Hydrological Summary

for the United Kingdom

May 2016

General

Overall, May was a warm month with above average temperatures recorded across the country. Although the UK rainfall was near-average, there were regional differences. Parts of south-east England and south Wales saw localised thundery showers throughout May and received above-average rainfall. In contrast, rainfall was below average in northern England, south-west England and eastern Scotland, notably so in some areas. In response to the generally dry conditions in May, soil moisture deficits climbed and were near-average at month end, a contrast from the minimal deficits at the end of April. Reflecting the rainfall patterns in May, river flows were generally in the normal range, with below normal flows in south-western and northern England. Correspondingly, reservoir levels are moderately below average at some impoundments in northern and south-western England, following steep declines through May. However, overall reservoir stocks are near-average at the national scale. This, coupled with normal to above normal groundwater levels across the main aquifers, implies that the water resource outlook for the summer remains favourable.

Rainfall

A westerly air flow meant that the cold, wet conditions at the end of April continued into the start of May (81mm of rainfall was recorded on Skye on the 1st). Easterly air flows bringing warm and sunny conditions were dominant from the 5th although were accompanied by localised rainfall. A return to a westerly air flow brought unsettled conditions from the 17th-22nd; localised showers were widespread, but rain was focused in southern England, with much of the north of the UK remaining dry throughout the month. Warm settled conditions returned to all areas at month-end. Localised heavy, thundery showers were common and triggered some surface water flooding (e.g. 54mm was recorded at Wattisham, Suffolk, on the 31st, with numerous instances of surface water flooding across the south-east; South Wales experienced several surface water flooding episodes and subsequent travel disruption throughout the month). May rainfall totals were around average at the national scale (102% of average for the UK as a whole), but notable contrasts were evident regionally. Above average rainfall was recorded in western Scotland, much of East Anglia and in a band from the Thames estuary to Pembrokeshire. Large swathes of northern England and eastern Scotland, as well as south-west England, received less than 70% of average rainfall (50% of average or less in some areas). Spring (Mar-May) was dry across most of northern and western Britain, areas which were exceptionally wet during the preceding winter. Much of Scotland and northern England received less than 90% of average spring rainfall and the South West England region received 88% of average. Over this same period, much of southern England received more than 110% of average; the Thames and Anglian regions were particularly wet (133% and 132% of average, respectively).

River flows

River flows started the month at or above average in the majority of catchments in response to rainfall in late April and early May. Seasonal recessions continued to dominate the flow response as warm, dry conditions prevailed. Recessions were interrupted in most catchments mid-month which, in many cases, briefly returned flows to average or above, although flows in some responsive catchments (e.g. the Luss and Blackwater) as well as some groundwater dominated catchments (e.g. the Kennet) increased substantially above average. Recessions then continued, although were broken again at month-end in the far south-east by rapid flow responses to localised heavy rainfall (e.g. the Mole, Ouse and Colne). Flows in Wales were more variable, responding to the more unsettled conditions throughout the month although flows were still, for the most part, below average. New daily minimum flows for May were established on the Eden for 19 days from the 10th, illustrating the prolonged nature of the dry conditions in this responsive north-west catchment. For May overall, flows were in the normal range for the majority of catchments, although there were pockets of above average flows in central southern England (notably so on the Itchen) and below average flows in northern and south-western England (including notably low flows on the Eden and the Tone). National outflows for Great Britain were below average for much of May although peaked just above average at the start and middle of May in response to the wetter conditions. Over the spring (Mar-May), average flows showed a similar regional pattern, although below normal flows in south-western and northern England were less pronounced, with above normal flows more widespread across the south-east of England.

Groundwater

Groundwater levels remained average or slightly above for May, except in northern England and southern Scotland where levels were still notably high in response to winter rainfall. In the Chalk, levels were in the normal range or above at all the index boreholes except Dial Farm. Levels generally fell across the English Chalk; apart from in the slower responding Chalk (e.g. Aylesby, Stonor Park, Therfield Rectory and Dial Farm) where small amounts of recharge were recorded. In Yorkshire, levels at Wetwang fell from notably high at the end of April to above normal at the end of May. Throughout the Permo-Triassic sandstones, levels continued to fall or were stable, with the exception of small rises at Heathlanes and Nuttalls Farm. Levels in south-west England, the Midlands and north Wales remained in the normal range or just above, but at Skirwith and Newbridge were notably high for the time of year. In the Jurassic limestones, levels fell and remained in the normal range at New Red Lion and above normal at Ampney Crucis. Levels remained well above average in the Magnesian Limestone. Levels fell overall in the Carboniferous Limestone during May at Greenfield Garage and Alstonefield, but rose at Pant y Lladron; however all three sites remained within the normal range for the month.

