Table S1. Regional models forced by the ERA-Interim reanalysis from the European Centre for Medium-Range Weather Forecasts, for the 1989-2008 period.

RCM	Reference	acronym
CLMcom-CCLM4-8-17	Keuler et al. (2016)	CCLM
ETH-COSMO-crCLIM-v1-1	Pothapakula et al. (2020), Vautard et al. (2020)	ETH
CNRM-ALADIN53	Colin et al. (2010), Herrmann et al. (2011)	CNRM53
CNRM-ALADIN63	Daniel et al. (2019), Nabat et al. (2020)	CNRM63
DHMZ-RegCM4-2	Giorgi et al. (2012)	DHMZ
DMI-HIRHAM5	Christensen et al. (2007)	DMI
GERICS-REMO2015	Remedio et al. (2019)	GERICS
ICTP-RegCM4-6	Giorgi et al. (2012)	ICTP
IPSL-INERIS-WRF381P	Vautard et al. (2013)	IPSL
KNMI-RACMO22E	van Meijgaard et al. (2008)	KNMI
MPI-CSC-REMOO2009	Jacob et al. (2012)	MPI
SMHI-RCA4	Samuelsson et al. (2011)	SMHI
HadREM3-GA7-05	Tinker et al. (2015)	MOHC

Table S2. EURO-CORDEX Regional models driven by the CMIP5 GCMs. Also shown the approximate spatial resolution from each GCM taken from <u>https://portal.enes.org/data/enes-model-data/cmip5/resolution</u>. References: (A) Keuler et al. (2016) (B) Colin et al (2010), Herrmann et al (2011), (C) Daniel et al (2019), Nabat et al (2020), (D) Christensen et al. (2007), (E) Remedio et al. (2019), (F) Vautard et al. (2013), (G) van Meijgaard et al. (2008), (H) Samuelsson et al. (2011), (I) Tinker et al. (2015), (J) Giorgi et al. (2012), (K) Jacob et al. (2012).

