

## SUMMARY

Following the dry January, the Outlook for February is for normal to below normal flows and groundwater levels across much of the country, with a few localised exceptions. The three month outlook is similar, but for river flows there is an increasing tendency for more normal conditions rather than below, whereas for groundwater there is an increasing chance of below normal levels in some areas.

### Rainfall:

January was very dry across most of the country: the UK as a whole saw around half the typical January rainfall. All areas except northwest Scotland saw below significantly below average rainfall, with exceptionally low rainfall in parts of southern and eastern England.

The rainfall outlook (issued by the Met Office on 31.01.2022) suggests that the chances of February being either particularly wet or particularly dry are both moderately smaller than normal. The chances of the three-month period (February – April) being wet are slightly higher than normal.

### River flows:

River flows in January were normal or below normal across England, Wales and Northern Ireland, reflecting the dry January (note that data are currently unavailable for Scotland).

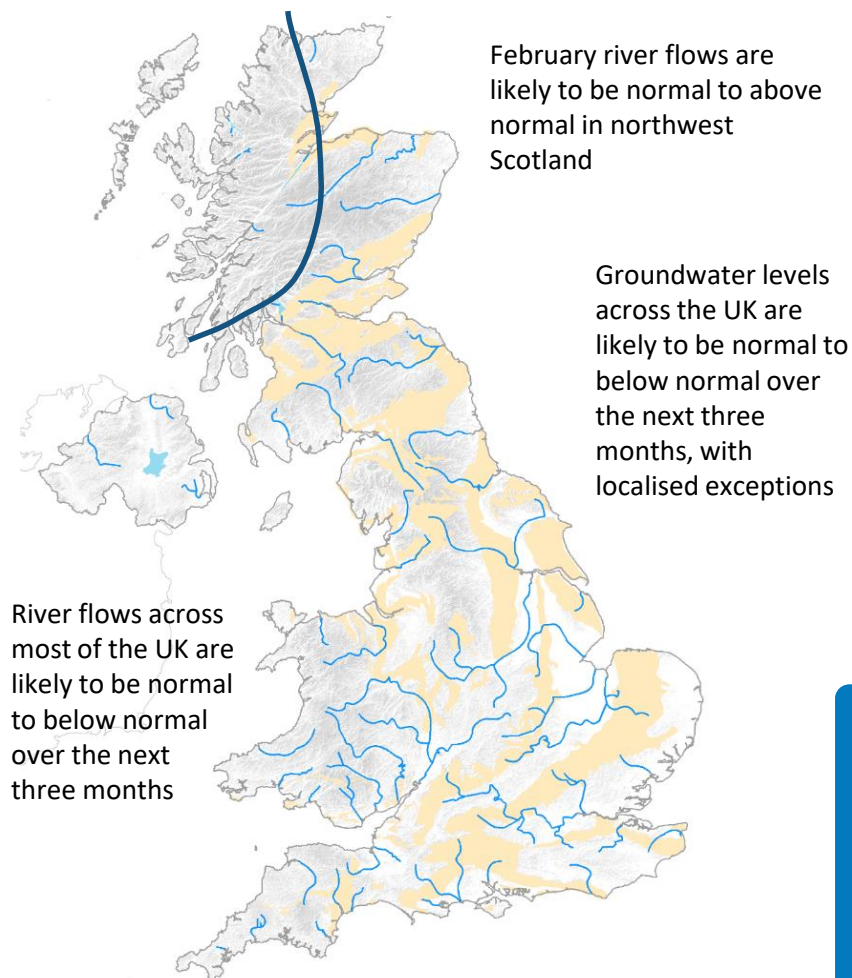
The outlook for February is for flows to be in the normal to below normal across most of the UK. In north-west Scotland, flows are likely to be normal to above normal. The outlook to the end of April is similar, with below normal flows likely to persist in many southern areas but with an increased chance of normal flows elsewhere.

### Groundwater:

Observed groundwater levels in January were in the normal to below normal range in southern Britain, and normal to above normal in the north and some central areas. Fewer observations than normal are available because of Covid-19 related access restrictions and IT issues in Scotland.

In February, normal to below normal levels are most likely across much of the country, but above normal levels are likely to persist in some central and northern areas. Over the three-month period to April, the outlook is also for normal to below normal levels, but more areas of the Chalk are likely to see below normal levels.

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](http://www.hydoutuk.net)



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:

The Hydrological Outlook partnership aims to ensure that all Content provided is accurate and consistent with its current scientific understanding. However, the science which underlies hydrological and hydrogeological forecasts and climate projections is constantly evolving. Therefore any element of the Content which involves a forecast or a prediction should not be relied upon as though it were a statement of fact. To the fullest extent permitted by applicable law, the Hydrological Outlook Partnership excludes all warranties or representations (express or implied) in respect of the Content.

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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:

Hydrological Outlooks UK, UK Centre for Ecology & Hydrology, Wallingford, Oxfordshire, OX10 8BB  
t: 01491 692371 e: [enquiries@hydoutuk.net](mailto:enquiries@hydoutuk.net)

## Reference for the Hydrological Outlook:

Hydrological Outlook UK, 2022, February, 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>

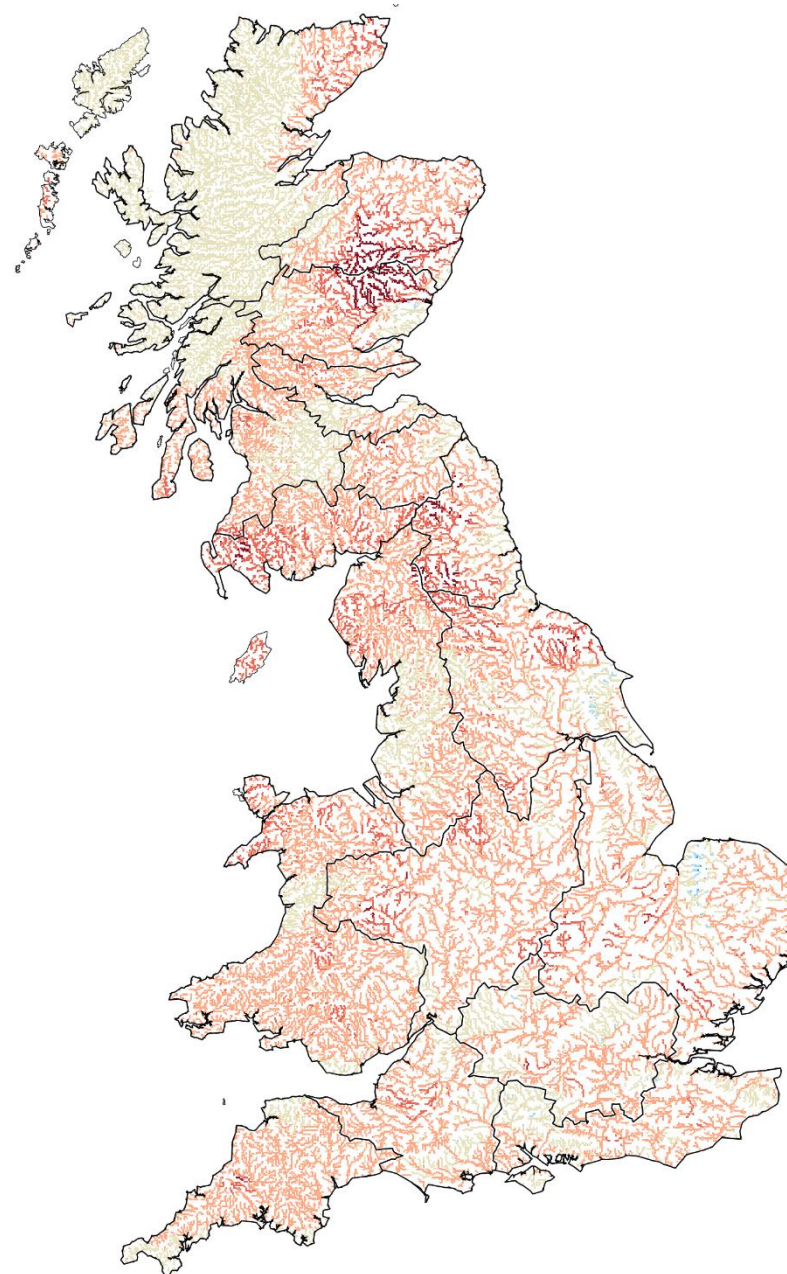
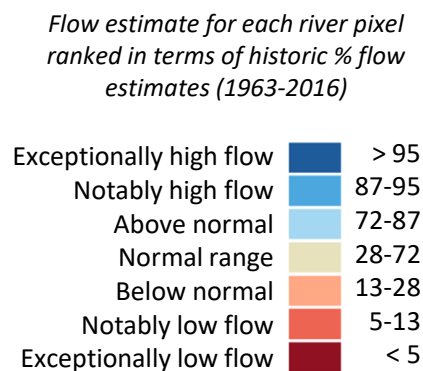
UK Water Resources Portal: monitor the UK hydrological situation in near real-time including rainfall, river flow, groundwater and soil moisture from COSMOS-UK:

