Hydrological Summary *for the United Kingdom*

April 2021

General

April was an exceptionally dry, sunny and cool month, an unusual combination of low rainfall and temperatures for the time of year (scatterplot on third page). It was both the frostiest and sunniest April on record for the UK (in series from 1960 and 1919, respectively), and in the Central England Temperature series it was the second coldest April since World War Two. For the UK, rainfall was 29% of the long-term average, the driest April since 1980 and fourth driest in a series from 1910; substantial parts of southern and eastern England recorded little appreciable rainfall. Soil moisture deficits (SMDs) increased across the UK in April and soils were substantially drier than average for the time of year; late April soil moisture in the South West region was the driest on record (in a series from 1961). Having receded throughout the month, river flows were below normal or lower across most of England, Wales and Northern Ireland, less than half of average across western areas, and notably or exceptionally low in south-west England and Northern Ireland. The lack of recharge across the UK in April meant groundwater levels fell in all aquifers, and whilst levels at several boreholes were in a lower category than at the end of March, they generally remained within the normal range or above. Whilst reservoir stocks fell, totals for England & Wales remained near average. However, stocks in some reservoirs were substantially below their late April average (e.g. by more than 20% at Loch Thom); previous late April minimum stocks were equalled at Washburn and eclipsed at Loch Thom (in series from 1988). At the end of April, whilst healthy in the English Lowlands, the outlook for late spring and summer in the responsive north and west was more tentative given low flows and some declining reservoir stocks. However, substantial rainfall over the first fortnight of May has provided some respite from the sustained dry weather of spring. Across most of the UK, average May rainfall has already been recorded (and substantially exceeded in the north and west), likely ameliorating concerns for water resources.

Rainfall

Anticyclonic conditions dominated the weather in April and limited the transit of rain-bearing systems across the UK. Under a prevailing northerly airflow, cold air resulted in multiple snowy episodes. From the 4th, snow accumulations (e.g. 12cm on the 7th at Loch Glascarnoch, Ross & Cromarty) caused difficult driving conditions in parts of Scotland, Wales and Northern Ireland. On the 8th, 28mm of rainfall was recorded at Achnagart (Ross & Cromarty), remarkably one of the highest daily totals of the month. On the 11th, further snowfall in Greater Manchester and Yorkshire contributed to disruption on the roads. The weather turned showery towards month-end, though not sufficient to generate appreciable rainfall totals. Wildfires occurred in Northern Ireland, south Wales, West Yorkshire and Cumbria towards month-end, with the persistent dryness a contributing factor. Overall, rainfall was exceptionally low for the UK; northern Scotland, western Northern Ireland and areas along the M4 corridor were the wettest places, yet only recorded around half of long-term average rainfall. Elsewhere, rainfall was a third of average or less, with less than 10% of average recorded across substantial areas of south-east England and the East Midlands, and parts of south-west England. Despite the exceptionally dry weather in the south-east, it was remarkably only the fourth driest April in the last decade and a half. Spring rainfall to date (March-April) was less than 70% of average across the majority of the country (64% of average for the UK), with southern, central and eastern England recording less than half the average (Southern and South West regions recorded around a third of the long-term average rainfall).

River flows

The limited appreciable rainfall in April meant notable river flows were largely absent. Following moderate flows in late March (the highest daily flows of April were on the 1st in almost all catchments), recessions were established and continued throughout the month. They were particularly steep in responsive western catchments (e.g. in Wales, north-west and south-west England), though flows in slowly responding catchments (e.g. Lud, Little Ouse, Coln, Itchen) also returned to near average after winter high flows. By month-end, daily flows were very close to historical minima in catchments across Wales (e.g. Yscir, Tywi, Dee), Northern Ireland (e.g. Lagan), and north-west (e.g. Cumbria Leven) and south-west England (e.g. Dart, Kenwyn, Taw). The outflow series illustrate the widespread nature of river flow recessions with swift declines from near average flows in late March to approaching (Wales) or eclipsing (Northern Ireland) previous late April daily minima. Overall, mean river flows for April were less than half of the long-term average in Wales, Northern Ireland, and northern and south-western England, and around a quarter of average or less on the Taw, Welsh Dee and Annacloy (the latter was exceptionally low). In contrast, flows in south-east England were within the normal range (albeit below average), or above normal in catchments like the Wensum, Stringside and Itchen which were still responding to winter wet weather. Mean river flows over the spring so far (March-April) also reflect the dry weather, with below normal flows characterising a swathe of catchments from south-west into central England, as well as Northern Ireland. Flows were exceptionally low on the Annacloy, at a third of average establishing a new minimum flow over this timeframe (in a series from 1979).

Groundwater

With SMDs developing due to several months of below average rainfall, groundwater levels receded at all of the Chalk boreholes except Dial Farm. Levels in Yorkshire and the majority of southern England were within the normal range, but in the Chilterns and East Anglia varied between the normal range and exceptionally high (at Washpit Farm and Frying Pan Lodge, although the latter is based on mid-April data). Levels also fell in the limestone aquifers, remaining within the normal range or above in the Jurassic limestones, exceptionally high in the Magnesian Limestone and dropping to below normal or notably low in the Carboniferous Limestone. Levels fell similarly in the sandstone boreholes, remaining exceptionally high in the Permo-Triassic at Skirwith (where a new April maximum in a 41-year record was established), Llanfair DC and Weir Farm. Further south, at Nuttalls Farm levels dropped from notably high to above normal and remained within the normal range at Bussels No.7a. Levels remained above normal at Lime Kiln Way (Upper Greensand) and notably high at Royalty Observatory (Fell Sandstone).

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

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.

