Hydrological Summary

for the United Kingdom

General

August was a mild month of notable contrasts; unseasonal persistent wet and occasionally very windy weather more typical of autumn featured either side of heatwave conditions. The culmination of a wet summer, August rainfall was substantially above average across most of the UK, generally exceeding 150% of average away from northern Scotland, Kent and the East Anglian coast. Soil moisture deficits (SMDs) reduced substantially; August soils were wetter than average, a remarkable transition from near-record dry soils in late spring. River flows were above average across a broad swathe from the south-west to the north-east, and notably to exceptionally high in Wales and Northern Ireland. Near-average flows characterised the south-east whilst river flows were below normal in the far north of Scotland. Groundwater levels generally continued to decline in the main aquifers, with some exceptions mainly in the west. Reservoir stocks for England & Wales increased substantially and returned to above average for the first month since late winter. Some reservoirs in south-west England were moderately below average and stocks at Ardingly fell by a quarter of capacity to 38%, a new August minimum in a series from 1988. Notwithstanding the localised low reservoir stocks and groundwater levels, the summer's wet weather has bolstered UK water resources overall. With reservoir stocks generally healthy approaching the winter half-year, attention turns to outlooks for autumn rainfall to determine the timing and magnitude of groundwater recharge, which will be influential for water resources in the south-east for 2021.

August 2020

Rainfall

August began unsettled (e.g. 99mm at Inveruglas, Dunbartonshire on the 4th) before heatwave conditions prevailed, accompanied by thunderstorm activity. Across the 10th-12th, heavy rainfall and surface water flooding caused landslips, power outages and travel disruption in northern and western Wales, south-east England, and eastern Scotland (including a train derailment on the 12th near Stonehaven, Aberdeenshire), and on the 13th, 104mm was recorded at Hollies (Staffordshire). Thereafter, a succession of Atlantic depressions were propelled across the UK on a strong jet stream that resulted in persistent frontal rainfall that was more autumnal in nature. Predominantly impacting the west and north of the UK, storm Ellen (19th-21st) brought flooding to parts of Northern Ireland and Wales, and storm Francis (25th; 104mm at Bethesda Quarry, north Wales) brought flooding to Newcastle, Glasgow, and parts of western Scotland and north Wales. These storms were exceptional for August but not unprecedented, despite breaking August records locally for surface pressure and/or wind gusts. For August overall, the UK received 138% of average rainfall, but notably high rainfall totals relative to average were registered across most of the UK. Rainfall totals exceeded 170% of average most widely in central Scotland and the Welsh Borders; Severn-Trent and Tweed regions received 178% and 185%, respectively. Drier than average conditions were restricted to the far south-east and north-west; the Highlands recorded 53% of average with less than a third of average rainfall in some areas, and the Western Isles recorded its driest August since 1976 (all in series from 1910). Summer (June-August) rainfall anomalies were similar to those of August, with wetter than average conditions across the vast majority of the UK away from the far north-west and far south-east. Much of the west recorded more than 150% of average, with 172% and 179% of average for Solway and North West England, respectively, their third wettest summers in series from 1910.

River flows

Flows initially increased in early August; localised wet weather in eastern Scotland on the 12th led to a new August peak flow maximum on the Bervie. Following recessions mid-month, the succession of frontal systems sharply increased and sustained river flows to month-end. Throughout the stormy interlude from 24th-27th around storm Francis, flows in Northern Ireland regularly exceeded daily maxima, and some rivers in western Britain recorded their highest August peak flow in series of at least 50 years (e.g. Kenwyn, Tawe, Conwy). On the 26th, rivers around Bethesda and Beddgelert (both Gwynedd) overtopped, with 40 homes evacuated. Outflows from Wales on the 26th represented the second highest August event in a 60-year record, and from Northern Ireland the third highest August event in a 40-year record. In contrast, by month-end flows in north-west Scotland were approaching the low flow envelope (and eclipsing previous minima on the Carron). Overall, August river flows were substantially above average across Wales, Northern Ireland, central and southern Scotland, and northern and central England. Flows more than double the average were commonplace in Wales and Northern Ireland; the Annacloy recorded more than 350% of average, and together with the Conwy, Welsh Dee and Teifi experienced exceptionally high flows. In contrast, river flows were below normal and notably low across the far north of Scotland; the Naver and Oykel recorded around a fifth of their average August flows. Summer (June-August) river flows were generally near average across the English Lowlands and northern Scotland, but above average elsewhere. Flows were notably high in Northern Ireland and notably to exceptionally high in Wales and north-west England, with the Ribble and Cumbrian Leven recording around twice their average flows, and the Lune and Conwy around 250% of average, establishing new maxima for summer mean flows in series from 1959 and 1964, respectively.

Groundwater

SMDs decreased substantially in August across most of the aquifer outcrop areas. Groundwater levels in the Chalk fell at all of the index boreholes, except for Killyglen where they rose to a new maximum level for the end of August. Elsewhere, levels were in the normal range or below, exceptionally so at Compton House. In the Jurassic and Magnesian limestones, levels generally fell, except at Ampney Crucis where they rose after storm Ellen and recorded an overall rise for the month. The levels remained in the normal range, apart from Brick House Farm where levels remained notably high. Levels in the Carboniferous Limestone rose overall in both the Peak District and south Wales (where they fell towards month-end), with a new August maximum at Pant-y-Lladron. In the Permo-Triassic sandstones, levels rose in south-west Scotland at Newbridge and Annan, but were stable or fell elsewhere. Levels were above normal for the month, exceptionally so at Weir Farm, except for Annan which remained in the normal range. Levels fell at Royalty Observatory in the Fell Sandstone but remained above normal. In the Devonian sandstones, levels fell at Feddan Junction and rose at Easter Lathrisk, reflecting differences in rainfall.

UK Centre for Ecology & Hydrology

British Geological Survey

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1981-2010 average.

