Hydrological Summary

for the United Kingdom

April 2022

General

Following an unsettled start with some wintry showers, settled conditions dominated April, bringing widespread warm and dry weather for most. The UK received around two-thirds of the average rainfall for the month in all areas except for northern Scotland and parts of Northern Ireland. Despite a peak at the start of the month, river flows across much of the country continued recessions established in March, with much of the country experiencing below normal flows, most notably in south-west England, Wales, and central Scotland. With soil moisture deficits (SMDs) increasing in all areas except for north-east Scotland, groundwater levels receded in all aquifers except within a few slow responding Chalk boreholes. Monthly groundwater levels were generally in the normal range or below. Reservoir stocks at the national scale fell to marginally below average for April. As evaporation rates increase, and with Outlooks favouring near-average rainfall over the next three months, below-normal groundwater levels are likely to persist through the summer in many areas, particularly in the Carboniferous Limestone of south Wales and the Chalk.

Rainfall

During the first week of April, low pressure systems brought unsettled weather, wintry at times, and particularly over eastern coasts – 10cm of lying snow was recorded at Redesdale Camp (Northumberland) on the 1st. Longer spells of rain in the south-west and showers elsewhere gave way to some appreciable rainfall totals in the first week, e.g. 62mm was recorded at Achfary (Sutherland) on the 3rd and 52mm was recorded at Mickleden Middlewell Farm (Cumbria) on the 5th. From the second week onwards, settled weather prevailed as high pressure situated over the Azores led to drier, warmer weather with only localised and isolated showers in western areas. These drier conditions continued as high-pressure systems moved northwards and centred on the UK. At month-end, there was a return to more unsettled conditions in the west of the country e.g. on the 30th, 23mm fell at Altnahinch (County Antrim). For the UK as a whole April rainfall was below average and in much of England and Wales, less than half the average was recorded. In central, eastern and southern England, large areas received less than 30% of average rainfall and the Anglian region recorded its ninth driest April in a series from 1910. April followed a winter of alternating dry and wet months, with the spring so far (March-April) being dry. Over this timeframe, almost the whole of the UK received below average rainfall (with the exception of north-east Scotland which received average rainfall) and areas of south-east England, central Wales and western Scotland received less than half of the average. The UK recorded its second driest March-April since 1974 and was ninth driest since 1910. Over a longer timeframe, the November-April rainfall for England was the driest since 2011, whilst the Southern, South West, Wessex and Thames regions recorded their driest November-April since 1976.

River flows

Following recessions established in March, flows across the UK rose to average or above in the first week of April. From this point onwards, recessions resumed as settled weather took hold, with only the occasional interruption due to localised showers in western areas. Low flows became well established in some places, e.g. new April daily flow minima were recorded for three quarters of the month on the Lagan. By month-end, flows in all index catchments were below average. National outflow series reflected the general rainfall patterns, and monthly outflows in Wales were the sixth lowest in a series from 1961. April monthly mean flows were below normal, notably so across western and southern areas of the country. The Forth recorded exceptionally low flows, and the second lowest April flows in a series since 1982. April 2022 also continued a run of dry Aprils on the Forth, with five of the last seven years featuring in the top seven driest Aprils. Flows were generally in the normal range in north-east England and above normal in the far north-east of Scotland. The Annacloy, Welsh Dee, Twyi, Yscir and Taw all recorded flows less than a third of their respective averages. For March-April, flows followed a similar spatial pattern to those in April, and the Luss and Forth both recorded their driest March-April in records from 1976 and 1982, respectively. Exceptionally low flows were also registered on the Conwy and Dee, both recording their second driest March-April after 1984 (in records since 1965 and 1970, respectively).

Groundwater

In a continuation of warm and dry conditions in most areas, SMDs continued to increase, and at the end of April UK soil moisture was drier than normal at more than three-quarters of COSMOS-UK sites. Groundwater levels in the Chalk aquifer receded everywhere except in the Chilterns and parts of East Anglia, and levels remained in the normal to below normal range. In the Jurassic limestones levels fell and remained in the normal range at New Red Lion but dropped to below normal at Ampney Crucis. In the Carboniferous Limestone, levels fell and were in the normal range at Alstonfield, but were notably low at Pant y Lladron and a record April low was registered at Greenfield Garage (in a series from 1994). In the Permo-Triassic sandstones, levels fell and ended the month in either the normal range (Llanfair DC, Nuttalls Farm) or below normal (Annan, Skirwith and Bussels No. 7a). In the Upper Greensand, levels at Lime Kiln Way fell and remained in the normal range. In the Devonian sandstones, levels rose at Feddan Junction in the first part of April then stabilised and later fell, ending the month above normal, whilst at Easter Lathrisk levels fell ending April notably low.

There are no data available for the Fell Sandstone or Magnesian Limestone.

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 1991-2020 average.