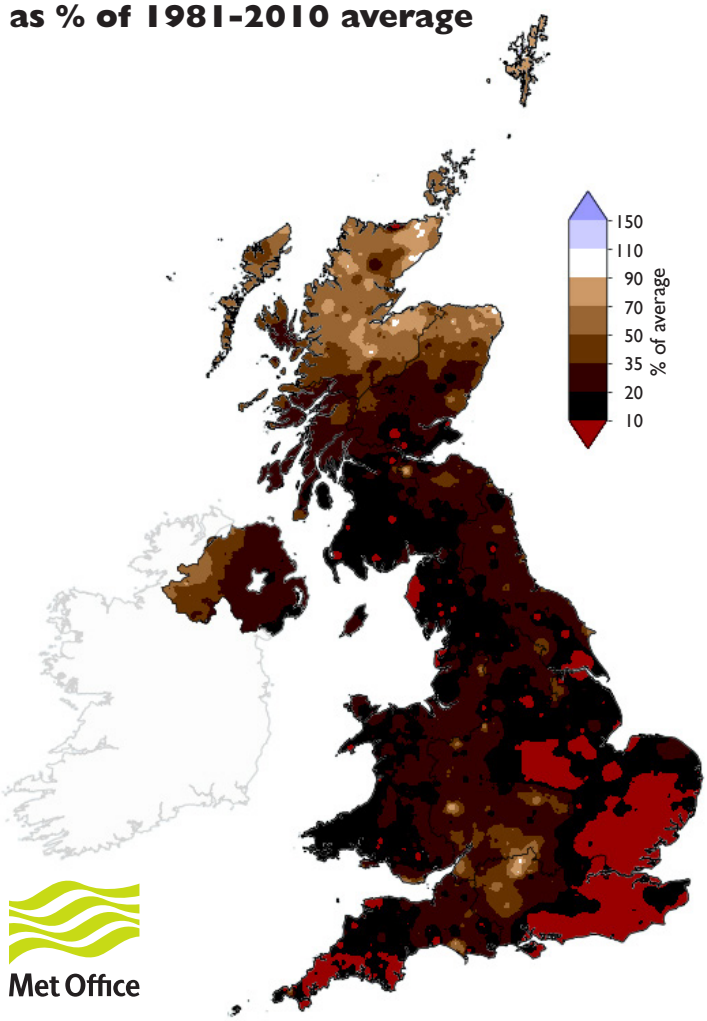
Region	Rainfall	Apr 2021	Mar21 – Apr21	RP	Nov20 – Apr21	RP	Aug20 – Apr21	RP	May20 – Apr21	RP
United Kingdom	mm	**20**	104		606		980		1214	
	%	**29**	64	5-10	100	2-5	107	5-10	107	5-10
England	mm	**11**	61		451		746		909	
	%	**19**	51	10-20	104	2-5	112	5-10	107	2-5
Scotland	mm	**35**	176		802		1279		1613	
	%	**41**	79	2-5	95	2-5	101	2-5	106	8-12
Wales	mm	**17**	114		865		1325		1591	
	%	**20**	57	5-10	111	2-5	114	5-10	112	5-10
Northern Ireland	mm	**25**	99		573		973		1247	
	%	**33**	58	5-10	96	2-5	107	5-10	110	10-15
England & Wales	mm	**12**	68		507		825		1002	
	%	**19**	52	10-20	105	2-5	113	5-10	108	2-5
North West	mm	**13**	142		741		1185		1493	
	%	**18**	84	2-5	115	5-10	120	20-30	122	25-40
Northumbria	mm	**16**	71		501		803		987	
	%	**26**	55	5-10	111	2-5	118	10-15	113	5-10
Severn-Trent	mm	**13**	54		407		666		818	
	%	**22**	47	10-20	104	2-5	111	2-5	104	2-5
Yorkshire	mm	**12**	67		474		766		969	
	%	**20**	53	8-12	109	2-5	116	5-10	115	5-10
Anglian	mm	**6**	39		311		531		649	
	%	**13**	43	15-25	105	2-5	114	2-5	104	2-5
Thames	mm	**13**	44		338		628		744	
	%	**24**	43	10-20	93	2-5	113	2-5	104	2-5
Southern	mm	**6**	43		399		681		762	
	%	**10**	38	15-25	93	2-5	106	2-5	95	2-5
Wessex	mm	**17**	57		431		732		868	
	%	**29**	45	10-20	91	2-5	103	2-5	98	2-5
South West	mm	**10**	61		685		1064		1277	
	%	**13**	35	20-35	99	2-5	106	2-5	104	2-5
Welsh	mm	**17**	106		830		1279		1538	
	%	**20**	55	8-12	111	2-5	114	5-10	112	5-10
Highland	mm	**57**	256		920		1405		1777	
	%	**57**	94	2-5	88	2-5	92	2-5	98	2-5
North East	mm	**35**	104		518		873		1137	
	%	**54**	72	5-10	100	2-5	108	5-10	112	5-10
Tay	mm	**21**	137		723		1186		1481	
	%	**28**	71	2-5	97	2-5	108	5-10	111	8-12
Forth	mm	**16**	108		648		1083		1345	
	%	**24**	63	5-10	101	2-5	111	10-20	112	10-20
Tweed	mm	**17**	91		602		974		1213	
	%	**26**	63	5-10	113	5-10	120	20-35	118	15-25
Solway	mm	**13**	138		824		1364		1747	
	%	**15**	64	2-5	102	2-5	111	15-25	117	50-80
Clyde	mm	**25**	185		992		1608		2017	
	%	**25**	70	2-5	98	2-5	106	5-10	111	10-20

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

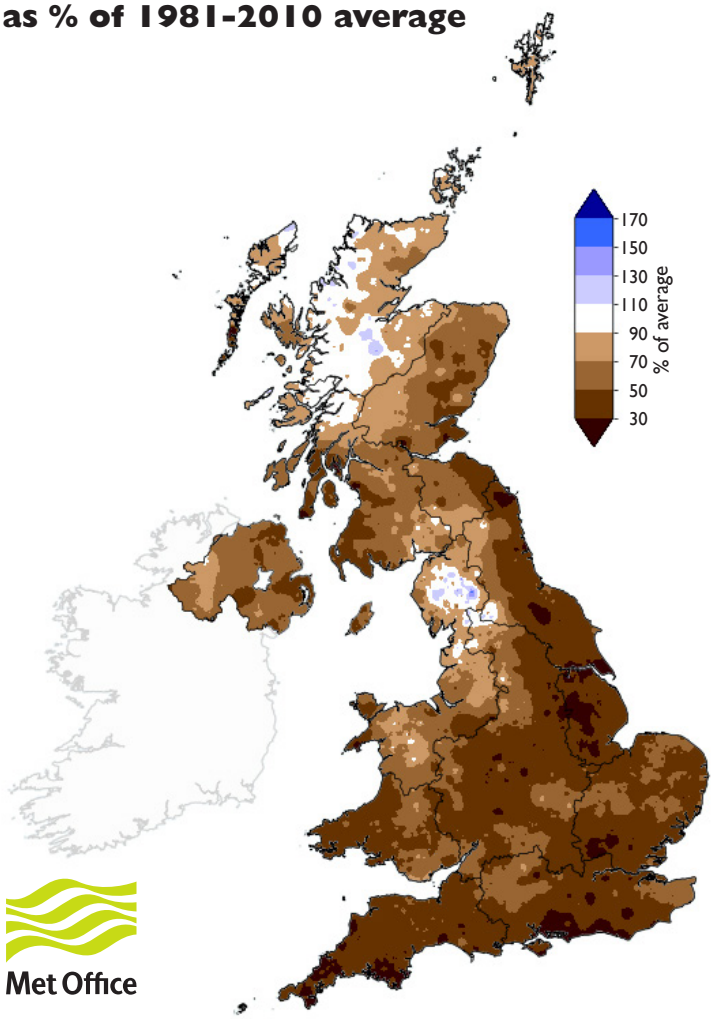
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

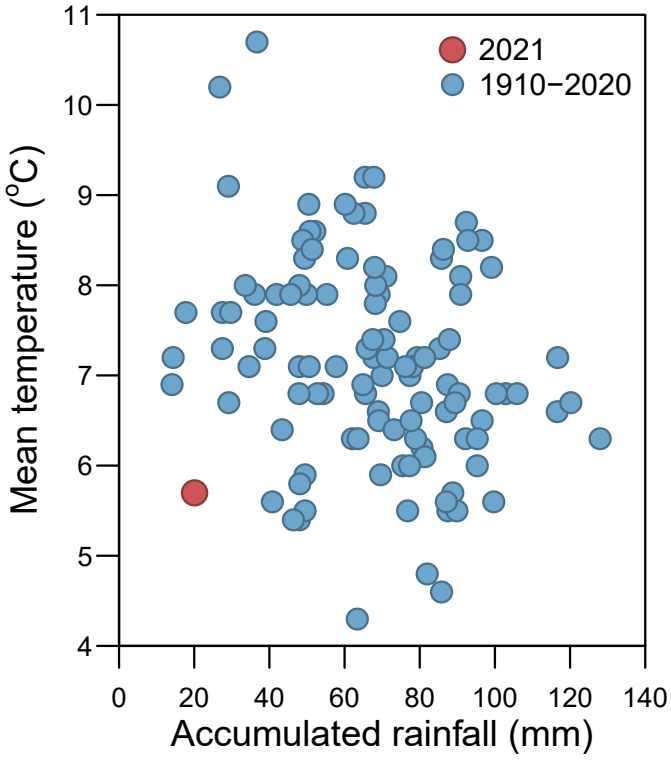
April 2021 rainfall as % of 1981-2010 average



