CMIP5 – Performance and Climate Change Assessment of maximum and minimum temperatures in Europe

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Motivation

Climate Change, especially in the regime of **extreme events** is the focus of many studies. This is due to the fact that extreme events have a near-immediate effect on every-day life issues.

Under a changing climate, it is expected that these events will become more common.

Is this true for Europe? And if so, what are the geographical differences?

Objective

I. Evaluate the performance of CMIP5 models in recent-past simulations for **Europe**.

II. Within Europe, define areas of coherent climate change patterns in temperature

III. Determine what is happening and will happen in the future to extreme events.

Model Performance

Model	tasmax/ tasmin
ACCESS1-0	99.6
CanESM	99.3
CCSM4	99.7
CNRM-CM5	99.7
CSIRO Mk3-6-0	99.6
EC-EARTH r1i1p1	99.8
EC-EARTH r12i1p1	99.8
HadGEM2-ES	99.6
GFDL-ESM2M	99.4
IPSL-CM5A-MR	99.4
MIROC5	99.7
MIROC-ESM-CHEM	99.3
MPI-ESM-LR (r1i1p1)	99.6
MPI-ESM-LR (r2i1p1)	99.6
NorESM1-M	99.5

Table 1: List of models and % of overland points where the maximum (tasmax)/ minimum

the same distribution at the 95% confidence level.

Taking the time series for the recent-past (1986 - 2005), the 2 sample **Kolmogorov-Smirnov** test was used to compare the modeled and observed data sets for maximum and minimum temperatures, at the 95% confidence level.

All models perform similarly. However, in order to reduce uncertainty associated to climate change projections an ensemble of the mentioned models was used

Regionalization

RCP8.5 Daily Climat. – Historical Daily Climat.

Multi-feature K-Means Clustering Analysis

The multi-features are, not only the 2 variables, but also the 15 simulations.

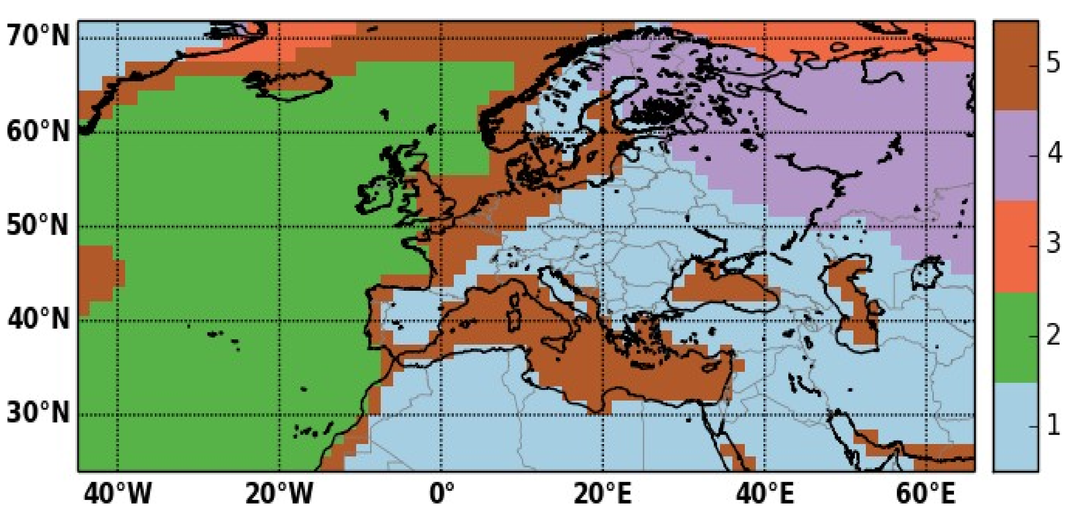

Figure 1: European Regions of coherent seasonal climate change for minimum and maximum temperature for the 13-model ensemble.

Data & Methodology

OBSERVED DATASET:

→ E-OBS V9.0 on a 0.25 degree regular grid
→ Re-gridded to each of the models' grids

MODELED DATASETS:

Model List in Table 1.
→ Each model has a different horizontal resolution;
→ Ensemble mean is determined based on the re-gridded form of the models, with a 1.5º x 1.5º horizontal resolution.

TIME PERIODS:

→ Recent-past 1986 – 2005

→ Long-term future 2081 – 2100

RCP 8.5

INDEXES USED:

→ **Maximum Temperature**
- **Cold Days (TX10p):** Number of days when the tasmax < 10th percentile.
- **Warm Days (TX90p):** Number of days when the tasmax > 10th percentile.

→ **Minimum Temperature**
- **Cold Nights (TN10p):** Number of days when the tasmin < 10th percentile.
- **Warm Nights (TN90p):** Number of days when the tasmin > 90th percentile.