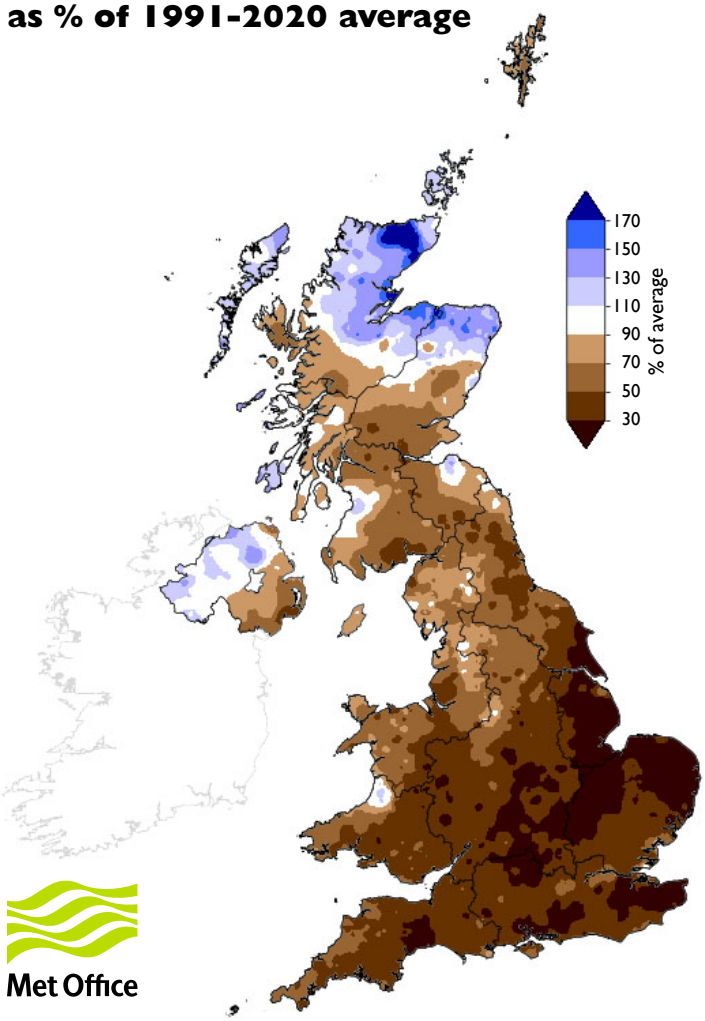
Region	Rainfall	Apr 2022	Mar22 – Apr22		Feb22 – Apr22		Nov21 – Apr22		May21 – Apr22	
				RP		*RP*		*RP*		*RP*
United Kingdom	mm	**49**	99		245		496		1038	
	%	**69**	63	10-15	98	2-5	80	5-10	90	2-5
England	mm	**25**	67		163		323		790	
	%	**44**	58	8-12	91	2-5	73	8-12	92	2-5
Scotland	mm	**86**	148		363		748		1370	
	%	**94**	69	5-10	103	2-5	86	2-5	88	2-5
Wales	mm	**47**	98		296		619		1342	
	%	**54**	52	10-20	96	2-5	78	5-10	93	2-5
Northern Ireland	mm	**71**	121		265		524		1042	
	%	**96**	75	2-5	105	2-5	86	2-5	90	2-5
England & Wales	mm	**28**	71		181		363		865	
	%	**46**	57	10-15	92	2-5	74	8-12	92	2-5
North West	mm	**49**	91		281		569		1210	
	%	**70**	57	10-20	106	2-5	86	2-5	96	2-5
Northumbria	mm	**36**	81		178		366		781	
	%	**60**	66	5-10	93	2-5	79	5-10	87	2-5
Severn-Trent	mm	**23**	62		168		318		741	
	%	**41**	57	8-12	101	2-5	81	5-10	94	2-5
Yorkshire	mm	**30**	72		205		370		819	
	%	**52**	62	5-10	111	2-5	84	2-5	95	2-5
Anglian	mm	**12**	43		105		214		548	
	%	**28**	53	10-15	85	2-5	73	8-12	88	2-5
Thames	mm	**18**	58		125		227		678	
	%	**35**	59	5-10	83	2-5	61	15-25	94	2-5
Southern	mm	**16**	54		113		238		735	
	%	**31**	52	8-12	68	5-10	54	30-50	90	2-5
Wessex	mm	**24**	82		152		289		798	
	%	**39**	67	5-10	80	2-5	59	15-25	89	2-5
South West	mm	**33**	99		209		467		1164	
	%	**43**	59	5-10	77	2-5	66	10-20	94	2-5
Welsh	mm	**45**	97		282		583		1291	
	%	**53**	53	10-20	95	2-5	77	5-10	93	2-5
Highland	mm	**119**	171		429		957		1600	
	%	**110**	65	5-10	99	2-5	91	2-5	87	2-5
North East	mm	**81**	138		242		467		1023	
	%	**118**	98	2-5	110	2-5	88	2-5	98	2-5
Tay	mm	**59**	142		330		595		1232	
	%	**75**	76	2-5	108	2-5	78	2-5	90	2-5
Forth	mm	**45**	92		285		515		1092	
	%	**64**	56	10-20	105	2-5	78	2-5	89	2-5
Tweed	mm	**45**	103		260		464		993	
	%	**67**	71	2-5	112	5-10	82	2-5	92	2-5
Solway	mm	**57**	139		376		694		1385	
	%	**63**	67	2-5	110	5-10	82	2-5	90	2-5
Clyde	mm	**89**	156		432		873		1547	
	%	**85**	61	5-10	102	2-5	83	2-5	83	2-5

% = percentage of 1991-2020 average *RP = Return period*

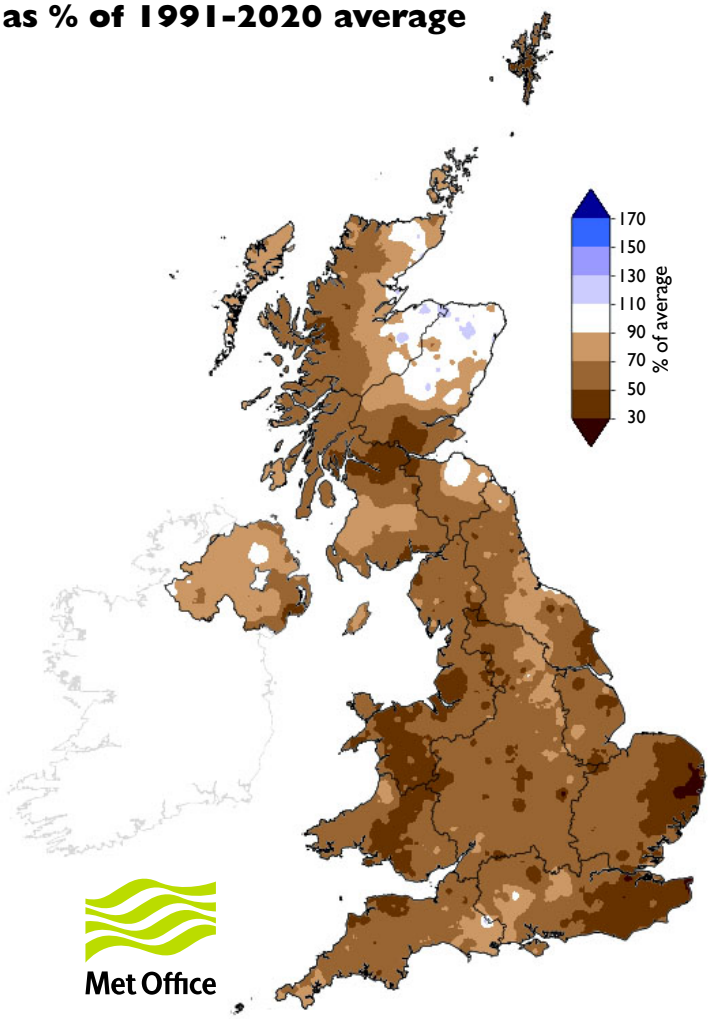
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

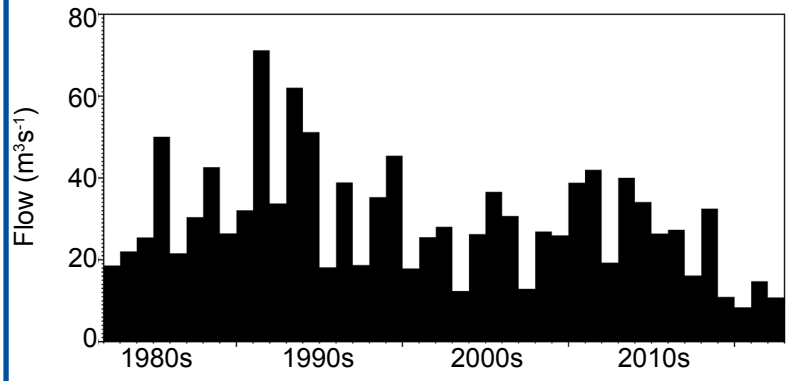
April 2022 rainfall
as % of 1991-2020 average



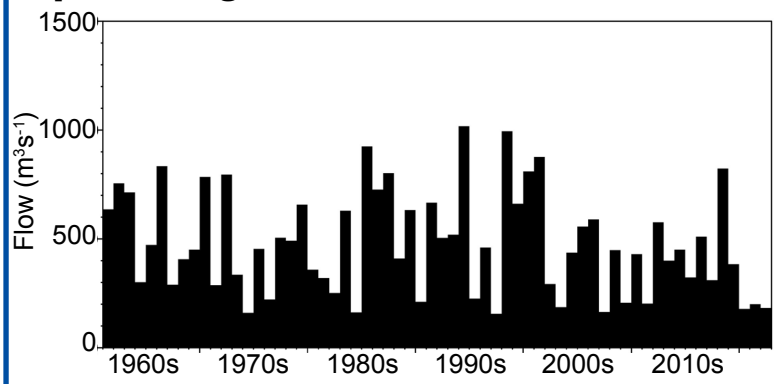
March 2022 - April 2022 rainfall
as % of 1991-2020 average



