Hydrological Summary

for the United Kingdom

August 2021

General

August did not feel particularly summery for most of the UK; whilst it was dry overall, it was for the most part either unsettled or dull and cloudy. Rainfall in August was below average for the vast majority of the UK (75% of the long-term average), notably so across the Scottish Highlands and parts of central and eastern England. Wetter than average exceptions were limited to parts of Northern Ireland, eastern Scotland and south-east England. Late August soils were wetter than average in southern England at the conclusion of a wet summer here, but soils elsewhere were generally drier than average (as well as at the national scale). River flows in August were generally below average across most of the UK, notably or exceptionally so across parts of Wales and northern and central England. Groundwater levels generally continued their seasonal recession in all aquifers; they remained in the normal range or above, apart from the Chalk and limestone boreholes in Northern Ireland and South Wales, respectively, in which levels were below average. Reservoir stocks in Scotland, Wales and Northern Ireland were exceptionally low. In the last month, stocks at Haweswater and Thirlmere fell by a fifth of their total capacity. Loch Thom and Daer were a third below their late August average stocks, and Loch Katrine and Loch Thom (as well as Scotland overall) recorded their lowest late August stocks in records from 1994 (eclipsing those of the 1995 drought). Following a dry summer, river flows and particularly reservoir stocks in parts of the north and west are notably or exceptionally low; in late August, Scottish Water stepped up water conservation campaigns to manage demand accordingly. With no strong indication of a wet start to autumn in seasonal outlooks, vigilance will be required in managing water resources in these areas.

Rainfall

August was fairly unsettled and moderately wet at the beginning of the month, before more settled conditions emerged from mid-month under increasingly high pressure towards month-end. The disruption caused by unsettled weather in late July continued into early August though impacts were generally localised. On the 2nd, intense rainfall on the Isle of Wight damaged roads and required people to be rescued from cars; although lacking verified rainfall totals, it has been suggested that a month's rainfall fell in two hours, and the impacts suggest a significant event. On the 6th/7th, surface water flooding of major roads, railways and tunnels disrupted transport in and around Glasgow, and property flooding was reported in Belfast. On the 8th, 74mm was recorded in Spadeadam (Cumbria), and on the 9th, there was further disruption to public transport in Scotland, as well as in Brighton and Newbury. Thereafter, more settled conditions generally prevailed through to month-end under anticyclonic conditions. Overall for August, most of the UK received below average rainfall; whilst it was only notably (rather than exceptionally) dry, nevertheless remarkably for the UK it was the driest August in almost 20 years since the heatwave summer of 2003. This reflects the sequence of unsettled or wet summers since the turn of the century. Anglian region recorded around half of average rainfall, and parts of the Scottish Highlands received less than half of average. Rainfall for the summer (June-August) was less than 70% of average across Wales, Cumbria and western Scotland (55% of average for both Solway and Clyde). It was the driest summer for Scotland since the 1995 drought. Above average summer rainfall was generally limited to Southern region, which recorded 148% of average.

River flows

River flows in most parts of England, Wales and Northern Ireland were near or (more frequently) below average throughout most of August, reflecting the prevailing dry weather. Low flow envelopes were eclipsed in some Welsh catchments (e.g. Dyfi, Dee) in early August, and flows on the Lagan were similarly low both early and late in the month. Nevertheless, localised responses to intense rainfall in southern England did cause some more notable peak flows, although only relative to the time of year and without reported streamflow impacts. For example, on the 9th, flows on the Mole, Medway and Ouse were amongst their highest on record for August (all in records exceeding 50 years), and on the Itchen it was the highest August flow (in a series from 1958). Overall, river flows for August reflected rainfall patterns over the summer: flows were above average in southern England after a wet summer, but flows further north and west were below average. Below normal river flows characterised parts of Wales and northern England, whilst flows on the Soar and Erch were notably low, the latter less than a third of average. In southern England, flows on the Ouse were notably high (twice the average), and exceptionally high flows were recorded on the Itchen and Medway (the latter almost three times the average, and second highest August mean flow in a series from 1957). Mean river flows for the summer (June-August) were above average across southern England and East Anglia, and exceptionally high on the Itchen and the Medway (which recorded twice its average summer flow). Elsewhere, flows were below normal, often around half the average or less, and notably low on the Welsh Dee and in catchments draining the Lake District.

Groundwater

Groundwater levels in the Chalk receded, apart from three boreholes along the South Downs (Compton House, Chilgrove House and Westdean No.3) where levels rose and became notably to exceptionally high for August following three months of above average rainfall and lower than average SMDs. Elsewhere, Chalk levels were in the normal range or above, except at Killyglen where they remained below normal. Levels in the limestones fell, and were normal to above normal in the Jurassic, normal to below normal in the Carboniferous, and notably high in the Magnesian limestones with a record monthly maximum at Brick House Farm (for the second month in succession). Groundwater levels in the sandstone aquifers receded but remained above normal in the Permo-Triassic (and remained exceptionally high at Weir Farm), with the exception of Nuttalls Farm. In the Upper Greensand levels were exceptionally high at Lime Kiln Way and remained above normal in the Fell Sandstone at Royalty Observatory. *Note that due to continuing issues with data access, no data are available for Scotland.*

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 1981-2010 average.

