Hydrological Summary

for the United Kingdom

General

May was a generally dry and settled month dominated by high pressure with the exception of a few wet interludes, and thunderstorm activity in the final fortnight. For the UK as a whole, May was warm (the second warmest for the UK in a record from 1910) and brought to a close the warmest spring in the Central England Temperature series from 1659. Rainfall was moderately below average at the national scale, but there was a reversal of the typical UK rainfall gradient: large parts of the north and west registered less than half of the average, whilst parts of the south and east were significantly wetter than average. Soil moisture deficits (SMDs) increased rapidly in May in the north and west; month-end deficits in some regions approached twice the average. In the south-east increases were more modest due to the above average rainfall, although exceptionally dry soils in early May caused some agricultural stress and the early onset of irrigation in some areas. River flows in the majority of catchments were below average throughout May and were notably or exceptionally low across much of Scotland and parts of central and southern England. Groundwater levels continued their seasonal recession at all sites and the majority were below normal or notably low, with the exception of south-west Scotland and north-east England. Reservoir stocks fell relative to average during May, substantially so in some impoundments in Scotland and northern England. Stocks in the majority of impoundments were below average, with anomalies greater than 10% in several index reservoirs and greater than 20% in Bewl and Teesdale. Despite the wetter May in the south-east, the effect of long-term rainfall deficits are evident in low river flows and groundwater levels, which are likely to persist into summer with continuing likelihood of environmental stress and localised pressure on water resources. In more responsive northern and western catchments, summer rainfall will be more influential; many areas with exceptionally low May river flows have seen a very wet first week of June.

May 2017

Rainfall

The anticyclonic conditions that dominated April continued into the first half of May for northern Britain, while frontal rainfall affected southern Britain (although no notable rainfall totals were recorded). On the 17th, persistent slow-moving rainfall affected England and Wales, with 40mm recorded at Holbeach (Lincolnshire). Anticyclonic conditions returned for the second half of the month with warm and sunny conditions, interrupted by thunderstorms and intense rainfall. On the 27th, 53mm was recorded at Levens Hall (Cumbria) and localised flooding was reported in Lanarkshire and Fife. For May, rainfall for the UK was 86% of average; however, there was a marked contrast between the north-west and south-east. Much of Scotland and north-east England received less than 70% of average rainfall, with parts of Scotland, north Wales and northern England registering less than half the average. In contrast, many parts of southern and eastern England received more than 130% of average rainfall. Following the dry April, it was the third driest April-May for the Forth region and fifth driest for the Tay, Tweed and Northumbrian regions (all in records from 1910). Despite the above average rainfall in the south-east during May, the rainfall deficiencies that have accrued since summer 2016 are still evident; rainfall for the July-May period was the lowest since the 1975/1976 drought for the Southern region (in a record from 1910).

River flows

Recessions or stable low flows again dominated river flows across the UK in May, only broken mid-month in most catchments and, due to isolated thunderstorms, towards month-end in some catchments. During these interludes, flows generally only returned to near-average, although seasonally high flows were recorded in some catchments; the Tawe registered one of its highest May daily flows in a series from 1957. Daily flow minima were re-defined at thirty index stations and for more than ten consecutive days on the Spey, Don, Clyde and Forth. Average river flows for May were normal or below for the whole of the UK and exceptionally low in parts of eastern Scotland and north-east England. May average flows on the English Tyne and Spey were the lowest on record (in series from 1956 and 1952, respectively). Flows were less than a third of average on the Faughan, Carron and English Tyne, and only 20% of average for the Annacloy. Average outflows from Great Britain for May were the third lowest in a series from 1961 (and the second lowest for Scotland). For the July-May timeframe, exceptionally low flows were registered in parts of Scotland, Northern Ireland and south-west England, with new record minima established for the Luss, Faughan, Annacloy and Warleggan.

Groundwater

As a result of the dry May in the north and west, SMDs increased rapidly and were above normal at month-end. In the south-east, despite the above average rainfall, SMDs also increased but were closer to normal at month-end. In the Chalk, groundwater levels fell and remained below normal at all sites except Aylesby and Dalton Holme where levels were in the normal range. Levels were notably low at some sites in East Anglia, southern England and Northern Ireland, all areas with rainfall deficits extending back to summer 2016. In the more rapidly responding Jurassic and Magnesian limestones, levels fell and generally remained in the normal range; at Ampney Crucis levels remained below normal. In the Permo-Triassic sandstones, levels fell at all index sites, but remained in the same range as at the end of April, with the exception of Bussels No.7A which dropped to notably low. Levels were in the normal range or below in England and Wales, but notably high at Newbridge. In the Carboniferous Limestone levels fell and were below normal at both Alstonfield and Pant y Lladron. Levels fell at Royalty Observatory in the Fell Sandstone, but remained above average.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1981-2010 average.

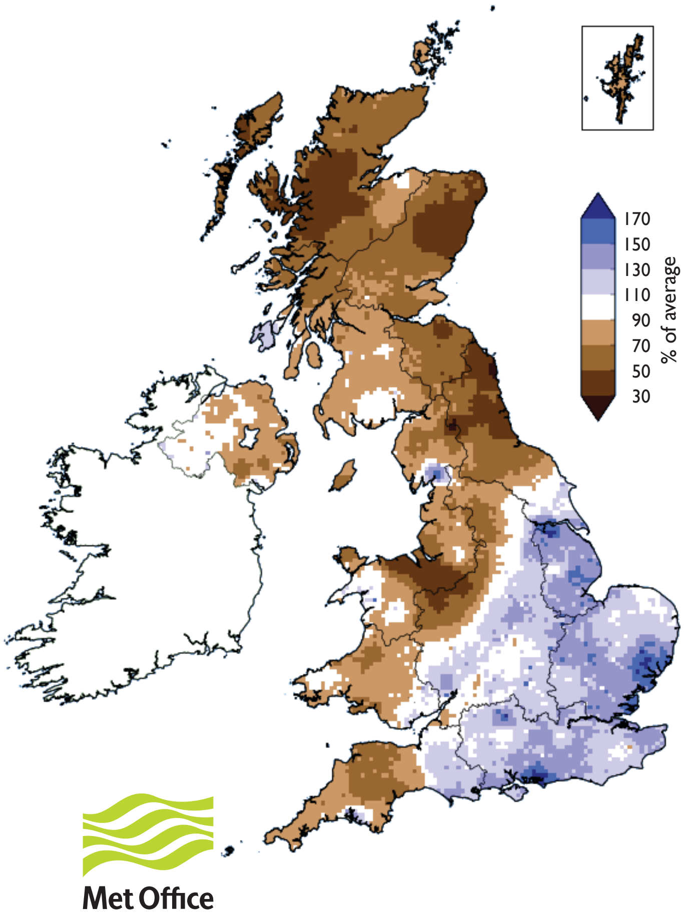
Region	Rainfall	May 2017	Apr17 – May17	RP	Mar17 – May17	RP	Dec16 – May17	RP	Jun16 – May17	RP
United	mm	**58**	93		192		439		948	
Kingdom	%	**86**	67	8-12	83	2-5	79	5-10	84	5-10
England	mm	**58**	77		147		309		706	
	%	**101**	67	5-10	83	2-5	76	8-12	83	5-10
Scotland	mm	**54**	118		245		627		1299	
	%	**68**	71	5-10	81	2-5	82	2-5	85	2-5
Wales	mm	**72**	99		264		566		1185	
	%	**86**	59	8-12	93	2-5	80	5-10	83	5-10
Northern	mm	**63**	92		198		405		884	
Ireland	%	**87**	62	5-10	81	2-5	72	15-25	78	30-50
England &	mm	**60**	80		163		344		772	
Wales	%	**98**	65	5-10	85	2-5	77	5-10	83	5-10
North West	mm	**55**	80		219		472		1099	
	%	**77**	56	10-15	91	2-5	80	5-10	90	2-5
Northumbria	mm	**29**	53		150		322		762	
	%	**52**	45	25-40	82	2-5	77	5-10	87	5-10
Severn-Trent	mm	**57**	76		145		296		681	
	%	**99**	66	5-10	84	2-5	79	5-10	87	2-5
Yorkshire	mm	**47**	68		140		296		709	
	%	**88**	59	8-12	78	2-5	73	10-20	84	5-10
Anglian	mm	**64**	81		118		229		546	
	%	**130**	85	2-5	85	2-5	80	5-10	87	2-5
Thames	mm	**69**	78		121		258		575	
	%	**123**	72	2-5	76	2-5	74	5-10	80	5-10
Southern	mm	**69**	79		120		279		601	
	%	**130**	75	2-5	73	2-5	72	8-12	75	10-20
Wessex	mm	**66**	80		147		319		684	
	%	**110**	67	5-10	79	2-5	73	5-10	77	10-15
South West	mm	**56**	95		209		434		923	
	%	**75**	62	5-10	85	2-5	69	10-15	75	15-25
Welsh	mm	**71**	97		254		544		1140	
	%	**87**	59	8-12	93	2-5	80	5-10	83	5-10
Highland	mm	**50**	162		308		780		1545	
	%	**57**	86	2-5	85	2-5	83	2-5	85	2-5
North East	mm	**40**	91		159		379		911	
	%	**60**	69	5-10	76	5-10	80	8-12	90	2-5
Tay	mm	**51**	81		180		496		1052	
	%	**65**	53	15-25	66	10-15	73	8-12	78	15-25
Forth	mm	**48**	65		162		440		930	
	%	**69**	48	30-50	67	5-10	74	5-10	77	10-15
Tweed	mm	**43**	62		177		411		902	
	%	**66**	48	15-25	84	2-5	83	2-5	88	2-5
Solway	mm	**73**	99		255		612		1223	
	%	**89**	58	8-12	86	2-5	83	2-5	82	5-10
Clyde	mm	**71**	121		278		750		1556	
	%	**80**	64	5-10	78	2-5	82	2-5	85	2-5