<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 31<sup>st</sup> January 2022

Issue date: 03.02.2022

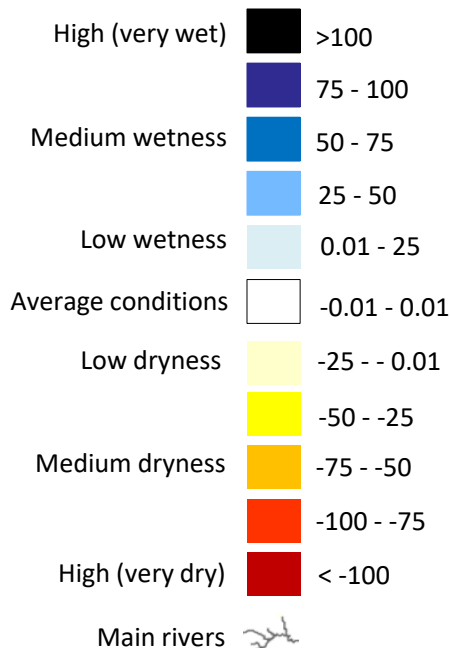
These maps are based on Grid-to-Grid (G2G) hydrological model simulated subsurface water storage, expressed as an anomaly from the historical monthly mean. To highlight areas that are particularly wet or dry, the storage anomaly is presented here using a colour scale highlighting water storage relative 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.

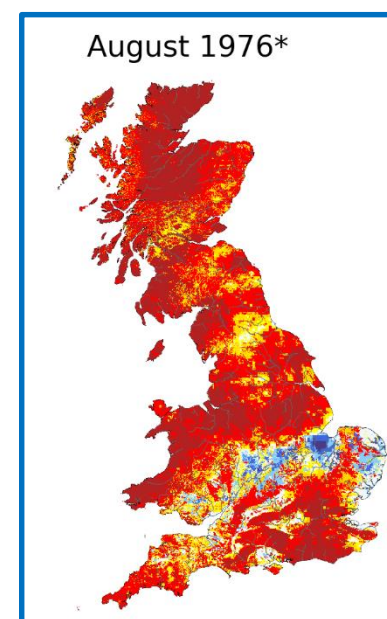
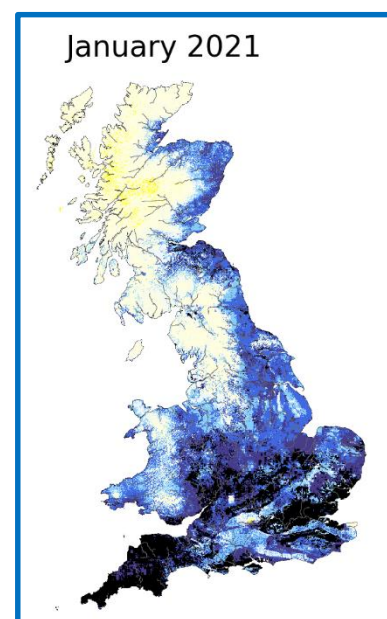
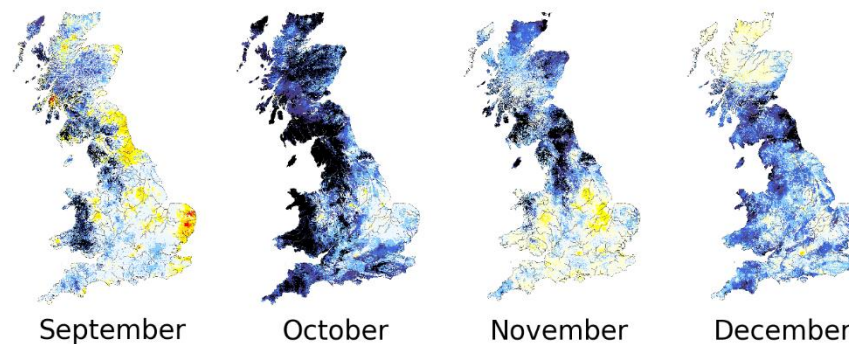
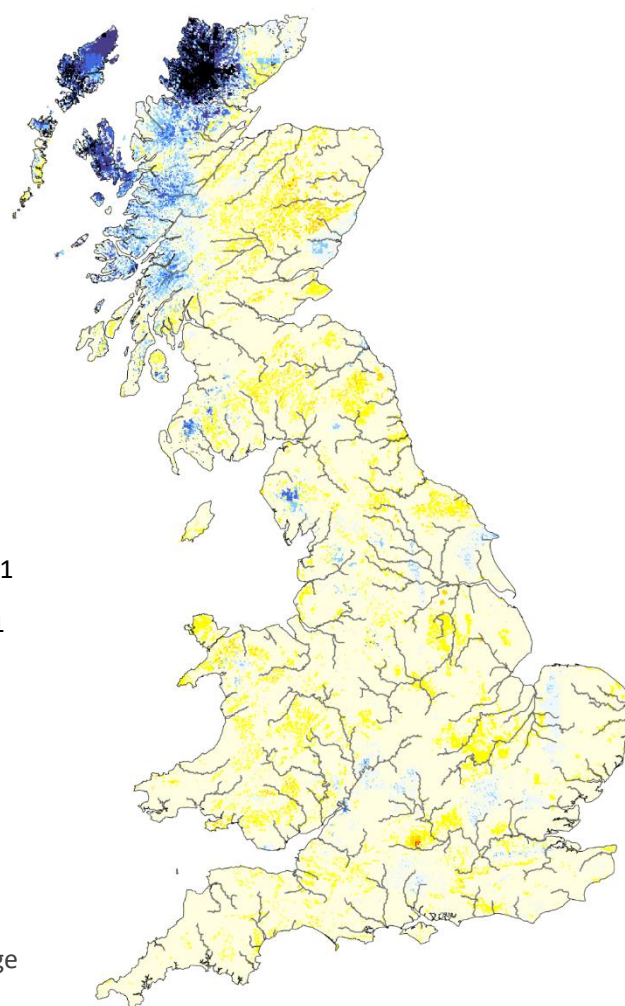
**SUMMARY:** At the end of January, subsurface water levels were generally normal or lower (drier) than normal across much of Britain. Wetter areas were mostly confined to north west Scotland.

