	5.6	5.3	5.7	5.9
2070–2099	SSP5-8.5	95 %	10.2	8.0	8.3	8.7	8.6

Table S2. Projected seasonal and annual mean changes in precipitation (in %) for Finland; for further information, see the caption of Table S1.

Period	Forcing	Quantile	DJF	MAM	JJA	SON	ANN
2020–2049	SSP1-2.6	5 %	-3	-4	-7	-2	-1
2020–2049	SSP1-2.6	Median	7	7	4	7	6
2020–2049	SSP1-2.6	95 %	18	18	15	15	13
2020–2049	SSP2-4.5	5 %	-1	-2	-5	-1	1
2020–2049	SSP2-4.5	Median	8	8	4	6	6
2020–2049	SSP2-4.5	95 %	16	19	13	13	12
2020–2049	SSP3-7.0	5 %	-2	-3	-6	0	0
2020–2049	SSP3-7.0	Median	9	7	4	7	6
2020–2049	SSP3-7.0	95 %	19	18	14	13	12
2020–2049	SSP5-8.5	5 %	-1	-3	-8	0	1
2020–2049	SSP5-8.5	Median	10	9	3	8	7
2020–2049	SSP5-8.5	95 %	20	20	15	15	13
2040–2069	SSP1-2.6	5 %	-2	-3	-4	0	1
2040–2069	SSP1-2.6	Median	10	9	6	8	8
2040–2069	SSP1-2.6	95 %	21	22	16	16	15
2040–2069	SSP2-4.5	5 %	0	-2	-6	-2	1
2040–2069	SSP2-4.5	Median	12	10	5	9	9
2040–2069	SSP2-4.5	95 %	24	22	17	19	16
2040–2069	SSP3-7.0	5 %	4	0	-7	2	3
2040–2069	SSP3-7.0	Median	14	12	4	10	10
2040–2069	SSP3-7.0	95 %	24	24	16	18	16
2040–2069	SSP5-8.5	5 %	4	1	-9	1	2
2040–2069	SSP5-8.5	Median	16	14	4	11	11
2040–2069	SSP5-8.5	95 %	29	27	18	21	19
2070–2099	SSP1-2.6	5 %	-6	-3	-6	0	0
2070–2099	SSP1-2.6	Median	8	10	6	8	8
2070–2099	SSP1-2.6	95 %	22	23	18	16	16
2070–2099	SSP2-4.5	5 %	2	1	-10	1	1
2070–2099	SSP2-4.5	Median	14	14	7	11	11
2070–2099	SSP2-4.5	95 %	26	26	24	21	20
2070–2099	SSP3-7.0	5 %	12	4	-11	5	5
2070–2099	SSP3-7.0	Median	26	18	5	17	15
2070–2099	SSP3-7.0	95 %	40	33	22	29	26
2070–2099	SSP5-8.5	5 %	12	4	-13	6	7
2070–2099	SSP5-8.5	Median	32	24	5	20	19
2070–2099	SSP5-8.5	95 %	52	43	23	34	31

Table S3. Projected seasonal and annual mean changes in incident solar radiation (in %) for Finland; for further information, see the caption of Table S1.

Period	Forcing	Quantile	DJF	MAM	JJA	SON	ANN
2020–2049	SSP1-2.6	5 %	-6	-3	1	-1	0
2020–2049	SSP1-2.6	Median	1	2	4	4	3
2020–2049	SSP1-2.6	95 %	7	6	8	9	6
2020–2049	SSP2-4.5	5 %	-6	-4	0	-2	0
2020–2049	SSP2-4.5	Median	-1	1	4	4	2
2020–2049	SSP2-4.5	95 %	5	5	7	9	5
2020–2049	SSP3-7.0	5 %	-8	-5	0	-2	-1
2020–2049	SSP3-7.0	Median	-2	0	2	3	2
2020–2049	SSP3-7.0	95 %	5	5	5	7	4
2020–2049	SSP5-8.5	5 %	-7	-5	0	-2	-1
2020–2049	SSP5-8.5	Median	-1	1	4	3	3
2020–2049	SSP5-8.5	95 %	5	7	8	8	6
2040–2069	SSP1-2.6	5 %	-8	-4	0	-2	0
2040–2069	SSP1-2.6	Median	1	3	5	5	4
2040–2069	SSP1-2.6	95 %	10	9	10	13	9
2040–2069	SSP2-4.5	5 %	-9	-5	-1	-3	-1
2040–2069	SSP2-4.5	Median	-2	1	4	5	3
2040–2069	SSP2-4.5	95 %	5	7	9	12	7
2040–2069	SSP3-7.0	5 %	-11	-6	-1	-3	-2
2040–2069	SSP3-7.0	Median	-4	-1	4	3	2
2040–2069	SSP3-7.0	95 %	3	5	9	9	6
2040–2069	SSP5-8.5	5 %	-12	-7	-1	-3	-2
2040–2069	SSP5-8.5	Median	-5	0	5	4	3
2040–2069	SSP5-8.5	95 %	2	6	11	10	7
2070–2099	SSP1-2.6	5 %	-10	-5	0	-4	-1
2070–2099	SSP1-2.6	Median	3	3	6	6	5
2070–2099	SSP1-2.6	95 %	15	11	12	16	11
2070–2099	SSP2-4.5	5 %	-12	-6	-2	-4	-3
2070–2099	SSP2-4.5	Median	-3	1	5	5	3
2070–2099	SSP2-4.5	95 %	6	8	13	14	9
2070–2099	SSP3-7.0	5 %	-20	-10	-2	-6	-4
2070–2099	SSP3-7.0	Median	-9	-2	5	3	2
2070–2099	SSP3-7.0	95 %	2	6	13	12	8
2070–2099	SSP5-8.5	5 %	-24	-11	-3	-6	-5
2070–2099	SSP5-8.5	Median	-12	-3	6	4	2
2070–2099	SSP5-8.5	95 %	0	6	15	14	9

Table S4. Projected seasonal and annual mean changes in the difference between the daily maximum and minimum temperatures (in %) for Finland; for further information, see the caption of Table S1.

