Hydrological Summary

for the United Kingdom

May 2022

General

May was unsettled, but despite frequent showers and widespread thunderstorms, was largely quiescent in hydrological terms. It was moderately warmer than average with some hotter periods, especially in the south. While western Scotland was wet, it was mostly drier-than-average elsewhere, and especially dry in parts of Wales and central and eastern England. For much of the UK, spring (March-May) has been dry, continuing a general trend towards dry spring months in recent years, and longer-term rainfall deficiencies can be traced back to the autumn. Correspondingly, May mean river flows were below normal (notably so in some catchments) away from western Scotland, and groundwater levels were below normal at a majority of boreholes (again, notably so in some localities). Similarly, while reservoir stocks were moderately below average nationally, there were more pronounced deficiencies in Wales (16% below average for Wales as whole, with new May minima in Brianne and the Elan Valley), the Pennines, southwest England and at some reservoirs in southeast England (Ardingly registered the lowest May stocks on record). With below average flows, groundwater levels and reservoir stocks entering summer (and the dry and warm conditions in early June), increased vigilance will be required as evaporation rates climb. Current Outlooks suggest below normal flows and groundwater levels are likely to persist through summer, implying the possibility of localised impacts (e.g. on agriculture and the environment) if these forecasts are realised.

Rainfall

May started cloudy, cool and unsettled. Frequent and occasionally heavy showers were a feature of the first half of the month, particularly in the north and west, but daily rainfall totals were generally modest (with 50mm at Achnagart, Aberdeenshire, on the 5th and 65mm at Honister, Cumbria, on the 9th). Following an anticyclonic spell mid-month, a plume of warm air from the continent bought hotter weather (with 27.5°C recorded at Heathrow on the 17th) and triggered thunderstorms across large parts of England and Northern Ireland (where 43mm was registered on the 16th at Lough Fea, County Tyrone), with some localised transport disruption due to surface water flooding. The latter part of the month was also unsettled and showery but with limited appreciable rainfall, especially in southern England. For the UK as a whole, May rainfall was moderately above average, but this primarily reflects wetness in western Scotland (where large areas received over 150% of average) and Northern Ireland. Below-average rainfall was received across most of England and Wales, and May was particularly dry (with less than half the average May rainfall) in parts of East Anglia, south Wales and the Welsh borders. The dry May extends rainfall deficiencies across England and Wales: spring rainfall was below 70% of average across most regions, with 59% received in Wales (the ninth driest spring in a record from 1910, with both 2020 and 2022 in the top ten). Over the longer-term, rainfall over the last nine months (Sept-May) was below 80% of average across most of southern England.

River flows

Across much of the country, river flows were receding entering May, continuing recessions established in April. In some responsive rivers in the west there were muted responses to downpours in May, particularly in Scotland, but flows were rarely substantially above the daily average. For a majority of catchments in England and Wales, recessions continued through May with only brief and minor interruptions. Consequently, May river flows were below average across most of England and Wales, and notably low (with less than 60% of average in many catchments) across much of the south. New May minima were registered on the Soar and Yscir (both in records from 1972), and May outflows from England & Wales were the fourth lowest on record (in a series from 1961). In contrast, May flows were substantially above average in the western Highlands (with twice the average May flow for the Carron) and in the normal range across the rest of Scotland. For the spring as a whole, flows were below normal across most of the UK, with widespread notably low flows. The English Tyne and the Conwy recorded the second lowest average flow for spring (in records from 1957 and 1965, respectively) while the Welsh Dee registered its eighth lowest spring in a record from 1938. More generally, for many catchments, 2022 ranks among the lowest 5-10 spring flows on record, among notable drought years (e.g. 1984, 1990, 2011). Modest longer-term river flow deficiencies are present in many catchments around the UK over the 6- to 9-month timescales.

Groundwater and soil moisture

While soils were wetter than normal by the end of May in parts of Scotland and Northern Ireland, soil moisture at most COSMOS-UK sites was in the normal range or below normal, and notably dry at some sites in central and eastern England. Similarly, soil moisture deficits continued to climb (albeit less steeply than in April) across most aquifer areas. Hence, groundwater levels receded at all Chalk index sites, except Therfield Rectory and Dial Farm, and were typically in the normal range or lower, with notably low levels at many sites – Ashton Farm and Houndean registered their third and fourth lowest May levels (in records from 1974 and 1977, respectively). Levels fell in the other limestones. They remained normal (New Red Lion) to below normal (Ampney Crucis) in the Jurassic limestones, and were below normal (Alstonfield) to notably low (south Wales) in the Carboniferous Limestone. In the Magneisan limestone, levels were below normal at Aycliffe but above normal at Brick House Farm. In the Permo-Triassic sandstones, levels fell at Annan, Llanfair D.C. and Bussels No. 7a and were stable at Weir Farm and Nuttalls Farm and rose at Skirwith. May levels were above normal at Weir Farm, and otherwise normal to notably low. In the other sandstones levels fell. Levels were in the normal range at Lime Kiln Way (Upper Greensand), above average at Royalty Observatory (Fell Sandstone), whilst in the Devonian sandstones Feddan Junction dropped into the normal range and Easter Lathrisk remained notably low.

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.