## 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

February 2022

# Return Period of Rainfall Required to Overcome Dry Conditions

Period: February 2022 – July 2022








Issue date: 03.02.2022

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 February to July, 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
High (less likely)	< 4%		25 - 50
	< 2%		50 - 100
	< 1%		100 - 200
Extreme (unlikely but still possible)			< 0.5%
			> 200

## SCOTLAND

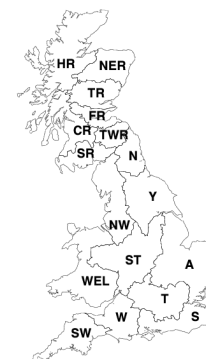
HR Highlands Region  
NER North East Region  
TR Tay Region  
FR Forth Region  
CR Clyde Region  
TWR Tweed Region  
SR Solway Region

## 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

# Estimate of Additional Rainfall Required to Overcome Dry Conditions

Based on subsurface water storage estimated for 31<sup>st</sup> January 2022

Issue date: 03.02.2022

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

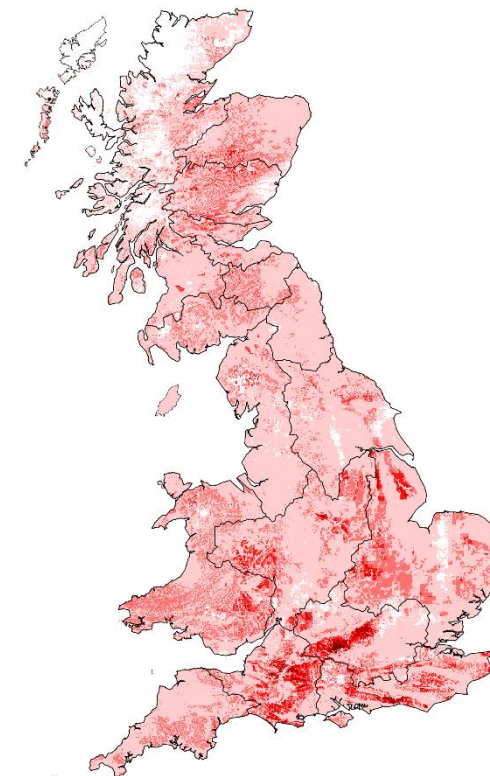
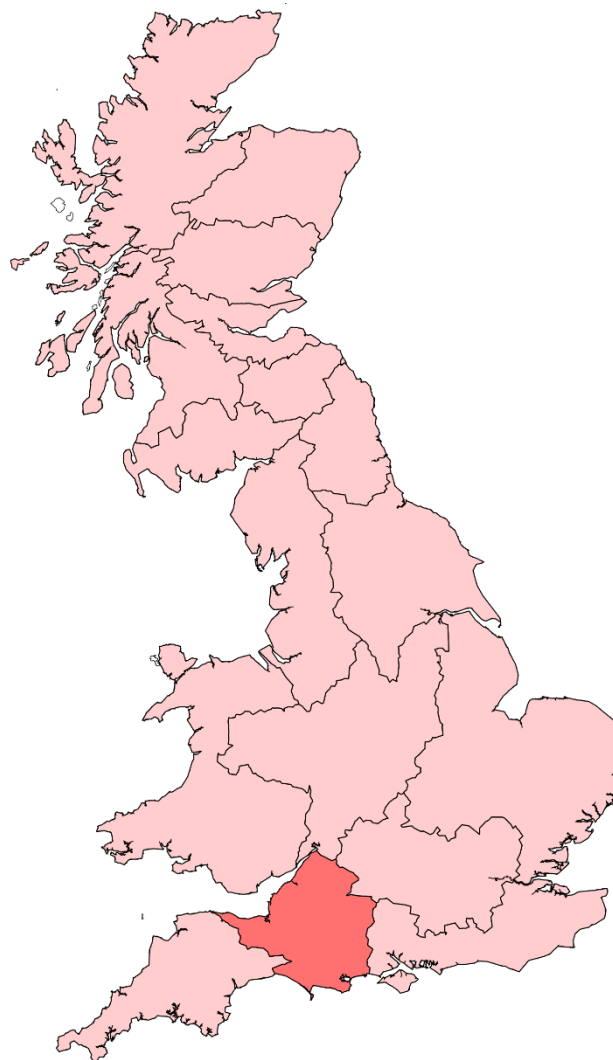
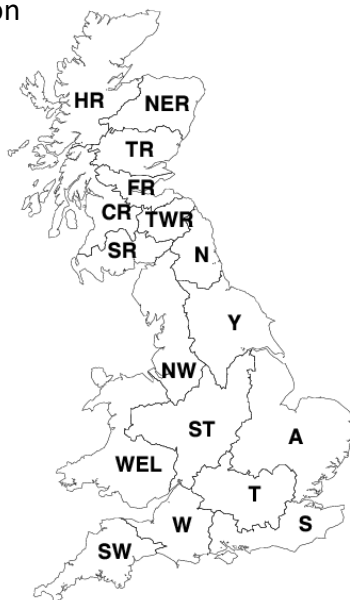
2	HR	Highlands Region
18	NER	North East Region
19	TR	Tay Region
17	FR	Forth Region
8	CR	Clyde Region
19	TWR	Tweed Region
15	SR	Solway Region

## ENGLAND

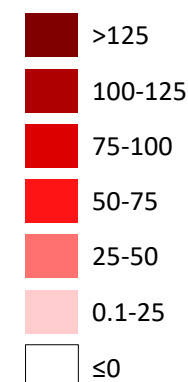
10	N	Northumbria
10	NW	North West
10	Y	Yorkshire
18	ST	Severn Trent
17	A	Anglian
20	T	Thames
30	W	Wessex
21	S	Southern
20	SW	South West

## WALES

20	WEL	Welsh
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Water storage deficit  
(anomaly, mm)

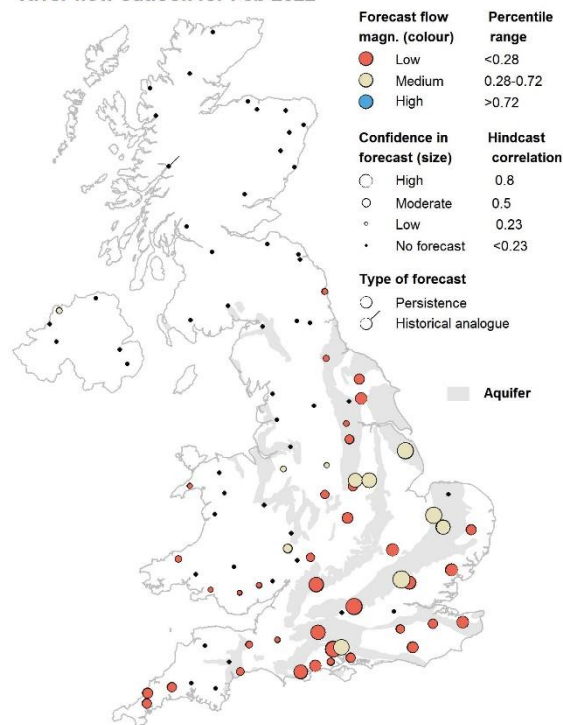




### SUMMARY

The outlook for February is for mainly below normal flows for Southern England and Wales, and normal and below normal flows for Western England. The outlook for February to April is for mainly below normal flows for Southern England, and a mixture of below normal, normal and above normal flows for Western England. Note there are no forecasts available for Scotland.

River flow outlook for Feb 2022



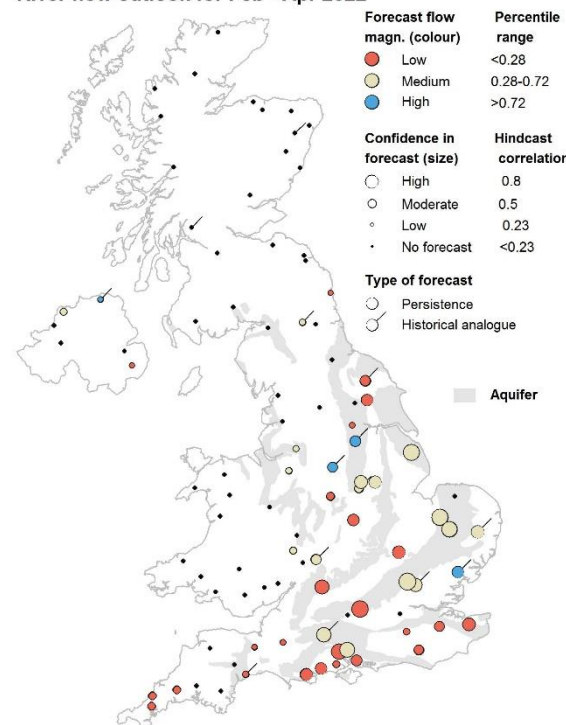
1-month flow outlook

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 Feb - Apr 2022



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.

