Hydrological Summary *for the United Kingdom*

May 2024

General

May was often changeable with sunshine, showers, and thunderstorms, although there was an interlude of more settled conditions during the first half of the month, and widespread notable rainfall in the second half. The UK experienced its warmest May on record, in a series going back to 1884, owing to high overnight temperatures and cloud cover, rather than notable maximum daytime temperatures. River flows in May remained high across much of the UK, with many rivers in England and southern Scotland recording notably and exceptionally high flows. Conversely, in Wales and Northern Ireland flows were mostly normal, and in northern Scotland they were normal or below, exceptionally so in some cases. Groundwater levels remained very high across the UK, with levels above normal at all but three index sites, exceptionally high at 13 sites, and setting new maximum May records at seven sites. However, levels fell over most locations as the seasonal recession continued across most aquifers. Surface water resources remained in a healthy position with above average reservoir stocks at the national scale. The UK Hydrological Outlook for June to August suggests a continuation of normal and above normal flows and groundwater levels across the country, further strengthening the water resources position as we move into summer.

Rainfall

May started unsettled, and with thunderstorms in southern England on the 2nd (43mm at Chivenor, Devon) that caused lightning damage to railway equipment in Westbury (Wiltshire), homes in Sussex, and surface water flooding in Devon and Somerset. Low pressure systems continued to bring scattered showers across the UK, sometimes heavy, for the first week of May. High pressure prevailed on the 7th, bringing more settled conditions. During this period, high solar activity meant the aurora borealis was visible across the whole of the UK on the 10th. Low pressure systems returned mid-month, again bringing unsettled weather and thunderstorms, although without notable daily rainfall totals. Between 21st and 23rd, widespread rainfall, heavy at times tracked north-westwards from south-east England towards southern and central Scotland and led to pluvial flooding and transport disruption in Norfolk, Cumbria, and Edinburgh (including at the UKCEH site). The 22nd was, provisionally, the wettest spring day on record for northern England, with many gauges registering record amounts of rainfall e.g. 95mm at Keswick (Cumbria). Unsettled weather continued to month-end. Total rainfall was 116% of the May average for the UK, and most of England and southern Scotland registered above normal rainfall, with over 170% of average in parts of southern and central Scotland, northern England, East Anglia, and Wessex. By contrast, below normal rainfall was recorded in Northern Ireland, northern and western Scotland, south-west Wales and south-west England. The spring months (March-May) were the wettest on record for Forth, and second wettest for Solway, Tweed and North West England. The longer-term accumulations remain remarkable with both the nine-month (September-May) and twelve-month (June 2023-May 2024) periods registering the wettest on record for the UK (all in series from 1890).

River Flows

River flows generally began above average, but recessions continued through the start of May. Responses to unsettled conditions and thunderstorms in the first part of the month were modest, although some rivers recorded their highest May peak flows on record (e.g. Tamar on the 2nd and Sussex Ouse on the 6th – both in records of at least 60 years). Mid-month, recessions resumed and were again moderately buoyed by scattered and sometimes heavy showers. On the 21st, most rivers responded to the widespread rainfall, and the Eden registered its highest May peak flow on the 23rd (40% higher than the previous record May peak in 2013, in a series from 1968). The English Tyne and South Tyne recorded the second highest May peak flow during this event (both in series of at least 60 years). Mean river flows for May were above normal in England, (exceptionally so in the north and the south-east) and in the Scottish borders. In Wales and Northern Ireland, however, flows were normal and in western Scotland notably or exceptionally low (e.g the Oykel registered just 18% of the May average). New maximum May mean flows were established in catchments in southern England (e.g. the Itchen and Ouse – both in records over 60 years). May outflows for England were the fifth highest (in a record from 1961). Sustained and widespread high flows over the previous autumn, winter, and spring (September-May), resulted in numerous new records across the UK including the Weaver, Warwickshire Avon, Witham, Stringside and Brue which recorded over twice their average September-May flows. Correspondingly, September-May outflows were the highest on record for England, Wales (both in series from 1961), and Northern Ireland (in a series from 1980).

Soil Moisture and Groundwater

Soil moisture remained near field capacity over much of central and western UK, while sites elsewhere were slightly below field capacity by month-end. The seasonal recession in groundwater levels continued across the Chalk, with decreases observed at all sites except Dial Farm. Levels were exceptionally high at five sites: Therfield Rectory, Stonor Park, Rockley, Westdean No.3 and Little Bucket Farm. Groundwater levels fell in the Jurassic limestones with notably high and above normal levels at New Red Lion and Ampney Crucis, respectively. Levels fell in the Upper Greensand but remained exceptionally high with a record high at Lime Kiln Way (in a series of 55 years). In the Magnesian Limestone, record monthly highs were again recorded at Brick House Farm and at Aycliffe (both in series more than 40 years) despite falling levels at both sites. Levels fell at all Carboniferous Limestone sites. They remained normal at Pant y Lladron and moved to notably high at Greenfield Garage and Alstonfield. In the Permo-Triassic sandstones, record highs were observed at Bussels No.7a, Weir Farm (both in records of at least 40 years) and Newbridge (a series of 32 years). Levels remained exceptionally high at Skirwith but fell back to notably high at Llanfair DC. Levels receded at Royalty Observatory in the Fell Sandstone but remained exceptionally high and at monthly record levels. In the Devonian sandstones at Easter Lathrisk levels were fairly stable and remained in the normal range. At Feddan Junction levels fell and were in the above normal range.

National Hydrological Monitoring Programme | UK Centre for Ecology & Hydrology | BGS British Geological Survey

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1991-2020 average.

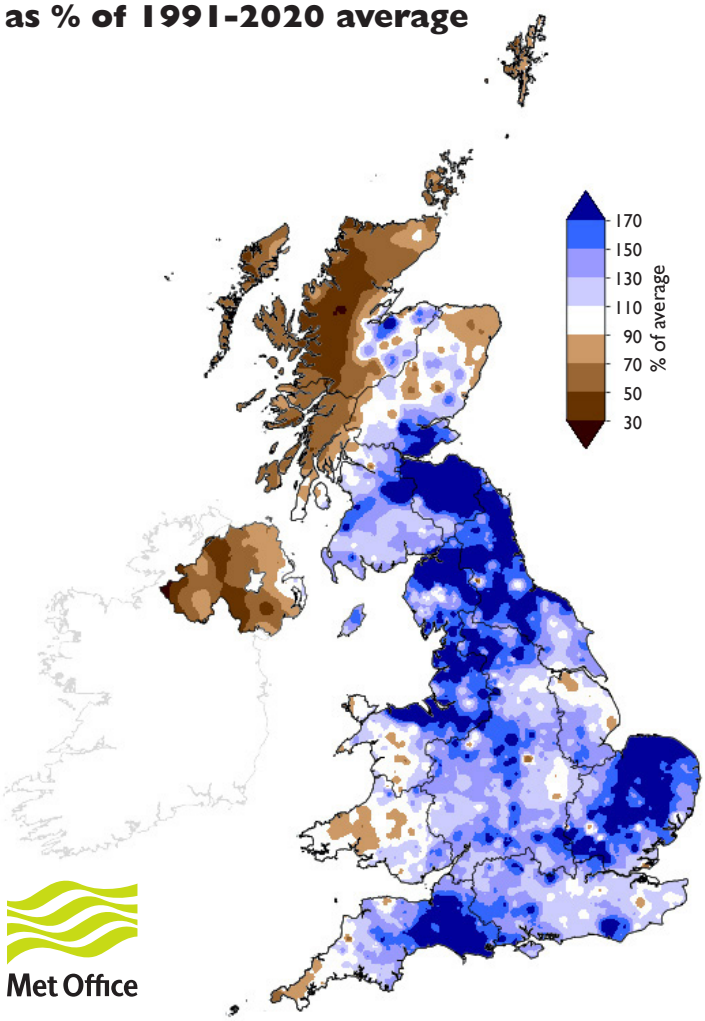
Region	Rainfall	May 2024	Mar24 – May24	RP	Dec23 – May24	RP	Sep23 – Mar24	RP	Jun23 – May24	RP
United Kingdom	mm	**83**	302		748		1157		1439	
	%	**116**	132	25-40	131	80-120	128	>>100	124	>100
England	mm	**84**	264		623		963		1196	
	%	**147**	154	40-60	152	>100	146	>100	139	>100
Scotland	mm	**83**	344		905		1394		1721	
	%	**93**	112	5-10	113	10-15	111	15-25	110	15-25
Wales	mm	**95**	389		1015		1554		1897	
	%	**110**	140	15-25	140	>100	134	>100	131	>100
Northern Ireland	mm	**47**	281		621		1050		1434	
	%	**63**	119	5-10	110	5-10	119	>100	124	>100
England & Wales	mm	**85**	281		677		1044		1292	
	%	**139**	151	30-50	149	>100	143	>100	137	>100
North West	mm	**123**	389		920		1388		1783	
	%	**165**	164	>100	150	>>100	141	>>100	140	>>100
Northumbria	mm	**97**	282		600		958		1220	
	%	**172**	157	20-30	141	>100	141	>>100	135	>100
Severn-Trent	mm	**78**	252		582		892		1111	
	%	**134**	150	20-30	154	>100	149	>100	139	>100
Yorkshire	mm	**81**	255		615		952		1216	
	%	**148**	148	15-25	150	>100	146	>100	141	>100
Anglian	mm	**71**	175		423		678		841	
	%	**148**	136	5-10	151	70-100	148	>100	134	40-60
Thames	mm	**75**	239		540		829		1017	
	%	**140**	158	20-35	155	>100	149	>100	141	80-120
Southern	mm	**66**	239		596		972		1154	
	%	**128**	154	20-30	150	50-80	150	80-120	141	60-90
Wessex	mm	**96**	298		710		1083		1317	
	%	**163**	164	60-90	160	>100	152	>100	146	>100
South West	mm	**87**	369		932		1384		1668	
	%	**123**	155	60-90	147	>100	138	80-120	133	70-100
Welsh	mm	**94**	382		982		1501		1832	
	%	**111**	142	20-30	141	>100	135	>100	131	>100
Highland	mm	**61**	306		991		1515		1880	
	%	**58**	83	2-5	101	2-5	100	2-5	101	5-10
North East	mm	**69**	297		682		1124		1364	
	%	**100**	140	15-25	139	>100	139	>>100	129	>>100
Tay	mm	**89**	353		847		1402		1702	
	%	**107**	130	10-20	120	10-15	127	>100	123	50-80
Forth	mm	**128**	394		821		1245		1522	
	%	**177**	165	>100	133	40-60	129	>100	123	80-120
Tweed	mm	**128**	373		745		1101		1378	
	%	**197**	177	>100	142	>100	133	>>100	127	>100
Solway	mm	**114**	449		1000		1418		1771	
	%	**129**	149	60-90	128	50-80	114	30-50	113	15-25
Clyde	mm	**96**	399		1037		1585		1967	
	%	**94**	111	5-10	108	5-10	105	5-10	104	5-10

