

SUMMARY

River flows across the UK are likely to be normal to above normal for October. Groundwater levels are likely to be within the normal range, with localised exceptions for October, and within the normal range for October-November-December.

Rainfall:

September rainfall was below average for the majority of the UK, with large areas experiencing less than 70 percent of the 1981-2010 average rainfall. A few localised areas of southern England and south Wales saw some wetter weather. Rainfall has been below average for most of the UK (with the exception of southern England) for the past six months.

The rainfall outlook for the UK for October (issued by the Met Office on 23.09.2021) is that rainfall is slightly more likely to be normal than dry. For October-November-December as a whole, it is slightly more likely to be normal than wet.

River flows:

River flows in September were normal to exceptionally low across the UK, though above normal to notably high flows were recorded in some catchments over the Chalk aquifer of south-eastern England. The lowest flows were focussed in northern England.

Despite low September flows, heavy rainfall at the end of September and first week of October has caused most river levels to rise. Flows across the UK are therefore likely to be normal to above normal for October. Flows in Scotland are likely to be within the normal range, but with considerable uncertainty due to continuing issues with data access. The three month forecast suggests that flows are most likely to be within the normal range, though this is uncertain at this transitional time of year.

Groundwater:

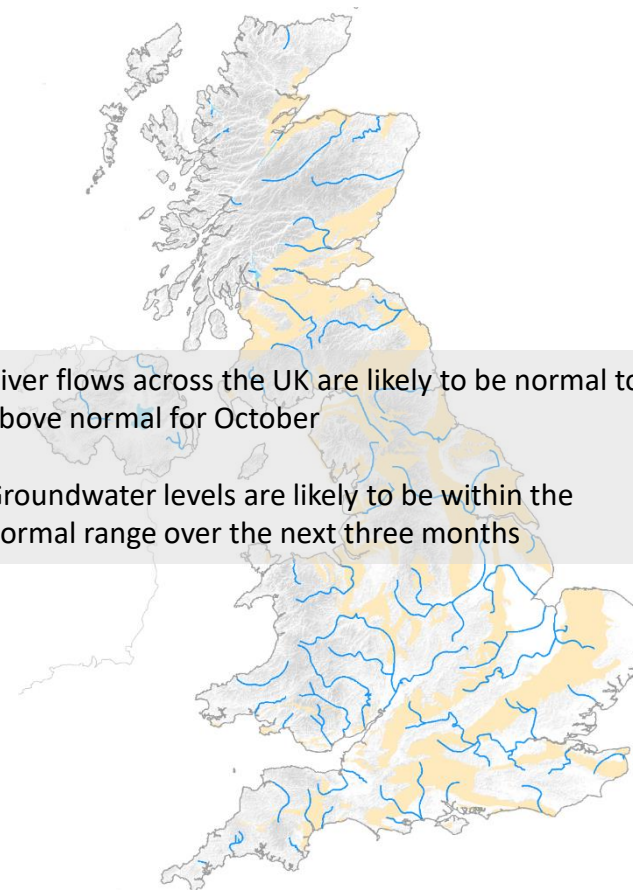
Groundwater levels in September were normal to above normal across the UK. Above normal to exceptionally high groundwater levels were recorded along the south coast, and in the northern limestones and sandstones.

Groundwater levels are likely to be within the normal range for October and October-November-December as a whole, though above normal and below normal flows are expected in some localised boreholes for October.

The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

River flows across the UK are likely to be normal to above normal for October

Groundwater levels are likely to be within the normal range over the next three months



Shaded areas show principal aquifers

About the Hydrological Outlook:

This document presents an outlook for the UK water situation for the next 1 – 3 months and beyond, using observational datasets, meteorological forecasts and a suite of hydrological modelling tools. The outlook is produced in a collaboration between the UK Centre for Ecology and Hydrology (UKCEH), British Geological Survey (BGS), the Met Office, the Environment Agency (EA), Natural Resources Wales (NRW), the Scottish Environment Protection Agency (SEPA), and for Northern Ireland, the Department for Infrastructure – Rivers (DfIR).

Data and Models:

The Hydrological Outlook depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged. Historic river flow and groundwater data are sourced from the UK National River Flow Archive and the National Groundwater Level Archive. Contemporary data are provided by the EA, SEPA, NRW and DfIR. These data are used to initialise hydrological models, and to provide outlook information based on statistical analysis of historical analogues.

Climate forecasts are produced by the Met Office. Hydrological modelling is undertaken by UKCEH using the Grid-to-Grid, PDM and CLASSIC hydrological models and by the EA using CATCHMOD. Hydrogeological modelling uses the R-groundwater model run by BGS and CATCHMOD run by the EA. Supporting documentation is available from the Outlooks website:

<https://www.hydoutuk.net/about/methods>

Presentation:

The language used in the summary presented overleaf generally places flows and groundwater levels into just three classes, i.e. below normal, normal, and above normal. However, the underpinning methods use as many as seven classes as defined in the graphic to the right, i.e. the summary uses a simpler classification than some of the methods. On those occasions when it is appropriate to provide greater discrimination at the extremes the terminology and definitions of the seven class scheme will be adopted.

Percentile range of historic values for relevant month

Exceptionally high flow	> 95
Notably high flow	87-95
Above normal	72-87
Normal range	28-72
Below normal	13-28
Notably low flow	5-13
Exceptionally low flow	< 5

Disclaimer and liability:

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From April 2018 the Hydrological Outlook is supported by the Natural Environment Research Council funded [UK-SCAPE](#) and [Hydro-JULES](#) Programmes.

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Further information:

For more detailed information about the Hydrological Outlook, and the derivation of the maps, plots and interpretation provided in this outlook, please visit the Hydrological Outlook UK website.

The website features a host of other background information, including a wider range of sources of information which are used in the preparation of this Outlook.

Contact:

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t: 01491 692371 e: enquiries@hydoutuk.net

Reference for the Hydrological Outlook:

Hydrological Outlook UK, 2021, October, UK Centre for Ecology and Hydrology, Oxfordshire UK, Online, <https://www.hydoutuk.net/latest-outlook/>

Other Sources of Information:

The Hydrological Outlook should be used alongside other sources of up-to-date information on the current water resources status and flood risk.

Environment Agency Water Situation Reports: provides summary of water resources status on a monthly and weekly basis for England:

<https://www.gov.uk/government/collections/water-situation-reports-for-england>

Flood warnings are continually updated, and should be consulted for an up-to-date and localised assessment of flood risk:

Environment Agency: <https://flood-warning-information.service.gov.uk/map>

Natural Resources Wales: <https://flood-warning.naturalresources.wales/>

Scottish Environment Protection Agency: <https://www.sepa.org.uk/flooding.aspx>

Hydrological Summary for the UK: provides summary of current water resources status for the UK:

<https://nrfa.ceh.ac.uk/monthly-hydrological-summary-uk>

UK Met Office forecasts for the UK: <https://www.metoffice.gov.uk/#?tab=regionalForecast>

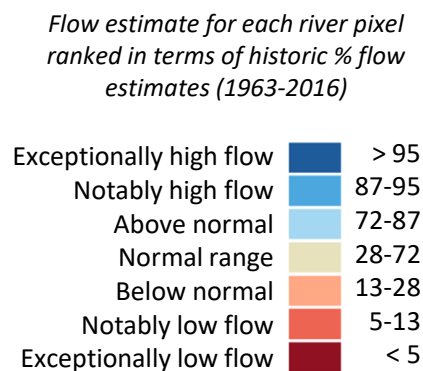
UK Water Resources Portal: monitor the UK hydrological situation in near real-time including rainfall, river flow, groundwater and soil moisture from COSMOS-UK:

<https://eip.ceh.ac.uk/hydrology/water-resources/>

This map shows the simulated monthly mean flow across Great Britain for last month, ranked in terms of 54 years of historical flow estimates (1963 – 2016).

These flows are produced by the 1km resolution Grid-to-Grid (G2G) hydrological model, which is run up to the end of each calendar month using observed rainfall and MORECS potential evaporation as input.

Note that the G2G model provides estimates of natural flows.



Current Daily Simulated Subsurface Water Storage Conditions

Based on subsurface water storage estimated for 30th September 2021

Issue date: 05.10.2021

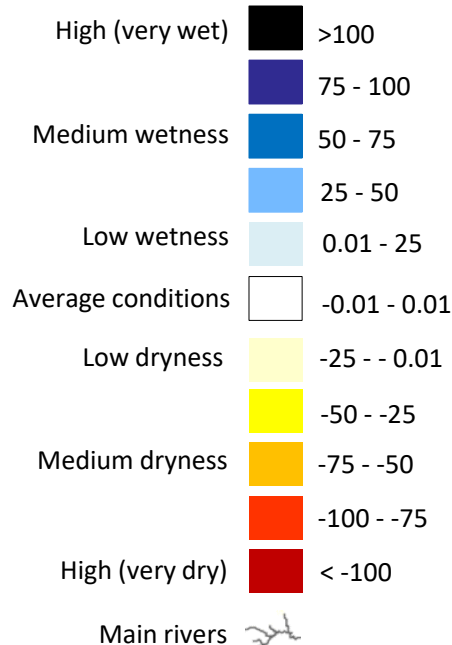
These maps are based on Grid-to-Grid (G2G) hydrological model simulated subsurface water storage, expressed as an anomaly from the historical monthly mean. To highlight areas that are particularly wet or dry, the storage anomaly is presented here using a colour scale highlighting water storage relative to historical extremes. The maps below show the “relative wetness” which combines maps previously shown separately as the “relative wetness” and “relative dryness”.

