Hydrological Summary for the United Kingdom

February 2017

General

February felt decidedly like spring at times; with the exception of an early cold spell, it was mild and showery, and generally lacking typical winter storms. Nevertheless, a windy and wet final week punctuated by Storm Doris signalled a return to wintry conditions entering March. February was particularly wet in southern Scotland and northern England but drier than average in Northern Ireland. Despite the UK registering near average rainfall, February was the wettest month of a winter characterised by an unusual combination of dry and mild weather. In contrast to winter 2015/16, few places in the UK were wetter than normal. Parts of south-west England received less than half the average rainfall and it was the driest winter since 1970/71 in Northern Ireland. February river flows were generally in the normal range at the end of a winter characterised by substantially below average flows across most of the country. Winter mean flows in Northern Ireland, Wales and south-west England were amongst the lowest on record. Although groundwater levels rose in nearly all of the index boreholes during February, levels remained below normal throughout most of the Chalk, but less so than at the end of January. Reservoir stocks increased throughout the UK, in some cases substantially (e.g. at Ardingly, which registered its third largest monthly increase in a record from 1987), and provided welcome replenishment during a notably dry winter. Overall stocks for England & Wales were as expected for the late winter, though some impoundments in Northern Ireland and south-west England remained well below average. With below normal groundwater levels and some substantially below average reservoir stocks, the weather over the next six weeks is likely to be influential in the outlook for water resources for the summer half-year.

Rainfall

February began with showery conditions under a mild south-westerly airflow, though it soon turned colder and drier under the influence of easterly winds. Travel networks were disrupted at times by snow and ice in localised upland areas of the north and west of the UK. Over the last fortnight, relatively dry and mild weather gave way to windy and wet conditions. The result of explosive cyclogenesis on approach to the UK, Storm Doris rapidly traversed the country on the 23rd bringing unusually strong winds to inland parts of England and Wales (e.g. 94mph gusts at Capel Curig, Snowdonia). There was substantial localised disruption to energy and transport networks; power cuts reportedly affected more than 80,000 properties, and flights and ferries were cancelled. Heavy snow on the northern flank of the storm also closed main roads in Scotland. Other notable rainfall totals included 50mm on the 22nd at Cluanie Inn (Wester Ross) and 61mm on the 25th at Capel Curig. Towards month-end Ewan became the fifth named storm of the winter 2016/17 half-year, though impacts were limited to the Republic of Ireland. February rainfall totals exceeded 130% of the long-term average in parts of central, southern and eastern Scotland, and around Greater Manchester, Merseyside and Humberside. Nevertheless, this was the wetter exception in a winter of notably low rainfall. Much of Northern Ireland, Wales and south-west England registered less than three quarters of average winter rainfall. The dry winter also contributed to longer duration rainfall deficiencies. It was the second driest September-February for Northern Ireland in a series from 1910, ranking behind only the 1933/34 drought, and the driest for the UK since the early 1970s.

River flows

The relatively quiet weather which characterised much of February ensured that there were few notable peak flows or reports of flooding. Reflecting the dry winter conditions in Northern Ireland, new daily flow minima were established for the Faughan during the second week. Whilst flows in the west were generally in recession across the middle of the month, in parts of eastern Britain flows increased steadily though rarely were notably high, even following Storm Doris. Average river flows for February were within the normal range (though below average) across much of the UK, with above normal flows in south-west Scotland and below normal flows restricted to south-east England. For the winter overall, river flows were below normal across the majority of the country, notably so in Northern Ireland, Wales, south-west England, Kent and parts of northern Britain. Many rivers in these areas recorded around half their average winter flows (and for the Medway, around a third), and new period of record minima were established for the Eden and Faughan in series from 1967 and 1976, respectively. Winter outflows from the UK were the second lowest in a series from 1980, ranking behind only those during the 2004-06 drought. Over the September-February timeframe, notably low flows were even more widespread across almost all of the north and west of the UK. Average flows in Northern Ireland, south-west England, much of Wales, and parts of northern Scotland and north-west England were exceptionally low, with new period of record minima registered for the Faughan, Annacloy, Yscir, Naver and Eden.

Groundwater

Despite the dry winter, end of month soil moisture deficits were near zero across the UK due to the wet weather in late February. In the Chalk, groundwater levels rose at all the indicator sites except for Therfield Rectory where the response to recharge is slow due to the 75m thick unsaturated zone. Water levels rose by over 7m at West Woodyates Manor, Tilshead, Compton House, Chilgrove House and Houndean Bottom, but generally remained below normal, with Stonor Park notably low. In the more rapidly responding Jurassic and Magnesian limestones, levels were in the normal range having risen or remained relatively stable. In the Permo-Triassic sandstones, groundwater levels rose or were stable. Most indicator sites were in the normal range, but Llanfair D.C. and Bussels No.7A remained below normal and Nuttalls Farm above normal. Levels in the Carboniferous Limestone rose during February and were average (in south-west Wales) to below normal (south-west Wales and the Peak District). Levels in the Fell Sandstone at Royalty Observatory rose slightly and remained above average.

Centre for Ecology & Hydrology
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Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1981-2010 average.

