Hydrological Summary

for the United Kingdom

General

For most of the UK, June was a quiet month in hydrological terms. North-west Scotland was cool, unsettled and very wet at times but elsewhere, despite a very unsettled start and some thundery outbreaks, most of the month saw a good deal of fine summer weather. Overall, June was dry, especially in parts of south-east England, and sunnier than average. Monthly average temperatures were fairly typical for June but it was slightly warmer than average in the far south-east and there were some warm spells, with heatwave conditions developing through the final days and extending into early July. As expected for the time of year, soil moisture deficits (SMDs) climbed steeply and, correspondingly, the seasonal recession of river flows and groundwater levels continued, leading to some notably low late June river flows. Across most of England the year so far has seen below-average rainfall, particularly in parts of central southern England and along the east coast, and this is reflected in moderate runoff deficiencies and below-normal groundwater levels. However, the water resources situation remains favourable for the summer, with reservoir stocks just above-average at the national scale (partly reflecting the wet May) and moderately below at some impoundments in southern England. The current river flow and groundwater situation is unlikely to change substantially over the next few months, implying notably low flows and levels in some areas in early autumn, which could signal a delay in the onset of the recharge season.

June 2015

Rainfall

Summer got off to a very unsettled start, with the first few days of June dominated by an unseasonably deep low pressure system centered off western Scotland, bringing strong (occasionally gale-force) winds and persistent and sometimes heavy rainfall, particularly in the west (including 64mm at Rest-and-be-Thankful in Argyll on the 1st). Few impacts were reported although localised flash flooding on roads was reported in south Wales. For Scotland, much of June remained unsettled (albeit with some summery interludes) due to the prevalent westerly or north-westerly flow, which brought persistent rainfall to the northern and western Highlands and islands especially. Elsewhere, more settled conditions ensued as high pressure became established, bringing some long periods of sunshine and warmth, albeit with thundery outbreaks and a more unsettled spell mid-month – persistent showers combined with convective downpours in parts of central England on the 12th, led to 39mm at Nottingham. At the national scale, June was dry for England (56% of the typical June rainfall), Wales and Northern Ireland, but saw moderately above-average rainfall for Scotland. South-east England was particularly dry, with London and large areas of East Anglia receiving less than a third of the typical June rainfall. In contrast, localised parts of the western Highlands received >150% of average and Orkney registered its wettest June on record (following on from the record May rainfall recorded last month). An exaggerated north-west/south-east gradient is also seen in long-term rainfall accumulations, largely reflecting the predominance of westerly airflows since December. Western Scotland has seen exceptionally high rainfall, while rain-shadowed parts of the east coast have been very dry. Below-normal rainfall is also apparent across southern Britain, with notable deficiencies since early spring (all regions in south-east England have seen <70% rainfall over this period).

River flows

The heavy rainfall at the turn of the month triggered brisk flow responses across the north and west, leading to flood alerts in a number of catchments in Wales and north-west England. New peak flow maxima for June were registered in a few catchments in Wales (e.g. the Tawe, in a record from 1958) and on the Nith, south-west Scotland (in a record from 1957). There were further, modest increases in flow late in the month in northern Scotland, but in responsive northern and western catchments June was generally characterised by steep recessions after the peak of the first few days. Across the English Lowlands, the seasonal recessions established since late winter continued and were largely uninterrupted in June, except for a minor peak mid-month in central England (e.g. on the Trent and Warwickshire Avon). June runoff totals were above average in north-west Scotland (substantially in some catchments, with the Nevis approaching double the June average) and a few catchments in Wales affected by the early June spate. Runoff was below normal in central southern England and some eastern catchments, and notably low in several cases (e.g. the Great Ouse and Whiteadder with <55% of average). Notably low runoff accumulations can be seen from March in Wessex (the Brue and the Tone), while runoff has been moderately below average across southern Britain since the start of 2015. Over this timeframe, notable runoff deficiencies are apparent in small catchments along the east coast. It was the third lowest January-June runoff for the Whiteadder, south-east Scotland, in a record from 1969; by contrast, the Mourne, Northern Ireland, registered its highest runoff in a record from 1982, illustrating the west-east gradient over this period.

Groundwater

With dry conditions over the main outcrop areas, particularly in the far south-east, and some notably warm spells later in the month, by the end of the month SMDs climbed to well above the average for late June. Correspondingly, groundwater levels in all indicator wells fell during June as would be expected at this time of year, when any rainfall is likely to be lost as evapotranspiration. In the Chalk the pattern established in recent months continued. Levels were above normal for the time of year at Little Bucket Farm (Kent), but generally levels were normal or below, with below normal levels in western parts of the aquifer (Wessex and western parts of the South Downs) and parts of East Anglia and Yorkshire. Ashton Farm in Wessex recorded its fifth lowest June average level in a 42 year record. In the Magnesian and Jurassic limestone aquifers levels were either normal or below, and levels in the Carboniferous Limestone of South Wales and Derbyshire remained in the normal range. In the Permo-Triassic sandstones, levels were average or well above; Nuttalls Farm in the West Midlands saw exceptionally high levels while Newbridge (south-west Scotland) reached a record high for June. These aquifers respond slowly to changes in rainfall, and the latter is located in an area that has seen moderately above-average rainfall over recent months.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL
British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

