

Differences between EURO-CORDEX ensemble and the full CMIP5 and CMIP6 ensembles, with focus on Europe

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Summary:

A very large ensemble of more than 130 regional climate simulations for Europe is finalized for the climate change scenarios RCP2.6, RCP4.5 and RCP8.5 (downscaling the CMIP5 GCMs). These simulations constitute a major contribution to the scientific basis on future climate change in Europe, which is needed for impact studies and for taking appropriate adaptation measures:

RCP8.5	RCA4	CCLM4-8-17	CCLM-GPU	REMO_09_15	RACMO22E	HIRHAM5	WRF361H	WRF381P	ALADIN53	ALADIN63	RefCM4.6.1	HadREM3-RA
MOHC-HadGEM2-ES	1	1	1	1	1	1	1	1	1	1	1	1
ICHEC-EC-EARTH	1,12,3	12	12,1,3	12	1,12,3	1	12	1	12	12	12	12
CNRM-CERFACS-CNRM-CM5	1	1	1	1	1	1	1	1	1	1	1	1
NCC-NonESM1-M	1	1	1	1	1	1	1	1	1	1	1	1
MPI-M-MPI-ESM-LR	1,2,3	1	1,2,3	1,2,3	1	1	1	1	1	1	1	1
IPSL-IPSL-CM5A-MR	1	1	1	1	1	1	1	1	1	1	1	1
CCma-CanESM2	1	1	1	1	1	1	1	1	1	1	1	1
MIROC-MIROC5	1	1	1	1	1	1	1	1	1	1	1	1

Now the new CMIP6 simulations and the data itself are available. This circumstance makes it very important to compare the different ensembles: the well-established CMIP5 ensemble and the EURO-CORDEX ensemble can now be compared with the newer CMIP6 models.

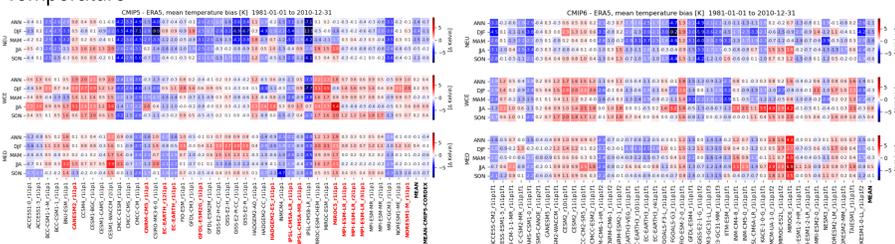
The 30-year mean annual and seasonal temperature and precipitation are calculated for the historical period 1981-2010 and two future time slices 2036-2065 (not shown) and 2070-2099 and averaged over three regions: Northern Europe (NEU), Western & Central Europe (WCE) and the Mediterranean (MED).

The projected climate change results for the future are compared between the CMIP5 results for scenario RCP2.6, RCP4.5, RCP8.5 with their corresponding, but not identical, scenarios of CMIP6 SSP1-2.6, SSP2-4.5, SSP5-8.5.

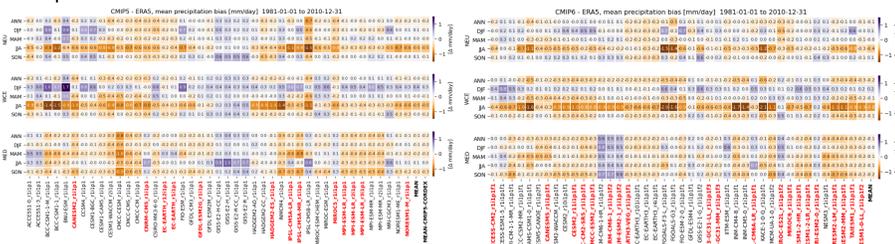
Evaluation of the historical period 1981-2010

Comparing CMIP5 and CMIP6 to ERA5 reanalysis data

Temperature



Precipitation



The spread of the annual mean temperature bias is smaller for CMIP6 than for its precursor CMIP5 in Northern Europe (NEU) and Western & Central Europe (WCE), but larger in the Mediterranean (MED). Individual CMIP6 models still show strong temperature and precipitation biases.

