Hydrological Summary

for the United Kingdom

October 2015

General

On the whole, October was settled, with anticyclonic conditions dictating weather patterns for much of the month. Monthly temperatures were moderately above average and it was unseasonably warm and sunny at times, especially in the north and west (north-west Scotland saw 121% of the average sunshine hours). Overall, it was a dry month with the majority of the UK receiving below average rainfall, and it was particularly dry in Scotland and Wales. Following notably low rainfall over the last three months, October river flows were generally in the normal range or below, with exceptionally low flows in some northern and western catchments. Groundwater levels were generally in the normal range or moderately below, although recoveries were evident in some boreholes, particularly in the far south. At the national scale, reservoir stocks were moderately below average at the end of October. Several impoundments in the north and west were more than 15% below average, e.g. the Northern Command Zone and Derwent Valley groups. The unsettled conditions of late October continued into early November, and current forecasts favour wetter-than-average conditions over the coming few months. Therefore, moderate short-term rainfall and runoff deficiencies are evident in western Britain, in general the water resources outlook remains favourable.

Rainfall

With blocking high pressure systems dominating the synoptic situation, rain-bearing frontal systems made little impression for much of October. Many areas saw heavy rain between the 5th and 7th (47mm was recorded at Charr, Aberdeenshire on the 7th), with flash flooding causing disruption to road and rail networks in Yorkshire on the 6th. Conditions were generally more unsettled from the 21st, with locally heavy and occasionally persistent rainfall bringing some localised disruption (e.g. in south-east England on the 28th). For the UK as a whole, the October monthly rainfall total was 64% of average (the driest since 2007), but it was particularly dry in the north and west. Wales and Scotland received 52% and 57% of the average October rainfall, respectively, with substantial areas receiving less than half the average. In contrast, rainfall in north-east England was generally close to, or above average; Yorkshire was the only UK region to record above average rainfall (110%). The dry October contributed to some notable short-term rainfall deficiencies. The last two months have seen below-average rainfall across most of the UK, but north-west Britain has been particularly dry: Scotland received less than 50% of average rainfall, the third driest September-October total in a record since 1910 (the Highland region of Scotland received 42%, the second lowest over this timeframe). It was also dry over the last three months in northern and western areas: it was the sixth driest August-October for the Forth region, also in a record from 1910. For this same period, rainfall was above average in parts of southern and north-east England.

River flows

With dry conditions around the turn of the month, many index rivers were in recession through the first week of October. Many catchments approached seasonal flow minima around mid-month as recessions continued. However, there were some rapid flow responses between the 5th and 7th that prompted flood alerts across south-west and northern England and north-east Scotland. From the 21st flows climbed steeply in responsive catchments. Flood alerts were issued between the 28th and 30th in central and southern England and south-east Scotland and there were two flood warnings for Tayside and the Earn. By month-end, daily flows throughout the UK largely returned to near-normal or above with the exception of catchments in particularly dry regions of Scotland and Wales (e.g. Tyne, Clyde, Severn) and some catchments in central and southern England. Despite the dryness of the last two months, October average river flows in the south and east of England were mostly in the normal range. In the north and west many catchments registered notably low flows, with exceptionally low flows in some catchments (e.g. the Welsh Dee, Clyde, Severn) and new October monthly minima in northern Scotland (the Naver, Carron and Ewe, all in records that began before 1980). River flow accumulations over the last two and three months showed a similar regional pattern, with notable runoff deficiencies in northern Scotland (the lowest August-October average for the Naver and the Ness). Average flows in catchments in the south and east of England were largely in the normal range or above for the three month period, in part reflecting the residual effect of the wet late summer in southern England. Average September-October outflows for both Scotland and Great Britain as a whole were the third lowest on record (from 1961).

Groundwater

End of October soil moisture deficits were lower than average in the south of England reflecting the late summer rainfall, but above average in central and eastern England. Groundwater levels remained stable or continued their seasonal recession in the majority of index boreholes. However, in the Chalk of south Dorset and the western South Downs levels at Ashton Farm, Compton House, West Woodyates Manor and Chilgrove House continued to rise (the last two by three metres) in response to recent recharge. Levels at Compton House and Chilgrove House rose to the normal range, whilst levels at Ashton Farm remained notably high. Elsewhere, levels fell in October and were generally average or slightly below at month-end, with the exception of Tilshead, Well House Inn, Dalton Holme and Wetwang which were notably low and Little Bucket Farm which rose to above normal. In the Jurassic and Magnesian limestones, levels fell or stabilised and were in the normal range. In the slower responding Permo-Triassic sandstones levels fell, returning to the normal range after four months of record high levels at Newbridge. Levels were average or above, with the exception of Llanfair DC which is notably low. Levels in the rapidly responding Carboniferous Limestone boreholes of south Wales and the Peak District fell and were all below normal. Levels at Greenfield Garage fell from notably high at the end of September to below normal.

