UK Hydrological Outlook

Delivered in partnership by: UK Centre for Ecology & Hydrology

HYDROLOGICAL OUTLOOK UK

Period: From June 2023 Issued on 08.06.2023 using data to the end of May 2023

SUMMARY The outlook for June is for below normal river flows in the north and west, and normal to below normal river flows elsewhere. For groundwater, normal to above normal levels are expected, with above normal levels most likely in the far south. For summer, the outlook is for normal to below normal flows across the UK, and normal to above normal groundwater levels. In parts of the far south, above normal groundwater levels and flows are likely to persist through the summer.

Rainfall:

The May rainfall was above average in some parts of the south and east, but overall it was a very dry month for most of the UK (with around half the average rainfall for the UK as a whole) and notably dry in the north and west.

The forecast (issued by the Met Office on 29.05.2023) shows no strong signal for wet or dry conditions. Chance of each are similar to normal in both June and summer (June – August). Over both these periods the forecast shows increased likelihood of above-average temperatures, with increased chance of localised thundery downpours. While these are possible anywhere they are likely to be more prevalent in southern Britain.

River flows:

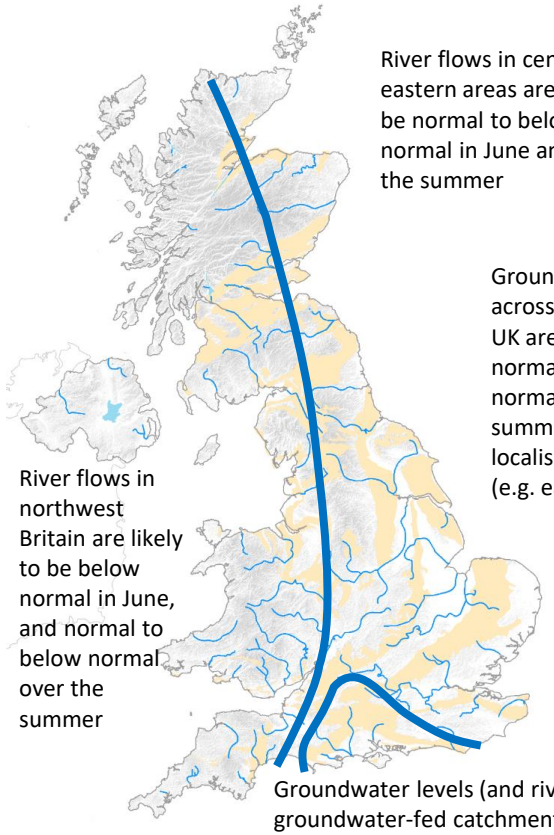
River flows in May were above normal across much of southern England, contrasting with below normal (and notably or exceptionally low in many catchments) flows in Scotland and parts of western England and Wales.

The outlook for June is for below normal flows across the north and west, with notably or exceptionally low flows likely to persist in some catchments, particularly in western Scotland. Elsewhere, normal to below normal flows are most likely except in groundwater-fed catchments in the far south where above normal levels will persist. The outlook for summer is for above normal flows in the far south and normal to below normal flows elsewhere

Groundwater:

Across most aquifers, groundwater levels in May were normal to above normal, with the exception of some below normal levels in Scotland and east Anglia. In central southern England, levels were notably high and exceptionally so in some boreholes.

The outlook for June is for a similar picture, with normal to above normal levels across much of the country, with some localised exceptions of below normal levels in central and eastern England and parts of Wales. Above normal groundwater levels are likely to persist in southern England, with notably or exceptionally high levels to be maintained in some localities. The outlook for the summer is similar.



Shaded areas show principal aquifers

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

June 2023

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HYDROLOGICAL OUTLOOK UK

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

Reference for the Hydrological Outlook:

Hydrological Outlook UK, 2023, June, 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/

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UK Centre for Ecology & Hydrology

Monthly mean river flows simulated by the Grid-to-Grid hydrological model

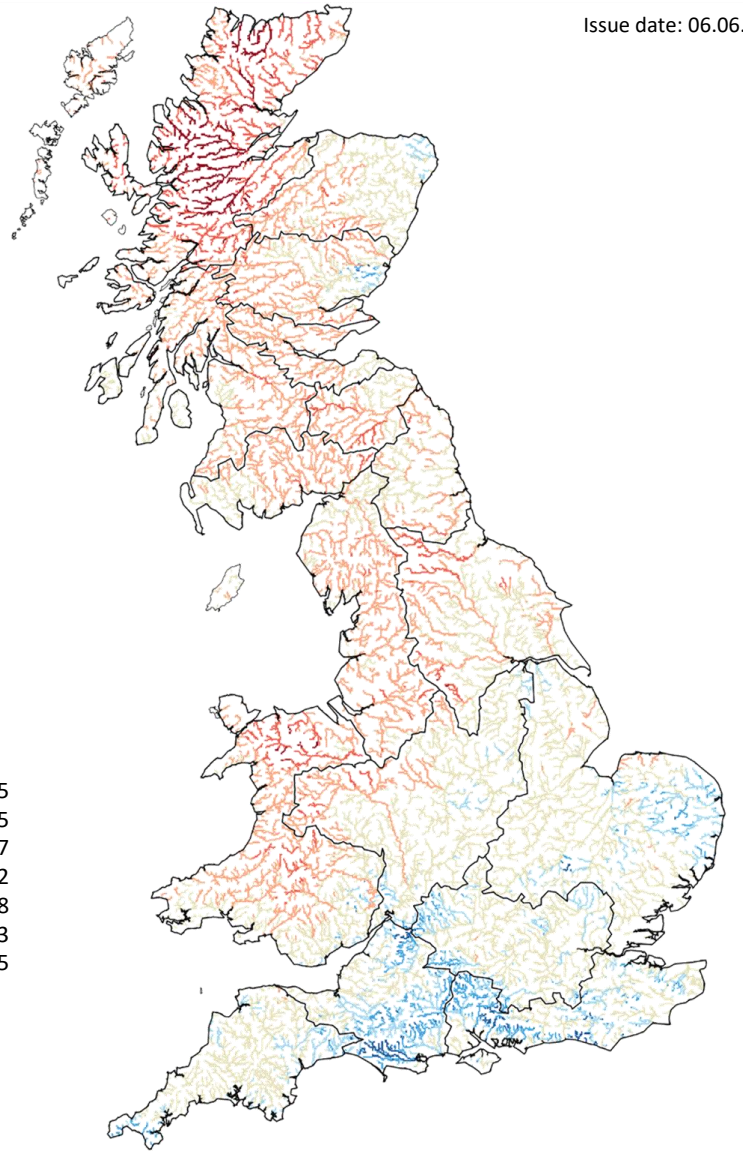
Period: May 2023

Issue date: 06.06.2023

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.



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OUTLOOK BASED ON CURRENT CONDITIONS

June 2023

UK Centre for Ecology & Hydrology

Current Daily Simulated Subsurface Water Storage Conditions

Based on subsurface water storage estimated for 31st May 2023

Issue date: 06.06.2023

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.

