Hydrological Summary

for the United Kingdom

April 2024

General

The first half of April was mild and unsettled for most of the UK, continuing the wet conditions established at the end of March. The last two weeks were cooler than average with comparatively drier weather. April as a whole saw close to average temperatures and above average rainfall, with notably high rainfall in south Scotland and northern England. April river flows remained high across the UK, with twice the average flows for some catchments in south Wales and south-west England. Groundwater levels remain very high across the UK, with a number of new maxima recorded, however, they are falling in the majority of locations and the seasonal recession has commenced across most aquifers. The water resources situation remains healthy with above average reservoir stocks at most impoundments and just above average at the national scale. The outlook for May-July suggests an increased likelihood of above normal flows across southern and eastern areas of the UK. Further rain at the start of May means flood risk remains elevated for the time of year.

Rainfall

April began with unsettled conditions associated with storm 'Kathleen' on the 4th, bringing unseasonably strong winds and heavy rains across northern and western UK. Localised travel disruptions and power outages were reported in Scotland and Northern Ireland. Low pressure systems brought further persistent rain across southwest England, west Scotland and Wales and some wintery rainfall in Scotland across the second week of April but without notable daily totals. Through this seven-day period, coastal and surface water flooding were reported in many areas (e.g. Humber estuary, Hampshire and the Isle of Wight). The rest of the month was comparatively drier until further rain at month-end for south-east England (on the 27th) and for northern and western Britain (28th-29th). The UK saw its fifth wettest April (155% of average), with North West England registering its wettest April (195%) and amongst the top three wettest for Forth, Tweed and Solway (all in records from 1890). England and Wales have already received above average spring rainfall given March-April rainfall accumulations. The February-April period was the wettest on record for North West England, Severn Trent, Welsh, Wessex and Southern regions (all receiving >150% of average). April further marks the tenth consecutive month of above average rainfall for Wales and the ninth for England, resulting in the wettest August-April period on record for the UK (in a series from 1890).

River Flows

River flows were high at the start of April (except in western Scotland) and climbed in response to rainfall associated with storm 'Kathleen', resulting in over 240 flood alerts across the UK by the 9th. During the first two weeks of April, the South Tyne, Eden, Cumbrian Leven, Erch , Teifi and Thames all established their April peak flow maximum (all in records of >40 years). River flows in Scotland were above average by the 14th, with some catchments registering their highest daily mean flows (e.g. Ness and Deveron in records from 1972 and 1960 respectively)*, but flows generally receded to below normal by month end. Elsewhere, flows receded from 17th-23rd but remained above normal, particularly across the south. River flows across England further climbed in response to rainfall from 27th-29th, which saw the Mimram and Dover Beck register their second highest and highest April peak flow on the 27th and 28th (in records from 1953 and 1972 respectively). April mean flows were notably or exceptionally high across northern England, Wales, and south-west England, and above normal elsewhere except for north-west Scotland where flows were normal. New maximum April mean flows were established in catchments in northern England (Eden, Tyne and Cumbrian Leven), south Wales (Teifi, Tywi and Tawe), and the south-west (Kenwyn, Warleggan, Tamar and Dorset Stour), with many recording over twice their average flows. April outflows were the highest for England and Wales and the third highest for Scotland (both in records from 1961). Over the nine months from August to April, average flows across England and Wales were notably to exceptionally high. New maxima were established across the UK, including the Weaver, Stringside, Warwickshire Avon and Brue recording over twice their average August-April flows. Correspondingly, August-April outflows were the highest on record for the UK (in a series from 1980).

**Highest Instantaneous Flows are no longer available for Scotland, and so daily mean flows are used as an alternative for flood event ranking.*

Soil Moisture and Groundwater

Soil moisture deficits increased at many COSMOS-UK sites, and sites were fairly evenly divided into wet and slightly below field capacity at month end. Groundwater levels were above normal at all but one site, with exceptionally high values at almost half of the sites. Levels remained normal at Killyglen. The seasonal recession commenced across most of the Chalk, with falling levels observed at three quarters of Chalk sites. The more slowly responding part of the aquifer, across the Chilterns and Cambridgeshire, had not yet reached the 'turning point'. Groundwater levels fell in the Jurassic limestones, remaining exceptionally high at New Red Lion and becoming notably high at Ampney Crucis. In the Magnesian Limestone, another record high for April was recorded at Brick House Farm despite falling levels and a new record high at Aycliffe (in a 46 year record). Levels fell at all Carboniferous Limestone sites, becoming normal at Pant y Lladron, remaining above normal at Greenfield Garage and moving into exceptionally high at Alstonfield. Record high groundwater levels were observed for another month at Weir Farm (in a 39 year record) and Bussels No.7a (in a 53 year record). Levels at Skirwith and Llanfair D.C. became exceptionally high. The groundwater level fell but remained exceptionally high in the Upper Greensand at Lime Kiln Way. Levels rose to a record high at Royalty Observatory in the Fell Sandstone (in a 34 year record). In the Devonian sandstones at Easter Lathrisk, the level was fairly stable 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.

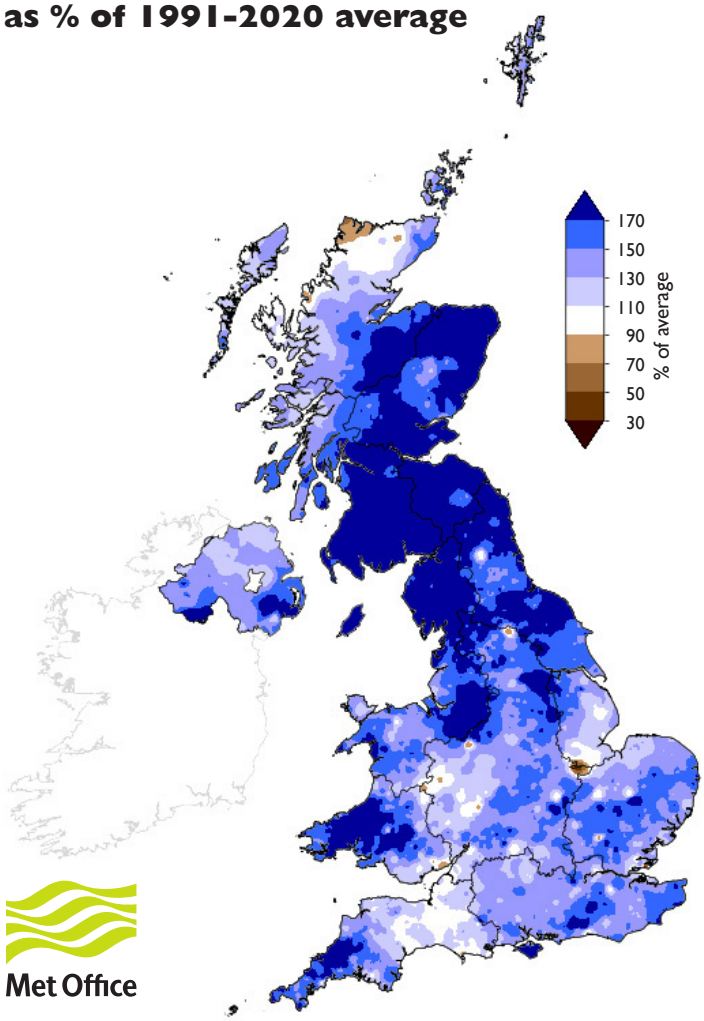
Region	Rainfall	Apr 2024	Feb24 – Apr24	RP	Nov23 – Apr24	RP	Aug23 – Apr24	RP	May23 – Apr24	RP
United Kingdom	mm	**111**	359		784		1164		1395	
	%	**155**	142	>100	126	80-120	126	>100	121	>100
England	mm	**86**	309		650		951		1151	
	%	**152**	171	>100	146	>100	141	>100	134	>100
Scotland	mm	**149**	411		944		1414		1677	
	%	**160**	115	8-12	108	8-12	110	10-20	107	10-15
Wales	mm	**136**	500		1094		1578		1836	
	%	**154**	160	>100	137	60-90	134	>100	126	70-100
Northern Ireland	mm	**105**	318		666		1129		1436	
	%	**141**	126	10-20	109	8-12	124	>>100	125	>100
England & Wales	mm	**92**	336		711		1037		1245	
	%	**153**	169	>100	144	>100	139	>100	132	>100
North West	mm	**139**	403		956		1378		1692	
	%	**195**	151	>100	143	>>100	135	>>100	133	>100
Northumbria	mm	**105**	252		608		948		1155	
	%	**174**	130	10-20	131	50-80	135	>100	127	60-90
Severn-Trent	mm	**78**	292		586		869		1066	
	%	**140**	175	>100	147	80-120	143	>100	133	60-90
Yorkshire	mm	**95**	271		639		955		1163	
	%	**165**	146	25-40	144	80-120	142	>100	134	80-120
Anglian	mm	**58**	211		422		659		812	
	%	**139**	171	40-60	143	30-50	141	80-120	130	25-40
Thames	mm	**73**	291		561		815		984	
	%	**142**	193	>100	150	60-90	144	>100	136	50-80
Southern	mm	**78**	331		674		976		1121	
	%	**149**	198	>100	152	50-80	148	80-120	137	40-60
Wessex	mm	**73**	368		747		1061		1274	
	%	**121**	192	>100	153	>100	147	>100	141	>100
South West	mm	**111**	521		1040		1391		1639	
	%	**143**	190	>>100	147	>100	136	50-80	131	40-60
Welsh	mm	**131**	489		1055		1522		1773	
	%	**154**	164	>100	138	70-100	135	>100	127	80-120
Highland	mm	**142**	440		1055		1584		1856	
	%	**129**	100	2-5	99	2-5	103	5-10	100	2-5
North East	mm	**132**	316		717		1129		1339	
	%	**189**	142	30-50	134	80-120	136	>>100	126	>>100
Tay	mm	**145**	374		868		1404		1647	
	%	**177**	121	5-10	113	8-12	125	50-80	119	30-50
Forth	mm	**148**	366		788		1195		1425	
	%	**210**	133	20-35	119	15-25	121	50-80	115	20-35
Tweed	mm	**132**	319		711		1064		1286	
	%	**197**	136	30-50	125	30-50	124	>100	119	30-50
Solway	mm	**183**	471		1017		1388		1697	
	%	**198**	136	50-80	118	20-35	109	10-15	108	10-15
Clyde	mm	**178**	489		1094		1598		1918	
	%	**168**	114	5-10	103	5-10	103	5-10	102	5-10