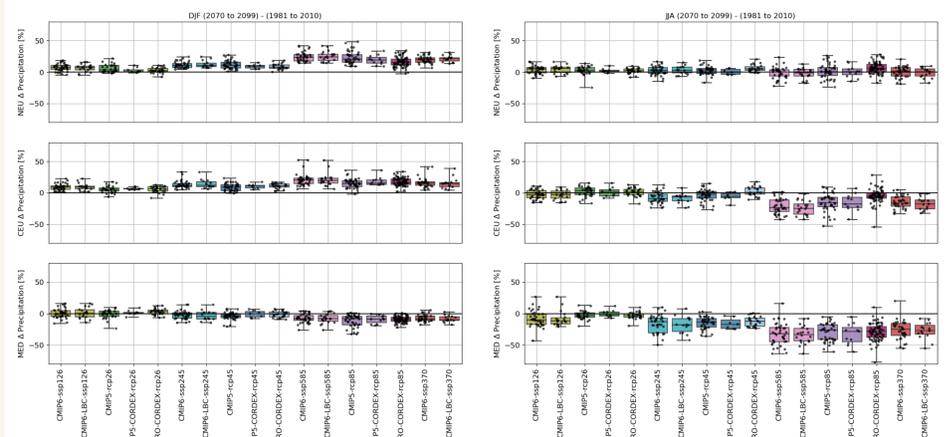


DOI 10.5281/zenodo.5925641

Data and more details are available:
https://github.com/KatharinaBuelow/cmip5_cmip6_euro-cordex-plotting-routines

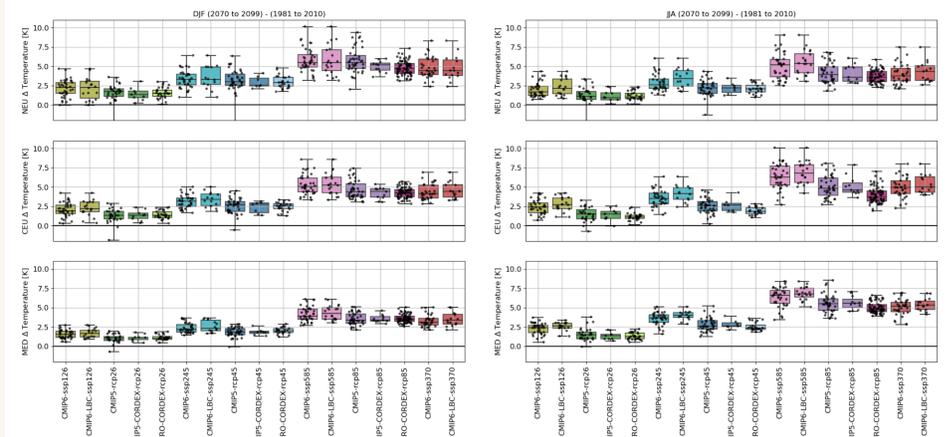
Precipitation change:

DJF, JJA, 2070-2099: CMIP5, CMIP6, EURO-CORDEX



Temperature change:

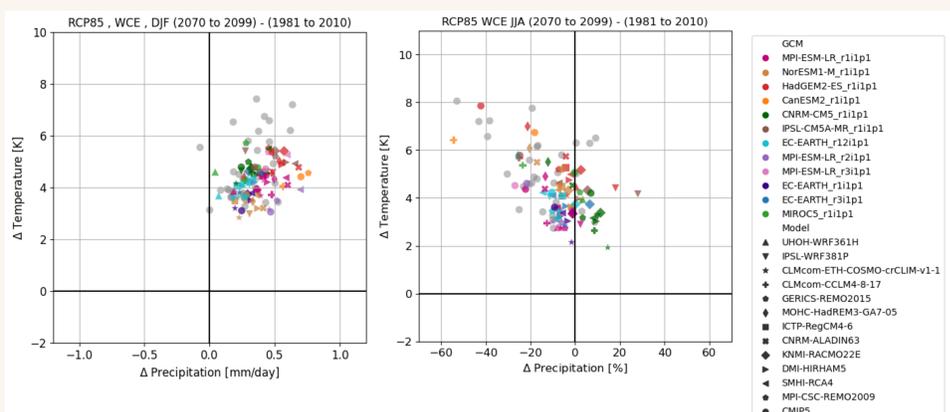
DJF, JJA, 2070-2099: CMIP5, CMIP6, EURO-CORDEX



This study confirms the previous finding for temperature and precipitation change at the end of the 21st century in Europe. Regional and seasonal features of temperature and precipitation changes in Europe exist in the results of the CMIP5 and CMIP6 ensemble:

- Distinct precipitation and temperature increase during winter in Northern Europe
- Pronounced drying in the Mediterranean during summer in RCP8.5/SSP585.
- The median and interquartile spread of the temperature change of each scenario from CMIP6 is higher than its corresponding scenario in CMIP5.
- The CMIP5 models used as forcing for EURO-CORDEX RCMs cover half of the full spread of the temperature and precipitation change of the CMIP5 ensemble in Western & Central Europe and the Mediterranean. For Northern Europe, the spread is even less well represented.

Temperature and precipitation change 2070-2099 CMIP5 and EURO-CORDEX RCP8.5



The climate change signal of the individual RCM is similar to its forcing GCM.