Hydrological Summary
for the United Kingdom

General
The year began with a wintry complexion: it was the coldest January since 2010 (the UK average temperature was 2.2°C, 1.5°C below the long-term average) and most areas saw frequent wintry showers, with some notable snow accumulations. January was a wet month at the national scale (with 114% of the January average) but in a reversal of the usual rainfall gradient, parts of Scotland were relatively dry and much of eastern and central England was exceptionally wet. In northern England and Wales, a significant proportion of the monthly rainfall was associated with the passage of storm 'Christoph' mid-month, which brought exceptionally high flows across a large swathe of the country, and locally severe flood impacts – a second consecutive month of significant winter flooding. Correspondingly, groundwater levels were exceptionally high across much of northern Britain and near- to above average across the south, with some localised groundwater flood alerts. Reservoir levels increased in the majority of impoundments and stocks were above average at the national scale. The water resources outlook at the outset of 2021 is very healthy, but with widespread high river flows entering February, the potential for further flooding remains elevated for the remainder of the winter. Current outlooks suggesting above normal river flows are likely to persist into spring in eastern and southern England.

January 2021

Rainfall
Northerly and easterly airflows in early January brought a continuation of the cold spell established in late December. This persisted for the first ten days, with frequent wintry showers, icy conditions and snow in upland areas bringing travel disruption to parts of Scotland and northern England. Milder and wetter conditions then became established in the south but colder weather prevailed elsewhere, with further snow (e.g. with 20cm recorded at Copley, County Durham, on the 15th). Between the 19th and 21st, storm 'Christoph' traversed north-eastwards across the UK, bringing high winds and widespread heavy rainfall, with exceptional totals across north Wales and northern England (e.g. 111mm was recorded on the 19th at Capel Curig, north Wales, and 133mm on the 20th at Honister Pass, Cumbria). Totals of over 100mm for the three-day period were widespread (with 150mm-250mm in some upland locations) and parts of north-west England received more than the typical January rainfall during this event. Widespread colder conditions then returned from the 22nd to the 25th and persisted until month-end in many northern areas. January rainfall totals saw a pronounced contrast, with over 170% of average across much of eastern and central England (the Yorkshire region received 181% of average, the fourth wettest January in a record from 1910) and below average rainfall in western and central Scotland (with less than 50% in parts of the Highlands). Accumulations for the winter so far (December-January) followed a similar spatial pattern, with exceptional totals across large parts of England and Wales (151% of average for England), particularly in eastern areas; the Anglian and Northumbria regions received their third highest totals for this period (both in series from 1910).

River Flows
Flows in the majority of rivers were receding at the turn of the year and, largely, recessions continued for the first ten days, given the cold but generally settled conditions. In many responsive rivers, flows began to climb around mid-month, with widespread flood alerts in Wales and central and eastern England. Storm 'Christoph' triggered pronounced increases in flows across north Wales and northern England, leading to over 200 flood warnings (including a number of severe flood warnings in Cheshire and Merseyside) and more than 200 flood alerts on the 21st. New January maximum flows were established in some rivers draining the Pennines (e.g. the Weaver, the Don and Derbyshire Derwent) and North York Moors (e.g. the Yorkshire Derwent and Dove). Flood inundations caused widespread disruption, evacuations (e.g. in north Wales, Cheshire and Merseyside) and property flooding (approaching 400 properties reported in England). Several major incidents were declared, e.g. in Didsbury in Greater Manchester following flooding from the Mersey, and incident responses were further hampered by the ongoing COVID-19 restrictions. The accumulated rainfall led to heightened flood risk thereafter, with the focus shifting to major rivers. Flooding occurred along the Severn in Shropshire and Worcestershire, with provisional data suggesting the level at Bewdley approached the peak recorded in the February 2020 episode (both within the top ten levels in a record from 1921). Mean river flows for January as a whole were above average across England and Wales, with exceptionally high flows across areas impacted by storm 'Christoph' (with double the typical January flows common, and new records established, e.g. on the Mersey, Weaver, Don and Trent). Unsurprisingly, flows for the winter so far (December-January) were also record-breaking in this area, and exceptional accumulations were seen in many other catchments, with new maxima as far apart as the Warleggan and the Stringside. The combined outflows for these months for England & Wales were the third highest on record after 2015-2016 and 1993-1994 (in a record from 1961).

Groundwater
With soils saturated across the major outcrops following a wet late-autumn and December, groundwater levels continued to rise in the majority of index boreholes. Levels in the Chalk were generally in the normal range or above, but were notably or exceptionally high in a few boreholes. Near the south coast, levels receded at several sites and at month-end levels were lower than the start of the month at Chilgrove and West Woodyates Manor, dropping from above normal to normal, and at Houndean from exceptionally high to above normal. Elsewhere, Chalk levels rose with new January maxima established at Washpit Farm and Wetwang. In the Jurassic limestones, levels at both Ampney Crucis and New Red Lion rose to new monthly maxima. Levels in the Magnesian limestones also rose and were above normal. In the Carboniferous Limestone, levels remained exceptionally high but fell overall during January at Pant y Lladron. In the Permo-Triassic sandstones, levels rose and were generally exceptionally high, with a January record maximum set at Weir Farm, whilst at Bussels 7a they remained in the normal range. Levels in the Upper Greensand at Lime Kiln Way rose and remained notably high.

Note: Due to unforeseen circumstances no data are available for Scotland.

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.

