Supplementary Material

Catchment descriptors for the example catchments are given in Table S1. These help to explain the differences in response to climatic changes between the example catchments. The Tay at Ballathie (15006) in Scotland is the steepest catchment, comprising mainly of mountains and moorland with several large lochs. The Ouse at Skelton (27009) in northeast England is a predominantly rural grassland/arable catchment with some moorland headwaters. The Thames at Kingston (39001) is a large and diverse catchment in southeast England, with baseflow sustained from the Chalk and Oolites combined with a flashy response from tributaries draining the clay vales. The Severn at Haw Bridge (54057) in west England and Wales is another very large diverse catchment.

The flow duration curves for the example catchments are given in Figure S1. These demonstrate that bias correcting the climate model data results in flow duration curves that more closely match those produced using observed data. They also show that for many RCM ensemble members bias correction only results in small changes to the flow duration curve.

The change in flow frequency curves between the baseline and future periods is shown in Figure S2. Results are presented for each ensemble member, to expand on the summary results presented in the main manuscript. These show how a single ensemble member predicts an increase in high return period low flows for the Ouse at Skelton and Thames at Kingston.

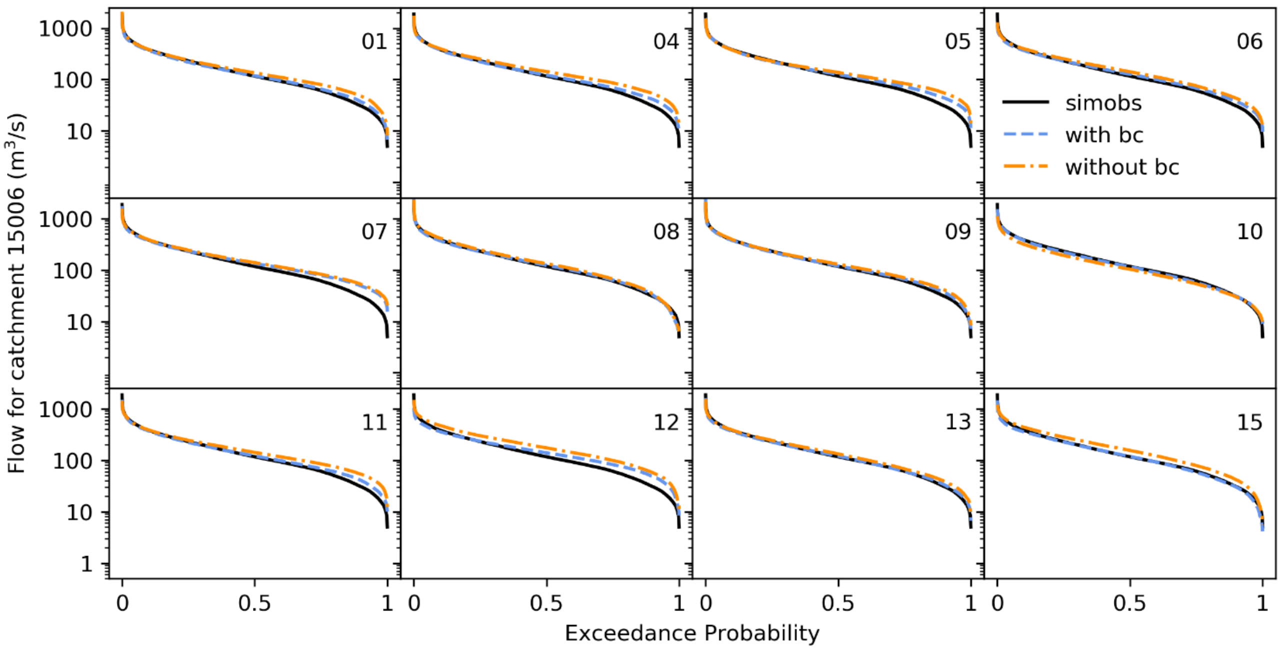
Maps showing the percentage change in 10-year high flows (Figure S3) and low flows (Figure S4) are presented, to complement the summary maps in the main manuscript. Each of these maps presents a spatially consistent national simulation produced using a single RCM ensemble member. These demonstrate how the spatial pattern of high flow changes differs between ensemble members, although there is a general tendency for increases along the west coast. There is more consistency with the spatial pattern of changes for low flows, with all ensemble members predicting an overall decrease in low flows across GB, and most predicting the largest reductions to low flows in the south.

