UK Hydrological Outlook

Delivered in partnership by:
UK Centre for Ecology & Hydrology

SUMMARY The outlook for July is for below normal river flows in the north and west of the UK, and for normal to below normal river flows elsewhere. For groundwater, normal to below normal levels are expected, with the exception of in southern England where normal to above normal levels are most likely. For July–September, the outlook is for normal to below normal river flows and groundwater levels across the UK although normal to above normal groundwater levels are likely to persist in parts of southern England.

Rainfall:

June rainfall was below average across the UK. Some areas, including south-west England, East Anglia and south Wales, received less than half of the expected rainfall. There were some isolated areas of above average rainfall in central England and Scotland attributed to heavy, and often thundery, showers. The forecast (issued by the Met Office on 26.06.2023) shows for July that the chances of a dry or wet month are similar, and for the July–September period there is a slight increase in the likelihood of drier than average conditions. Over both of these periods the forecast is for considerably warmer than average temperatures (two times the usual chance for July–September), and as such, there is an increased chance of localised thundery downpours.
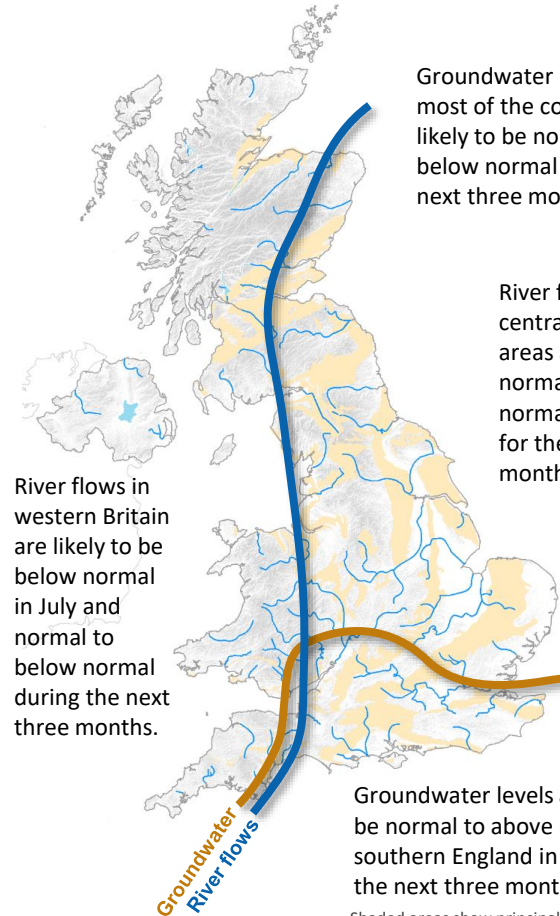
River flows:

River flows in June were below normal across much of the country, exceptionally so in Scotland (where many catchments registered their lowest June river flows on record), Wales and north-west England. In central and southern England river flows were normal and above normal.

The outlook for July is for below normal flows across western Britain, and elsewhere, normal to below normal flows are expected. The outlook for the July–September period is similar, although with normal to below normal flows expected across the country. In southern England for both these periods, groundwater-fed catchments are likely to see their normal to above normal flows persisting.

Groundwater:

Groundwater levels in June were mainly normal or below normal across the country, with the exception of southern England, where groundwater levels were above normal and in some cases, notably so.

As seasonal recessions continue, the outlook for July and for July–September, for most of the UK, is for mainly normal to below normal groundwater levels with the exception of southern England where normal to above normal levels are likely to persist.

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Groundwater levels for most of the country are likely to be normal to below normal over the next three months.

River flows in central and eastern areas are likely to be normal to below normal in July and for the next three months.

River flows in western Britain are likely to be below normal in July and normal to below normal during the next three months.

Groundwater levels are likely to be normal to above normal in southern England in July and for the next three months.

Shaded areas show principal aquifers

Groundwater
River flows

UK Centre for Ecology & Hydrology

BGS British Geological Survey

Department for Infrastructure An Roinn Bonneagair www.infrastructure-ni.gov.uk

Environment Agency

Met Office

Cyfoeth Naturiol Cymru Natural Resources Wales

SEPA Scottish Environment Protection Agency

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

	Percentile
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.

Your use of the Content is entirely at your own risk. We make no warranty, representation or guarantee that the Content is error free or fit for your intended use.

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

Copyright:

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, 2023, July, 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:
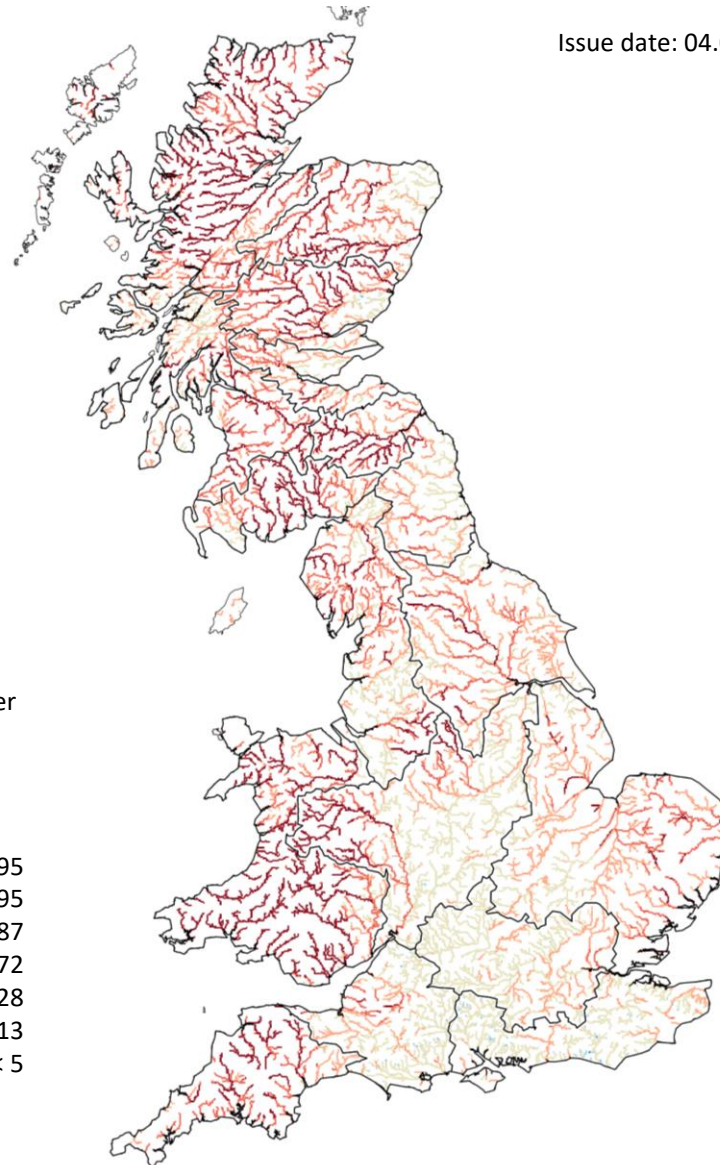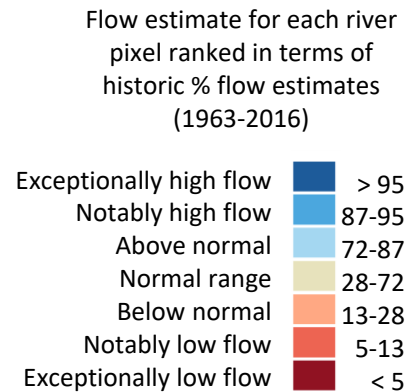https://eip.ceh.ac.uk/hydrology/water-resources/

UK Centre for Ecology & Hydrology

June's mean river flows as simulated by the Grid-to-Grid hydrological model

Issue date: 04.07.2023

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.