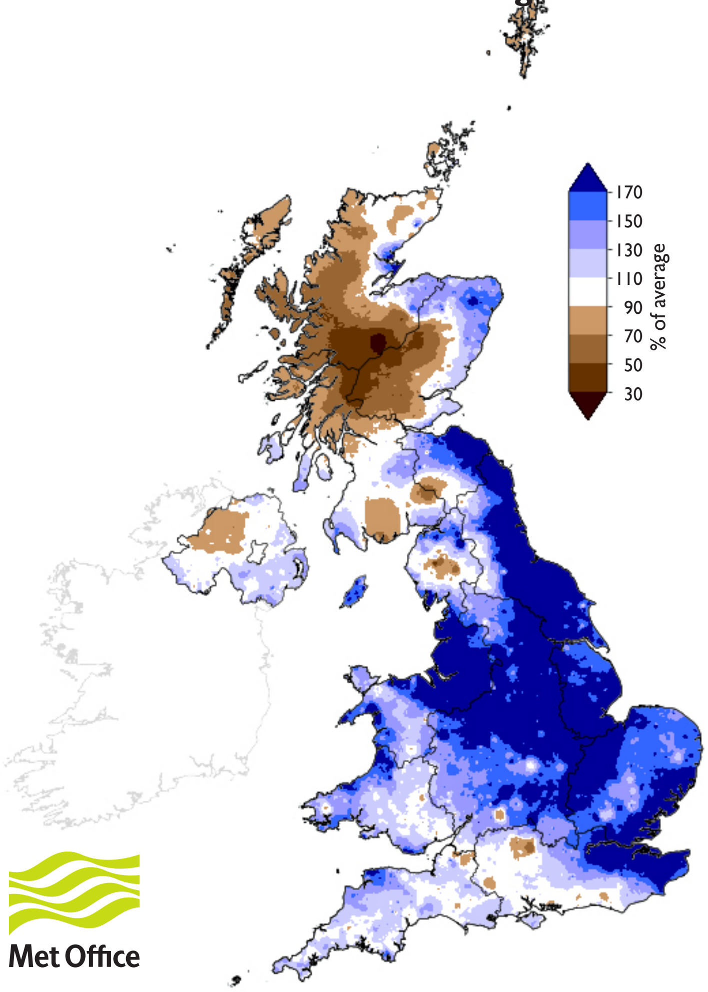
Region	Rainfall	Jan 2021	Dec20 – Jan21	RP	Aug20 – Jan21	RP	May20 – Jan21	RP	Feb20 – Jan21	RP
United Kingdom	mm	**137**	299		773		1007		1323	
	%	**114**	125	8-12	117	10-20	115	10-20	117	60-90
England	mm	**124**	255		612		775		1007	
	%	**152**	151	20-30	127	10-20	116	5-10	119	15-25
Scotland	mm	**141**	337		967		1301		1728	
	%	**81**	100	2-5	106	5-10	111	8-12	114	25-40
Wales	mm	**208**	465		1057		1323		1746	
	%	**137**	147	20-30	123	10-20	119	10-15	123	30-50
Northern Ireland	mm	**119**	248		767		1041		1358	
	%	**103**	107	2-5	117	10-20	118	15-25	119	>100
England & Wales	mm	**136**	283		673		850		1108	
	%	**148**	150	20-30	126	10-20	117	5-10	120	20-30
North West	mm	**183**	337		916		1224		1617	
	%	**147**	130	8-12	125	10-20	126	15-25	132	>100
Northumbria	mm	**146**	275		625		810		1022	
	%	**176**	162	50-80	128	15-25	119	8-12	117	10-20
Severn-Trent	mm	**120**	245		551		702		925	
	%	**168**	164	25-40	127	10-20	114	5-10	118	10-20
Yorkshire	mm	**146**	267		615		818		1061	
	%	**181**	159	20-30	130	10-20	124	10-15	126	30-50
Anglian	mm	**93**	195		448		566		694	
	%	**176**	183	70-100	132	10-20	114	5-10	111	5-10
Thames	mm	**99**	197		539		655		849	
	%	**144**	142	5-10	133	10-20	116	5-10	118	5-10
Southern	mm	**111**	240		587		668		900	
	%	**135**	141	5-10	123	5-10	106	2-5	113	2-5
Wessex	mm	**99**	234		606		742		995	
	%	**110**	124	2-5	117	2-5	107	2-5	112	5-10
South West	mm	**165**	405		885		1098		1455	
	%	**122**	144	10-20	121	5-10	115	5-10	118	10-20
Welsh	mm	**200**	449		1024		1282		1684	
	%	**138**	149	20-35	124	10-20	120	10-15	123	30-50
Highland	mm	**150**	375		1040		1412		1931	
	%	**69**	90	2-5	95	2-5	103	2-5	107	5-10
North East	mm	**98**	279		690		954		1151	
	%	**100**	146	25-40	118	8-12	120	10-15	114	5-10
Tay	mm	**101**	294		879		1174		1559	
	%	**62**	98	2-5	110	5-10	113	5-10	116	20-30
Forth	mm	**126**	279		831		1092		1453	
	%	**92**	108	2-5	117	10-20	117	10-20	121	70-100
Tweed	mm	**143**	300		748		987		1290	
	%	**135**	142	20-35	127	20-35	123	15-25	126	70-100
Solway	mm	**159**	338		1037		1420		1834	
	%	**100**	104	2-5	116	10-15	122	20-35	123	80-120
Clyde	mm	**179**	385		1233		1643		2195	
	%	**85**	94	2-5	111	5-10	117	15-25	121	50-80

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

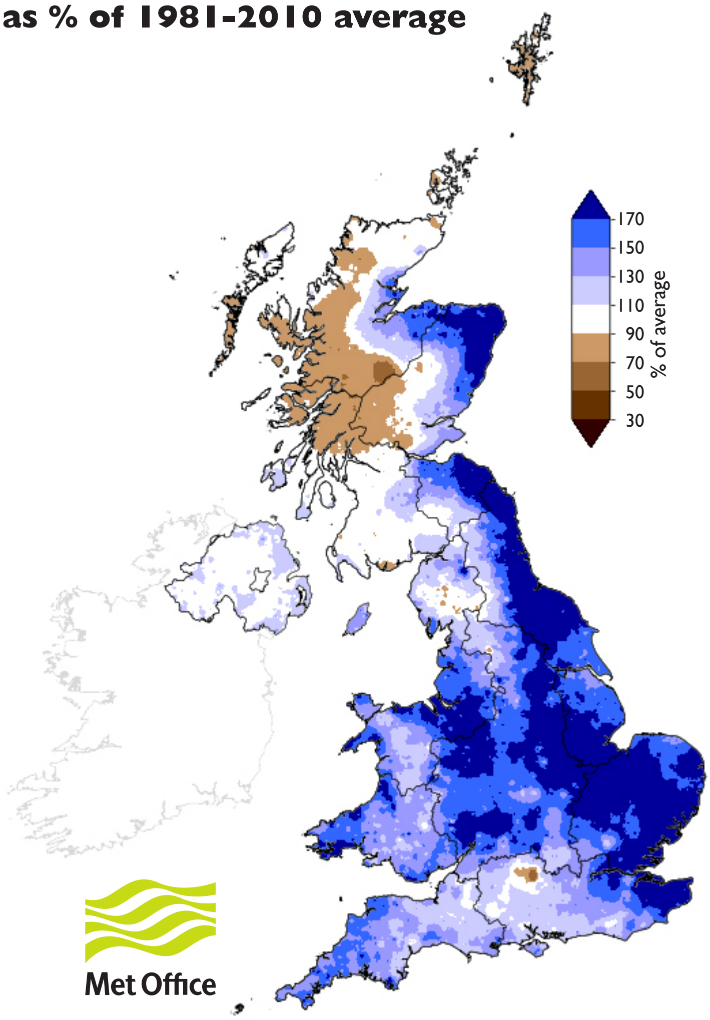
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 December 2017 are provisional.

Rainfall . . . Rainfall . . .

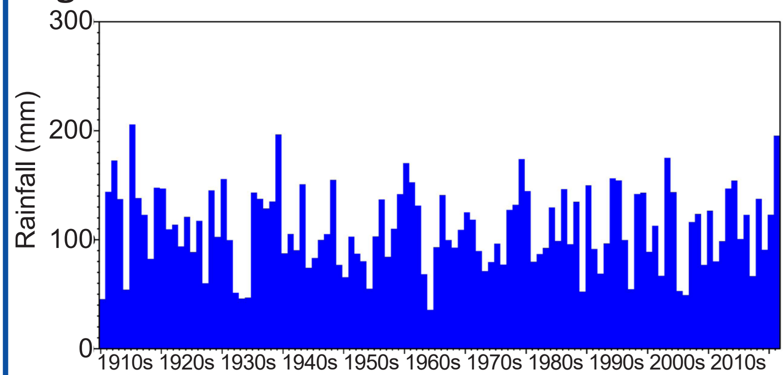
January 2021 rainfall as % of 1981-2010 average



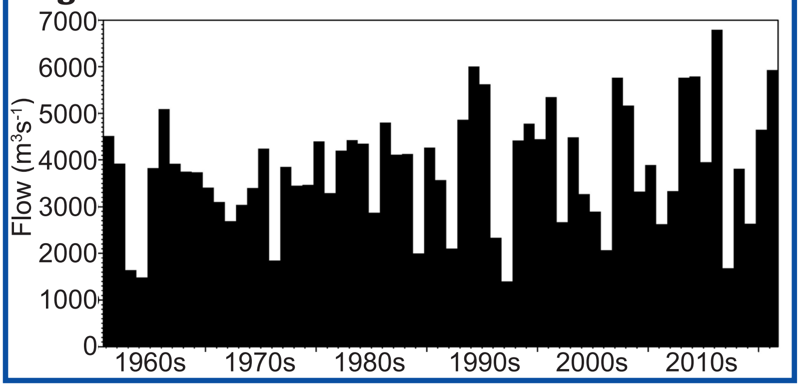
December 2020 - January 2021 rainfall as % of 1981-2010 average