The relationship between increasing high flows and decreasing low flows for each river grid across GB is in Figure S5, to expand on the analysis of compound hydro-hazards in the main manuscript. Results are given separately for each RCM ensemble member, to show how the relationship between high and low flow changes varies between the ensemble members.

Table S1. Summary information for the example catchments, from the UK Hydrometric Register. BFIHOST provides a measure of catchment responsiveness - it is the base flow index (BFI) derived from the Hydrology of Soil Types (HOST) dataset. PROPWET is a catchment wetness index providing a measure of the PROPortion of time soils are WET. DPSBAR (mean Drainage Path Slope) indicates catchment steepness in m/km, with values >300 in mountainous terrain to <25 in very flat catchments. The bedrock classes broadly categorise the catchment into high, moderate or very low permeability underlying bedrock (where these do not sum to 100% the remainder is formations of mixed permeability).

General info				Descriptors			Elevation		Bedrock		
Station number	River	Location	Area (km^2)	BFIHOST	PROPWET	DPSBAR	Station level (mOD)	Maximum level (mOD)	High perm. (%)	Moderate perm. (%)	Very low perm. (%)
15006	Tay	Ballathie	4587	0.47	58	167	26	1210	0	13	83
27009	Ouse	Skelton	3315	0.44	37	69	5	714	34	56	10
39001	Thames	Kingston	9948	0.65	30	42	5	330	43	10	37
54057	Severn	Haw Bridge	9895	0.51	32	73	11	826	16	<1	71

a)



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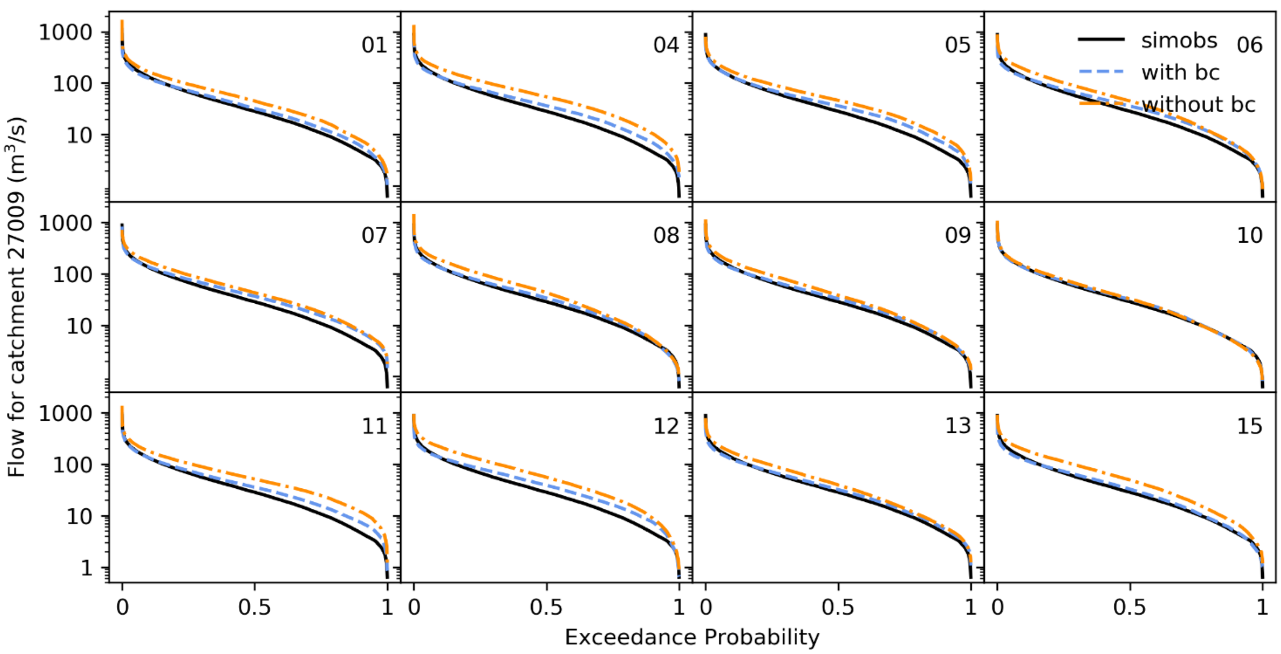
Flow for catchment 15006 (m³/s)
0
0.5
1
Exceedance Probability