CMIP5 GCM	Variant	Resolution	RCM	Reference	Acronym
			CLMcom-CCLM4-8-17	А	CNRM-CCLM
			CNRM-ALADIN53	В	CNRM-CNRM5
			CNRM-ALADIN63	С	CNRM-CNRM6
CNRM-CERFACS-	r1i1p1	1.40° X 1.41°	DMI-HIRHAM5	D	CNRM-DMI
CNRM-CM5	•		GERICS-REMO2015	E	CNRM-GERICS
			IPSL-WRF381P	F	CNRM-IPSL
			KNMI-RACMO22E	G	CNRM-KNMI
			SMHI-RCA4	н	CNRM-SMHI
			DMI-HIRHAM5	D	ICHEC1-DMI
	r1i1p1		KNMI-RACMO22E	G	ICHEC1-KNMI
			SMHI-RCA4	н	ICHEC1-SMHI
		-	CLMcom-CCLM4-8-17	А	ICHEC2-CCLM
ICHEC-EC-EARTH		1.12º X 1.13º	ETH-COSMO-crCLIM-v1-1	A	ICHEC2-ETH
		1.12" \ 1.13"	DMI-HIRHAM5	D	ICHEC2-DMI
	r12i1p1		IPSL-WRF381P	F	ICHEC2-IPSL
			KNMI-RACMO22E	G	ICHEC2-KNMI
			MOHC- HadREM3-GA7-05	I U	ICHEC2-MOH
		4 000 X 2 750	SMHI-RCA4	<u>H</u>	ICHEC2-SMHI
IPSL-CM5A-LR	r1i1p1	1.89° X 3.75°	GERICS-REMO2015 IPSL-WRF381P	E F	IPSL-GERICS IPSL-IPSL
IPSL-CM5A-MR	r1i1p1	1.27º X 2.5º	KNMI-RACMO22E	G	IPSL-KNMI
	·			Ч	IPSL-KINIVII IPSL-SMHI
			SMHI-RCA4		
			CLMcom-CCLM4-8-17	A	MPI1-CCLM
			ETH-COSMO-crCLIM-v1-1	A	MPI1-ETH
			CNRM-ALADIN63	C	MPI1-CNRM6
	r1i1p1		DMI-HIRHAM5	D	MPI1-DMI
			ICTP-RegCM4-6	J	MPI1-ICTP
			KNMI-RACMO22E	G	MPI1-KNMI
MPI-ESM-LR		1.87º X 1.88º	MPI-REMO2009	К	MPI1-MPI
		_	SMHI-RCA4	Н	MPI1-SMHI
			ETH-COSMO-crCLIM-v1-1	А	MPI2-ETHZ
	r2i1p1		MPI-REMO2009-MPI2-MPI	К	MPI2-MPI
		_	SMHI-RCA4	Н	MPI2-SMHI
			ETH-COSMO-crCLIM-v1-1	А	MPI3-ETH
	r3i1p1		GERICS-REMO2015	E	MPI3-GERICS
			SMHI-RCA4	н	MPI3-SMHI
			CLMcom-CCLM4-8-17	А	MOHC-CCLM
			ETH-COSMO-crCLIM-v1-1	А	MOHC-ETH
			CNRM-ALADIN63	С	MOHC-CNRM
			DMI-HIRHAM5	D	MOHC-DMI
MOHC-HadGEM2-ES	r1i1p1	1.25° X 1.88°	ICTP-RegCM4-6	J	MOHC-ICTP
			IPSL-WRF381P	F	MOHC-IPSL
			KNMI-RACMO22E	G	MOHC-KNMI
			MOHC- HadREM3-GA7-05	I	МОНС-МОНС
			SMHI-RCA4	н	MOHC-SMHI
			ETH-COSMO-crCLIM-v1-1	A	NCC-ETH
			DMI-HIRHAM5	D	NCC-DMI
			GERICS-REMO2015	E	NCC-GERICS
NCC-NorESM1-M	r1i1p1	1.89° X 2.5°			
	r -	-	IPSL-WRF381P	F	NCC-IPSL
			KNMI-RACMO22E	G	NCC-KNMI
			MOHC- HadREM3-GA7-05	 	NCC-MOHC
			SMHI-RCA4	<u>H</u>	NCC-SMHI
NOAA-GFDL-ESM2G	r1i1p1	2.02° X 2.00°	GERICS-REMO2015	E	NOAA-GERICS

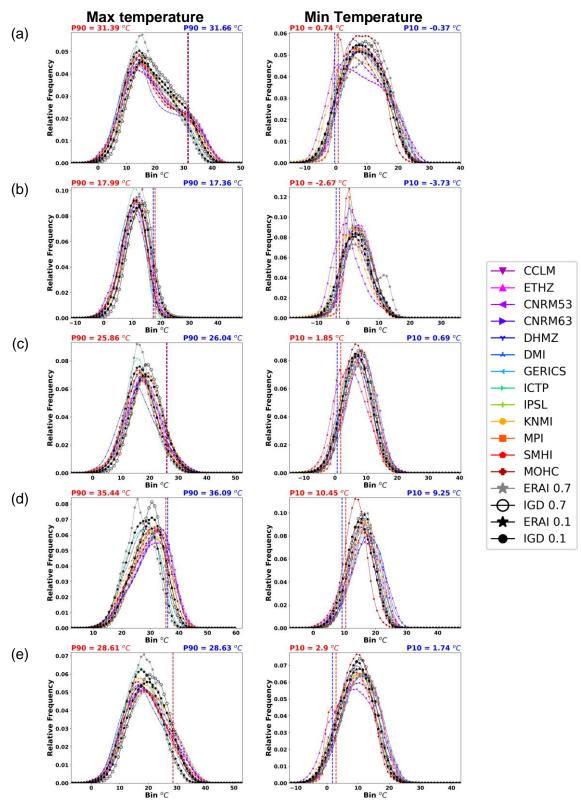


Figure S1. Maximum (left) and minimum (right) daily temperature distributions taken from the hindcast EURO-CORDEX RCMs and ERA-Interim reanalysis (1989-2008) for the Iberian Peninsula. Also shown the Iberian Gridded Dataset distribution for the same domain and period. All RCM data was previously interpolated into the IGD 0.1° regular resolution. As for Era-Interim, two PDFs are shown, one for the original resolution of the low-resolution and other interpolated into the IGD resolution. The dash point and the value written refers to either the 90<sup>th</sup> percentile for max temperature or the 10<sup>th</sup> percentile for min temperature of the observations for NGD on the original resolution (blue) and interpolated into the ERA-Interim resolution (red). The time periods are (a) Year, (b) DJF, (c) MAM, (d) JJA and (e) SON.