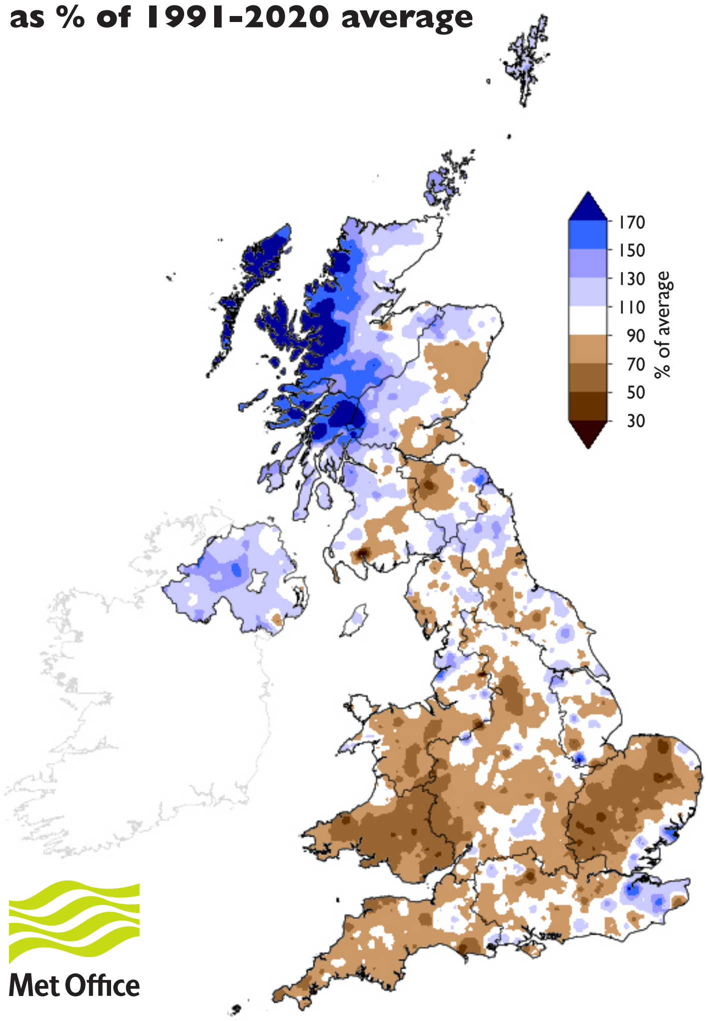
Region	Rainfall	May 2022	Mar22 – May22	RP	Dec21 – May22	RP	Sep21 – May22	RP	Jun21 – May22	RP
United	mm	**76**	174		497		813		994	
Kingdom	%	**107**	77	5-10	88	2-5	90	2-5	87	2-5
England	mm	**51**	117		334		555		729	
	%	**89**	69	8-12	82	5-10	84	2-5	85	5-10
Scotland	mm	**118**	266		729		1190		1379	
	%	**134**	88	2-5	92	2-5	96	2-5	89	2-5
Wales	mm	**63**	162		613		1006		1195	
	%	**73**	59	20-30	85	2-5	88	2-5	83	5-10
Northern	mm	**89**	210		544		825		1014	
Ireland	%	**120**	89	2-5	97	2-5	93	2-5	88	2-5
England &	mm	**52**	123		372		616		793	
Wales	%	**86**	67	10-15	82	2-5	85	2-5	85	5-10
North West	mm	**72**	163		555		947		1149	
	%	**97**	69	5-10	92	2-5	97	2-5	91	2-5
Northumbria	mm	**56**	137		354		588		740	
	%	**101**	77	2-5	84	2-5	87	2-5	82	5-10
Severn-Trent	mm	**49**	111		336		525		673	
	%	**84**	66	8-12	90	2-5	88	2-5	85	2-5
Yorkshire	mm	**51**	123		367		575		746	
	%	**94**	72	5-10	90	2-5	89	2-5	87	2-5
Anglian	mm	**39**	82		225		366		505	
	%	**82**	63	8-12	80	5-10	80	5-10	81	5-10
Thames	mm	**45**	102		257		436		624	
	%	**84**	68	5-10	74	5-10	78	5-10	87	2-5
Southern	mm	**52**	106		276		471		702	
	%	**101**	68	5-10	70	8-12	73	8-12	86	2-5
Wessex	mm	**52**	133		323		546		731	
	%	**88**	74	5-10	73	5-10	77	5-10	81	5-10
South West	mm	**57**	156		470		812		1042	
	%	**81**	66	8-12	75	5-10	81	5-10	84	5-10
Welsh	mm	**61**	158		579		961		1146	
	%	**73**	59	20-30	84	2-5	87	2-5	83	5-10
Highland	mm	**163**	334		911		1468		1665	
	%	**157**	91	2-5	94	2-5	98	2-5	91	2-5
North East	mm	**72**	210		453		765		963	
	%	**107**	101	2-5	93	2-5	96	2-5	92	2-5
Tay	mm	**95**	237		610		956		1175	
	%	**116**	88	2-5	87	2-5	87	2-5	85	2-5
Forth	mm	**76**	168		527		868		1055	
	%	**105**	71	5-10	86	2-5	91	2-5	86	2-5
Tweed	mm	**61**	164		459		779		936	
	%	**94**	78	2-5	88	2-5	95	2-5	87	2-5
Solway	mm	**85**	225		686		1176		1341	
	%	**97**	76	2-5	89	2-5	96	2-5	87	2-5
Clyde	mm	**138**	294		875		1400		1593	
	%	**138**	83	2-5	92	2-5	94	2-5	85	2-5

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

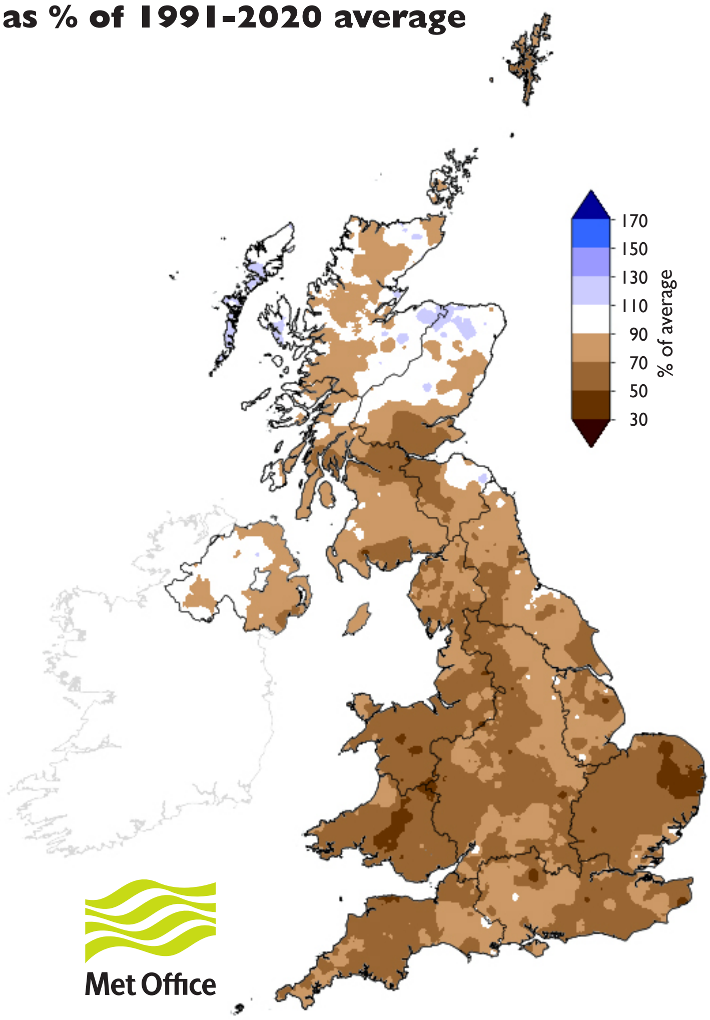
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