b)



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Flow for catchment 27009 (m³/s)
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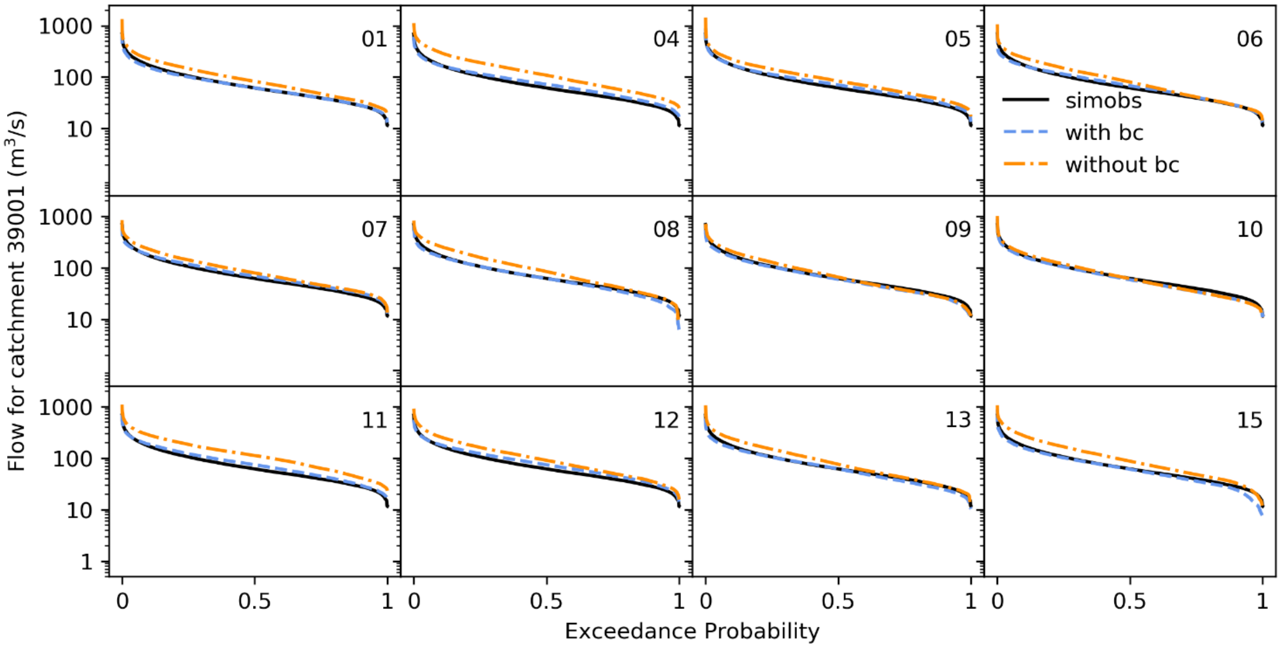
0.5
1
Exceedance Probability

c)



d)