Period	Forcing	Quantile	DJF	MAM	JJA	SON	ANN
2020–2049	SSP1-2.6	5 %	-21	-13	-4	-12	-10
2020–2049	SSP1-2.6	Median	-10	-4	1	-4	-4
2020–2049	SSP1-2.6	95 %	1	5	7	3	2
2020–2049	SSP2-4.5	5 %	-22	-13	-5	-11	-10
2020–2049	SSP2-4.5	Median	-12	-5	1	-5	-5
2020–2049	SSP2-4.5	95 %	-1	2	7	2	1
2020–2049	SSP3-7.0	5 %	-25	-14	-5	-11	-12
2020–2049	SSP3-7.0	Median	-12	-5	1	-5	-5
2020–2049	SSP3-7.0	95 %	1	4	7	2	1
2020–2049	SSP5-8.5	5 %	-26	-15	-6	-14	-12
2020–2049	SSP5-8.5	Median	-13	-6	1	-6	-6
2020–2049	SSP5-8.5	95 %	0	3	7	2	1
2040–2069	SSP1-2.6	5 %	-27	-13	-6	-13	-12
2040–2069	SSP1-2.6	Median	-13	-5	1	-5	-6
2040–2069	SSP1-2.6	95 %	1	3	8	2	1
2040–2069	SSP2-4.5	5 %	-29	-17	-9	-16	-14
2040–2069	SSP2-4.5	Median	-16	-7	0	-6	-7
2040–2069	SSP2-4.5	95 %	-3	2	10	3	0
2040–2069	SSP3-7.0	5 %	-37	-20	-8	-17	-17
2040–2069	SSP3-7.0	Median	-19	-9	1	-7	-8
2040–2069	SSP3-7.0	95 %	-2	2	10	2	0
2040–2069	SSP5-8.5	5 %	-39	-22	-10	-18	-18
2040–2069	SSP5-8.5	Median	-22	-10	1	-8	-9
2040–2069	SSP5-8.5	95 %	-4	2	12	2	-1
2070–2099	SSP1-2.6	5 %	-26	-15	-7	-14	-12
2070–2099	SSP1-2.6	Median	-14	-6	1	-6	-6
2070–2099	SSP1-2.6	95 %	-2	3	9	3	0
2070–2099	SSP2-4.5	5 %	-40	-22	-11	-18	-18
2070–2099	SSP2-4.5	Median	-22	-9	0	-8	-9
2070–2099	SSP2-4.5	95 %	-3	4	11	2	-1
2070–2099	SSP3-7.0	5 %	-54	-30	-10	-21	-23
2070–2099	SSP3-7.0	Median	-31	-13	2	-10	-13
2070–2099	SSP3-7.0	95 %	-9	4	14	2	-2
2070–2099	SSP5-8.5	5 %	-61	-33	-14	-23	-26
2070–2099	SSP5-8.5	Median	-36	-15	1	-11	-15
2070–2099	SSP5-8.5	95 %	-10	3	17	2	-3

Table S5. Projected seasonal and annual mean changes in surface air pressure reduced to the sea level (in hPa) for Finland; for further information, see the caption of Table S1.

Period	Forcing	Quantile	DJF	MAM	JJA	SON	ANN
2020–2049	SSP1-2.6	5 %	-2.3	-1.0	-1.1	-1.3	-0.9
2020–2049	SSP1-2.6	Median	-0.2	-0.0	-0.0	0.0	-0.0
2020–2049	SSP1-2.6	95 %	1.9	1.0	1.1	1.3	0.8
2020–2049	SSP2-4.5	5 %	-2.2	-1.4	-1.0	-1.3	-0.7
2020–2049	SSP2-4.5	Median	-0.1	-0.2	-0.1	-0.1	-0.1
2020–2049	SSP2-4.5	95 %	1.9	1.1	0.8	1.1	0.5
2020–2049	SSP3-7.0	5 %	-2.7	-1.0	-1.0	-1.4	-0.9
2020–2049	SSP3-7.0	Median	-0.4	-0.1	-0.1	-0.1	-0.2
2020–2049	SSP3-7.0	95 %	1.9	0.9	0.7	1.1	0.5
2020–2049	SSP5-8.5	5 %	-2.3	-1.4	-1.1	-1.5	-1.0
2020–2049	SSP5-8.5	Median	-0.5	-0.2	-0.0	-0.2	-0.2
2020–2049	SSP5-8.5	95 %	1.3	1.0	1.0	1.1	0.5
2040–2069	SSP1-2.6	5 %	-2.7	-1.0	-1.1	-1.4	-1.1
2040–2069	SSP1-2.6	Median	-0.2	0.1	-0.0	0.0	-0.0
2040–2069	SSP1-2.6	95 %	2.3	1.2	1.0	1.5	1.0
2040–2069	SSP2-4.5	5 %	-2.6	-1.1	-1.3	-1.9	-1.1
2040–2069	SSP2-4.5	Median	-0.2	-0.1	-0.1	-0.2	-0.1
2040–2069	SSP2-4.5	95 %	2.2	1.0	1.1	1.5	0.9
2040–2069	SSP3-7.0	5 %	-3.4	-1.6	-1.1	-1.7	-1.2
2040–2069	SSP3-7.0	Median	-0.6	-0.3	-0.1	-0.2	-0.3
2040–2069	SSP3-7.0	95 %	2.2	1.0	1.0	1.3	0.7
2040–2069	SSP5-8.5	5 %	-2.8	-1.8	-1.4	-1.3	-1.3
2040–2069	SSP5-8.5	Median	-0.5	-0.2	-0.0	-0.2	-0.2
2040–2069	SSP5-8.5	95 %	1.8	1.4	1.3	1.0	0.8
2070–2099	SSP1-2.6	5 %	-2.5	-1.3	-1.0	-1.3	-0.9
2070–2099	SSP1-2.6	Median	-0.0	0.2	0.2	0.0	0.1
2070–2099	SSP1-2.6	95 %	2.5	1.6	1.4	1.4	1.1
2070–2099	SSP2-4.5	5 %	-2.4	-1.2	-1.6	-1.5	-0.9
2070–2099	SSP2-4.5	Median	-0.2	0.1	-0.1	0.0	-0.0
2070–2099	SSP2-4.5	95 %	2.1	1.3	1.5	1.5	0.8
2070–2099	SSP3-7.0	5 %	-4.0	-1.8	-1.4	-2.2	-1.6
2070–2099	SSP3-7.0	Median	-1.0	-0.3	-0.1	-0.4	-0.4
2070–2099	SSP3-7.0	95 %	1.9	1.3	1.3	1.5	0.7
2070–2099	SSP5-8.5	5 %	-4.3	-2.3	-2.0	-2.0	-1.8
2070–2099	SSP5-8.5	Median	-1.1	-0.4	-0.2	-0.3	-0.5
2070–2099	SSP5-8.5	95 %	2.0	1.4	1.7	1.5	0.8