December - January rainfall for Anglian Region



December - January average outflows for England & Wales



Hydrological Outlook UK

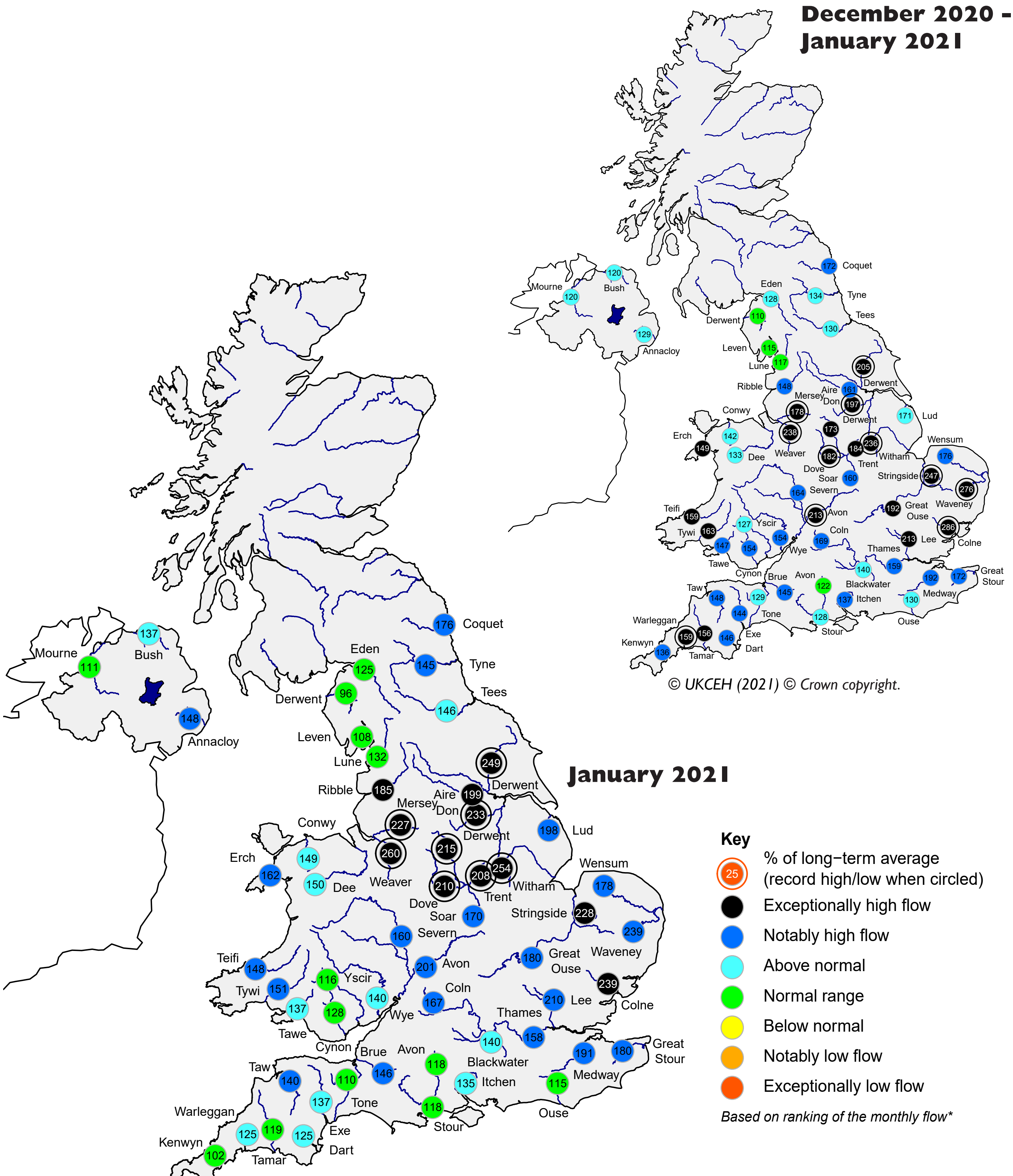
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from February 2021**
Issued: **09.02.2021**
using data to the end of January 2021

Above normal to exceptionally high river flows are expected to persist in eastern and southern parts of the UK over the next three months. Elsewhere, river flows are likely to be within the normal range for February. Groundwater levels in northern aquifers are likely to be exceptionally high over the next three months, whilst levels in southern aquifers are likely to be normal to exceptionally high in February, and normal to notably high over the three month period February-April.

River flow . . . River flow . . .

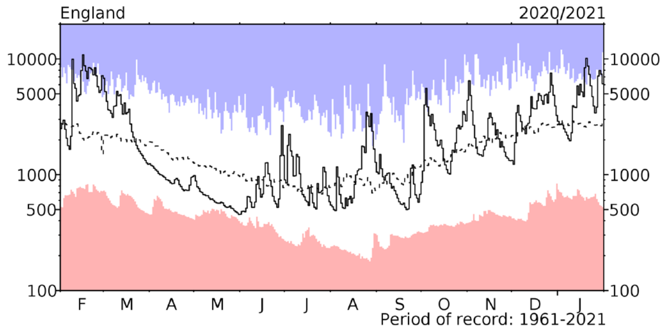


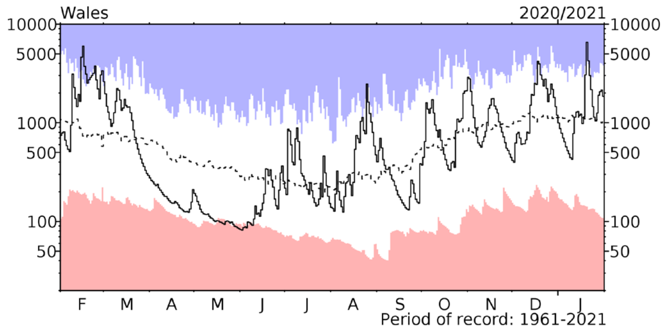
River flows

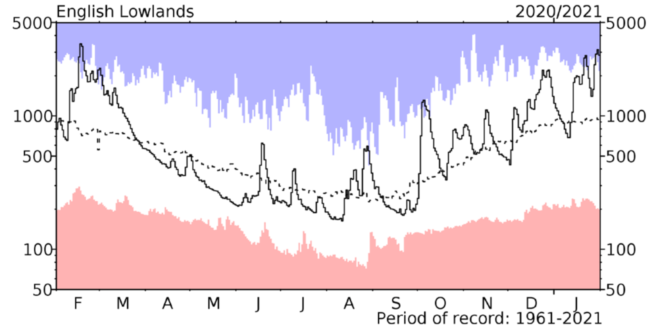
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

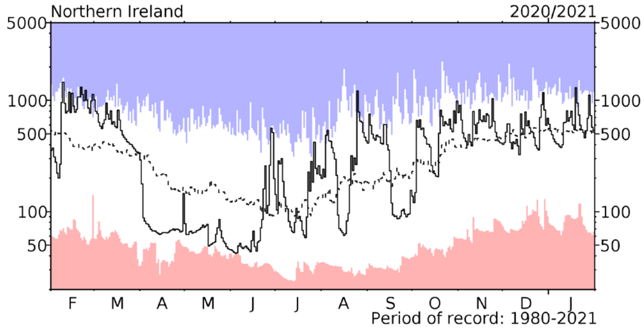
Note: Due to unforeseen circumstances no data are available for Scotland.