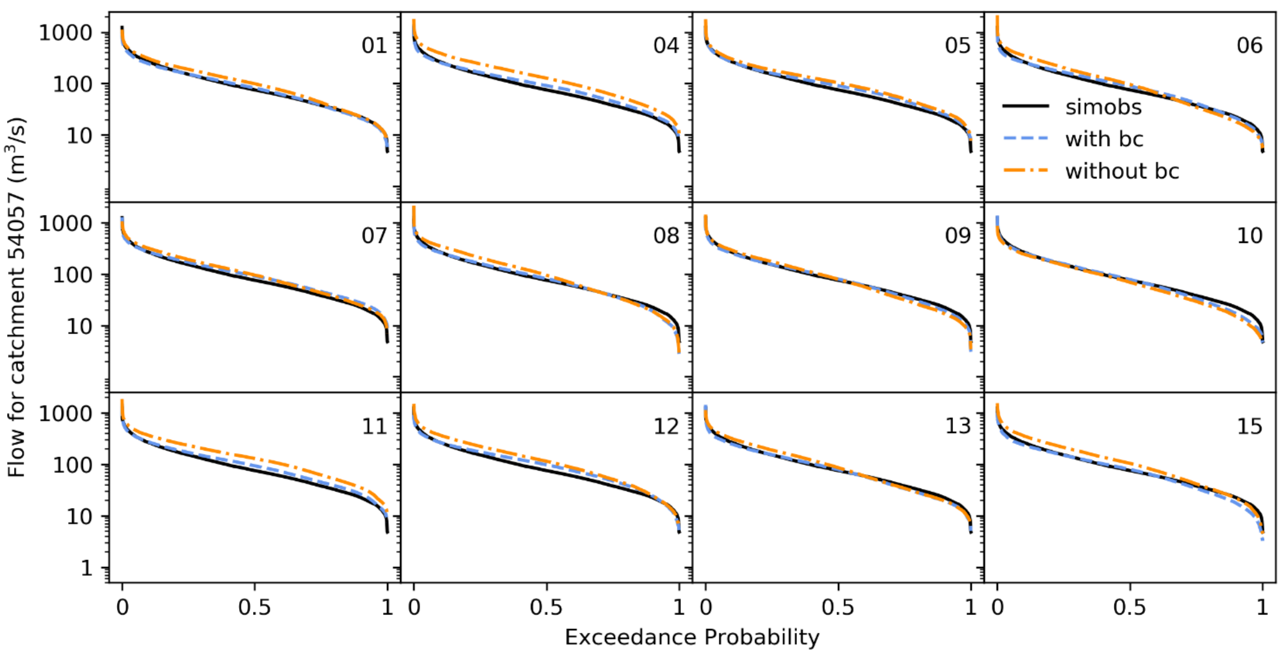


Figure S1. Flow duration curves for the a) Tay at Ballathie, b) Ouse at Skelton, c) Thames at Kingston and d) Severn at Haw Bridge. Lines show flow duration curves from simulations driven by observations (solid black line), bias corrected climate data (dashed blue line) and raw climate data (dotted and dashed orange line). Results are given separately for each ensemble member, with the ensemble member numbers given in the top right of each subplot.

