Hydrological Summary

for the United Kingdom

July 2024

General

July was cool with average rainfall. However, it was a month of two halves — the first fortnight was notable for being the coldest start to July since 2004 with heavy rainfall and reports of surface water flooding. The second half was characterised by warmer than average conditions and more settled weather prior to thundery weather at month end. Total rainfall was above average for England and parts of north-west Scotland but below average for Scotland, Northern Ireland and Wales. River flows were widely normal to above normal across much of the UK, and in south-east England many remained notably high, exceptionally so in some cases. Reservoir stocks fell but remained close to or above average at the national scale. Groundwater levels continued to fall across the UK but remained above normal at the majority of sites. With an outlook for August-October of normal to above normal river flows and groundwater levels across eastern parts of the UK, there are no immediate water resources concerns for the end of summer and into early autumn.

Rainfall

The start of July saw several low-pressure systems which brought heavy rainfall for north-west Scotland (3rd-5th) and across England (3rd-8th). The seven-day period from 3rd-9th was the wettest week for England in the year so far with some notable daily rainfall totals (e.g. 76mm was recorded at White Barrow, Devon on the 8th). Between 9th-10th, heavy rainfall in north-east Scotland and northern England led to localised flooding and road closures (e.g. in Peterhead, Elgin and Aberdeen). Unsettled conditions continued on 15th-16th bringing heavy rainfall to large parts of north-east Scotland and central England. Many areas of England received more than the average July rainfall by mid-month. By contrast, apart from further rain for north-east Scotland and western parts of the UK on the 20th, the rest of the month was comparatively drier with warmer than average conditions, especially over southern England, as high pressure dominates. Total July rainfall was average for the UK (100%), but with a marked spatial gradient. Rainfall was above average for England (119%), including 149% for the Thames region, but mostly below average elsewhere. Parts of north-east Scotland and southern England received over 150% whilst parts of south-west Scotland and Wales received less than 50%. Following the dry June, the summer so far (June-July) has been slightly drier than average for the UK. Over longer accumulations, July marked a return for England to wetter than average conditions. The 6-month period (February-July) was the wettest for Wessex and within the top three wettest for a number of regions including Southern, Thames, South West, and Wales. The 12-month (August 2023-July 2024) period was the wettest on record for England and Wales and the second wettest for the UK as a whole (all in a series from 1890).

River Flows

River flows generally declined following the dry end to June although catchments in south-east England remained notably to exceptionally high flows at the beginning of July. River flows across north-west Scotland and southern England climbed in response to rainfall from the 3rd. The Itchen registered its second highest July gauged peak flow on the 5th (in a series from 1994) and the Lee its third highest on the 6th (in a series from 1965). Many catchments in central and northern England recorded flows in the normal range over the first week then saw rapid flow increases following heavy rainfall between 8-10th and from 15-16th. By mid-month, flows across the UK were widely above normal, and notably to exceptionally high in groundwater-dominated catchments in south-east England. Recessions resumed from mid-month and flows ended July below normal in Scotland and Northern Ireland but in the normal range to above normal elsewhere, notably so in catchments in south-east England. Monthly mean July river flows were generally in the normal range to above normal across the UK. Notably high to exceptionally high flows persisted for some rivers in the south and east of England, including the Stringside and the Lee which registered more than twice their average July flows. Monthly mean flows of greater than 150% of average were also recorded for rivers in northeast (e.g. Inver, Ewe) and northwest Scotland (e.g. Deveron) and on the Wensum, Colne and Itchen. Mean flows for the summer so far (June-July) were below normal for Wales and above normal in the south and east of England, with a new maximum for the Itchen (in a series from 1959). Over the 12-month period from August 2023-July 2024, new maxima were established across the UK and flows were generally notably to exceptionally high, except for catchments in northwest Scotland where flows were in the normal range. Consequently, England outflows over the 12-month period remained the highest on record (in a series from 1961).

Soil Moisture and Groundwater

Soil moisture was within the normal range at the end of July with a sharp decline towards the end of the month. Groundwater levels continued to fall in July, but remained above normal to exceptionally high across the Chalk of England. The level fell but became exceptionally high at Westdean No.3; whilst falling levels moved into the normal range at West Woodyates Manor and Chilgrove House. At Killyglen, groundwater levels fell and remained in the exceptionally low range. Levels fell in both the Jurassic limestones and the Magnesian Limestone aquifers, becoming above normal at Ampney Crucis and remaining notably high at New Red Lion. Further record high levels for July were recorded at Aycliffe and Brick House Farm in the Magnesian Limestone (in 49- and 44-year series, respectively). Groundwater levels fell in the Carboniferous Limestone of south Wales, becoming exceptionally low at Pant-y-Lladron but remained in the normal range at Greenfield Garage. Levels receded at all sites in the Permo-Triassic Sandstones. In Scotland, levels were notably high at Newbridge and above normal at Annan. The groundwater level remained at record high at Skirwith and Weir Farm (45- and 41-year series, respectively), and at Bussels No. 7a levels remained exceptionally high. A record high for July (in a 55-year series) was also recorded at Lime Kiln Way (Upper Greensand). Levels in the Fell Sandstone at Royalty Observatory fell and moved into the exceptionally high range (following a June record high). In the Devonian sandstones at Easter Lathrisk, groundwater levels fell and remained in the 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.