These maps do not provide a forecast and are not maps of soil moisture. Instead they indicate areas which are particularly wet or dry. Rainfall in areas with high positive relative wetness could result in flooding in the coming days/weeks. Areas of negative relative wetness provide an indication of locations which are particularly dry, and little or no rain in these areas could potentially lead to (or prolong) a drought.

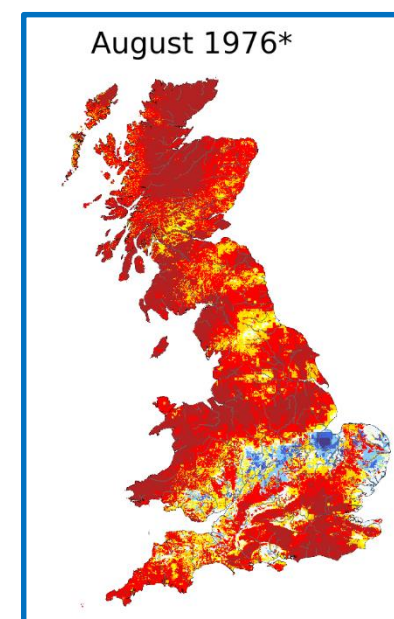
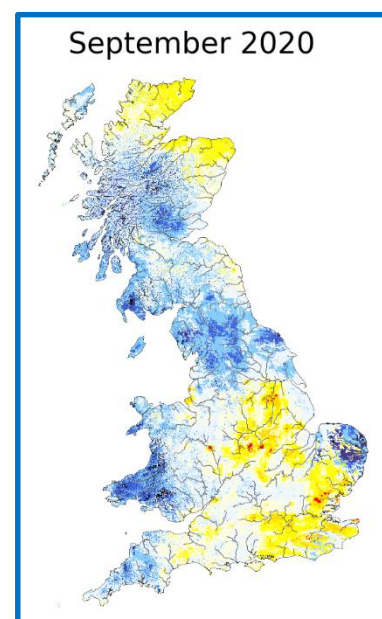
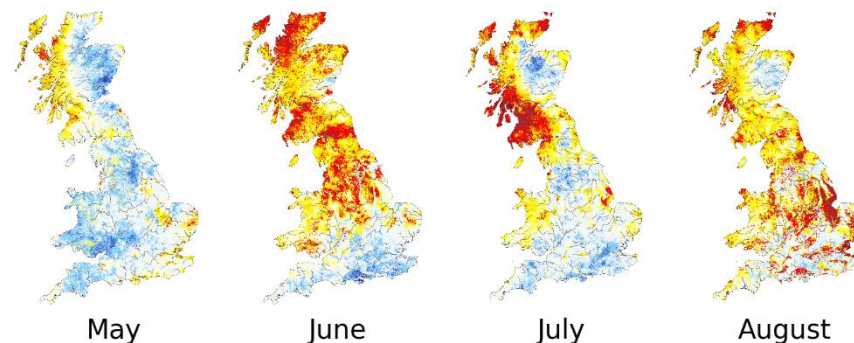
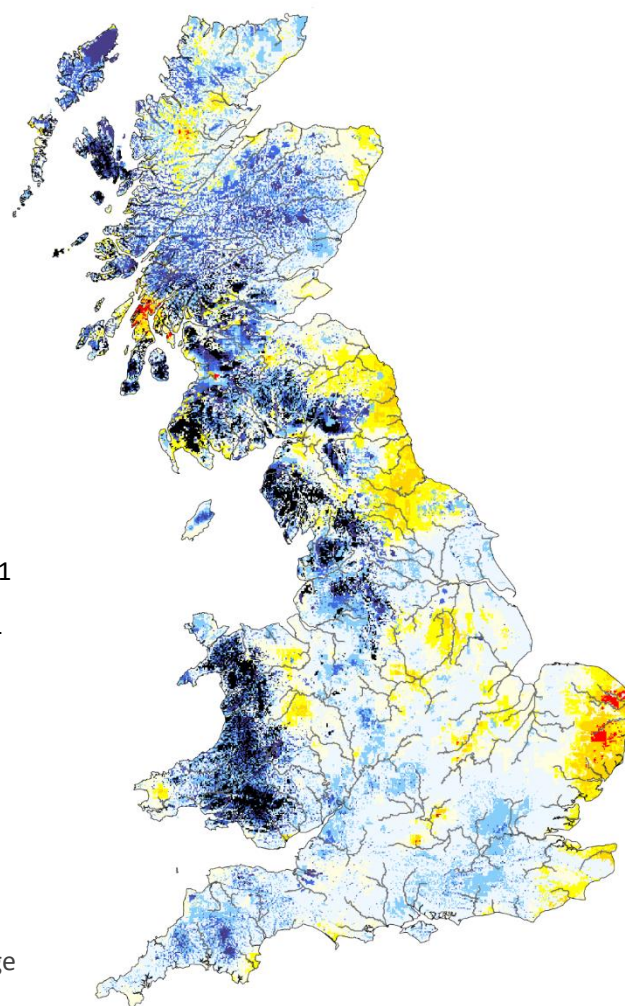
SUMMARY: At the end of September, subsurface water levels were lower (drier) than normal in East Anglia and Northumbria as well as small areas scattered across Britain. Elsewhere subsurface water levels were higher (wetter) than normal, especially so for higher ground in the west (very wet).

Relative wetness

Water storage anomaly as a % of maximum (positive wetness) or minimum (negative wetness) storage anomaly (zero indicates average value)



Labels refer to estimated storage on *final day* of named month



*Example month displaying extreme negative wetness

Relative wetness

- Each month, to highlight areas that are particularly wet or dry, the total daily mean subsurface water storage (S , mm) is presented using a colour scale showing water storage anomaly relative to the historical maximum or minimum anomaly. The “relative wetness” map combines maps previously shown separately as the “relative wetness” and “relative dryness”.
- The relative wetness in the sub-surface, R_w (%), is expressed as an anomaly from the monthly mean (1981 – 2010) wetness at that location:

$$\begin{aligned} \text{for } S \leq S_{\text{average}} \quad R_w (\%) &= \frac{(S - S_{\text{average}})}{(S_{\text{max}} - S_{\text{average}})} \times 100 \\ &= \frac{(\text{storage at end of last month} - \text{average storage for this month})}{(\text{historical maximum storage} - \text{average storage for this month})} \times 100 \end{aligned}$$

$$\begin{aligned} \text{for } S > S_{\text{average}} \quad R_w (\%) &= \frac{(S - S_{\text{average}})}{(S_{\text{average}} - S_{\text{min}})} \times 100 \\ &= \frac{(\text{storage at end of last month} - \text{average storage for this month})}{(\text{average storage for this month} - \text{historical minimum storage})} \times 100 \end{aligned}$$

- A value of $R_w = 0$ indicates that the sub-surface water storage in the region matches the monthly average value.
- Places where $R_w > 0$ and $R_w < 0$ are wetter or drier, respectively, than is average for that month.
- Values where $|R_w| > 100$ indicate the subsurface water storage is higher/lower than the previous maximum/minimum monthly mean storage estimated by the G2G over the period 1971 to 2010 (over all months), and is thus an unusually extreme value.
- These maps **do not provide a forecast**, but the relative wetness can provide an indication of locations which are particularly wet or dry. Rainfall in areas with high positive relative wetness areas **could** result in flooding in the coming days/weeks. Areas of negative relative wetness provide an indication of locations which are particularly dry, and little or no rain in these areas **could** potentially lead to (or prolong) a drought.

Return Period of Rainfall Required to Overcome Dry Conditions

Period: October 2021 – March 2022








Issue date: 05.10.2021

These maps show the **return period** of the rainfall required to overcome dry conditions simulated using the Grid-to-Grid (G2G) hydrological model. The maps are coloured according to the return period of accumulated rainfall required to overcome the estimated current subsurface water storage deficit over the next few months.

These maps do not provide a drought forecast. Instead they indicate the return period of rainfall required to overcome the dry conditions for the following 6 months based on current conditions.

SUMMARY: During October to March, Great Britain will not require particularly unusual rainfall (<5 year return periods) to return to average conditions for the time of year.