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

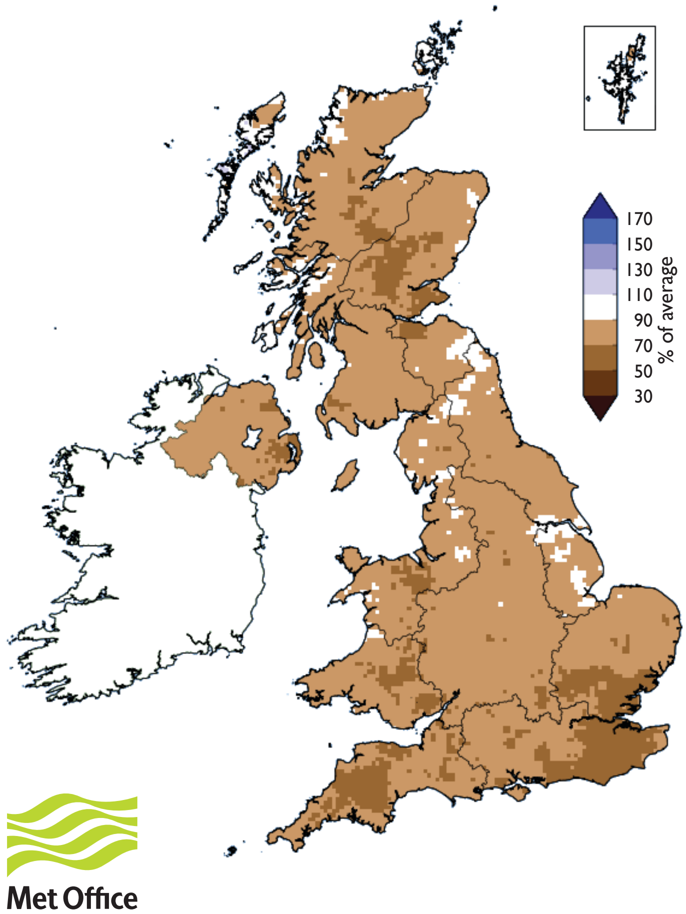
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability since 1910; they also assume a stable climate. The quoted RPs relate to the specific timespans only; for the same timespans, but beginning in any month the RPs would be substantially shorter. The timespans featured do not purport to represent the critical periods for any particular water resource management zone. For hydrological or water resources assessments of drought severity, river flows and/or groundwater levels normally provide a better guide than return periods based on regional rainfall totals. Note that precipitation totals in winter months may be underestimated due to snowfall undercatch. All monthly rainfall totals since January 2017 are provisional.

Rainfall . . . Rainfall . . .

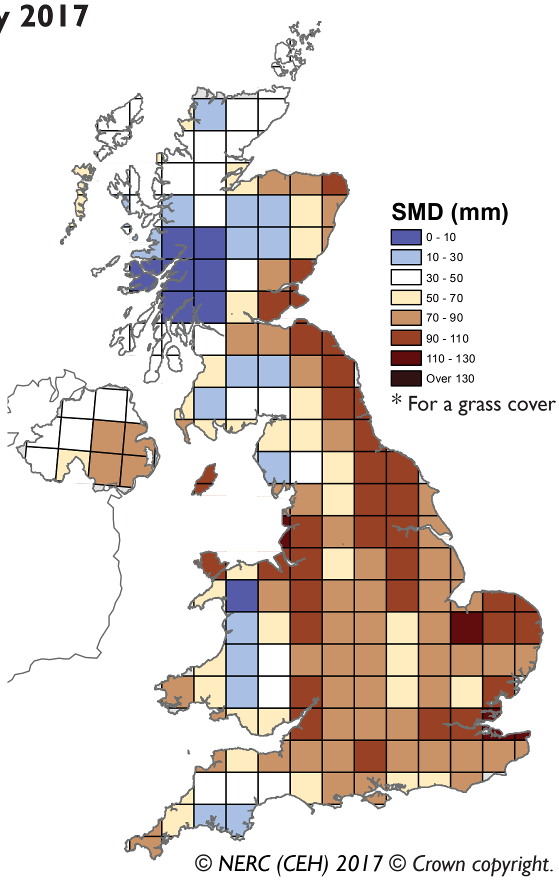
May 2017 rainfall
as % of 1981-2010 average



July 2016 - May 2017 rainfall
as % of 1981-2010 average



MORECS Soil Moisture Deficits*
May 2017



* For a grass cover

Hydrological Outlook UK

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

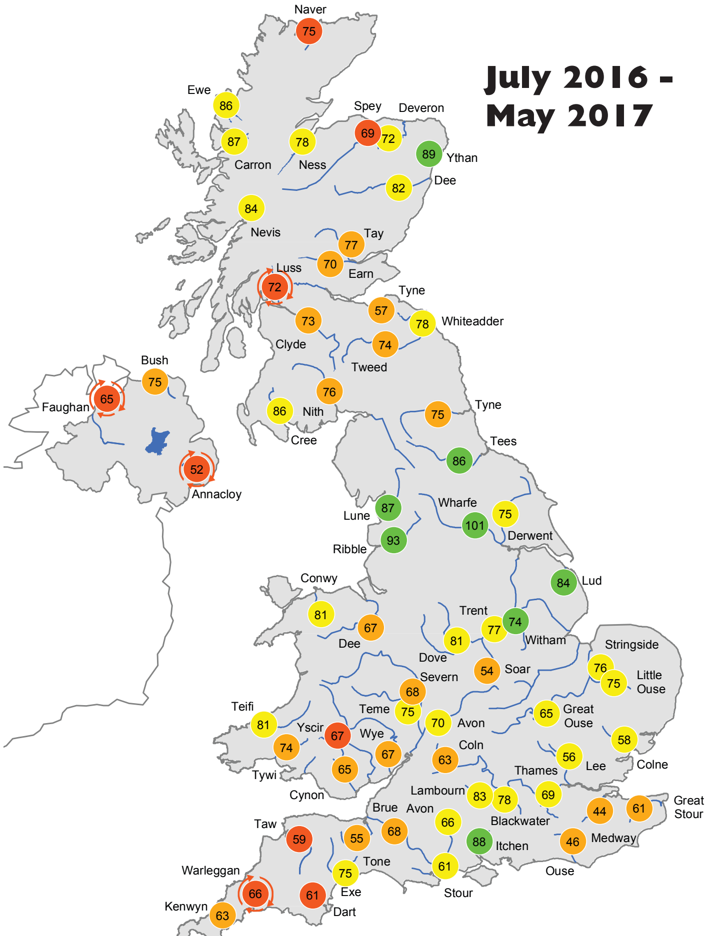
The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from June 2017**
Issued: **09.06.2017**
using data to the end of May 2017