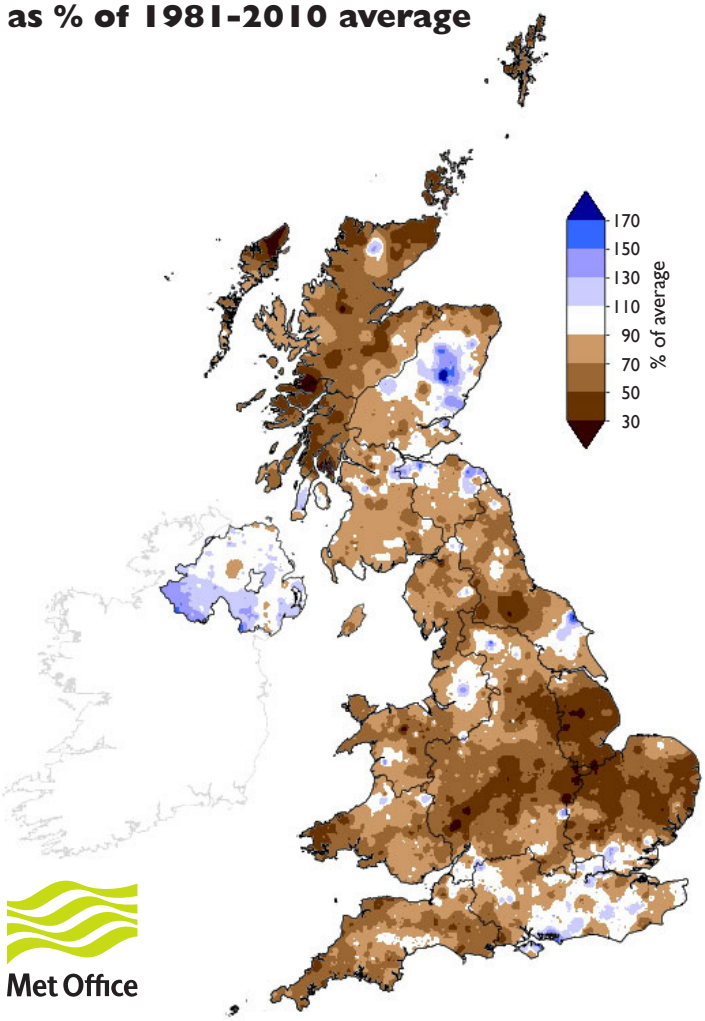
Region	Rainfall	Aug 2021	Jun21 – Aug21	RP	Mar21 – Aug21	RP	Dec20 – Aug21	RP	Sep20 – Aug21	RP
United Kingdom	mm	**65**	181		405		806		1161	
	%	**75**	78	5-10	87	5-10	102	2-5	103	2-5
England	mm	**49**	175		347		675		923	
	%	**71**	92	2-5	94	2-5	113	5-10	109	2-5
Scotland	mm	**83**	189		474		947		1460	
	%	**74**	65	15-25	80	5-10	90	2-5	96	2-5
Wales	mm	**77**	189		513		1132		1548	
	%	**74**	68	8-12	92	2-5	115	5-10	109	5-10
Northern Ireland	mm	**107**	189		405		760		1123	
	%	**110**	74	5-10	81	5-10	93	2-5	99	2-5
England & Wales	mm	**53**	177		370		737		1008	
	%	**72**	87	2-5	94	2-5	113	5-10	109	2-5
North West	mm	**81**	201		477		940		1346	
	%	**80**	75	5-10	94	2-5	110	2-5	110	5-10
Northumbria	mm	**54**	152		321		703		934	
	%	**73**	73	5-10	82	5-10	112	2-5	107	2-5
Severn-Trent	mm	**40**	148		319		625		816	
	%	**62**	79	2-5	89	2-5	111	2-5	105	2-5
Yorkshire	mm	**56**	171		362		712		941	
	%	**79**	85	2-5	95	2-5	117	5-10	112	2-5
Anglian	mm	**31**	139		260		500		677	
	%	**54**	85	2-5	86	2-5	112	2-5	108	2-5
Thames	mm	**46**	188		331		574		819	
	%	**82**	119	2-5	104	2-5	114	2-5	114	5-10
Southern	mm	**53**	231		358		649		930	
	%	**94**	148	5-10	112	2-5	119	5-10	117	5-10
Wessex	mm	**50**	185		361		665		931	
	%	**78**	104	2-5	99	2-5	108	2-5	105	2-5
South West	mm	**57**	230		470		993		1330	
	%	**69**	100	2-5	98	2-5	116	5-10	108	2-5
Welsh	mm	**73**	186		497		1096		1498	
	%	**73**	69	5-10	92	2-5	116	5-10	110	5-10
Highland	mm	**77**	197		550		1035		1635	
	%	**63**	63	20-30	81	5-10	82	2-5	90	2-5
North East	mm	**75**	198		435		792		1125	
	%	**94**	89	2-5	101	2-5	113	2-5	111	5-10
Tay	mm	**93**	219		509		972		1428	
	%	**97**	86	2-5	96	2-5	104	2-5	107	5-10
Forth	mm	**85**	187		408		831		1218	
	%	**90**	74	5-10	83	2-5	98	2-5	101	2-5
Tweed	mm	**75**	157		365		801		1094	
	%	**89**	68	5-10	83	2-5	110	2-5	107	2-5
Solway	mm	**97**	166		432		959		1455	
	%	**81**	55	30-50	72	10-15	93	2-5	98	2-5
Clyde	mm	**98**	193		469		1044		1712	
	%	**70**	55	40-60	66	25-40	83	2-5	94	2-5

% = percentage of 1981-2010 average *RP = Return period*

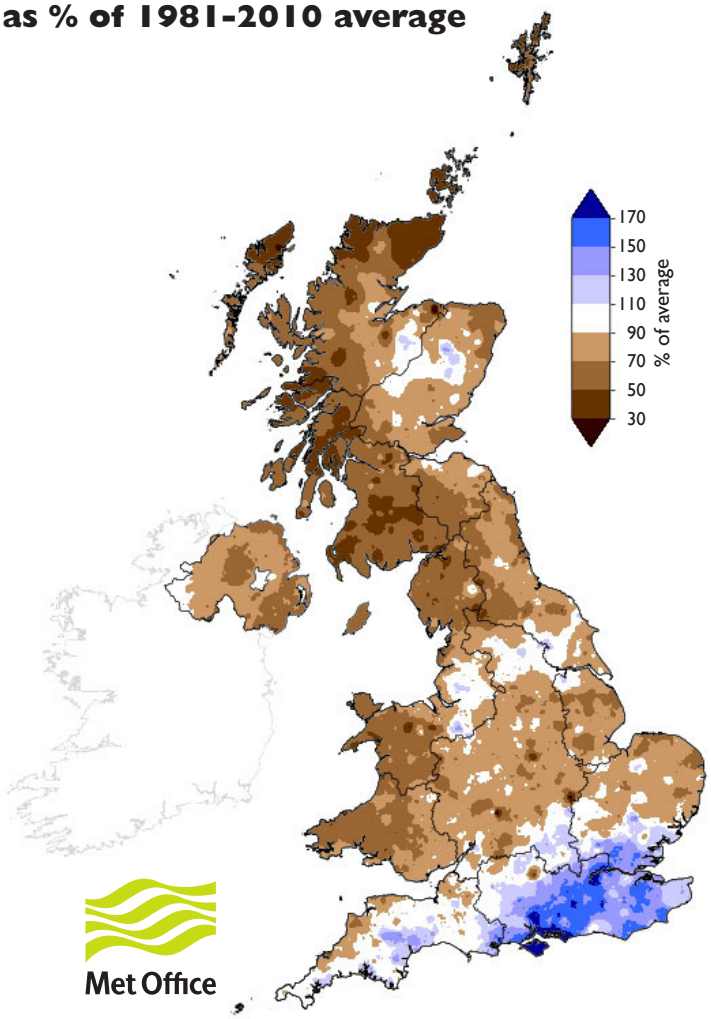
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability since 1910; 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 2018 are provisional.

Rainfall . . . Rainfall . . .

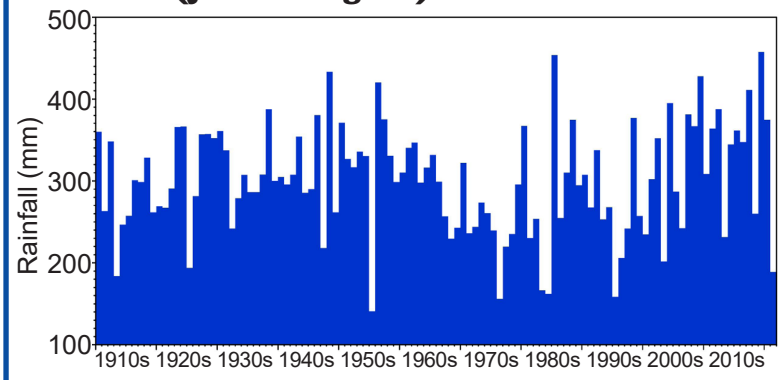
August 2021 rainfall
as % of 1981-2010 average



