Hydrological Summary

for the United Kingdom

August 2024

General

August was unsettled and began with warmer than average temperatures and associated thunderstorms and showers across the country. In contrast, the second half was cooler than average but still unsettled with more organised 'westerlies' bringing rainfall – particularly to northern Britain. Rainfall was above average for the UK as a whole; however this masked a stark contrast between above normal rainfall in north-western Britain and below normal rainfall elsewhere. River flows were in the normal range or above in southern and eastern England and north-western UK, and in the normal range or below in central and south-west England. Reservoir stocks in England & Wales fell by 5% but remained above average. Surpluses relative to average were recorded at some northern impoundments (e.g. Vyrnwy and Loch Katrine were 24% and 23% above average, respectively), whilst small deficits (5-10%) were recorded at Bewl, Ardingly, Derwent Valley, Bristol, and Elan Valley. Groundwater levels continued to fall across the UK and were in the normal range to exceptionally high at the majority of sites. The Outlook suggests unsettled conditions are likely to persist through autumn, meaning water resources are likely to remain healthy. The potential for flooding could be of concern. Soil moisture deficits particularly in central and southern areas, suggest there is capacity to attenuate any rainfall, however, there has been some significant rainfall at the start of September in southern areas which may have reduced this capacity.

Rainfall

August saw changeable weather, beginning with scattered showers interspersed with dry spells. Widespread thunderstorms across central and southern England on the 1st brought heavy downpours, surface water flooding, and resulted in travel disruption in Birmingham, Hampshire, and Surrey. Over the next week, all areas occasionally saw showers, some heavy, although with few notable daily totals. The hottest day of the year so far (34.8°C in Cambridge) coincided with further intense thunderstorms in central and northern Britain on the 12th. This led to power losses for over 10,000 properties in Northern Ireland and the Republic of Ireland, a house fire in Aviemore (Highland) and once again caused pluvial flooding in Birmingham. On the 21st and 22nd, a low-pressure system formed from the remnants of hurricane 'Ernesto' and brought widespread rainfall to northern Britain (e.g. 154mm at Honister Pass, Cumbria). Storm 'Lilian' (the twelfth named storm of the 2023/2024 storm season, making it the stormiest season since the naming system was launched in 2015), arrived on the 23rd, bringing widespread rainfall and high winds. The named storm caused power cuts, disruption at the Leeds and Creamfields (Cheshire) festivals, whilst flights were cancelled at London Heathrow and the Severn Bridge (Gloucestershire) was temporarily closed. Total August rainfall was above average for the UK (110%), but with a clear spatial gradient. Rainfall was above average for north-west Britain (most notably for Highland, Forth, Solway and Clyde regions, with at least 150% of their respective averages). The Western Isles registered the second wettest August, whilst overall Scotland registered its seventh wettest August (both in series from 1890). Elsewhere, rainfall was below average with Severn-Trent and Yorkshire regions recording less than half the average. For the summer (June-August), rainfall was slightly below average (95%) for the UK, although Scotland registered above average rainfall (118%), whilst the other three nations were all near average (Northern Ireland) or, drier than average (England and Wales).

River Flows

River flows generally began the month below average, but with some above normal flows persisting in the groundwater dominated catchments in south-east England. Periods of unsettled weather resulted in isolated peaks particularly in western Scotland and north-west England on the 5th and 15th. Scottish and Welsh rivers recorded new daily flow maxima in the first 10 days of the month e.g. Erch, Cree, Nevis, and Carron as well as groundwater dominated rivers in the south e.g. Blackwater, Itchen. River flows in Scotland and north-west England remained above average until the end of the month, with many Scottish rivers recording new daily maxima from in the final 10 days of the month e.g. Forth, Tweed, Eden, Nith, Clyde. Both the Cumbrian Derwent and Cumbrian Leven recorded their second highest August peak flows on the 24th and 28th, respectively (both in records of more than 50 years). Monthly mean August river flows were mixed but were above normal to exceptionally high in western Scotland and north-west England, Northern Ireland and in groundwater dominated catchments of the south-east England. In western Scotland both the Carron and Nevis registered record average August flows (in records from 1979 and 1983, respectively). Elsewhere river flows in central and south-west England were in the normal range or below normal with some catchments recording less than half the monthly average (e.g. Aire, Exe, Taw). Over the summer (June-August), river flows reflected a similar pattern to August, albeit with more flows in the normal range in central and south-west England and some below normal flows registered in south Wales e.g. Teifi, Yscir and Cynon. Conversely, both the Carron and the Itchen recorded their highest average summer flows on record (both in records of more than 45 years).

Soil Moisture and Groundwater

Soil moisture was within the normal range at the end of August in central and southern England, whilst in Scotland, Wales, and northern England it was above normal and in places, notably or exceptionally high. Groundwater levels continued to fall in the Chalk throughout August and were normal to exceptionally high; whilst levels at several sites moved towards or into the normal range. Levels rose at Killyglen and became normal for August. In the Jurassic limestones, levels fell and moved into or towards the normal range. Groundwater levels in the Magnesian Limestone also continued receding but remained exceptionally high with a further record high value at Brick House Farm (in a 44-year series). Levels fell in the Carboniferous Limestone, remaining exceptionally low at Pant-y-Lladron and moving into the normal range at Alstonfield. Levels receded at all sites in the Permo-Triassic Sandstones, and the record high groundwater levels persisted at Skirwith and Weir Farm (both in records of more than 40 years) but became above normal at Bussels No.7a. A record high for August (in a 55-year series) was also recorded at Lime Kiln Way (Upper Greensand). Levels in the Fell Sandstone at Royalty Observatory fell and remained exceptionally high. In the Devonian sandstones, groundwater levels fell and were in the normal range at both Feddan Junction and Easter Lathrisk.

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.

