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# UK Hydrological Outlook using Historic Weather Analogues

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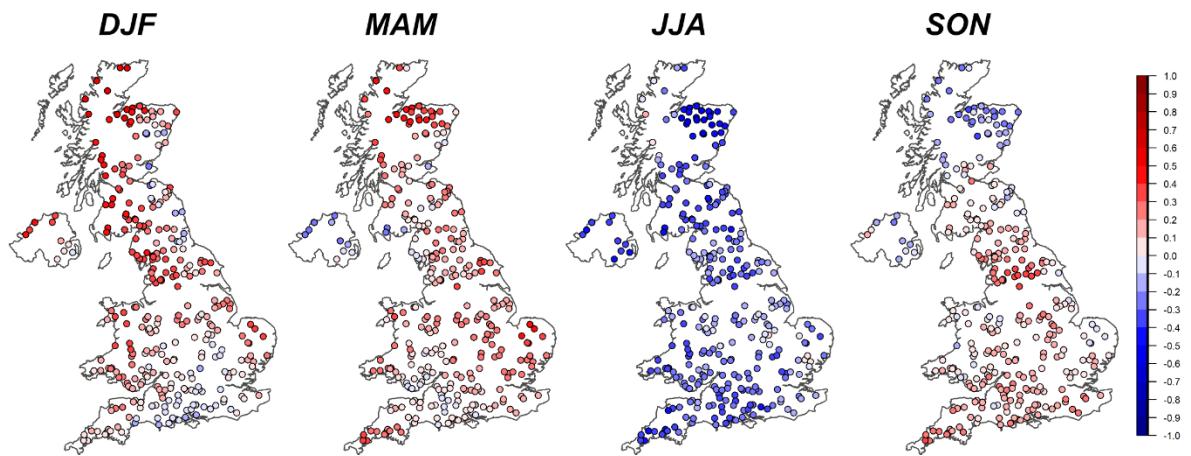
Figure S1 Correlation between HWA forecast ensemble mean and HadUK-Grid observed seasonal rainfall across 314 UK catchments.
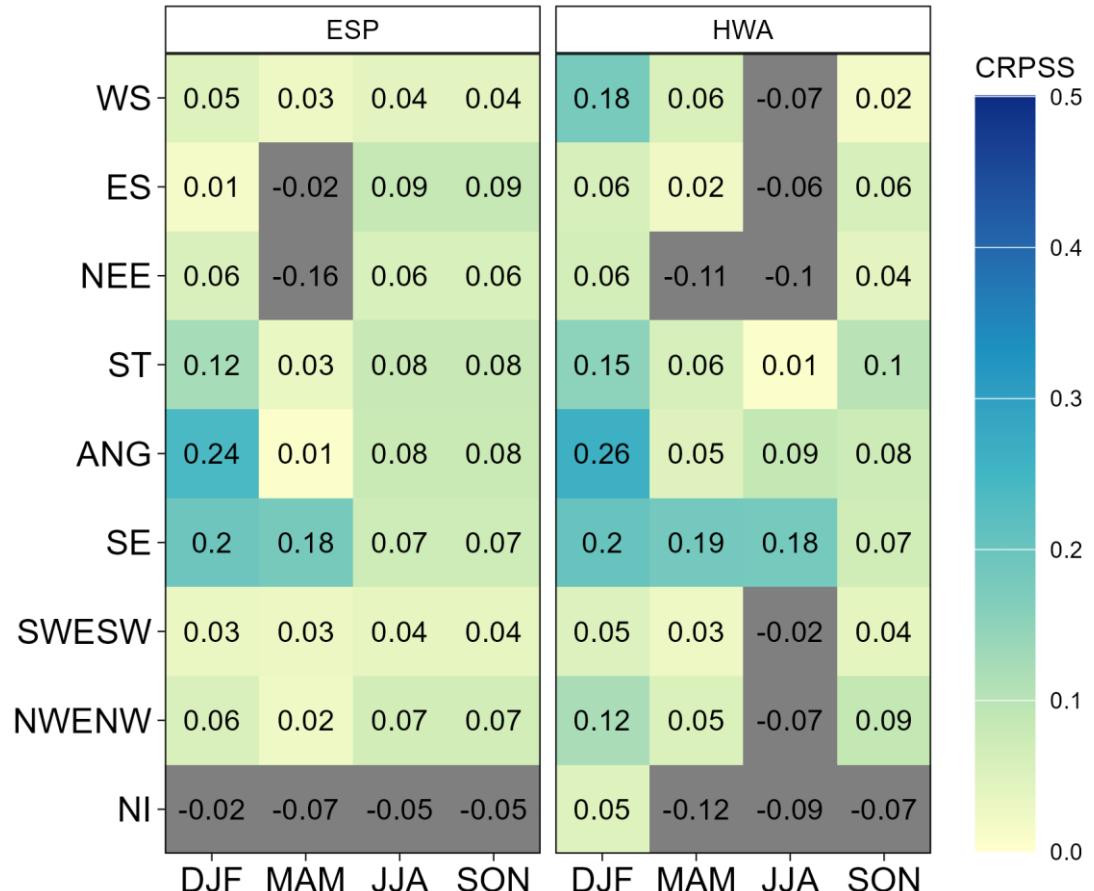

Figure S2 CRPSS values assessed against benchmark climatology averaged across different hydroclimate regions and across the four seasons for the standard ESP (left) and HWA (right) methods.