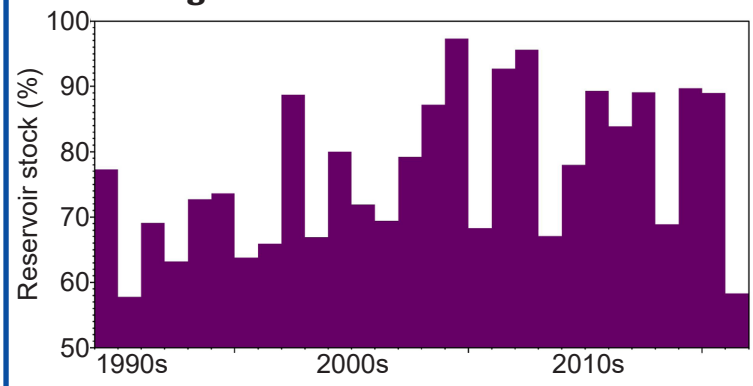
June 2021 - August 2021 rainfall
as % of 1981-2010 average



Summer (June - August) rainfall for Scotland



End of August reservoir stocks for Scotland



Hydrological Outlook UK

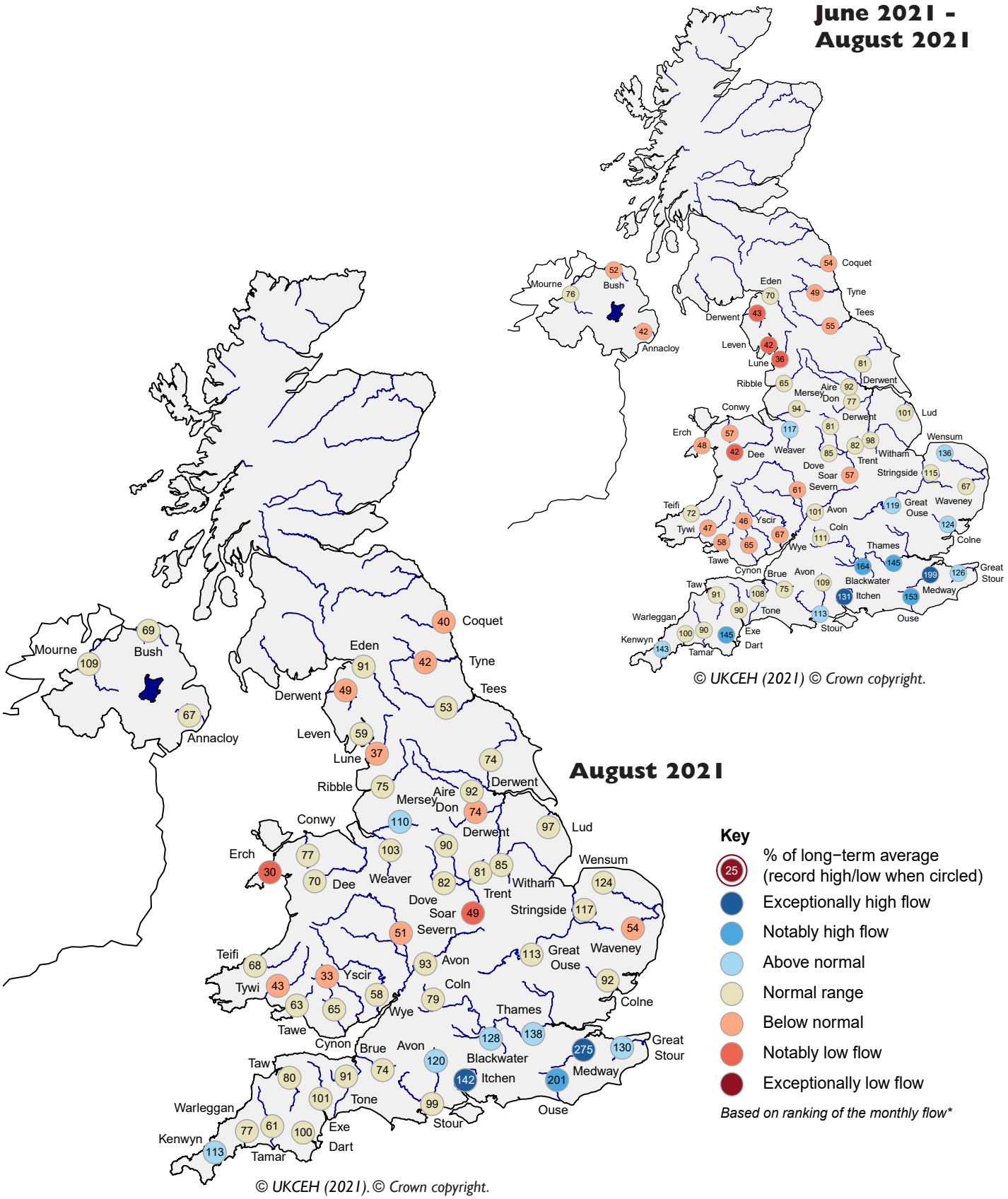
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from September 2021**
Issued: **09.09.2021**
using data to the end of August 2021

River flows in northern and western areas are likely to be normal to below normal in both September and September-November, whereas river flows in the south-east are likely to be normal to above normal over both timeframes. Groundwater levels in most boreholes of the UK are likely to be normal to above normal in September, but normal to below normal during September-November.

River flow . . . River flow . . .

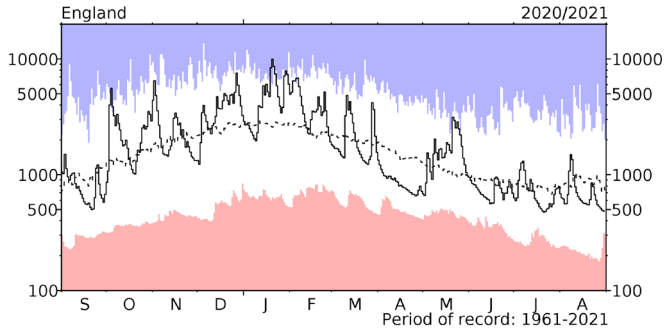


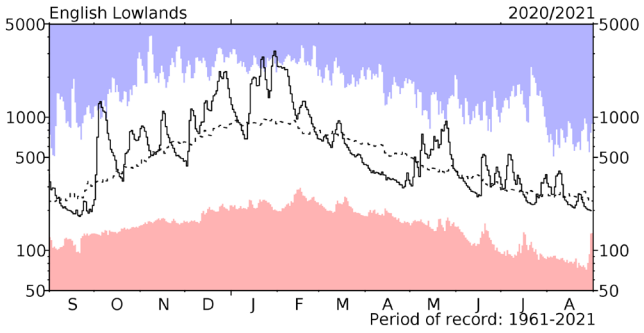
River flows

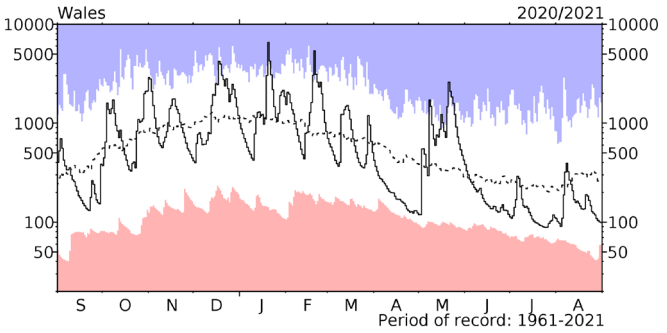
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the averaging period on which these percentages are based is 1981-2010. Percentages may be omitted where flows are under review.

