Climate change of precipitation extremes in the Iberian Peninsula: CLIPE project results

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CLIPE objectives

(i) To diagnose the climate change signal in the precipitation extremes over the Iberian Peninsula (IP).

(ii) To identify the underlying physical mechanisms.

NOTE: Only the first aim is addressed in this presentation; other works performed under the CLIPE project are presented by other colleagues.

Layout

- Original data
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- Methodology
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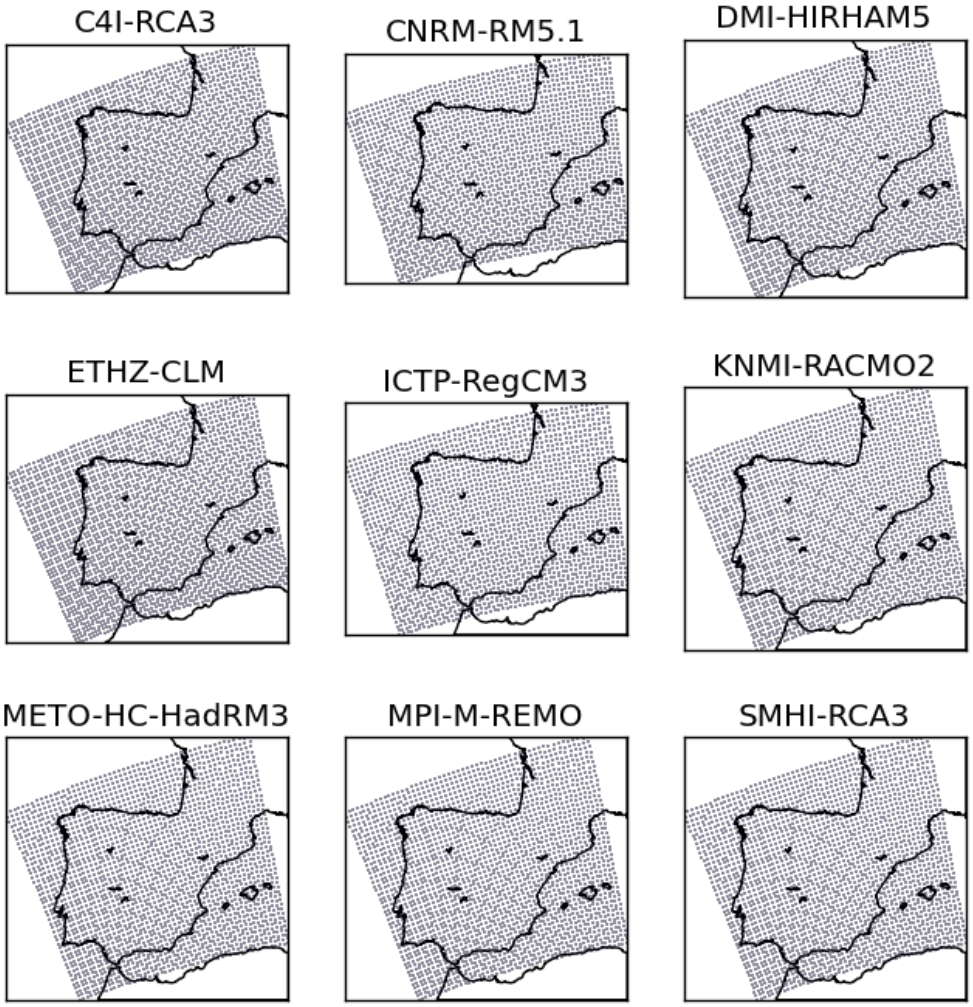
Original data: Daily-total Precipitation

Precipitation daily-total data obtained from the **Multi-Model Ensemble (MME)** of Regional Climate Model (RCM) simulations provided by the **ENSEMBLES project** (spatial resolution of ~25km).

MME: 15 GCM-driven RCM simulations from 1961 to 2098 (9 RCMs forced by 11 GCMs).

