Hydrological Summary
for the United Kingdom

General

Whilst temperatures remained below average, the high rainfall in May marked a sharp transition from an arid April. Recovery to warmer weather was delayed until the last week of May, making it the coldest April-May period in England since 1951. The total May rainfall for the UK was 177% of average, and Wales saw its wettest May in a series from 1910. River flows were above average across much of the UK, exceptionally so in Wales, where the mean May outflow was the highest in a series from 1961. Despite the high May rainfall and accompanying reduction in soil moisture deficits (SMDs; which by month-end were below average except in Southern region), groundwater levels in the index boreholes continued to recede (with the exception of some in the west). Generally, reservoir stocks were close to average, with notable recoveries in Yorkshire (Washburn and Bradford Supply) and south-west England (Clatworthy and Wimbleball), whilst at Loch Thom and Teesdale below-average stocks persisted. With near-average groundwater levels in the south and east, and reservoir stocks healthy across England, Wales and Northern Ireland, the water resources situation is generally favourable entering the summer. June started with a dry spell, but only in western Scotland does this add to longer-term deficiencies.

Rainfall

May saw successive westerly bands of rain across the UK, interspersed by northerly airflows and showers (sometimes wintry or thundery), before high pressure eventually dominated for a drier final week. The first of several low pressure systems (arriving on the 3rd) brought strong winds and outbreaks of heavy rain. It was unseasonably cold, with subsequent showers turning to sleet and snow over high ground. The wet and often cold conditions persisted, although with few notable daily rainfall totals, except on the 8th when 98mm was recorded at Treherbert, Mid Glamorgan. By the 13th, Wales, which along with the south-west was bearing the brunt of the westerly systems, had already seen 129% of its average May rainfall. There was further rain affecting the north of England on the 16th (bringing flooding to Langcliffe, Settle and Giggleswick, North Yorkshire) and on the 20th (e.g. 103mm at Mickleden, Cumbria), and causing road and rail disruption in south Wales on the 21st. The final week of May was in marked contrast to the first few weeks, as high pressure brought dry weather from the 24th to month-end. With the persistent wet weather, rainfall was above average across most of the country (only north-west Scotland was below average). More than twice the May average rainfall was recorded in the North East Scotland, Yorkshire, Severn-Trent and South West England regions, and Wales (with 252% of average). The dry April and wet May, with March having been closer to average, meant rainfall for spring (March-May) was near-average at the national scale.

River flows

After starting the month below average, there were sharp increases in river flows (except in the south and east) on the 3rd which further increased on the 8th. This was especially marked in Wales, with new May peak flow maxima established on the Tawe and the Cynon, both in series from 1957 (the record on the latter more than one and a half times that established in 1996). For the next fortnight, flows remained substantially above average, also rising markedly in the south and east. New daily flow maxima were established on multiple rivers in Wales (most notably 21st-23rd on the Welsh Dee for its long series from 1937) and south-west England, and flooding on the 21st suspended train services on the Conwy Valley line (north Wales). Sustained recessions finally began on the 25th and continued to month-end. Overall, river flows were in the normal range and above across England and Northern Ireland. However, the duration and magnitude of the high flows across Wales resulted in record-breaking May monthly mean flows on the Conwy, Dee, Teifi, Twyi, Tawe and Cynon (where flows were more than four times the average) in series of 50 years or more (most notably for its long series, the Welsh Dee on 21st-23rd). With both north and south Wales affected, the May outflow series for Wales (from 1961) saw a new daily maximum established on the 21st (141% of the previous maximum recorded in May 2006). Elsewhere, record-breaking May monthly mean flows were also recorded on the Wensum and Dart (in series from 1966 and 1958, respectively). With high flows affecting several of the winter and spring months (December to May), mean flows for this six month period were notably or exceptionally high across England and Wales (the Weaver recording its highest mean over this timeframe in a long series from 1937), and normal or above normal in Northern Ireland and southern England. For a second consecutive year, the mean outflow from England across these six months ranked in the top five of a series from 1961.

Groundwater

Although SMDs declined slightly during May, groundwater levels receded at all the Chalk index sites, except Dial Farm. Levels in Yorkshire and the majority of the southern England Chalk remained in the normal range. However, levels in the Chilterns and East Anglia varied between notably high at Washpit Farm and Frying Pan Lodge and the normal range at Redlands Hall. Levels also fell in the Magnesian limestone and in the northern parts of the Carboniferous (Alstonfield) and Jurassic (New Red Lion) limestone aquifers, generally ending the month notably to exceptionally high. Further south, levels rose in the Jurassic limestone at Ampney Crucis (moving from normal to exceptionally high) and in the Carboniferous Limestone of south Wales (moving from below normal and notably low to in the normal range and notably high at Greenfield Garage and Pant y Lladron, respectively). In the Permo-Triassic sandstones, levels rose overall at Llanfair DC and Bussels No. 7A, and fell at Skirwith, Weir Farm and Nuttalls Farm; levels were above normal to exceptionally high, with a new May maximum recorded at Weir Farm. Levels fell and were above normal for the time of year at Lime Kiln Way (Upper Greensand) and Royalty Observatory (Fell Sandstone).

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

May 2021

National Hydrological Monitoring Programme
UK Centre for Ecology & Hydrology
BGS British Geological Survey

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1981-2010 average.