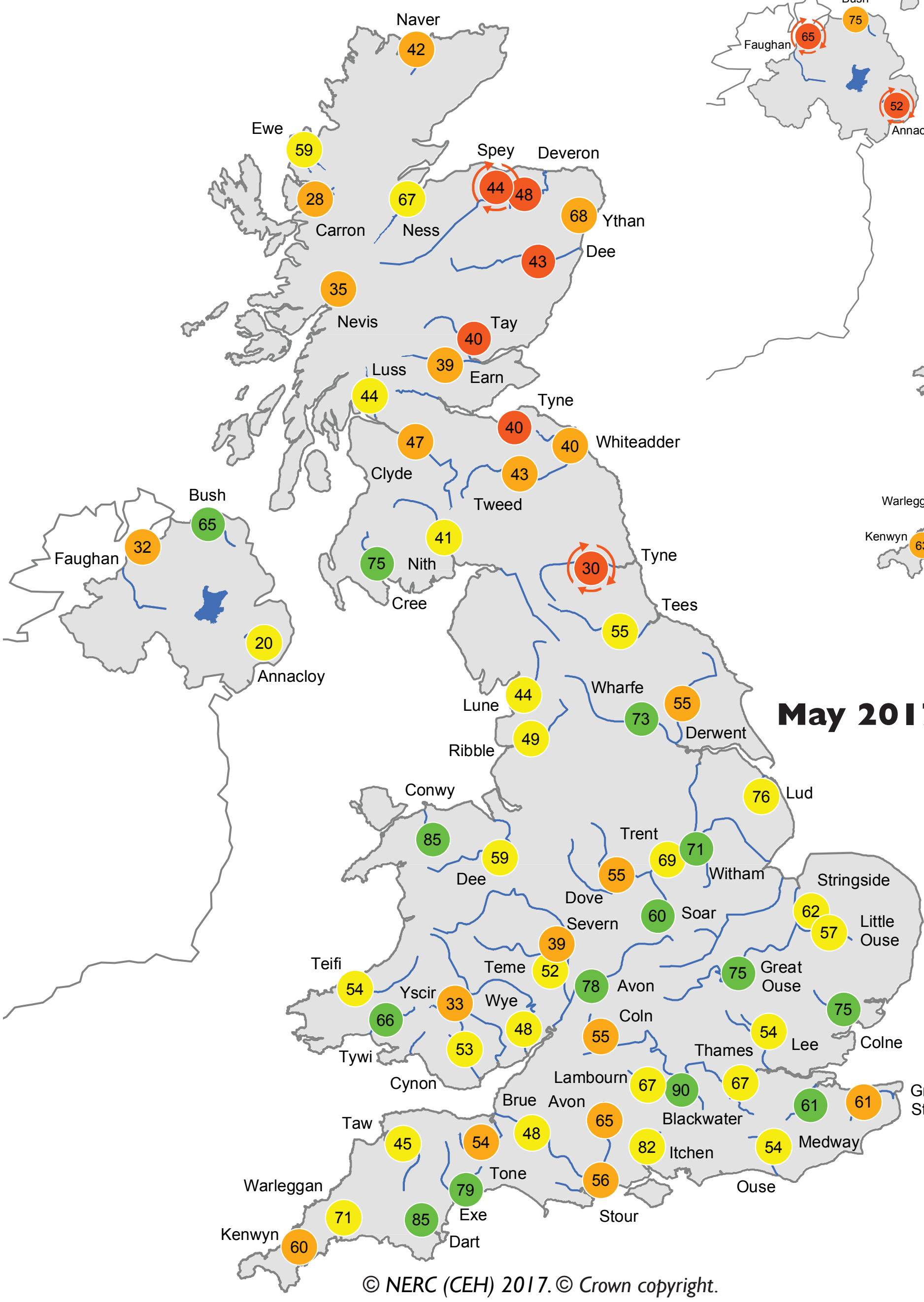
With above average rainfall in the south-east in May after a prolonged period of below average rainfall, the outlook is for normal to above normal river flows across the UK for June. However, this period is expected to be short-lived, and river flows over June-July-August as a whole are likely to return to being normal to below normal. Groundwater levels in the south-east of England are likely to be below normal to notably low over the next one to three months, whilst levels in southern Scotland are likely to be above normal or higher over this period.

River flow . . . River flow . . .

July 2016 - May 2017



May 2017



Key

25 % of long-term average (record figure when circled)

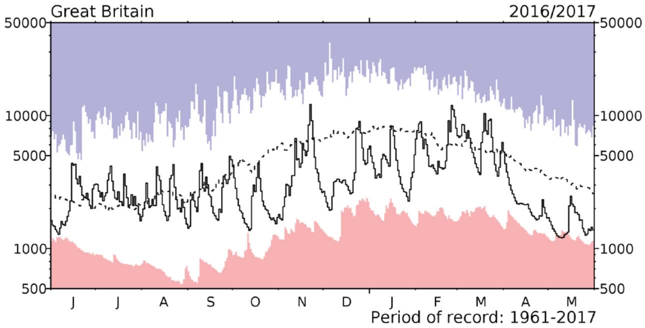
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

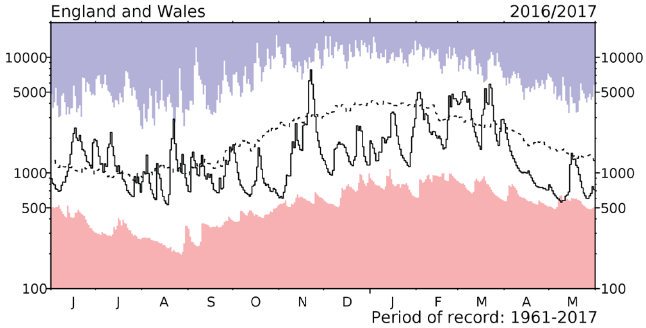
*Based on ranking of the monthly flow**

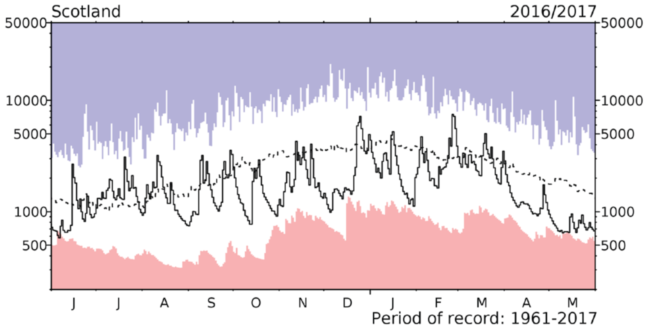
River flows

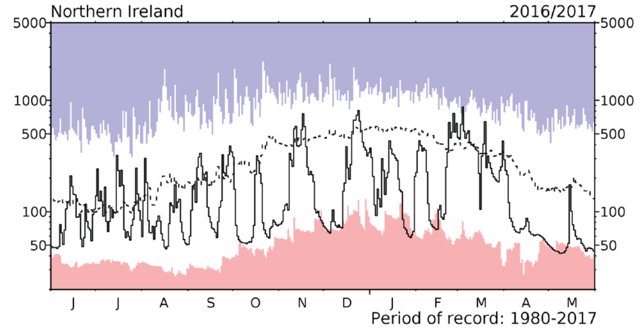
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

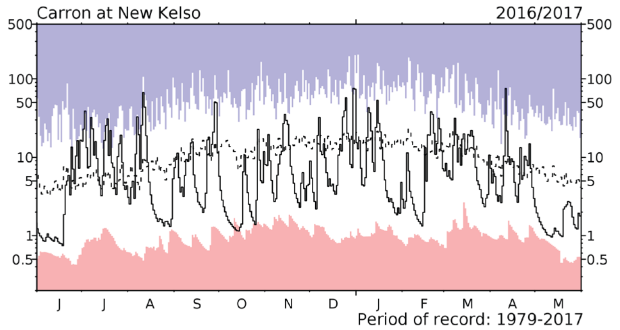
River flow . . . River flow . . .