Flow estimate for each river pixel ranked in terms of historic % flow estimates (1963-2016)

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

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UK Centre for Ecology & Hydrology

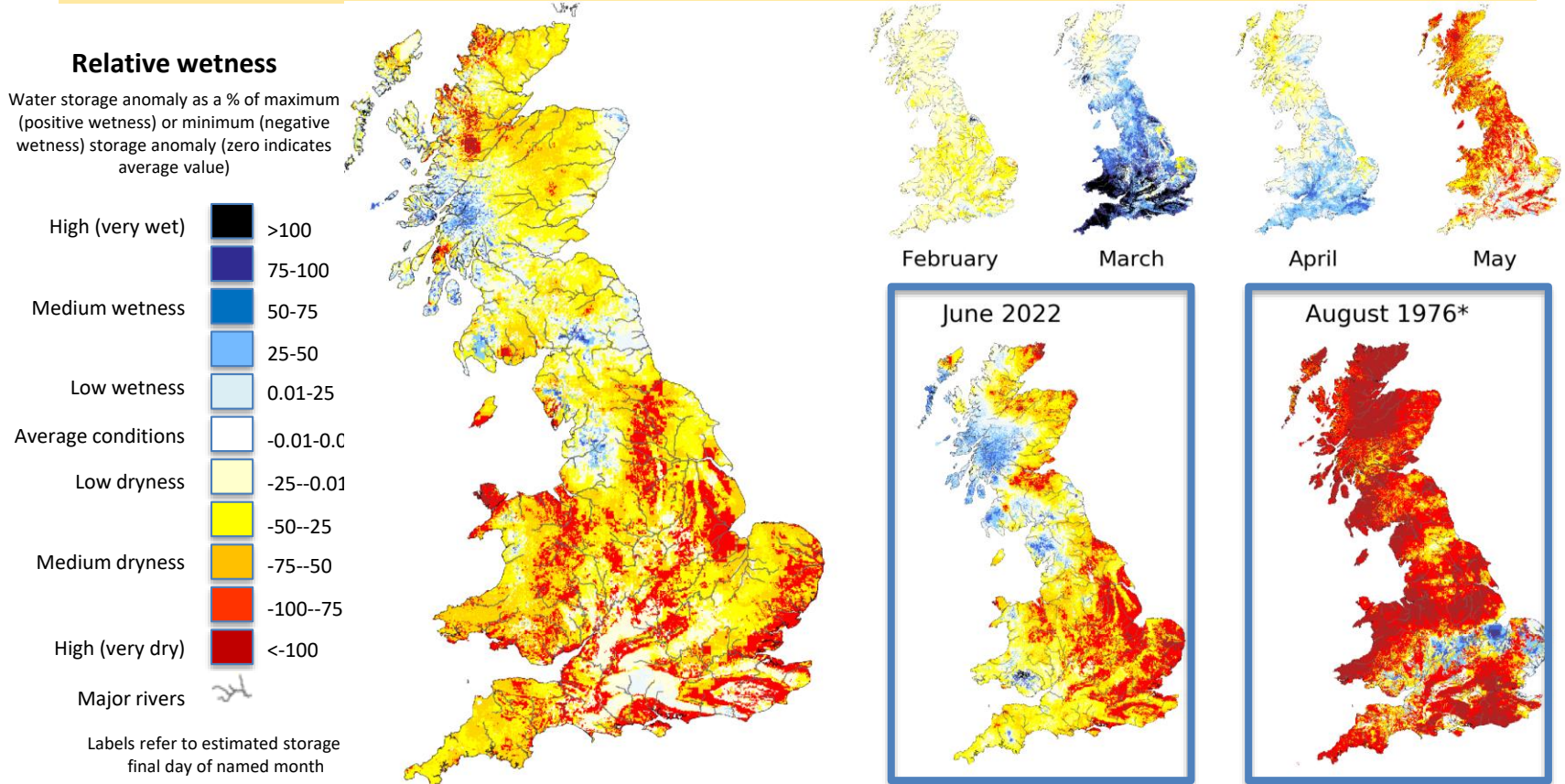# Current Daily Simulated Subsurface Water Storage Conditions