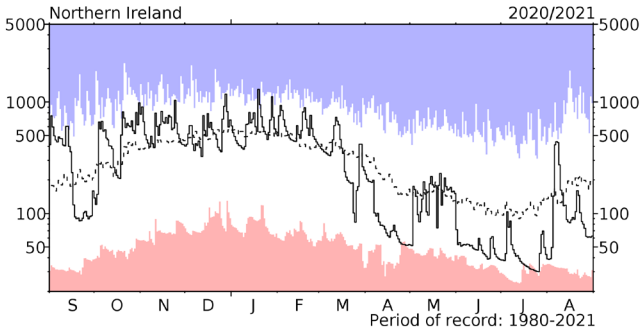
Note that due to continuing issues with data access, no data are available for Scotland.

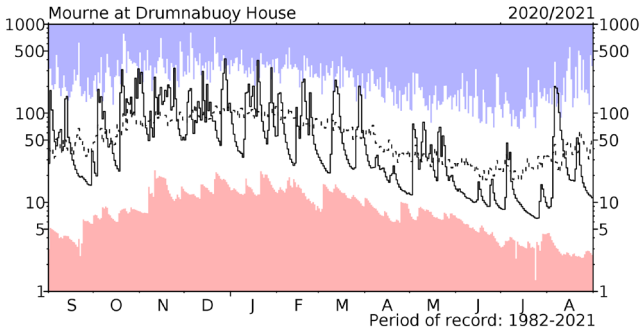
River flow . . . River flow . . .

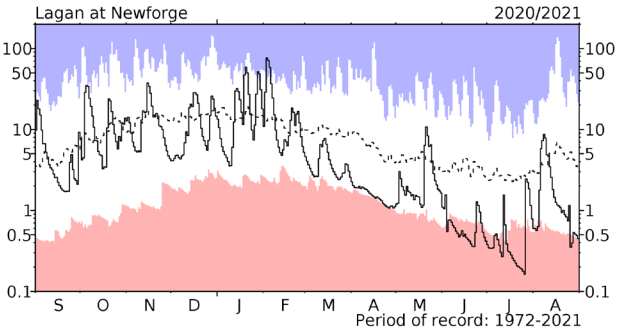


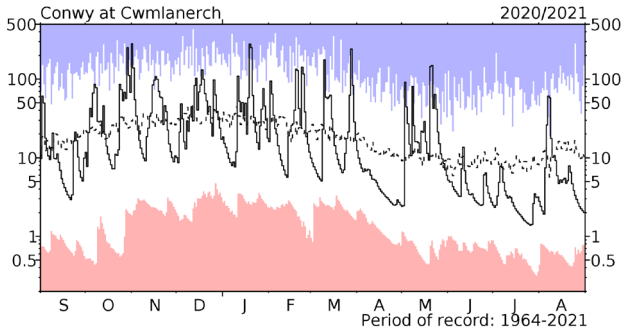


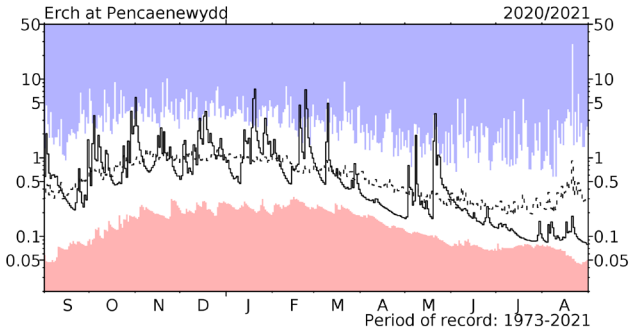


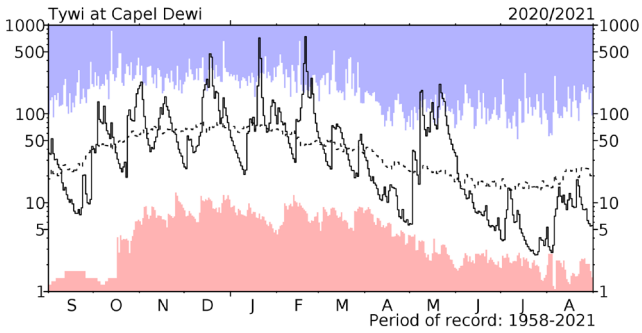


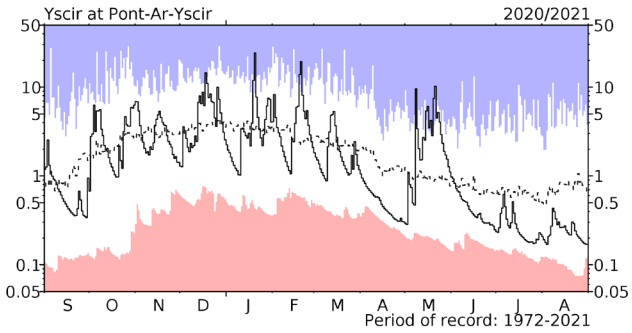








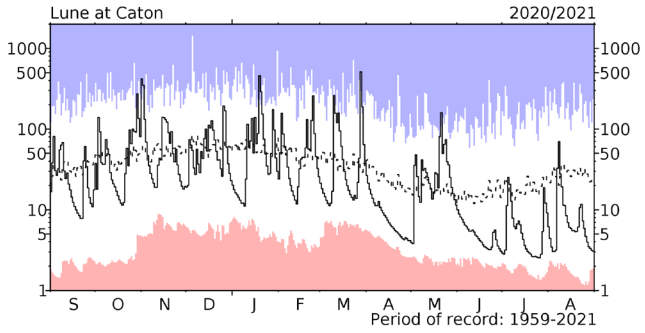


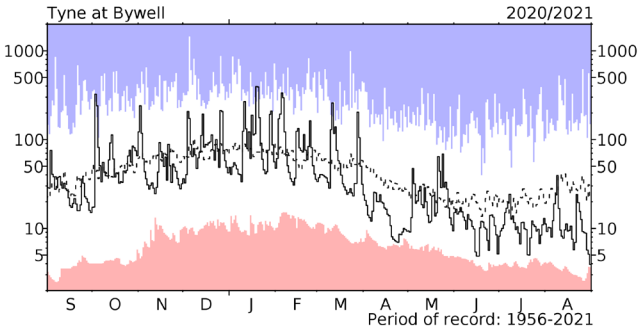


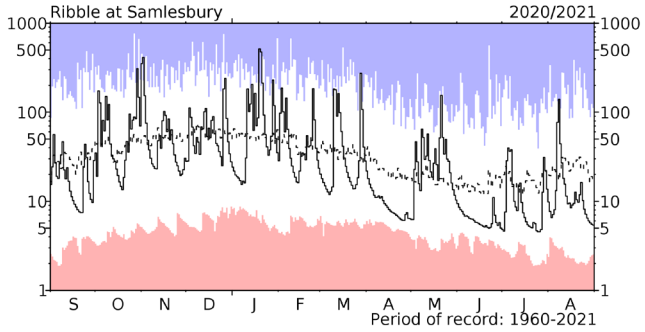
River flow hydrographs

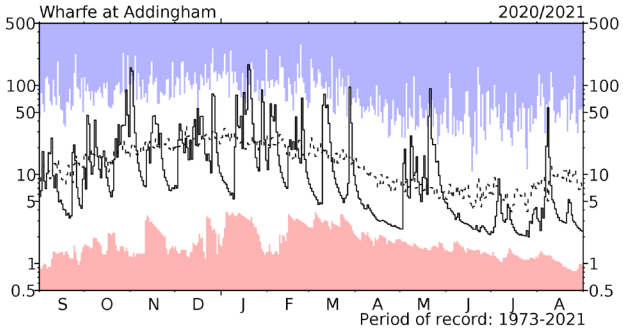
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to September 2020 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

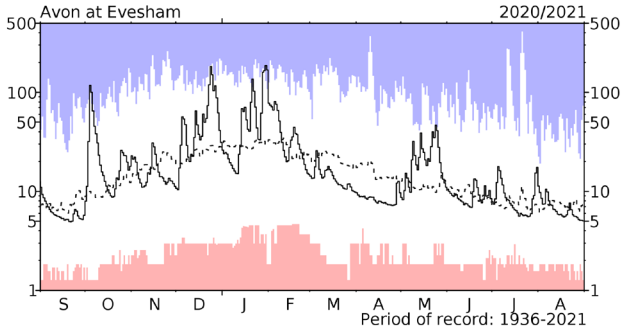
River flow ... River flow ...