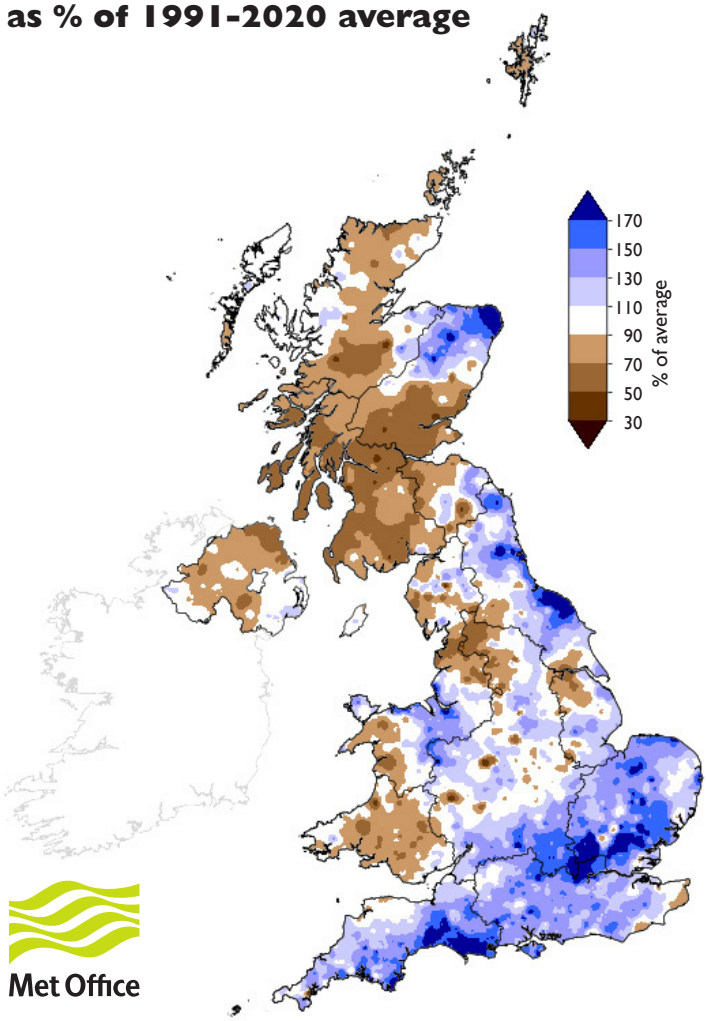
Region	Rainfall	Jul 2024	Jun24 – Jul24	RP	Feb24 – Jul24	RP	Nov23 – Jul24	RP	Aug23 – Jul24	RP
United Kingdom	mm	**82**	138		579		1004		1384	
	%	**100**	86	2-5	120	40-60	118	40-60	120	>100
England	mm	**79**	113		506		847		1148	
	%	**119**	86	2-5	137	>100	134	>100	133	>>100
Scotland	mm	**87**	179		672		1206		1675	
	%	**84**	91	2-5	104	5-10	104	5-10	107	10-15
Wales	mm	**89**	137		732		1327		1810	
	%	**90**	72	2-5	124	25-40	123	30-50	124	70-100
Northern Ireland	mm	**77**	137		503		850		1314	
	%	**86**	80	2-5	101	2-5	100	2-5	114	30-50
England & Wales	mm	**80**	116		537		913		1239	
	%	**113**	83	2-5	135	>100	131	>100	131	>100
North West	mm	**91**	161		688		1241		1662	
	%	**92**	87	2-5	130	60-90	133	>100	130	>>100
Northumbria	mm	**92**	131		480		836		1176	
	%	**125**	89	2-5	121	10-20	125	60-90	130	>>100
Severn-Trent	mm	**71**	105		475		768		1052	
	%	**107**	79	2-5	132	40-60	130	40-60	131	80-120
Yorkshire	mm	**74**	122		475		842		1159	
	%	**108**	87	2-5	124	15-25	132	60-90	134	>100
Anglian	mm	**72**	98		379		591		828	
	%	**129**	88	2-5	135	25-40	130	30-50	132	>100
Thames	mm	**80**	98		465		734		988	
	%	**149**	93	2-5	150	>100	138	80-120	137	>100
Southern	mm	**67**	86		483		826		1128	
	%	**128**	81	2-5	149	>100	137	70-100	138	>100
Wessex	mm	**84**	105		569		948		1262	
	%	**138**	87	2-5	153	>>100	142	>>100	140	>>100
South West	mm	**105**	139		747		1266		1617	
	%	**128**	87	2-5	148	>>100	135	>100	129	80-120
Welsh	mm	**86**	131		714		1281		1748	
	%	**90**	71	2-5	126	30-50	124	30-50	125	80-120
Highland	mm	**93**	227		729		1344		1872	
	%	**86**	109	2-5	97	2-5	98	2-5	101	2-5
North East	mm	**105**	177		562		963		1375	
	%	**127**	109	2-5	124	20-35	125	>100	130	>>100
Tay	mm	**72**	138		601		1094		1630	
	%	**74**	75	2-5	104	2-5	106	5-10	117	25-40
Forth	mm	**62**	115		609		1031		1438	
	%	**66**	64	5-10	116	10-20	113	10-20	116	30-50
Tweed	mm	**82**	128		575		967		1320	
	%	**96**	78	2-5	124	25-40	121	30-50	122	>100
Solway	mm	**82**	155		739		1285		1656	
	%	**74**	74	2-5	115	15-25	111	10-20	105	5-10
Clyde	mm	**86**	174		758		1363		1867	
	%	**68**	74	5-10	99	2-5	98	2-5	99	2-5

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

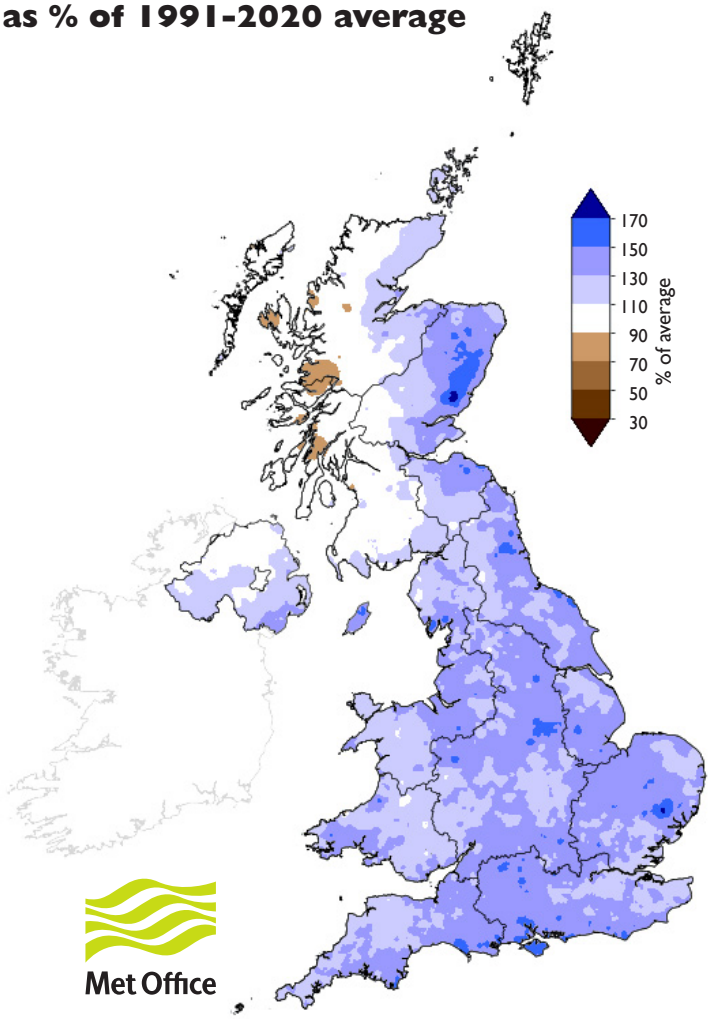
Important note: Figures in the above table may be quoted provided their source is acknowledged. Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability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

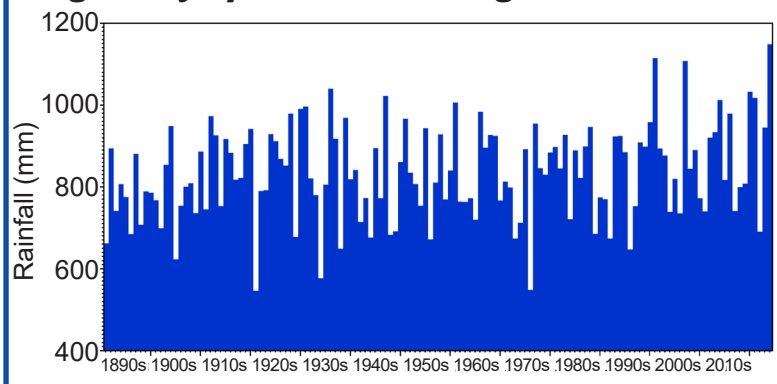
July 2024 rainfall
as % of 1991-2020 average



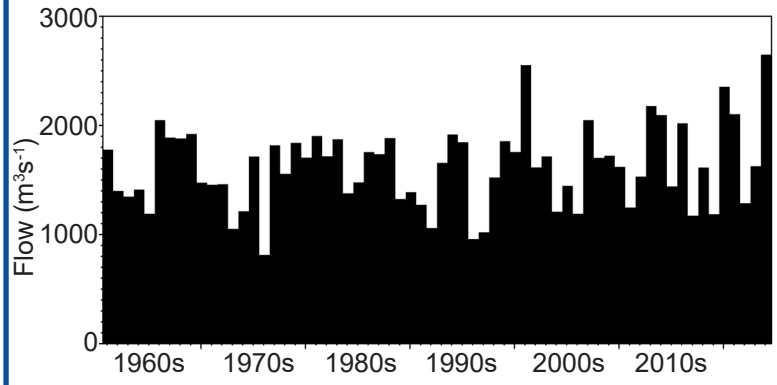
August 2023 - July 2024 rainfall
as % of 1991-2020 average



