Hydrological Summary

for the United Kingdom

October 2020

General

October was blustery and remarkably wet; it was the fifth wettest October for the UK in a series from 1862. A UK-wide average rainfall total of 32mm was recorded on the 3rd, a volume of water sufficient to more than fill Loch Ness, making it the wettest day on record for the UK (in a series from 1891). Correspondingly, October river flows ranged from normal to exceptionally high, although limited flooding occurred, likely due to the drier soils established in previous months. Soil Moisture Deficits (SMDs) fell in all regions and were eliminated in regions in the south and east of the UK, initiating groundwater recharge in many of the index boreholes. Overall, groundwater levels were high in the Permo-Triassic sandstones and normal or above in other aquifers. Reservoir stocks for England & Wales were marginally above average, notably so at Washburn, Bradford Supply and Clatworthy where they were around 30% above average. The onset of groundwater recharge and the status of reservoir stocks mean the water resources situation is healthy. However with soils now at or close to saturation, there is an enhanced risk of fluvial flooding heading into the winter.

Rainfall

Three named storms dominated October, accompanied by frequent bands of frontal rainfall from large Atlantic low pressure systems brought to the UK on a strong Jet Stream. Storm 'Alex' (named by Météo-France) brought heavy rainfall with totals over 50mm recorded widely on the 3rd (the highest: 127mm at Fettercairn, Kincardineshire) and set a record 3-day total of 105mm at Oxford (in a series from 1828). There was resulting widespread travel disruption across the UK and localised flooding and power cuts in southern England. More settled, but still showery, conditions prevailed from the 14th until storm 'Barbara' (named by the Spanish State Meteorological Agency) delivered large rainfall totals on the 19th (e.g. 73mm at Tiree, Inner Hebrides, and 58mm at Trassey, County Down) and caused travel disruption across Scotland and Northern Ireland on the 22nd. At month-end, two Atlantic low-pressure systems brought strong winds and further heavy and persistent rainfall on the 29th during storm 'Aiden' (e.g. 90mm at Seathwaite, Cumbria), which again resulted in travel disruption, and on the 30th (e.g. 61mm at Achnagart, Inverness-shire). Above average rainfall was registered across the UK in October (144% of average for the UK as a whole) with more than twice the average recorded in parts of north-east Scotland and southern England (and localised areas of more than 225% of average in the latter). It was the wettest October on record for Thames region and second wettest for the Tay and North East regions in Scotland (after 1932, in series from 1910). Welsh region was the driest with 128% of the October average. September-October rainfall was above average across much of the UK, despite the dry September, with the exception of a band from Cornwall to Lincolnshire.

River flows

River flows across the country responded to rainfall accompanying storm 'Alex' at the start of the month. A new October peak flow maximum was set on the Bervie on the 3rd (in a series from 1979) and the second highest recorded on the Deveron on the 4th (in a series from 1960). Despite the heavy rainfall brought by 'Alex', little flooding was reported, with the exception of Rothbury (Northumberland) and Abergwyngregyn (Gwynedd) on the 4th. Flows began to recede mid-month, but were halted by 'Barbara' in some catchments – particularly in the north and west. New daily flow maxima were established between the 20th and 22nd in northern Scotland and some residents were evacuated due to flooding in Ellon (Aberdeenshire) on the 22nd. Flow responses to 'Aiden' were visible across the UK, but were again particularly prominent in northern and western catchments. October monthly mean flows were in the normal range to exceptionally high and exceeded twice the average in a number of catchments (e.g. the Deveron, Bush and Lee). A new October maximum was recorded on the Ythan where flows were more than twice the average (in a series from 1983). Exceptionally high flows on the Brue were more than three times the average, the second highest for October (behind 2000) in a series from 1964. Outflows for the UK showed similar responses highlighting the widespread nature of the persistent wet weather throughout the month. For the autumn so far (September-October), flows were also in the normal range to notably high, with a number of catchments across country recording more than 150% of average (e.g. the Ness, Bush, Great Ouse and Teifi).

Groundwater

Most SMDs across the UK were eliminated by October rainfall, although deficits remained around The Wash and Humber Estuary. SMDs in Thames region fell by 108mm to near-zero, the biggest September to October recovery in a series from 1961. A response to storm 'Alex' was observed at several boreholes in the Chalk, the Jurassic limestones and the Permo-Triassic sandstones. Levels in the Chalk were mainly normal or above normal as groundwater recharge commenced at about half of the Chalk index sites, although recessions continued over the Chilterns and North Downs. At Chilgrove House, seasonal recharge began in earnest towards month-end but levels remained notably low. In the Jurassic and Magnesian limestones, levels rose or were stable; rising to notably high at Ampney Crucis and remaining so at Brick House Farm. Levels in the Carboniferous Limestone at Alstonfield rose and remained in the normal range. Levels fell to within the normal range in the Upper Greensand at Lime Kiln Way. In the Permo-Triassic sandstones, levels were mainly above normal and rose at over half of the available boreholes, while at Weir Farm the level fell but remained exceptionally high. The level rose at Royalty Observatory in the Fell Sandstone and remained above normal. At Feddan Junction in the Devonian sandstones, the level which had been below normal, rose rapidly and ended the month above normal. The level at Easter Laskrith rose but remained in the normal range.

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.