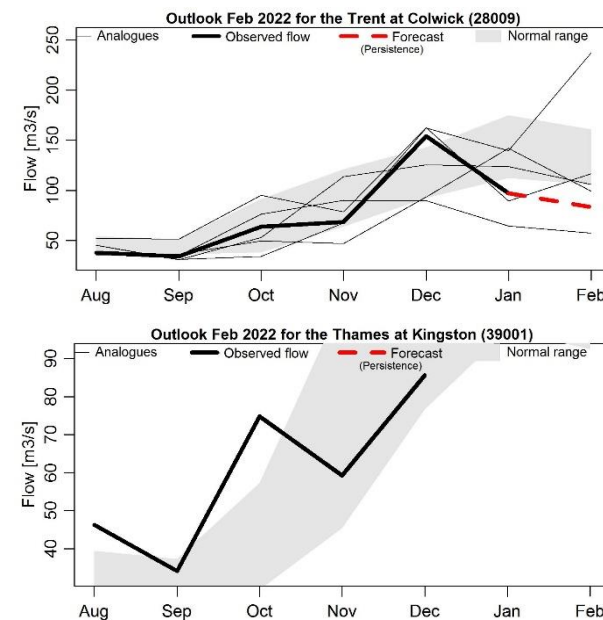
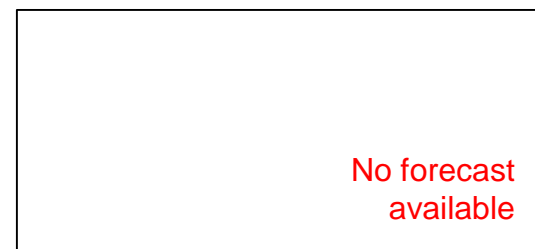
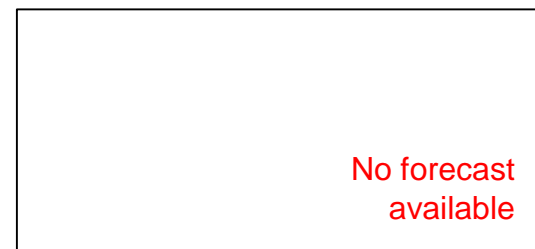
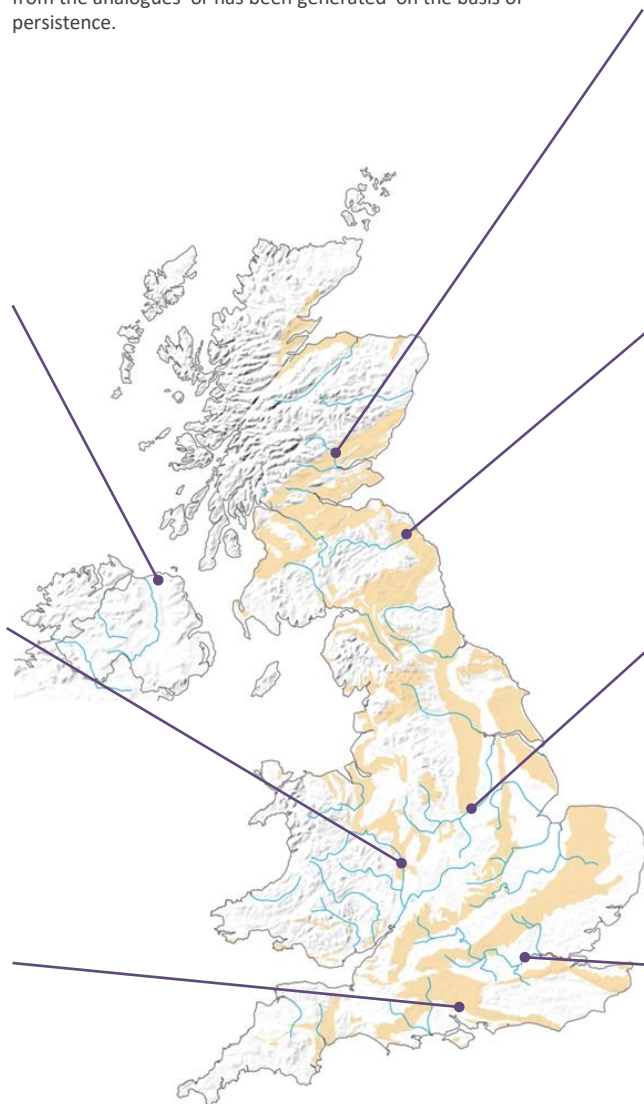
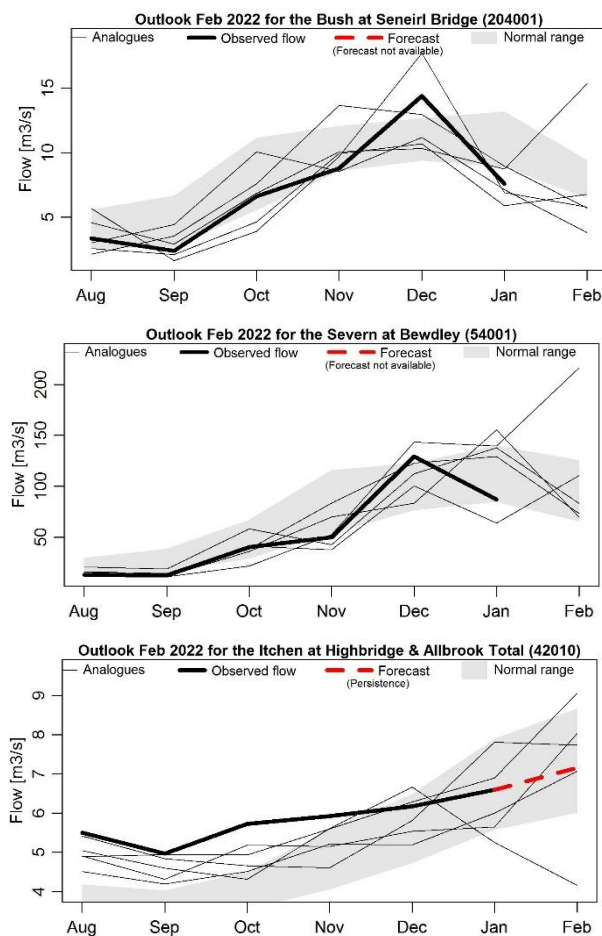
Period: February 2022

Issued on 04.02.2022 using data to the end of January 2022

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.





