Hydrological Summary
for the United Kingdom

November 2020

General

November was generally mild (the fifth warmest for the UK, and third for Scotland, in records from 1910) with south-westerly winds and outbreaks of rain, interspersed by periods of high pressure with patchy fog. Rainfall was above average in the north-west, but for the UK as a whole it was below average, most notably in some eastern areas. Following a wet October, river flows in many catchments started high, and average November flows for some rivers were notably high, particularly in the north-west. Elsewhere, however, average monthly river flows were predominantly normal or above normal. Groundwater levels increased at the majority of index wells, with the recharge season widely underway. Levels were normal or above at most index sites, with some exceptionally high levels observed. Reservoir stocks were close to normal at the national scale, and November saw increases in some impoundments in western Britain (e.g. Northern Command Zone and Loch Thom). Overall, despite a generally dry November, current conditions indicate a healthy water resources outlook entering the winter. Conversely, with some groundwater levels above normal and soils wetted across most of the country, above average rainfall over the next few months would carry an elevated risk of winter flooding.

Rainfall

The wet October weather continued into November with heavy rainfall (e.g. 96mm at Beckermonds, North Yorkshire and 94mm at Capel Curig, Gwynedd on the 1st) resulting in road and rail closures, and power outages in Scotland, Wales and northern England. A ridge of high pressure brought fog and sunshine from 4th-7th before westerly winds with bands of frontal rain dominated the middle fortnight. Rainfall was heavy at times (e.g. 129mm was recorded on the 11th at Skye Alltdearg House, Inverness-shire) causing some flooding of roads in Wales on the 11th, Northern Ireland on the 15th and Scotland on the 17th. A brief cold snap followed, with wintry showers over high ground in Scotland on the 19th, before a return to unsettled conditions. Separation of the jet stream brought high pressure and patchy fog from 26th–29th before rain returned on the 30th. Overall, November was somewhat dry, with 85% of the long-term average monthly rainfall at the national scale, but there was a marked east-west gradient in the north. Clyde was the wettest region with 123% of long-term average rainfall, and areas of upland western Scotland recorded more than 130% of average. By contrast, the North East (of Scotland), Northumbria and Anglian regions each recorded around half of their respective typical November rainfall, with less than 30% in some north-east coastal areas. September and November were the only predominantly dry months of those comprising summer and autumn (June-November), and the UK as a whole received 119% of average rainfall over this timescale. For Northern Ireland, it was the wettest June-November in a series from 1910, narrowly exceeding the maximum established in 1950.

River flows

Flows were high at the start of the month, as the response to heavy rain associated with storm 'Aiden' at the end of October continued. New November peak flow maxima were established on the 1st on the Ribble (exceeding its November 2000 peak) and on the Welsh Dee (equalling the November 2009 peak that was, in fact, the highest recorded in any month in a series from 1969). Roads and local amenities were inundated by fluvial floodwater from the Ure in North Yorkshire, where nine people were rescued from vehicles in Appersett, whilst in West Yorkshire the Wharfe recorded its highest peak flow on record (in a series from 1973). Flows receded widely from the 4th-11th, before rising again mid-month (12th-18th) although no notable peaks were recorded. Thereafter, flows receded to month-end, with some interruptions, predominantly in the north-west. November monthly mean flows were normal or above normal across much of the UK, and below normal in some north-east coastal catchments. However, in parts of the north and west flows were notably high — the Earn recorded 175% of its long-term average November flow, the fourth highest in a long record (starting in 1948). For the autumn (September–November), flows were also generally normal or above, with those on the Earn and Conwy the third highest on record (in series starting in 1948 and 1964, respectively).

Groundwater

Soil moisture deficits were near zero across most of the UK with some remaining in a region adjacent to The Wash. Groundwater levels in the Chalk rose at the majority of sites, with seasonal recharge occurring across the aquifer, with the exception of Aylesby and Therfield Rectory. Killyglen received some recharge but fell overall. All sites were in the normal range or above, except Frying Pan Lodge where a mid-month dip was below normal for November. Exceptionally high levels were recorded at Washpit Farm. Levels in the Jurassic and Magnesian limestones rose (New Red Lion) or were stable, and remained normal or above at all sites. Levels also rose in the Carboniferous Limestone at Alstonfield and were stable at Greenfield Garage, with levels both in the normal range. Levels continued to fall in the Upper Greensand at Lime Kiln Way and remained normal. In the Permo Triassic sandstones, levels rose in the north and fell in the Midlands, but were normal or above at all sites. The groundwater level continued to rise and became exceptionally high at Annan, while Newbridge was notably high. The level remained exceptionally high for the time of year at Weir Farm despite a small fall in level. The level continued to rise at Royalty Observatory in the Fell Sandstone. Groundwater levels in the Devonian sandstones were in the normal range, with a decline at Feddan Junction and a slight rise at Easter Lathrisk.

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.