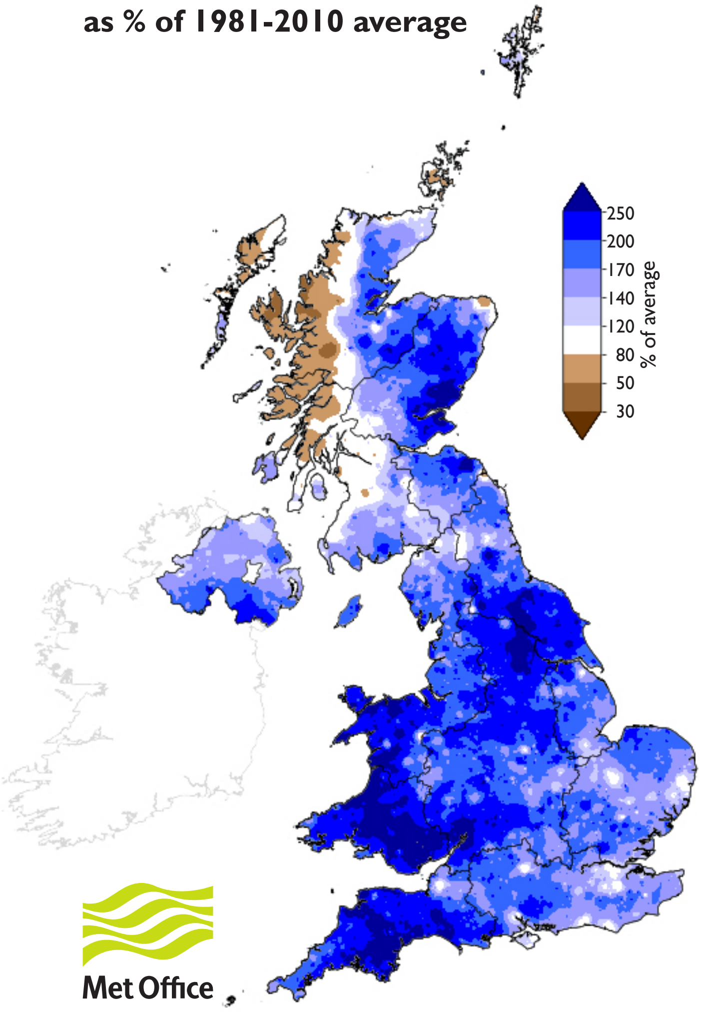
Region	Rainfall	May 2021	Apr21 – May21	RP	Mar21 – May21	RP	Dec20 – May21	RP	Jun20 – May21	RP
United	mm	**120**	140		224		625		1300	
Kingdom	%	**177**	101	2-5	97	2-5	112	5-10	115	20-35
England	mm	**111**	122		172		500		1011	
	%	**193**	106	2-5	97	2-5	123	10-15	119	10-20
Scotland	mm	**110**	145		285		758		1646	
	%	**138**	87	2-5	94	2-5	99	2-5	108	10-15
Wales	mm	**210**	227		324		943		1787	
	%	**252**	134	5-10	114	2-5	133	40-60	126	40-60
Northern	mm	**116**	141		215		571		1333	
Ireland	%	**160**	95	2-5	88	2-5	102	2-5	117	40-60
England &	mm	**125**	137		193		561		1117	
Wales	%	**204**	111	2-5	100	2-5	125	10-20	121	15-25
North West	mm	**133**	146		275		739		1605	
	%	**186**	102	2-5	114	5-10	125	20-35	131	>100
Northumbria	mm	**98**	114		169		551		1063	
	%	**177**	97	2-5	92	2-5	132	30-50	122	15-25
Severn-Trent	mm	**117**	130		171		478		929	
	%	**206**	113	2-5	100	2-5	128	10-15	119	8-12
Yorkshire	mm	**124**	136		191		542		1079	
	%	**233**	119	2-5	107	2-5	133	15-25	128	20-30
Anglian	mm	**83**	88		121		361		727	
	%	**167**	93	2-5	87	2-5	127	8-12	116	5-10
Thames	mm	**99**	112		143		386		840	
	%	**177**	103	2-5	90	2-5	111	2-5	117	5-10
Southern	mm	**84**	90		127		418		840	
	%	**160**	85	2-5	77	2-5	107	2-5	105	2-5
Wessex	mm	**120**	137		177		480		982	
	%	**199**	115	2-5	95	2-5	109	2-5	111	2-5
South West	mm	**179**	189		240		763		1443	
	%	**239**	124	5-10	97	2-5	121	5-10	117	8-12
Welsh	mm	**205**	222		312		910		1730	
	%	**252**	135	5-10	114	2-5	134	40-60	126	50-80
Highland	mm	**98**	155		353		838		1759	
	%	**111**	82	2-5	98	2-5	89	2-5	97	2-5
North East	mm	**133**	168		237		595		1216	
	%	**203**	129	2-5	113	2-5	125	15-25	120	15-25
Tay	mm	**152**	173		290		753		1574	
	%	**194**	113	2-5	106	2-5	110	5-10	117	15-25
Forth	mm	**113**	129		220		644		1414	
	%	**160**	94	2-5	91	2-5	108	5-10	117	20-35
Tweed	mm	**118**	135		209		644		1297	
	%	**180**	104	2-5	100	2-5	129	30-50	126	50-80
Solway	mm	**129**	142		267		793		1829	
	%	**156**	83	2-5	90	2-5	108	5-10	123	>100
Clyde	mm	**91**	117		276		851		2034	
	%	**103**	62	8-12	78	2-5	93	2-5	112	10-20

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

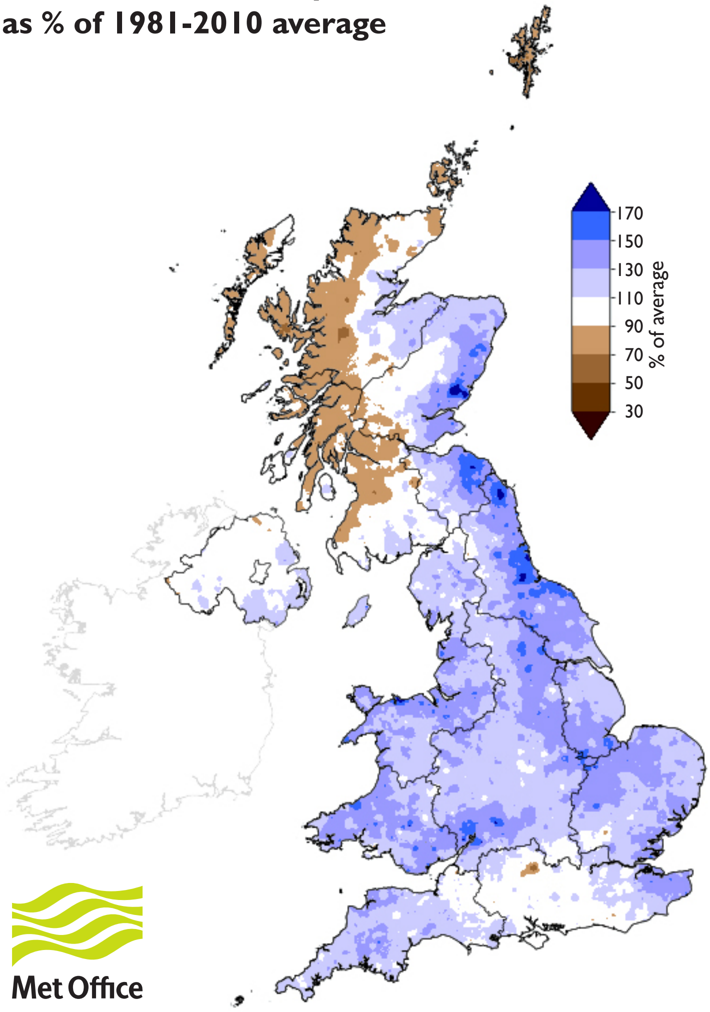
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

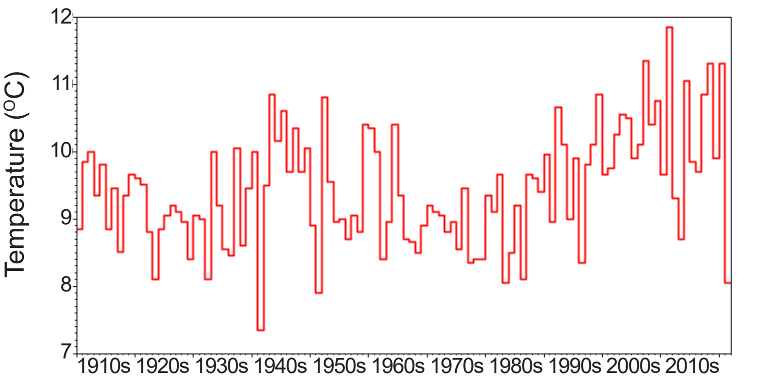
May 2021 rainfall as % of 1981-2010 average



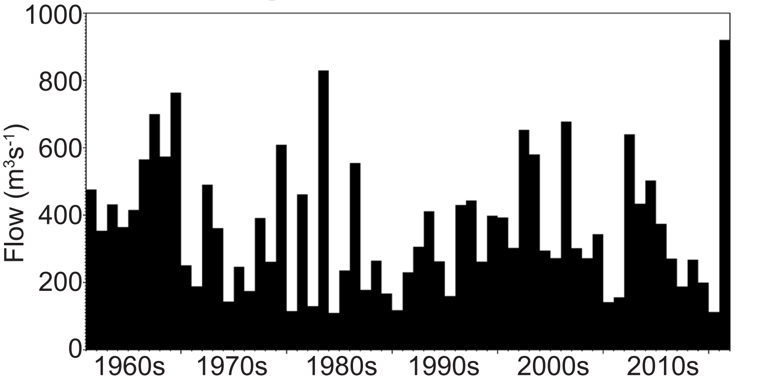
December 2020 - May 2021 rainfall as % of 1981-2010 average



April - May mean temperature for England



December - May mean outflows for 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.