Original data: RCM grids



Original data: GCM x RCM matrix

Institution	RCM	GCM driver						N
		ARPEGE	BCM	ECHAM5-r3	HadCM3 -Q0	-Q3	-Q16	
C4I	RCA3						✓	1
CNRM	Aladin (RM5.1)	✓						1
DMI	HIRHAM5	✓	✓	✓				3
ETHZ	CLM				✓			1
ICTP	REGCM3			✓				1
KNMI	RACMO2			✓				1
METO-HC	HadRM3							1
	-Q0				✓			1
	-Q3					✓		1
	-Q16						✓	1
MPI-M	REMO			✓				1
SMHI	RCA3		✓	✓		✓		3
	N	2	2	5	2	2	2	15

Derived data: ETCCDI-MME & ETCCDI-MMEM

Annual and seasonal indices of precipitation extremes, proposed by the CCI/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (**ETCCDIs**), derived from the daily precipitation MME.

Each index was computed for each member of the MME (**ETCCDI-MME**) and for the MME Median **(ETCCDI-MMEM)**.

***ETCCDIs*:**

PRCTOT: Total amount of precipitation.
CDD: Consecutive dry days (PRP < 1.0 mm).
Rx5day: Maximum total precipitation over five consecutive wet days.
R95T: % of PRCTOT due to days with daily-total amount ≥95th percentile of wet days of the reference climate (1961-1990).

Methodology: non-parametric approach

TREND

Theil-Sen linear trend, from 1961 to 2098, tested by the Mann-Kendall test.