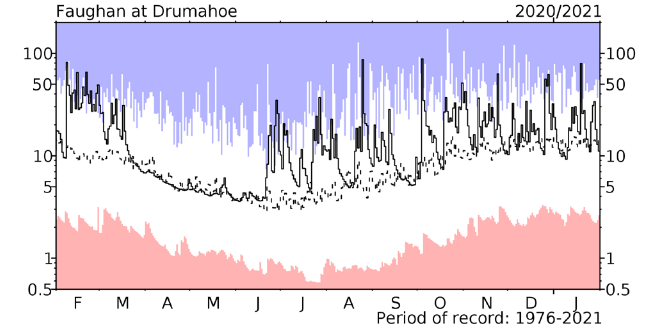
River flow . . . River flow . . .

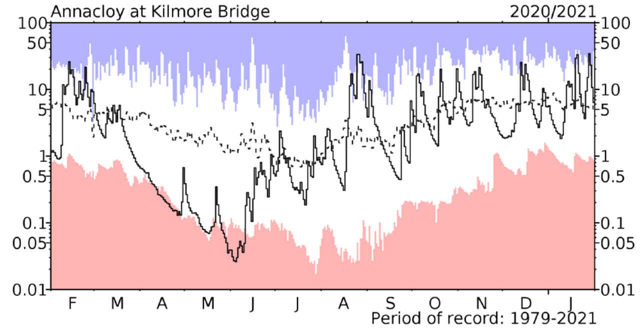


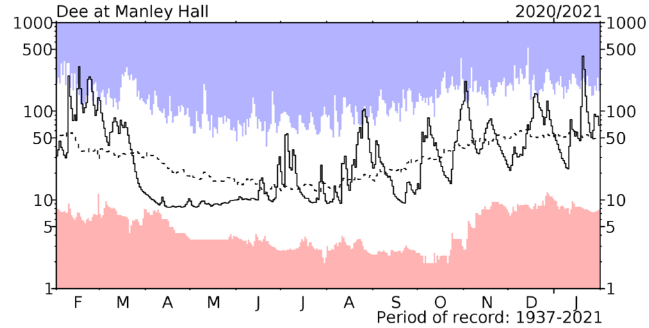


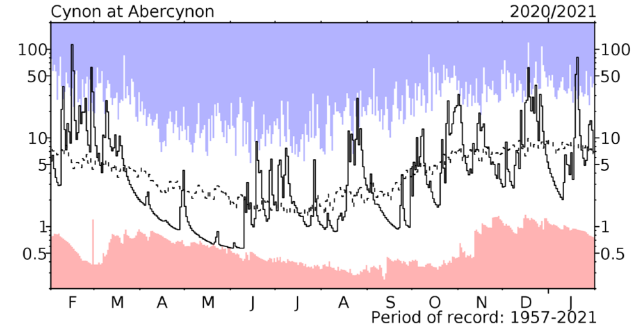


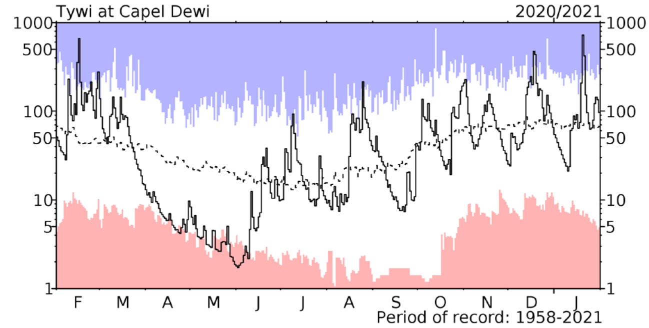


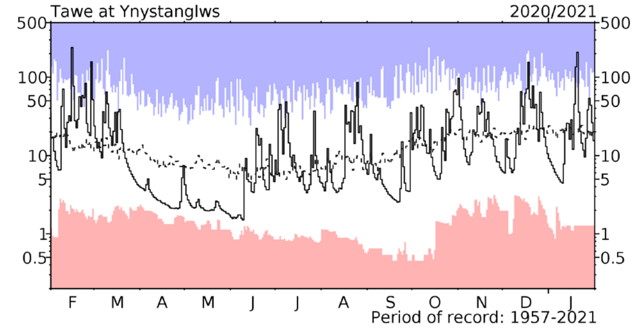








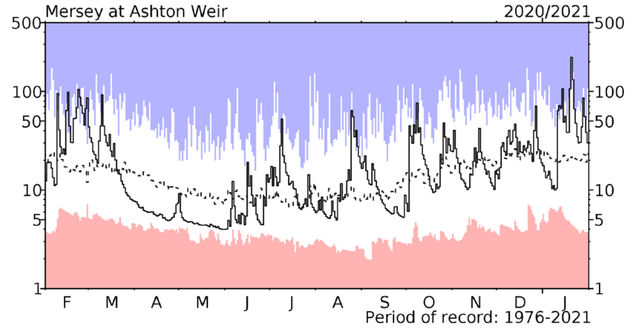


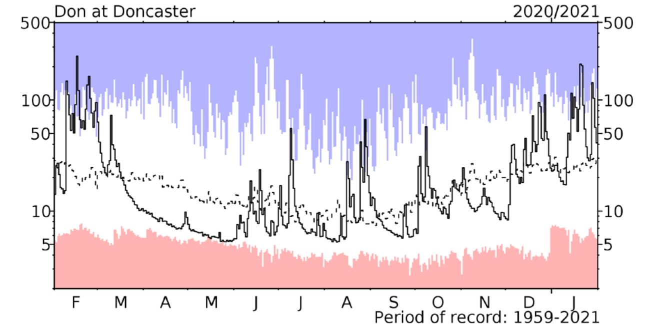


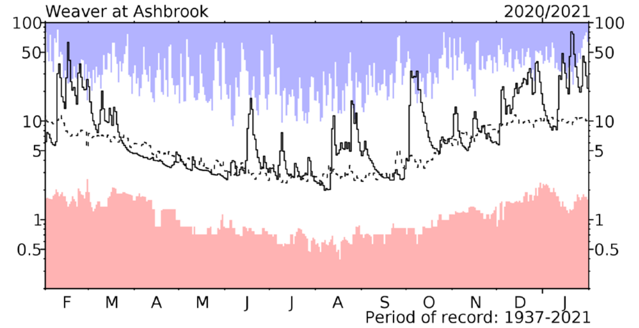
River flow hydrographs

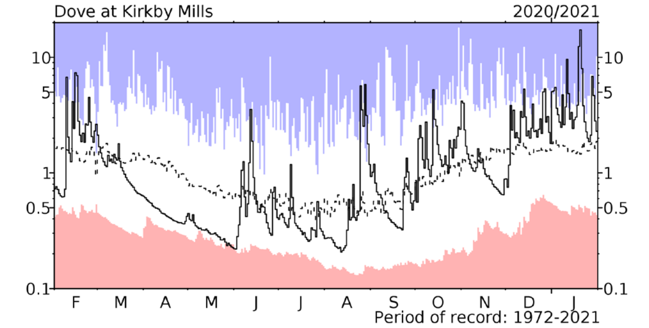
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to February 2020 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

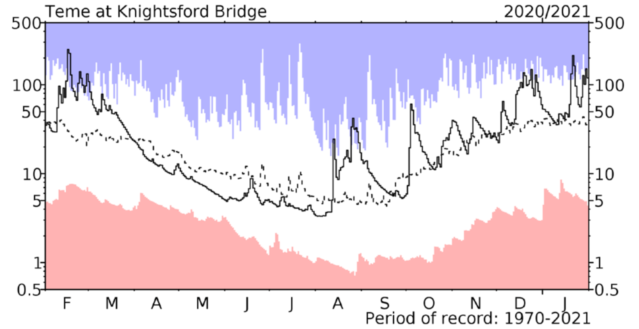
River flow ... River flow ...