March 2021 - April 2021 rainfall as % of 1981-2010 average



April rainfall and mean temperature for the UK 1910-2021



Hydrological Outlook UK

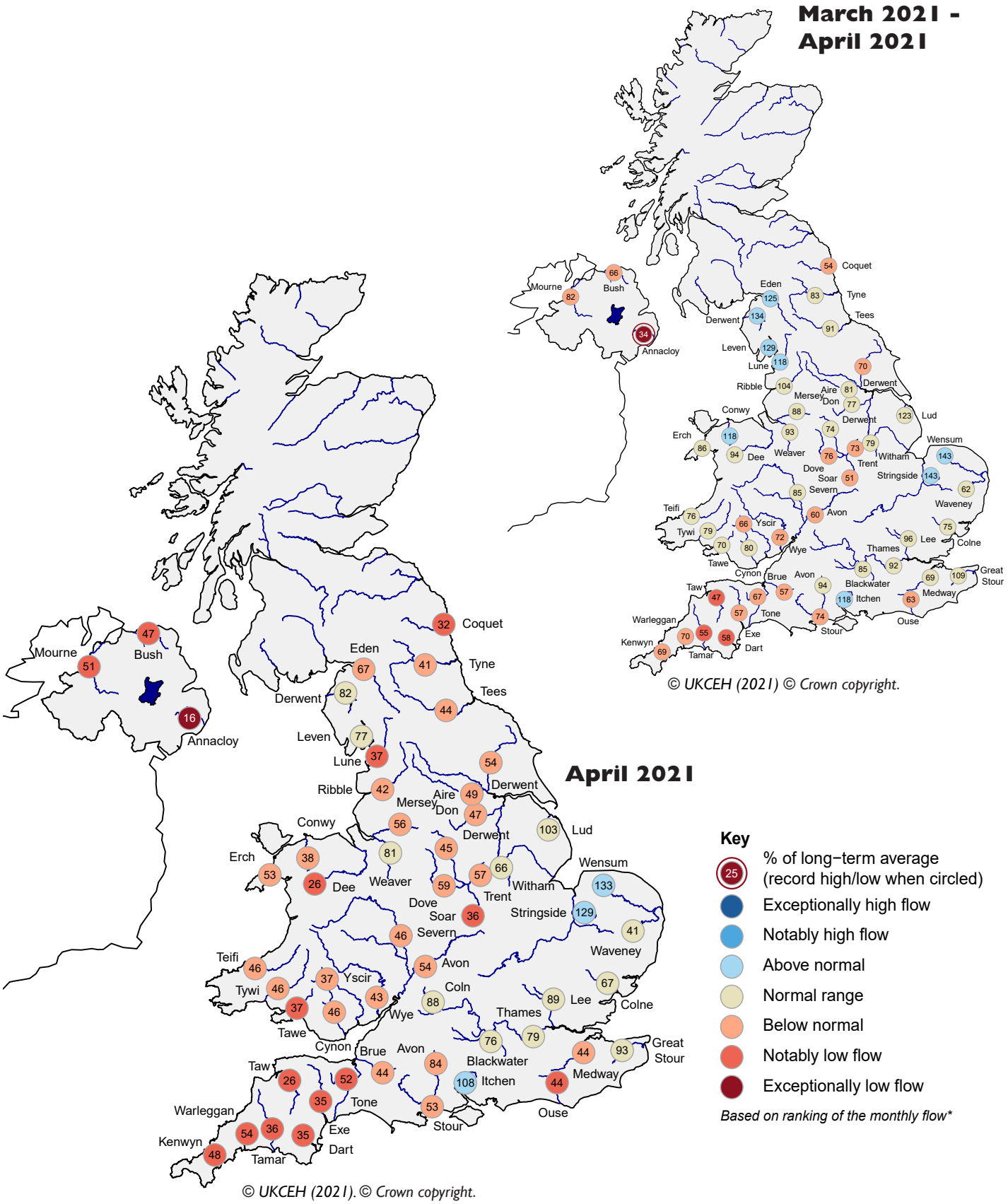
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from May 2021**
Issued: **10.05.2021**
using data to the end of April 2021

The outlook for May, and for the next three months, is for river flows to be normal to below normal, in most parts of the UK, the exception being the south-west of England where below normal river flows are likely to persist. Groundwater levels in May, and for the next three months, are likely to be normal to above normal across most of the UK. Again there is an exception, with groundwater levels in central southern England being normal to below normal in both May and the period to July.

River flow . . . River flow . . .

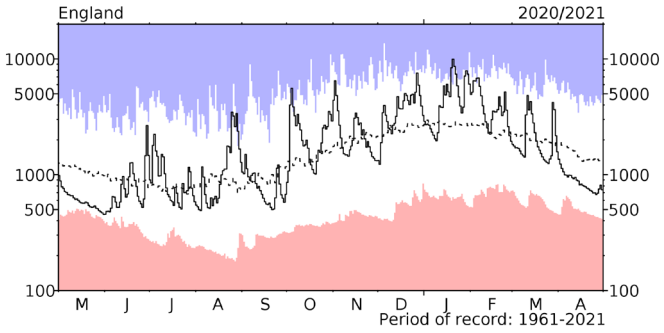


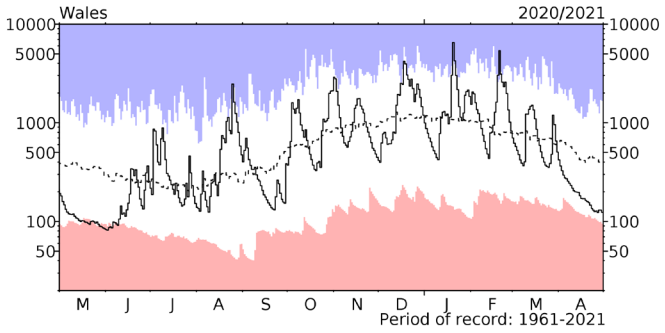
River flows

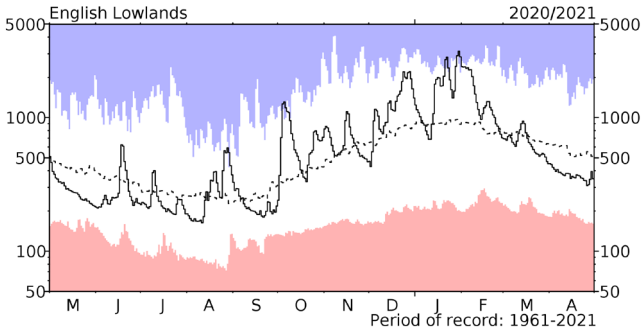
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

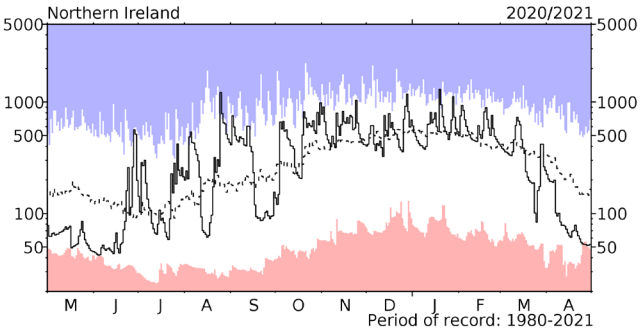
Note: Due to unforeseen circumstances no data are available for Scotland.

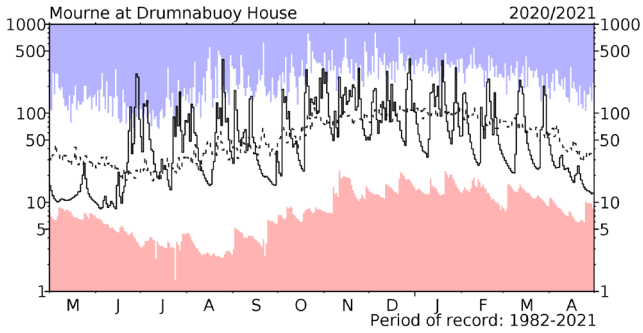
River flow . . . River flow . . .