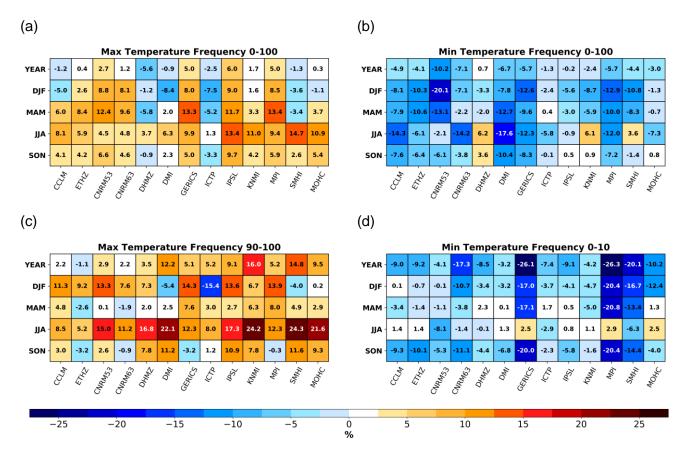


Figure S2. Yearly and seasonal distribution added values (DAV) of the Iberian Peninsula, between the RCMs and the ERA-Interim reanalysis for the 1989-2008 period, taken from the Hindcast EURO-CORDEX simulations, with the IGD regular dataset as a reference for (a) maximum daily temperature, considering the whole PDF, (b) minimum daily temperature considering the whole PDF, (c) maximum daily temperature extremes, only considering the values above the observational 90<sup>th</sup> percentile from maximum temperatures and (d) minimum temperature extremes only considering the values above the observational 10<sup>th</sup> percentile from minimum temperatures. All model data were previously interpolated to 0.1° regular resolution from the observations.

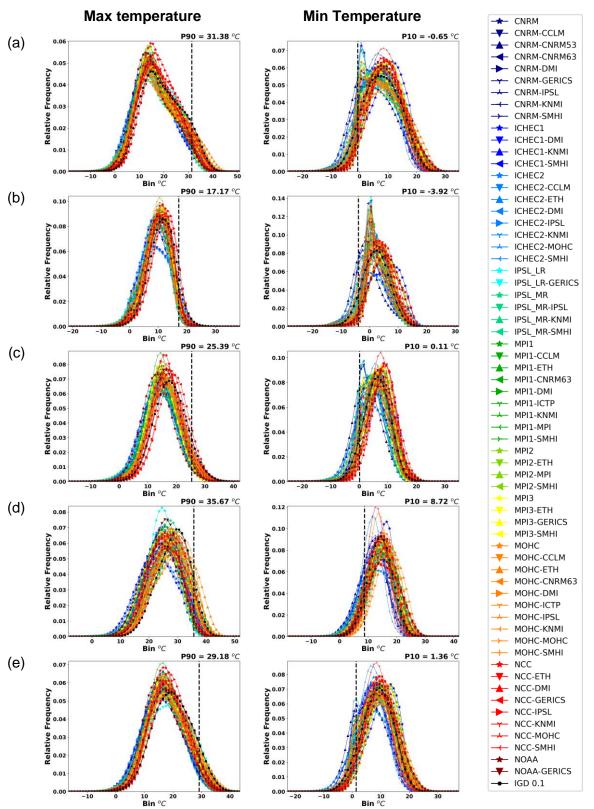


Figure S3. Maximum (left) and minimum (right) daily temperature distribution for the historical EURO-CORDEX RCMs driven by the CMIP5 GCMs, for the Iberian Peninsula, considering the 1971-2005 period, where all results were previously interpolated into the observational grid. The dash point and the value written refers to the 90<sup>th</sup> percentile of the observations for the maximum temperature and to the 10<sup>th</sup> percentile of the observations for the minimum temperature. (a) Year, (b) DJF, (c) MAM, (d) JJA and (e) SON.