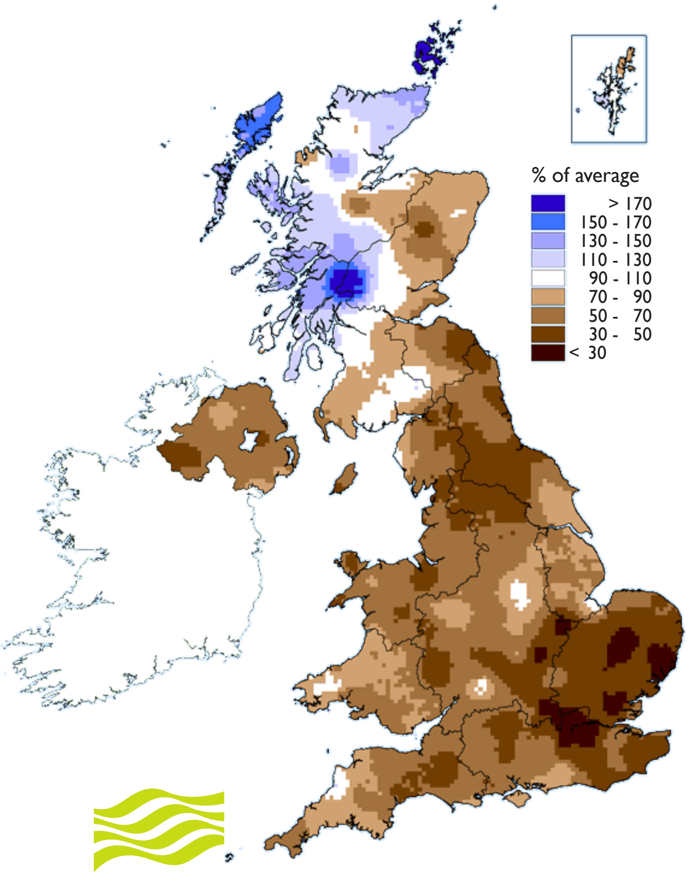
Area	Rainfall	Jun 2015	Apr15 – Jun15	RP	Jan15 – Jun15	RP	Oct14 – Jun15	RP	Jul14 – Jun15	RP
United	mm	**55**	211		539		954		1180	
Kingdom	%	**79**	106	2-5	109	5-10	114	10-20	109	2-5
England	mm	**34**	140		332		615		789	
	%	**56**	81	2-5	88	2-5	98	2-5	97	2-5
Scotland	mm	**91**	320		865		1472		1788	
	%	**116**	138	10-20	134	30-50	132	>100	124	60-90
Wales	mm	**57**	228		600		1089		1306	
	%	**69**	95	2-5	97	2-5	102	2-5	96	2-5
Northern	mm	**44**	235		543		1000		1218	
Ireland	%	**61**	112	2-5	107	2-5	118	50-80	110	5-10
England &	mm	**38**	152		369		680		861	
Wales	%	**58**	84	2-5	90	2-5	99	2-5	97	2-5
North West	mm	**46**	231		575		998		1233	
	%	**59**	109	2-5	111	2-5	112	5-10	106	2-5
Northumbrian	mm	**33**	164		361		618		791	
	%	**54**	92	2-5	93	2-5	98	2-5	96	2-5
Severn-Trent	mm	**40**	139		305		561		721	
	%	**64**	81	2-5	85	2-5	98	2-5	96	2-5
Yorkshire	mm	**35**	159		334		582		770	
	%	**56**	90	2-5	87	2-5	94	2-5	95	2-5
Anglian	mm	**25**	100		213		425		591	
	%	**46**	69	5-10	76	5-10	95	2-5	99	2-5
Thames	mm	**25**	106		258		501		652	
	%	**43**	66	5-10	78	5-10	94	2-5	94	2-5
Southern	mm	**30**	111		312		640		808	
	%	**53**	70	2-5	89	2-5	106	2-5	105	2-5
Wessex	mm	**34**	127		330		623		791	
	%	**56**	74	5-10	82	2-5	93	2-5	92	2-5
South West	mm	**52**	167		485		893		1073	
	%	**72**	79	2-5	87	2-5	94	2-5	90	2-5
Welsh	mm	**55**	219		573		1039		1252	
	%	**68**	94	2-5	96	2-5	101	2-5	96	2-5
Highland	mm	**113**	381		1087		1806		2211	
	%	**126**	146	10-20	141	30-50	134	70-100	128	60-90
North East	mm	**57**	211		442		838		1155	
	%	**87**	109	2-5	102	2-5	117	5-10	122	8-12
Tay	mm	**77**	273		705		1255		1510	
	%	**111**	130	2-5	119	5-10	126	20-35	120	10-15
Forth	mm	**68**	251		656		1059		1253	
	%	**99**	127	5-10	127	10-20	122	15-25	111	5-10
Tweed	mm	**49**	204		521		930		1126	
	%	**75**	107	2-5	118	5-10	127	25-40	119	5-10
Solway	mm	**71**	289		812		1450		1685	
	%	**91**	123	2-5	130	30-50	134	>100	121	15-25
Clyde	mm	**112**	396		1093		1822		2135	
	%	**126**	153	10-20	143	80-120	137	>100	123	30-50

% = 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 from January 2015 (inclusive) are provisional.

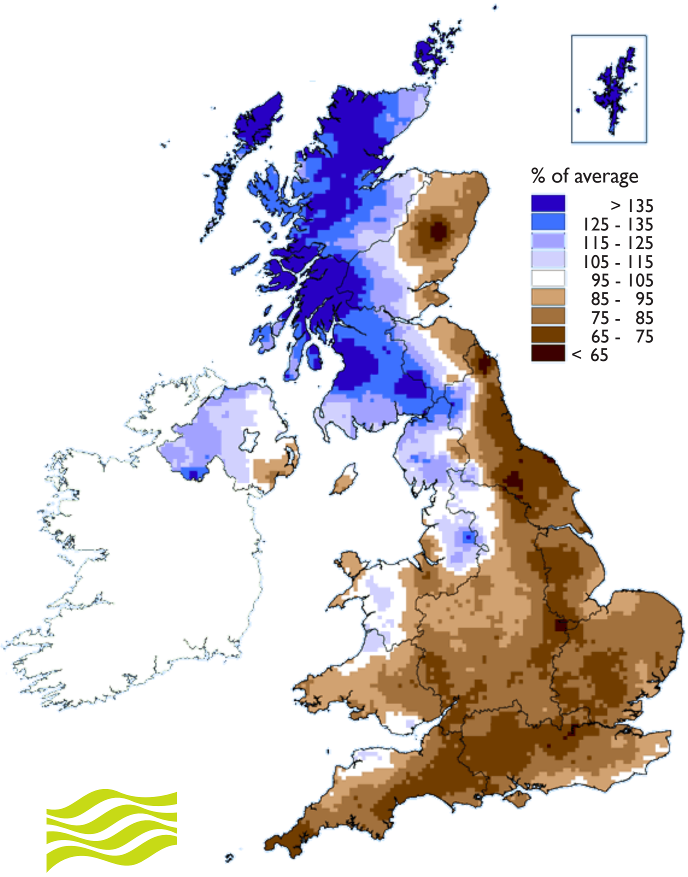
Rainfall . . . Rainfall . . .