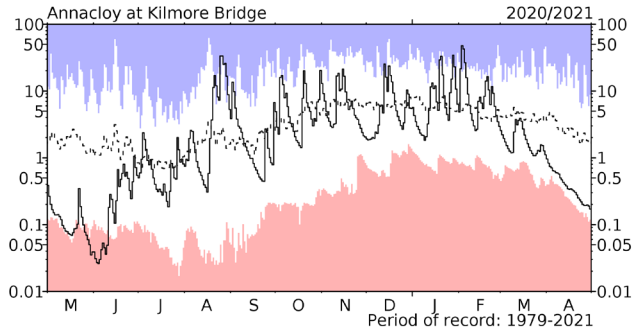


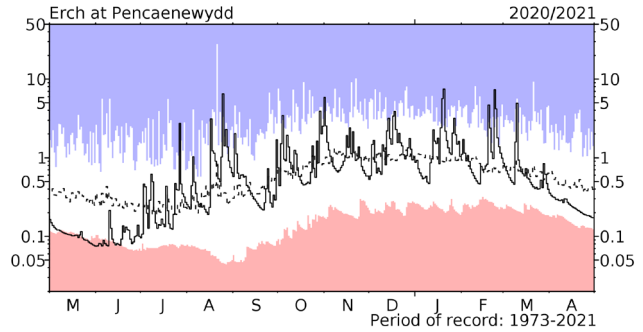


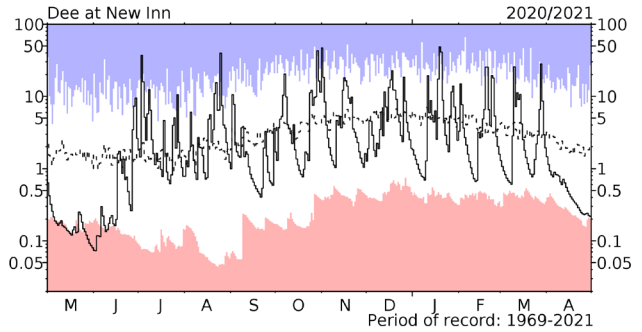


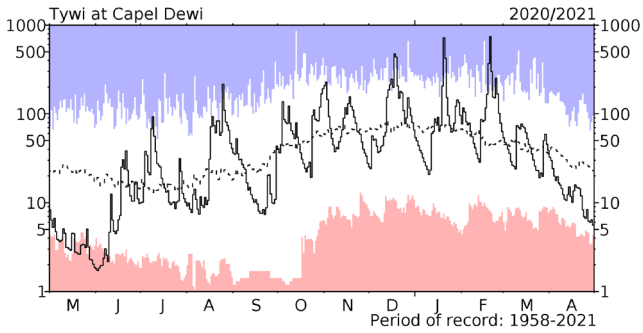


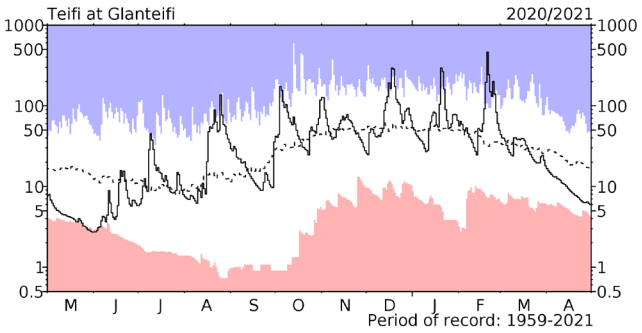








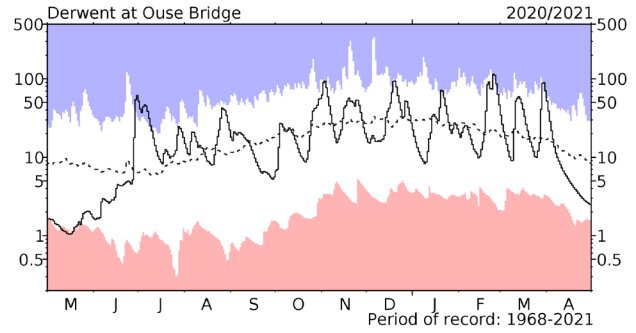


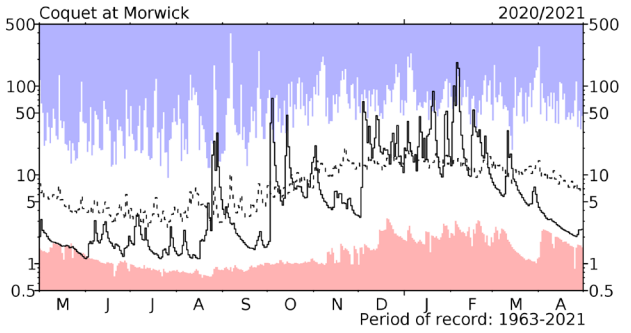


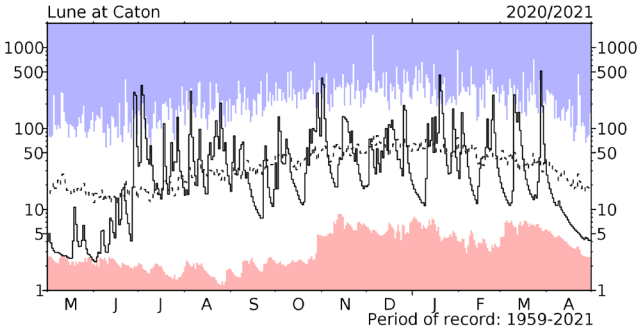
River flow hydrographs

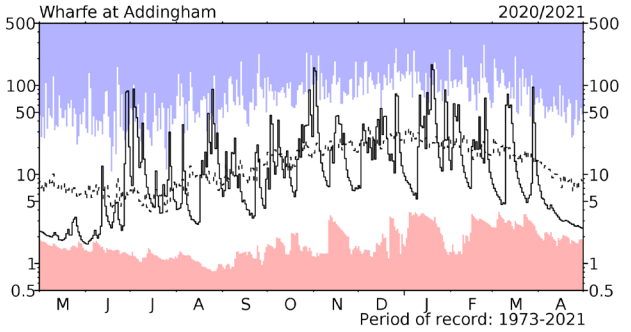
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to May 2020 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line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

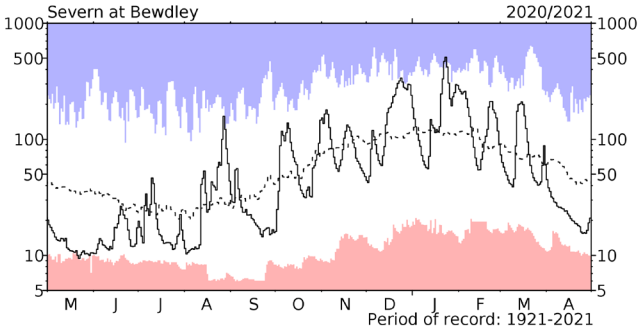
River flow . . . River flow . . .

