Hydrological Summary

for the United Kingdom

August 2022

General

August was another hot and remarkably dry month, continuing the pattern that has dominated in recent months. June-August 2022 joined an exclusive cluster of exceptional hot and dry summers (1976, 1995, 1921) in series from 1884. The UK received around half the average August rainfall, capping an exceptionally dry summer – the fifth driest for England & Wales in a series from 1836. Soils in August were notably or exceptionally dry and much of the English countryside turned into a parched, arid landscape with increased susceptibility to wildfires (e.g. in Northamptonshire and Nottinghamshire). By late August, daily river flows were tracking amongst the lowest ever recorded for some catchments in southern and eastern England, rivalling and sometimes eclipsing those of droughts in 2018, 1995 and 1976. As a result, August river flows were below normal across large swathes of Northern Ireland and Scotland and notably low in many catchments in England and Wales. Groundwater levels continued to fall during August and remained mostly below normal to exceptionally low. Stocks in many reservoirs in southern Britain were exceptionally low, around 40% below average at Colliford (Cornwall) and Ardingly (West Sussex); just two examples of those which established new record minima in series from 1988. In the face of unprecedented water demand through a hot summer including two heatwaves, late August stocks in some reservoirs were around half of those recorded in late June. Temporary Use Bans were implemented by many water companies in England and declarations of drought were enacted for much of England and Wales. Heavy rainfall in early September has been appreciable in places but sustained wet weather will be necessary over the next few months to reverse deficits that have been entrenched throughout 2022. The timing and amount of rainfall in the autumn will be influential in determining the extent of drought recovery in winter.

Rainfall

High pressure was the dominant influence over the UK in August; anticyclonic conditions built over the first fortnight culminating in a heatwave notable for its duration of high (rather than record-breaking) temperatures. Much of south-east England recorded no rainfall at all over the first fortnight. A showery and often thundery interlude followed mid-month. On the 16th, 146mm rainfall was recorded at Holbeach (Lincolnshire) and 93mm in just three hours at Worksop (Nottinghamshire) – the latter almost twice the monthly average – resulting in flooding of roads and properties in the East Midlands. On the 17th, roads and tube stations were inundated in London, and on the 24th property flooding occurred in Bury St Edmunds (76mm at Brooms Barn, Suffolk). Thereafter, drier weather returned once again and continued to month-end. With the exception of very localised parts of East Anglia and eastern Scotland, rainfall totals for August were exceptionally low. Large parts of Scotland recorded less than 70% of average rainfall, with most of the rest of the UK less than half the average. Less than a third of average rainfall was received in parts of southern and eastern England. For summer (June-August) overall, most of England and Wales received less than 70% of average rainfall, with less than half the average recorded across most of southern, central and eastern England. Rainfall deficits now extend throughout 2022 (fourth driest January-August for Anglian region since 1836, only behind notable drought years 1976, 1921 and 1929) and back into autumn 2021. In series from 1836, November-August rainfall totals were the second, third, third and fourth driest for Wessex, Southern, Thames and Anglian regions, respectively.

River flows

River flows generally remained low throughout August with few notable high flows. For some catchments in south Wales, the English Lowlands and Northern Ireland, flows were amongst the lowest on record; for each of the Lagan, Yscir, Little Ouse and Gannel, new daily flow minima were established for at least 20 days in August. The contraction of streamflow networks continued and the measuring authorities responded to environmental incidents requiring oxygenation of water or fish rescues (e.g. on the Mole and Lathkill). August outflows from the English Lowlands were the fourth lowest in a series from 1961 (trailing 1976, 1990 and 1995), and daily outflows from England have been below average continuously since early April. River flows for August were substantially below average away from north-west Scotland. Elsewhere, most catchments recorded less than half the August average flow (with the Yscir and Annacloy at 11% and 4%, respectively). Flows were exceptionally low in many catchments with new August minima recorded on the Annacloy, Yscir, Waveney and Great Stour in series of at least 42 years. For the summer (June-August), notably to exceptionally low flows occurred across a broad swathe of England and south Wales. Flows were exceptionally low (and less than half of average) in some catchments in southern Scotland, north-east England, Devon and those draining mid-Wales, with new record summer minima established on the Yscir, Waveney and Yorkshire Derwent in series of at least 48 years. Mean river flows for 2022 to date were around two thirds of average and notably low across south-west and northern England and parts of Wales, with record minimum flows for this period recorded on the Annacloy.

Groundwater

Soil Moisture Deficits remained exceptionally high for the time of year across most of England and Wales, and the east coast of Scotland. The summer recession continued throughout August. Groundwater levels in the Chalk remained predominantly below normal to exceptionally low, although a few sites remained in the normal range (Washpit Farm and Therfield Rectory) or moved towards the normal range (e.g. Rockley). Levels at Ashton Farm became exceptionally low, with the second lowest August level in a 49 year record, and remained so at Compton House and Chilgrove House. In the Jurassic limestones and Magnesian Limestone levels were mainly below normal, with Ampney Crucis remaining notably low; at Brick House Farm levels continued to be above normal. Receding levels in the Carboniferous Limestone led to a third successive month of record lows (in a 27 year record) at Pant y Lladron, and levels at Alstonfield fell to below normal. Levels fell but were mostly in the normal range in the Permo-Triassic sandstones, except at Bussels No.7A where they were below normal and at Annan where they became notably low. Levels also fell in the other sandstones and were in the normal range at Lime Kiln Way (Upper Greensand), moved into the normal range at Royalty Observatory (Fell Sandstone), and were below normal and notably low at Feddan Junction and Easter Laskrith, respectively (both Devonian sandstones).

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

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1991-2020 average.