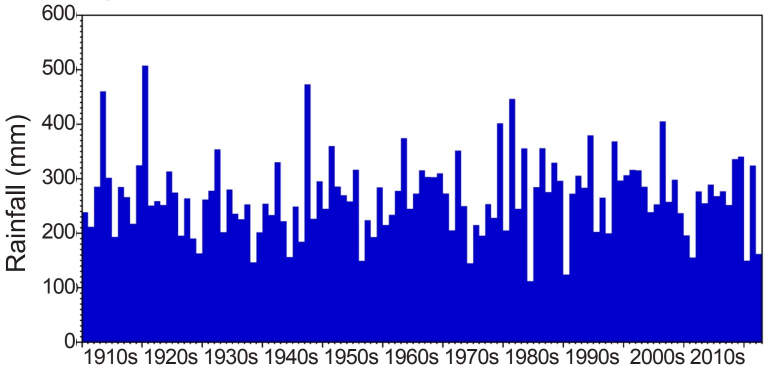
May 2022 rainfall as % of 1991-2020 average



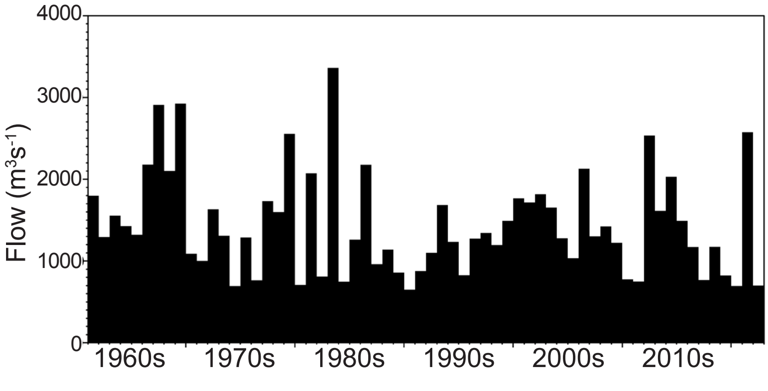
March 2022 - May 2022 rainfall as % of 1991-2020 average



Spring (March - May) rainfall for Wales



May mean outflows for England & Wales



UK Hydrological Outlook

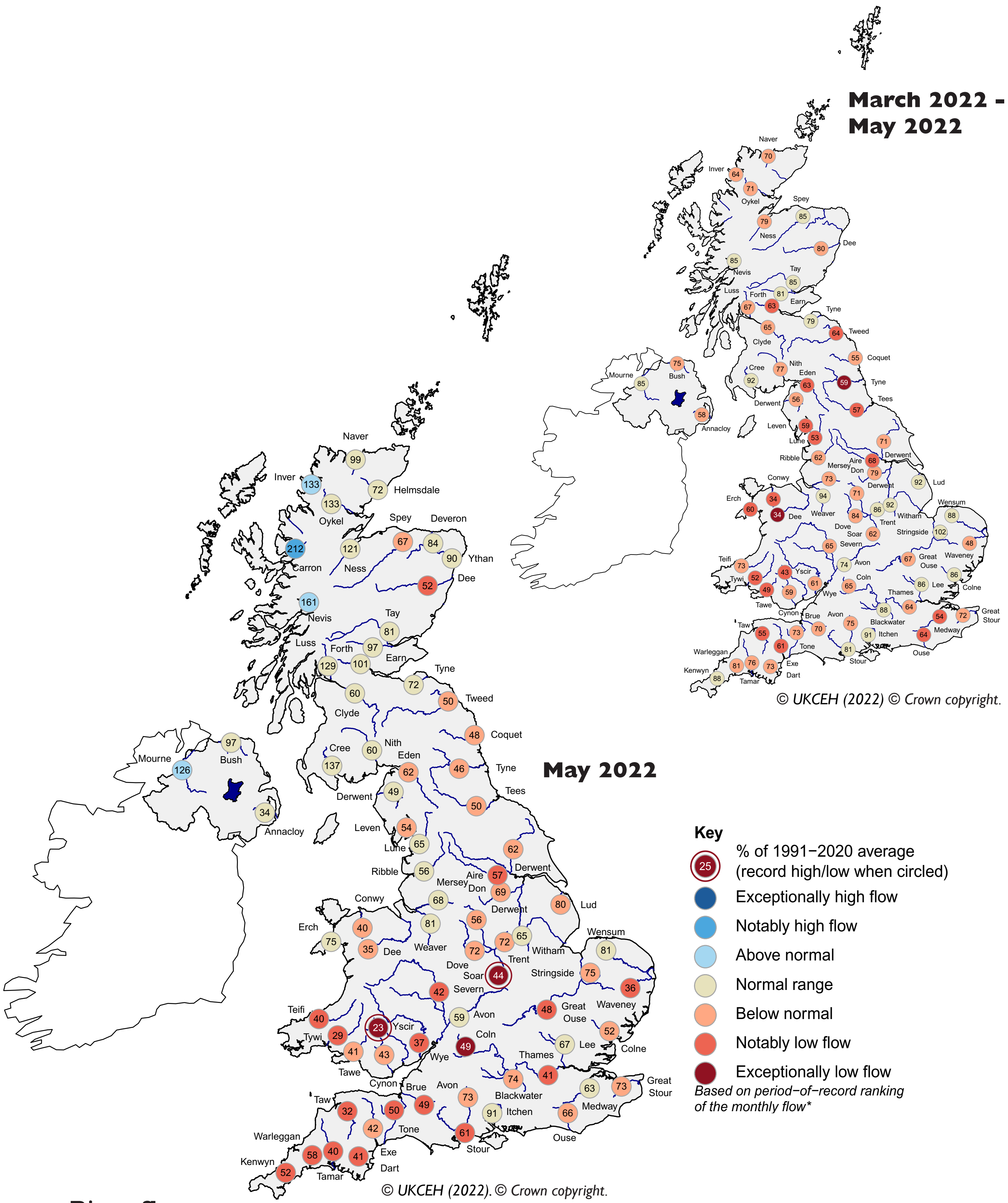
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from June 2022**
Issued: **10.06.2022**
using data to the end of May 2022

The outlook for June and for June-August is that below normal river flows are likely in south Wales and southern and central England, and normal to below normal flows elsewhere. Groundwater levels in June and over the three-month timeframe are likely to be normal to below normal across most of the UK.