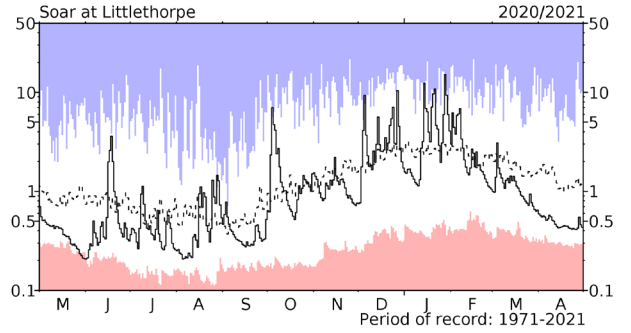


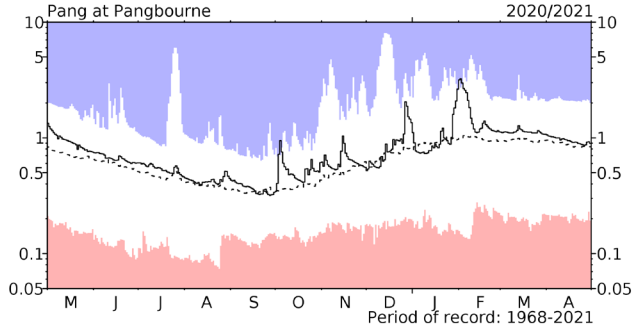


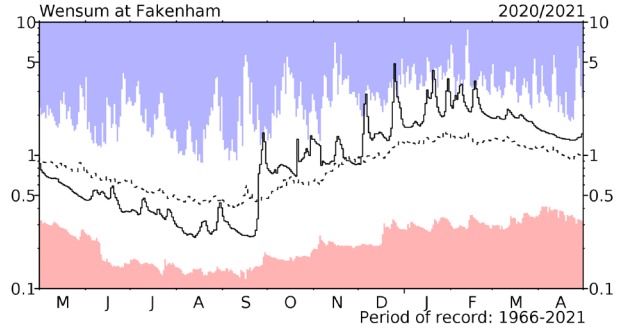


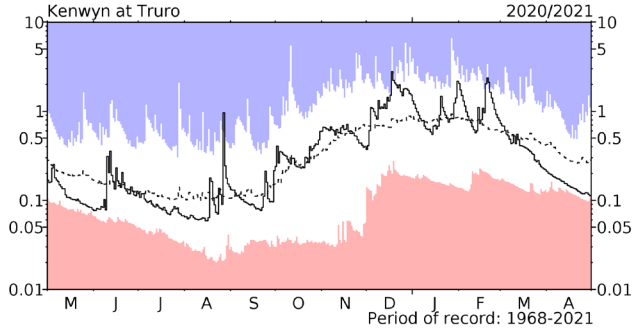


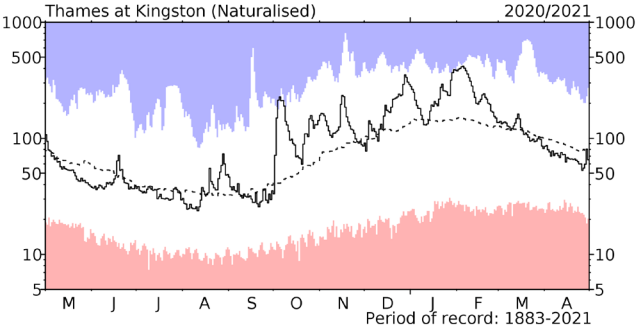


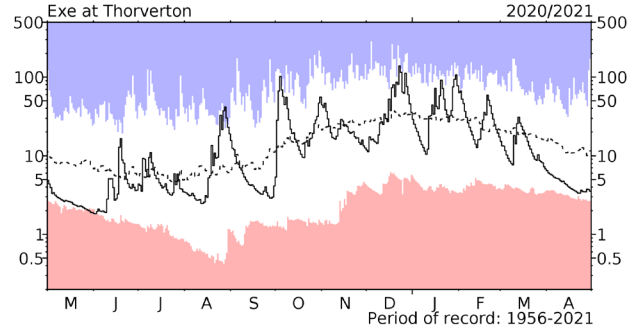


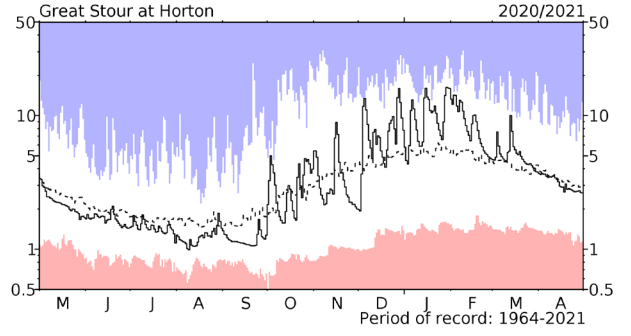




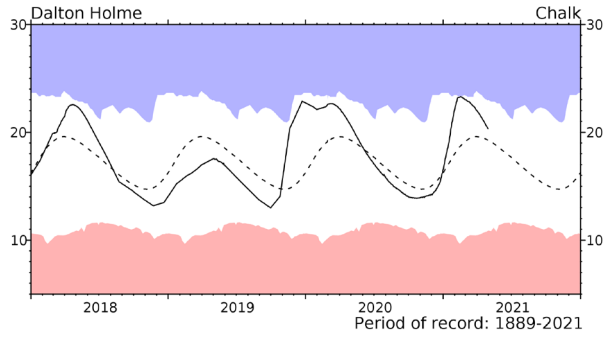


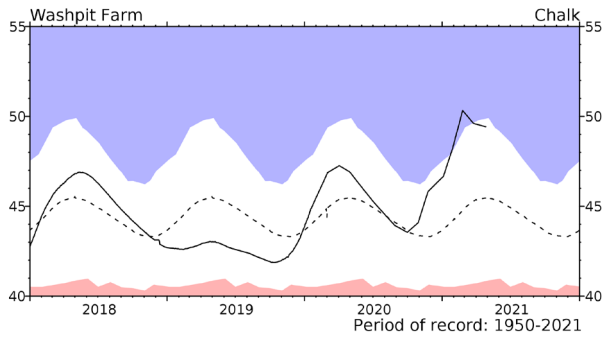


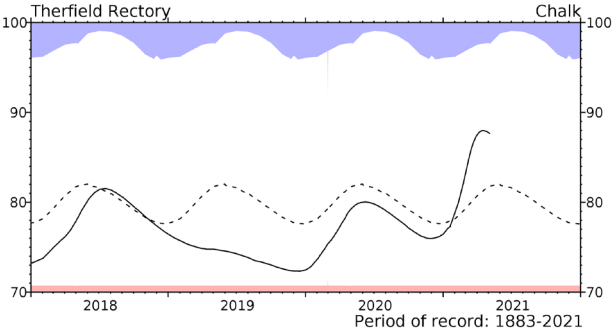


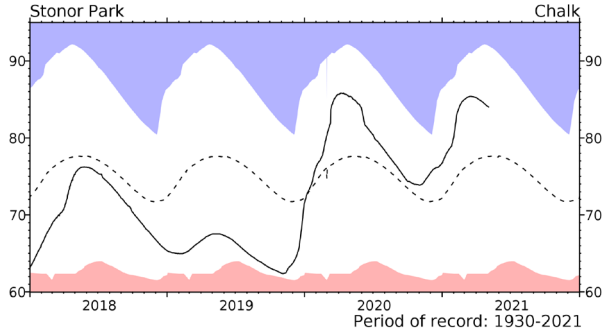


