Hydrological Summary

for the United Kingdom

February 2022

General

February was notable for the turbulent weather, including three named storms in a week, which brought wet and extremely windy weather for the UK. Rainfall totals were above average for much of the UK, particularly across northern and western areas. Correspondingly, river flows for February were generally above normal, notably or exceptionally so in Northern Ireland, Wales, southern Scotland and central and northern England. Winter flows (December-February) were less extreme, although still above normal in central England. Soil moisture deficits remained negligible across the country and groundwater levels rose at most sites, with a large response to rainfall recorded in the Carboniferous Limestone. Reservoir levels increased in most impoundments and stocks were above average at the national scale. In the short-term, saturated catchments in northern and western imply an increased sensitivity to heavy rainfall, however latest Outlooks for below average spring rainfall and receding river flows evident in early March, lessen this risk. Seasonal recessions in the southern Chalk have begun earlier than expected and a dry spring forecast could lead to low levels over the next few months.

Rainfall

After a mild and settled start, February saw a succession of low-pressure systems bringing unsettled and, at times, extremely stormy conditions. Storm 'Dudley' arrived on the 16th causing travel and power disruption in northern parts of the UK. The following day, storm 'Eunice' arrived bringing further wind and rain (35mm was recorded at Lake Vyrnwy, Powys). Two severe 'red' weather warnings for wind were issued for south-west and south-east England, and much of the UK experienced gales of 60-80mph. Power outages left more than 1.4 million properties across the UK without power, schools were closed, and many buildings suffered damage including the O2 Arena in London. Snow brought travel disruption in Scotland (8cm was recorded on the 18th at Aboyne, Aberdeenshire), stranding vehicles, and Network Rail also issued a UK wide 'do not travel' warning. Bridges across the UK were shut including both Severn Bridges simultaneously for the first time. Storm 'Franklin' followed on the 20th, again bringing rain to north-west UK, which pushed south-eastwards during the day (85mm was recorded at Shap, Cumbria) and high winds resulted in further travel disruption on roads and public transport. Whilst daily rainfall totals were not outstanding accumulated totals in the Pennines and central Wales over the 12th-20th period accounted for more than 150% of the average (expected for the whole months. The UK received 154% of the average February rainfall with regions Severn Trent, Yorkshire, and North West (recording its fourth wettest February in a series from 1910) all registering more than 180% of average. Only the Southern region recorded below average rainfall (94%). Winter rainfall for the UK was below average (94%), and regions in southern England recorded less than three-quarters of average (e.g. Southern, Thames).

River flows

Flows continued to increase over the first week of February following wet weather in late January, then receded until mid-month, when marked responses were seen due to the succession of storms and associated rainfall. On the 17th, ten severe flood warnings were issued on the Severn and Wye estuaries as 'Dudley' was forecast to coincide with high tides, although fortunately it arrived later. A day later, on the 18th, rain from 'Eunice' sustained the flow increases, however the cumulative effect of successive storms was most realised during 'Franklin' from the 20th. In Northern Ireland, there was flooding on the Drumragh and Finn, and pumps were used to divert flood water. On the Mersey, two severe flood warnings were issued, and properties were evacuated as the Didsbury Flood Basin was utilised, and in North Yorkshire there were evacuations in Tadcaster due to flooding from the Wharfe. Temporary barriers were installed on the Severn at Ironbridge as evacuations took place and a major incident declared. In England, 221 properties were flooded in total, whilst 35,000 were protected by defences. Following the passage of storm 'Franklin' on the 20th, new record February peak flows were recorded on the Mourne, Yorkshire Don and Derbyshire Derwent (with its second highest peak flow of any month on record, in a series from 1969), and the Mersey recorded its second highest daily mean flow (in a series from 1977). Monthly mean flows were generally above normal, exceptionally so on the Clyde, Ribble and Aire which all recorded more than two times the long-term average and their third highest February mean flows (all in records from 1961). In southern England however, flows were normal or below – with the Kenwyn, Stour and Coln registering just over half of their respective averages. Flow accumulations for the winter (December-February) were mostly in the normal range, although exceptionally high flows were registered on the Mersey. Below normal flows were registered in the south and east of England, highlighting the drier than normal winter in these areas.

Groundwater

Little or no soil moisture deficit remained across the UK after the February rainfall. Groundwater levels in the Chalk fell in Wessex and the South Downs and ended the month below normal at several sites (e.g. West Woodyates Manor, Houndean Bottom). Elsewhere in the Chalk, levels rose and mostly remained in the normal range. In the Jurassic Limestones, groundwater levels fell to below normal at New Red Lion, whilst they rose to above normal at Ampney Crucis. Levels fell in the northern Magnesian Limestone at Aycliffe, although remained normal, and rose at Brick House Farm where levels were above normal for February. Levels rose significantly across the Carboniferous Limestone and at Alstonfield, increased from normal in January to exceptionally high at the end of February. Levels at sites in south Wales returned to the normal range. In the Permo-Triassic Sandstones, levels rose in most sites and became notably high at Weir Farm. Falling levels at Skirwith ended the month below normal, while at Bussels No. 7a levels fell but remained in the normal range. At Lime Kiln Way, in the Upper Greensand, the levels fell but remained in the normal range; levels also decreased in the Fell Sandstone but remained above normal for the time of year.

Note that due to issues with data access, 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 1991-2020 average.