Rainfall amount / Probability		Return period (years)	
Low (this rain is likely to occur)	> 20%		< 5
	< 20%		5 - 10
	< 10%		10 - 25
	< 4%		25 - 50
High (less likely)	< 2%		50 - 100
	< 1%		100 - 200
Extreme (unlikely but still possible)	< 0.5%		> 200

SCOTLAND

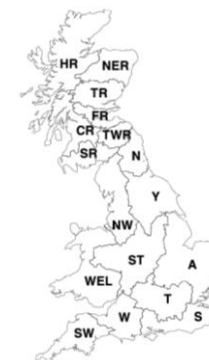
HR Highlands Region
NER North East Region
TR Tay Region
FR Forth Region
CR Clyde Region
TWR Tweed Region
SR Solway Region

ENGLAND

N Northumbria
NW North West
Y Yorkshire
ST Severn Trent
A Anglian
T Thames
S Southern
W Wessex
SW South West

WALES

WEL Welsh



NORTHERN IRELAND

This method cannot currently be used in Northern Ireland

Method

- These maps show the **return period** of the rainfall required to overcome dry conditions simulated using the Grid-to-Grid (G2G) hydrological model. The maps are coloured according to the return period of rainfall required to overcome the estimated current subsurface water storage deficit.
- For **dry areas** within a Hydrological Outlook region, i.e. where subsurface water storage anomaly < 0 , we estimate **regional average subsurface water storage deficit (mm)** from the last day of the most recent G2G model run.
- For each region we also estimate the **regional monthly average rainfall total (mm)** (for the period 1971-2000).
- For each of the next 6 months, we estimate the rainfall total (including what is normally expected for each month) required to overcome the dry conditions.
 - To overcome the dry conditions by the end of month 1:
rainfall required (mm) = regional monthly average rainfall for month 1 + regional average storage deficit
 - To overcome the dry conditions by the end of month 2 (more likely):
rainfall required (mm) = regional monthly average rainfall for months 1 and 2 + regional average storage deficit
 - To overcome the dry conditions by the end of month n (likely):
rainfall required (mm) = regional monthly average rainfall for months 1 to n + regional average storage deficit
- Using Tabony tables we estimate the return period of the **rainfall required** in each region and over the next 1 to 6 months to overcome the dry conditions.
- The return period results are displayed as regional maps with the colour scale based on the return period (years) of the rainfall required to replenish subsurface stores over the next 1, 2, ..., 6 months ahead.
- Note: These maps do not provide a drought forecast. Instead they indicate the return period of rainfall required to overcome the dry conditions for the following 6 months based on current conditions.

Estimate of Additional Rainfall Required to Overcome Dry Conditions

Based on subsurface water storage estimated for 30th September 2021

Issue date: 05.10.2021

These maps show the Grid-to-Grid (G2G) hydrological model simulated subsurface water storage, expressed as an anomaly from the historical monthly mean (1981-2010), presented on a 1km grid and as regional means.

Subsurface storage deficits, i.e. where the subsurface water storage anomaly is less than zero, are highlighted by the red/pink colours.

The **subsurface storage deficit (mm)** can be interpreted as an estimate of additional rainfall that would be required in future months to overcome dry conditions (i.e. rainfall in addition to what is expected on average). Regional mean values of additional rainfall required are provided in the table below.

Regional estimate of additional
rainfall required (mm)

SCOTLAND

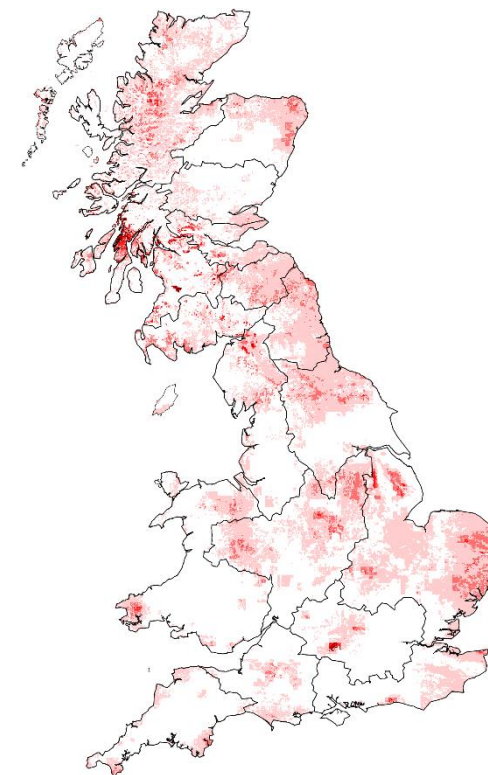
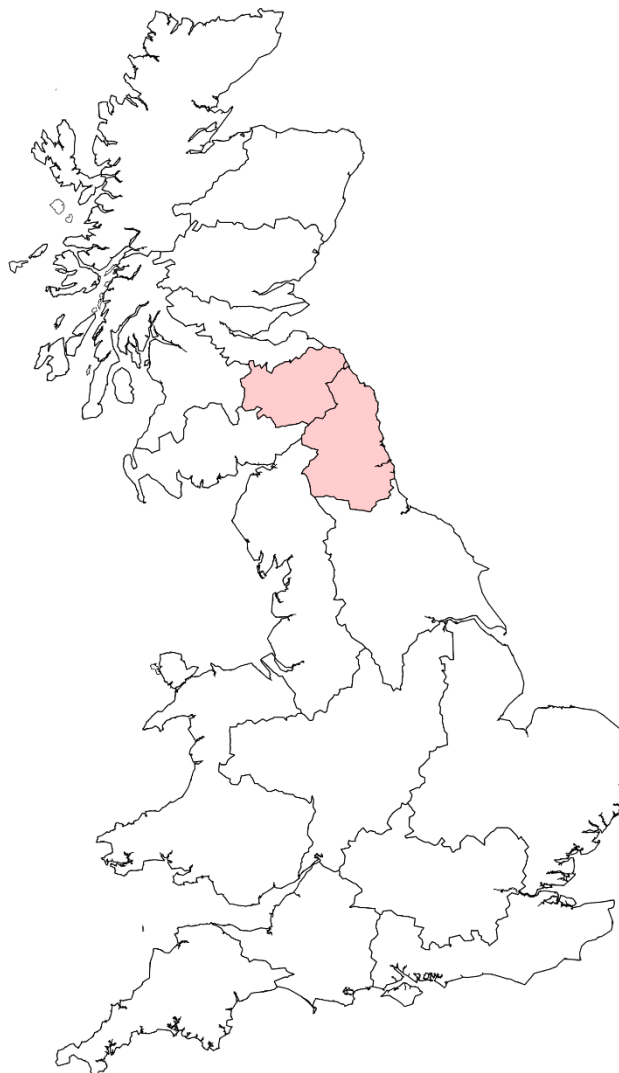
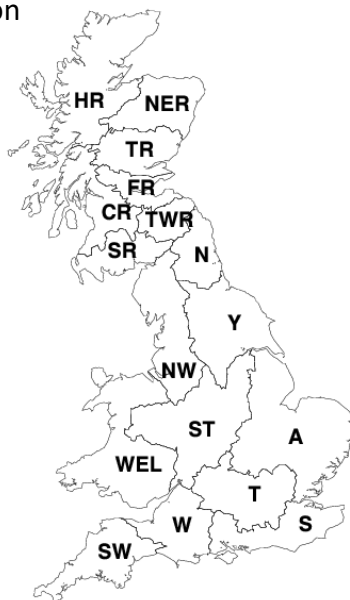
0	HR	Highlands Region
0	NER	North East Region
0	TR	Tay Region
0	FR	Forth Region
0	CR	Clyde Region
4	TWR	Tweed Region
0	SR	Solway Region

ENGLAND

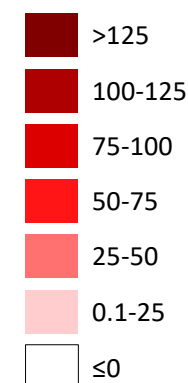
6	N	Northumbria
0	NW	North West
0	Y	Yorkshire
0	ST	Severn Trent
0	A	Anglian
0	T	Thames
0	W	Wessex
0	S	Southern
0	SW	South West

WALES

0	WEL	Welsh
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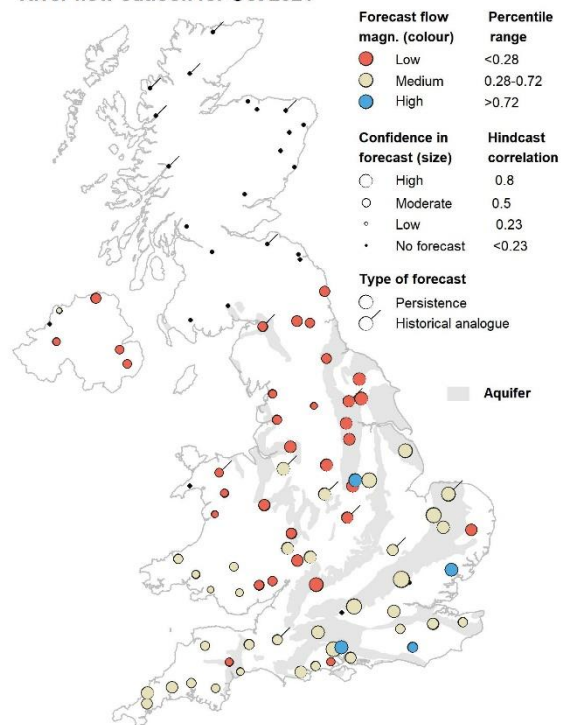
Water storage deficit
(anomaly, mm)



SUMMARY

The outlooks for October and for October to December are for mainly normal flows in the south and south-east of England. Elsewhere flows are likely to be normal to below normal. Note there are no forecasts available for Scotland.

River flow outlook for Oct 2021



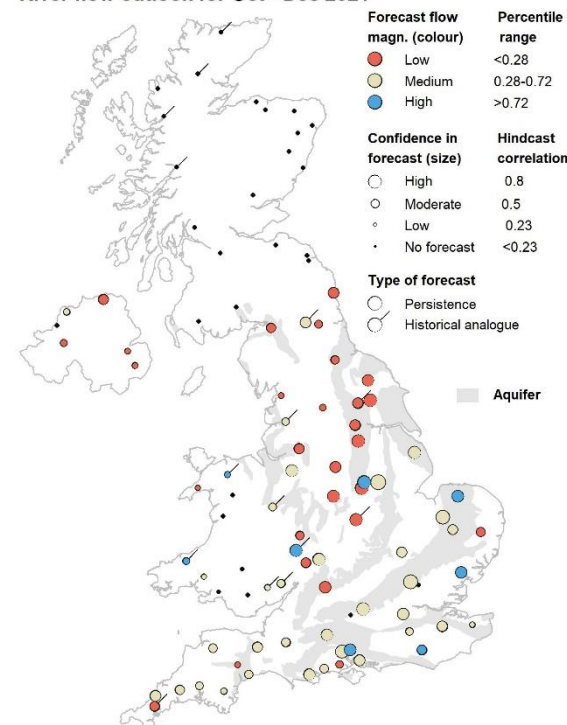
1-month flow outlook

Outlooks from hydrological analogues are based on a comparison of river flow during recent months with flows during the same months in previous years at a set of approximately 90 sites from across the UK. These sites are depicted on the two maps. Years with observed flows that most closely resemble current conditions are identified as the best analogues and the outlook is based on extrapolating from current conditions based on these analogues.