June 2015 rainfall as % of 1971-2000 average



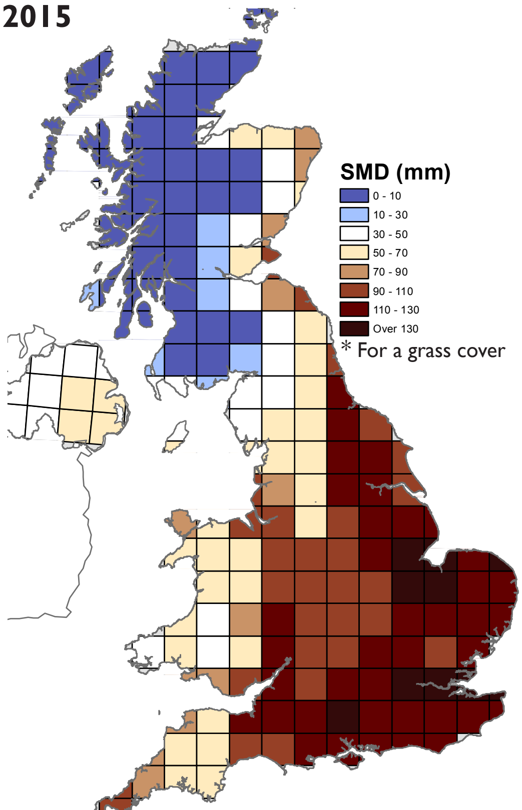
Met Office

December 2014 - June 2015 rainfall as % of 1971-2000 average



Met Office

MORECS Soil Moisture Deficits* June 2015



Met Office

Met Office 3-month outlook Updated: June 2015

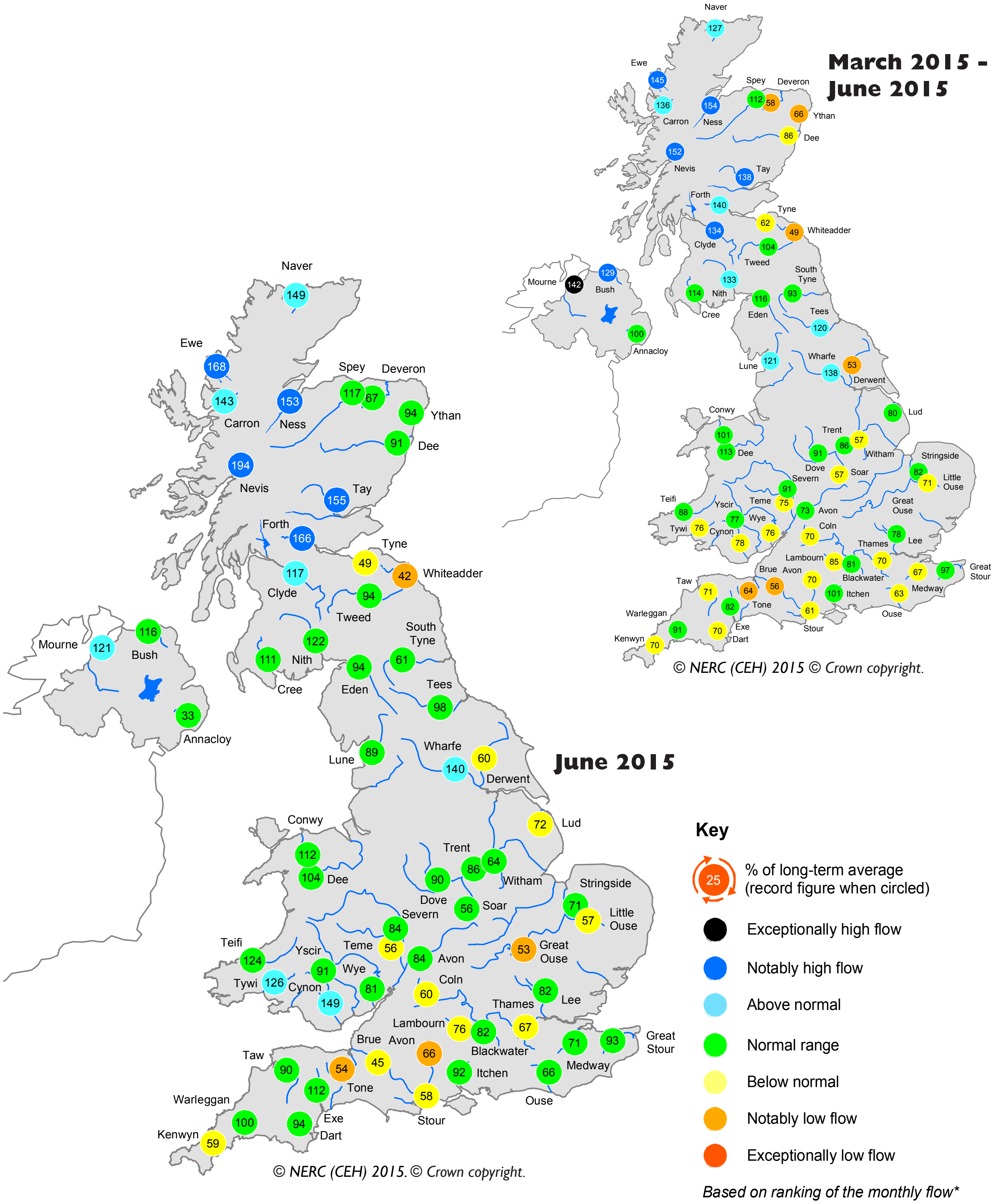
The latest predictions for UK precipitation favour near- or below-average rainfall for July-August-September as a whole.

The probability that UK precipitation for July-August-September will fall into the driest of our five categories is close to 25% and the probability that it will fall into the wettest category is approximately 15% (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.

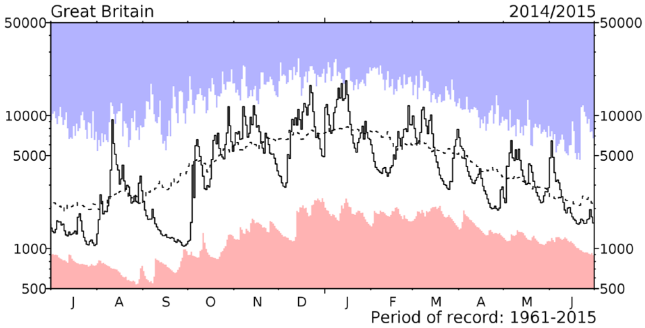
River flow . . . River flow . . .