Based on subsurface water storage estimated for 30 June 2023

Issue date: 04.07.2023

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".
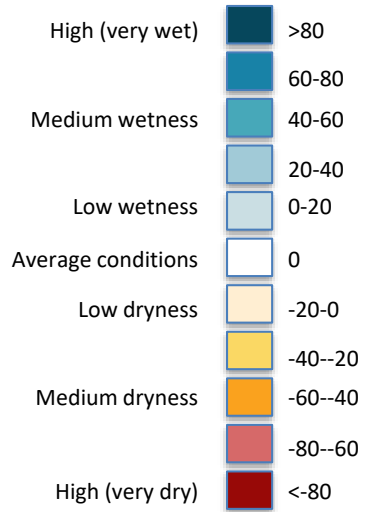
These maps do not provide a forecast and are not maps of soil moisture. Instead they indicate areas which are particularly wet or dry. Rainfall in areas with high positive relative wetness could result in flooding in the coming days/weeks. Areas of negative relative wetness provide an indication of locations 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 June, subsurface water levels were lower (drier) than is typical for this time of year across most of Great Britain, apart from some areas of average conditions in the southeast. There were also scattered areas where subsurface water levels were wetter than average, particularly in the Lake District and western Scotland.
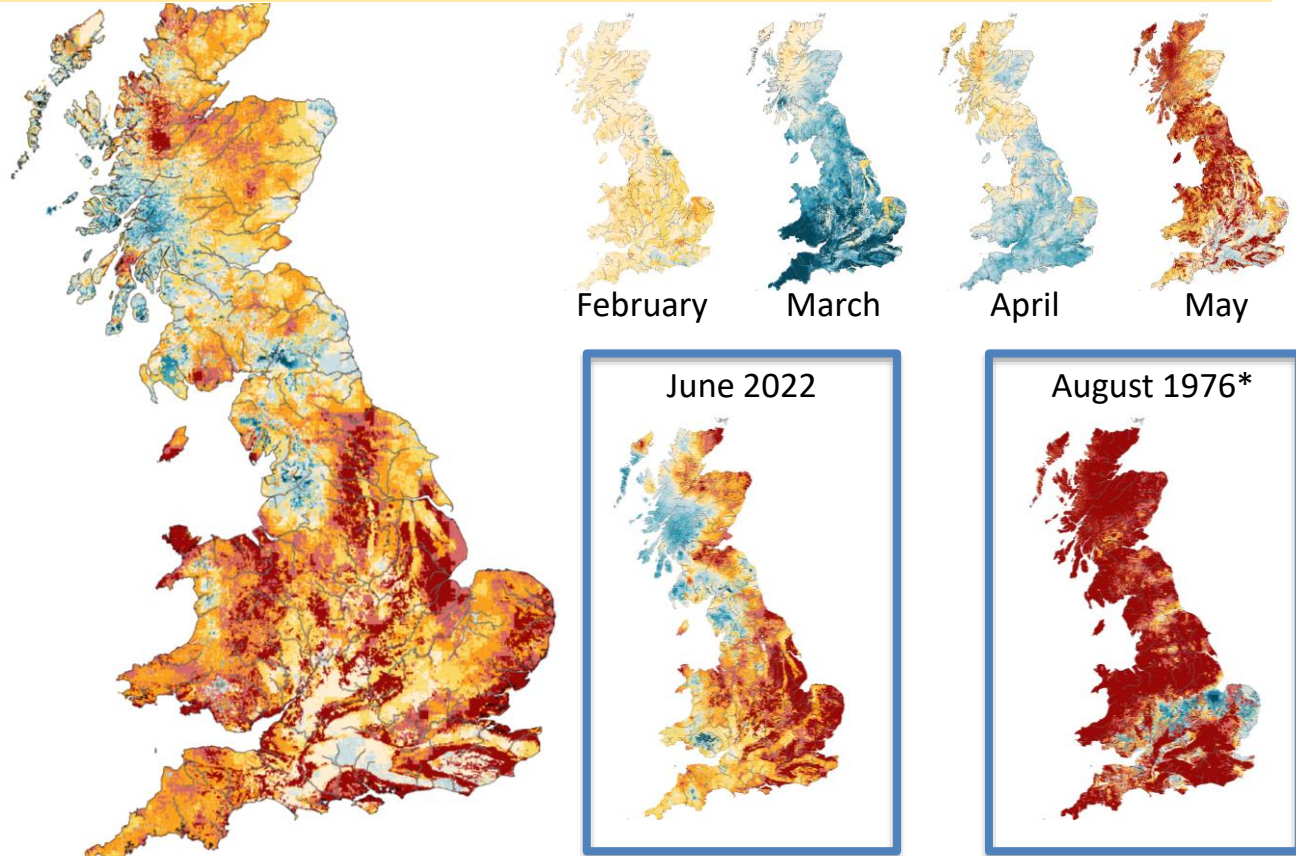
Relative wetness

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

High (very wet)	>100
	75-100
Medium wetness	50-75
	25-50
Low wetness	0.01-25
Average conditions	-0.01-0.0
Low dryness	-25--0.01
	-50--25
Medium dryness	-75--50
	-100--75
High (very dry)	<-100

Major rivers

Labels refer to estimated storage final day of named month

February   March   April   May

June 2022

August 1976*

*Example month displaying extreme negative wetness

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Current Daily Simulated SOIL MOISTURE Conditions

UK Centre for Ecology & Hydrology

Based on soil moisture estimated for 30 June 2023

Issue date: 04.07.2023

These maps are based on Grid-to-Grid (G2G) hydrological model simulated soil moisture, expressed as an anomaly from the historical monthly mean. To highlight areas that are particularly wet or dry, the soil moisture anomaly is presented here using a colour scale highlighting soil moisture 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. These maps are prototype representations of model estimates of soil moisture, which are currently under development.

Soil moisture will often look similar to total storage (shown on the previous slide), since total storage comprises both soil moisture and storage in the saturated zone.

SUMMARY: At the end of June, soil wetness was lower (drier) than is typical for this time of year across most of Great Britain, apart from some areas of average wetness in the southeast. There were also scattered areas where soil wetness was higher than average, particularly in the Lake District and western Scotland.

Relative soil wetness

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

High (very wet)	>80
	60-80
Medium wetness	40-60
	20-40
Low wetness	0-20
Average conditions	0
Low dryness	-20-0
	-40--20
Medium dryness	-60--40
	-80--60
High (very dry)	<-80

Major rivers

Labels refer to estimated soil moisture on final day of named month

February   March   April   May

June 2022

August 1976*

*Example month displaying extreme negative wetness

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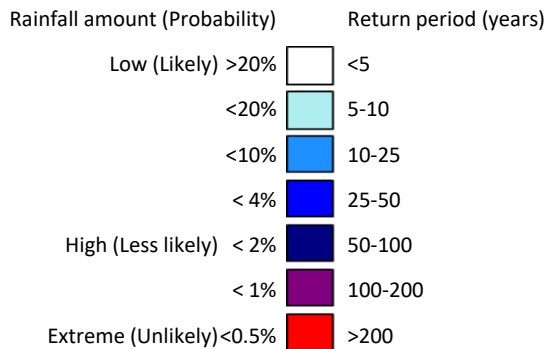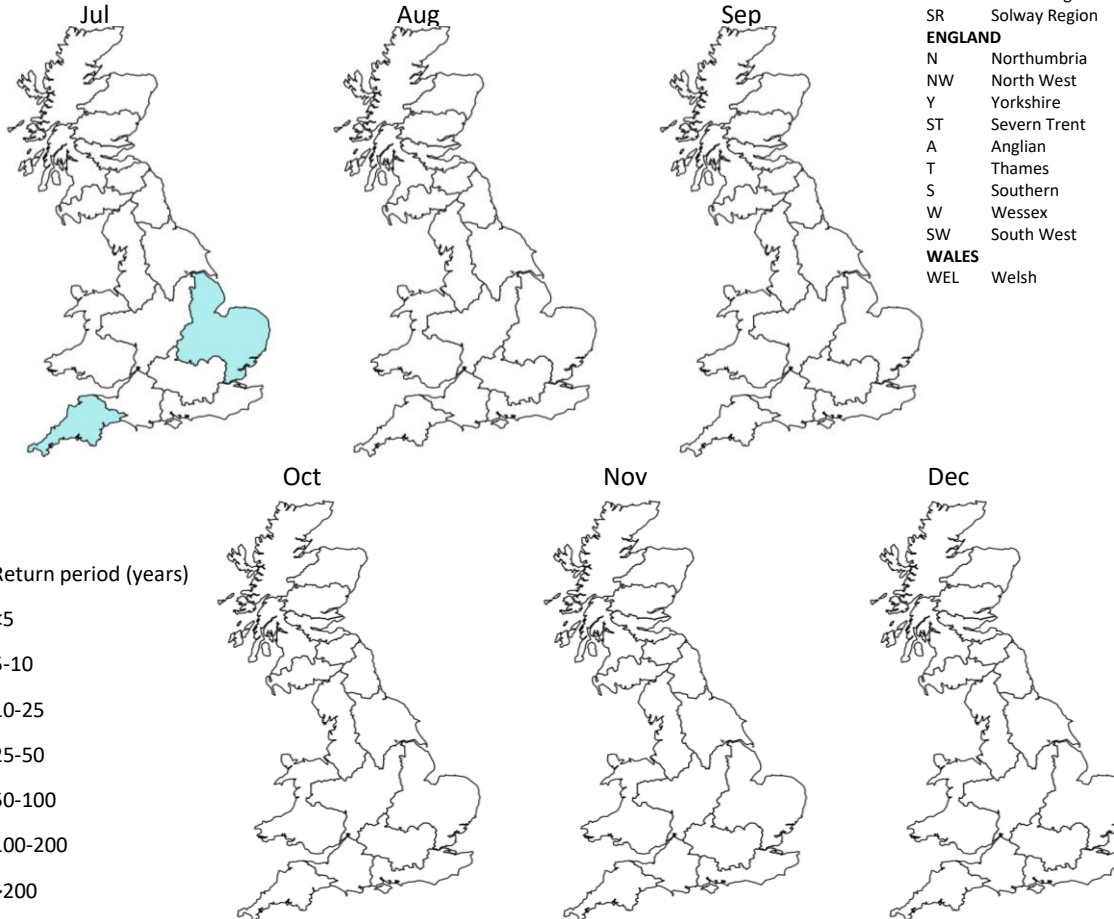# Return Period of Rainfall Required to Overcome Dry Conditions