It is, however, often the case that a simpler forecast based on the persistence of river flow provides a better forecast than provided by analogy. This is particularly true for slowly responding catchments associated with aquifer outcrops.

Both methods are considered at each site and the forecast from the method with the higher confidence is presented. A simple classification of flows is used (high, medium and low) as indicated by the colours of the dots, with the confidence

River flow outlook for Oct - Dec 2021



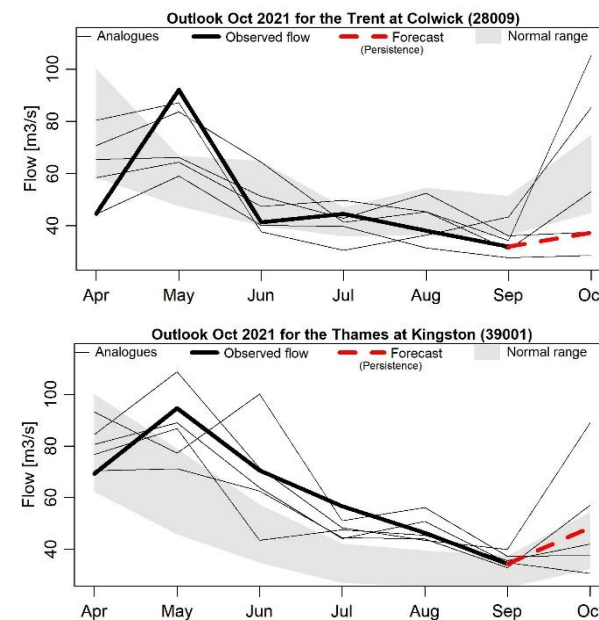
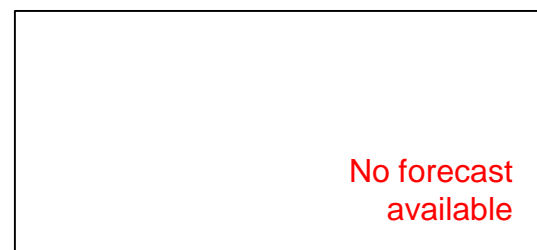
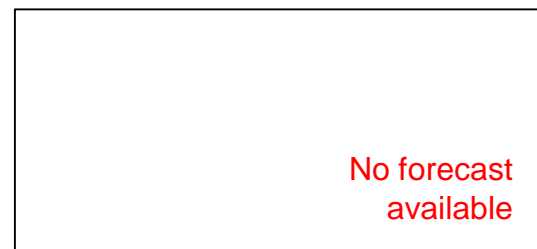
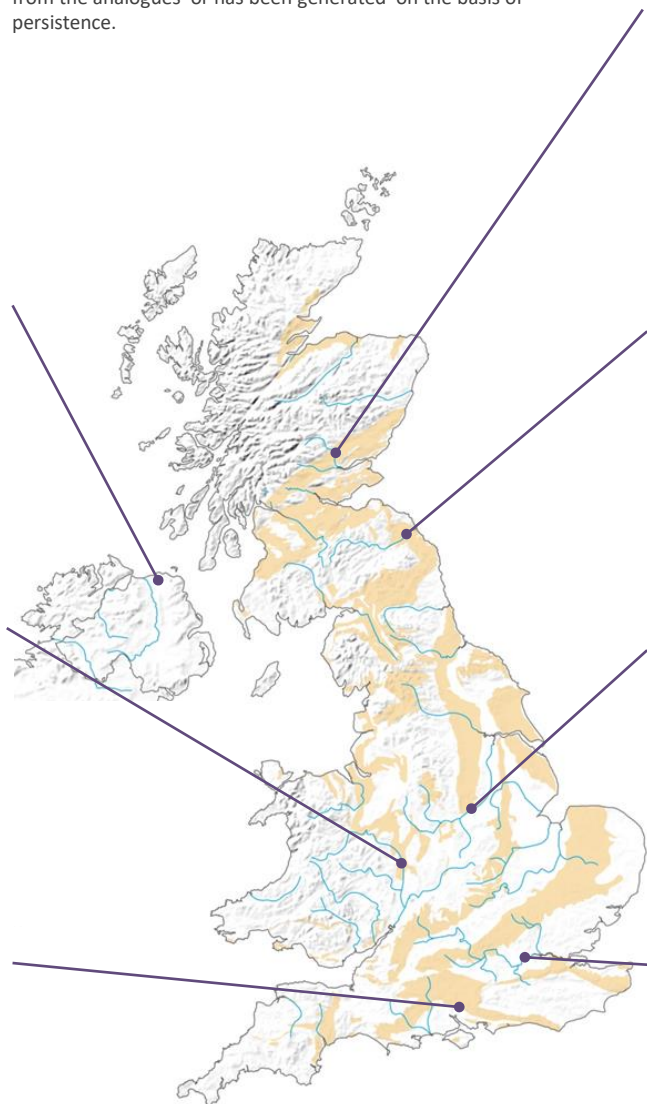
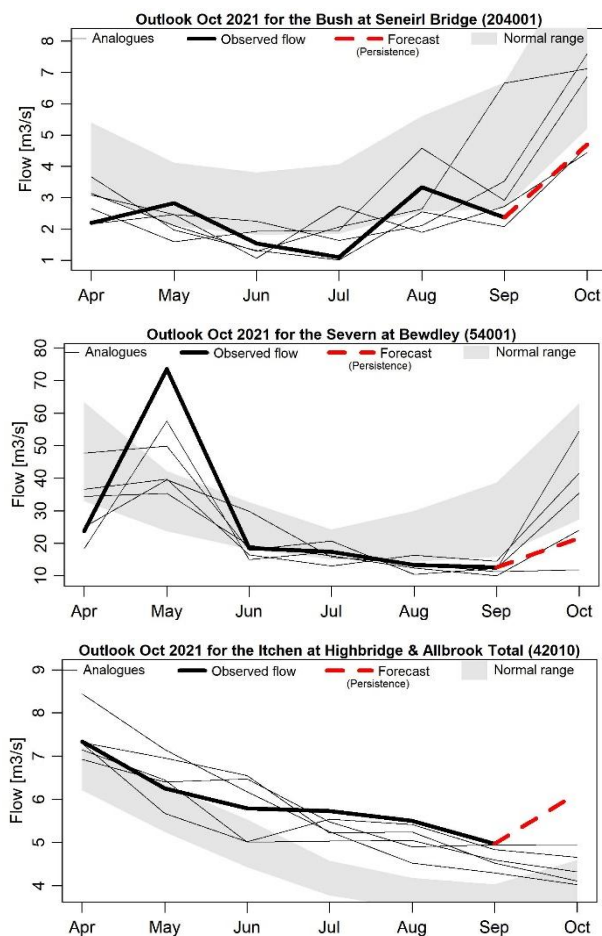
3-month flow outlook

of the forecast being represented by the size of the dot. A tag on the dot indicates which method has been used in each instance.

These figures provide insight into the hydrological analogue methodology for a set of sites from across the UK.

In each of the time series graphs the bold black line represents the observed flow during the past six months. The grey band indicates the normal flow range (the normal band includes 44%