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 1971-2000 average.

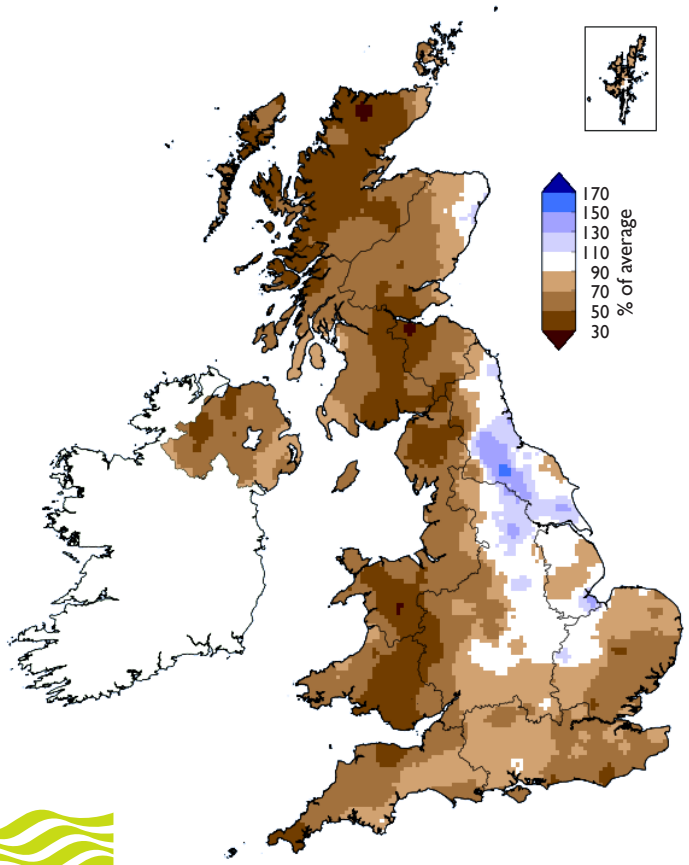
Area	Rainfall	Oct 2015	Sep15 – Oct15	RP	Aug15 – Oct15	RP	May15 – Oct15	RP	Feb15 – Oct15	RP
United Kingdom	mm	**72**	126		234		508		729	
	%	**64**	60	10-20	81	5-10	104	2-5	100	2-5
England	mm	**62**	115		212		408		536	
	%	**76**	75	2-5	97	2-5	105	2-5	95	2-5
Scotland	mm	**88**	139		254		647		1020	
	%	**57**	49	20-35	66	50-80	104	2-5	107	2-5
Wales	mm	**76**	151		288		591		813	
	%	**52**	57	8-12	79	2-5	99	2-5	90	2-5
Northern Ireland	mm	**70**	117		235		527		761	
	%	**61**	56	10-15	78	5-10	103	2-5	100	2-5
England & Wales	mm	**64**	120		223		434		574	
	%	**71**	71	2-5	93	2-5	104	2-5	94	2-5
North West	mm	**76**	125		238		528		767	
	%	**60**	55	10-20	74	5-10	97	2-5	96	2-5
Northumbrian	mm	**73**	111		196		433		576	
	%	**96**	76	5-10	91	2-5	110	2-5	99	2-5
Severn-Trent	mm	**53**	94		174		354		469	
	%	**74**	69	5-10	87	2-5	97	2-5	88	5-10
Yorkshire	mm	**84**	131		228		445		571	
	%	**110**	91	2-5	108	2-5	117	2-5	101	2-5
Anglian	mm	**47**	96		162		320		403	
	%	**81**	86	2-5	99	2-5	103	2-5	92	2-5
Thames	mm	**53**	108		189		340		441	
	%	**75**	81	2-5	100	2-5	100	2-5	89	2-5
Southern	mm	**60**	137		262		412		520	
	%	**68**	86	2-5	123	2-5	113	2-5	99	2-5
Wessex	mm	**62**	125		243		433		550	
	%	**71**	76	2-5	106	2-5	110	2-5	94	2-5
South West	mm	**80**	161		329		585		769	
	%	**63**	72	2-5	107	2-5	115	2-5	98	2-5
Welsh	mm	**75**	147		283		576		787	
	%	**53**	58	8-12	80	2-5	99	2-5	90	2-5
Highland	mm	**89**	144		271		693		1177	
	%	**49**	42	30-50	60	10-20	97	2-5	106	2-5
North East	mm	**78**	132		235		511		685	
	%	**77**	70	5-10	91	2-5	113	2-5	104	2-5
Tay	mm	**84**	129		235		616		906	
	%	**62**	52	10-15	71	5-10	113	2-5	108	2-5
Forth	mm	**61**	95		172		534		804	
	%	**51**	42	20-30	56	15-25	104	2-5	105	2-5
Tweed	mm	**58**	93		166		455		662	
	%	**61**	53	15-25	66	10-15	102	2-5	101	2-5
Solway	mm	**87**	139		259		636		986	
	%	**56**	50	10-20	67	5-10	102	2-5	105	2-5
Clyde	mm	**115**	163		300		794		1268	
	%	**61**	46	15-25	63	8-12	105	2-5	110	5-10