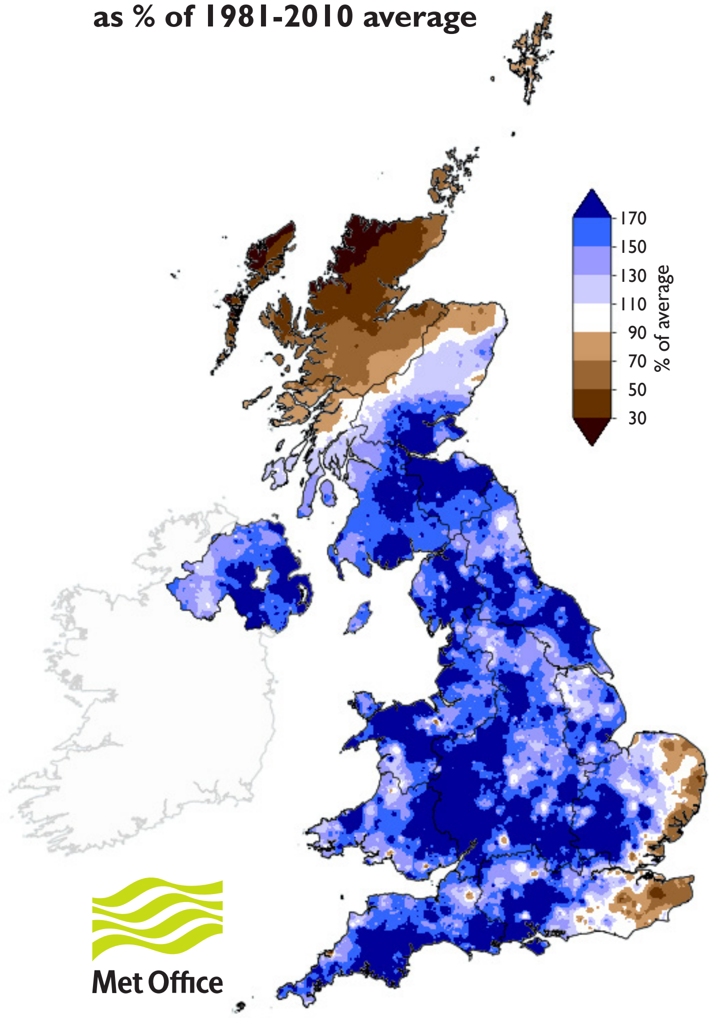
Region	Rainfall	Aug 2020	Jun20 – Aug20	RP	Mar20 – Aug20	RP	Dec19 – Aug20	RP	Sep19 – Aug20	RP
United	mm	**120**	321		461		930		1309	
Kingdom	%	**138**	137	10-15	99	2-5	118	20-30	116	60-90
England	mm	**109**	263		350		679		1027	
	%	**161**	138	5-10	95	2-5	114	5-10	122	15-25
Scotland	mm	**117**	375		602		1280		1668	
	%	**104**	130	8-12	102	2-5	121	30-50	110	15-25
Wales	mm	**176**	428		577		1188		1745	
	%	**170**	155	10-20	103	2-5	121	10-20	123	30-50
Northern	mm	**156**	399		525		925		1265	
Ireland	%	**160**	157	25-40	105	2-5	114	8-12	111	15-25
England &	mm	**119**	286		381		749		1126	
Wales	%	**162**	141	8-12	96	2-5	115	5-10	122	20-30
North West	mm	**173**	461		589		1134		1557	
	%	**172**	172	30-50	116	5-10	132	50-80	127	>100
Northumbria	mm	**119**	281		360		631		972	
	%	**159**	135	5-10	92	2-5	101	2-5	112	5-10
Severn-Trent	mm	**115**	260		335		634		988	
	%	**178**	138	5-10	93	2-5	113	2-5	127	20-30
Yorkshire	mm	**120**	309		377		695		1096	
	%	**167**	154	10-20	99	2-5	114	5-10	130	30-50
Anglian	mm	**76**	189		240		444		695	
	%	**132**	115	2-5	79	5-10	99	2-5	111	2-5
Thames	mm	**96**	209		296		574		852	
	%	**170**	132	2-5	93	2-5	114	2-5	119	5-10
Southern	mm	**66**	142		244		583		903	
	%	**118**	91	2-5	76	5-10	107	2-5	113	2-5
Wessex	mm	**105**	235		348		717		1083	
	%	**164**	133	2-5	96	2-5	116	5-10	123	10-20
South West	mm	**143**	343		486		1019		1564	
	%	**174**	148	8-12	102	2-5	119	5-10	127	30-50
Welsh	mm	**173**	418		561		1145		1685	
	%	**172**	156	10-20	103	2-5	121	10-20	123	30-50
Highland	mm	**65**	321		643		1480		1867	
	%	**53**	102	2-5	95	2-5	118	15-25	103	5-10
North East	mm	**79**	290		399		711		1053	
	%	**99**	130	2-5	92	2-5	102	2-5	104	2-5
Tay	mm	**129**	365		534		1148		1514	
	%	**135**	143	5-10	101	2-5	122	10-20	113	10-20
Forth	mm	**165**	383		533		1090		1442	
	%	**176**	152	15-25	108	2-5	128	40-60	120	50-80
Tweed	mm	**155**	360		482		907		1249	
	%	**185**	156	10-20	109	2-5	124	15-25	122	40-60
Solway	mm	**203**	539		705		1357		1820	
	%	**170**	179	80-120	118	10-15	131	>100	122	>100
Clyde	mm	**180**	515		781		1663		2117	
	%	**127**	146	30-50	110	5-10	132	>100	116	50-80

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

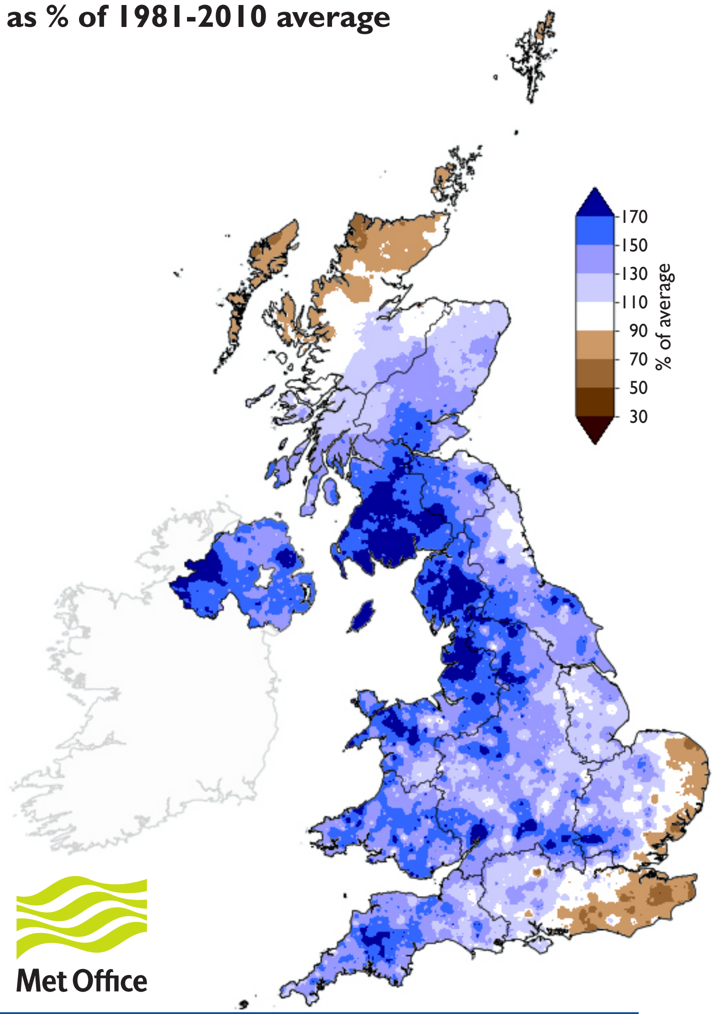
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

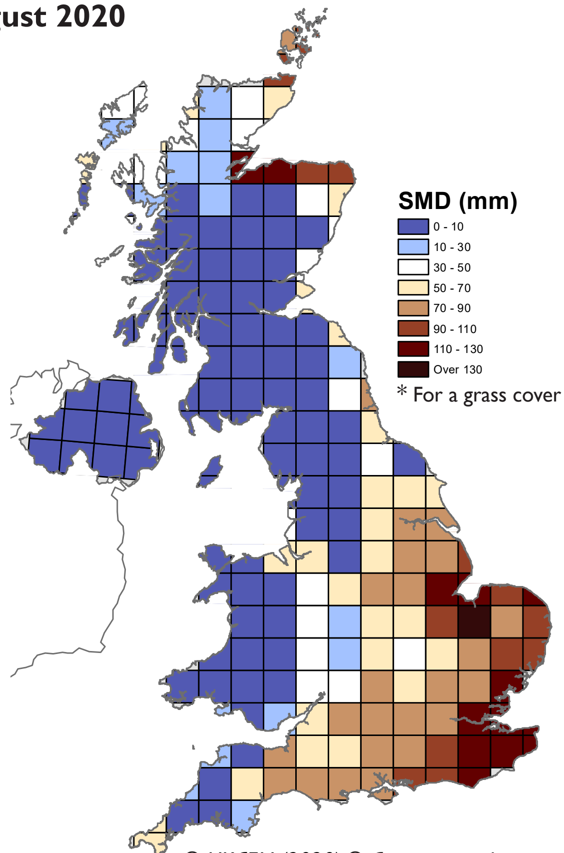
August 2020 rainfall as % of 1981-2010 average