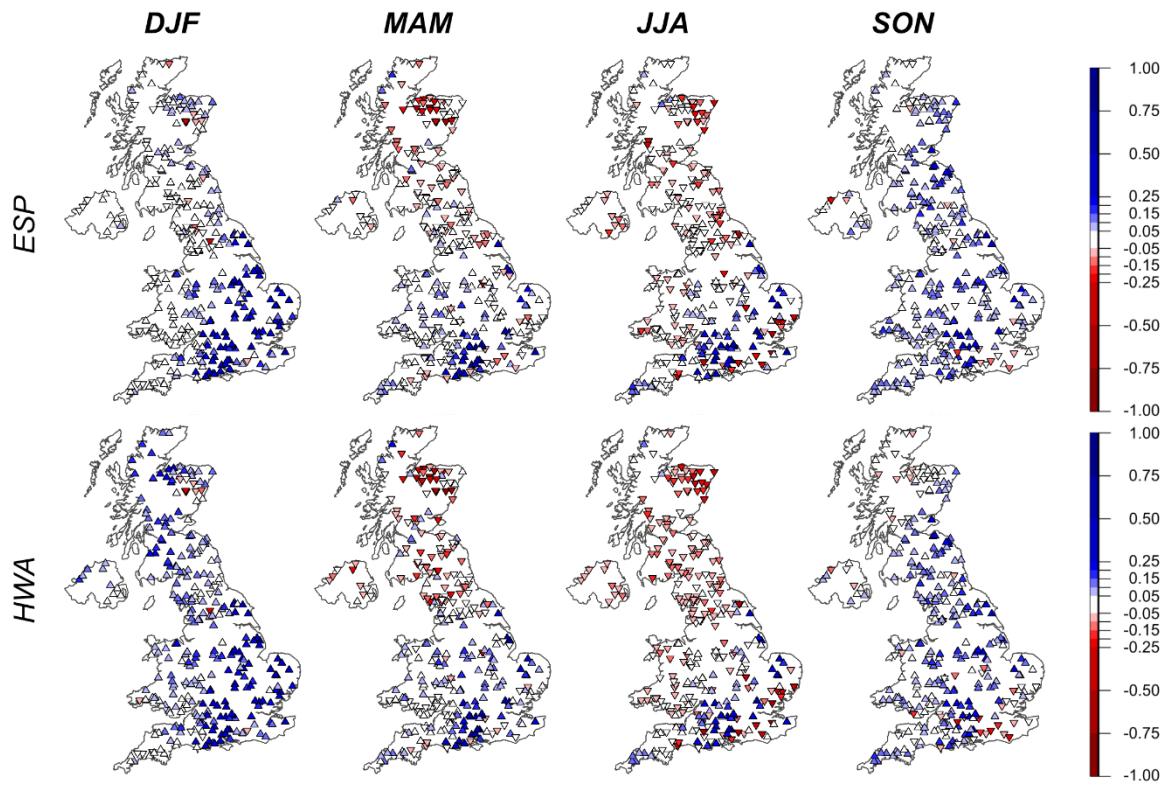
Figure S3 Probabilistic hindcast skill for the ESP (top) and HWA (bottom) methods across the hindcast period (1993-2016) for 314 UK catchments. The metric used is the CRPSS, and is calculated for the hindcast period by comparing HWA and ESP with benchmark climatology (observed river flows) per season. Blue colours indicate the historic weather analogues method has higher skill than the benchmark climatology (red colours show the historic weather analogues method is worse than climatology). White colours indicate neutrally skilful forecasts. The direction of the symbol indicates the sign of the respective skill score.
