Hydrological Summary

for the United Kingdom

January 2023

General

January was a month of two parts, firstly characterised by a continuation of the mild, unsettled weather seen during the latter half of December, leading to both pluvial and fluvial flooding in western areas. Drier and colder weather then dominated, leading to river flow recessions to month-end. Despite the unsettled start to the month, rainfall was only slightly above average for January. January monthly river flows were above normal across much of northern and western Britain, exceptionally so in south-west England and south Wales. Elsewhere, in Northern Ireland, northern Scotland and eastern England river flows remained in the normal range. Soil moisture was above average for the time of year, contributing to the continuation of groundwater recharge at many sites, however at more responsive sites, recessions in groundwater levels occurred. Reservoir stocks continued to recover, however in many areas, such as Wales, south-west and eastern England, stocks remained below average for the time of year (Colliford was 37% below average; Celyn & Brenig was 17% below average). Settled conditions have continued into February and longer-term outlooks suggest they are likely to persist, particularly in southern and eastern areas, which highlights an increasing risk of water resource uncertainty for later in 2023 – rainfall over the remainder of the recharge season will be crucial in combatting this uncertainty.

Rainfall

The first half of January was unsettled and for the most part, mild, with successive westerly and south-westerly cyclonic airflows, bringing frontal rain, blustery showers and coastal gales. On the 12th, south Wales and south-west England saw substantial daily totals, e.g. 100mm was recorded at Maerdy Water Works (Mid-Glamorgan) causing property flooding in the Rhondda Cynon Taff borough, power outages and travel disruption. On the 14th, heavy rain falling on saturated ground caused transport disruption e.g. the mainline to south Wales was flooded in Badminton (Gloucestershire). From the 15th, a northerly airflow brought lower temperatures, and away from the far north, areas were dominated by settled weather bringing hard frosts and freezing fog. However, between the 16th-19th sleet and snow featured in the north and west; a snow depth of 34cm was measured at Loch Glascarnoch (Ross & Cromarty) on the 18th and 19th, and caused disruption to air, rail and road travel and school closures. January rainfall was near average (103% for the UK overall) with some isolated areas in Wales and western England seeing over 150% of average, whilst Northern Ireland, central England and the east coast of Britain saw below normal rainfall, and as little as 50% of average in the north-east. The Welsh, North West, Wessex and South West regions all recorded over 120% of the January average, whilst in Northern Ireland, Northumbrian, Anglian and Tay regions less than 85% was registered. Rainfall for November-January was seventh highest for both the Southern and South West regions in England (in records since 1835).

River Flows

In most catchments, river flows began the month above average, and unsettled weather during the first half of the month led to peaks in many catchments around mid-month. Demountable barriers were erected in Ironbridge and Bewdley on the Severn and flooding was reported in Tewkesbury (Gloucestershire) on the 12th. Property flooding was also reported in the Tiverton area (Devon) on the Exe. Peak flows on the 11th on the Yscir were the highest for January whilst between the 11th and 14th the Severn, Exe, Wye, and Cynon all recorded their second highest January peak flows. The Piddle recorded its highest peak flow for any month on the 16th in a series from 1963. As the weather became more settled, after the 16th, recessions became established in most catchments to month-end, with many responsive catchments in western areas ending the month below average, despite the high flows earlier in the month. January mean flows were above normal across much of western Britain, exceptionally so in south-west England and south Wales, with many catchments in these areas recording over 150% of the January average. The Dart, Tone, Twyi and Cumbrian Leven recorded their highest January monthly river flows (all in records longer than 60 years). Elsewhere, flows in Northern Ireland, northern Scotland and eastern England were in the normal range, with some below normal flows persisting (e.g. Stringside registered 58% of its January average). January outflows for England & Wales were the eighth highest in a series from 1961. Over the last three months (November-January) there was a similar pattern with above normal flows in most areas, exceptionally so in south Wales, Sussex and the south-west of England, where the highest November-January flows were recorded on the Dart (in a record since 1959). Below normal flows for the same period were restricted to northern Scotland and East Anglia (where the Stringside and Waveney both recorded less than 50% of the November-January average).

Soil Moisture and Groundwater

Most COSMOS-UK sites showed normal to above-normal soil wetness, although declining towards month-end. Groundwater levels in the Chalk showed a north/south divide reflecting January's rainfall distribution. Levels were normal to notably low at Killyglen and from Yorkshire to the Chilterns (Stonor Park), whilst further west and south, levels were mostly above normal. Levels were still rising in most northern Chalk sites, whilst those in the south saw mid-month peaks followed by recessions. Exceptionally high levels were recorded at Tilshead, Compton House, Chilgrove House and Westdean No.3. In the Jurassic limestones, levels rose and were above normal at New Red Lion but fell into the normal range at Ampney Crucis. Recharge continued in the Magnesian Limestone, with levels ending January in the normal range at Aycliffe and above normal at Brick House Farm. Levels continued to rise in the Carboniferous Limestone at Alstonfield, where they were in the normal range, while levels fell at the sites in south Wales towards the end of January with Greenfield Garage becoming below normal. Groundwater levels continued to rise in the Permo-Triassic sandstones, although many were levelling off by month-end. Levels rose from below normal to above normal at Skirwith, and were normal or above normal elsewhere. At Lime Kiln Way in the Upper Greensand, levels rose slightly and remained in the normal range. Levels continued to rise in the Devonian and Carboniferous sandstones, moving into the normal range at Feddan Junction and remaining normal at East Lathrisk and Royalty Observatory.

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.