June 2020 - August 2020 rainfall as % of 1981-2010 average



MORECS Soil Moisture Deficits* August 2020



Hydrological Outlook UK

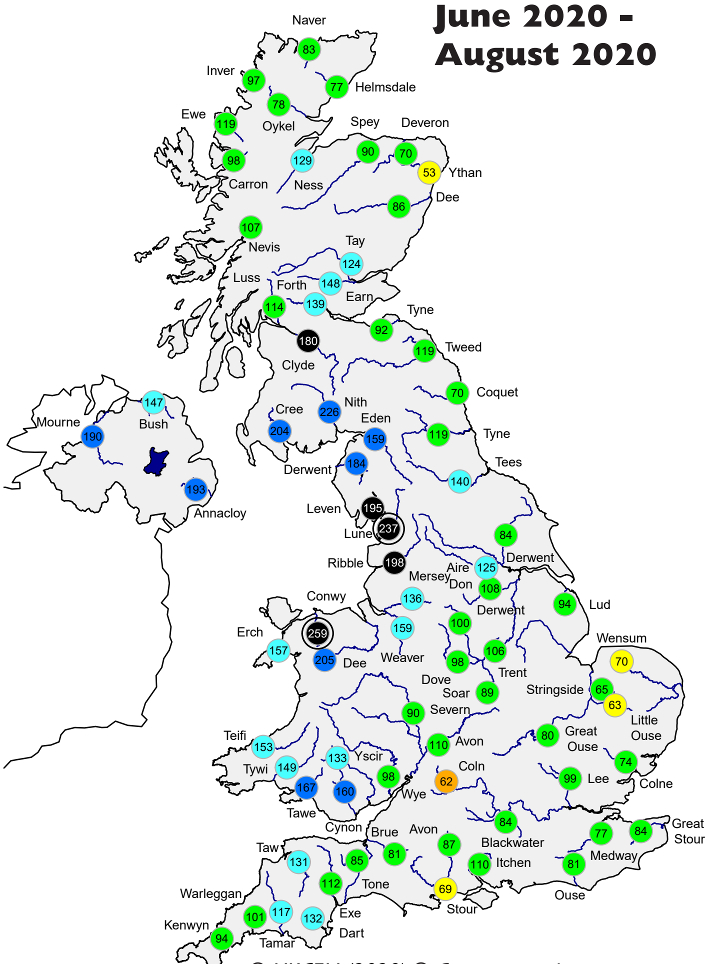
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

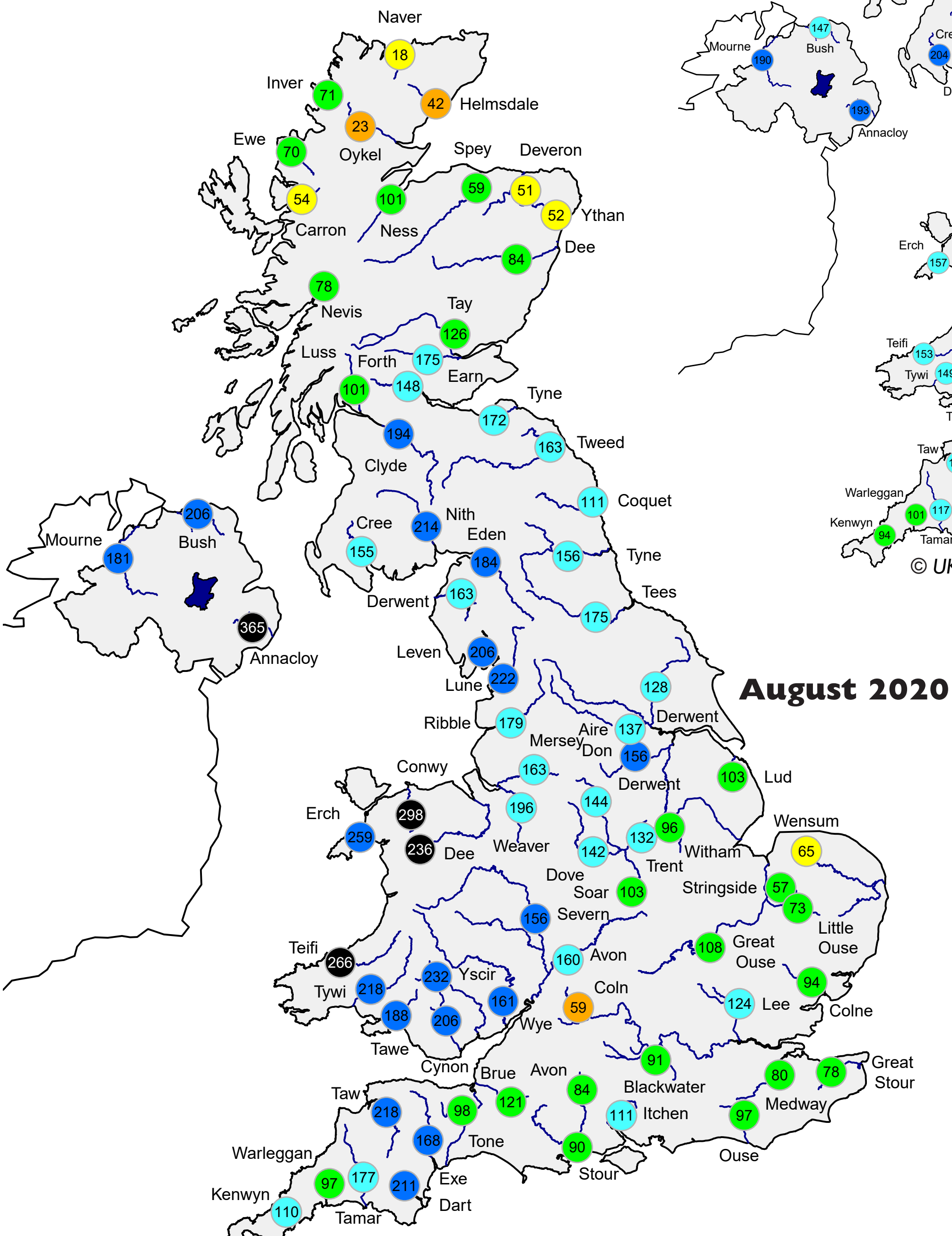
The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from September 2020**
Issued: **09.09.2020**
using data to the end of August 2020

The outlook for September is for river flows within the normal range in the south-east and groundwater levels below normal to exceptionally low along the south coast, with normal to above normal river flows and groundwater levels elsewhere. The three-month outlook is for a continuation of river flows within the normal range in the south-east with no strong signal elsewhere, and groundwater level outlooks over the seasonal timeframe ultimately determined by the onset of the recharge season.

River flow . . . River flow . . .





Key

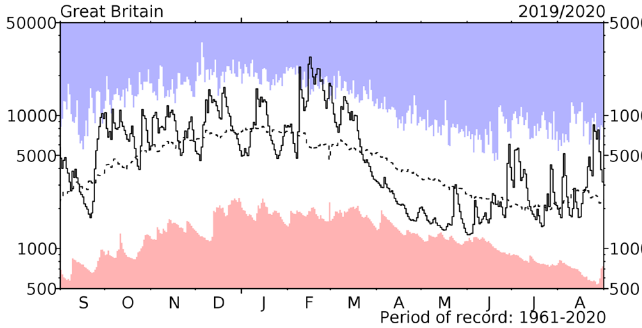
- 25 — % of long−term average (record high/low when circled)
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