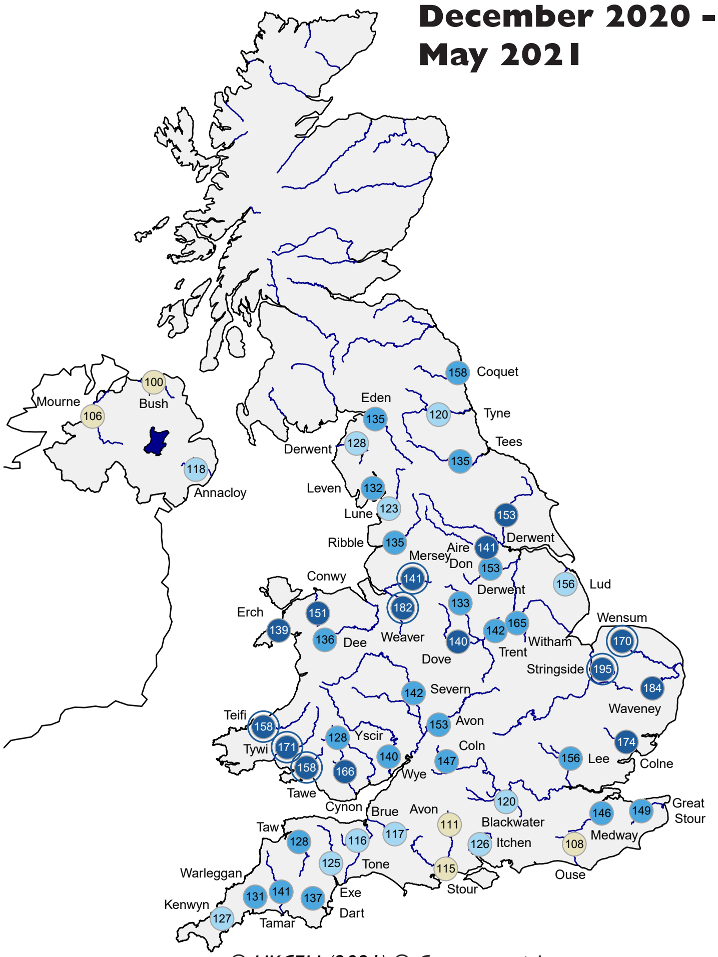
The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from June 2021**
Issued: **08.06.2021**
using data to the end of May 2021

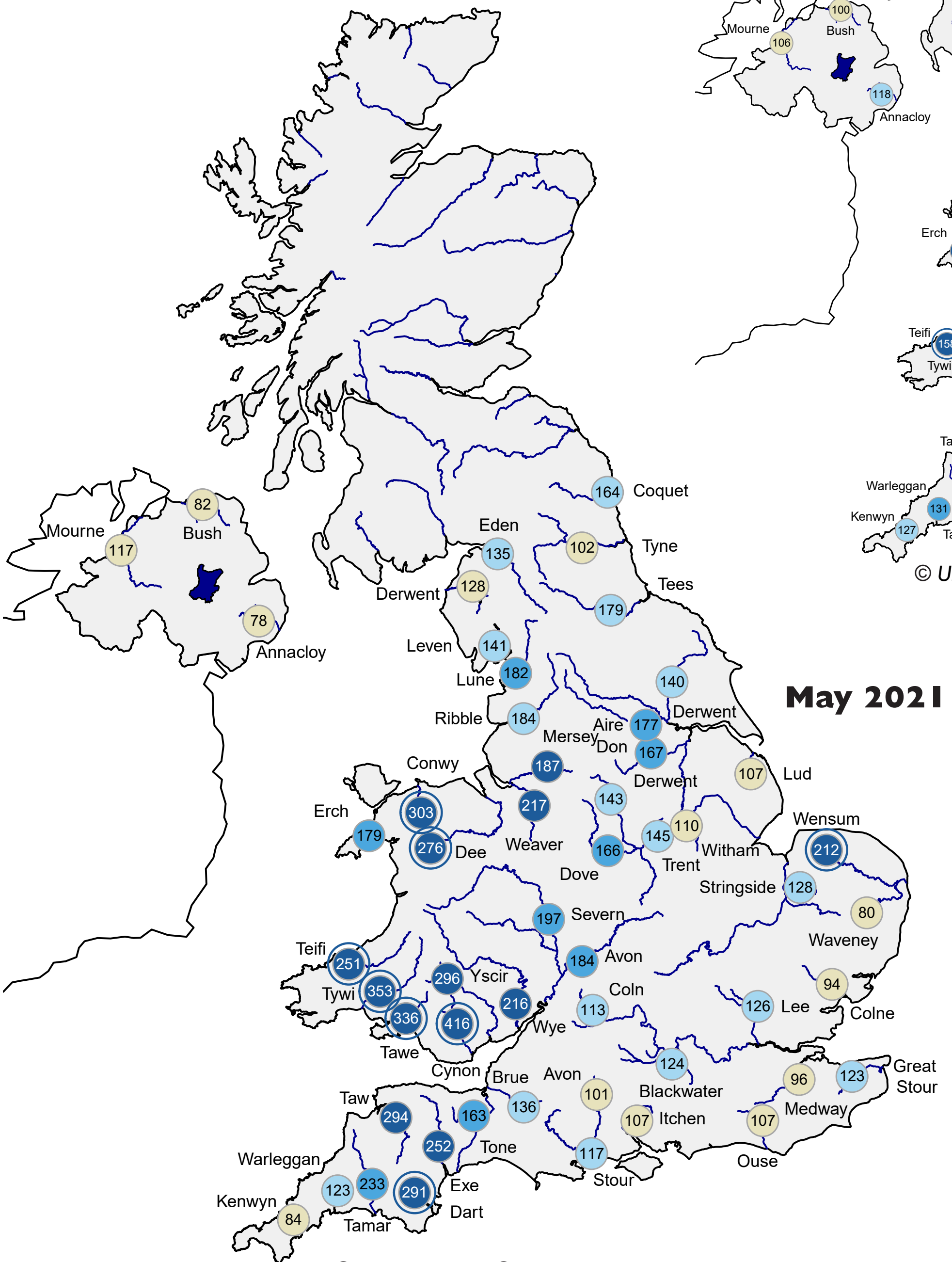
The outlook for June and for the June–August period is for river flows to be normal to above normal in most parts of the UK, the exception being the north west of Scotland and Northern Ireland where normal to below normal flows are likely in June. Groundwater levels in June, and for the next three months, are likely to be normal to above normal across most of the UK, the exception being the south east of England where normal to below normal levels are expected.

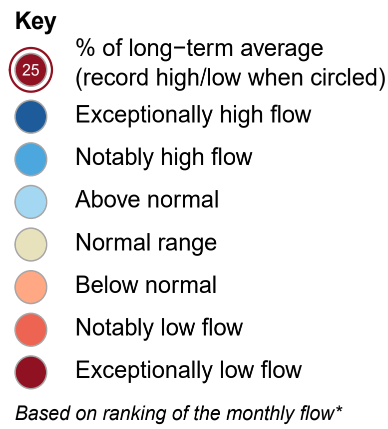
River flow . . . River flow . . .