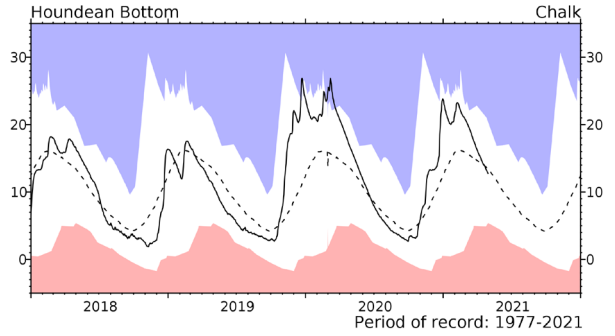
Groundwater…Groundwater

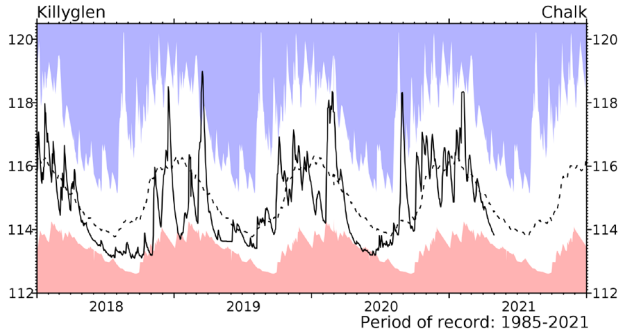


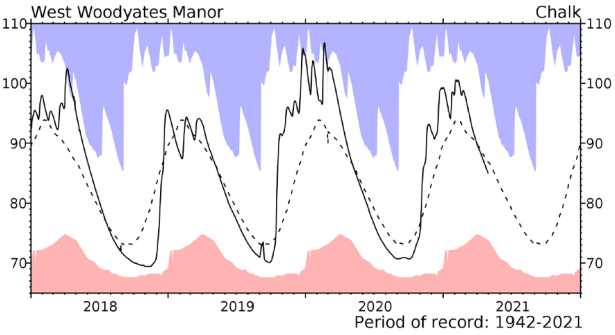


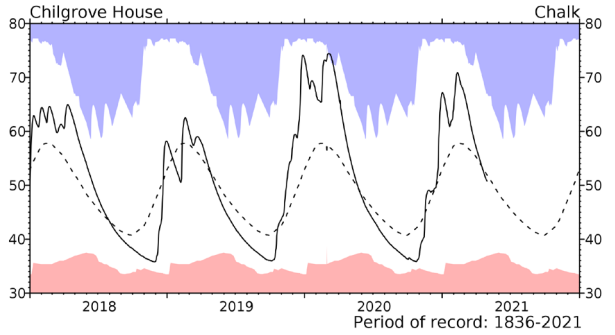


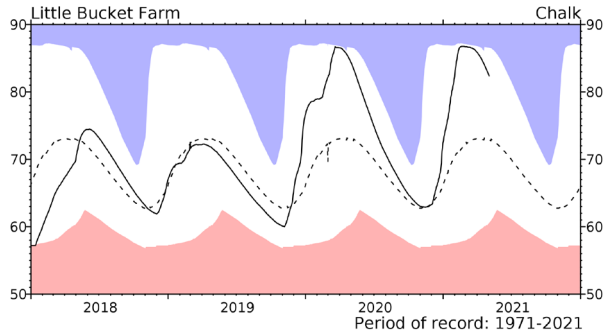


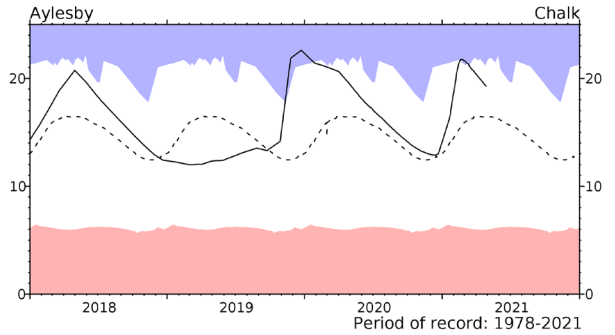






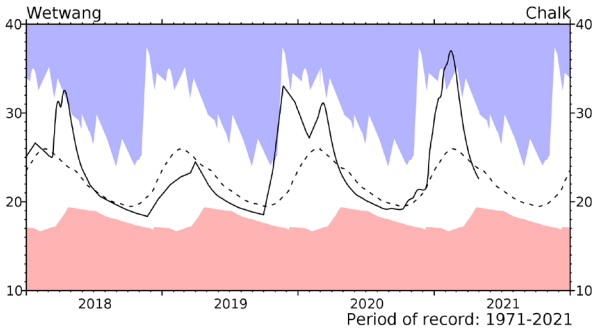


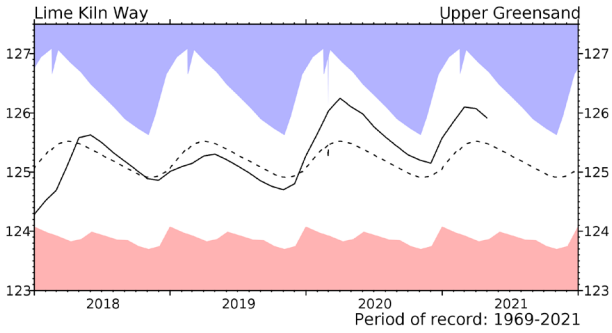


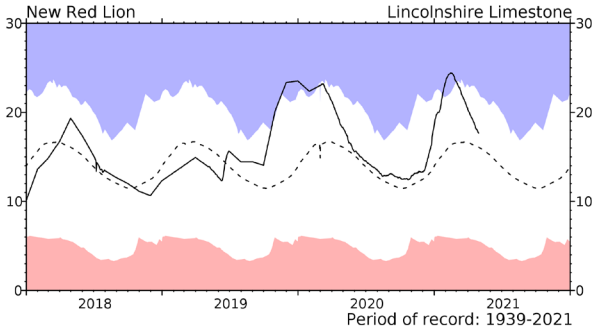


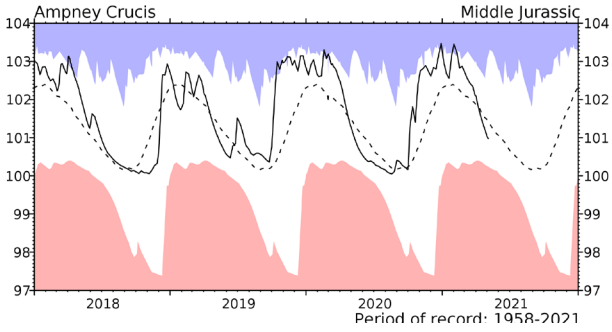
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