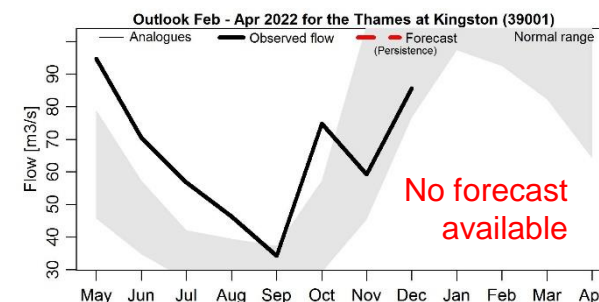
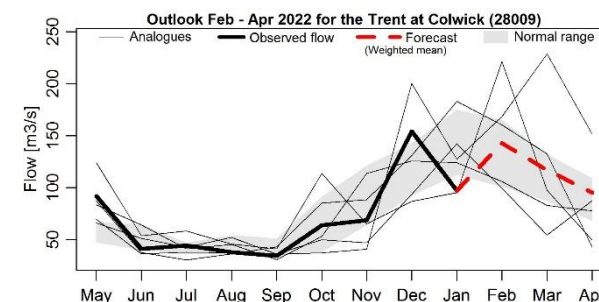
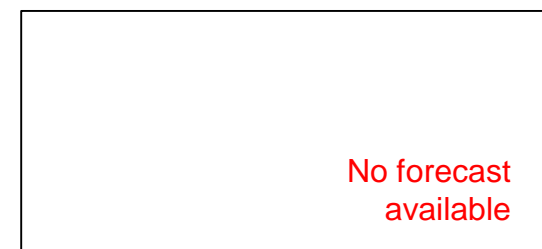
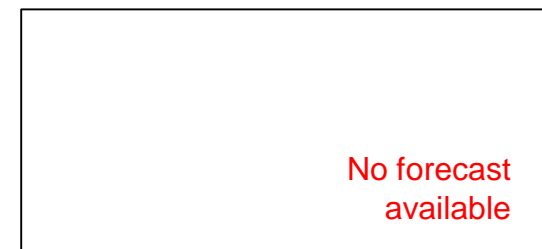
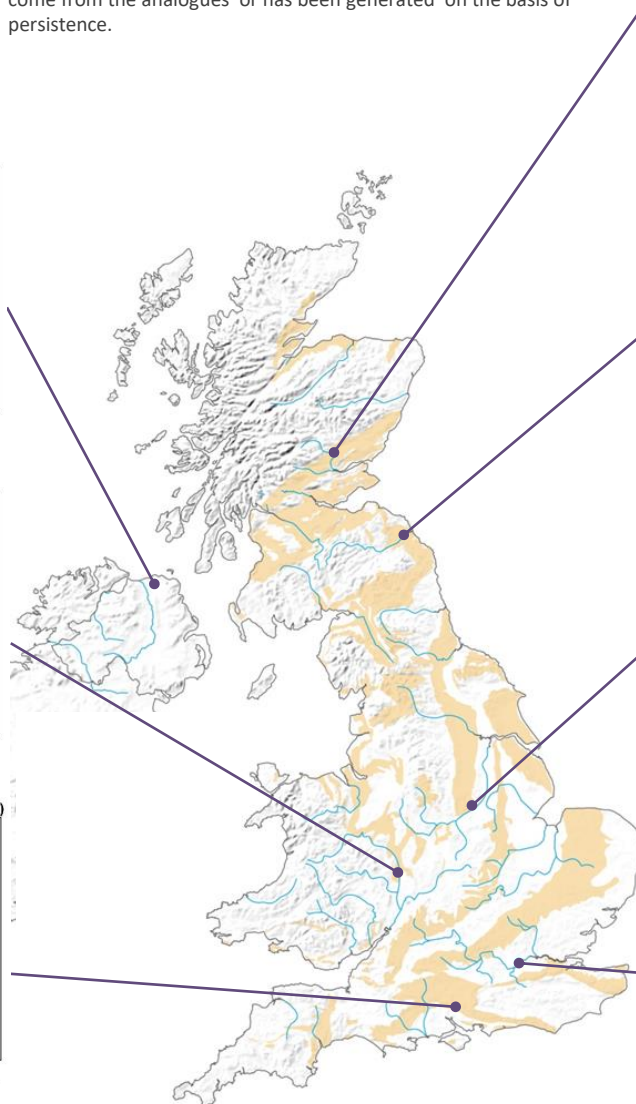
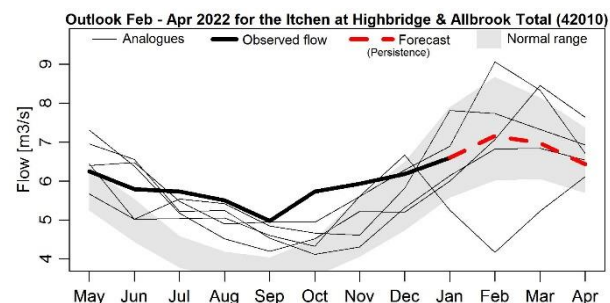
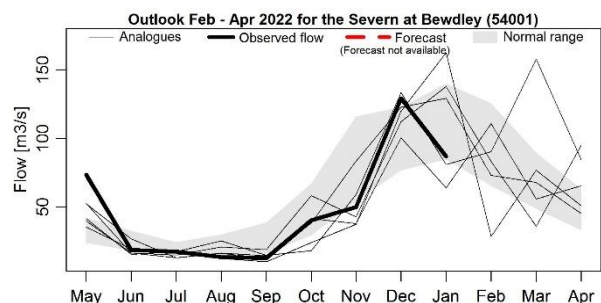
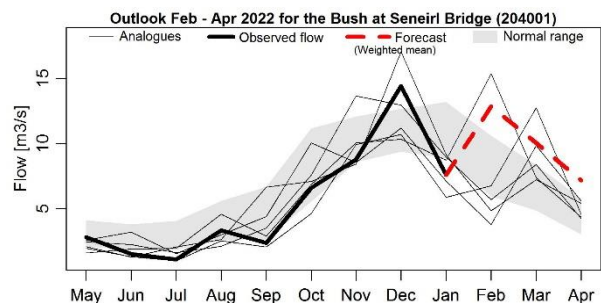
Period: February 2022 – April 2022

Issued on 04.02.2022 using data to the end of January 2022

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.

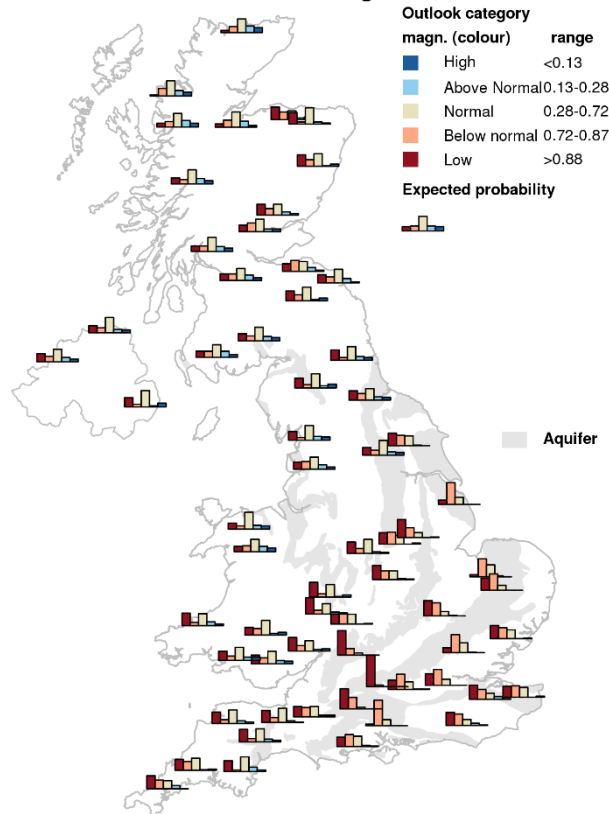


Period: February 2022 –July 2022

Issued on 02.02.2022 using data to the end of January 2022

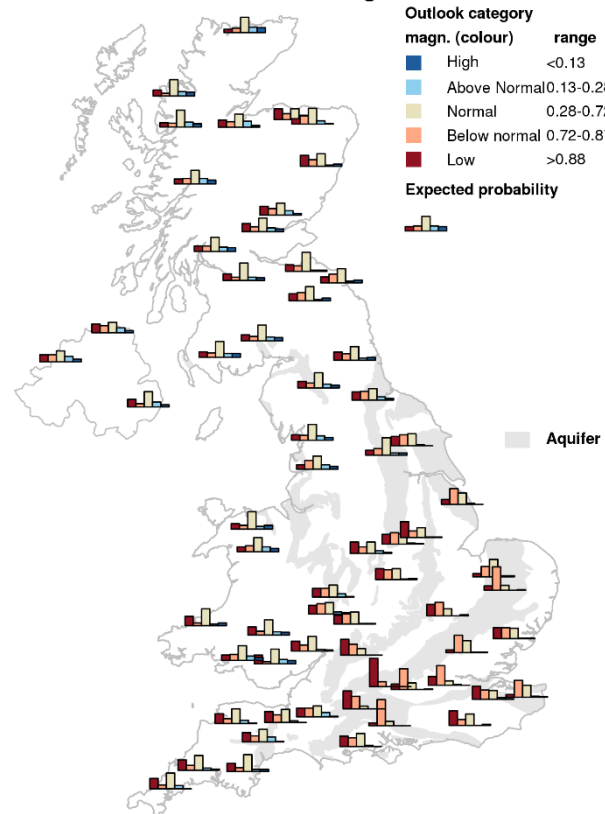
The outlook for February indicates that flows are most likely to be below normal for central and southern England, and normal to below normal for the rest of the UK. The February-March-April outlook indicates that flows will remain below normal for central and southern England with a shift towards normal flows for the rest of the UK.