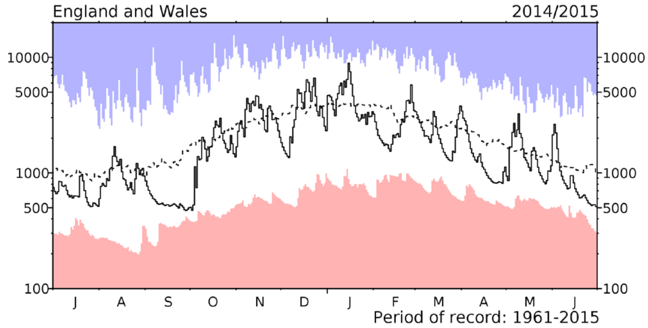


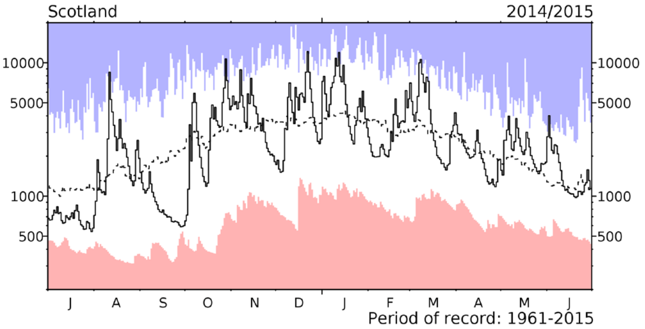
River flows

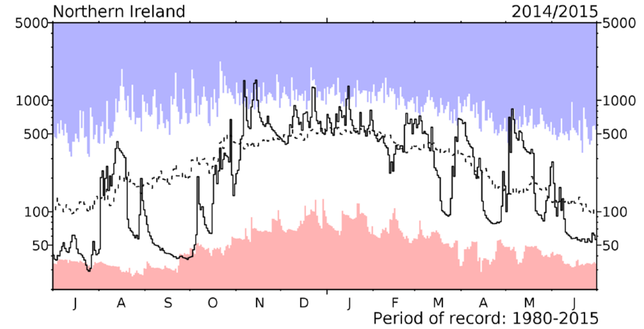
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

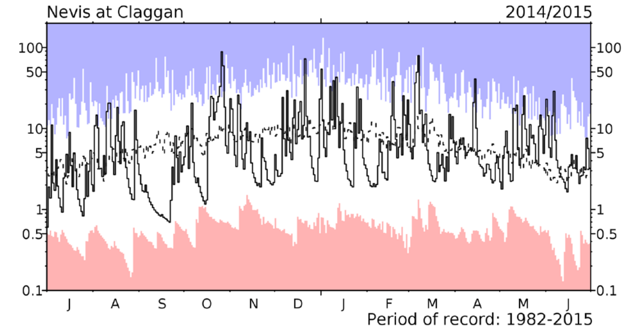
River flow . . . River flow . . .