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

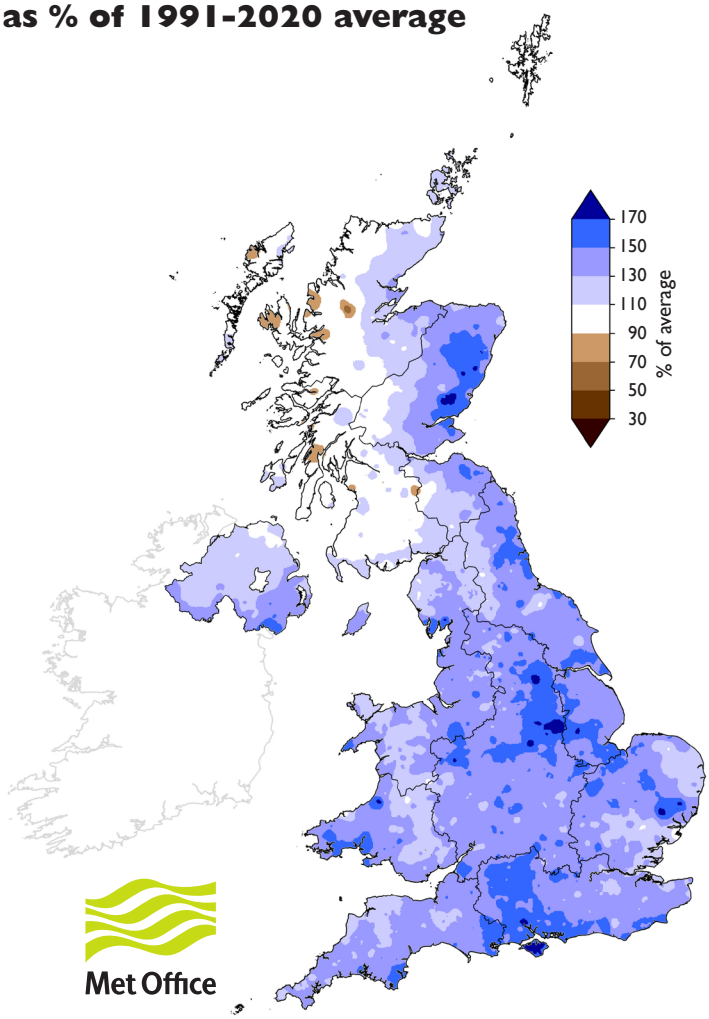
Important note: Figures in the above table may be quoted provided their source is acknowledged. Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability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

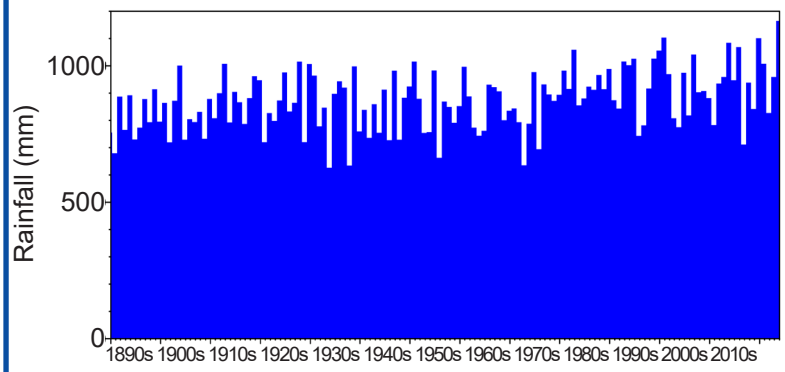
April 2024 rainfall
as % of 1991-2020 average



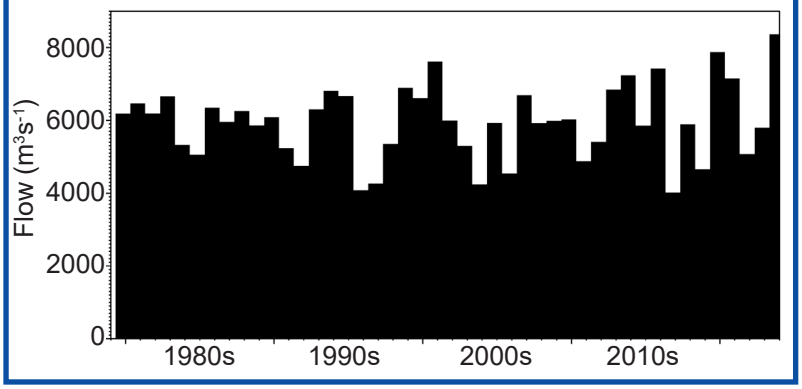
August 2023 - April 2024 rainfall
as % of 1991-2020 average