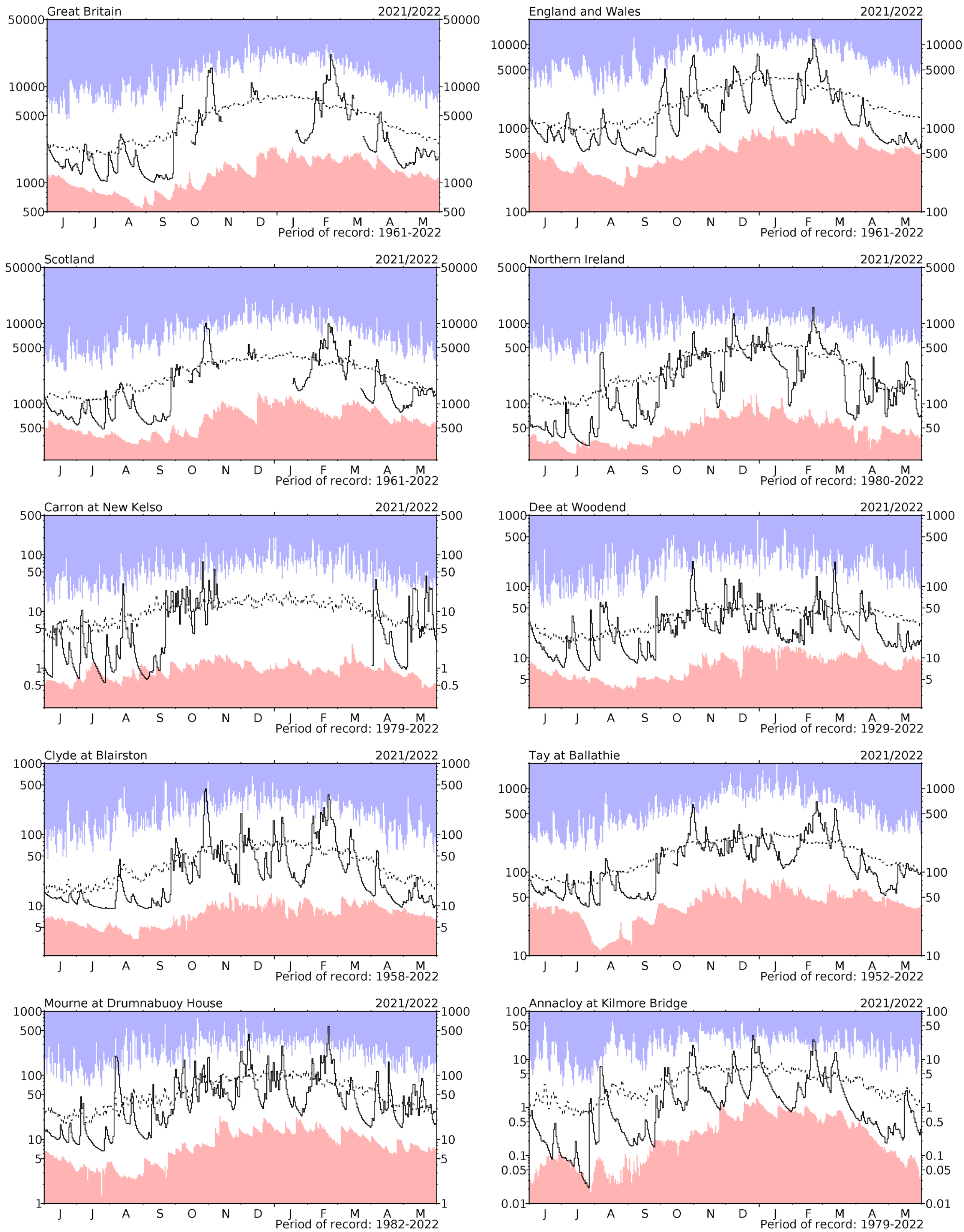
River flow . . . River flow . . .



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.

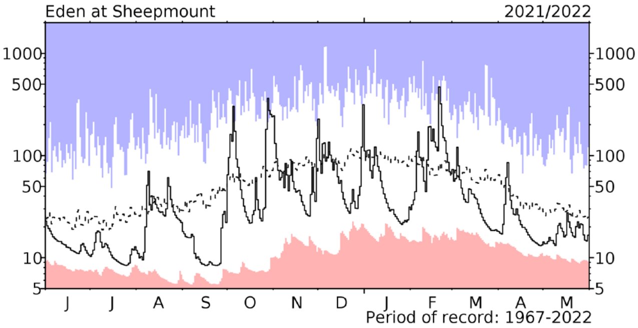
River flow . . . River flow . . .

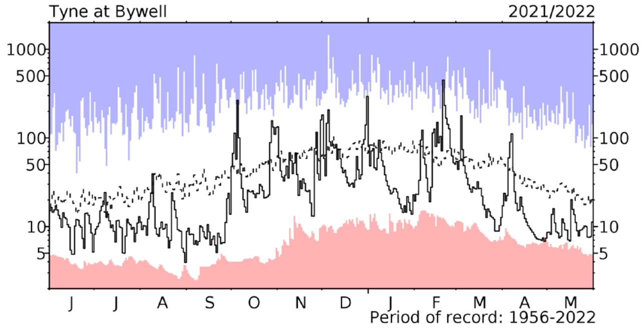


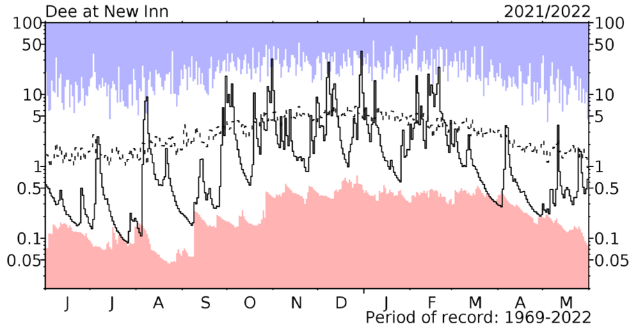
River flow hydrographs

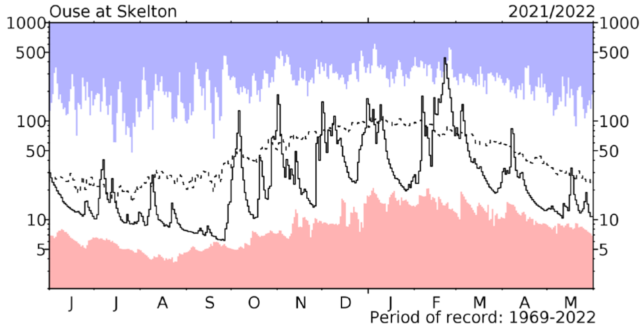
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to June 2021 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

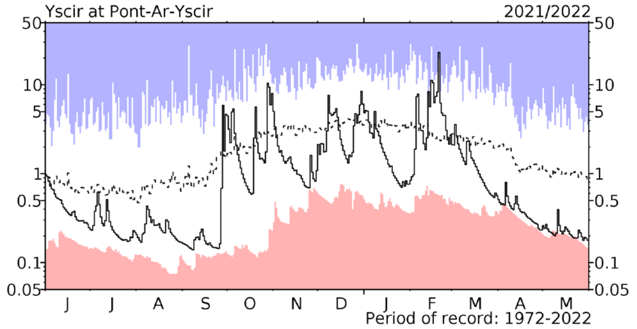
River flow . . . River flow . . .