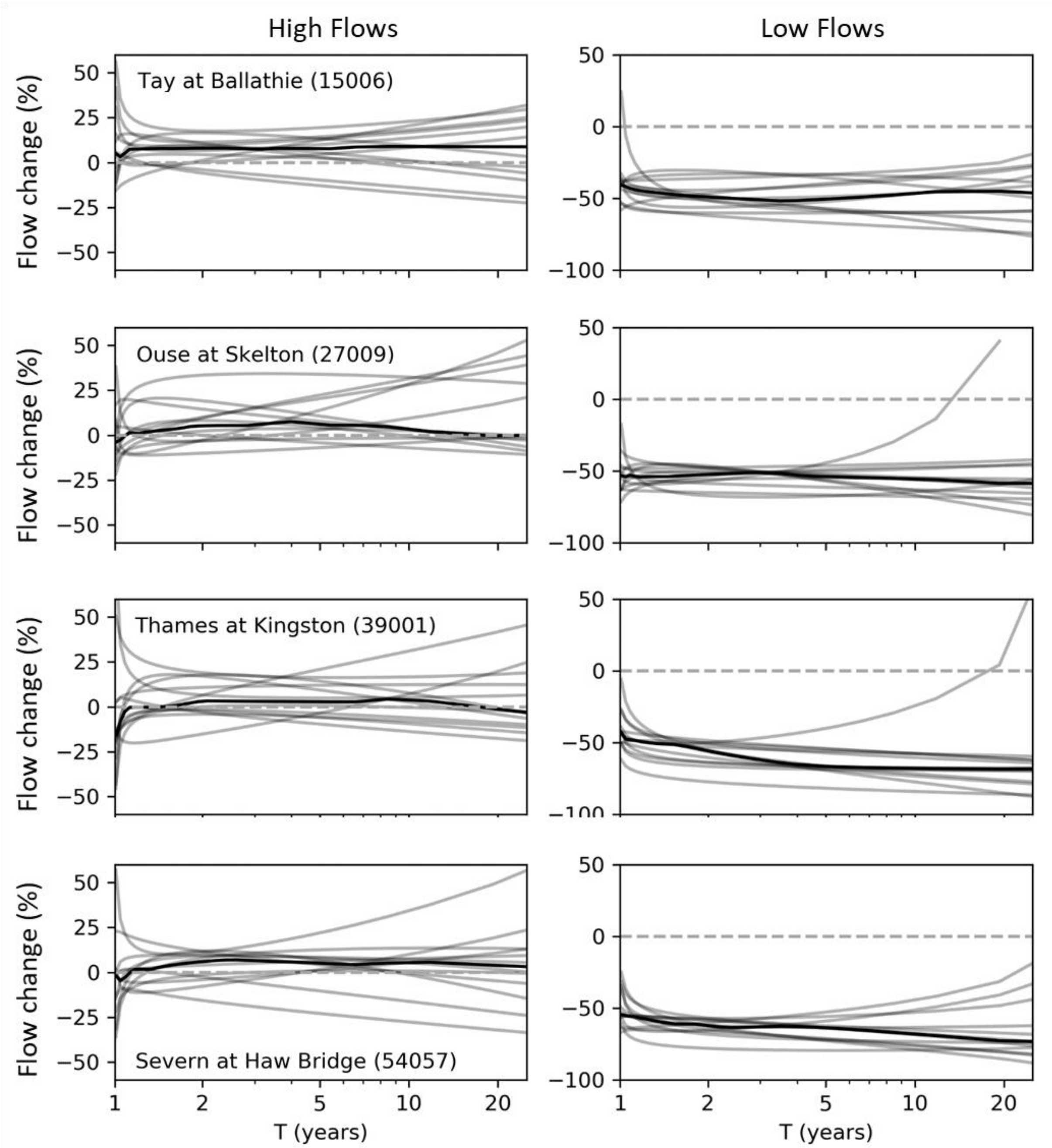


Figure S2. Change in flow frequency curves for high flows (left) and low flows (right) at the four example catchments. These show the percentage change between baseline and future flows for different return periods. Grey lines are given for each ensemble member, whilst the solid line shows the median of all ensemble members.