Table S6. Projected seasonal and annual mean changes in the near-surface wind speed (in %) for Finland; for further information, see the caption of Table S1.

Period	Forcing	Quantile	DJF	MAM	JJA	SON	ANN
2020–2049	SSP1-2.6	5 %	-7	-6	-6	-5	-5
2020–2049	SSP1-2.6	Median	-1	-1	-1	-1	-1
2020–2049	SSP1-2.6	95 %	5	4	4	3	4
2020–2049	SSP2-4.5	5 %	-6	-5	-6	-5	-5
2020–2049	SSP2-4.5	Median	0	0	-1	0	0
2020–2049	SSP2-4.5	95 %	6	5	4	5	4
2020–2049	SSP3-7.0	5 %	-6	-5	-6	-5	-5
2020–2049	SSP3-7.0	Median	0	-1	-1	-1	-1
2020–2049	SSP3-7.0	95 %	5	4	3	4	4
2020–2049	SSP5-8.5	5 %	-6	-6	-6	-4	-5
2020–2049	SSP5-8.5	Median	0	0	-1	0	0
2020–2049	SSP5-8.5	95 %	7	5	4	4	4
2040–2069	SSP1-2.6	5 %	-6	-6	-6	-6	-6
2040–2069	SSP1-2.6	Median	-1	-1	-1	-1	-1
2040–2069	SSP1-2.6	95 %	5	4	4	4	4
2040–2069	SSP2-4.5	5 %	-6	-5	-8	-6	-6
2040–2069	SSP2-4.5	Median	0	0	-1	0	0
2040–2069	SSP2-4.5	95 %	7	5	5	5	5
2040–2069	SSP3-7.0	5 %	-7	-6	-9	-7	-7
2040–2069	SSP3-7.0	Median	0	-1	-2	-1	-1
2040–2069	SSP3-7.0	95 %	6	5	4	5	5
2040–2069	SSP5-8.5	5 %	-7	-7	-10	-6	-7
2040–2069	SSP5-8.5	Median	0	0	-2	0	-1
2040–2069	SSP5-8.5	95 %	7	7	5	6	6
2070–2099	SSP1-2.6	5 %	-8	-6	-9	-7	-7
2070–2099	SSP1-2.6	Median	-1	-1	-2	-1	-1
2070–2099	SSP1-2.6	95 %	6	5	5	4	5
2070–2099	SSP2-4.5	5 %	-8	-7	-11	-9	-8
2070–2099	SSP2-4.5	Median	0	-1	-2	-1	-1
2070–2099	SSP2-4.5	95 %	7	6	7	7	6
2070–2099	SSP3-7.0	5 %	-7	-9	-14	-9	-9
2070–2099	SSP3-7.0	Median	0	-1	-5	-2	-2
2070–2099	SSP3-7.0	95 %	7	6	5	6	5
2070–2099	SSP5-8.5	5 %	-7	-8	-16	-9	-9
2070–2099	SSP5-8.5	Median	1	-1	-5	-1	-1
2070–2099	SSP5-8.5	95 %	8	6	7	8	7

Table S7. Projected seasonal changes (means of parallel runs) in six climate variables from 1981–2010 to 2040–2069 under the SSP2-4.5 scenario as simulated by the individual models; spatial averages over Finland. DJF: December to February; MAM: March to May; JJA: June to August; SON: September to November.