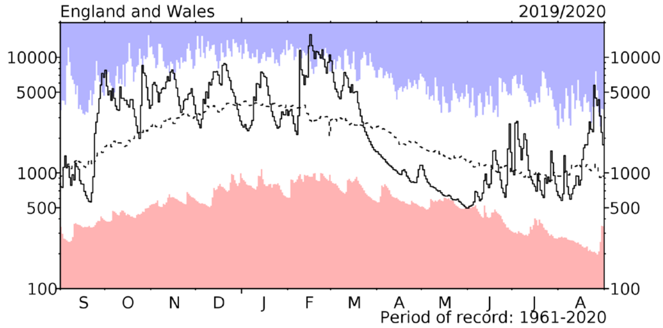
*Based on ranking of the monthly flow**

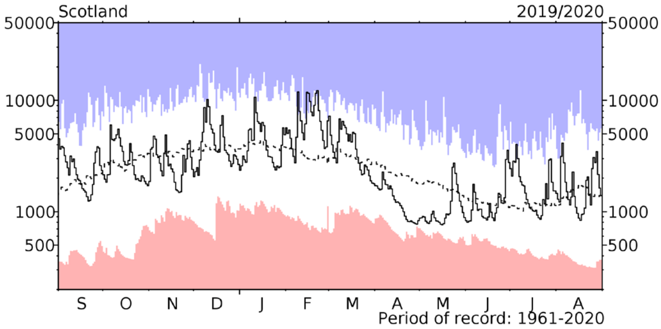
River flows

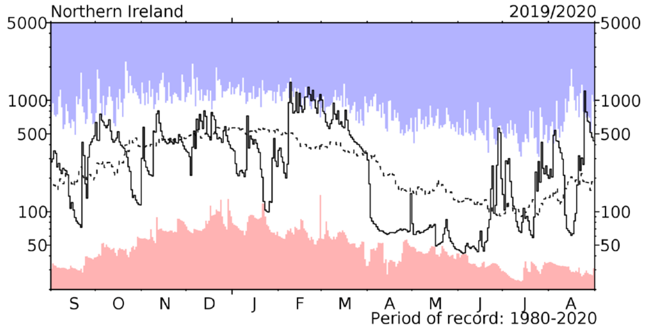
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

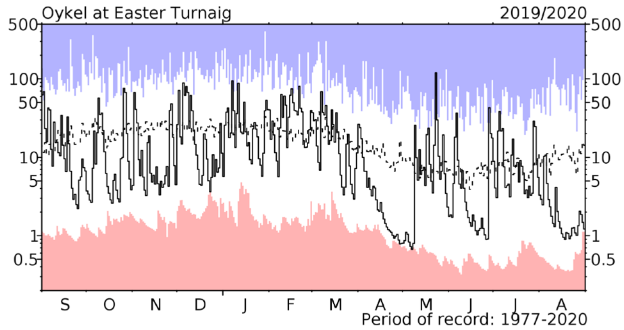
River flow . . . River flow . . .

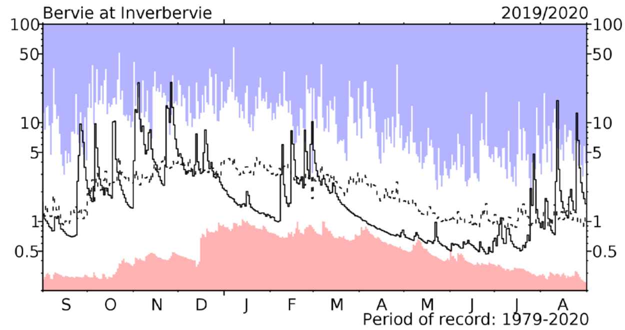


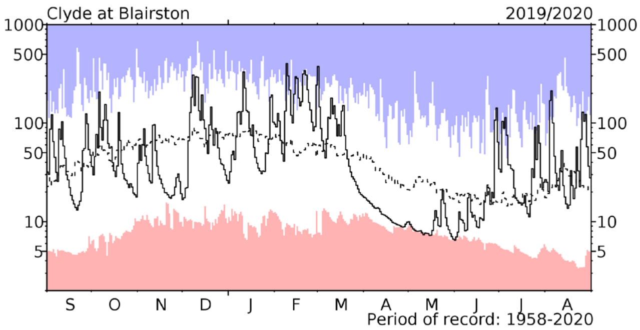


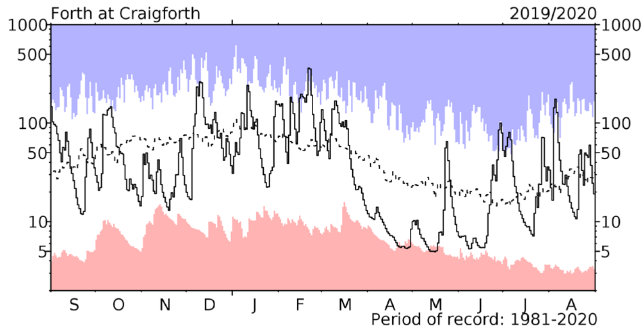


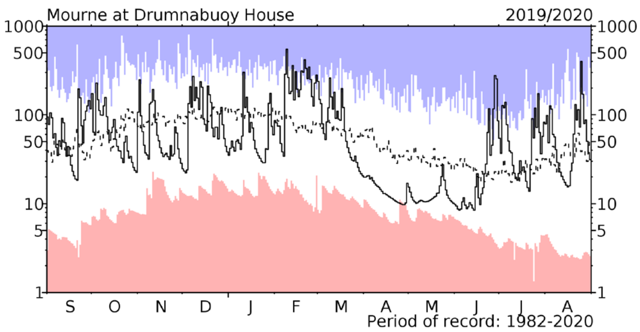


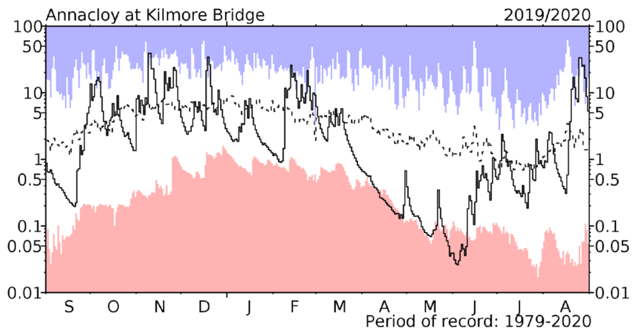








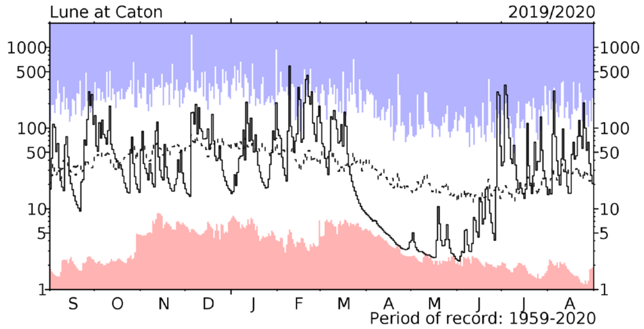


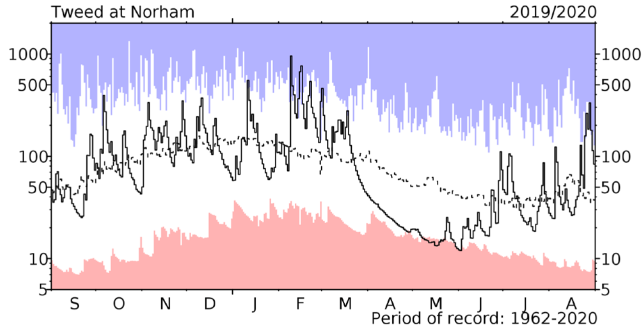


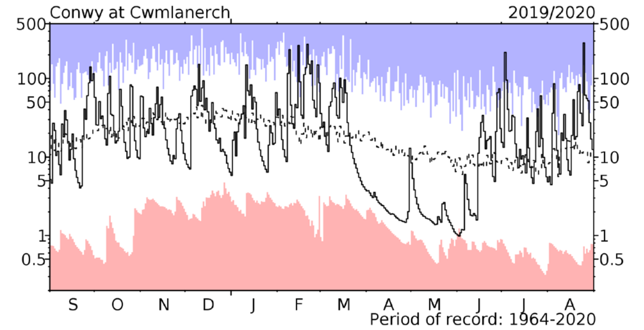
River flow hydrographs

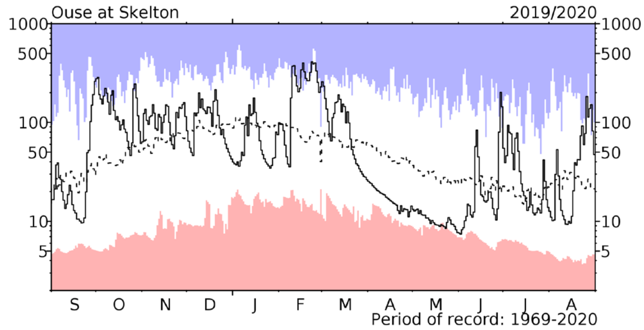
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to September 2019 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

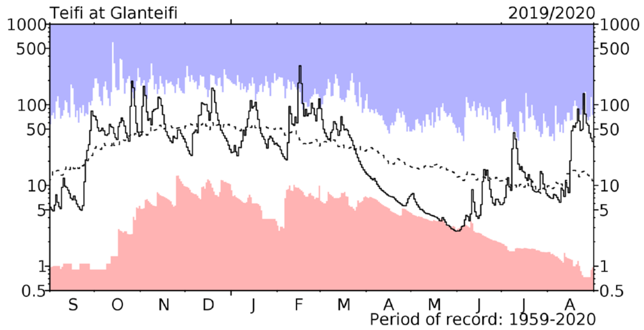
River flow . . . River flow . . .