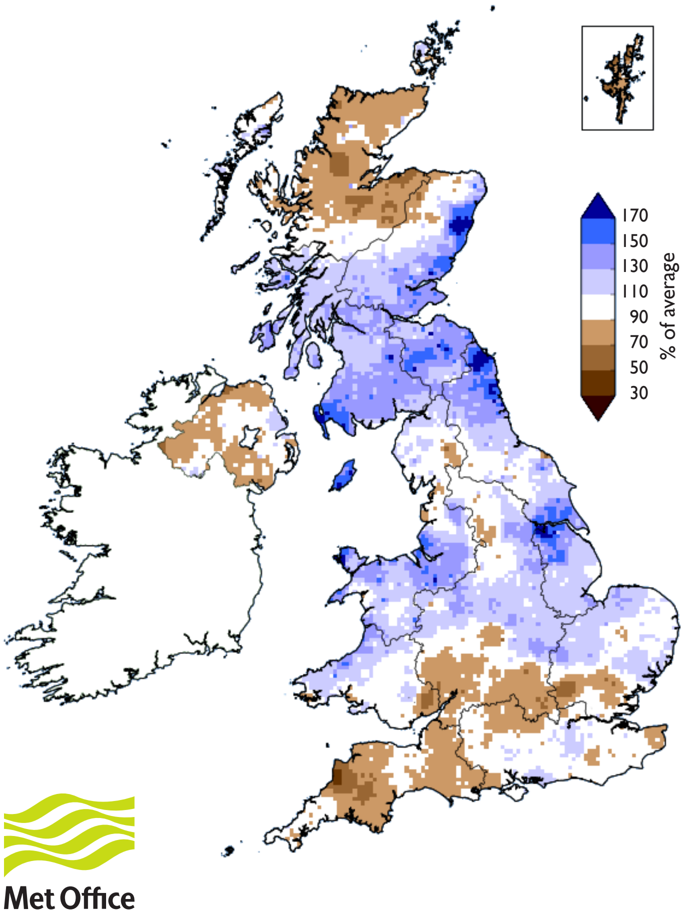
Region	Rainfall	Feb 2017	Dec16 – Feb17	RP	Sep16 – Feb17	RP	Jun16 – Feb17	RP	Mar16 – Feb17	RP
United	mm	**94**	252		508		779		1012	
Kingdom	%	**108**	77	5-10	77	10-15	87	5-10	90	2-5
England	mm	**62**	162		369		578		780	
	%	**104**	71	5-10	78	5-10	87	5-10	92	2-5
Scotland	mm	**141**	393		716		1075		1345	
	%	**111**	85	2-5	77	5-10	88	2-5	89	2-5
Wales	mm	**126**	307		633		964		1260	
	%	**117**	72	5-10	74	10-15	85	5-10	89	2-5
Northern	mm	**75**	206		441		710		925	
Ireland	%	**90**	65	15-25	69	30-50	79	20-30	81	15-25
England &	mm	**71**	182		405		631		846	
Wales	%	**107**	71	5-10	77	5-10	86	5-10	91	2-5
North West	mm	**100**	253		538		913		1144	
	%	**112**	73	5-10	75	8-12	93	2-5	93	2-5
Northumbria	mm	**84**	175		417		663		834	
	%	**131**	75	5-10	87	2-5	96	2-5	96	2-5
Severn-Trent	mm	**59**	153		333		543		749	
	%	**113**	76	5-10	79	5-10	89	2-5	96	2-5
Yorkshire	mm	**67**	158		363		584		806	
	%	**109**	69	5-10	79	5-10	88	2-5	95	2-5
Anglian	mm	**44**	112		273		446		626	
	%	**112**	76	5-10	84	2-5	91	2-5	100	2-5
Thames	mm	**44**	138		314		467		678	
	%	**91**	74	2-5	79	2-5	84	5-10	94	2-5
Southern	mm	**56**	160		337		490		682	
	%	**99**	71	5-10	71	5-10	77	8-12	85	5-10
Wessex	mm	**58**	172		402		572		793	
	%	**89**	68	5-10	77	5-10	82	5-10	89	2-5
South West	mm	**82**	221		514		727		935	
	%	**82**	58	10-20	69	15-25	74	15-25	76	15-25
Welsh	mm	**119**	294		613		928		1216	
	%	**116**	73	5-10	74	10-15	85	5-10	89	2-5
Highland	mm	**147**	496		853		1249		1569	
	%	**90**	85	2-5	75	2-5	86	2-5	87	2-5
North East	mm	**82**	225		464		780		975	
	%	**107**	84	2-5	80	5-10	97	2-5	96	2-5
Tay	mm	**139**	332		602		910		1124	
	%	**125**	81	2-5	74	8-12	85	2-5	84	5-10
Forth	mm	**126**	287		521		795		990	
	%	**131**	81	2-5	73	5-10	83	2-5	82	5-10
Tweed	mm	**113**	235		473		747		935	
	%	**147**	81	2-5	81	5-10	92	2-5	91	2-5
Solway	mm	**161**	361		666		1003		1278	
	%	**142**	83	2-5	75	5-10	84	2-5	86	2-5
Clyde	mm	**188**	480		884		1293		1616	
	%	**126**	86	2-5	79	2-5	88	2-5	89	2-5

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

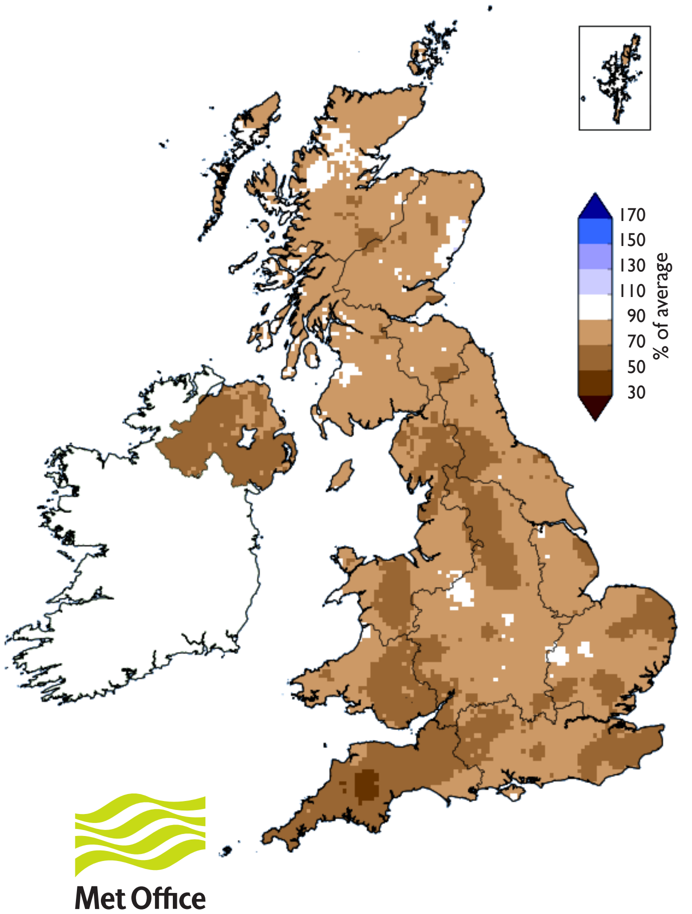
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 February 2016 are provisional.

Rainfall . . . Rainfall . . .

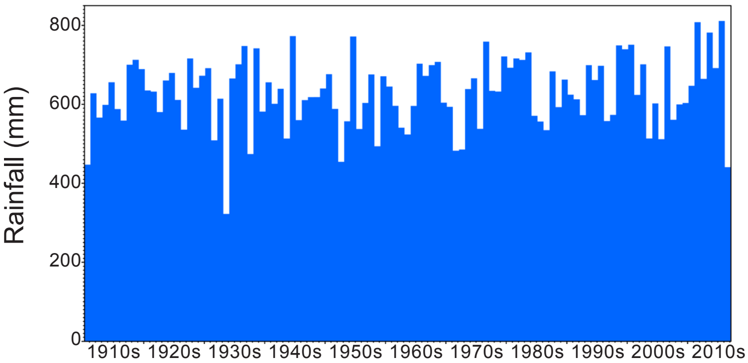
February 2017 rainfall as % of 1981-2010 average



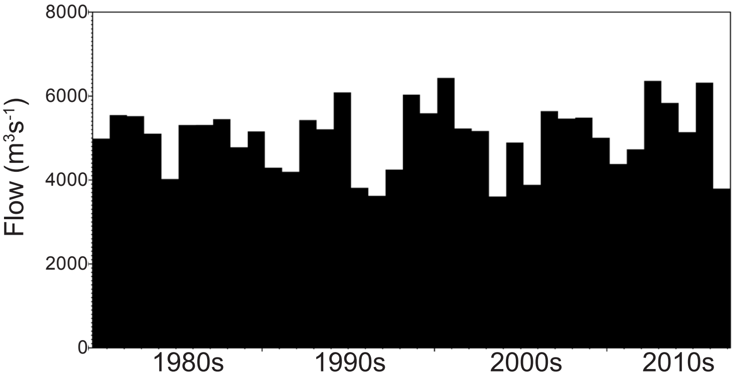
December 2016 - February 2017 rainfall as % of 1981-2010 average



September - February rainfall for Northern Ireland



December - February (winter) average outflows from the UK



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.