Model	Temperature (°C)				Precipitation (%)				Pressure (hPa)				Radiation (%)				Temp. range (%)				Wind speed (%)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
MIROC6	3.4	2.5	2.2	2.5	6	4	7	1	0.2	0.6	-0.5	0.5	-2	0	2	5	-17	-2	1	0	-1	-2	1	-2
MRI-ESM2-0	3.1	3.2	1.9	2.6	8	12	3	4	-0.2	0.7	0.1	0.2	-3	1	3	8	-22	-12	-3	-2	-2	0	2	2
TaiESM1	3.1	2.3	3.6	3.1	21	6	2	6	-2.3	-0.5	0.1	-0.0	5	7	6	14	****	****	****	****	9	8	12	10
BCC-CSM2-MR	3.7	2.4	2.3	2.8	16	5	-1	9	-0.2	0.0	0.5	-1.4	-2	3	7	4	-18	-8	7	-6	4	4	1	2
CAMS-CSM1-0	2.7	1.4	1.0	1.6	14	10	2	7	-1.5	-1.3	-0.1	-0.4	-1	-1	0	-2	****	****	****	****	3	1	0	1
NESM3	3.4	4.2	2.7	3.1	11	9	10	11	1.1	-0.6	-0.9	0.1	-5	5	5	6	****	****	****	****	****	****	****	****
INM-CM4-8	2.2	2.3	1.2	1.1	11	14	1	2	-1.3	-0.3	-0.6	0.4	3	-2	1	2	-7	-12	1	-4	0	1	-1	0
INM-CM5-0	2.4	2.5	1.2	1.4	2	8	4	4	-0.4	0.1	-0.3	0.1	1	-1	1	-2	-9	-12	-2	-9	-1	1	-3	-1
NorESM2-LM	2.1	1.7	1.7	1.1	14	3	1	8	-0.4	1.0	0.6	-0.1	2	6	5	6	****	****	****	****	2	3	0	-1
NorESM2-MM	2.4	1.3	1.9	1.5	8	-1	-6	1	1.4	1.7	0.5	0.8	2	5	6	6	****	****	****	****	1	0	0	-2
HadGEM3-GC31-LL	4.1	2.9	3.7	4.6	-2	24	11	14	3.5	-0.7	-0.1	0.1	-2	-4	10	9	-22	-14	7	-14	-3	0	0	-2
UKESM1-0-LL	6.2	4.0	4.9	5.4	17	19	6	13	0.4	0.1	0.2	-0.6	-9	-3	14	12	-28	-16	10	-13	-3	-4	-7	-4
MPI-ESM1-2-HR	2.6	2.2	1.5	2.0	9	6	0	4	-0.2	0.1	-0.2	-0.7	-2	4	3	0	-15	-6	-1	-7	2	1	1	2
MPI-ESM1-2-LR	3.0	2.9	1.6	2.2	9	5	7	4	0.1	-0.3	-0.4	-0.2	-2	3	3	1	-17	-7	-2	-6	-1	-2	-2	-2
AWI-CM-1-1-MR	3.8	3.3	2.2	3.3	15	5	11	8	-1.4	-0.7	-1.0	-0.7	-6	5	2	5	****	****	****	****	1	2	0	1
CNRM-CM6-1	2.4	1.7	2.1	2.1	11	7	-1	8	0.6	0.6	0.4	0.9	-1	0	2	1	-10	-2	0	0	3	0	0	1
CNRM-ESM2-1	3.1	2.4	2.2	2.3	11	13	5	7	-0.1	0.4	-0.1	0.4	-3	-2	0	1	-13	-4	-2	-1	3	0	-2	-1
IPSL-CM6A-LR	4.0	2.6	2.8	3.1	16	8	5	7	-1.1	-0.7	-0.3	0.5	-7	-1	5	4	-23	-9	1	-7	1	0	-3	-2
CMCC-CM2-SR5	2.5	2.5	3.0	2.4	9	2	6	10	-1.7	0.1	0.2	-0.3	6	6	6	6	****	****	****	****	1	1	-1	-1
EC-Earth3	4.5	4.2	3.1	3.9	15	28	18	18	0.3	-0.8	-0.6	-0.7	-2	-6	2	-2	-16	-4	-4	-11	-7	-4	-7	-6
EC-Earth3-Veg	4.2	3.8	2.9	3.3	16	19	14	19	-0.5	0.1	-0.0	-1.3	-4	-6	3	-2	-14	-1	-2	-8	-8	-7	-8	-7
CESM2	1.5	2.4	2.5	1.7	13	13	-6	6	0.1	-0.8	1.6	1.2	10	5	8	8	****	****	****	****	-1	2	-4	-2
CESM2-WACCM	2.6	2.2	2.3	2.2	11	9	2	11	0.0	0.6	0.7	0.0	3	4	4	5	****	****	****	****	2	-1	-2	0
GFDL-ESM4	3.2	1.5	1.7	2.1	10	9	2	4	-0.0	-0.8	-0.1	0.0	-4	7	8	11	-13	-13	-15	-16	****	****	****	****
GISS-E2-1-G	3.3	2.4	2.2	2.8	12	9	12	6	0.2	0.2	-0.7	0.3	3	3	2	10	-8	-1	0	-6	2	1	0	0
CanESM5	5.0	3.6	3.2	4.2	16	21	16	21	0.0	-0.3	-0.5	-0.7	-8	-2	4	-1	-27	-15	-2	-18	-6	-4	-5	-1
ACCESS-CM2	4.9	2.6	3.4	3.3	20	20	9	17	-1.0	-0.4	-1.0	-2.4	-7	-2	9	8	-13	-4	8	0	3	1	-2	2
ACCESS-ESM1-5	3.3	2.4	2.8	2.4	17	8	1	14	-1.2	-0.0	-0.2	-1.2	-4	5	7	7	-12	8	8	7	5	3	4	5

Table S8. As in Table S7, but for the period 2070–2099 under the SSP2-4.5 scenario.