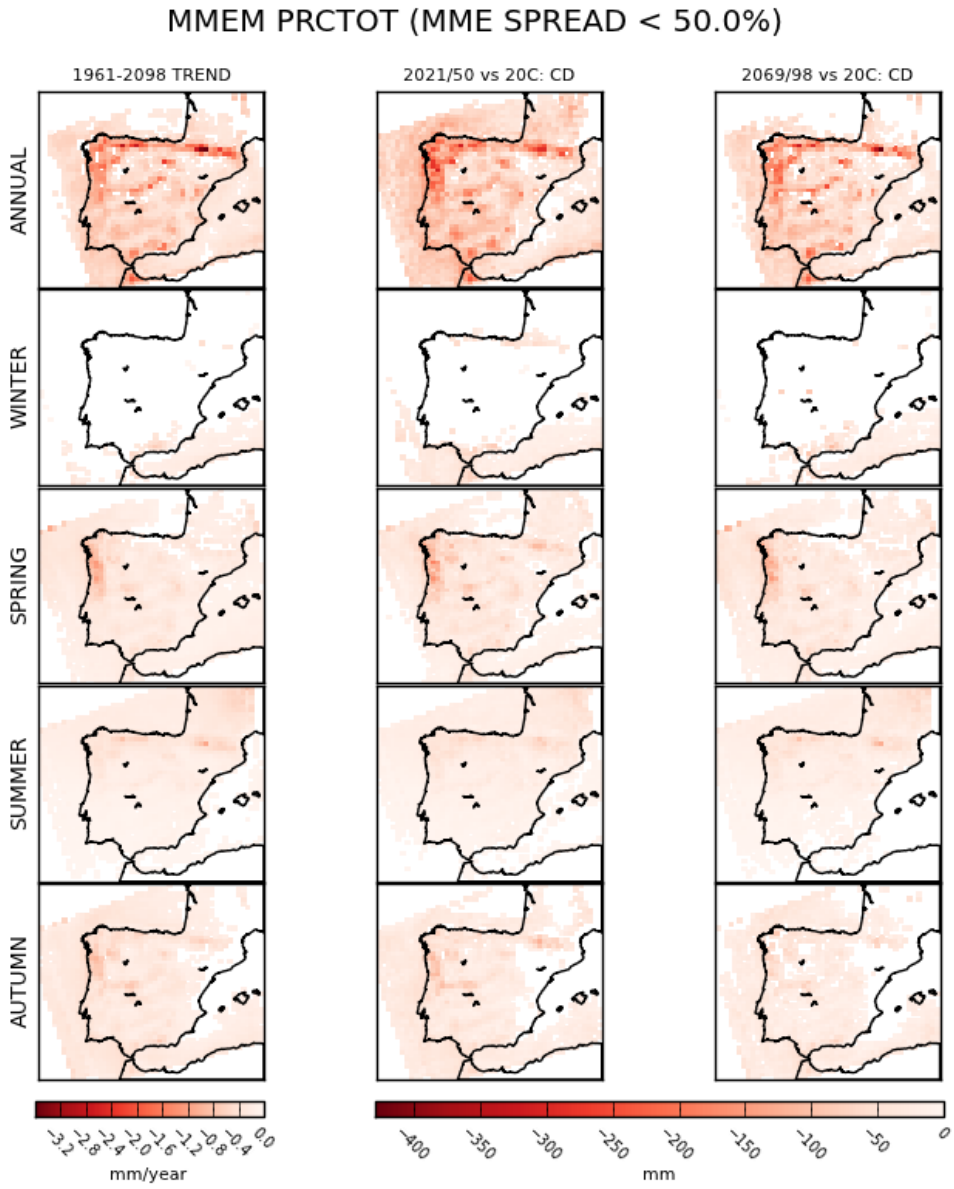
CD

Differences between the climatologies, estimated by the time Median, of a **near-future (2021-2050)** and a **distant-future (2071-2098)** climates from the climatology of a recent-past **reference climate (1961-1990)**, tested by the Mann-Whitney test.