August - April rainfall for the UK



August - April outflows for the UK



UK Hydrological Outlook

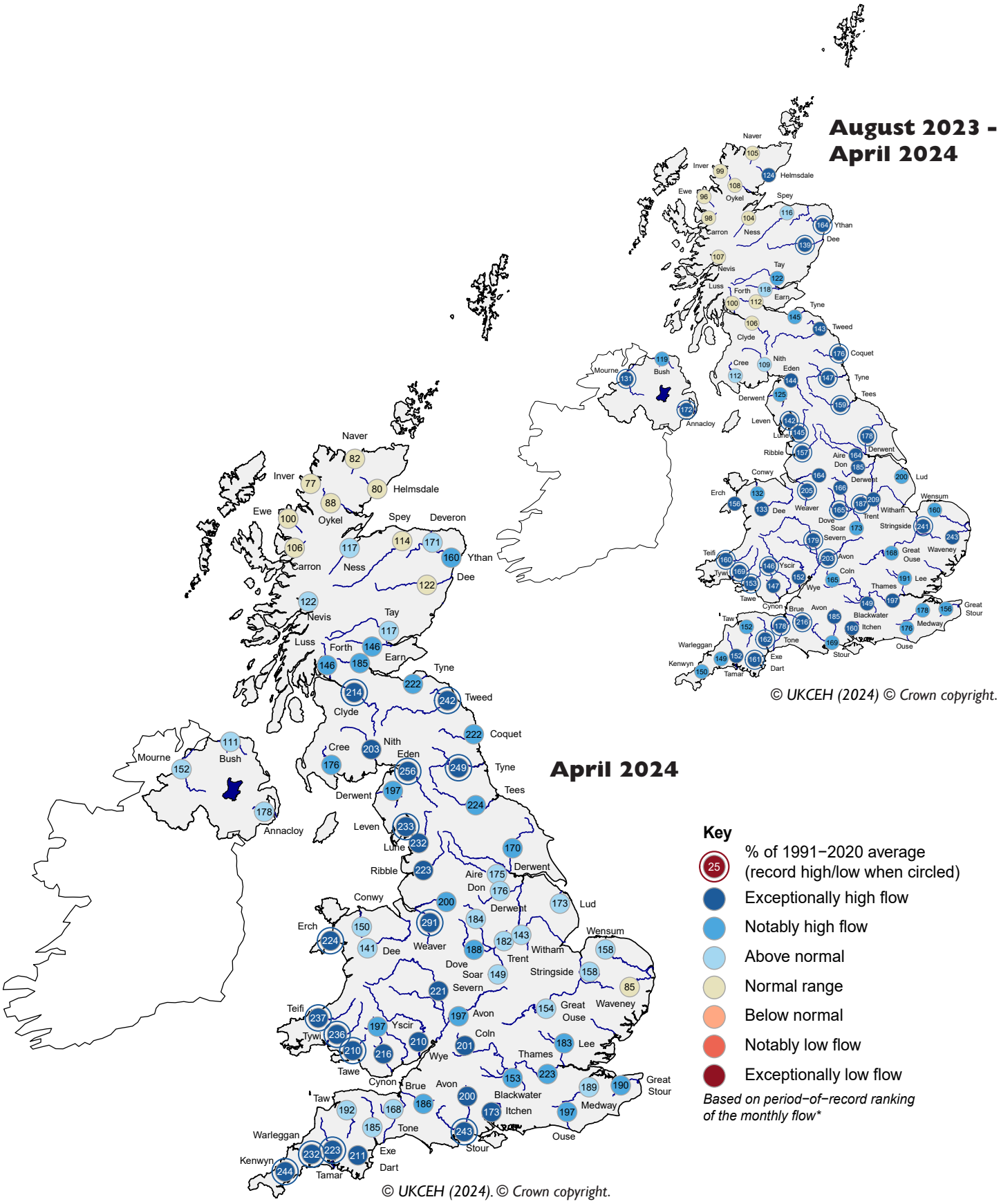
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from May 2024**
Issued: **10.05.2024**
using data to the end of April 2024

The outlook is for above normal to exceptionally high river flows and groundwater levels to persist in the south-east of England for May and for May-June-July as a whole. Over this three-month period, normal to above normal river flows are also likely across eastern parts of the UK, and groundwater levels are likely to remain above normal in the Permo-Triassic sandstones of northern England. Elsewhere river flows and groundwater levels are less certain.

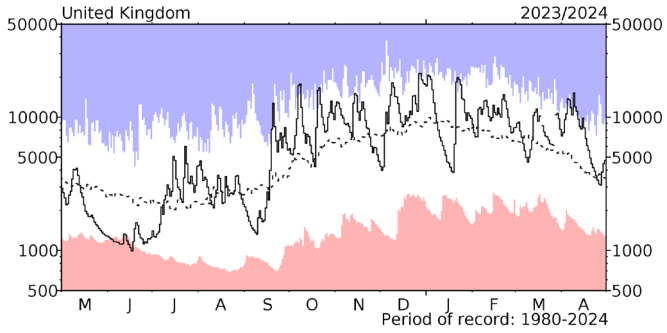
River flow . . . River flow . . .

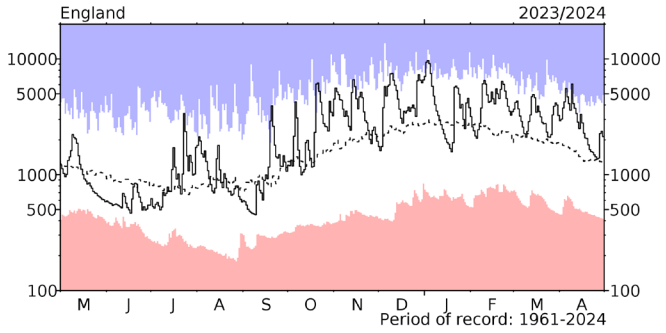


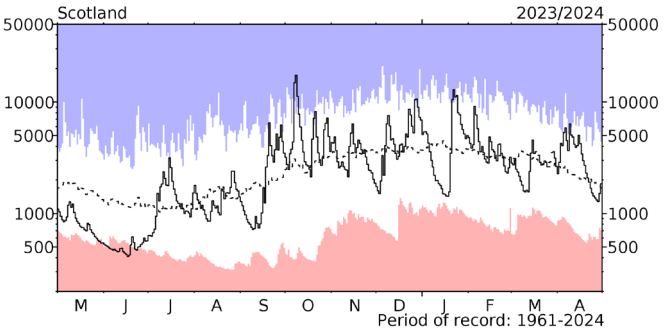
River flows

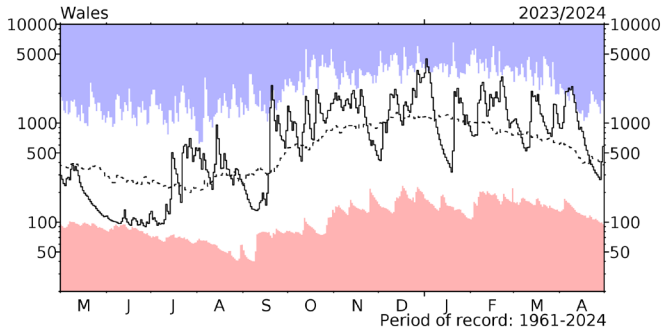
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

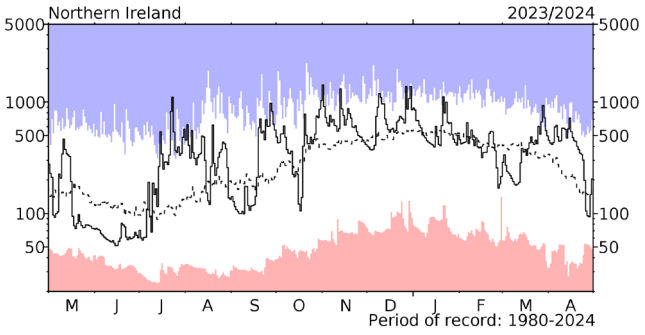
River flow . . . River flow . . .

