SUPPLEMENT

EXPLAINING EXTREME EVENTS OF 2016 FROM A CLIMATE PERSPECTIVE

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ES24. ANTHROPOGENIC INFLUENCE ON THE EASTERN CHINA 2016 SUPER COLD SURGE

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Model data.

Daily minimum temperatures simulated by the climate models participating in the Coupled Model Intercomparison Project Phase 5 (CMIP5) were used. The 62 simulations from 16 models forced with the combined effect of anthropogenic and natural external forcings (ALL) and the 26 simulations from 6 models forced with the natural external forcings only (NAT) for the period 1961–2012 were obtained and used to estimate the model response to ALL and NAT forcings respectively. Some ALL simulations end in 2005, in these cases, the scenario simulations under the RCP4.5 2006–12 were used to extend these simulations to 2012. Table ES24.1 lists the models and number of model runs that were used in this study.

The model data come with different spatial resolutions; they are all re-gridded into 2° × 2° resolution. The model data were then averaged to obtain regional mean daily minimum temperature as was done for the observational data. The winter minimum values of the regional mean daily series were extracted and the anomalies (relative to 1961–90 average) series were calculated. The multimodel ensemble mean under ALL and NAT forcings were obtained after all the available runs were averaged for each individual models. The preindustrial control (CTL) simulations were divided into 51-year long blocks and then processed similarly. There are a total of 287 blocks of control simulation. The detection and attribution analysis requires two independent estimates of co-variance matrix which are obtained from two sets of noise data. Our noise data consists of intra-ensemble differences of the forced simulations as well as control simulations. The intra-ensemble difference is obtained by removing the ensemble mean of a model from its simulations under the same forcing. We split available noise data into two equal halves for the two estimates of the co-variance matrix.

Table ES24.1. List of multimodel simulations used in this study. Numbers represent the ALL, NAT, GHG simulation ensemble sizes or the number of 51-year chunks for the CTL simulations. The symbol, *, indicates that these model runs were not century-long simulations and as such not used in noise estimation.

Model Name	ALL(16)	CTL(28)	NAT (6)
bcc-csm1-1	3	9	—
bcc-csm1-1-m	3	7	—
CanCM4	5*	—	—
CanESM2	5	21	5
CCSM4	—	3	—
CESM1-BGC	—	9	—
CMCC-CESM	—	5	—
CMCC-CM	—	5	—
CMCC-CMS	—	9	—
CNRM-CM5	5	16	6
CSIRO-Mk3-6-0	5	9	5
FGOALS-s2	—	9	—
GFDL-CM3	5	15	—
GFDL-ESM2G	—	9	—
GFDL-ESM2M	—	9	—
HadGEM2-CC	—	4	—
HadGEM2-ES	—	11	4
IPSL-CM5A-LR	5	19	3
IPSL-CM5A-MR	3	5	3
IPSL-CM5B-LR	—	5	—
MIROC4h	3*	1	—
MIROC5	5	13	—
MIROC-ESM	3	12	—
MIROC-ESM-CHEM	—	4	—
MPI-ESM-LR	3	19	—
MPI-ESM-MR	3	19	—
MPI-ESM-P	—	22	—
MRI-CGCM3	3	9	—
NorESM1-M	3	9	—
SUM(models)	**62(16)* 54(14)**	**287(28)**	**26(6)**