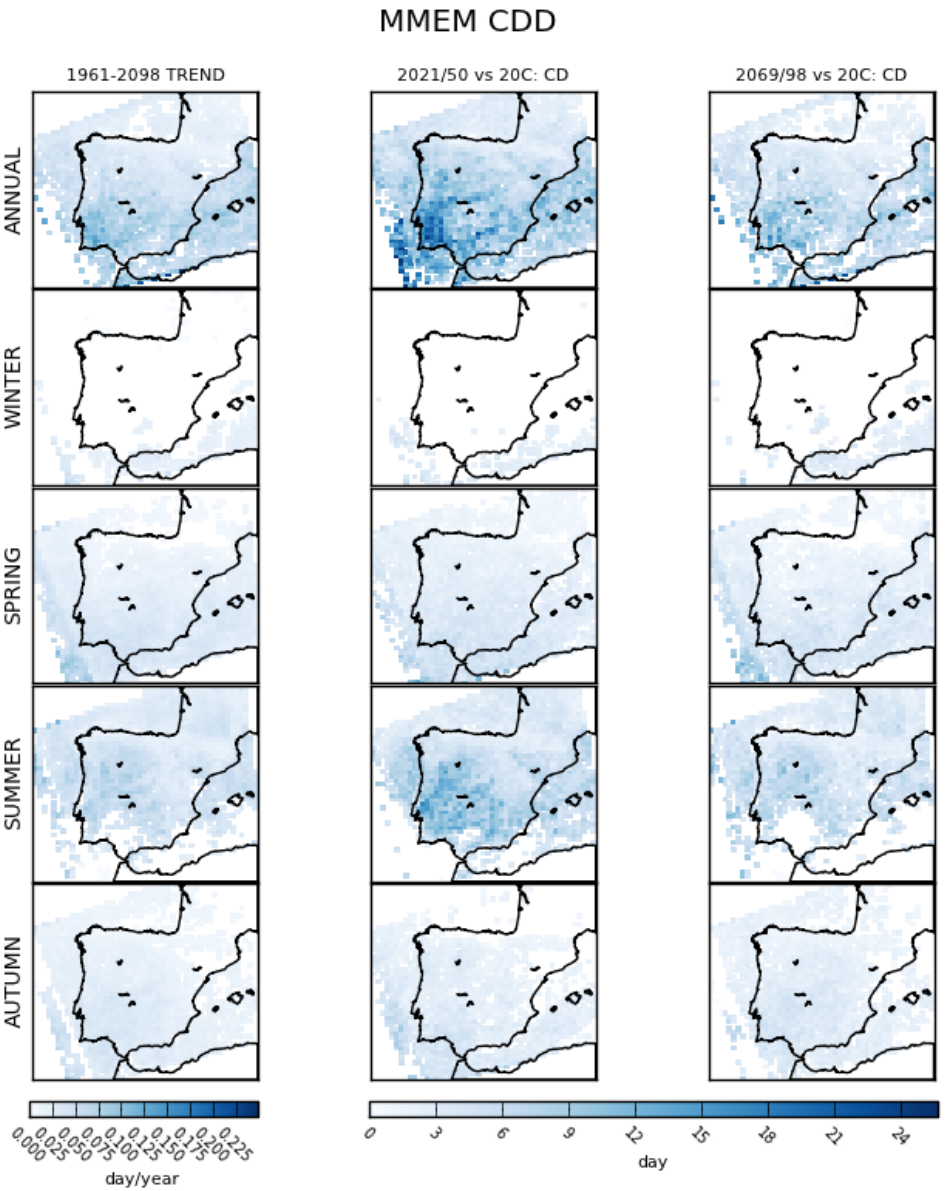
Climate change projections are evaluated from the statistics obtained from the ETCCDI-MMEM, while the uncertainties of those projections are evaluated by a rank-based measure of the spread of these statistics across the ETCCDI-MME: modified version of MAD (Median Absolute Deviation) statistic.