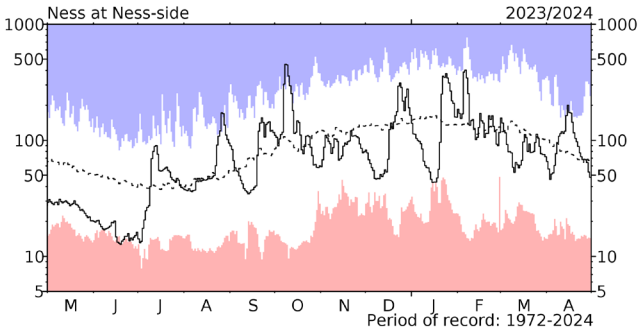


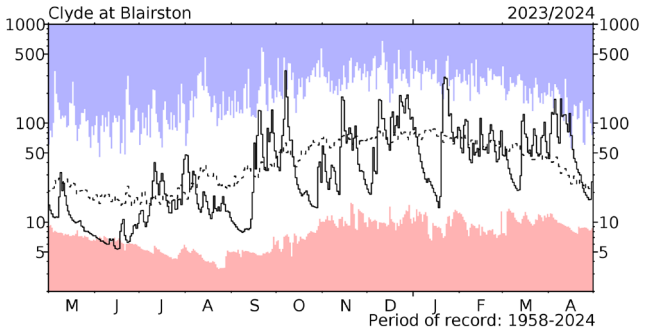


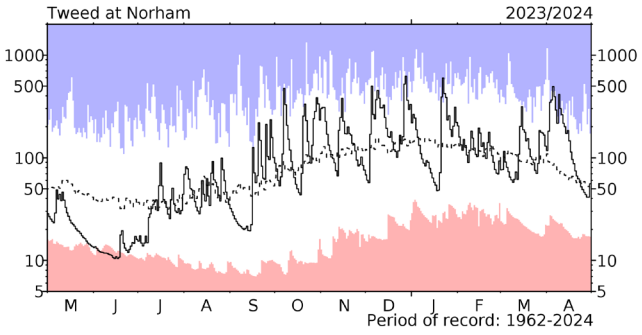


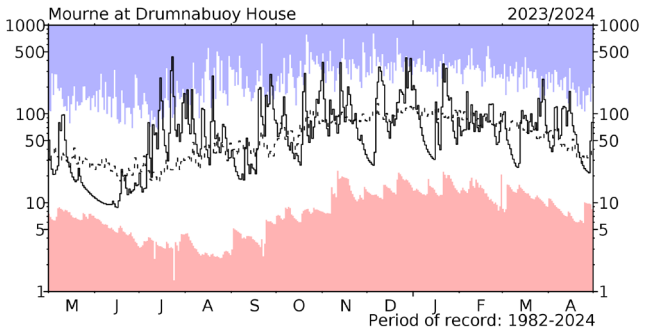


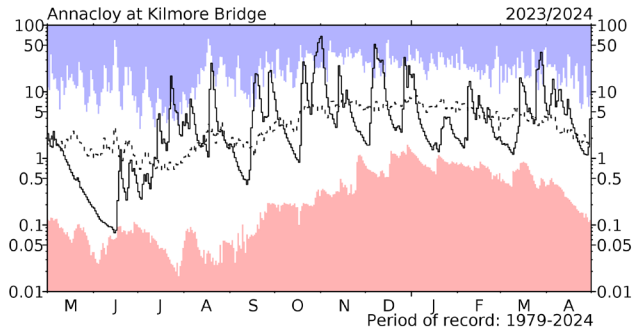








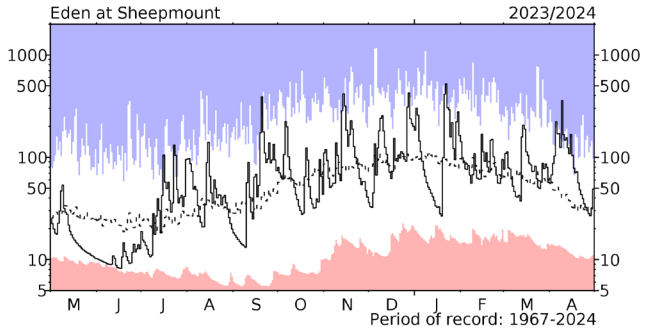


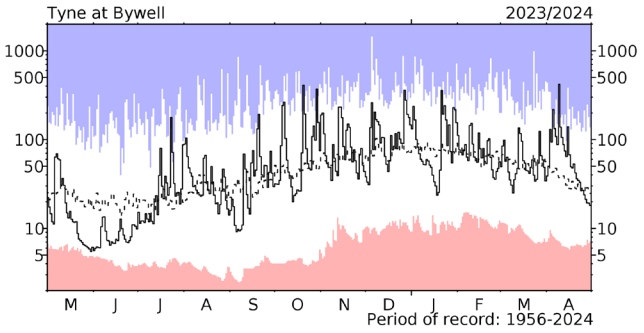


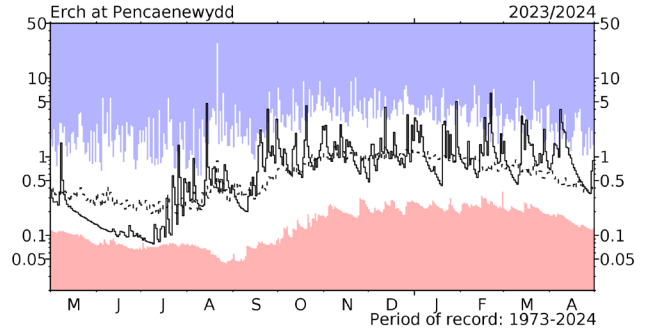
River flow hydrographs

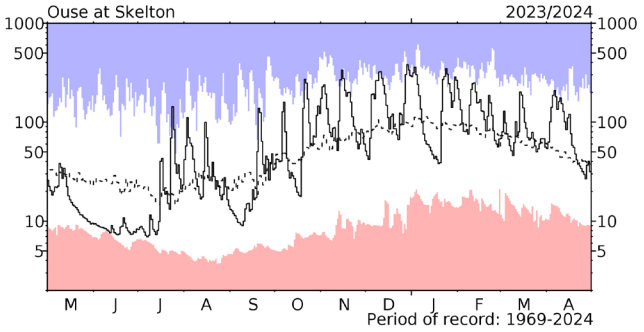
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to March 2023 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

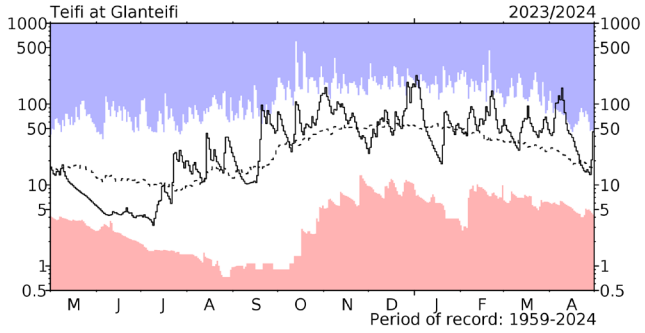
River flow . . . River flow . . .