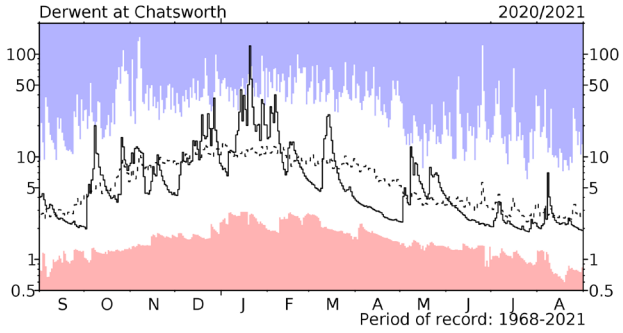


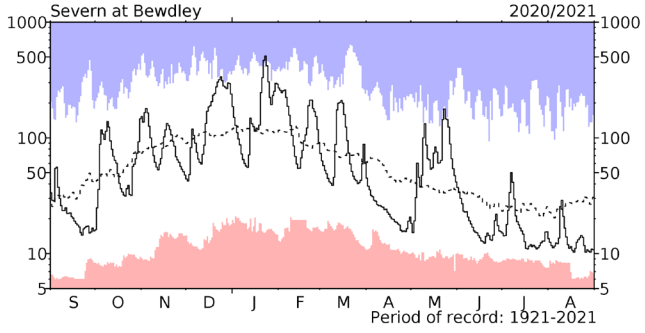


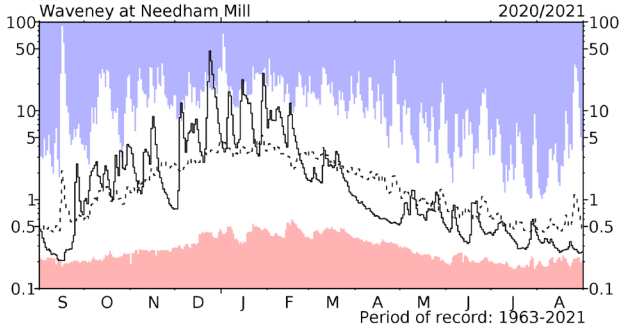


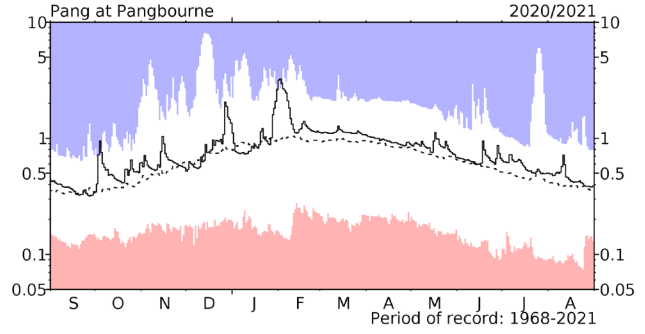


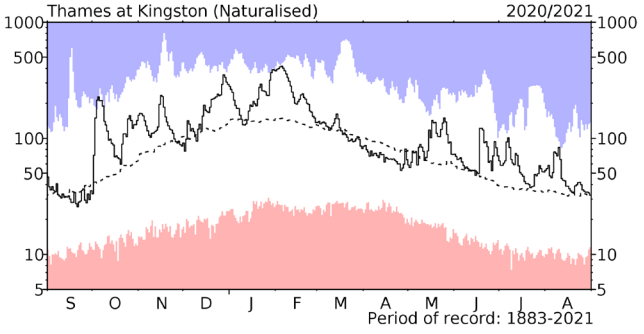


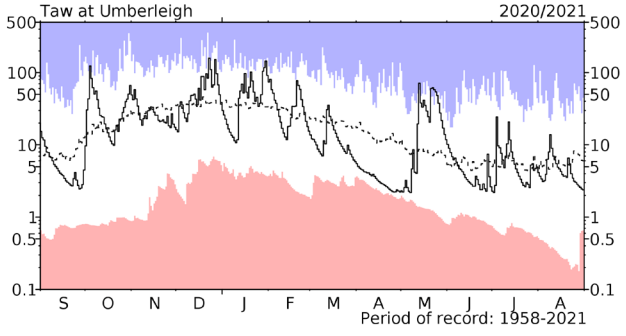


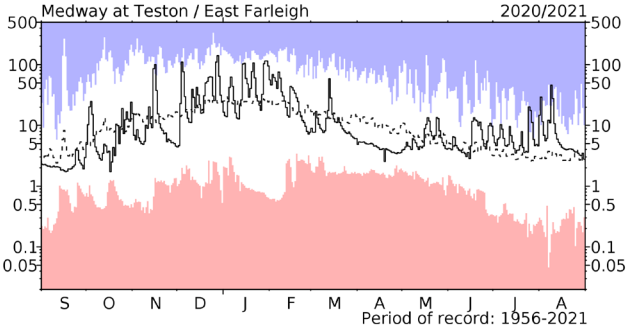




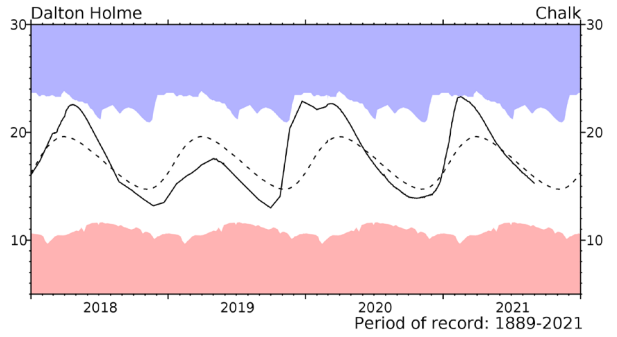


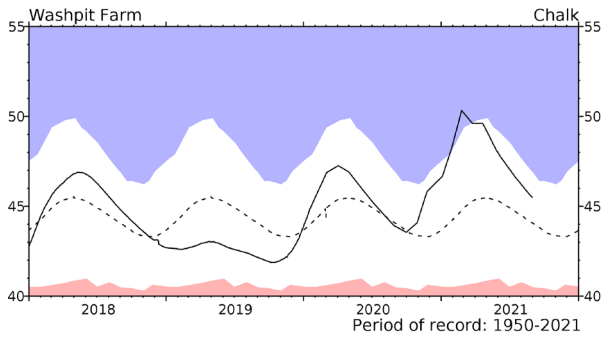


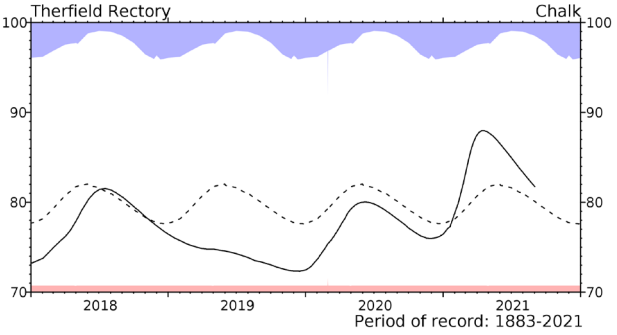


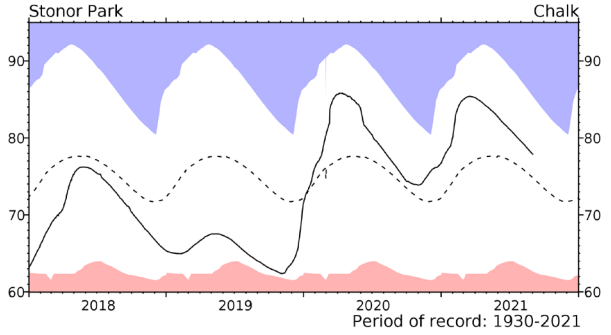


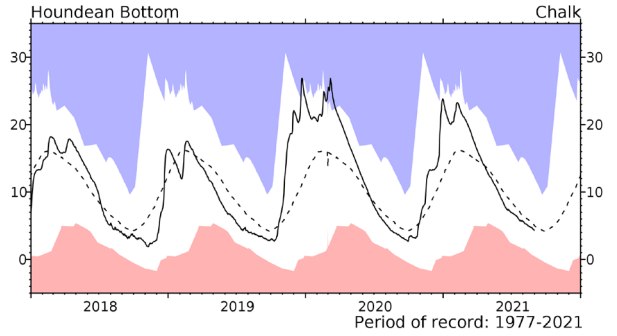
Groundwater…Groundwater

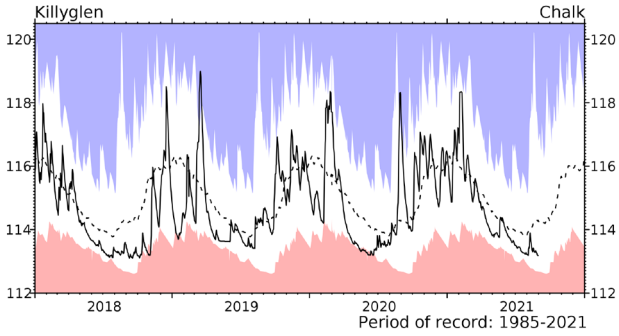


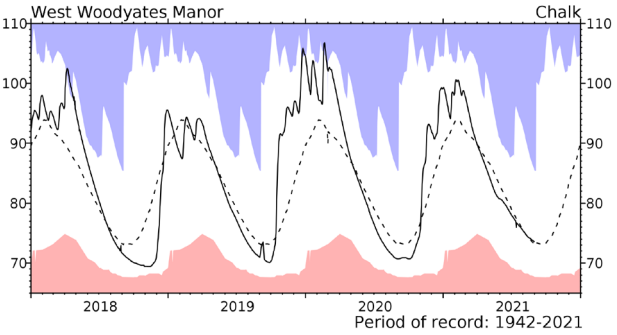