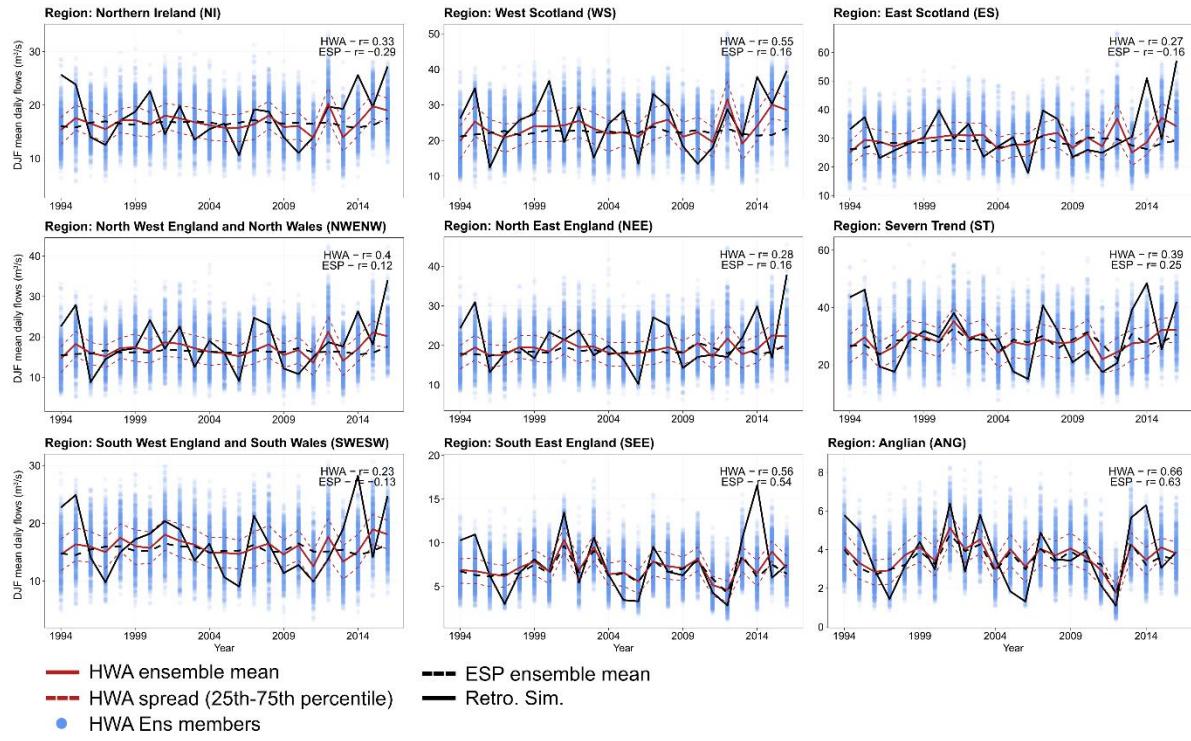
Figure S4 December-January-February (DJF) mean daily simulated flows (m³/s) aggregated across catchments in each hydroclimate regions. Blue dots show the individual ensemble members from the historic weather analogues approach, the red solid line shows the HWA ensemble mean, the red dotted lines show the HWA spread (25th-75th percentiles), the dotted black line shows the standard ESP ensemble mean and the solid black line shows the retrospective simulated river flows. The correlation coefficient for the ensemble mean of HWA and ESP compared to the retrospective simulated flows is shown on each plot.