Model	Temperature (^{o}C)				Precipitation (%)				Pressure (hPa)				Radiation (%)				Temp. range (%)				Wind speed (%)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
MIROC6	3.7	3.3	2.7	3.2	5	8	9	9	1.2	0.6	-0.5	-0.3	-2	-1	2	2	-20	-4	0	-4	-2	-1	1	-2
MRI-ESM2-0	2.5	2.9	2.4	2.3	2	19	11	4	1.2	1.0	0.4	-0.6	2	1	3	7	-19	-12	-2	-6	-1	1	2	0
TaiESM1	4.1	3.9	4.9	4.9	22	9	10	16	-2.7	-0.5	0.2	0.3	4	8	6	13	****	****	****	****	11	10	14	11
BCC-CSM2-MR	5.1	2.9	2.3	3.1	23	7	2	12	-2.0	0.4	-0.3	-0.9	-7	1	4	4	-26	-12	3	-8	4	4	1	3
CAMS-CSM1-0	4.8	2.3	1.3	2.3	17	6	14	8	-1.5	-0.8	-0.8	-0.9	-5	-3	-3	-2	****	****	****	****	5	3	3	2
NESM3	4.7	5.5	3.3	4.4	11	16	18	25	1.2	-1.3	-1.0	-1.0	-7	4	5	3	****	****	****	****	****	****	****	****
INM-CM4-8	1.9	2.5	1.3	1.5	3	17	1	5	-0.7	-0.3	-0.8	-0.3	4	-3	1	1	-8	-13	0	-6	-2	2	0	0
INM-CM5-0	4.7	3.7	2.0	2.6	6	10	8	6	-0.1	-0.2	-0.6	0.0	-2	-3	2	-1	-20	-19	1	-14	0	-2	-1	1
NorESM2-LM	2.6	1.9	2.3	1.8	17	6	-6	8	-0.6	1.8	1.1	1.5	3	6	5	7	****	****	****	****	1	0	-1	-2
NorESM2-MM	2.4	1.4	2.5	1.5	11	1	-12	6	1.5	2.3	1.6	1.0	1	5	8	5	****	****	****	****	0	-2	-3	-3
HadGEM3-GC31-LL	6.2	4.3	5.4	5.9	11	18	16	2	1.6	-0.6	-0.3	0.6	-7	-1	13	15	-31	-15	9	-12	-3	-1	-4	-3
UKESM1-0-LL	7.5	5.1	6.5	6.8	18	19	8	13	1.7	0.6	0.5	-0.3	-12	-2	17	16	-36	-17	13	-13	-5	-7	-10	-6
MPI-ESM1-2-HR	3.3	3.2	2.3	3.5	8	8	6	2	-0.1	-0.1	-0.4	0.5	-4	3	3	3	-20	-9	-1	-7	1	1	-1	4
MPI-ESM1-2-LR	3.5	3.5	2.0	2.9	10	7	7	4	-0.1	-0.4	-0.8	-0.2	-5	3	3	0	-20	-8	-2	-8	-1	-1	-2	-1
AWI-CM-1-1-MR	4.7	3.9	2.8	4.2	10	7	3	7	-1.5	-0.2	-0.7	-0.4	-9	3	3	5	****	****	****	****	0	-2	1	4
CNRM-CM6-1	4.1	3.0	3.3	3.3	14	12	1	10	0.8	0.6	0.4	1.1	-3	-2	2	2	-18	-4	-1	-2	1	-1	-2	0
CNRM-ESM2-1	4.5	3.7	3.3	3.6	14	14	10	10	0.1	0.9	-0.3	0.3	-5	-4	0	1	-21	-5	-4	-2	1	-4	-4	-1
IPSL-CM6A-LR	6.0	4.0	4.0	4.5	24	14	9	12	-1.5	-0.9	-0.3	0.2	-13	-2	7	3	-34	-13	2	-10	2	-1	-3	-2
CMCC-CM2-SR5	3.9	4.3	4.9	4.2	9	15	4	12	-2.6	0.0	0.0	0.4	6	5	11	13	****	****	****	****	-2	2	-3	-1
EC-Earth3	5.1	5.3	4.0	5.0	10	31	25	23	1.6	-0.5	-0.7	-0.5	-3	-8	2	-4	-19	0	-3	-15	-9	-6	-11	-10
EC-Earth3-Veg	5.5	5.7	4.0	4.9	17	37	22	20	0.5	-0.4	-0.2	-0.3	-6	-10	3	-3	-19	0	-3	-12	-9	-8	-13	-11
CESM2	1.4	2.0	3.0	2.0	17	16	-6	9	-0.1	-0.4	2.1	1.3	12	5	10	10	****	****	****	****	0	1	-3	-2
CESM2-WACCM	2.9	2.5	2.8	2.6	16	12	-3	11	0.3	0.2	1.5	1.2	6	4	6	7	****	****	****	****	1	-1	-3	-1
GFDL-ESM4	3.9	2.1	2.4	2.7	10	9	-4	6	0.1	-0.2	0.3	0.0	0	7	9	13	-15	-16	-17	-16	****	****	****	****
GISS-E2-1-G	4.5	2.9	2.7	3.6	14	8	11	10	-0.2	0.7	-0.8	0.4	5	5	2	12	-11	0	0	-6	3	0	0	1
CanESM5	6.0	4.8	4.3	5.3	23	27	17	27	-0.8	0.0	-0.2	-0.8	-11	-2	6	-1	-32	-19	-1	-22	-8	-6	-8	-4
ACCESS-CM2	6.2	3.7	4.9	4.7	27	23	8	17	-0.7	-0.0	-0.7	-1.0	-9	-1	12	12	-17	-3	10	1	2	-1	-1	1
ACCESS-ESM1-5	4.6	3.4	3.9	3.6	21	12	-2	16	-1.1	-0.2	-0.1	-1.1	-6	5	10	9	-16	10	12	9	6	4	4	6