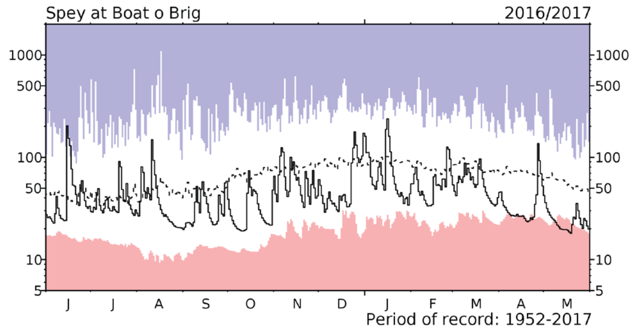


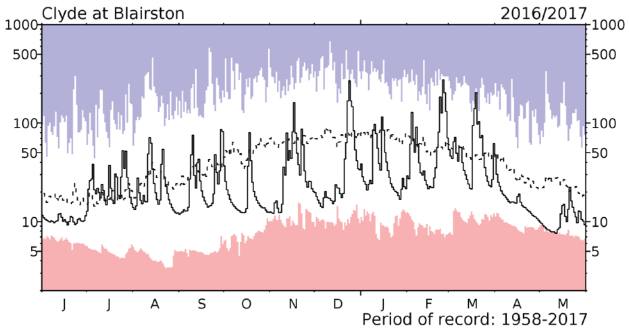


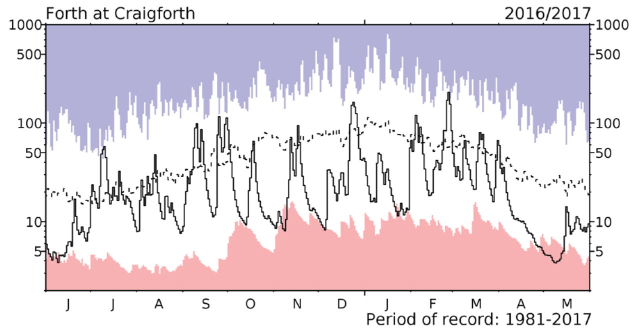


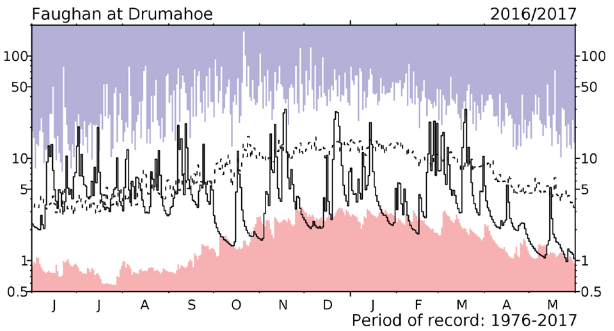


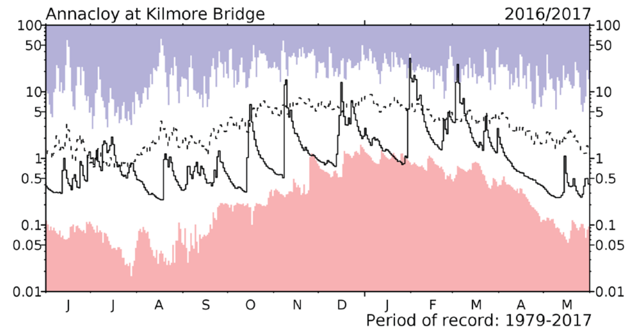








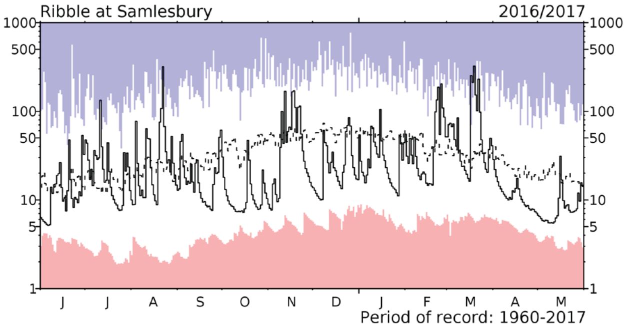


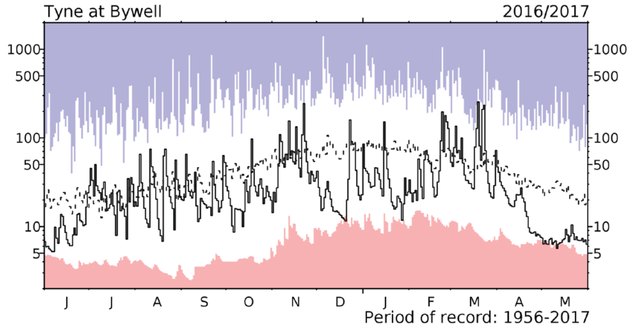


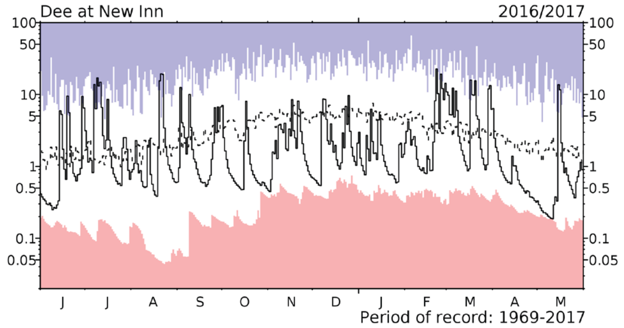
River flow hydrographs

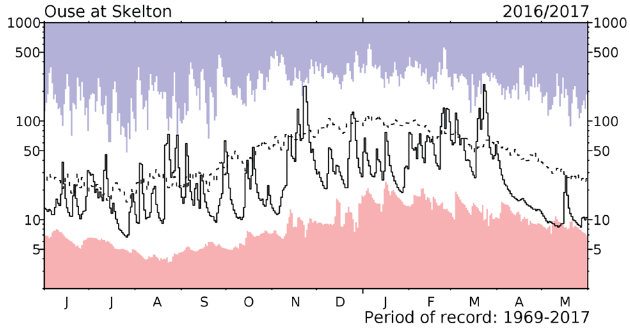
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to June 2016 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

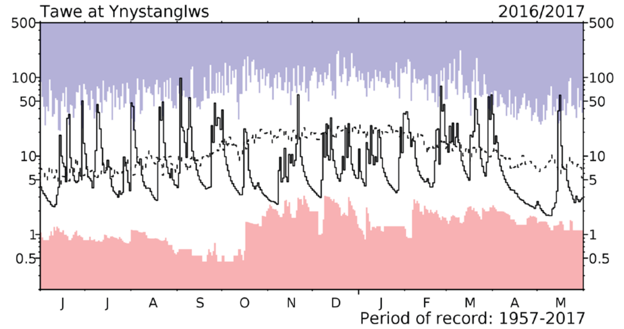
River flow . . . River flow . . .