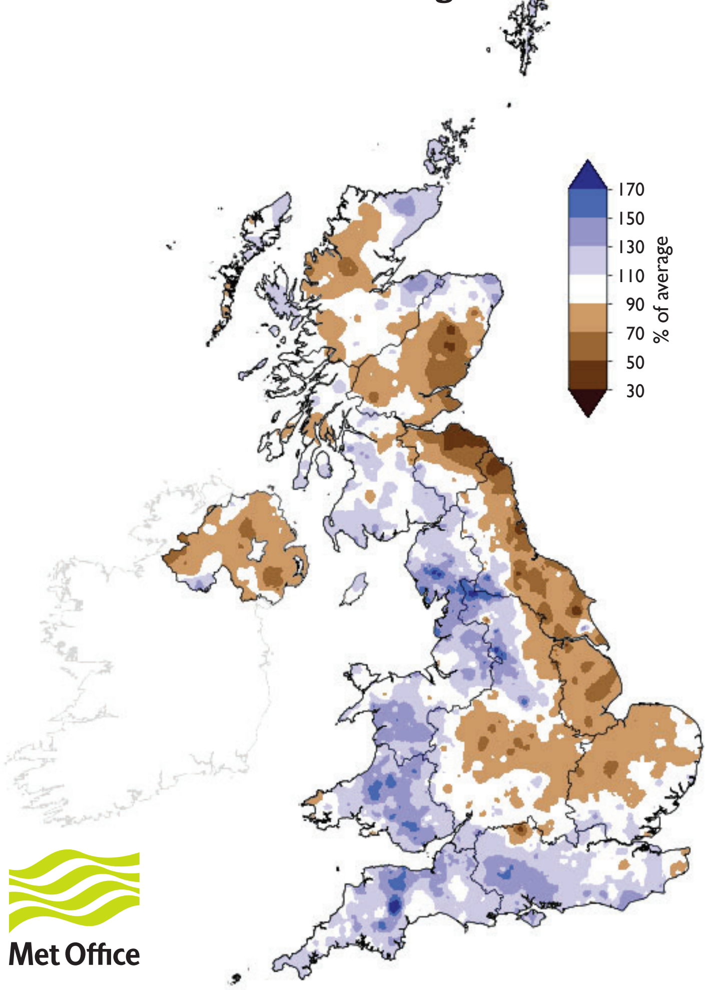
Region	Rainfall	Jan 2023	Nov22 – Jan23	RP	Aug22 – Jan23	RP	May22 – Jan23	RP	Feb22 – Jan23	RP
United	mm	**126**	397		690		871		1116	
Kingdom	%	**103**	107	5-10	102	2-5	96	2-5	96	2-5
England	mm	**91**	314		523		642		805	
	%	**109**	118	5-10	106	2-5	94	2-5	94	2-5
Scotland	mm	**172**	508		919		1196		1559	
	%	**96**	99	2-5	99	2-5	99	2-5	99	2-5
Wales	mm	**195**	560		889		1076		1372	
	%	**125**	114	5-10	103	2-5	94	2-5	95	2-5
Northern	mm	**95**	303		662		882		1147	
Ireland	%	**83**	85	2-5	101	2-5	98	2-5	99	2-5
England &	mm	**105**	347		573		701		883	
Wales	%	**113**	117	5-10	105	2-5	94	2-5	94	2-5
North West	mm	**163**	446		783		996		1278	
	%	**129**	111	5-10	104	2-5	99	2-5	101	2-5
Northumbria	mm	**71**	263		491		632		811	
	%	**85**	97	2-5	96	2-5	89	2-5	90	2-5
Severn-Trent	mm	**72**	247		436		553		720	
	%	**101**	107	2-5	99	2-5	88	2-5	90	2-5
Yorkshire	mm	**82**	271		467		596		801	
	%	**103**	105	2-5	96	2-5	88	2-5	93	2-5
Anglian	mm	**45**	188		329		411		516	
	%	**85**	110	2-5	95	2-5	82	5-10	83	5-10
Thames	mm	**75**	273		462		550		675	
	%	**105**	122	5-10	112	2-5	96	2-5	94	2-5
Southern	mm	**104**	418		634		722		835	
	%	**119**	151	25-40	129	10-20	111	2-5	102	2-5
Wessex	mm	**118**	401		609		720		872	
	%	**125**	134	10-20	114	5-10	101	2-5	97	2-5
South West	mm	**169**	576		854		993		1203	
	%	**122**	133	15-25	114	5-10	102	2-5	96	2-5
Welsh	mm	**183**	540		861		1042		1324	
	%	**124**	115	5-10	104	2-5	95	2-5	95	2-5
Highland	mm	**208**	563		987		1340		1769	
	%	**95**	90	2-5	90	2-5	95	2-5	95	2-5
North East	mm	**95**	344		637		810		1052	
	%	**94**	109	2-5	105	2-5	97	2-5	99	2-5
Tay	mm	**132**	495		897		1129		1459	
	%	**81**	108	2-5	110	5-10	105	5-10	105	5-10
Forth	mm	**118**	399		765		950		1235	
	%	**87**	102	2-5	107	5-10	99	2-5	100	2-5
Tweed	mm	**94**	351		648		795		1055	
	%	**88**	105	2-5	104	2-5	94	2-5	97	2-5
Solway	mm	**189**	562		1031		1279		1655	
	%	**112**	109	5-10	111	5-10	105	5-10	105	8-12
Clyde	mm	**220**	581		1099		1449		1881	
	%	**101**	92	2-5	98	2-5	99	2-5	99	5-10

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

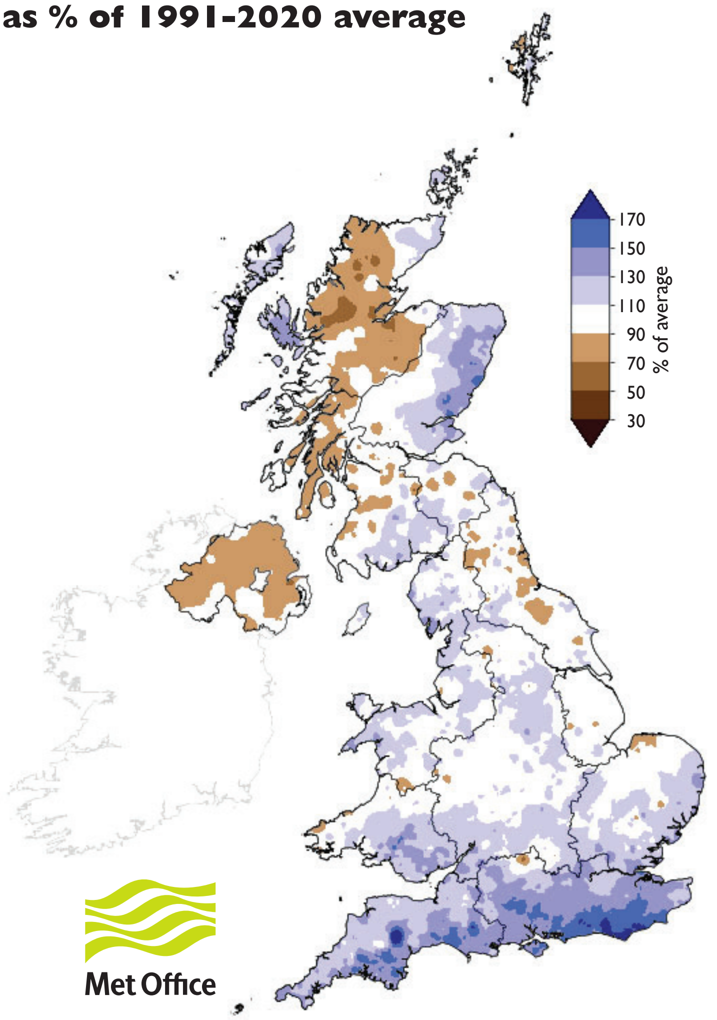
Important note: Figures in the above table may be quoted provided their source is acknowledged. Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability since 1836; 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 2022 are provisional. Source: Data from HadUK-Grid dataset at 1km resolution v1.1.0.0.

Rainfall . . . Rainfall . . .

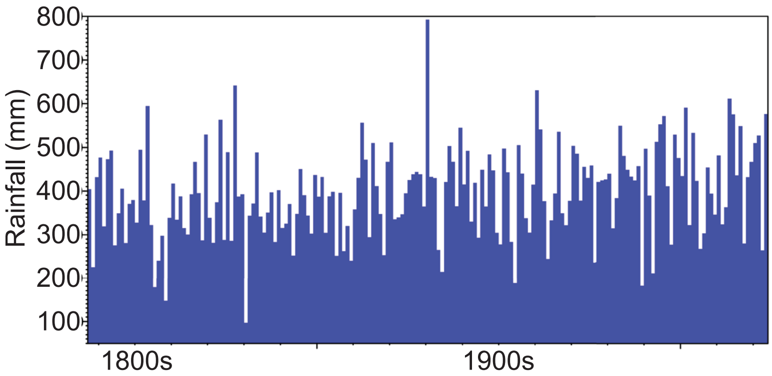
January 2023 rainfall as % of 1991-2020 average



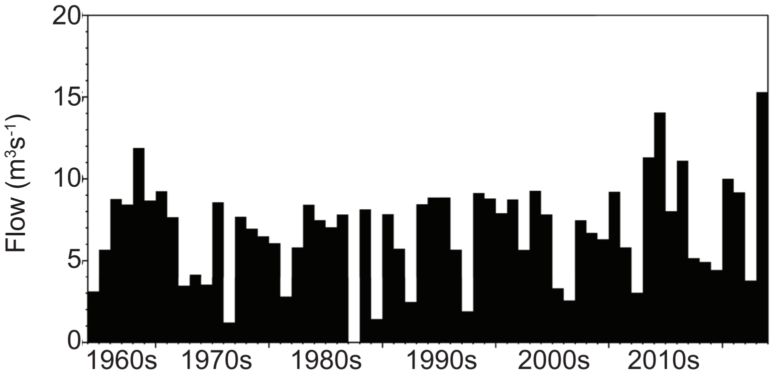
November 2022 - January 2023 rainfall as % of 1991-2020 average