August - July rainfall for England



August - July average outflows for England



UK Hydrological Outlook

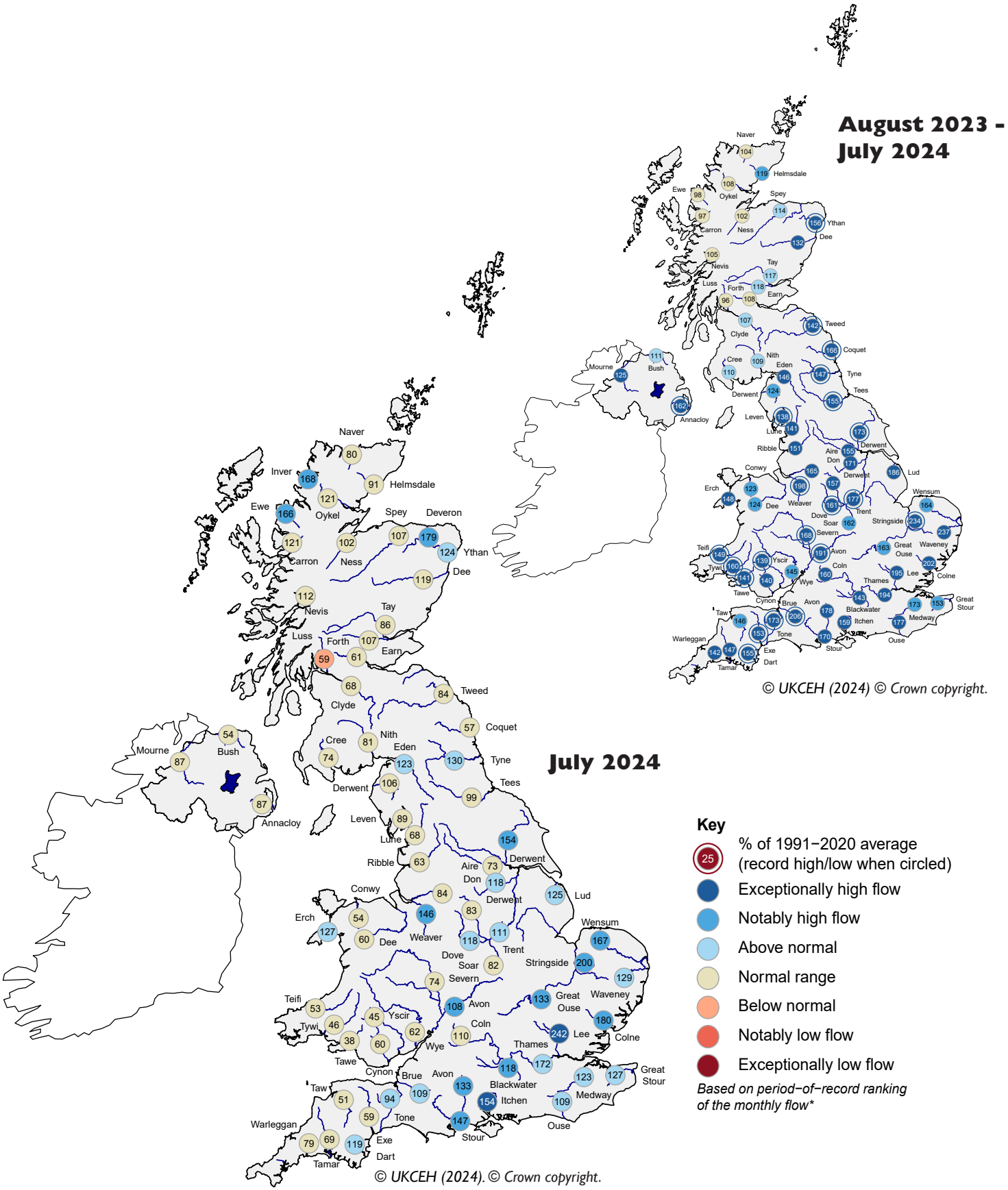
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from August 2024**
Issued: **08.08.2024**
using data to the end of July 2024

The outlook for August, and the next three months, indicates that river flows are likely to be normal to below normal across the western parts of the UK, and normal to above normal in the south and east. River flows in groundwater dominated catchments of the south-east are likely to be above normal to high. Groundwater levels are expected to be normal to above normal across the majority of the UK, and normal to below normal in parts of central England and the south-west.

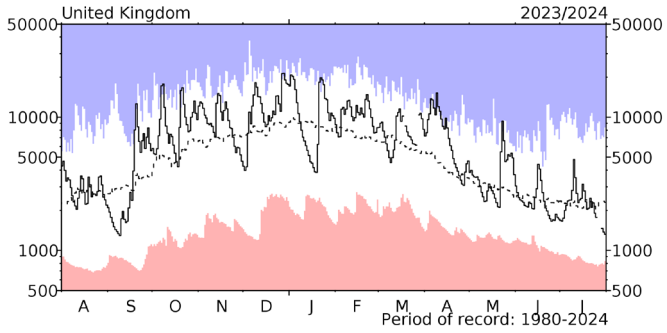
River flow . . . River flow . . .

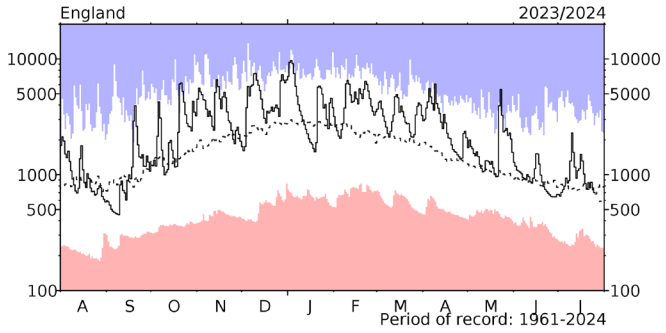


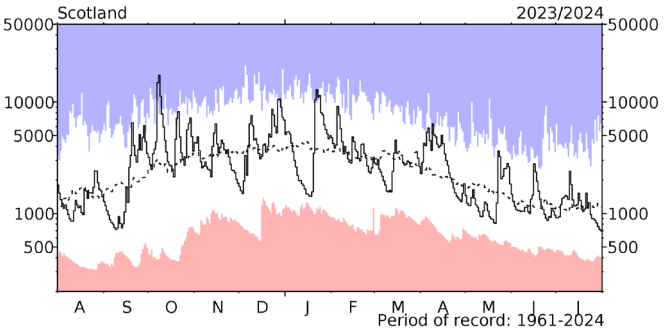
River flows

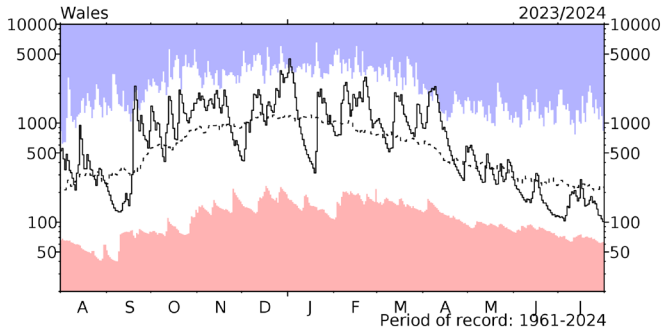
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

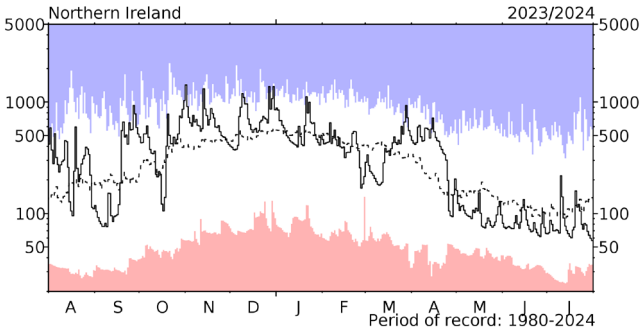
River flow . . . River flow . . .