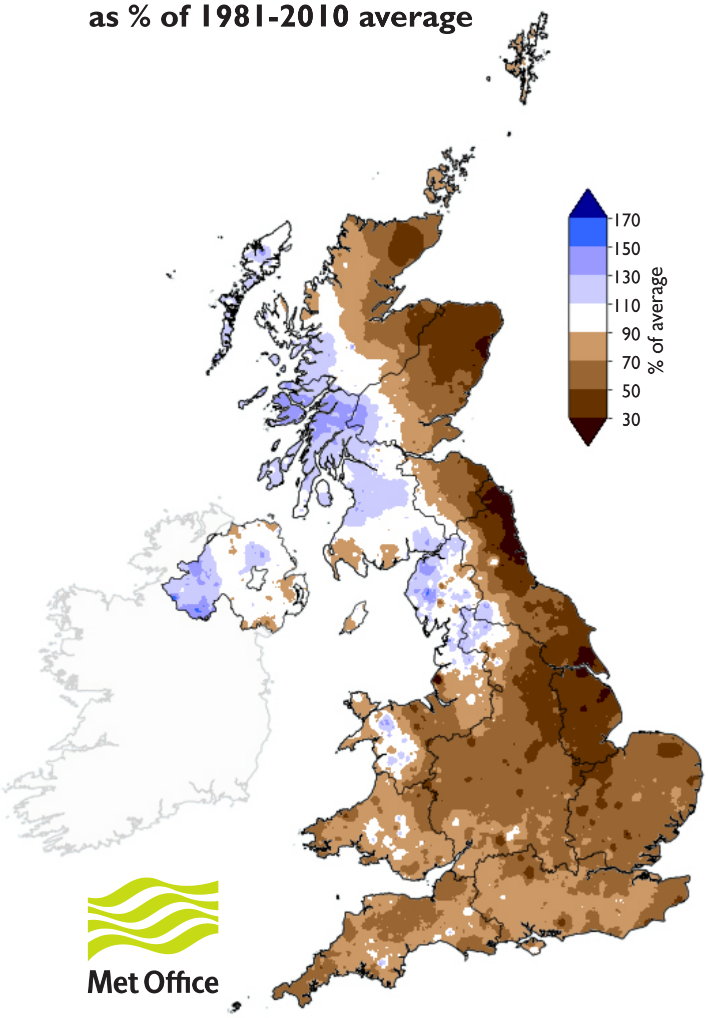
Region	Rainfall	Nov 2020	Oct20 – Nov20	RP	Sep20 – Nov20	RP	Jun20 – Nov20	RP	Dec19 – Nov20	RP
United	mm	**101**	280		355		675		1285	
Kingdom	%	**85**	116	5-10	106	2-5	119	8-12	114	20-30
England	mm	**62**	203		248		511		927	
	%	**72**	114	2-5	101	2-5	117	5-10	110	2-5
Scotland	mm	**154**	392		514		888		1793	
	%	**96**	119	5-10	112	5-10	118	10-15	118	40-60
Wales	mm	**132**	340		417		844		1605	
	%	**84**	105	2-5	96	2-5	119	5-10	113	5-10
Northern	mm	**119**	285		363		762		1287	
Ireland	%	**106**	123	5-10	112	2-5	132	30-50	113	10-20
England &	mm	**72**	222		271		556		1019	
Wales	%	**74**	112	2-5	100	2-5	117	5-10	111	5-10
North West	mm	**135**	326		406		867		1540	
	%	**107**	124	5-10	111	2-5	137	15-25	126	30-50
Northumbria	mm	**48**	181		231		512		863	
	%	**54**	103	2-5	94	2-5	113	2-5	99	2-5
Severn-Trent	mm	**47**	161		191		451		825	
	%	**63**	104	2-5	87	2-5	111	2-5	106	2-5
Yorkshire	mm	**57**	174		229		537		924	
	%	**68**	106	2-5	98	2-5	124	5-10	110	2-5
Anglian	mm	**32**	131		177		365		621	
	%	**54**	106	2-5	100	2-5	107	2-5	99	2-5
Thames	mm	**51**	218		245		454		820	
	%	**69**	143	8-12	116	2-5	123	5-10	115	5-10
Southern	mm	**65**	245		281		422		864	
	%	**71**	130	5-10	112	2-5	104	2-5	108	2-5
Wessex	mm	**71**	233		266		502		983	
	%	**73**	119	2-5	101	2-5	113	2-5	111	2-5
South West	mm	**101**	283		337		680		1356	
	%	**73**	102	2-5	92	2-5	114	2-5	111	5-10
Welsh	mm	**125**	329		402		820		1547	
	%	**83**	106	2-5	96	2-5	119	5-10	113	5-10
Highland	mm	**179**	444		600		921		2079	
	%	**93**	113	2-5	109	2-5	107	2-5	115	15-25
North East	mm	**57**	278		332		622		1043	
	%	**52**	122	5-10	105	2-5	115	2-5	103	2-5
Tay	mm	**122**	372		456		821		1604	
	%	**87**	127	5-10	112	5-10	124	10-15	119	20-35
Forth	mm	**116**	308		387		770		1477	
	%	**99**	122	5-10	109	2-5	127	15-25	123	50-80
Tweed	mm	**77**	242		293		653		1200	
	%	**74**	113	2-5	99	2-5	124	5-10	117	10-20
Solway	mm	**160**	386		497		1036		1854	
	%	**101**	117	5-10	110	2-5	138	30-50	125	70-100
Clyde	mm	**233**	502		668		1183		2331	
	%	**123**	127	10-15	121	5-10	131	30-50	128	>100

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

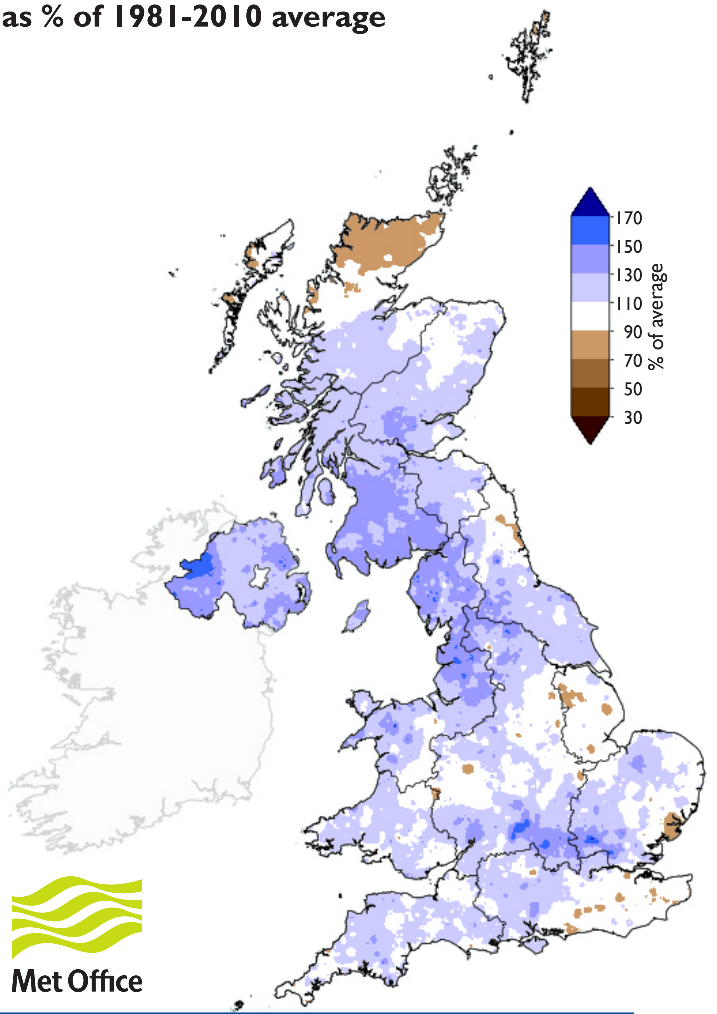
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

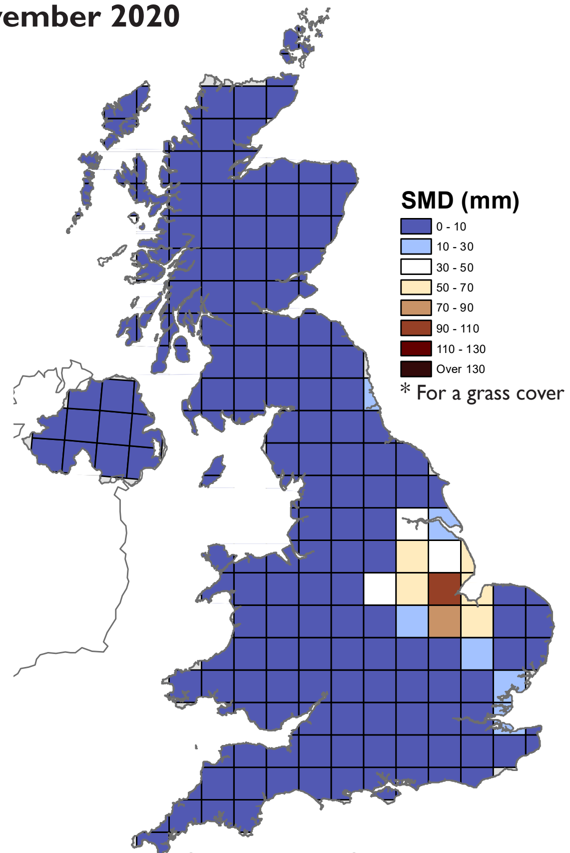
November 2020 rainfall as % of 1981-2010 average



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



MORECS Soil Moisture Deficits* November 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.