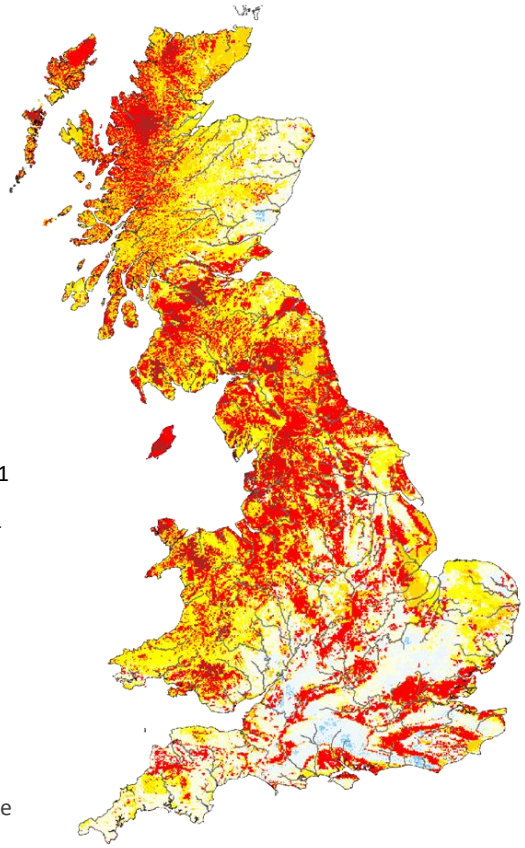
SUMMARY: At the end of May, subsurface water levels were lower (drier) than is typical for this time of year across most of Great Britain, apart from some areas of average conditions in the southeast. There were scattered areas where subsurface water levels were very dry, particularly in the Scottish highlands and northern England/ southern Scotland.

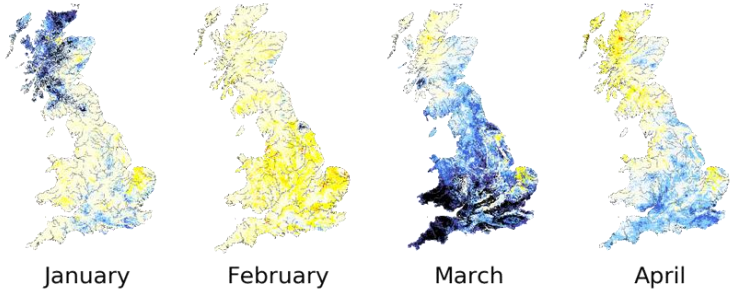
Relative wetness

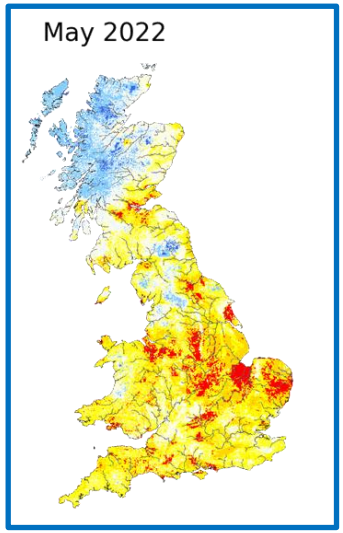
Water storage anomaly as a % of maximum (positive wetness) or minimum (negative wetness) storage anomaly (zero indicates average value)

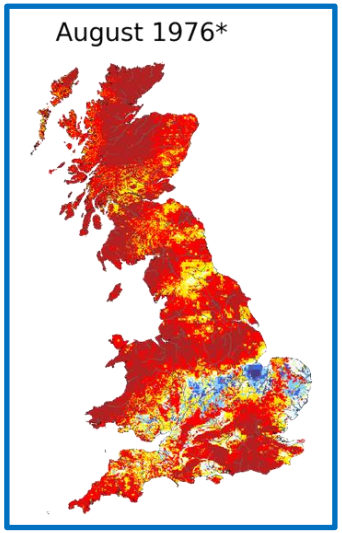
High (very wet)	>100
	75 - 100
Medium wetness	50 - 75
	25 - 50
Low wetness	0.01 - 25
Average conditions	-0.01 - 0.01
Low dryness	-25 - - 0.01
	-50 - -25
Medium dryness	-75 - -50
	-100 - -75
High (very dry)	< -100
Main rivers	

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









*Example month displaying extreme negative wetness

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OUTLOOK BASED ON CURRENT CONDITIONS

June 2023

UK Centre for Ecology & Hydrology

Current Daily Simulated SOIL MOISTURE Conditions

PROTOTYPE

Based on soil moisture estimated for 31st May 2023

Issue date: 06.06.2023

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.

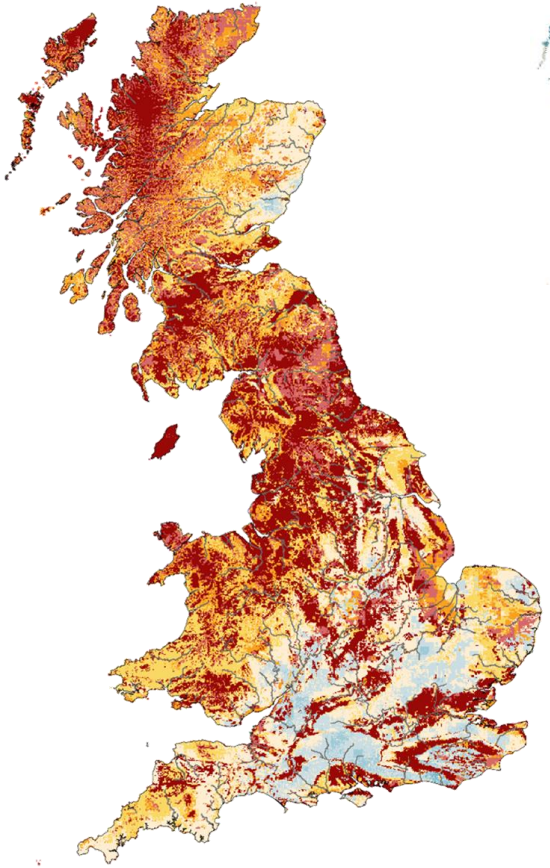
SUMMARY: Soil moisture stores have reduced over May, and are now lower (drier) than normal across most of Great Britain. There are some areas of southern/eastern England and east Scotland where conditions remain average or slightly higher (wetter) than normal for this time of year.

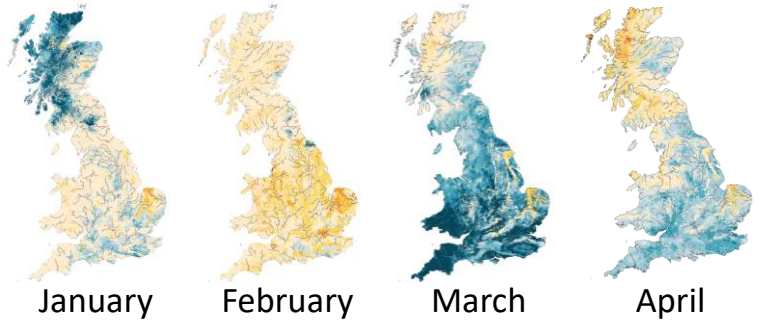
Relative soil wetness

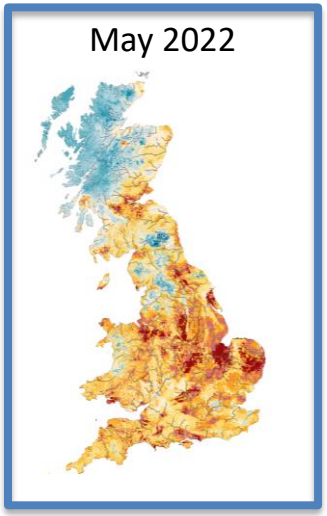
Soil moisture anomaly as a % of maximum (positive wetness) or minimum (negative wetness) moisture anomaly (zero indicates average value)

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







*Example month displaying extreme negative wetness

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OUTLOOK BASED ON CURRENT CONDITIONS

June 2023

UK Centre for Ecology & Hydrology

Return Period of Rainfall Required to Overcome Dry Conditions

Period: June 2023 – November 2023

Issue date: 06.06.2023

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.