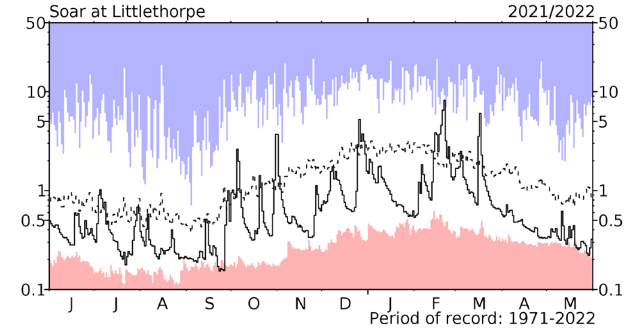


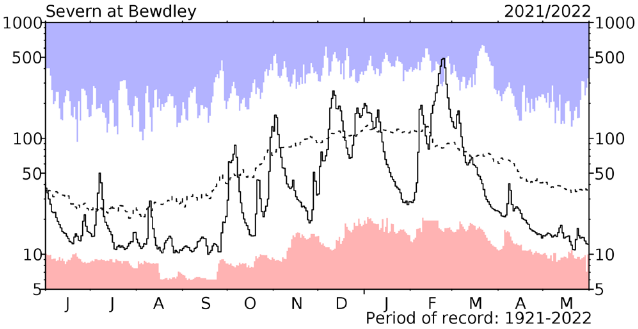


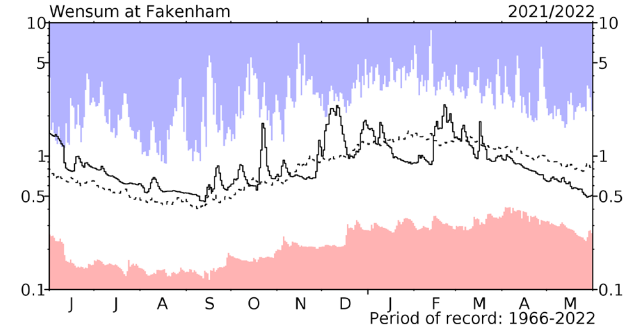


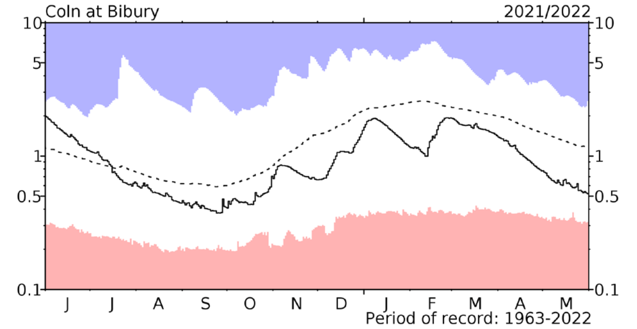


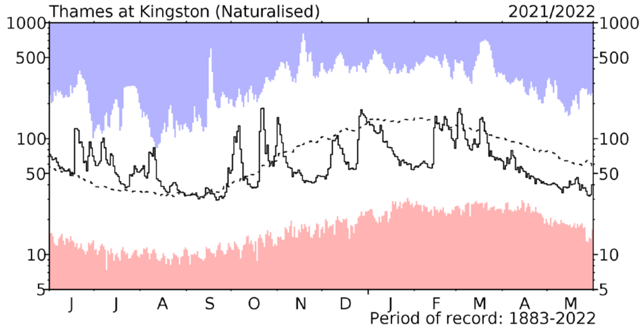


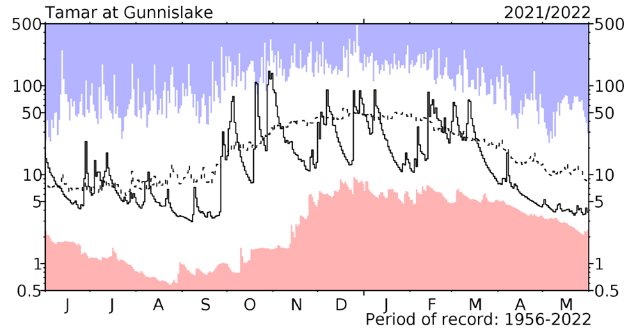


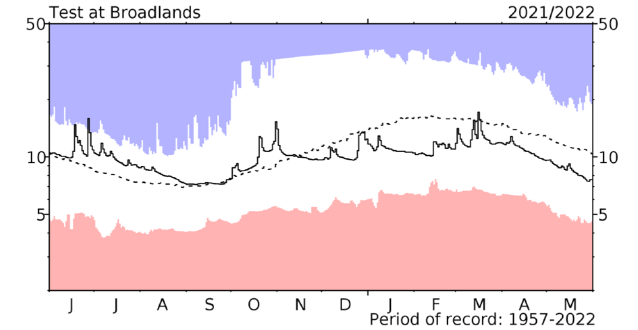