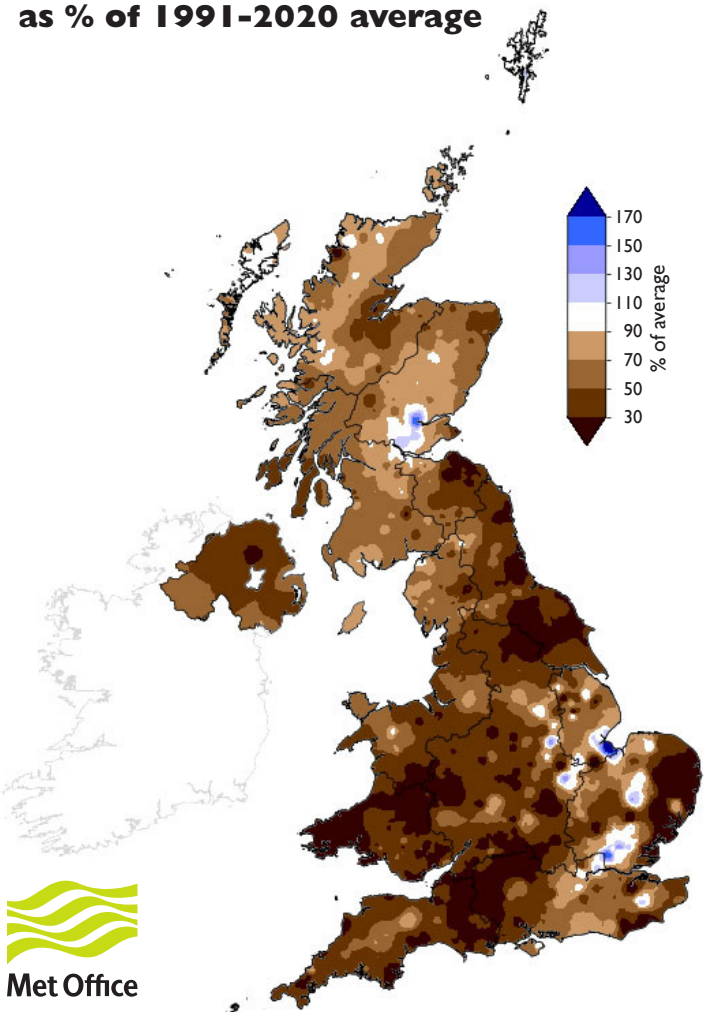
Region	Rainfall	Aug 2022	Jun22 – Aug22	RP	Apr22 – Aug22	RP	Jan22 – Aug22	RP	Sep21 – Aug22	RP
United Kingdom	mm	**51**	156		281		538		981	
	%	**54**	62	15-25	71	15-25	77	10-20	85	5-10
England	mm	**35**	103		178		349		667	
	%	**47**	50	20-35	56	50-80	66	30-50	77	10-20
Scotland	mm	**81**	239		443		831		1447	
	%	**68**	76	5-10	89	2-5	88	2-5	92	2-5
Wales	mm	**40**	164		274		592		1188	
	%	**36**	54	15-25	57	50-80	69	25-40	81	8-12
Northern Ireland	mm	**45**	175		335		583		999	
	%	**45**	65	10-20	80	5-10	82	5-10	86	5-10
England & Wales	mm	**36**	111		191		382		738	
	%	**45**	51	20-35	56	50-80	67	30-50	78	10-20
North West	mm	**61**	203		324		617		1157	
	%	**55**	69	5-10	73	10-15	81	5-10	90	2-5
Northumbria	mm	**34**	119		212		380		707	
	%	**41**	52	20-30	61	15-25	68	25-40	78	10-15
Severn-Trent	mm	**29**	96		168		341		629	
	%	**42**	48	20-30	53	50-80	68	20-30	78	10-15
Yorkshire	mm	**29**	106		187		395		689	
	%	**37**	49	20-30	57	30-50	73	10-20	79	8-12
Anglian	mm	**34**	77		127		237		460	
	%	**55**	45	25-40	49	40-60	60	50-80	73	15-25
Thames	mm	**33**	75		138		265		518	
	%	**53**	45	15-25	51	30-50	60	30-50	71	15-25
Southern	mm	**34**	70		139		262		554	
	%	**54**	42	30-50	51	30-50	55	40-60	68	20-30
Wessex	mm	**22**	81		157		318		629	
	%	**30**	42	20-35	50	50-80	59	30-50	69	20-35
South West	mm	**39**	122		212		453		951	
	%	**41**	48	15-25	53	50-80	61	30-50	76	10-20
Welsh	mm	**40**	160		266		567		1138	
	%	**37**	55	15-25	57	50-80	69	25-40	81	8-12
Highland	mm	**92**	281		564		1045		1759	
	%	**70**	83	2-5	102	2-5	95	2-5	95	2-5
North East	mm	**57**	157		310		517		928	
	%	**63**	62	8-12	79	5-10	80	5-10	87	2-5
Tay	mm	**80**	217		372		705		1207	
	%	**75**	74	2-5	81	2-5	83	2-5	87	2-5
Forth	mm	**80**	189		309		606		1069	
	%	**79**	67	5-10	73	5-10	79	2-5	86	2-5
Tweed	mm	**43**	128		234		485		931	
	%	**46**	50	20-30	60	20-30	73	10-15	86	2-5
Solway	mm	**81**	244		386		775		1437	
	%	**63**	73	2-5	75	5-10	82	2-5	91	2-5
Clyde	mm	**89**	301		527		1005		1733	
	%	**60**	79	2-5	90	2-5	89	2-5	92	2-5

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

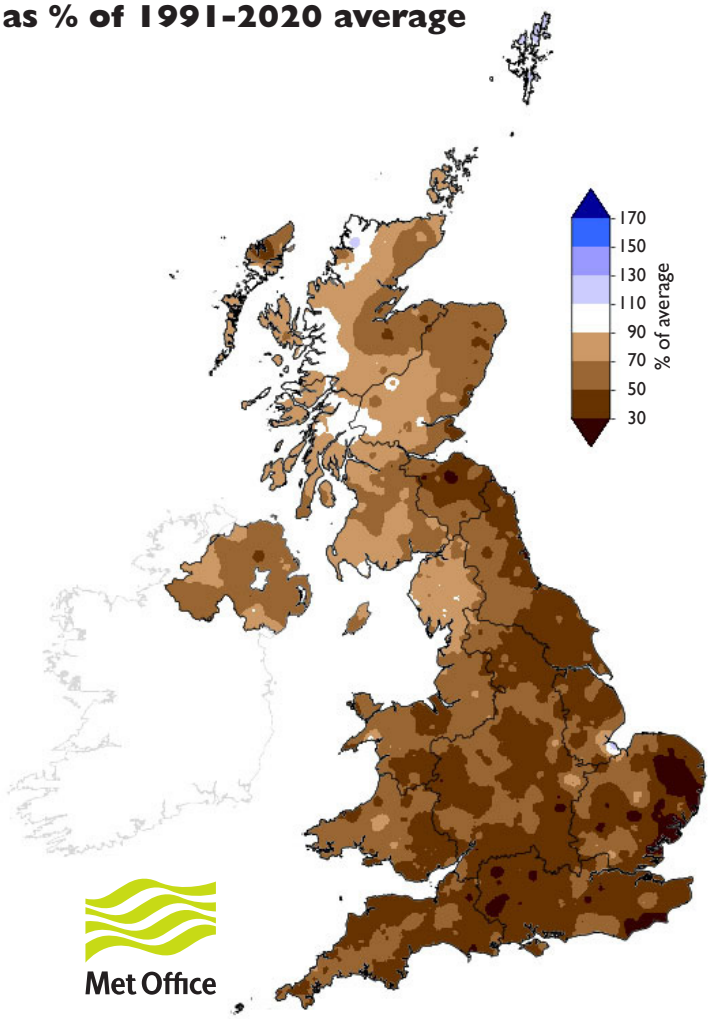
Important note: Figures in the above table may be quoted provided their source is acknowledged. Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability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