April average river flows on the Forth



April average outflows for Wales



UK Hydrological Outlook

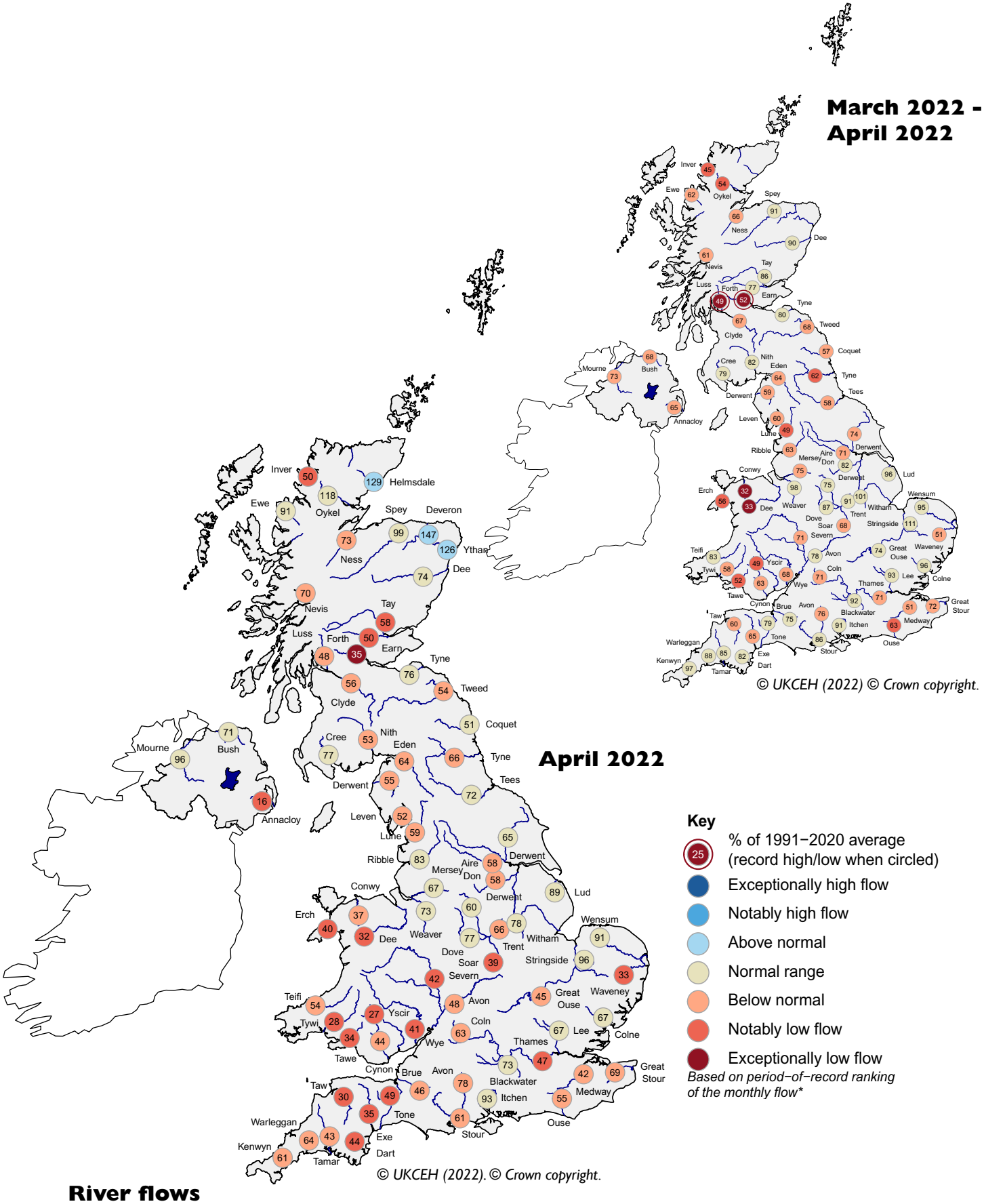
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from May 2022**
Issued: **10.05.2022**
using data to the end of April 2022

The outlook May and for May–July is for river flows to be below normal for southern and central England and in the normal to below normal range elsewhere. Groundwater levels in May, and for the next three months, are likely to be in the normal to below normal range across the UK.

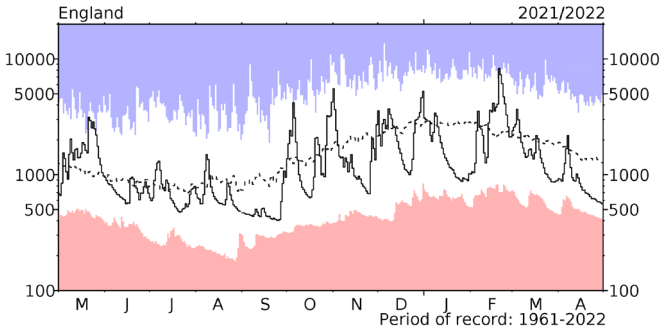
River flow . . . River flow . . .

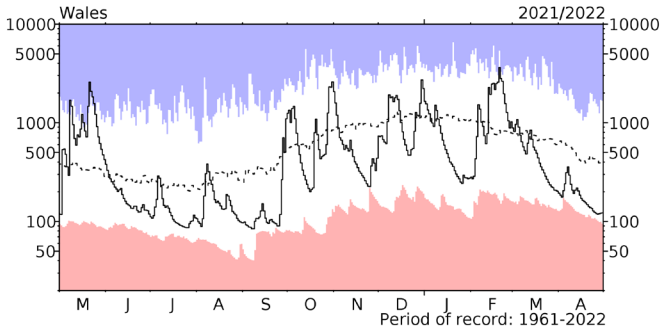


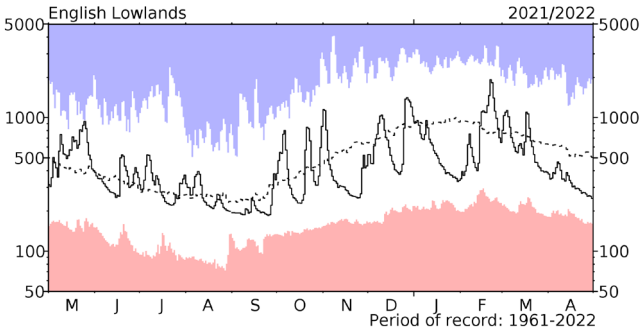
River flows

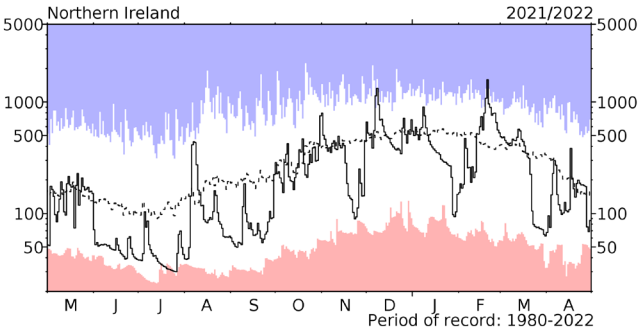
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. The categories of the spots are based on the full period-of-record data whereas the percentages are based on the 1991-2020 averaging period for consistency between rainfall and river flows. Percentages may be omitted where flows are under review.

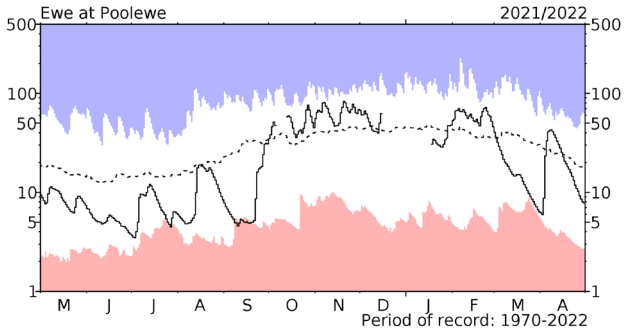
River flow . . . River flow . . .