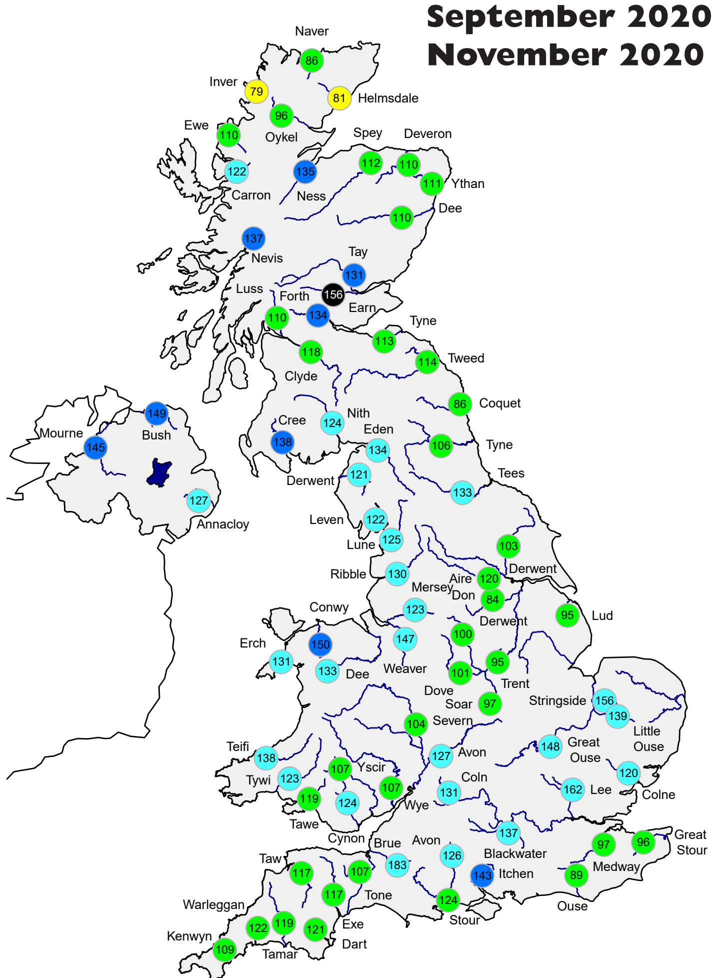
The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: from December 2020
Issued: 08.12.2020
using data to the end of November2020

The outlook for December is for normal flows, and normal to above normal groundwater levels across the majority of the UK. River flows across the Chalk aquifer of the south-east are likely to be above normal over the next one-to-three months, and groundwater levels in the south-western parts of this aquifer are also likely to be above normal for December and notably to exceptionally high over the next three months. For December-January-February as a whole, river flows and groundwater levels across northern and western parts of the UK are likely to be above normal to notably high.

River flow . . . River flow . . .

September 2020 - November 2020



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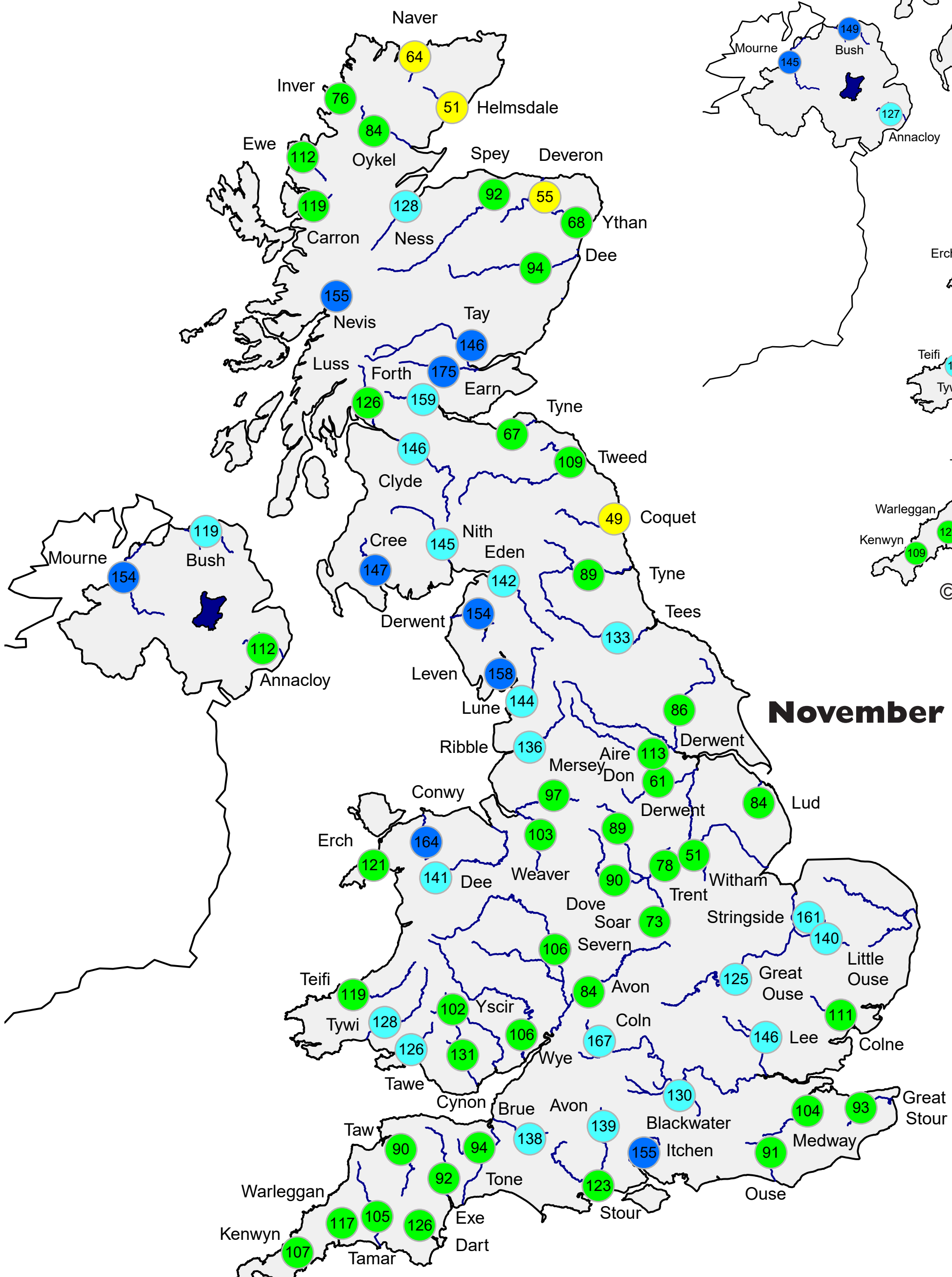
November 2020