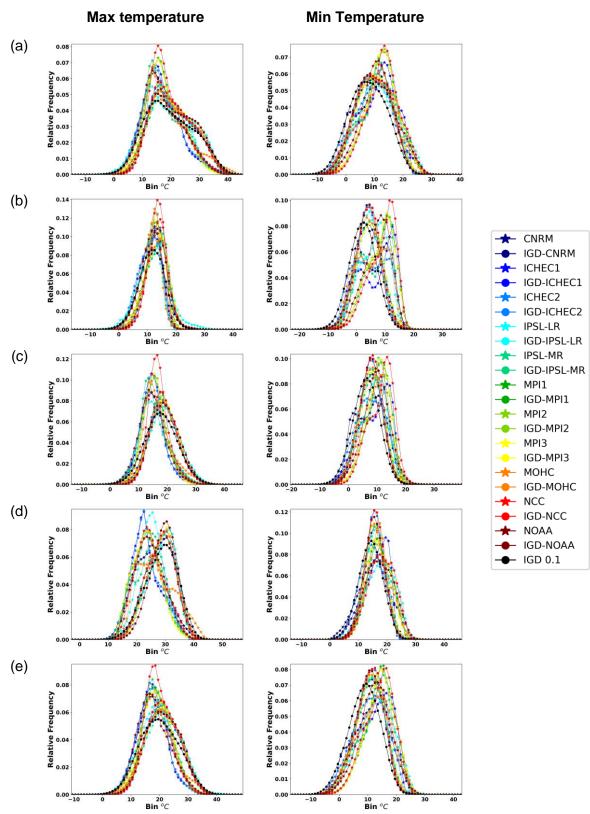


Figure S4. Maximum (left) and minimum (right) daily temperature distributions for the historical driving CMIP5 GCMs and NGD observations interpolated into each GCM resolution for the Iberian Peninsula, considering the 1971-2005 period. Also shown the PDF from the NGD observations at the original resolution. (a) Year, (b) DJF, (c) MAM, (d) JJA and (e) SON.