SUMMARY: During June, some regions across Great Britain would require 5-10 year return period rainfall to overcome the dry conditions.

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

Jun

Jul

Aug

Sep

Oct

Nov

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

OUTLOOK BASED ON CURRENT CONDITIONS

June 2023

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UK Centre for Ecology & Hydrology

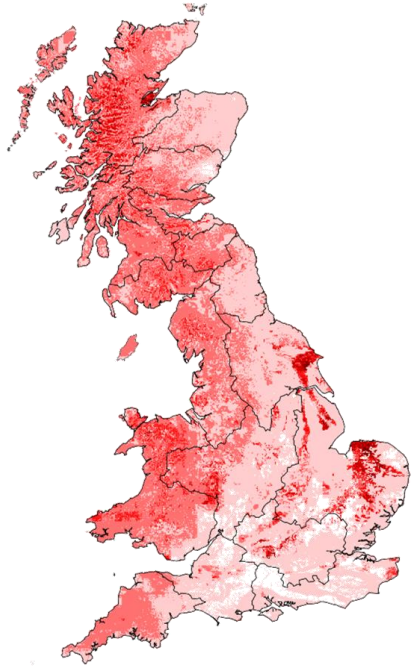
Estimate of Additional Rainfall Required to Overcome Dry Conditions

Based on subsurface water storage estimated for 31st May 2023

Issue date: 06.06.2023

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.

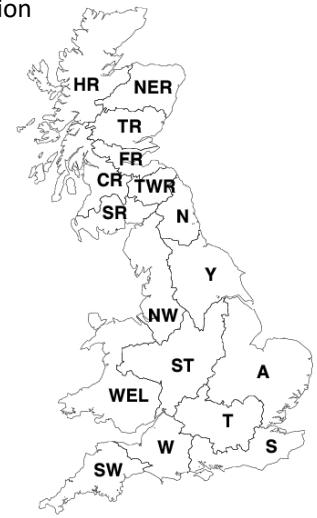


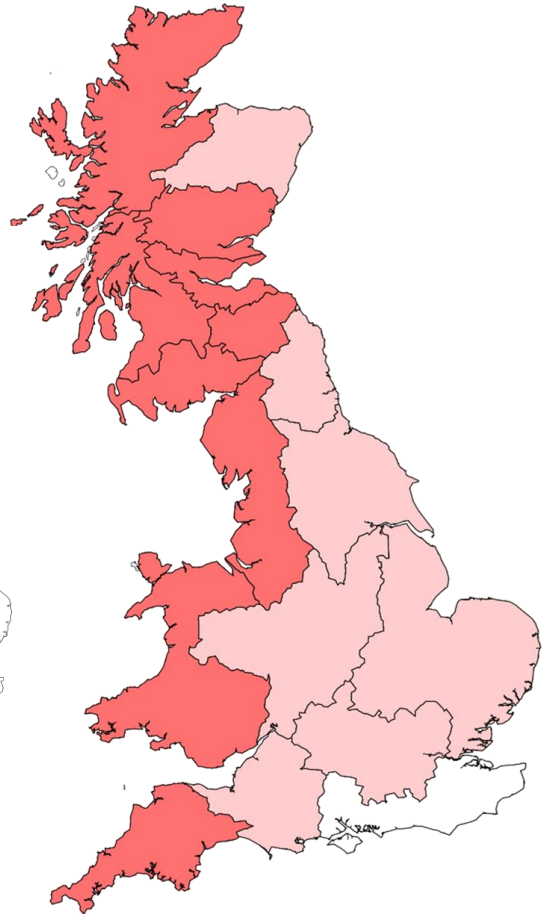
Water storage deficit (anomaly, mm)

- >125
- 100-125
- 75-100
- 50-75
- 25-50
- 0.1-25
- ≤0

Regional estimate of additional rainfall required (mm)

	SCOTLAND	
38	HR	Highlands Region
18	NER	North East Region
26	TR	Tay Region
33	FR	Forth Region
33	CR	Clyde Region
33	TWR	Tweed Region
35	SR	Solway Region
	ENGLAND	
19	N	Northumbria
28	NW	North West
25	Y	Yorkshire
21	ST	Severn Trent
21	A	Anglian
8	T	Thames
0	W	Wessex
0	S	Southern
27	SW	South West
	WALES	
35	WEL	Welsh





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OUTLOOK BASED ON CURRENT CONDITIONS

June 2023

UK Centre for Ecology & Hydrology

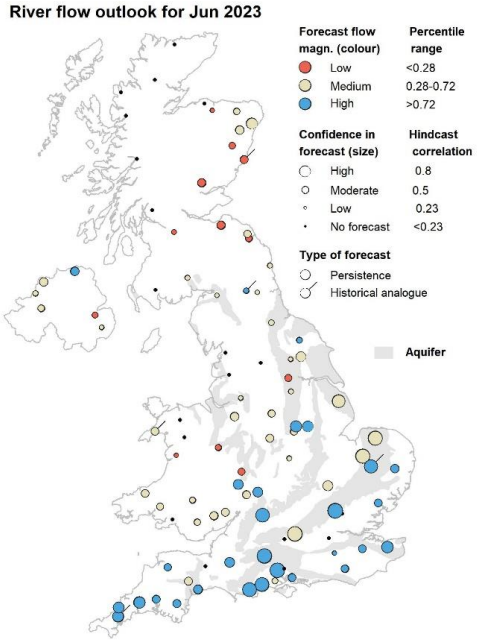
Outlook based on hydrological persistence and analogy

Overview

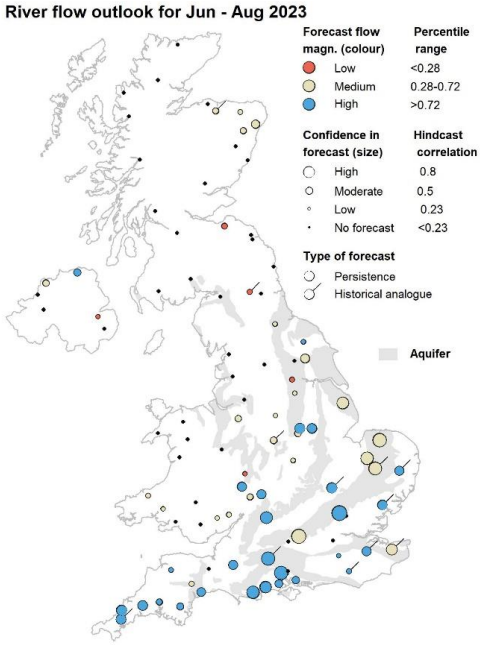
Period: June 2023 – August 2023

Issued on 06.06.2023 using data to the end of May 2023

SUMMARY:
The outlook for June and for June – August is for mainly normal to above normal flows in southern and central England, and mostly normal to below normal flows elsewhere. Please note that not many forecasts are available in Wales and western Scotland for the June – August 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.