Period: July 2023 - December 2023

Issue date: 04.07.2023

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.

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

SUMMARY: During July, Anglian and South West would require 5-10 year return period rainfall to overcome the dry conditions.

By August , Great Britain would not require particularly unusual rainfall (<5 year return periods) to return to average conditions for the time of year.

Jul
Aug
Sep

Oct
Nov
Dec

Rainfall amount (Probability)		Return period (years)
Low (Likely) >20%	☐	<5
<20%	☐	5-10
<10%	☐	10-25
< 4%	☐	25-50
High (Less likely) < 2%	☐	50-100
< 1%	☐	100-200
Extreme (Unlikely) <0.5%	☐	>200

UK Centre for Ecology & Hydrology
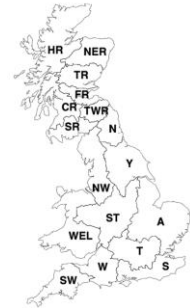
Estimate of Additional Rainfall Required to Overcome Dry Conditions

Based on subsurface water storage estimated for 30 June 2023
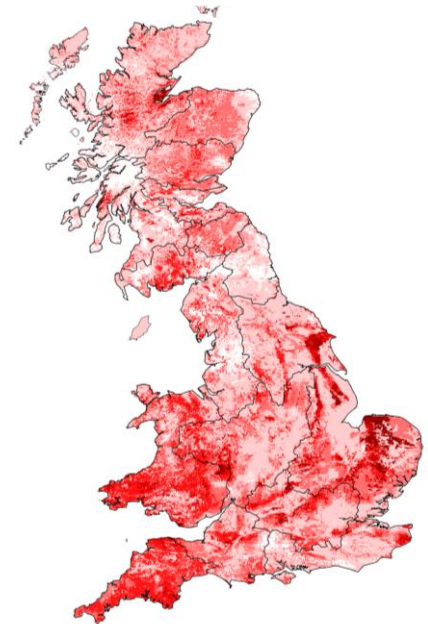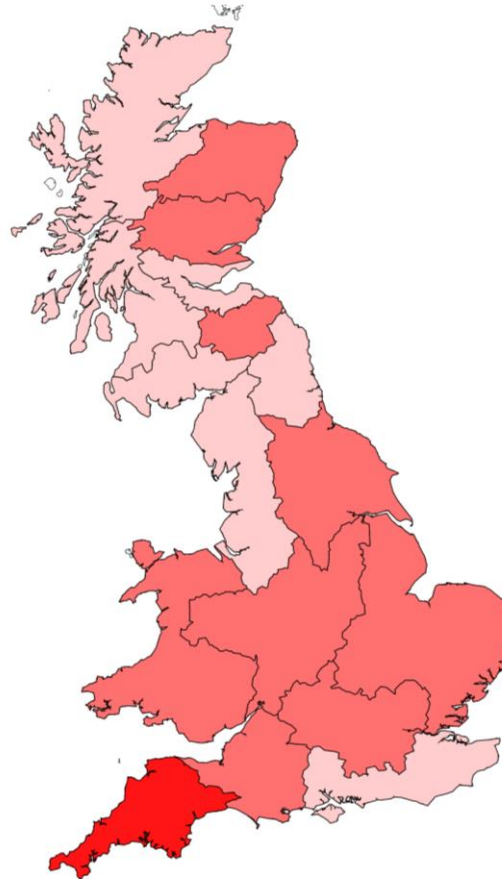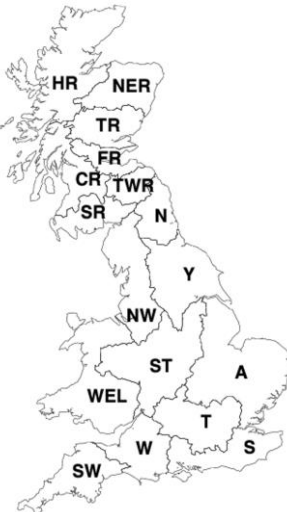
Issue date: 04.07.2023

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

20	HR	Highlands Region
26	NER	North East Region
28	TR	Tay Region
20	FR	Forth Region
5	CR	Clyde Region
27	TWR	Tweed Region
23	SR	Solway Region

ENGLAND

5	N	Northumbria
14	NW	North West
26	Y	Yorkshire
29	ST	Severn Trent
40	A	Anglian
31	T	Thames
29	W	Wessex
17	S	Southern
50	SW	South West

WALES

44	WEL	Welsh

Water storage deficit (anomaly; mm)

>125
100-125
75-100
50-75
25-50
0-25
<0

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# Outlook based on hydrological persistence and analogy

Overview
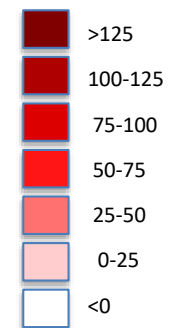
Period: July 2023 – September 2023

Issued on 06.07.2023 using data to the end of June 2023

SUMMARY:

The July outlook is for mainly below normal flows in Scotland, Wales, and northern England. In central and southern England flows tend towards normal, and in some cases e.g on the southern Chalk, they are above normal. The pattern is similar for the July – September Outlook, however more catchments are normal in England and Wales. Please note that not many forecasts are available in western Scotland for the July – September outlook.
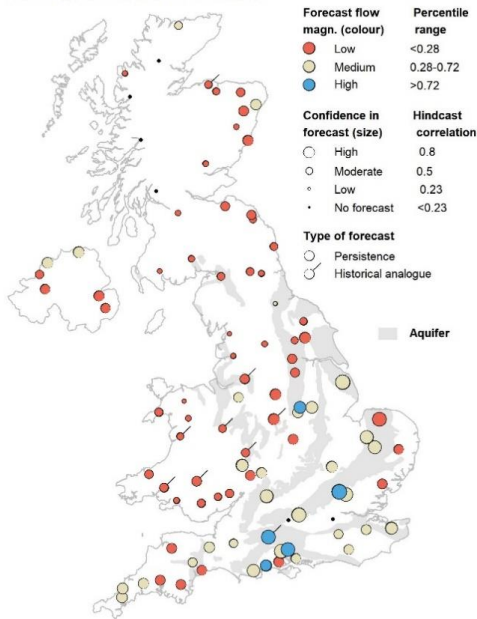
1-month flow outlook
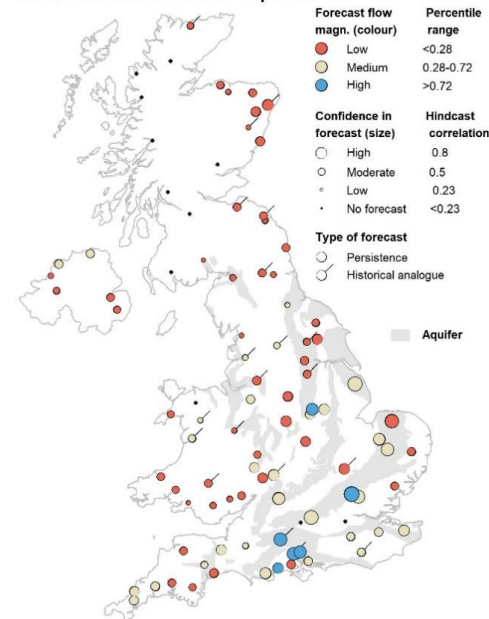
3-month flow outlook

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 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.
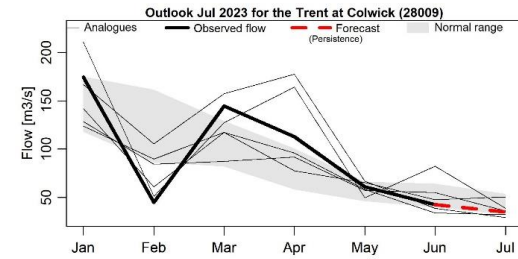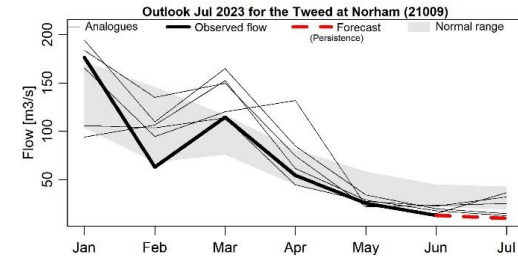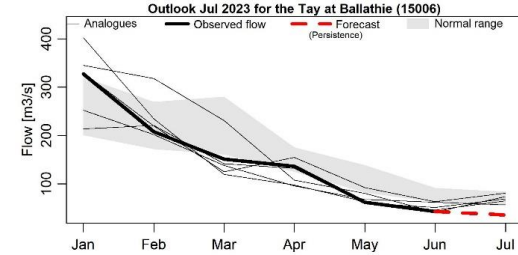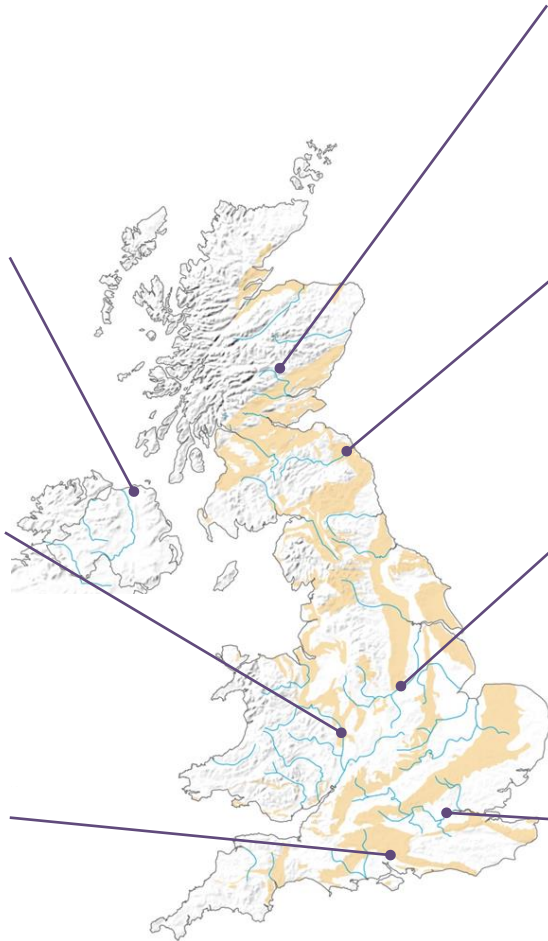
Outlook based on hydrological persistence and analogy

Site-based: 1 month outlook

Period: July 2023

Issued on 06.07.2023 using data to the end of June 2023
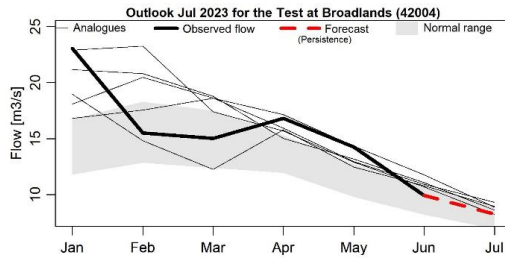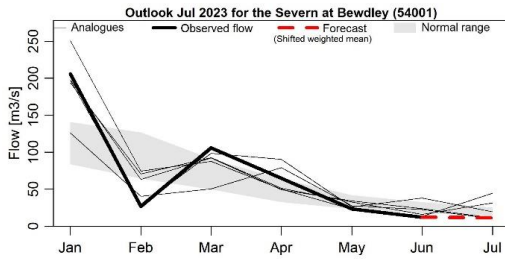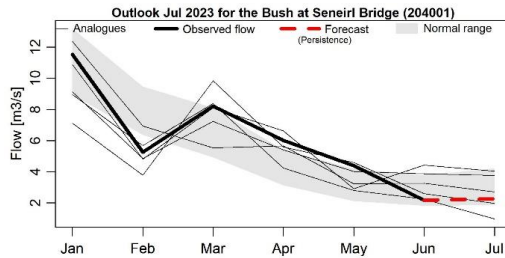
These figures provide insight into the hydrological analogue methodology for a set of sites from across the UK.

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.