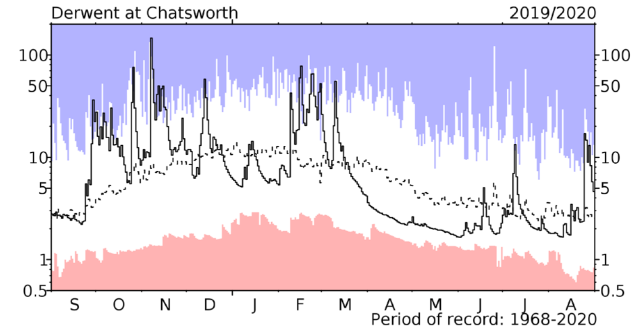


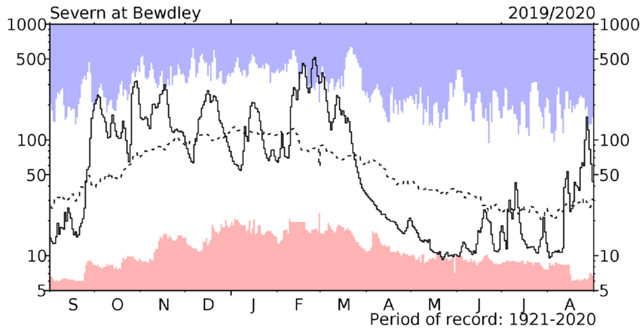


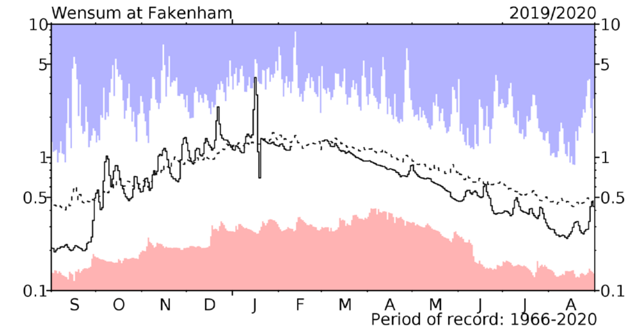


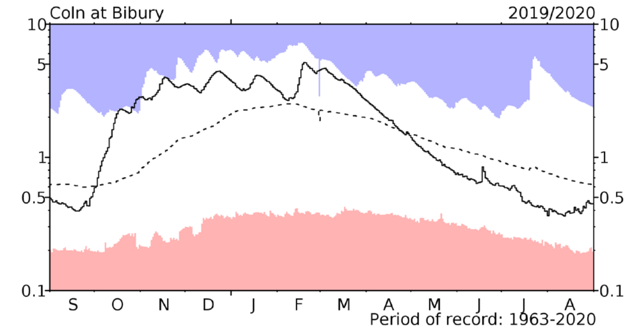


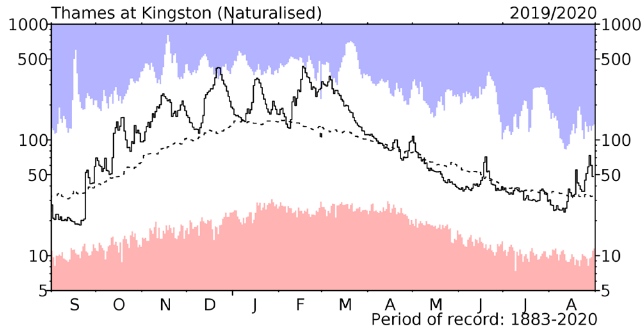


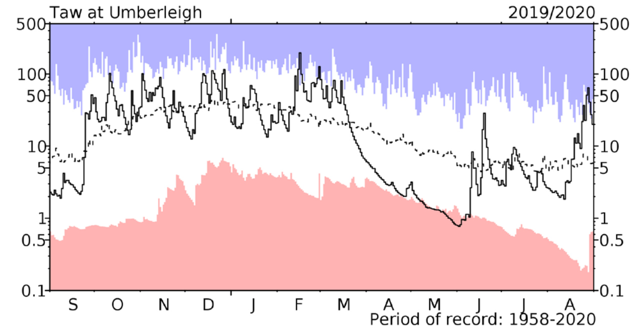


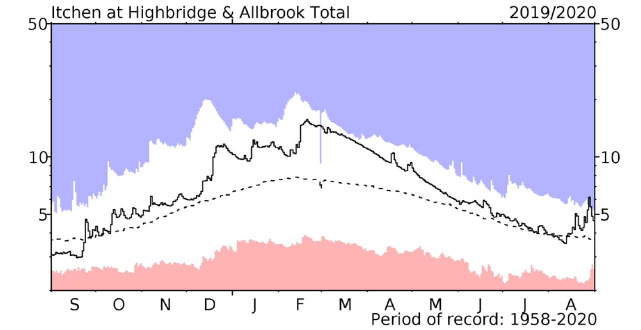




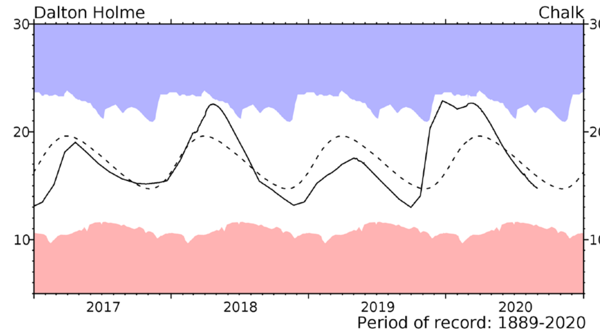


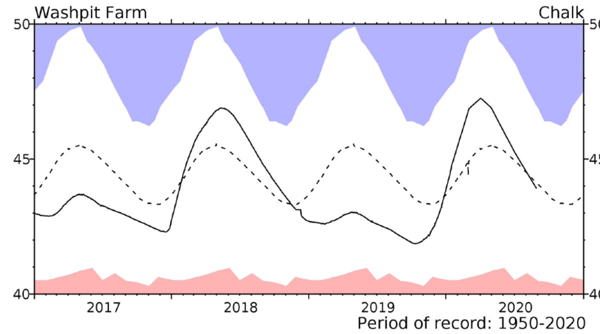


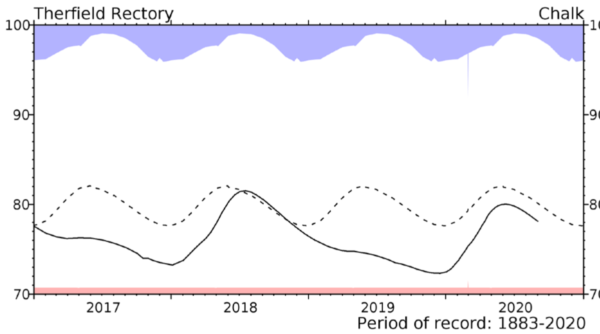


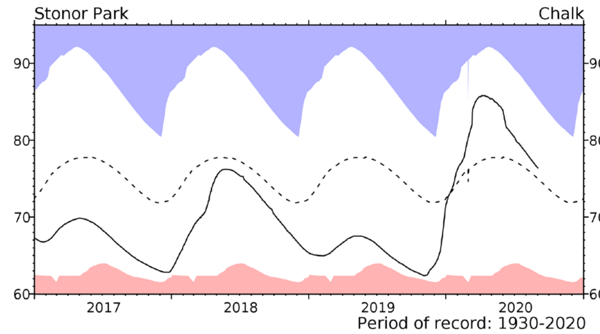