December 2020 - May 2021



May 2021



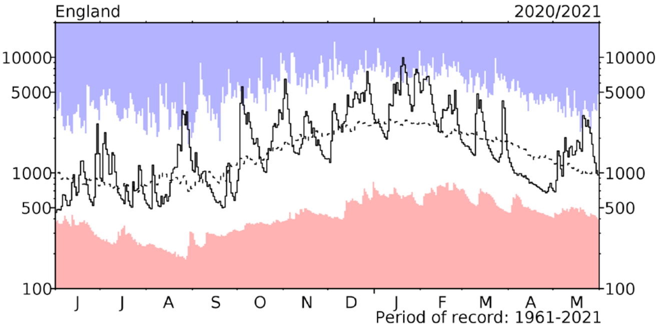


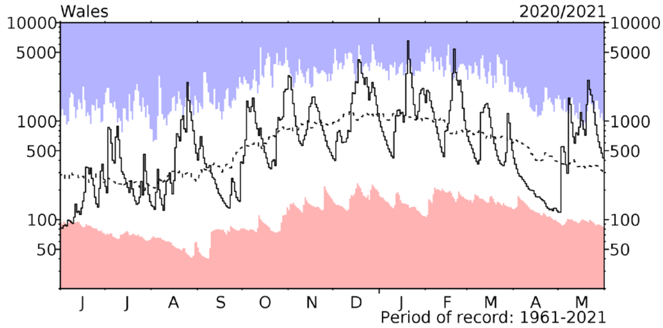
River flows

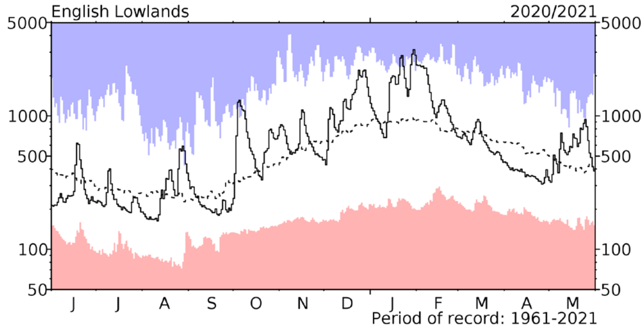
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

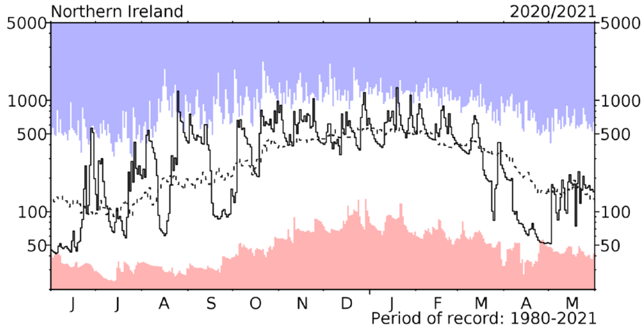
Note: Due to unforeseen circumstances no data are available for Scotland.

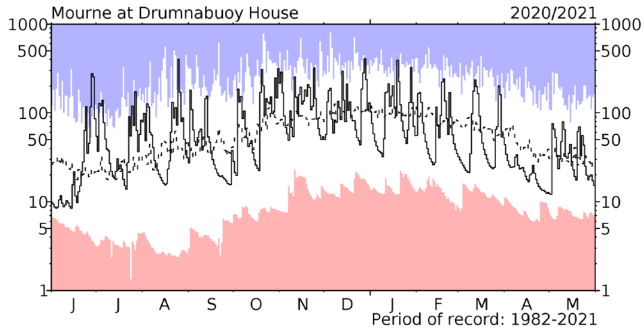
River flow . . . River flow . . .