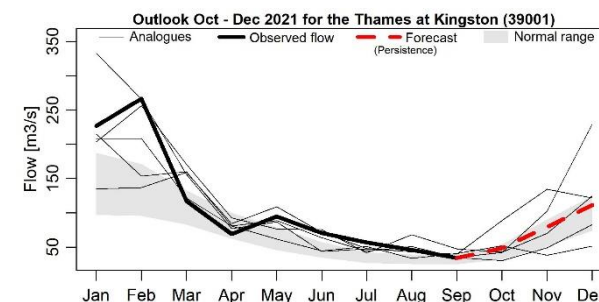
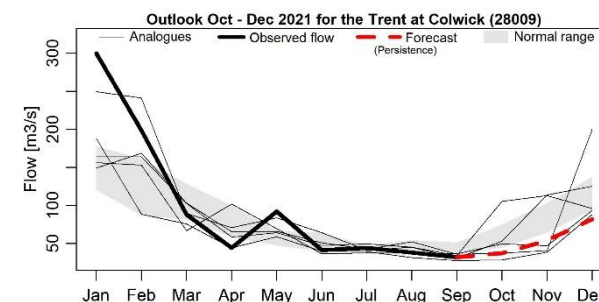
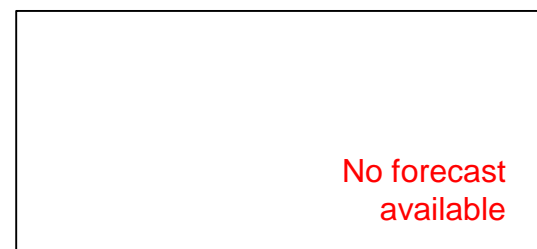
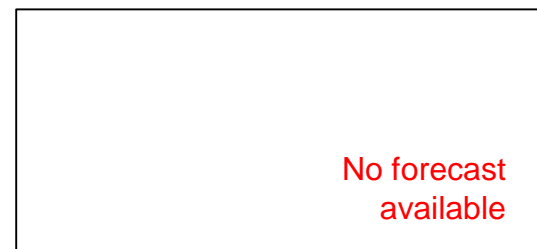
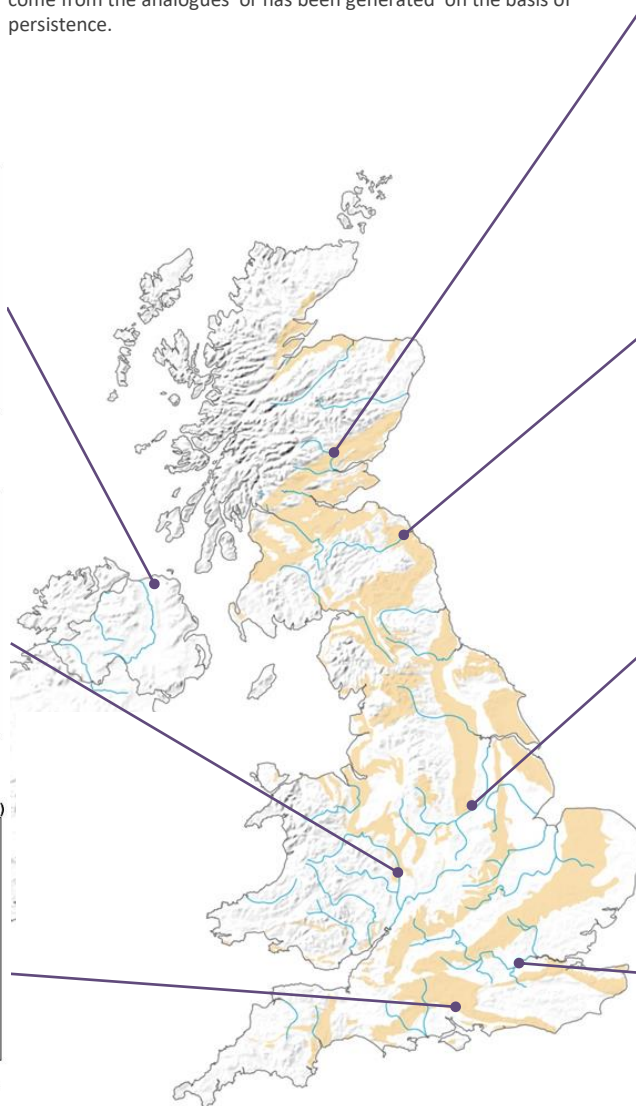
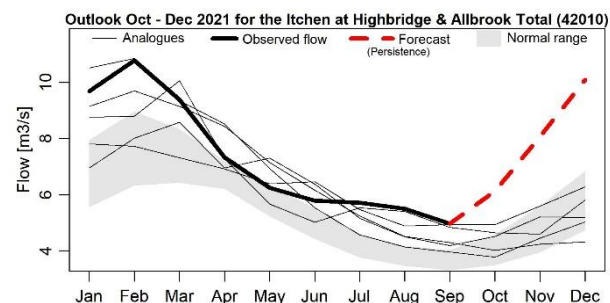
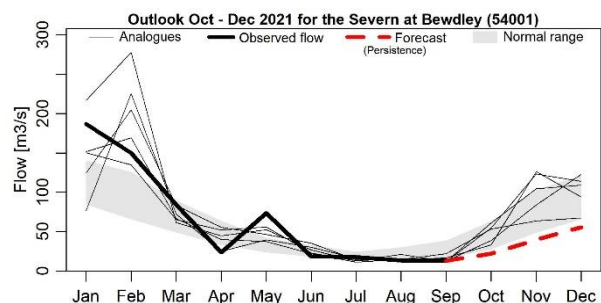
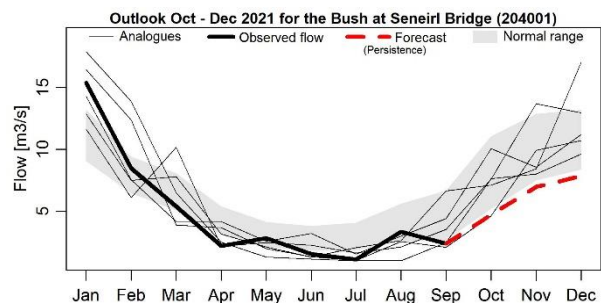
of observed flows in each month). The selected analogues are shown as thin lines and the trajectories that flows took in the following month are also shown. The forecast is shown as the dashed red line, and in each plot it states whether this has come from the analogues or has been generated on the basis of persistence.



These figures provide insight into the hydrological analogue methodology for a set of sites from across the UK.

In each of the time series graphs the bold black line represents the observed flow during the past nine months. The grey band indicates the normal flow range (the normal band includes 44%

of observed flows in each month). The selected analogues are shown as thin lines and the trajectories that flows took in the following three months are also shown. The forecast is shown as the dashed red line, and in each plot it states whether this has come from the analogues or has been generated on the basis of persistence.

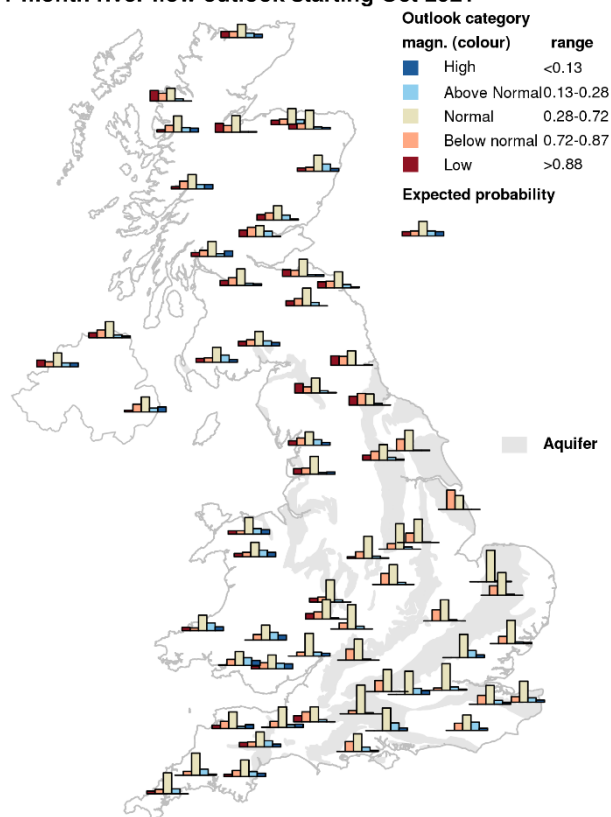


Period: October 2021 –March 2022

Issued on 04.10.2021 using data to the end of September 2021

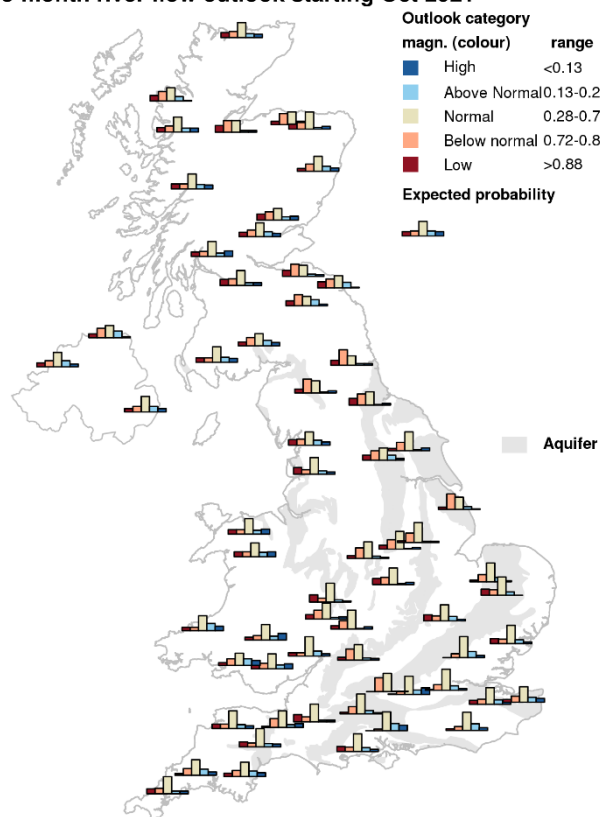
The outlook for October and October-November-December indicates that flows are most likely to be within the normal range for the majority of the UK, though flows are likely to be normal to below normal in some northern parts of the UK. In October for the midlands and the south-east, flows are likely to be normal, with a decreased likelihood of above normal flows.