November-January rainfall for the South West region



January peak flows on the Piddle



UK Hydrological Outlook

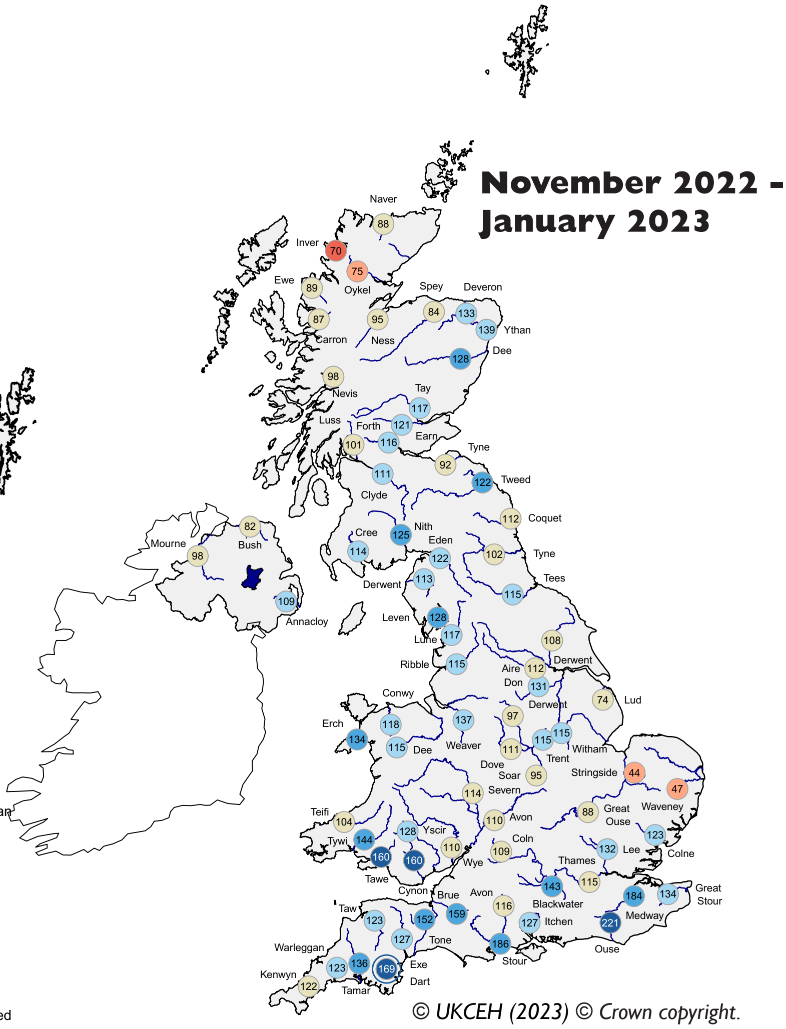
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

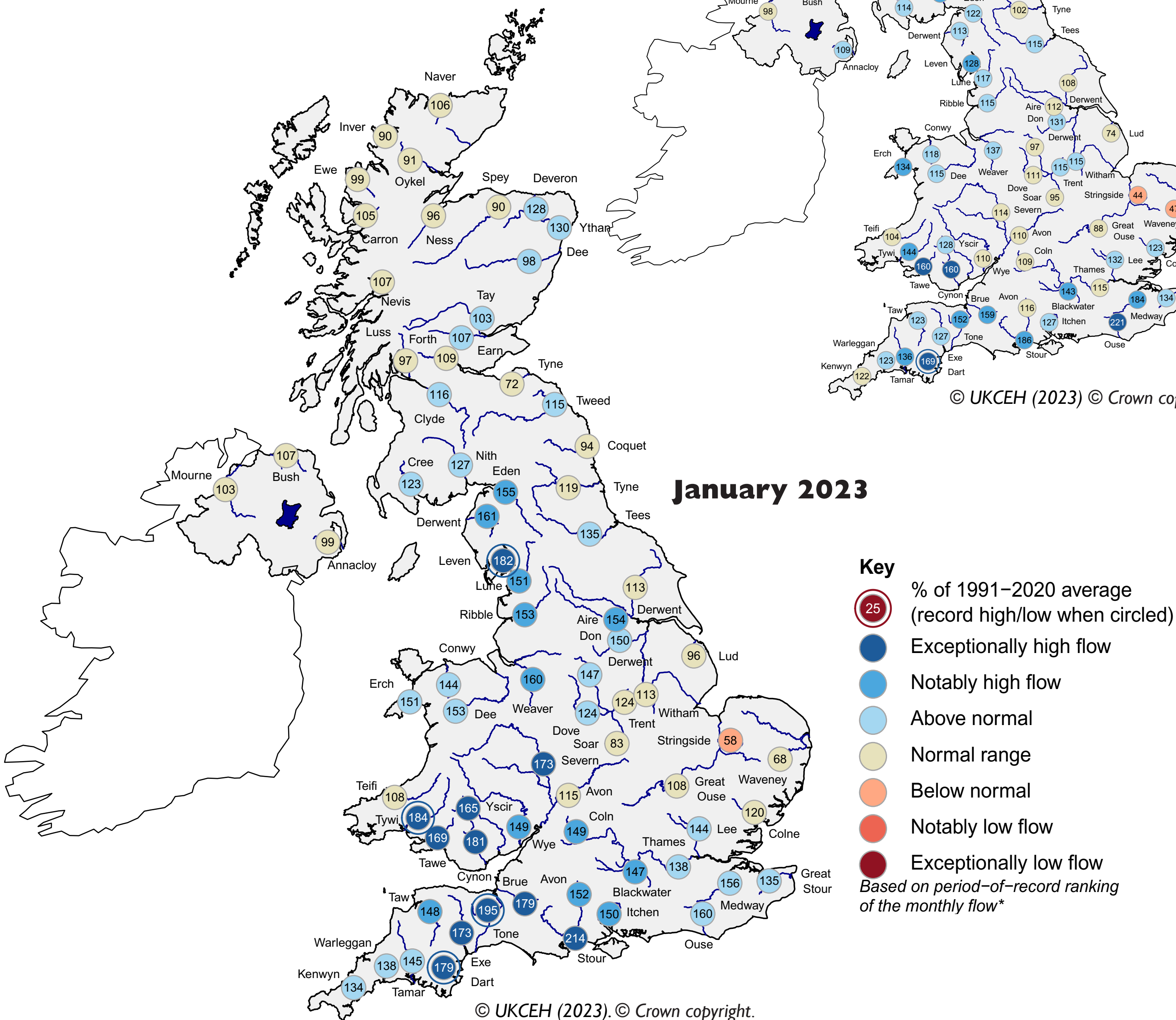
The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from February 2023**
Issued: **08.02.2023**
using data to the end of January 2023

The outlook for February is for normal to above normal river flows in northwest Britain, and normal to below normal flows elsewhere. Groundwater levels are likely to be normal to above normal in most aquifers, and normal to below normal in East Anglia. The outlook for February to April is for normal to below normal flows and groundwater levels across most of the UK, but with normal to above normal groundwater levels persisting in some parts of the southeast.

River flow ... River flow ...

