Supplemental Material

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The Extremely Wet May of 2021 in the United Kingdom
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The extremely wet May of 2021 in the United Kingdom

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Table ES1. The CMIP6 models used in the analysis. The table shows the number of simulations with (ALL) and without (NAT) anthropogenic forcings that each model provides. The ALL simulations are extended to future years with the SSP2 4.5 scenario.

	Model	ALL + SSP2 4.5	NAT
1	BCC-CSM2-MR	1	3
2	CNRM-CM6-1	6	10
3	CanESM5	25	15
4	GFDL-ESM4	3	3
5	HadGEM3-GC31-LL	1	4
6	IPSL-CM6A-LR	9	10
7	MIROC6	3	3
8	MRI-ESM2-0	1	5
9	NorESM2-LM	3	3
	Total	**52**	**56**

Appendix ES1. Evaluating a multi-model ensemble.

Our multi-model ensemble is evaluated here as a whole, by comparing the sample of data from the historical simulations of all the models against the observational data. The aim is to test whether some main statistical characteristics of the relevant variable (in this case rainfall) constructed with the multi-model ensemble are overall consistent with the observations. Such evaluation tests have been developed and tried over years in event attribution studies and typically include an assessment of a) the simulated trend, pertinent to non-stationary distributions, b) the simulated variability at different timescales, and c) the representation of different parts of the distribution (main body and tails). Sampling noise due to short observational records means that these assessments offer only a broad, but still very useful indication of whether reliable probability estimates can be obtained by the modelled distribution. Models not fit-for-purpose appear to lie outside the range of the rest of the ensemble and can thus be screened out (no models needed to be eliminated in this study). While it is essential to ensure that statistical properties are simulated well, more detailed studies that consider mechanisms driving forced climatic changes, would also need to evaluate other aspects of the simulated climate, like dynamical factors, land-atmosphere interactions, etc.

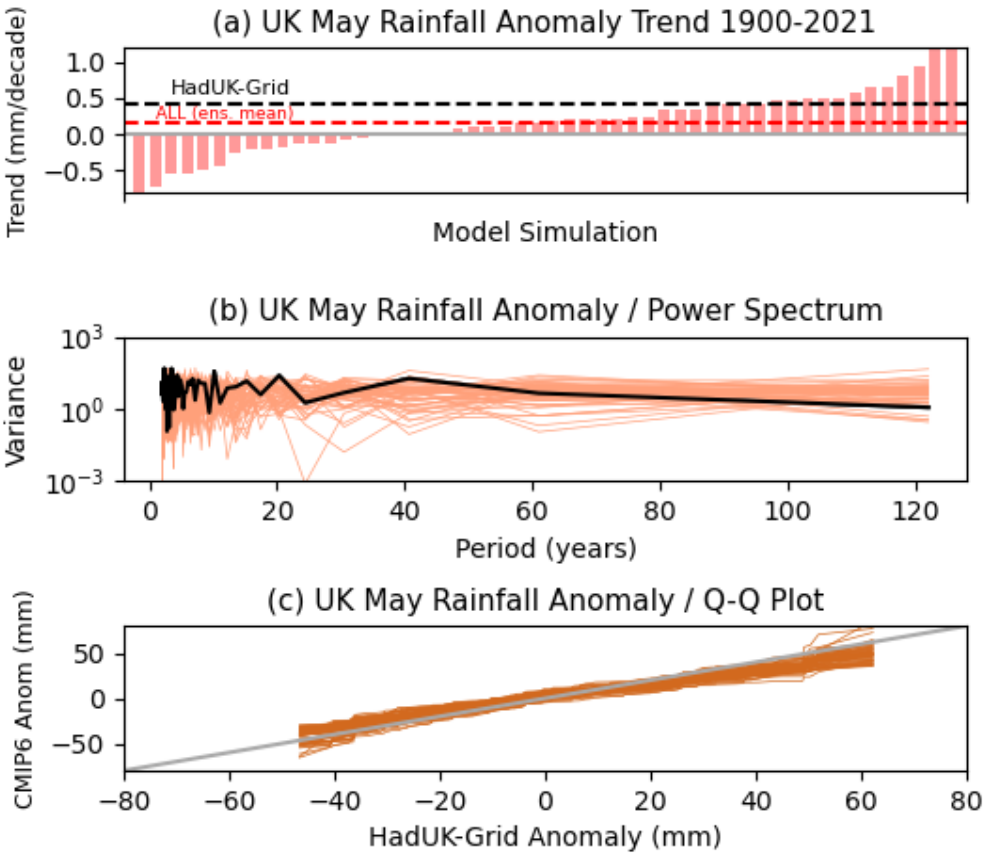

Fig. ES1 Model evaluation. (a) May rainfall trends in the UK since 1900 from individual ALL simulations (pink bars). Trends from HadUK-Grid and the mean of the ALL ensemble are marked by the horizontal black and dashed red lines respectively. (c) Power spectra from HadUK-Grid (black) and the ALL simulations (orange). (d) Quantile-Quantile plots comparing each of the ALL simulations against HadUK-Grid observations. The evaluation tests indicate that the models provide a realistic representation of the observed trends, variability and overall May rainfall distribution.