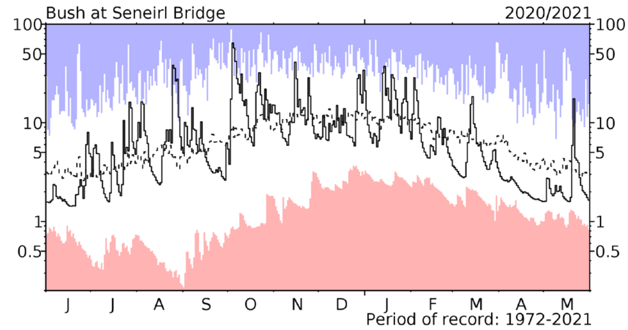


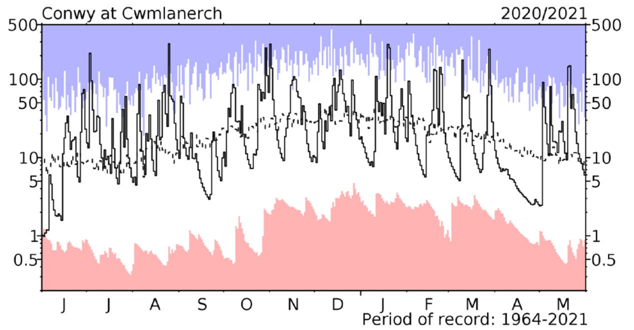


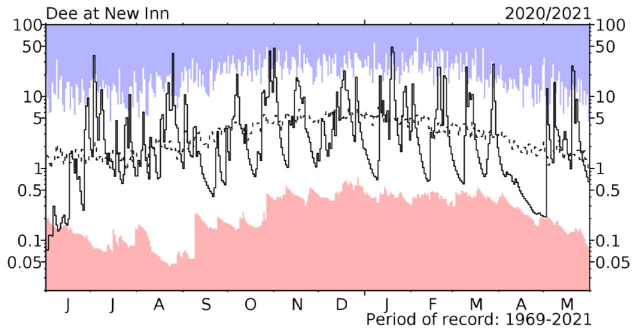


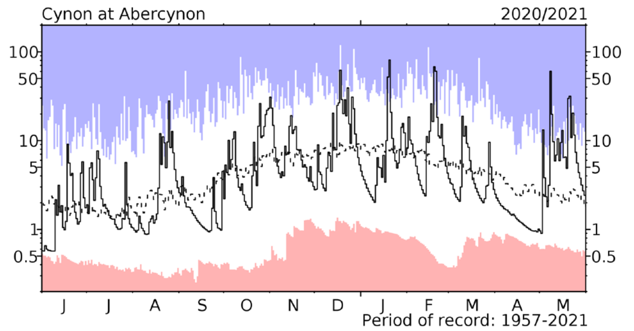


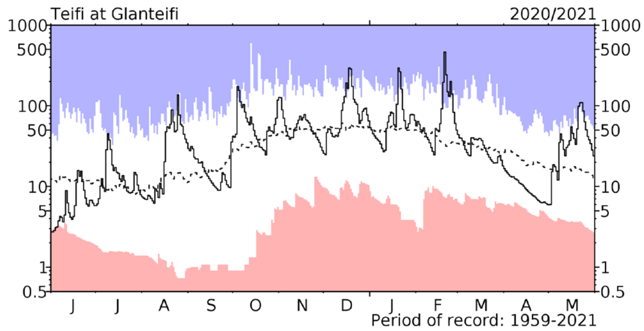






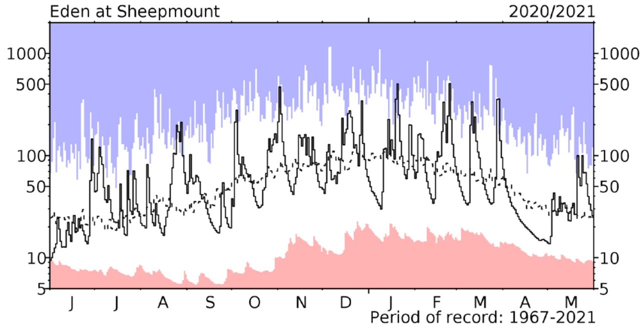


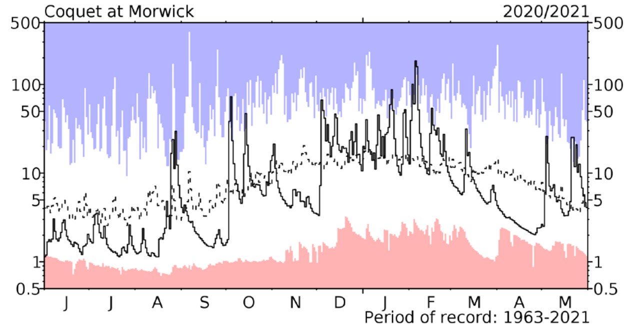


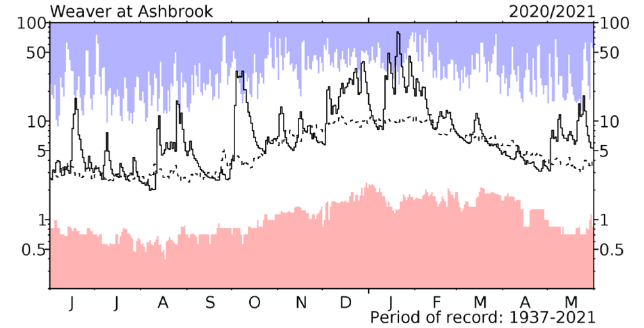


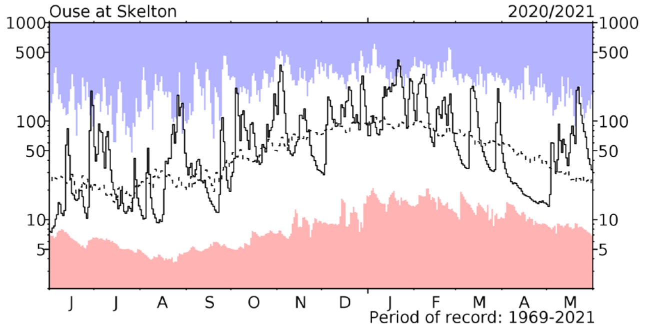
River flow hydrographs

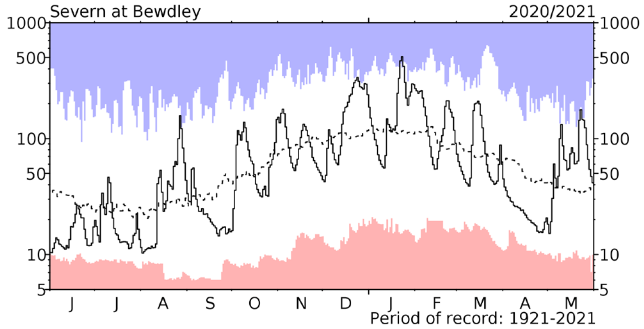
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to June 2020 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

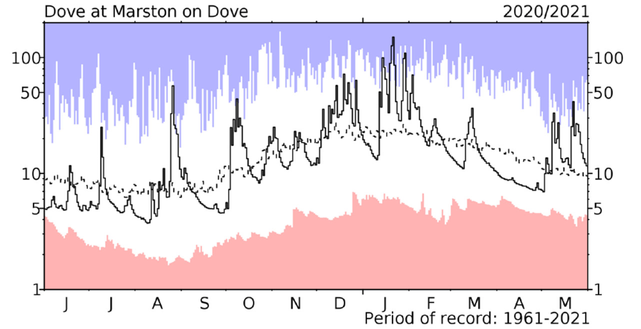

Eden at Sheepmount
2020/2021
J J A S O N D J F M A M
Period of record: 1967-2021

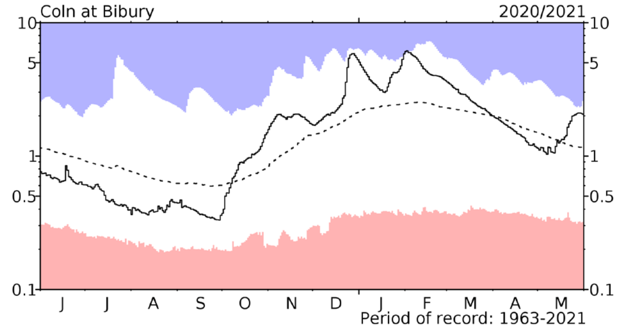

Coquet at Morwick
2020/2021
J J A S O N D J F M A M
Period of record: 1963-2021

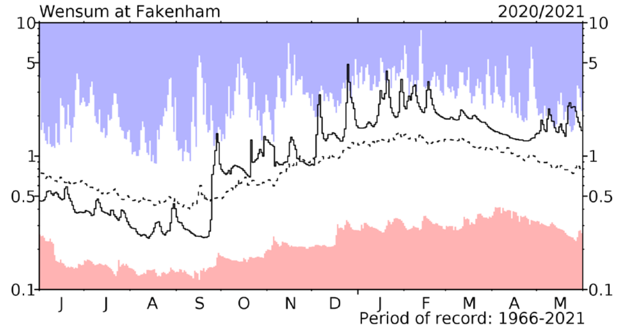

Weaver at Ashbrook
2020/2021
J J A S O N D J F M A M
Period of record: 1937-2021

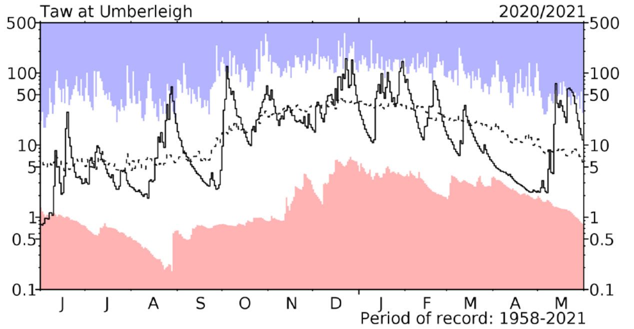

Ouse at Skelton
2020/2021
J J A S O N D J F M A M
Period of record: 1969-2021

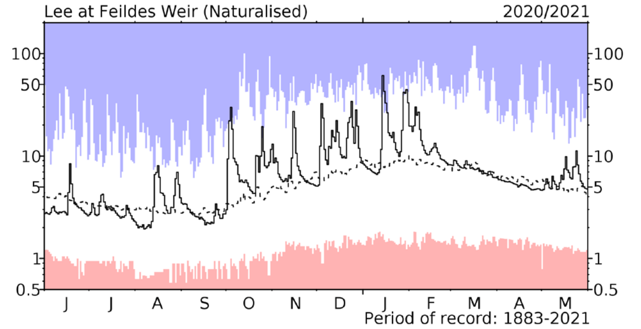

Severn at Bewdley
2020/2021
J J A S O N D J F M A M
Period of record: 1921-2021

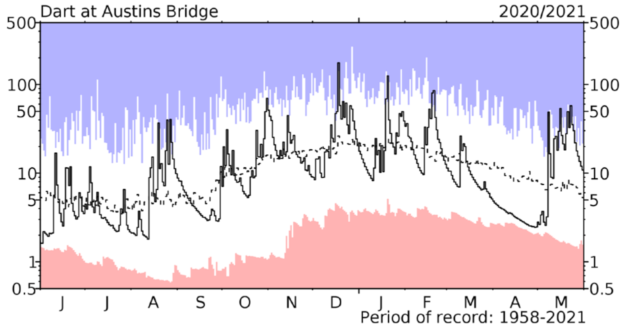

Dove at Marston on Dove
2020/2021
J J A S O N D J F M A M
Period of record: 1961-2021