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UK Centre for Ecology & Hydrology

Outlook based on hydrological persistence and analogy

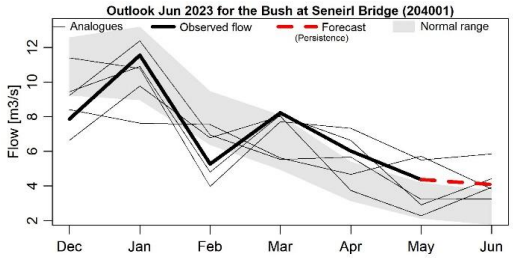
Site-based: 1 month outlook

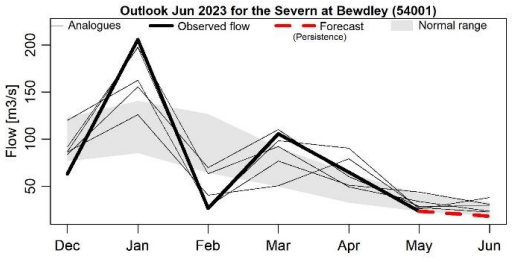
Period: June 2023

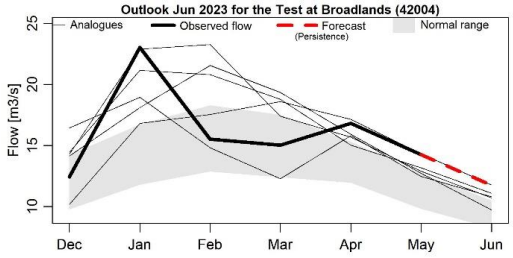
Issued on 06.06.2023 using data to the end of May 2023

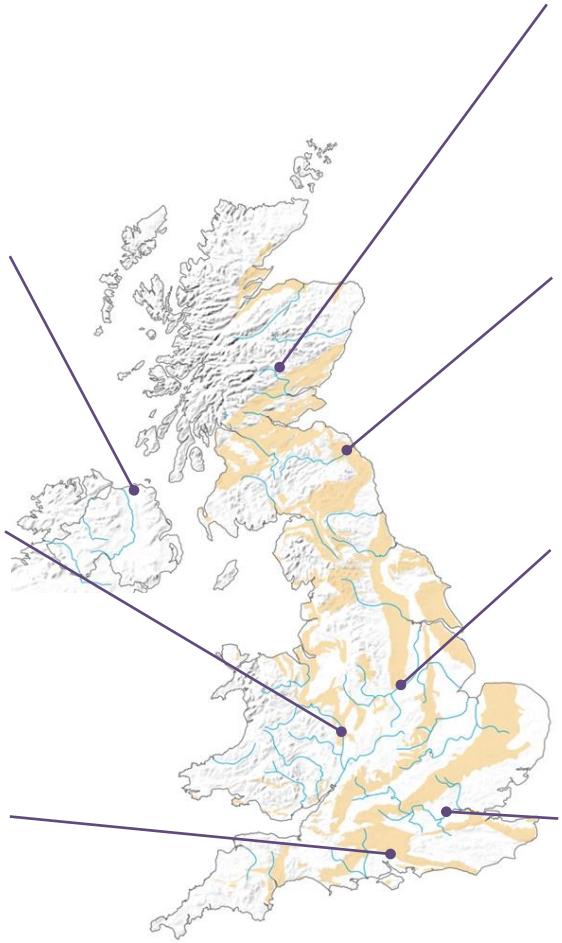
These figures provide insight into the hydrological analogue methodology for a set of sites from across the UK.

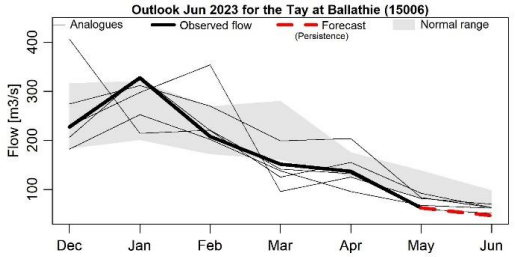
In each of the time series graphs the bold black line represents the observed flow during the past six months. The grey band indicates the normal flow range (the normal band includes 44% of observed flows in each month). The selected analogues are shown as thin lines and the trajectories that flows took 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.

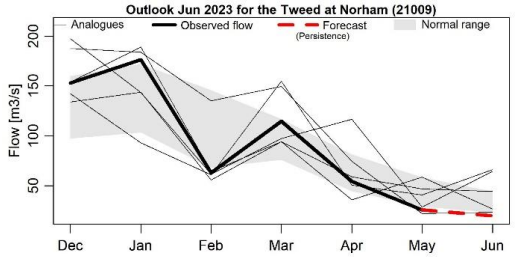


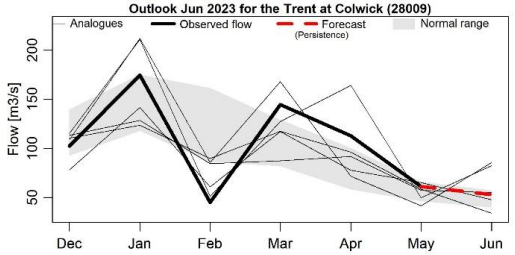












No forecast available

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RIVER FLOW ANALOGY

June 2023

UK Centre for Ecology & Hydrology

Outlook based on hydrological persistence and analogy

Site-based: 3 month outlook

Period: June 2023 – August 2023

Issued on 06.06.2023 using data to the end of May 2023

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

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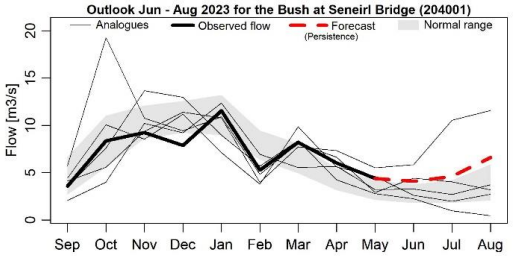
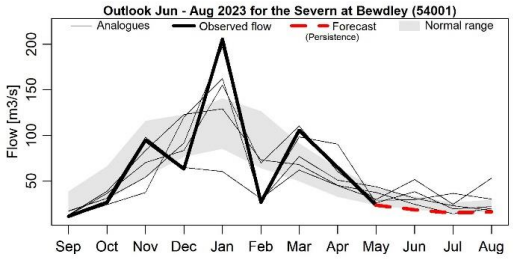
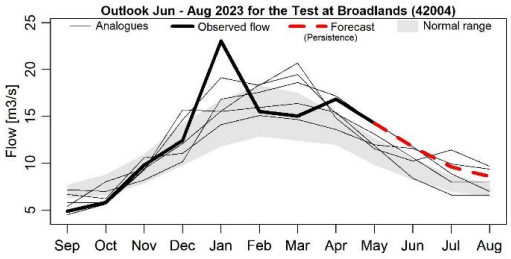
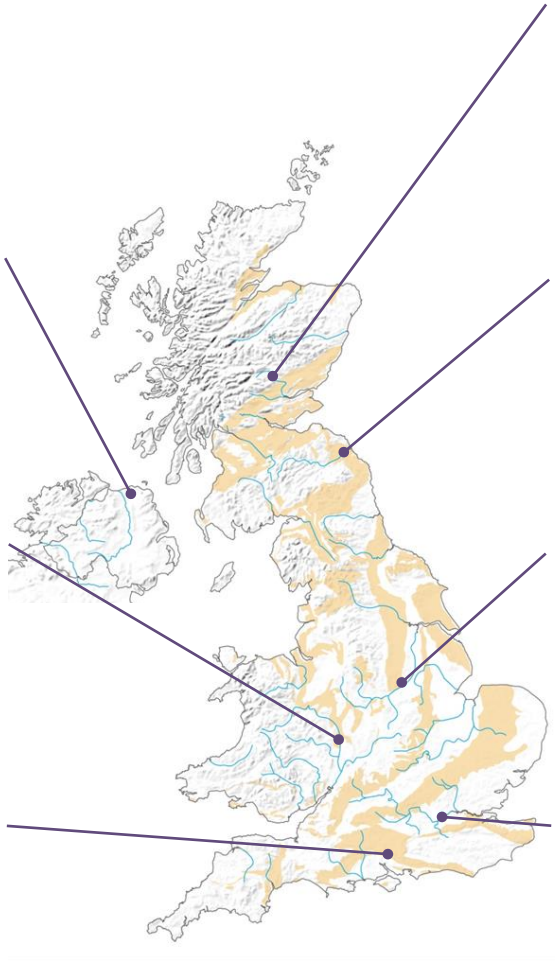
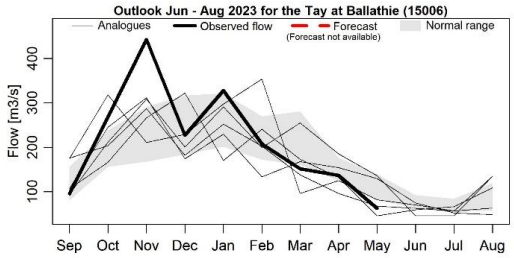
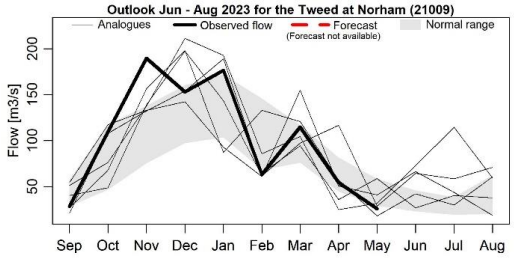