% = percentage of 1991-2020 average *RP = Return period*

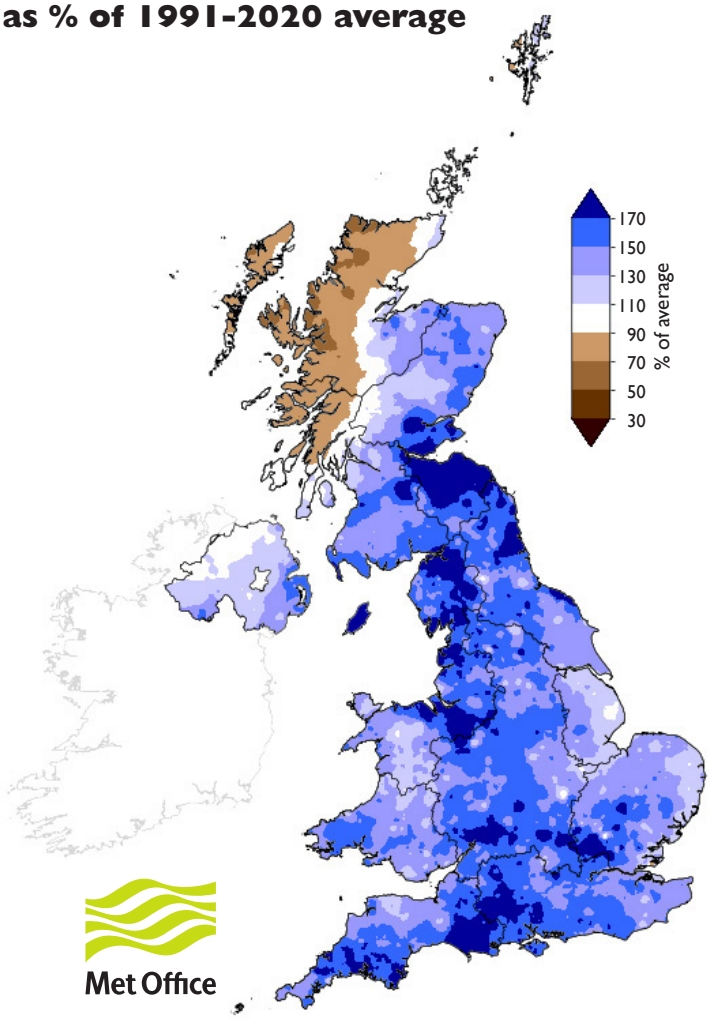
Important note: Figures in the above table may be quoted provided their source is acknowledged. Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability since 1890; they also assume a stable climate. The quoted RPs relate to the specific timespans only; for the same timespans, but beginning in any month the RPs would be substantially shorter. The timespans featured do not purport to represent the critical periods for any particular water resource management zone. For hydrological or water resources assessments of drought severity, river flows and/or groundwater levels normally provide a better guide than return periods based on regional rainfall totals. Note that precipitation totals in winter months may be underestimated due to snowfall undercatch. All monthly rainfall totals since January 2023 are provisional. Source: Data from HadUK-Grid dataset at 1km resolution v1.2.0.0.

Rainfall . . . Rainfall . . .

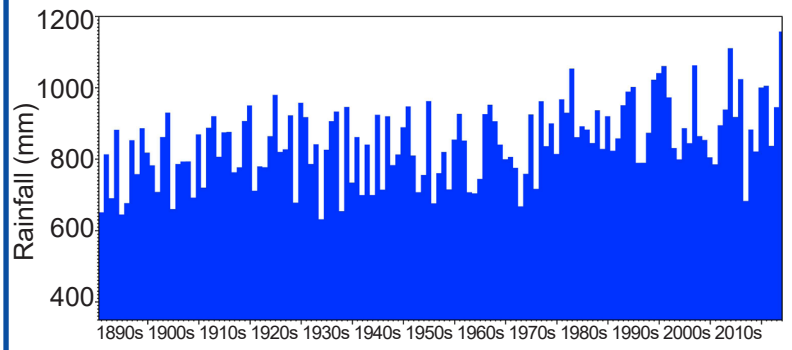
May 2024 rainfall
as % of 1991-2020 average



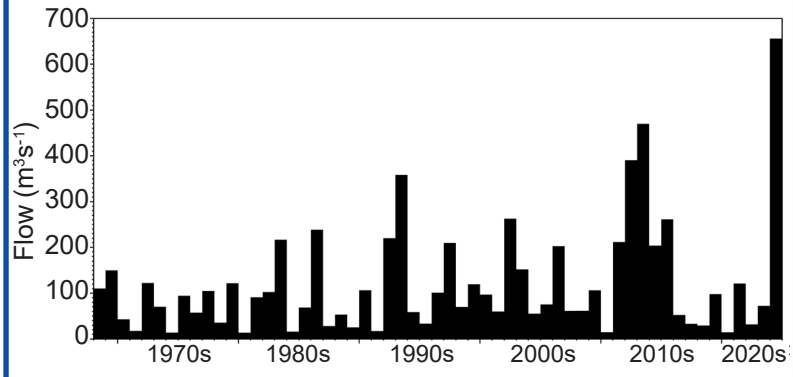
March 2024 - May 2024 rainfall
as % of 1991-2020 average