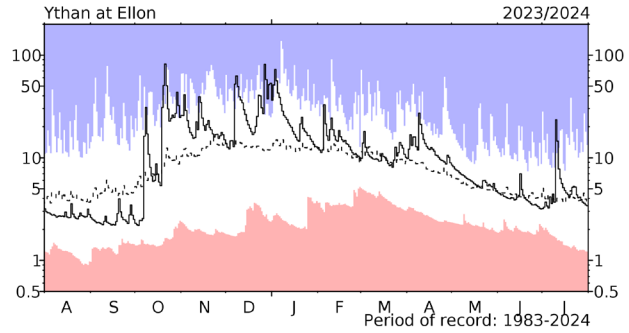


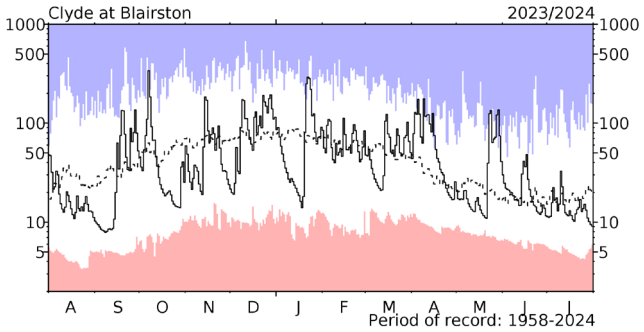


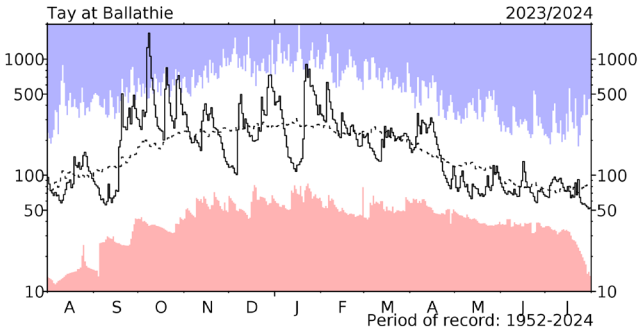


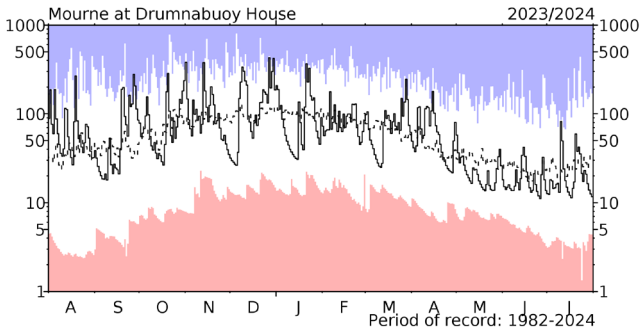


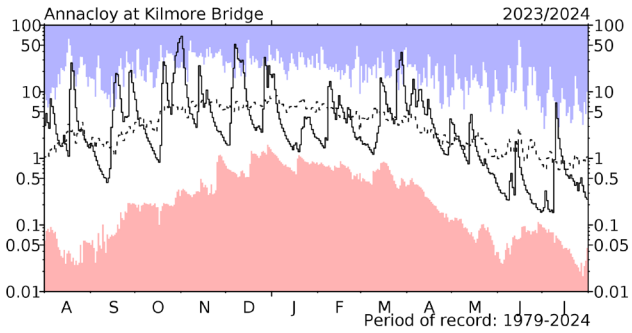








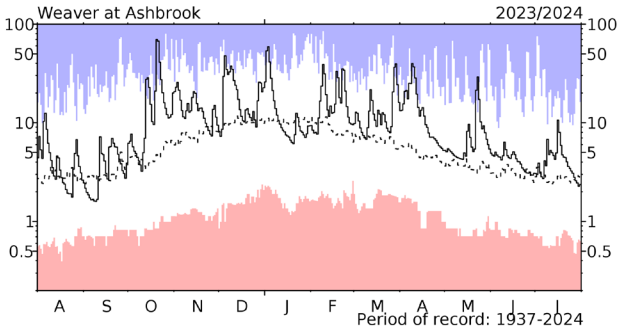


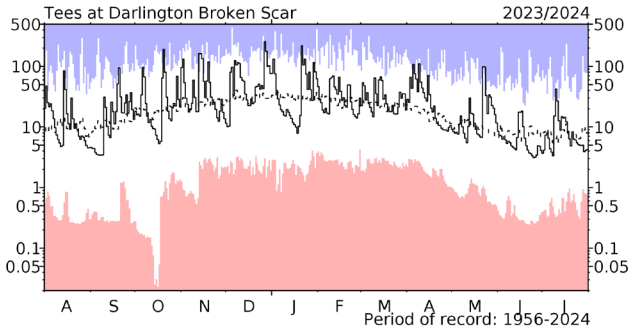


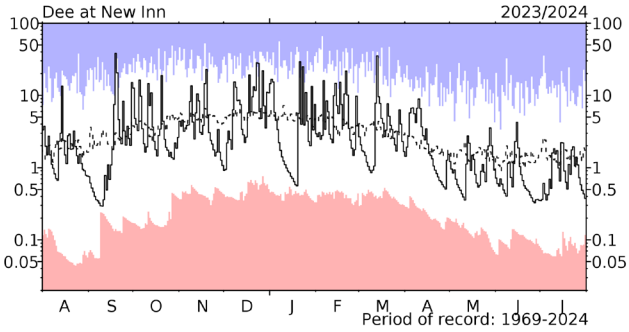
River flow hydrographs

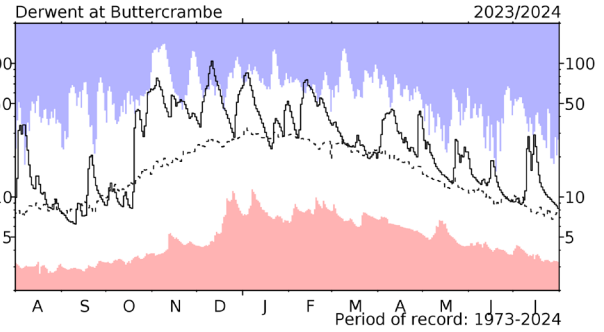
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to August 2023 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

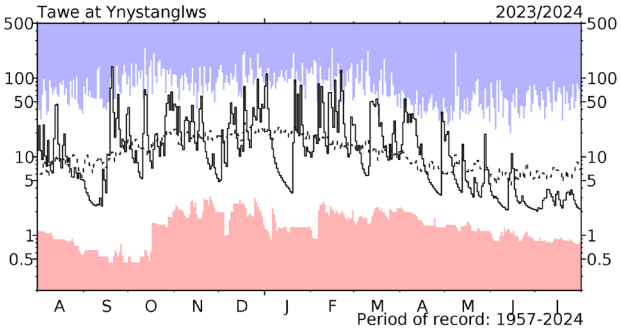
River flow . . . River flow . . .