1-month river flow outlook starting Oct 2021



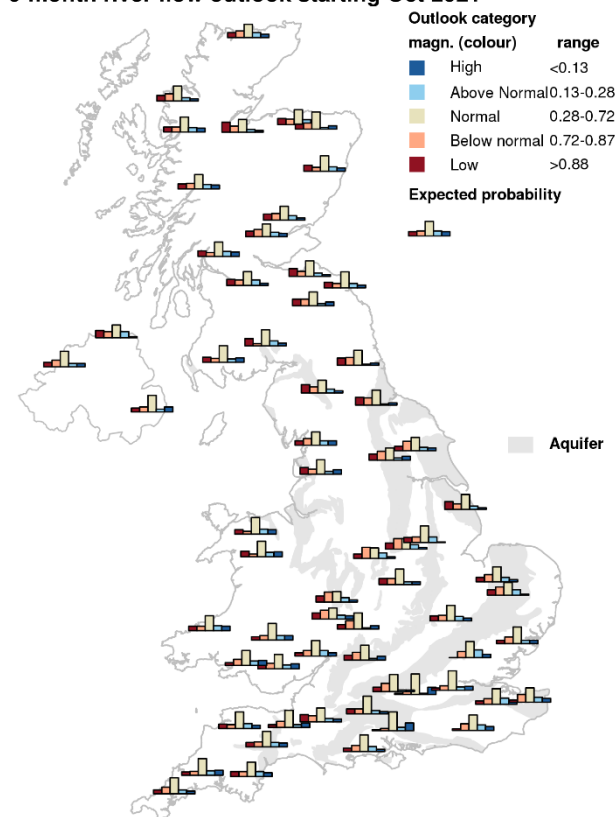
This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evapotranspiration) that form input to a hydrological model. The outputs are probabilistic simulations of the average river flow over the forecast period (1 to 12 months ahead), at each location. The simulations are generated by the GR4J conceptual rainfall-runoff model from IRSTEA (France) calibrated on observed or naturalised flows.

3-month river flow outlook starting Oct 2021



The bar plot maps show the outlook distribution for 1, 3 and 6-month period for 64 catchments across England and Wales. Each bar plot represents the probabilistic distribution of the simulated river flow compared to the historical river flow, for the same n-month period. The probabilities fall within five categories, classified as: low, below normal, normal, above normal and high.

6-month river flow outlook starting Oct 2021



This outlook is based entirely on historical sequences and therefore does not contain any knowledge of the state of the atmosphere and ocean. It is hence possible that some of the historical sequences used might be inconsistent with current large-scale atmospheric conditions and would therefore be unlikely to occur in the next few months.



This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evapotranspiration) that form input to a hydrological model. The outputs are probabilistic simulations of the average river flow over the forecast period (1 to 12 months ahead), at each location. The simulations are generated by the GR4J conceptual rainfall-runoff model from IRSTEA (France) calibrated on observed or naturalised flows.

The stack diagrams show the variation over time of the outlook distribution for a number of individual catchments. Each graph represents variation over time of the number of simulated river flows, in each month ensemble, that fall within each of seven categories: exceptionally low, notably low, below normal, normal, above normal, notably high and exceptionally high. The categories represent cumulative flow conditions, e.g. For 3-month, the simulated total 3-month flow compared to the historical 3-month flow distribution. The monthly variations can be compared to the long-term average distribution of river flows (shown as columns

on the right of each timeline graph).

This outlook is based entirely on historical sequences and therefore does not contain any knowledge of the state of the atmosphere and ocean. It is hence possible that some of the historical sequences used might be inconsistent with current large-scale atmospheric conditions and would therefore be unlikely to occur in the next few months.

SUMMARY: During October river flows are most likely to be in the *Normal range* or above in Wales and southwest England, elsewhere river flows are likely to be in the *Normal range*.

Over the next 3 months river flows are likely to be in the *Normal range* in Severn Trent and southern England, elsewhere river flows are most likely to be in the *Normal range* or *Below normal*.

These forecasts are produced by using five members of the Met Office rainfall forecast ensemble as input to a water balance hydrological model to provide the five estimates of river flows shown on the left for one month and three months ahead.

Regional forecast monthly-mean river flows are derived from the average of 1km river flow estimates within each region and ranked in terms of 54 years of historical flow estimates (1963 – 2016).

The five maps illustrate the wide range of possible flows and while there is a 50% chance of flows between the 1st and 3rd quartiles, actual flows may be more extreme than the flows derived using the highest or lowest rainfall forecasts.

1-month flow outlook

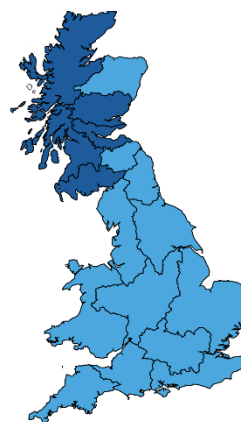
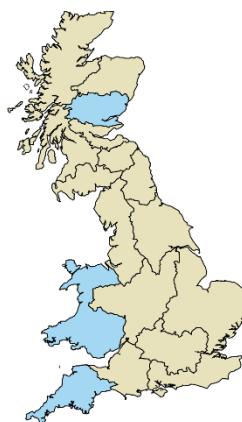
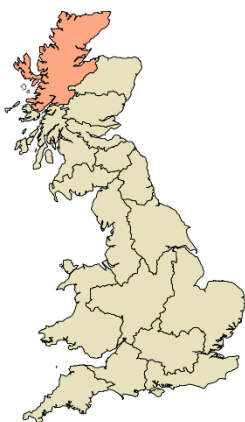
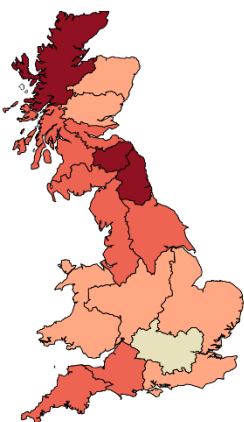
Lowest rainfall forecast

1st quartile

Median

3rd quartile

Highest rainfall forecast



Key

Exceptionally high flow
Notably high flow
Above normal
Normal range
Below normal
Notably low flow
Exceptionally low flow

Percentile range of historic values for relevant month

> 95
87-95
72-87
28-72
13-28
5-13
< 5

3-month flow outlook

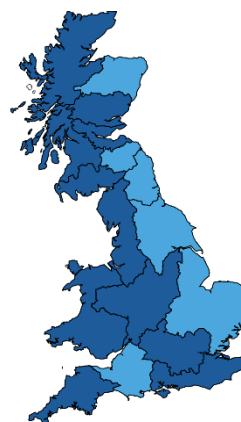
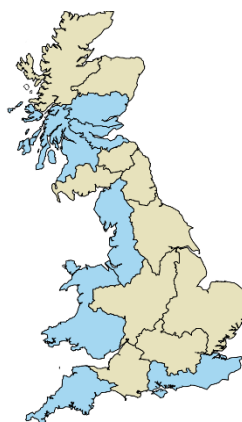
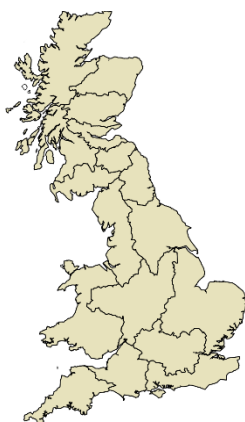
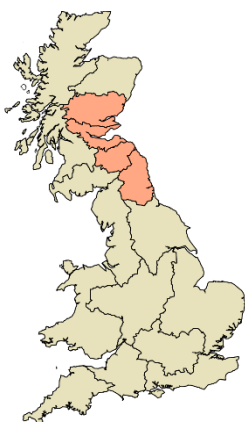
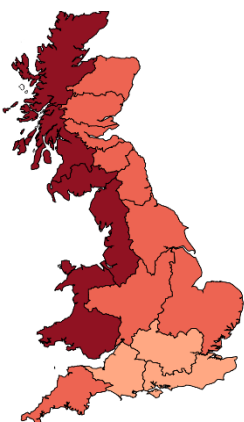
Lowest rainfall forecast

1st quartile

Median

3rd quartile

Highest rainfall forecast



SCOTLAND

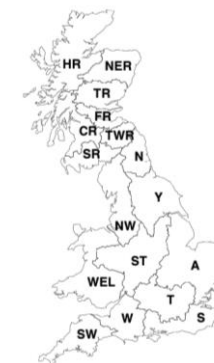
HR Highlands Region
NER North East Region
TR Tay Region
FR Forth Region
CR Clyde Region
TWR Tweed Region
SR Solway Region

ENGLAND

N Northumbria
NW North West
Y Yorkshire
ST Severn Trent
A Anglian
T Thames
S Southern
W Wessex
SW South West