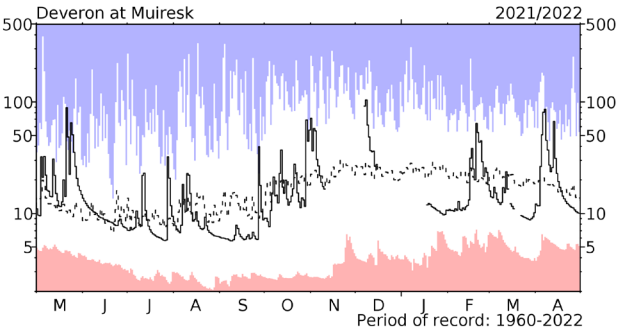


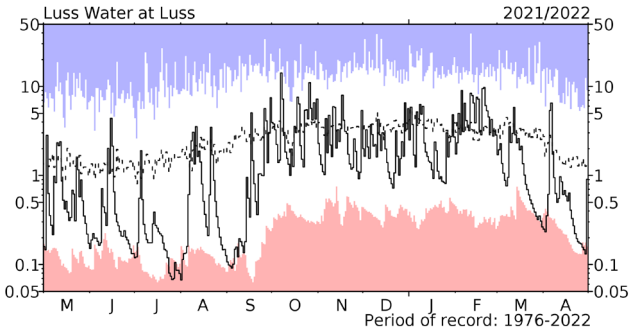


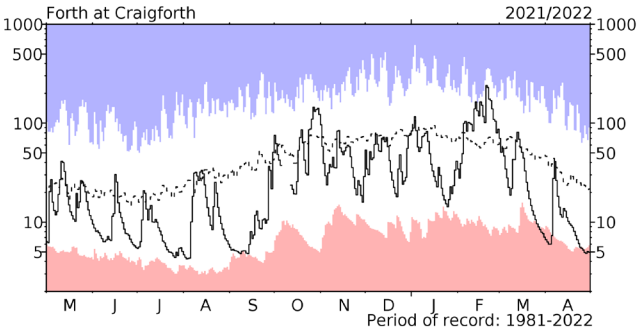


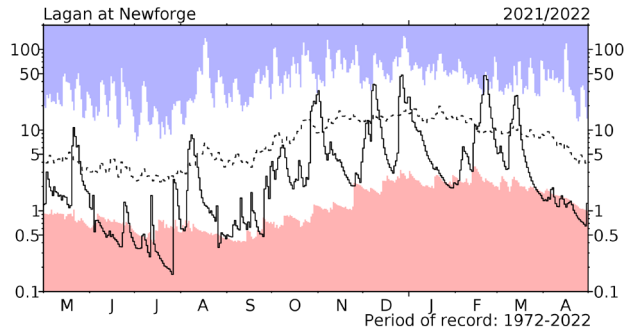


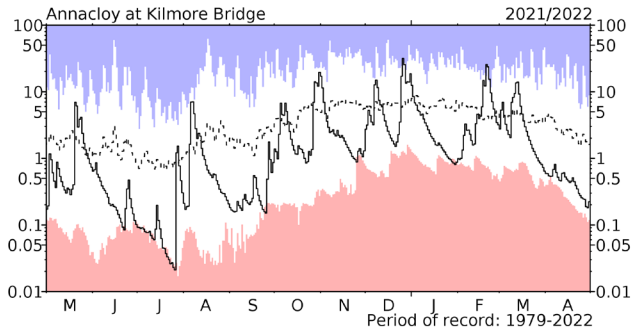








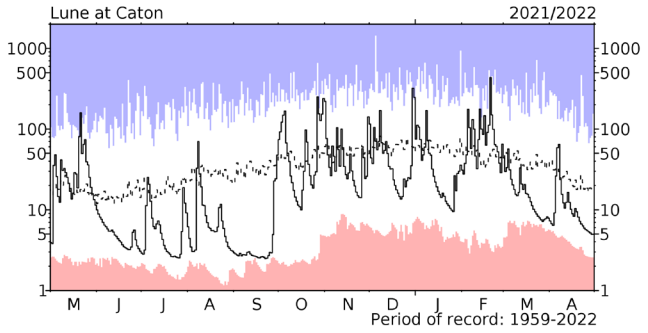


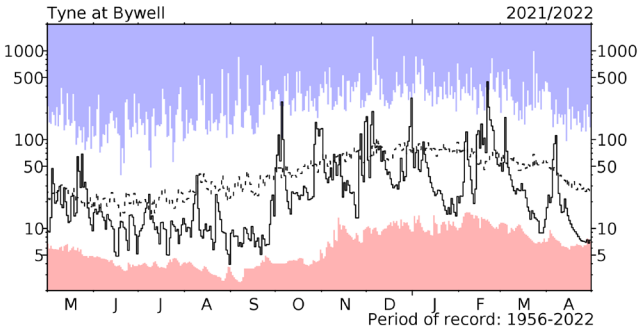


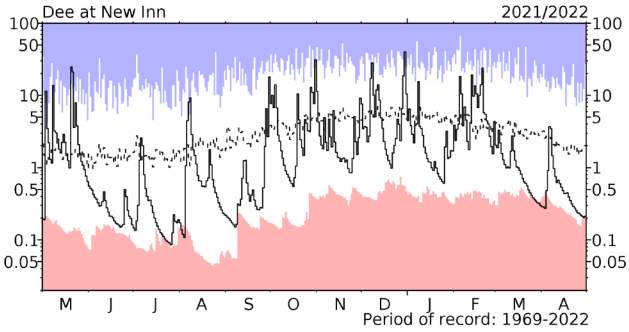
River flow hydrographs

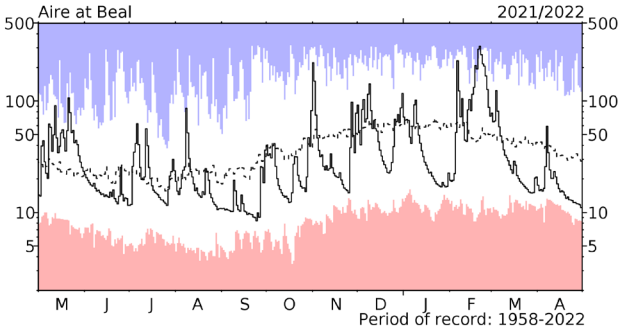
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to May 2021 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

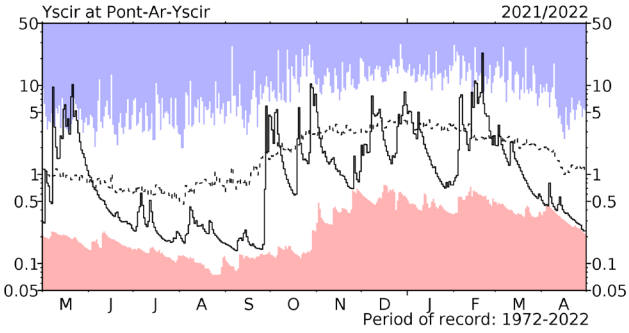
River flow . . . River flow . . .