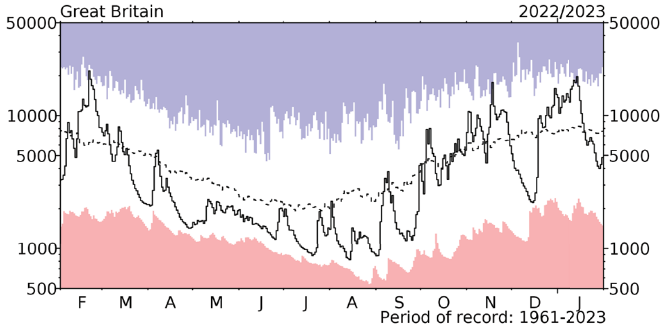


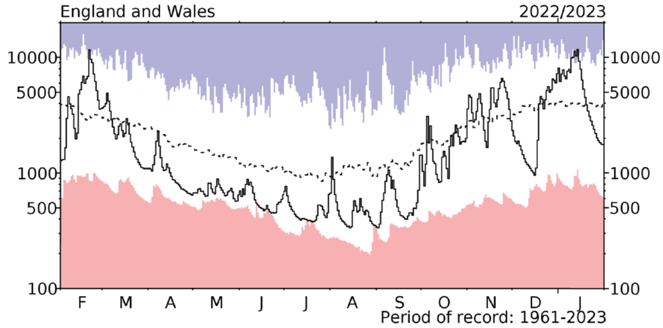


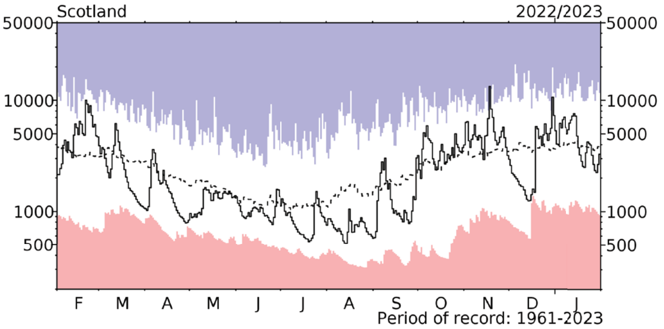
River flows

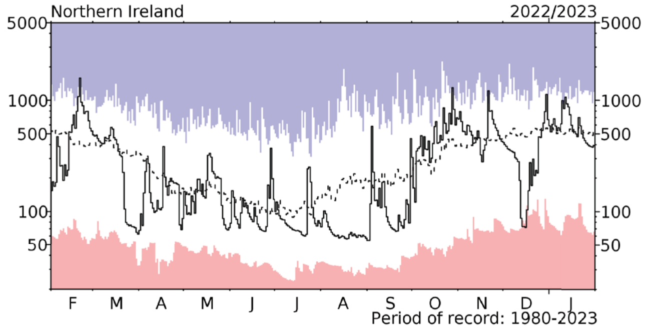
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

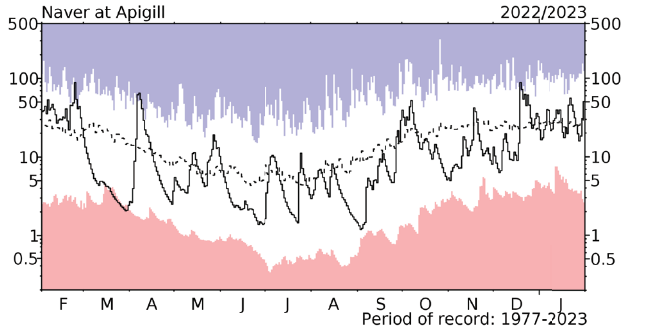
River flow . . . River flow . . .