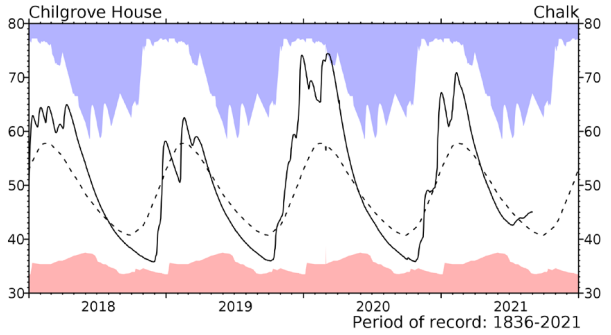


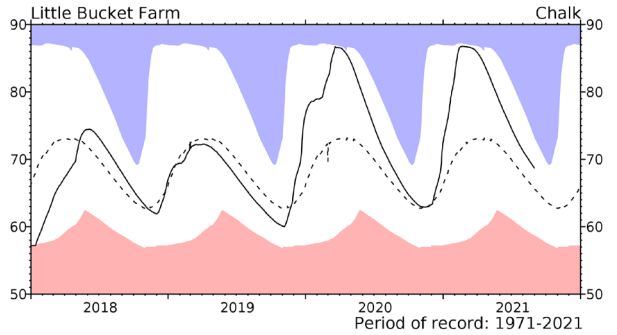


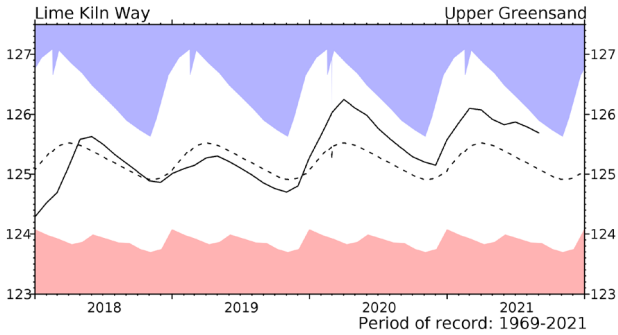






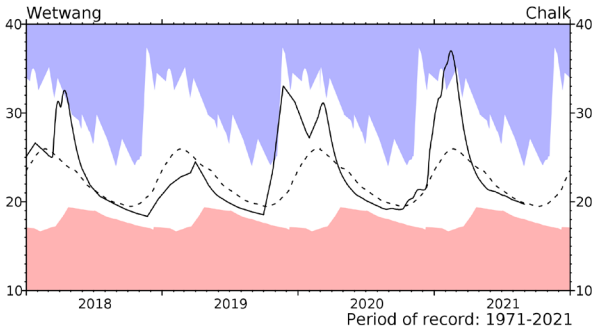


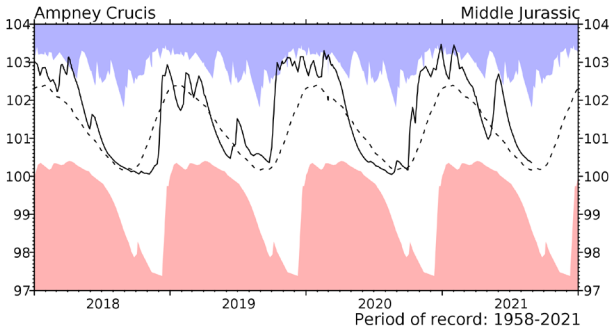


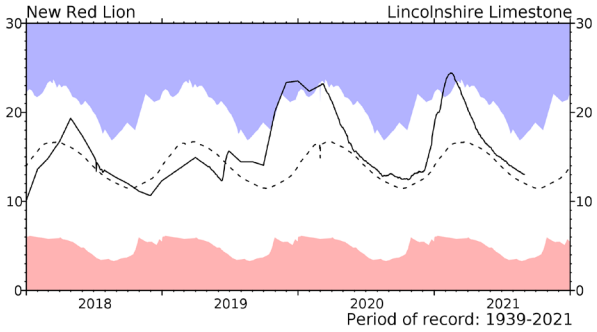


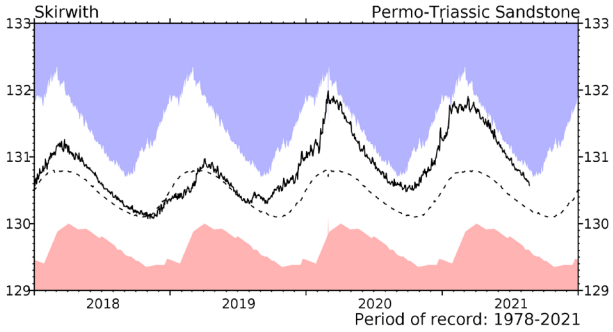
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is 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 2017. Note that most groundwater levels are not measured continuously and, for some index wells, the greater frequency of contemporary measurements may, in itself, contribute to an increased range of variation.