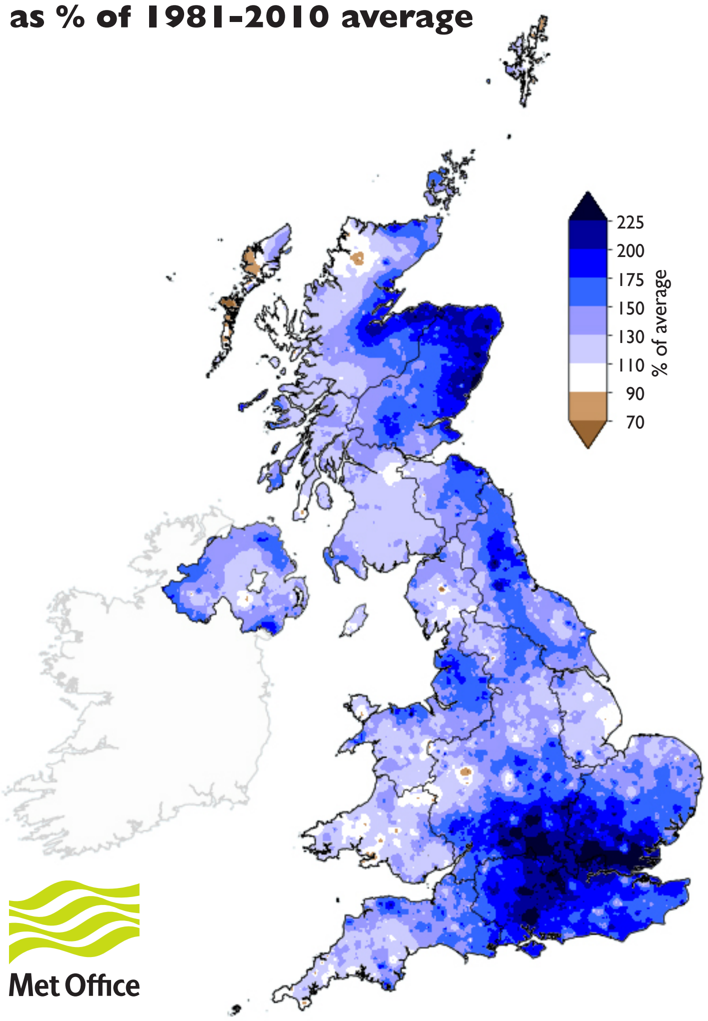
Region	Rainfall	Oct 2020	Sep20 – Oct20	RP	Aug20 – Oct20	RP	Jun20 – Oct20	RP	Nov19 – Oct20	RP
United	mm	**179**	254		374		575		1302	
Kingdom	%	**144**	116	5-10	123	5-10	127	15-25	116	25-40
England	mm	**141**	186		295		448		980	
	%	**156**	117	2-5	130	5-10	128	8-12	116	8-12
Scotland	mm	**238**	360		477		734		1743	
	%	**140**	120	5-10	116	5-10	125	10-20	115	30-50
Wales	mm	**208**	285		460		712		1645	
	%	**126**	103	2-5	121	2-5	129	8-12	116	10-15
Northern	mm	**166**	244		400		643		1297	
Ireland	%	**138**	115	2-5	129	8-12	138	30-50	114	15-25
England &	mm	**150**	199		318		485		1072	
Wales	%	**149**	114	2-5	128	5-10	128	8-12	116	8-12
North West	mm	**191**	271		444		732		1505	
	%	**140**	113	2-5	130	5-10	144	15-25	123	20-30
Northumbria	mm	**133**	183		302		464		946	
	%	**156**	117	2-5	130	5-10	127	5-10	109	2-5
Severn-Trent	mm	**114**	144		259		404		906	
	%	**142**	99	2-5	124	5-10	121	5-10	116	5-10
Yorkshire	mm	**118**	172		292		481		999	
	%	**144**	115	2-5	132	5-10	137	10-20	119	8-12
Anglian	mm	**98**	145		220		333		672	
	%	**156**	123	5-10	126	5-10	119	5-10	108	2-5
Thames	mm	**167**	194		291		403		865	
	%	**213**	142	8-12	151	15-25	137	10-15	121	8-12
Southern	mm	**180**	216		282		357		916	
	%	**185**	135	5-10	130	5-10	113	2-5	115	5-10
Wessex	mm	**163**	196		301		431		1023	
	%	**163**	116	2-5	129	5-10	125	5-10	116	5-10
South West	mm	**182**	236		379		579		1449	
	%	**131**	103	2-5	122	2-5	126	5-10	118	10-15
Welsh	mm	**204**	276		449		694		1590	
	%	**128**	103	2-5	122	5-10	129	8-12	116	10-15
Highland	mm	**264**	421		485		742		1983	
	%	**133**	119	5-10	101	2-5	111	2-5	110	10-15
North East	mm	**222**	276		355		565		1142	
	%	**187**	134	8-12	124	5-10	132	10-20	112	5-10
Tay	mm	**250**	334		463		698		1613	
	%	**164**	126	5-10	128	5-10	134	15-25	120	25-40
Forth	mm	**191**	271		435		653		1470	
	%	**144**	114	2-5	131	10-20	133	15-25	122	40-60
Tweed	mm	**165**	217		372		577		1248	
	%	**149**	112	2-5	134	8-12	136	10-20	122	20-30
Solway	mm	**226**	337		539		876		1808	
	%	**132**	115	2-5	131	10-15	147	50-80	122	50-80
Clyde	mm	**269**	436		616		951		2186	
	%	**131**	120	5-10	122	5-10	133	20-30	120	40-60

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

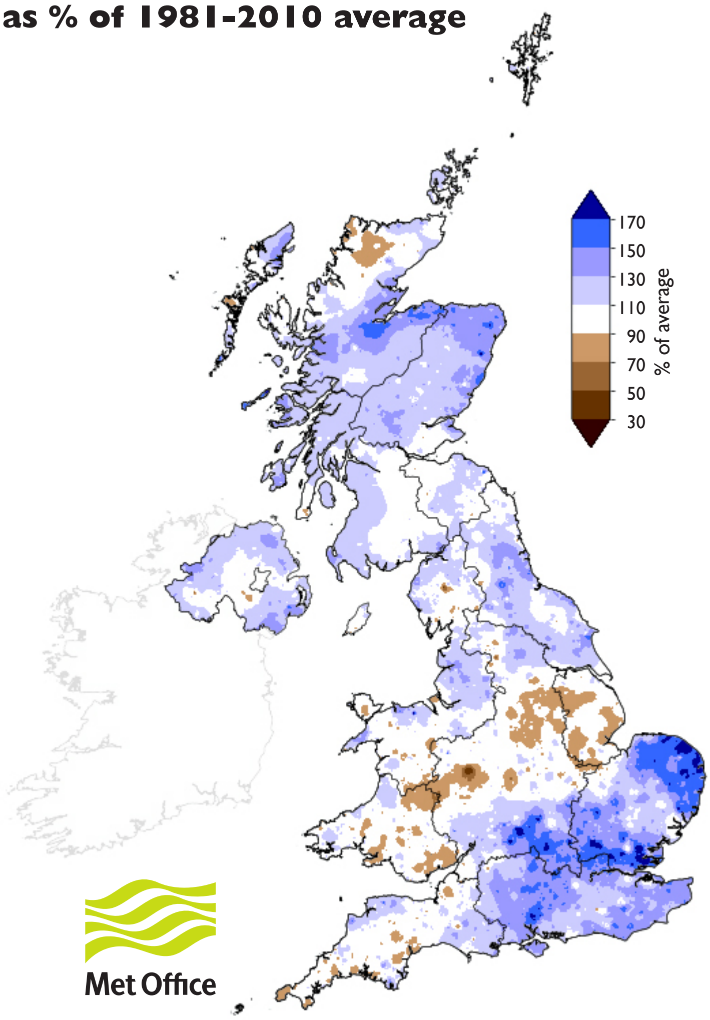
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

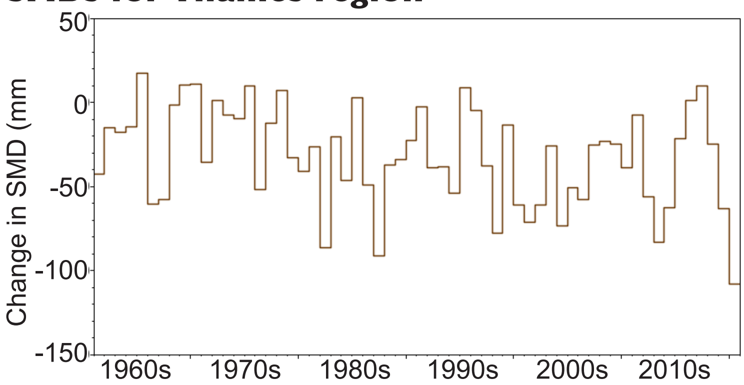
October 2020 rainfall as % of 1981-2010 average



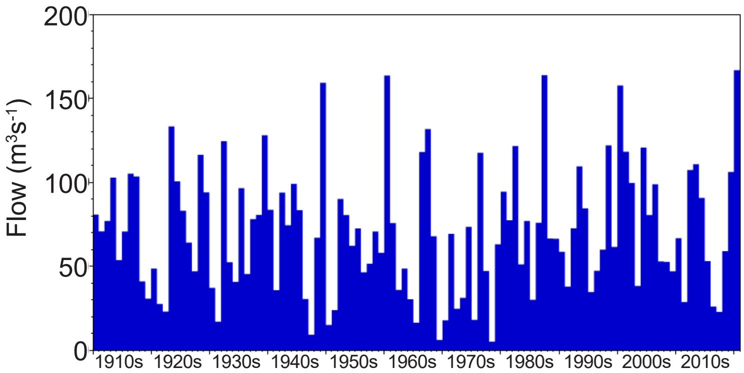
September 2020 - October 2020 rainfall as % of 1981-2010 average



September - October changes in MORECS SMDs for Thames region



October rainfall for Thames region



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.