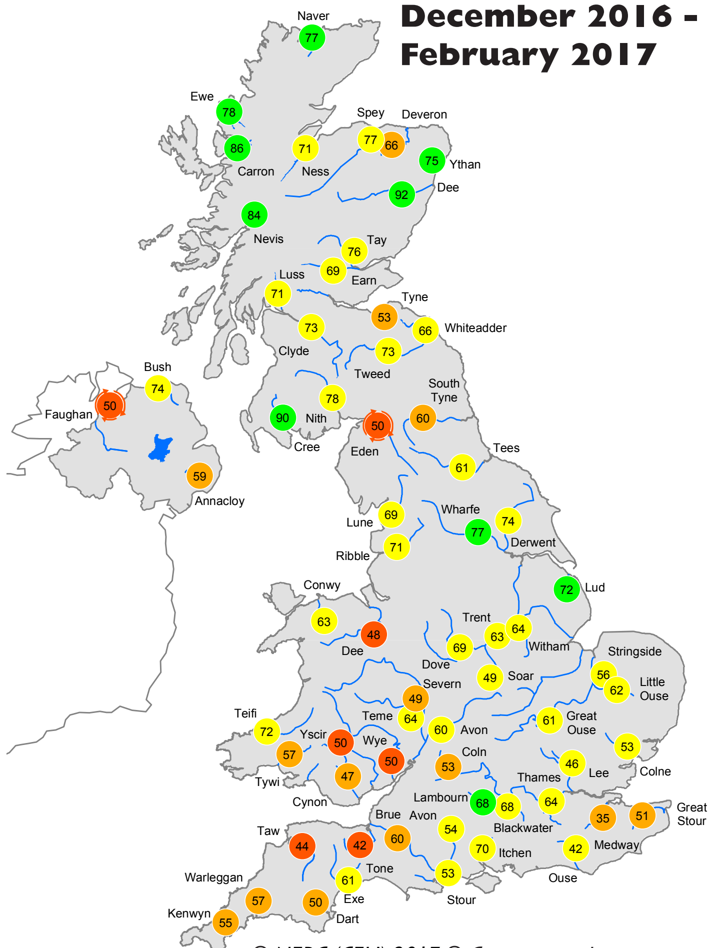
The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from March 2017**
Issued: **10.03.2017**
using data to the end of February 2017

The one month outlook indicates flows are likely to be in the normal range for much of the country, but with normal to above normal flows in parts of northern Britain which received higher rainfall in February (the wet start to March increases the likelihood of flows being above normal) and normal to below normal flows in south-east England. The outlook is for normal to below normal flows and groundwater levels to persist in south-east England over the next three months, with below normal flows and levels most likely across the Chalk aquifer. Elsewhere, flows and levels are most likely to be in the normal range over the next three months.

River flow . . . River flow . . .

December 2016 - February 2017



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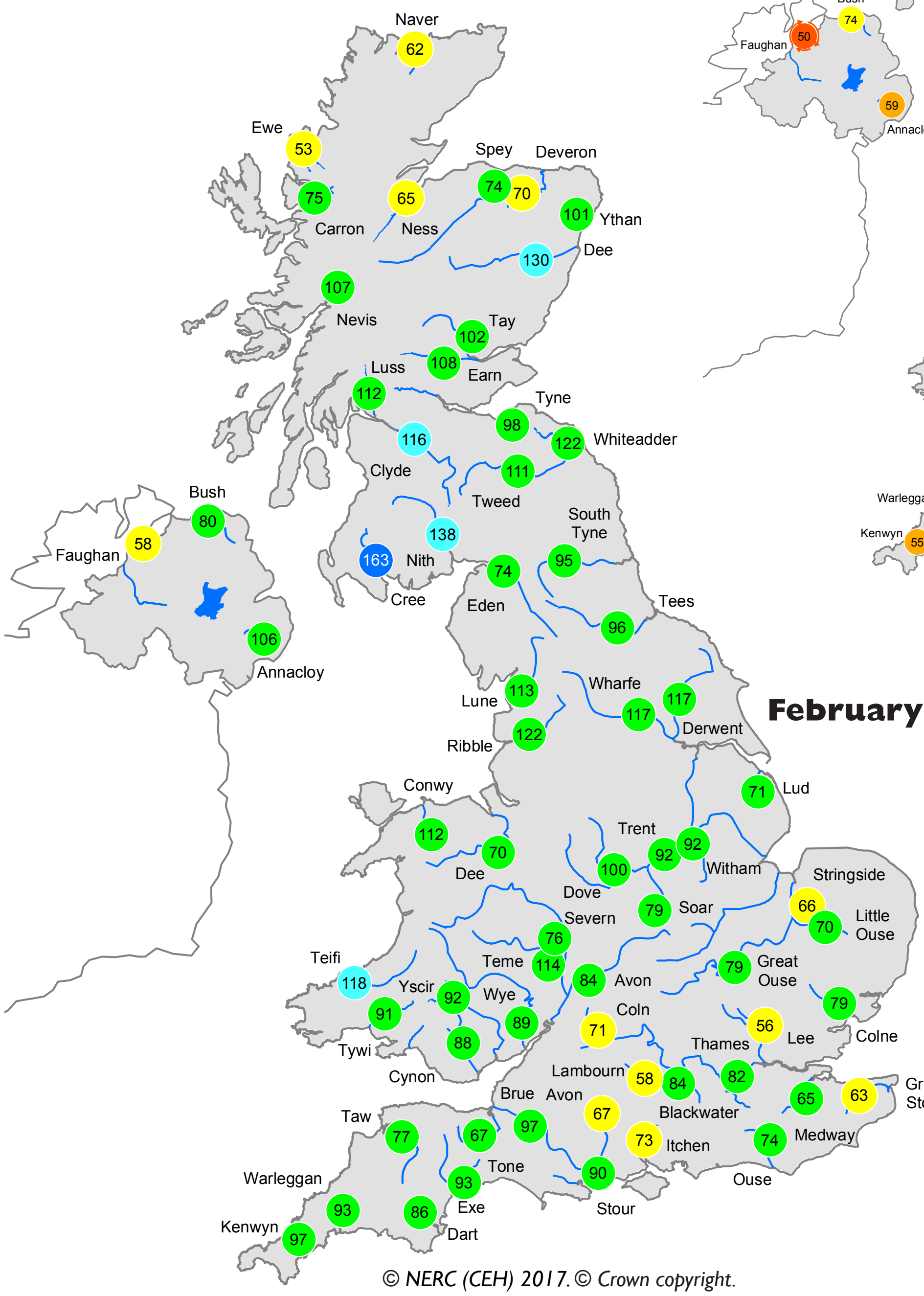
February 2017