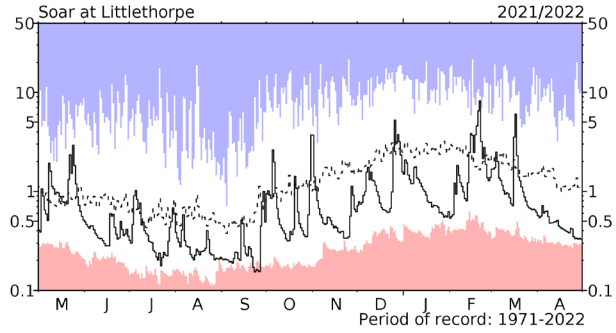


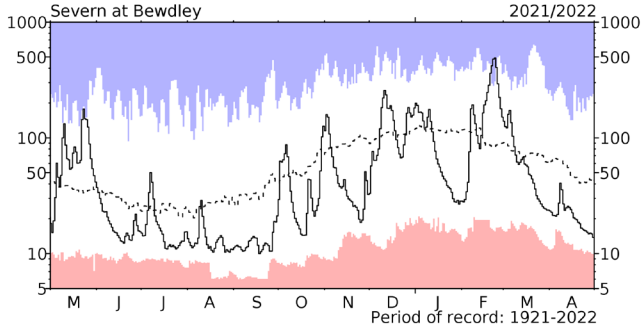


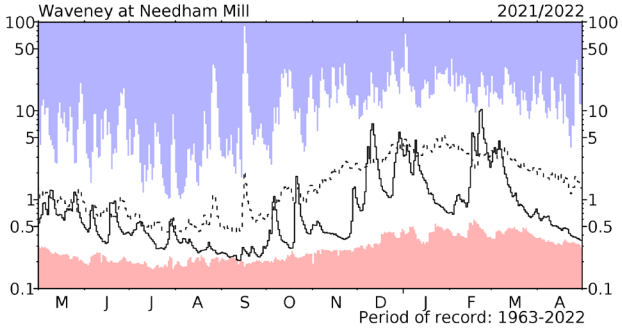


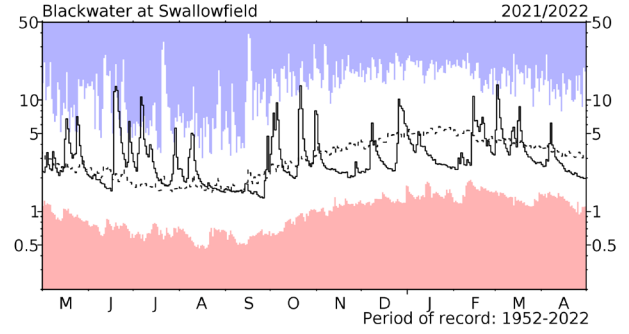


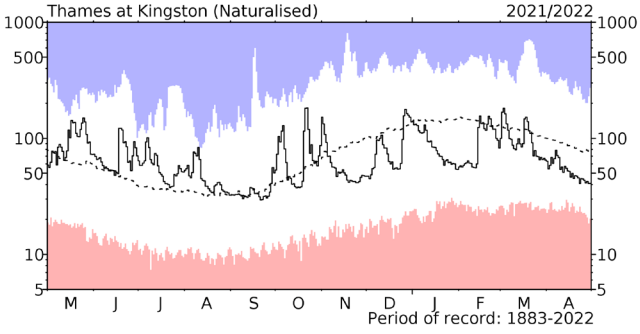


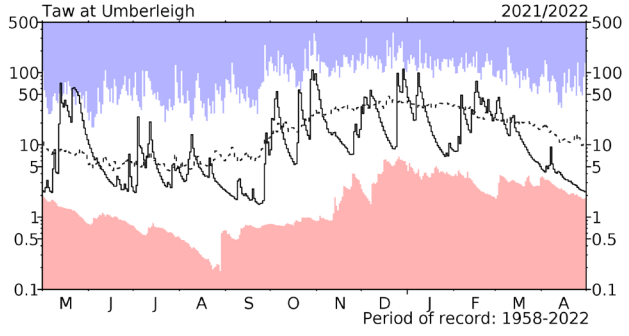


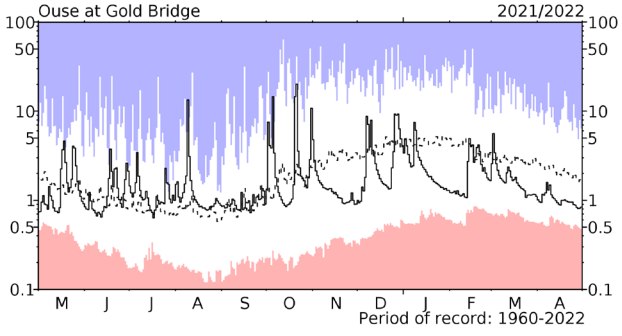




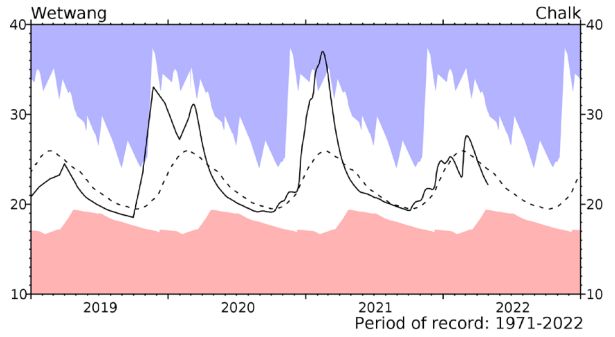


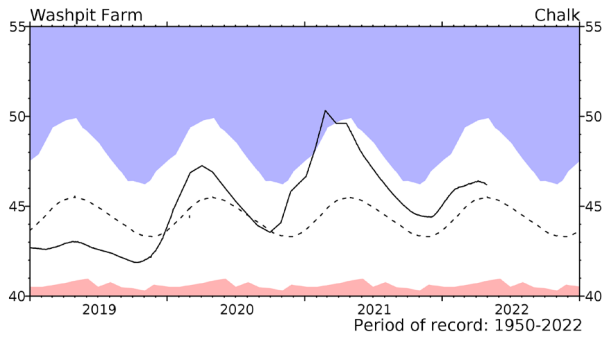


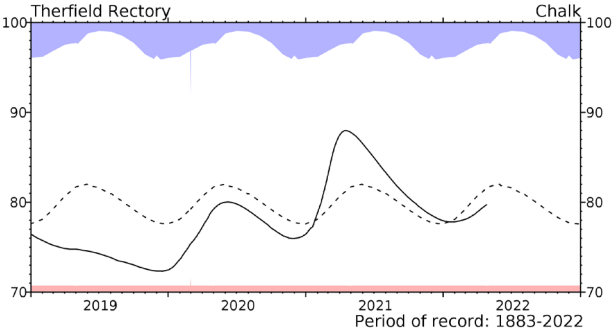


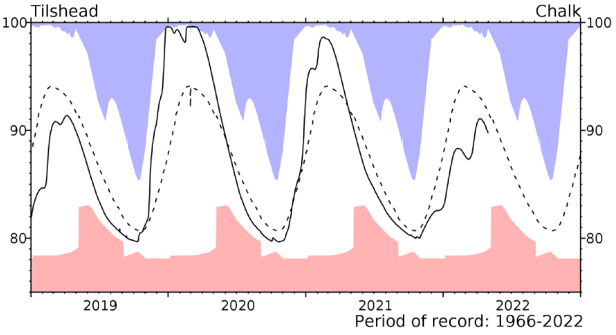


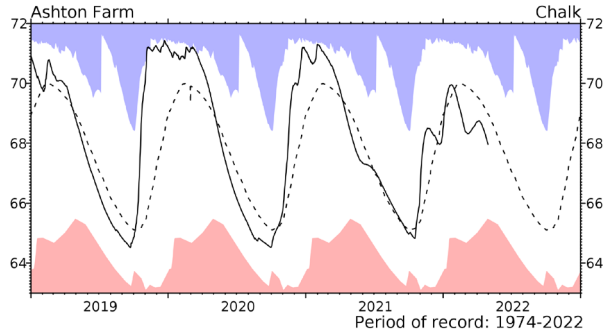
Groundwater…Groundwater