September - May rainfall for the UK



May Peak Flows for the Eden



UK Hydrological Outlook

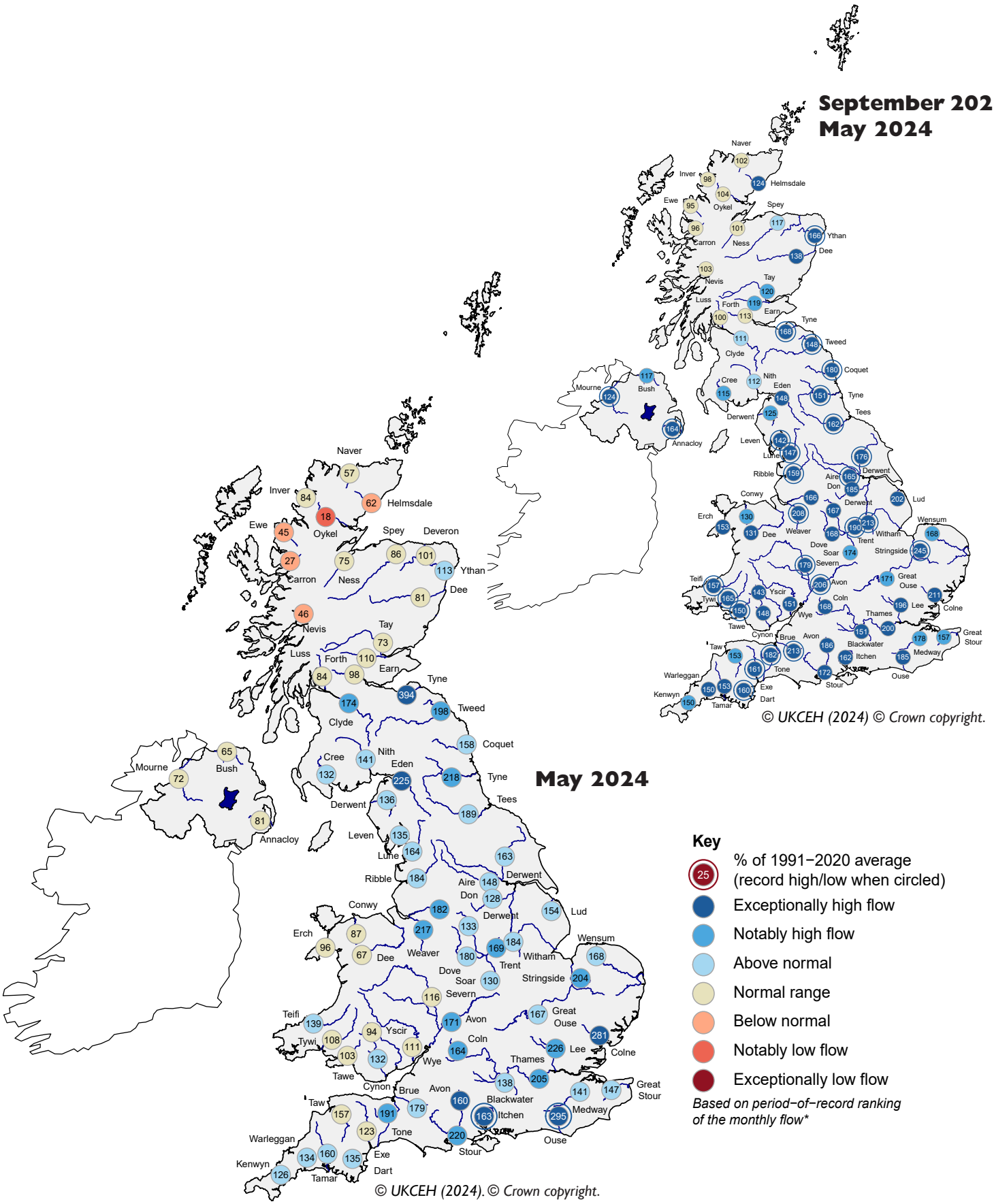
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from June 2024**
Issued: **12.06.2024**
using data to the end of May 2024

The outlook for June is for above normal river flows in southeast England and normal to above normal river flows elsewhere. The June-August outlook suggests normal to above normal flows across the country. The groundwater outlook is for above normal levels across the country in June, and normal to above normal levels for the June-August period.

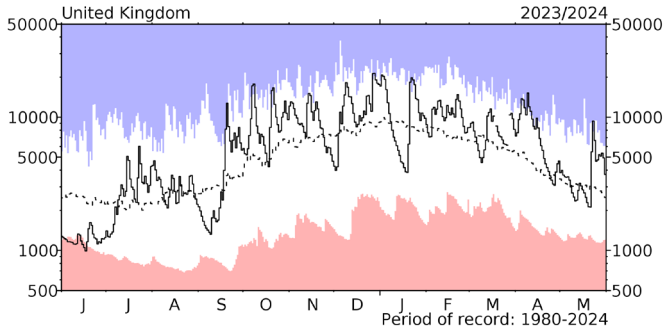
River flow . . . River flow . . .

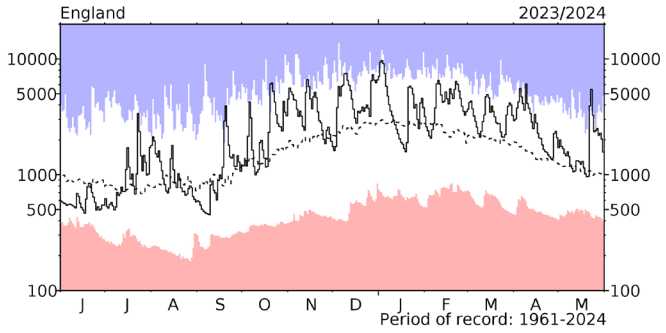


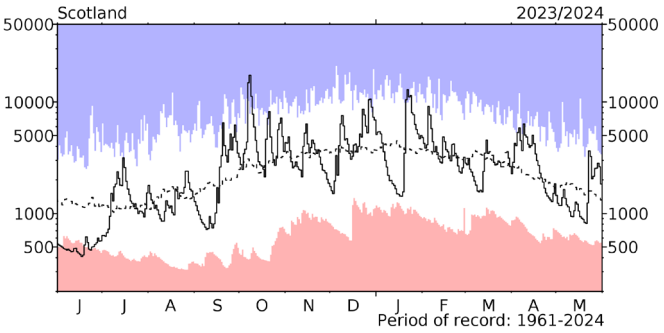
River flows

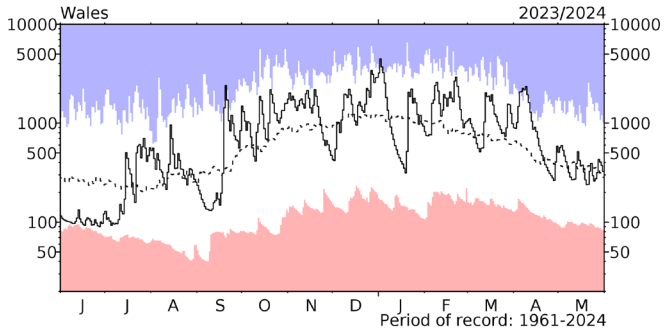
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. The categories of the spots are based on the full period-of-record data whereas the percentages are based on the 1991-2020 averaging period for consistency between rainfall and river flows. Percentages may be omitted where flows are under review.

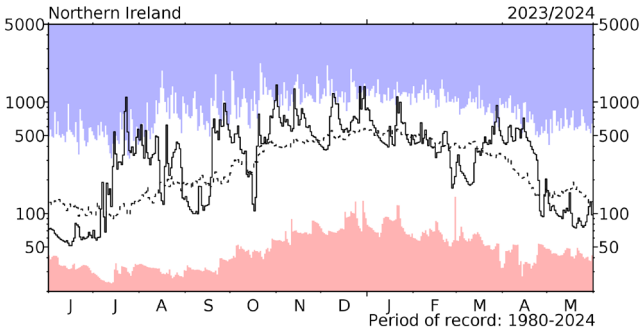
River flow . . . River flow . . .