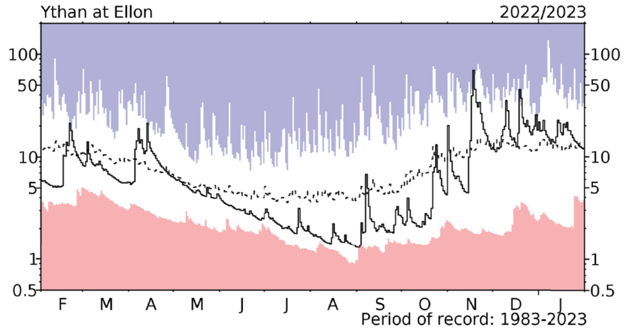


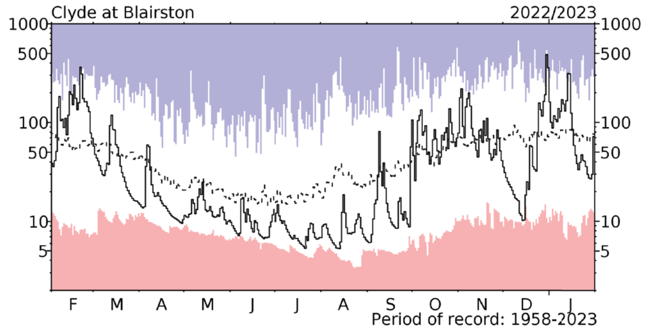


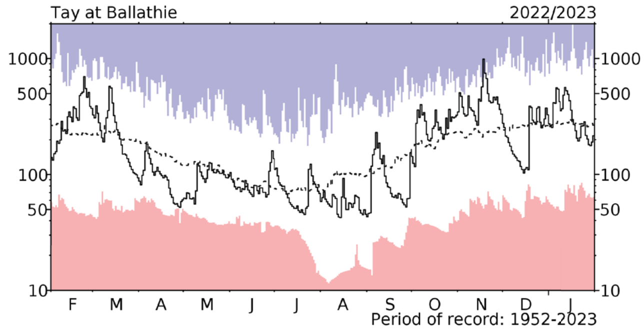


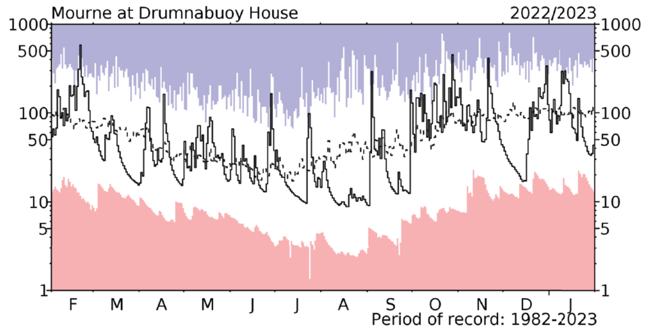


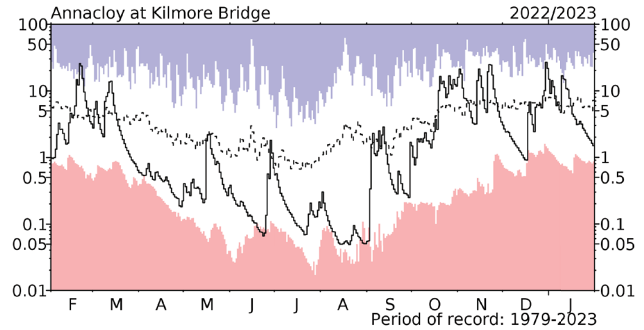






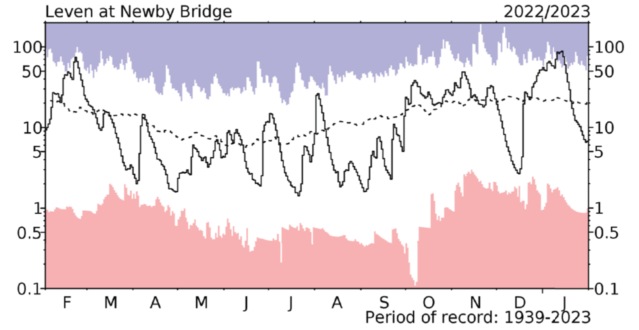


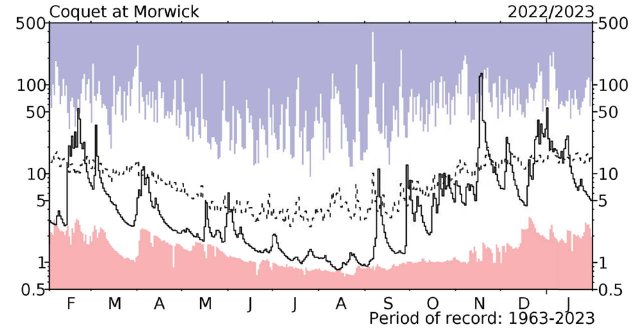


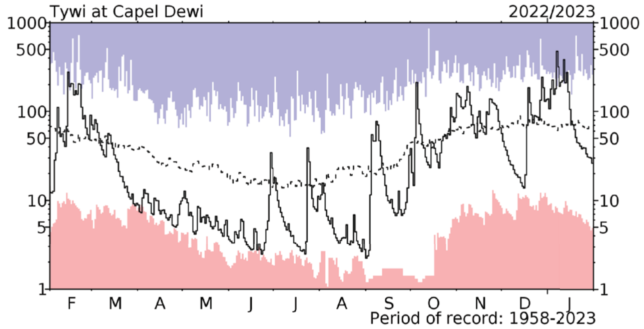


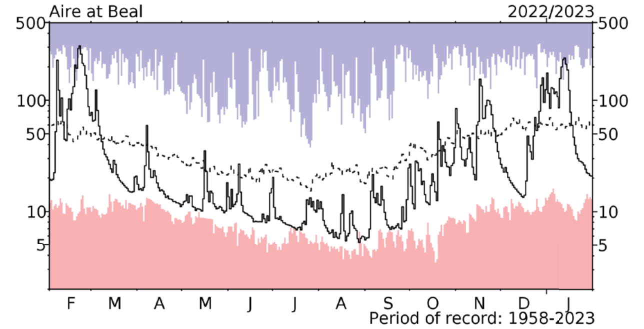
River flow hydrographs

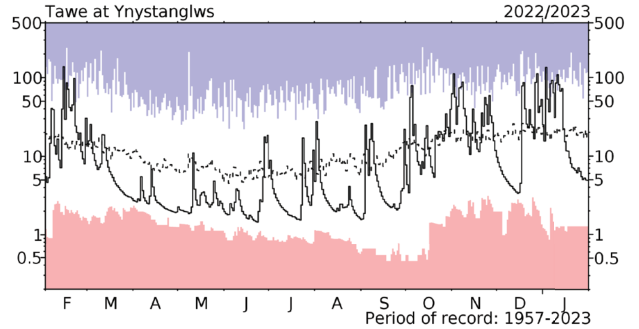
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to February 2022 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