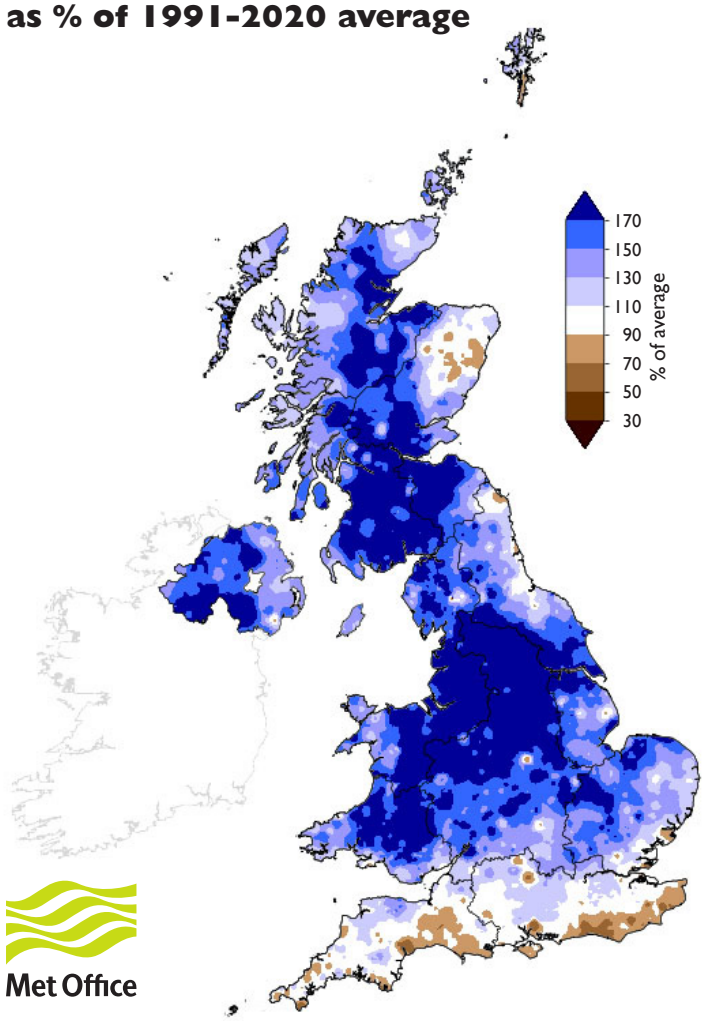
Region	Rainfall	Feb 2022	Jan22 – Feb22	RP	Dec21 – Feb22	RP	Sep21 – Feb22	RP	Mar21 – Feb22	RP
United Kingdom	mm	**146**	208		323		639		1044	
	%	**154**	96	2-5	94	2-5	95	2-5	91	2-5
England	mm	**97**	128		217		437		784	
	%	**148**	87	2-5	91	2-5	90	2-5	92	2-5
Scotland	mm	**216**	326		463		924		1398	
	%	**155**	103	2-5	95	2-5	98	2-5	90	2-5
Wales	mm	**198**	267		451		845		1357	
	%	**166**	98	2-5	102	2-5	97	2-5	94	2-5
Northern Ireland	mm	**145**	198		335		615		1020	
	%	**159**	96	2-5	103	2-5	95	2-5	88	5-10
England & Wales	mm	**111**	147		249		493		863	
	%	**152**	89	2-5	93	2-5	91	2-5	92	2-5
North West	mm	**191**	251		392		785		1261	
	%	**183**	110	2-5	106	2-5	106	2-5	100	2-5
Northumbria	mm	**98**	124		217		451		772	
	%	**140**	82	2-5	89	2-5	91	2-5	86	5-10
Severn-Trent	mm	**106**	134		225		414		733	
	%	**185**	105	2-5	108	2-5	97	2-5	93	2-5
Yorkshire	mm	**133**	166		244		452		814	
	%	**197**	114	2-5	104	2-5	95	2-5	95	2-5
Anglian	mm	**62**	79		143		284		544	
	%	**147**	83	2-5	95	2-5	87	2-5	87	2-5
Thames	mm	**68**	88		154		334		665	
	%	**128**	70	2-5	78	2-5	82	2-5	92	2-5
Southern	mm	**59**	86		170		365		723	
	%	**94**	57	5-10	70	2-5	74	5-10	89	2-5
Wessex	mm	**70**	104		189		412		774	
	%	**103**	64	5-10	72	2-5	78	5-10	86	2-5
South West	mm	**111**	176		315		656		1126	
	%	**104**	72	2-5	80	2-5	86	2-5	91	2-5
Welsh	mm	**185**	249		421		803		1300	
	%	**163**	96	2-5	100	2-5	96	2-5	94	2-5
Highland	mm	**258**	430		577		1135		1685	
	%	**149**	110	5-10	96	2-5	100	2-5	91	2-5
North East	mm	**104**	150		242		555		990	
	%	**132**	84	2-5	87	2-5	94	2-5	94	2-5
Tay	mm	**188**	250		373		718		1227	
	%	**158**	88	2-5	86	2-5	87	2-5	89	2-5
Forth	mm	**193**	249		359		700		1108	
	%	**181**	103	2-5	96	2-5	98	2-5	90	2-5
Tweed	mm	**157**	193		295		615		981	
	%	**179**	99	2-5	95	2-5	100	2-5	91	2-5
Solway	mm	**236**	306		461		951		1384	
	%	**177**	102	2-5	97	2-5	103	5-10	89	2-5
Clyde	mm	**276**	410		581		1106		1575	
	%	**163**	106	5-10	97	2-5	97	2-5	84	2-5

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

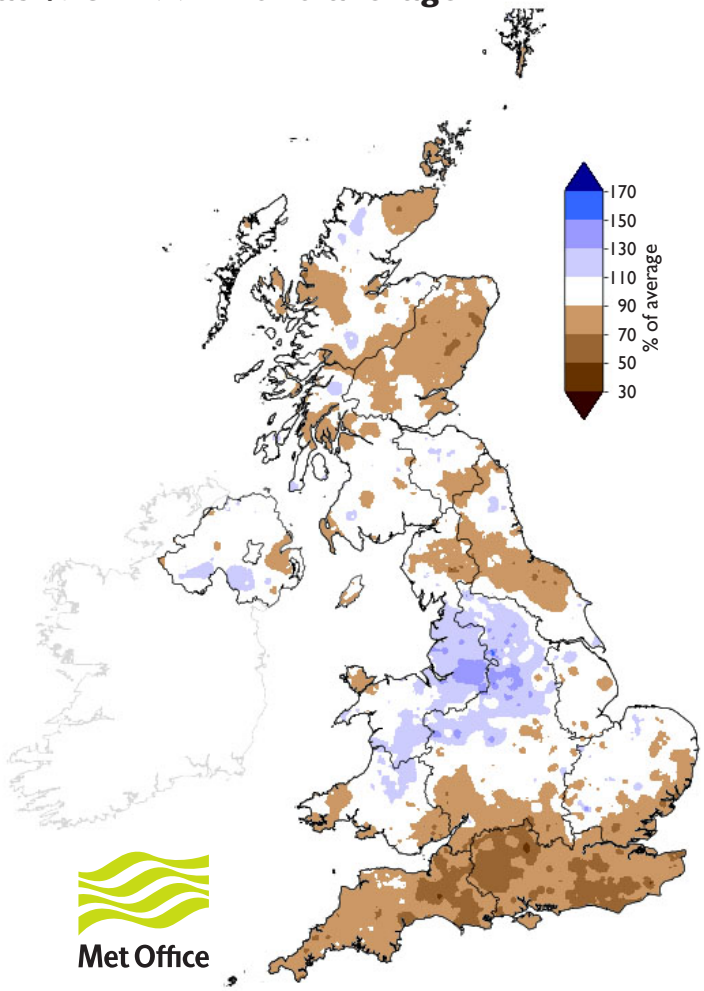
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

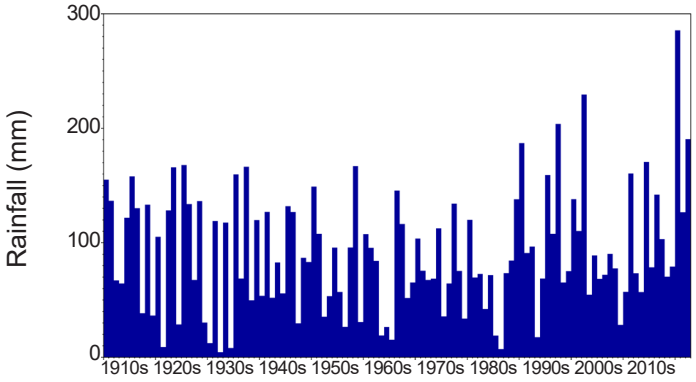
February 2022 rainfall as % of 1991-2020 average



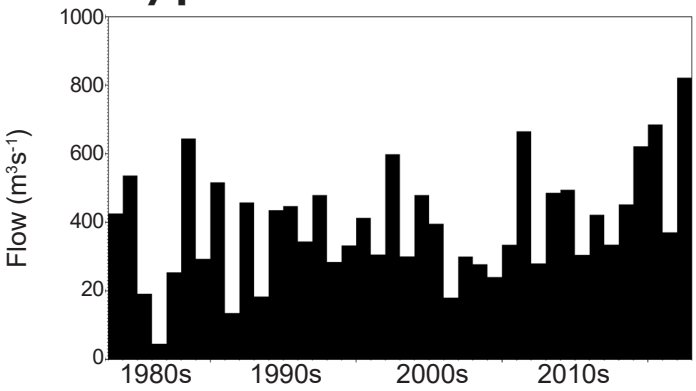
December 2021 - February 2022 rainfall as % of 1991-2020 average