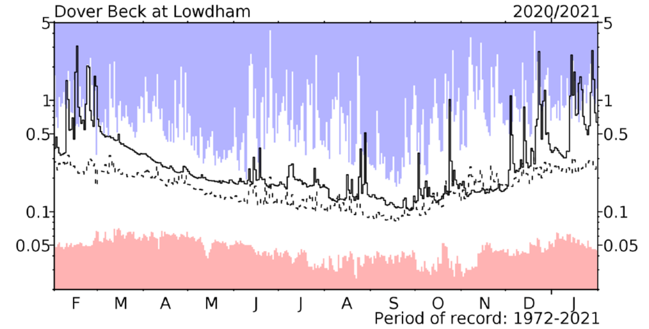


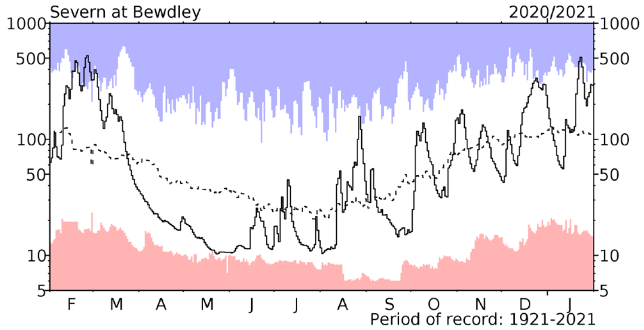


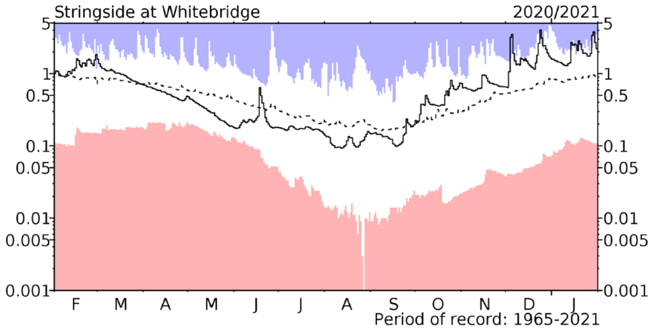


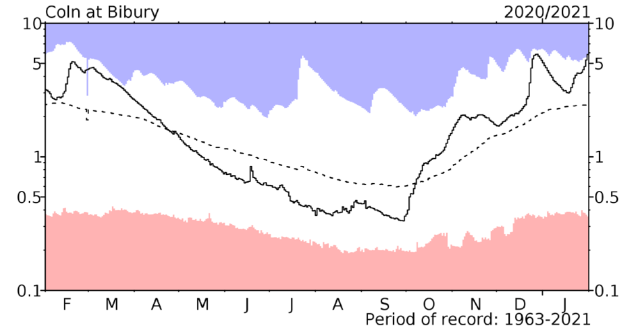


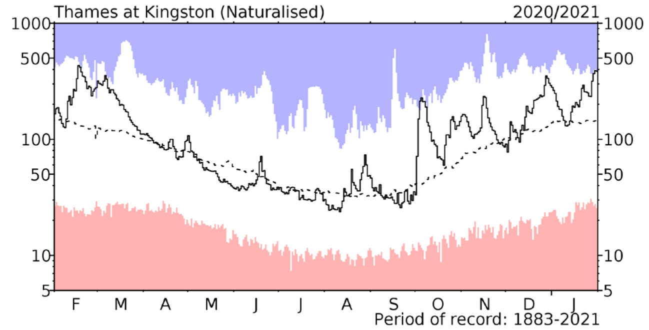


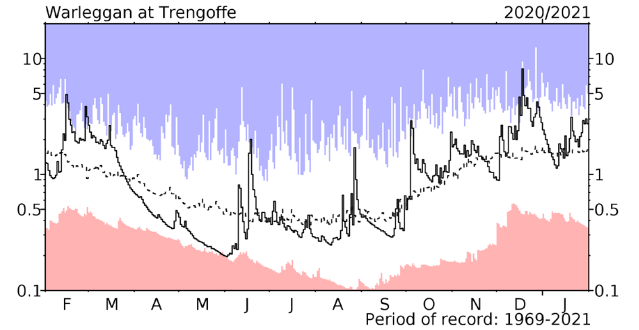


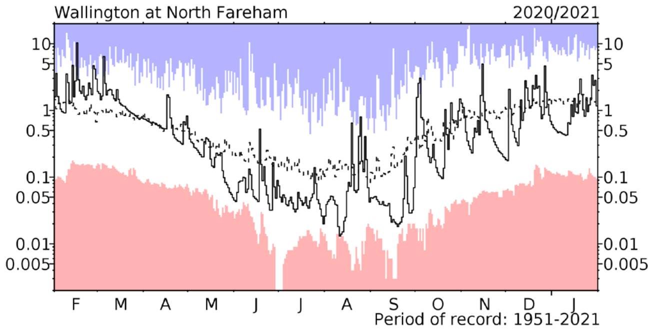




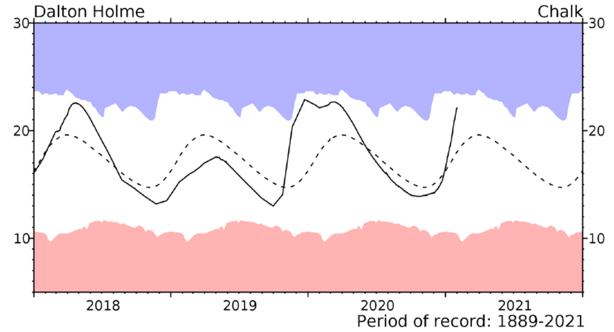


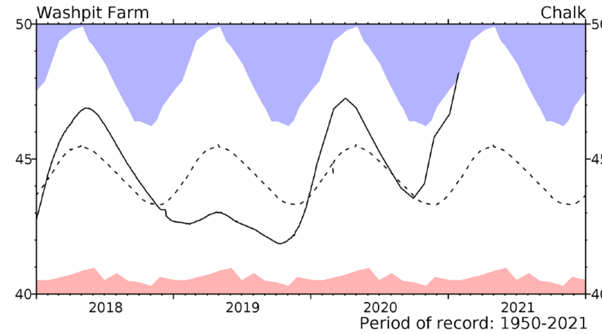


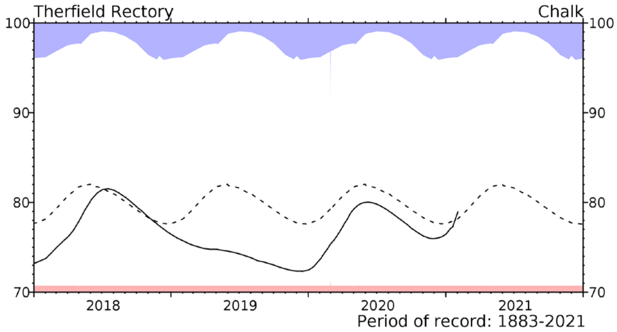


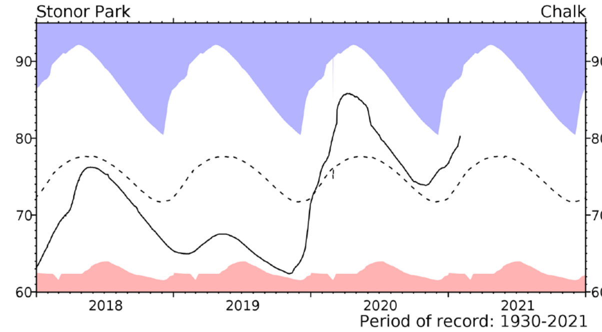