### 1-month river flow outlook starting Feb 2022



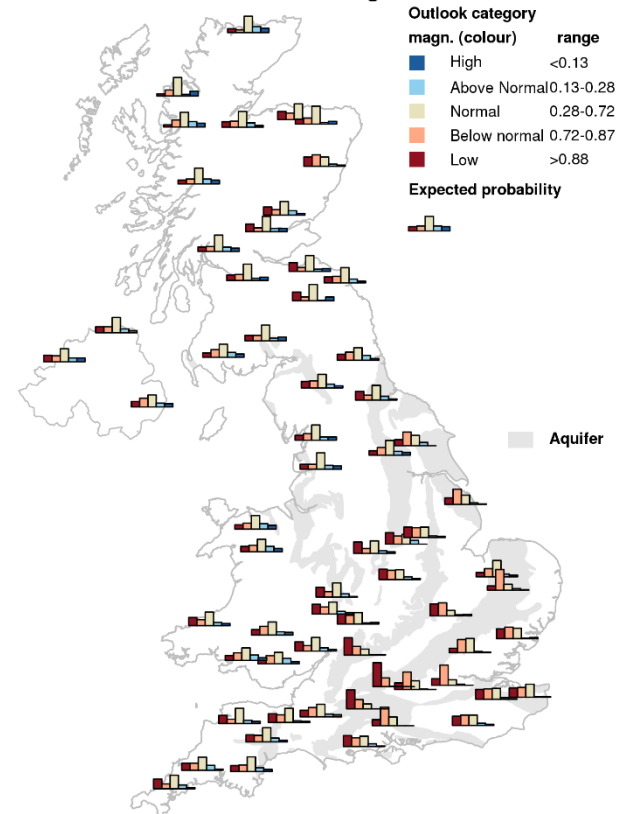
This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evapotranspiration) that form input to a hydrological model. The outputs are probabilistic simulations of the average river flow over the forecast period (1 to 12 months ahead), at each location. 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 Feb 2022



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 Feb 2022



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 January, river flows are likely to be in the *Normal range* or below except in North West Scotland where they are likely to be in the *Above Normal range*.

**Over the next 3 months** river flows are likely to be in the *Normal range* or below across most regions, except for North West Scotland where river flows are more likely to be in the *Normal range* or above.

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 1<sup>st</sup> and 3<sup>rd</sup> quartiles, actual flows may be more extreme than the flows derived using the highest or lowest rainfall forecasts.

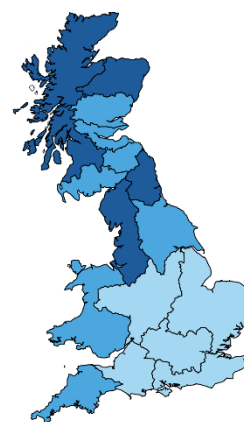
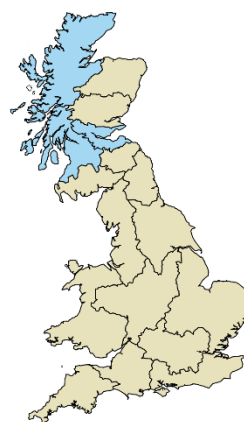
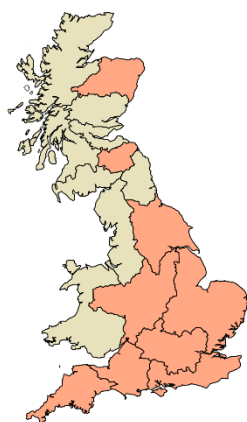
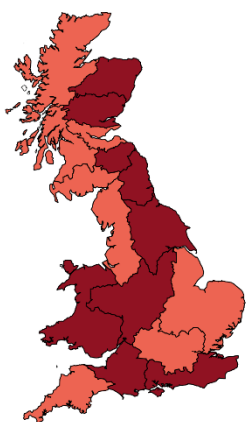
Lowest rainfall forecast

1<sup>st</sup> quartile

Median

3<sup>rd</sup> 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

## 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

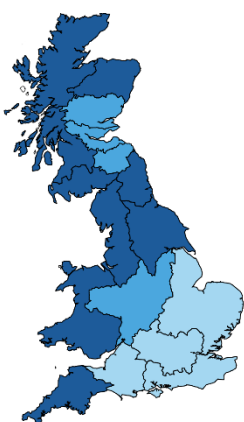
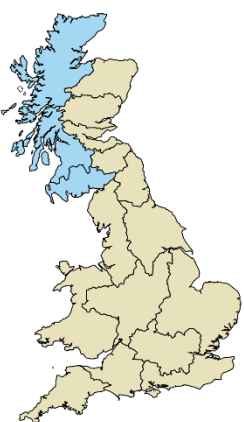
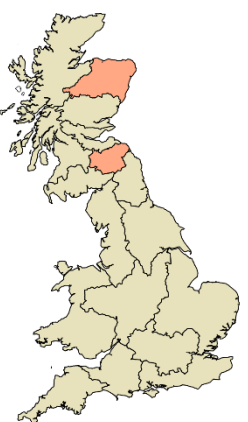
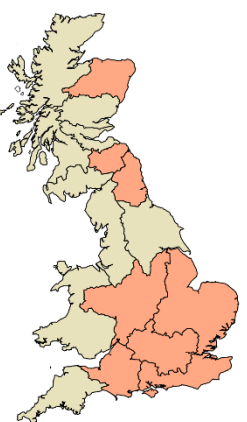
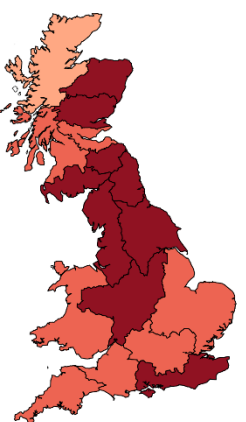
Lowest rainfall forecast

