



Supplement of

Human influence on growing-period frosts like in early April 2021 in central France

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This supplement provides more details about the model ensembles used in this study.

1 EURO-CORDEX

The Euro-Cordex ensemble is made of 75 simulations of 12 Regional climate models downscaling 8 Global Climate Models. The description of the ensemble is detailed in Vautard et al. (2021) and Coppola et al. (2020), but between the article publication and the start of the study, the ensemble size passed from 55 models to 75 models. The reader is referred to this publication for a description and an assessment of this ensemble in the historical period. Daily mean and minimum temperatures were corrected at grid point level using the E-OBS observation dataset from 1981 to 2020. Bias correction follows the method described in Vrac et al. (2016) refined in Bartok et a. (2019) and applied on daily data instead of hourly data. The GCM-RCM ensemble is described in Table A.1 below.

RCM / GCM	CNRM	EC-EARTH	HadGEM	MPI	NorESM	IPSL	CanESM	MIROC
CCLM								
HIRHAM		3						
RACMO		3						
RCA		3		3				
REMO				3				
WRF361H								
WRF381P								
ALADIN53								
ALADIN63								
RegCM								
COSMO -crCLIM		3		3				
HadREM								

10 Table A.1: Euro-CORDEX Simulations analyzed in this study. Grey cells indicate a GCM-RCM couple used, and numbers in the cell indicate the number of realizations used (essentially 3 for two of the GCMs).

2 CMIP6 selected ensemble

The CMIP6 multi-model ensemble is a set of global climate models, developed by several institutes around the world (Eyring et al., 2016). Here a subset of CMIP6 models are used, with historical and SSP3-7.0 experiments (Meehl et al. 2014; O'Neill et al. 2014, Vuuren et al. 2014, and O'Neill et al. 2016) together spanning the period between 1850 and 2099 for tas and tasmin variables. The analysis, as for the other ensembles, is however restricted to the years after 1950. Simulations were also bias-

corrected but we kept only 3 members maximum per ensemble in order not to overload the results with models having many members. In total, given the available simulations initially, we obtained 45 simulations with models described in Table A.2 below.

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Model	Realization	Model	Realization
ACCESS-CM2	r1ilp1f1 r2ilp1f1 r3ilp1f1	INM-CM5-0	r1ilp1f1 r2ilp1f1 r3ilp1f1
ACCESS-ESM1-5	r1ilp1f1 r2ilp1f1 r3ilp1f1	IPSL-CM6A-LR	r1ilp1f1 r2ilp1f1 r3ilp1f1
AWI-CM-1-1-MR	r1ilp1f1 r2ilp1f1 r3ilp1f1	KACE-1-0-G	r1ilp1f1 r3ilp1f1
BCC-CSM2-MR	r1ilp1f1	MIROC6	r1ilp1f1 r2ilp1f1 r3ilp1f1
CanESM5	r1ilp1f1 r1ilp2f1 r2ilp1f1	MIROC-ES2L	r1ilp1f2
CNRM-CM6-1	r1ilp1f2	MPI-ESM1-2-LR	r1ilp1f1 r2ilp1f1 r3ilp1f1
CNRM-ESM2-1	r1ilp1f2	MRI-ESM2-0	r1ilp1f1 r2ilp1f1 r3ilp1f1
EC-Earth3-AerChem	r1ilp1f1	NorESM2-LM	r1ilp1f1
EC-Earth3	r1ilp1f1 r4ilp1f1	NorESM2-MM	r1ilp1f1
EC-Earth3-Veg-LR	r1ilp1f1	UKESM1-0-LL	r1ilp1f2 r2ilp1f2 r3ilp1f2
EC-Earth3-Veg	r1ilp1f1		
GFDL-ESM4	r1ilp1f1		
INM-CM4-8	r1ilp1f1		

Table A.2: CMIP6 models used in this study, together with the realization when several were available

3 IPSL-CM6 single model ensemble

25 The IPSL-CM6A-LR model ensemble is a 32-member ensemble of the coupled climate model with the same name. The model is described in Boucher et al. (2020) and the ensemble is presented and evaluated in Bonnet et al., (2021). Simulations start in the pre-industrial period with slightly different initial conditions and are saved in this study for the whole historical period and beyond, until 2029. The ensemble has been used for attribution studies, for instance in the 2019 heatwave attribution described in Vautard et al. (2020).

30 4 HighResMIP SST-forced and coupled ensembles

We also consider two sets of ensembles from the High Resolution Model Intercomparison Project (HighResMIP, Haarsma et al. 2016), which is a coordinated set of experiments as a part of CMIP6, designed to assess the impact of model horizontal resolution. HighResMIP consists of atmosphere-only (SST-forced) and coupled runs, both spanning 1950-2050. In this study,

- we make use of both the SST-forced and coupled ensembles. As briefly described in the main text, in the SST-forced ensemble, for the ‘present’ time period (1950-2014), the SST and sea ice forcings used are based on the daily, 0.25° x 0.25° Hadley Centre Global Sea Ice and Sea Surface Temperature dataset, with area-weighted regridding used to map this to each model grid; for the ‘future’ time period (2015-2050), SST/sea-ice data are derived from RCP8.5 (CMIP5) data, and combined with greenhouse gas forcings from SSP5-8.5 (CMIP6) simulations (interested readers are referred to Section 3.3 of Haarsma et al. 2016 for further details).
- Bias correction was performed using the same method as for the other ensembles.

Model	High	Medium	Low	DOI	Contributed by	Number of simulations used
CNRM-CM6-1-HR		720*360		https://doi.org/10.22033/ESGF/CMIP6.1387	CNRM (Centre National de Recherches Meteorologiques), CERFACS (Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique) (CNRM-CERFACS)	1
CNRM-CM6-1			256*128	https://doi.org/10.22033/ESGF/CMIP6.1375	CNRM-CERFACS	1
EC-Earth3P-HR	1024*512			https://doi.org/10.22033/ESGF/CMIP6.2323	EC-Earth-Consortium	3
EC-Earth3P		512*256		https://doi.org/10.22033/ESGF/CMIP6.2322	EC-Earth-Consortium	3
HadGEM3-GC31-HM	1024*768			https://doi.org/10.22033/ESGF/CMIP6.446	the Met Office Hadley Centre	1
HadGEM3-GC31-MM		432*324		https://doi.org/10.22033/ESGF/CMIP6.190	the Met Office Hadley Centre	1

Table A3. Spatial grids of the HighResMIP models in high-, medium-, and low-resolution groups used in this study, along with relevant references for the simulations, their origins, and the number of simulations used in the analysis

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