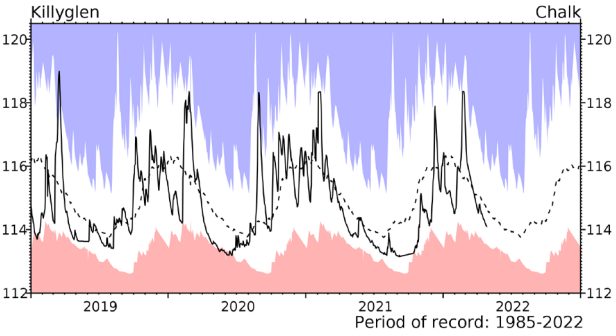


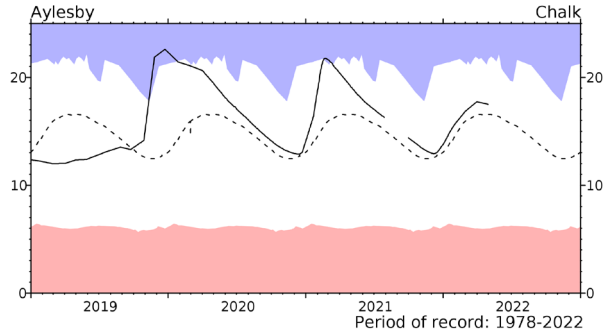


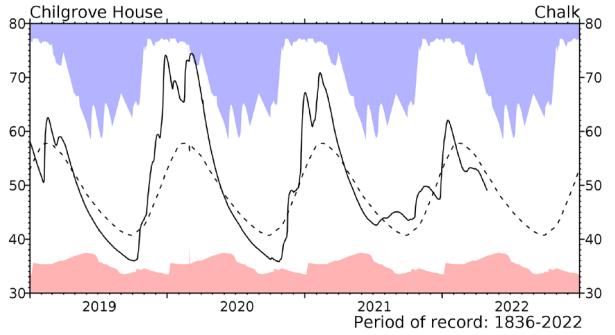


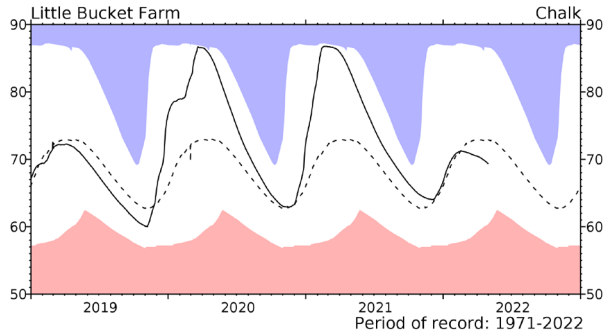


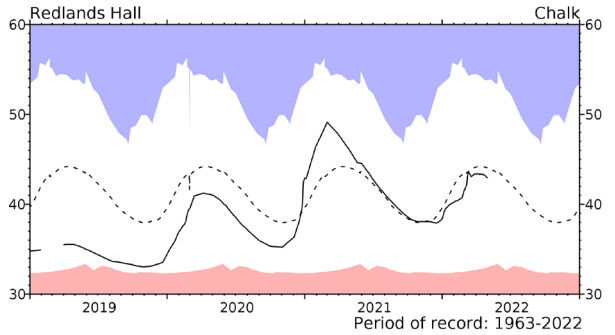






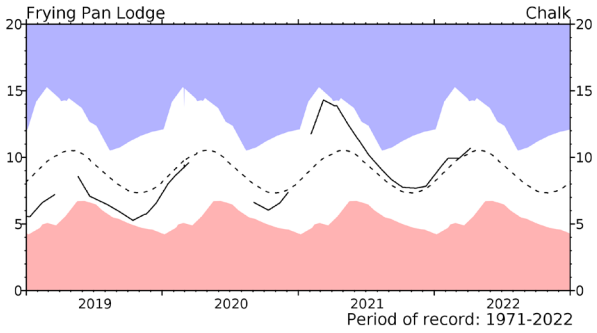


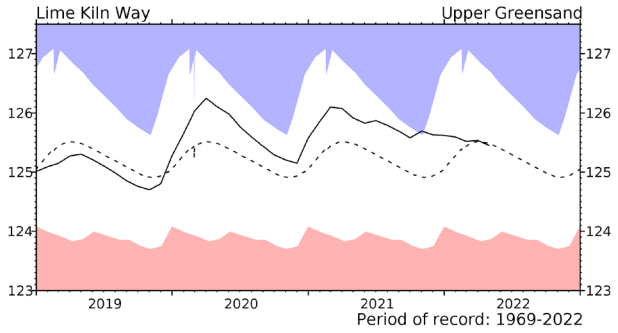


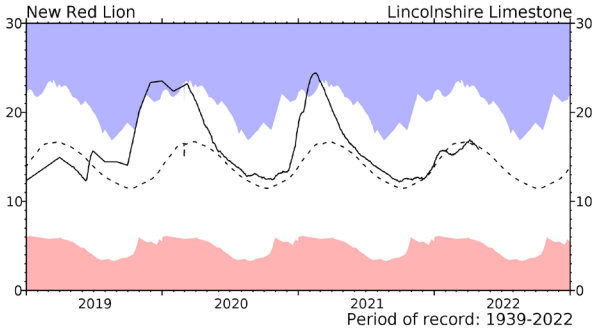


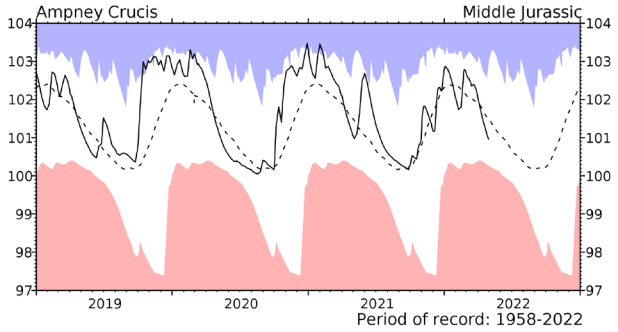
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is 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 2018. 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.