February rainfall for the North West Region



February peak flows for the Mourne



UK Hydrological Outlook

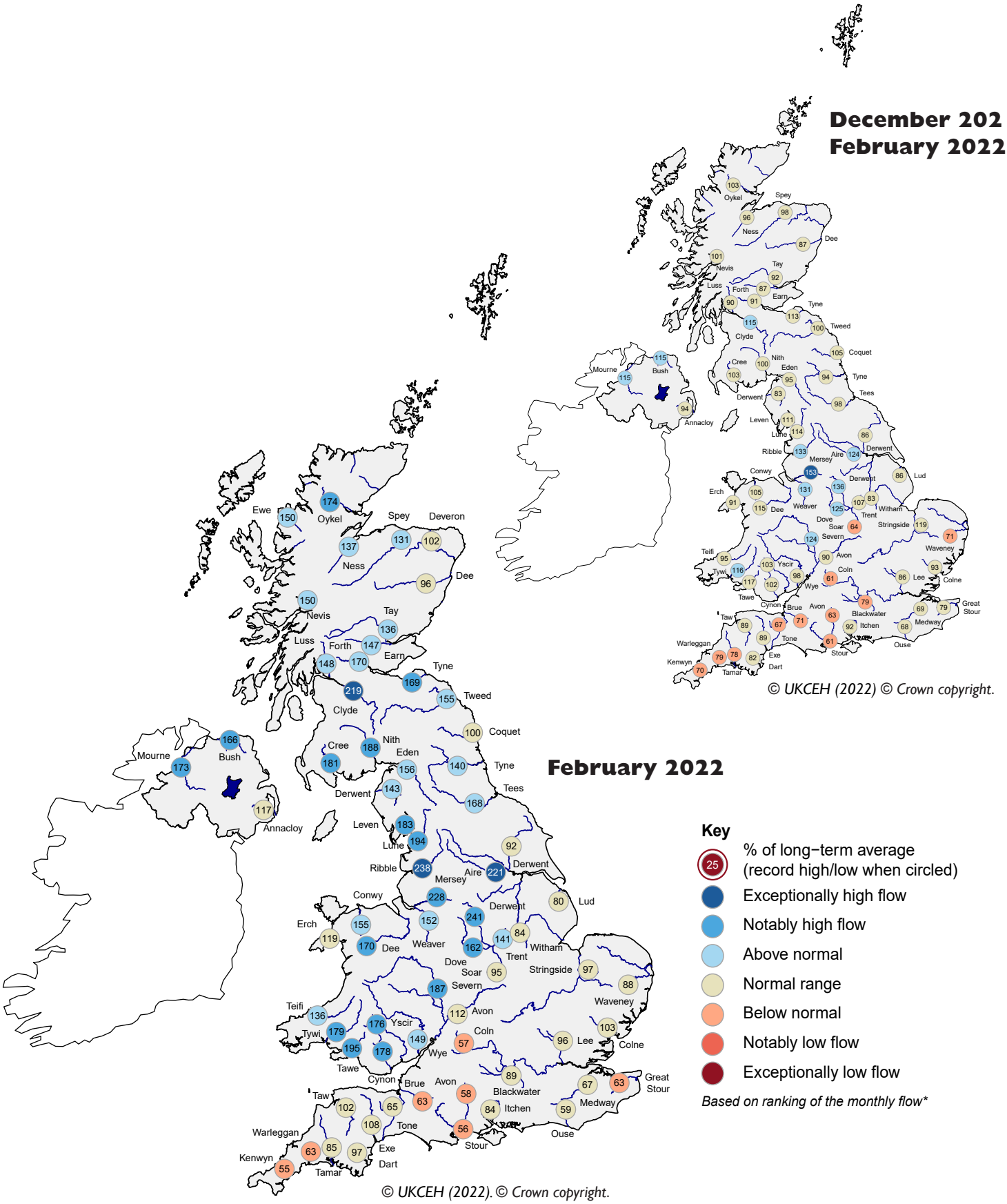
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

Period: **from March 2022**
Issued: **09.03.2022**
using data to the end of February 2022

The outlook for March and for the March–May period is for river flows to be normal to below normal for the south and south-east England and north-east Scotland, and normal to above normal elsewhere. Groundwater levels in March, and for the next three months, are likely to be normal to below normal across most of the UK, with a few localised exceptions.

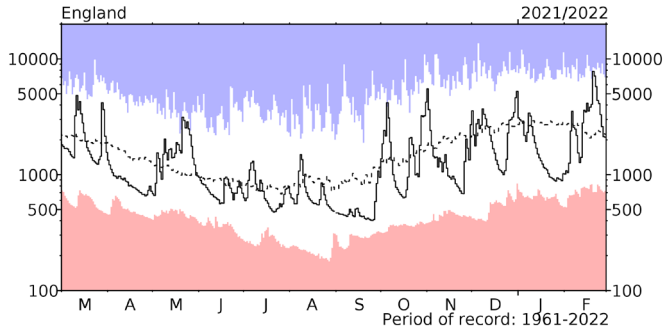
River flow . . . River flow . . .

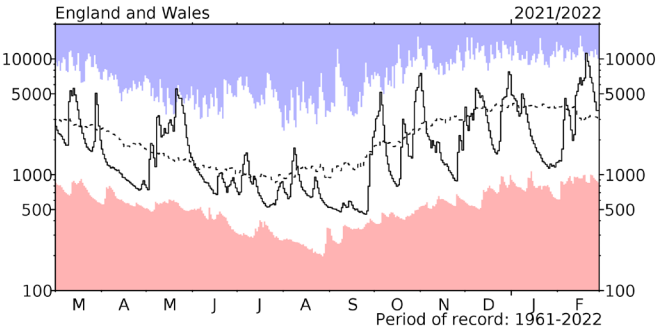


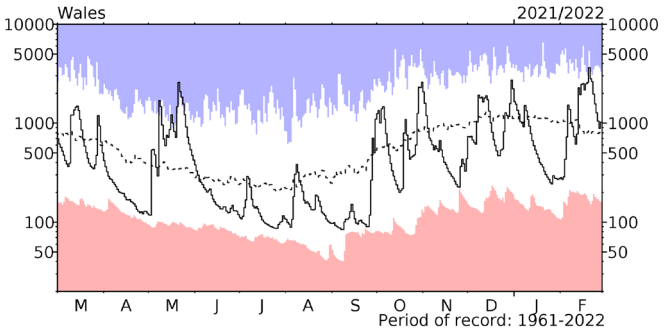
River flows

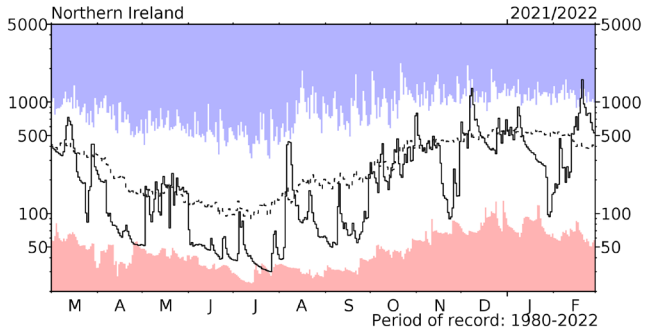
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

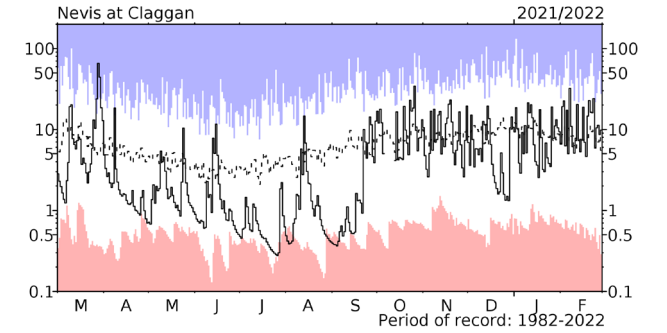
River flow . . . River flow . . .