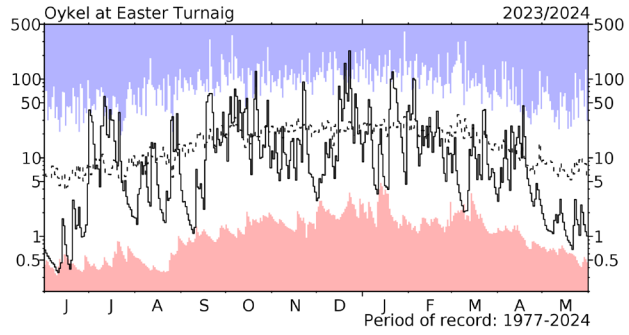


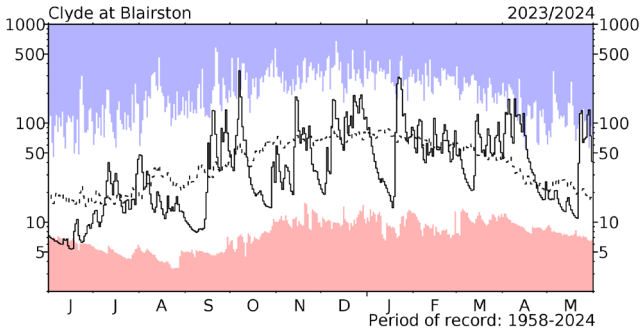


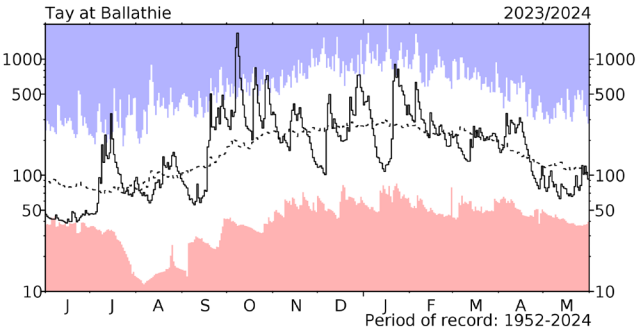


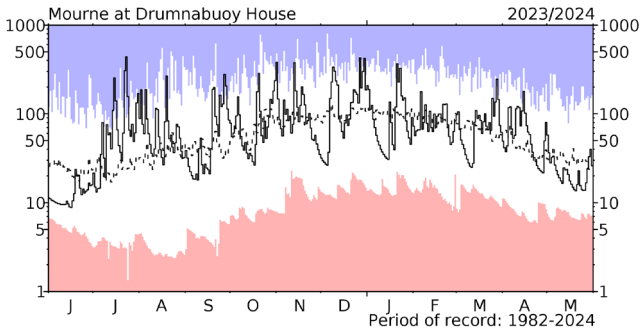


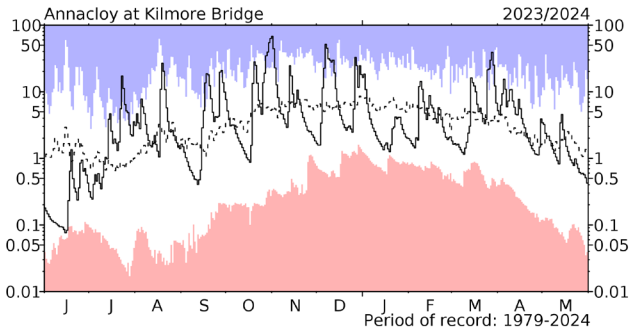








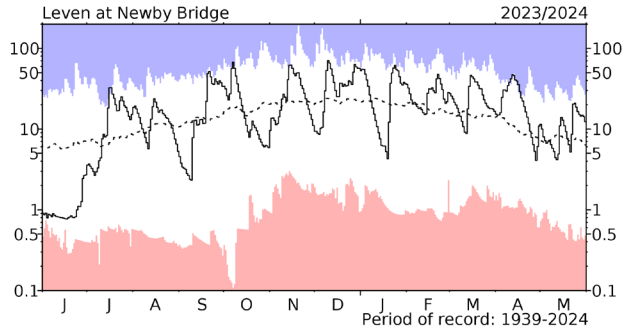


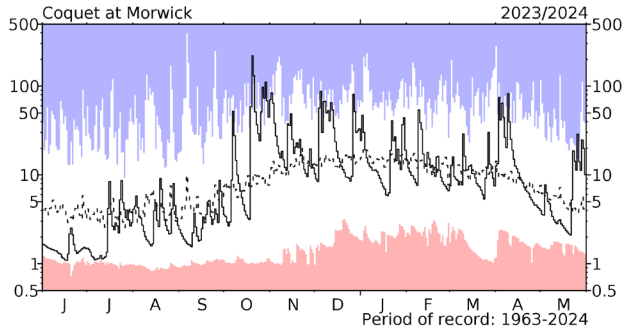


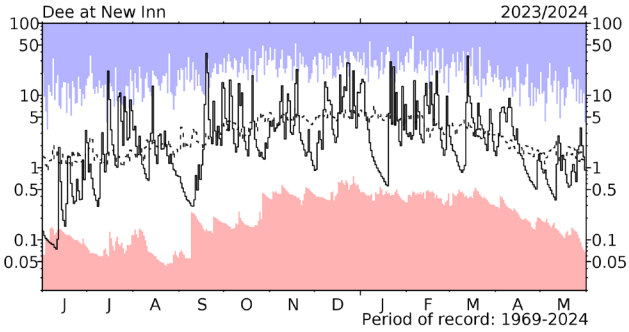
River flow hydrographs

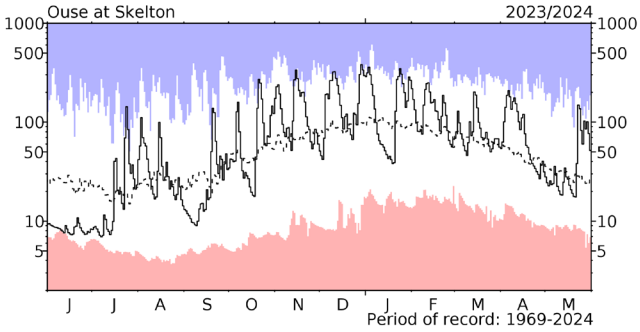
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to March 2023 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

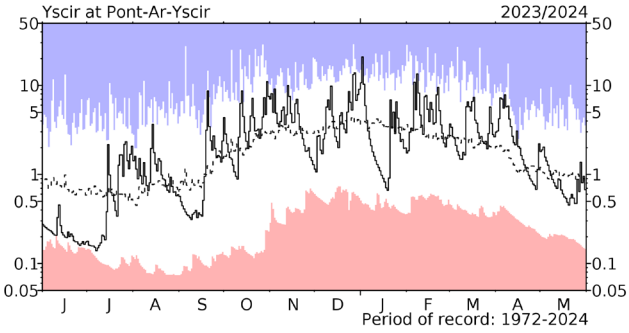
River flow . . . River flow . . .