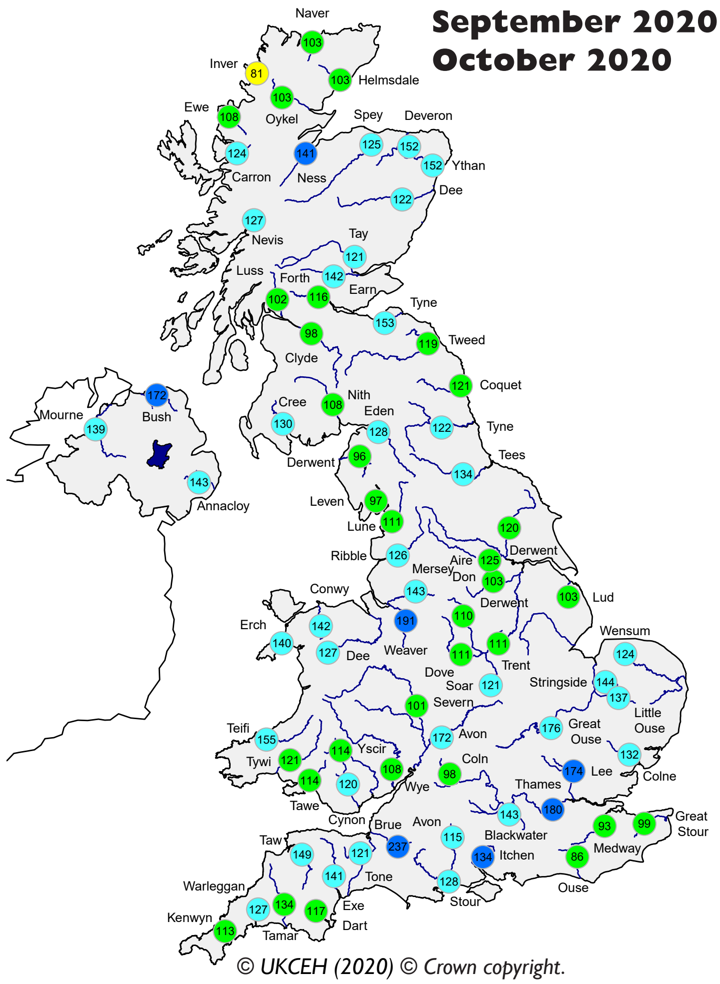
The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from November 2020**
Issued: **09.11.2020**
using data to the end of October 2020

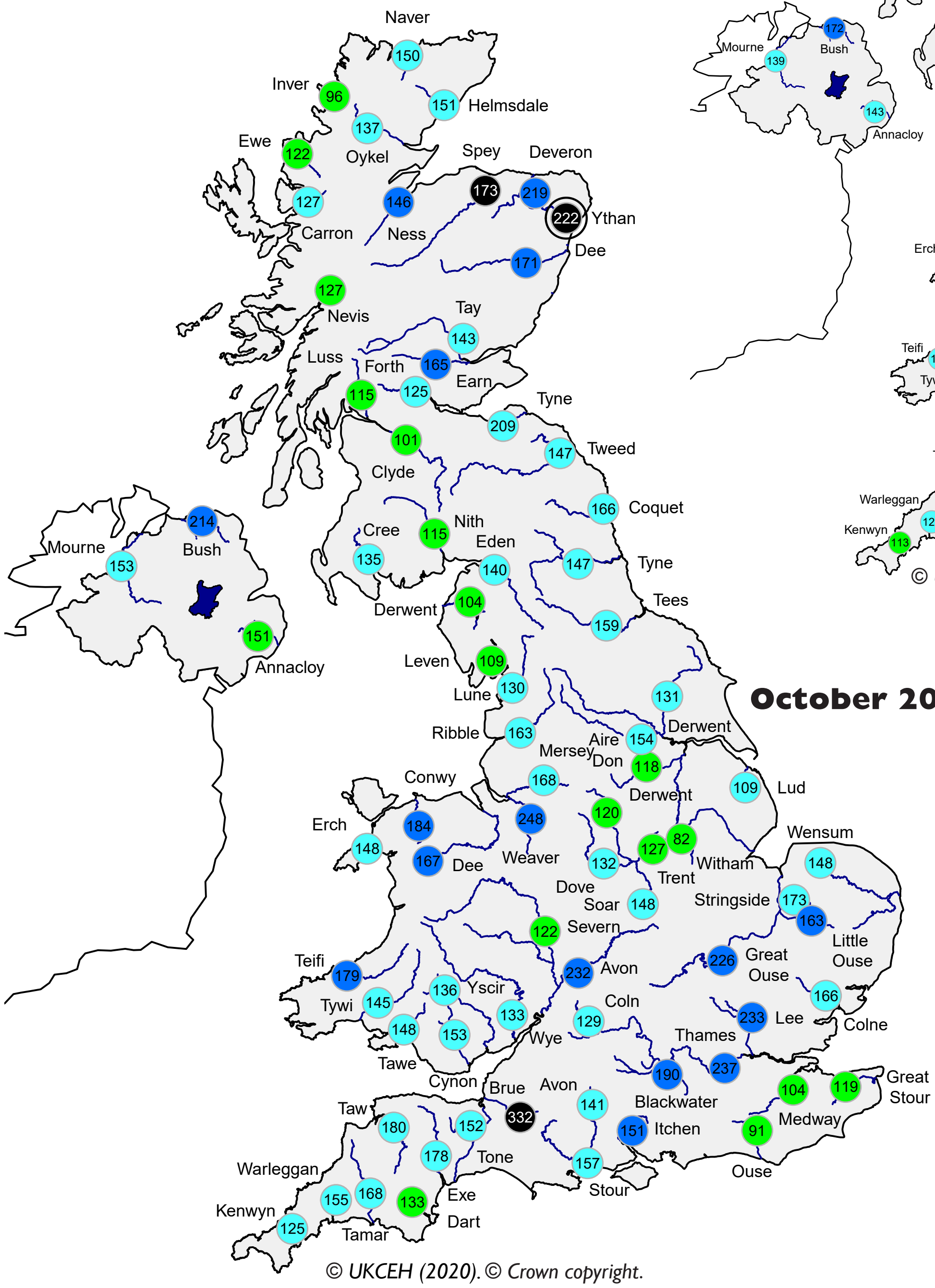
Following a wet October across the majority of the UK, river flows are in the normal to above normal range. Normal to above normal flows are expected to continue through November to the east and south of the UK, but to the north-west normal flows are more likely. Over the three month period to the end of January river flows are expected to be normal. In November and the three months to January, groundwater levels are expected to be normal in the Chalk of south-east England, and normal to above normal in all other areas.

River flow . . . River flow . . .