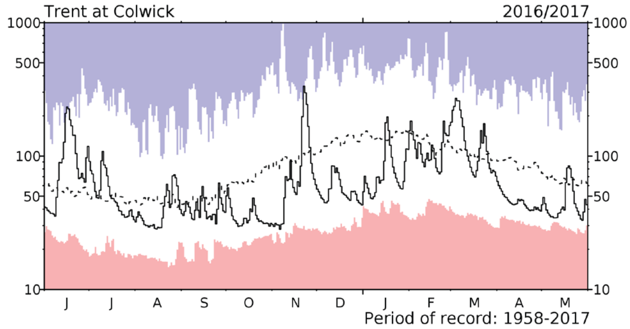


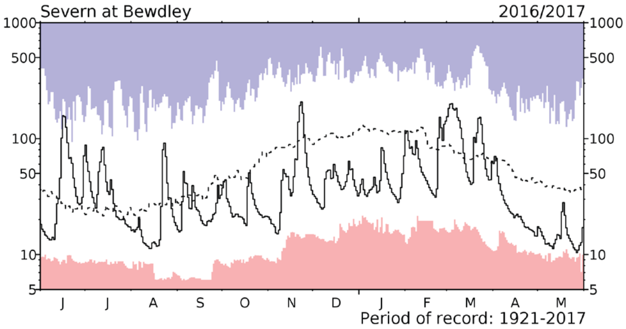


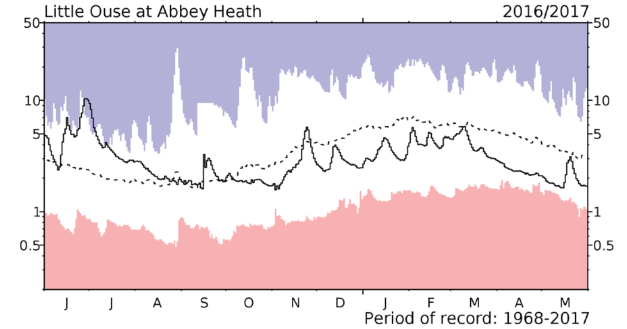


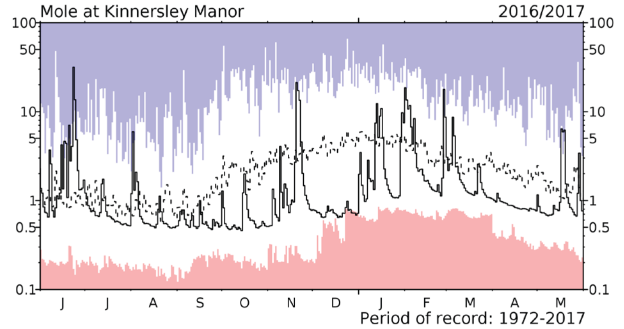


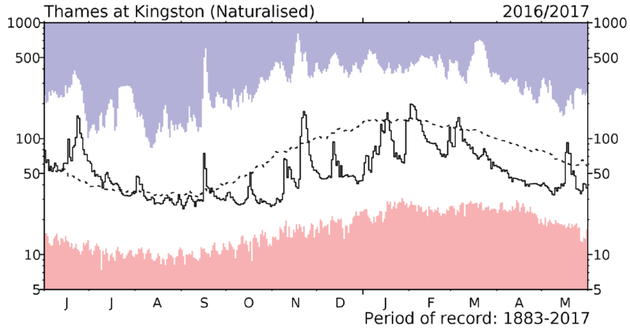


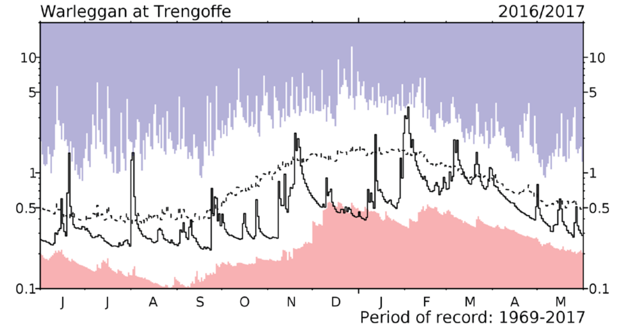


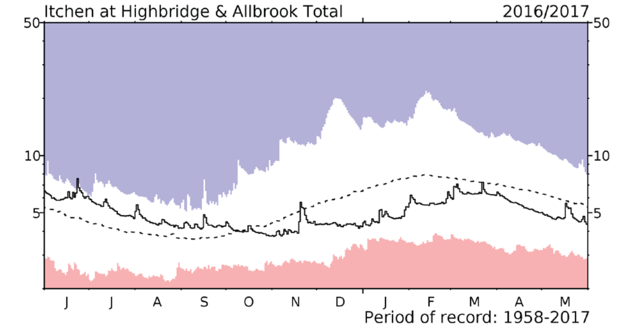


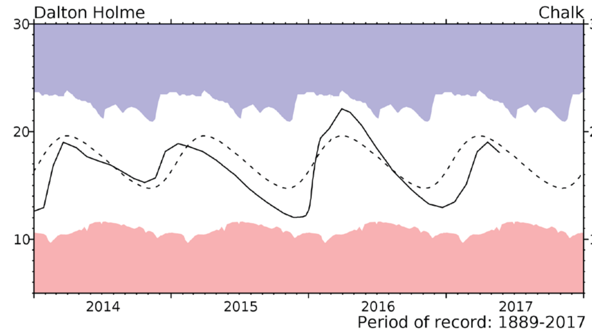


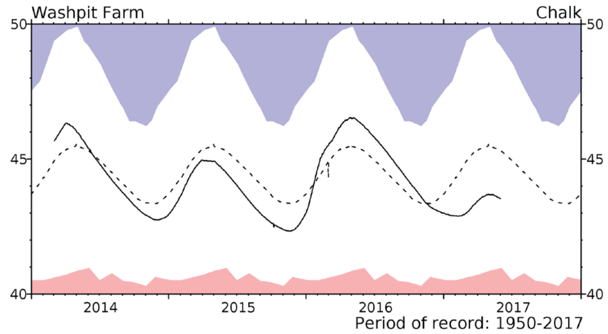


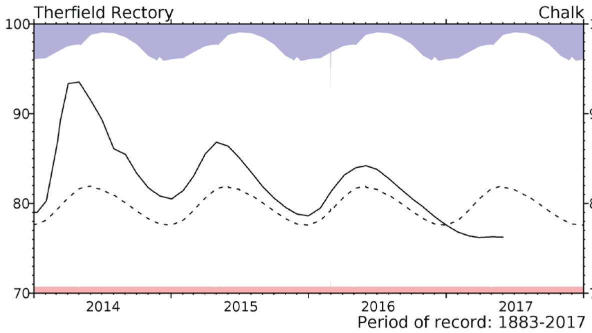


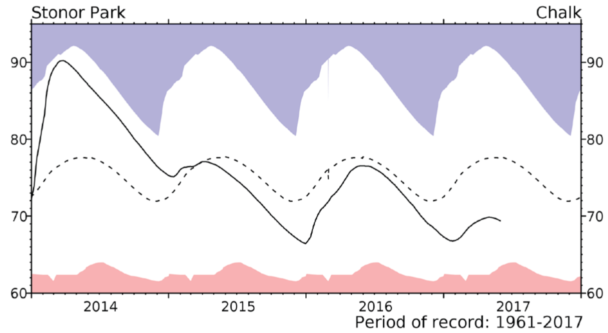


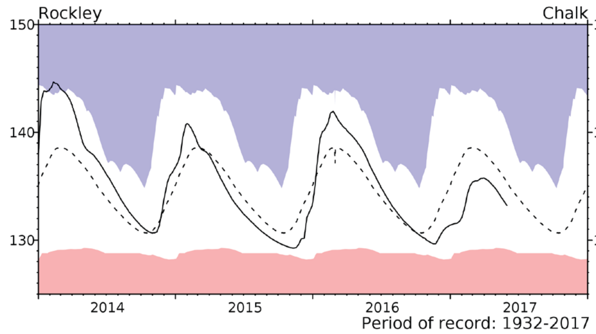


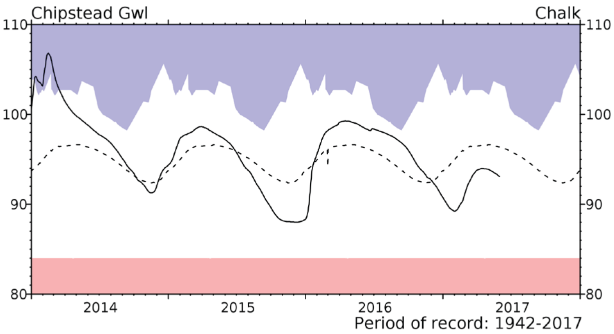


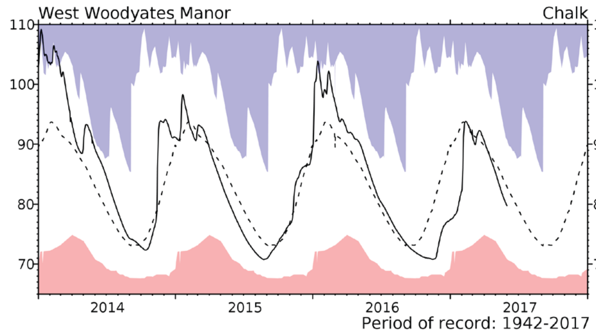


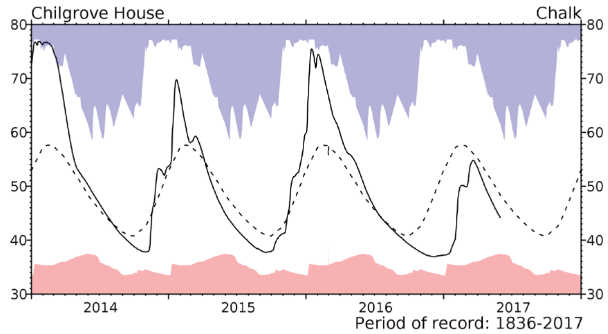


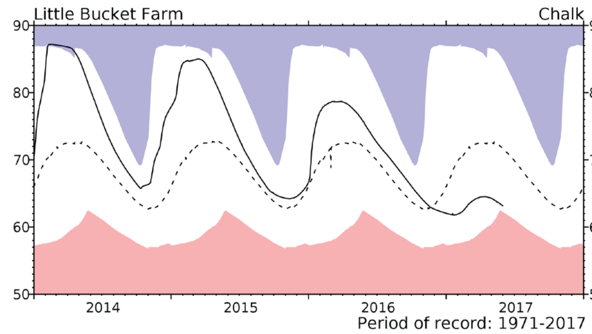