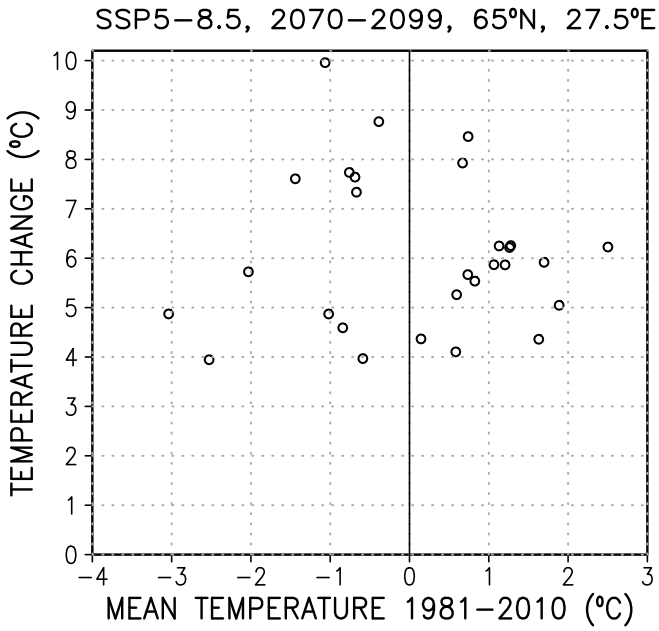

Figure S1. Annual mean temperature change (1981–2010 -> 2070–2099) under SSP5-8.5 as a function of the baseline-period (1981–2010) mean temperature at 65°N, 27.5°E simulated by the 28 GCMs. Unit: °C.

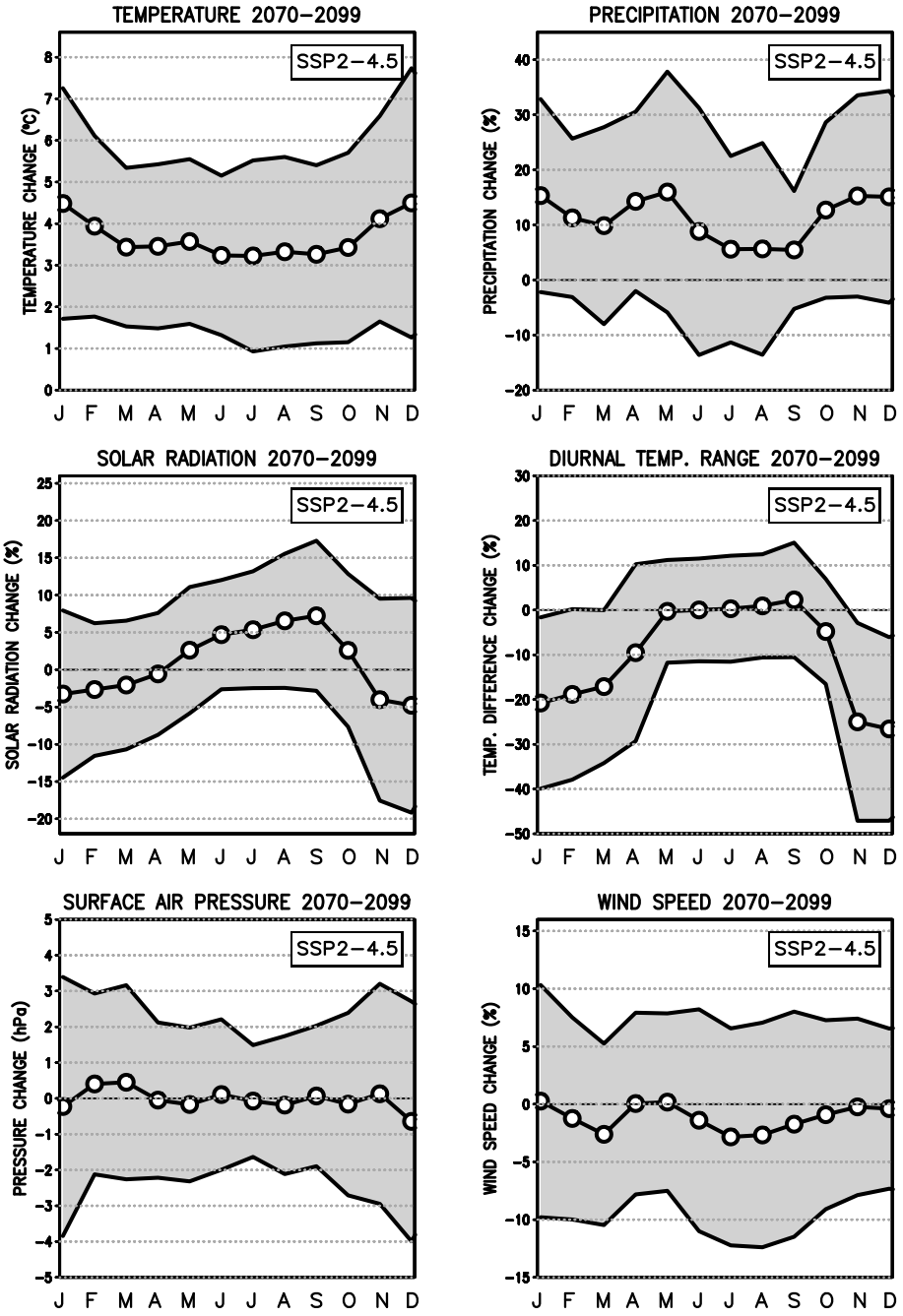

Figure S2. Projected changes in the mean surface air temperature (in °C, top left), precipitation (in %, top right), incident solar radiation (in %, middle left), diurnal temperature range (in %, middle right), surface air pressure reduced to the sea level (in hPa, bottom left) and wind speed (in %, bottom right) in Finland under the SSP2-4.5 scenario for the period 2070–2099, relative to 1981–2010. The multi-model mean projections for every calendar month (J = January, F = February, ...), derived from the simulations performed with 19–28 GCMs (see Table 1 of the main text), are denoted by open circles. Grey shading reveals the 90 % uncertainty intervals for the change.