September 2020 - October 2020



October 2020



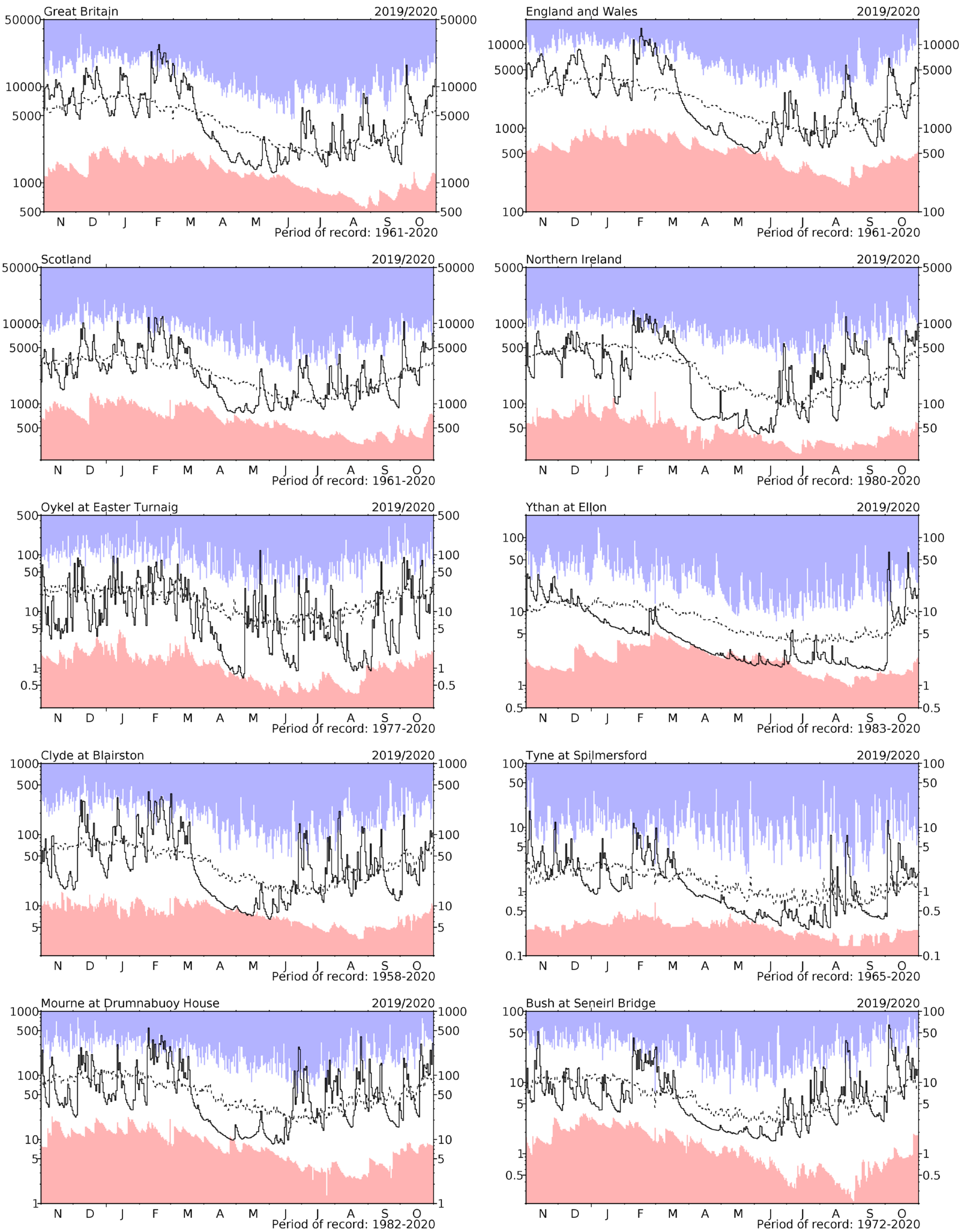
Key

- 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**

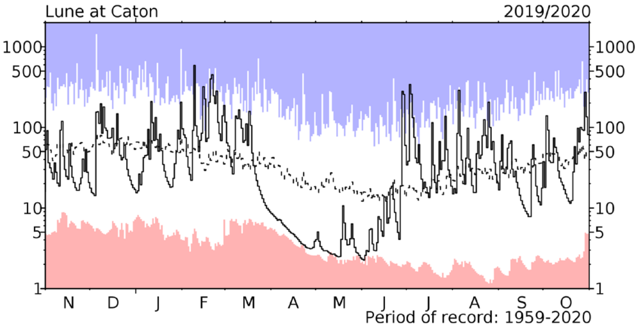
River flows

*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.

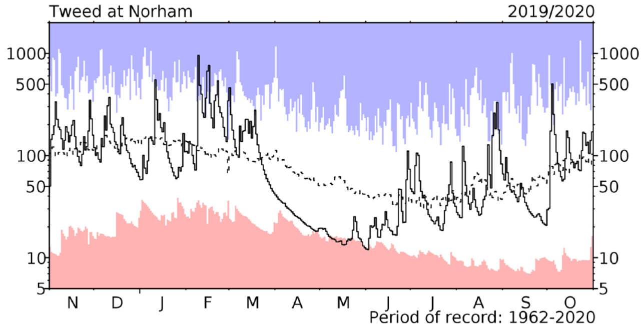


River flow hydrographs

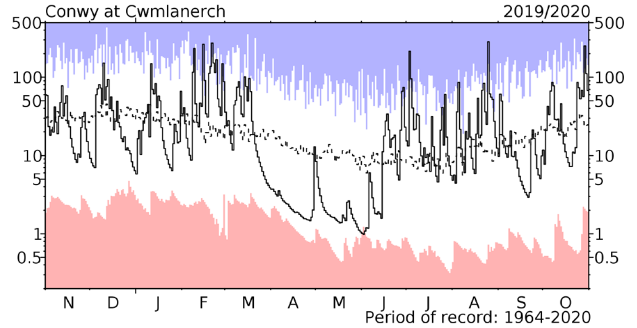
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to Novemer 2019 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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



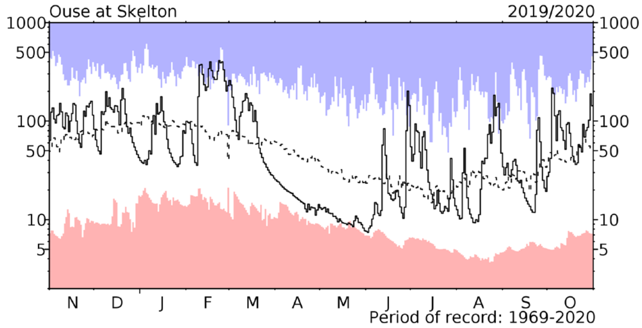
Lune at Caton
2019/2020
N D J F M A M J J A S O
Period of record: 1959-2020



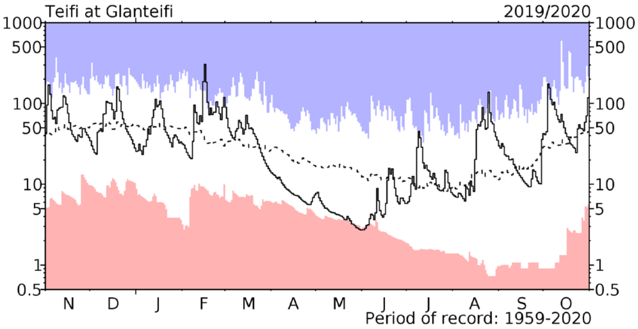
Tweed at Norham
2019/2020
N D J F M A M J J A S O
Period of record: 1962-2020



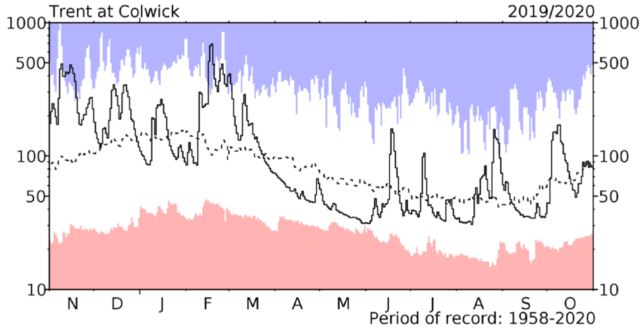
Conwy at Cwmlanerch
2019/2020
N D J F M A M J J A S O
Period of record: 1964-2020



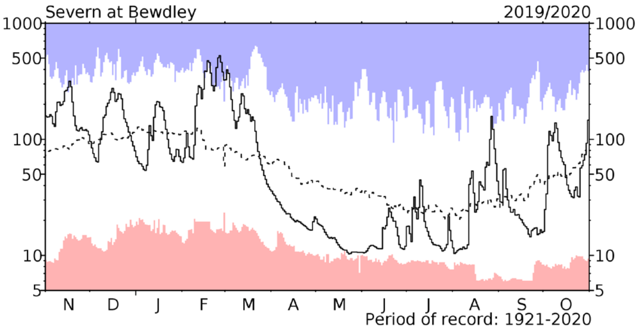
Ouse at Skelton
2019/2020
N D J F M A M J J A S O
Period of record: 1969-2020