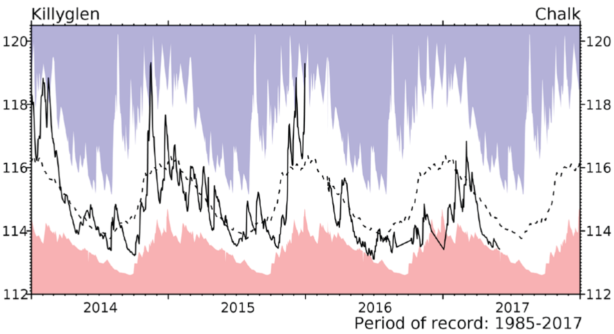




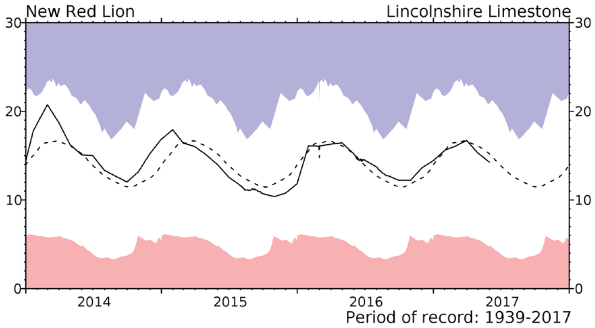


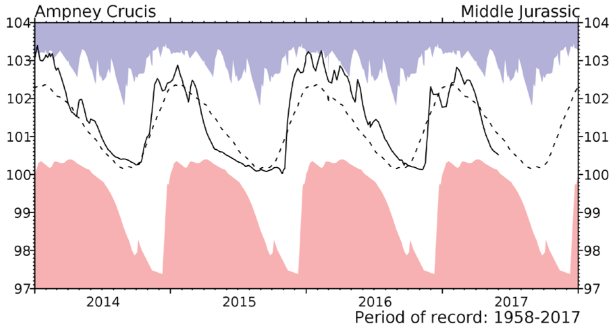


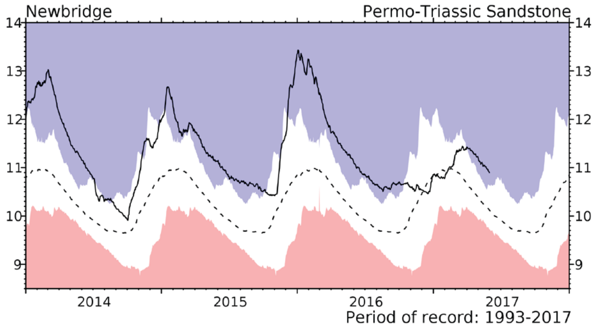


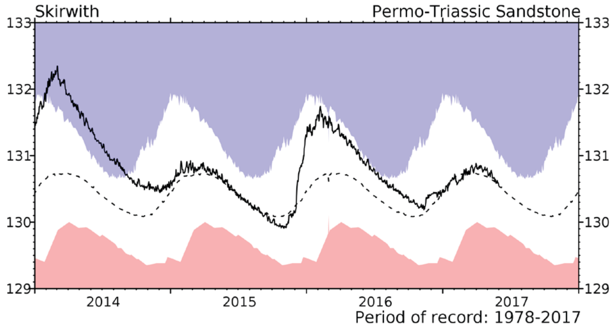


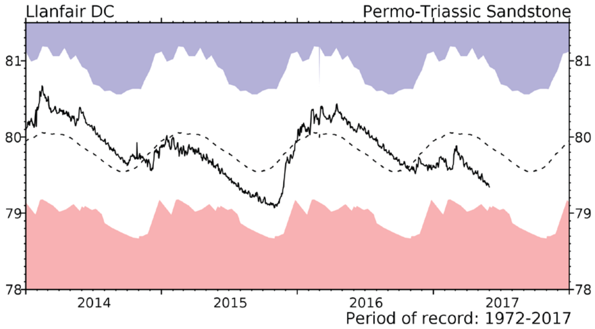
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

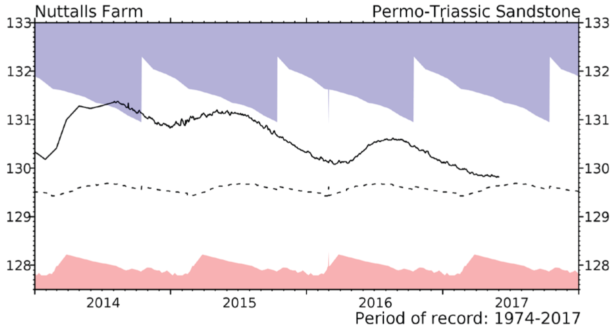

New Red Lion
Lincolnshire Limestone
2014 2015 2016 2017
Period of record: 1939-2017

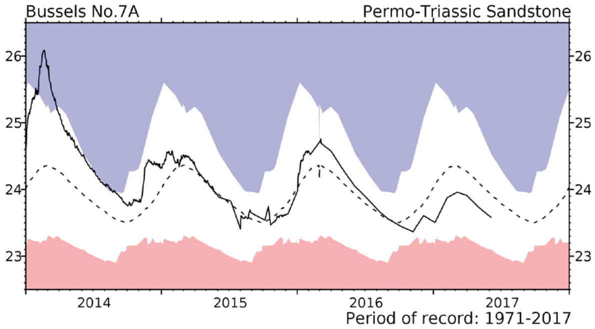

Ampney Crucis
Middle Jurassic
2014 2015 2016 2017
Period of record: 1958-2017

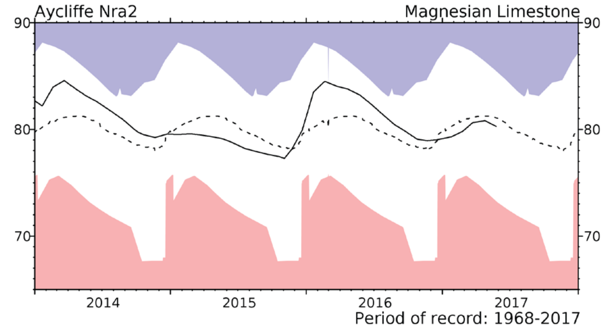

Newbridge
Permo-Triassic Sandstone
2014 2015 2016 2017
Period of record: 1993-2017