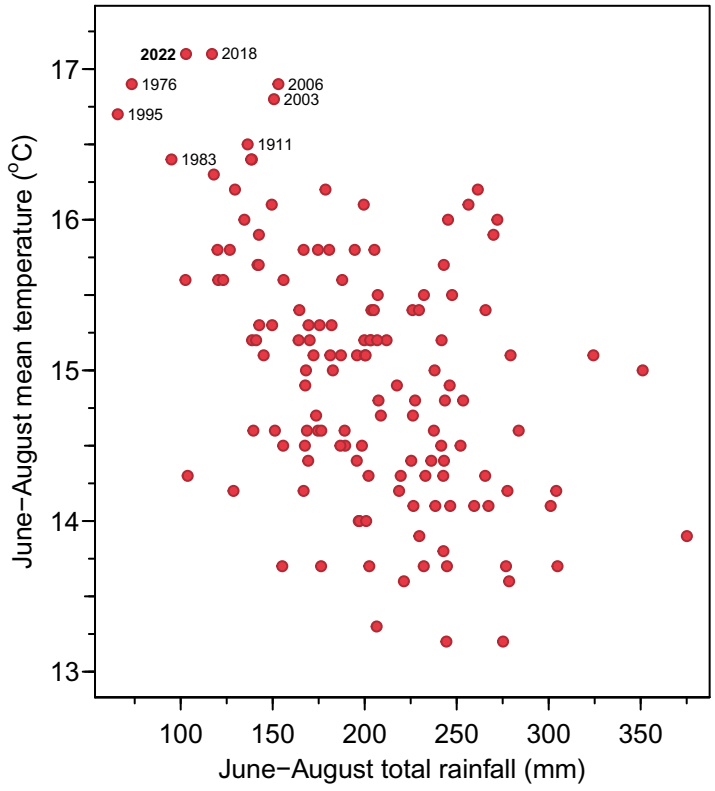
August 2022 rainfall as % of 1991-2020 average



June 2022 - August 2022 rainfall as % of 1991-2020 average



June-August total rainfall (mm) and mean temperature (°C) for England



UK Hydrological Outlook

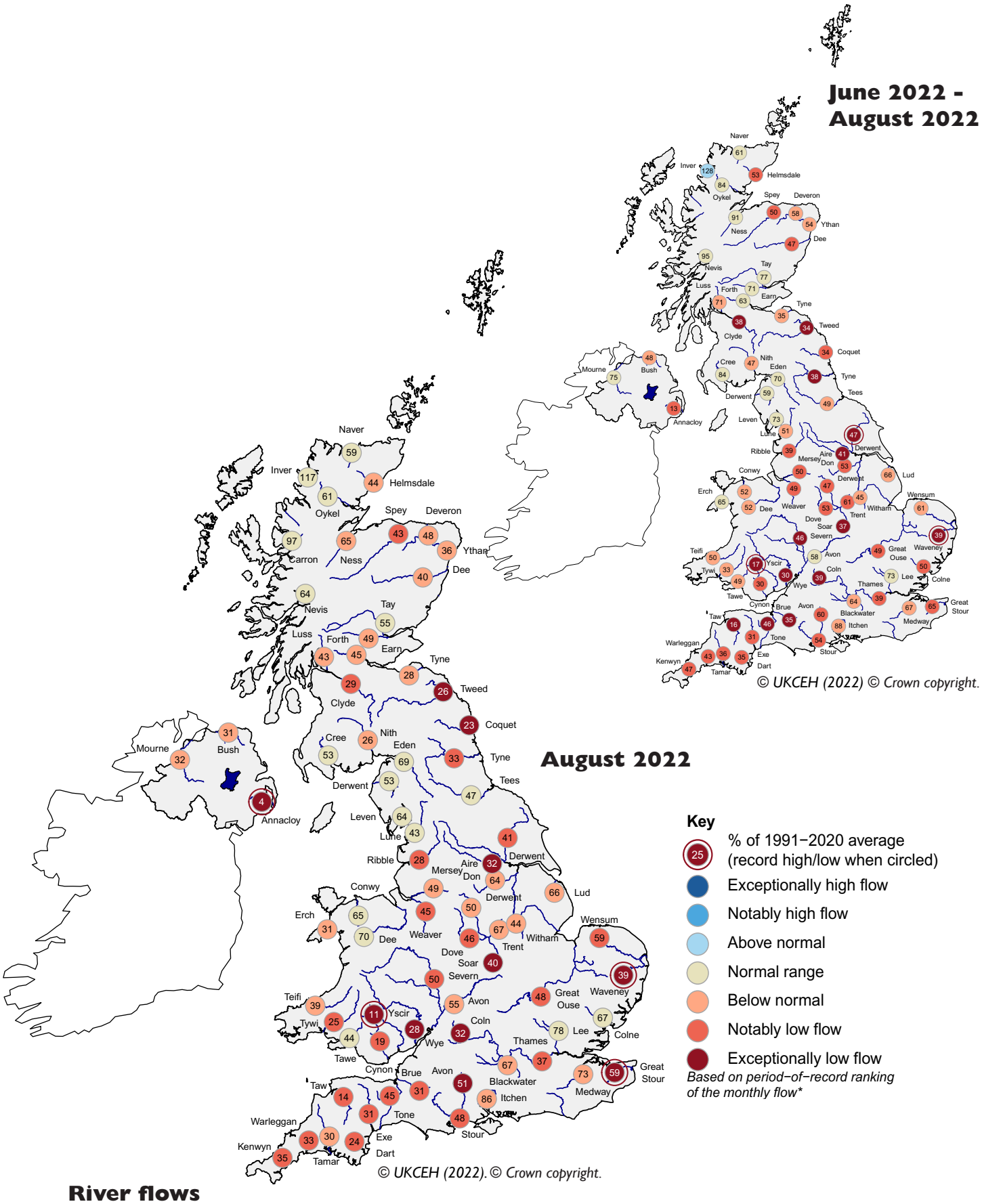
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from September 2022**
Issued: **08.09.2022**
using data to the end of August 2022

The outlook for September favours below normal river flows and groundwater levels across much of the country. For September–November, below normal river flows are likely in southern Britain, and normal to below normal flows in northern Britain. Groundwater levels are likely to be below normal in the far south, and normal to below normal elsewhere.

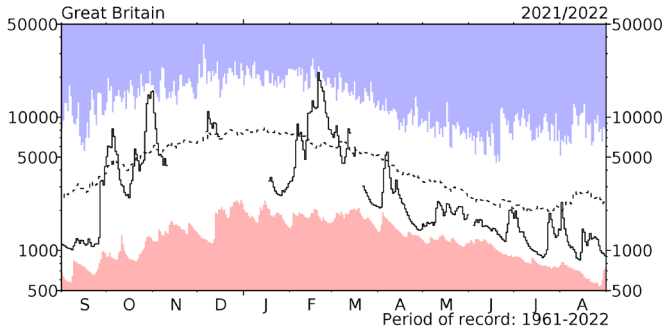
River flow . . . River flow . . .