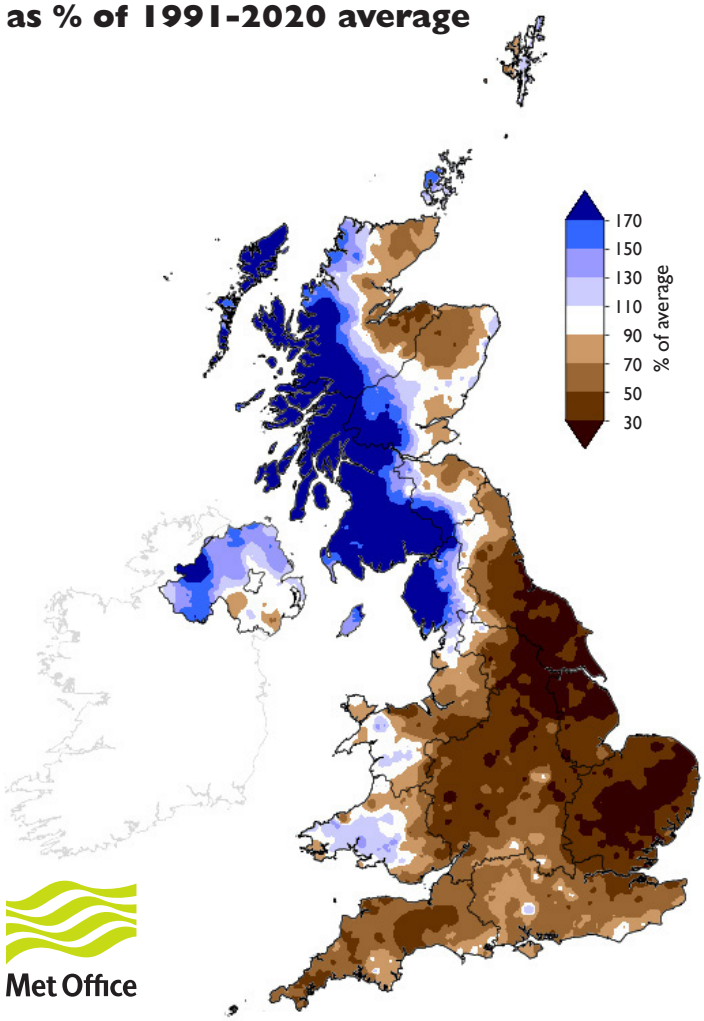
Region	Rainfall	Aug 2024	Jun24 – Aug24	RP	Mar24 – Aug24	RP	Dec23 – Aug24	RP	Sep23 – Aug24	RP
United Kingdom	mm	**104**	241		543		989		1398	
	%	**110**	95	2-5	113	8-12	120	40-60	121	>100
England	mm	**46**	159		423		783		1122	
	%	**62**	77	2-5	112	2-5	127	40-60	130	>100
Scotland	mm	**195**	373		718		1278		1767	
	%	**162**	118	5-10	115	15-25	114	15-25	112	25-40
Wales	mm	**104**	240		630		1256		1794	
	%	**93**	79	2-5	108	2-5	122	20-35	123	50-80
Northern Ireland	mm	**128**	265		546		886		1315	
	%	**129**	98	2-5	108	2-5	106	5-10	114	50-80
England & Wales	mm	**54**	171		451		847		1214	
	%	**68**	78	2-5	111	2-5	126	40-60	128	>100
North West	mm	**143**	303		692		1224		1691	
	%	**129**	103	2-5	130	50-80	135	>100	132	>>100
Northumbria	mm	**53**	184		465		784		1142	
	%	**64**	80	2-5	114	5-10	120	15-25	126	>>100
Severn-Trent	mm	**31**	136		388		718		1028	
	%	**45**	67	5-10	105	2-5	124	15-25	128	40-60
Yorkshire	mm	**30**	153		408		768		1105	
	%	**39**	70	5-10	105	2-5	122	15-25	127	50-80
Anglian	mm	**20**	118		293		541		796	
	%	**33**	69	5-10	98	2-5	120	8-12	127	30-50
Thames	mm	**36**	134		373		674		963	
	%	**58**	80	2-5	117	2-5	131	20-30	133	40-60
Southern	mm	**41**	127		367		723		1100	
	%	**66**	75	2-5	113	2-5	128	15-25	134	50-80
Wessex	mm	**45**	150		448		860		1233	
	%	**62**	78	2-5	119	5-10	135	50-80	136	>100
South West	mm	**54**	193		562		1125		1577	
	%	**58**	76	2-5	114	5-10	127	40-60	126	40-60
Welsh	mm	**98**	229		611		1212		1730	
	%	**90**	78	2-5	109	2-5	123	25-40	123	50-80
Highland	mm	**214**	441		747		1432		1956	
	%	**164**	130	10-20	105	2-5	109	5-10	106	5-10
North East	mm	**72**	250		546		932		1373	
	%	**80**	99	2-5	118	5-10	125	30-50	129	>>100
Tay	mm	**144**	282		635		1129		1684	
	%	**135**	97	2-5	113	5-10	113	8-12	121	60-90
Forth	mm	**152**	267		661		1088		1512	
	%	**151**	95	2-5	127	30-50	122	25-40	122	>100
Tweed	mm	**115**	243		615		987		1344	
	%	**122**	94	2-5	131	25-40	126	50-80	124	>100
Solway	mm	**255**	409		858		1409		1828	
	%	**199**	122	5-10	135	80-120	126	70-100	116	40-60
Clyde	mm	**295**	469		868		1506		2053	
	%	**201**	123	8-12	117	15-25	112	10-20	109	10-20

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

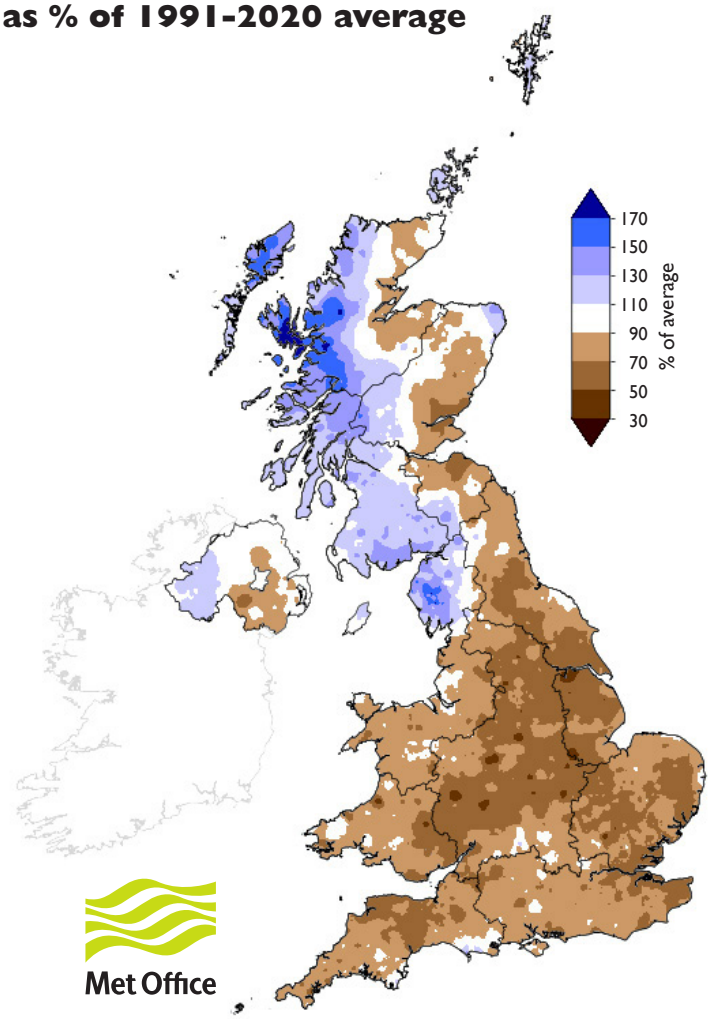
Important note: Figures in the above table may be quoted provided their source is acknowledged. Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability 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 . . .

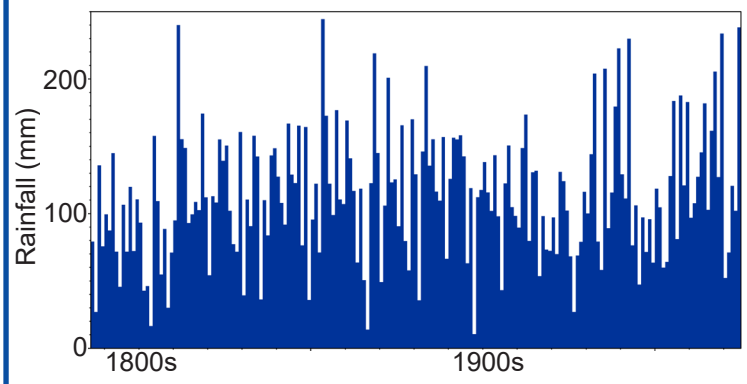
August 2024 rainfall as % of 1991-2020 average



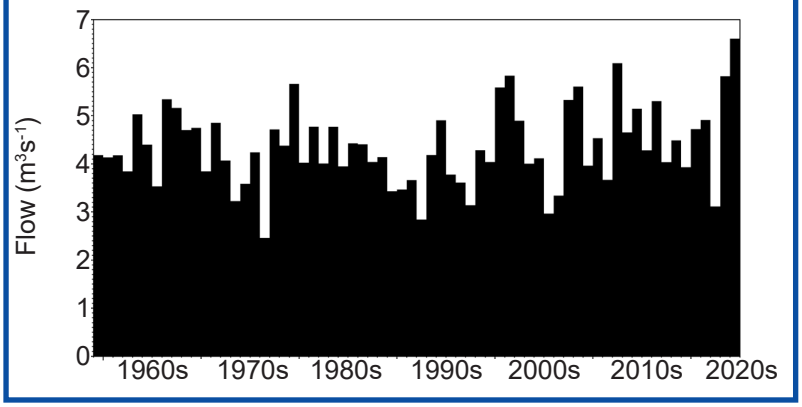
June 2024 - August 2024 rainfall as % of 1991-2020 average