Results: PRCTOT

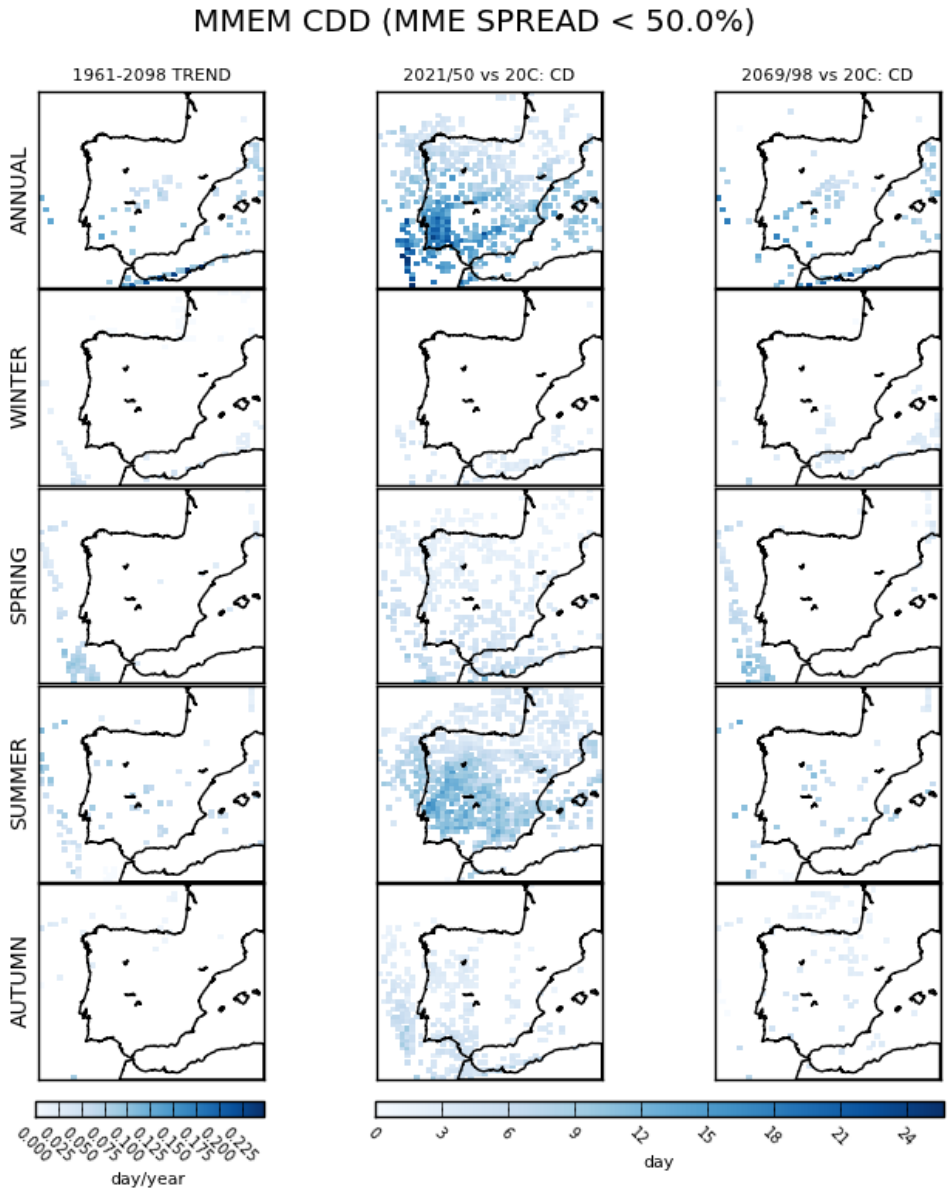
Results: PRCTOT (MME SPREAD < 50%)