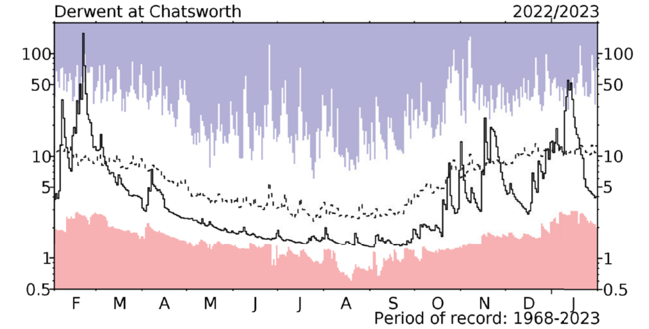

Leven at Newby Bridge
2022/2023
Period of record: 1939-2023

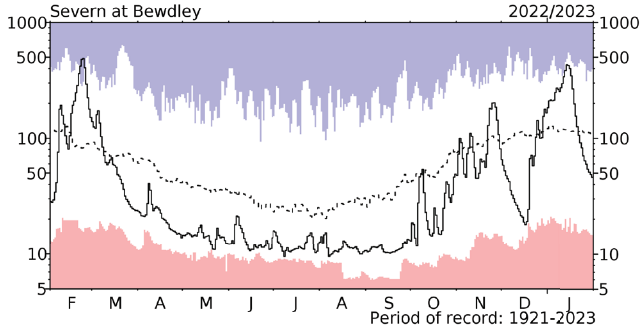

Coquet at Morwick
2022/2023
Period of record: 1963-2023

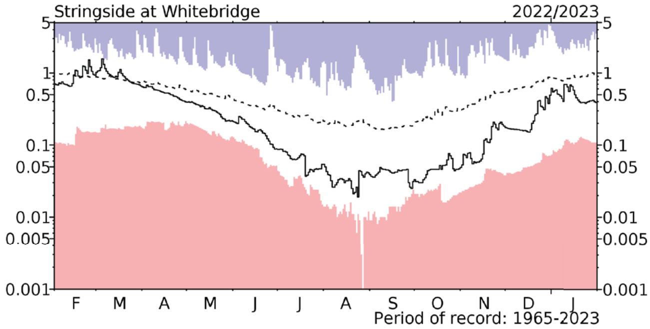

Tywi at Capel Dewi
2022/2023
Period of record: 1958-2023

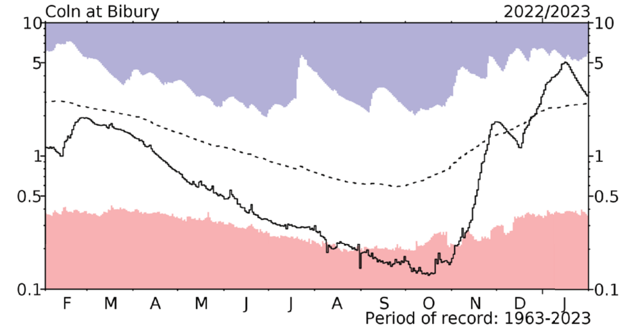

Aire at Beal
2022/2023
Period of record: 1958-2023

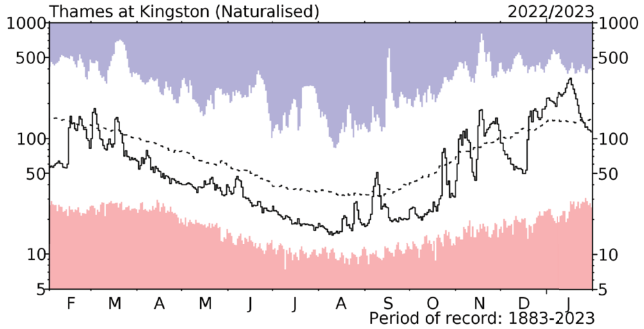

Tawe at Ynystanglws
2022/2023
Period of record: 1957-2023

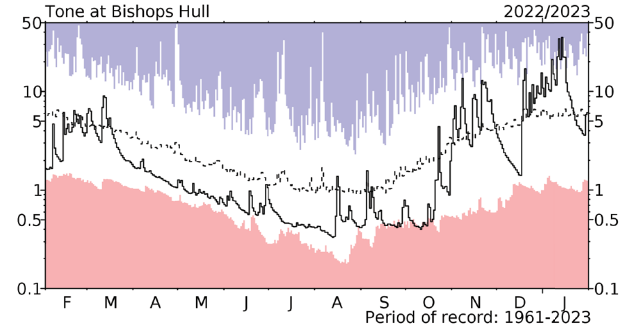

Derwent at Chatsworth
2022/2023
Period of record: 1968-2023

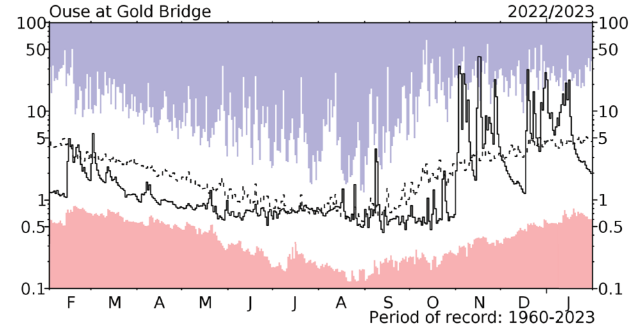

Severn at Bewdley
2022/2023
Period of record: 1921-2023


Stringside at Whitebridge
2022/2023
Period of record: 1965-2023

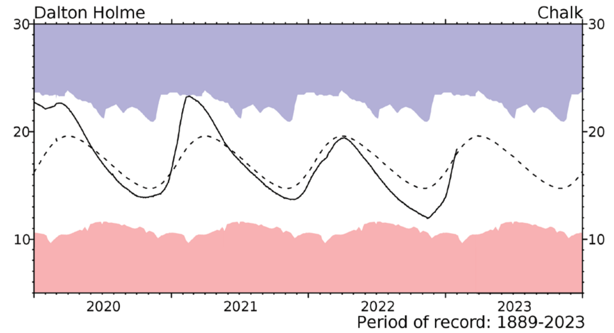

Coln at Bibury
2022/2023
Period of record: 1963-2023

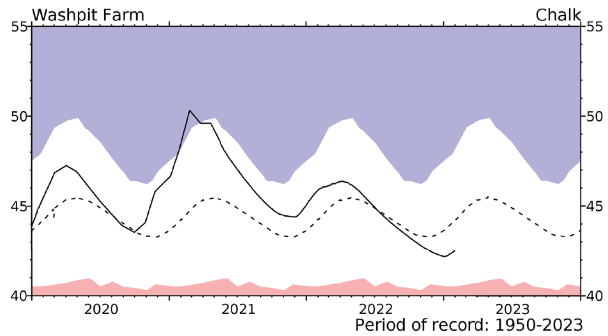

Thames at Kingston (Naturalised)
2022/2023
Period of record: 1883-2023

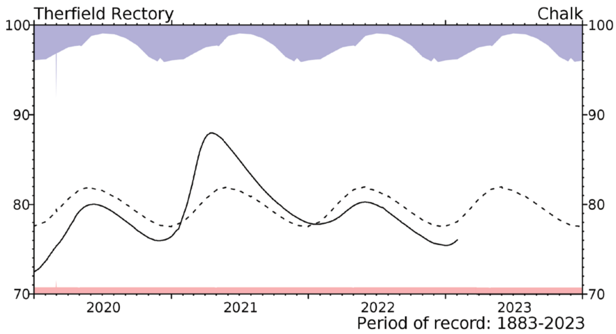

Tone at Bishops Hull
2022/2023
Period of record: 1961-2023

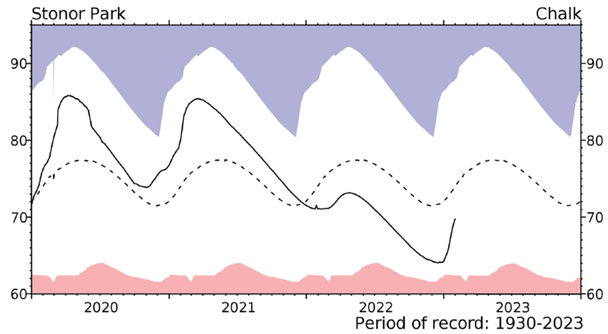

Ouse at Gold Bridge
2022/2023
Period of record: 1960-2023

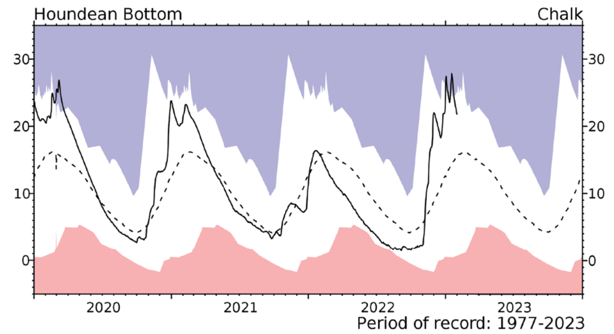
Groundwater . . . Groundwater

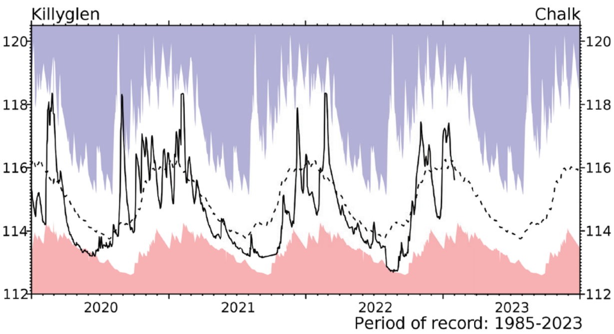


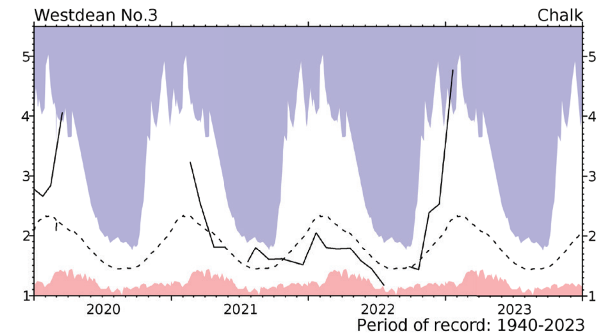


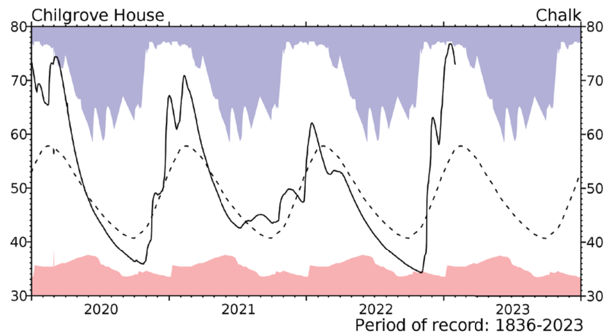


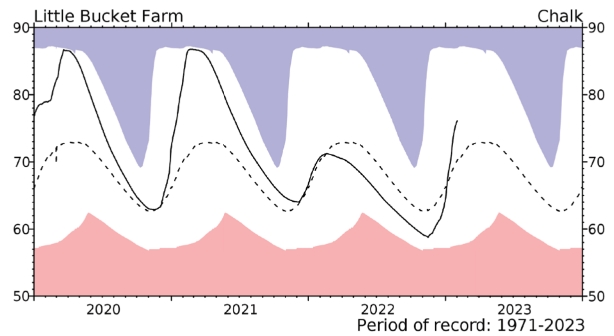


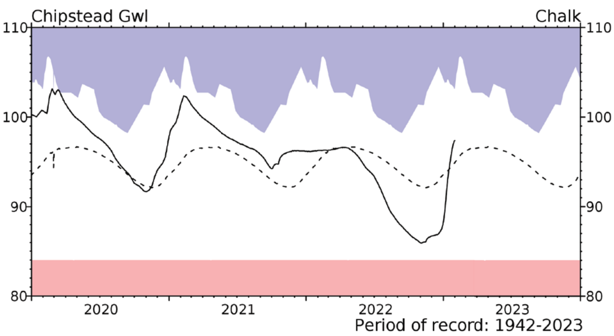






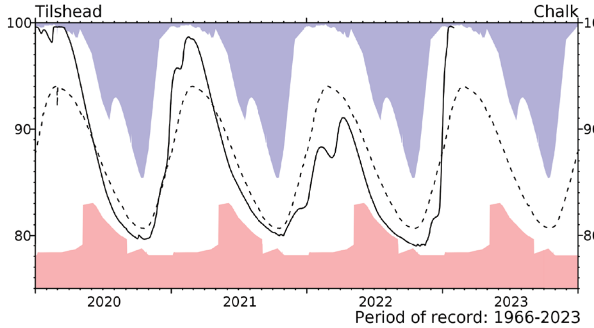


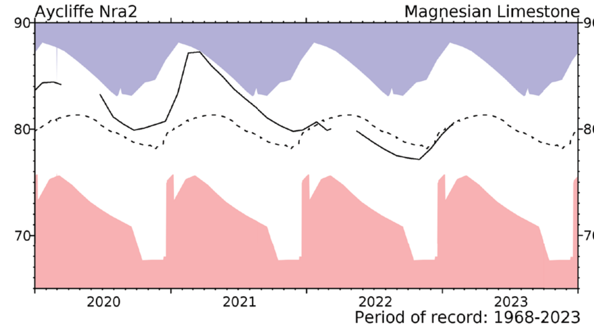


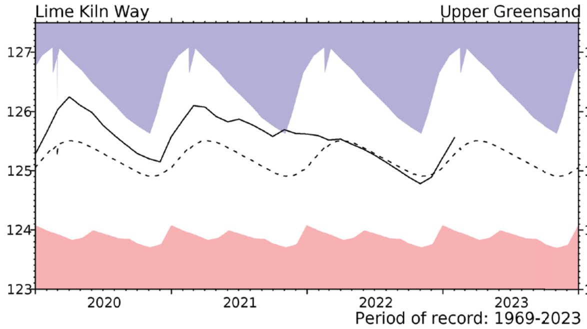


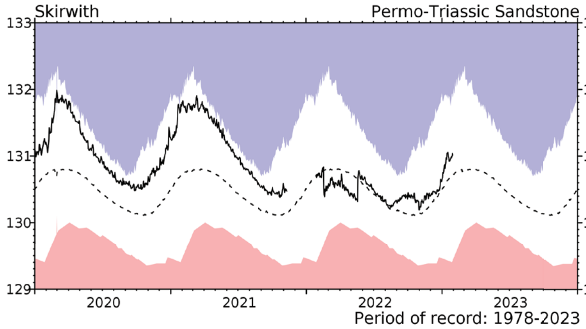
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is 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 2019. 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.