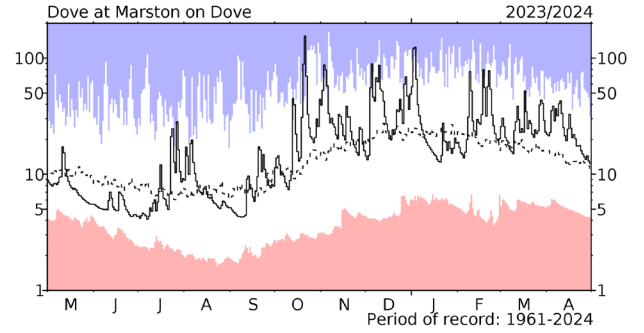


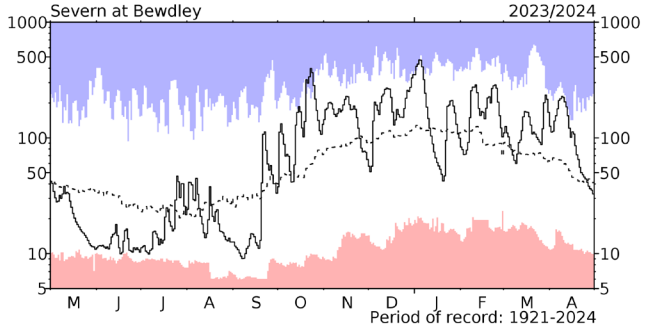


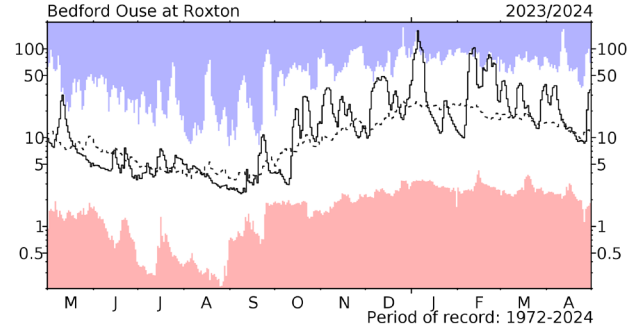


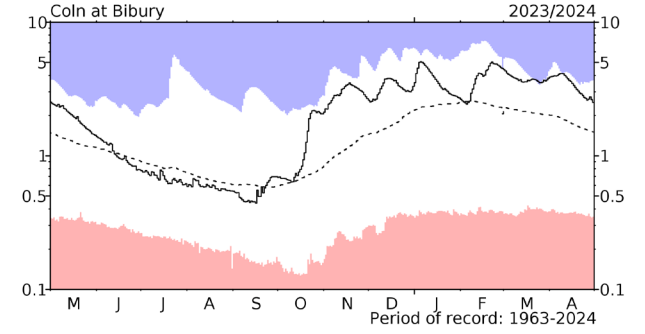


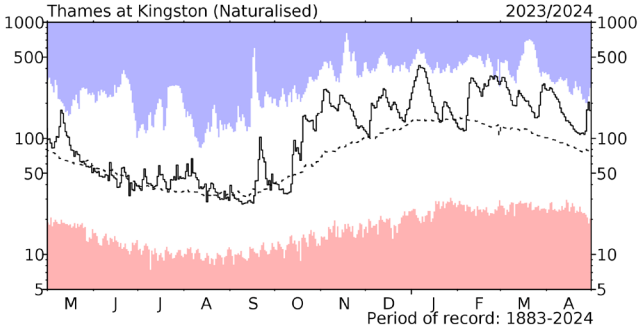


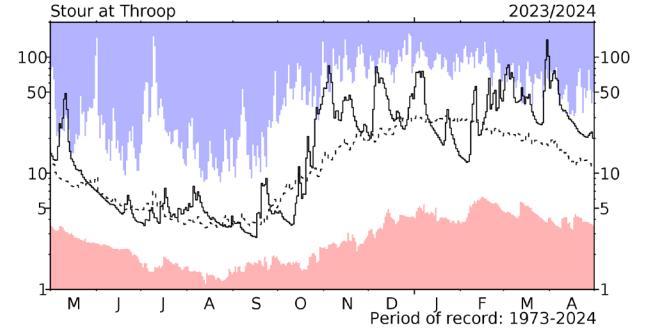


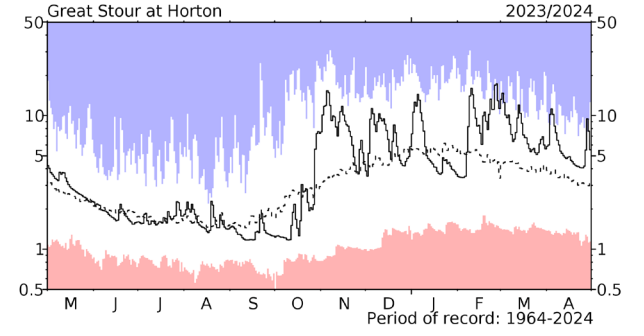




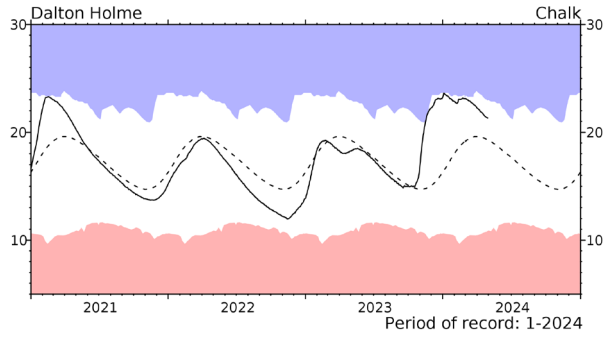


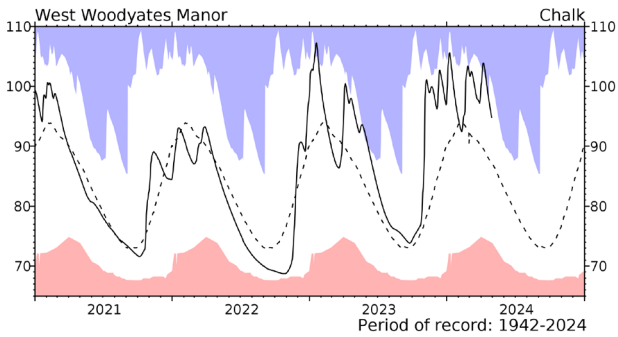


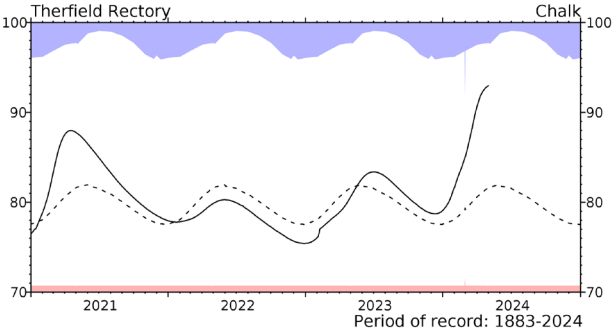


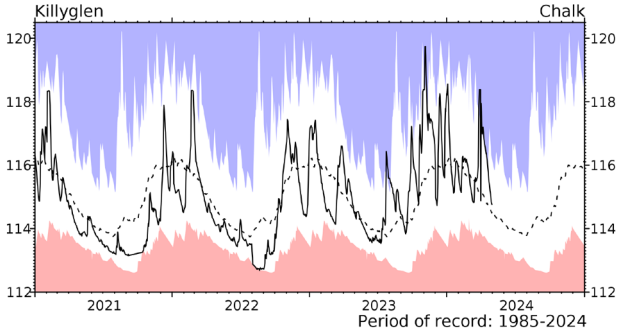