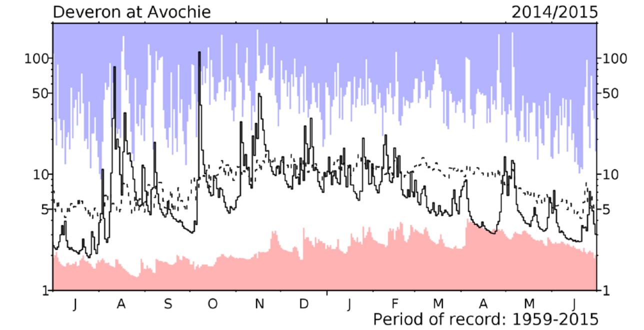


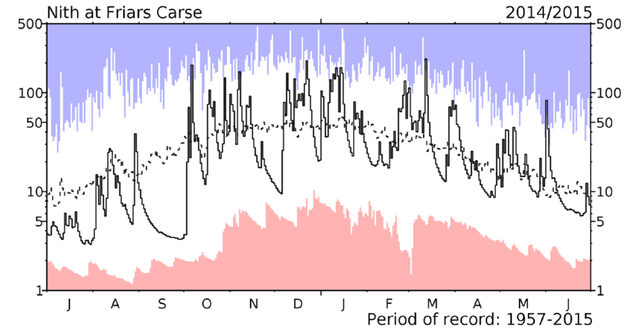


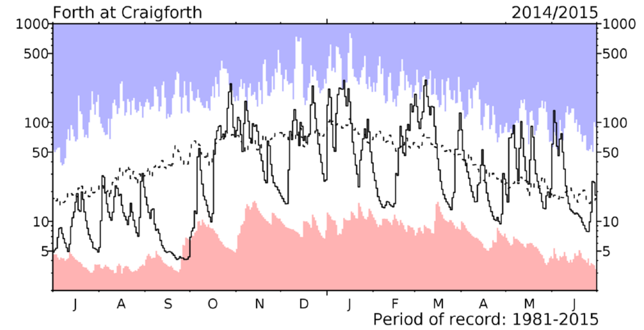


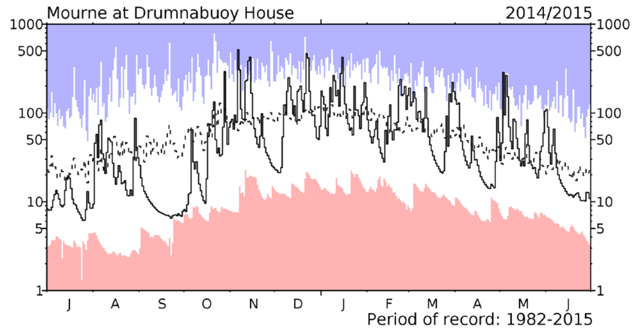


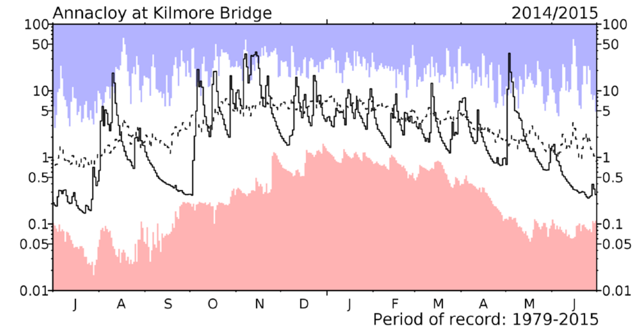








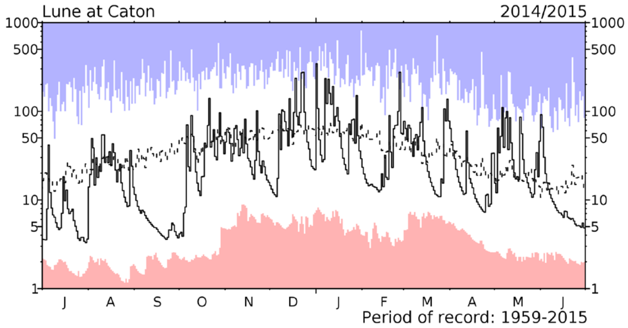


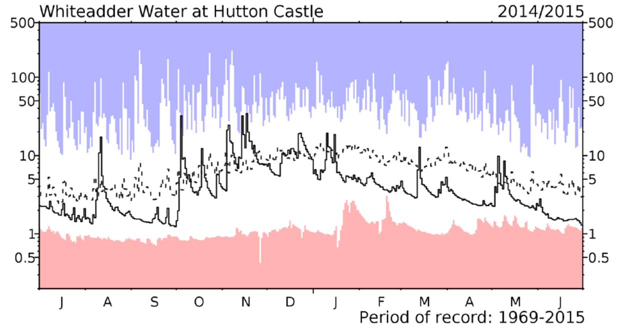


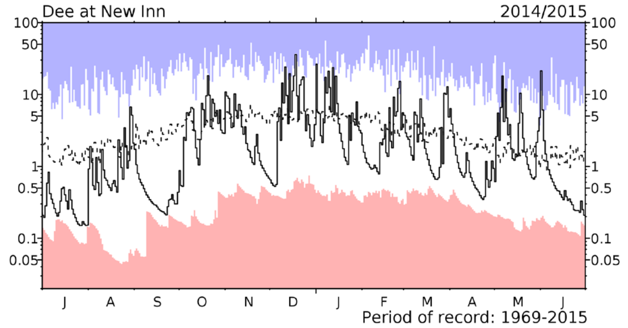
River flow hydrographs

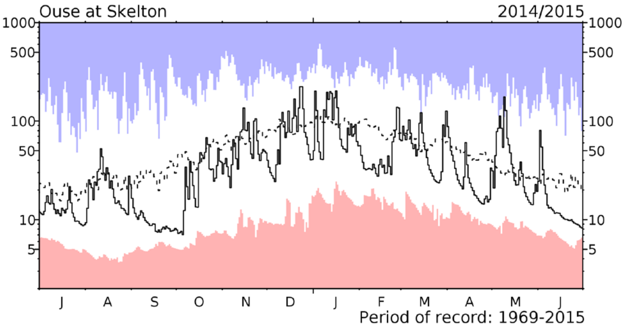
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to July 2014 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed line.

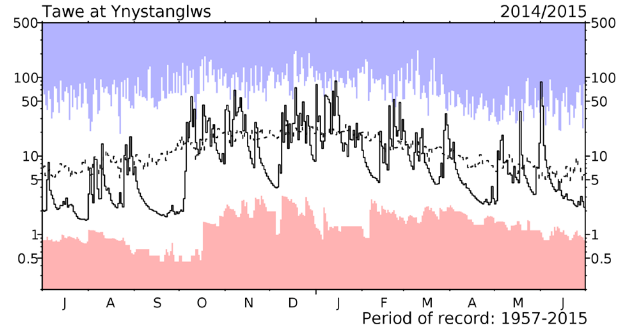
River flow . . . River flow . . .