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Key

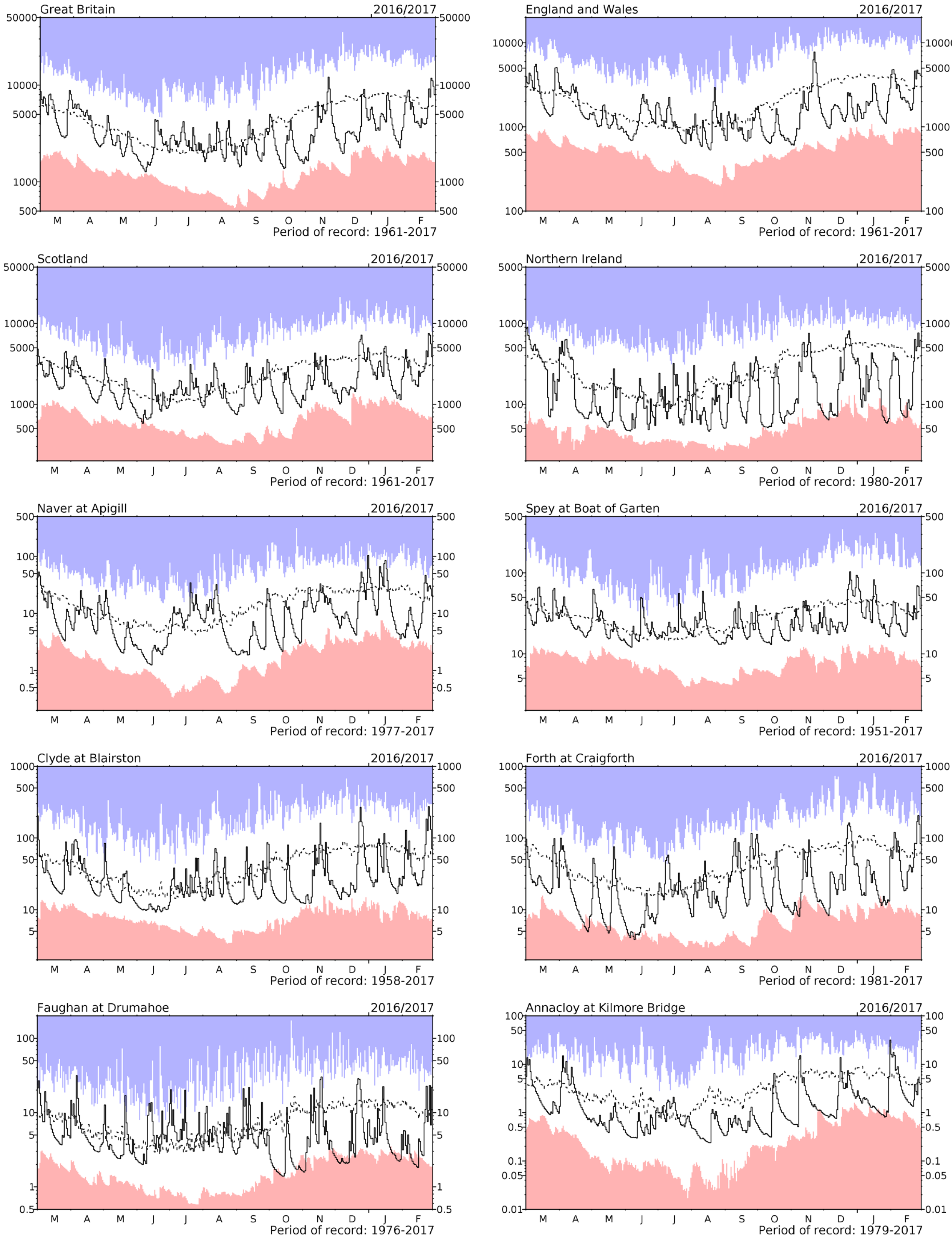
- 25 — % of long-term average (record figure when circled)
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

*Based on ranking of the monthly flow**

River flows

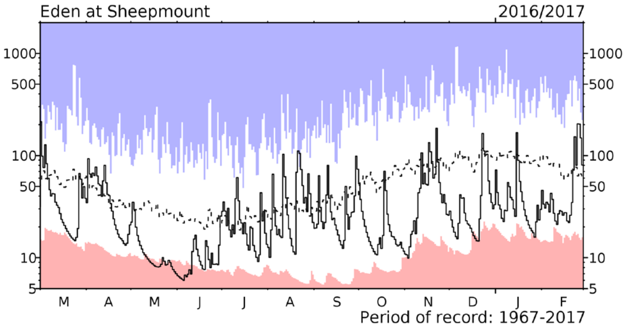
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

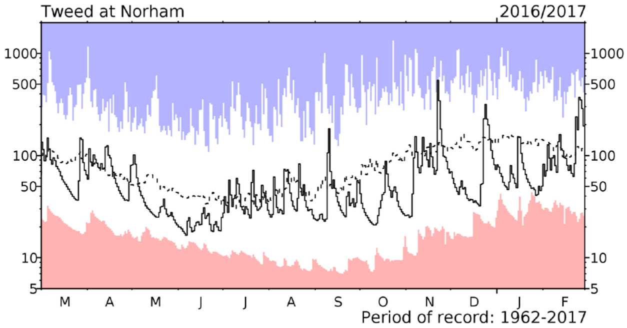
River flow . . . River flow . . .

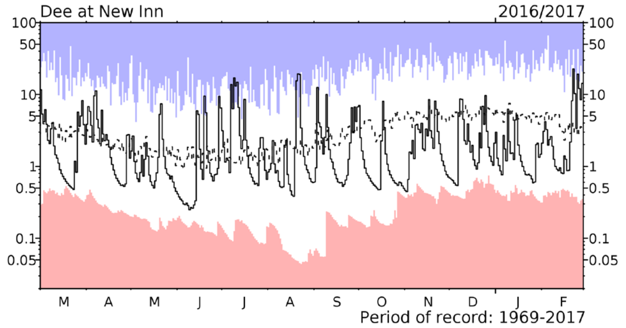


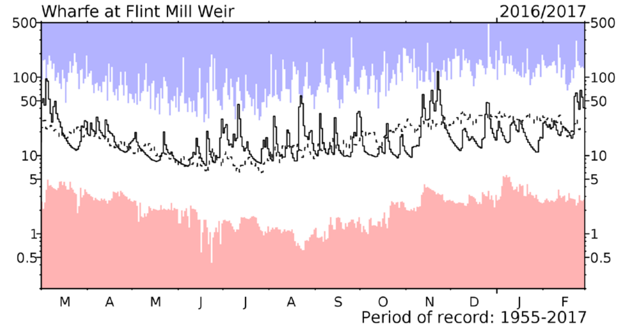
River flow hydrographs

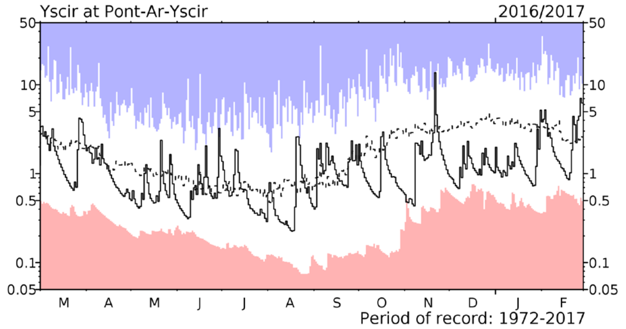
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to March 2016 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed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