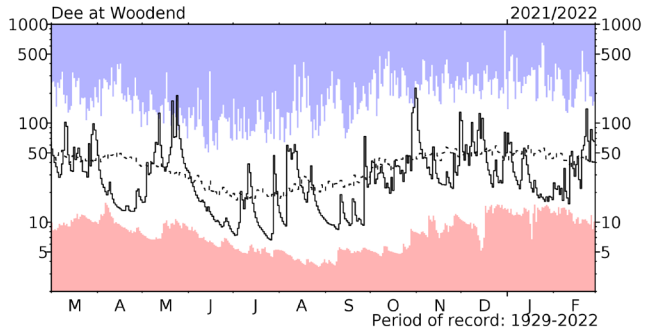


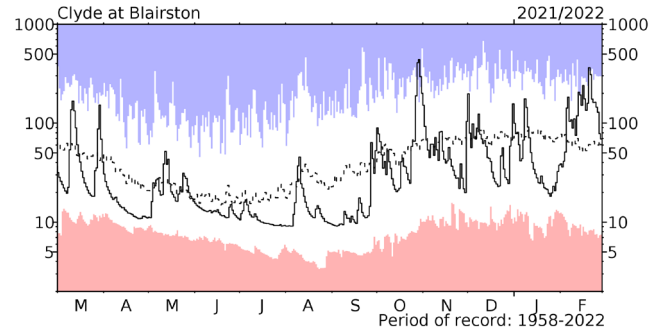


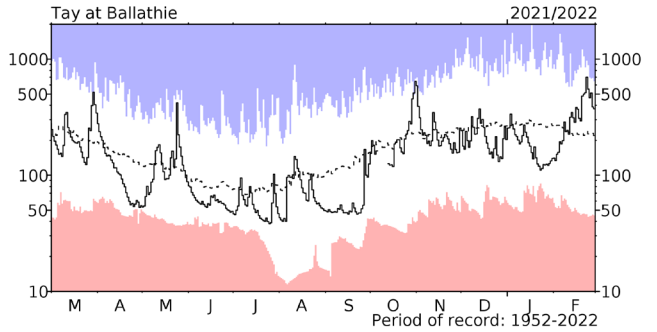


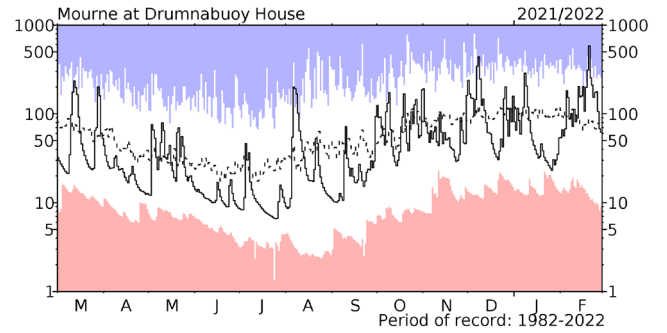


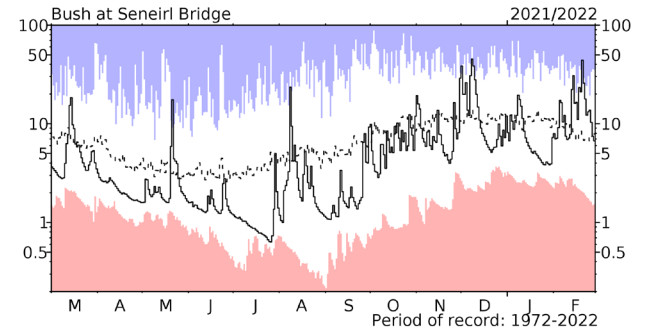








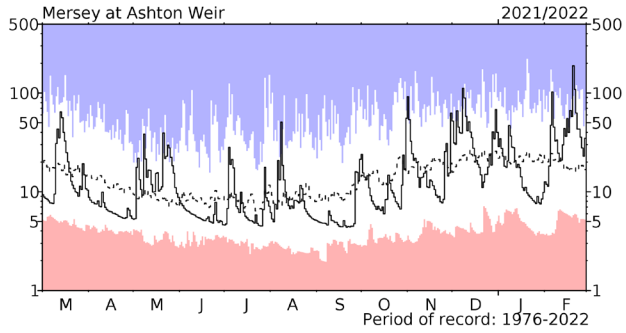


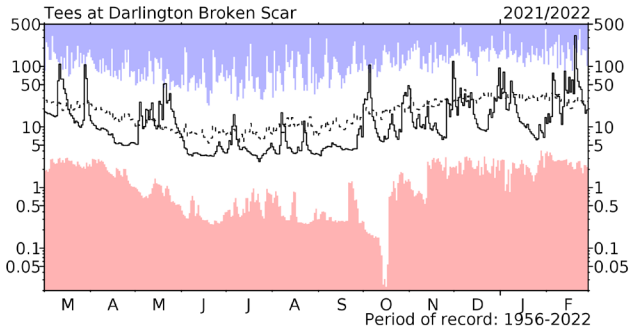


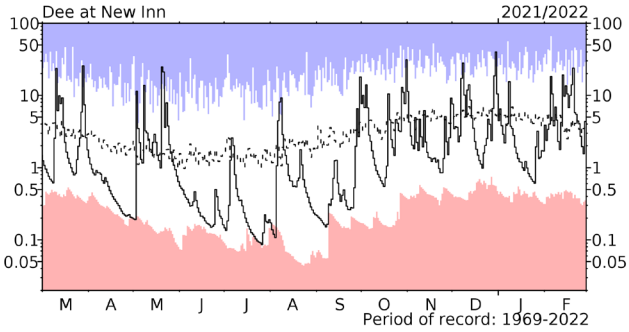
River flow hydrographs

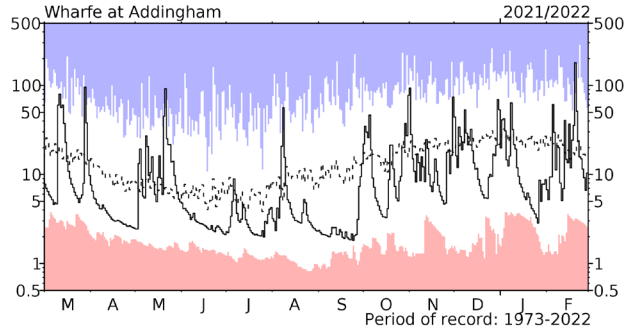
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to March 2021 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

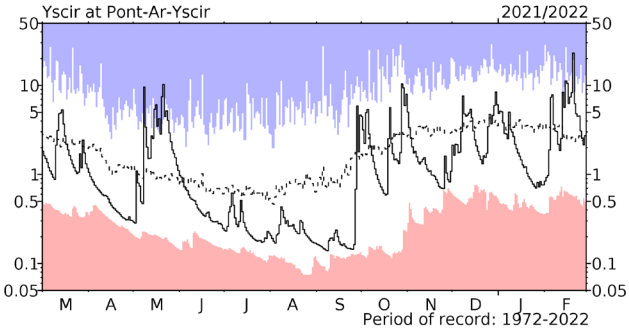
River flow . . . River flow . . .