% = 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.

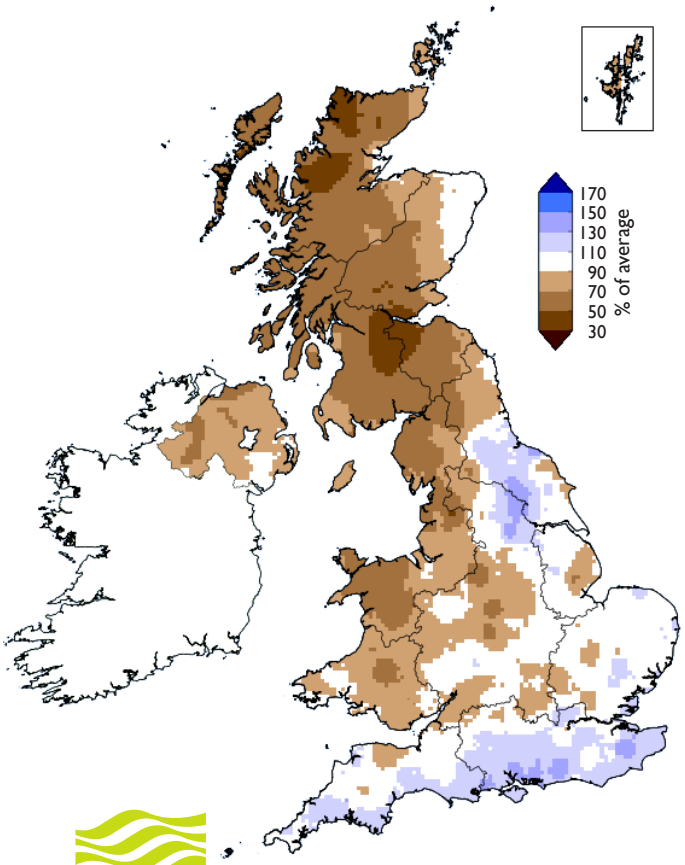
Rainfall . . . Rainfall . . .