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Key

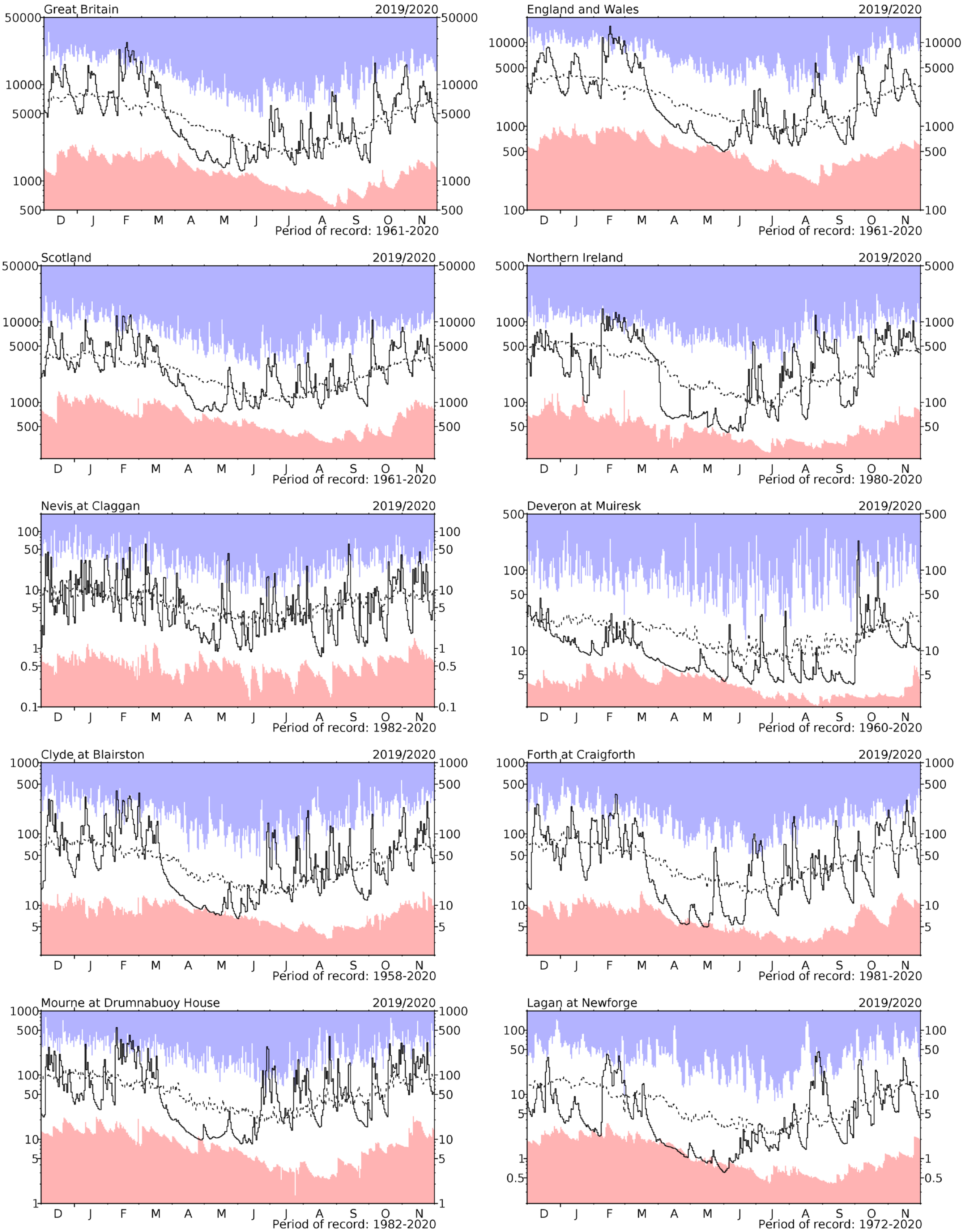
- 25 — % of long−term average (record high/low when circled)
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

*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.

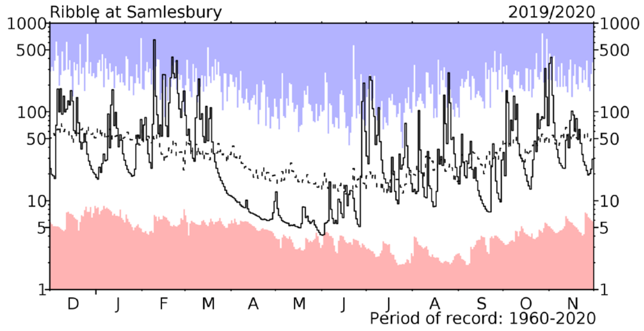
River flow . . . River flow . . .

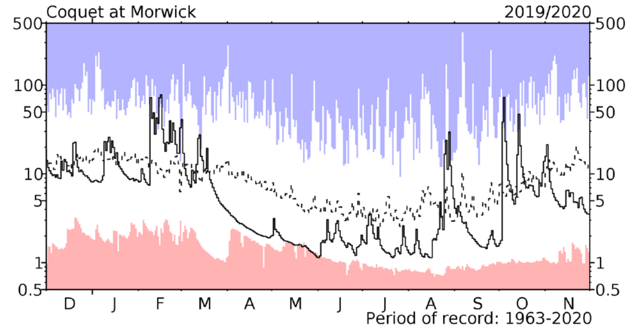


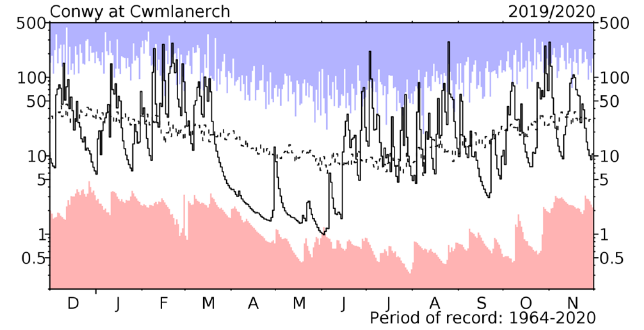
River flow hydrographs

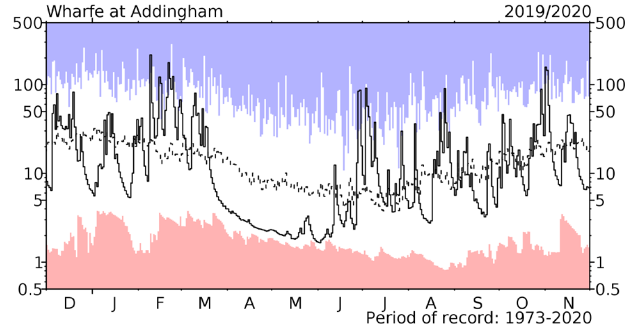
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to December 2019 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

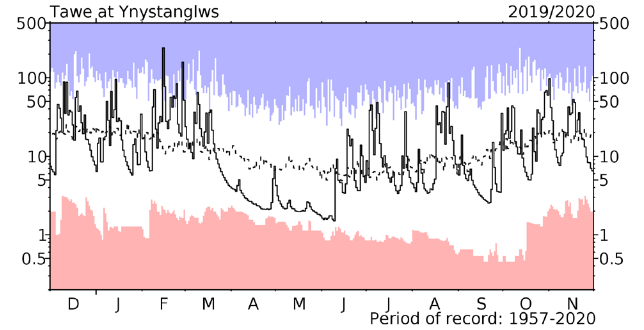
River flow . . . River flow . . .