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

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

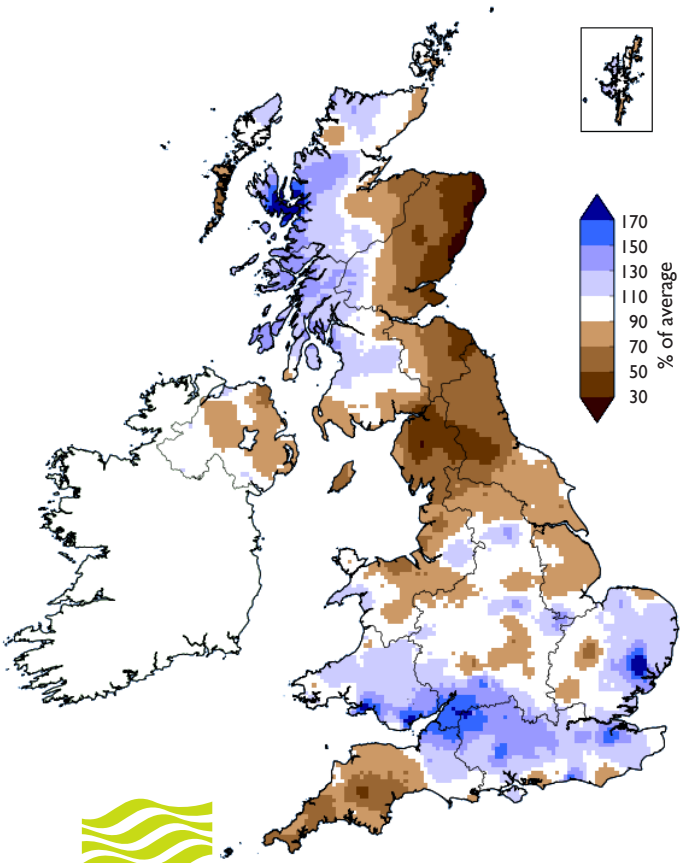
Region	Rainfall	May 2016	Apr16 – May16	RP	Mar16 – May16	RP	Dec15 – May16	RP	Jun15 – May16	RP
United Kingdom	mm	**64**	146		233		751		1318	
	%	**102**	113	2-5	105	2-5	139	>100	122	30-50
England	mm	**52**	119		202		539		976	
	%	**96**	108	2-5	115	2-5	134	20-35	120	5-10
Scotland	mm	**79**	183		270		1027		1772	
	%	**108**	119	2-5	95	2-5	141	>100	123	30-50
Wales	mm	**88**	178		296		1049		1742	
	%	**116**	113	2-5	109	2-5	152	>100	128	25-40
Northern Ireland	mm	**61**	143		216		723		1315	
	%	**90**	103	2-5	93	2-5	131	>100	119	25-40
England & Wales	mm	**57**	127		215		610		1082	
	%	**99**	109	2-5	114	2-5	138	40-60	122	8-12
North West	mm	**47**	146		231		906		1536	
	%	**71**	109	2-5	99	2-5	159	>>100	132	40-60
Northumbria	mm	**33**	118		171		643		1128	
	%	**56**	100	2-5	92	2-5	156	>>100	137	50-80
Severn-Trent	mm	**54**	124		206		490		866	
	%	**101**	114	2-5	123	5-10	131	15-25	115	2-5
Yorkshire	mm	**47**	126		222		600		1077	
	%	**86**	112	2-5	123	5-10	147	70-100	134	20-30
Anglian	mm	**49**	108		180		337		667	
	%	**106**	119	2-5	132	5-10	119	5-10	111	2-5
Thames	mm	**65**	125		211		439		787	
	%	**122**	120	2-5	133	5-10	128	8-12	113	2-5
Southern	mm	**59**	110		192		479		900	
	%	**119**	108	2-5	119	2-5	125	5-10	117	2-5
Wessex	mm	**72**	122		222		546		984	
	%	**128**	109	2-5	122	5-10	124	5-10	115	2-5
South West	mm	**50**	103		208		725		1363	
	%	**73**	73	5-10	88	2-5	115	5-10	114	5-10
Welsh	mm	**87**	173		288		1004		1668	
	%	**117**	113	2-5	109	2-5	151	>100	127	20-35
Highland	mm	**103**	213		321		1138		1928	
	%	**131**	125	2-5	96	2-5	130	10-20	112	5-10
North East	mm	**39**	140		196		696		1197	
	%	**62**	110	2-5	96	2-5	152	>>100	126	10-20
Tay	mm	**61**	154		214		1010		1744	
	%	**83**	109	2-5	83	2-5	153	>100	138	>100
Forth	mm	**59**	146		195		863		1512	
	%	**88**	114	2-5	84	2-5	151	>100	134	>100
Tweed	mm	**46**	132		188		814		1370	
	%	**71**	105	2-5	91	2-5	170	>>100	145	>100
Solway	mm	**71**	188		275		1142		1926	
	%	**94**	121	2-5	99	2-5	163	>>100	138	>100
Clyde	mm	**103**	219		323		1221		2175	
	%	**130**	129	2-5	98	2-5	141	70-100	126	40-60

% = percentage of 1971-2000 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 2016 are provisional.

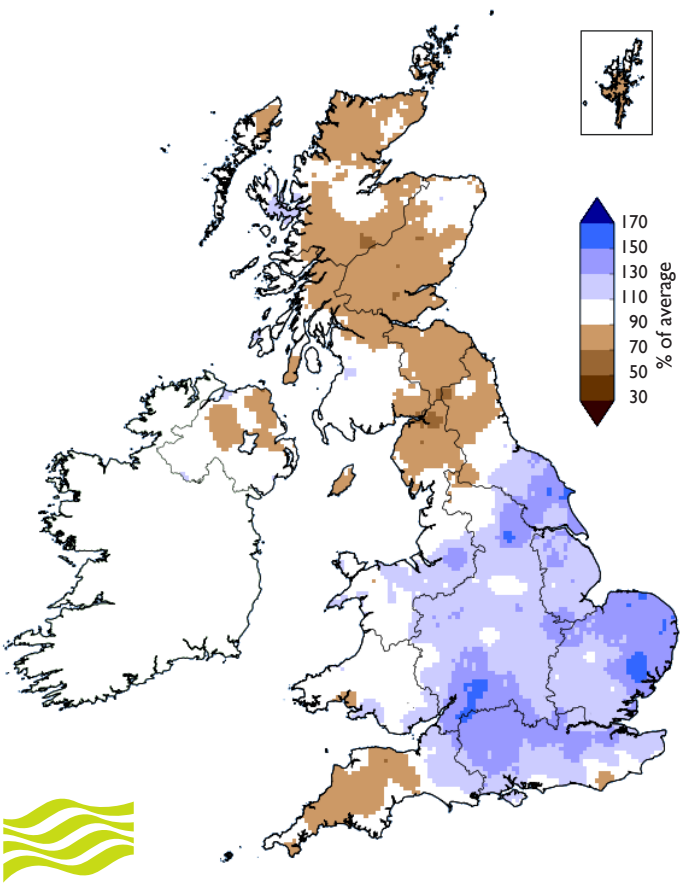
Rainfall . . . Rainfall . . .