WALES

WEL Welsh



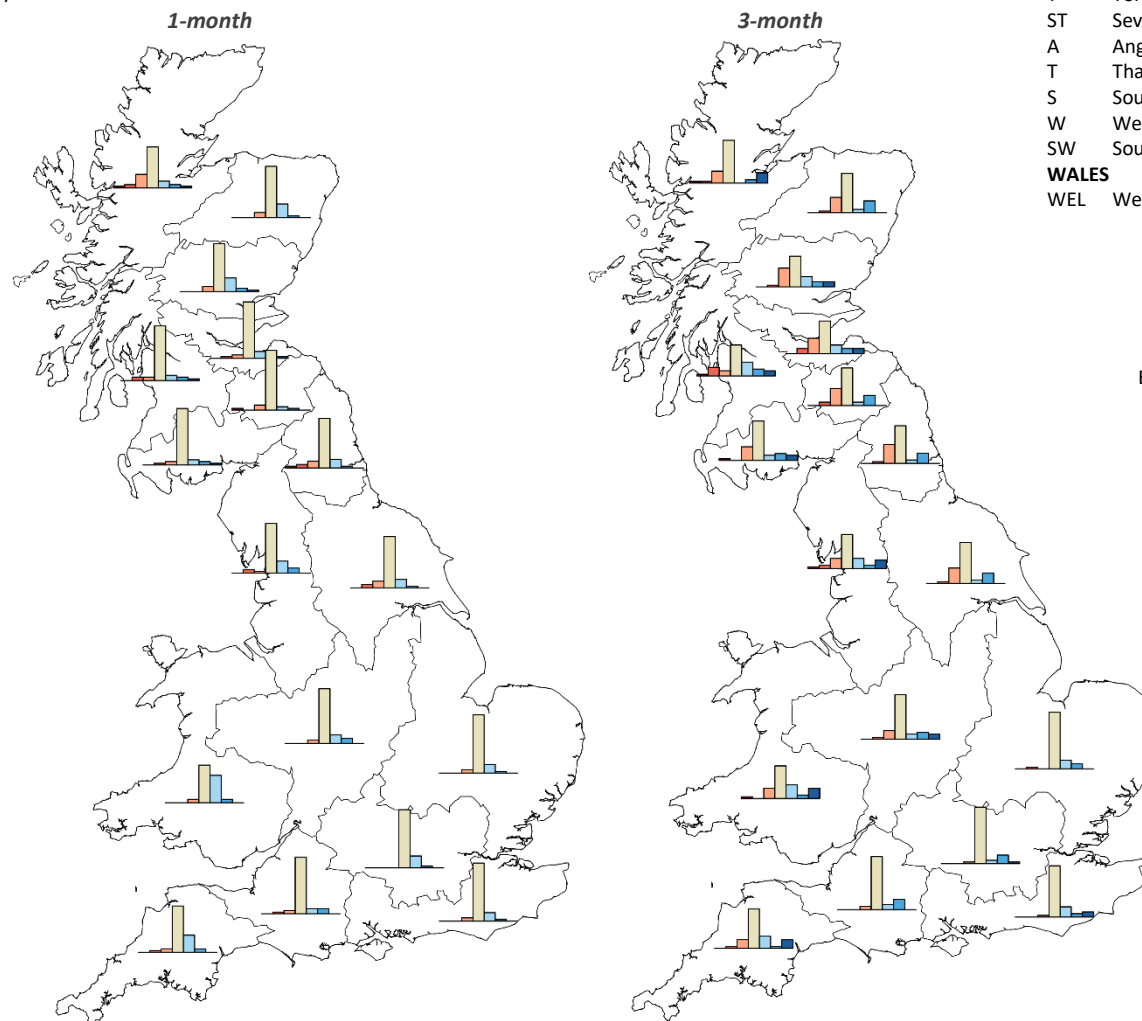
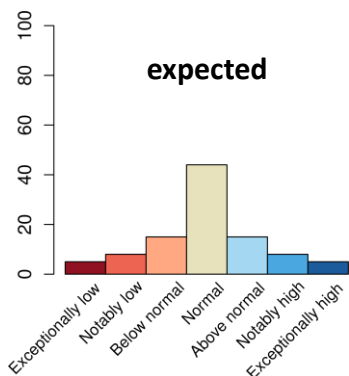
NORTHERN IRELAND
This method cannot currently be used in Northern Ireland

The regional maps illustrating the regional river flows for five members of the Met Office ensemble of rainfall forecasts give some indication of the range of possible river flows in the coming months. As noted previously, the actual flows could be more extreme than the flows generated by either the lowest or highest members of the rainfall ensemble.

The bar charts (below) give further insight into the range of river flow forecasts by considering all members of the forecast rainfall ensemble. The regional bar charts show the percentage of ensemble forecasts falling in each of the flow categories as generated by the monthly-resolution water-balance model. As before results are averaged by region then ranked in terms of 54 years of historical regional flow estimates (1963 – 2016).

SUMMARY: During October river flows are most likely to be in the *Normal range* or above in Wales and southwest England, elsewhere river flows are likely to be in the *Normal range*.

Over the next 3 months river flows are likely to be in the *Normal range* in Severn Trent and southern England, elsewhere river flows are most likely to be in the *Normal range* or *Below normal*.



SCOTLAND

HR Highlands Region
NER North East Region
TR Tay Region
FR Forth Region
CR Clyde Region
TWR Tweed Region
SR Solway Region

ENGLAND

N Northumbria
NW North West
Y Yorkshire
ST Severn Trent
A Anglian
T Thames
S Southern
W Wessex
SW South West

WALES

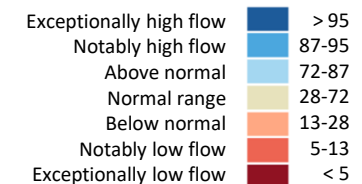
WEL Welsh



NORTHERN IRELAND

This method cannot currently be used in Northern Ireland

Percentile range of historic values for relevant month



The maps illustrating the regional river flows for five members of the Met Office ensemble of rainfall forecasts give some indication of the range of possible river flows in the coming months. As noted previously, the actual flows could be more extreme than the flows generated by either the lowest or highest members of the rainfall ensemble.

The tables below give further insight into the range of river flow forecasts by considering all members of the forecast rainfall ensemble. The numbers in the tables are the percentage of ensemble forecasts falling in each of the flow categories as generated by the monthly-resolution water-balance model. As before results are averaged by region then ranked in terms of 54 years of historical regional flow estimates (1963 – 2016).

SUMMARY: During October river flows are most likely to be in the *Normal range* or above in Wales and southwest England, elsewhere river flows are likely to be in the *Normal range*.

Over the next 3 months river flows are likely to be in the *Normal range* in Severn Trent and southern England, elsewhere river flows are most likely to be in the *Normal range* or *Below normal*.

SCOTLAND

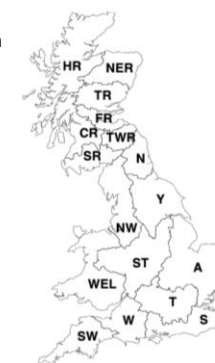
HR Highlands Region
NER North East Region
TR Tay Region
FR Forth Region
CR Clyde Region
TWR Tweed Region
SR Solway Region

ENGLAND

N Northumbria
NW North West
Y Yorkshire
ST Severn Trent
A Anglian
T Thames
S Southern
W Wessex
SW South West

WALES

WEL Welsh



NORTHERN IRELAND

This method cannot currently be used in Northern Ireland

1-month ahead	A	NW	N	ST	SW	S	T	Welsh	W	Y	CR	FR	HR	NER	SR	TR	TWR
Exceptionally high flow	0	0	0	0	0	0	0	0	0	0	2	2	2	0	2	2	0
Notably high flow	2	7	2	7	5	2	2	5	7	2	5	2	5	2	5	5	2
Above normal	12	17	12	12	24	12	17	38	7	12	7	10	10	19	7	19	5
Normal range	81	69	69	76	64	81	81	52	79	71	76	79	57	71	79	67	83
Below normal	5	2	10	5	5	5	0	5	5	10	5	5	19	7	5	7	7
Notably low flow	0	5	5	0	2	0	0	0	2	5	5	2	5	0	2	0	0
Exceptionally low flow	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	2

3-months ahead	A	NW	N	ST	SW	S	T	Welsh	W	Y	CR	FR	HR	NER	SR	TR	TWR
Exceptionally high flow	0	12	0	7	12	7	2	14	0	0	7	7	14	0	7	7	0
Notably high flow	7	5	14	10	2	5	12	5	14	14	10	7	5	17	10	7	14
Above normal	12	14	5	7	17	14	5	19	7	5	19	12	0	5	7	14	5
Normal range	79	48	52	62	55	71	79	45	74	57	43	45	60	55	55	43	52
Below normal	0	14	26	12	12	2	2	14	5	21	7	21	17	21	19	26	24
Notably low flow	2	5	2	2	2	0	0	0	0	2	12	7	2	2	0	2	5
Exceptionally low flow	0	2	0	0	0	0	0	2	0	0	2	0	2	0	2	0	0