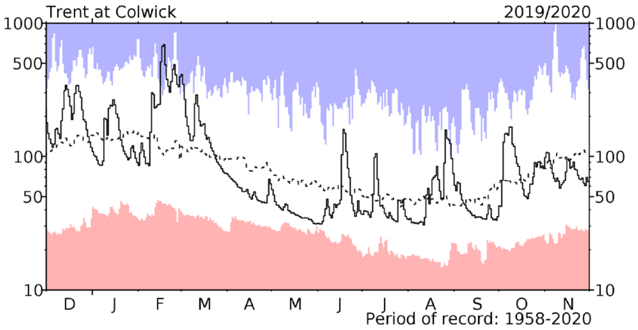


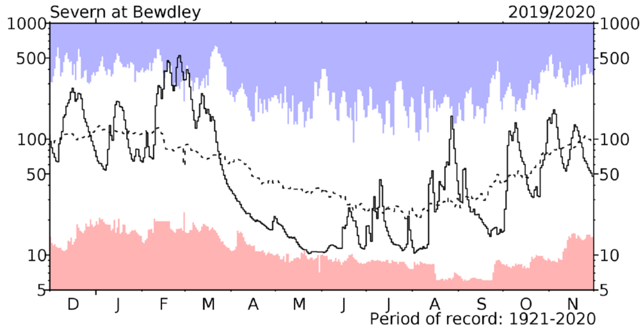


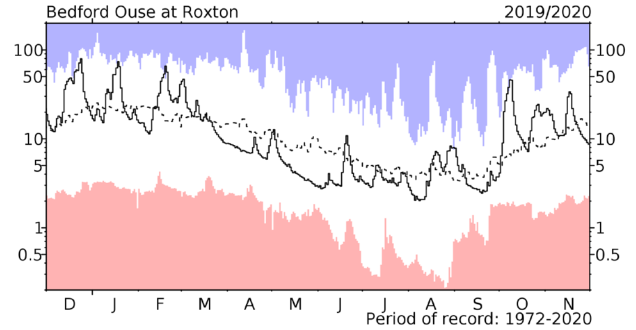


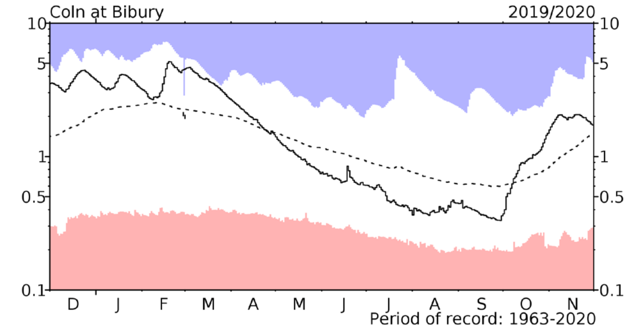


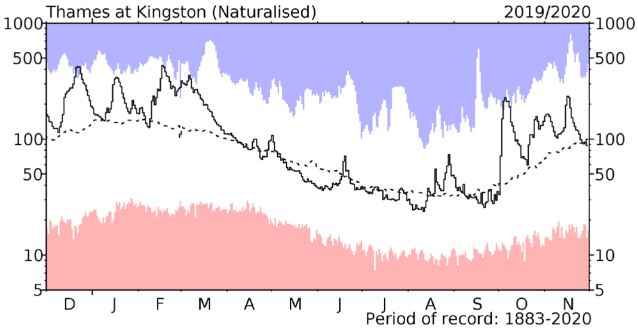


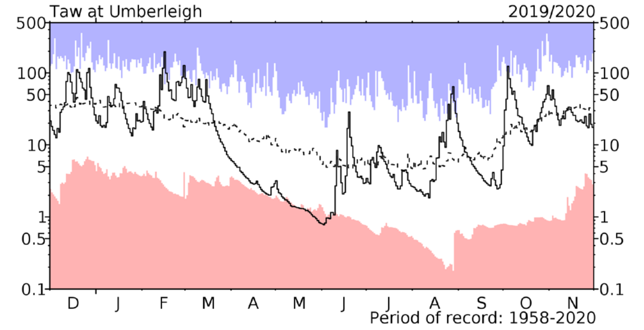


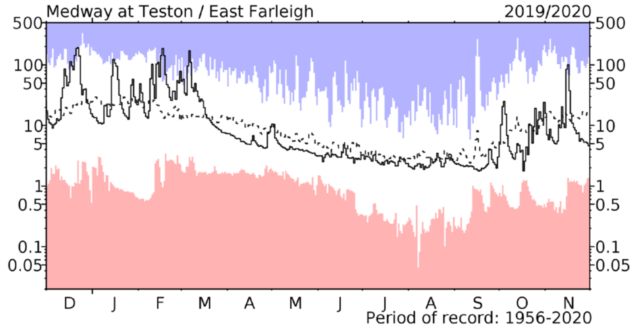




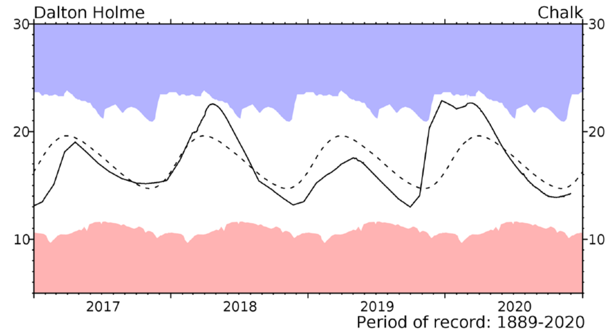


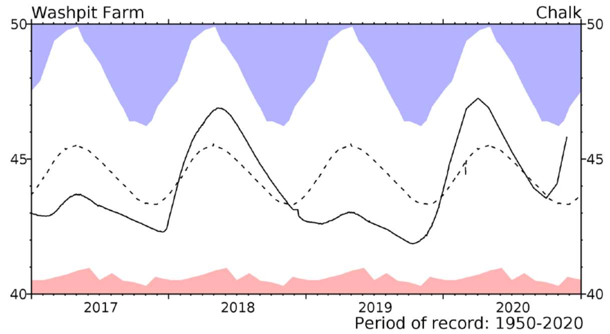


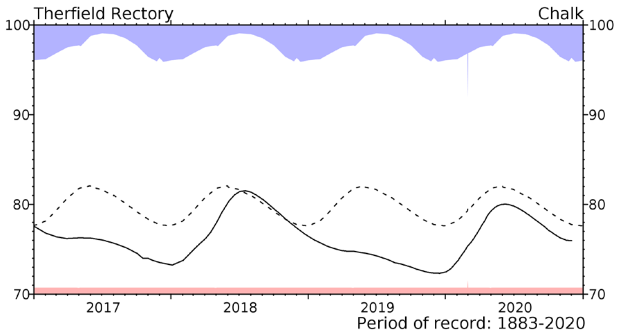


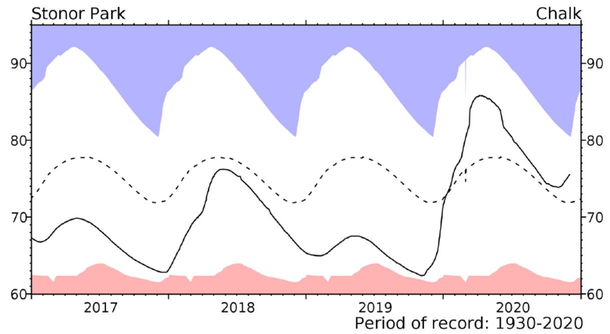