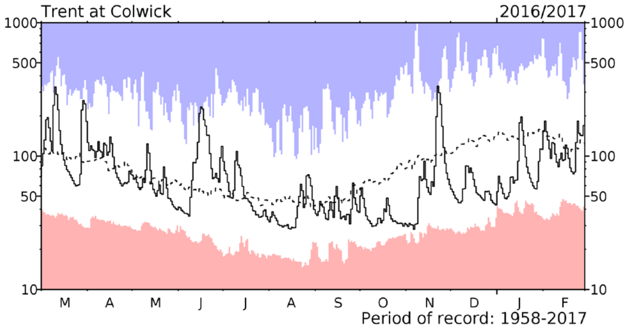

Eden at Sheepmount
2016/2017
M A M J J A S O N D J F
Period of record: 1967-2017

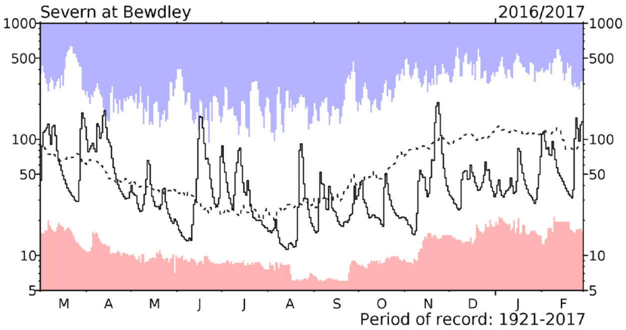

Tweed at Norham
2016/2017
M A M J J A S O N D J F
Period of record: 1962-2017

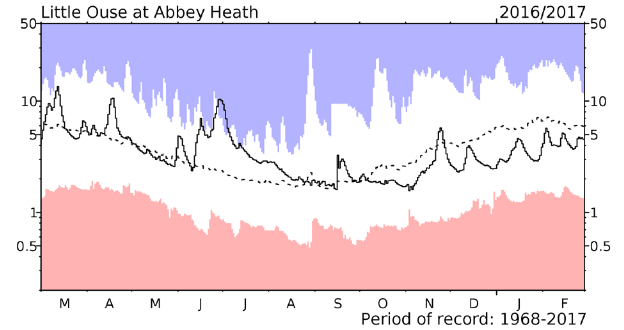

Dee at New Inn
2016/2017
M A M J J A S O N D J F
Period of record: 1969-2017

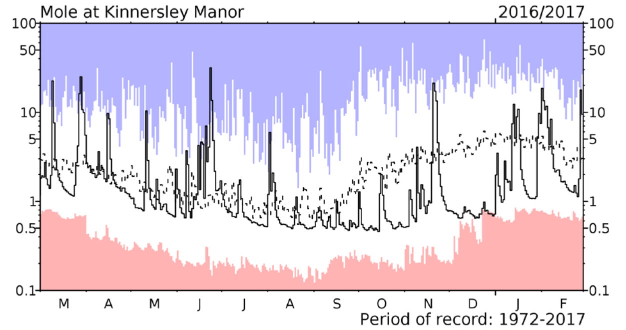

Wharfe at Flint Mill Weir
2016/2017
M A M J J A S O N D J F
Period of record: 1955-2017

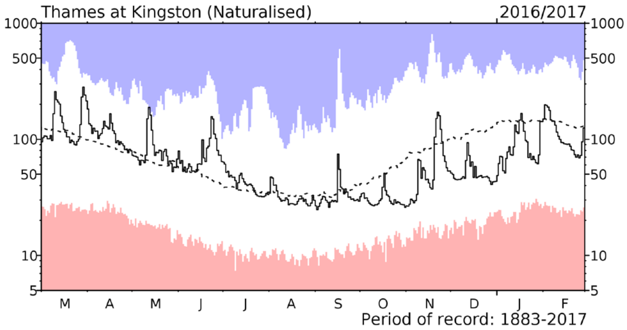

Yscir at Pont-Ar-Yscir
2016/2017
M A M J J A S O N D J F
Period of record: 1972-2017

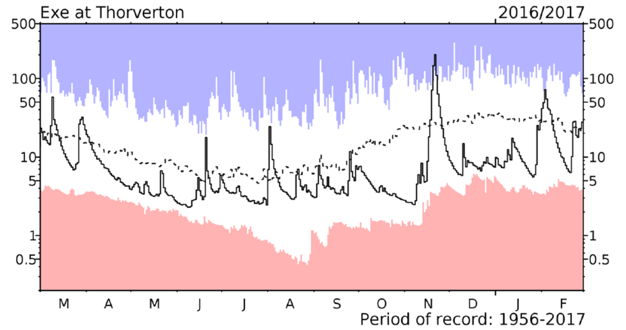

Trent at Colwick
2016/2017
M A M J J A S O N D J F
Period of record: 1958-2017

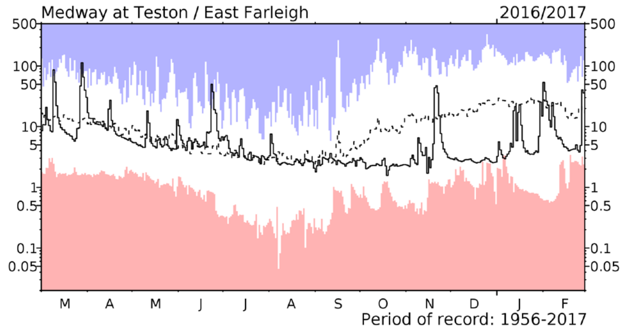

Severn at Bewdley
2016/2017
M A M J J A S O N D J F
Period of record: 1921-2017


Little Ouse at Abbey Heath
2016/2017
M A M J J A S O N D J F
Period of record: 1968-2017

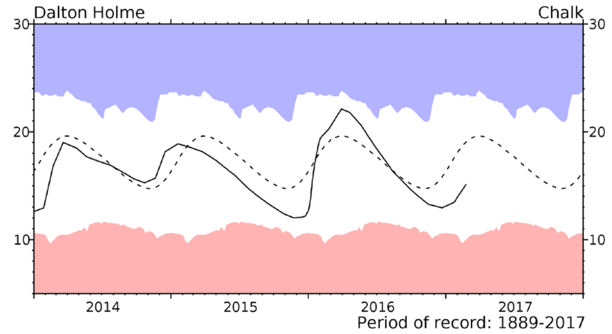

Mole at Kinnersley Manor
2016/2017
M A M J J A S O N D J F
Period of record: 1972-2017

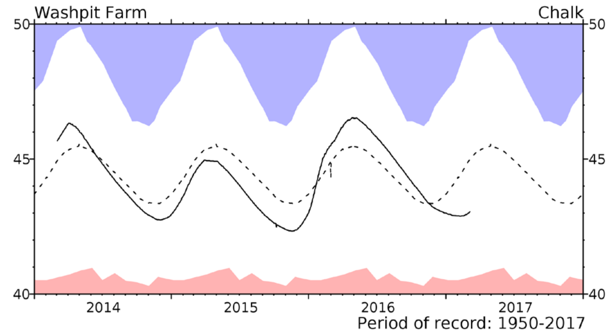

Thames at Kingston (Naturalised)
2016/2017
M A M J J A S O N D J F
Period of record: 1883-2017