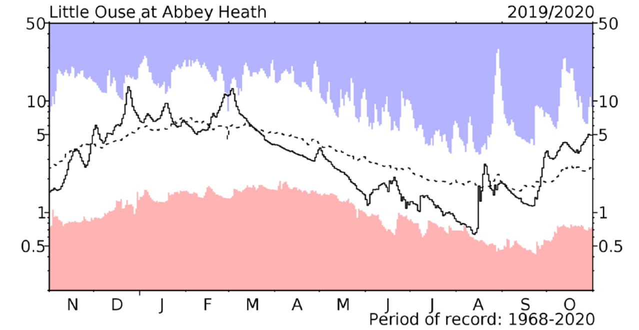
Teifi at Glanteifi
2019/2020
N D J F M A M J J A S O
Period of record: 1959-2020



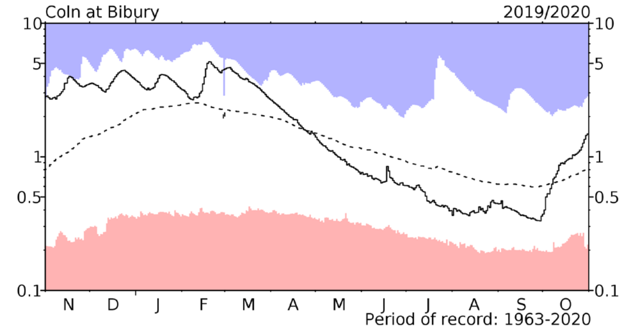
Trent at Colwick
2019/2020
N D J F M A M J J A S O
Period of record: 1958-2020



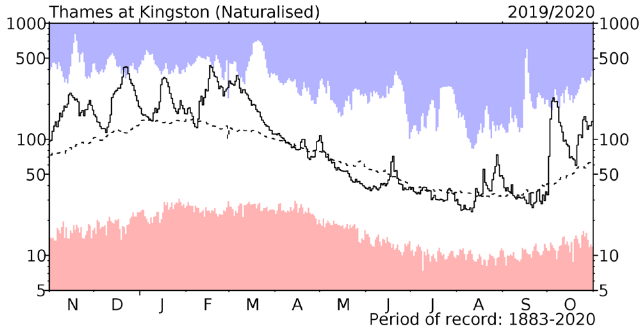
Severn at Bewdley
2019/2020
N D J F M A M J J A S O
Period of record: 1921-2020



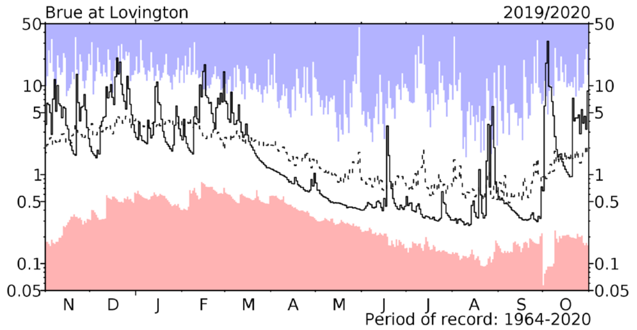
Little Ouse at Abbey Heath
2019/2020
N D J F M A M J J A S O
Period of record: 1968-2020



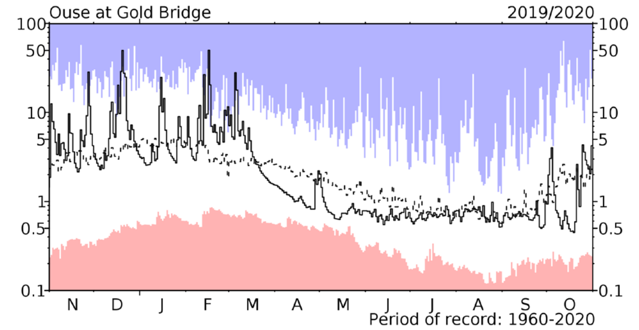
Coln at Bibury
2019/2020
N D J F M A M J J A S O
Period of record: 1963-2020



Thames at Kingston (Naturalised)
2019/2020
N D J F M A M J J A S O
Period of record: 1883-2020

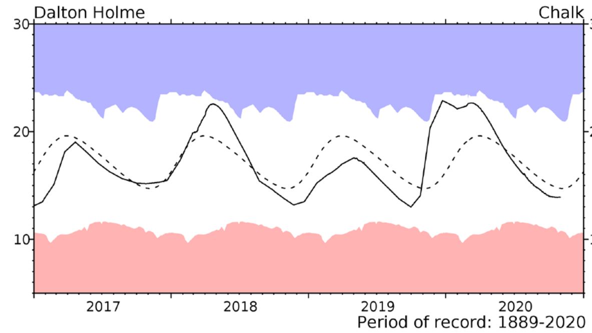


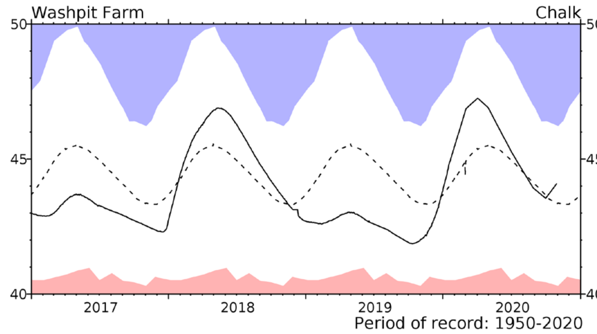
Brue at Lovington
2019/2020
N D J F M A M J J A S O
Period of record: 1964-2020

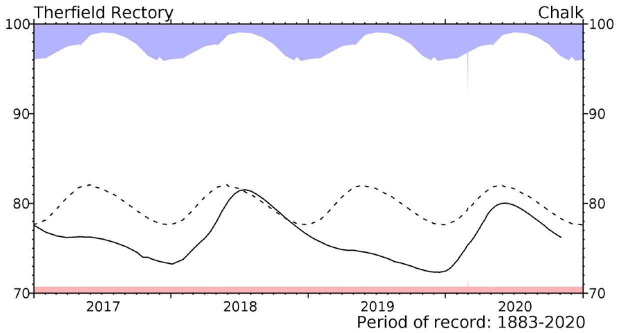


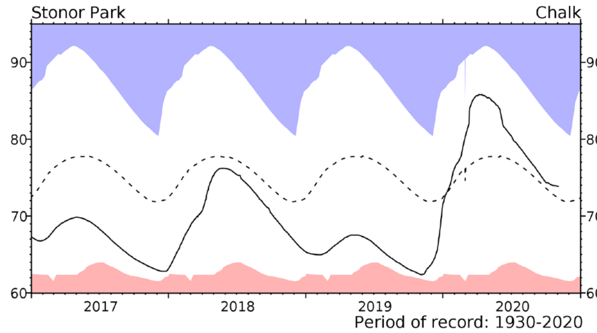
Ouse at Gold Bridge
2019/2020
N D J F M A M J J A S O
Period of record: 1960-2020