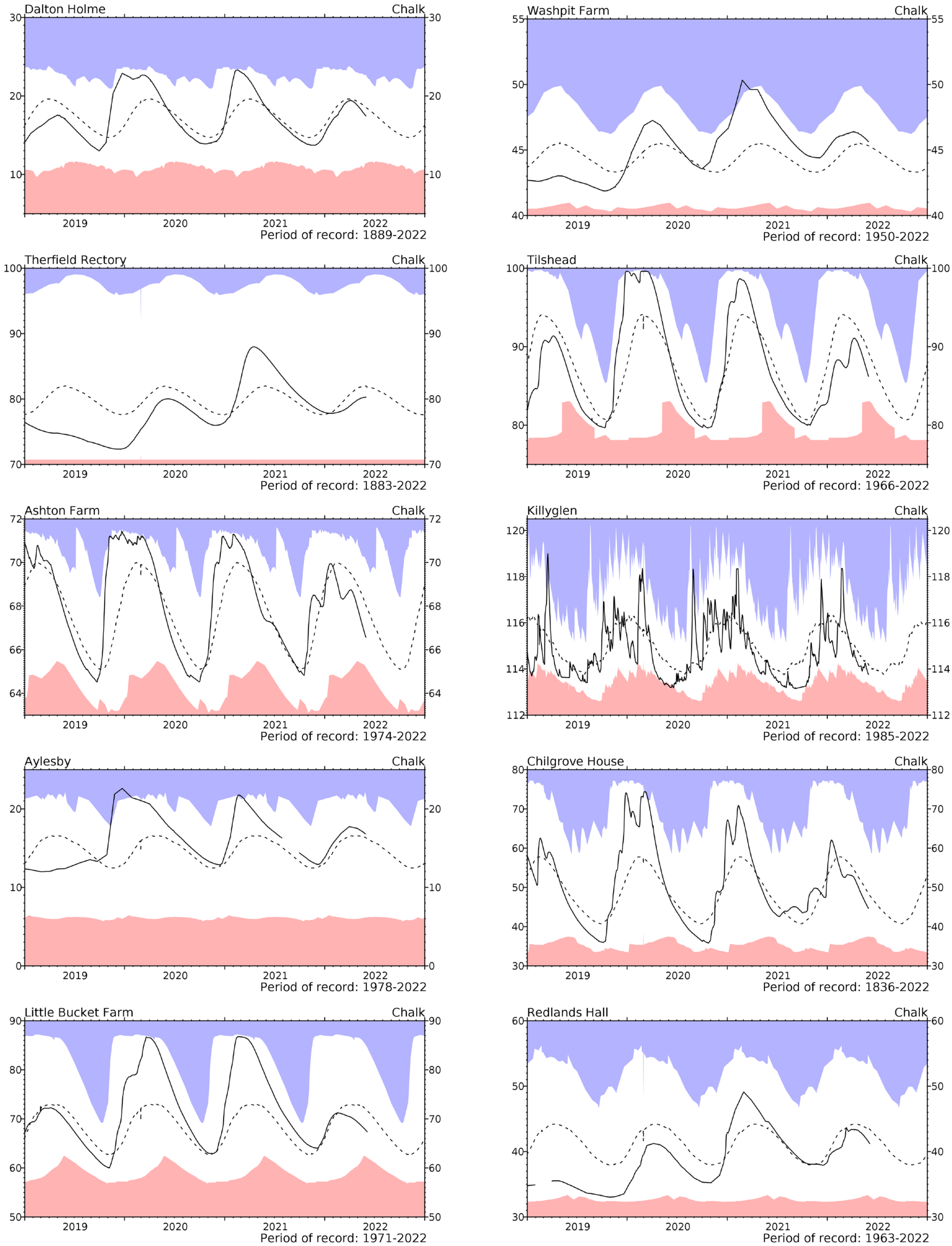




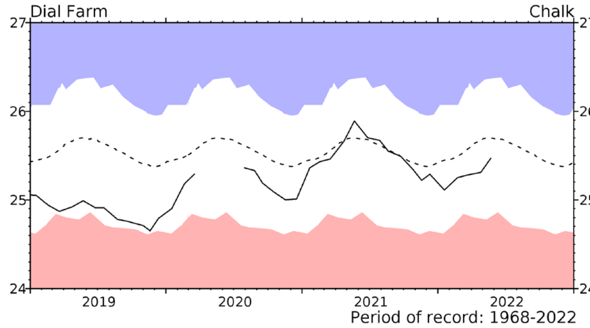


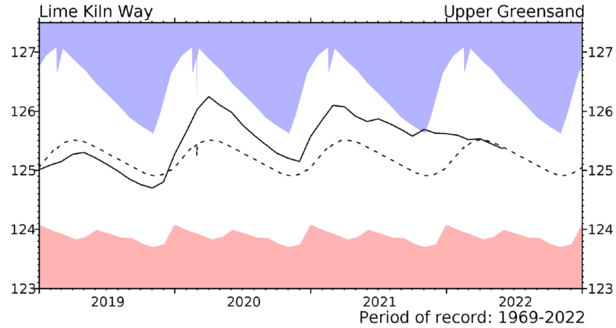


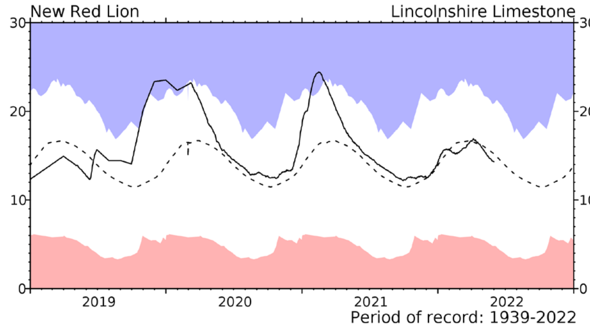
Groundwater . . . Groundwater

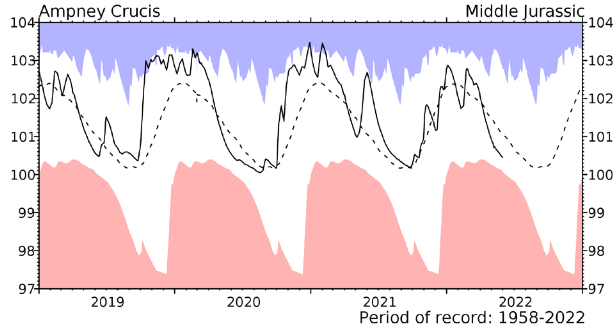


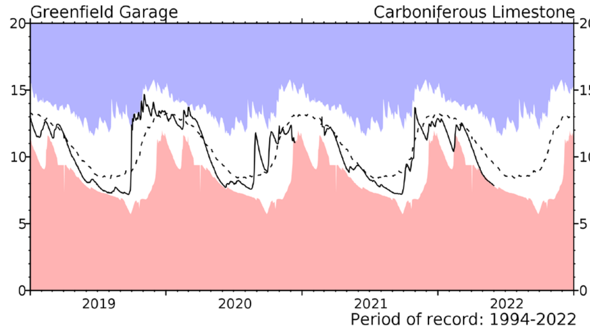
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