UK Centre for Ecology & Hydrology

Outlook Jul 2023 for the Tay at Ballathie (15006)

Outlook Jul 2023 for the Bush at Seneirl Bridge (204001)

Outlook Jul 2023 for the Tweed at Norham (21009)

Outlook Jul 2023 for the Severn at Bewdley (54001)

Outlook Jul 2023 for the Trent at Colwick (28009)

Outlook Jul 2023 for the Test at Broadlands (42004)

No forecast available

![UK Centre for Ecology & Hydrology]

Outlook based on hydrological persistence and analogy

Site-based: 3 month outlook

Period: July 2023 – September 2023

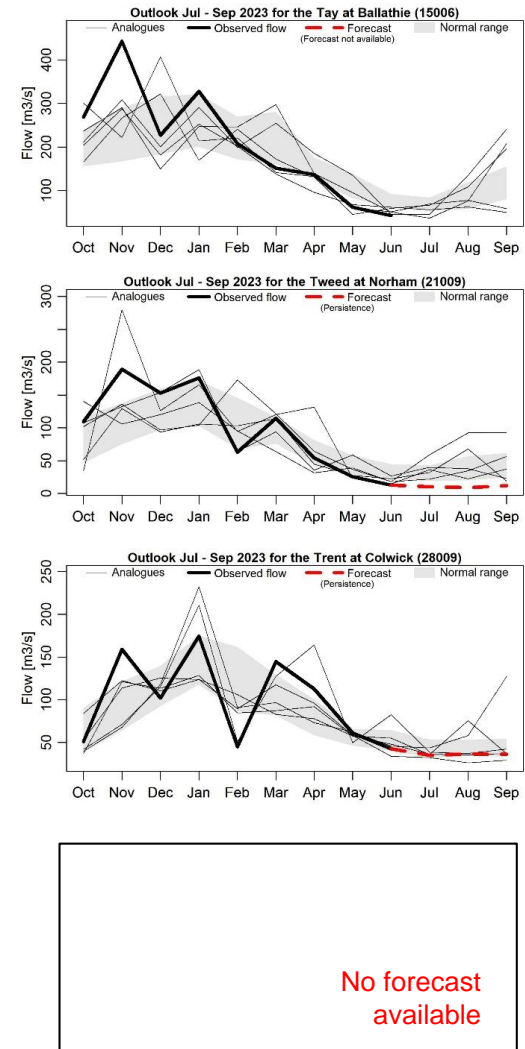Issued on 06.07.2023 using data to the end of June 2023

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.

Outlook Jul - Sep 2023 for the Tay at Ballathie (15006)

Outlook Jul - Sep 2023 for the Bush at Seneirl Bridge (204001)

Outlook Jul - Sep 2023 for the Tweed at Norham (21009)

Outlook Jul - Sep 2023 for the Severn at Bewdley (54001)

Outlook Jul - Sep 2023 for the Trent at Colwick (28009)

Outlook Jul - Sep 2023 for the Test at Broadlands (42004)

No forecast available

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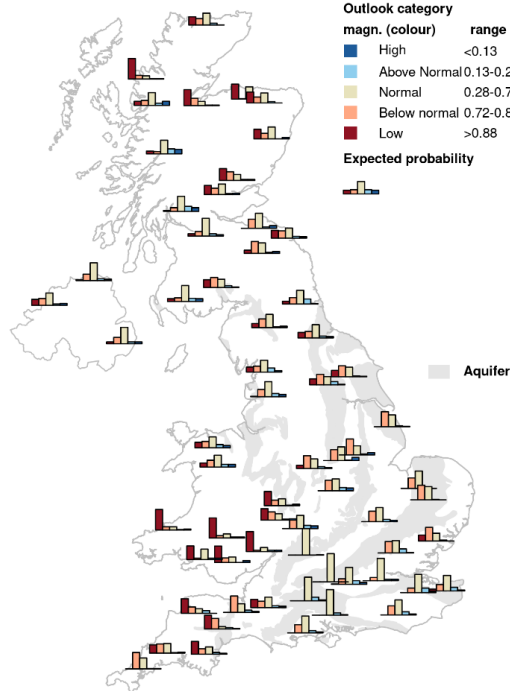# Outlook based on modelled flow from historical climate
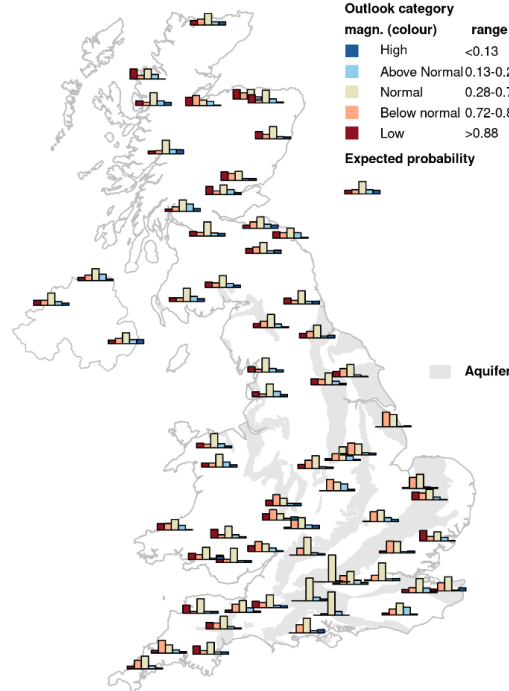
Overview

Period: July 2023 – December 2023

Issued on **05.07.2023** using data to the end of June 2022

The outlook for July indicates that flows in south-western England, Wales and eastern and northern Scotland are likely to be low, with normal to below normal flows expected elsewhere. The July-August-September outlook indicates the same pattern may persist over the coming three months, though confidence over this period is lower than the 1-month forecast.

1-month river flow outlook starting Jul 2023

Outlook category

magn. (colour)	range
High	<0.13
Above Normal	0.13-0.28
Normal	0.28-0.72
Below normal	0.72-0.87
Low	>0.88

Expected probability

Aquifer

3-month river flow outlook starting Jul 2023

Outlook category

magn. (colour)	range
High	<0.13
Above Normal	0.13-0.28
Normal	0.28-0.72
Below normal	0.72-0.87
Low	>0.88

Expected probability

Aquifer

6-month river flow outlook starting Jul 2023

Outlook category

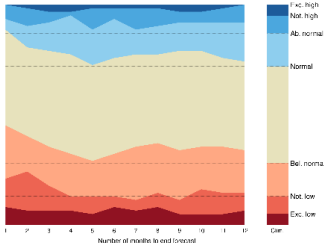| magn. (colour)	range
High	<0.13
Above Normal	0.13-0.28
Normal	0.28-0.72
Below normal	0.72-0.87
Low	>0.88

Expected probability

Aquifer

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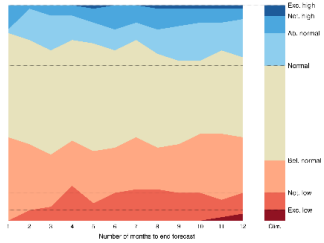
The bar plot maps show the outlook distribution for 1, 3 and 6-month period for 64 catchments across England and Wales. Each bar plot represents the probabilistic distribution of the simulated river flow compared to the historical river flow, for the same n-month period. The probabilities fall within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

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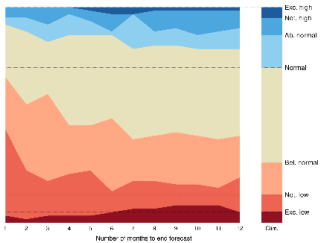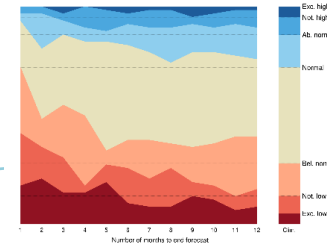
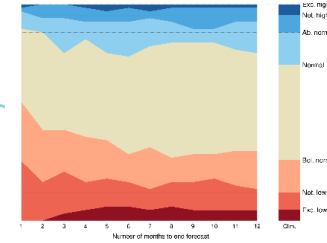The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net
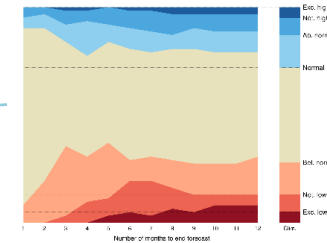
Outlook based on modelled flow from historical climate

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.