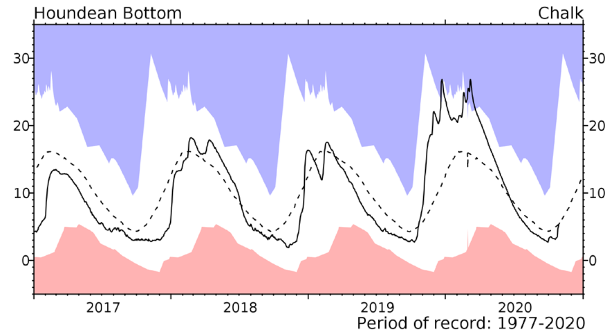
Groundwater . . . Groundwater

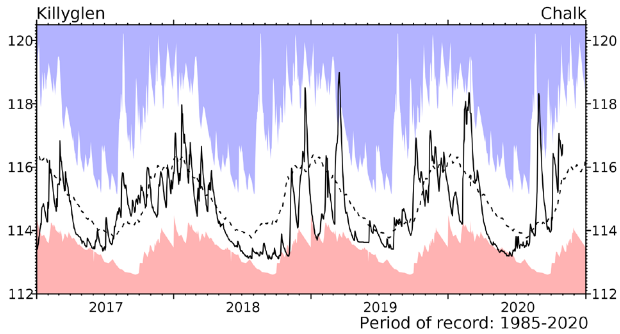


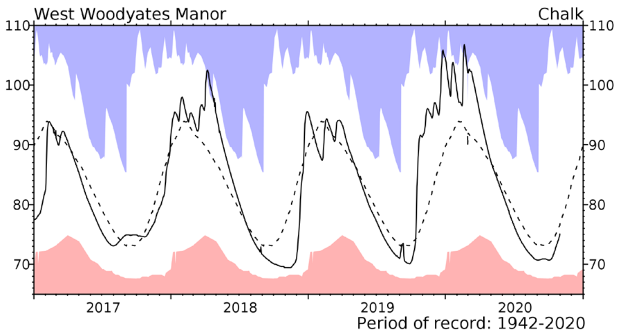


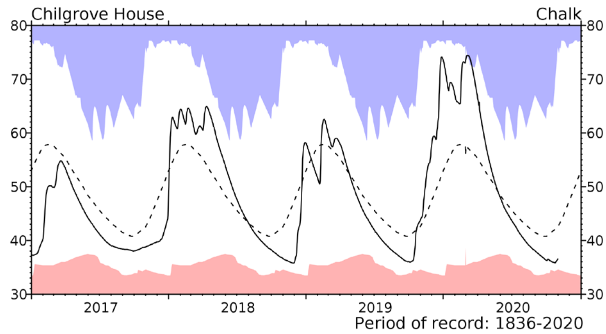


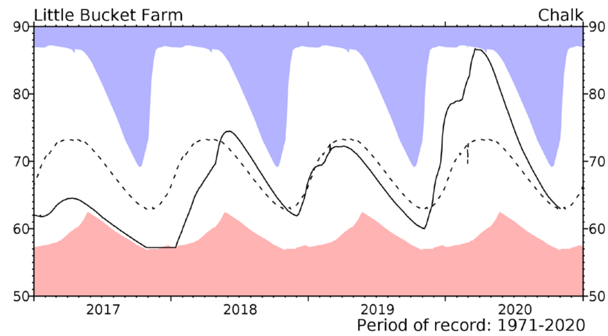


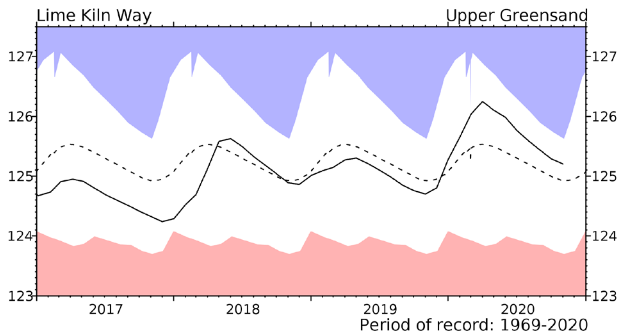






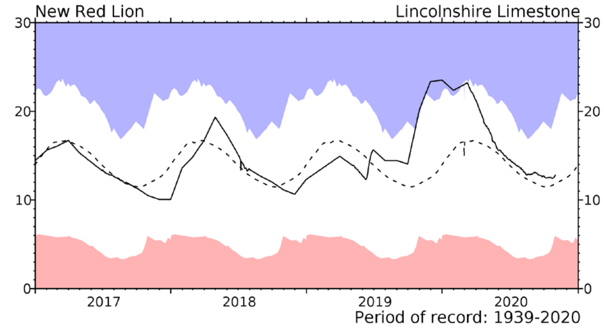


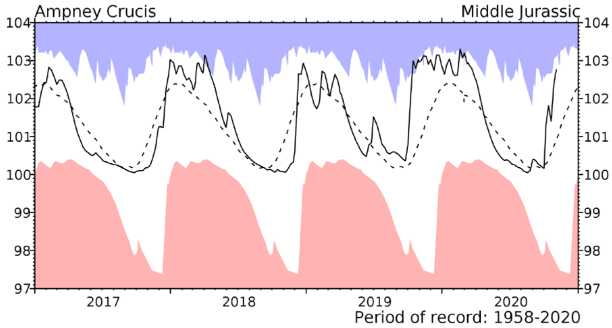


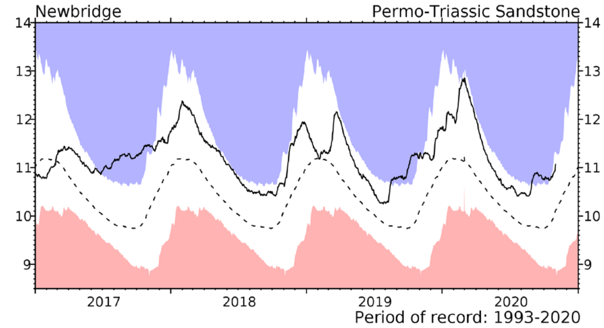


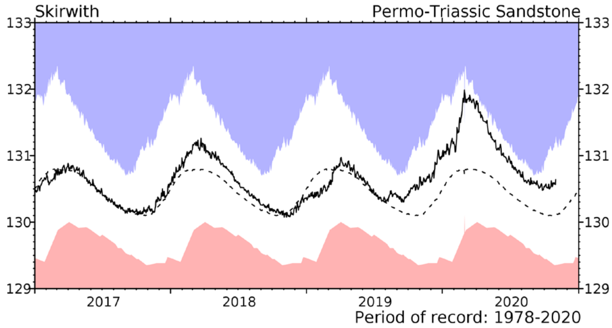
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