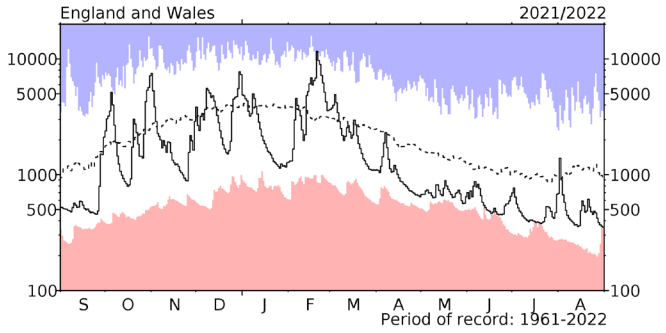


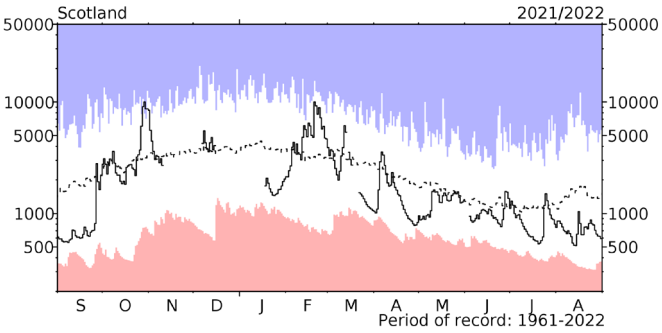
River flows

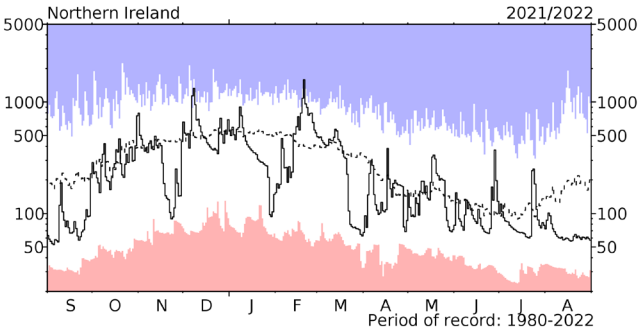
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

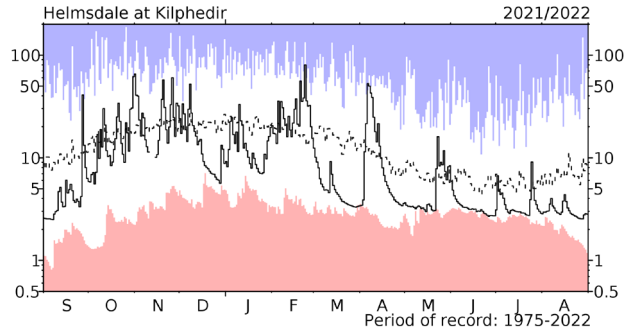
River flow . . . River flow . . .