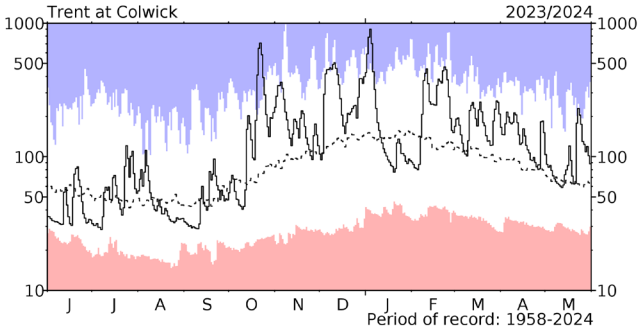


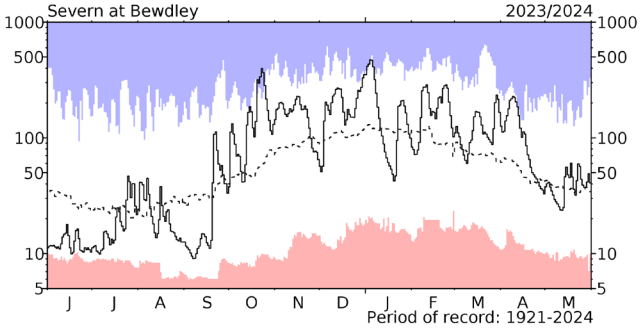


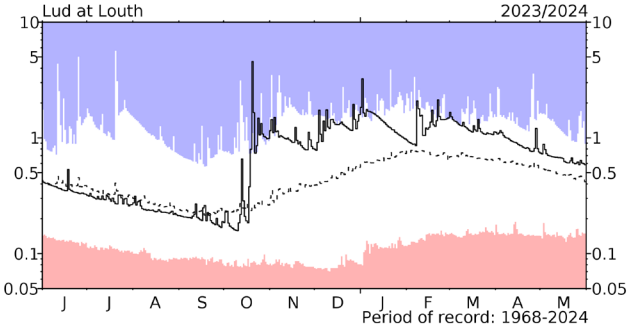


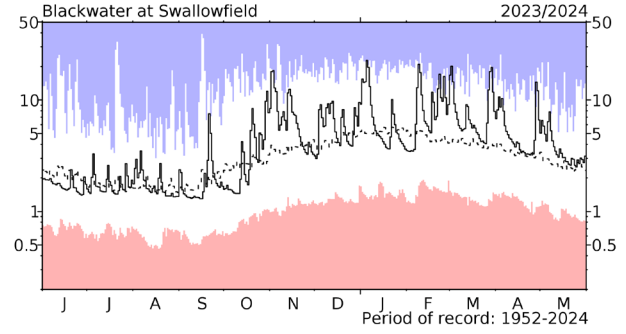


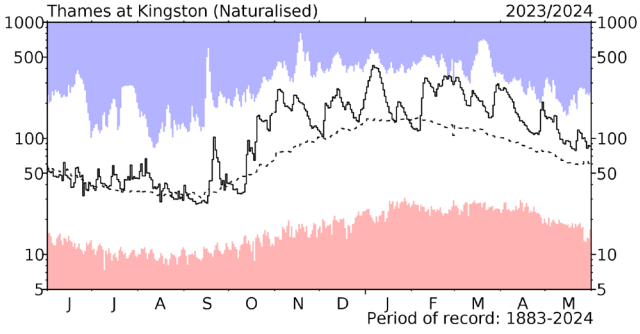


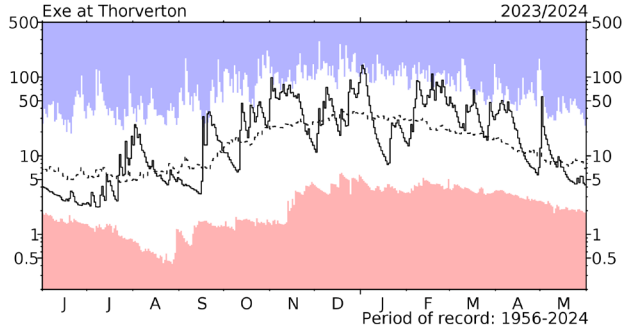


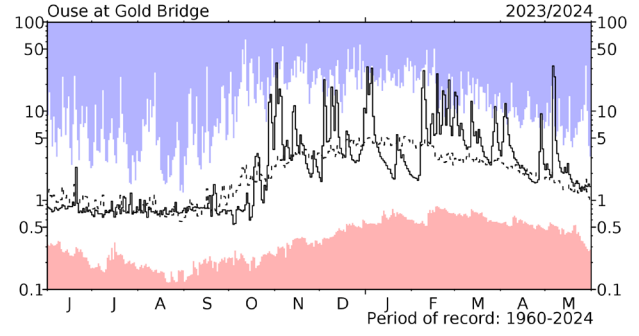




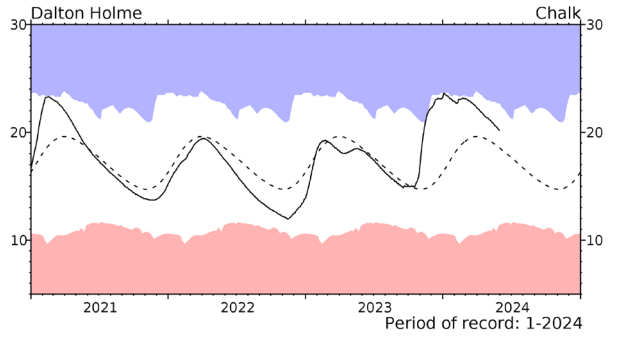


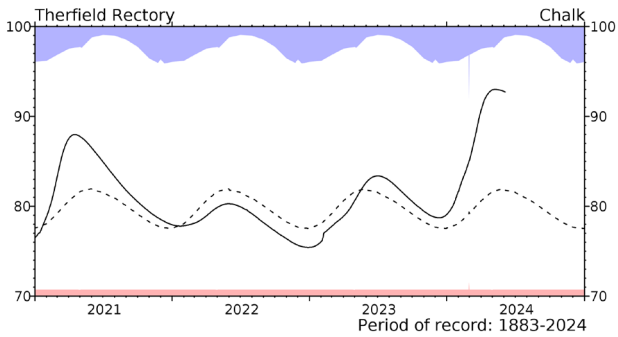


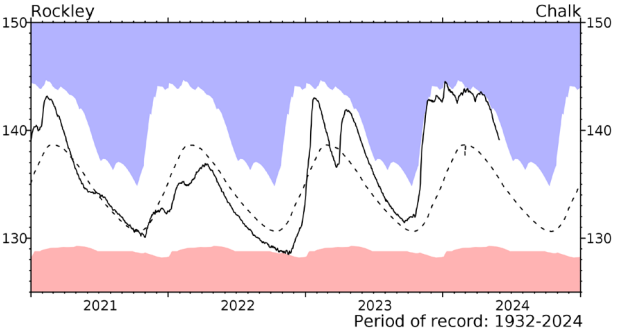


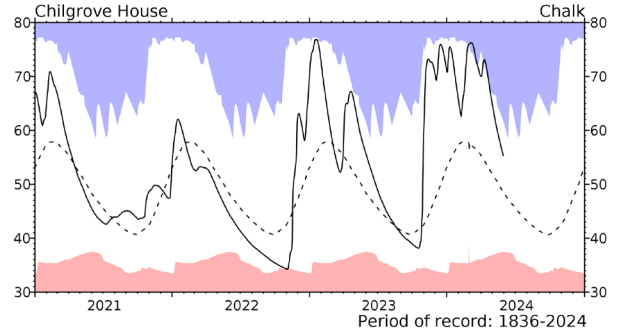


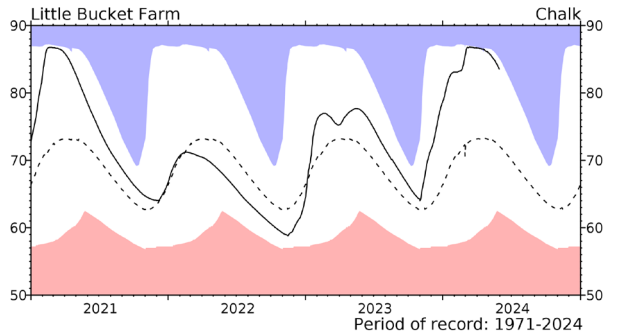
Groundwater…Groundwater

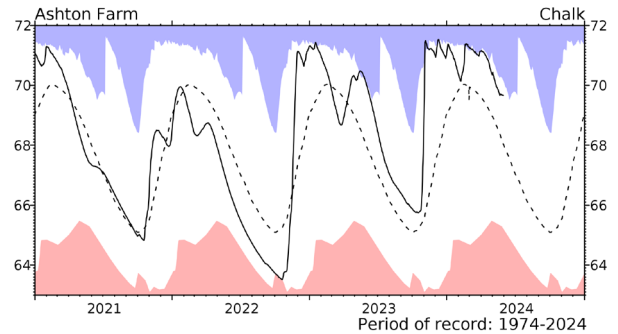


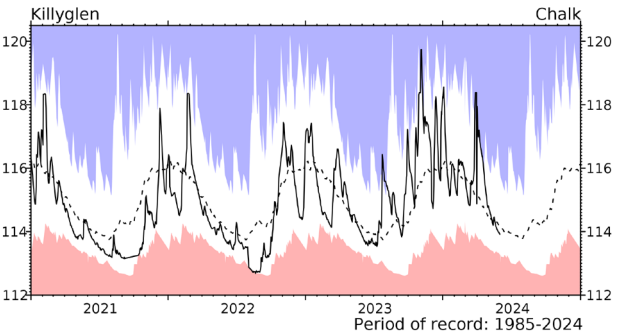


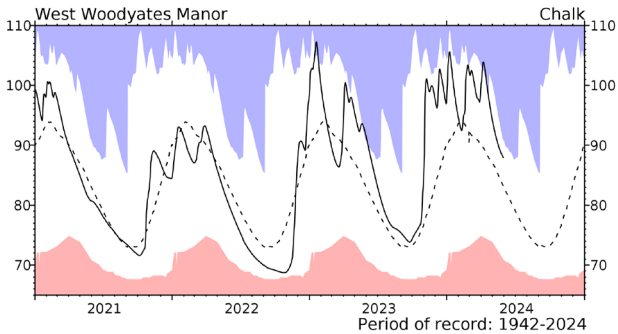