May 2016 rainfall
as % of 1971-2000 average



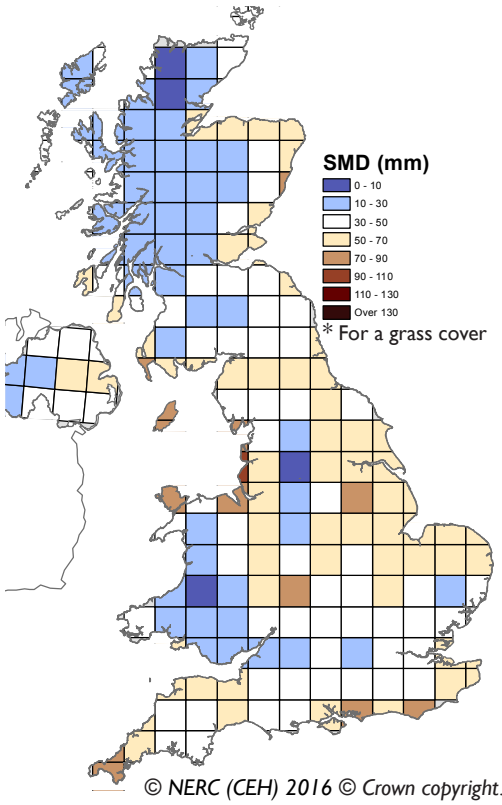
Met Office

March 2016 - May 2016 rainfall
as % of 1971-2000 average



Met Office

MORECS Soil Moisture Deficits*
May 2016



Met Office

Met Office
3-month outlook
Updated: May 2016

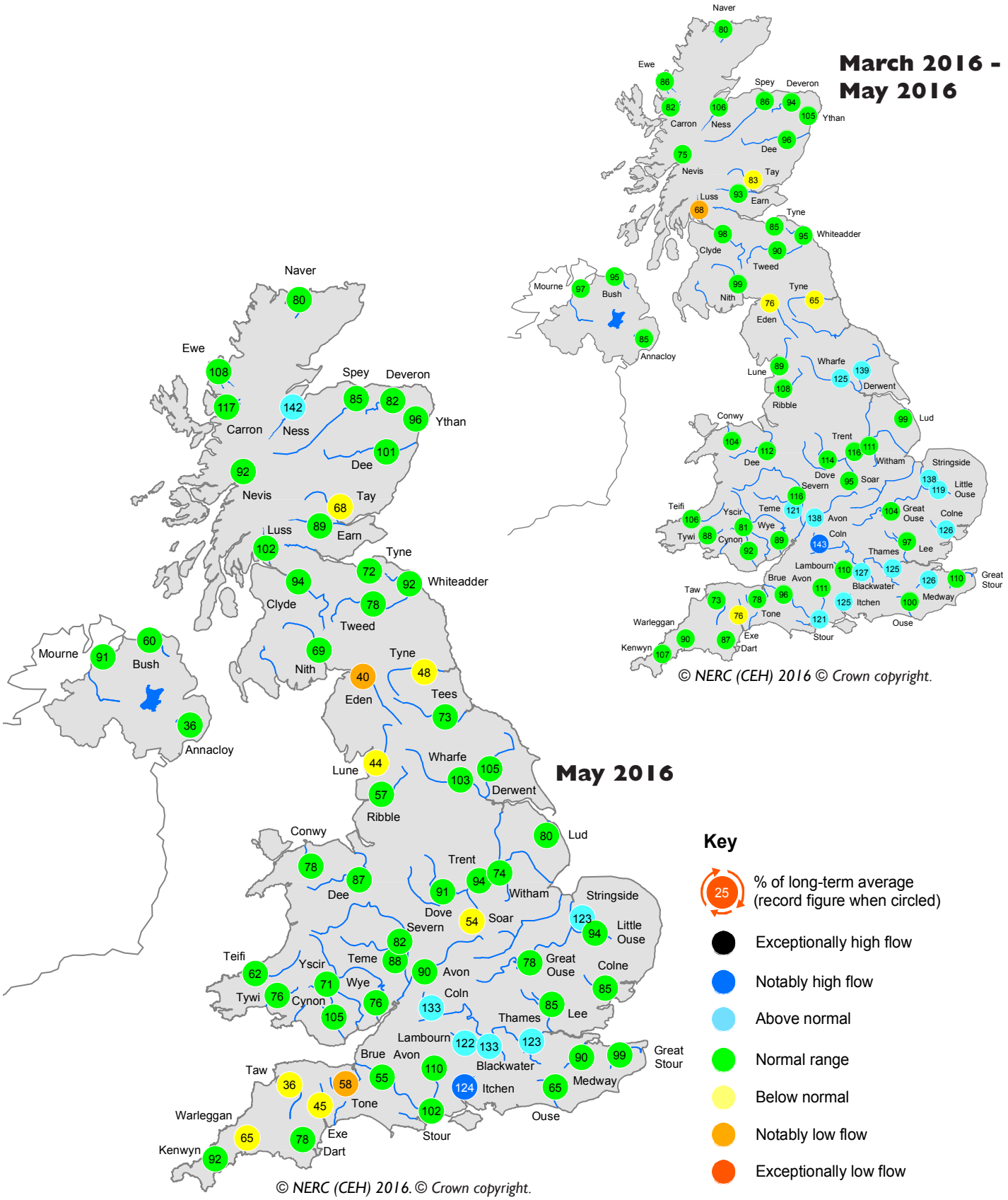
For June-July-August as a whole, the forecast for UK precipitation suggests that the chances of above- and below-average rainfall are fairly balanced. There are only relatively weak influences acting to modify the likelihood of above- and below-normal from what would normally be expected.

The probability that UK precipitation for June-July-August will fall into the driest of our five categories is around 20% and the probability that it will fall into the wettest of our five categories is also around 20% (the 1981-2010 probability for each of these categories is 20%).

The complete version of the 3-month outlook may be found at:
http://www.metoffice.gov.uk/publicsector/contingency-planners
This outlook is updated towards the end of each calendar month.

The latest shorter-range forecasts, covering the upcoming 30 days, can be accessed via:
http://www.metoffice.gov.uk/weather/uk/uk_forecast_weather.html
These forecasts are updated very frequently.

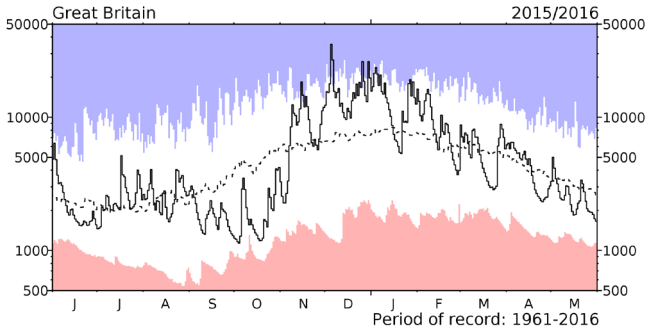
River flow . . . River flow . . .

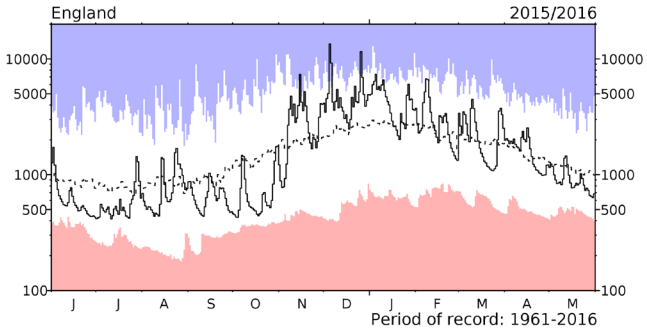


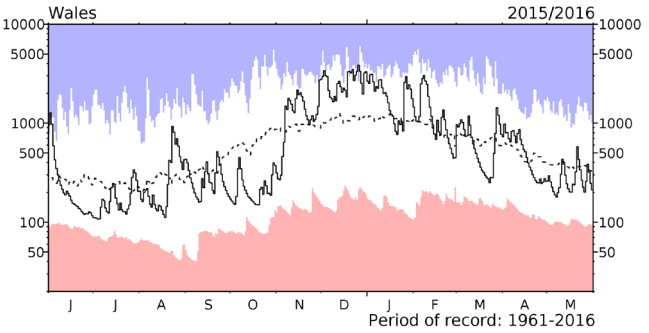
River flows

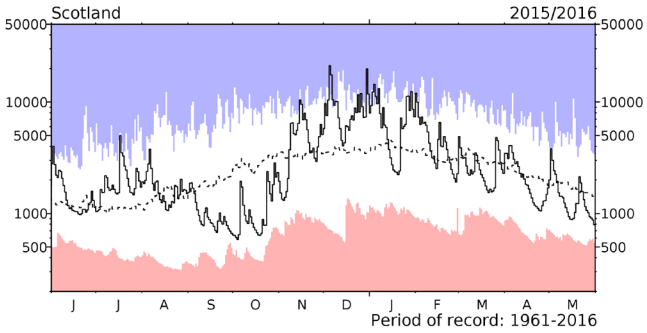
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

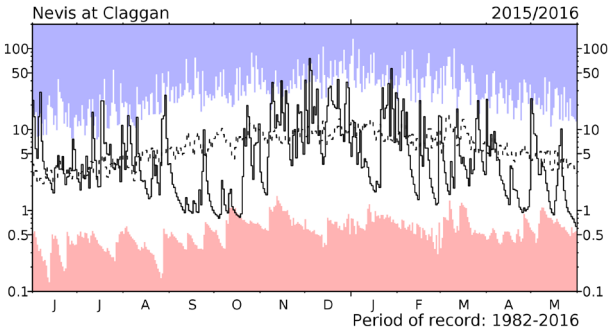
River flow . . . River flow . . .