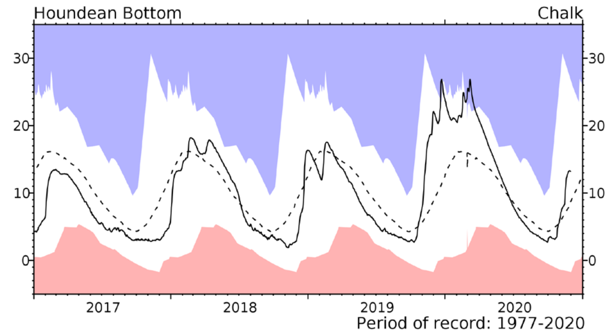
Groundwater . . . Groundwater

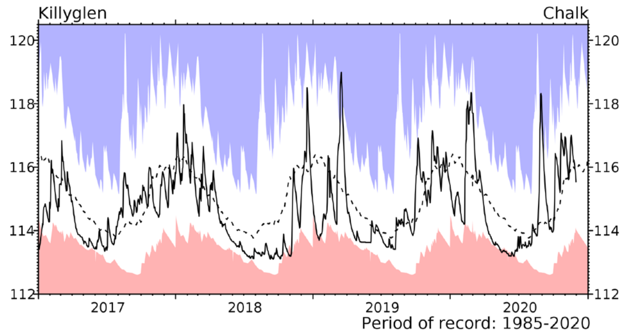


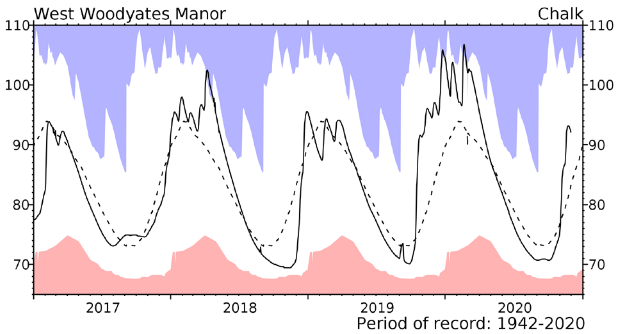


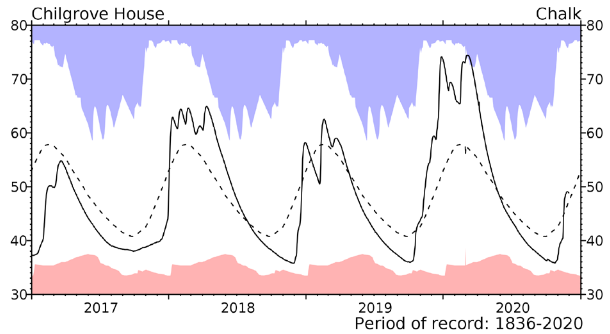


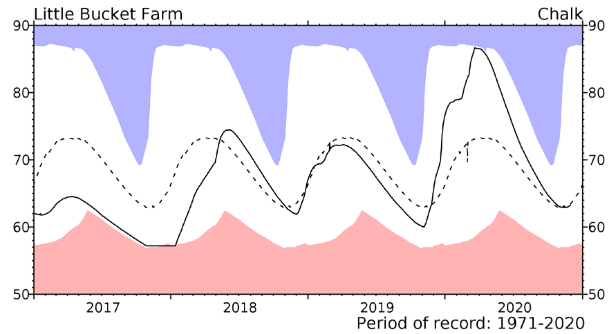


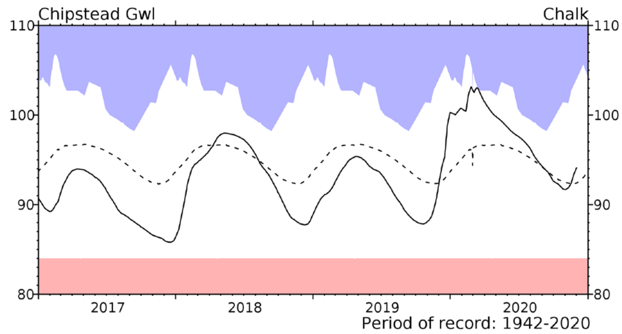






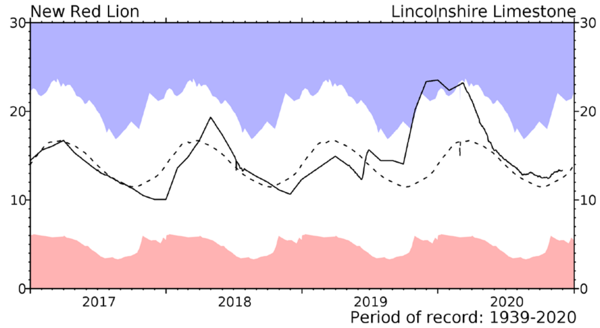


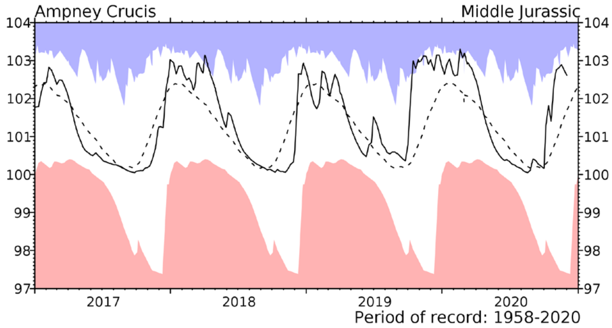


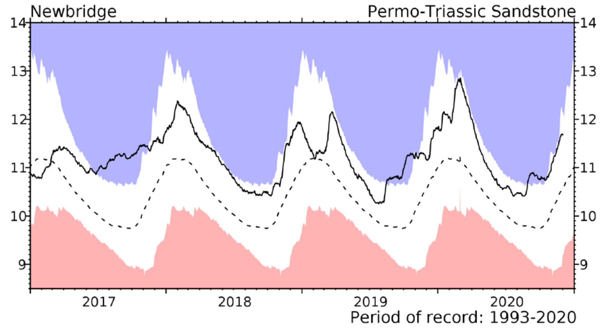


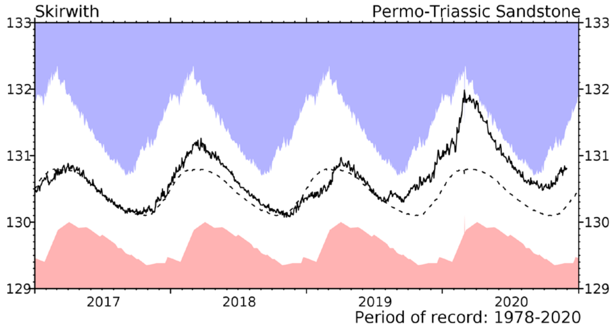
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