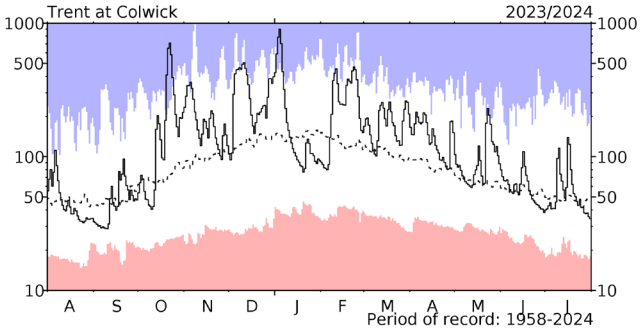


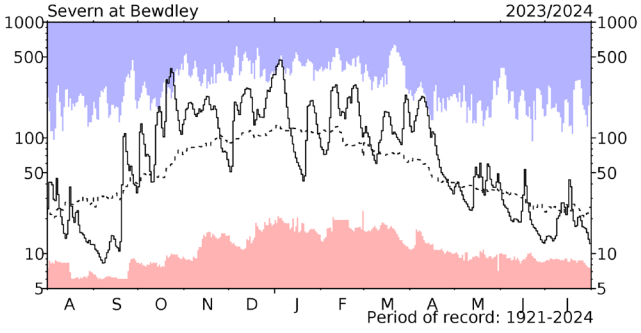


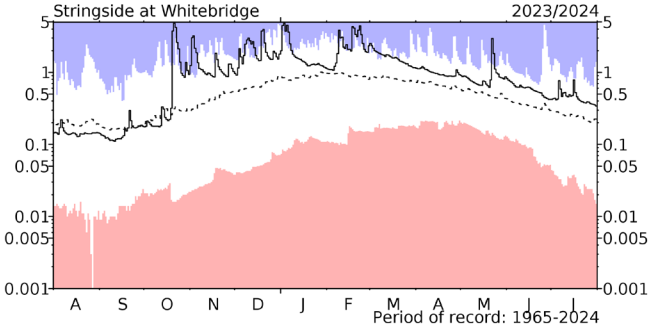


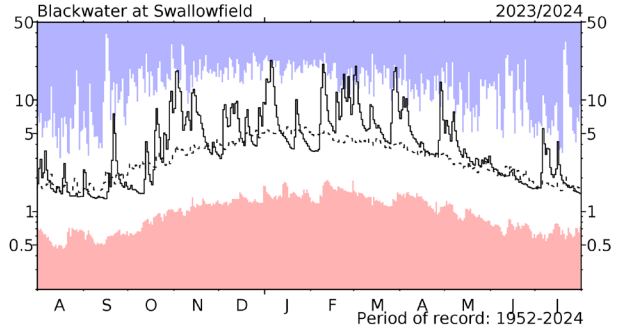


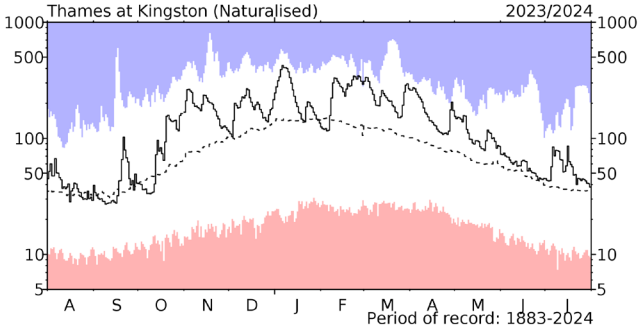


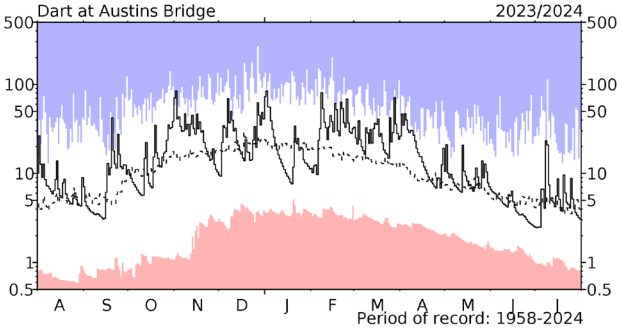


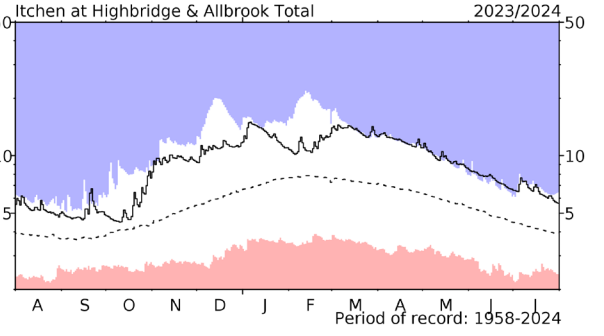




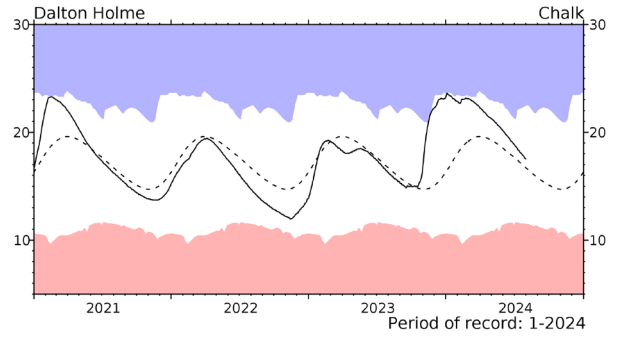


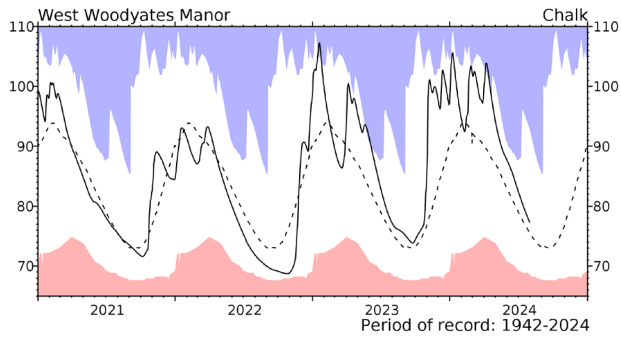


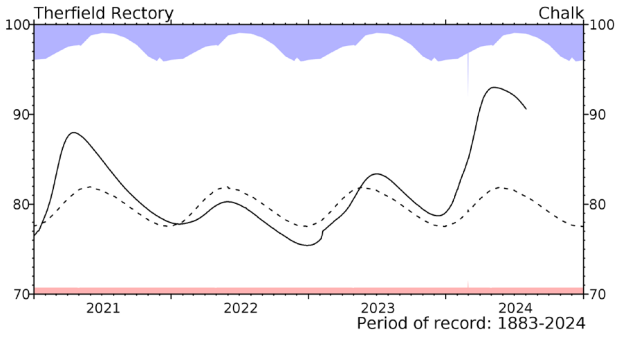


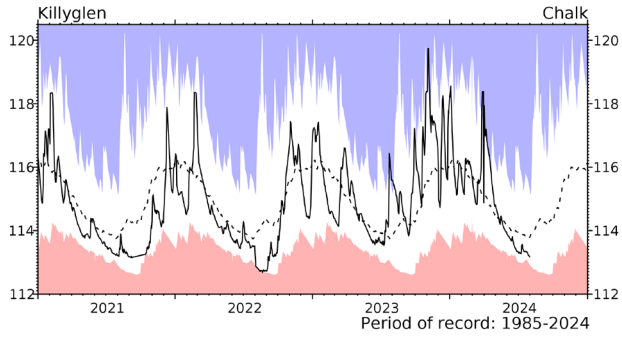