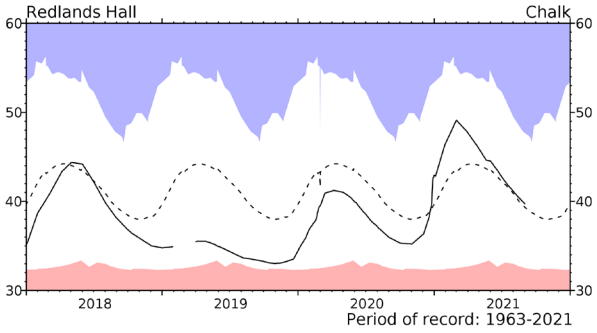
Groundwater…Groundwater

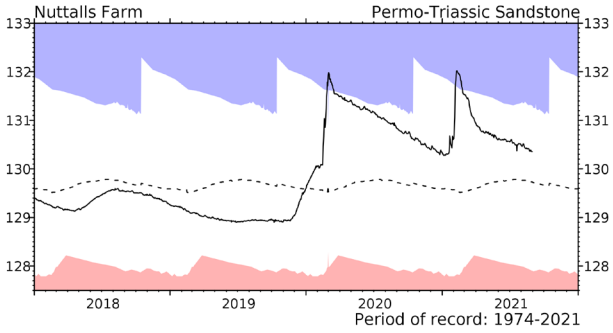


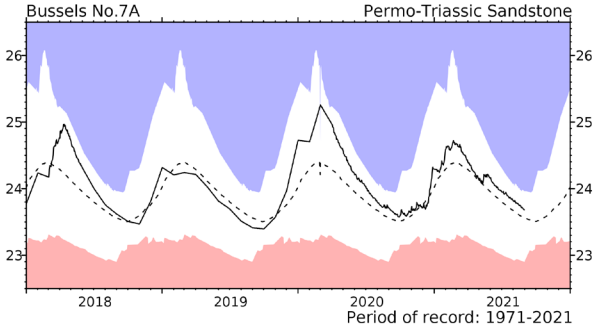


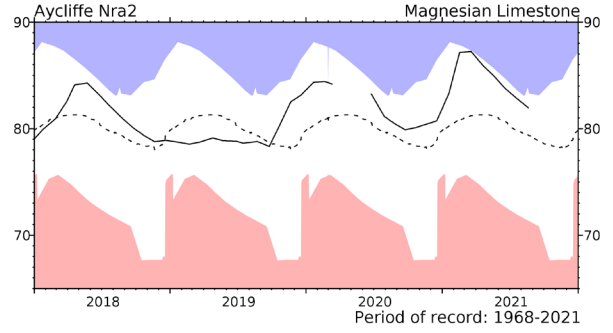


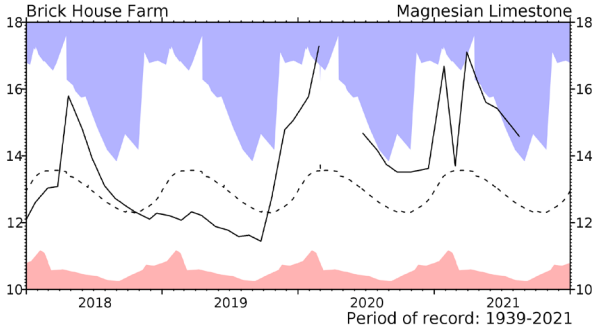


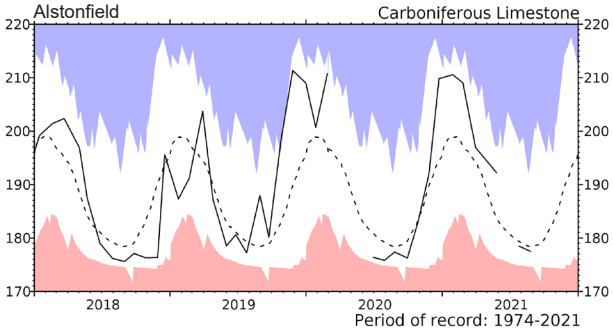


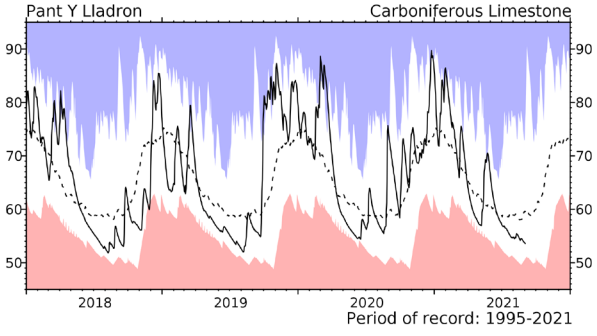


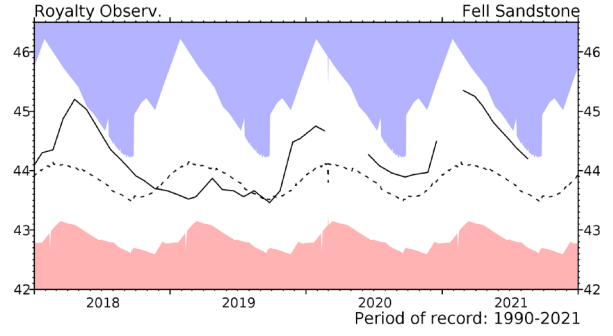












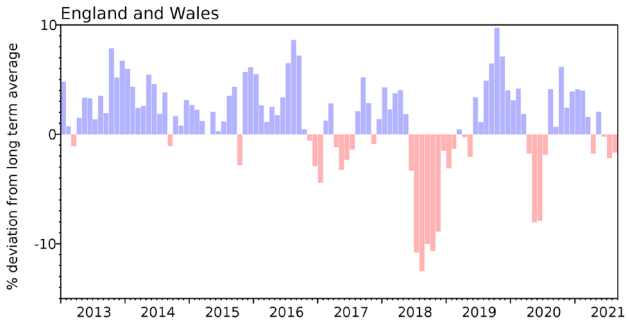
Groundwater levels - August 2021

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.