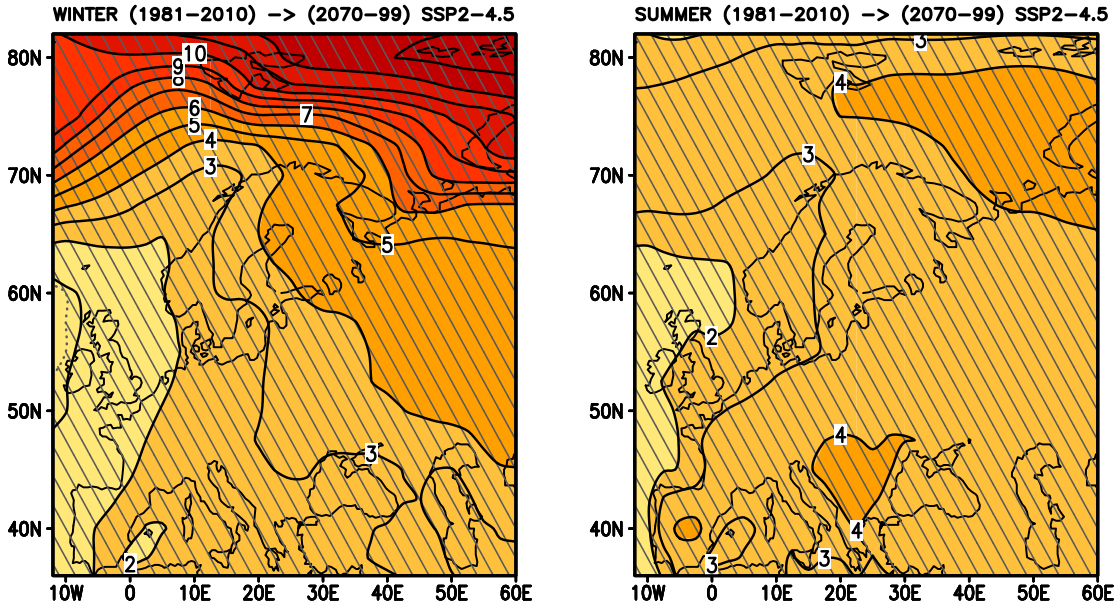

Figure S3. Multi-model mean changes in the mean surface air temperature (in °C) in Europe in the December-February (left) and June-August (right) seasons under the SSP2-4.5 scenario for the period 2070–2099, relative to 1981–2010; an average of the simulations performed with the 28 GCMs listed in Table 1 of the main text. Areas where more than 75 % of the models agree on the sign of change are hatched.

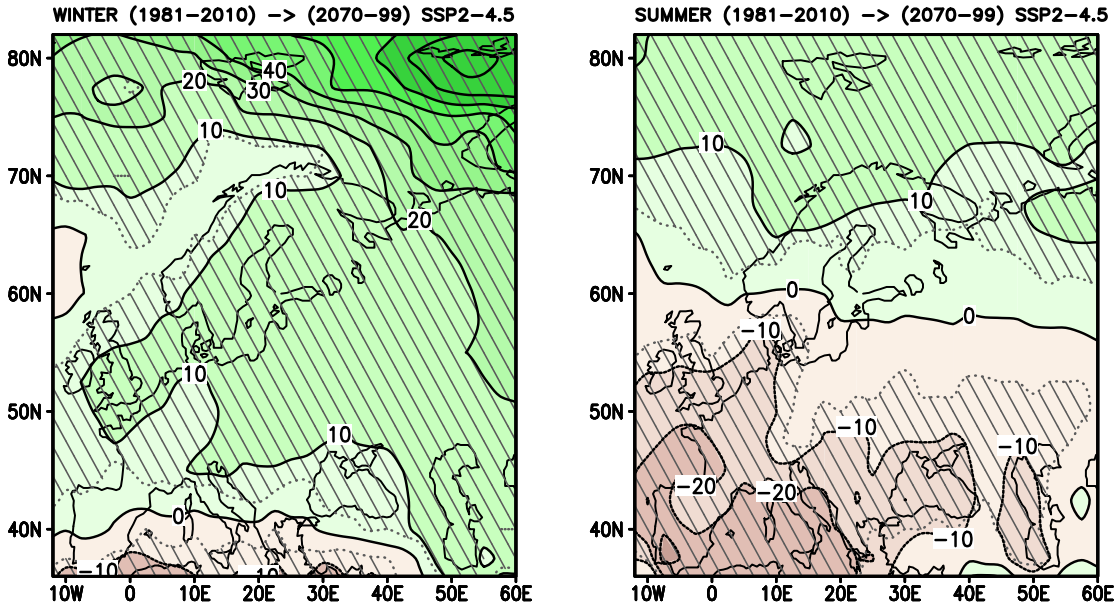

Figure S4. Projected changes in precipitation (in %) in December-February (left) and June-August (right) from 1981–2010 to 2070–2099 under the SSP2-4.5 scenario; an average of the simulations performed with the 28 GCMs listed in Table 1 of the main text. For more information, see the caption of Fig. S3.