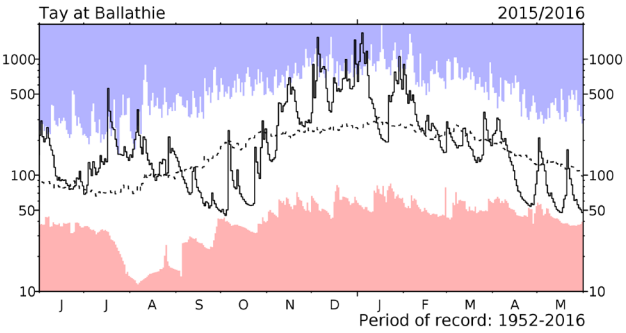


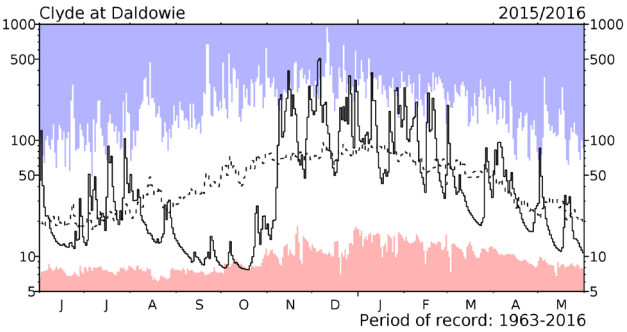


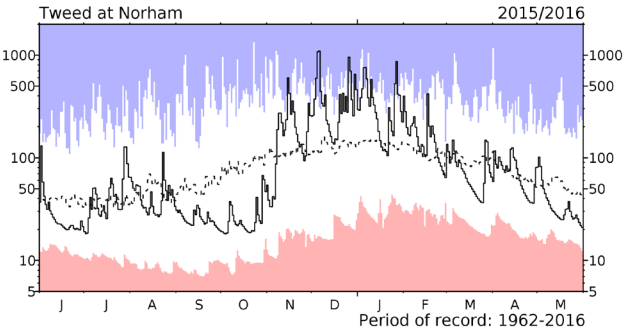


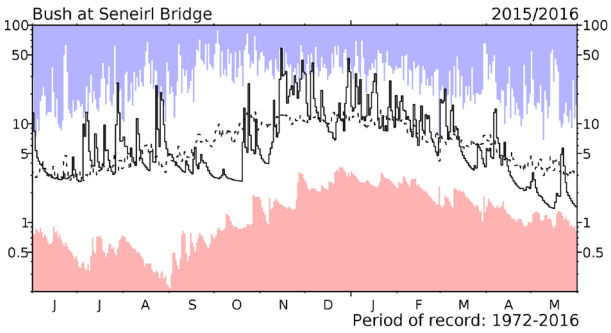


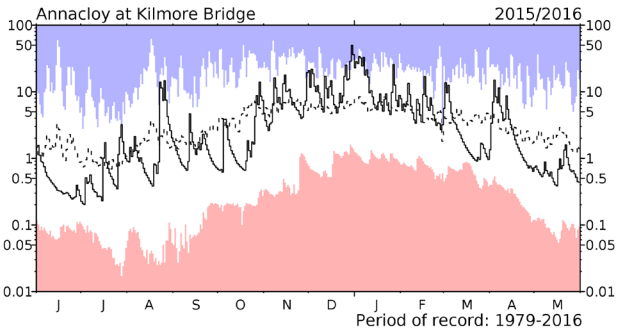








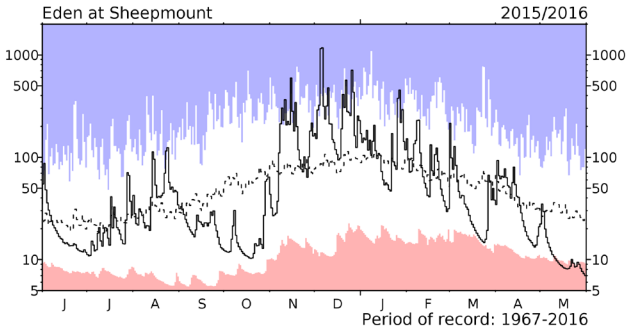


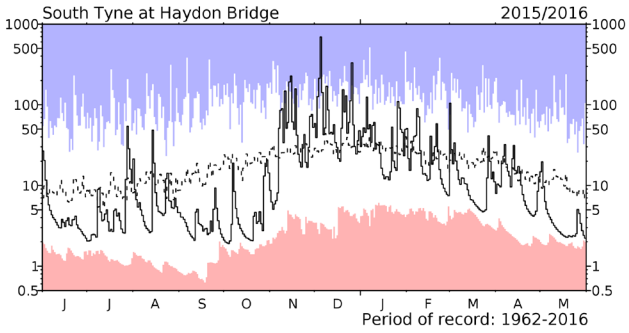


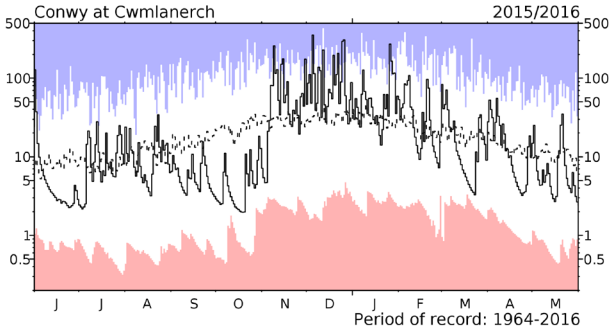
River flow hydrographs

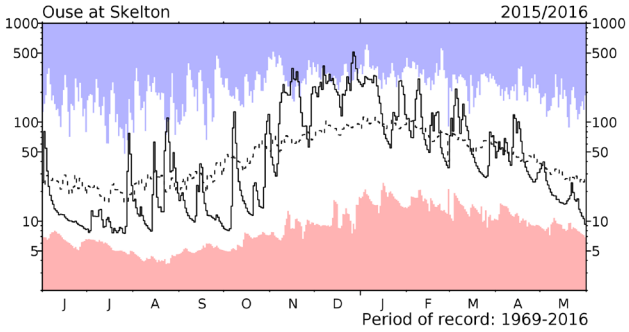
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to June 2015 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed line.

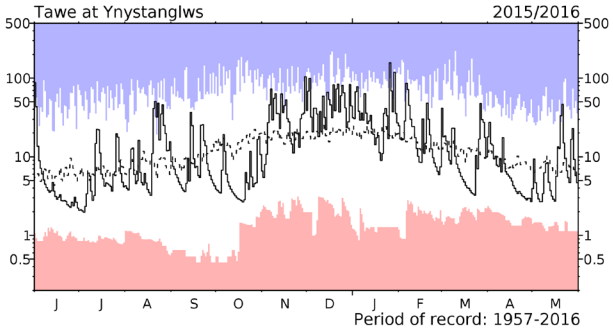
River flow . . . River flow . . .