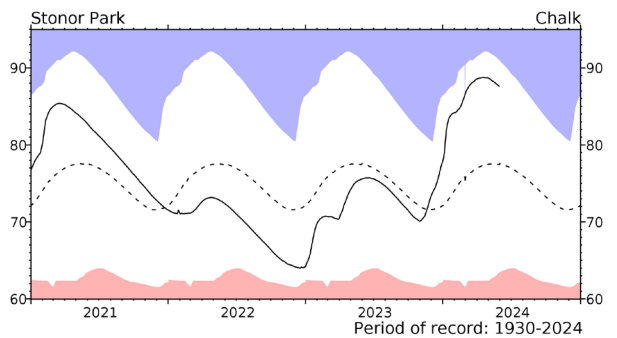


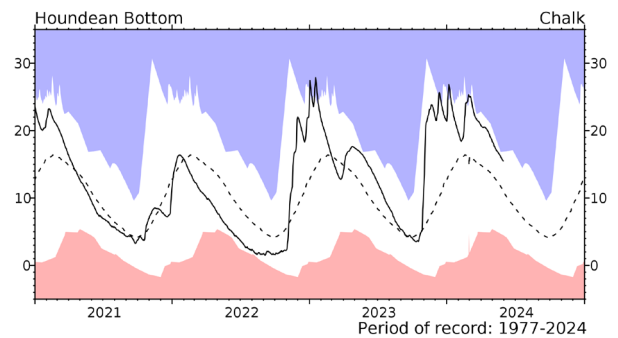






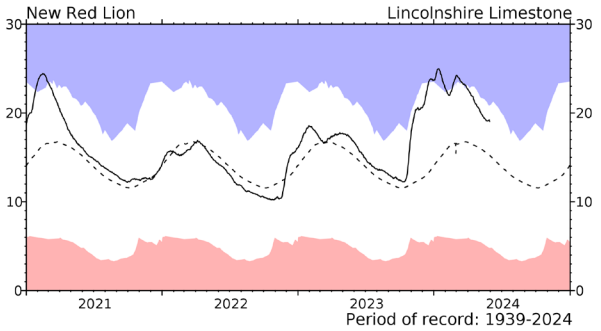


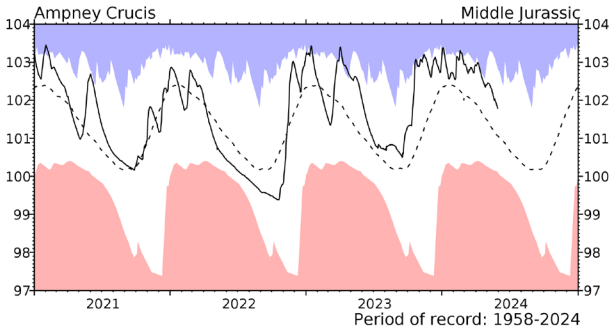


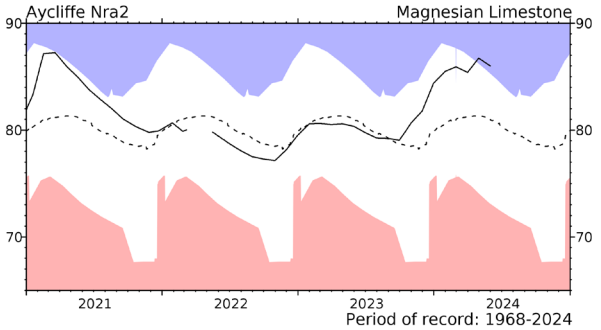


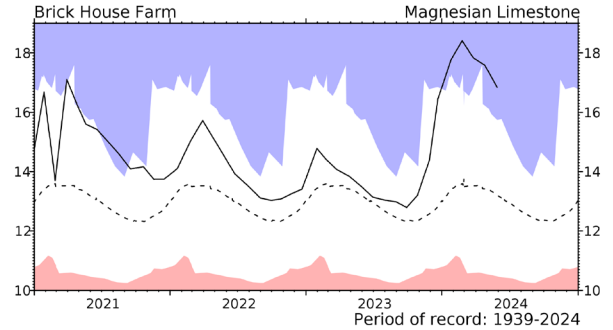
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly mean and the highest and lowest levels recorded for each month are calculated with data from the start of the record to the end of 2020. Note that most groundwater levels are not measured continuously and, for some index wells, the greater frequency of contemporary measurements may, in itself, contribute to an increased range of variation.