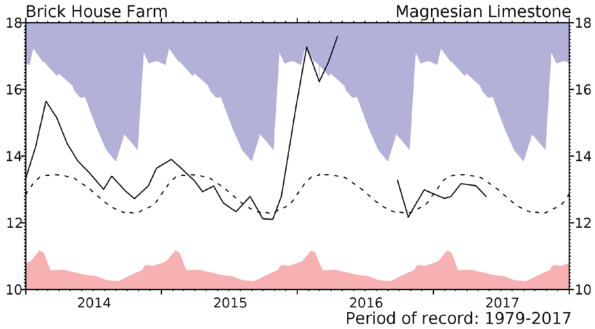

Skirwith
Permo-Triassic Sandstone
2014 2015 2016 2017
Period of record: 1978-2017

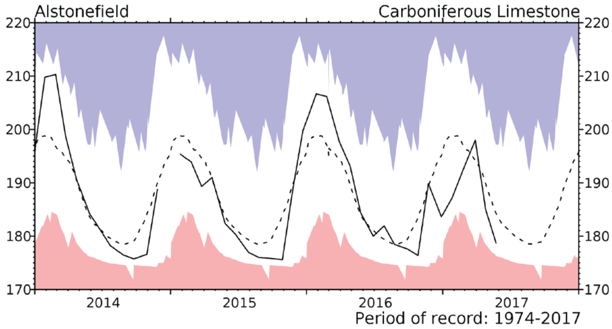

Llanfair DC
Permo-Triassic Sandstone
2014 2015 2016 2017
Period of record: 1972-2017

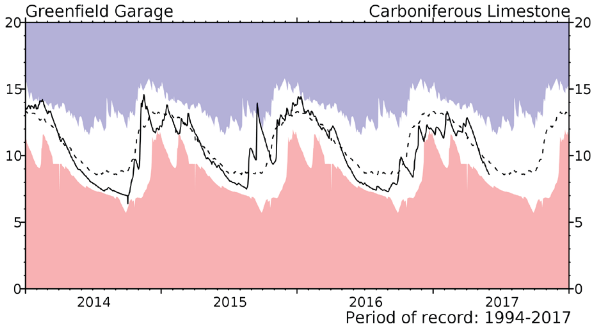

Nuttalls Farm
Permo-Triassic Sandstone
2014 2015 2016 2017
Period of record: 1974-2017

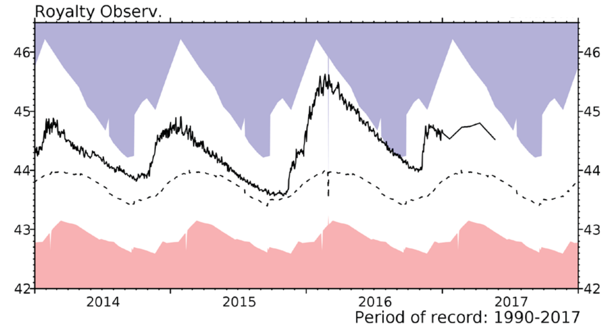

Bussels No.7A
Permo-Triassic Sandstone
2014 2015 2016 2017
Period of record: 1971-2017


Aycliffe Nra2
Magnesian Limestone
2014 2015 2016 2017
Period of record: 1968-2017

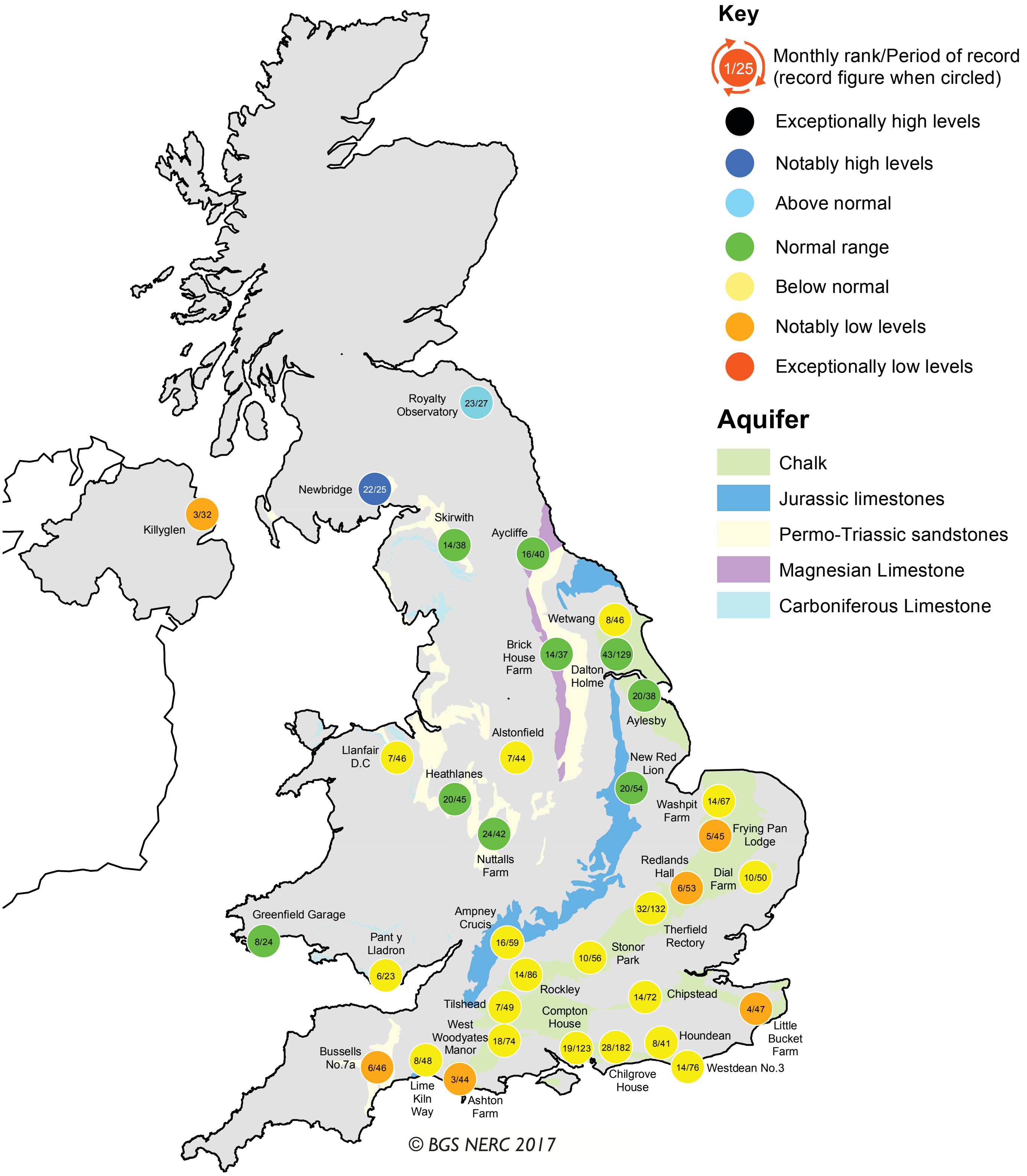

Brick House Farm
Magnesian Limestone
2014 2015 2016 2017
Period of record: 1979-2017


Alstonefield
Carboniferous Limestone
2014 2015 2016 2017
Period of record: 1974-2017


Greenfield Garage
Carboniferous Limestone
2014 2015 2016 2017
Period of record: 1994-2017


Royalty Observ.
2014 2015 2016 2017
Period of record: 1990-2017

Groundwater . . . Groundwater

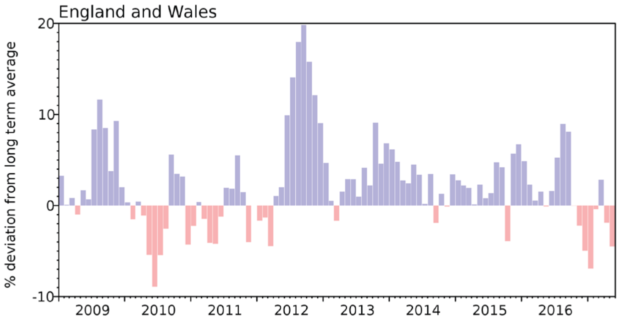


Groundwater levels - May 2017

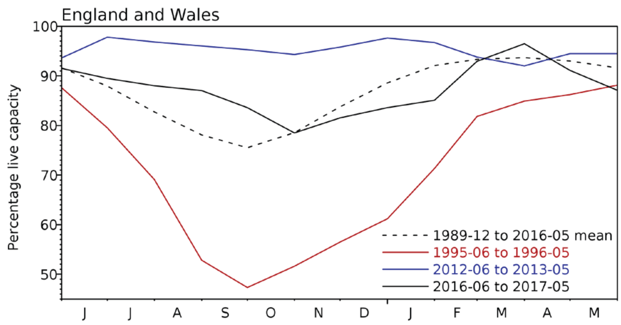
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated.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