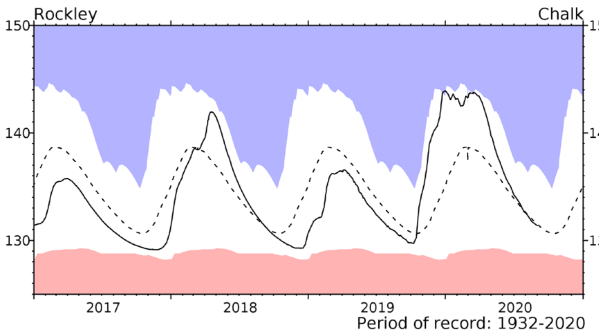
Groundwater . . . Groundwater

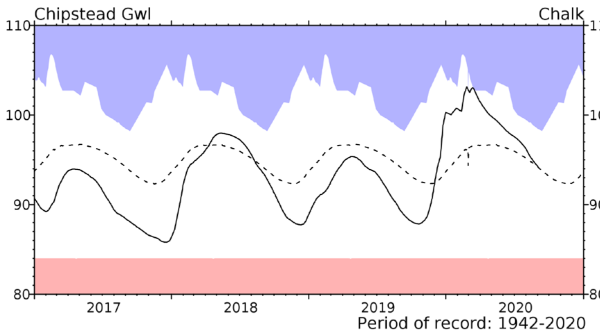


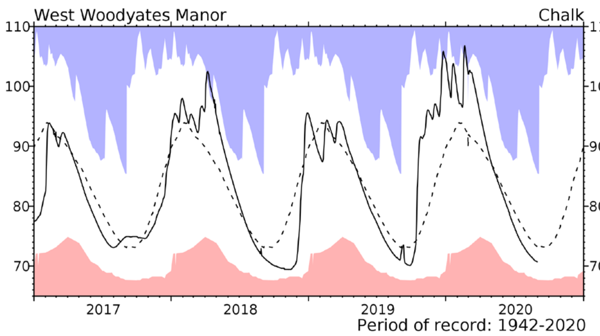


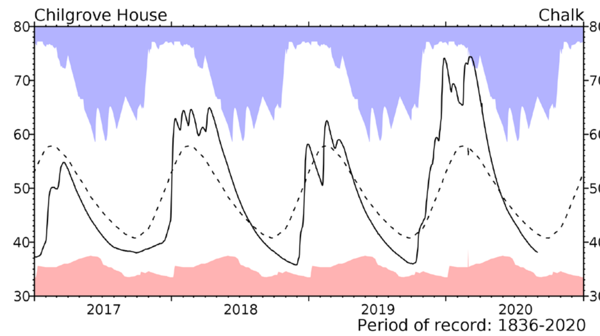


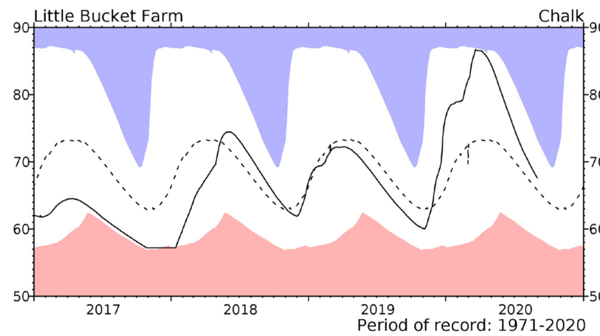


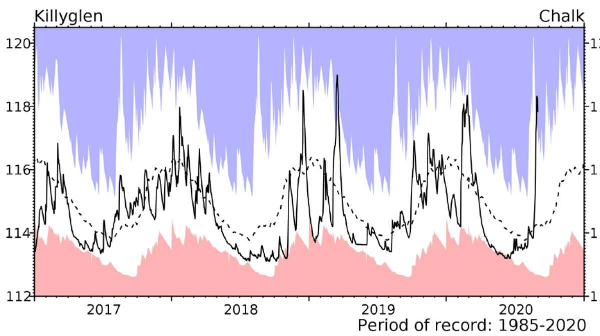






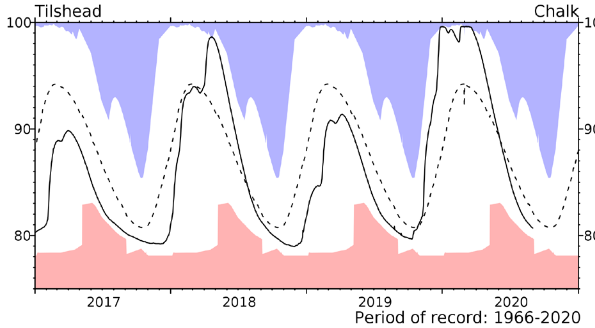


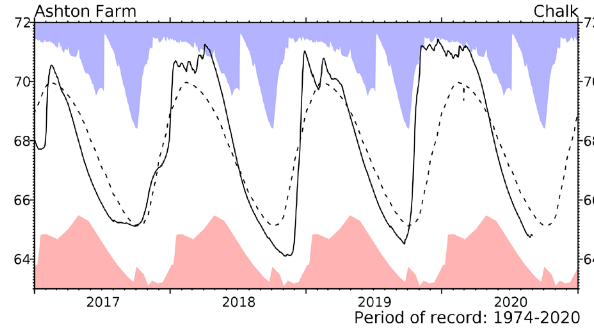


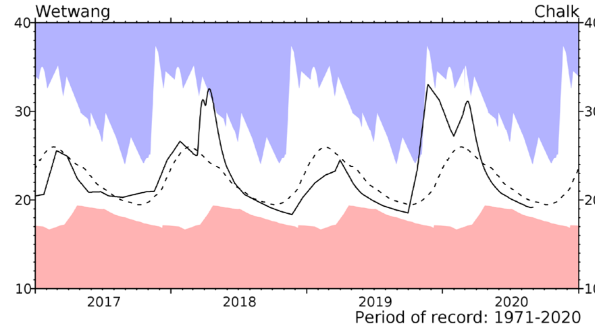


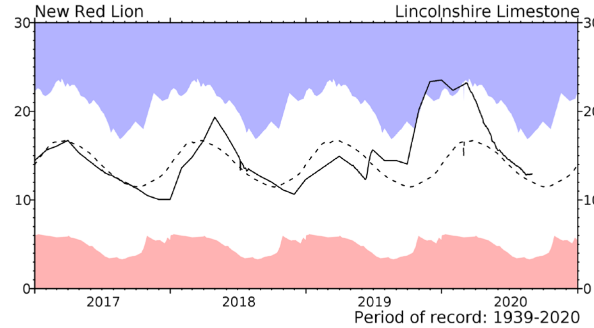
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