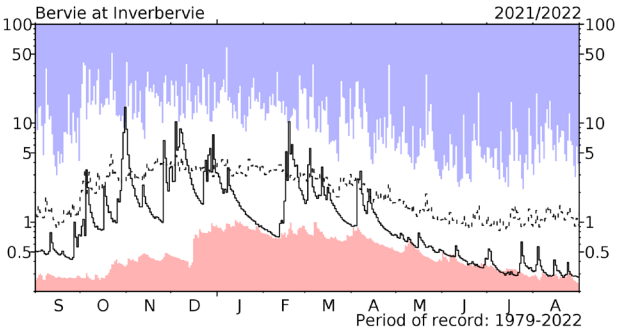


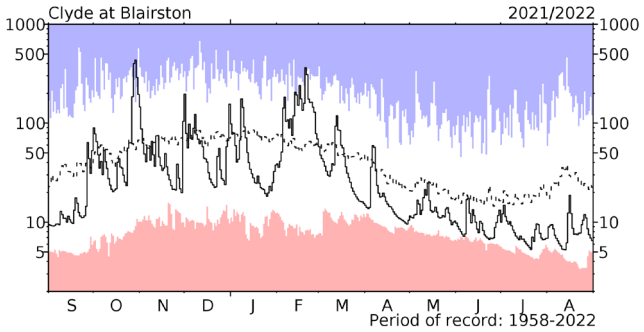


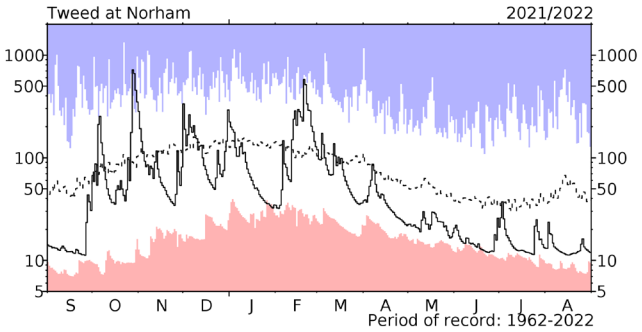


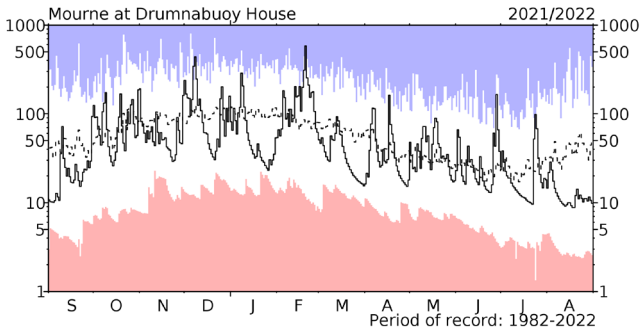


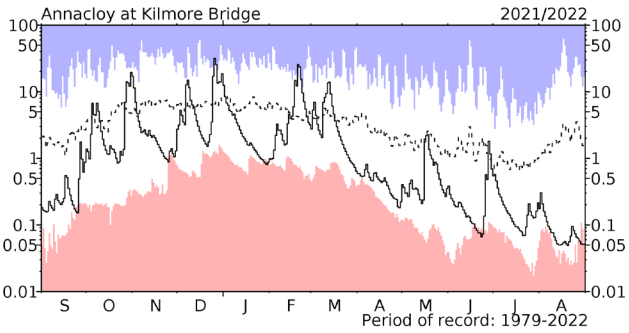








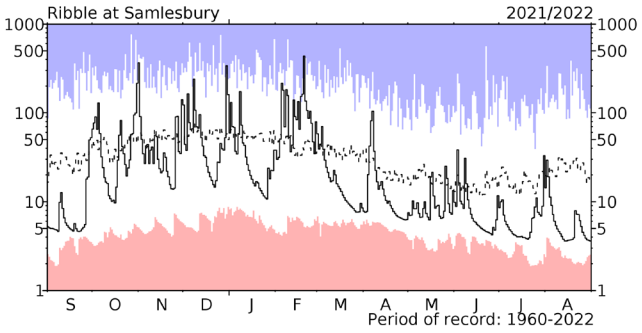


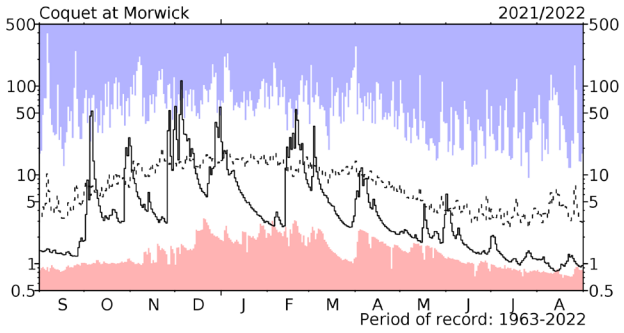


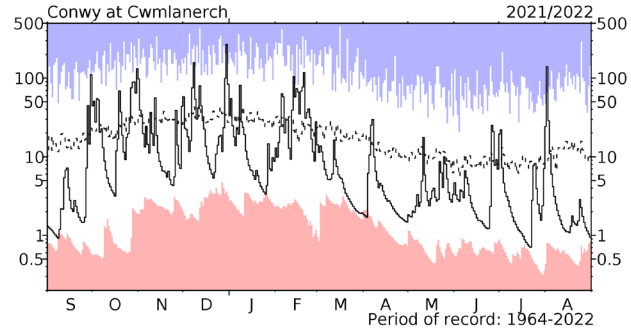
River flow hydrographs

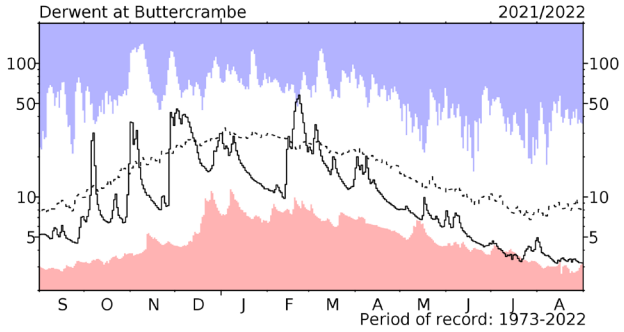
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to September 2021 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

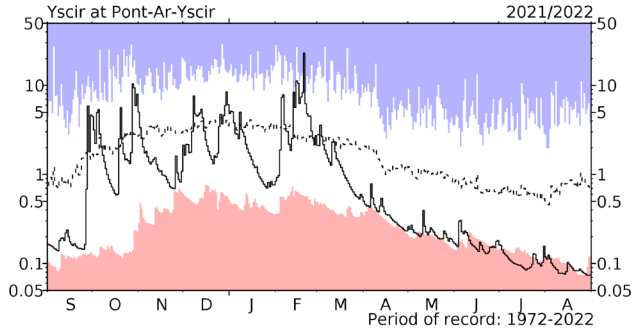
River flow . . . River flow . . .