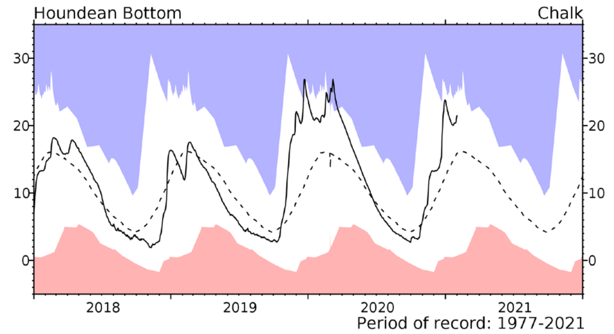
Groundwater . . . Groundwater

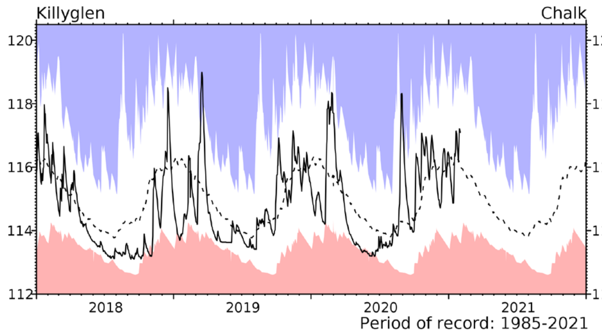


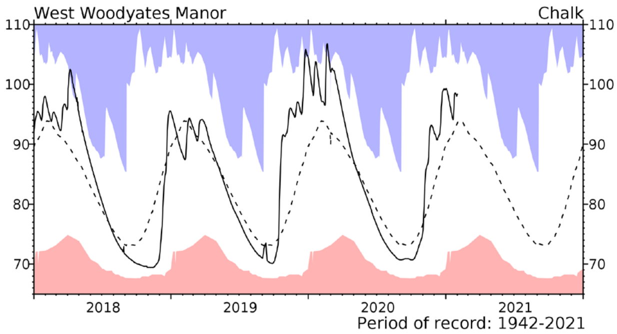


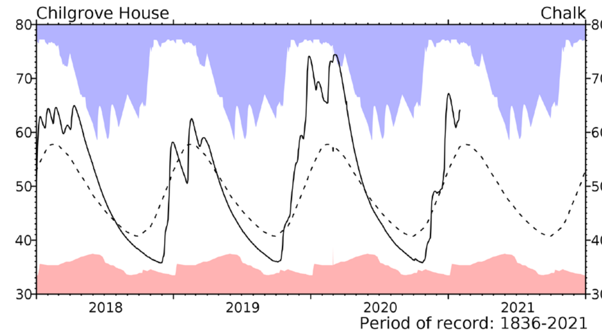


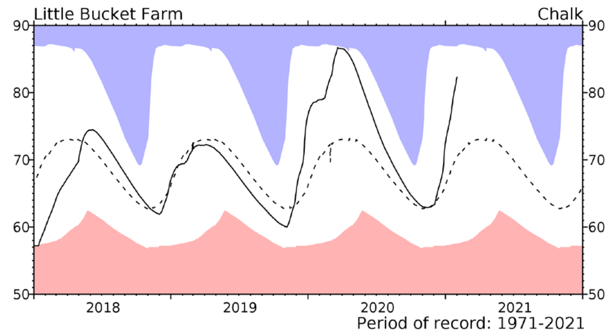


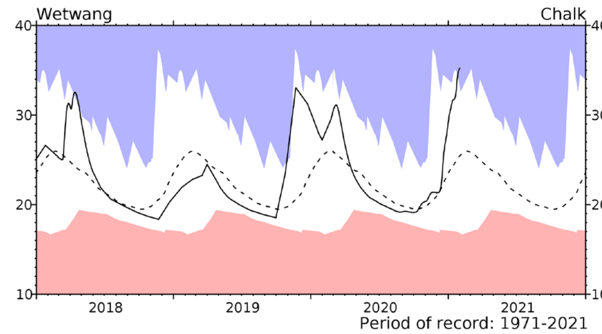






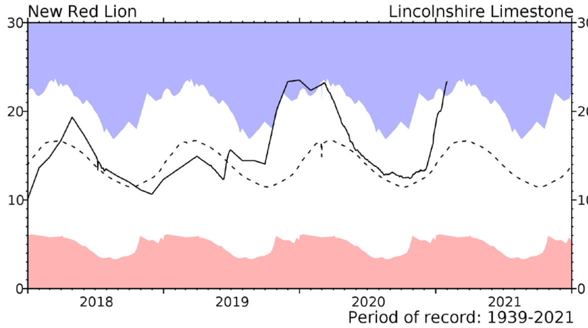


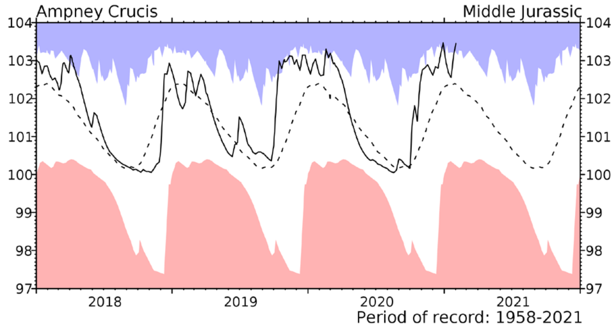


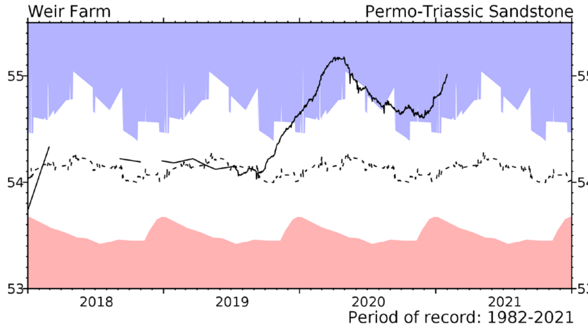


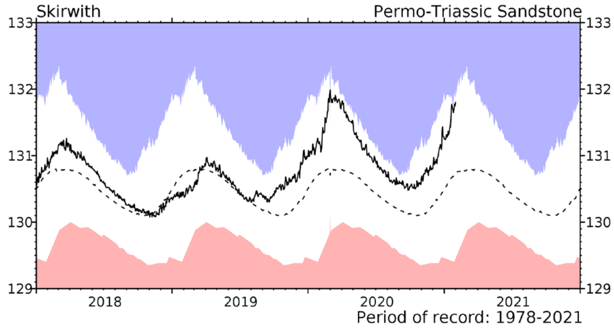
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