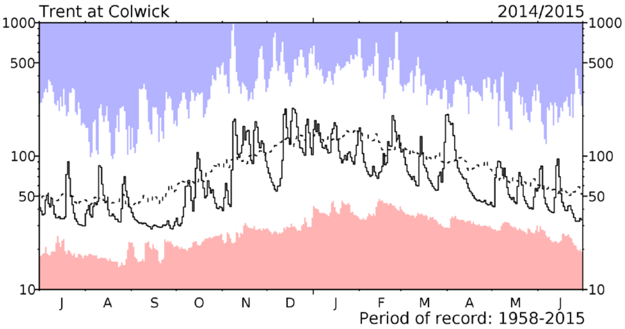


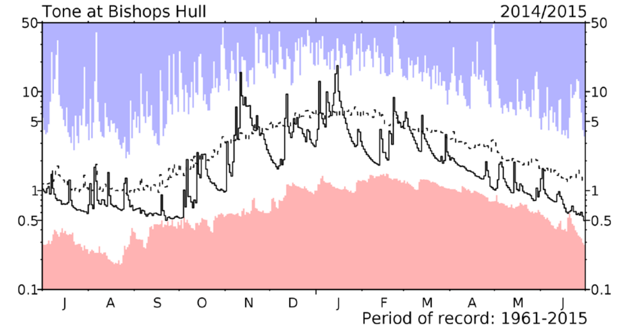


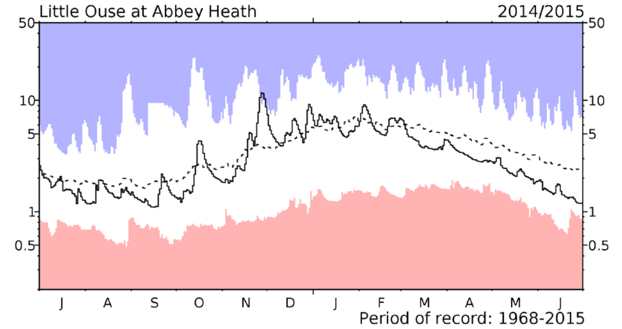


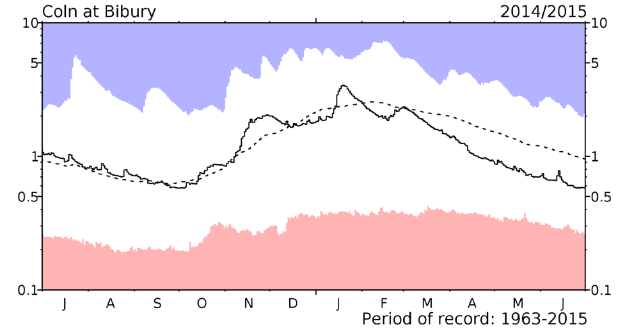


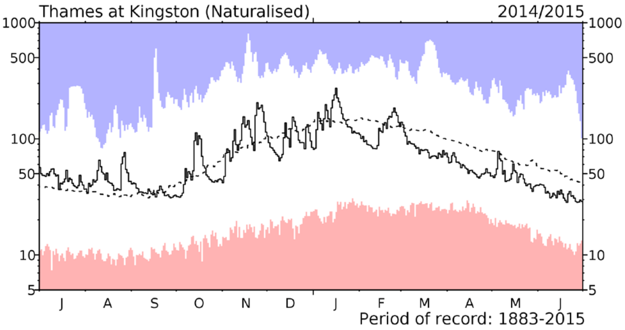


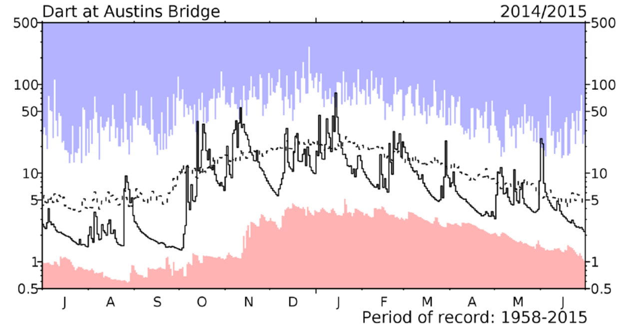


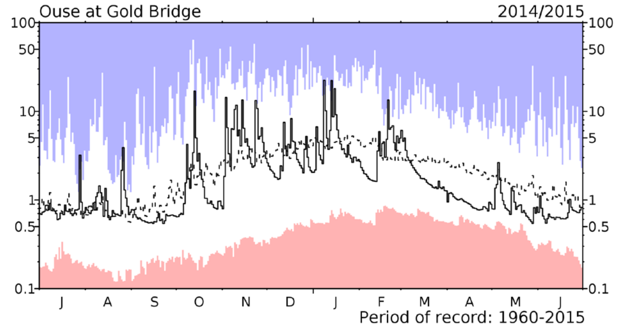




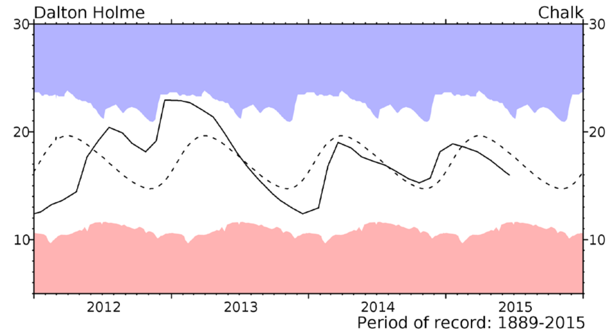


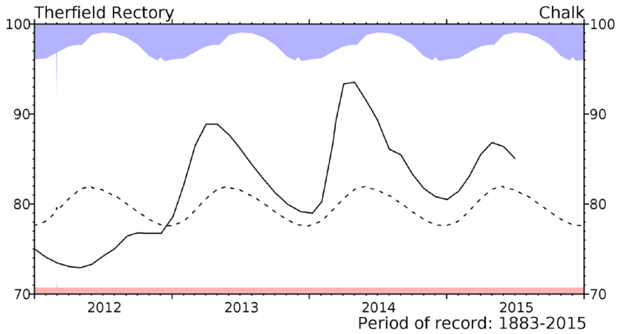


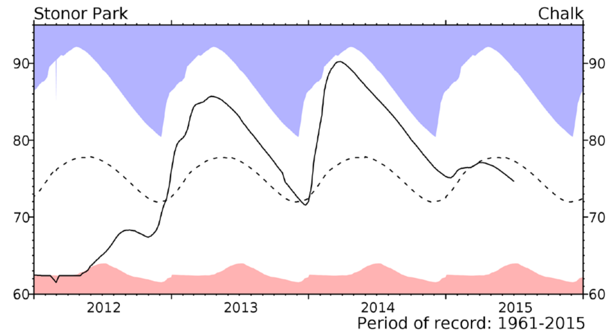


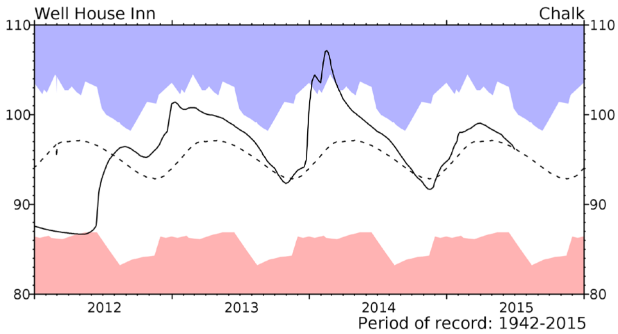


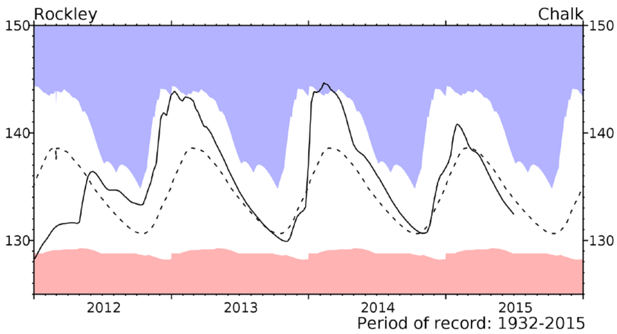
Groundwater . . . Groundwater

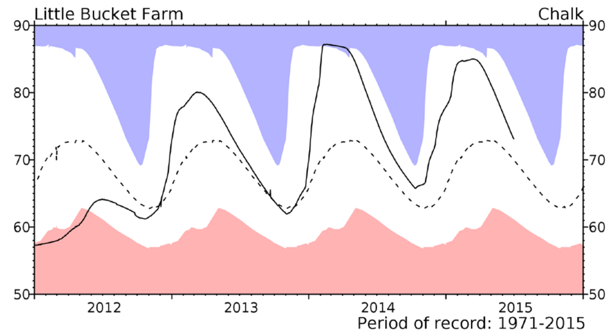


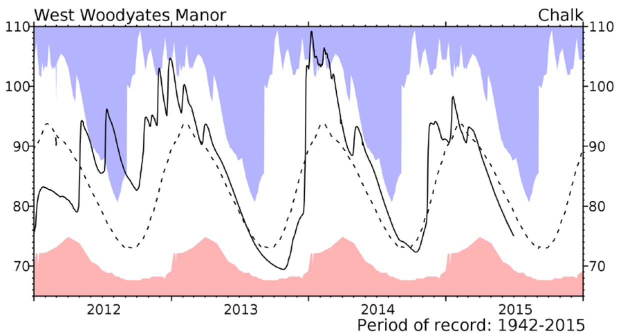


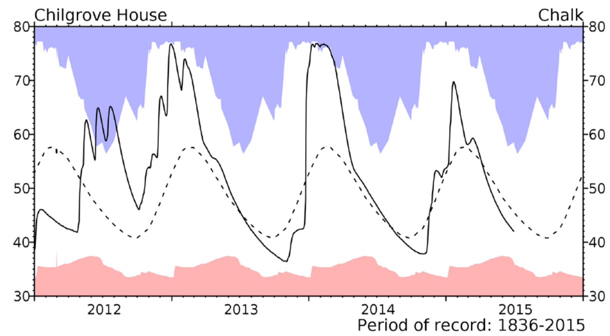


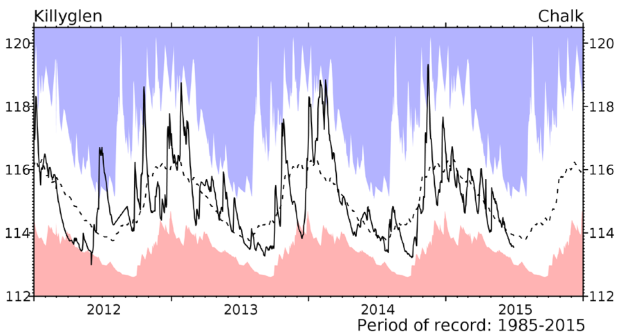


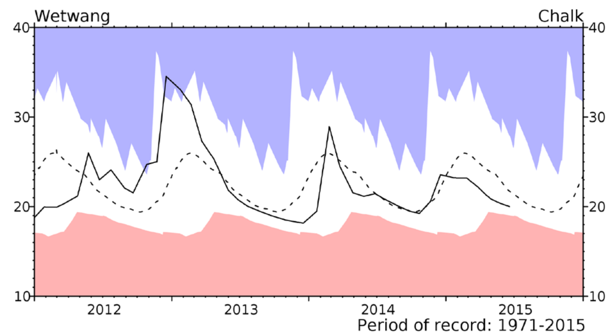






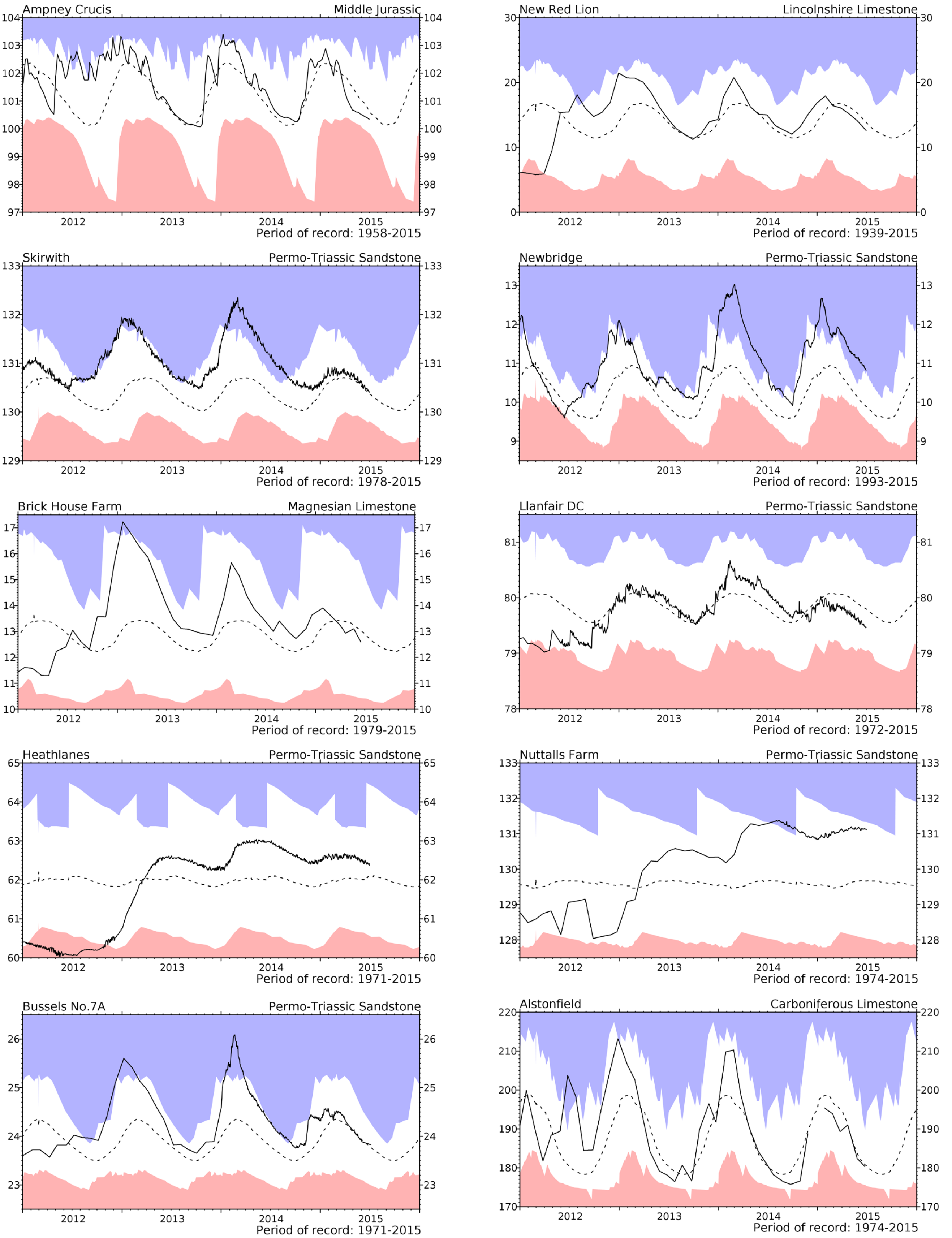






Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

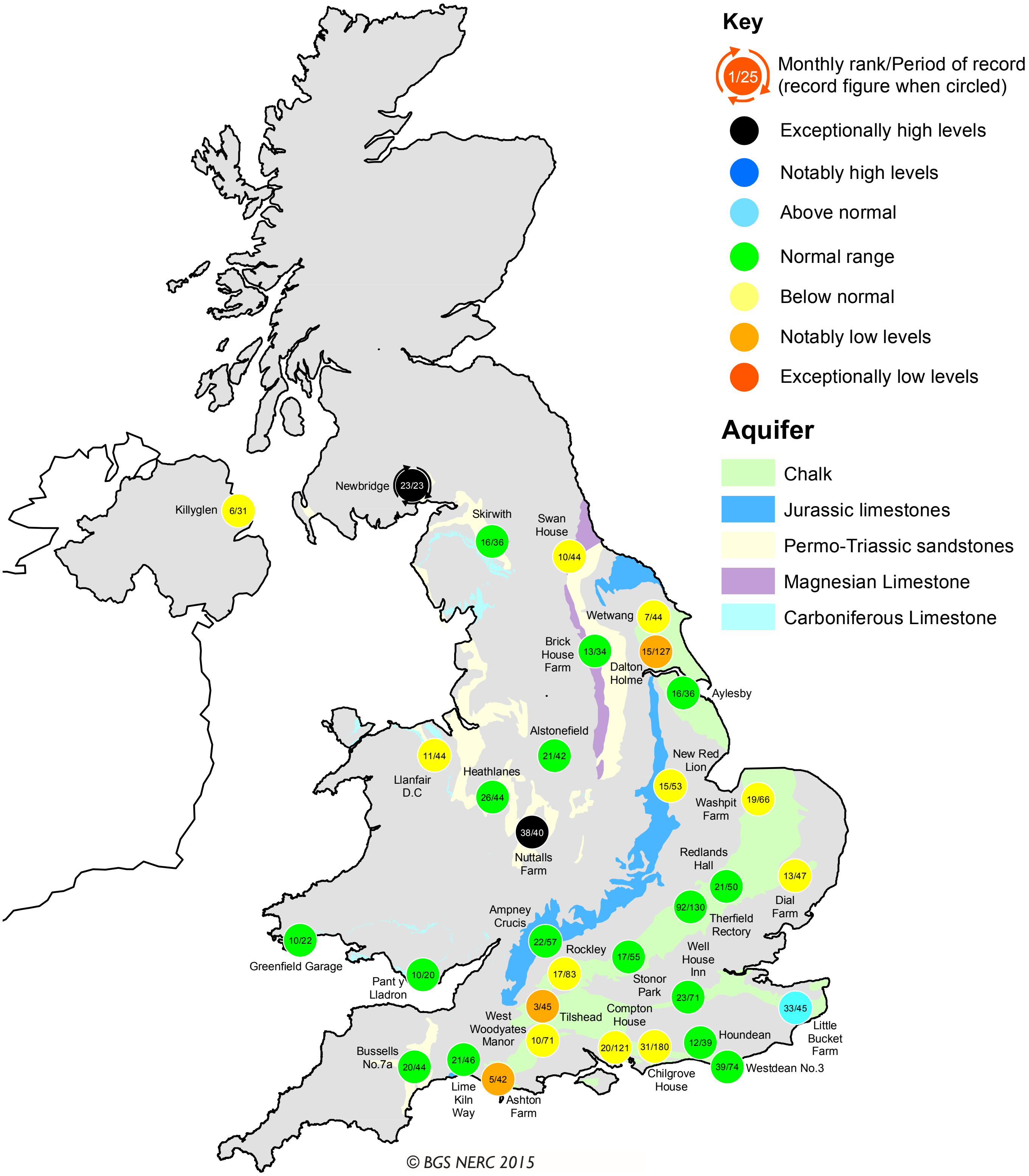


Groundwater levels June / July 2015

Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.
Dalton Holme	15.97	19/06	18.10	Chilgrove House	41.96	30/06	46.12	Brick House Farm	12.59	16/06	13.12
Therfield Rectory	85.06	01/07	81.92	Killyglen (NI)	113.54	30/06	114.04	Llanfair DC	79.47	30/06	79.85