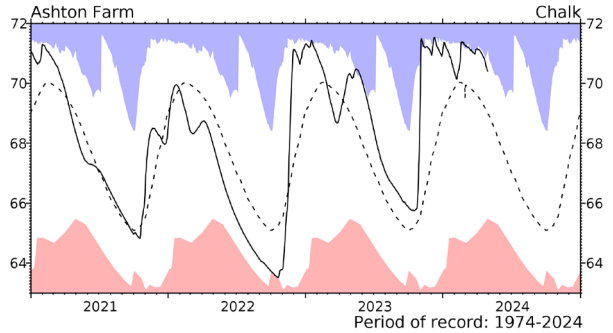
Groundwater…Groundwater

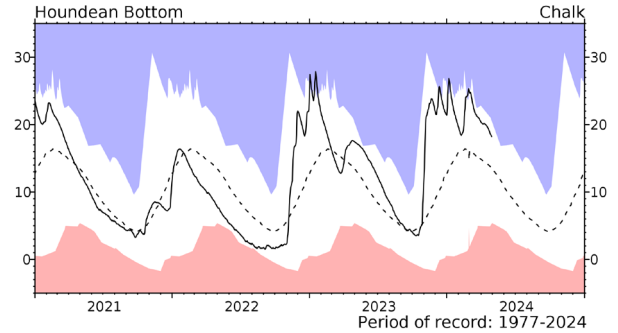


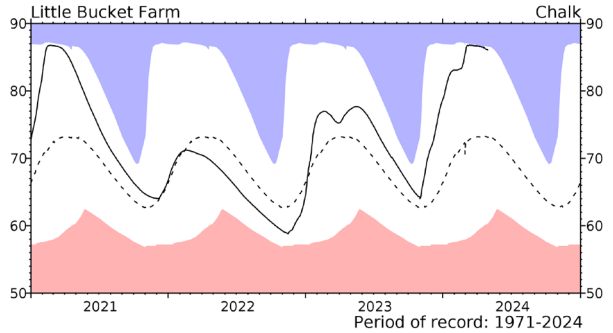


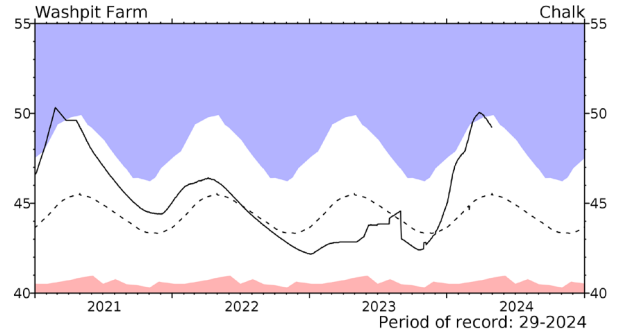


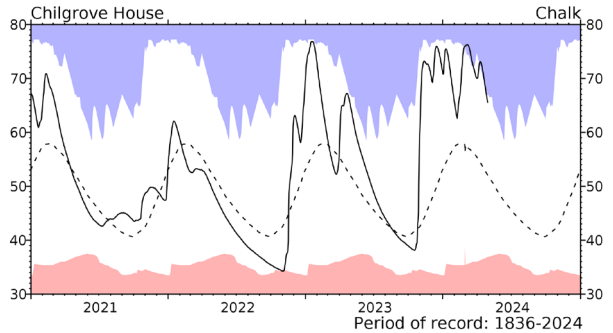


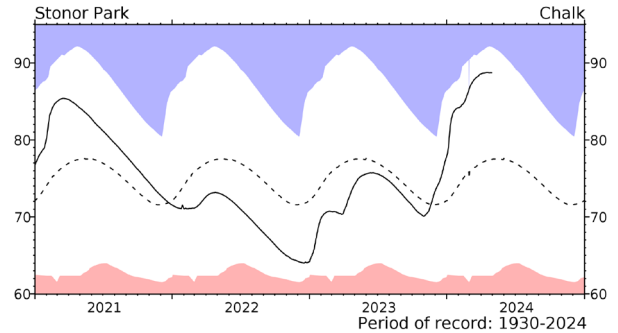






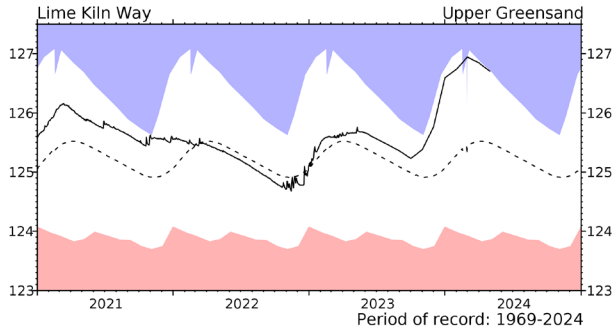


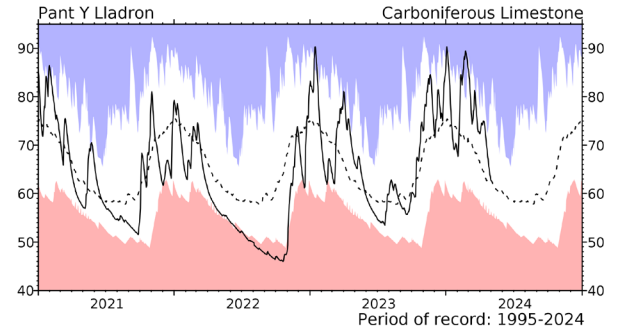


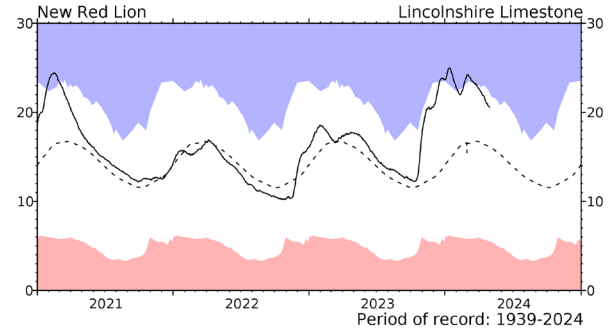


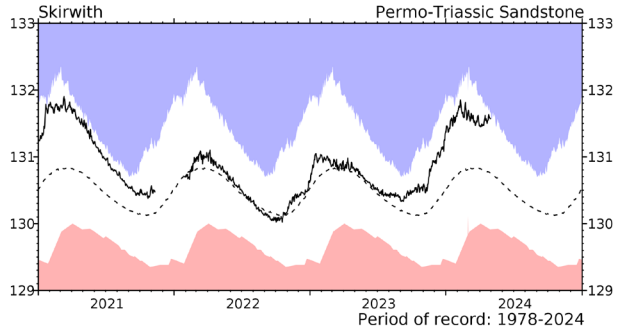
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