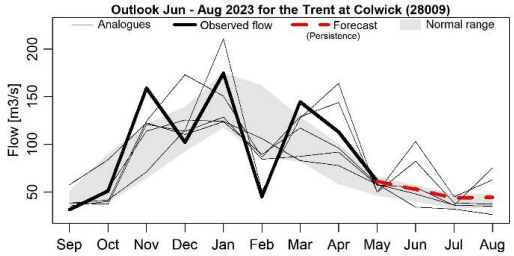












No forecast available

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 FLOW ANALOGY

June 2023

UK Centre for Ecology & Hydrology

British Geological Survey

Environment Agency

Outlook based on modelled flow from historical climate

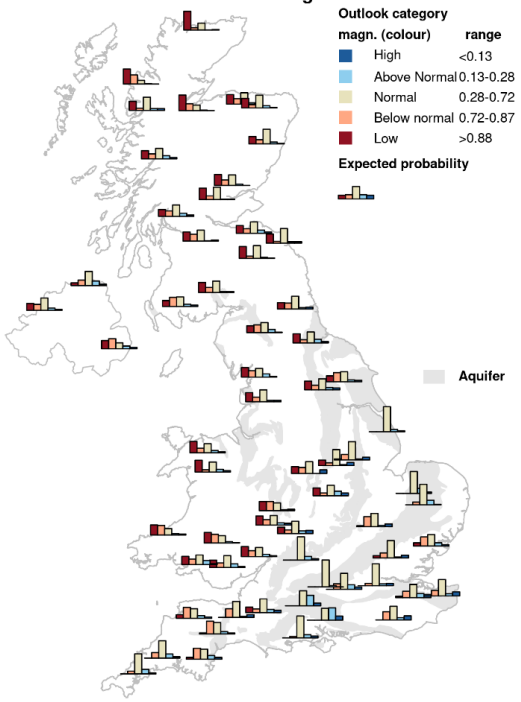
Overview

Period: June 2023 – November 2023

Issued on 02.06.2023 using data to the end of May 2022

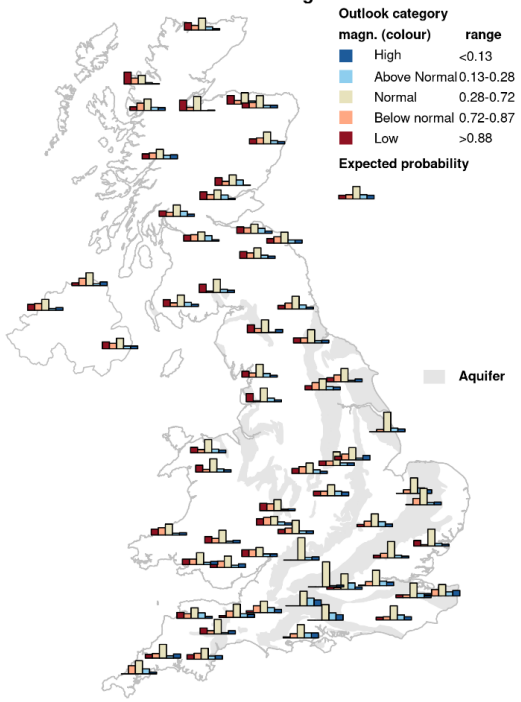
The outlook for June indicates that flows are most likely to be normal in the south and southeast of England, and normal to below normal for the rest of the UK. The June-July-August outlook indicates the same pattern is expected to persist over the coming three months, though a return to normal flow is more likely in most of the country.

1-month river flow outlook starting Jun 2023



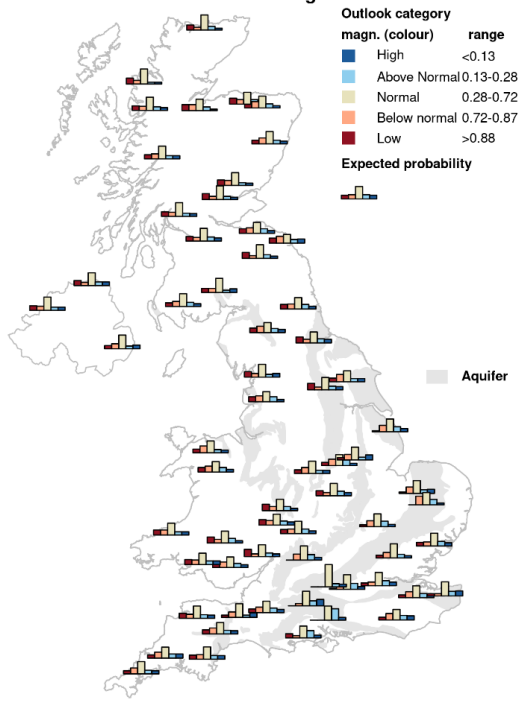
This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evapotranspiration) that form input to a hydrological model. The outputs are probabilistic simulations of the average river flow over the forecast period (1 to 12 months ahead), at each location. 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 Jun 2023