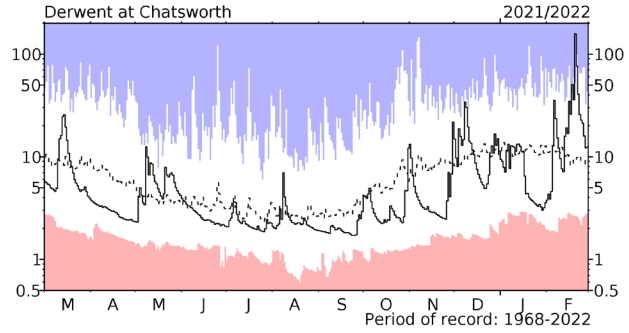


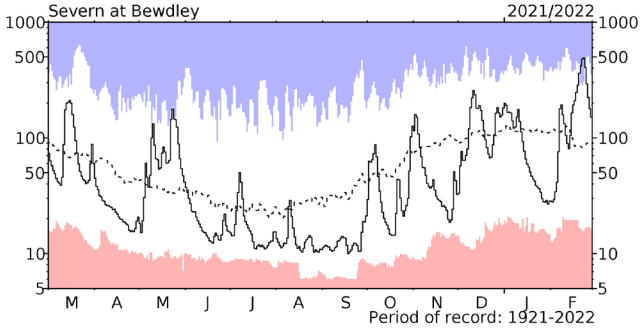


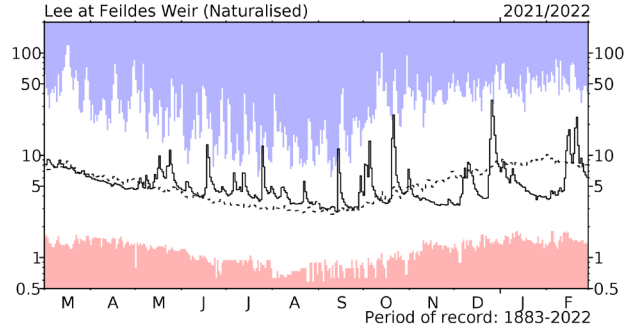


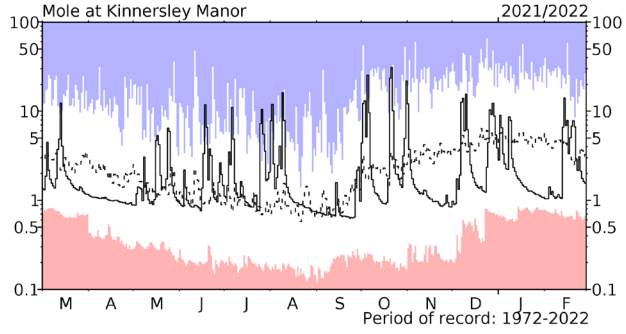


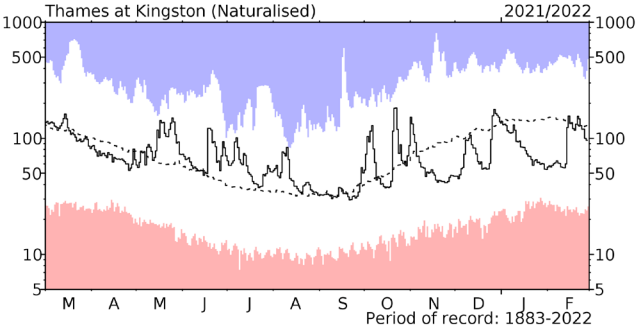


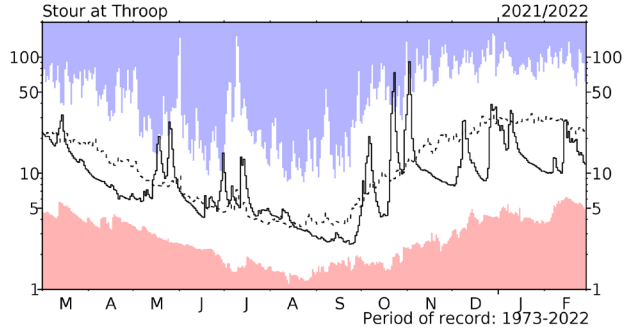


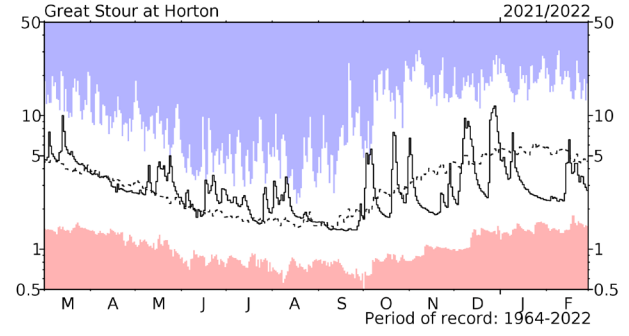




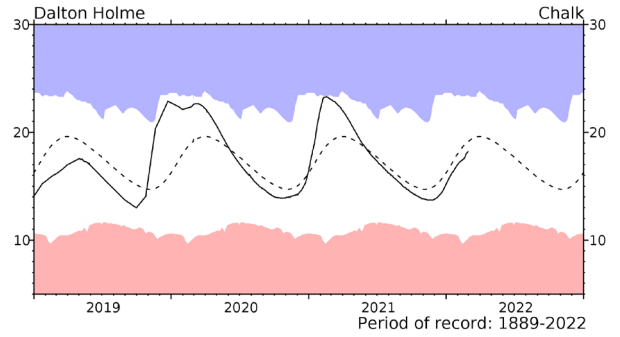


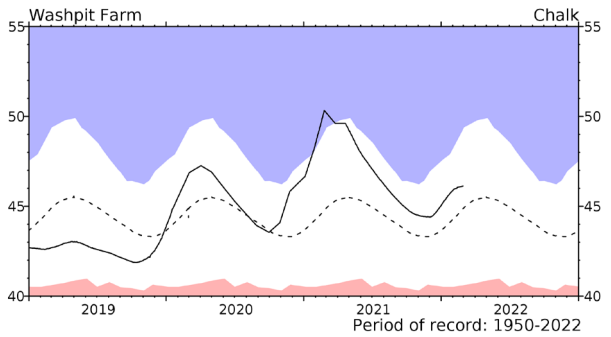


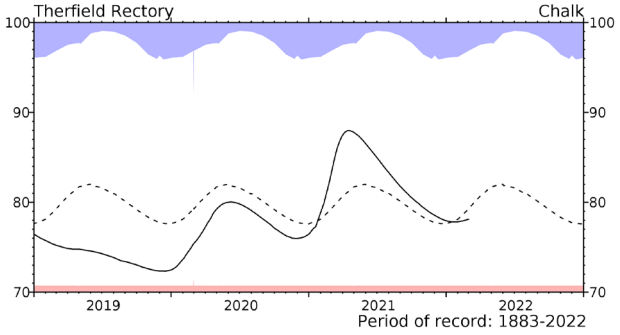


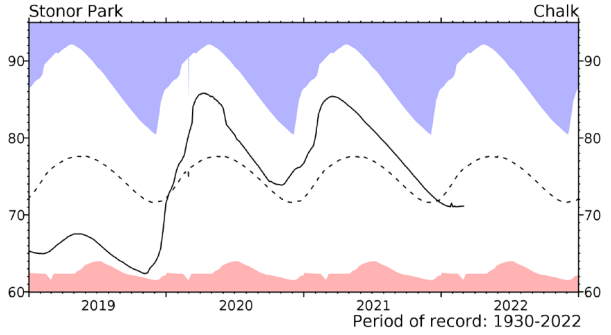