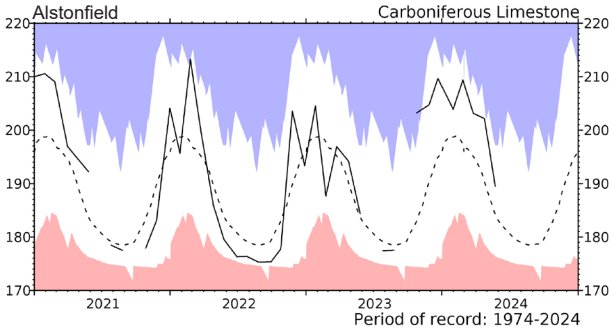
Groundwater … Groundwater

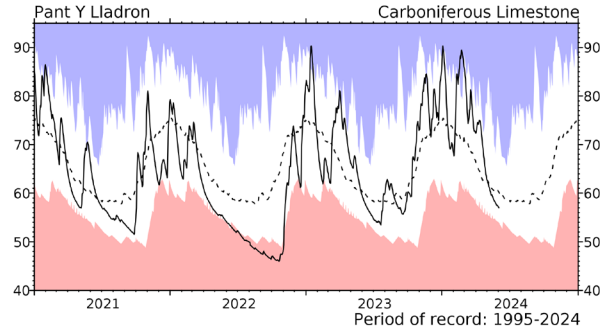


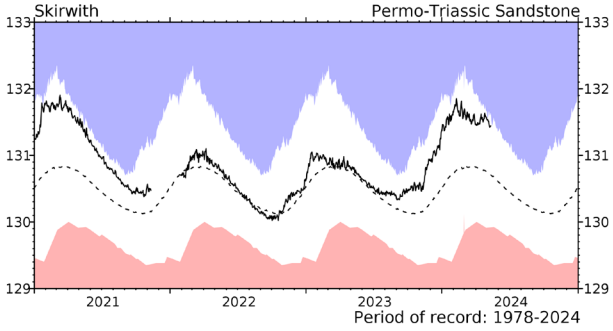


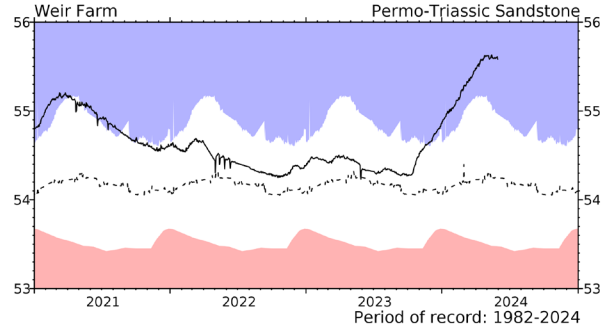


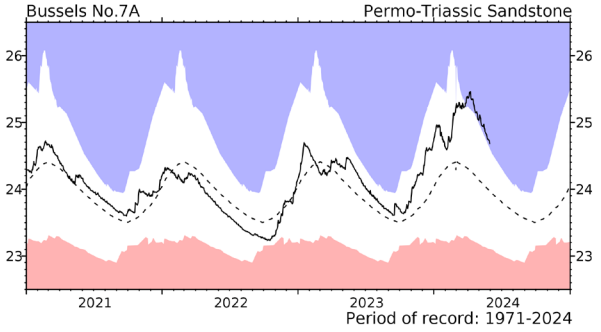


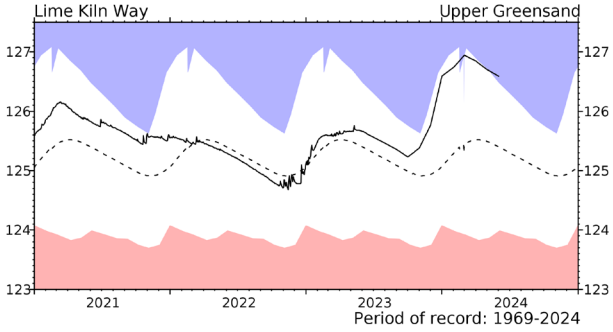


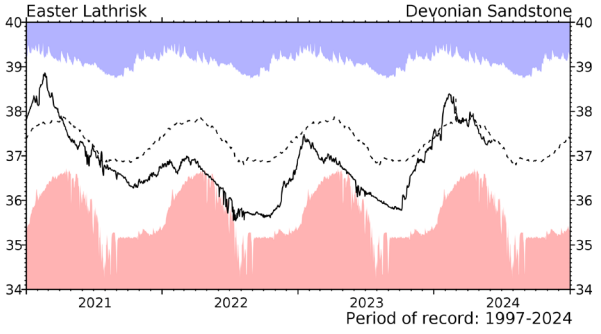


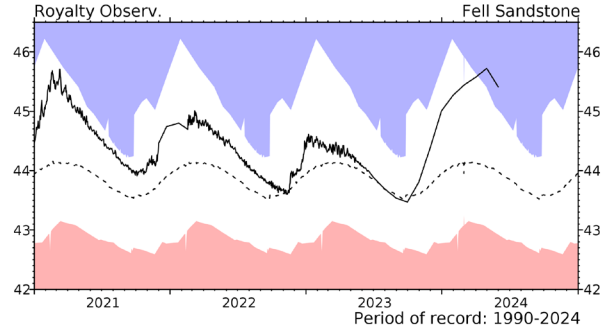


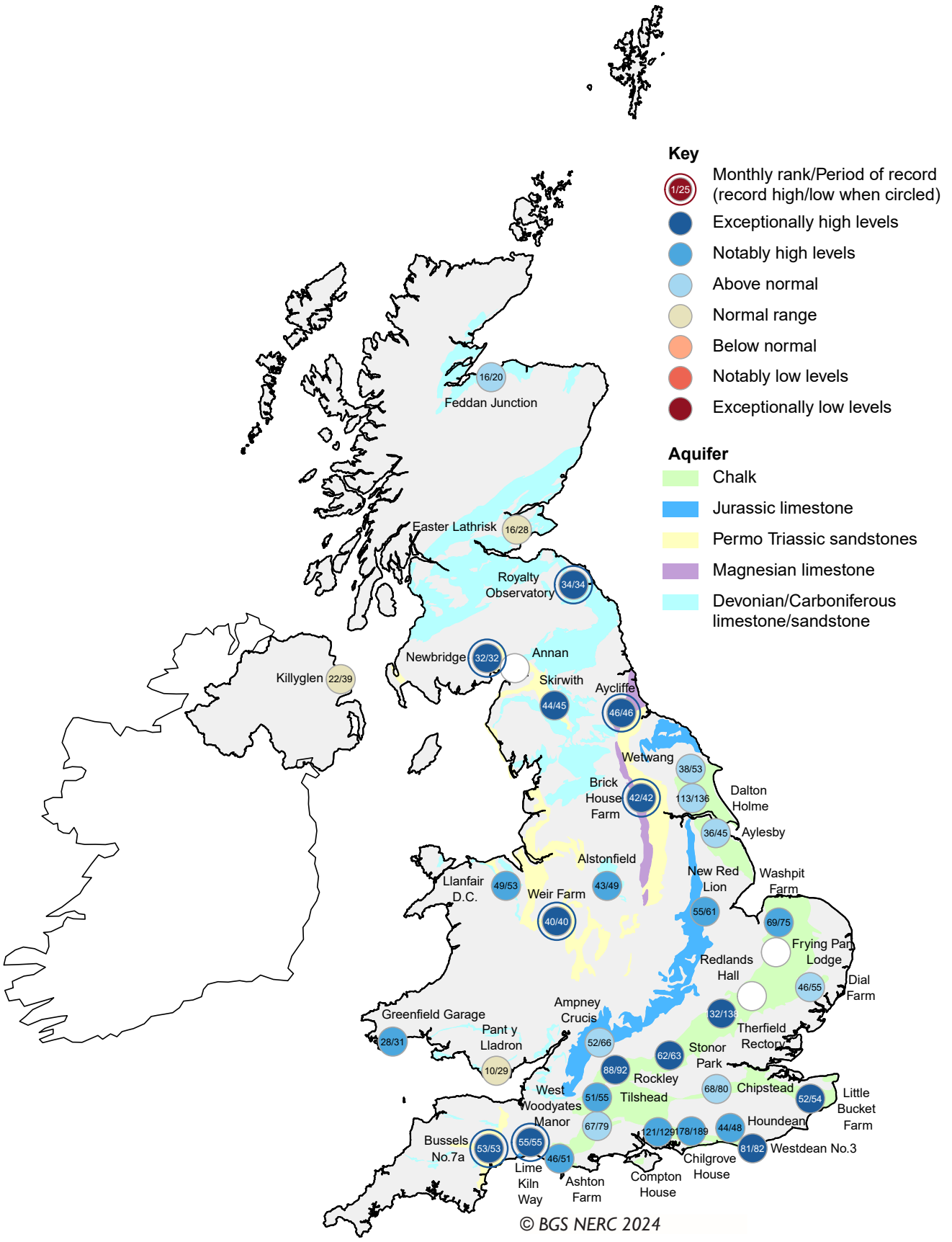










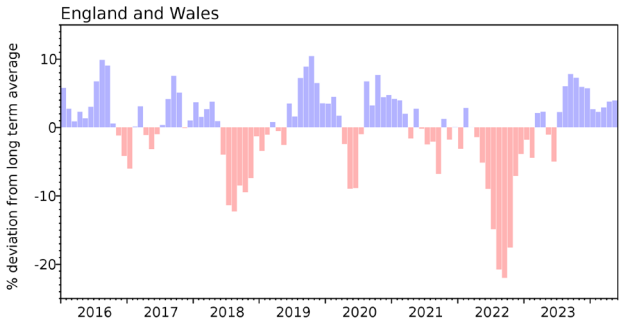


Groundwater levels - May 2024

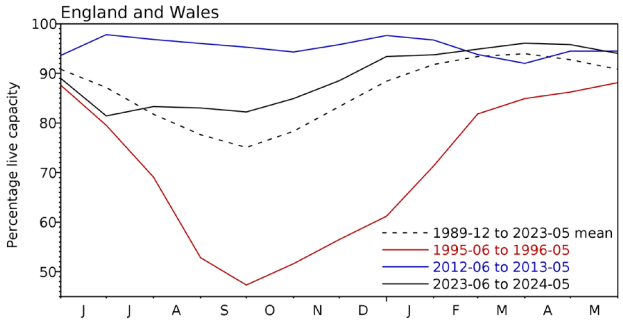
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. The rankings are designed as a qualitative indicator, and ranks at extreme levels, and when levels are changing rapidly, need to be interpreted with caution.

Reservoirs . . . Reservoirs . . .

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



Percentage live capacity of selected reservoirs at end of month

Area	Reservoir		Capacity (Ml)	2024 Mar	2024 Apr	2024 May	May Anom.	Min May	Year* of min	2023 May	Diff 24-23
North West	N Command Zone	•	124929	98	94	80	0	50	1984	80	0
	Vyrnwy		55146	100	100	92	3	69	1984	92	0
Northumbrian	Teesdale	•	87936	99	98	99	14	62	2020	77	22
	Kielder		(199175)	95	93	95	3	85	1989	93	3
Severn-Trent	Clywedog		49936	98	99	99	2	83	1989	99	-1
	Derwent Valley	•	46692	99	97	94	8	56	1996	67	27
Yorkshire	Washburn	•	23373	97	97	96	10	71	2020	93	2
	Bradford Supply	•	40942	100	97	95	10	68	2020	84	11
Anglian	Grafham		(55490)	85	90	95	1	72	1997	94	0
	Rutland		(116580)	93	98	94	2	75	1997	93	1
Thames	London	•	202828	96	96	98	4	83	1990	97	1
	Farmoor	•	13822	88	96	98	1	90	2002	99	-1
Southern	Bewl		31000	100	100	94	6	57	1990	98	-4
	Ardingly		4685	100	100	99	0	88	2022	100	-2
Wessex	Clatworthy		5662	100	98	97	10	67	1990	97	0
	Bristol	•	(38666)	97	95	93	4	70	1990	97	-4
South West	Colliford		28540	98	100	100	15	52	1997	68	32
	Roadford		34500	100	99	98	15	48	1996	68	30
	Wimbleball		21320	100	100	99	8	74	2011	96	3
	Stithians		4967	100	100	100	13	66	1990	94	6
Welsh	Celyn & Brenig	•	131155	88	89	88	-9	79	2020	85	3
	Brianne		62140	100	100	100	5	76	2022	96	4
	Big Five	•	69762	100	99	93	4	70	1990	88	5
	Elan Valley	•	99106	100	99	95	2	75	2022	90	5
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	99	98	97	7	52	1998	89	8
	East Lothian	•	9317	100	100	100	3	84	1990	100	0
Scotland(W)	Loch Katrine	•	110326	100	97	89	2	66	2001	78	11
	Daer		22494	88	83	85	-3	69	2020	73	12
	Loch Thom		10721	100	99	97	7	70	2020	83	14
Northern Ireland	Total+	•	56800	98	94	87	2	69	2008	93	-5
	Silent Valley	•	20634	100	96	89	6	56	2000	94	-5