Stonor Park	74.67	30/06	77.65	Wetwang	19.99	19/06	21.73	Heathlanes	62.37	30/06	62.13
Tilshead	82.13	30/06	87.73	Ampney Crucis	100.34	30/06	100.87	Nuttalls Farm	131.12	30/06	129.70
Rockley	132.44	30/06	134.60	New Red Lion	12.58	30/06	14.38	Bussells No.7a	23.82	06/07	23.89
Well House Inn	96.15	30/06	96.41	Skirwith	130.42	30/06	130.55	Alstonefield	180.31	24/06	181.85
West Woodyates	75.04	30/06	81.07	Newbridge	10.82	30/06	10.05				

Levels in metres above Ordnance Datum

Groundwater…Groundwater

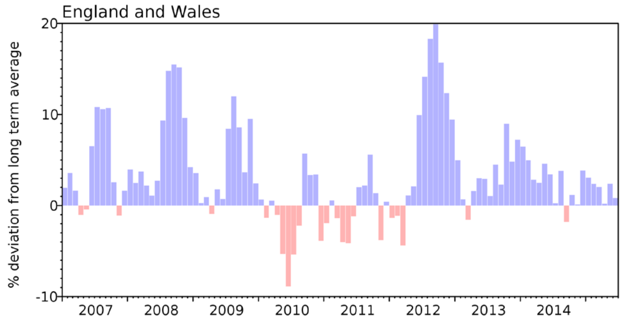


Groundwater levels - June 2015

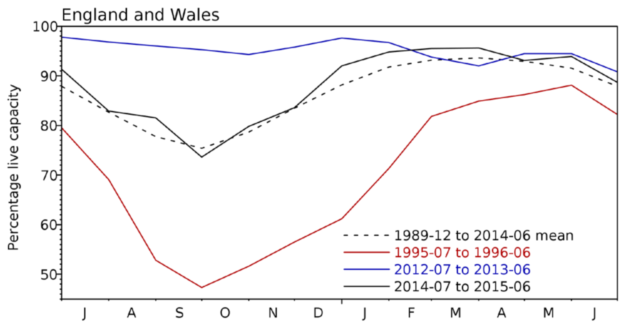
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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)	2015 Apr	2015 May	2015 Jun	Jun Anom.	Min Jun	Year* of min	2014 Jun	Diff 15-14
North West	N Command Zone	•	124929	88	90	81	9	38	1984	66	15
	Vyrnwy		55146	94	98	91	9	58	1984	90	1
Northumbrian	Teesdale	•	87936	92	96	83	2	58	1989	92	-9
	Kielder		(199175)	92	91	90	0	71	1989	92	-2
Severn-Trent	Clywedog		44922	99	100	97	5	32	1976	98	-1
	Derwent Valley	•	39525	94	96	90	10	53	1996	83	7
Yorkshire	Washburn	•	22035	82	82	74	-7	63	1995	77	-4
	Bradford Supply	•	41407	94	94	85	6	54	1995	87	-2
Anglian	Grafham		(55490)	95	96	95	2	70	1997	92	3
	Rutland		(116580)	95	93	90	2	75	1997	93	-3