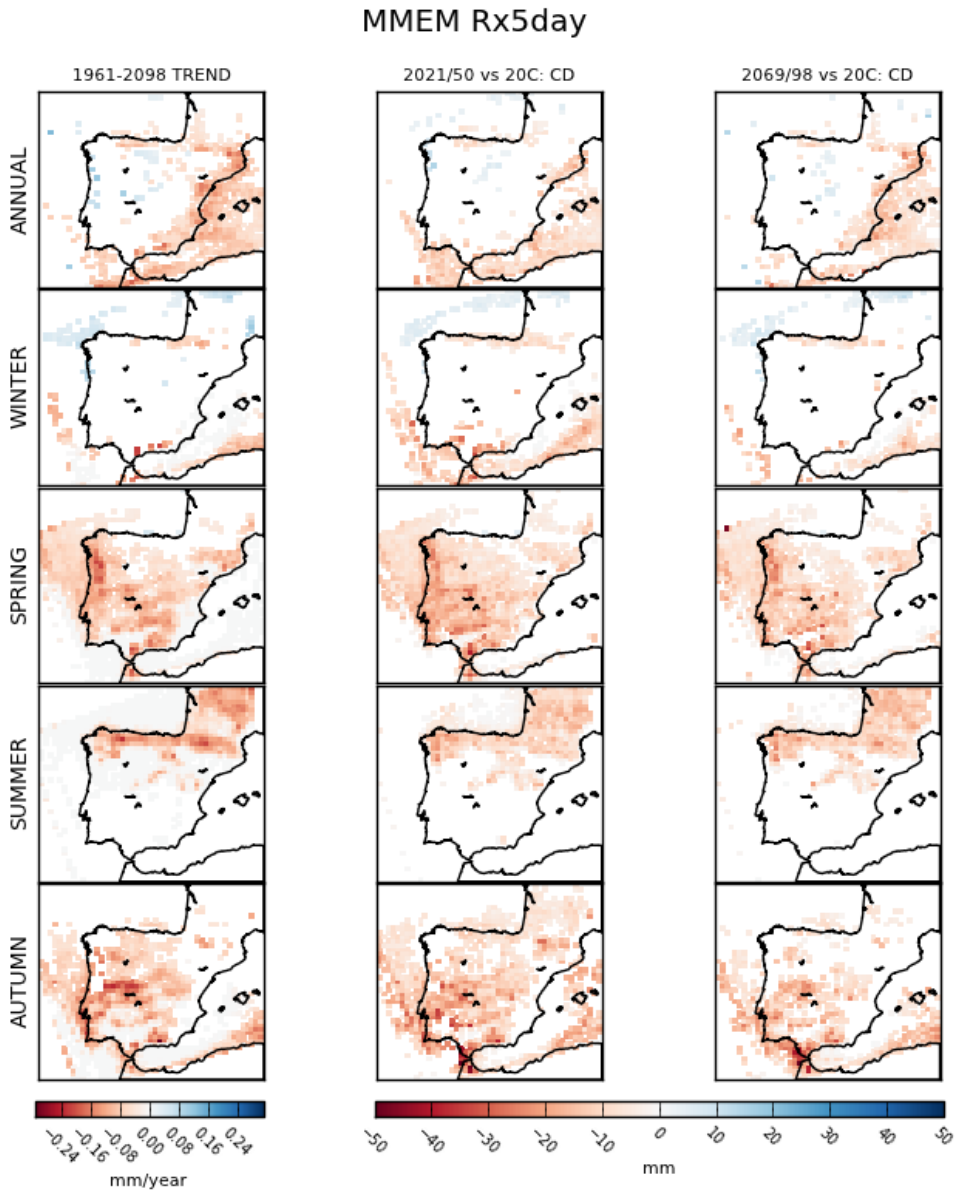
Results: CDD


MMEM CDD
1961-2098 TREND
2021/50 vs 20C: CD
2069/98 vs 20C: CD
ANNUAL
WINTER
SPRING
SUMMER
AUTUMN
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
day/year
0
3
6
9
12
15
18
21
24
day