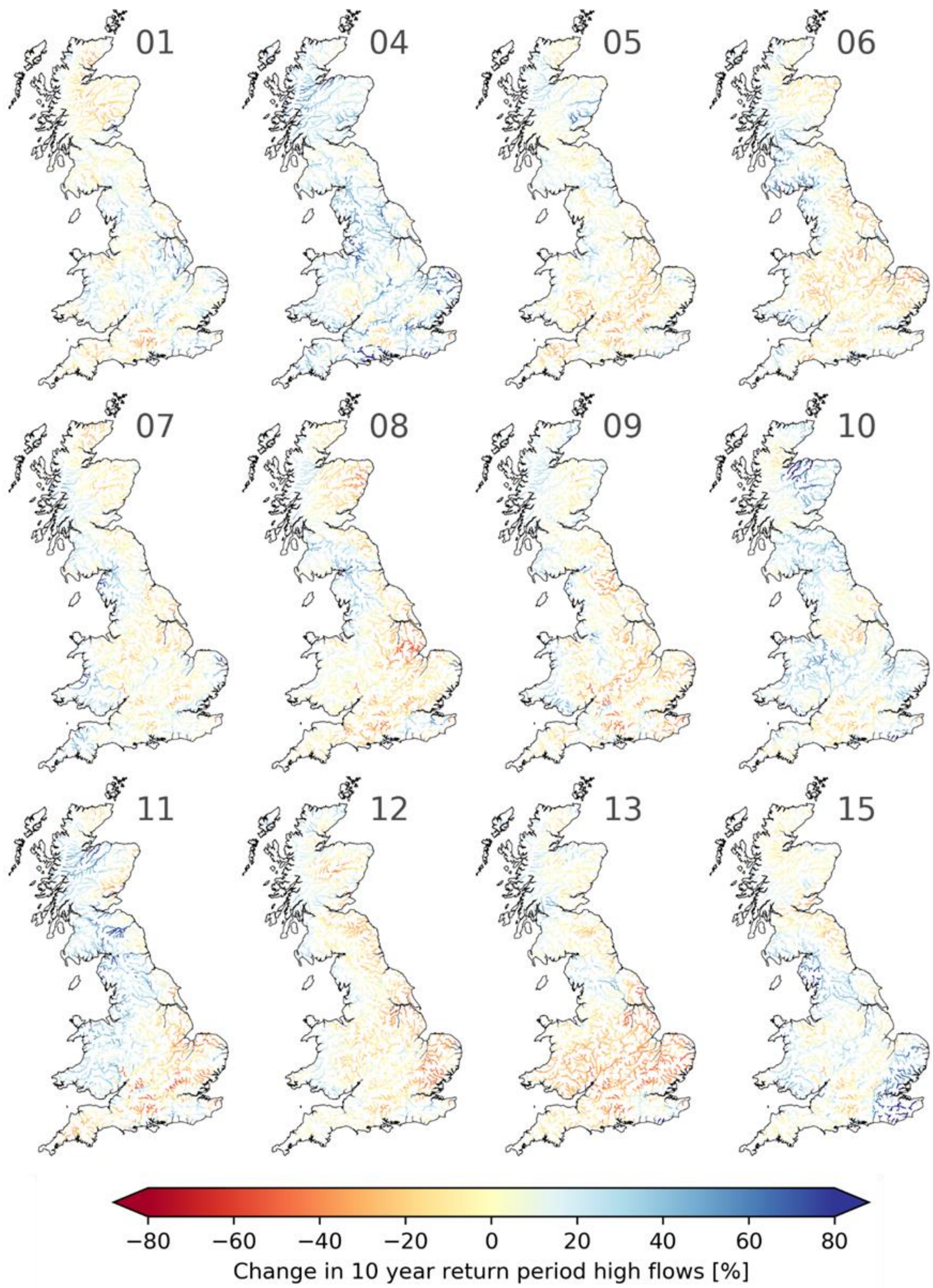


Figure S3. Maps showing the percentage change in 10-year return period high flows for each ensemble member. Ensemble member numbers are given in the top right of each plot.