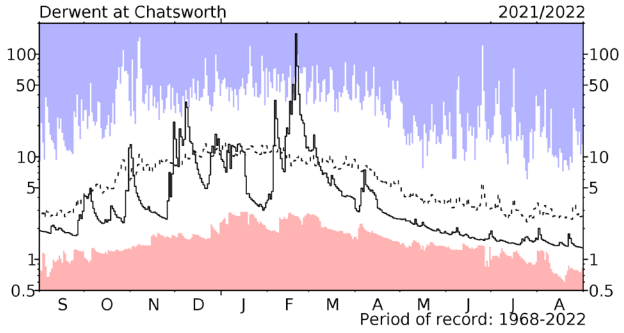


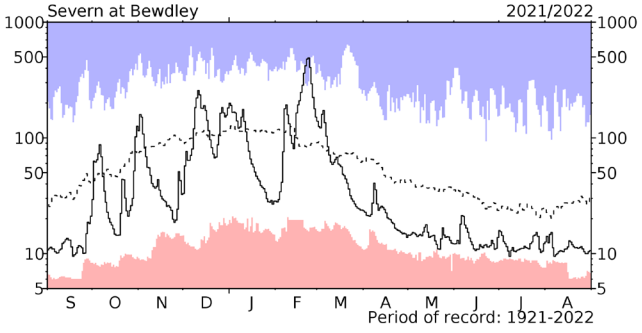


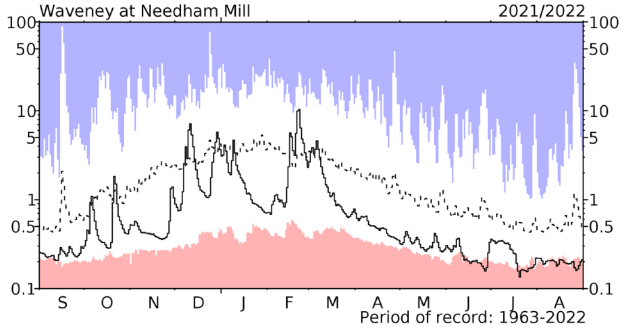


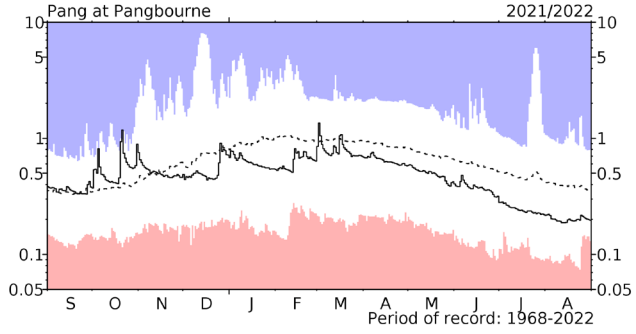


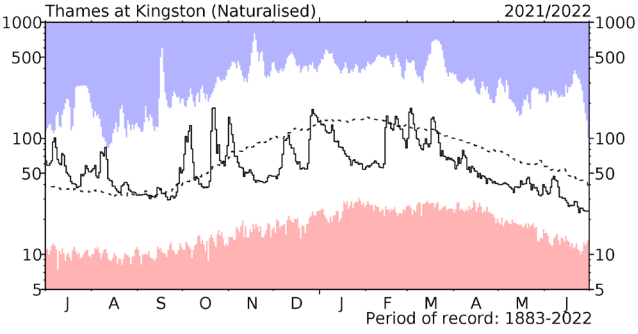


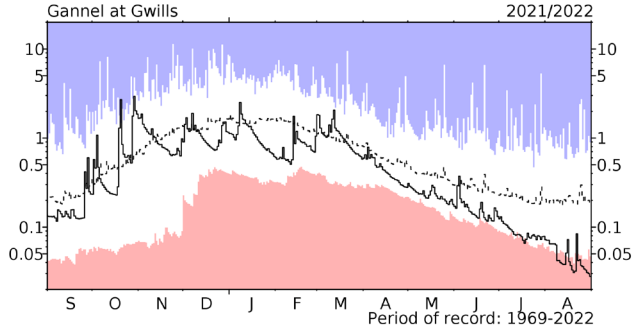


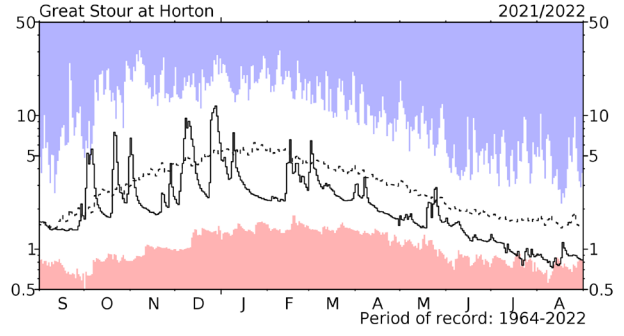




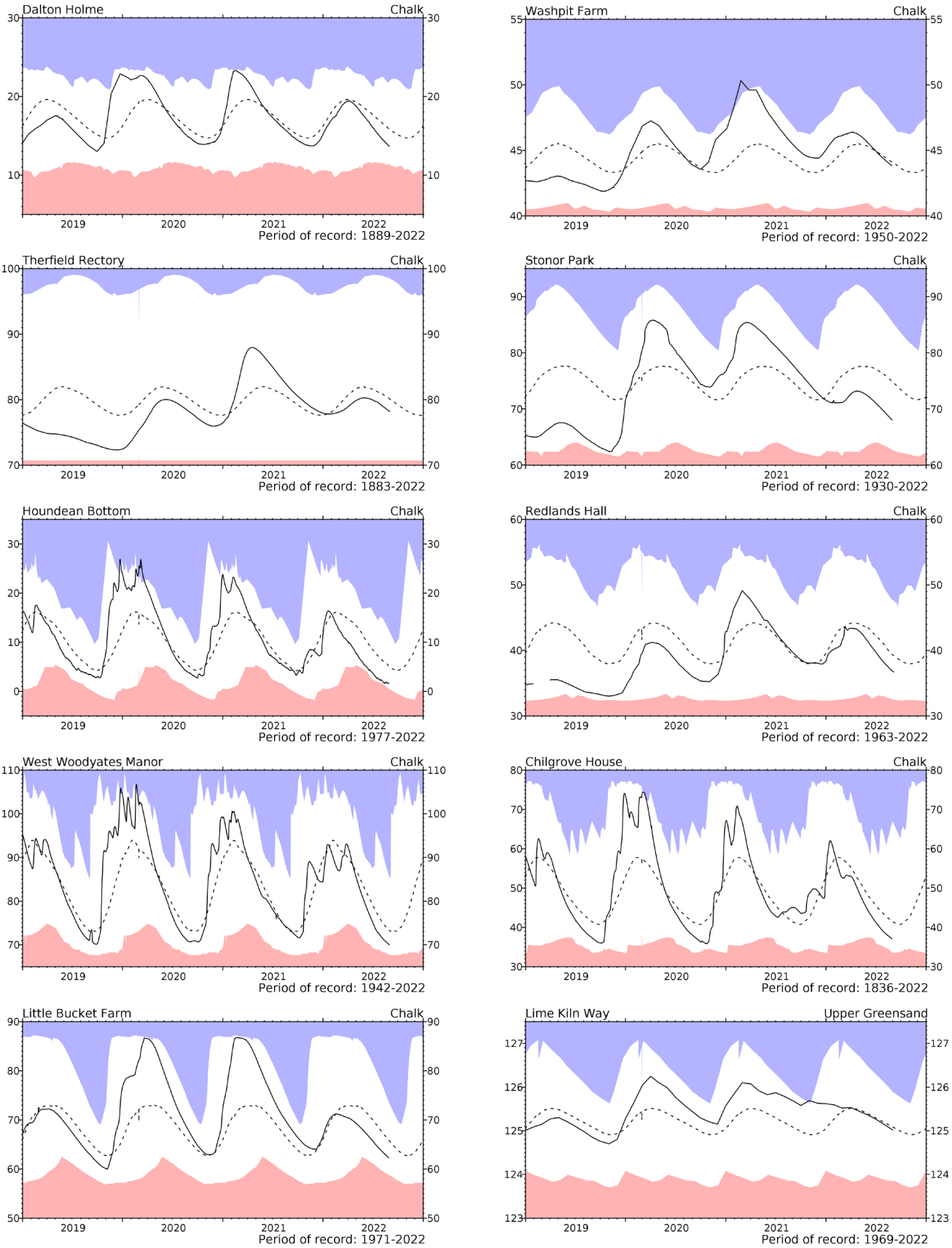






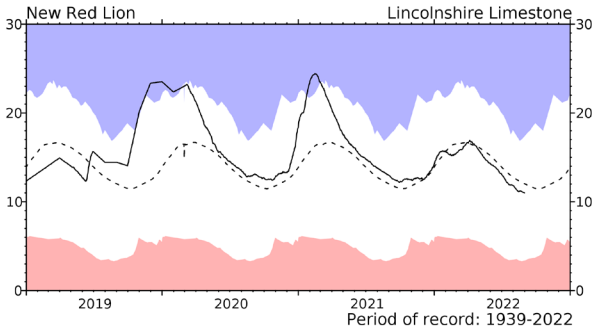


Groundwater…Groundwater

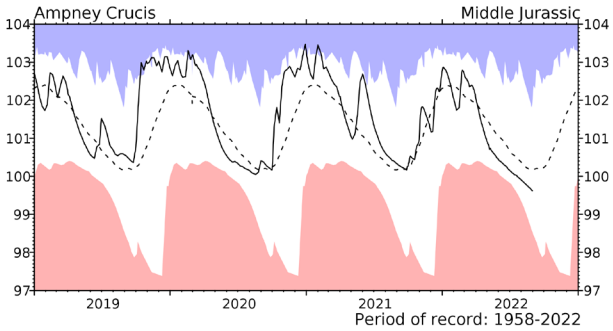


Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is 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 2018. 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.