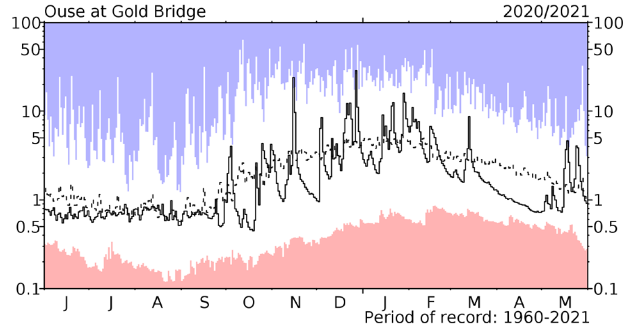

Coln at Bibury
2020/2021
J J A S O N D J F M A M
Period of record: 1963-2021


Wensum at Fakenham
2020/2021
J J A S O N D J F M A M
Period of record: 1966-2021

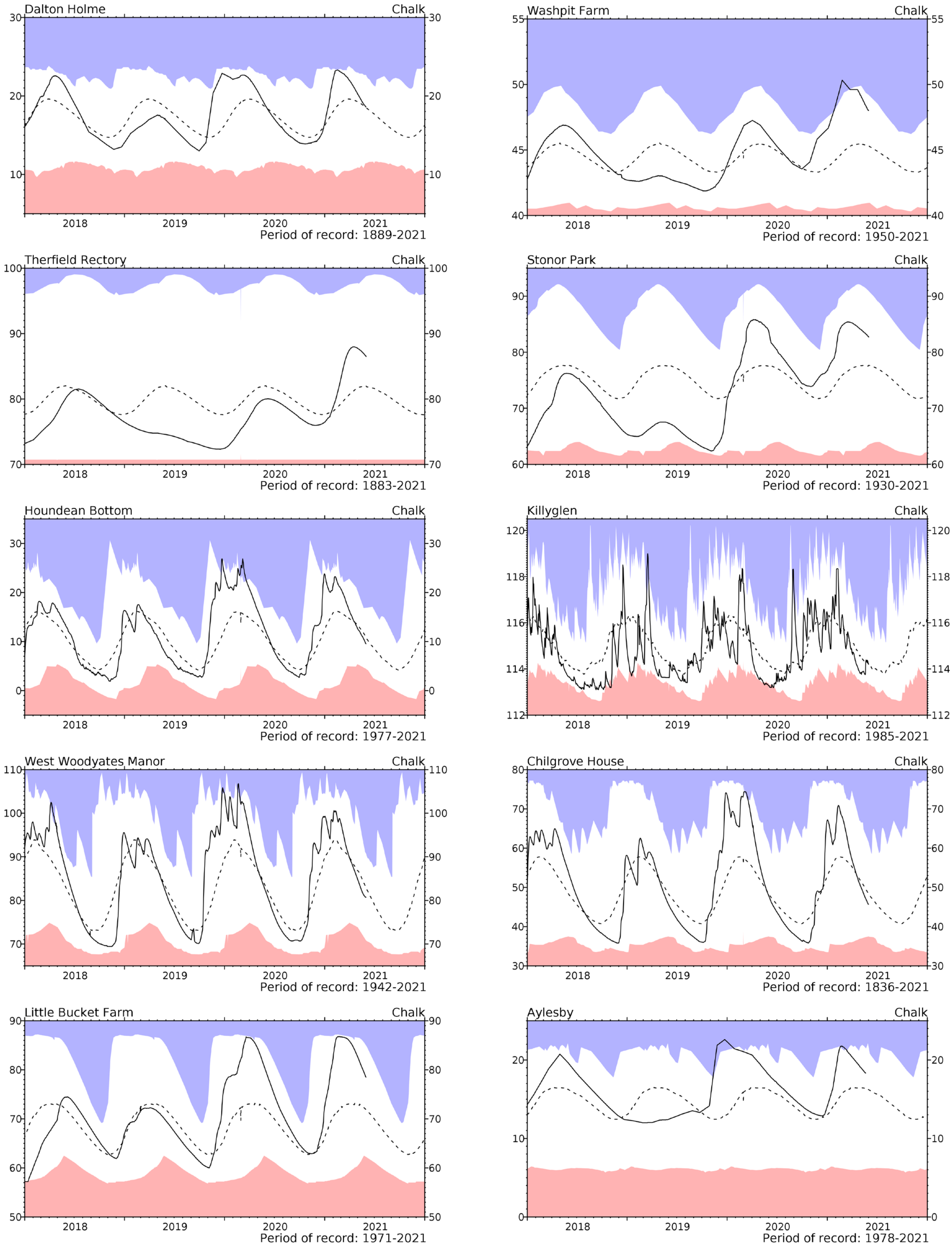

Taw at Umberleigh
2020/2021
J J A S O N D J F M A M
Period of record: 1958-2021


Lee at Feildes Weir (Naturalised)
2020/2021
J J A S O N D J F M A M
Period of record: 1883-2021


Dart at Austins Bridge
2020/2021
J J A S O N D J F M A M
Period of record: 1958-2021

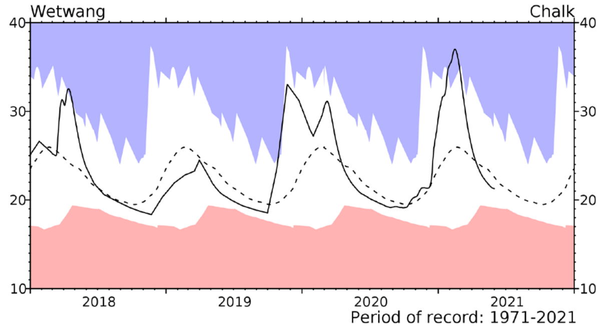

Ouse at Gold Bridge
2020/2021
J J A S O N D J F M A M
Period of record: 1960-2021

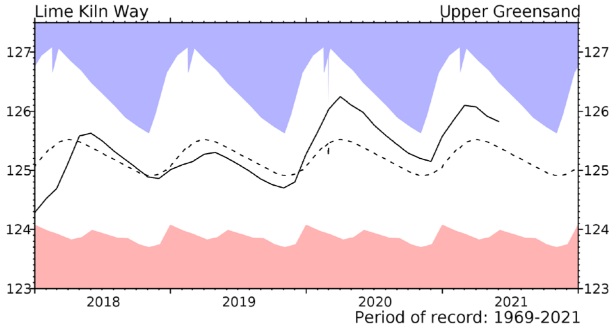
Groundwater . . . Groundwater

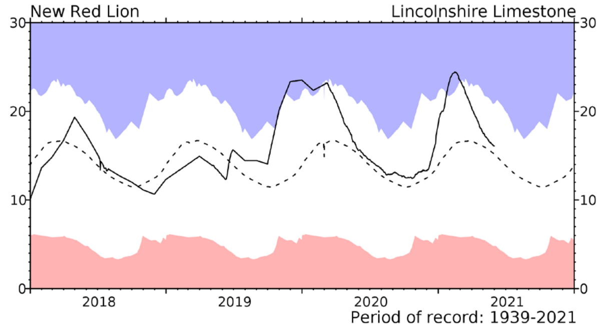


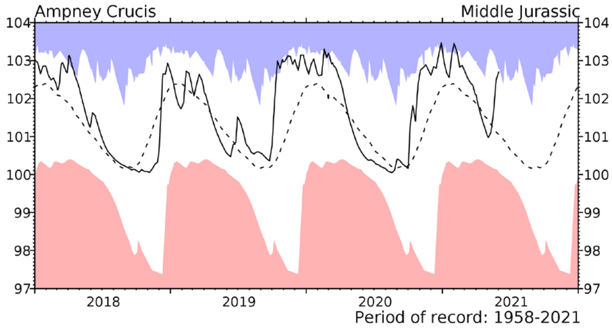
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly mean and the highest and lowest levels recorded for each month are calculated with data from the start of the record to the end of 2017. Note that most groundwater levels are not measured continuously and, for some index wells, the greater frequency of contemporary measurements may, in itself, contribute to an increased range of variation.