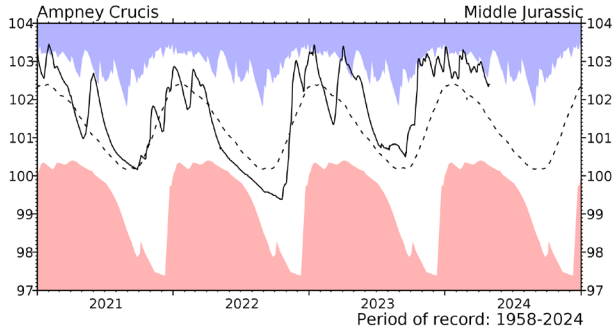
Groundwater … Groundwater

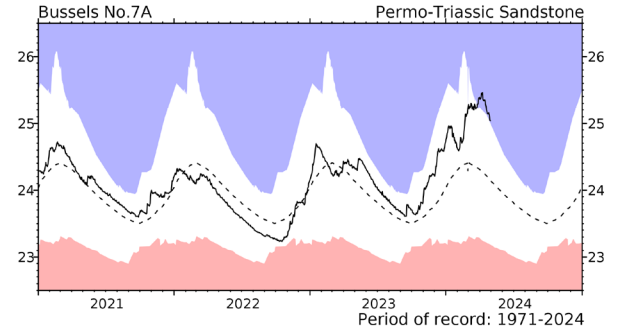


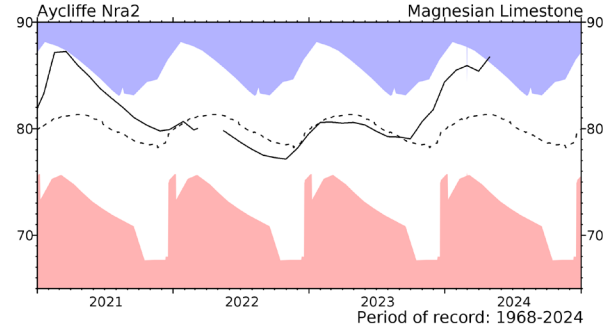


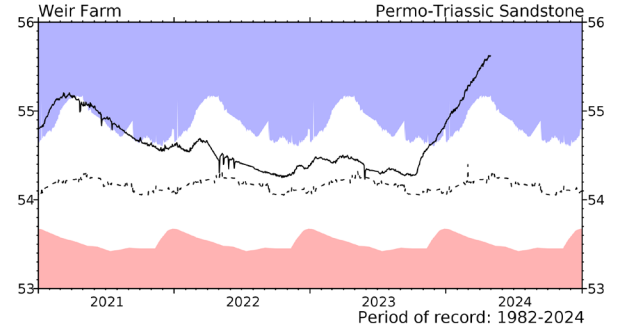


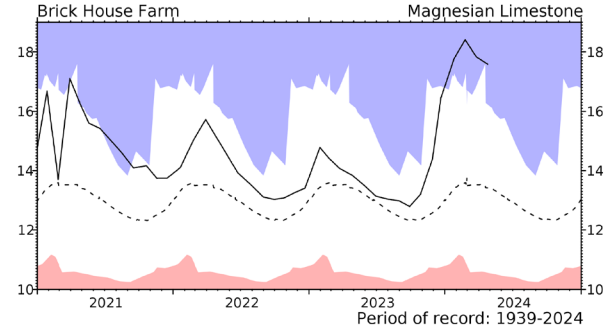


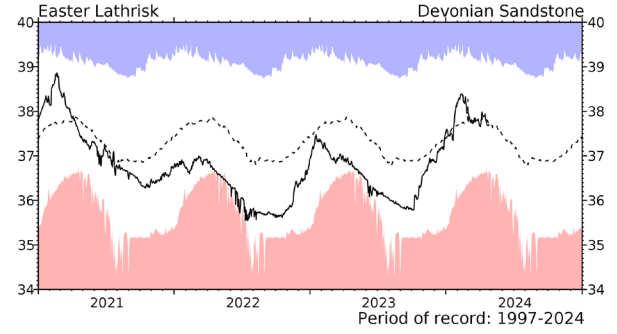


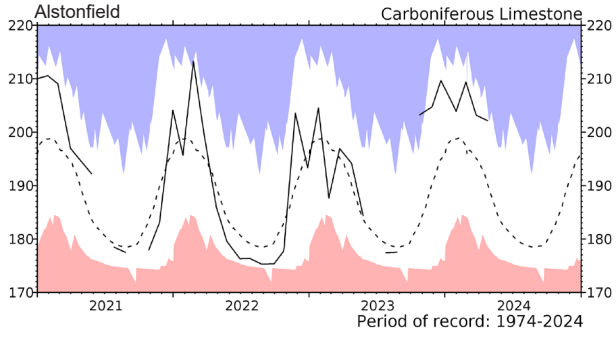


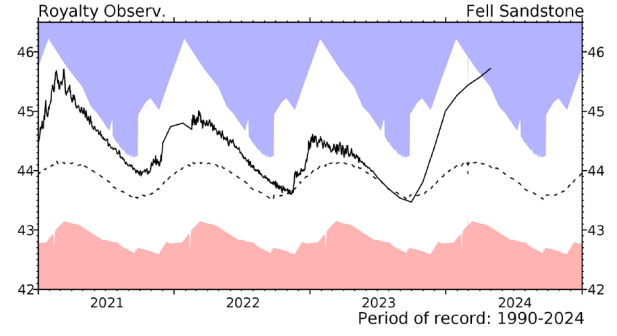


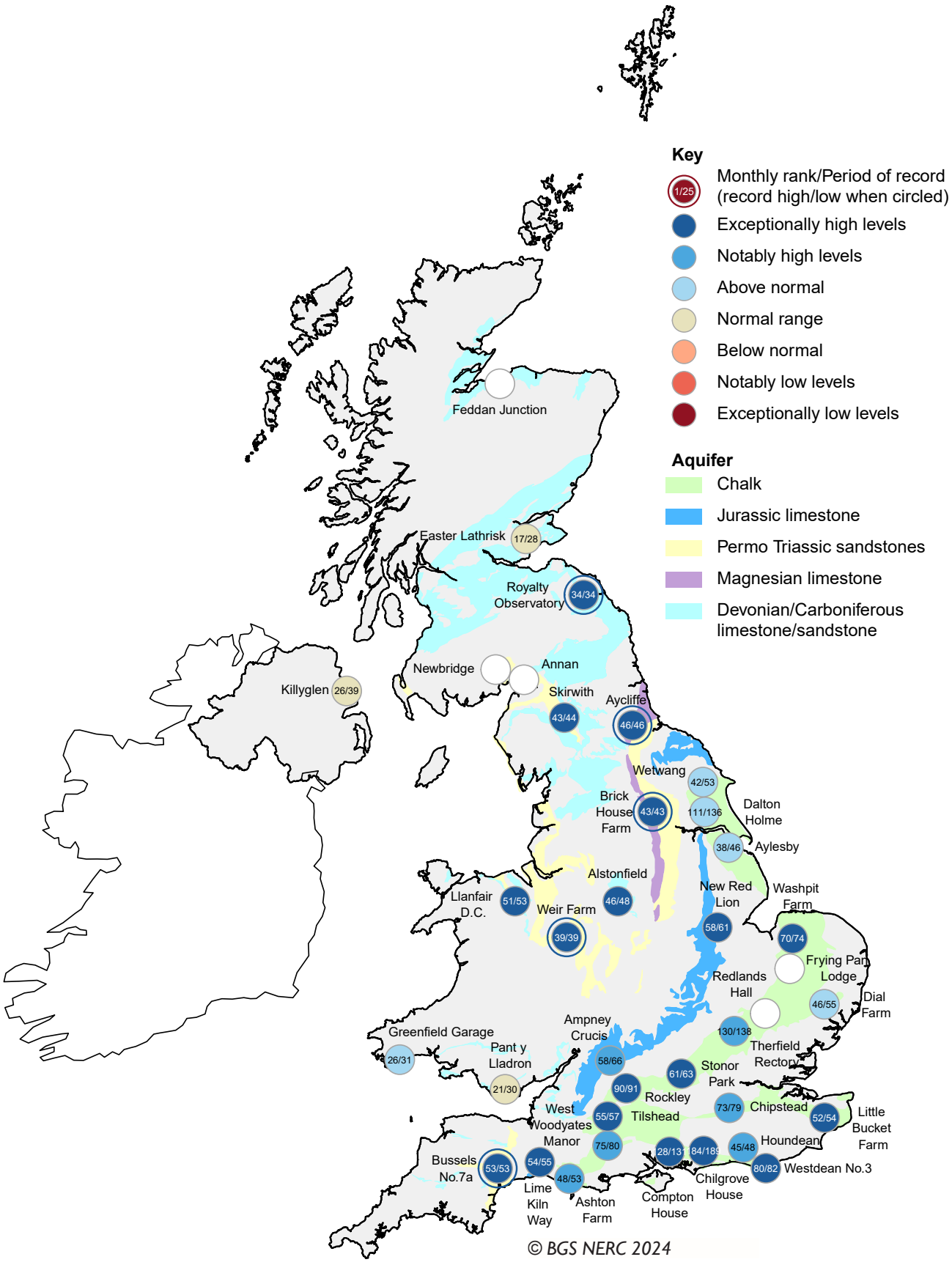










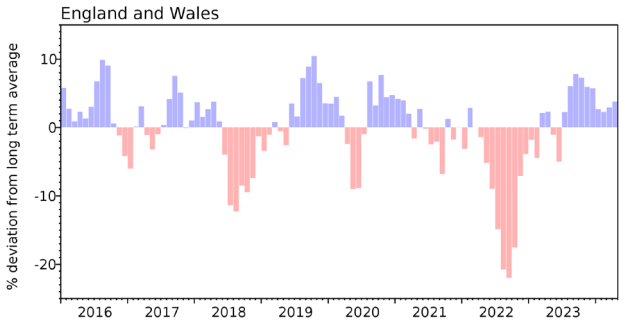


Groundwater levels - April 2024

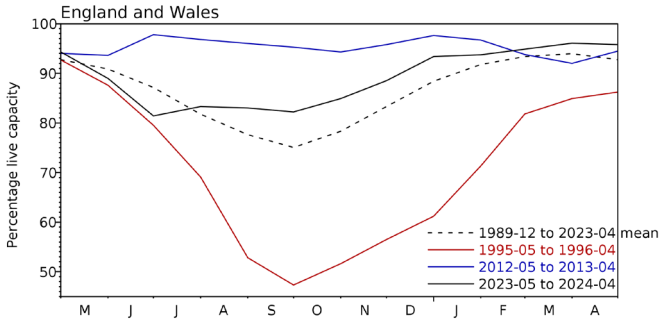
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Feb	2024 Mar	2024 Apr	Apr Anom.	Min Apr	Year* of min	2023 Apr	Diff 24-23
North West	N Command Zone	•	124929	100	98	94	7	65	1984	94	0
	Vyrnwy		55146	100	100	100	7	70	1996	100	0
Northumbrian	Teesdale	•	87936	99	99	98	8	73	2020	94	4
	Kielder		(199175)	95	95	93	2	85	1990	91	1
Severn-Trent	Clywedog		49936	95	98	99	1	85	1988	99	-1
	Derwent Valley	•	46692	100	99	97	5	54	1996	97	0
Yorkshire	Washburn	•	23373	98	97	97	8	76	1996	98	-1
	Bradford Supply	•	40942	100	100	97	7	60	1996	92	5
Anglian	Grafham		(55490)	77	85	90	-4	73	1997	87	2
	Rutland		(116580)	90	93	98	5	72	1997	96	2
Thames	London	•	202828	95	96	96	1	86	1990	97	-2
	Farmoor	•	13822	84	88	96	-1	81	2000	95	1
Southern	Bewl		31000	86	100	100	9	60	2012	99	1
	Ardingly		4685	100	100	100	1	69	2012	100	0
Wessex	Clatworthy		5662	100	100	98	5	81	1990	100	-2
	Bristol	•	(38666)	99	97	95	1	83	2011	100	-5
South West	Colliford		28540	89	98	100	13	56	1997	67	33
	Roadford		34500	100	100	99	14	41	1996	69	30
	Wimbleball		21320	100	100	100	5	79	1992	100	0
	Stithians		4967	100	100	100	8	65	1992	99	1
Welsh	Celyn & Brenig	•	131155	85	88	89	-9	75	1996	92	-3
	Brianne		62140	100	100	100	4	86	1997	100	0
	Big Five	•	69762	100	100	99	6	85	2011	99	0
	Elan Valley	•	99106	100	100	99	4	83	2011	97	2