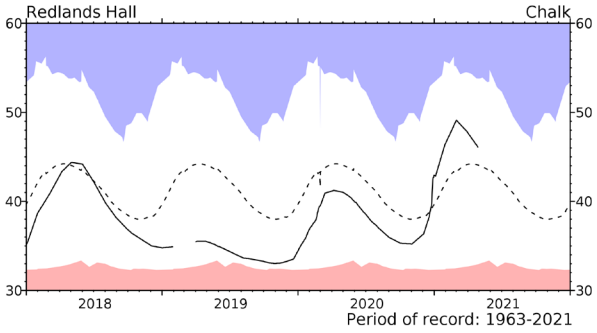
Groundwater… Groundwater

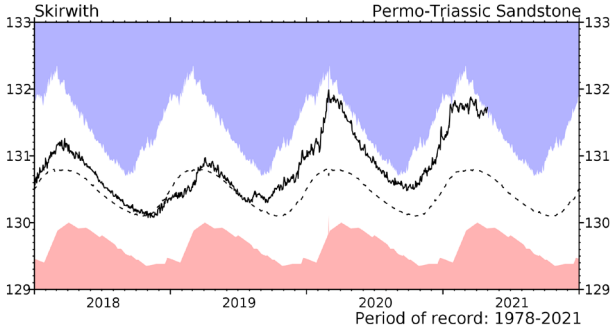


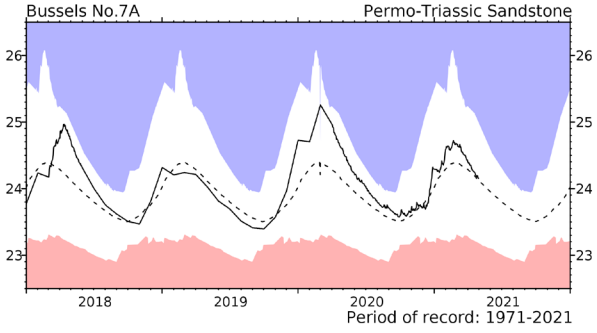


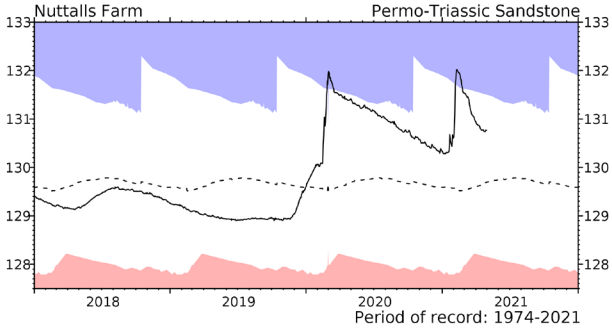


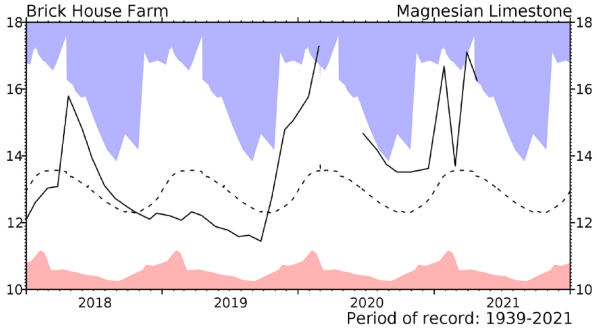


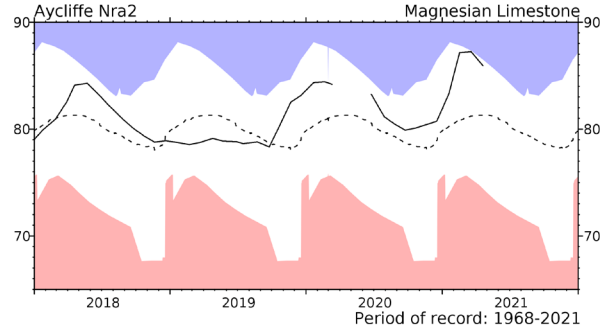


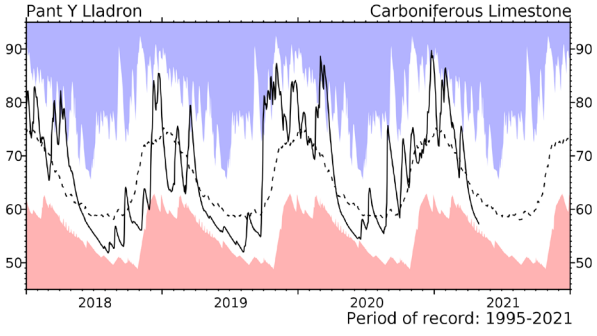


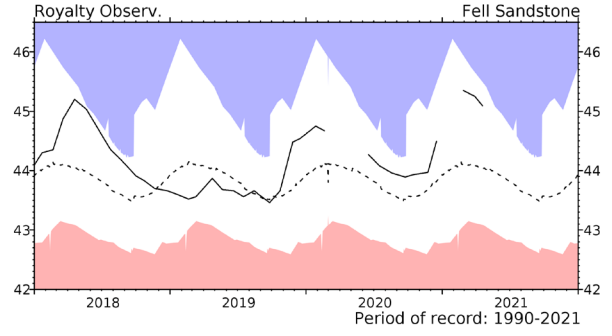




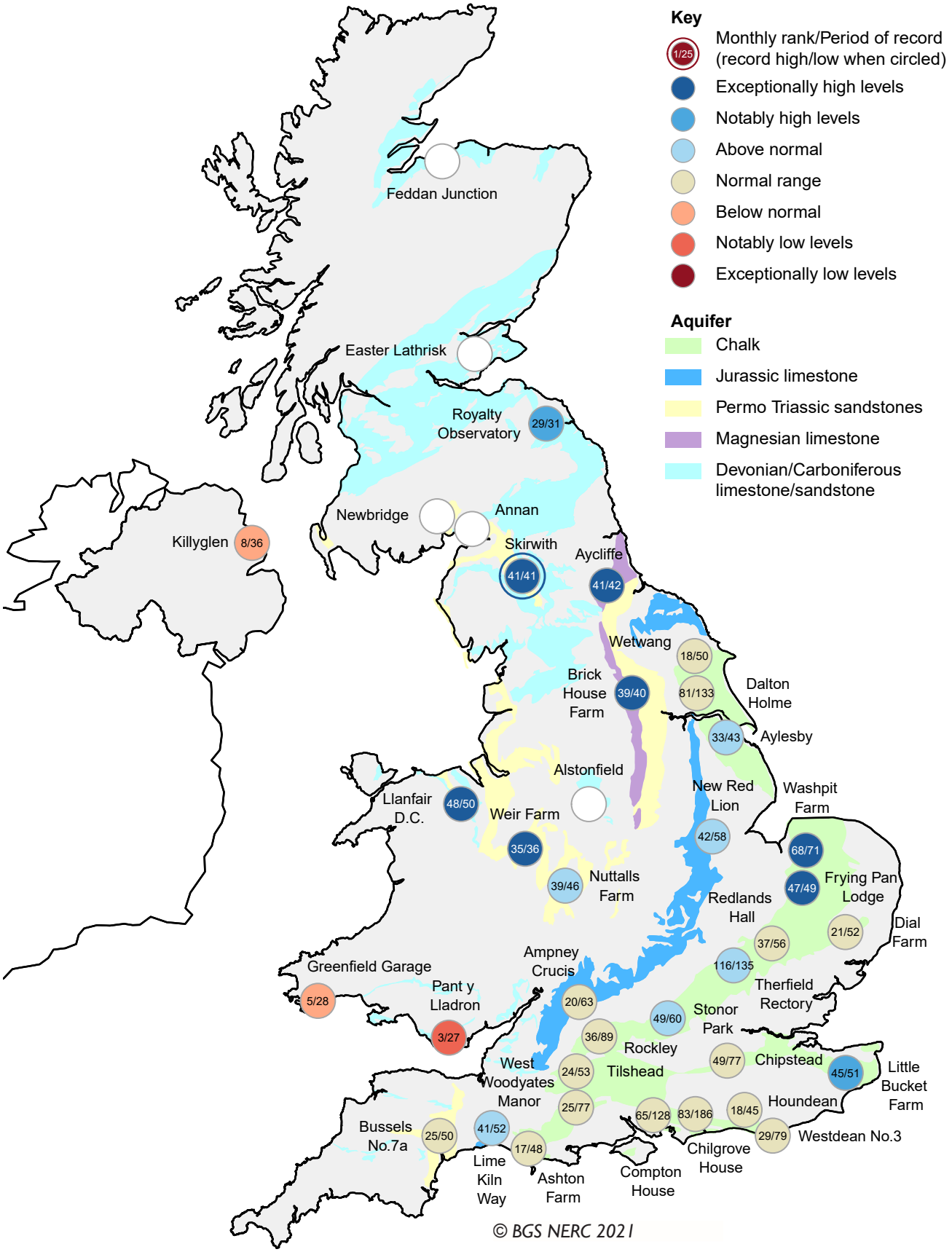








Groundwater…Groundwater



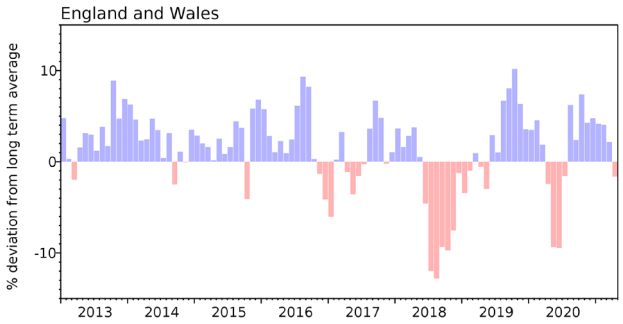
Groundwater levels - April 2021

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.