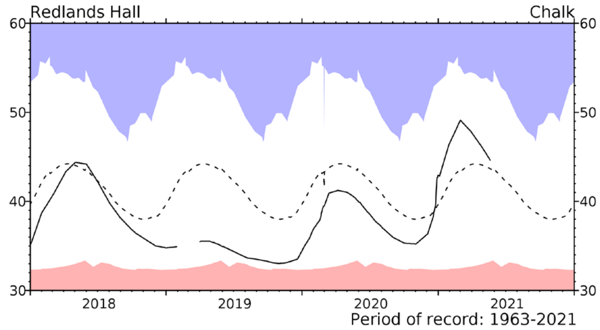
Groundwater ... Groundwater

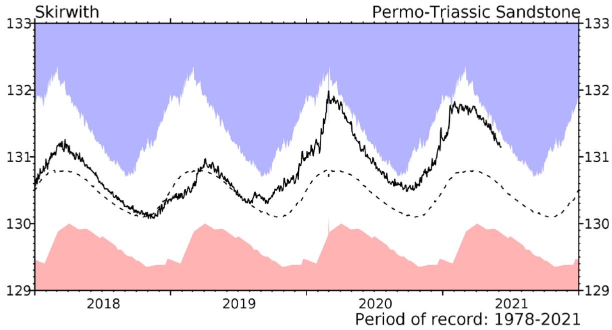


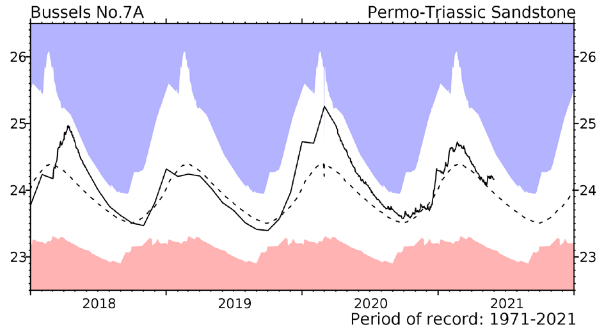


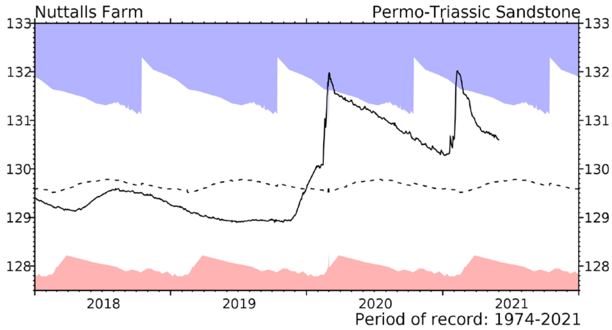


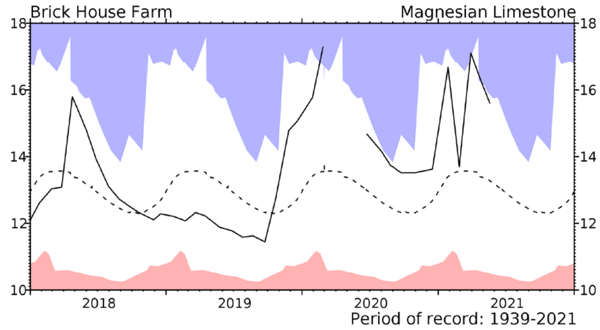


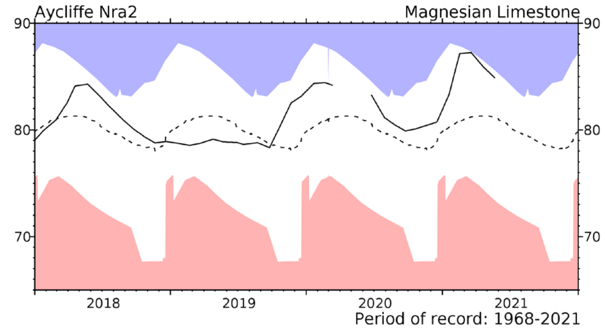


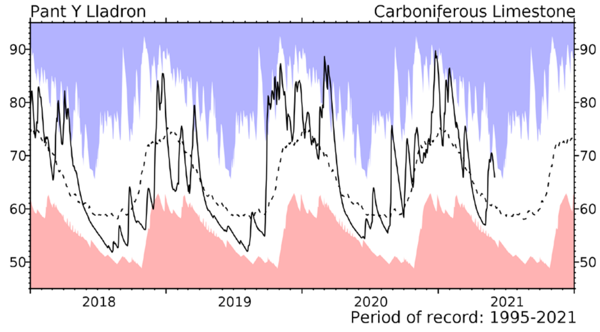


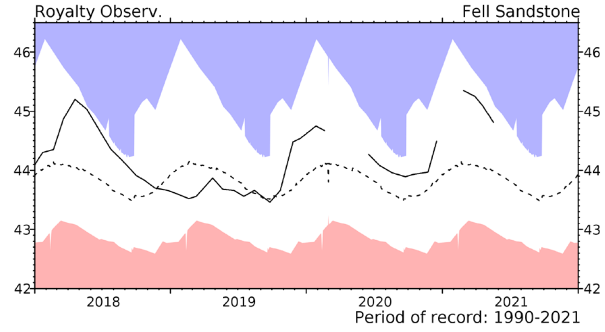




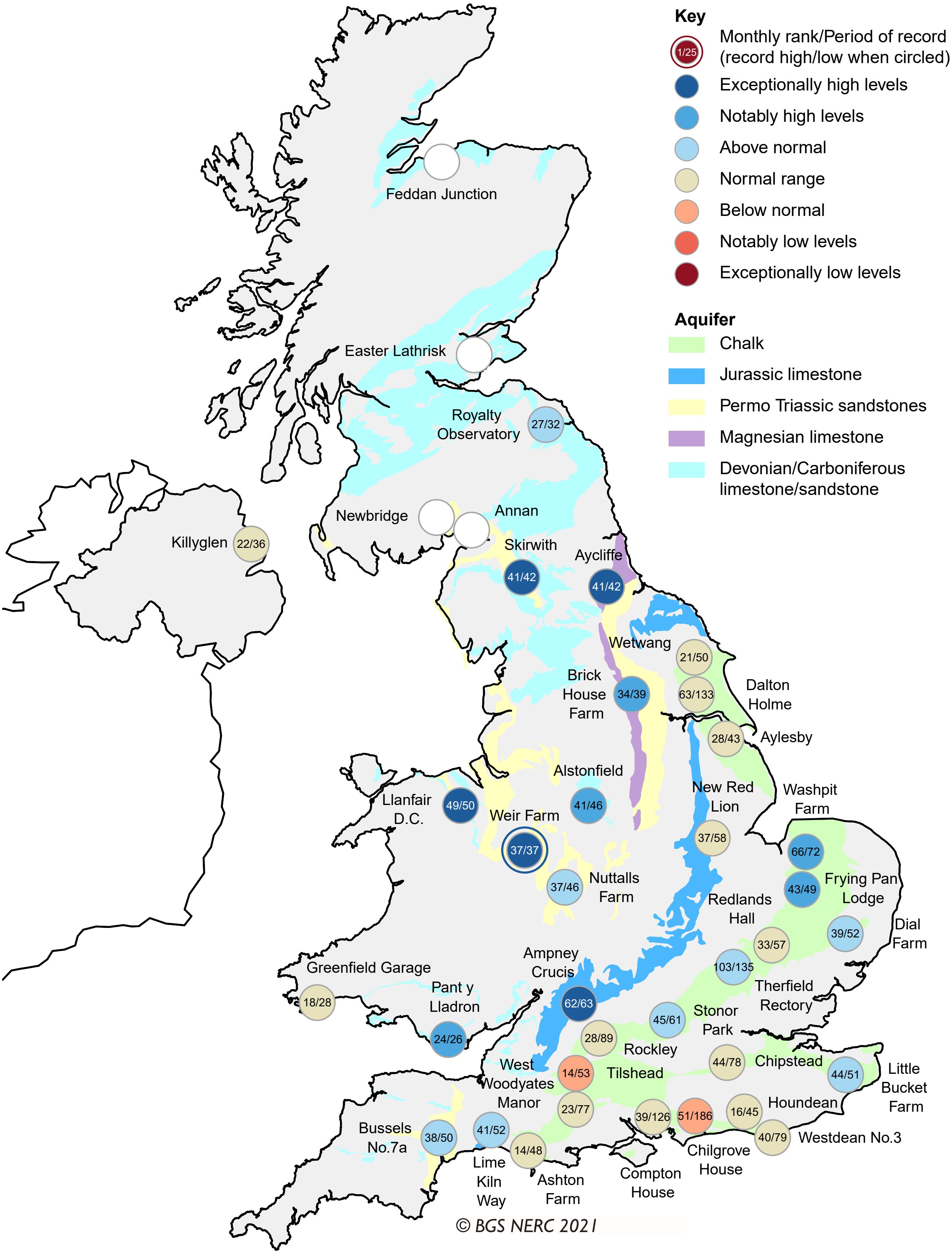








Groundwater...Groundwater



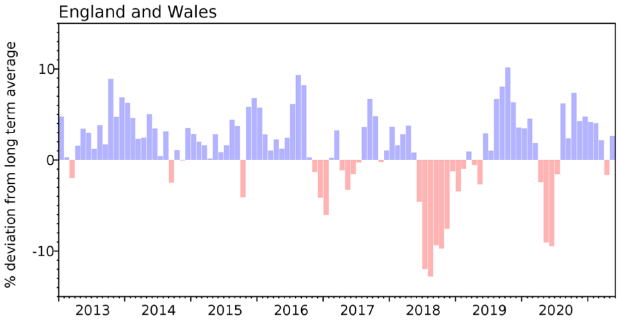
Groundwater levels - May 2021

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.