August rainfall for the Western Isles



June - August average river flows on the Itchen



UK Hydrological Outlook

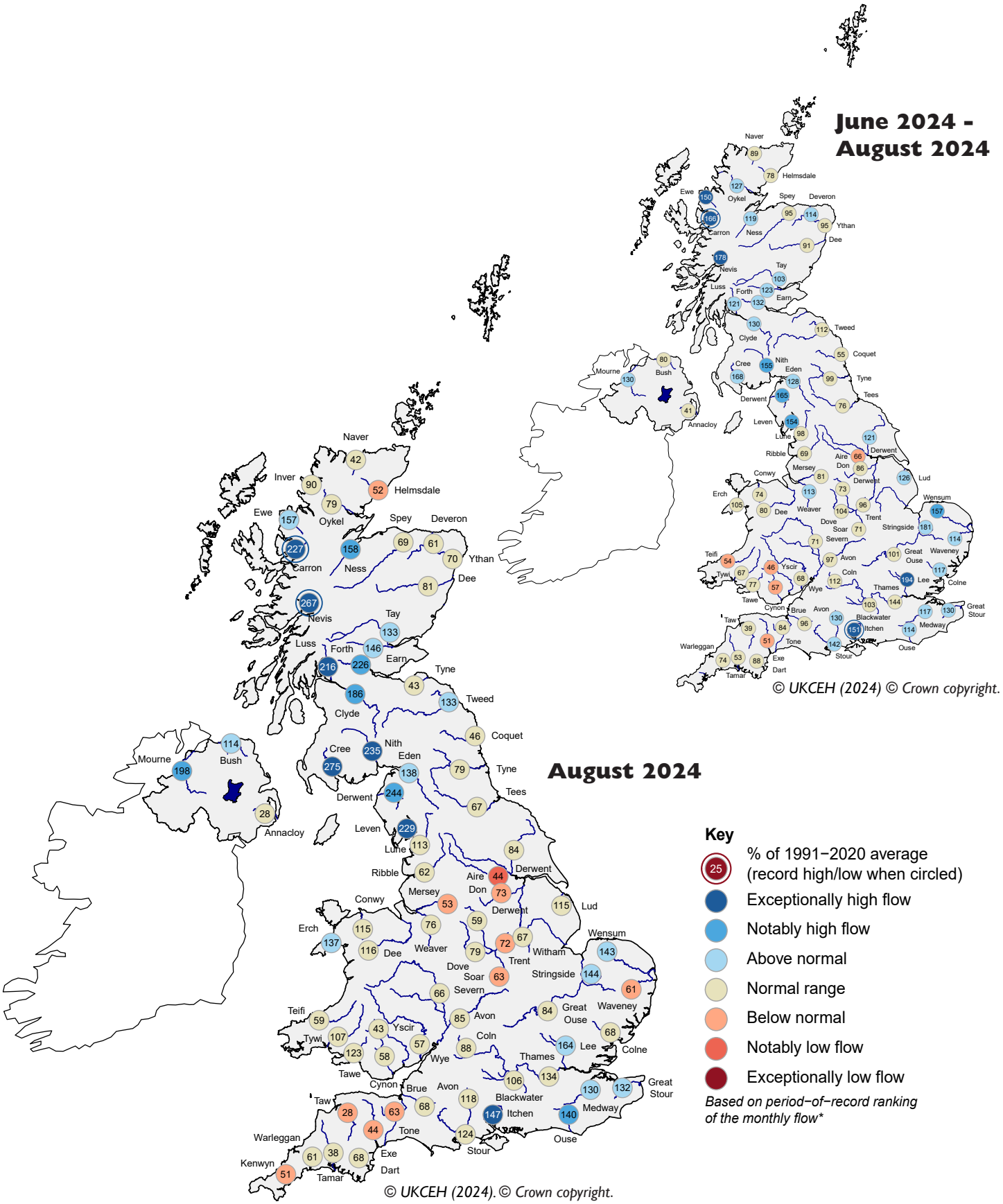
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from September 2024**
Issued: **10.09.2024**
using data to the end of August 2024

The outlook for September is for river flows to be normal to above normal across northern and western parts of the UK, as well as in parts of the south-east. Across the north-east and central England, flows are likely to be normal to below normal. Over the autumn period above normal to high river flows are expected over the north-west. Groundwater levels are likely to be normal to above normal across the UK for September to November.

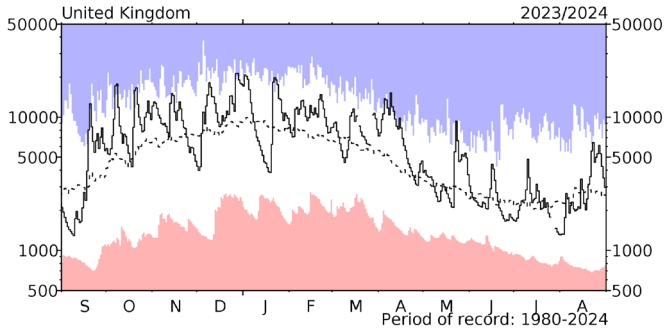
River flow . . . River flow . . .

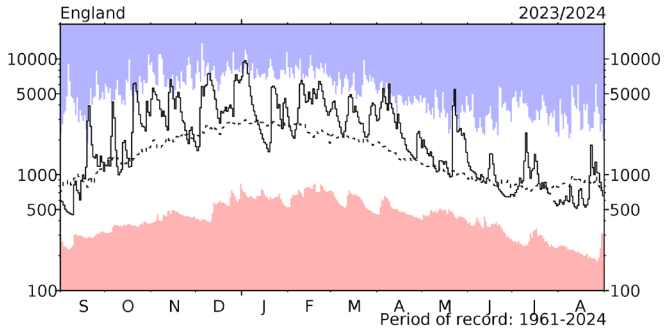


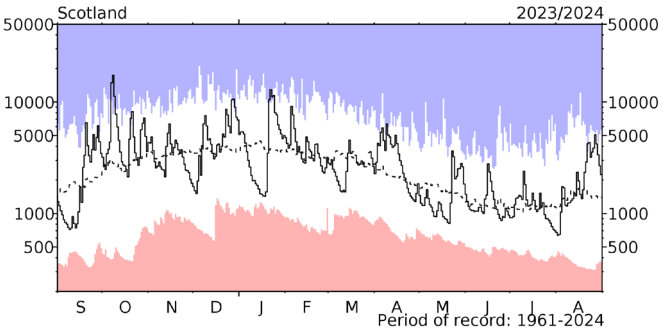
River flows

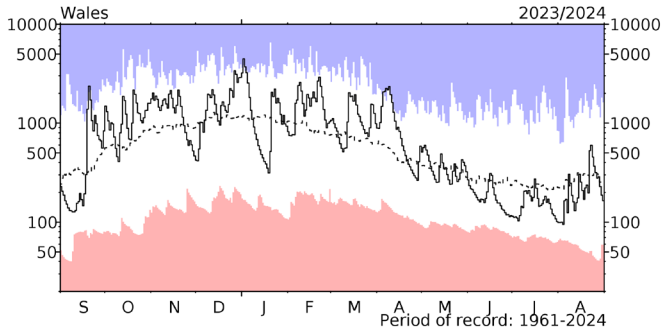
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much 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.

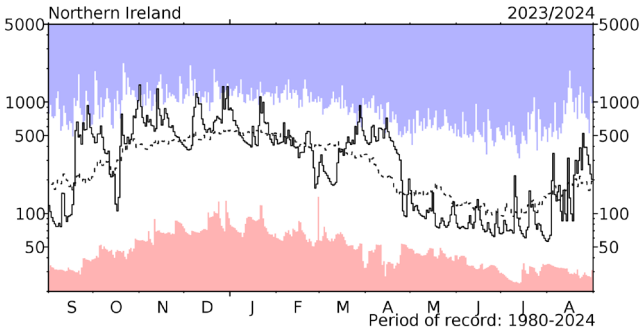
River flow . . . River flow . . .