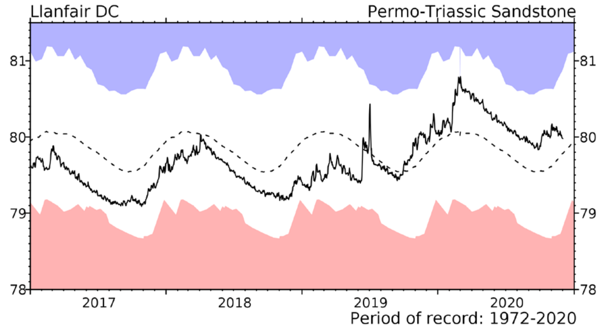
Groundwater ... Groundwater

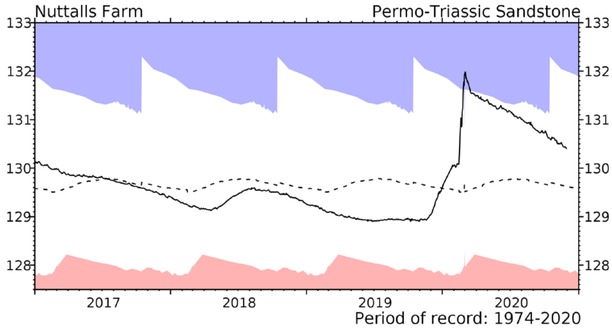


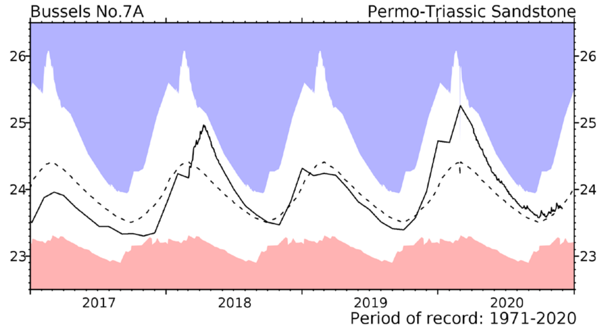


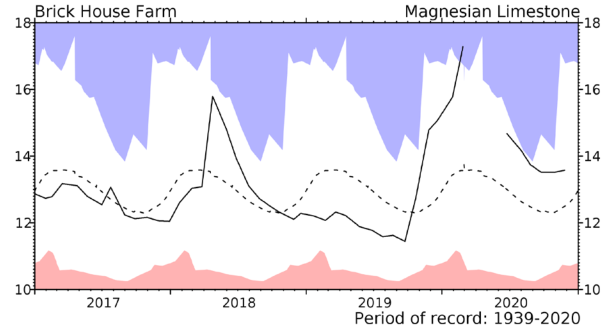


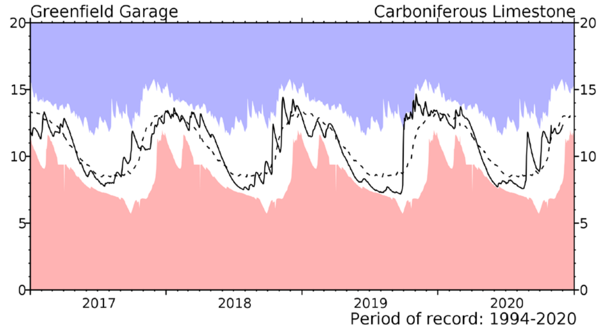


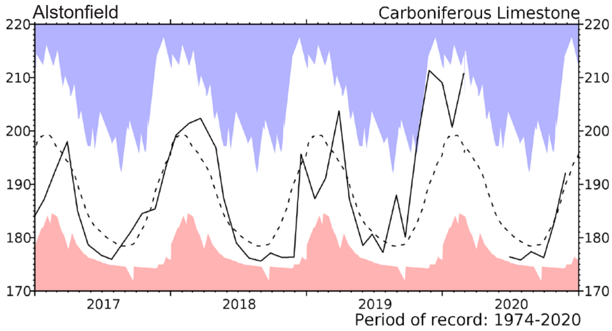


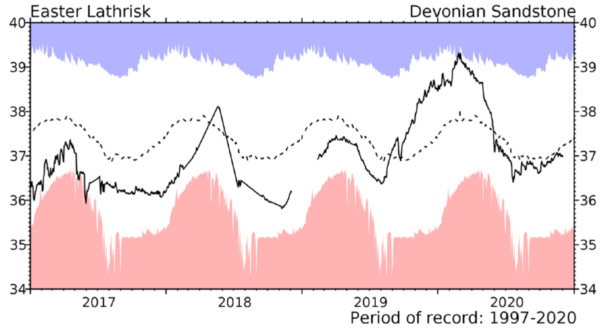


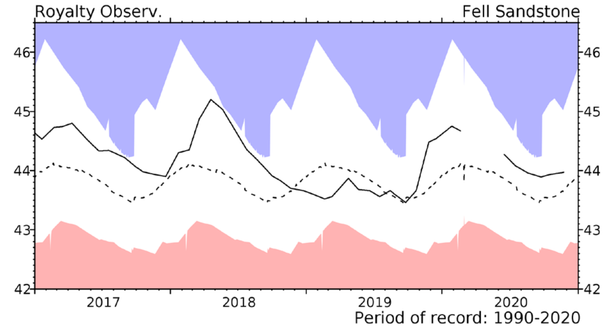




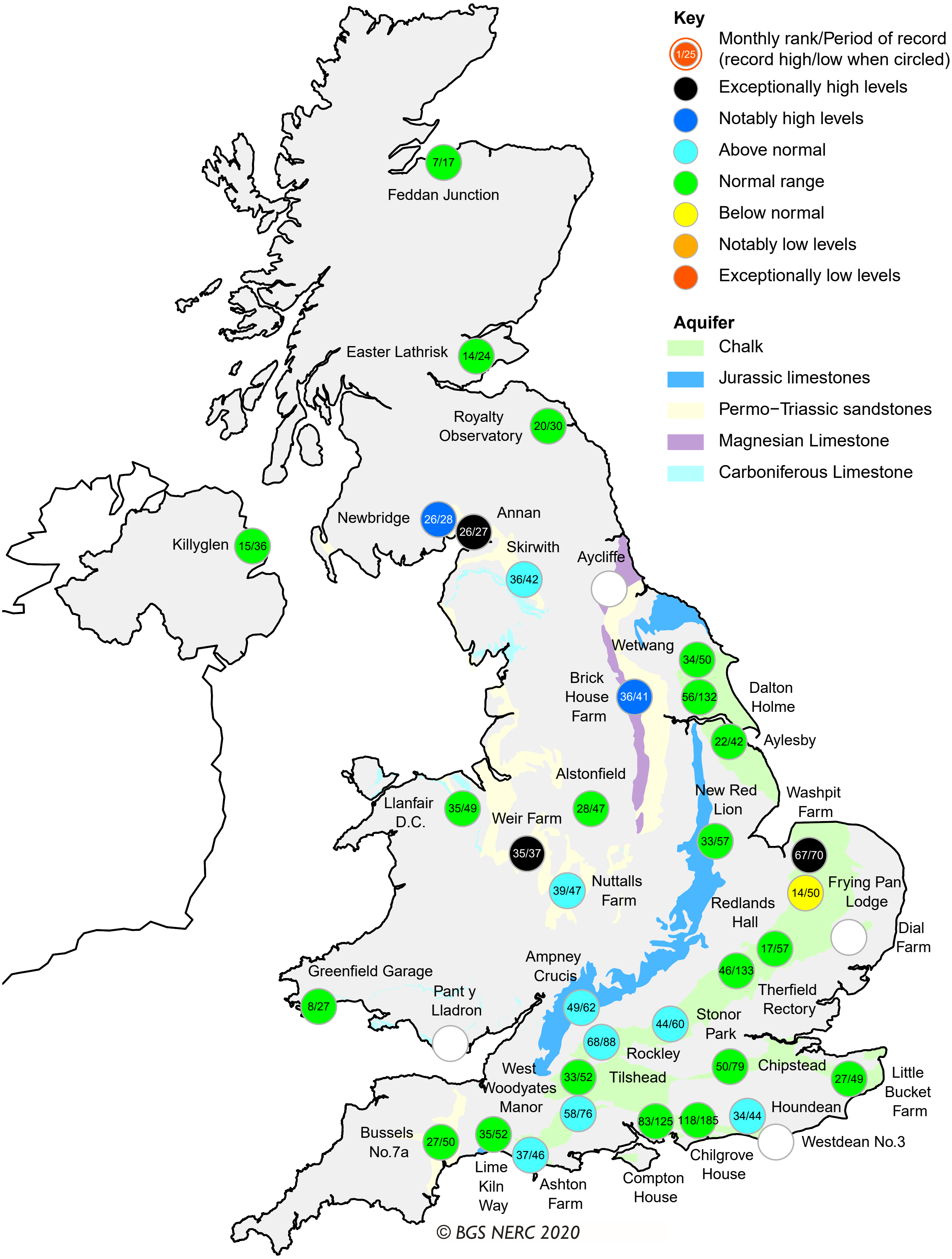








Groundwater...Groundwater

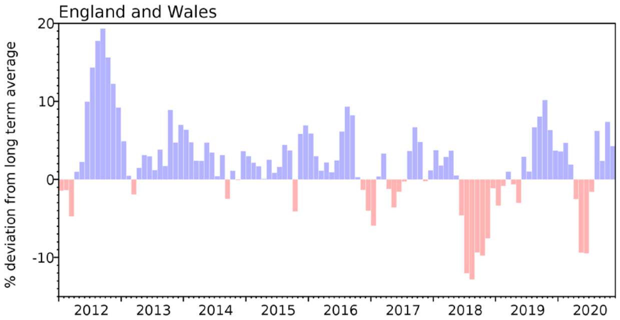


Groundwater levels - November 2020

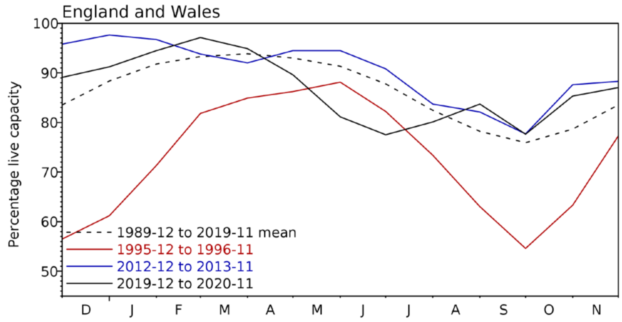
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated.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