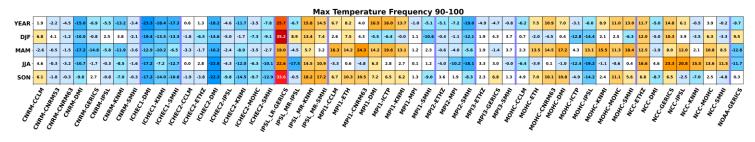


																								м	ax	Ten	npe	rat	ure	Fr	equ	uen	ю	0-1	100																					
YEAR	-2.7	0.	0 -3.	.0 -4	.2 4	.2	2.0	-2.5	-2.0	-0.6	0.7	7 4.	8 3	.4 4	1.4	0.2	8.8	2.0	4.4	2.4	7.9	-6.3	1.3	1.2	-2.	2 9.	5 -1	.0 1	9 1	.2 8	.3	0.8	3.3	-7.9	-1.6	-4.3	-2.0	-1.0	2.6	1.7	-0.6	2.6	3.9	-0.5	-2.4	3.1	9.1	1.4	6.1	2.4	16.2	8.4	2.9	9.4	6.4	10.9
DJF	-12.	5 -4.	.6 -2	1 -1	1.3 1	.9	0.7	-3.4	-3.3	3.1	9.9	9 22	.1 -2	.5	7.0	3.5	23.1	6.0	4.2	4.2	31.9	-2.7	3.0	2.5	18	4 29	.1 27	.2 -3	.3 -5	5.0 2	2.3	4.7	-2.3	-4.3	-1.6	-10.9	-5.6	2.9	2.6	7.5	-12.7	-3.1	1.6	-11.8	-11.7	-2.8	3.1	-5.3	13.2	-0.4	22.7	4.6	6.1	24.8	17.4	11.4
МАМ	-3.9	1.	5 -3.	.9 -5	.6 7	.2	1.6	-3.1	-6.2	5.8	5.3	3 2.	2 8	.6 !	9.6	3.1	17.7	4.9	7.3	2.1	14.2	-16.3	3 -1.3	-1.9	5 6.	6 16	.3 1	.3 5	9 1	.3 1	6.7	0.7	3.2	-7.5	0.2	-7.4	-0.9	0.4	0.5	-3.8	1.0	7.2	8.2	0.8	-4.0	7.5	17.1	1.3	14.7	6.8	8.8	12.2	10.0	13.1	7.7	24.4
JJA	4.3	0.	6 -2	.5 -1	1.1 0	.8 :	2.6	-10.5	5.2	-2.0	7.3	3 4.	1 24	1.8 2	2.4	3.2	19.5	9.0	27.2	21.6	9.6	-17.	0 10.3	3 15.	7 -4.	4 2.	4 -5	.9 19	.7 30	0.8 2	9.3 ·	-5.5	3.6	2.9	-2.7	-4.6	9.4	4.5	1.2	1.9	23.5	18.8	29.7	5.5	1.9	20.5	29.7	29.4	0.2	-3.6	2.8	1.3	0.8	0.6	-0.8	7.8
SON	-1.3	-1.	.1 -5	.9 -5	.2 6	.2	2.9	-4.2	-0.6	1.9	2.7	7 3.	1 6	.8 !	5.0	2.4	LO.9	0.7	6.6	5.7	7.6	-7.8	3.5	4.3	2.	5 9.	3 1	.6 -3	2 -2	2.3 6	i.5 -	-1.3	-0.8	-3.1	-0.8	-1.9	1.5	0.8	-0.1	0.0	-2.4	-1.8	1.2	-4.3	-9.4	-0.8	8.8	-1.3	6.5	1.7	7.9	2.9	3.8	8.6	5.4	15.3
Barrow	OUR AN CLAN	Cho. Cuere	C. WRAN	Chi Wen Das	C. CER.	CNPM CS	Chen, SL	CURATION	ICHEC.	ICHEC DMI	CHC KUM	IC. SM	LC CC	MEC2.ET	CHE TH2	CHE ONI	CHEC. "SI	CHEC KUM	ICHEC. MOHC	INWS TO ISAI	IPSI GERICC	IPSI	IDSL THR. HUM.	Mp. SMIL	ALCCIN	Mp. Flat	CUPA	The Com	The ICA	APLI TAN	In TIdey	lan law	MPIS MHI	MPIS	Idh SIdh	MPIS WHI	MPI3 ETHS	Mp1, CS	MON SMIN	MOLECEM	MOHC ETH	MOLANS	MOHO WI	MOHON	NOHO W	MOHIC TUNI	MOHC WOHC	WC SHAN	MCC WC	NCC. CM	MCC. N.	MCC.	NCC.MO.	NCC. OHC	NO44 - MHI	-cHICS

(b)