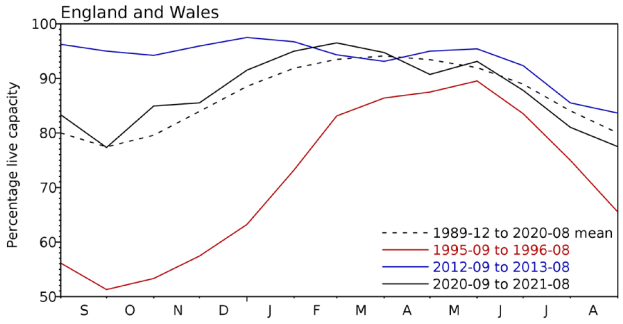
Note that due to continuing issues with data access, no data are available for Scotland.

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)	2021 Jun	2021 Jul	2021 Aug	Aug Anom.	Min Aug	Year* of min	2020 Aug	Diff 21-20
North West	Haweswater & Thirlmere	•	111132	67	65	46	-28	46	2021	79	-33
	Pennines		126991	75	79	73	-1	43	2018	87	-14
Northumbrian	Teesdale	•	87936	65	57	53	-19	38	1995	70	-17
	Kielder		(199175)	89	85	81	-7	66	1989	91	-10
Severn-Trent	Clywedog		49936	96	87	81	3	27	1976	94	-12
	Derwent Valley	•	46692	78	65	58	-9	34	1995	84	-26
Yorkshire	Washburn	•	23373	81	76	79	8	34	1995	90	-11
	Bradford Supply	•	40942	83	69	65	-4	21	1995	87	-22
Anglian	Grafham		(55490)	93	96	96	9	59	1997	90	5
	Rutland		(116580)	95	93	91	8	66	1995	91	0
Thames	London	•	202828	91	89	89	8	62	1995	88	2
	Farmoor	•	13822	99	98	95	1	64	1995	94	1
Southern	Bewl		31000	87	82	78	8	38	1990	69	9
	Ardingly		4685	99	95	89	17	38	2020	38	51
Wessex	Clatworthy		5662	91	79	67	3	31	1995	61	6
	Bristol	•	(38666)	81	72	65	-3	43	1990	62	3
South West	Colliford		28540	83	77	69	-2	43	1997	61	8
	Roadford		34500	90	87	84	12	40	1995	65	19
	Wimbleball		21320	97	84	81	11	40	1995	56	25
	Stithians		4967	82	74	66	3	30	1990	62	4
Welsh	Celyn & Brenig	•	131155	96	84	77	-6	49	1989	87	-10
	Brianne		62140	86	78	77	-12	55	1995	96	-19
	Big Five	•	69762	81	66	62	-11	29	1995	73	-11
	Elan Valley	•	99106	87	73	68	-8	37	1976	76	-8
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	82	74	68	-12	45	1998	89	-21
	East Lothian	•	9317	98	96	96	10	63	1989	98	-2
Scotland(W)	Loch Katrine	•	110326	75	58	50	-24	50	2021	88	-38
	Daer		22494	68	54	45	-34	41	1995	100	-55
	Loch Thom		10721	65	55	50	-34	50	2021	69	-19
Northern Ireland	Total+	•	56800	80	66	69	-8	40	1995	91	-22
	Silent Valley	•	20634	76	59	58	-16	33	2000	91	-32

( ) figures in parentheses relate to gross storage

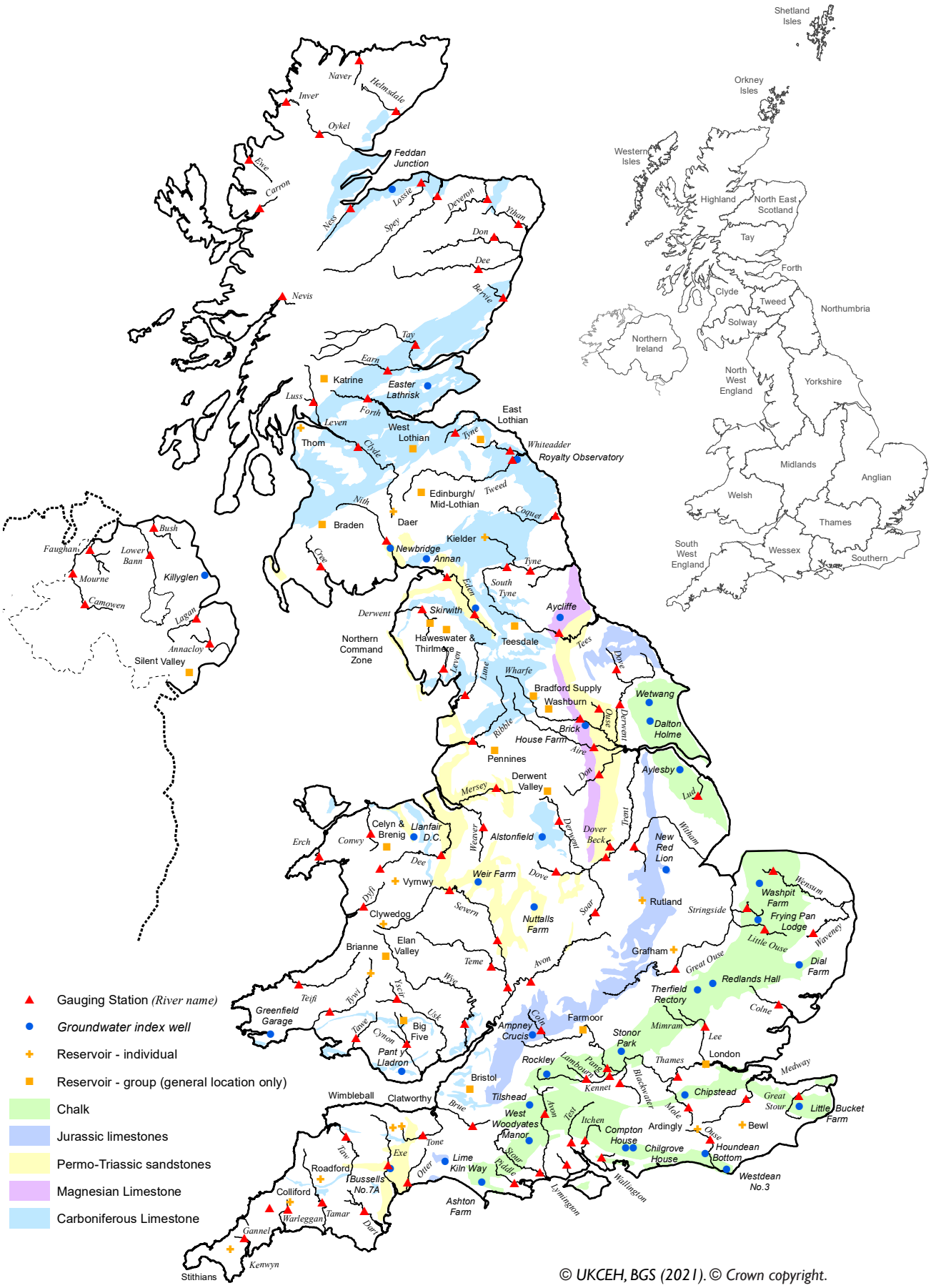
• denotes reservoir groups

*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.

Location map…Location map



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. 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 5km 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 1910 and form the official source of UK areal rainfall statistics which have been adopted by the NHMP. The gridding technique used is described in Perry MC and Hollis DM (2005) available at https://doi.org/10.1002/joc.1161

Long-term averages are based on the period 1981-2010 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: 0870 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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