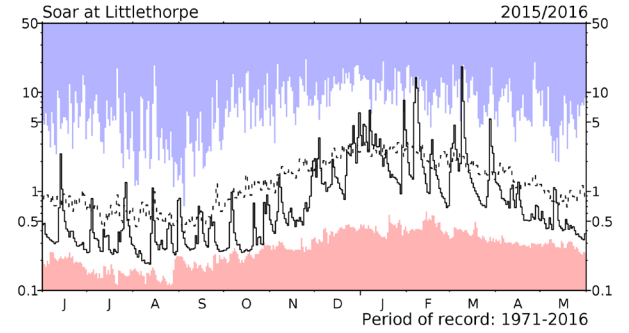


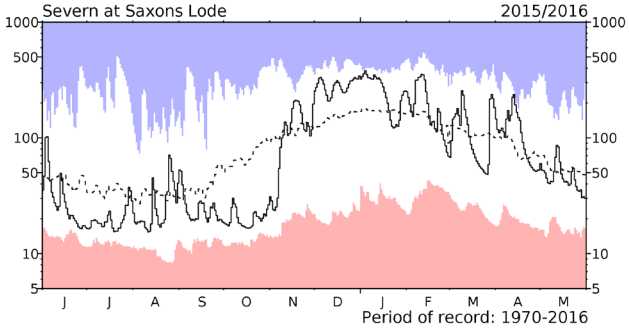


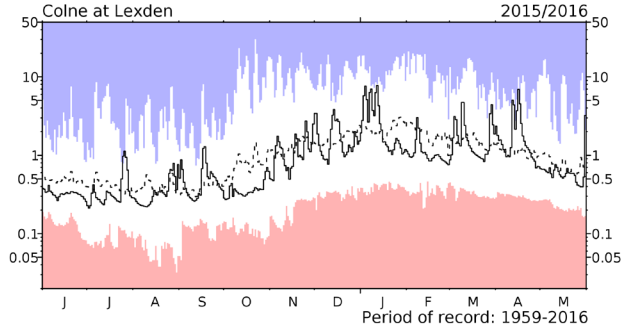


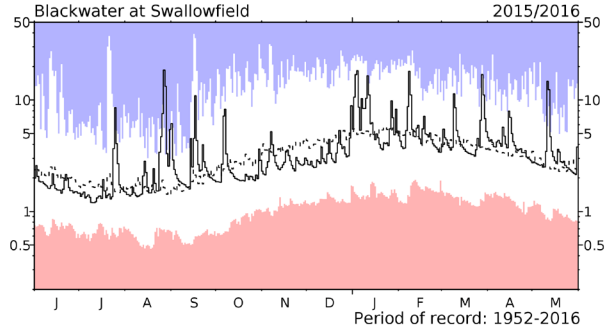


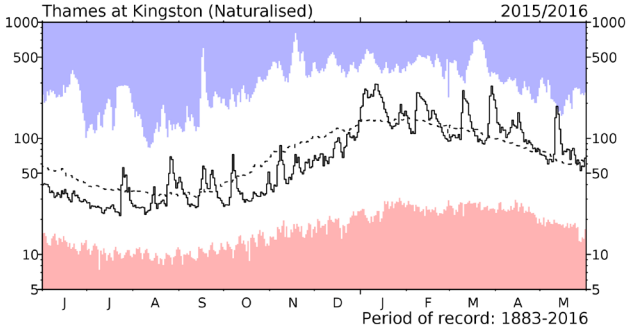


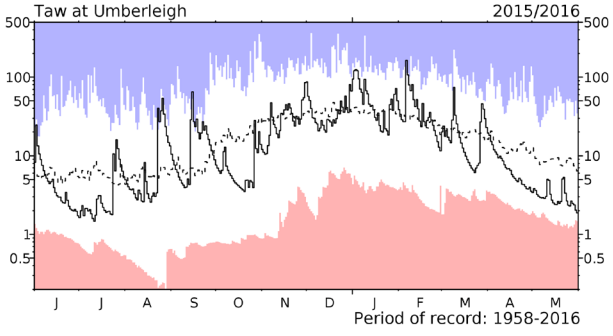


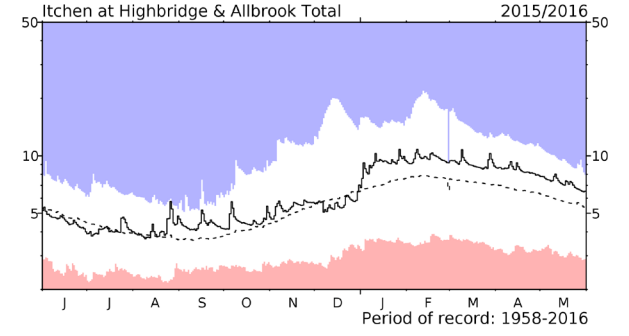




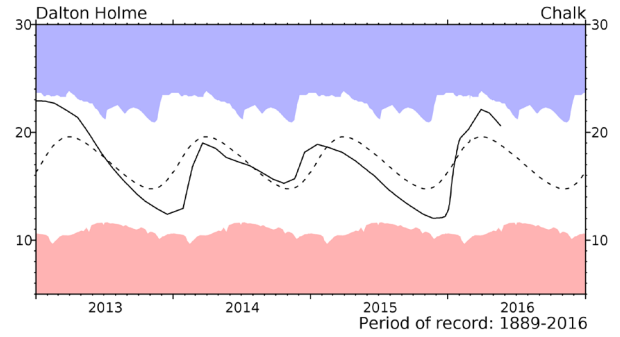


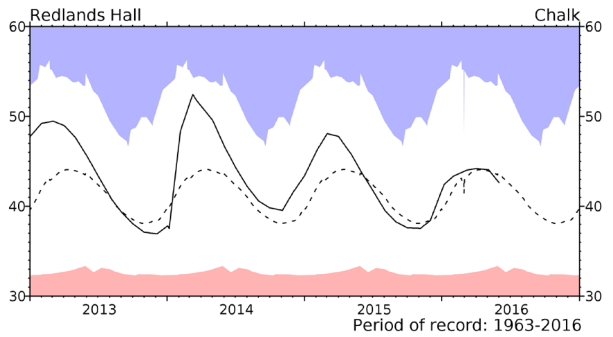


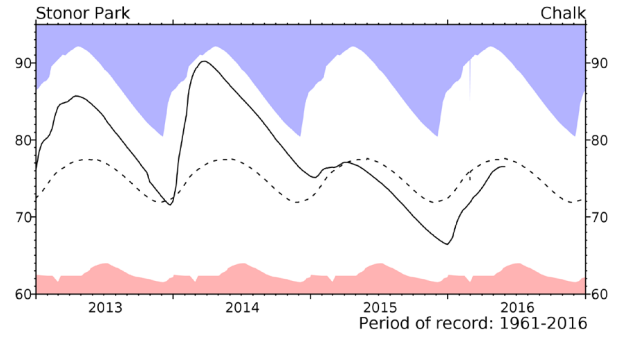


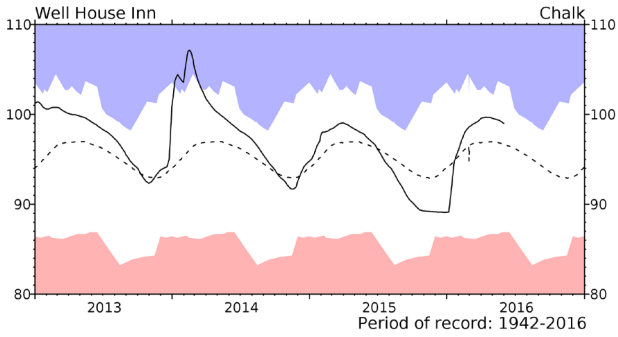


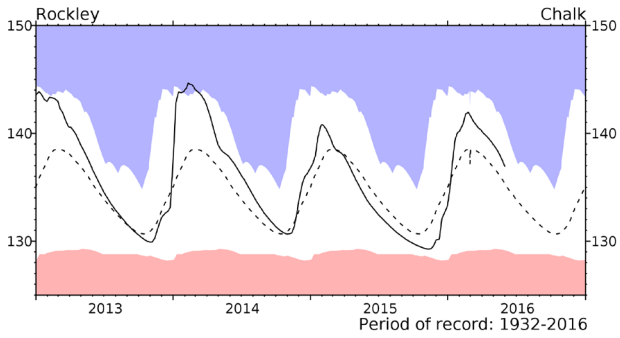
Groundwater…Groundwater