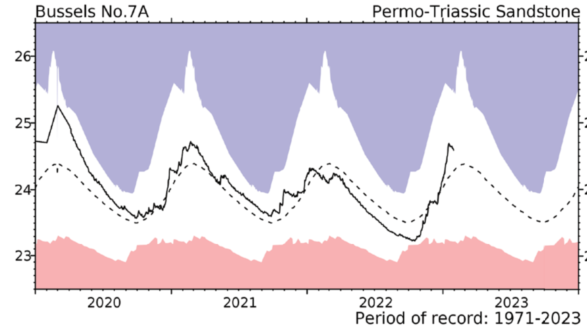
Groundwater ... Groundwater

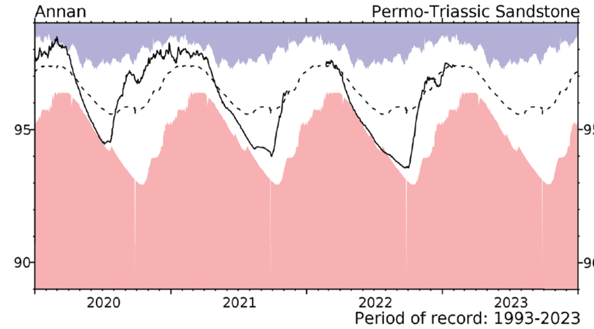


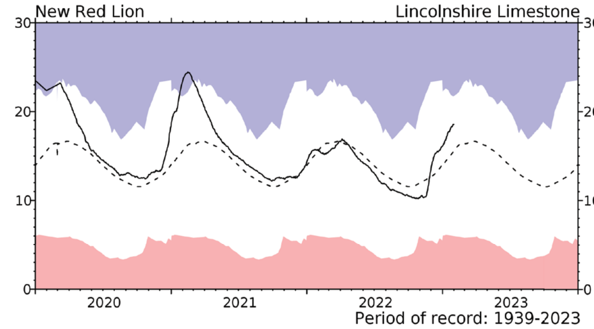


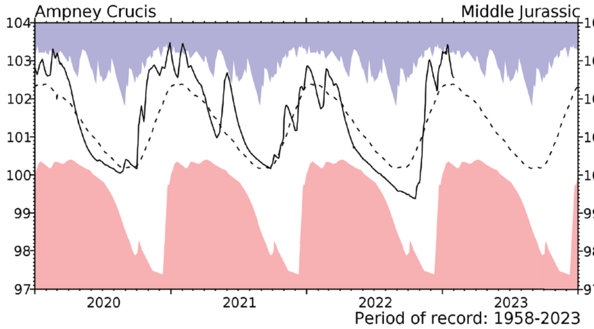


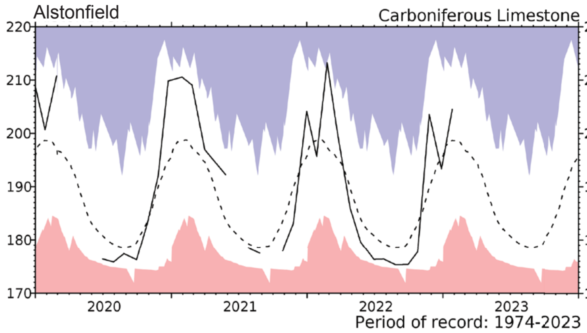


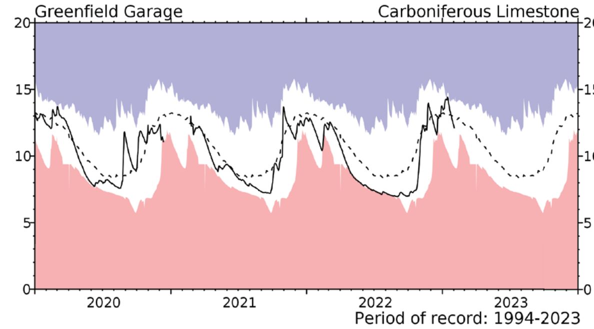


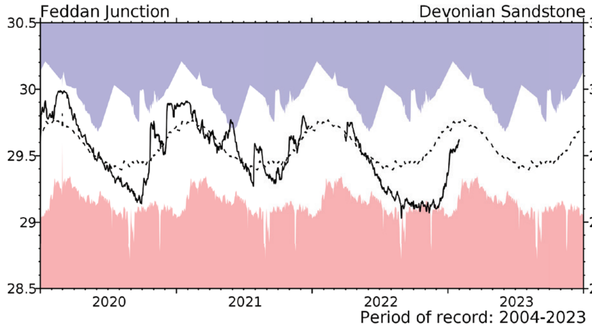


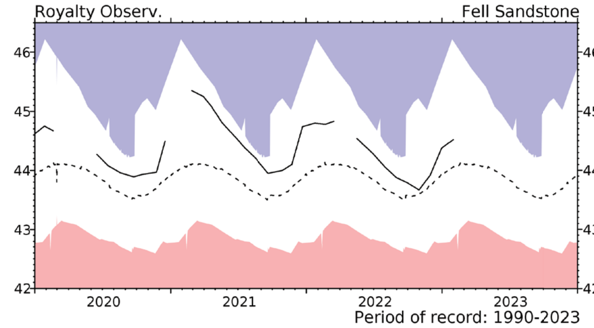












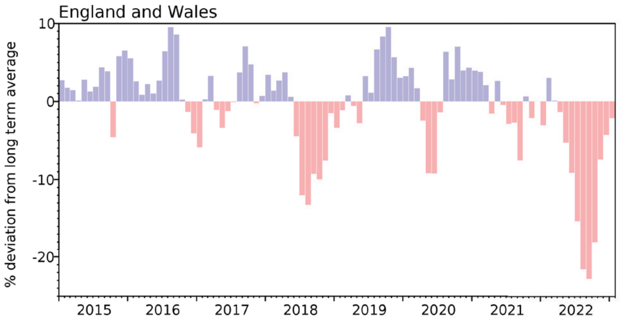
Groundwater . . . Groundwater

Groundwater levels - January 2023

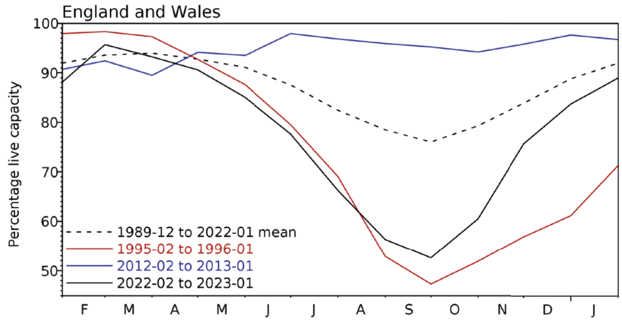
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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