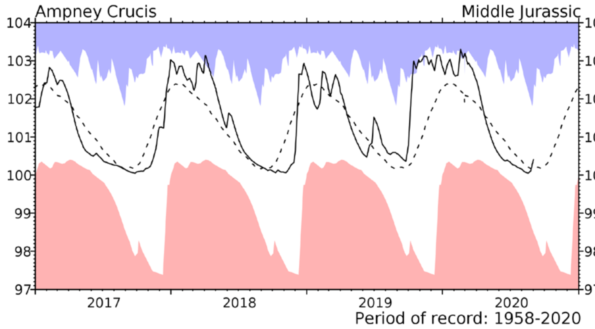
Groundwater ... Groundwater

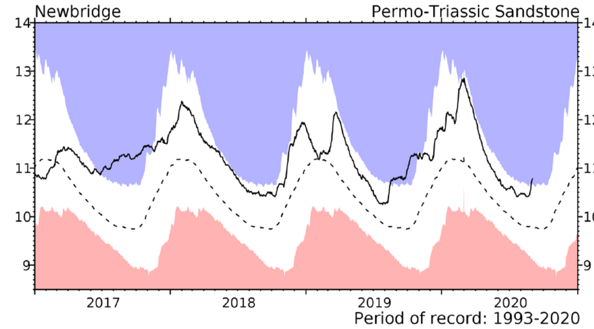


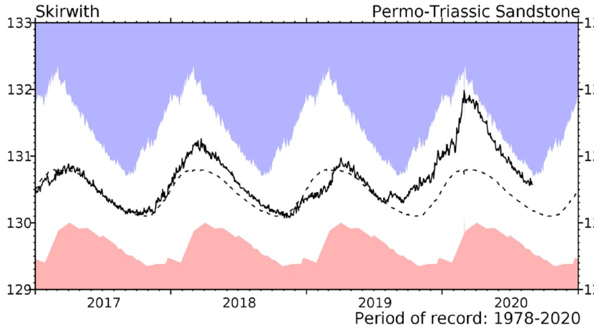


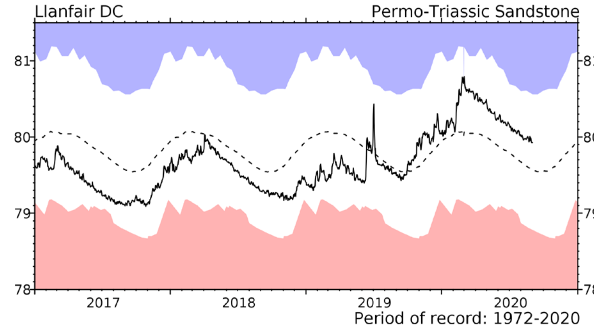


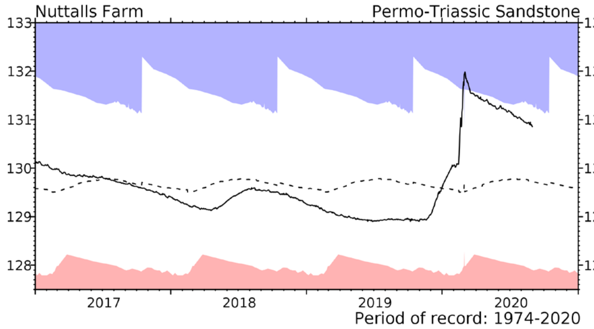


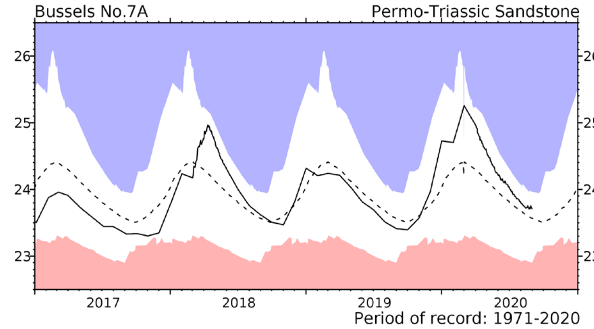


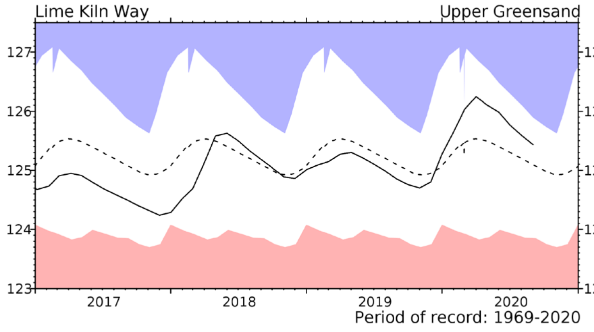


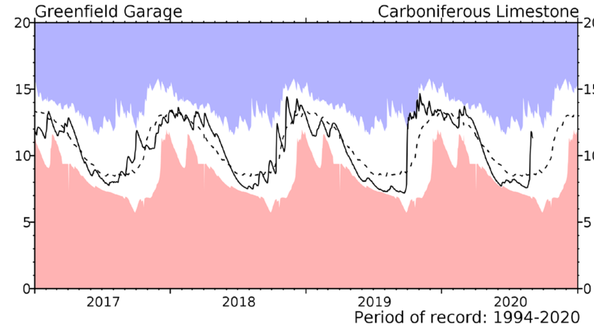




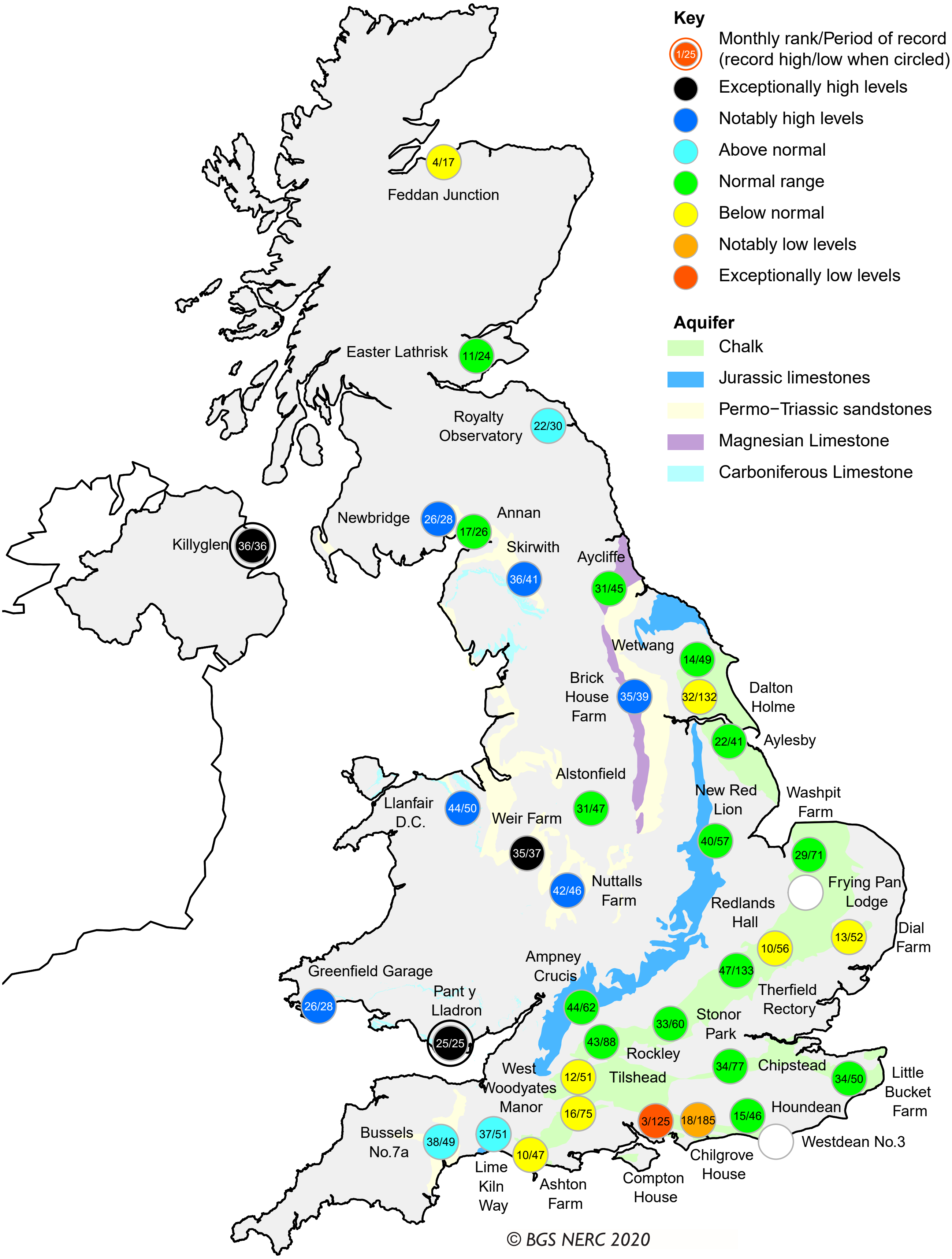








Groundwater...Groundwater

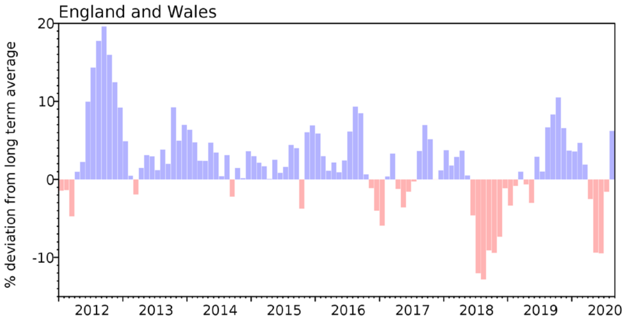


Groundwater levels - August 2020

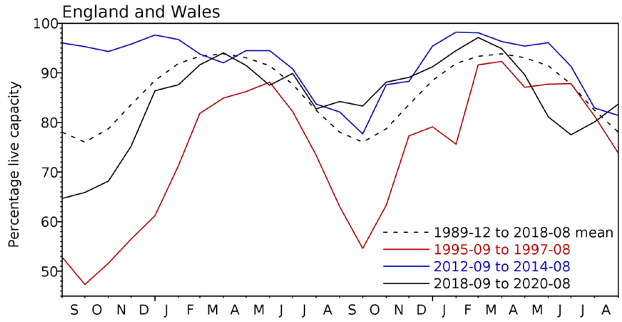
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated.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

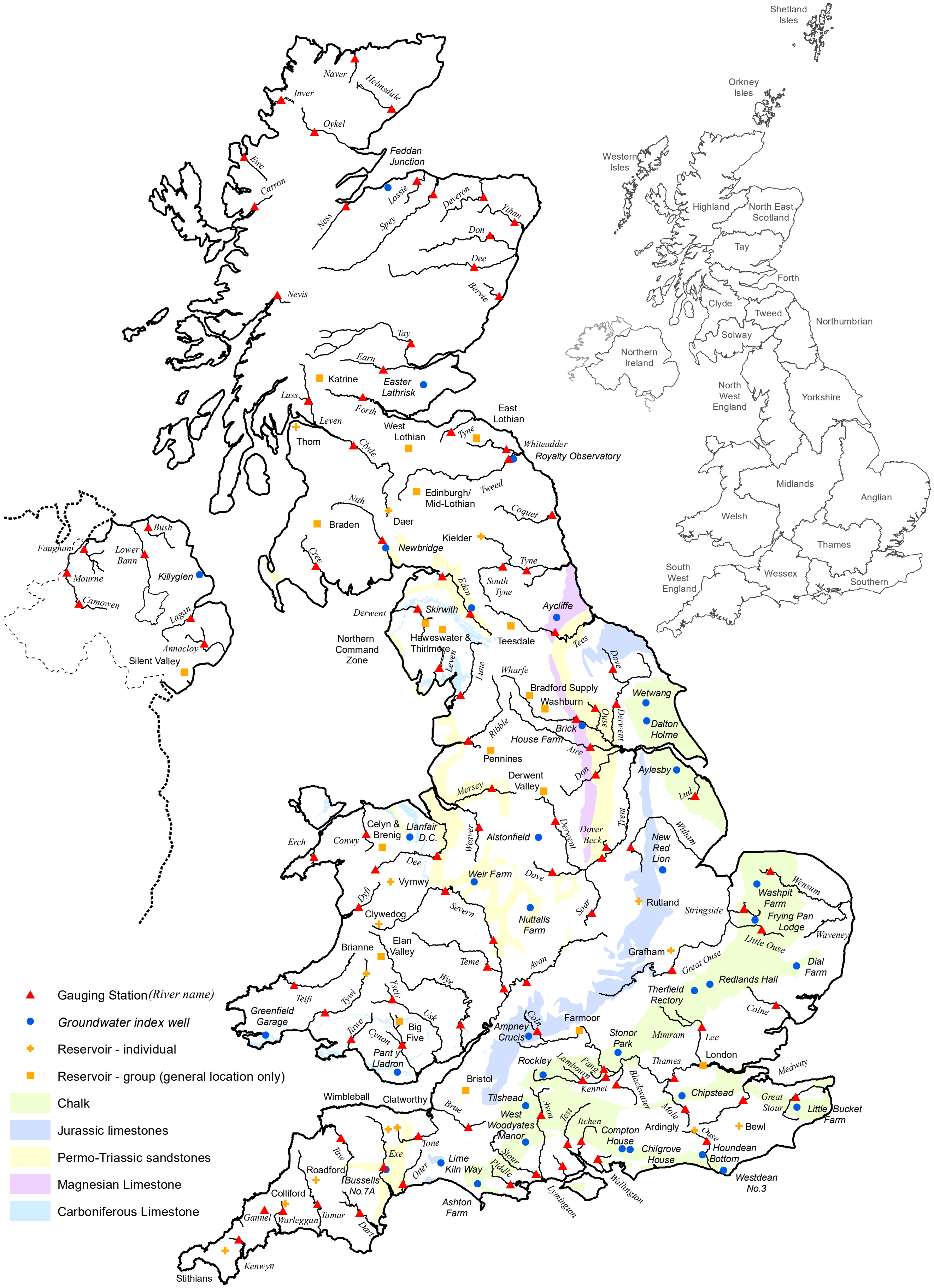
Area	Reservoir		Capacity (Ml)	2020 Jun	2020 Jul	2020 Aug	Aug Anom.	Min Aug	Year* of min	2019 Aug	Diff 20-19
North West	N Command Zone	•	124929	51	67	81	21	15	1984	80	1
	Vyrnwy		55146	73	81	100	27	36	1995	98	2
Northumbrian	Teesdale	•	87936	59	62	70	-2	38	1995	91	-21
	Kielder		(199175)	85	90	91	4	66	1989	90	2
Severn-Trent	Clywedog		49936	90	93	94	16	27	1976	95	-2
	Derwent Valley	•	46692	66	73	84	18	34	1995	86	-2
Yorkshire	Washburn	•	23373	67	77	90	20	34	1995	89	1
	Bradford Supply	•	40942	67	76	87	19	21	1995	83	4
Anglian	Grafham		(55490)	93	92	90	4	59	1997	81	10