Thames	London	•	202828	92	92	86	-7	85	1990	97	-11
	Farmoor	•	13822	96	95	95	-3	94	1995	100	-5
Southern	Bewl		28170	92	89	84	0	52	1990	99	-15
	Ardingly		4685	100	100	89	-6	82	2005	95	-6
Wessex	Clatworthy		5364	89	82	76	-7	61	1995	93	-17
	Bristol	•	(38666)	96	90	81	-2	64	1990	93	-12
South West	Colliford		28540	92	88	85	3	51	1997	96	-11
	Roadford		34500	93	90	87	7	49	1996	93	-6
	Wimbleball		21320	96	92	87	1	63	2011	97	-10
	Stithians		4967	84	95	76	-4	53	1990	88	-12
Welsh	Celyn & Brenig	•	131155	99	100	99	5	77	1996	97	2
	Brianne		62140	96	100	97	4	76	1995	96	1
	Big Five	•	69762	91	92	87	2	61	1989	94	-7
	Elan Valley	•	99106	93	99	91	2	68	1976	94	-3
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	92	95	89	2	54	1998	94	-5
	East Lothian	•	10206	98	100	98	4	81	1992	99	-1
Scotland(W)	Loch Katrine	•	111363	88	92	85	5	55	2010	86	-1
	Daer		22412	89	97	88	4	62	1994	86	2
	Loch Thom	•	11840	100	100	100	13	69	2000	99	1
Northern Ireland	Total+	•	56800	89	93	86	4	61	2008	79	7
	Silent Valley	•	20634	90	95	86	7	54	1995	79	7

( ) 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.

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://www.ceh.ac.uk/data/nrfa/nhmp/nhmp.html

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