1<sup>st</sup> quartile

Median

3<sup>rd</sup> quartile

Highest rainfall forecast

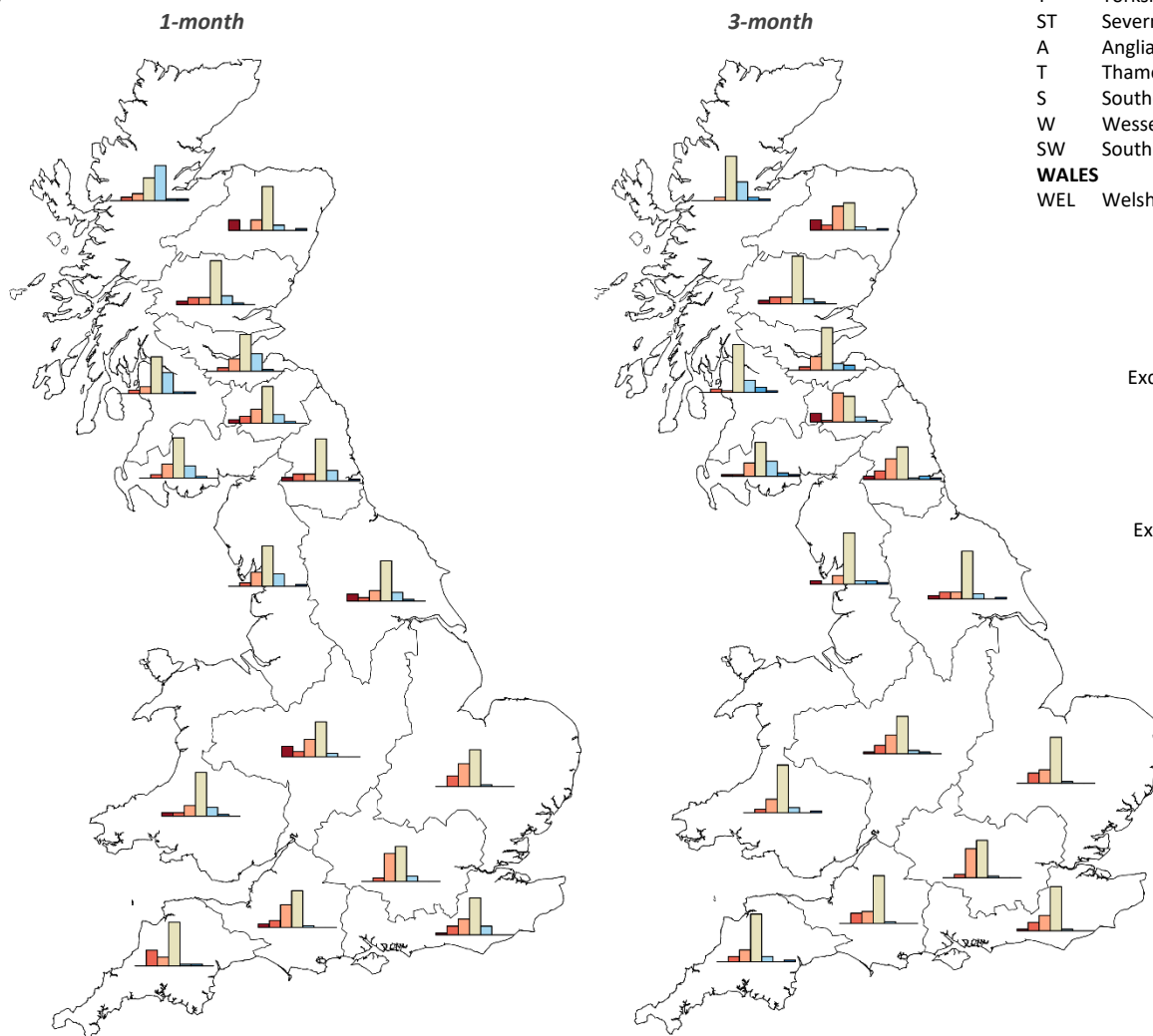
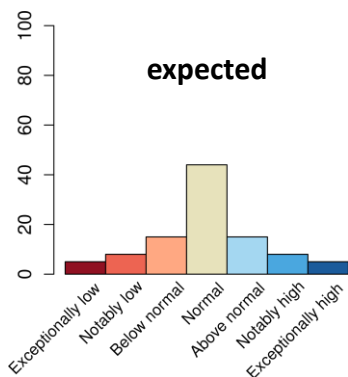


The regional maps illustrating the regional river flows for five members of the Met Office ensemble of rainfall forecasts give some indication of the range of possible river flows in the coming months. As noted previously, the actual flows could be more extreme than the flows generated by either the 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 January, river flows are likely to be in the *Normal range* or below except in North West Scotland where they are likely to be in the *Above Normal* range.

**Over the next 3 months** river flows are likely to be in the *Normal range* or below across most regions, except for North West Scotland where river flows are more likely to be in the *Normal range* or above.



## 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 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 January, river flows are likely to be in the *Normal range* or below except in North West Scotland where they are likely to be in the *Above Normal* range.

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ST Severn Trent  
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T Thames  
S Southern  
W Wessex  
SW South West

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WEL Welsh



**NORTHERN IRELAND**  
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1-month ahead	A	NW	N	ST	SW	S	T	Welsh	W	Y	CR	FR	HR	NER	SR	TR	TWR
Exceptionally high flow	0	2	2	0	0	0	0	0	0	0	2	0	2	2	0	0	0
Notably high flow	0	0	0	0	2	0	0	2	0	2	2	2	2	0	2	2	2
Above normal	2	17	15	5	2	12	7	12	2	12	29	24	49	7	17	12	12
Normal range	51	56	59	49	61	51	49	61	51	56	51	51	32	61	56	61	51
Below normal	32	20	10	24	12	22	39	15	32	15	10	17	10	15	20	10	20
Notably low flow	15	5	10	7	22	12	5	5	10	5	5	5	5	0	5	10	10
Exceptionally low flow	0	0	5	15	0	2	0	5	5	10	0	0	0	15	0	5	5

3-months ahead	A	NW	N	ST	SW	S	T	Welsh	W	Y	CR	FR	HR	NER	SR	TR	TWR
Exceptionally high flow	0	2	2	0	2	0	0	2	0	2	2	0	2	2	2	0	0
Notably high flow	0	5	5	2	0	0	0	0	0	0	7	7	5	0	5	2	2
Above normal	2	5	2	5	7	2	2	7	2	7	17	10	26	5	21	7	7
Normal range	64	71	45	52	67	62	52	67	67	67	67	60	62	38	48	67	36
Below normal	19	12	29	26	17	21	40	19	17	10	2	19	5	33	19	10	40
Notably low flow	14	0	12	12	7	12	5	5	14	10	5	5	0	7	2	10	2
Exceptionally low flow	0	5	5	2	0	2	0	0	0	5	0	0	0	14	2	5	12



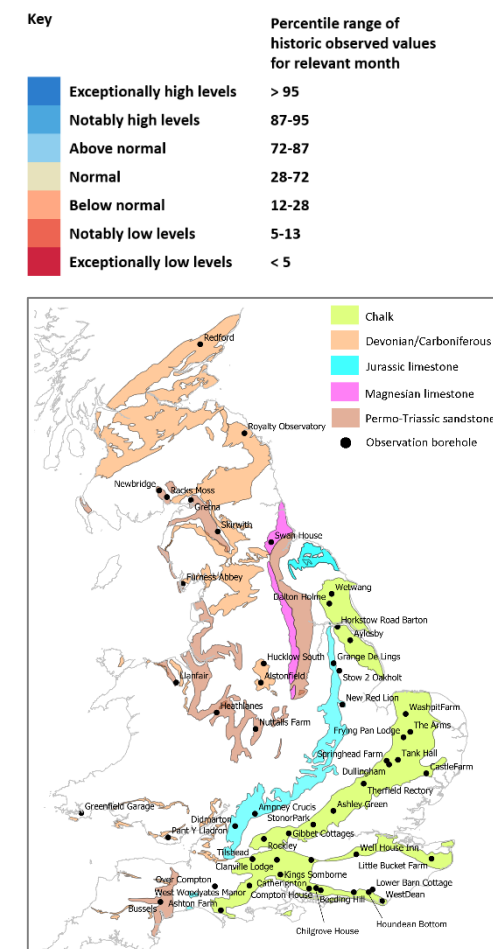
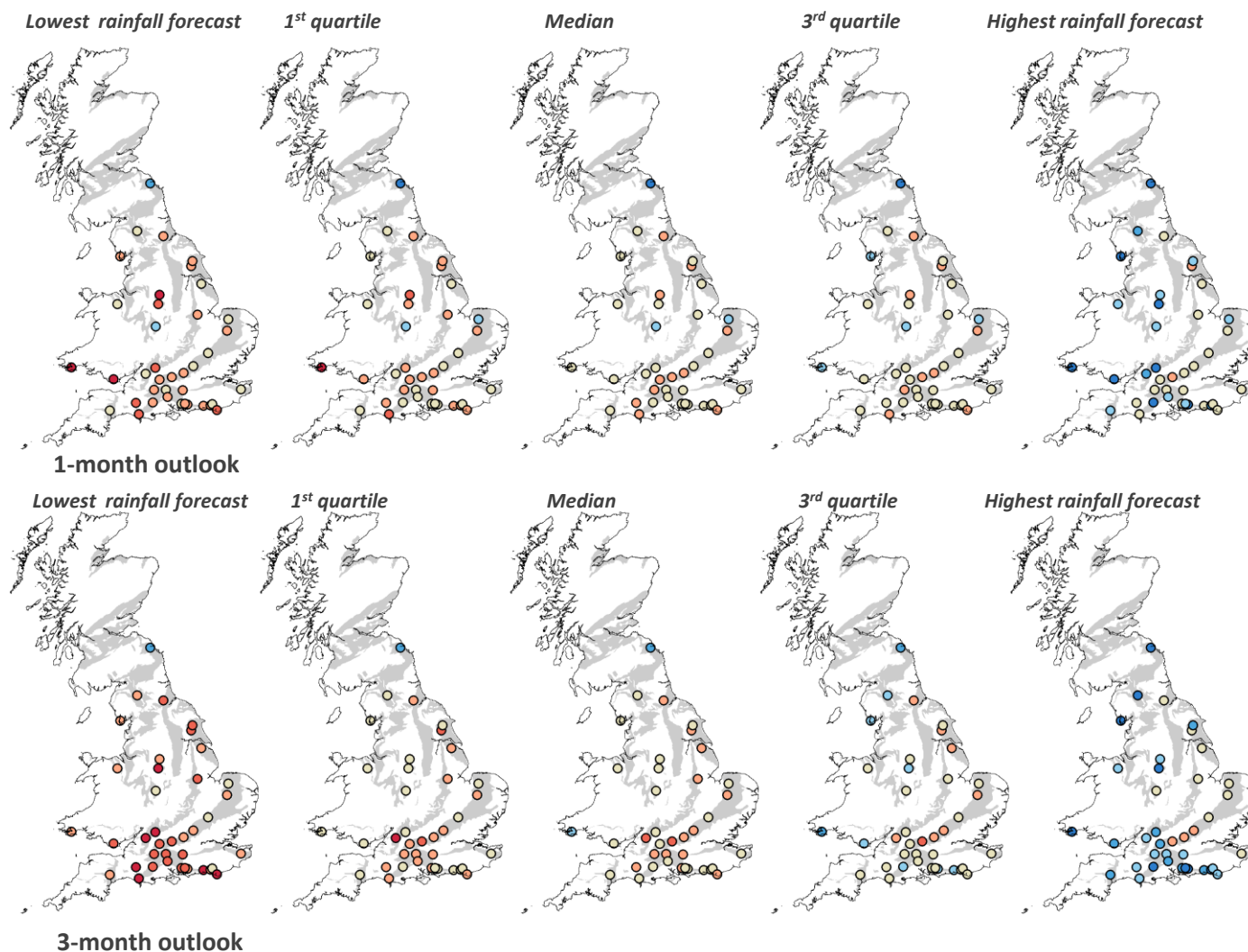
Period: February 2022 – April 2022