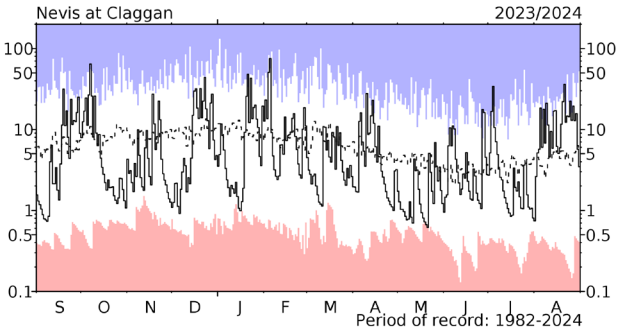


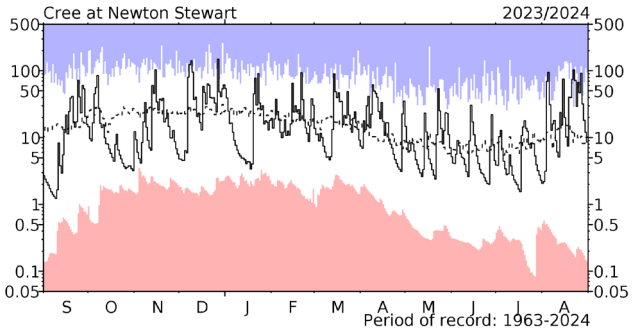


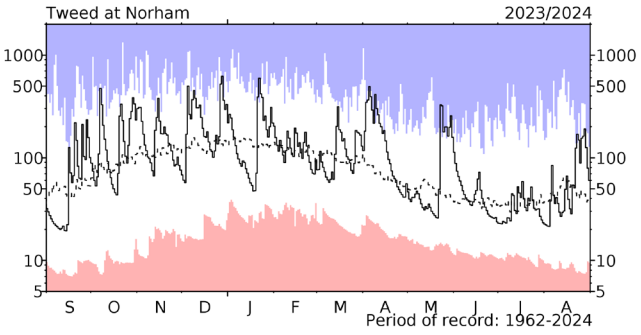


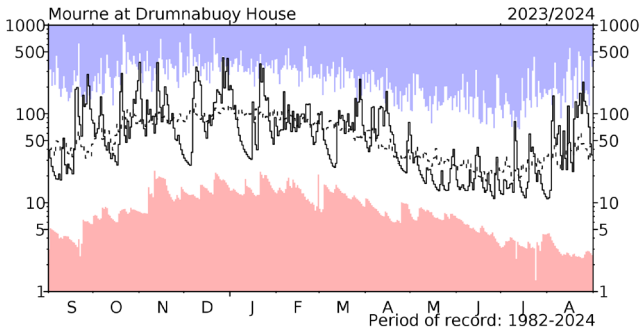


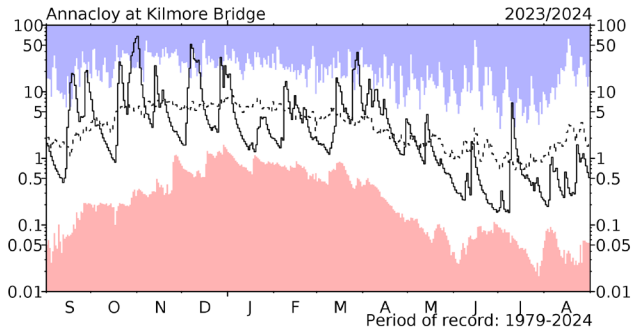








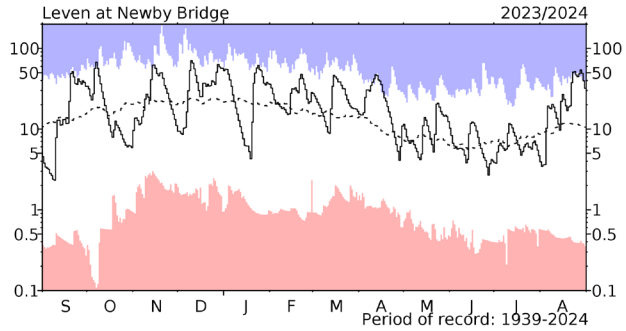


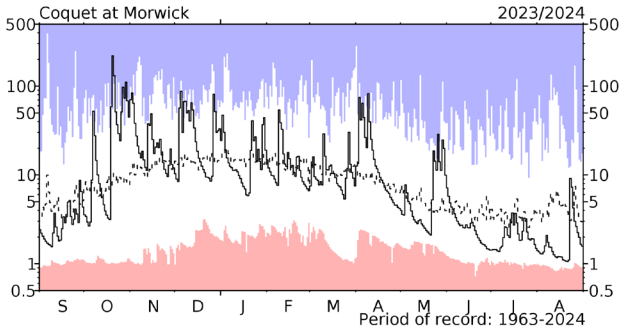


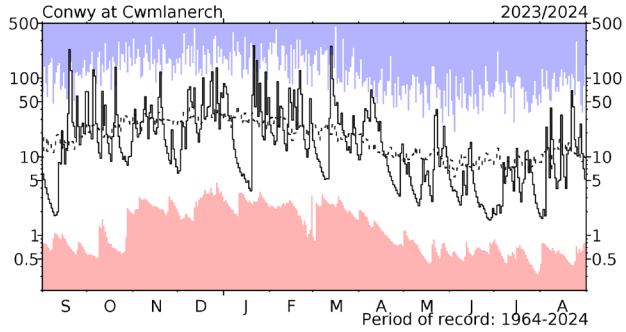
River flow hydrographs

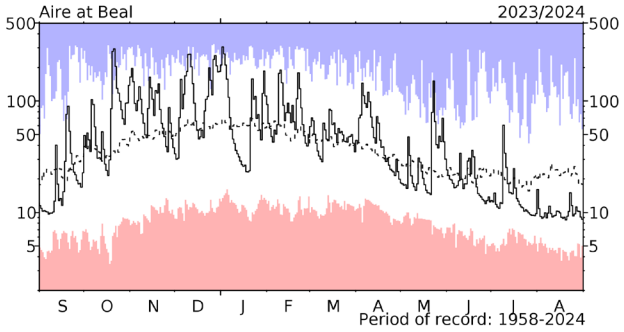
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to August 2023 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

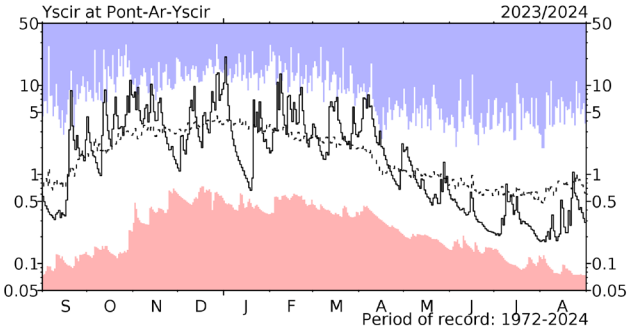
River flow . . . River flow . . .