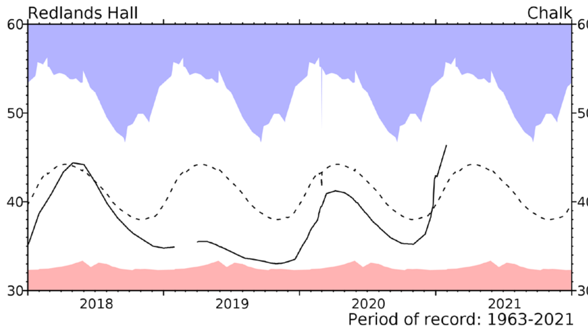
Groundwater ... Groundwater

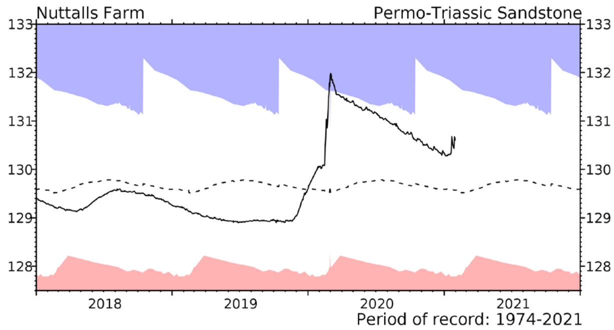


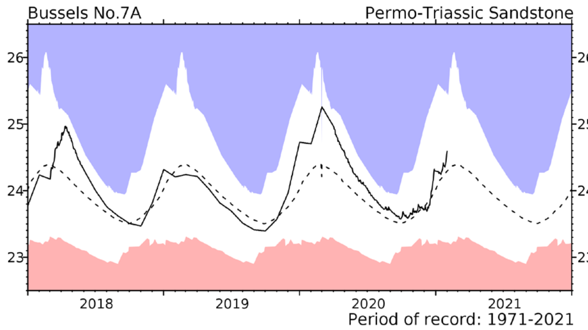


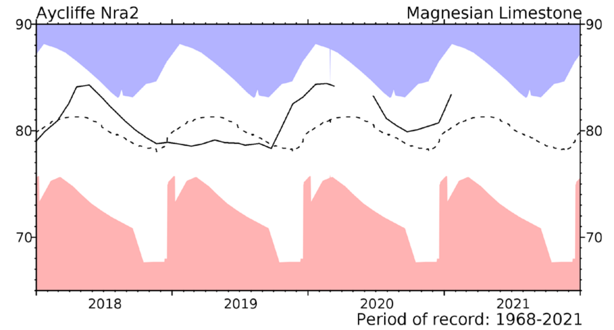


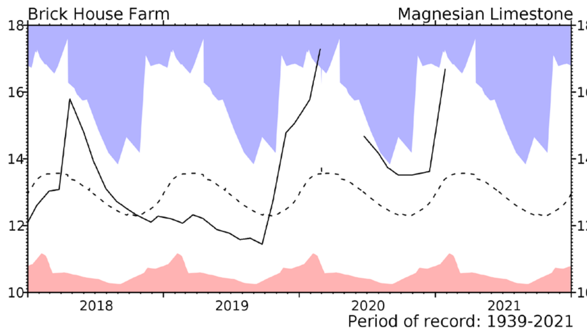


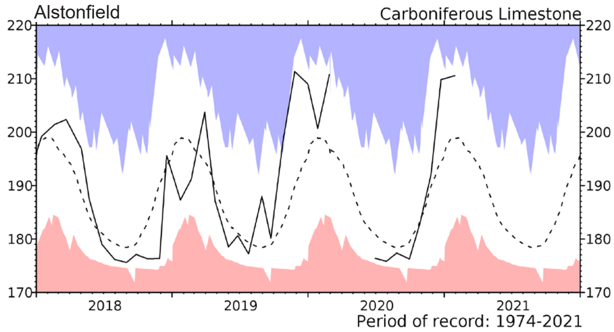


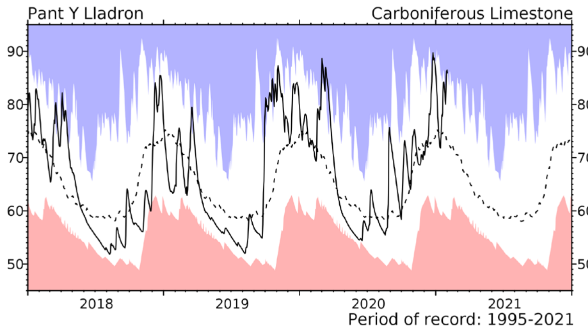


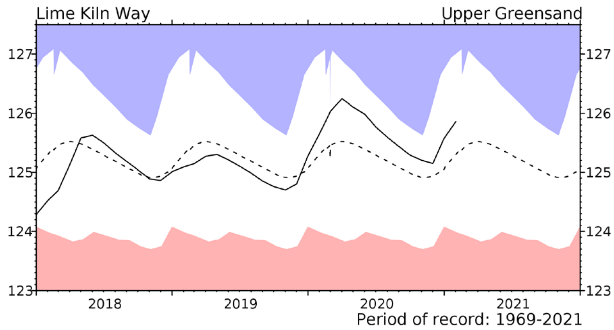




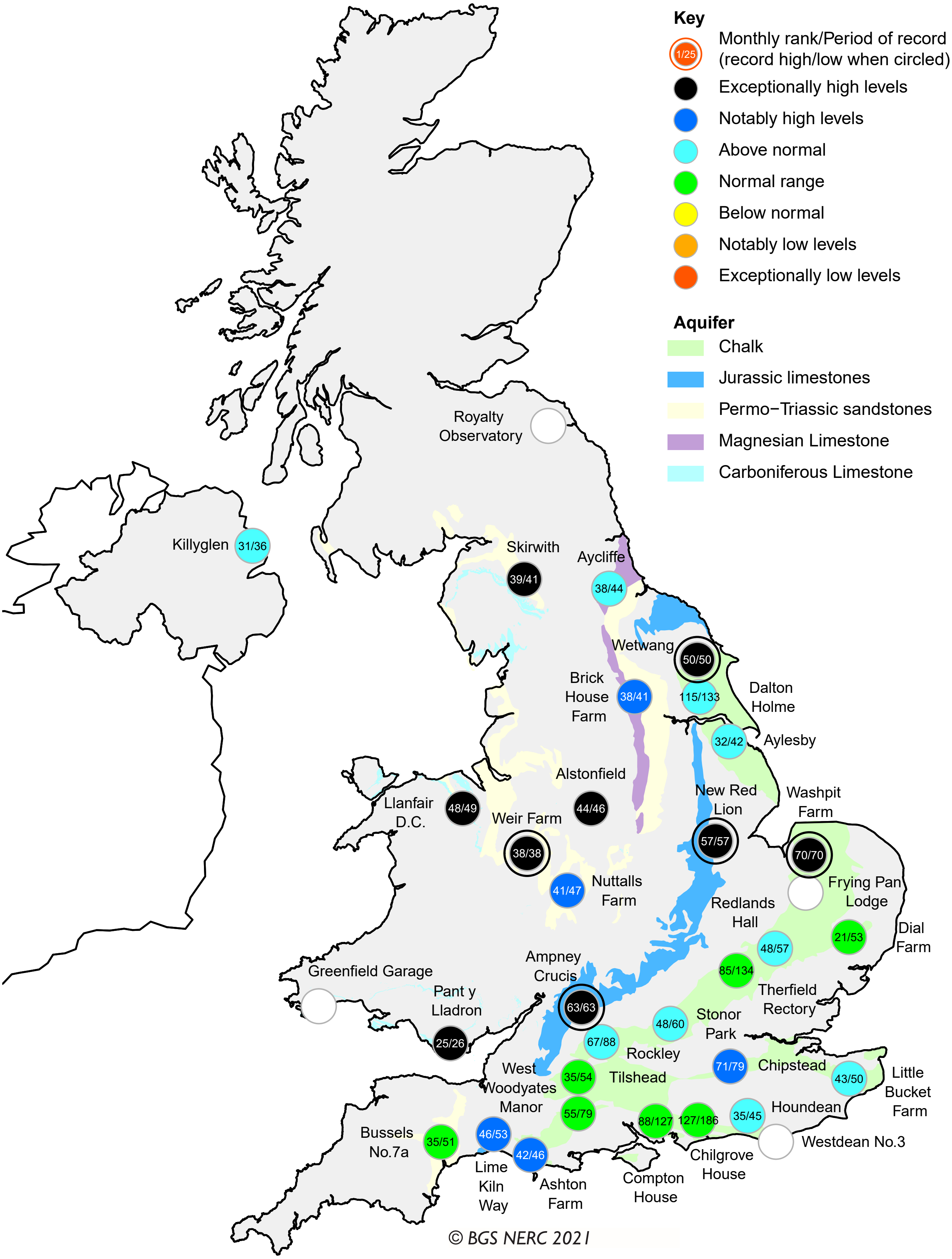








Groundwater…Groundwater



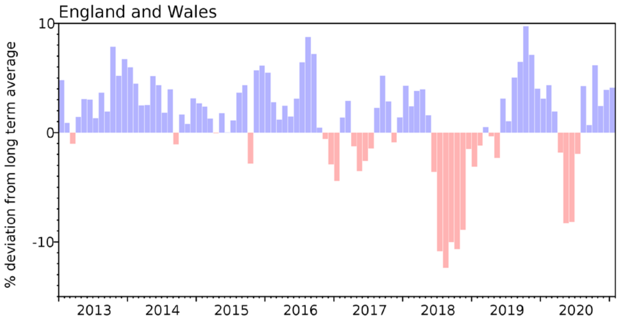
Groundwater levels - January 2021

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.