October 2015 rainfall as % of 1971-2000 average



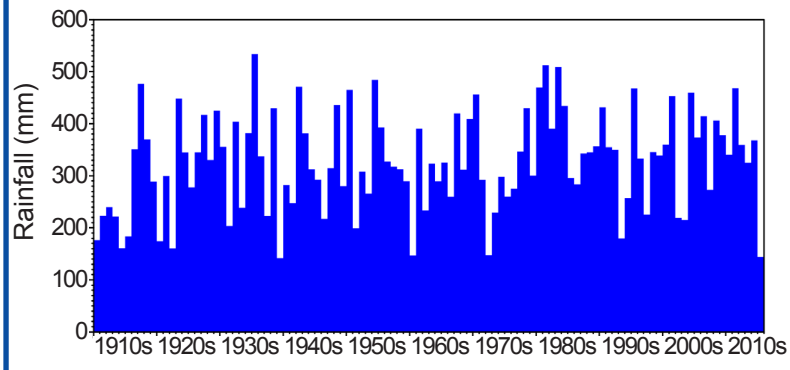
Met Office

August 2015 - October 2015 rainfall as % of 1971-2000 average

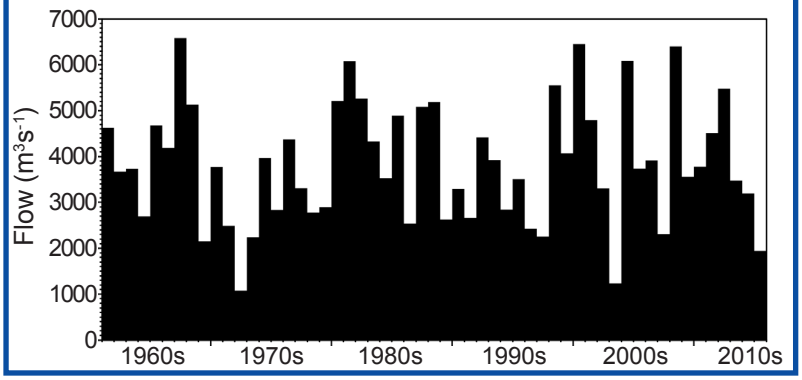


Met Office

September - October rainfall for the Highland region



September - October average outflows from Great Britain



Met Office

Met Office 3-month outlook Updated: October 2015

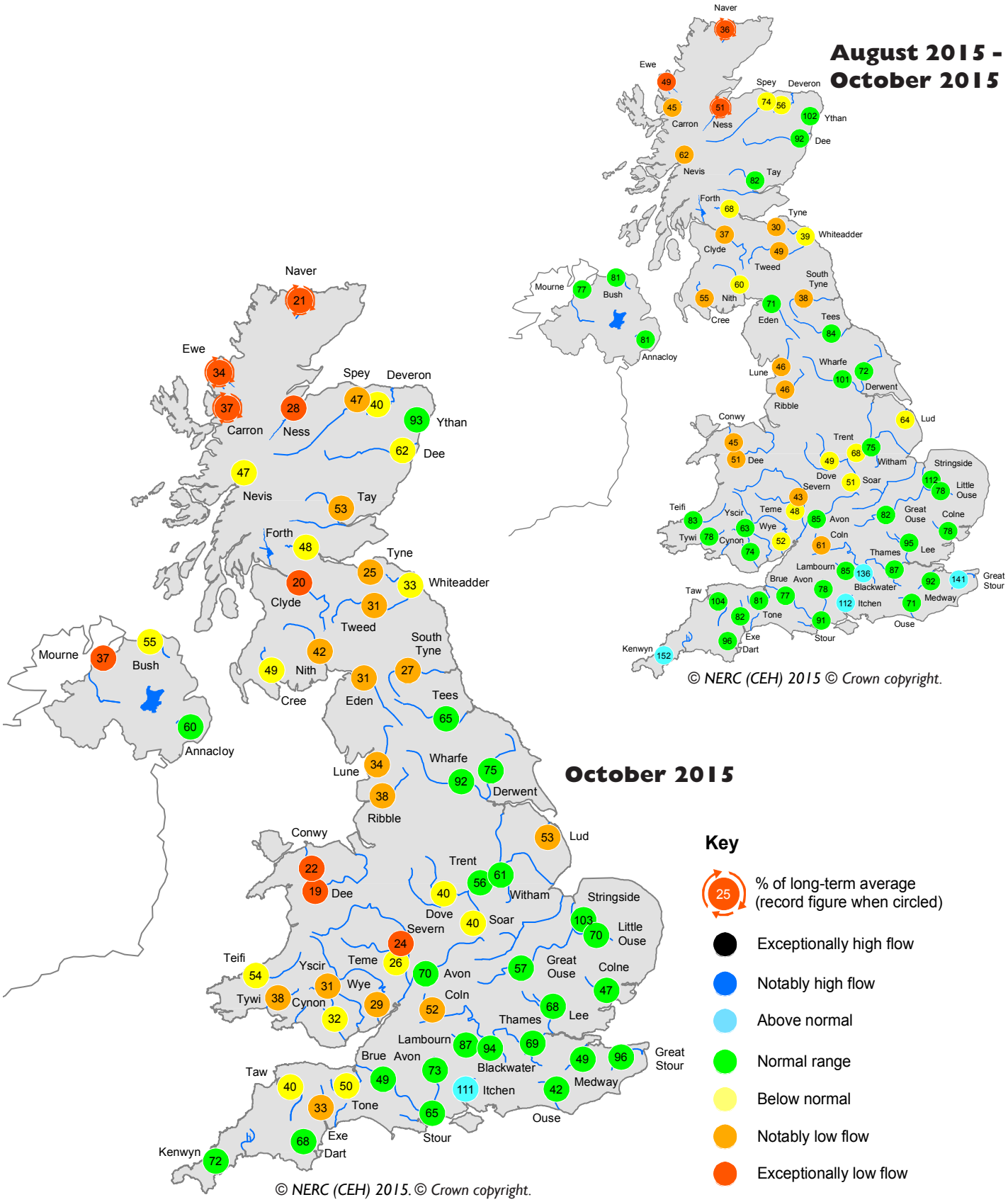
For November-December-January above-average precipitation is considered more probable than below-average.