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Period: July 2023 – September 2023

Issued on 04.06.2023 using data to the end of June

SUMMARY: During July, river flows are likely to be in the *Normal range* in central and northern England, Wales and Scotland and in the *Below normal* range in southern England and Yorkshire.
Over the next 3 months river flows will most likely be in the *Below normal* range across southern England, Wales and northern Scotland, with flows in the *the Normal range* elsewhere.

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.
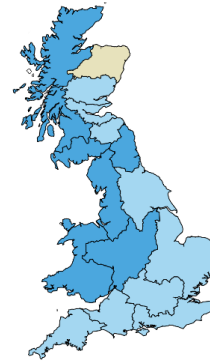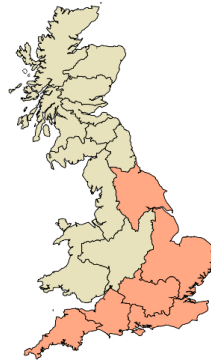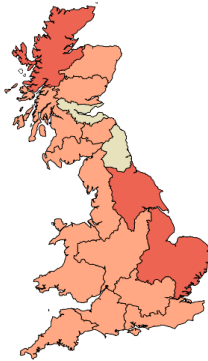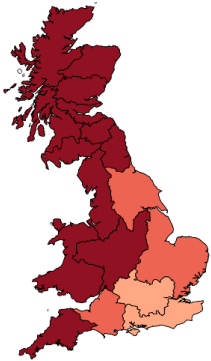
Lowest rainfall forecast	1st quartile	Median	3rd quartile	Highest rainfall forecast

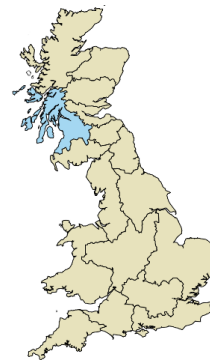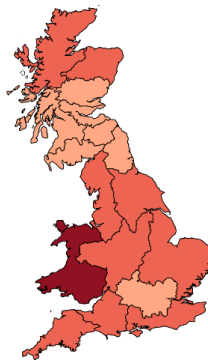| Lowest rainfall forecast	1st quartile	Median	3rd quartile	Highest rainfall forecast
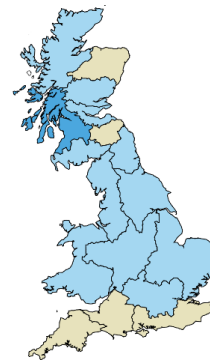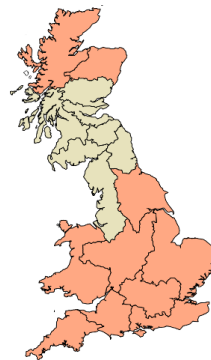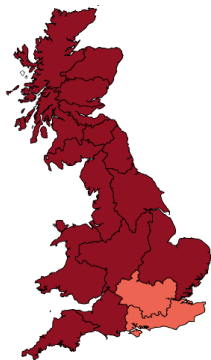
Key

	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

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

![UK Centre for Ecology & Hydrology]

Outlook based on Modelled Flow from Rainfall Forecasts

Period: July 2023 - September 2023

Issue date: 04.07.2023

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).

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

> **SUMMARY:** During July, river flows are likely to be in the *Normal range* in central and northern England, Wales and Scotland and in the *Below normal* range in southern England and Yorkshire.
> **Over the next 3 months** river flows will most likely be in the *Below normal* range across southern England, Wales and northern Scotland, with flows in the *the Normal range* elsewhere.
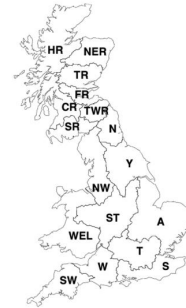
1-month

3-month

Flow estimate for each river pixel ranked in terms of historic % flow estimates (1963-2016)

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

Outlook based on modelled groundwater level & climate forecast

Overview

Period: July 2023 – September 2023

Issued on 06.07.2023 using data to the end of June

Under median rainfall conditions, levels are expected to be normal to above normal at most sites in the next month with the exception of a few sites in central England and Wales that will be below normal. Above normal levels for the time of year continue to be forecast in the southern Chalk and the sandstones of Scotland and north-east England. The 3-month forecasts are similar to the 1 month forecast and have a similar regional distributions for all rainfall scenarios.

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.

Key
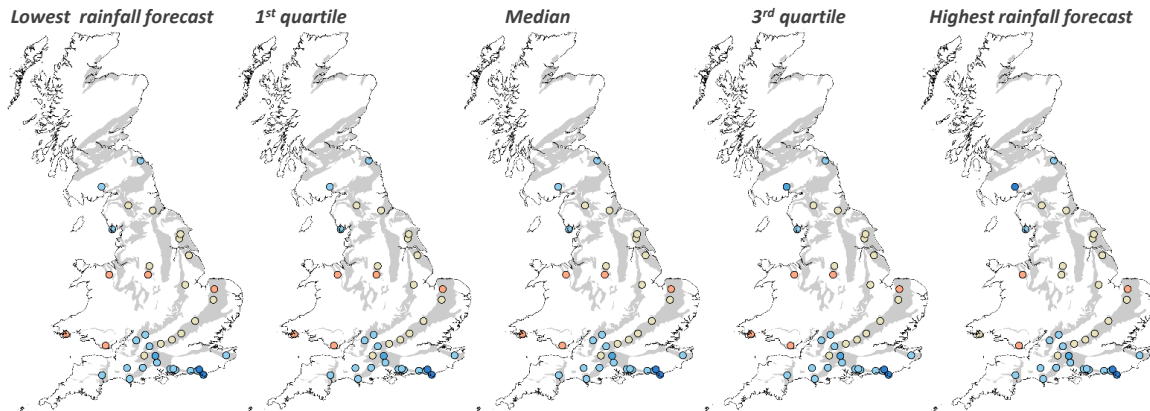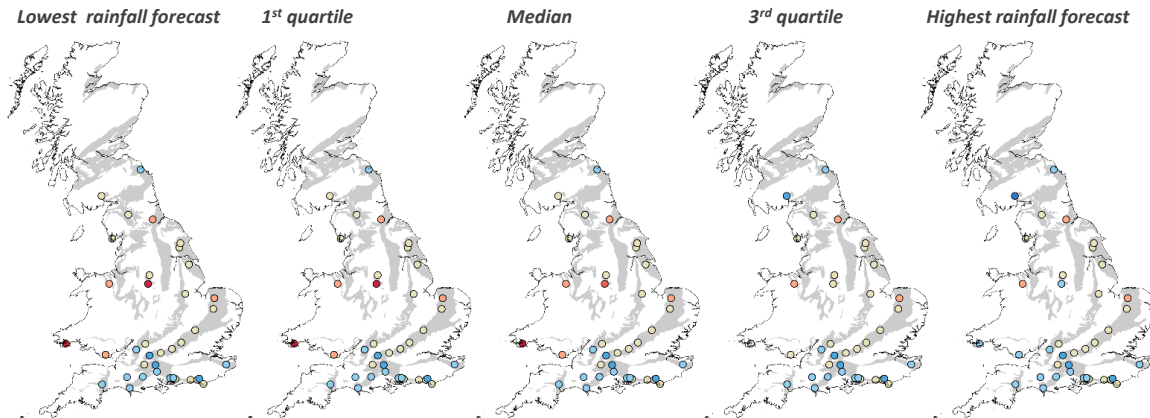
Percentile range of historic observed values for relevant month