( ) figures in parentheses relate to gross storage

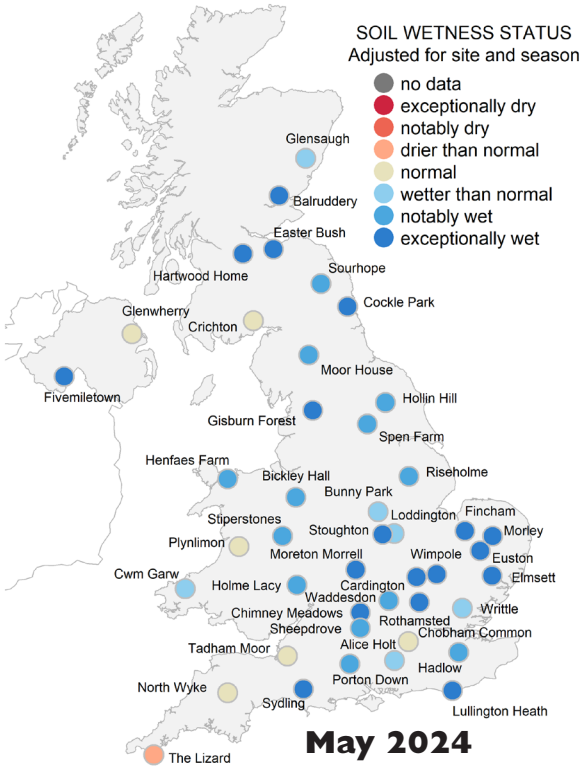
• denotes reservoir groups

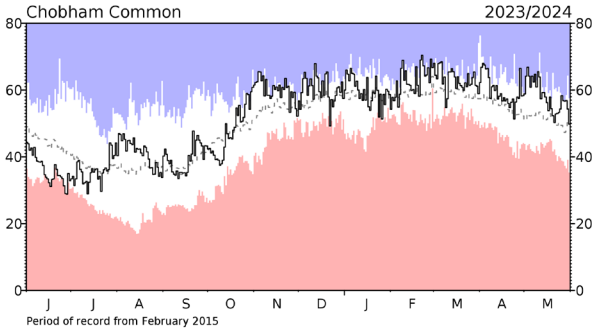
*last occurrence

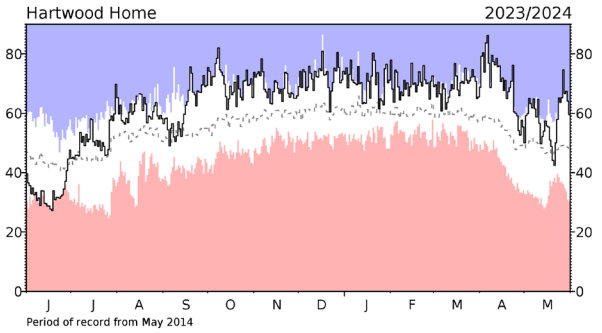
+ excludes Lough Neagh

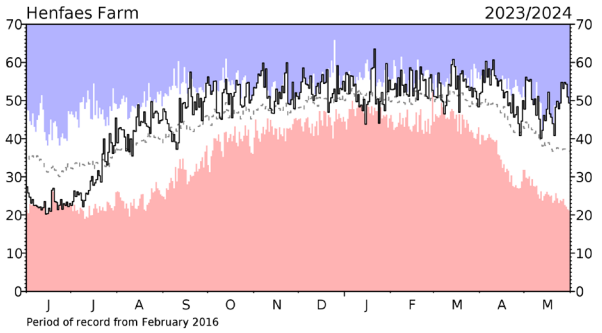
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes. Monthly figures may be artificially low due to routine maintenance or turbidity effects in feeder rivers.

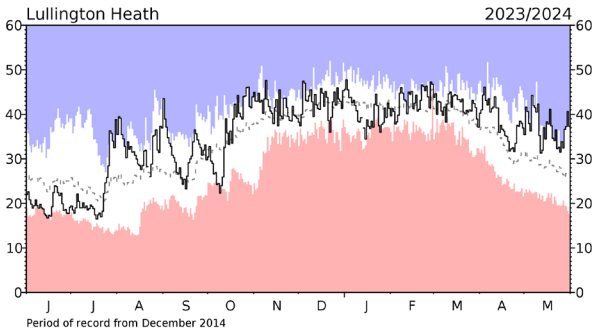
Soil Moisture . . . Soil Moisture

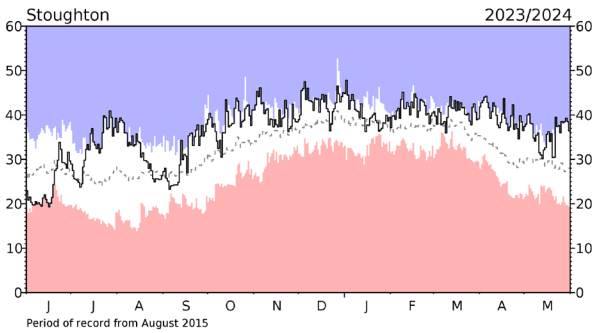












At the end of May, soil moisture remains high at many COSMOS-UK sites after a wet and mild month.

Soil moisture at some sites across Central and Southern England remains generally high (e.g. Lullington Heath, Stoughton and Sydling), whereas other sites are in a more normal range for the time of year (e.g. Chobham Common). Henfaes Farm in Northern Wales is wetter than normal after high rainfall in May, whereas it was a relatively drier month in Southern Wales which corresponded with more normal soil moisture levels at Cwm Garw. Sites in Southern Scotland (e.g. Easter Bush, Hartwood Home) are very wet following a rainy end to the month in this region, continuing a period of high soil moisture at the sites in this region since Winter 2023.

Overall, soil moisture remains generally high for much of the COSMOS-UK network, following a wetter-than-average May and mild temperatures.

Soil moisture data

These data are from UKCEH's COSMOS-UK network. The time series graphs show volumetric water content as a percentage in black together with the maximum and minimum daily values for the period-of-record of the sites. The dashed line represents the period-of-record mean VWC. For more information visit cosmos.ceh.ac.uk.

NHMP

The National Hydrological Monitoring Programme (NHMP) was started in 1988 and is undertaken jointly by the UK Centre for Ecology & Hydrology (UKCEH) and the British Geological Survey (BGS). The NHMP aims to provide an authoritative voice on hydrological conditions throughout the UK, to place them in a historical context and, over time, identify and interpret any emerging hydrological trends. Hydrological analysis and interpretation within the Programme is based on the data holdings of the National River Flow Archive (NRFA; maintained by UKCEH) and National Groundwater Level Archive (NGLA; maintained by BGS), including rainfall, river flows, borehole levels, and reservoir stocks.

The Hydrological Summary is supported by the Natural Environment Research Council award number NE/R016429/1 as part of the UK-SCAPE programme delivering National Capability.

Data Sources

The NHMP depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged. A location map of all sites used in the Hydrological Summary can be found on the NHMP website. River flow and groundwater level data are provided by the Environment Agency (EA), Natural Resources Wales - Cyfoeth Naturiol Cymru (NRW), the Scottish Environment Protection Agency (SEPA) and, for Northern Ireland, the Department for Infrastructure - Rivers and the Northern Ireland Environment Agency. In all cases the data are subject to revision following validation (high flow and low flow data in particular may be subject to significant revision).

Details of reservoir stocks are provided by the Water Service Companies, the EA, Scottish Water and Northern Ireland Water.

The Hydrological Summary and other NHMP outputs may also refer to and/or map soil moisture data for the UK. These data are provided by the Meteorological Office Rainfall and Evaporation Calculation System (MORECS). MORECS provides estimates of monthly soil moisture deficit in the form of averages over 40 x 40 km grid squares over Great Britain and Northern Ireland. The monthly time series of data extends back to 1961.

Rainfall data are provided by the Met Office. To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA, NRW and SEPA. The areal rainfall figures have been produced by the Met Office National Climate Information Centre (NCIC), and are based on the HadUK-Grid 1km resolution gridded data from rain gauges. The majority of the full rain gauge network across the UK is operated by the EA, NRW, SEPA and Northern Ireland Water; supplementary rain gauges are operated by the Met Office. The Met Office NCIC monthly rainfall series extend back to 1836 and form the official source of UK areal rainfall statistics which have been adopted by the NHMP. The gridding technique used is described in Hollis, 2019 available at https://doi.org/10.1002/gdj3.78

Long-term averages are based on the period 1991-2020 and are derived from the monthly areal series.

The regional figures for the current month in the hydrological summaries are based on a limited rain gauge network so these (and the associated return periods) should be regarded as a guide only.

The monthly rainfall figures are provided by the Met Office NCIC and are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation. These are provisional totals calculated from a sub set of Met Office registered gauges and will be subject to change once data from the complete network of Met Office registered gauges has been quality assured and gridded within the annual process of updating the HadUK-Grid dataset.

For further details on rainfall or MORECS data, please contact the Met Office:

Tel: 0370 900 0100
Email: enquiries@metoffice.gov.uk

Enquiries

Enquiries should be directed to the NHMP:

Tel: 01491 692599
Email: nhmp@ceh.ac.uk

A full catalogue of past Hydrological Summaries can be accessed and downloaded at:

http://nrfa.ceh.ac.uk/monthly-hydrological-summary-uk

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