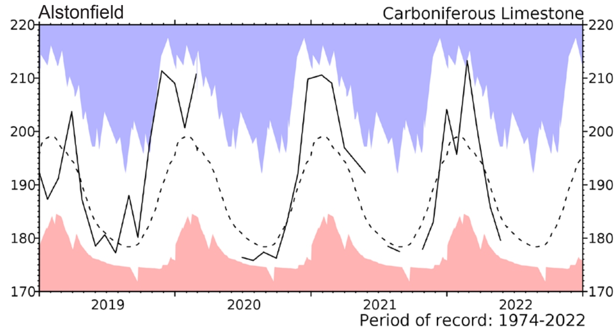

Dial Farm
Chalk
Period of record: 1968-2022

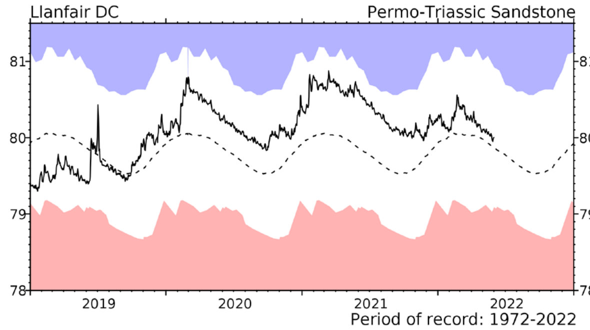

Lime Kiln Way
Upper Greensand
Period of record: 1969-2022

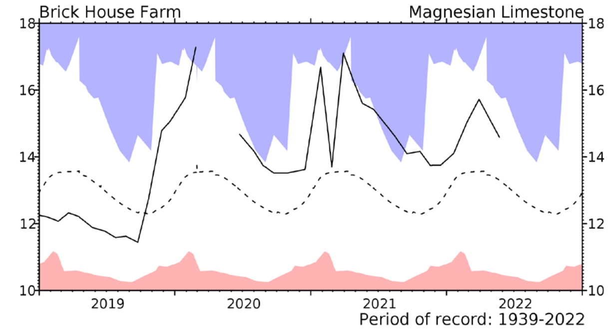

New Red Lion
Lincolnshire Limestone
Period of record: 1939-2022

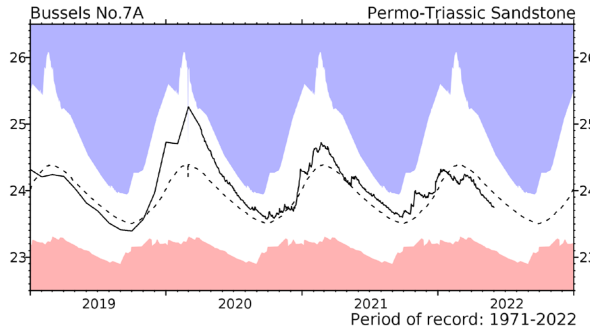

Ampney Crucis
Middle Jurassic
Period of record: 1958-2022

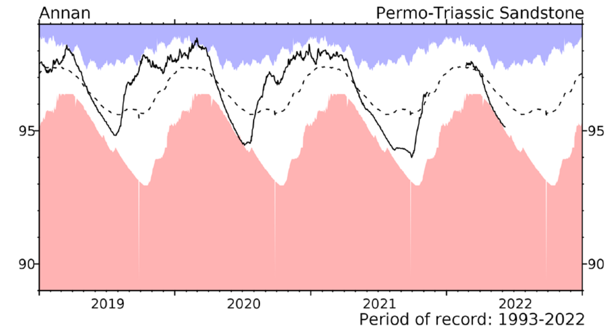

Greenfield Garage
Carboniferous Limestone
Period of record: 1994-2022

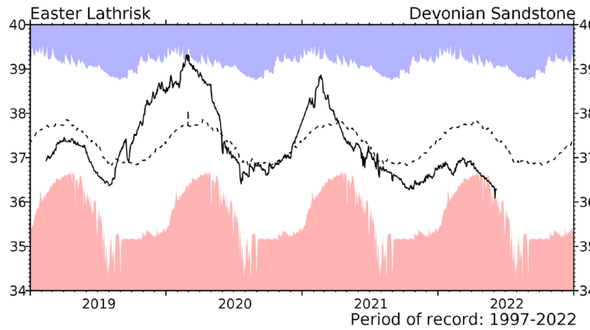

Alstonfield
Carboniferous Limestone
Period of record: 1974-2022

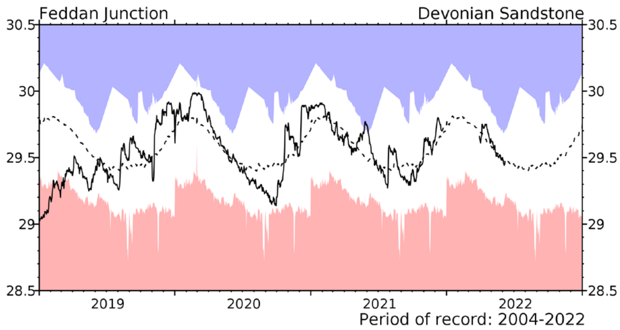

Llanfair DC
Permo-Triassic Sandstone
Period of record: 1972-2022


Brick House Farm
Magnesian Limestone
Period of record: 1939-2022


Bussels No.7A
Permo-Triassic Sandstone
Period of record: 1971-2022


Annan
Permo-Triassic Sandstone
Period of record: 1993-2022


Easter Lathrisk
Devonian Sandstone
Period of record: 1997-2022


Feddan Junction
Devonian Sandstone
Period of record: 2004-2022

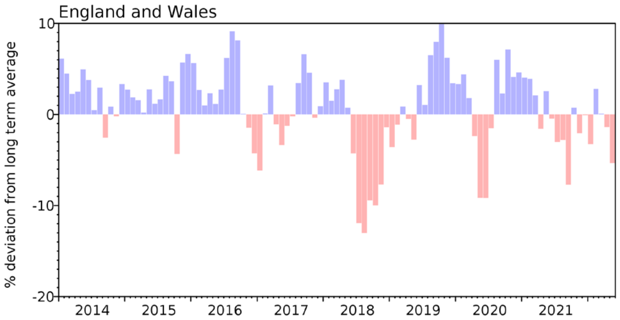
Groundwater...Groundwater

Groundwater levels - May 2022

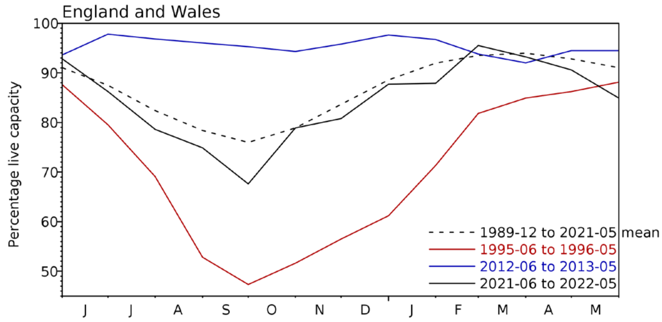
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated.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



