EURO-CORDEX ESD Intercomparison Experiment

The EURO-CORDEX intercomparison experiment for Empirical-Statistical Downscaling (ESD) methods is a follow on of the VALUE experimental framework (Maraun et al. 2015). VALUE conducted a first intercomparison experiment for assessing the relative merits and limitations of the different ESD approaches (PP, MOS and WG) and families with perfect (reanalysis) predictors (see Gutiérrez et al. 2018 and other papers in the VALUE special issue of *International Journal of Climatology*). The analysis considered as predictands daily precipitation and minimum and maximum temperatures over 86 stations accross Europe (see Gutiérrez et al. 2018).

The EURO-CODEX ESD Intercomparison Experiment will analyze the perfect prognosis and/or extrapolation assumptions of ESD approaches using GCM predictors from historical and future scenarios (this corresponds to VALUE experiment 3; Marun et al. 2015). Moreover, coupled RCM simulations will be also considered for the participating MOS methods in order to assess the effect of model output resolution (i.e. their suitability for GCM and RCM postprocessing). This experiment is open for participation to the ESD community. All contributing methods will provide appropriate simulations and metadata (in particular, comprehensive information of the predictors used) via the VALUE validation portal (details to be provided).

Selection of GCMs and RCMs: The current high-resolution (0.11º) simulations available from EURO-CORDEX are shown in Table 1 (rows correspond to GCMs and columns to the coupled RCMs). Three of the models (EC-EARTH-r1,r3 and NorESM1M-r1) are coupled to a single RCM, and a bug was recently reported for the historical simulations of CNRM-CM5-r1. Moreover, two GCMs (IPSL and HadGEM2-ES-r1) contain missing data (for gridboxes under surface) which affect typical predictors used in ESD. Therefore, these models are excluded from the selection for practical resasons.
The two remaining GCMs (EC-EARTH-r12, MPI-ESM-LR-r1) consistently reproduce key large scale proccesses affecting the European climate, in particular storm tracks. The two models have small biases (see Figure 2 for the case of EC-EARTH), so they are suitable for the downscaling process. Then, the models **EC-EARTH-r12** and **MPI-ESM-LR-r1** are selected for the intercomparison experiment.
Regarding the selection of RCMs for MOS methods, only two RCMs are coupled to more than two GCMs (**RCA** and **CCLM** regional models). Moreover, large and small biases have been recently reported for these two models, respectively (Kotlarski et al. 2017), independently of the observational reference used.
The selected GCM and RCM simulations are shown with red squares in Figure 1.

Data: GCM model outputs for the standard predictors used in VALUE (T, Z, U, V, Q at 1000, 850, 700, 500 hPa) will be provided for the historical (1976-2005, or should we consider 1971-2000?) and future (RCP8.5, 2071-2100) scenarios,

over a Euro-Atlantic domain. Moreover, RCM precipitation and temperatures for the nearest gridboxes to the 86 stations will be also provided.

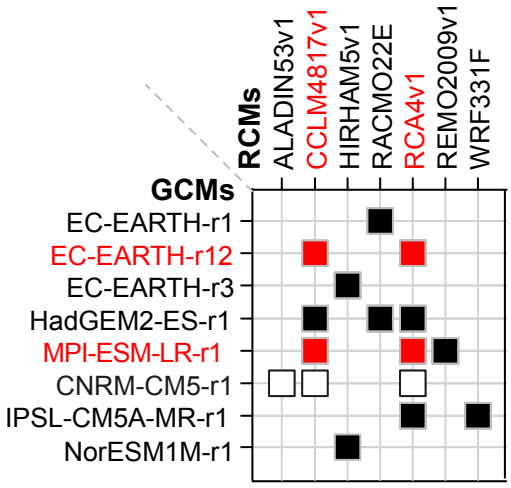

Figure 1. GCM/RCM coupling matrix for the EURO-CORDEX region at 0.11º (with both historical and RCP8.5 data). White squares indicate simulations affected by a bug reported for the CNRM-CM5-r1 historical scenario[1].

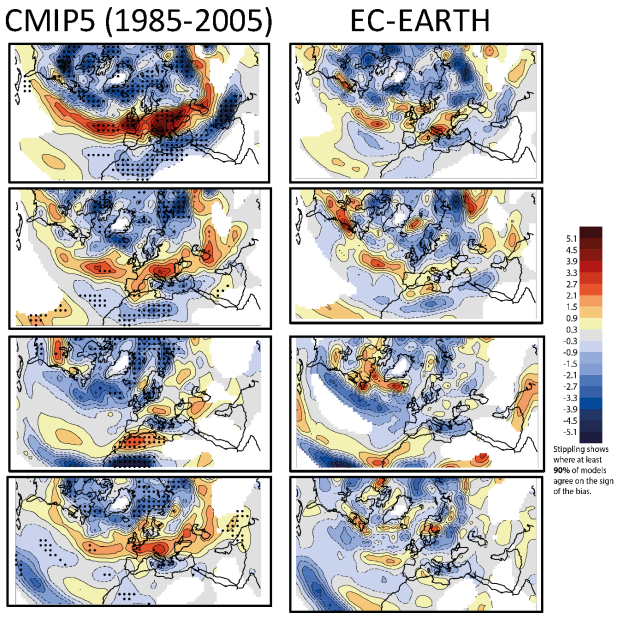

Figure 2. Storm track biases in the Euro-Atlantic region during Winter, Spring, Summer and Autumn (in rows) for the CMIP5 ensemble (first column), the EC-EARTH model (second); adapted from Lee (2014).

References

Maraun, D., et al. 2015. VALUE: A Framework to Validate Downscaling Approaches for Climate Change Studies. *Earth's Future* 3 (1): 2014EF000259.

[1] https://www.medcordex.eu/warnings/Communication-Issue-Files_CNRM-CM5_historical_6hLev_en.pdf

https://doi.org/10.1002/2014EF000259.

Gutiérrez, J. M., et al. 2018. An Intercomparison of a Large Ensemble of Statistical Downscaling Methods over Europe: Results from the VALUE Perfect Predictor Cross-Validation Experiment. *International Journal of Climatology*. https://doi.org/10.1002/joc.5462.

Kotlarski, S., et al. 2017. Observational Uncertainty and Regional Climate Model Evaluation: A pan-European Perspective. *International Journal of Climatology*. https://doi.org/10.1002/joc.5249.

Lee, R.W. 2014. Storm track biases and changes in a warming climate from an extratropical cyclone perspective using CMIP5. PhD Thesis. Atmosphere, Oceans and Climate. Department of Meteorology. http://www.met.reading.ac.uk/~xy744611/stormtracks/