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Non-parametric inferences on climate change of high-resolution spatial patterns of precipitation extremes in Iberia

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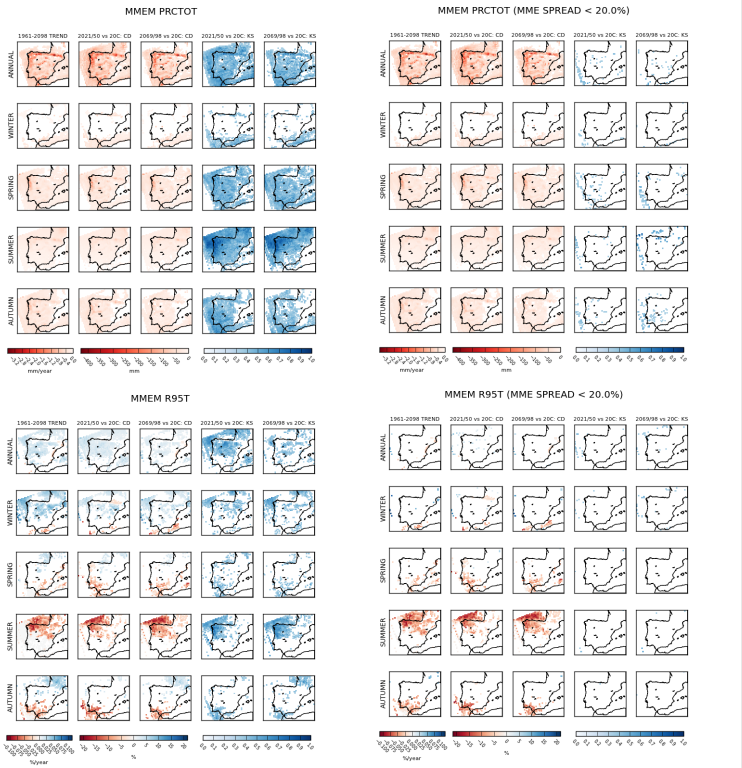

Data

Precipitation daily-total data obtained from the 15-member multi-model ensemble of Regional Climate Model (RCM) simulations, provided by the EU FP6 Integrated Project ENSEMBLES (spatial resolution of ~25km), for the periods 1961-2000 (historical runs) and 2001-2098 (A1B emission scenario).

Analysis: ETCCDI indices

Annual and seasonal indices of precipitation extremes, proposed by the CCI/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI), were derived from the daily precipitation ensemble:

- PRCTOT
  Total amount of precipitation

- R95T
  Fraction of PRCTOT due to days with daily-total amount ≥ 95th percentile of wet days of the reference climate (1961-1990)

Each index was computed for each member of the Multi-Model Ensemble (MME) and for the MME Median (MMEM).

Analysis: Climate change detection methods

The following methods were applied to each ETCCDI index:

(i) TREND - Theil-Sen linear trend, from 1961 to 2098, tested by the Mann-Kendall test;

(ii) CD - differences between the climatologies, estimated by the time median, of a near-future (2021-2050) and a distant-future (2069-2098) climates from the climatology of a recent-past reference climate (1961-1990), tested by the Mann-Whitney test;

(iii) KS - difference between the Probability Distributions of the near and distant climates from that of the reference climate, tested by the Kolmogorov-Smirnov test.

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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: a modified MAD (Median Absolute Deviation) statistic.

Results

Iberian regions with statistically significant, at 0.05 level, projected climate change, under the A1B scenario, detected by the three methods are identified (Figures of the left column).

Since these projections have associated uncertainties, estimated by their spread across the MME, we identify which of these regions have projected uncertainties less than 20% (Figures of the right column). That is, these figures show significant climate change signals detected by at least 80% of the RCMs.

Conclusions

Climate change is detected at a high spatial resolution by the MMEM for both PRCTOT and R95T over the Iberian Peninsula.

The decrease of annual PRCTOT is due to its decrease in Spring, Summer and Autumn.

The increase of annual R95T is mainly due to its increase in Winter.

RCMs agree in the climate change of PRCTOT but disagree for R95T.

Climate change detected using Probability Distributions (KS test) has a MME spread much higher than the one detected by the trend and climatology differences.

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