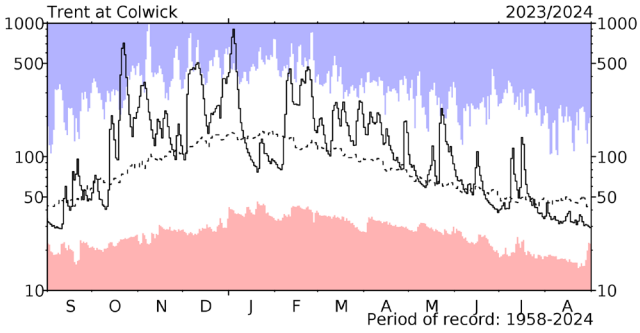


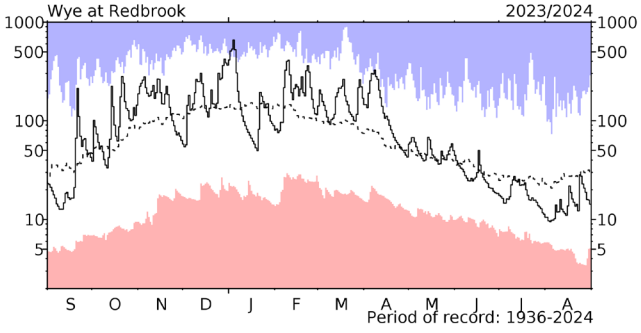


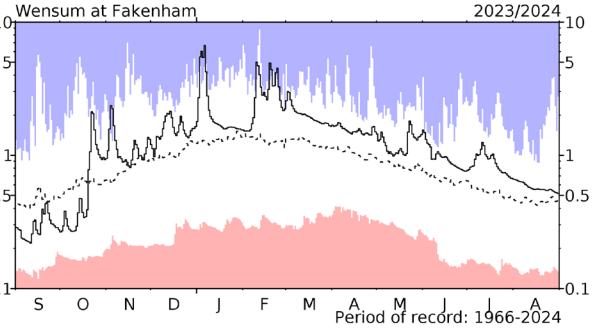


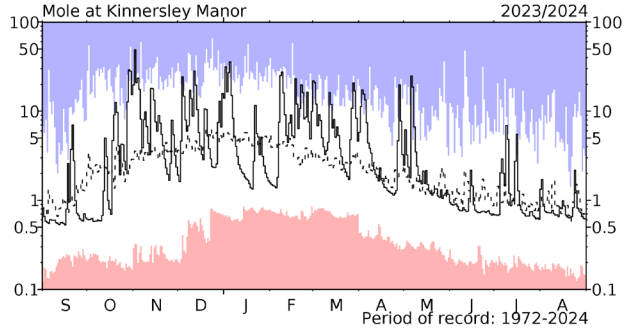


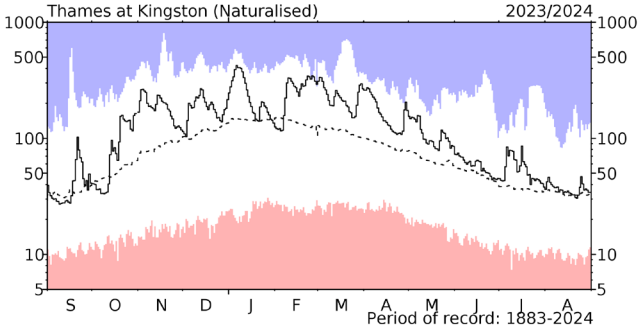


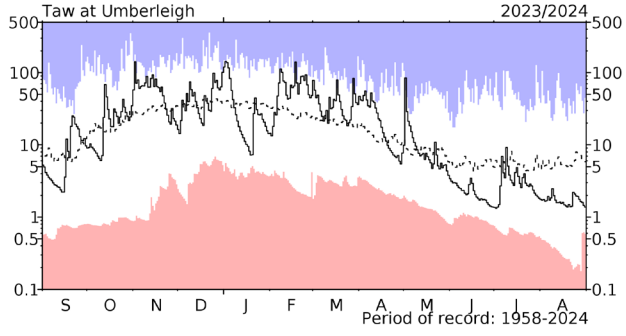


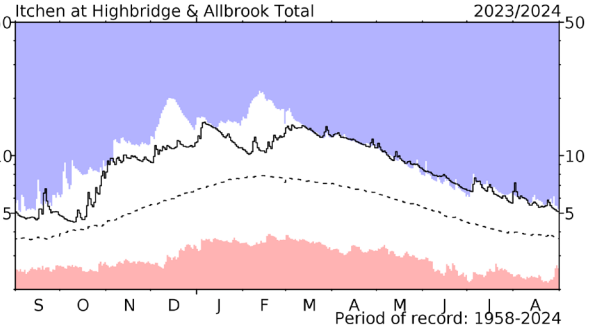




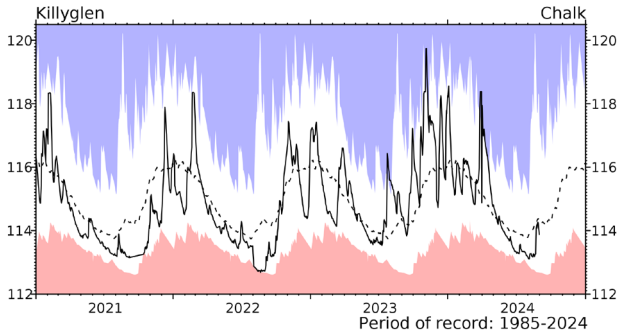


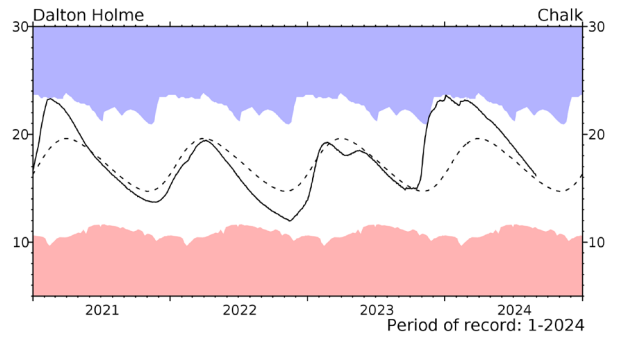


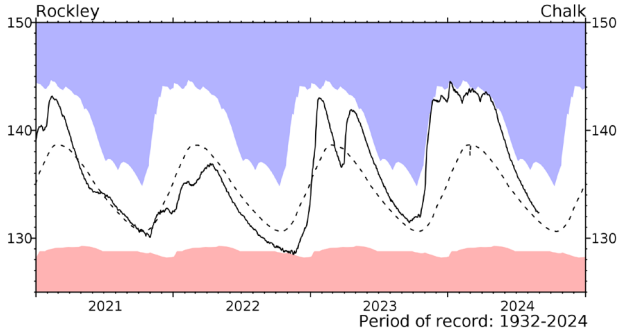


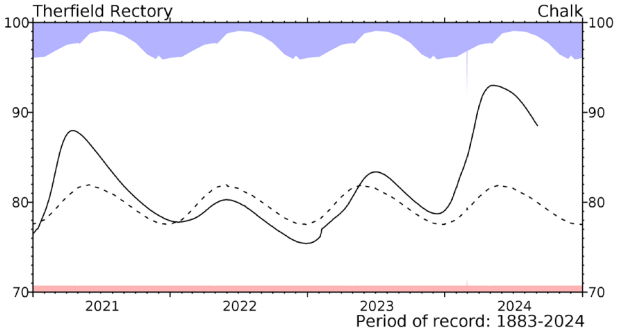


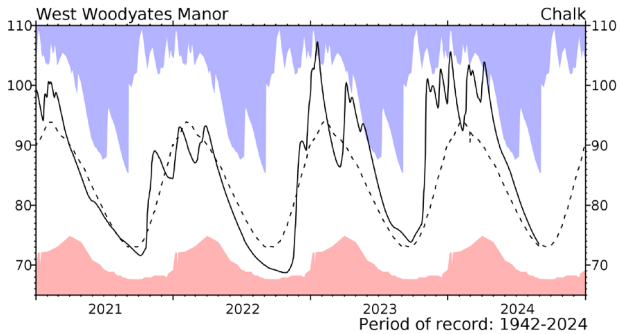