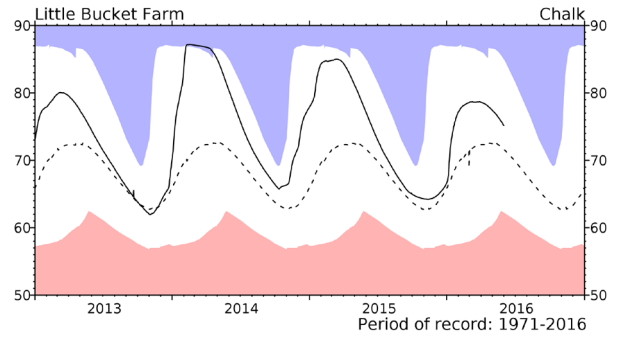


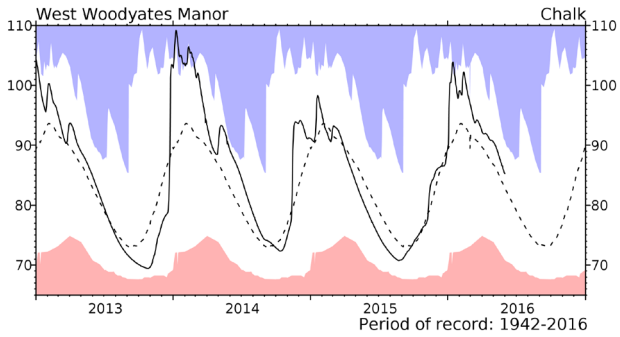


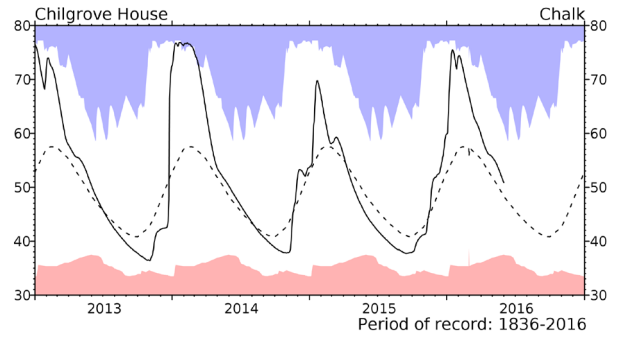


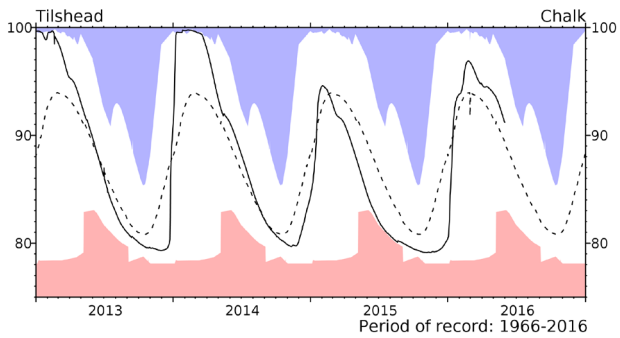


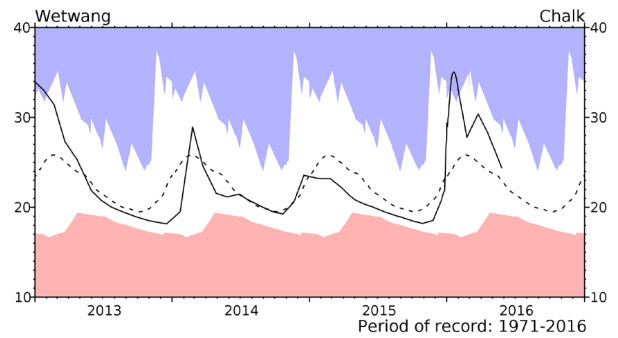






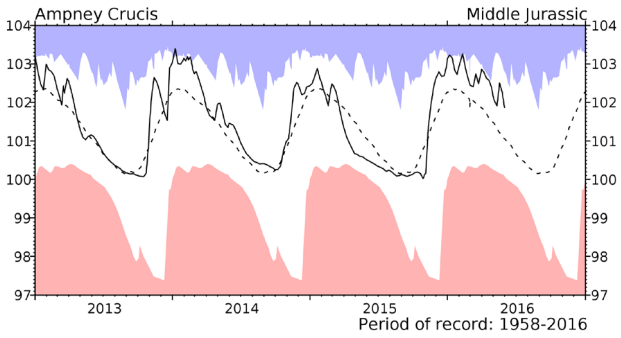


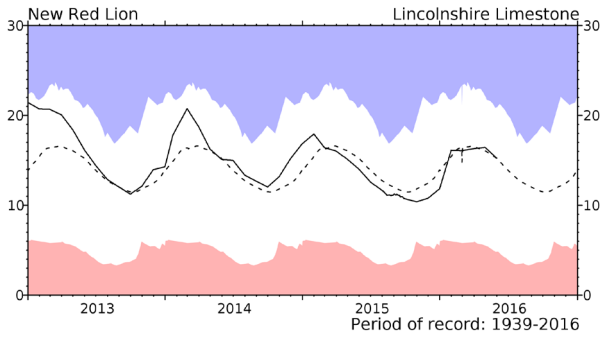


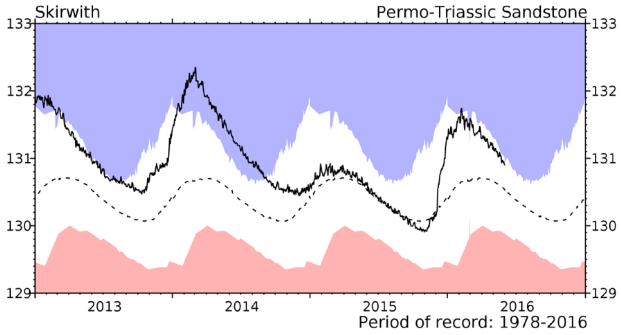


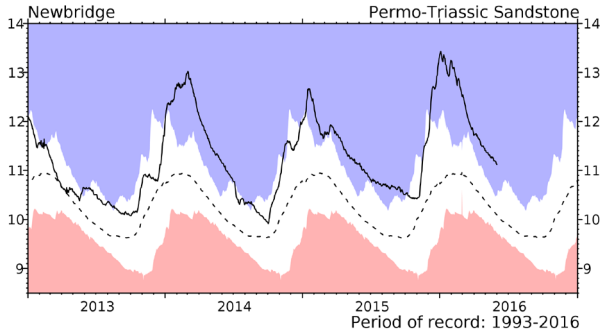
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined 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. The latest recorded levels are listed overleaf.