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 Jun 2023



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

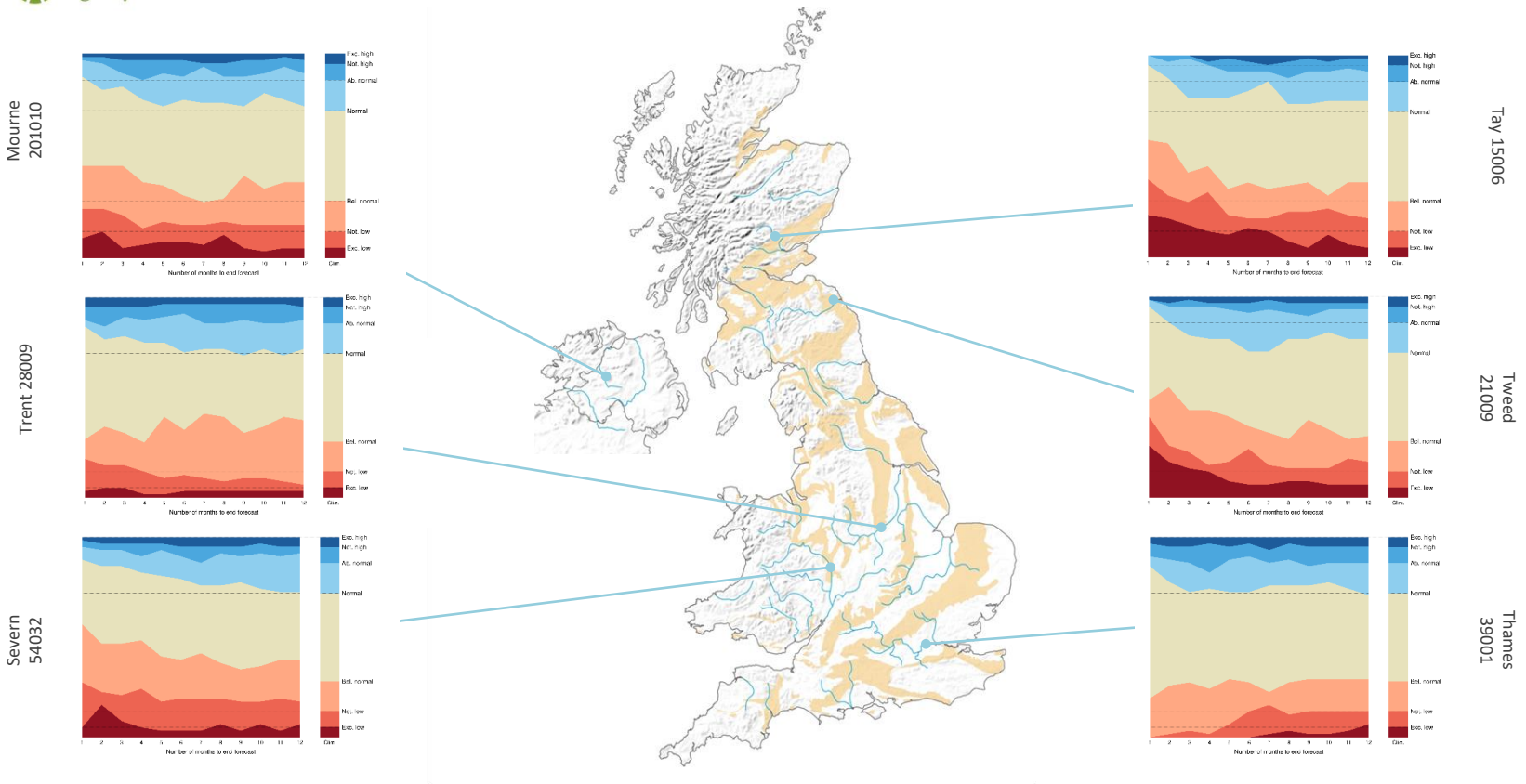
UK Centre for Ecology & Hydrology

British Geological Survey

Environment Agency

Outlook based on modelled flow from historical climate

Overview



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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June 2023

UK Centre for Ecology & Hydrology

Outlook Based on Modelled Flow from Rainfall Forecasts

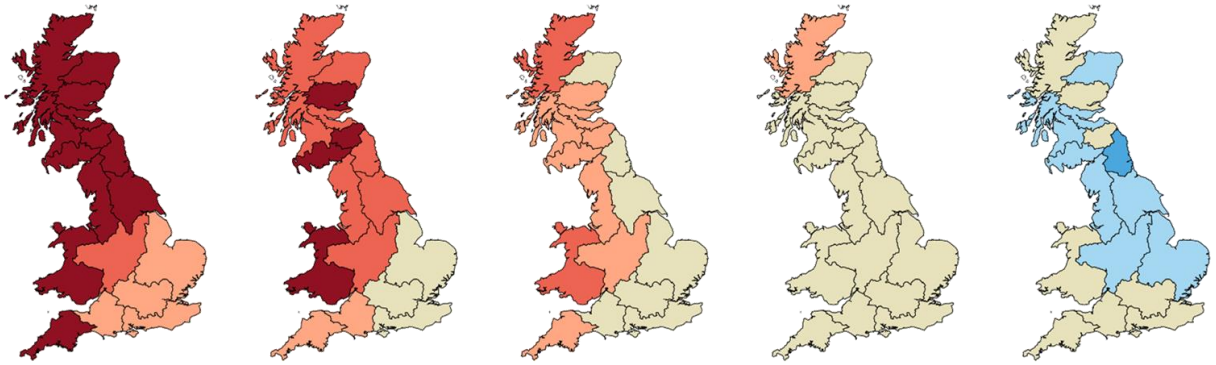
Period: June 2023 – August 2023

Issued on 06.06.2023 using data to the end of May

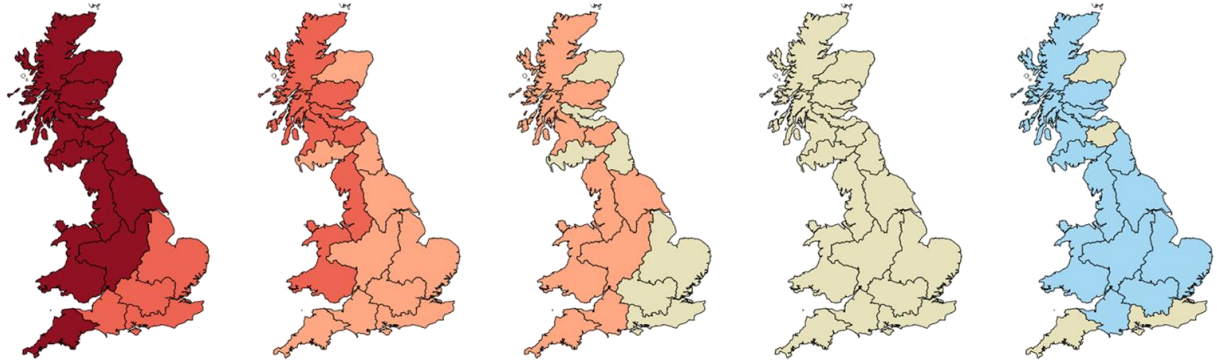
SUMMARY: During June, river flows are likely to be *Below normal* or lower to the west of Great Britain, in the *Notably low flow* range or lower in Wales and the Highlands, and in the *Normal range* or below elsewhere.

Over the next 3 months river flows will likely be in the *Normal range* or below across Great Britain, with flows across Wales, central England, western England, and large parts of Scotland likely to be *Below normal* or lower.

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



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



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.