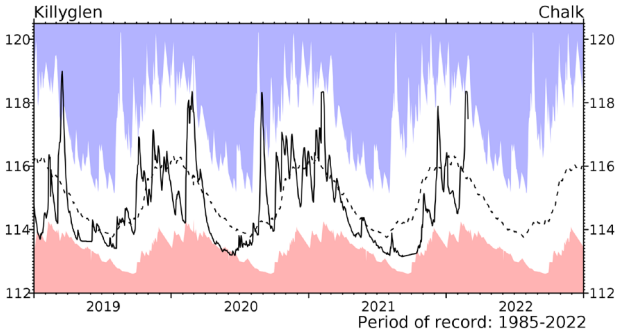
Groundwater…Groundwater

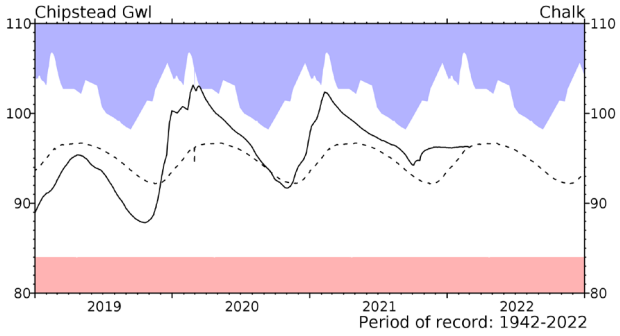


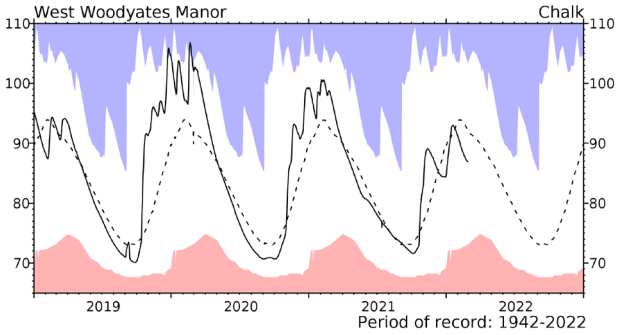


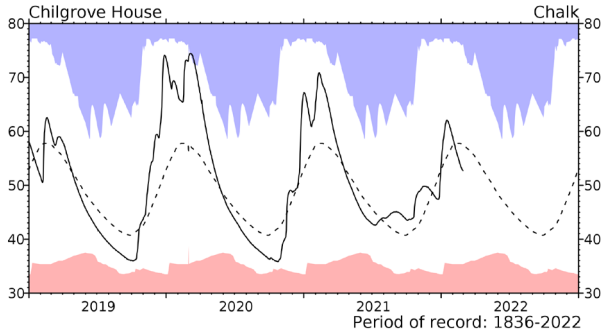


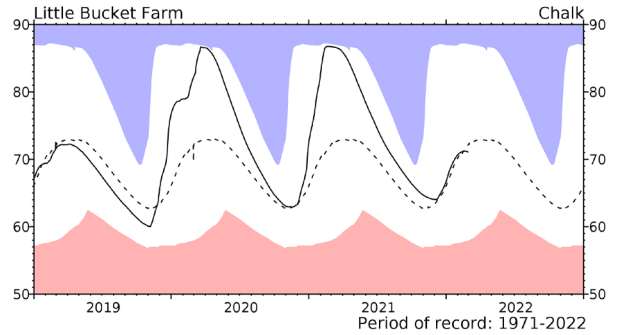


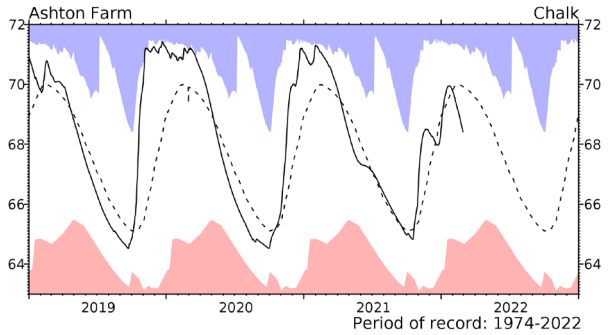






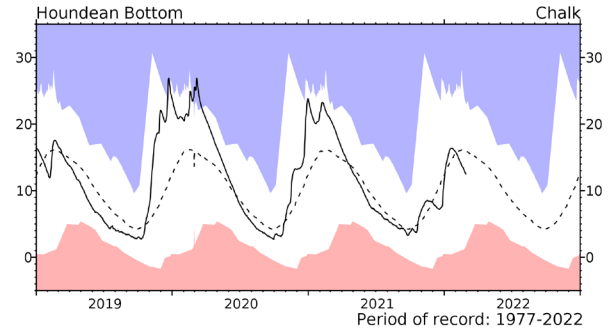


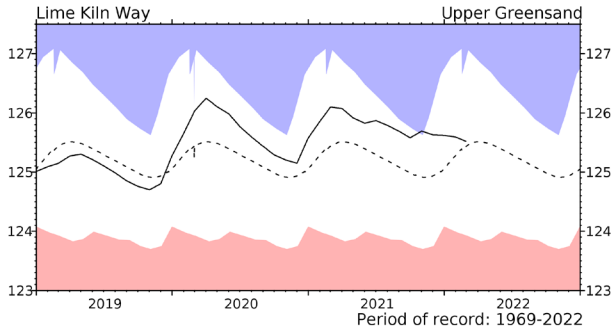


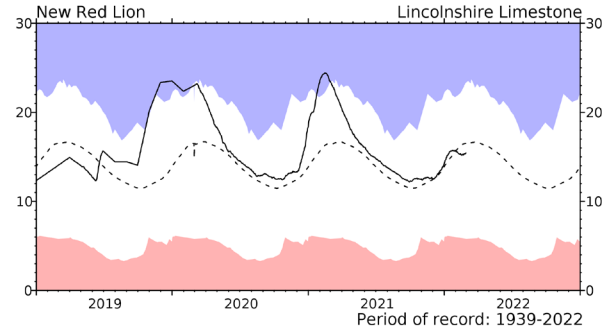


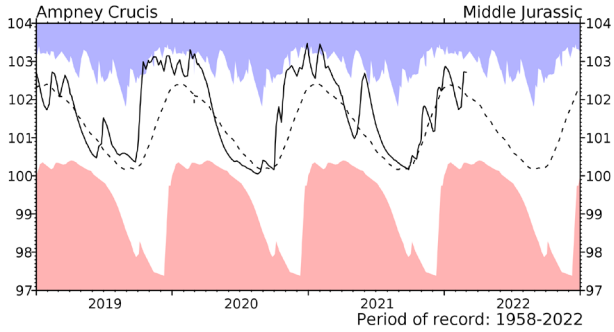
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