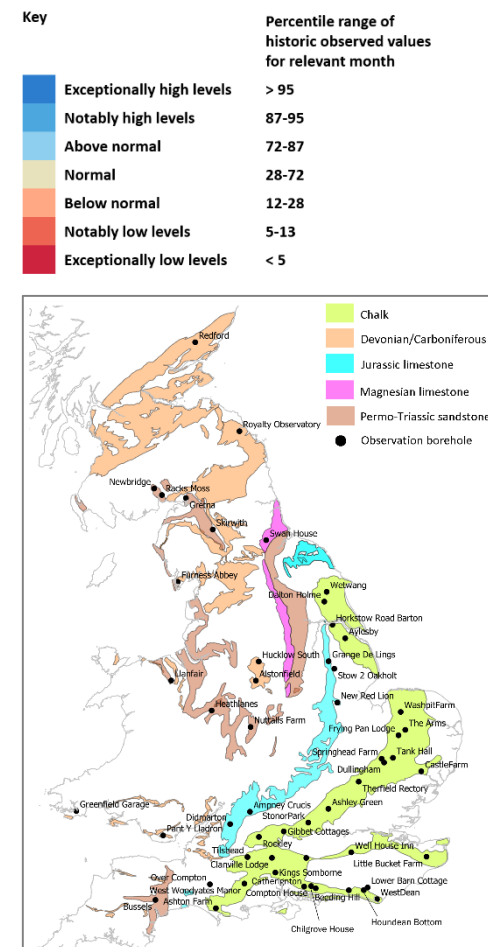
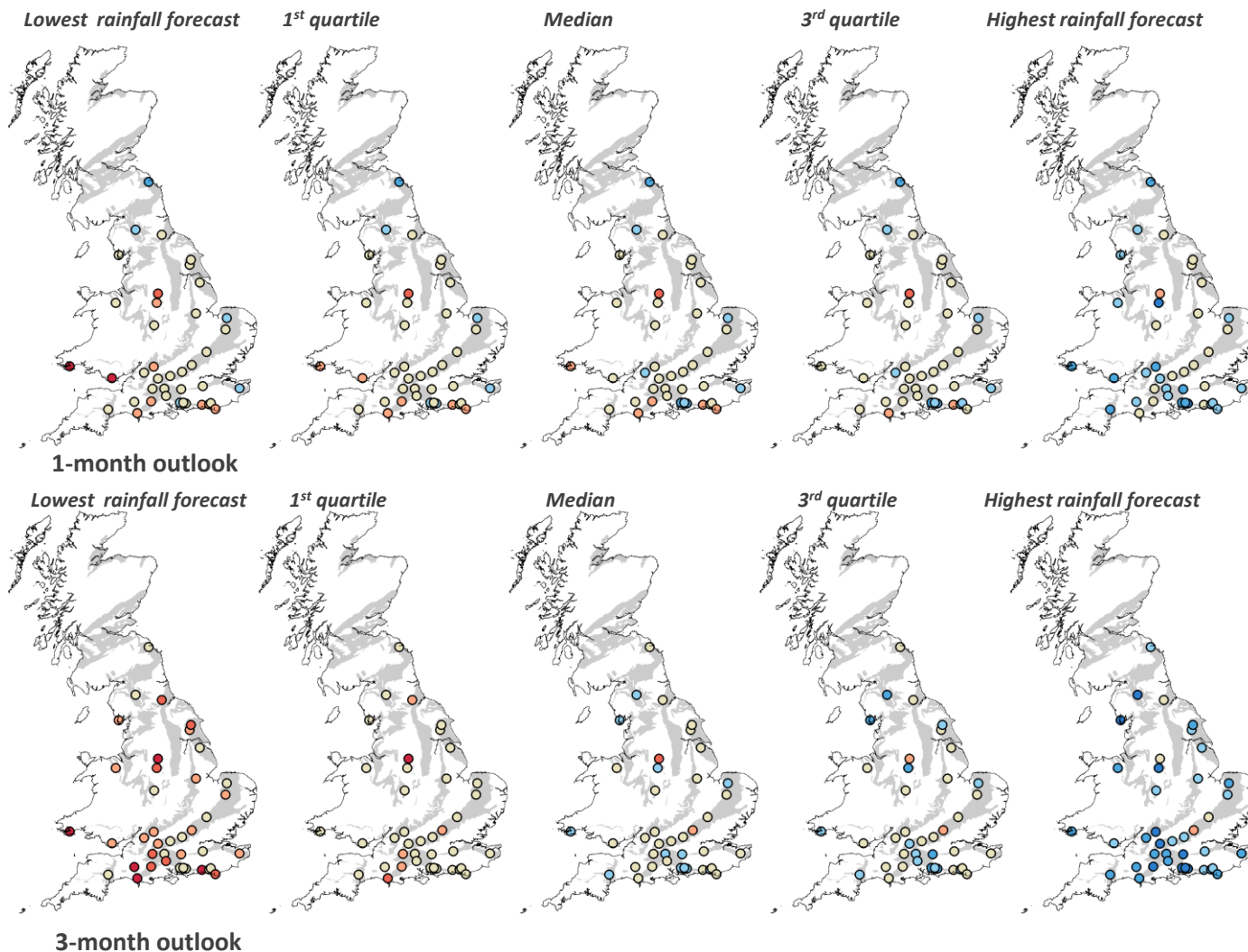
Period: October 2021 – December 2021

Issued on 07.08.2021 using data to the end of September

Below normal to above normal groundwater levels are predicted in the Chalk of southern England over the next month. Over three months levels tend towards normal to above normal at these sites. Elsewhere in the Chalk, levels are predicted to be normal over one and three months, with above normal forecasts for some sites. Levels in other aquifers are generally predicted to be normal over one and three months, with the exceptions of the notably high levels predicted at Royalty Observatory over the next month and conversely the notably low levels at Hucklow South over one and three months. Note there are a reduced number of modelled sites. This is due to Covid-19 restrictions on access to sites in England and IT issues in Scotland.

These forecasts are produced by running five members of the Met Office ensemble climate forecast through groundwater models of observation borehole hydrographs at 42 sites across the country. The sites are distributed across the principal aquifers.

Based on the distribution of observed historical groundwater levels in a given month, seven categories have been derived for each site: very low, low, below normal, normal, above normal, high, and very high. The forecast groundwater level is assigned to one of these seven categories depending on where it falls within the distribution of the historically observed values.



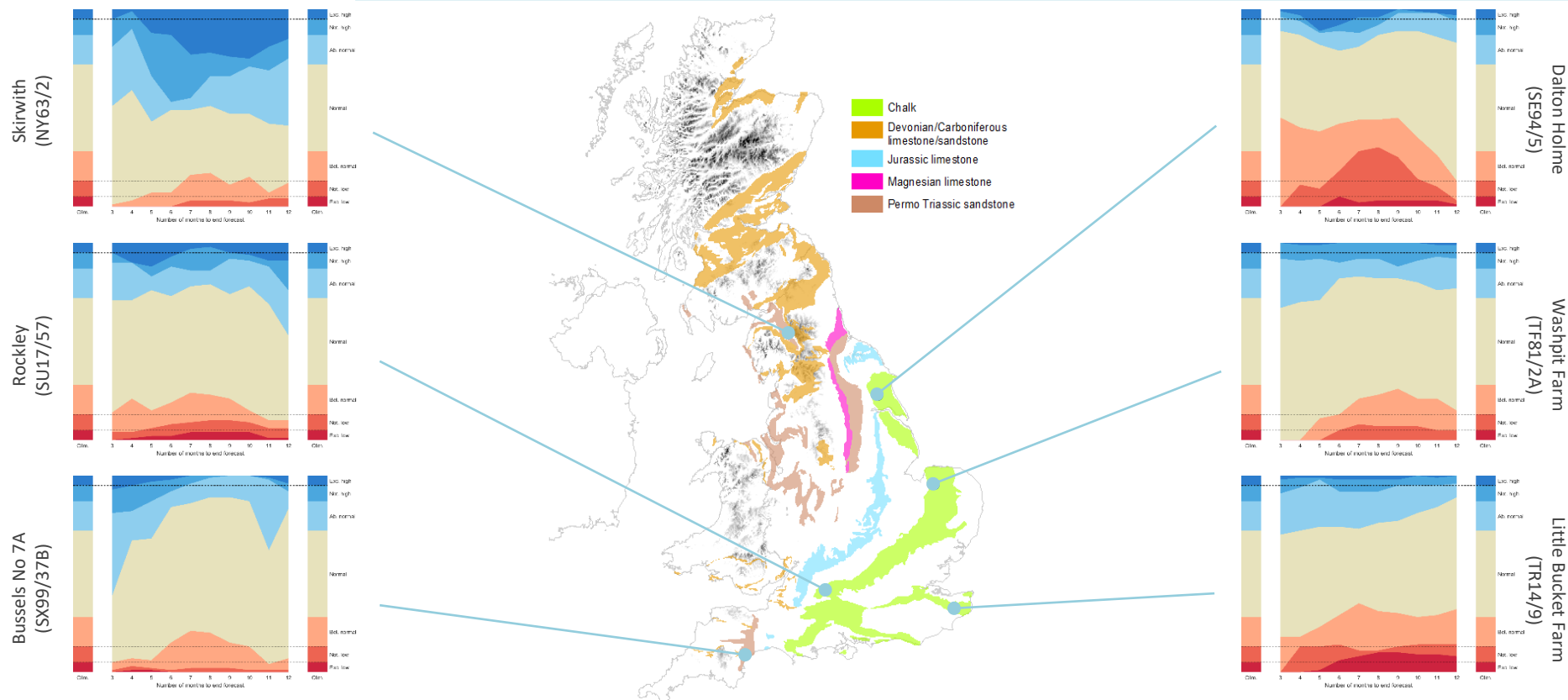
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Outlook based on modelled groundwater from historical climate

Period: October 2021 – September 2021

Issued on 07.10.2021 using data to the end of September

In the Chalk sites at Rockley, Washpit Farm and Little Bucket Farm the groundwater levels are predicted to be normal for the next 12 months, with normal to above normal levels predicted at Rockley from 10-12 months. At Dalton Holme, normal to below normal levels are predicted in the first 9 months, then normal levels are likely to prevail between 9-12 months. At Bussels, groundwater levels are predicted to remain above normal over the next 1-2 months, before returning to normal levels from 3-12 months. In the Permo-Triassic sandstone at Skirwith levels are predicted to remain normal to above normal throughout the 12-month period.



This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evapotranspiration) that form input to hydrological models. The outputs are probabilistic simulations of the average groundwater level over the forecast horizon (3 to 12 months ahead), at each location.

The graphs show variation over time of the number of simulated groundwater levels in each monthly ensemble,

that fall within each the seven categories: exceptionally low, notably low, below normal, normal, above normal, notably high and exceptionally high. The monthly variations can be compared to the long-term average distribution of levels, which are shown as columns on the left and right of each graph.

This outlook is based entirely on historical sequences and therefore does not contain any knowledge of the state of

the atmosphere and ocean. It is hence possible that some of the historical sequences used might be inconsistent with current large-scale atmospheric conditions and would therefore be unlikely to occur in the next few months.