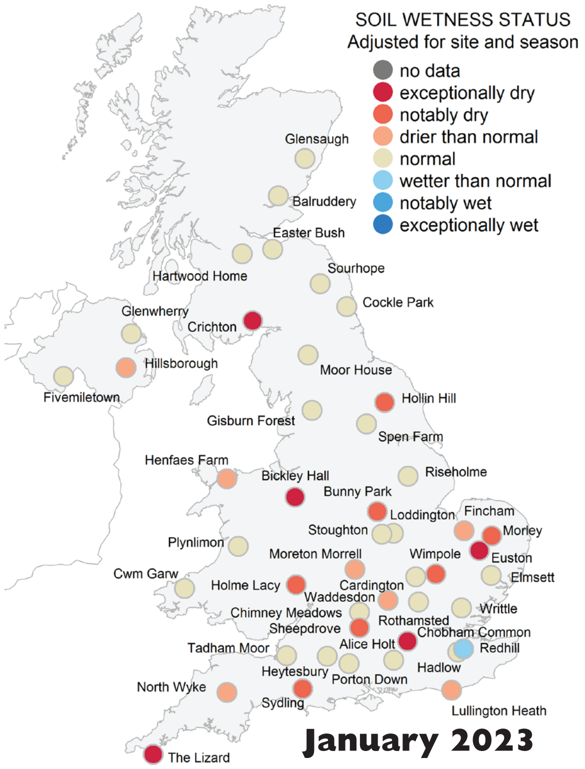
Percentage live capacity of selected reservoirs at end of month

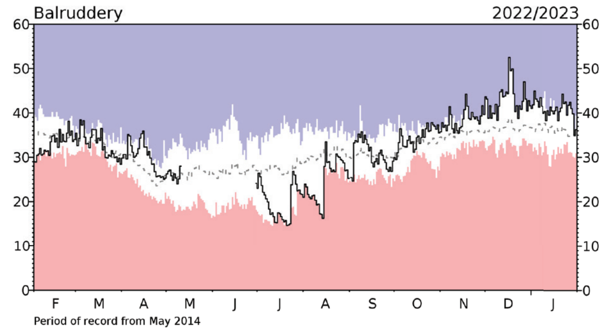
Area	Reservoir		Capacity (Ml)	2022 Nov	2022 Dec	2023 Jan	Jan Anom.	Min Jan	Year* of min	2022 Jan	Diff 23-22
North West	N Command Zone	•	124929	85	82	95	3	63	1996	80	15
	Vyrnwy		55146	83	88	100	7	45	1996	88	12
Northumbrian	Teesdale	•	87936	81	89	92	-1	51	1996	86	6
	Kielder		(199175)	91	92	90	-3	82	2019	84	7
Severn-Trent	Clywedog		49936	74	86	87	-2	62	1996	90	-3
	Derwent Valley	•	46692	68	85	93	-2	15	1996	89	4
Yorkshire	Washburn	•	23373	82	94	97	7	34	1996	81	16
	Bradford Supply	•	40942	68	75	87	-6	33	1996	89	-2
Anglian	Grafham		(55490)	64	67	75	-11	67	1998	94	-19
	Rutland		(116580)	77	87	96	10	68	1997	83	14
Thames	London	•	202828	76	82	87	-5	70	1997	94	-7
	Farmoor	•	13822	84	97	96	5	72	2001	94	2
Southern	Bewl		31000	64	78	96	14	37	2006	79	17
	Ardingly		4685	82	100	100	8	41	2012	100	0
Wessex	Clatworthy		5662	71	100	100	4	62	1989	100	0
	Bristol+	•									
South West	Colliford		28540	25	35	47	-37	47	2023	75	-28
	Roadford		34500	46	51	61	-22	30	1996	98	-36
	Wimbleball		21320	45	69	100	9	58	2017	94	7
	Stithians		4967	33	61	91	2	38	1992	81	10
Welsh	Celyn & Brenig	•	131155	65	76	78	-17	61	1996	87	-9
	Brianne		62140	98	100	92	-6	84	1997	94	-2
	Big Five	•	69762	73	88	94	1	67	1997	93	1
	Elan Valley	•	99106	71	95	96	-1	73	1996	96	0
Scotland (E)	Edinburgh/Mid-Lothian	•	97223	93	99	98	4	72	1999	87	11
	East Lothian	•	9317	100	100	100	2	68	1990	100	0
Scotland (W)	Loch Katrine	•	110326	98	100	96	2	85	2000	94	2
	Daer++		22494	90	94	90	-8	90	2023	91	-1
	Loch Thom		10721	81	97	100	3	90	2020	100	0
Northern Ireland	Total+++	•	56800	94	95	96	4	74	2017	88	9
	Silent Valley	•	20634	100	100	99	10	46	2002	87	12

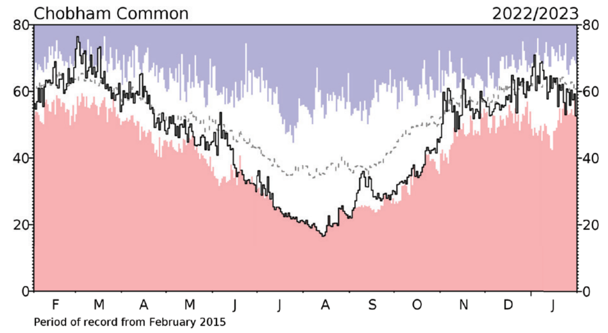
( ) figures in parentheses relate to gross storage
• denotes reservoir groups
*last occurrence
+ no data are available for Bristol
++ drawdown for maintenance
+++ excludes Lough Neagh

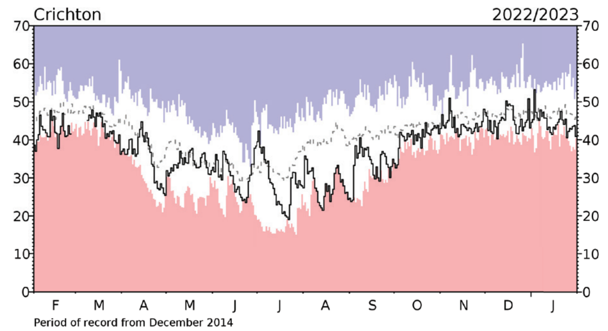
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed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

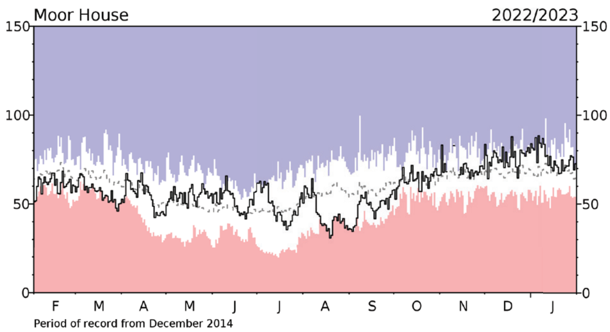
Soil Moisture . . . Soil Moisture

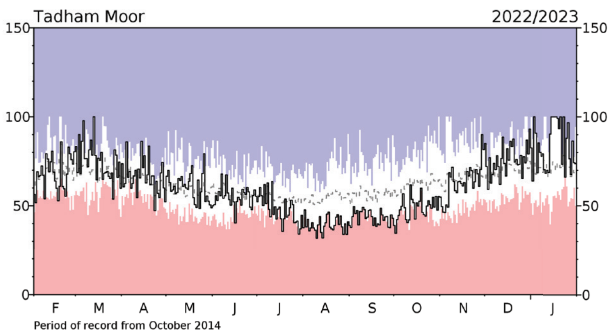












Most COSMOS-UK sites exhibited soil moisture within their normal range for January, though with a declining trend towards the end of the month after peaking in December to early January. Soil moisture status between sites varied considerably, with some sites such as Balruddery and Tadham Moor continuing to be wet for most of the month, whereas other sites such as Crichton and Chobham Common fell to drier levels.

Overall, most sites showed normal to wet soil moisture conditions, with a declining trend at the end of the month from their high moisture levels at the start of the year. This follows the decline in precipitation seen over the last 1-2 weeks of January.

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.

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