	Rutland		(116580)	94	93	91	8	66	1995	95	-4
Thames	London	•	202828	93	90	88	7	62	1995	76	12
	Farmoor	•	13822	97	98	94	1	64	1995	96	-2
Southern	Bewl		31000	82	75	69	0	38	1990	72	-3
	Ardingly		4685	77	62	38	-36	38	2020	63	-25
Wessex	Clatworthy		5662	70	62	61	-4	31	1995	70	-9
	Bristol	•	(38666)	78	71	62	-7	43	1990	75	-13
South West	Colliford		28540	75	68	61	-11	43	1997	55	6
	Roadford		34500	79	66	65	-7	40	1995	50	15
	Wimbleball		21320	74	63	56	-14	40	1995	78	-22
	Stithians		4967	80	70	62	-1	30	1990	72	-9
Welsh	Celyn & Brenig	•	131155	70	79	87	4	49	1989	89	-2
	Brianne		62140	81	91	96	8	55	1995	97	-1
	Big Five	•	69762	68	69	73	0	29	1995	82	-9
	Elan Valley	•	99106	70	70	76	0	37	1976	83	-7
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	83	84	89	10	45	1998	84	5
	East Lothian	•	9317	91	87	98	12	63	1989	100	-2
Scotland(W)	Loch Katrine	•	110326	71	82	88	15	50	2000	91	-3
	Daer		22494	84	98	100	22	41	1995	99	1
	Loch Thom		10721	73	76	69	-15	58	1997	100	-31
Northern Ireland	Total+	•	56800	73	77	91	15	40	1995	92	-1
	Silent Valley	•	20634	66	71	91	17	33	2000	94	-3

( ) figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence

+ excludes Lough Neagh

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

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.

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