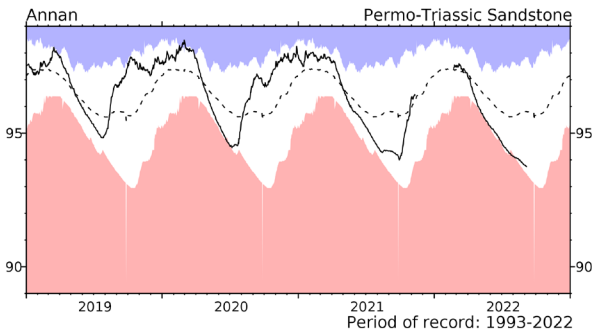
Groundwater… Groundwater



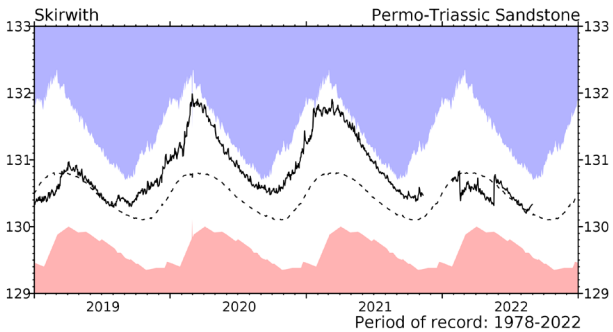
Period of record: 1939-2022



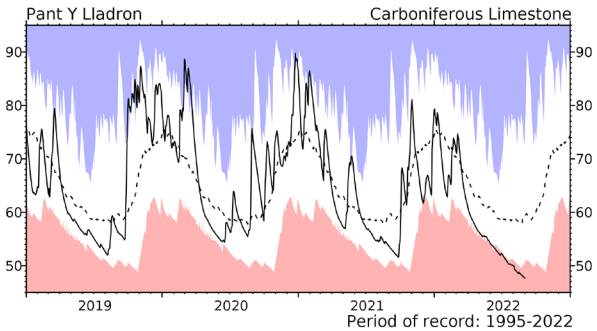
Period of record: 1958-2022



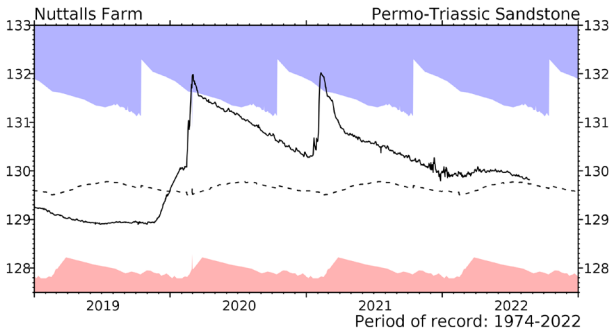
Period of record: 1993-2022



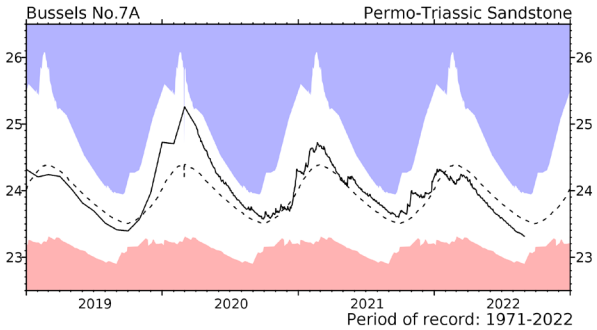
Period of record: 1978-2022



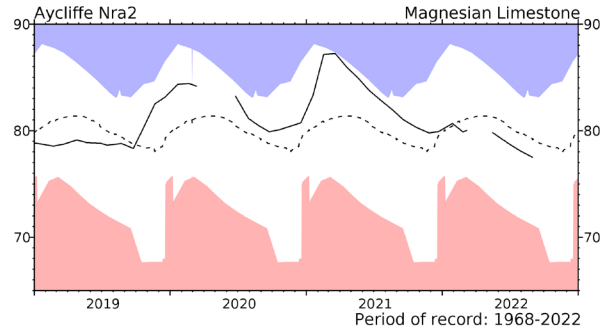
Period of record: 1995-2022



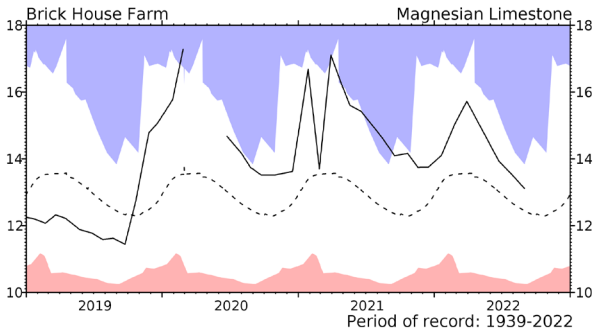
Period of record: 1974-2022



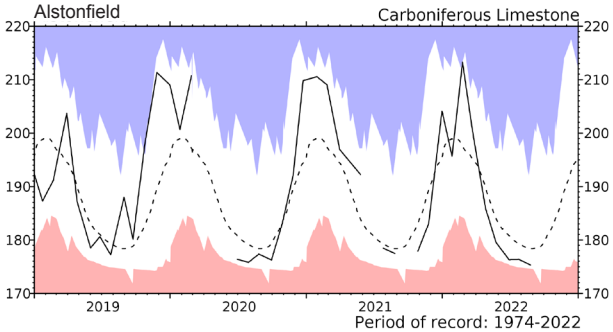
Period of record: 1971-2022



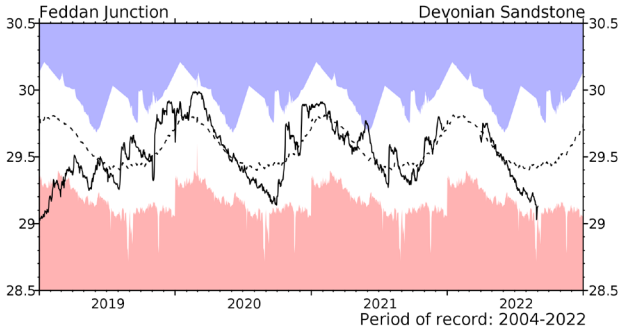
Period of record: 1968-2022



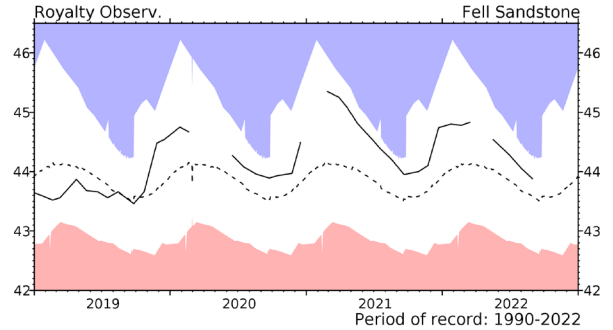
Period of record: 1939-2022



Period of record: 1974-2022



Period of record: 2004-2022



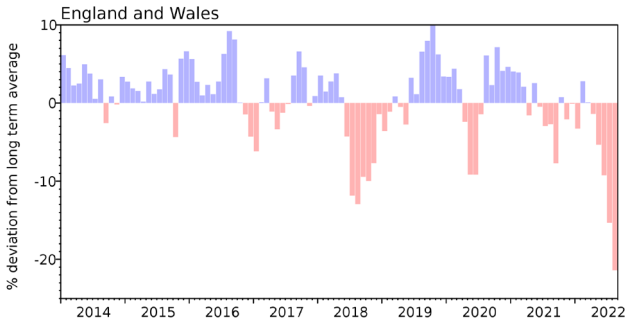
Period of record: 1990-2022

Groundwater levels - August 2022

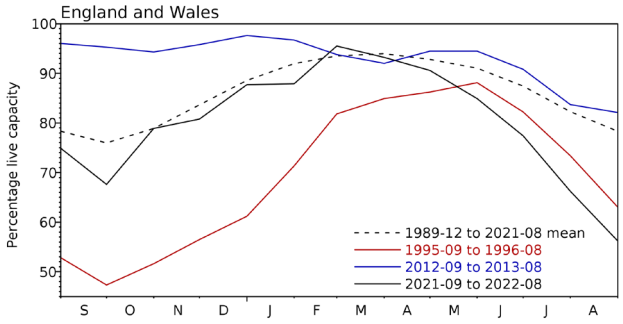
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Jun	2022 Jul	2022 Aug	Aug Anom.	Min Aug	Year* of min	2022 Aug	Diff 22-21
North West	N Command Zone	•	124929	63	53	45	-15	15	1984	46	-2
	Vyrnwy		55146	73	57	46	-27	36	1995	75	-29
Northumbrian	Teesdale	•	87936	83	73	66	-6	38	1995	53	12
	Kielder		(199175)	88	82	79	-8	66	1989	81	-2
Severn-Trent	Clywedog		49936	85	66	52	-27	27	1976	81	-30
	Derwent Valley	•	46692	59	45	36	-31	34	1995	58	-22
Yorkshire	Washburn	•	23373	68	50	37	-34	34	1995	79	-42
	Bradford Supply	•	40942	61	47	35	-33	21	1995	65	-30
Anglian	Grafham		(55490)	91	78	66	-21	59	1997	96	-30
	Rutland		(116580)	90	83	76	-7	66	1995	91	-15
Thames	London	•	202828	91	75	62	-20	62	2022	89	-27
	Farmoor	•	13822	92	89	72	-22	64	1995	95	-23
Southern	Bewl		31000	72	64	57	-13	38	1990	78	-21
	Ardingly		4685	75	57	31	-41	31	2022	89	-58
Wessex	Clatworthy		5662	71	60	45	-19	31	1995	67	-22
	Bristol	•	(38666)	73	62	53	-16	43	1990	65	-13
South West	Colliford		28540	56	43	31	-40	31	2022	69	-38
	Roadford		34500	74	60	47	-25	40	1995	84	-37
	Wimbleball		21320	64	49	37	-33	37	2022	81	-44
	Stithians		4967	61	44	27	-36	27	2022	66	-39
Welsh	Celyn & Brenig	•	131155	75	65	55	-28	49	1989	77	-22
	Brianne		62140	68	64	52	-36	52	2022	77	-25
	Big Five	•	69762	67	54	40	-32	29	1995	62	-22
	Elan Valley	•	99106	65	53	39	-37	37	1976	68	-29
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	84	77	71	-8	45	1998	68	3
	East Lothian	•	9317	90	80	67	-20	63	1989	96	-29
Scotland(W)	Loch Katrine	•	110326	93	88	79	6	50	2021	50	29
	Daer		22494	77	71	62	-16	41	1995	45	17
	Loch Thom		10721	84	82	75	-8	50	2021	50	25
Northern Ireland	Total+	•	56800	79	77	65	-12	40	1995	69	-4
	Silent Valley	•	20634	76	73	60	-13	33	2000	58	2