! The percentile was determined using a 5-day window, based on the recent-past period.

Results & Conclusions

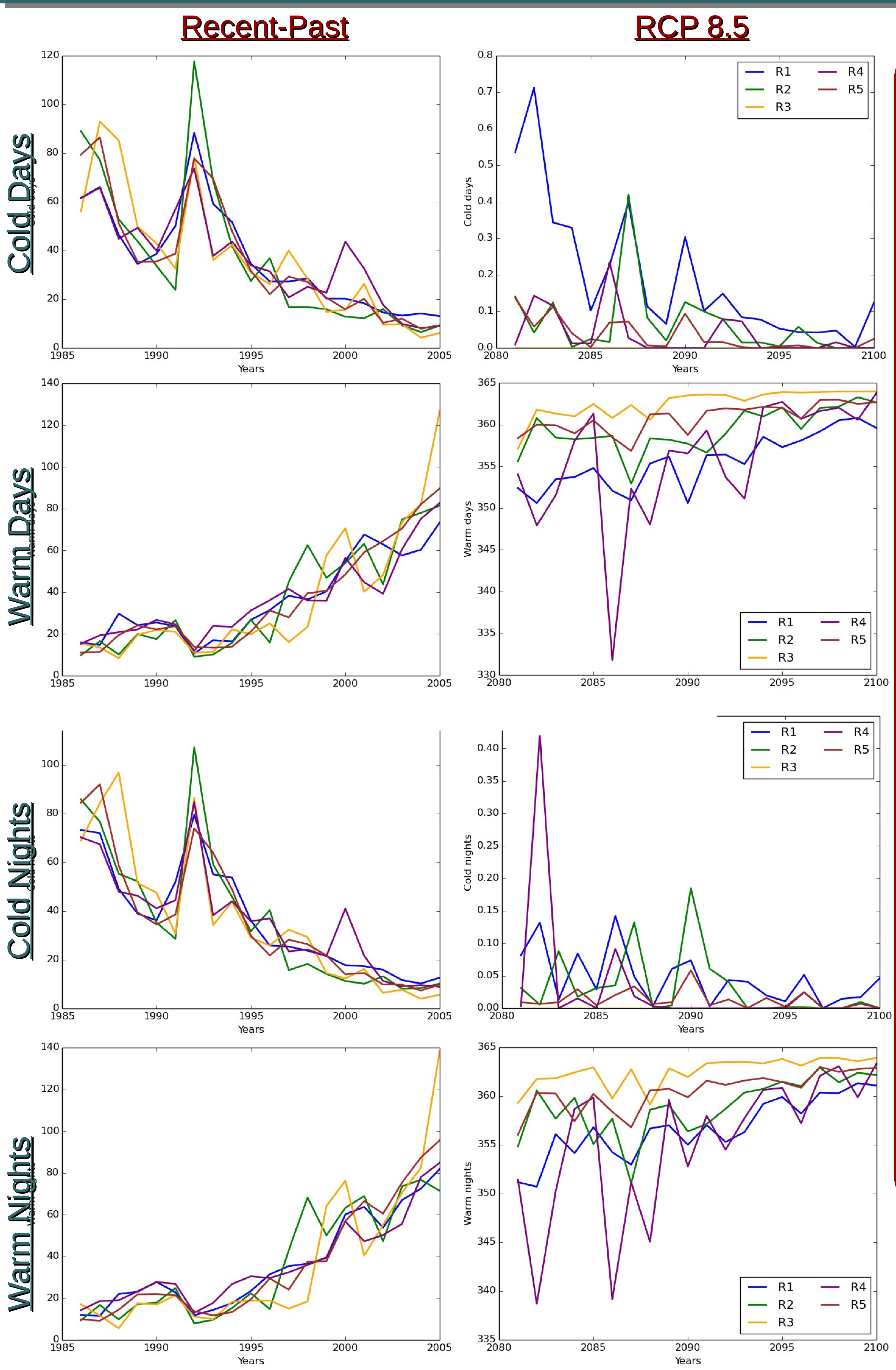

Figure 2: Mean yearly series of the cold/ warm days and cold/ warm nights for the recent-past (1986-2005) on the left and long-term future (2081-2100) on the right for each of the European regions.

Model Evaluation:

Most models show the same overall performance level. There is little difference between results from the same model with different initializations.

Recent-Past:

→ decrease in cold days and cold nights

+

→ increase in warm days and warm nights

↓

Higher maximum and minimum temperatures.

Long-Term Future:

→ Cold nights and days tend to disappear;
→ Warm nights and days, as defined tend towards the total number of days per year;
→ If the long-term-future percentile was used instead of the recent-past, there would still be an increase in warm nights/ days and decrease in cold nights/ days, but not reaching the mentioned magnitudes.

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