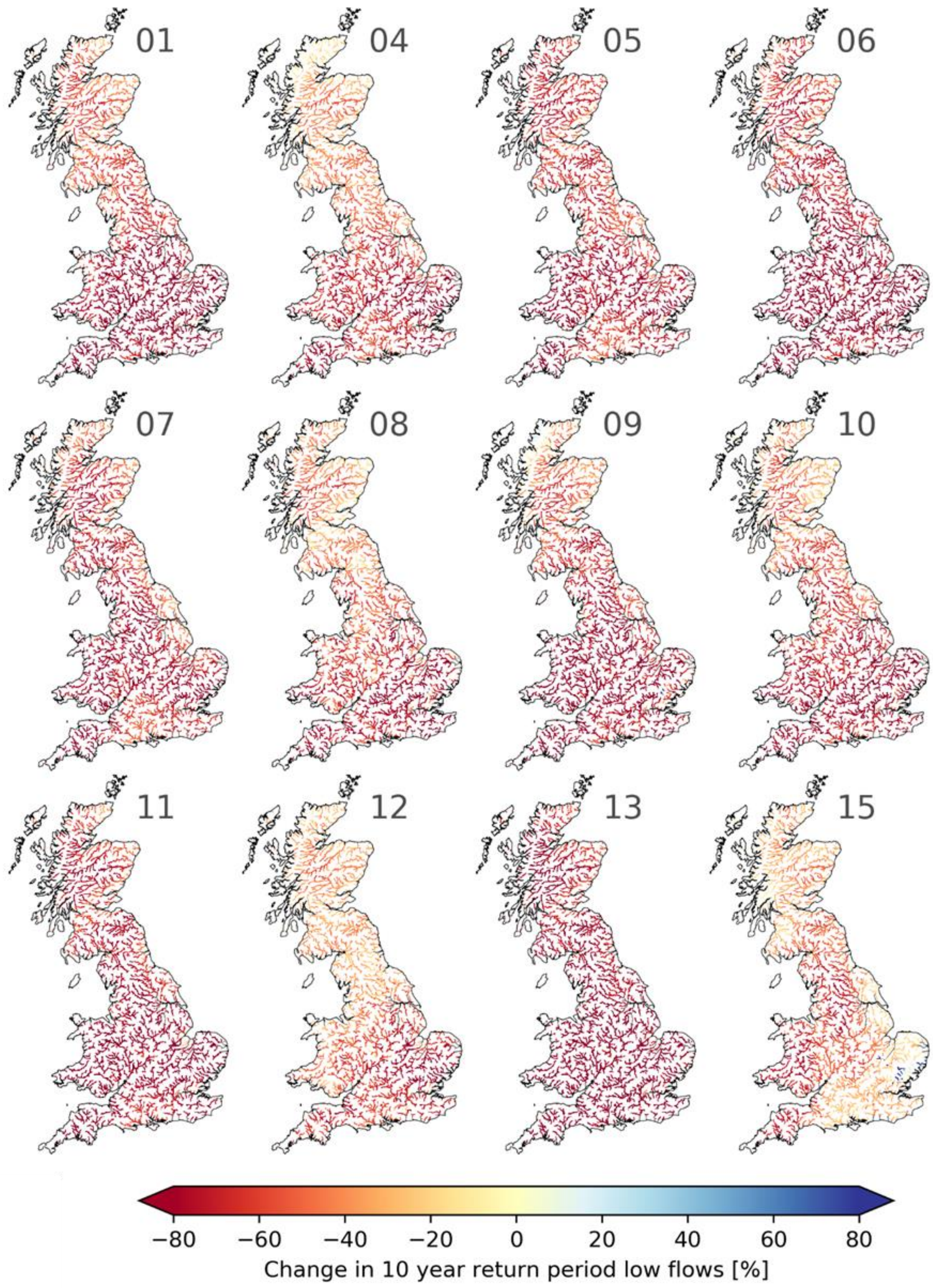


Figure S4. Maps showing the percentage change in 10-year return period low flows for each ensemble member. Ensemble member numbers are given in the top right of each plot.