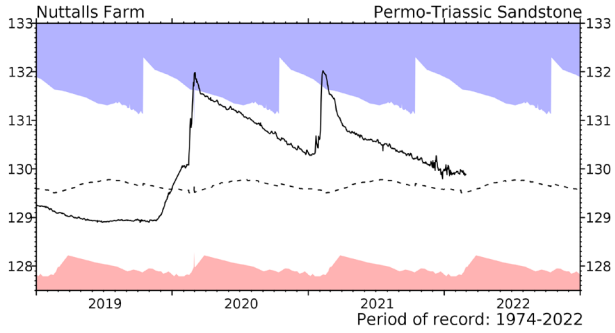
Groundwater…Groundwater

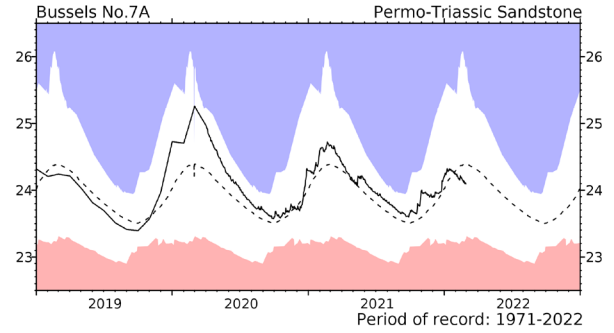


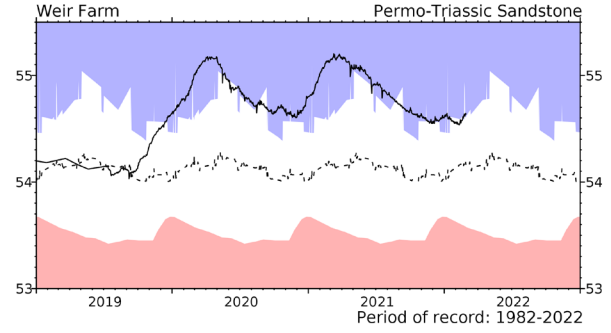


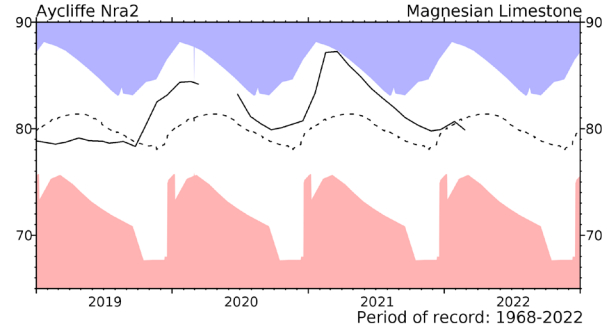


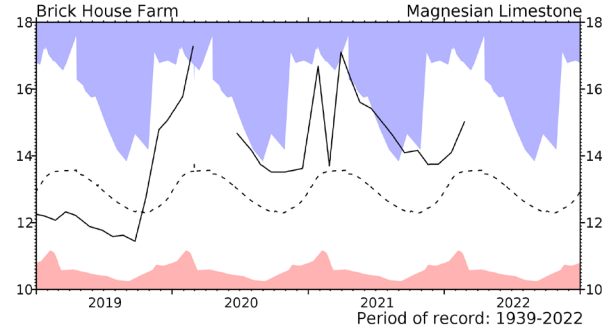


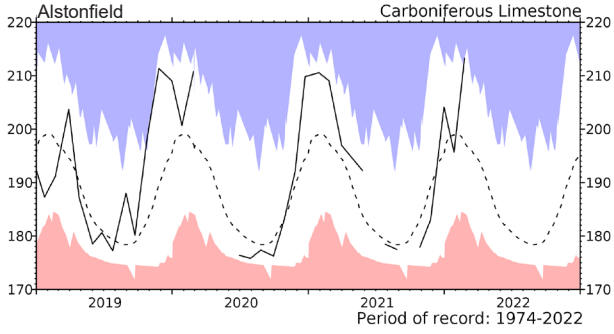


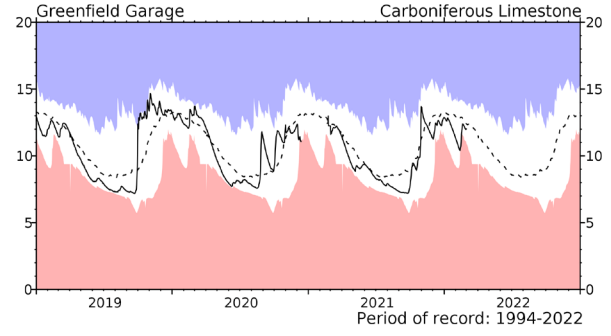


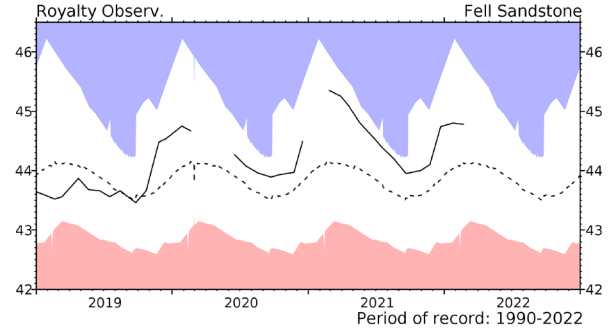


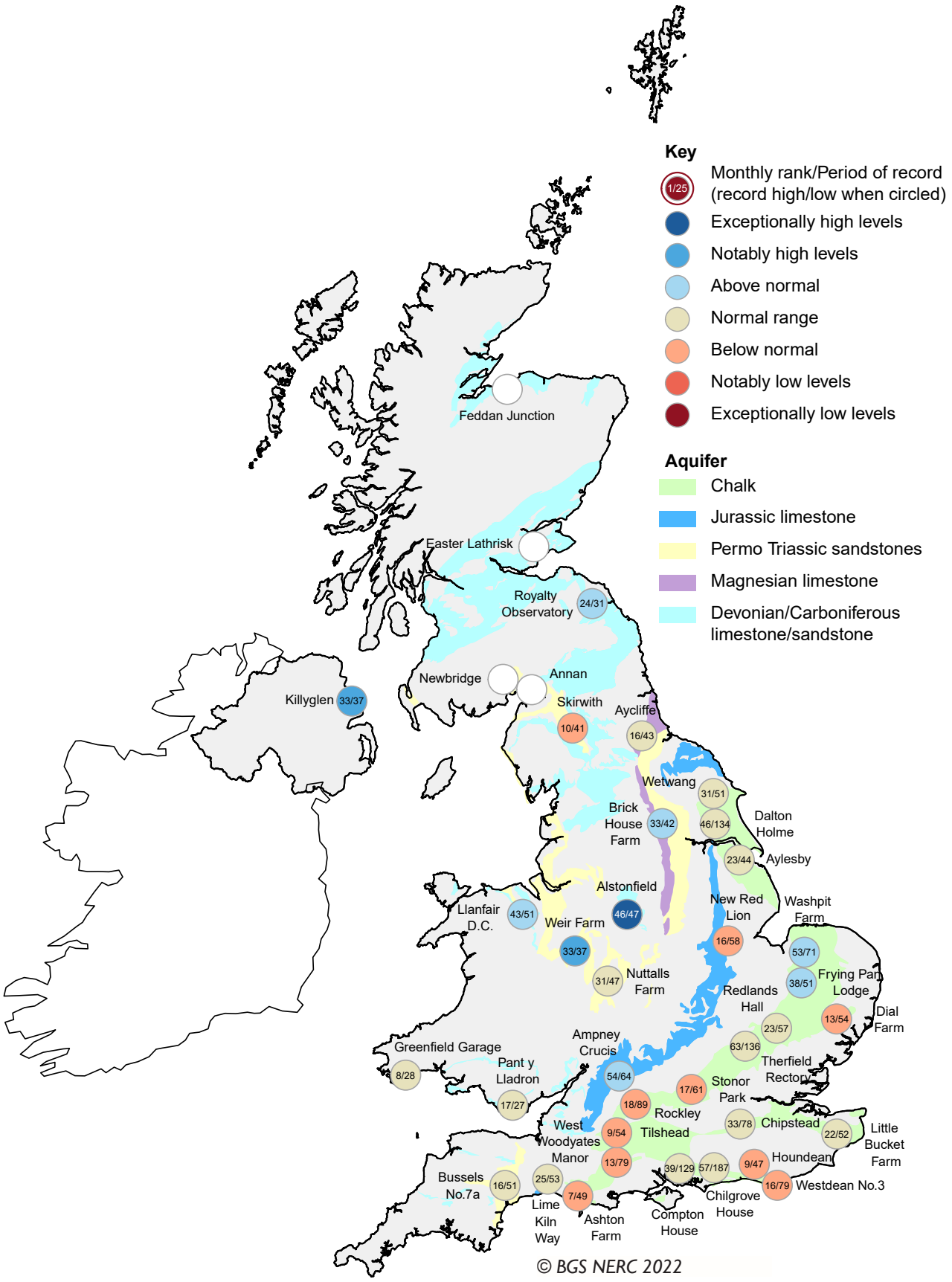












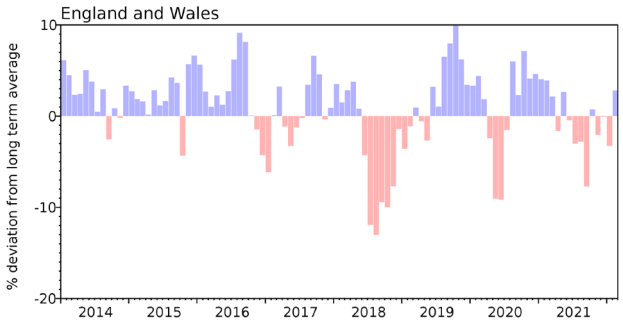
Groundwater levels - February 2022

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.

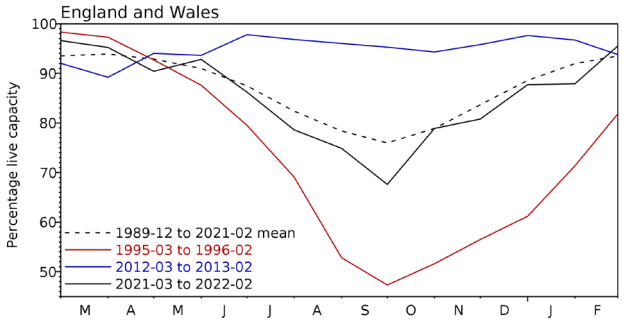
Note that due to issues with data access, no data are available for Scotland.