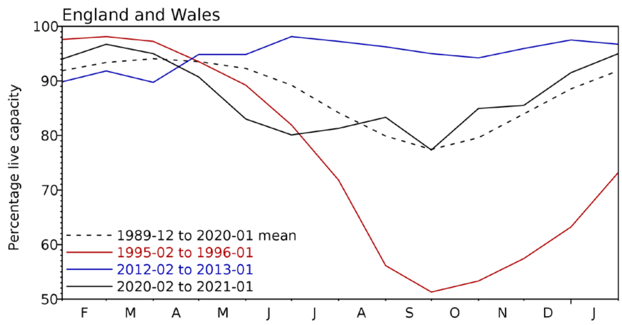
Note: Due to unforeseen circumstances no data are available for Scotland.

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

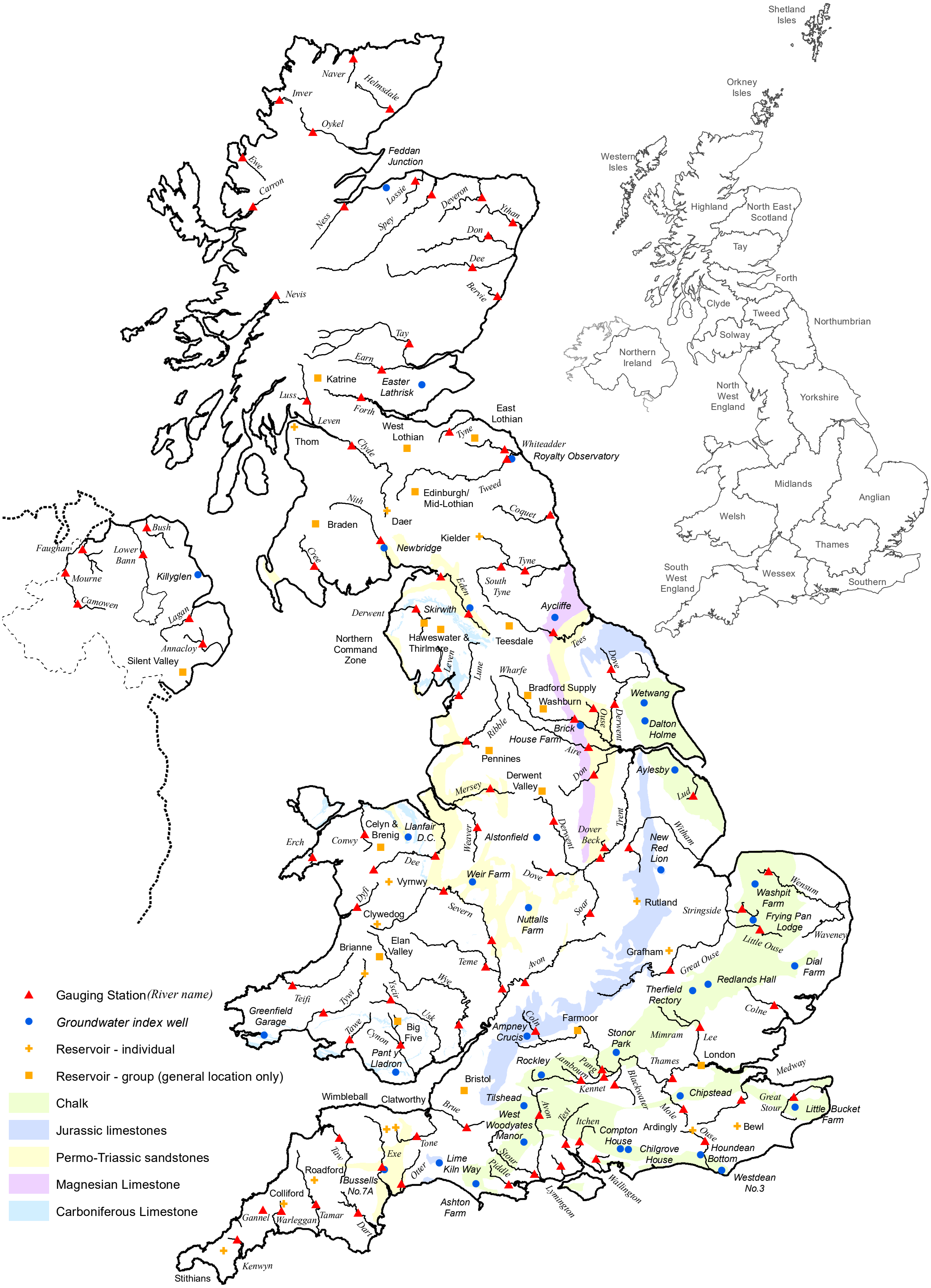
Area	Reservoir		Capacity (Ml)	2020 Nov	2020 Dec	2021 Jan	Jan Anom.	Min Jan	Year* of min	2020 Jan	Diff 21-20
North West	N Command Zone	•									
	Vyrnwy										
Northumbrian	Teesdale	•	87936	80	94	95	2	51	1996	99	-4
	Kielder		(199175)	89	89	92	-1	82	2019	91	1
Severn-Trent	Clywedog		49936	84	89	94	5	62	1996	93	1
	Derwent Valley	•	46692	91	100	99	4	15	1996	100	-1
Yorkshire	Washburn	•	23373	96	98	96	6	34	1996	91	5
	Bradford Supply	•	40942	98	100	100	6	33	1996	100	0
Anglian	Grafham		(55490)	89	87	83	-2	67	1998	86	-3
	Rutland		(116580)	87	87	93	6	68	1997	96	-3
Thames	London	•	202828	79	86	94	3	70	1997	91	3
	Farmoor	•	13822	90	78	89	-2	72	2001	97	-9
Southern	Bewl		31000	63	74	88	6	37	2006	93	-5
	Ardingly		4685	46	87	100	8	41	2012	100	0
Wessex	Clatworthy		5662	100	100	100	4	62	1989	100	0
	Bristol	•	(38666)	83	100	99	12	58	1992	98	1
South West	Colliford		28540	66	80	87	3	52	1997	81	6
	Roadford		34500	73	90	99	17	30	1996	82	17
	Wimbleball		21320	76	100	100	10	58	2017	100	0
	Stithians		4967	73	100	100	10	38	1992	100	0
Welsh	Celyn & Brenig	•	131155	97	95	100	5	61	1996	93	7
	Brianne		62140	100	98	100	2	84	1997	99	1
	Big Five	•	69762	76	94	99	6	67	1997	98	1
	Elan Valley	•	99106	86	100	96	-2	73	1996	98	-2
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	95	98	99	5	72	1999	99	0
	East Lothian	•	9317	100	100	100	2	68	1990	100	0
Scotland(W)	Loch Katrine	•	110326	96	100	99	6	85	2000	100	-1
	Daer		22494	100	98	100	2	90	2013	100	0
	Loch Thom		10721	83	92	93	-5	90	2020	90	3
Northern Ireland	Total+	•	56800	98	100	100	8	74	2017	96	3
	Silent Valley	•	20634	98	99	100	11	46	2002	94	6

( ) 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