Groundwater…Groundwater

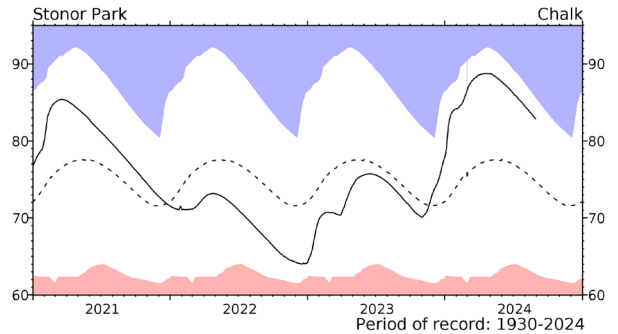


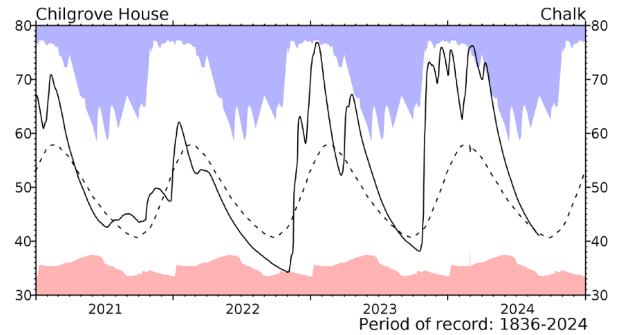


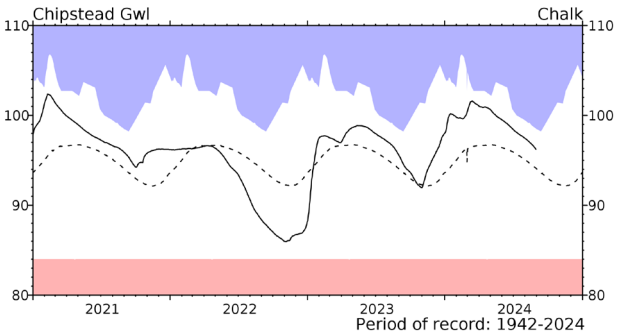


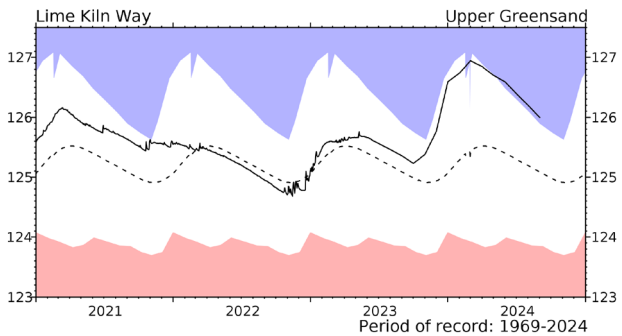


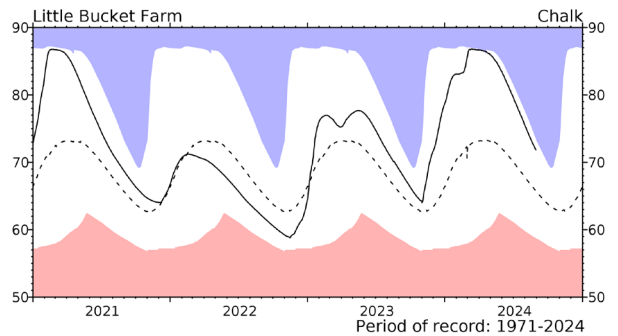






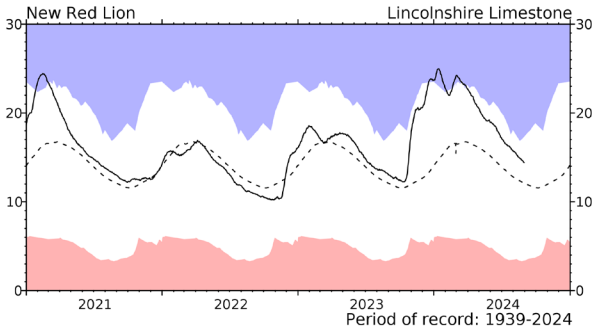


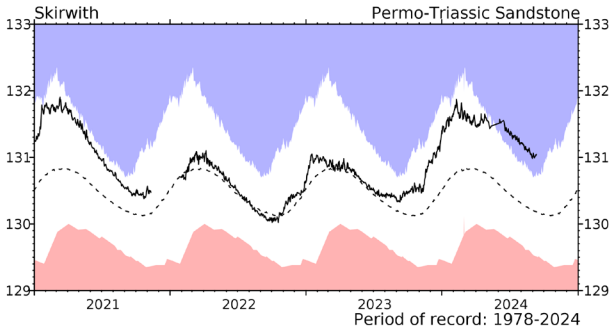


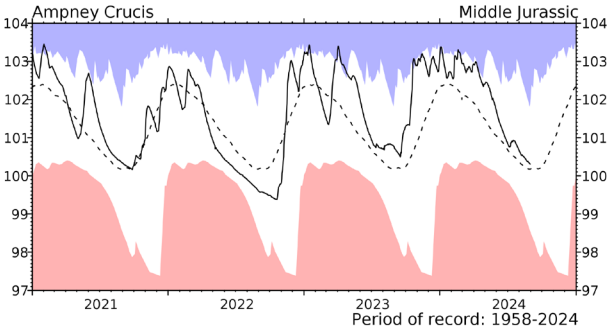


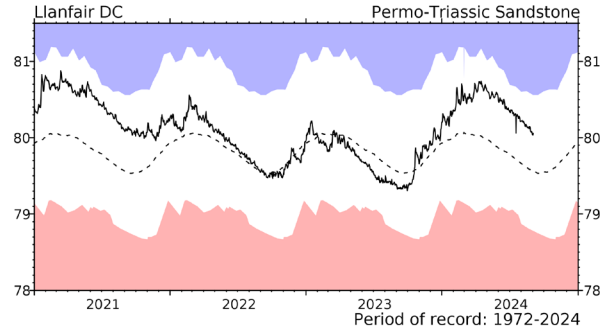
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is 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.