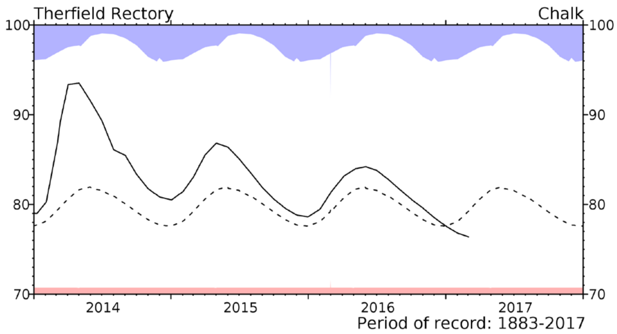

Exe at Thorverton
2016/2017
M A M J J A S O N D J F
Period of record: 1956-2017

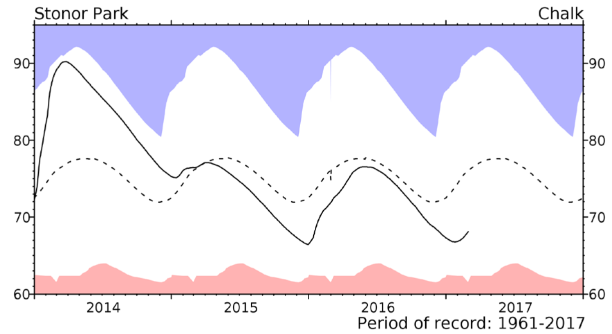

Medway at Teston / East Farleigh
2016/2017
M A M J J A S O N D J F
Period of record: 1956-2017