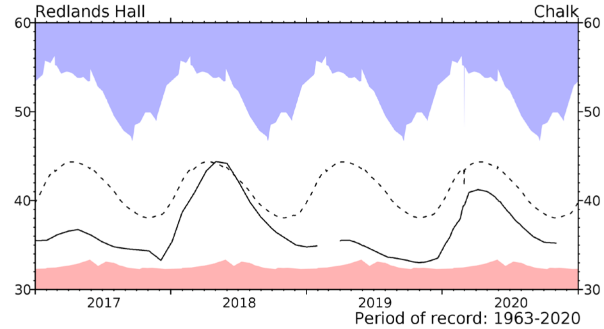
Groundwater ... Groundwater

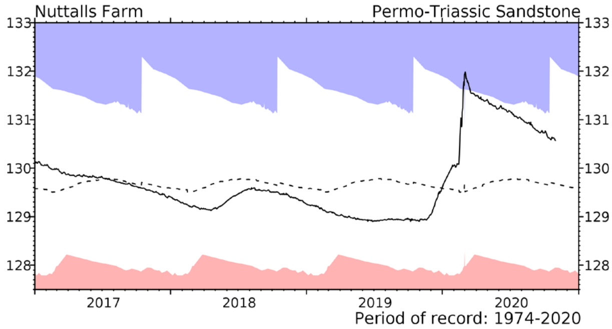


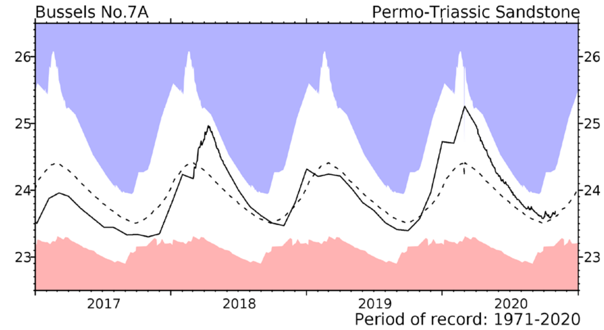


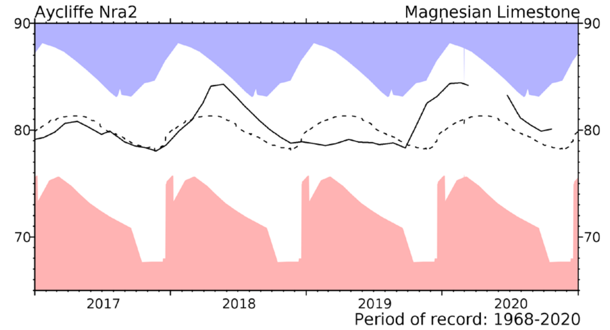


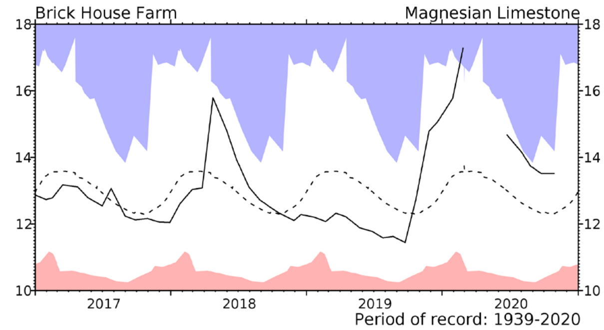


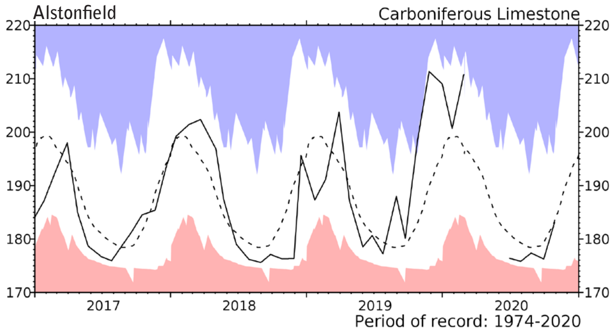


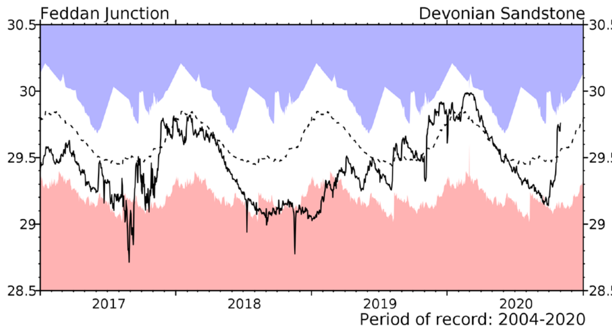


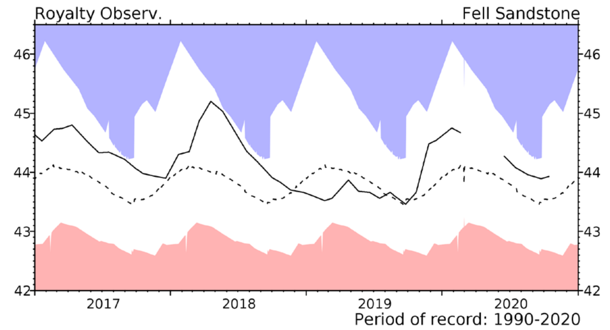




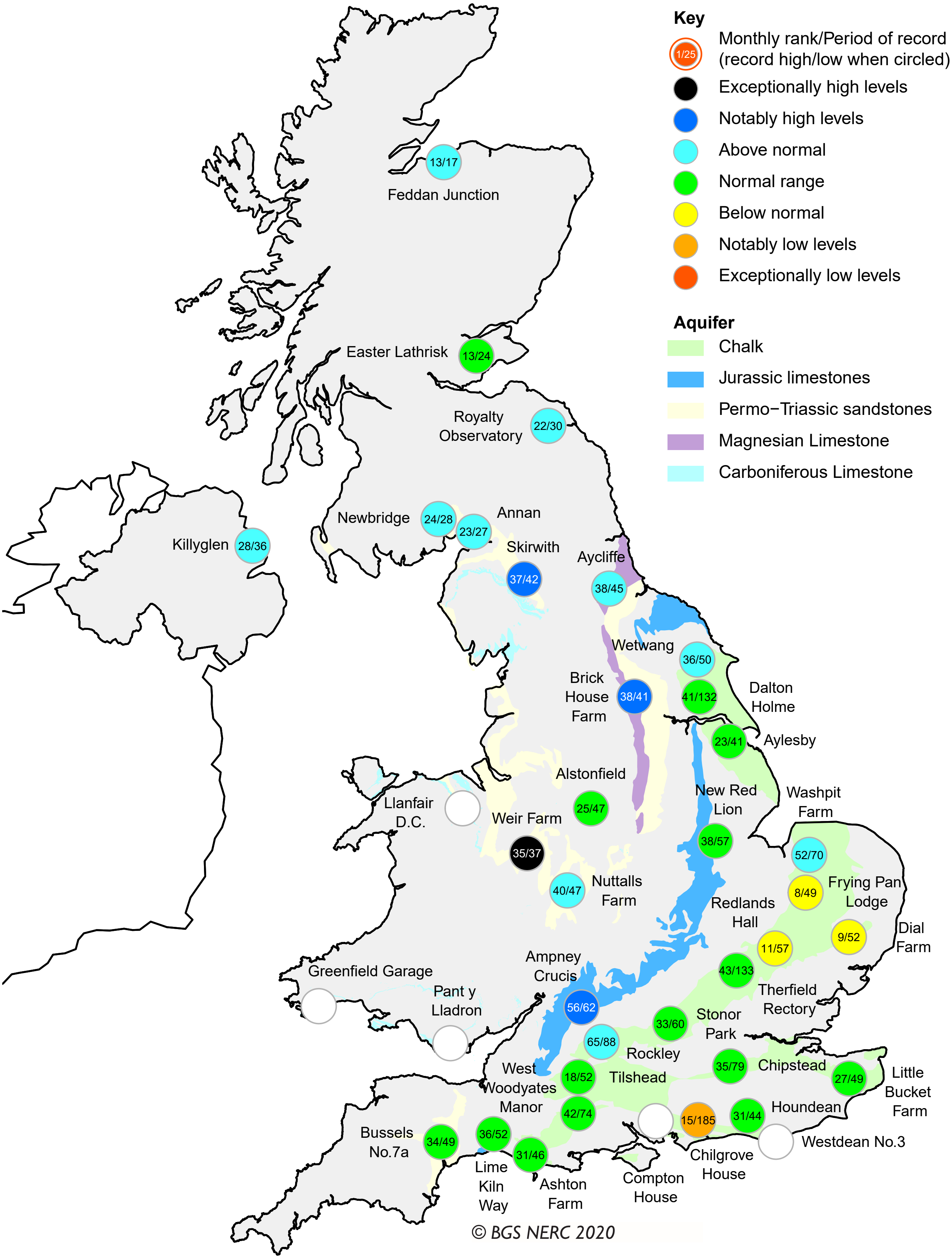








Groundwater...Groundwater

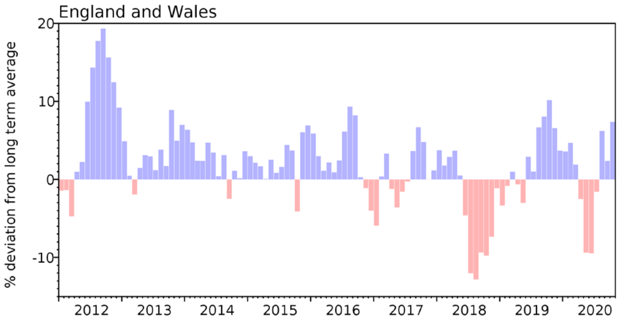


Groundwater levels - October 2020

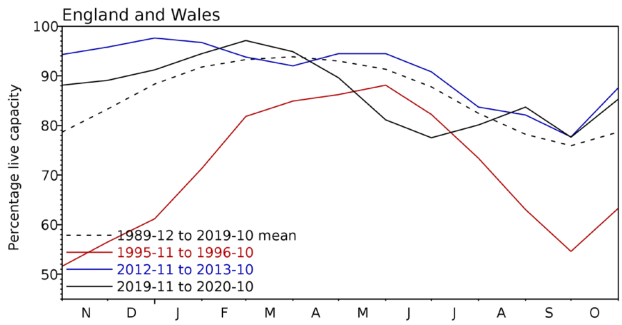
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated.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

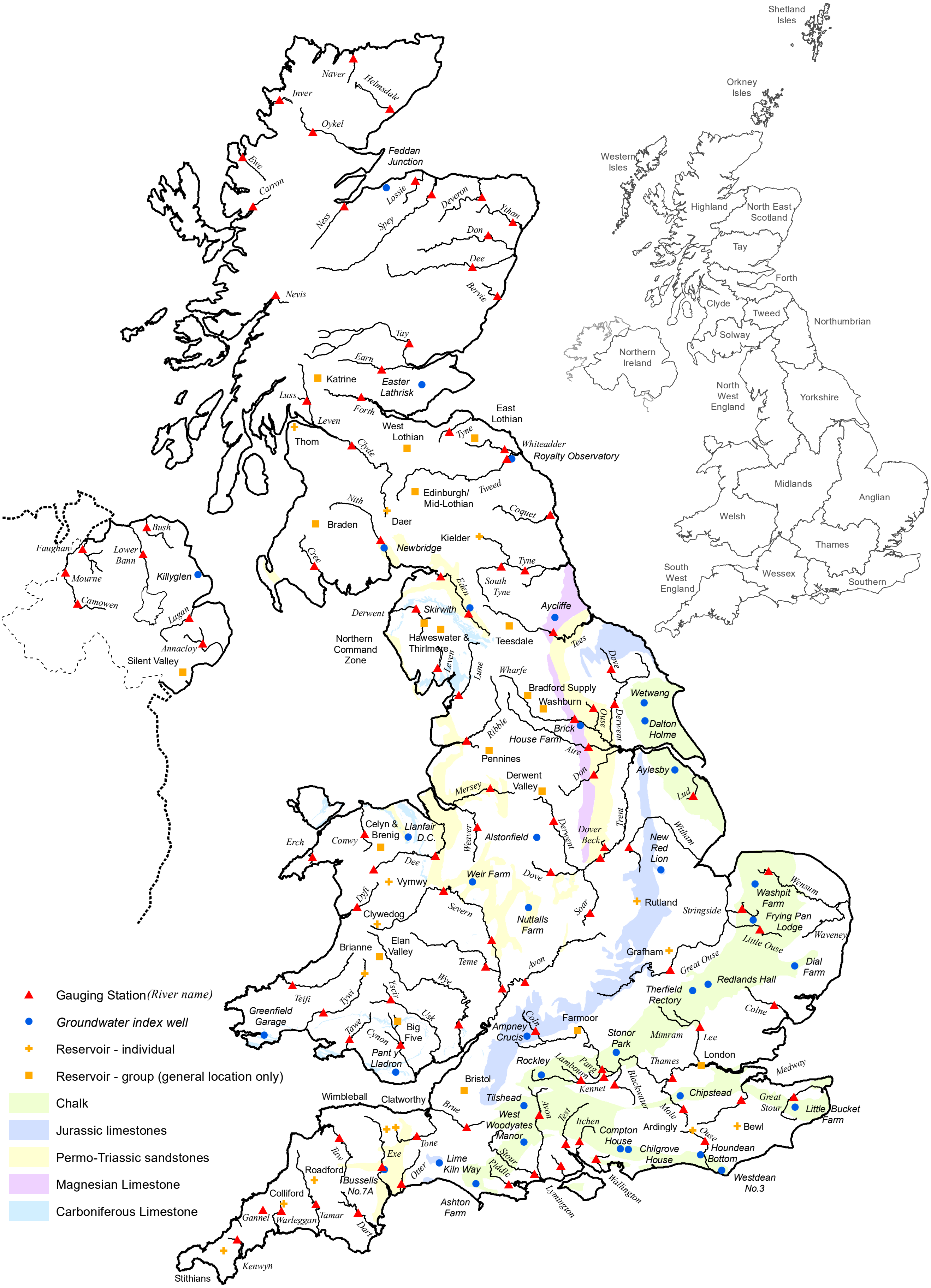
Area	Reservoir		Capacity (Ml)	2020 Aug	2020 Sep	2020 Oct	Oct Anom.	Min Oct	Year* of min	2019 Oct	Diff 20-19
North West	N Command Zone	•	124929	81	74	85	17	33	2003	78	7
	Vyrnwy		55146	100	93	98	21	25	1995	100	-3
Northumbrian	Teesdale	•	87936	70	65	83	6	33	1995	96	-13
	Kielder		(199175)	91	80	86	0	63	1989	82	4
Severn-Trent	Clywedog		49936	94	87	89	11	38	1995	88	1
	Derwent Valley	•	46692	84	78	92	22	15	1995	100	-8
Yorkshire	Washburn	•	23373	90	91	97	27	15	1995	99	-2
	Bradford Supply	•	40942	87	86	100	27	16	1995	100	0