Percentage live capacity of selected reservoirs at end of month

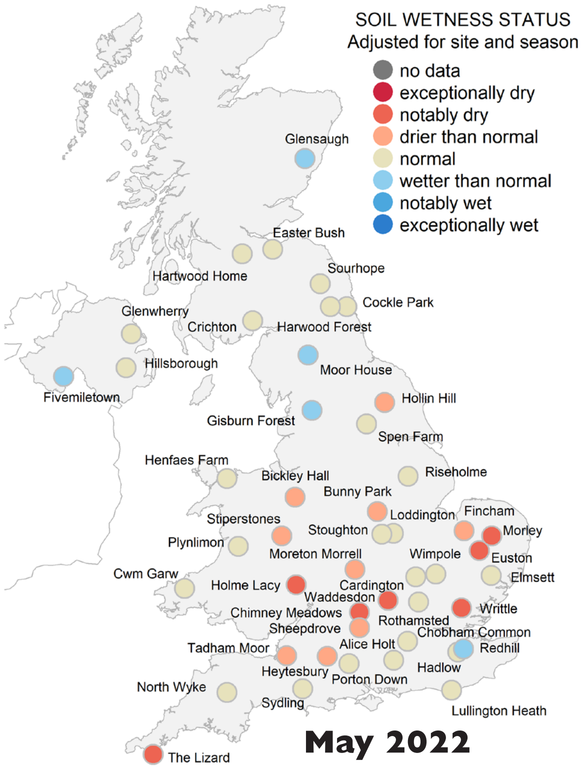
Area	Reservoir		Capacity (Ml)	2022 Mar	2022 Apr	2022 May	May Anom.	Min May	Year* of min	2021 May	Diff 22-21
North West	N Command Zone	•	124929	92	83	71	-9	50	1984	86	-15
	Vyrnwy		55146	96	87	82	-7	69	1984	99	-18
Northumbrian	Teesdale	•	87936	95	95	92	7	62	2020	74	18
	Kielder		(199175)	89	90	91	-1	85	1989	96	-6
Severn-Trent	Clywedog		49936	97	99	96	-2	83	1989	99	-3
	Derwent Valley	•	46692	92	88	72	-16	56	1996	92	-21
Yorkshire	Washburn	•	23373	91	87	77	-9	71	2020	87	-10
	Bradford Supply	•	40942	89	83	74	-12	68	2020	97	-23
Anglian	Grafham		(55490)	94	95	96	2	72	1997	92	4
	Rutland		(116580)	96	95	94	1	75	1997	95	-2
Thames	London	•	202828	97	97	96	2	83	1990	91	5
	Farmoor	•	13822	94	99	93	-4	90	2002	96	-3
Southern	Bewl		31000	90	88	80	-8	57	1990	90	-10
	Ardingly		4685	100	94	88	-10	88	2022	100	-12
Wessex	Clatworthy		5662	100	87	81	-6	67	1990	100	-19
	Bristol	•	(38666)	93	89	81	-8	70	1990	89	-8
South West	Colliford		28540	79	75	68	-18	52	1997	87	-19
	Roadford		34500	98	94	88	4	48	1996	93	-5
	Wimbleball		21320	100	93	80	-11	74	2011	98	-18
	Stithians		4967	100	86	77	-10	66	1990	88	-10
Welsh	Celyn & Brenig	•	131155	89	89	83	-13	79	2020	100	-17
	Brianne		62140	94	88	76	-19	76	2022	93	-17
	Big Five	•	69762	96	87	77	-13	70	1990	92	-15
	Elan Valley	•	99106	93	88	75	-18	75	2022	98	-23
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	98	95	90	0	52	1998	92	-2
	East Lothian	•	9317	100	100	98	1	84	1990	100	-2
Scotland(W)	Loch Katrine	•	110326	97	91	95	8	66	2001	85	10
	Daer		22494	84	81	79	-9	69	2020	85	-6
	Loch Thom		10721	95	93	92	2	70	2020	73	19
Northern Ireland	Total⁺	•	56800	93	85	84	-2	69	2008	91	-7
	Silent Valley	•	20634	96	82	82	0	56	2000	87	-5

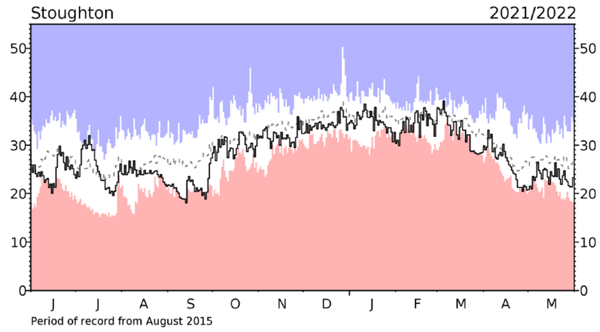
( ) figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence

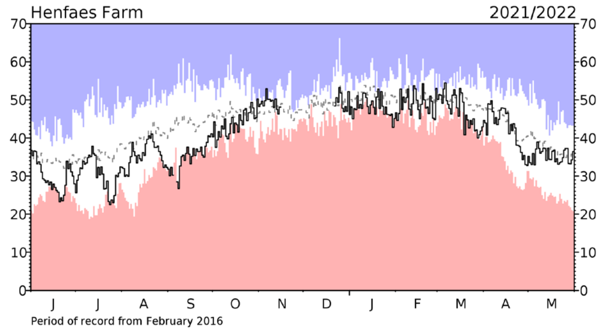
⁺ excludes Lough Neagh

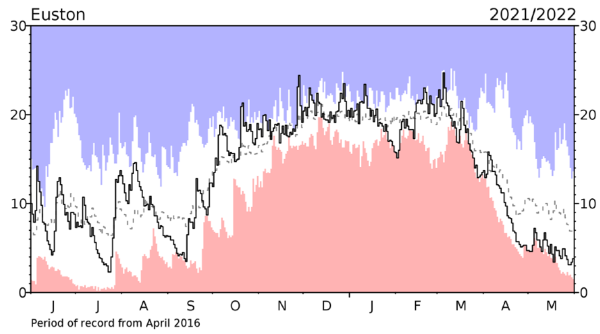
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed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

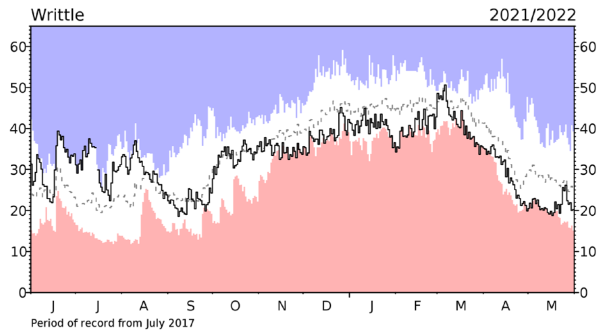
Soil Moisture . . . Soil Moisture

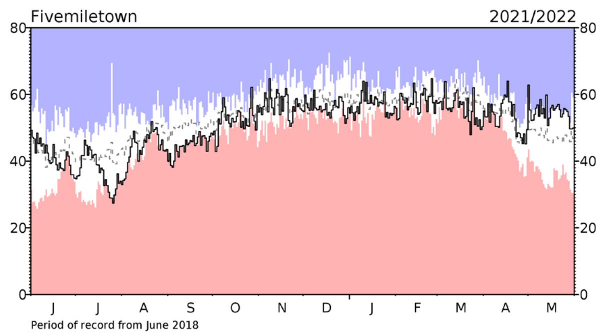












At the end of May, soil moisture for the majority of sites throughout the UK was normal for the time of year.

After a dry end to April, precipitation throughout May led to many soils across the UK transitioning from drier than normal or notably dry to normal levels for the time of year (e.g. Stoughton and Henfaes Farm).

In some regions where soil moisture was drier than normal for the time of year at the beginning of May, soils continued to dry throughout the month to notably dry levels for the time of year (e.g. East Anglia: Euston and Writtle).

In areas such as Scotland and Northern Ireland, where rainfall was higher than the long-term average, soils at some sites ended the month wetter than normal for the time of year (e.g. Fivemiletown).

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.

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