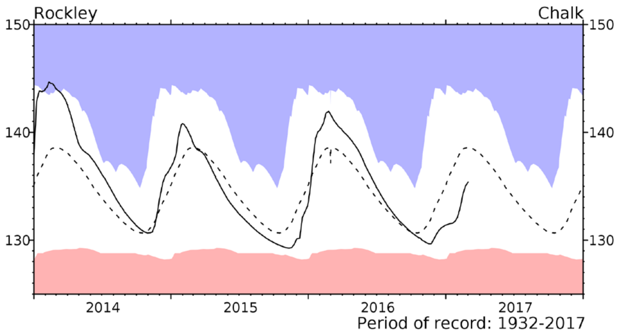
Groundwater . . . Groundwater

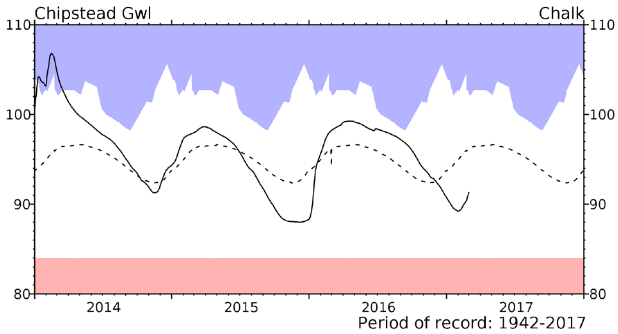


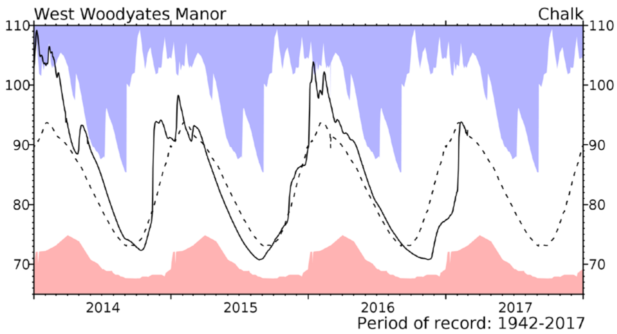


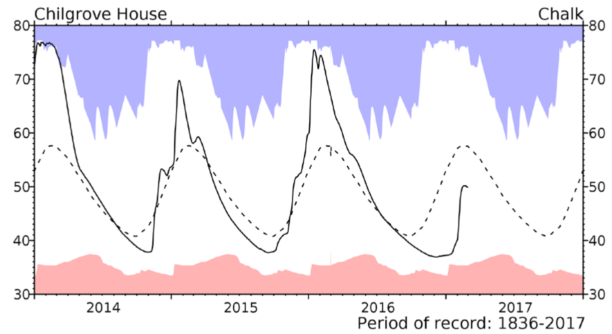


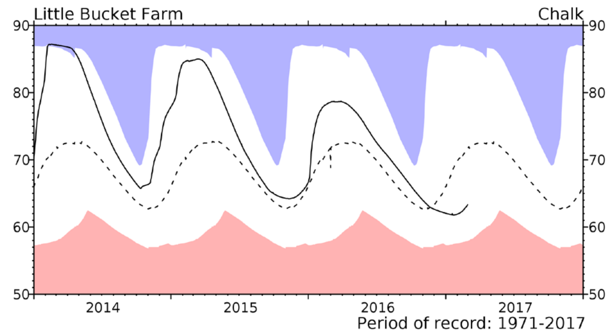


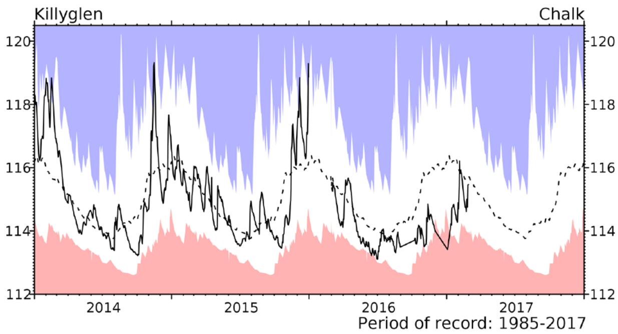






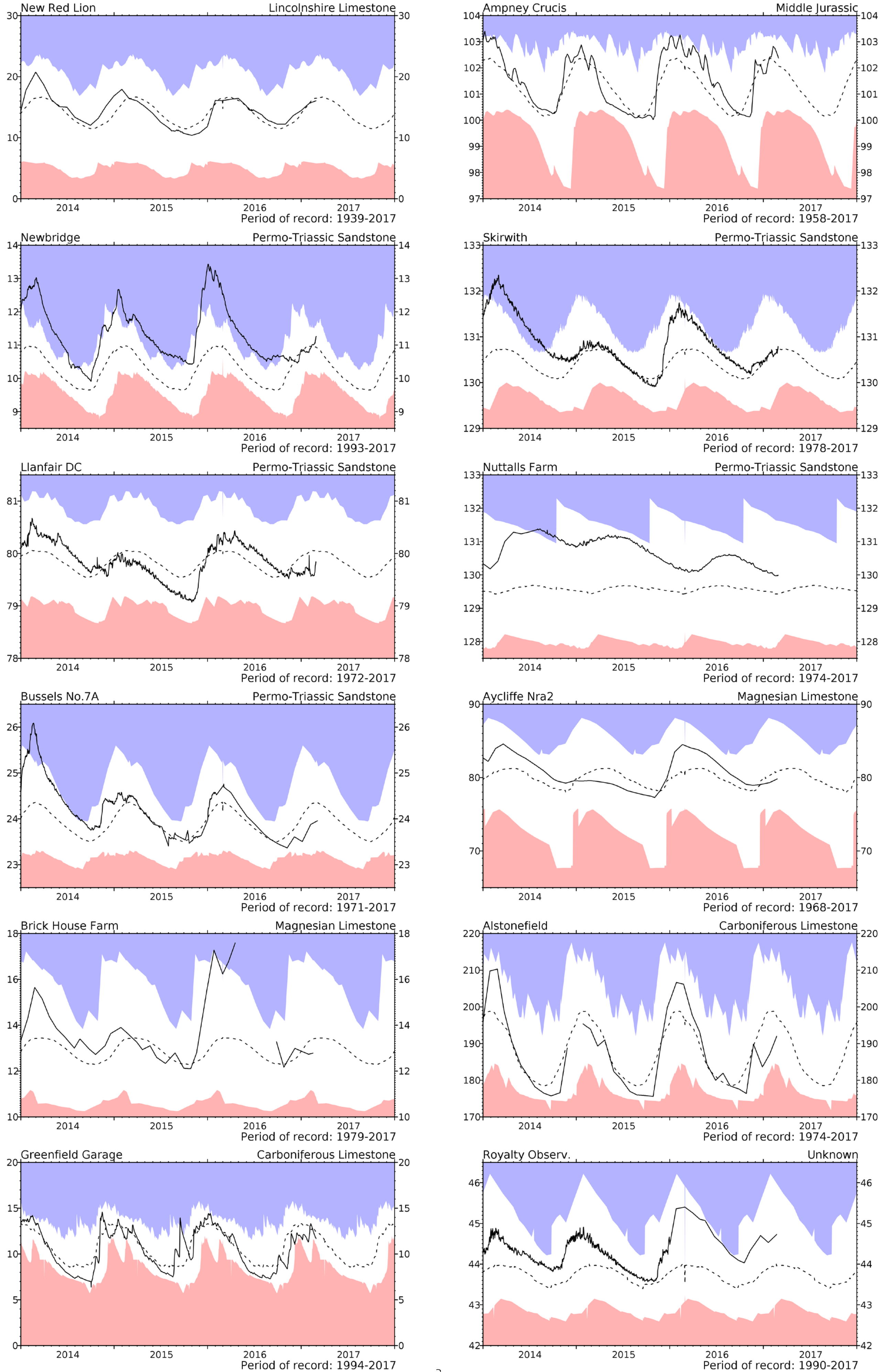


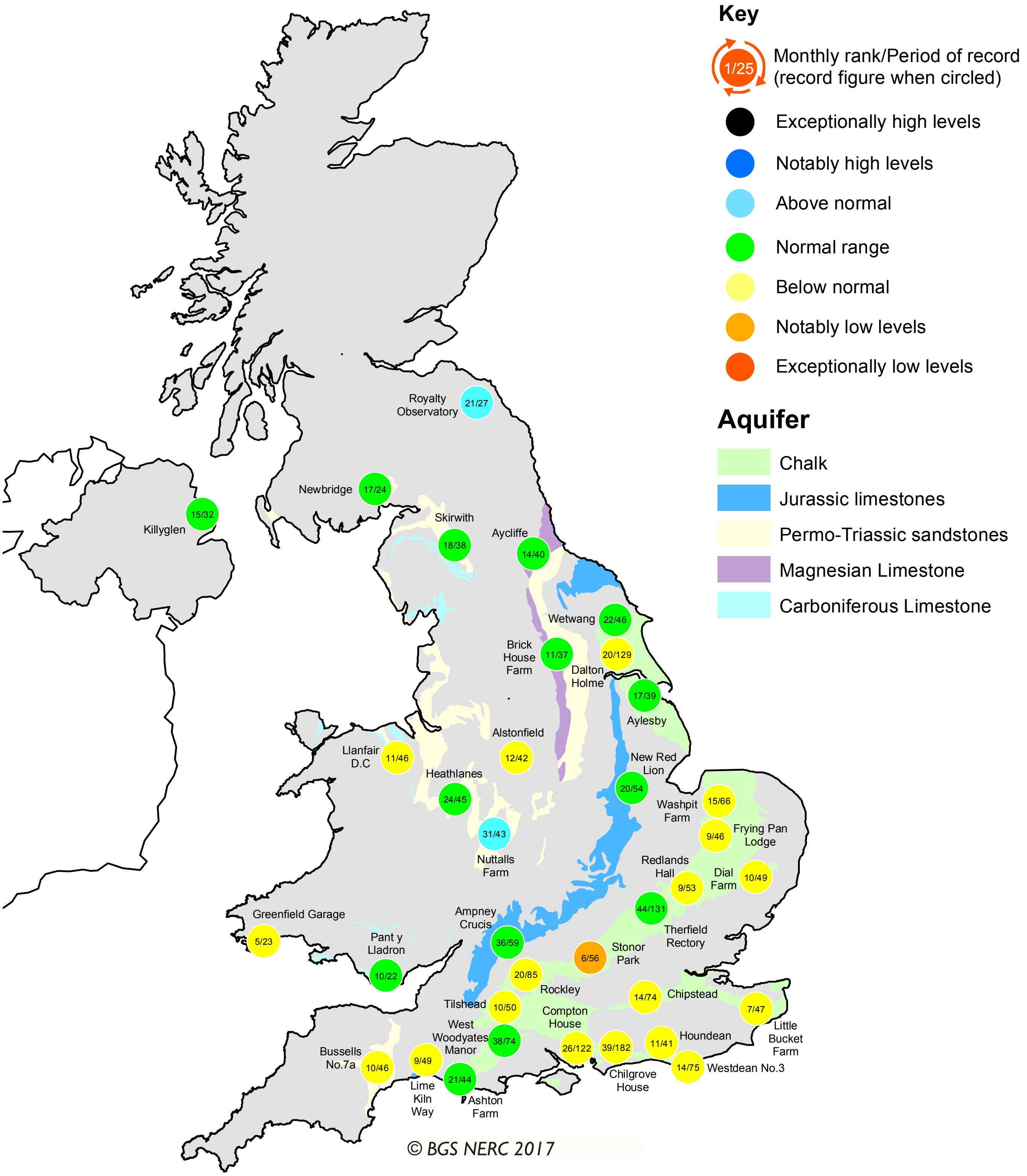




Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

Groundwater ... Groundwater



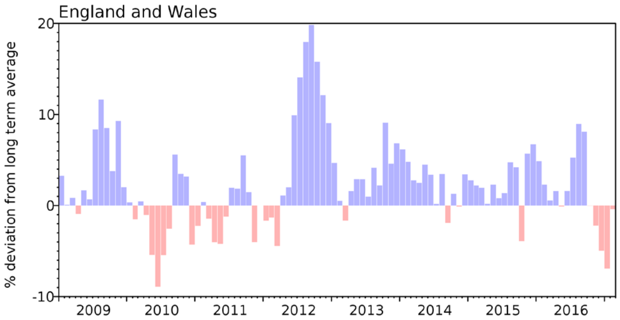


Groundwater levels - February 2017

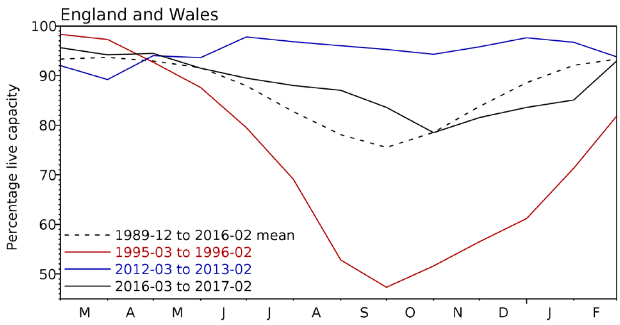
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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)	2016 Dec	2017 Jan	2017 Feb	Feb Anom.	Min Feb	Year* of min	2016 Feb	Diff 17-16
North West	N Command Zone	•	124929	70	69	80	-13	78	1996	98	-18
	Vyrnwy		55146	85	84	98	3	59	1996	97	1
Northumbrian	Teesdale	•	87936	92	93	100	8	72	1996	97	3
	Kielder		(199175)	88	84	95	2	81	1993	89	6
Severn-Trent	Clywedog		44922	87	91	100	9	77	1996	96	4
	Derwent Valley	•	39525	100	92	100	4	46	1996	100	0
Yorkshire	Washburn	•	22035	79	78	95	2	53	1996	95	0
	Bradford Supply	•	41407	80	78	86	-9	53	1996	98	-12
Anglian	Grafham		(55490)	78	87	95	7	72	1997	96	-1
	Rutland		(116580)	81	87	95	6	71	2012	95	0
Thames	London	•	202828	86	92	94	1	83	1988	96	-2