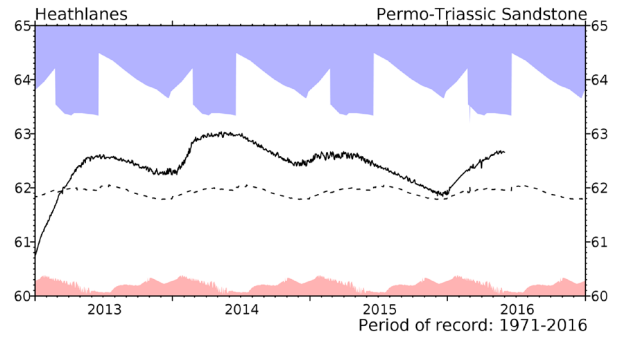
Groundwater ... Groundwater

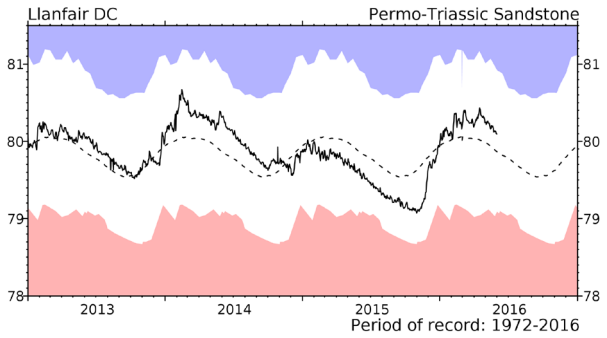


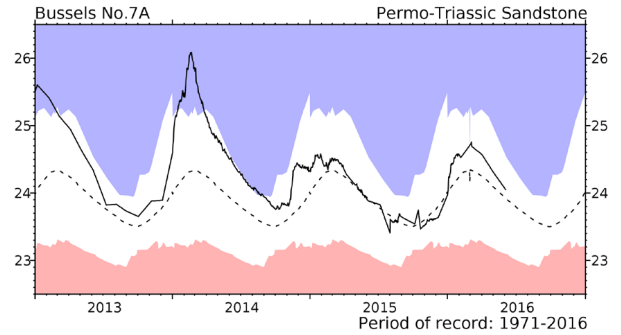


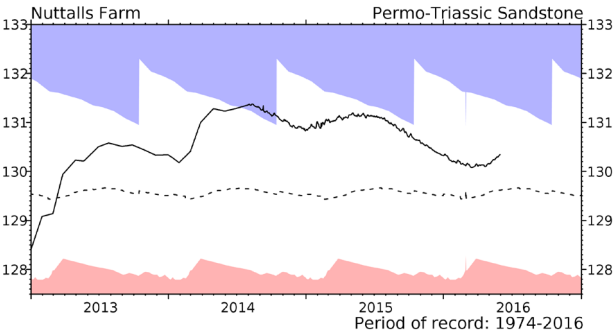


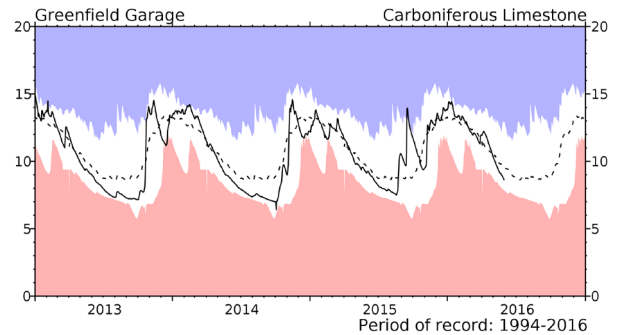


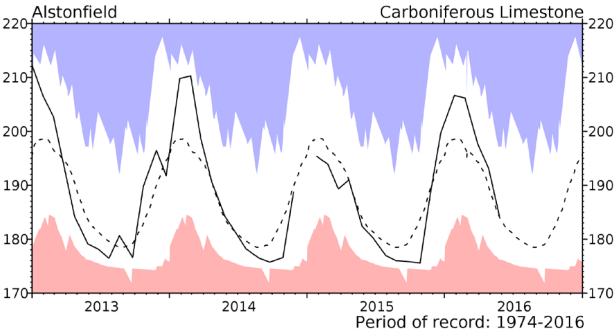








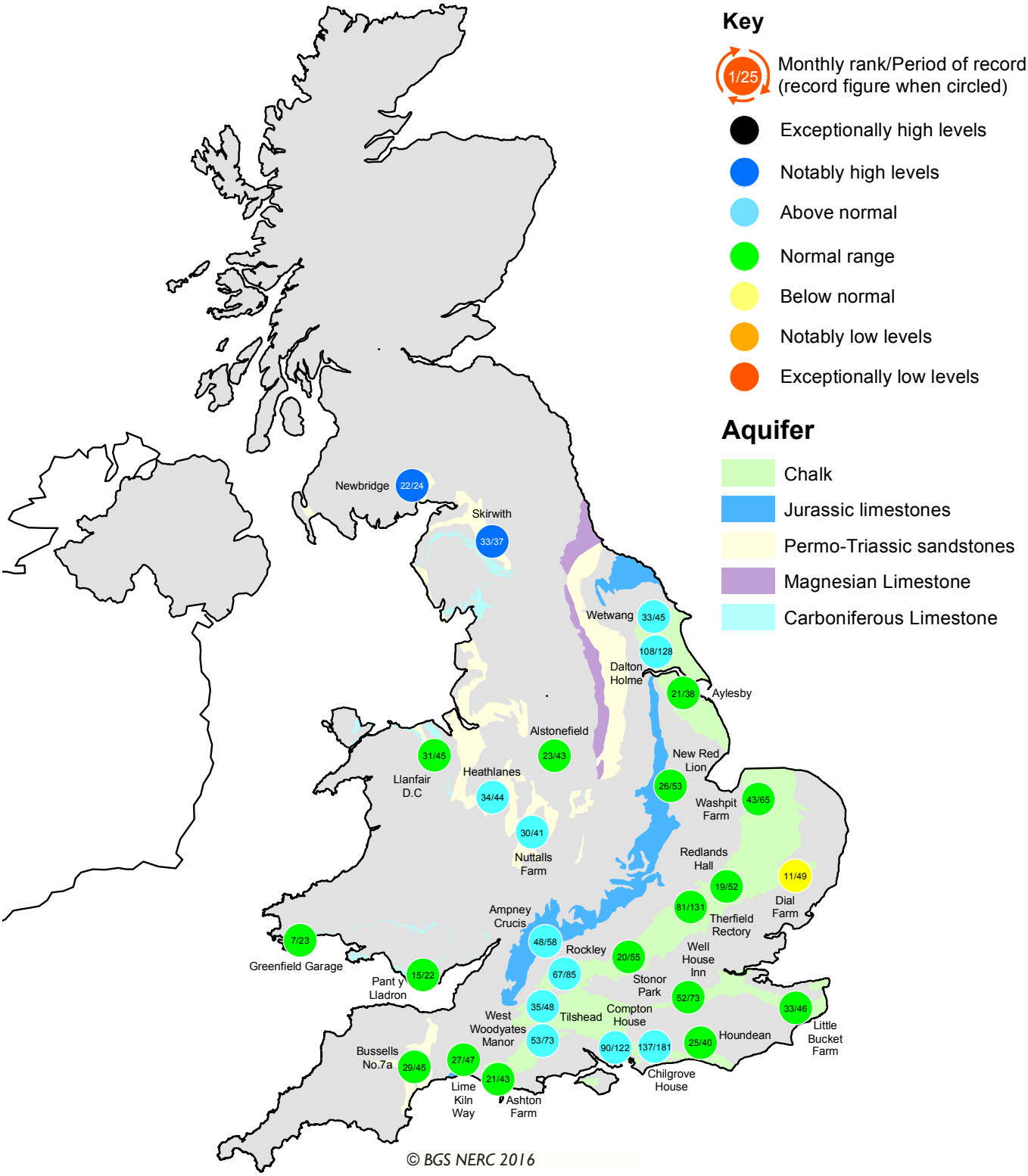




Groundwater levels May / June 2016

Borehole	Level	Date	May av.	Borehole	Level	Date	May av.	Borehole	Level	Date	May av.
Dalton Holme	20.61	20/05	18.92	Chilgrove House	50.75	31/05	49.05	Greenfield Garage	8.62	30/05	9.93
Therfield Rectory	84.19	02/06	81.78	Little Bucket Farm	75.16	31/05	72.76	Llanfair DC	80.09	31/05	79.96
Stonor Park	76.55	31/05	77.93	Wetwang	24.65	26/05	23.33	Heathlanes	62.66	31/05	62.02
Tilshead	91.17	31/05	89.92	Ampney Crucis	101.87	31/05	101.24	Nuttalls Farm	130.34	30/05	129.69
Rockley	136.95	31/05	136.17	New Red Lion	15.22	31/05	15.58	Bussells No.7a	24.05	03/06	24.03
Well House Inn	99.00	31/05	97.00	Skirwith	130.89	31/05	130.66	Alstonefield	184.39	25/05	185.68
West Woodyates	85.26	31/05	84.72	Newbridge	11.12	31/05	10.34				

Levels in metres above Ordnance Datum

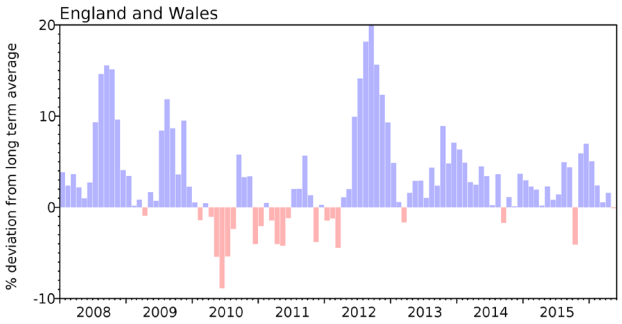


Groundwater levels - May 2016

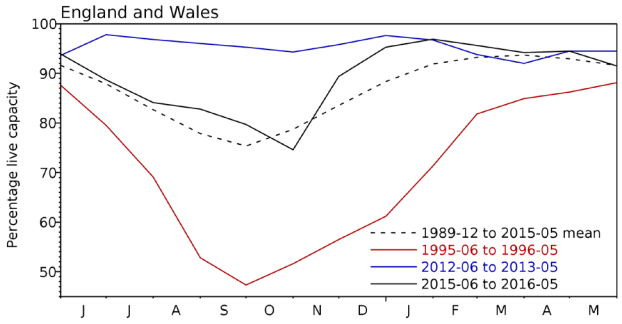
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Mar	2016 Apr	2016 May	May Anom.	Min May	Year* of min	2015 May	Diff 16-15
North West	N Command Zone	•	124929	90	85	74	-8	50	1984	90	-17
	Vyrnwy		55146	99	98	96	8	69	1984	98	-2
Northumbrian	Teesdale	•	87936	86	91	80	-7	64	1991	96	-16
	Kielder		(199175)	86	89	90	-2	85	1989	91	-1