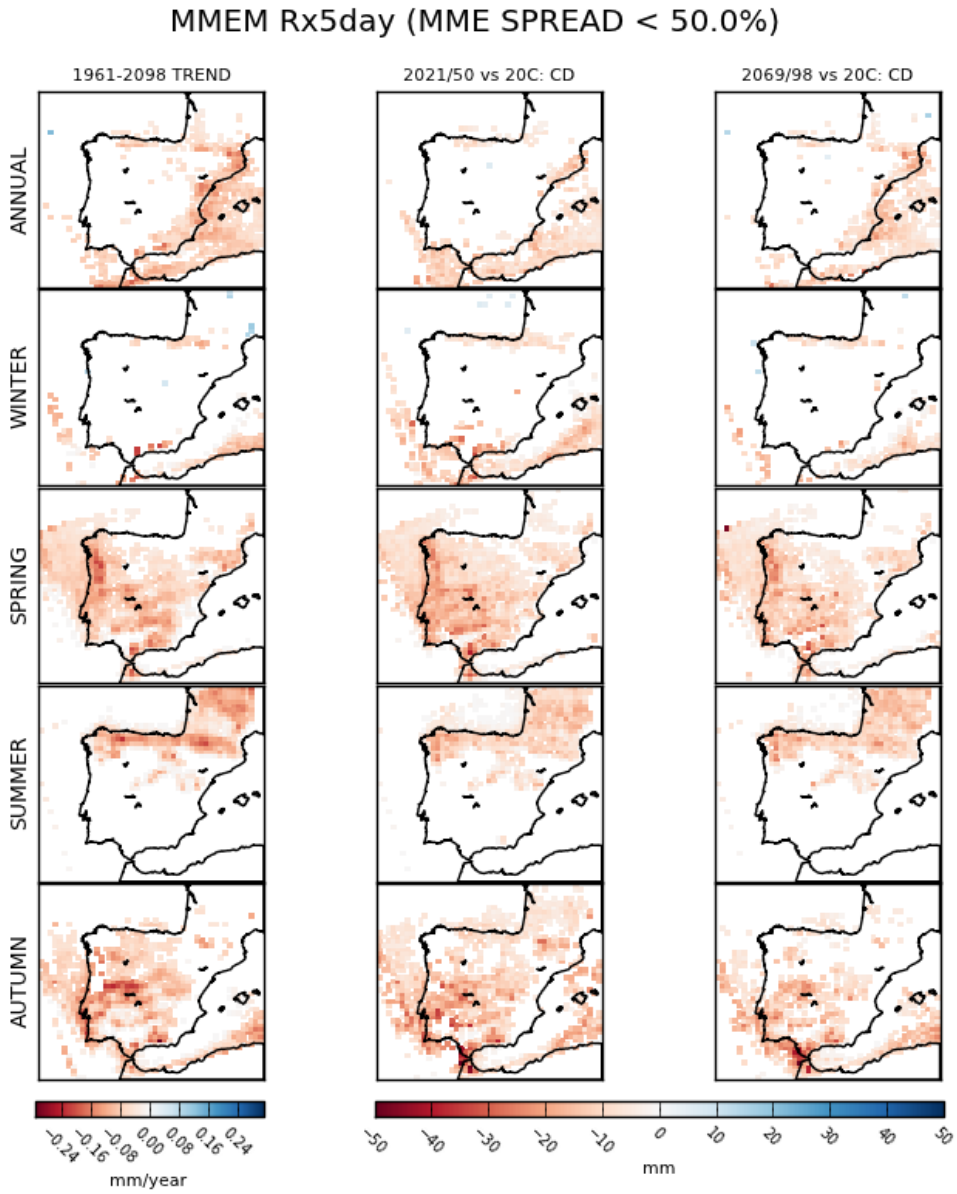
Results: CDD (MME SPREAD < 50%)