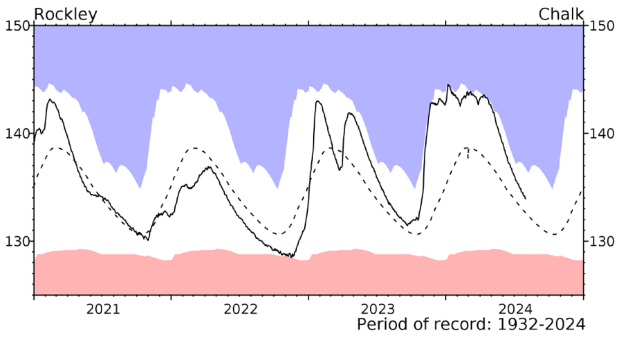
Groundwater…Groundwater

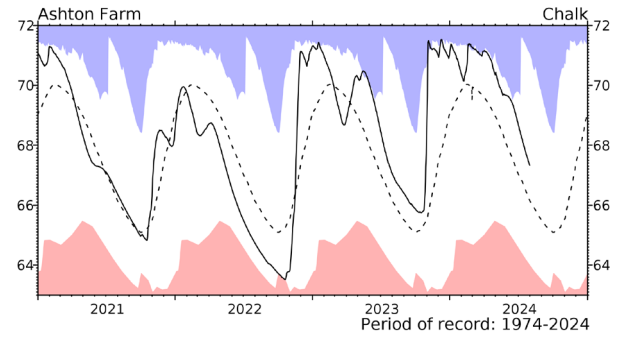


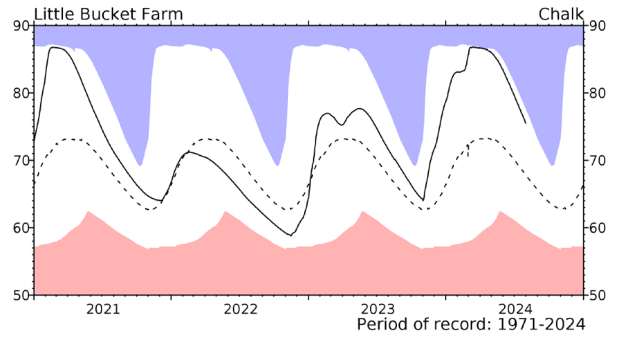


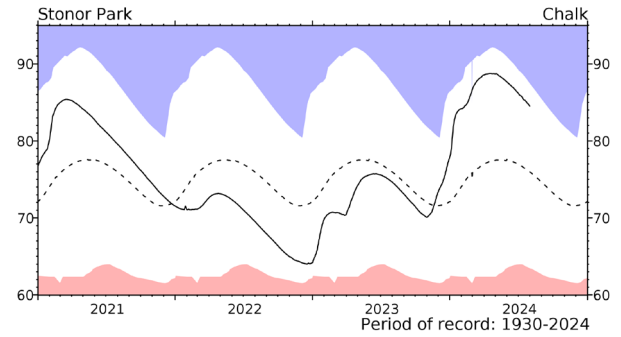


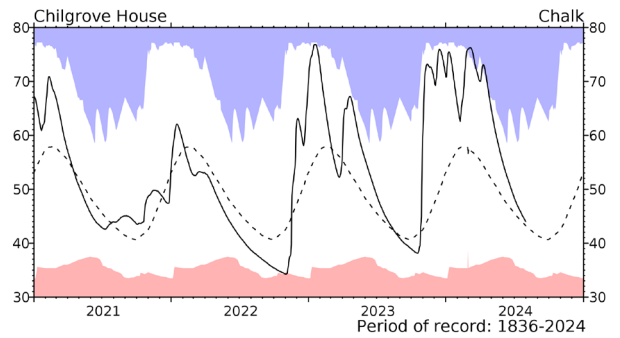


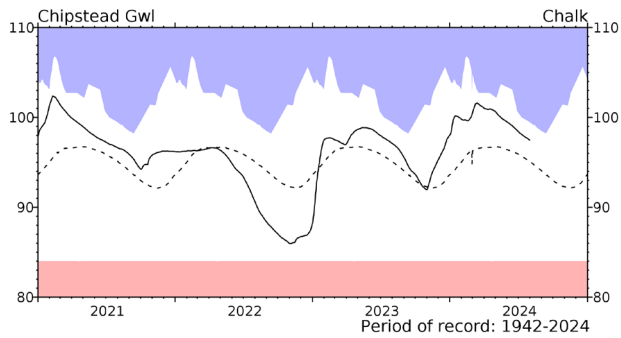






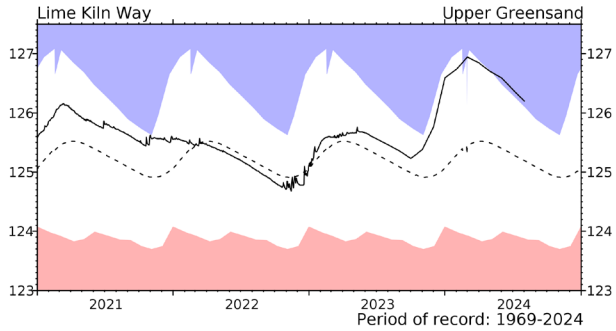


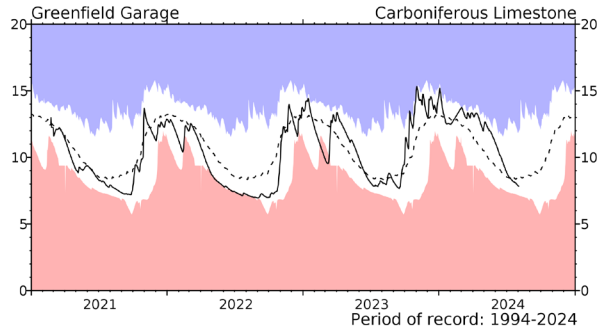


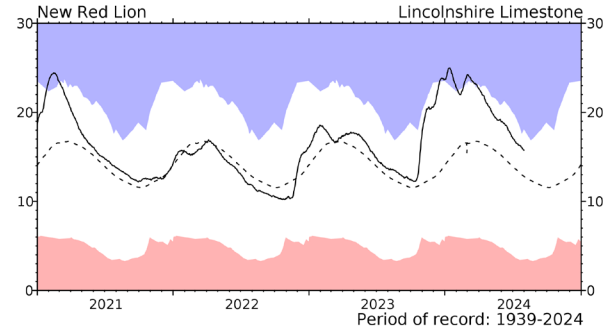


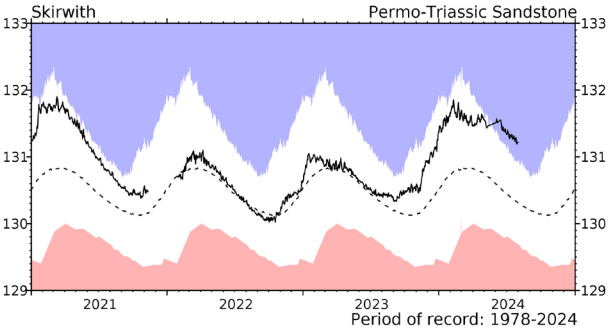
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