																								Mi	n Te	emp	oera	atu	re F	req	uer	ncy	0-1	.00																					
YEAR	0.0	-13	3.4 -5.	7 2	.7 -	1.5	-0.2	-7.5	-7.9	16.3	3 1.4	1.	2	3.0	0.9	6.1	1.9	-5.2	-4.9	-6.6	2.1	-3.9	-2.8	-5.6	13.0	11.9	9.3	7.7	4.5	6.6	-1.1	-2.1	-3.8	-7.8	1.7	1.9	0.1	-0.9	-0.8	8.6	7.6	6.8	5.7	11.0	10.0	6.3	5.8	2.0	-6.7	2.3	3.2	1.4	-4.4	-2.7	3.2
DJF	-1.0	-23	8.3 -8	.6 -0	.9 -	8.2	0.3	-12.4	-10.2	5.6	-11.	4 -10	0.8 1	3.3	11.5	16.8	14.0	-0.8	12.9	0.5	6.0	-0.5	-8.8	-11.9	4.9	0.9	-2.6	10.2	14.3	7.5	-11.7	-13.9	2.5	-21.6	-5.5	6.1	4.0	-4.1	6.4	16.9	11.6	18.4	12.8	22.0	21.3	8.3	15.3	11.4	2.2	8.9	8.2	7.3	-5.7	4.3	8.9
MAM	8.2	-16	5.6 -4.	6 1	3.9	B.O	-0.4	-10.6	-5.2	13.1	L -5.2	-3	.1 1	.5.8	16.9	17.9	11.4	-5.6	9.9	-2.8	-3.6	-18.4	-14.3	-15.0	7.5	7.0	2.5	8.7	3.7	7.7	2.0	-0.3	-1.2	-7.3	6.9	3.9	-0.8	5.6	-1.6	15.4	7.9	13.6	5.4	14.6	7.3	7.2	5.5	-5.4	-10.3	-7.3	2.4	12.8	1.7	8.5	8.5
JJA	2.7	-12	2.7 -1.	.5 6	.7	6.2	5.1	-11.2	-8.3	24.6	5 10.	<b>3</b> 9.	.9 1	2.9	12.5	19.0	12.0	-1.5	-12.4	-0.5	-7.5	4.5	15.3	10.5	11.1	8.0	12.1	4.4	-1.9	1.0	2.0	-0.8	-6.9	-1.0	2.8	4.7	-6.9	2.5	-8.3	-3.4	7.0	-2.8	-4.3	5.0	5.6	1.1	3.6	9.4	1.0	6.3	12.2	23.5	17.8	14.0	12.2
SON	-0.2	-15	5.7 -7.	7 1	.2	2.3	1.1	-9.4	-8.1	12.1	1.8	-0	.2 1	.0.7	4.1	12.1	5.8	-6.2	-5.3	-5.9	-2.4	1.2	4.5	-0.2	7.6	6.4	3.5	14.2	12.5	13.4	-1.5	-1.2	-3.0	-4.8	1.2	3.0	-1.7	0.3	-2.2	13.7	12.9	17.0	8.0	18.7	17.0	11.9	13.9	1.2	-4.2	-0.2	2.5	6.8	-2.8	1.1	7.0
Cho.	OWAR CCA	Cho. Cherry	Contraction of the	CAL VRA 03	NAM GEO	Chen, TICS	Chen Su	Chen Why	ICHEC JAHI	CHE DUN	Cyc. Kum.	ICL. SM	IL CONTRACT	CHE C. M	CHEC THIS	CHEC. DHI	ICHEC, IDSI	CHEC. KINN	ICHE MOHC	PSI LO SMHI	IPSI GERICO	IPSI AL IPSI	In Sci Pertury	MPR SMH	MD, CLM	HL3. TION	MP, NEW	MO'TOW	MP1, CP	ANN'S ANN	Idly Idly	HHWC IDW	Mo, CINZ	Idh CIDH	MP13 SMHI	MDI3 ETHY	Mp13.CS	MOHOW WHI	MON CLA	MOHC ETH	MOHOHO S	MOHON I	MONCIA	MOHC.	MONC. MAI	MOHC.C.	NCC. FUHI	MCC.	NC. ONI	MCCC.	NCC.L	WC. MAI	NCC. C.	Noqq Ge	CHICS .

(C)



(d)

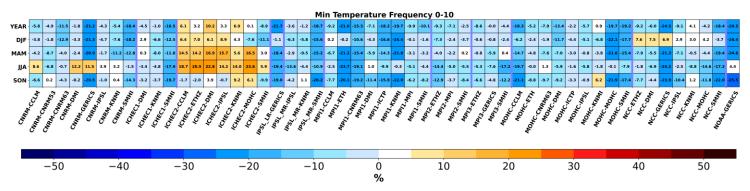


Figure S5. Yearly and seasonal distribution added values (DAV) of the Iberian Peninsula, between the RCMs and the CMIP5 GCMs for the 1989-2008 period, taken from the Historical EURO-CORDEX simulations, with the IGD regular dataset as a reference for (a) maximum daily temperature, considering the whole PDF shown in the left panels of Figure S3, (b) minimum daily temperature considering the whole PDF shown in the right panels of Figure S3, (c) maximum daily temperature extremes, only considering the values above the observational 90<sup>th</sup> percentile from maximum temperatures and (d) minimum daily temperature extremes, only considering the values below the observational 10<sup>th</sup> percentile from minimum temperatures. All model data were previously interpolated to 0.1° regular resolution from the observations.