Issued on 07.02.2022 using data to the end of January

Over the next month, normal to below normal groundwater levels are forecast across much of England and Wales. Some exceptions are noted, including exceptionally high levels predicated at Royalty Observatory in the one month, tending towards notably high over three months. In the three month forecast, groundwater levels at several more Chalk sites are predicted to be below normal, with some exceptionally low values. 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.



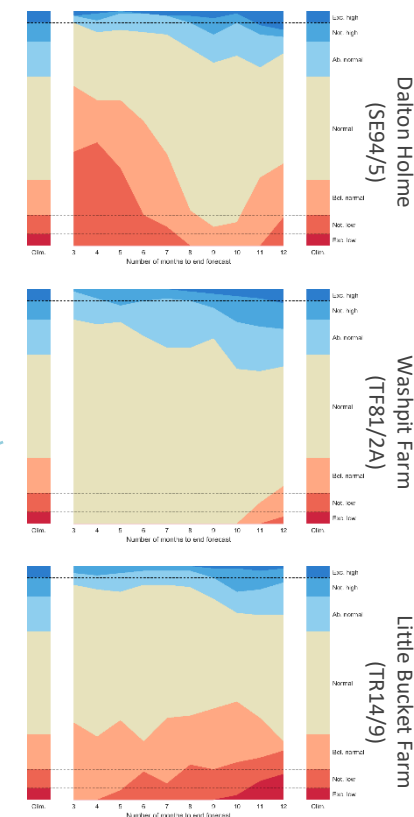
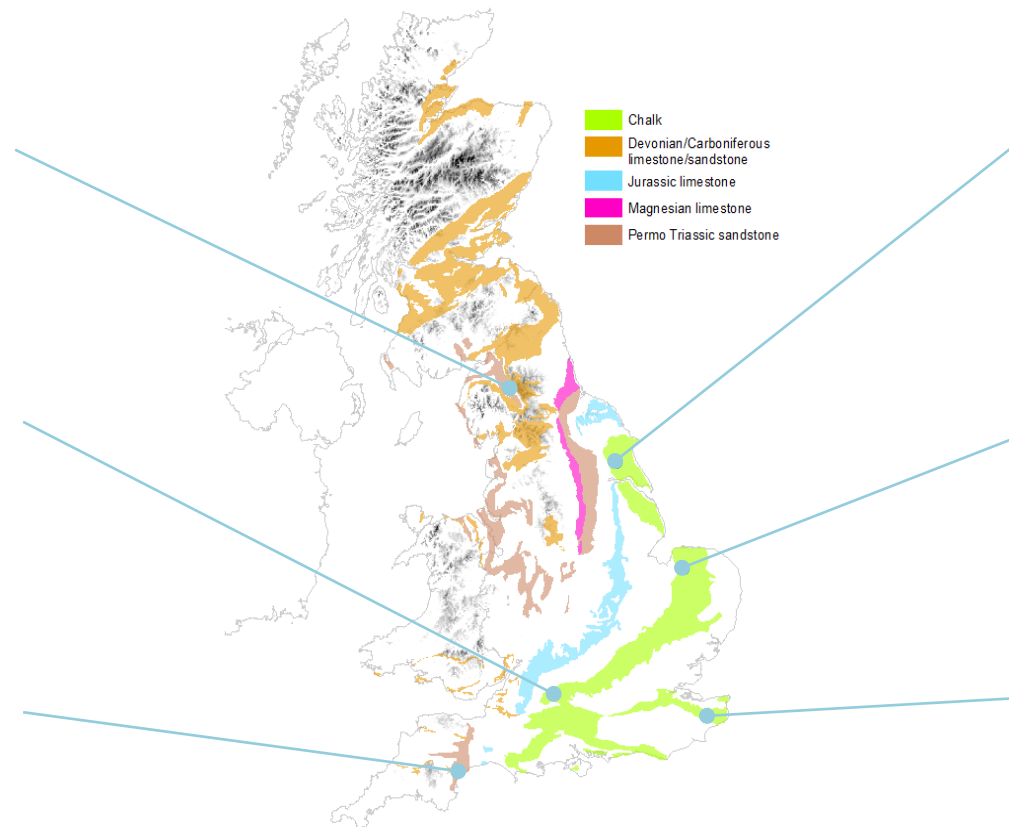
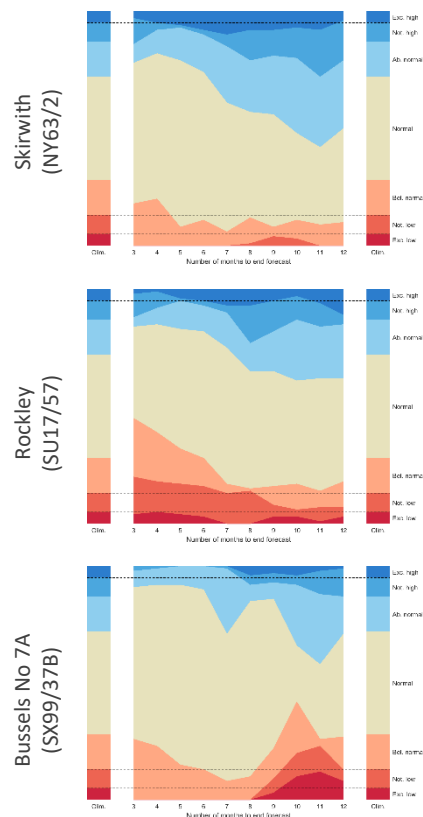
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: [www.hydoutuk.net](http://www.hydoutuk.net)

## Outlook based on modelled groundwater from historical climate

Period: February 2022 – January 2022

Issued on 07.02.2022 using data to the end of January

The groundwater levels are predicted to be predominantly normal in the Chalk sites at Rockley, Washpit Farm and Little Bucket Farm over the next 12 months. At Dalton Holme, normal to below normal levels are predicted in the next 7 months, then normal levels are likely to prevail between 7-12 months. In the Permo-Triassic sandstone at Skirwith levels are predicted to remain above 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.