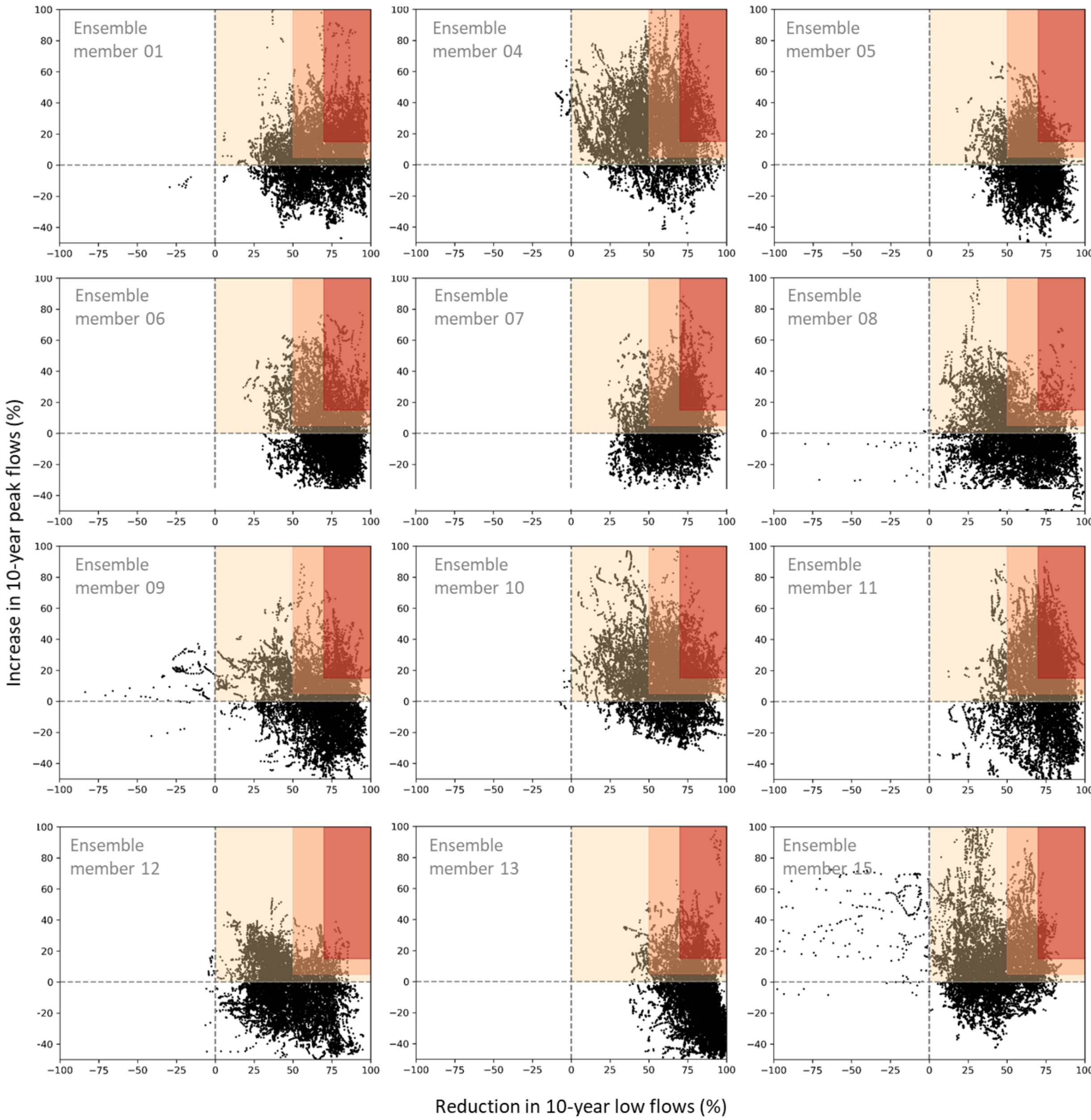


Figure S5. Scatter plots showing the relationship between increasing 10-year return period high flows and intensifying 10-year return period low flows, for all river pixels across GB. Results are given separately for each ensemble member. The shaded regions highlight where points fall within the three hydro-hazard categories (see Figure 5 in the main manuscript).