Severn-Trent	Clywedog		44922	98	99	100	3	83	1989	100	0
	Derwent Valley	•	39525	100	99	95	6	56	1996	96	-1
Yorkshire	Washburn	•	22035	95	91	84	-3	72	1990	82	2
	Bradford Supply	•	41407	95	93	82	-5	70	1996	94	-13
Anglian	Grafham		(55490)	96	95	93	-1	72	1997	96	-3
	Rutland		(116580)	95	93	94	2	75	1997	93	0
Thames	London	•	202828	93	97	97	3	83	1990	92	4
	Farmoor	•	13822	82	98	98	1	90	2002	95	3
Southern	Bewl		28170	100	96	94	6	57	1990	89	5
	Ardingly		4685	95	100	100	1	89	2012	100	0
Wessex	Clatworthy		5364	100	90	79	-7	67	1990	82	-3
	Bristol	•	(38666)	99	99	94	5	70	1990	90	4
South West	Colliford		28540	100	99	96	10	52	1997	88	7
	Roadford		34500	96	93	89	6	48	1996	90	-1
	Wimbleball		21320	100	98	90	-2	74	2011	92	-2
	Stithians		4967	100	99	91	5	66	1990	95	-4
Welsh	Celyn & Brenig	•	131155	100	100	100	2	82	1996	100	-1
	Brianne		62140	98	99	97	1	84	2011	100	-3
	Big Five	•	69762	97	94	95	5	70	1990	92	3
	Elan Valley	•	99106	99	99	93	-1	81	2011	99	-6
Scotland(E)	Edinburgh/Mid-Lothian	•	96518	100	98	94	3	52	1998	95	-1
	East Lothian	•	9374	100	100	99	2	84	1990	100	-1
Scotland(W)	Loch Katrine	•	110326	95	88	87	0	66	2001	92	-5
	Daer		22412	94	89	84	-7	70	1994	97	-13
	Loch Thom	•	10798	100	100	100	8	74	2001	100	0
Northern Ireland	Total+	•	56800	95	93	86	1	69	2008	93	-6
	Silent Valley	•	20634	94	94	87	6	56	2000	95	-8

( ) 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 1971-2000 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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iii. Met Office rainfall data. © Crown copyright.