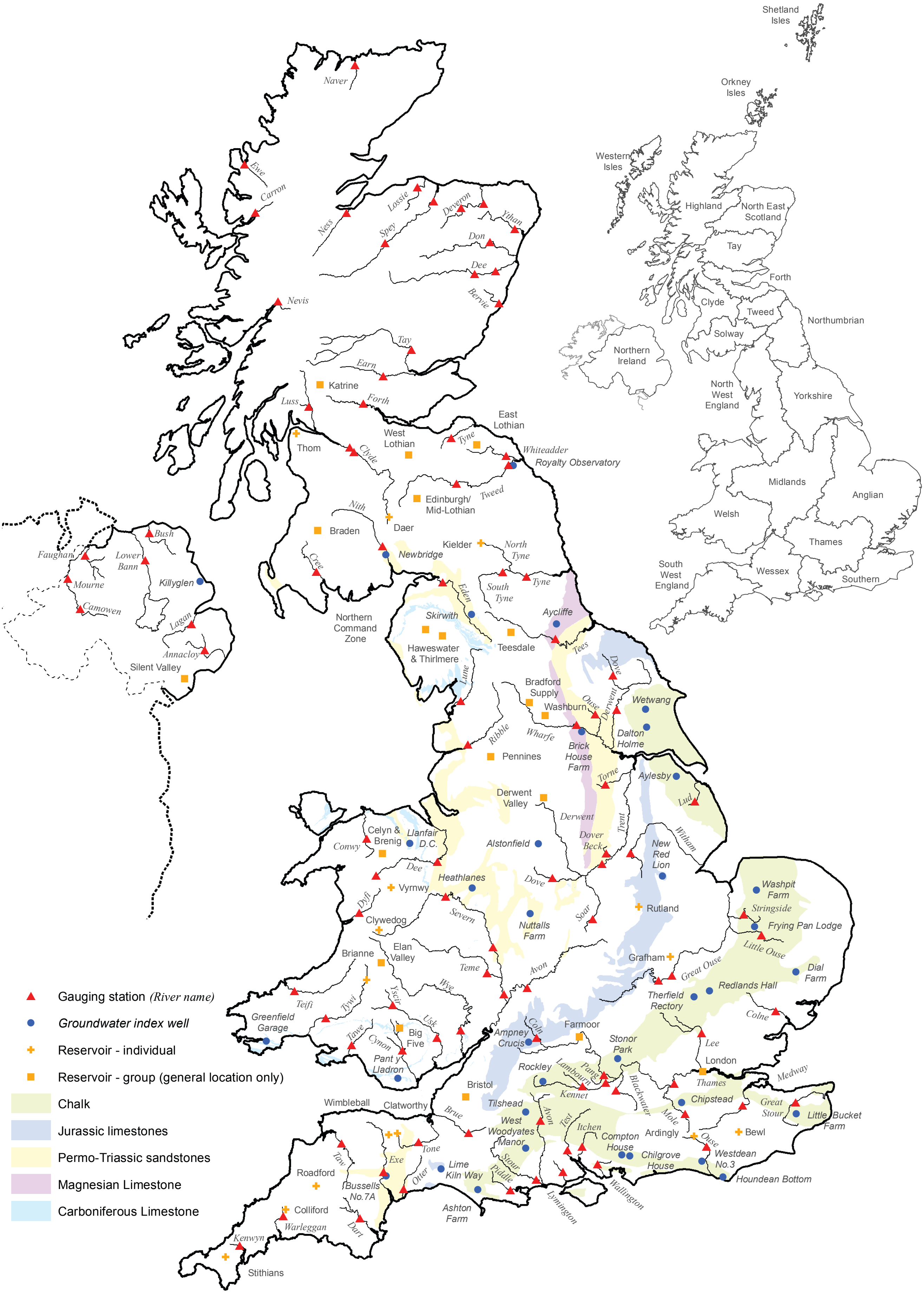
Area	Reservoir		Capacity (Ml)	2017 Mar	2017 Apr	2017 May	May Anom.	Min May	Year* of min	2016 May	Diff 17-16
North West	N Command Zone	•	124929	98	86	76	-6	50	1984	74	2
	Vyrnwy		55146	100	94	92	3	69	1984	96	-4
Northumbrian	Teesdale	•	87936	98	78	67	-21	64	1991	80	-14
	Kielder		(199175)	97	89	87	-5	85	1989	90	-3
Severn-Trent	Clywedog		44922	99	100	98	1	83	1989	100	-2
	Derwent Valley	•	39525	97	86	76	-13	56	1996	95	-19
Yorkshire	Washburn	•	22035	98	89	84	-3	72	1990	84	0
	Bradford Supply	•	41407	95	84	73	-14	70	1996	82	-9
Anglian	Grafham		(55490)	96	96	96	2	72	1997	93	3
	Rutland		(116580)	97	97	97	5	75	1997	94	3
Thames	London	•	202828	95	96	97	3	83	1990	97	1
	Farmoor	•	13822	96	98	97	0	90	2002	98	-1
Southern	Bewl		28170	79	72	68	-20	57	1990	94	-26
	Ardingly		4685	100	100	99	0	89	2012	100	-2
Wessex	Clatworthy		5364	100	91	84	-2	67	1990	79	5
	Bristol	•	(38666)	94	93	88	-1	70	1990	94	-6
South West	Colliford		28540	95	84	81	-5	52	1997	96	-15
	Roadford		34500	76	74	72	-12	48	1996	89	-17
	Wimbleball		21320	93	91	82	-9	74	2011	90	-8
	Stithians		4967	99	94	90	3	66	1990	91	-1
Welsh	Celyn & Brenig	•	131155	100	99	92	-6	82	1996	100	-8
	Brianne		62140	100	96	93	-3	84	2011	97	-4
	Big Five	•	69762	94	90	86	-4	70	1990	95	-9
	Elan Valley	•	99106	100	94	89	-5	81	2011	93	-4
Scotland(E)	Edinburgh/Mid-Lothian	•	96518	92	87	80	-11	52	1998	94	-14
	East Lothian	•	9374	100	99	93	-4	84	1990	99	-6
Scotland(W)	Loch Katrine	•	110326	97	88	75	-12	66	2001	87	-12
	Daer		22412	100	79	69	-22	69	2017	84	-15
	Loch Thom		10798	97	87	72	-21	72	2017	100	-28
Northern Ireland	Total+	•	56800	93	87	81	-4	69	2008	86	-5
	Silent Valley	•	20634	88	82	78	-4	56	2000	87	-10

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

+ excludes Lough Neagh

Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes. Monthly figures may be artificially low due to routine maintenance or turbidity effects in feeder rivers.

Location map . . . Location map



NHMP

The National Hydrological Monitoring Programme (NHMP) was started in 1988 and is undertaken jointly by the Centre for Ecology & Hydrology (CEH) 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 CEH) and National Groundwater Level Archive (NGLA; maintained by BGS), including rainfall, river flows, borehole levels, and reservoir stocks.

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 Rivers Agency 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
http://www.metoffice.gov.uk/climate/uk/about/methods

Long-term averages are based on the period 1981-2010 and are derived from the monthly areal series.

The regional figures for the current month in the hydrological summaries are based on a limited rain gauge network so these (and the associated return periods) should be regarded as a guide only.

The monthly rainfall figures are provided by the Met Office NCIC and are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation.

For further details on rainfall or MORECS data, please contact the Met Office:

Tel: 0870 900 0100
Email: enquiries@metoffice.gov.uk

Enquiries

Enquiries should be directed to the NHMP:

Tel: 01491 692599
Email: nhmp@ceh.ac.uk

A full catalogue of past Hydrological Summaries can be accessed and downloaded at:

http://nrfa.ceh.ac.uk/monthly-hydrological-summary-uk

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