Colour	Category	Percentile range
	Exceptionally high levels	> 95
	Notably high levels	87-95
	Above normal	72-87
	Normal	28-72
	Below normal	12-28
	Notably low levels	5-13
	Exceptionally low levels	< 5

Lowest rainfall forecast   *1st quartile*   *Median*   *3rd quartile*   *Highest rainfall forecast*

1-month outlook

Lowest rainfall forecast   *1st quartile*   *Median*   *3rd quartile*   *Highest rainfall forecast*

3-month outlook

Map legend:
- Chalk
- Devonian/Carboniferous
- Jurassic limestone
- Magnesian limestone
- Permo-Triassic sandstone
- Observation borehole

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Outlook based on modelled groundwater from historical climate

British Geological Survey

UK Centre for Ecology & Hydrology

Environment Agency

Period: July 2023 – June 2024

Issued on 06.07.2023 using data to the end of June

In the Chalk aquifers the differing speeds of response are illustrated by Washpit Farm where levels are expected to be below normal to normal for much of the next year and Dalton Holme where the effects of low rainfall may persist over the next year. In the faster responding part of the Chalk aquifer, where levels are currently above normal for Bussels No 7A and Rockley, predominantly normal levels are forecast to return over the next 3 to 12 months. In the Permo Trias, levels at Skirwith are likely to be normal to below normal, Over the next 12 months, while at Little Bucket Farm levels are expected to transition from below normal during the first 4 months to normal.
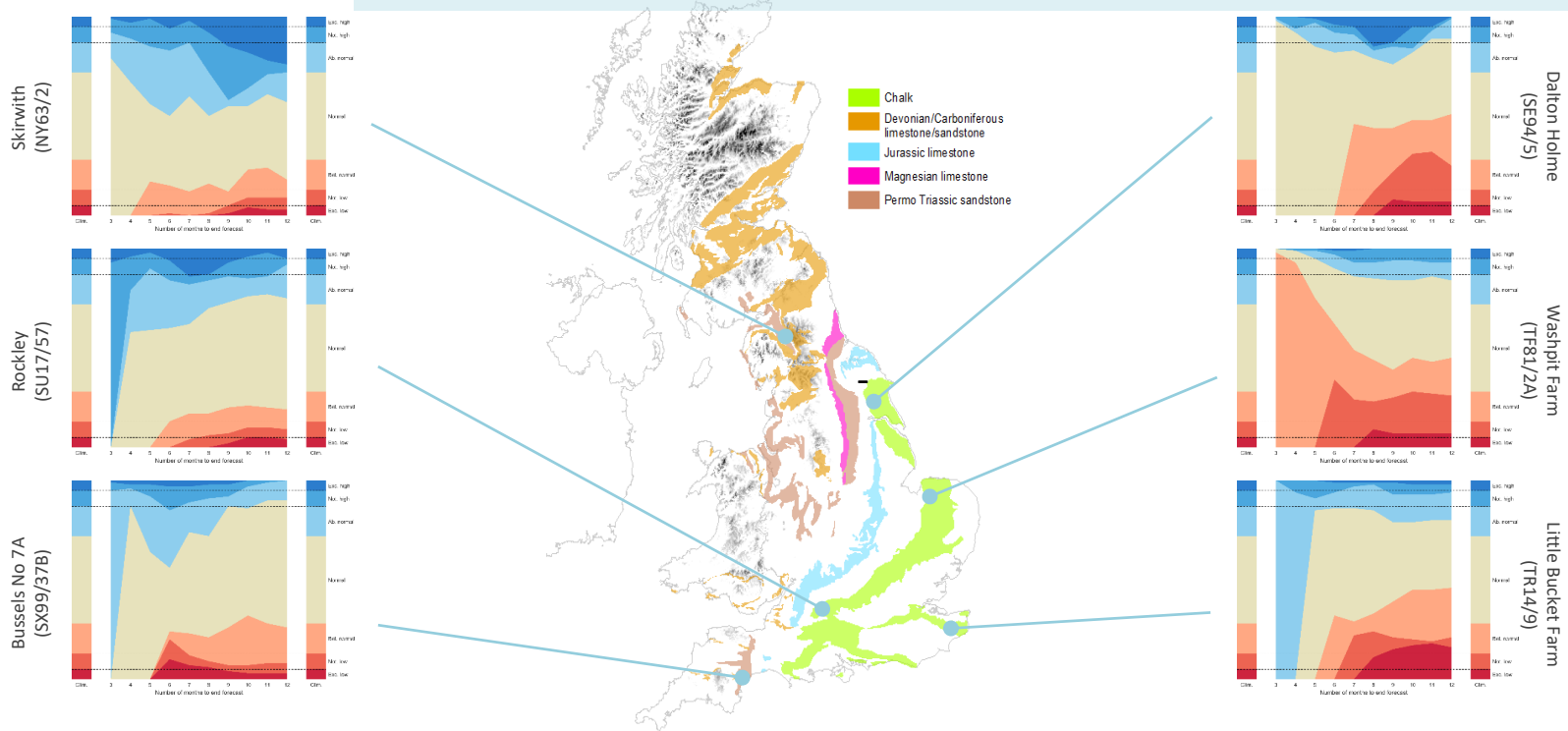
Skirwith (NY63/2)

Rockley (SU17/57)

Bussels No 7A (SX99/37B)

Dalton Holme (SE94/5)

Washpit Farm (TF81/2A)

Little Bucket Farm (TR14/9)

Legend:
- Chalk
- Devonian/Carboniferous limestone/sandstone
- Jurassic limestone
- Magnesian limestone
- Permo Triassic sandstone

This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evpotranspiration) 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.

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