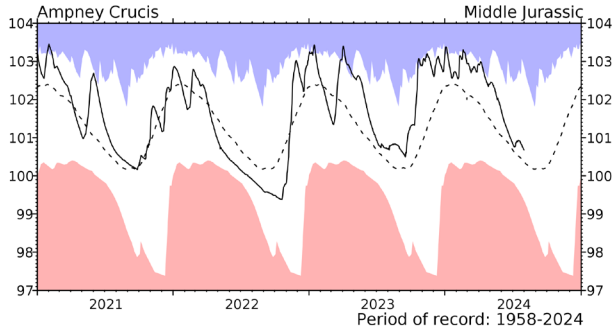
Groundwater … Groundwater

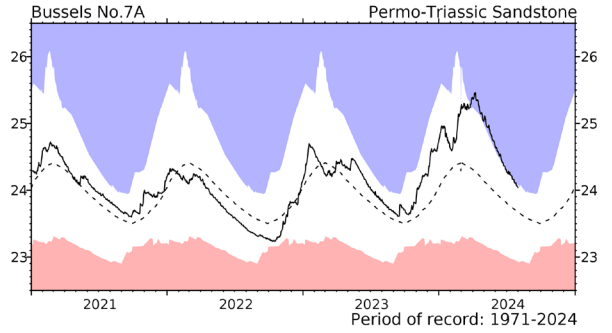


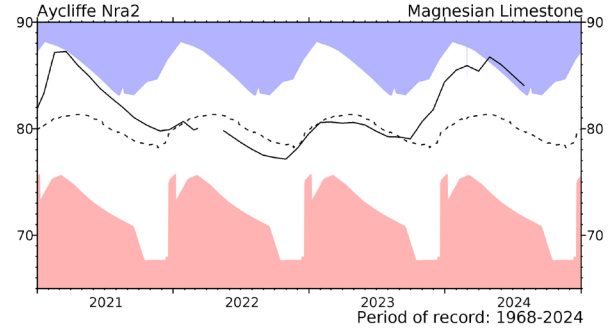


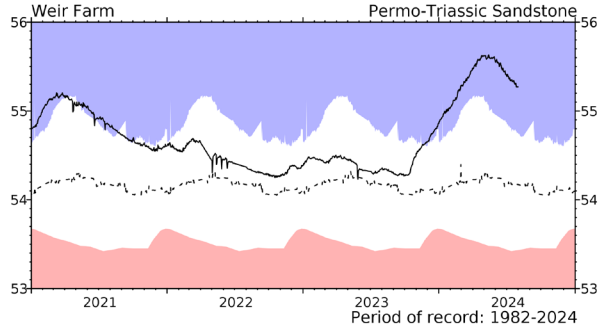


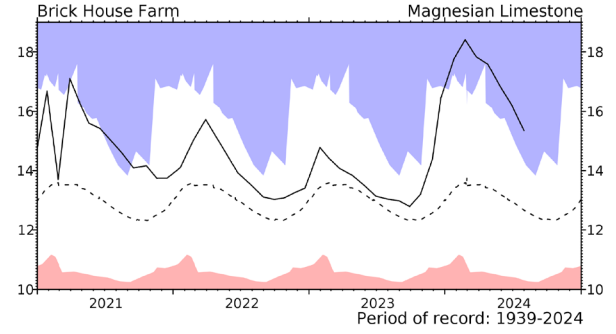


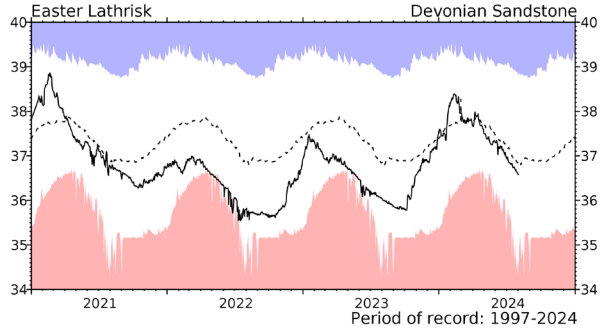


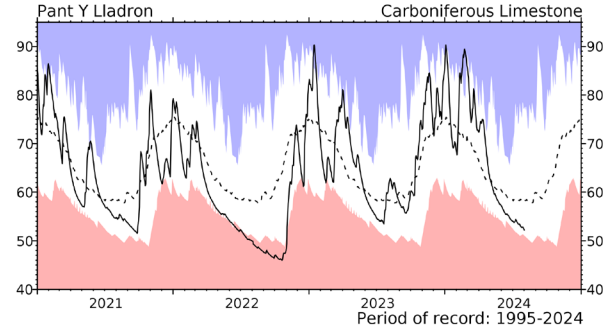


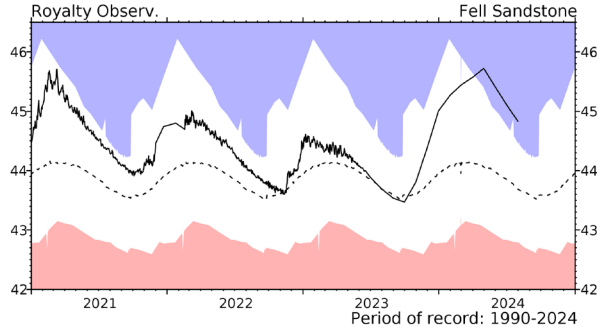


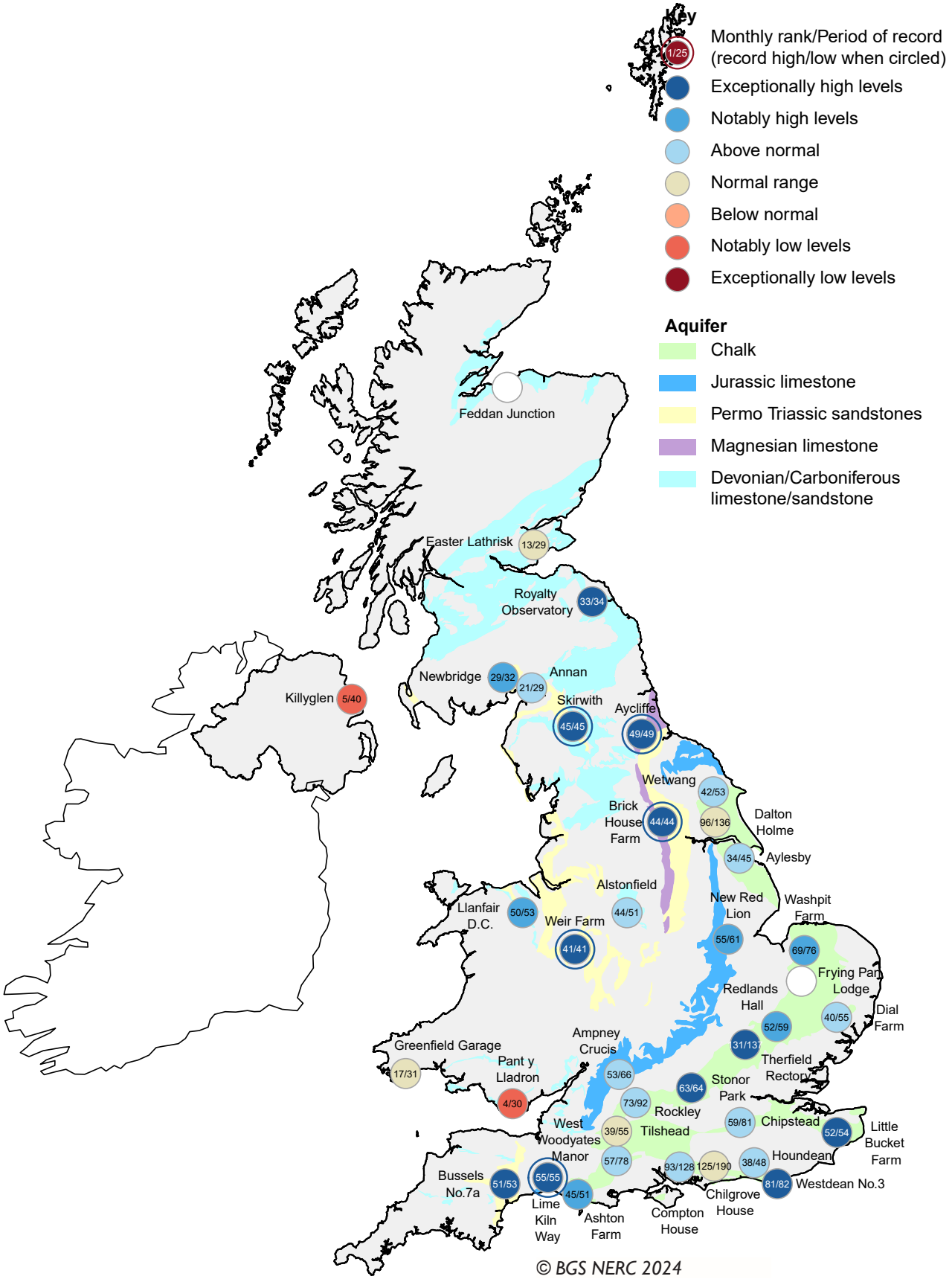










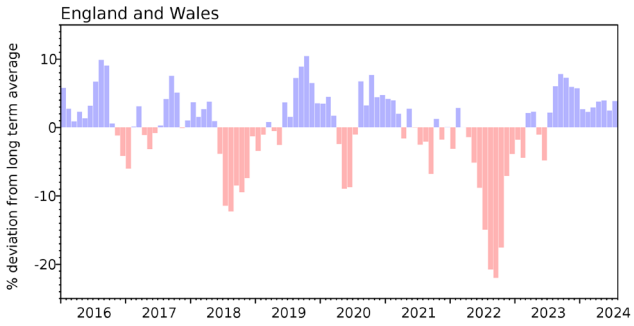


Groundwater levels - July 2024

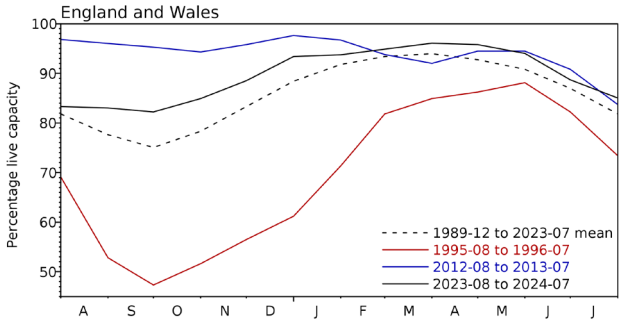
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 May	2024 Jun	2024 Jul	Jul Anom.	Min Jul	Year* of min	2023 Jul	Diff 24-23
North West	N Command Zone	•	124929	80	63	77	14	23	1984	68	10
	Vyrnwy		55146	92	89	88	11	45	1984	87	2
Northumbrian	Teesdale	•	87936	99	96	95	21	45	1989	76	18
	Kielder		(199175)	95	91	86	-3	66	1989	98	-12
Severn-Trent	Clywedog		49936	99	99	99	14	50	1976	91	9
	Derwent Valley	•	46692	94	84	77	4	43	1996	79	-3
Yorkshire	Washburn	•	23373	96	90	83	10	50	2022	78	5
	Bradford Supply	•	40942	95	87	80	10	38	1995	73	8
Anglian	Grafham		(55490)	95	95	95	5	66	1997	94	0
	Rutland		(116580)	94	93	90	4	74	1995	91	0
Thames	London	•	202828	98	95	93	6	73	1990	97	-4
	Farmoor	•	13822	98	98	99	3	84	1990	99	0
Southern	Bewl		31000	94	95	82	5	45	1990	87	-5
	Ardingly		4685	99	93	85	1	57	2022	77	9
Wessex	Clatworthy		5662	97	82	70	-3	43	1992	73	-3
	Bristol	•	(38666)	93	85	74	-1	53	1990	81	-7
South West	Colliford		28540	100	92	83	7	43	2022	57	26
	Roadford		34500	98	94	90	14	46	1996	57	33
	Wimbleball		21320	99	88	75	-2	49	2022	75	0
	Stithians		4967	100	80	69	-1	39	1990	73	-4
Welsh	Celyn & Brenig	•	131155	88	85	79	-8	65	1989	71	8
	Brianne		62140	100	97	92	3	64	2022	90	2
	Big Five	•	69762	93	85	73	-3	41	1989	73	0
	Elan Valley	•	99106	95	87	74	-7	53	2022	76	-2
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	97	94	89	6	51	1998	87	2