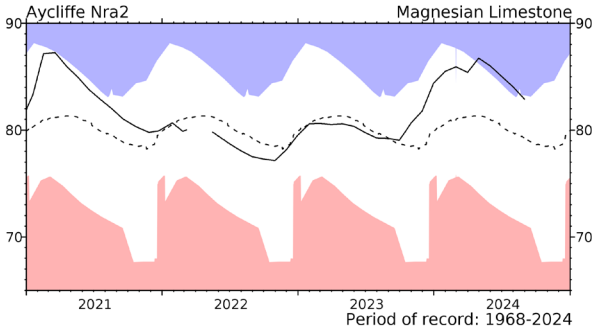
Groundwater … Groundwater

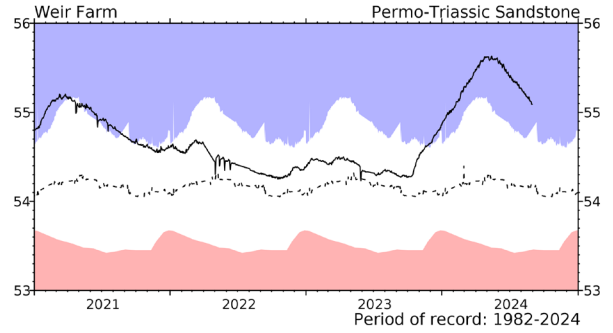


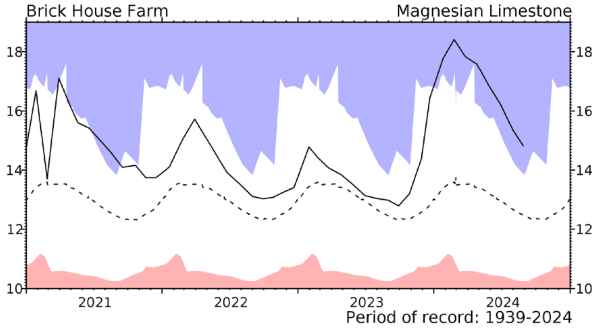


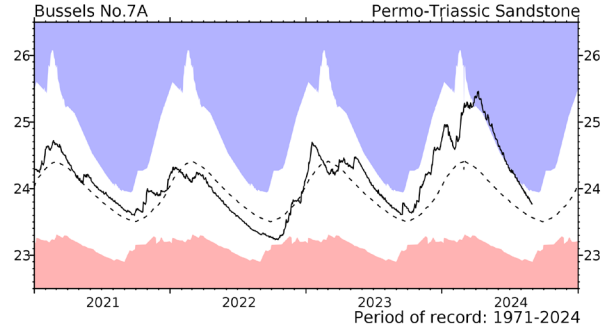


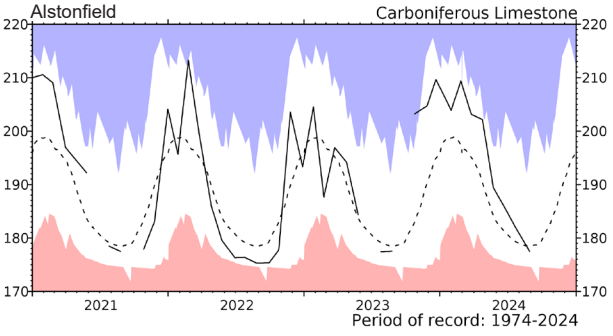


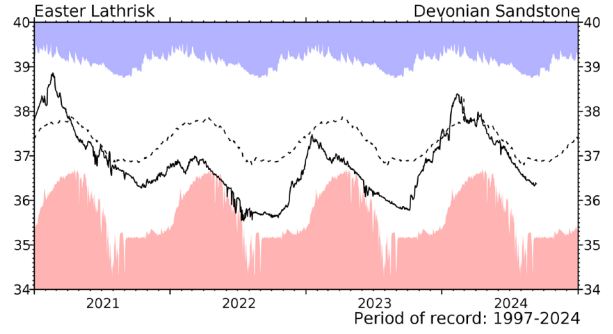


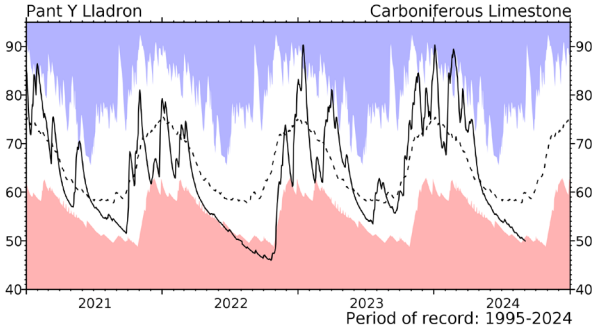


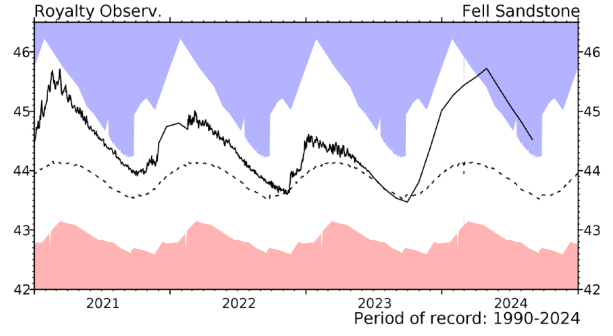


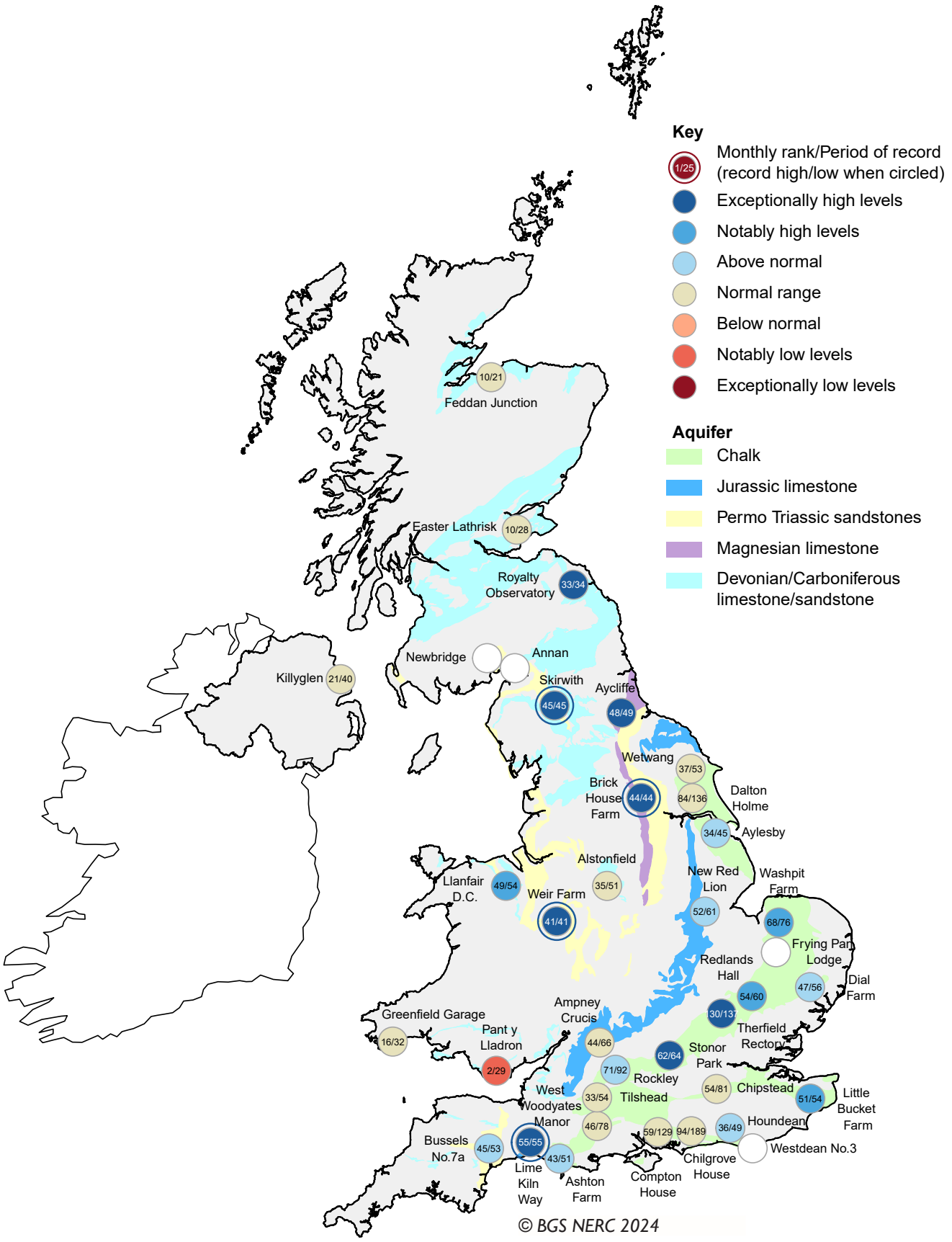










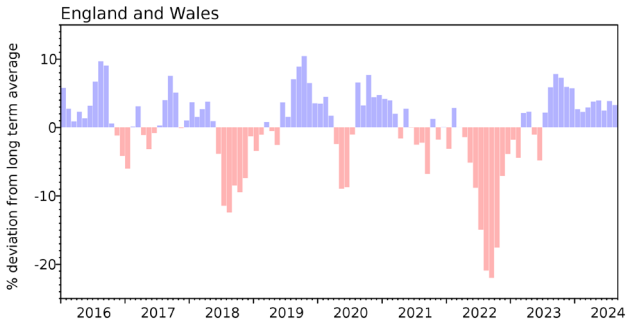


Groundwater levels - August 2024

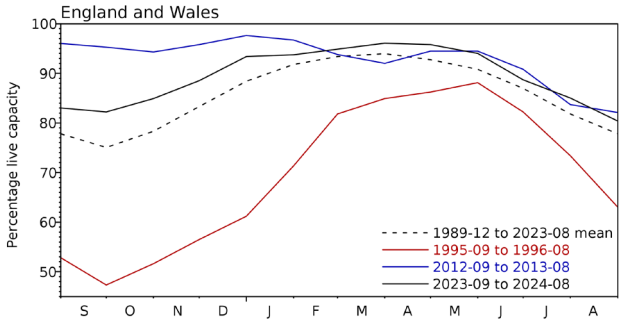
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Jun	2024 Jul	2024 Aug	Aug Anom.	Min Aug	Year* of min	2023 Aug	Diff 24-23
North West	N Command Zone	•	124929	63	77	73	13	15	1984	73	0
	Vyrnwy		55146	89	88	97	24	36	1995	97	0
Northumbrian	Teesdale	•	87936	96	95	91	19	38	1995	87	3
	Kielder		(199175)	91	86	89	2	66	1989	85	4
Severn-Trent	Clywedog		49936	99	99	97	19	27	1976	97	0
	Derwent Valley	•	46692	84	77	60	-6	34	1995	79	-18
Yorkshire	Washburn	•	23373	90	83	73	3	34	1995	82	-9
	Bradford Supply	•	40942	87	80	69	1	21	1995	76	-8
Anglian	Grafham		(55490)	95	95	91	5	59	1997	93	-2
	Rutland		(116580)	93	90	84	1	66	1995	87	-3
Thames	London	•	202828	95	93	83	2	62	2022	96	-13
	Farmoor	•	13822	98	99	96	3	64	1995	99	-3
Southern	Bewl		31000	95	82	64	-6	38	1990	82	-18
	Ardingly		4685	93	85	66	-6	31	2022	62	4
Wessex	Clatworthy		5662	82	70	60	-4	31	1995	68	-8
	Bristol	•	(38666)	85	74	61	-8	43	1990	78	-17
South West	Colliford		28540	92	83	76	6	31	2022	56	20
	Roadford		34500	94	90	87	16	40	1995	55	32
	Wimbleball		21320	88	75	66	-4	37	2022	73	-7
	Stithians		4967	80	69	60	-2	27	2022	61	-1
Welsh	Celyn & Brenig	•	131155	85	79	77	-5	49	1989	68	8
	Brianne		62140	97	92	94	6	52	2022	100	-6
	Big Five	•	69762	85	73	70	-1	29	1995	73	-3
	Elan Valley	•	99106	87	74	66	-9	37	1976	78	-12
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	94	89	93	14	45	1998	89	4
	East Lothian	•	9317	100	99	95	9	63	1989	92	3