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 Dec	2022 Jan	2022 Feb	Feb Anom.	Min Feb	Year* of min	2021 Feb	Diff 22-21
North West	N Command Zone	•	124929	78	80	99	6	78	1996	96	2
	Vyrnwy		55146	96	88	99	4	59	1996	98	1
Northumbrian	Teesdale	•	87936	83	86	100	7	72	1996	92	8
	Kielder		(199175)	87	84	96	3	81	1993	99	-3
Severn-Trent	Clywedog		49936	89	90	92	0	77	1996	96	-4
	Derwent Valley	•	46692	99	89	100	4	46	1996	97	3
Yorkshire	Washburn	•	23373	88	81	96	3	53	1996	82	14
	Bradford Supply	•	40942	87	89	100	5	53	1996	99	1
Anglian	Grafham		(55490)	90	94	93	5	72	1997	82	11
	Rutland		(116580)	77	83	90	0	71	2012	96	-6
Thames	London	•	202828	85	94	96	3	83	1988	96	0
	Farmoor	•	13822	91	94	87	-6	64	1991	98	-12
Southern	Bewl		31000	76	79	82	-4	40	2012	90	-8
	Ardingly		4685	100	100	100	4	46	2012	100	0
Wessex	Clatworthy		5662	91	100	100	2	82	1992	100	0
	Bristol	•	(38666)	75	81	88	-4	65	1992	99	-11
South West	Colliford		28540	72	75	77	-10	57	1997	93	-16
	Roadford		34500	96	98	100	15	35	1996	100	0
	Wimbleball		21320	86	94	100	5	72	1996	100	0
	Stithians		4967	71	81	91	-3	45	1992	100	-9
Welsh	Celyn & Brenig	•	131155	98	87	92	-5	69	1996	100	-8
	Brianne		62140	99	94	99	1	92	2004	99	0
	Big Five	•	69762	90	93	100	4	85	1988	98	2
	Elan Valley	•	99106	100	96	100	2	88	1993	100	0
Scotland(E)	Edinburgh/Mid-Lothian	•	97223	89	87	97	1	73	1999	99	-2
	East Lothian	•	9317	100	100	100	1	91	1990	100	0
Scotland(W)	Loch Katrine	•	110326	96	94	100	5	76	2010	100	0
	Daer		22494	100	91	97	-2	94	2004	99	-2
	Loch Thom		10721	100	100	100	1	90	2004	100	0
Northern Ireland	Total+	•	56800	89	88	88	-4	81	2004	99	-12
	Silent Valley	•	20634	89	87	99	10	57	2002	99	0

( ) figures in parentheses relate to gross storage

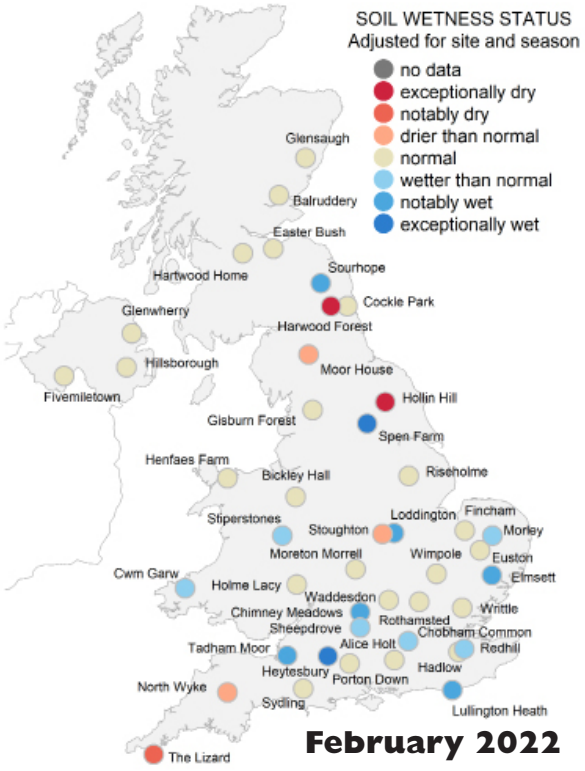
• denotes reservoir groups

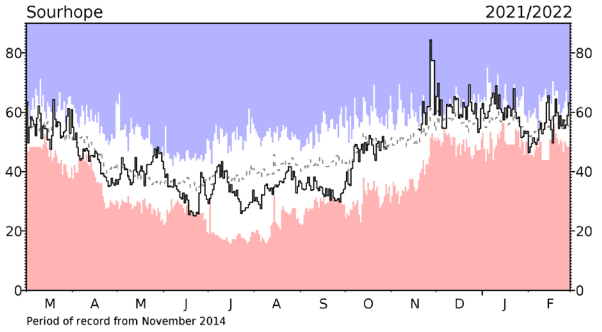
*last occurrence

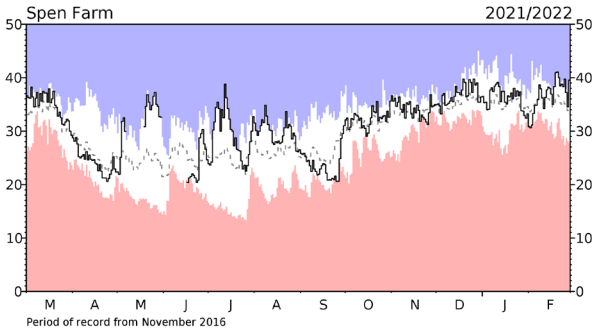
+ excludes Lough Neagh

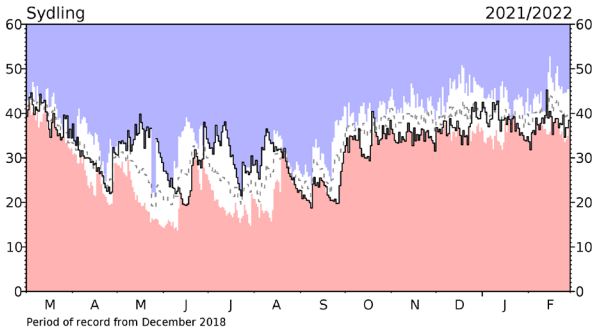
Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed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

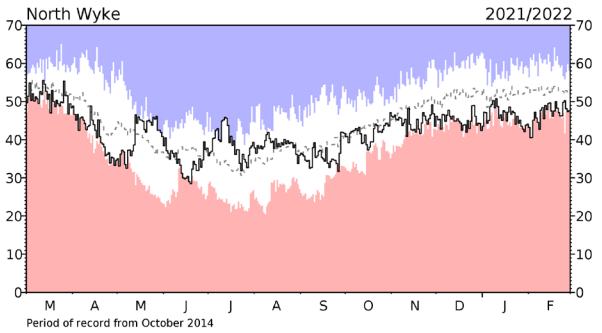
Soil Moisture . . . Soil Moisture

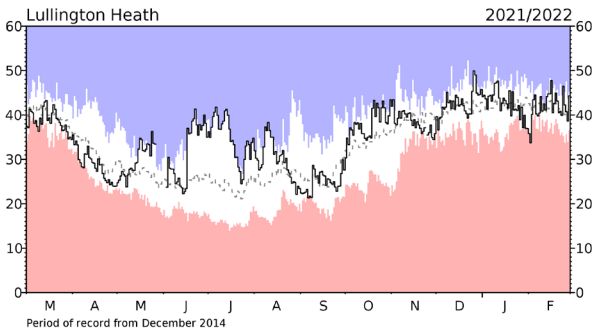












At the end of February, soil moisture was generally normal or wetter than normal for the time of year.

The majority of sites across the UK started February with soil moisture slightly below field capacity. Higher than average precipitation throughout the month led to most sites ending February above field capacity.

Some areas in northern England received heavy rainfall, increasing soil moisture from unseasonably low to exceptionally wet for the time of year (e.g. Spen Farm). Soil moisture at many southern sites increased from unusually dry to notably wet for the time of year (e.g. Lullington Heath).

Soil moisture in Scotland increased from notably dry to normal levels for the time of year (e.g. Sourhope). The south and southwest of England had the smallest increase in soil moisture from notably dry January levels to normal levels for the time of year (e.g. Sydling) and some drier than usual soils for the time of year (e.g. North Wyke).

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

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