	East Lothian	•	9317	100	100	99	9	72	1992	89	10
Scotland(W)	Loch Katrine	•	110326	89	81	72	-4	53	2000	85	-13
	Daer		22494	85	78	74	-6	54	2021	77	-3
	Loch Thom		10721	97	88	83	0	55	2021	70	13
Northern Ireland	Total+	•	56800	87	83	79	1	54	1995	92	-12
	Silent Valley	•	20634	89	85	82	8	42	2000	92	-10

( ) figures in parentheses relate to gross storage

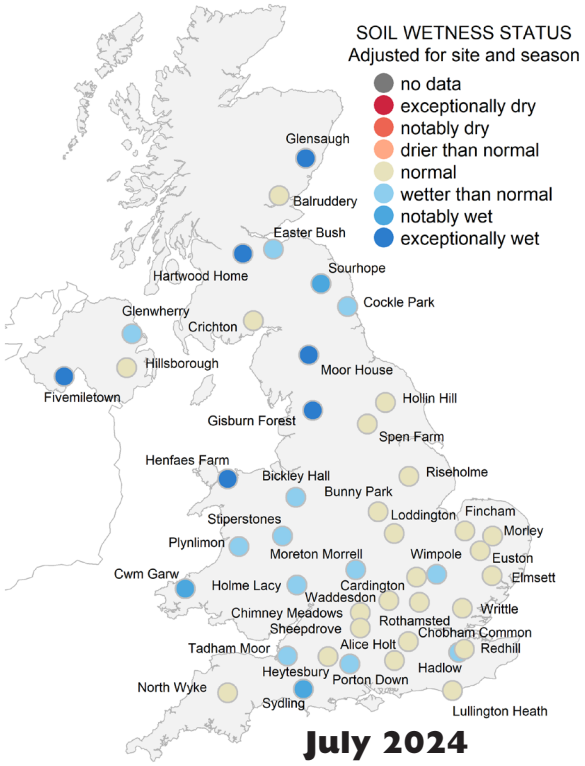
• denotes reservoir groups

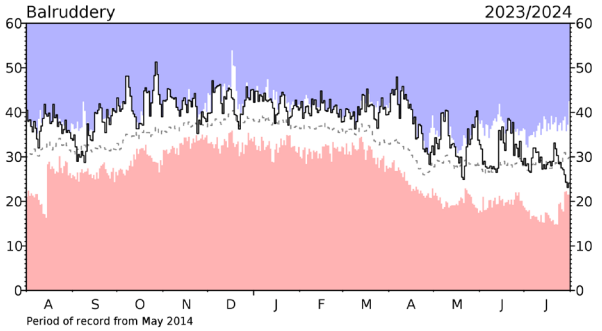
*last occurrence

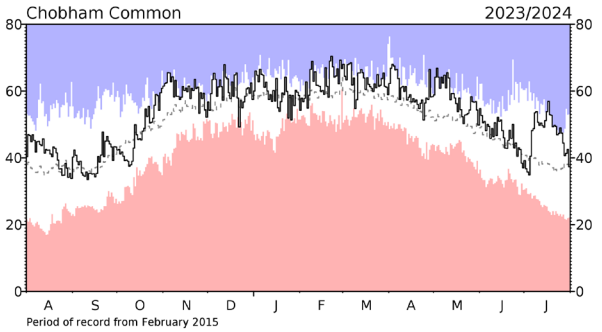
+ excludes Lough Neagh

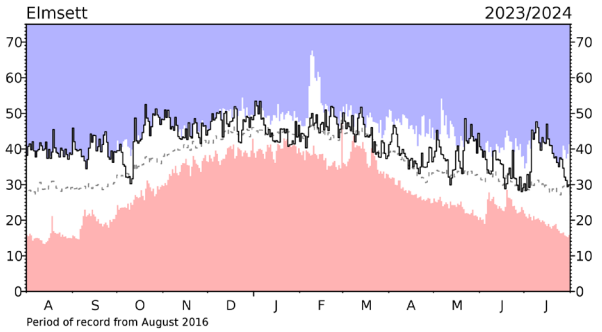
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed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

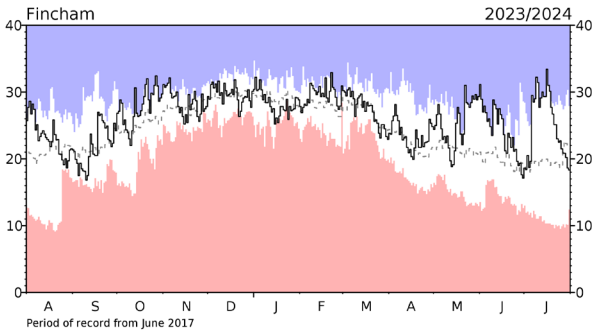
Soil Moisture . . . Soil Moisture

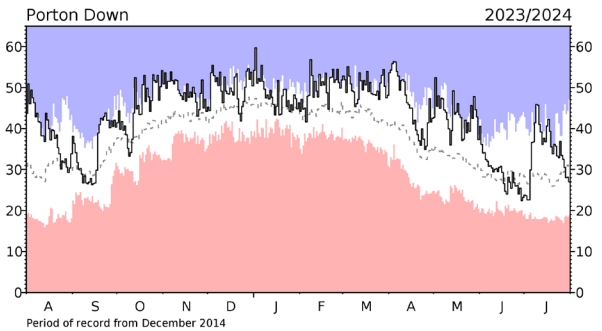












At the end of July, soil moisture was within the normal range for much of the COSMOS-UK network, however was highly variable throughout the month.

Soil moisture for many COSMOS-UK sites exhibited significant variability, reflecting the mixed weather patterns of the month. Sites across England saw very high soil moisture at the start of the month due to the high rainfall, with a sharp decline in soil moisture towards the end of the month with the hot and dry weather (e.g. Elmsett, Fincham, Porton Down). Balruddery in Scotland has had low soil moisture throughout the month, reflecting the below average rainfall in this region.

Overall, mixed weather conditions are reflected in the COSMOS-UK soil moisture levels. Most sites end the month with near-normal moisture levels for the time of year, while others, though sites in southern and eastern regions are starting to show signs of drying out.

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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