( ) figures in parentheses relate to gross storage

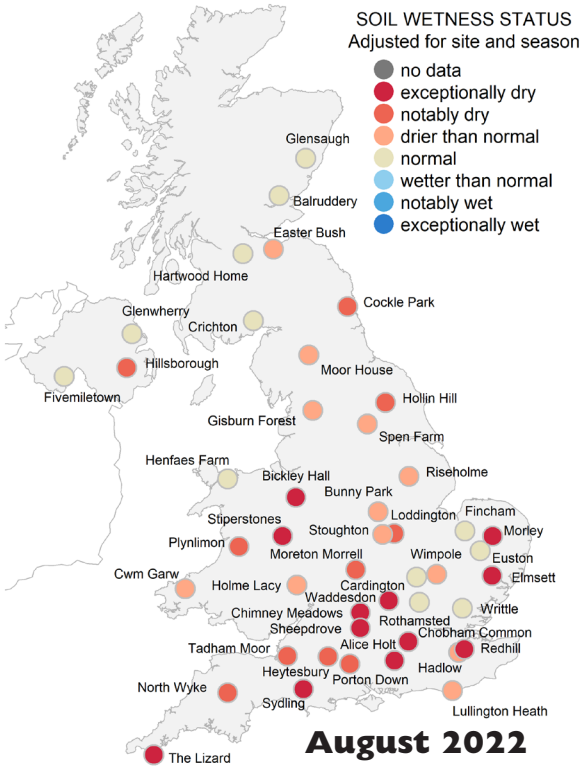
• denotes reservoir groups

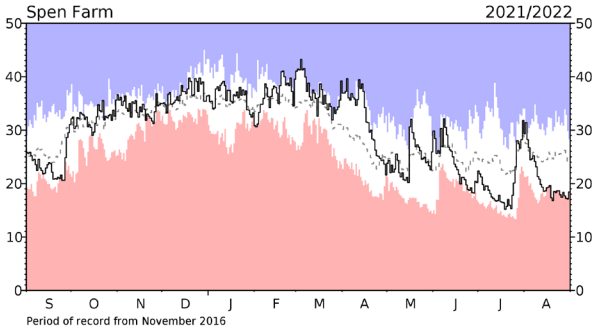
*last occurrence

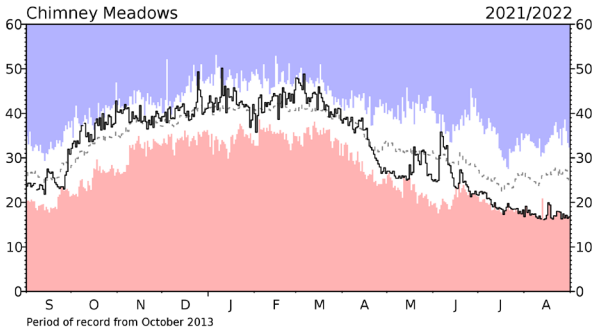
+ excludes Lough Neagh

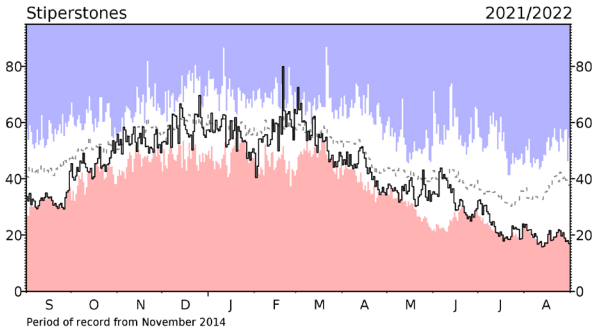
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed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

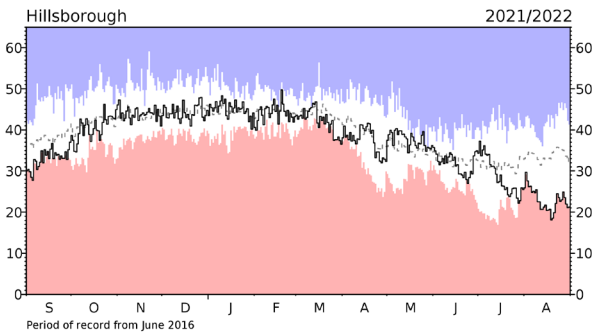
Soil Moisture . . . Soil Moisture

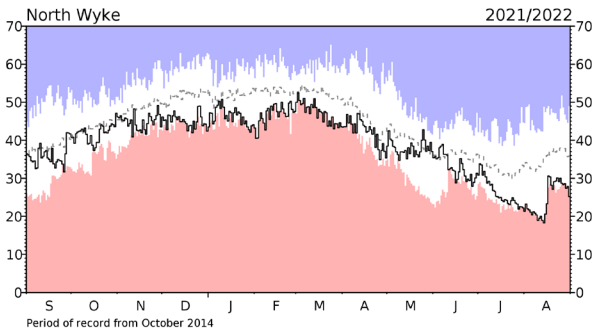












At the end of August many soils across the UK are notably or extremely dry for the time of year.

At the end of July, soils had been generally dry across the UK with a notable difference for southern England where soils had dried to extremely low levels following heatwave conditions. After another month with less than average precipitation and high air temperatures, many soils further north and west also became notably dry for the time of year (e.g. Spen Farm).

The combination of warm weather driving high levels of potential evapotranspiration and prolonged periods of very low rainfall means that some sites remained exceptionally dry (e.g. Chimney Meadows and Stiperstones). Many sites which received rain during the month experienced only a short-lived increase in soil moisture before drying again (e.g. Hillsborough), whilst others ended August with somewhat less dry soils than they started with (e.g. North Wyke).

40 out of 46 currently active COSMOS-UK sites observed the lowest average August soil moisture on project record.

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.

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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