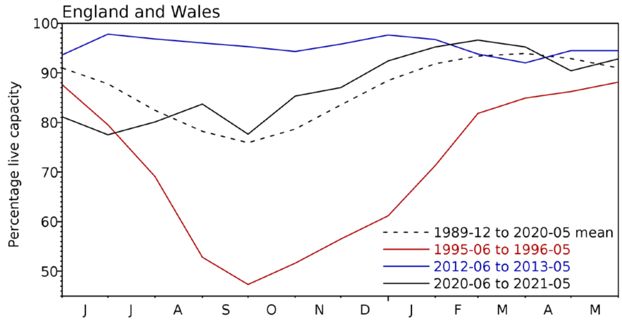
Note: Due to unforeseen circumstances no data are available for Scotland.

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

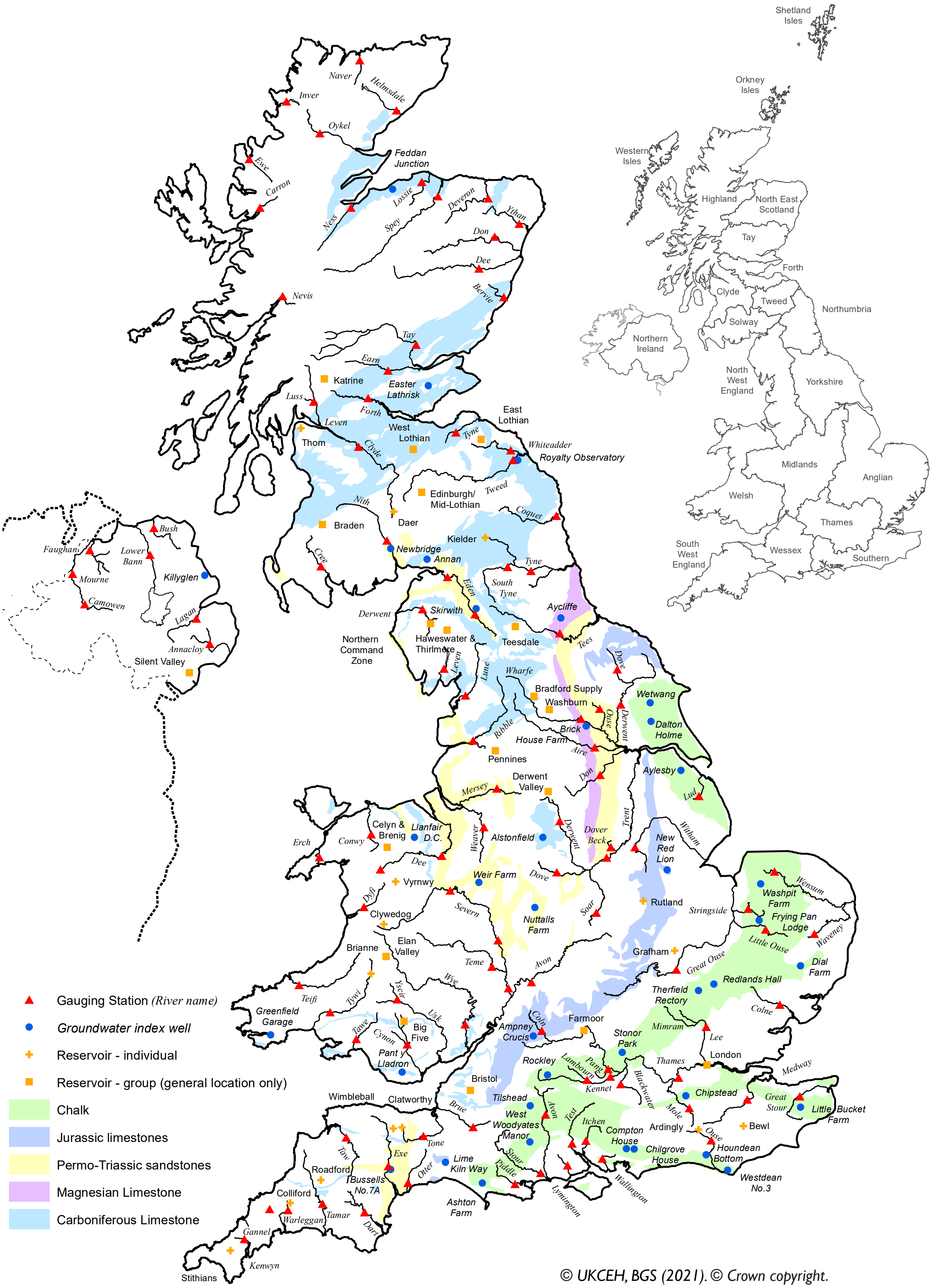
Area	Reservoir		Capacity (Ml)	2021 Mar	2021 Apr	2021 May	May Anom.	Min May	Year* of min	2020 May	Diff 21-20
North West	N Command Zone	•	124929	100	85	86	6	50	1984	61	25
	Vyrnwy		55146	99	95	99	11	69	1984	80	19
Northumbrian	Teesdale	•	87936	82	74	74	-11	62	2020	62	12
	Kielder		(199175)	93	89	96	5	85	1989	85	11
Severn-Trent	Clywedog		49936	98	99	99	2	83	1989	91	8
	Derwent Valley	•	46692	97	83	92	5	56	1996	68	24
Yorkshire	Washburn	•	23373	83	76	87	1	71	2020	71	17
	Bradford Supply	•	40942	91	84	97	12	68	2020	68	29
Anglian	Grafham		(55490)	92	96	92	-2	72	1997	94	-2
	Rutland		(116580)	96	96	95	3	75	1997	94	1
Thames	London	•	202828	97	96	91	-3	83	1990	92	-1
	Farmoor	•	13822	98	96	96	-2	90	2002	99	-3
Southern	Bewl		31000	92	90	90	2	57	1990	94	-4
	Ardingly		4685	100	99	100	1	89	2012	96	4
Wessex	Clatworthy		5662	100	89	100	14	67	1990	78	22
	Bristol	•	(38666)	97	89	89	0	70	1990	85	5
South West	Colliford		28540	94	86	87	1	52	1997	80	7
	Roadford		34500	97	91	93	9	48	1996	86	7
	Wimbleball		21320	100	85	98	6	74	2011	81	16
	Stithians		4967	98	89	88	0	66	1990	84	3
Welsh	Celyn & Brenig	•	131155	97	98	100	3	79	2020	79	21
	Brianne		62140	97	88	93	-2	82	2020	82	11
	Big Five	•	69762	97	87	92	2	70	1990	74	18
	Elan Valley	•	99106	96	90	98	5	76	2020	76	22
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	98	93	92	2	52	1998	82	10
	East Lothian	•	9317	100	99	100	3	84	1990	97	3
Scotland(W)	Loch Katrine	•	110326	98	88	85	-2	66	2001	79	6
	Daer		22494	99	87	85	-4	69	2020	69	16
	Loch Thom		10721	88	72	73	-18	70	2020	70	3
Northern Ireland	Total+	•	56800	96	89	91	6	69	2008	75	16
	Silent Valley	•	20634	93	84	87	5	56	2000	70	17

( ) 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