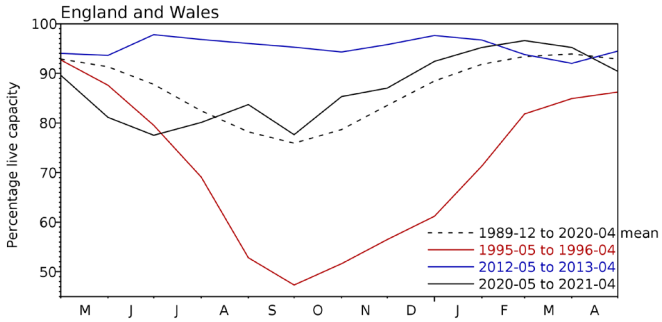
Note: Due to unforeseen circumstances no data are available for Scotland.

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 Feb	2021 Mar	2021 Apr	Apr Anom.	Min Apr	Year* of min	2020 Apr	Diff 21-20
North West	N Command Zone	•	124929	96	100	85	-2	65	1984	77	8
	Vyrnwy		55146	98	99	95	2	70	1996	90	5
Northumbrian	Teesdale	•	87936	92	82	74	-17	73	2020	73	1
	Kielder		(199175)	99	93	89	-1	85	1990	89	1
Severn-Trent	Clywedog		49936	96	98	99	1	85	1988	97	2
	Derwent Valley	•	46692	97	97	83	-9	54	1996	82	0
Yorkshire	Washburn	•	23373	82	83	76	-13	76	1996	84	-7
	Bradford Supply	•	40942	99	91	84	-7	60	1996	85	-1
Anglian	Grafham		(55490)	82	92	96	2	73	1997	96	0
	Rutland		(116580)	96	96	96	4	72	1997	97	-1
Thames	London	•	202828	96	97	96	2	86	1990	95	1
	Farmoor	•	13822	98	98	96	-1	81	2000	98	-2
Southern	Bewl		31000	90	92	90	0	60	2012	98	-8
	Ardingly		4685	100	100	99	0	69	2012	100	-1
Wessex	Clatworthy		5662	100	100	89	-4	81	1990	90	-1
	Bristol	•	(38666)	99	97	89	-4	83	2011	95	-5
South West	Colliford		28540	93	94	86	-2	56	1997	89	-2
	Roadford		34500	100	97	91	6	41	1996	94	-4
	Wimbleball		21320	100	100	85	-10	79	1992	93	-8
	Stithians		4967	100	98	89	-3	65	1992	93	-5
Welsh	Celyn & Brenig	•	131155	100	97	98	1	75	1996	93	5
	Brianne		62140	99	97	88	-9	86	1997	91	-3
	Big Five	•	69762	98	97	87	-6	85	2011	89	-2
	Elan Valley	•	99106	100	96	90	-6	83	2011	88	2
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	99	98	93	0	62	1998	89	4
	East Lothian	•	9317	100	100	99	0	89	1992	100	-1
Scotland(W)	Loch Katrine	•	110326	100	98	88	-3	80	2010	83	5
	Daer		22494	99	99	87	-6	78	2013	80	7
	Loch Thom		10721	100	88	72	-22	72	2021	76	-4
Northern Ireland	Total+	•	56800	99	96	89	0	77	2007	88	1
	Silent Valley	•	20634	99	93	84	-1	58	2000	85	-1

( ) figures in parentheses relate to gross storage

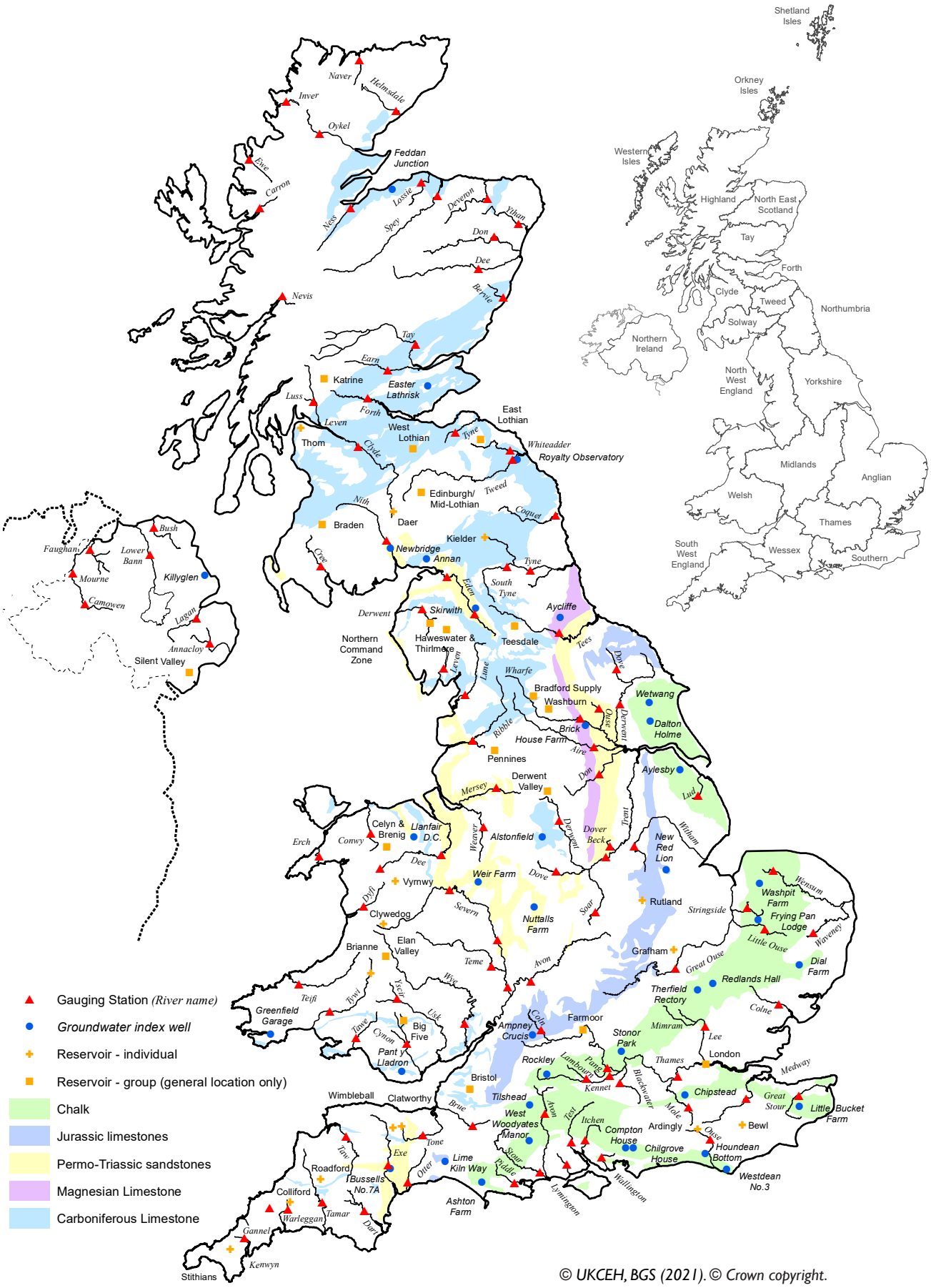
• denotes reservoir groups

*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.

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

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