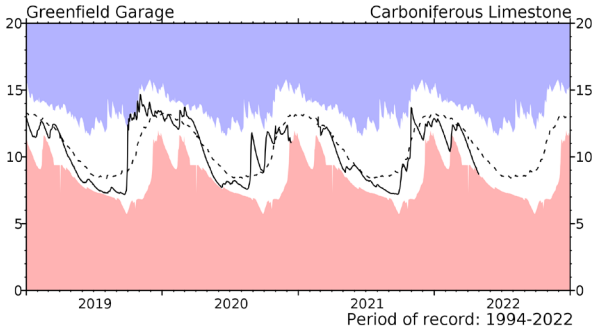
Groundwater…Groundwater

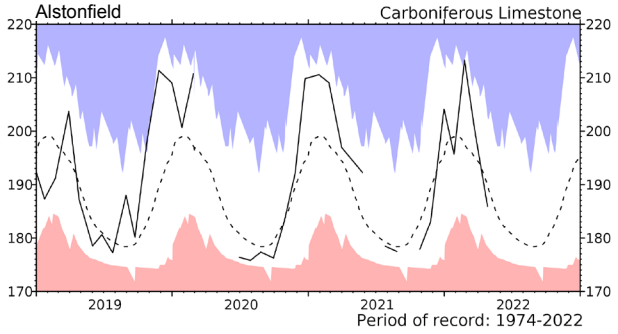


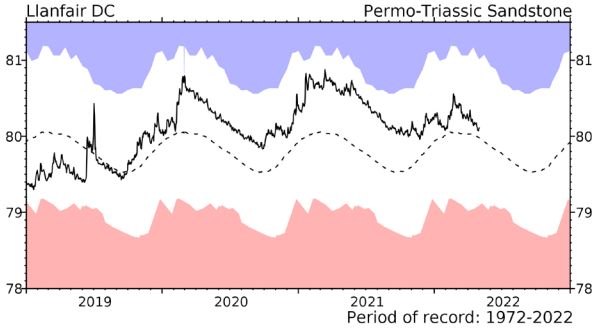


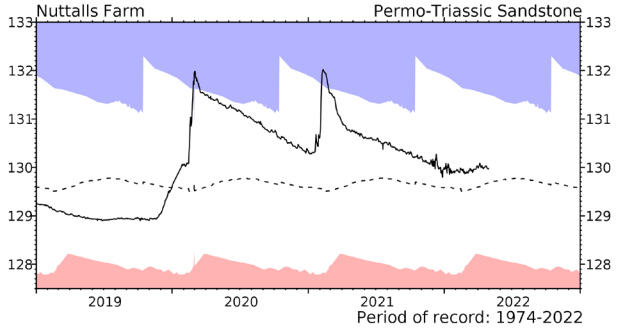


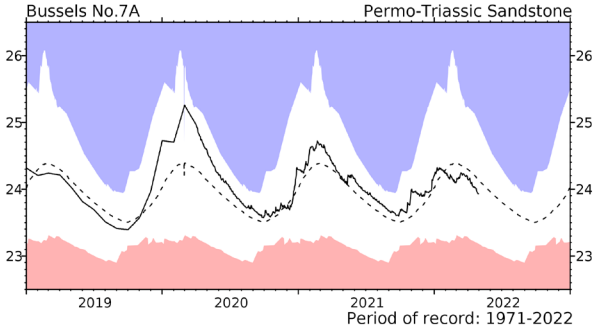


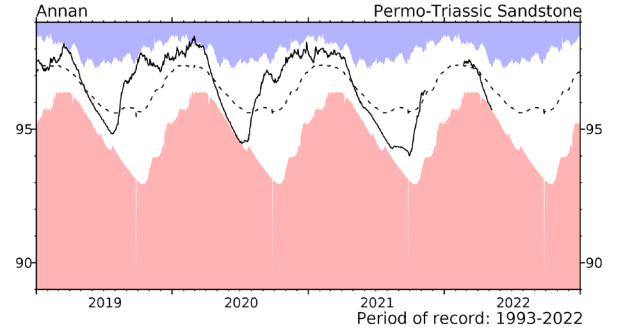


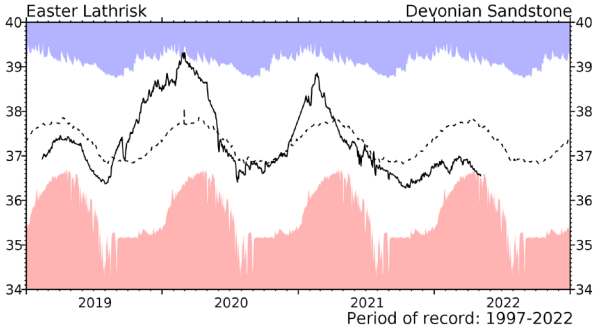


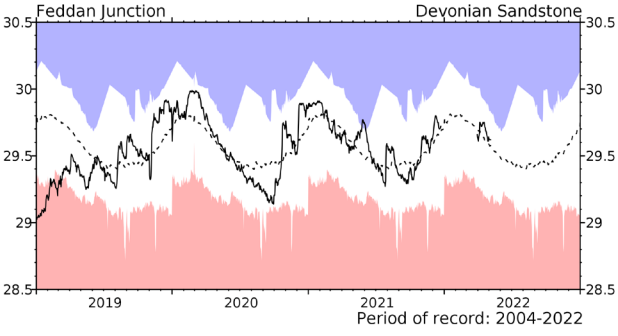










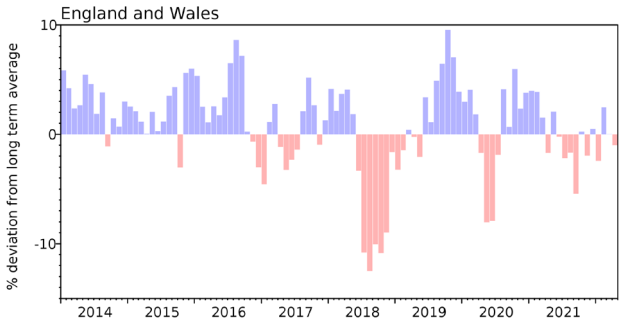


Groundwater levels - April 2022

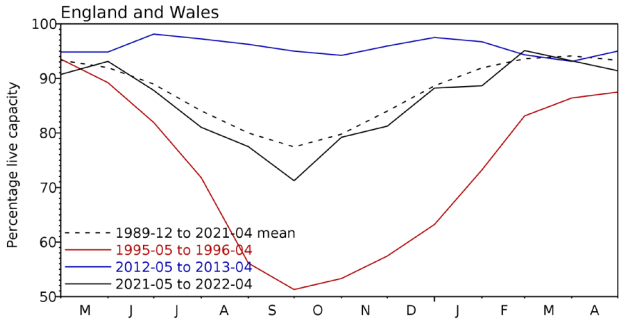
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. The rankings are designed as a qualitative indicator, and ranks at extreme levels, and when levels are changing rapidly, need to be interpreted with caution.

Reservoirs . . . Reservoirs . . .

Guide to the variation in overall reservoir stocks for England and Wales*



Comparison between overall reservoir stocks for England and Wales in recent years



*Note: Due to data access issues, the England and Wales stocks for April do not include the Northern Command Zone group or Vyrnwy.

Percentage live capacity of selected reservoirs at end of month

Area	Reservoir		Capacity (Ml)	2022 Feb	2022 Mar	2022 Apr	Apr Anom.	Min Apr	Year* of min	2021 Apr	Diff 22-21
North West	Haweswater and Thirlmere	•	111132	99	92	84	0	78	2020	83	1
Northumbrian	Teesdale	•	87936	100	95	95	5	73	2020	74	21
	Kielder		(199175)	96	89	90	-1	85	1990	89	1
Severn-Trent	Clywedog		49936	92	97	99	2	85	1988	99	0
	Derwent Valley	•	46692	100	92	88	-4	54	1996	83	5
Yorkshire	Washburn	•	23373	96	91	87	-3	76	1996	76	10
	Bradford Supply	•	40942	100	89	83	-8	60	1996	84	-1
Anglian	Grafham		(55490)	93	94	95	2	73	1997	96	-1
	Rutland		(116580)	90	96	95	3	72	1997	96	-1
Thames	London	•	202828	96	97	97	2	86	1990	96	1
	Farmoor	•	13822	87	94	99	2	81	2000	96	3
Southern	Bewl		31000	82	90	88	-2	60	2012	90	-2
	Ardingly		4685	100	100	94	-5	69	2012	99	-6
Wessex	Clatworthy		5662	100	100	87	-6	81	1990	89	-2
	Bristol	•	(38666)	88	93	89	-5	83	2011	89	-1
South West	Colliford		28540	77	79	75	-13	56	1997	86	-11
	Roadford		34500	100	98	94	9	41	1996	91	3
	Wimbleball		21320	100	100	93	-1	79	1992	85	8
	Stithians		4967	91	100	86	-6	65	1992	89	-3
Welsh	Celyn & Brenig	•	131155	92	89	89	-9	75	1996	98	-10
	Brianne		62140	99	94	88	-9	86	1997	88	0
	Big Five	•	69762	100	96	87	-6	85	2011	87	0
	Elan Valley	•	99106	100	93	88	-8	83	2011	90	-2
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	97	98	95	2	62	1998	93	2
	East Lothian	•	9317	100	100	100	1	89	1992	99	1
Scotland(W)	Loch Katrine	•	110326	100	97	91	0	80	2010	88	3
	Daer		22494	97	84	81	-12	78	2013	87	-6
	Loch Thom		10721	100	95	93	0	72	2021	72	21
Northern Ireland	Total+	•	56800	88	93	85	-4	77	2007	89	-4
	Silent Valley	•	20634	99	96	82	-3	58	2000	84	-2