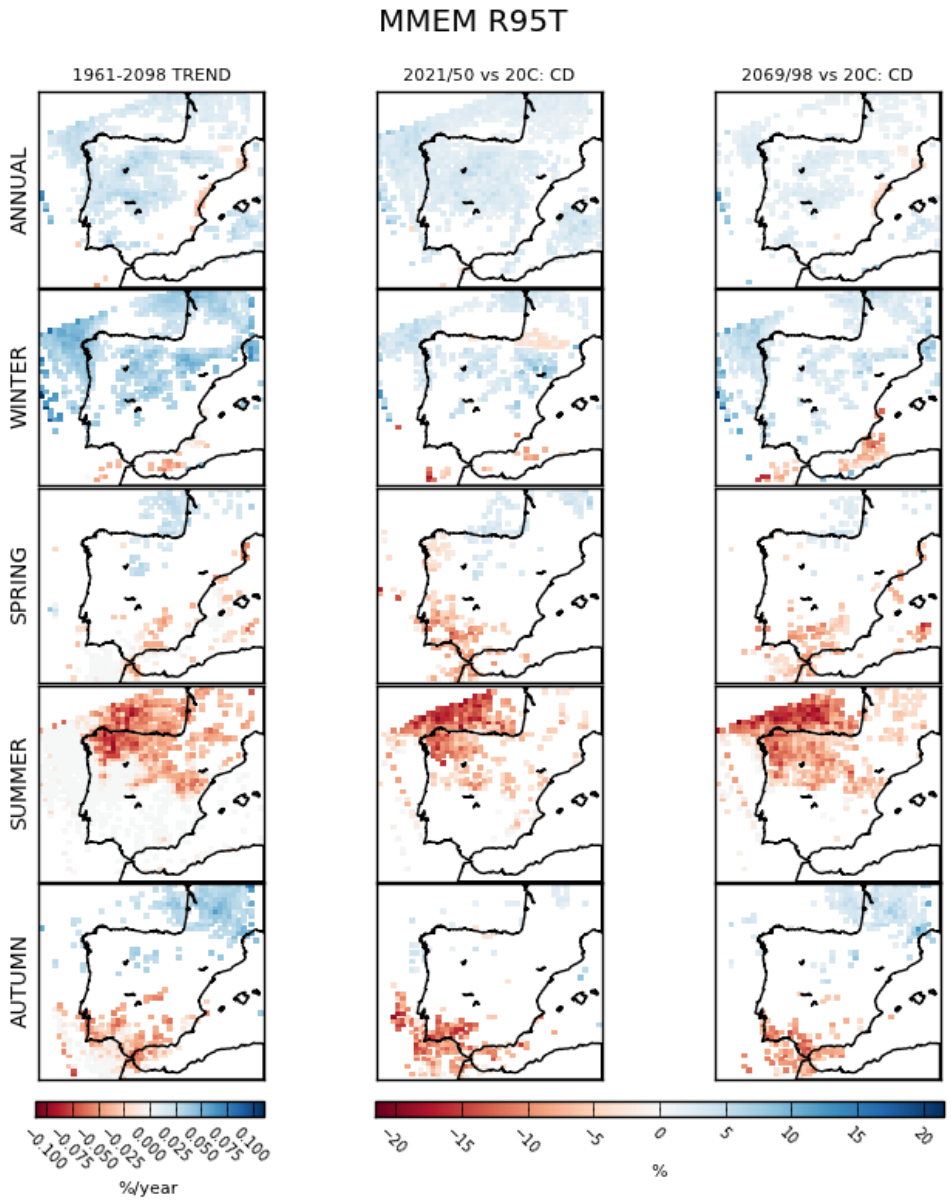
Results: Rx5day



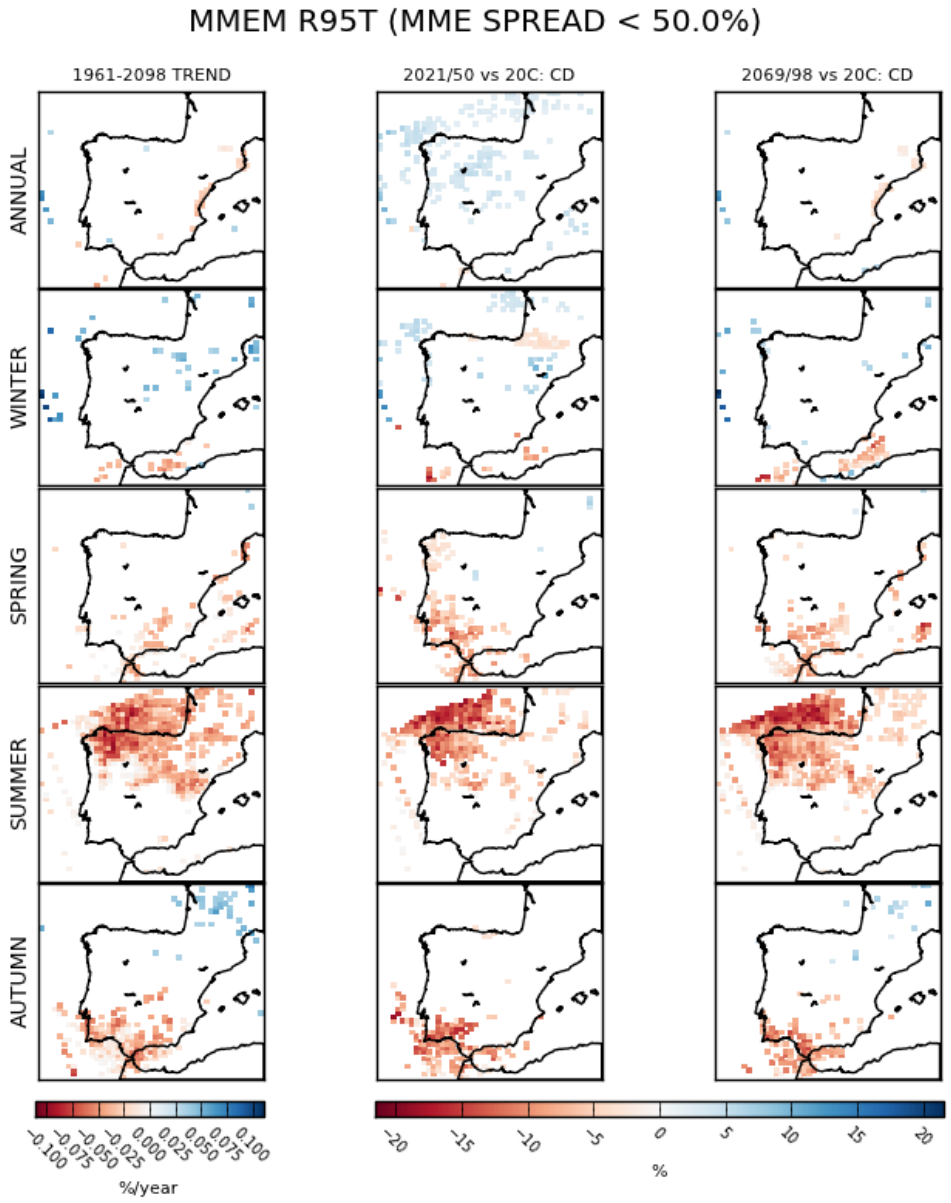
Results: Rx5day (MME SPREAD < 50%)



Results: R95T



Results: R95T (MME SPREAD < 50%)



Concluding remarks

RCM simulations differ between RCMs. Note that the physics of the RCMs are different and the driver GCMs are also different.

Climate change projections are highly depend on the chosen GCM/RCM simulation, specially for extreme indices or high-moment statistics.

Climate change detection methods should take into account the variability across the RCM ensemble.

Robust regional climate change projections based on ensembles of RCM simulations can be achieved by considering only the regions where the RCM projections agree.

Thank you for your time