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

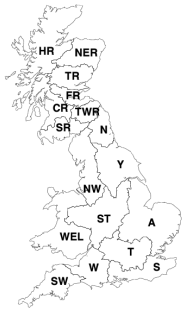
HR	Highlands Region
NER	North East Region
TR	Tay Region
FR	Forth Region
CR	Clyde Region
TWR	Tweed Region
SR	Solway Region

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

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RIVER FLOW FROM RAINFALL FORECASTS

June 2023

UK Centre for Ecology & Hydrology

Outlook Based on Modelled Flow from Rainfall Forecasts

Period: June 2023 – August 2023 Issue date: 06.06.2023

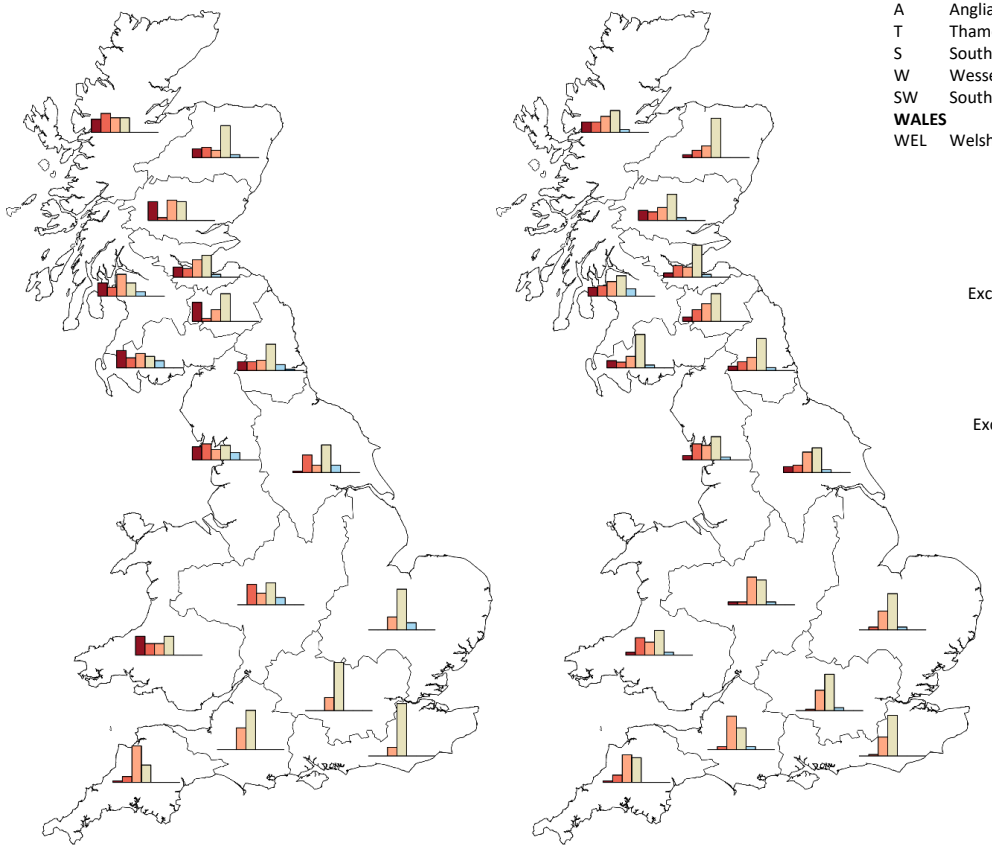
The regional maps illustrating the regional river flows for five members of the Met Office ensemble of rainfall forecasts give some indication of the range of possible river flows in the coming months. As noted previously, the actual flows could be more extreme than the flows generated by either the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

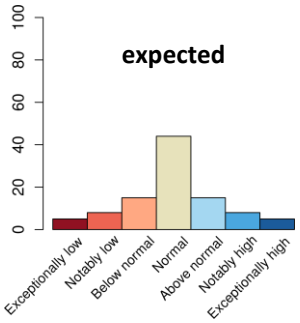
The bar charts (below) give further insight into the range of river flow forecasts by considering all members of the forecast rainfall ensemble. The regional bar charts show the percentage of ensemble forecasts falling in each of the flow categories as generated by the monthly-resolution water-balance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

SUMMARY: During June, river flows are likely to be *Below normal* or lower to the west of Great Britain, in the *Notably low flow* range or lower in Wales and the Highlands, and in the *Normal range* or below elsewhere.

Over the next 3 months river flows will likely be in the *Normal range* or below across Great Britain, with flows across Wales, central England, western England, and large parts of Scotland likely to be *Below normal* or lower.

1-month *3-month*





SCOTLAND

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

ENGLAND

N	Northumbria
NW	North West
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A	Anglian
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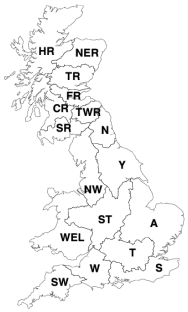
W	Wessex
SW	South West

WALES

WEL	Welsh



NORTHERN IRELAND
This method cannot currently be used in Northern Ireland

Percentile range of historic values for relevant month

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

RIVER FLOW FROM RAINFALL FORECASTS

June 2023

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UK Centre for Ecology & Hydrology

Outlook Based on Modelled Flow from Rainfall Forecasts

Period: June 2023 – August 2023 Issue date: 06.06.2023

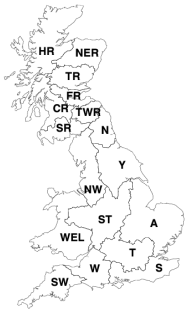
The maps illustrating the regional river flows for five members of the Met Office ensemble of rainfall forecasts give some indication of the range of possible river flows in the coming months. As noted previously, the actual flows could be more extreme than the flows generated by either the lowest or 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 June, river flows are likely to be *Below normal* or lower to the west of Great Britain, in the *Notably low flow* range or lower in Wales and the Highlands, and in the *Normal range* or below elsewhere.

Over the next 3 months river flows will likely be in the *Normal range* or below across Great Britain, with flows across Wales, central England, western England, and large parts of Scotland likely to be *Below normal* or lower.

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	0	0	0	0	0	0	0
Notably high flow	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above normal	12	12	10	12	0	0	0	0	0	12	7	5	0	5	12	0	0
Normal range	67	24	43	36	29	86	79	31	64	45	21	36	24	52	19	31	45
Below normal	21	17	17	19	60	14	21	19	36	12	36	29	24	12	24	33	19
Notably low flow	0	26	14	33	10	0	0	19	0	29	14	14	31	17	17	5	5
Exceptionally low flow	0	21	14	0	2	0	0	31	0	2	21	17	21	14	29	31	31

3-months 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	0	0	0	0	0	0	0
Notably high flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above normal	5	5	5	5	0	0	5	5	5	5	12	5	5	0	5	5	0
Normal range	60	38	52	40	40	67	60	40	36	40	33	52	36	64	55	43	45
Below normal	31	24	21	45	45	31	33	21	55	33	24	17	26	19	19	21	29
Notably low flow	5	26	14	5	12	2	2	29	5	12	17	19	17	12	10	14	19
Exceptionally low flow	0	7	7	5	2	0	0	5	0	10	14	7	17	5	12	17	7