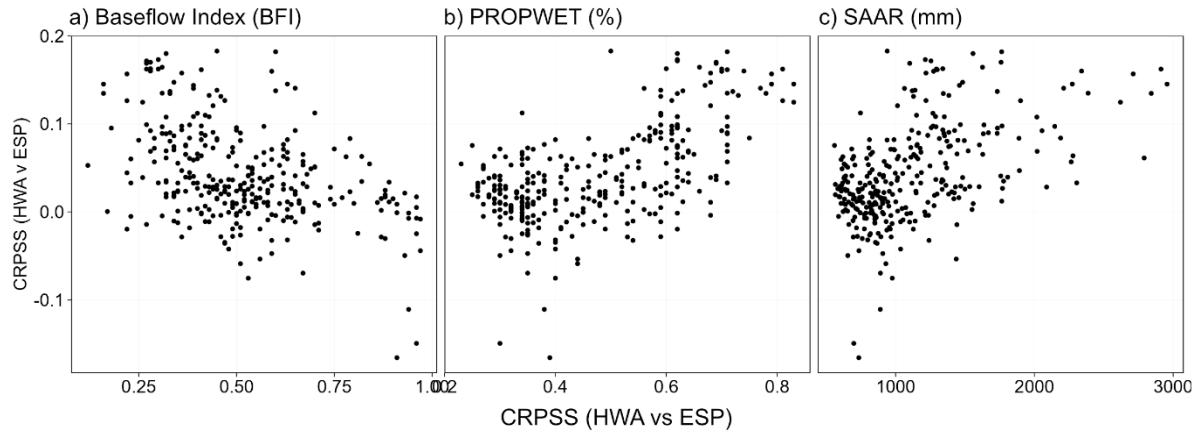

Figure S5 Relationship between CRPSS by comparing HWA the standard ESP for each catchment and the Baseflow Index (BFI), catchment wetness index taken as the proportion of time that catchment soils are wet (PROPWET) and Standardised Annual Average Rainfall 1961-1990 (SAAR).
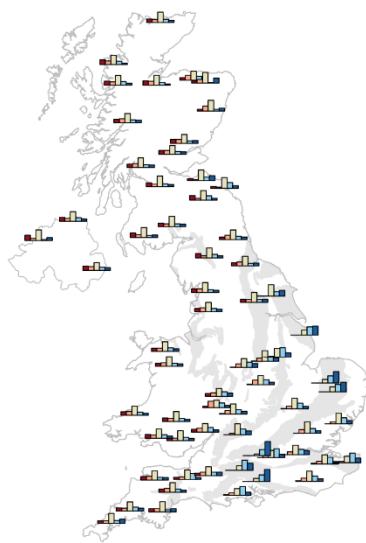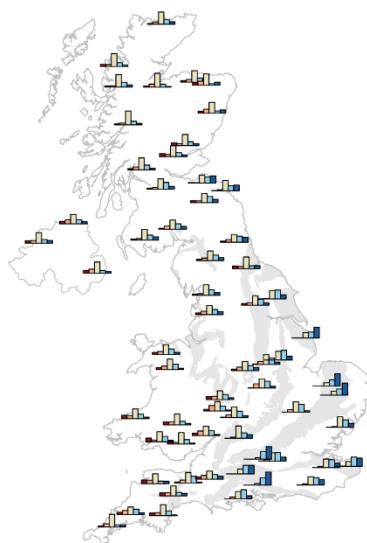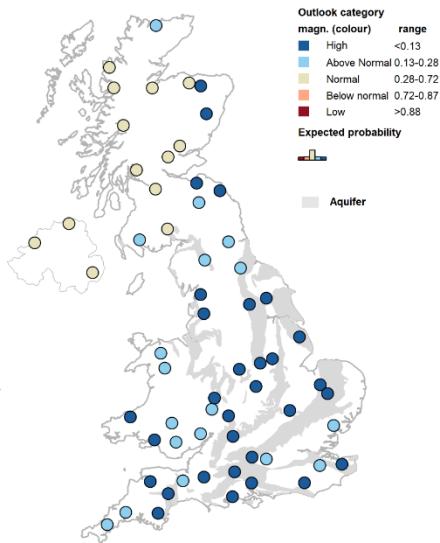
Figure S6 ESP (a) and HWA (b) 3-month forecasts issued operationally for December 2023 by the UK Hydrological Outlook. Panel (c) shows the river flow category for each catchment over winter 2023/24 computed from simulated observed river flows.

Table S1 River flow percentiles used within the UKHO based on the distribution of historical simulated observed river flows at each catchment

Outlook category	Range (percentiles)
High	<0.13
Above normal	0.13-0.28
Normal	0.28-0.72
Below normal	0.72-0.87
Low	>0.88