Anglian	Grafham		(55490)	90	90	91	8	44	1997	84	7
	Rutland		(116580)	91	88	88	8	59	1995	96	-8
Thames	London	•	202828	88	84	79	2	46	1996	89	-10
	Farmoor	•	13822	94	97	98	9	43	2003	97	1
Southern	Bewl		31000	69	60	60	0	33	1990	77	-17
	Ardingly		4685	38	21	27	-38	15	2003	67	-40
Wessex	Clatworthy		5662	61	60	93	31	14	2003	85	8
	Bristol	•	(38666)	62	51	75	13	24	1990	88	-13
South West	Colliford		28540	61	57	62	-9	38	2006	59	2
	Roadford		34500	65	61	68	-2	18	1995	58	10
	Wimbleball		21320	56	50	65	-1	26	1995	88	-23
	Stithians		4967	62	54	61	3	18	1990	99	-38
Welsh	Celyn & Brenig	•	131155	87	86	100	16	48	1989	84	16
	Brianne		62140	96	84	100	7	57	1995	100	0
	Big Five	•	69762	73	65	71	-6	38	2003	87	-16
	Elan Valley	•	99106	76	67	86	1	37	1995	97	-11
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	89	86	89	8	48	2003	88	1
	East Lothian	•	9317	98	100	100	15	38	2003	100	0
Scotland(W)	Loch Katrine	•	110326	88	88	95	8	40	2003	95	0
	Daer		22494	100	94	100	10	42	2003	100	0
	Loch Thom		10721	69	59	63	-28	63	2020	96	-33
Northern	Total+	•	56800	91	90	98	17	39	1995	96	2
Ireland	Silent Valley	•	20634	91	87	100	23	34	1995	97	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.

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