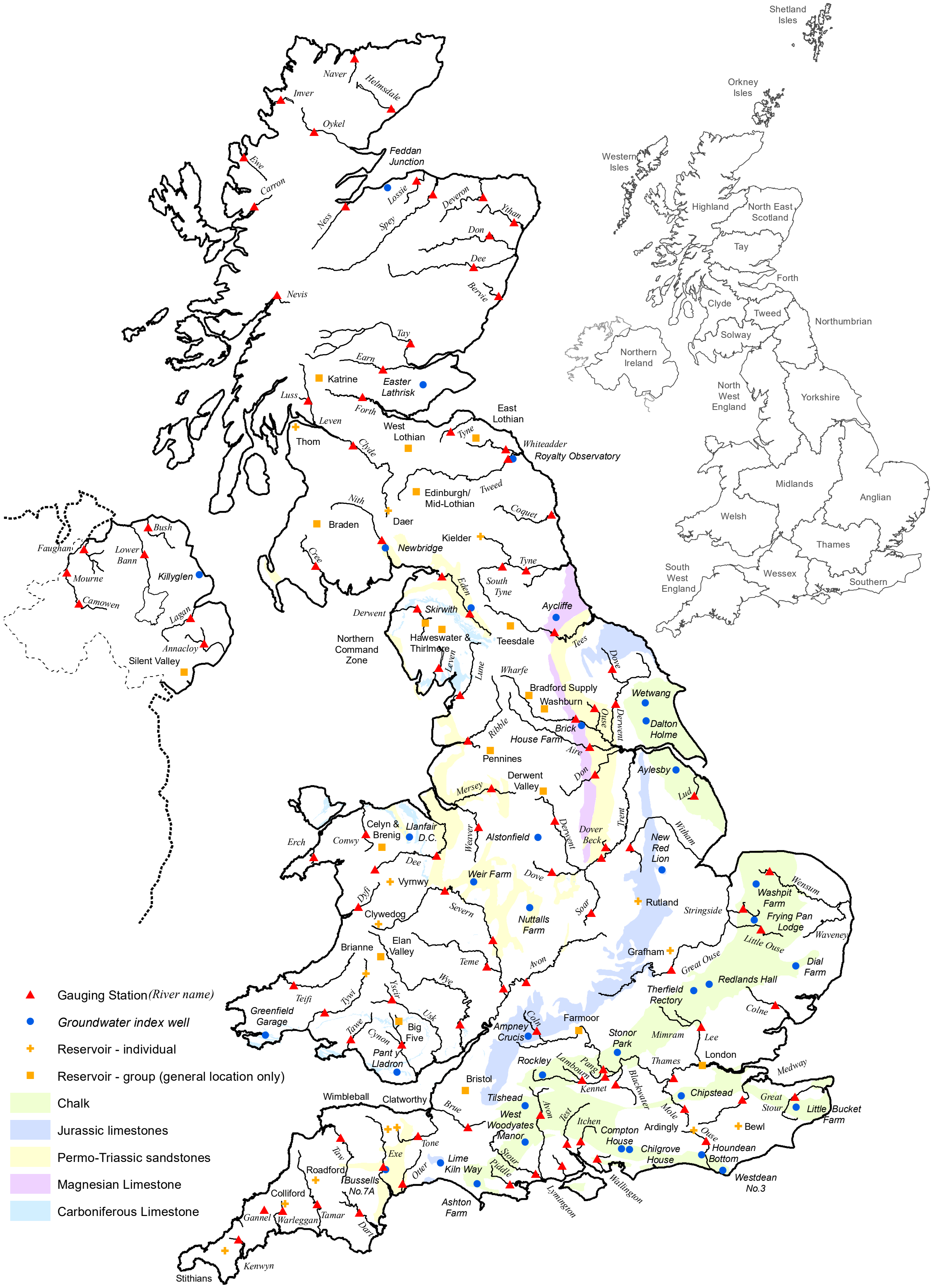
Area	Reservoir		Capacity (Ml)	2020 Sep	2020 Oct	2020 Nov	Nov Anom.	Min Nov	Year* of min	2019 Nov	Diff 20-19
North West	N Command Zone	•	124929	74	85	99	21	44	1993	74	25
	Vyrnwy		55146	93	98	97	14	33	1995	96	1
Northumbrian	Teesdale	•	87936	65	83	80	-4	39	1995	100	-20
	Kielder		(199175)	80	86	89	3	55	2007	81	8
Severn-Trent	Clywedog		49936	87	89	84	2	43	1995	86	-2
	Derwent Valley	•	46692	78	92	91	12	9	1995	100	-9
Yorkshire	Washburn	•	23373	91	97	96	20	16	1995	92	4
	Bradford Supply	•	40942	86	100	98	16	20	1995	100	-2
Anglian	Grafham		(55490)	90	91	89	7	47	1997	88	1
	Rutland		(116580)	88	88	87	7	57	1995	96	-9
Thames	London	•	202828	84	79	79	-3	52	1990	92	-13
	Farmoor	•	13822	97	98	90	1	52	1990	95	-5
Southern	Bewl		31000	60	60	63	-1	33	2017	85	-22
	Ardingly		4685	21	27	46	-28	14	2011	100	-54
Wessex	Clatworthy		5662	60	93	100	22	16	2003	100	0
	Bristol	•	(38666)	51	75	83	14	27	1990	99	-16
South West	Colliford		28540	57	62	66	-7	42	1995	68	-2
	Roadford		34500	61	68	73	-1	19	1995	66	7
	Wimbleball		21320	50	65	76	3	34	1995	100	-24
	Stithians		4967	54	61	73	5	29	2001	100	-28
Welsh	Celyn & Brenig	•	131155	86	100	97	9	50	1995	84	14
	Brianne		62140	84	100	100	4	72	1995	99	1
	Big Five	•	69762	65	71	76	-7	49	1990	86	-10
	Elan Valley	•	99106	67	86	86	-8	47	1995	99	-13
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	86	89	95	9	45	2003	90	5
	East Lothian	•	9317	100	100	100	11	38	2003	100	0
Scotland(W)	Loch Katrine	•	110326	88	95	96	5	65	2007	95	1
	Daer		22494	94	100	100	3	73	2003	97	3
	Loch Thom		10721	59	63	83	-12	72	2003	89	-6
Northern Ireland	Total+	•	56800	90	98	98	12	59	2003	99	-1
	Silent Valley	•	20634	87	100	98	16	43	2001	99	-1

( ) 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