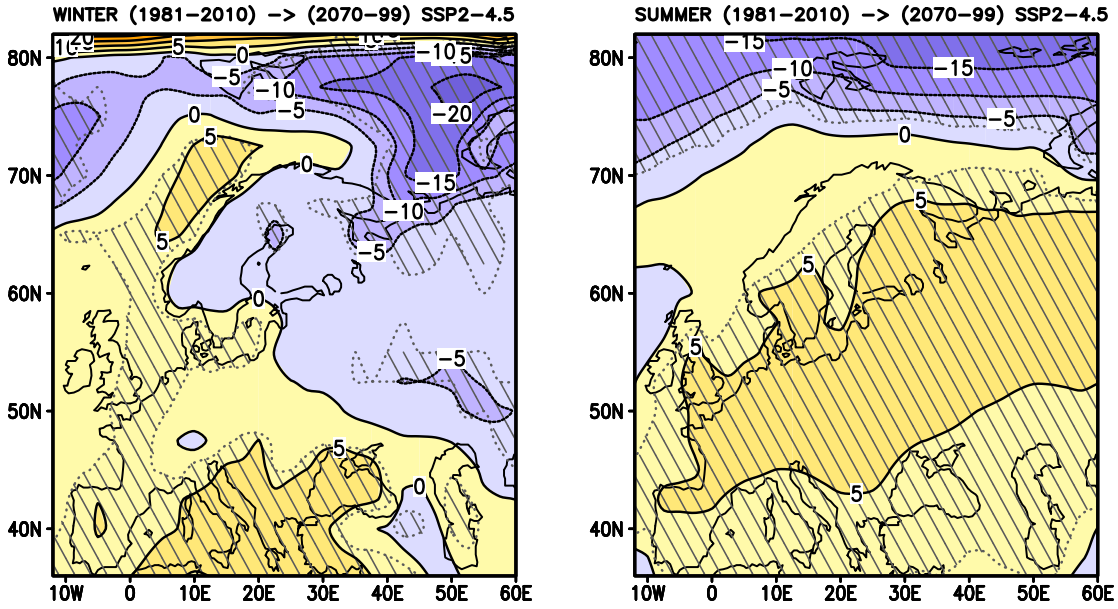

Figure S5. Projected changes in incident solar radiation at the surface (in %) in December-February (left) and June-August (right) from 1981–2010 to 2070–2099 under the SSP2-4.5 scenario; for more information, see the caption of Fig. S3.

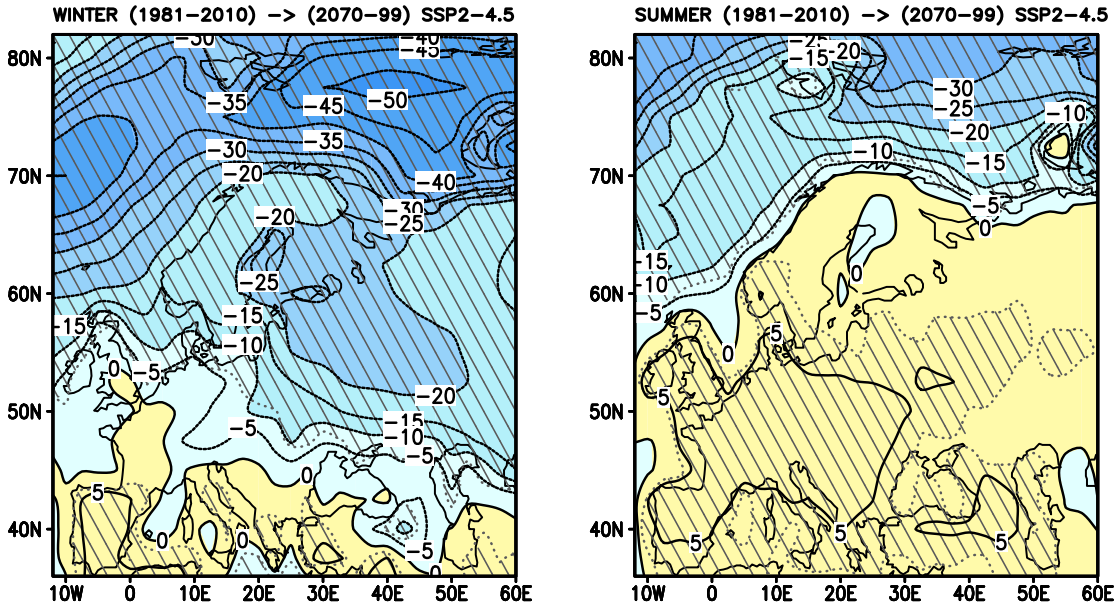

Figure S6. Projected multi-model mean changes in the diurnal temperature range (Tmax–Tmin) (in %) in December-February (left) and June-August (right) from 1981–2010 to 2070–2099 under the SSP2-4.5 scenario; for more information, see the caption of Fig. S3.

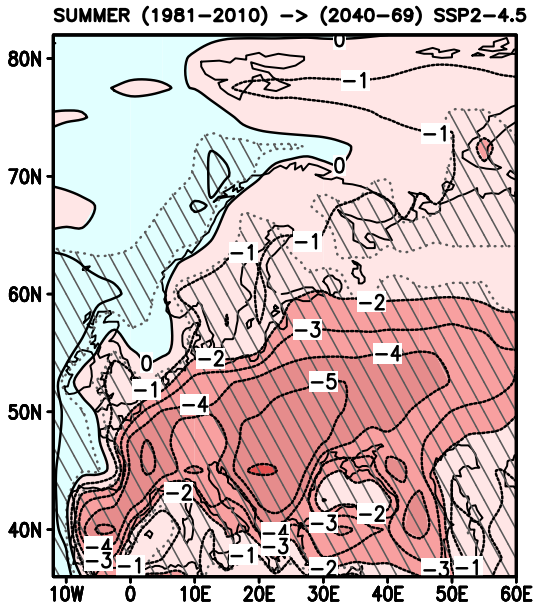

Figure S7. Changes in relative humidity (in % points) in Europe under the SSP2-4.5 scenario in June-August for the period 2040–2069, relative to 1981–2010; an average of the simulations performed with the 23 GCMs listed in Table 1 of the main text. Areas where more than 75 % of the models agree on the sign of change are hatched.