( ) figures in parentheses relate to gross storage

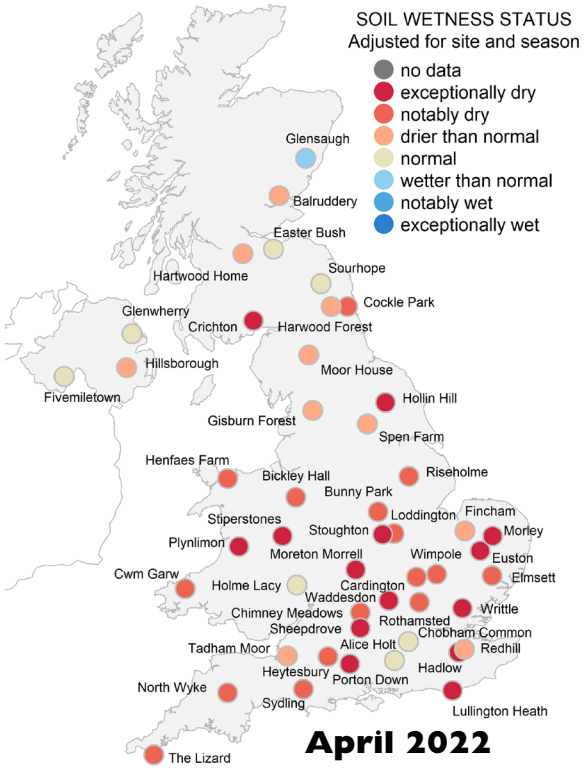
• denotes reservoir groups

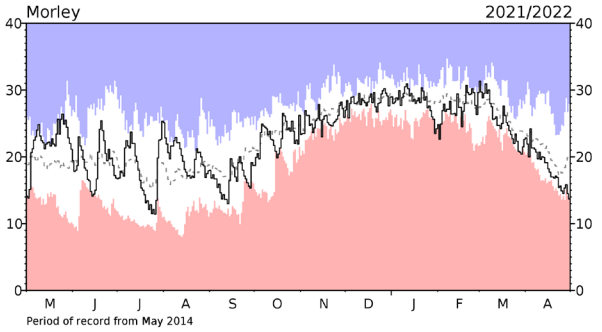
*last occurrence

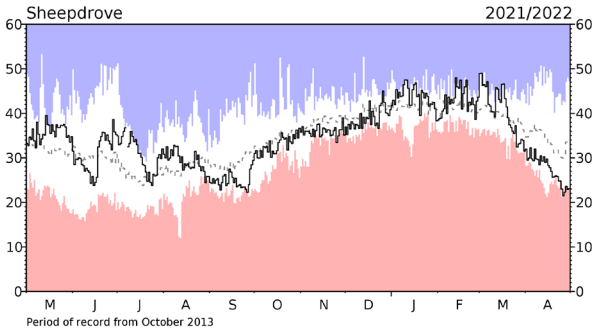
+ excludes Lough Neagh

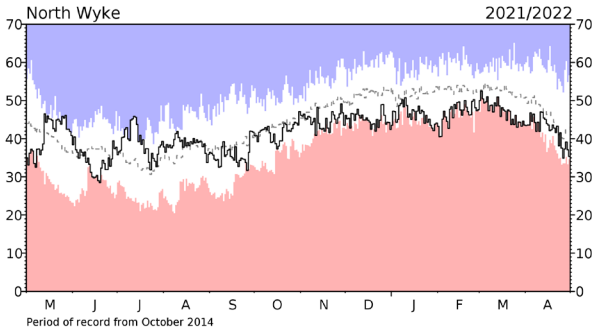
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed 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.

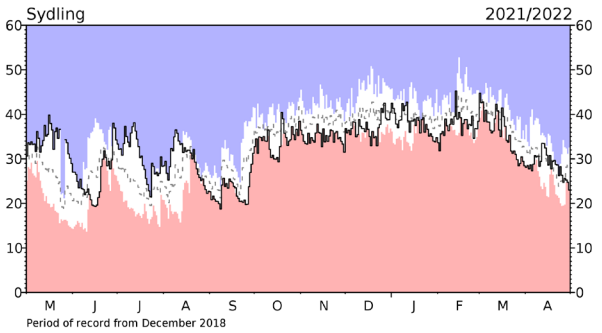
Soil Moisture . . . Soil Moisture

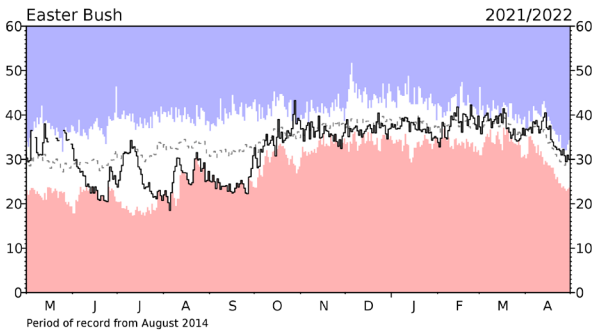












At the end of April, UK soil moisture is drier than normal for the time of year at 80% of sites.

Low rainfall in southeast and central England occurred mostly in the first half of April. This left many sites finishing April with exceptionally dry soils for the time of year (e.g. Morley and Sheepdrove).

Compared to central and southeast England, the west and southwest of the UK received slightly more precipitation relative to the regional long-term average. Despite closer to average precipitation many of these sites entered May with notably dry soils for the time of year, resulting in soil moisture well below field capacity at the end of April (e.g. North Wyke and Sydling).

Unlike England and Wales, sites in Scotland and Northern Ireland received higher than average precipitation. This led to sites in these regions ending April with normal soil moisture for the time of year, slightly below field capacity (e.g. Easter Bush).

Soil moisture data

These data are from UKCEH's COSMOS-UK network. The time series graphs show volumetric water content as a percentage in black together with the maximum and minimum daily values for the period-of-record of the sites. The dashed line represents the period-of-record mean VWC. For more information visit cosmos.ceh.ac.uk.

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 1991-2020 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

Some of the features displayed on the maps contained in this report are based on the following data with permission of the controller of HMSO.

i. Ordnance Survey data. © Crown copyright and/or database right 2005. Licence no. 100017897.
ii. Land and Property Services data. © Crown copyright and database right, S&LA 145.
iii. Met Office rainfall data. © Crown copyright.