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	98	99	98	5	62	1998	96	2
	East Lothian	•	9317	100	100	100	1	89	1992	100	0
Scotland(W)	Loch Katrine	•	110326	100	100	97	6	80	2010	97	1
	Daer		22494	88	88	83	-9	78	2013	84	-1
	Loch Thom		10721	100	100	99	6	72	2021	96	3
Northern Ireland	Total+	•	56800	99	98	94	6	77	2007	97	-3
	Silent Valley	•	20634	100	100	96	10	58	2000	98	-3

( ) figures in parentheses relate to gross storage

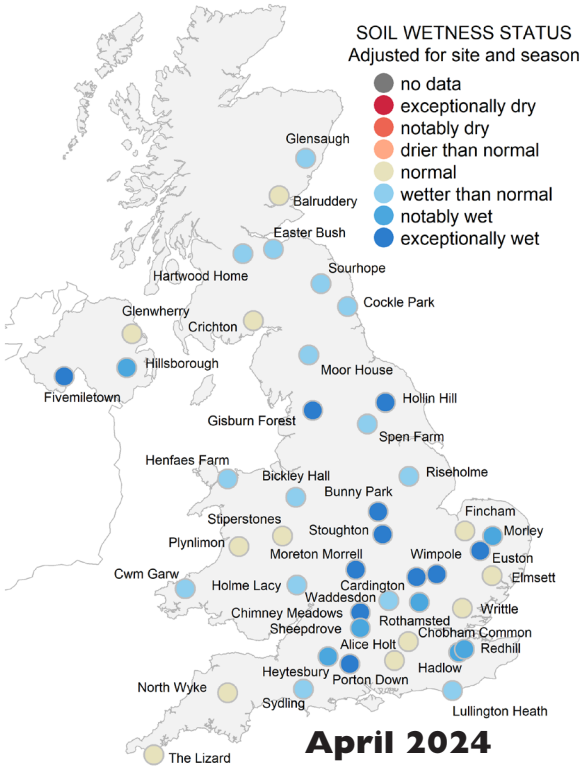
• denotes reservoir groups

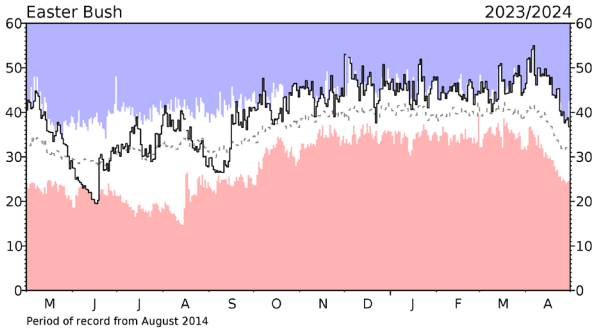
*last occurrence

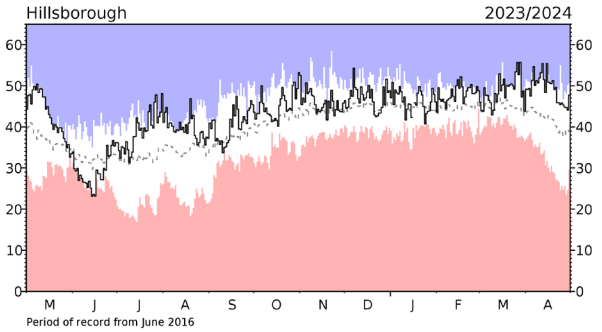
+ excludes Lough Neagh

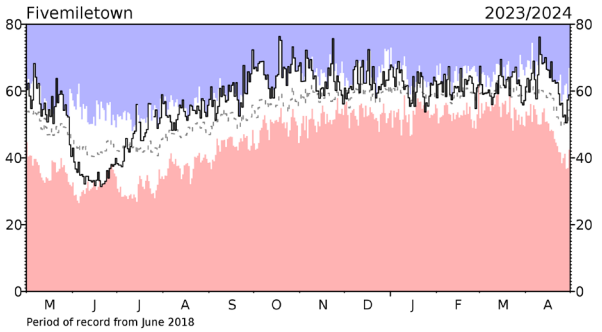
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed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

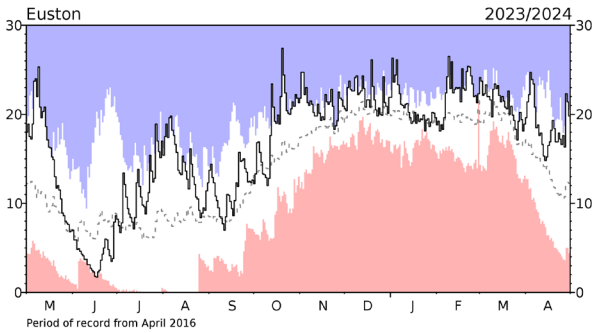
Soil Moisture . . . Soil Moisture

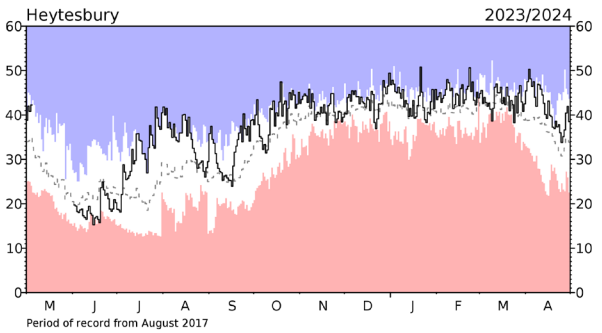












At the end of April, soil moisture is declining but remains wetter than normal to exceptionally wet for the time of year across most of the COSMOS-UK network.

Low pressure weather and storm Kathleen early in April brought rain to Scotland, Wales and Northern Ireland raising soil moisture. COSMOS-UK sites affected were Easter Bush, Crichton, Hillsborough, Filemiletown and Cwm Garw. Early in the month many sites were exceptionally wet for the time of year, although a downward soil moisture trend was then seen through to later parts of April. Central and Eastern England had rainfall late in April elevating soil moisture, at locations including Euston and Heytesbury.

Overall, soil moisture remains high for much of the COSMOS-UK network, following a wetter-than-average March 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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