Scotland(W)	Loch Katrine	•	110326	81	72	97	23	50	2021	84	13
	Daer		22494	78	74	96	18	41	1995	84	12
	Loch Thom		10721	88	83	100	18	50	2021	59	41
Northern Ireland	Total+	•	56800	83	79	77	0	40	1995	97	-20
	Silent Valley	•	20634	85	82	79	5	33	2000	99	-20

( ) figures in parentheses relate to gross storage

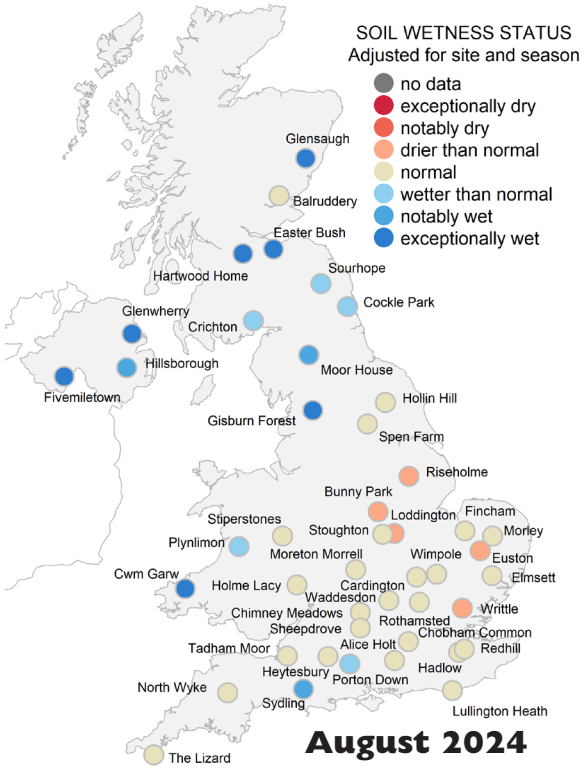
• denotes reservoir groups

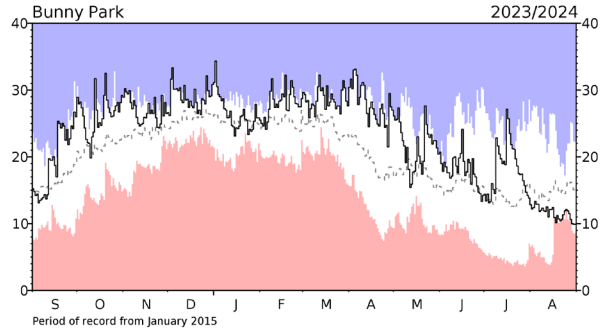
*last occurrence

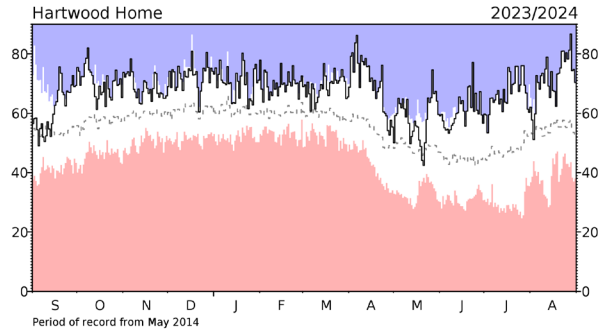
+ excludes Lough Neagh

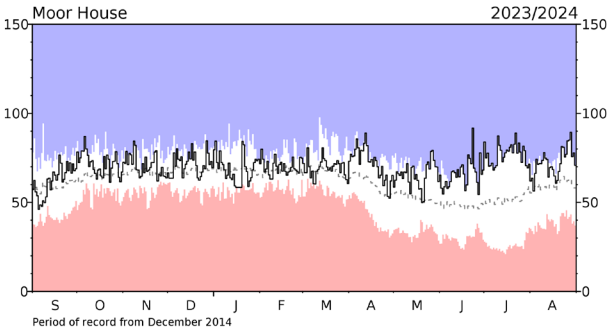
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed 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.

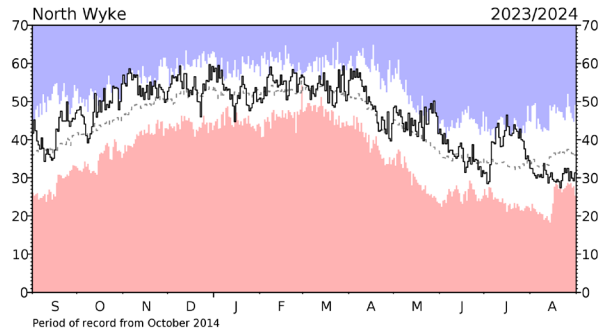
Soil Moisture . . . Soil Moisture

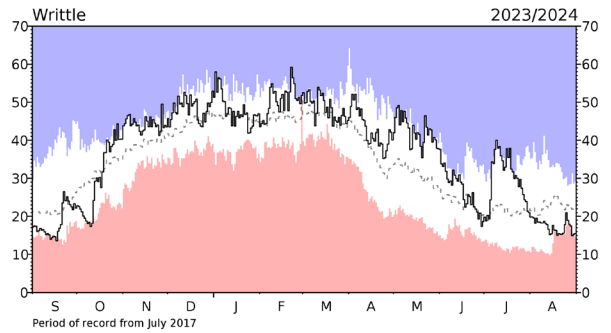












At the end of August, soil moisture was high in the north and west of the UK, with much drier conditions in the south and east.

Soil moisture levels across the UK showed regional variations due to the contrasting weather conditions during the month. Sites across central and southern England showed soil moisture levels below field capacity, with a steady decrease throughout August. Many of these sites were within their normal range for the time of year, as dry conditions are common through the summer, though some sites reached drier than usual conditions (e.g. Bunny Park, North Wyke, Writtle). In contrast, sites in northern England and Scotland (e.g. Hartwood Home, Moor House) maintained high soil moisture levels, reflecting the high rainfall of the month.

Overall, soil moisture conditions across the UK showed a general north (Wet) – south (Dry) divide. Sites in central and southern England are starting to approach very dry conditions as we enter the autumn months.

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/Y006208/1 as part of the NC-UK 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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