	Farmoor	•	13822	95	93	98	6	64	1991	88	10
Southern	Bewl		28170	56	59	71	-15	40	2012	89	-18
	Ardingly		4685	46	60	94	-2	46	2012	100	-6
Wessex	Clatworthy++		5364	65	71	90	-8	82	1992	100	-10
	Bristol	•	(38666)	68	73	84	-8	65	1992	99	-15
South West	Colliford		28540	67	70	77	-10	57	1997	100	-23
	Roadford		34500	64	65	69	-16	35	1996	98	-29
	Wimbleball		21320	50	58	76	-19	72	1996	100	-24
	Stithians		4967	81	86	95	2	45	1992	100	-5
Welsh	Celyn & Brenig	•	131155	94	94	100	2	69	1996	99	1
	Brianne		62140	97	94	100	2	92	2004	96	4
	Big Five	•	69762	85	86	92	-4	85	1988	92	0
	Elan Valley	•	99106	91	95	100	2	88	1993	98	2
Scotland(E)	Edinburgh/Mid-Lothian	•	96518	86	85	90	-6	73	1999	100	-10
	East Lothian	•	9374	100	100	100	1	91	1990	100	0
Scotland(W)	Loch Katrine	•	110326	93	89	98	4	76	2010	95	3
	Daer		22412	91	93	100	1	94	2004	99	1
	Loch Thom		10798	96	91	100	2	90	2004	100	0
Northern Ireland	Total+	•	56800	76	74	84	-8	81	2004	99	-15
	Silent Valley	•	20634	65	59	71	-17	57	2002	98	-27

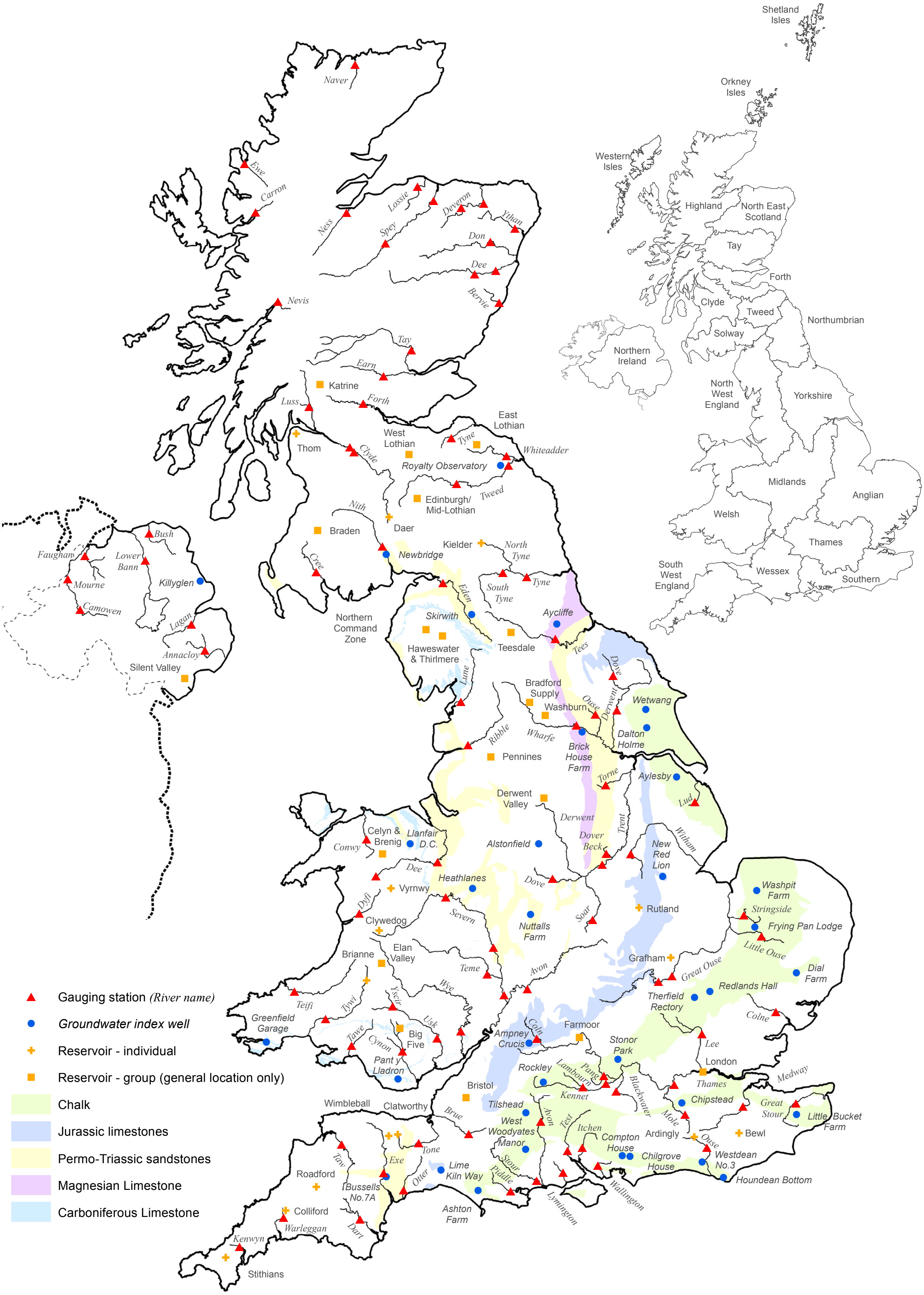
( ) figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence

\+ excludes Lough Neagh

++ last available data 20th February 2017

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.

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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