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British Geological Survey

Outlook based on modelled groundwater level & climate forecast

Overview

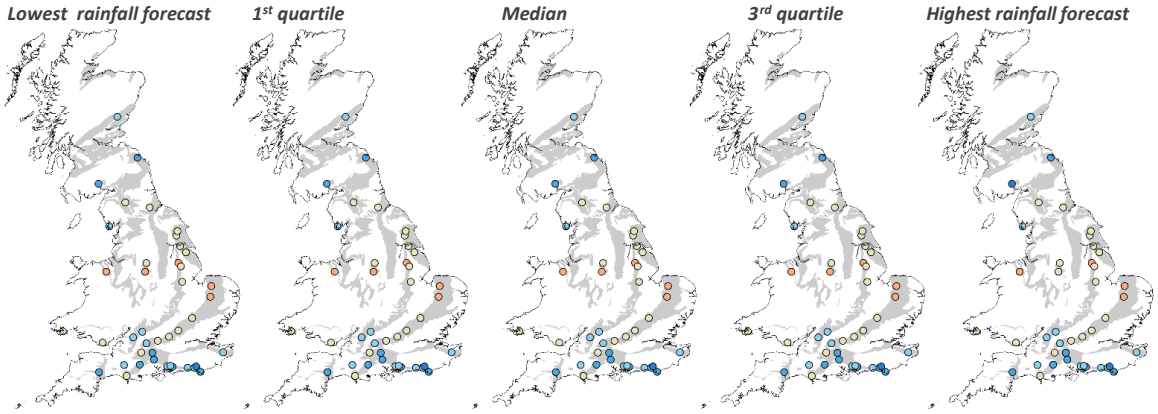
Period: June 2023 – August 2023

Issued on 07.06.2023 using data to the end of May

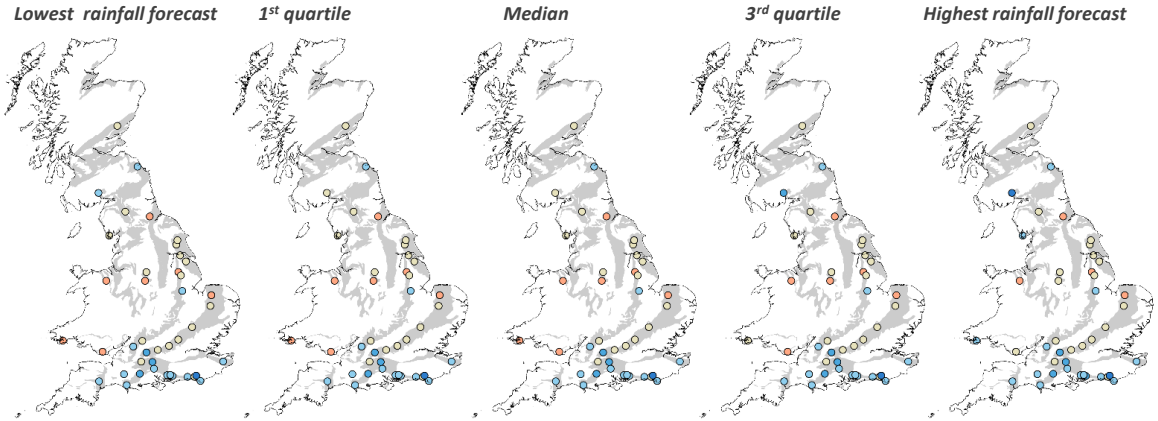
Groundwater levels across the UK are in recession following a high volume of rainfall over the preceding few months. Under median rainfall conditions, levels are expected to be normal to above normal at most sites in the next month with the exception of a few sites in central eastern England and North Wales that will be below normal. Above normal levels 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, with levels expected to be predominantly normal.

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.

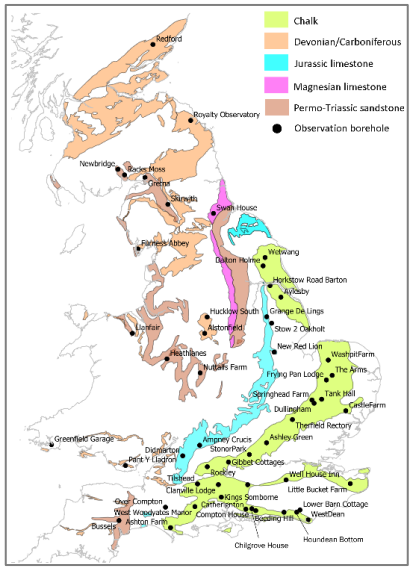


1-month outlook



3-month outlook

Key	Percentile range of historic observed values for relevant month
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



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GROUNDWATER FROM CLIMATE FORECASTS

June 2023

UK Centre for Ecology & Hydrology

British Geological Survey

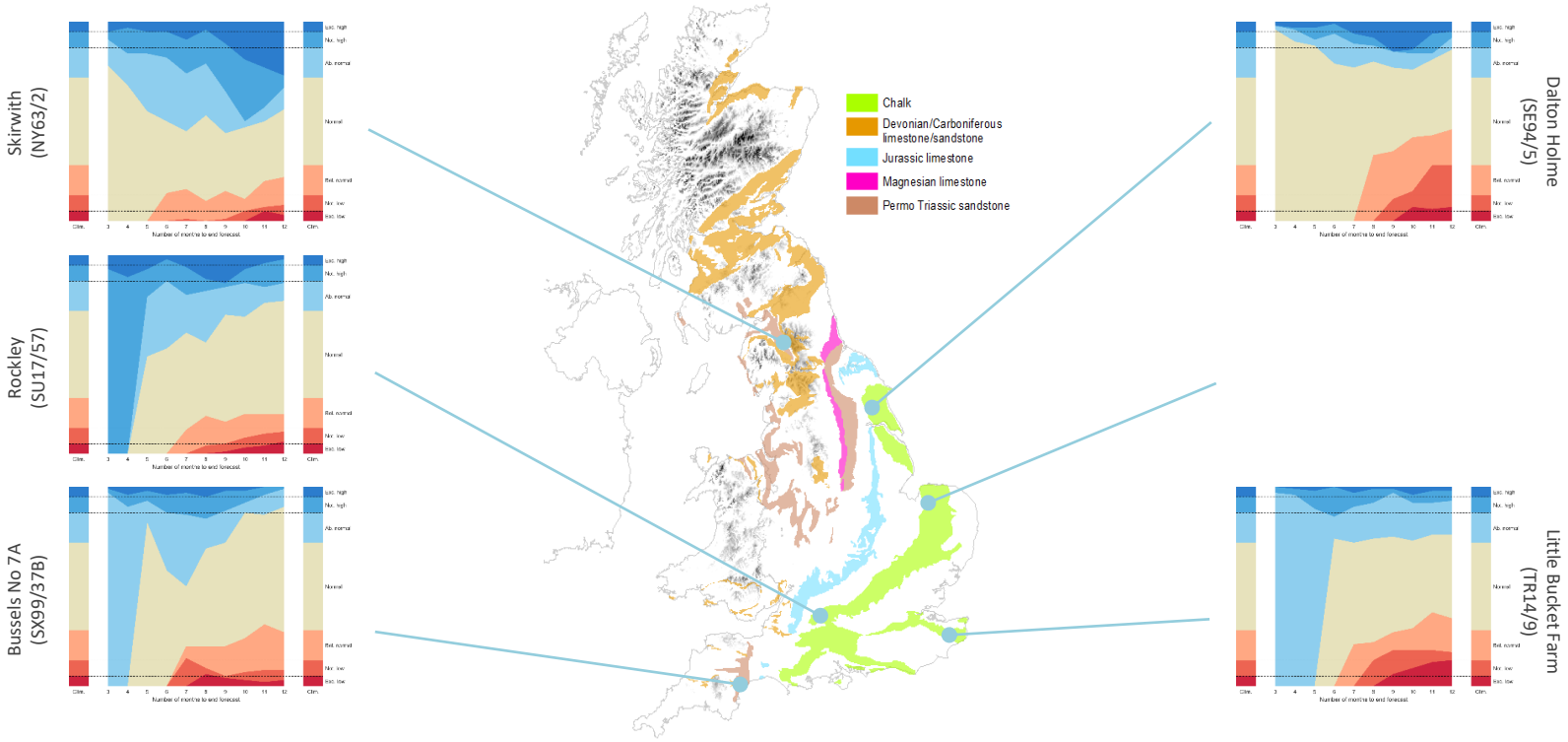
Environment Agency

Outlook based on modelled groundwater from historical climate

Period: June 2023 – May 2024

Issued on 07.06.2023 using data to the end of May

Groundwater levels are currently above normal for Bussels No 7A and Rockley, but predominantly normal levels are forecast to return over the next 3 to 12 months. Over the next 6 months, levels at Skirwith and Little Bucket Farm are likely to be normal to above normal, with levels at Dalton Holme expected to be normal during this period.



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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