The probability that UK-average precipitation for November-December-January will fall into the driest of our five categories is between 10% and 15% and the probability that it will fall into the wettest of our five categories is between 25% and 30% (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 . . .



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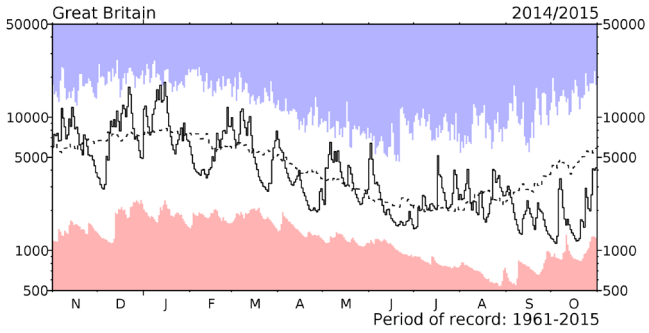
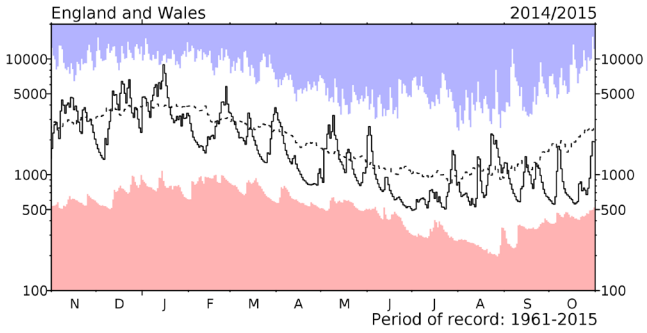
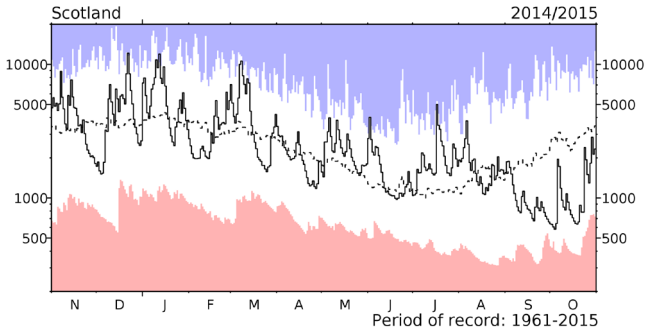
River flows

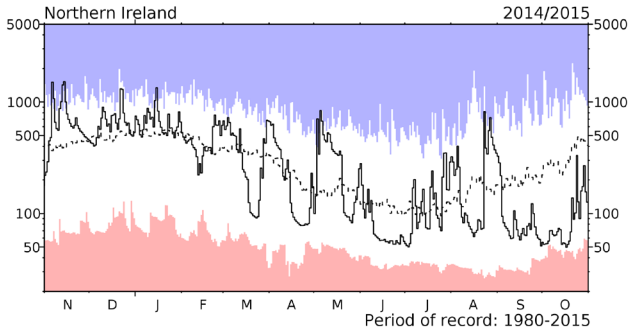
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

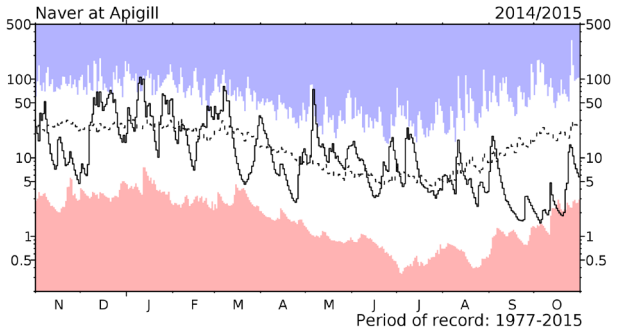
River flow . . . River flow . . .

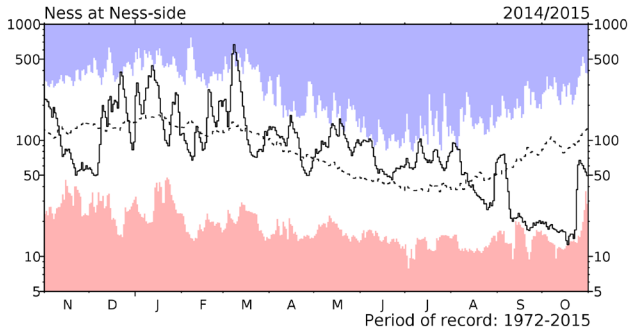


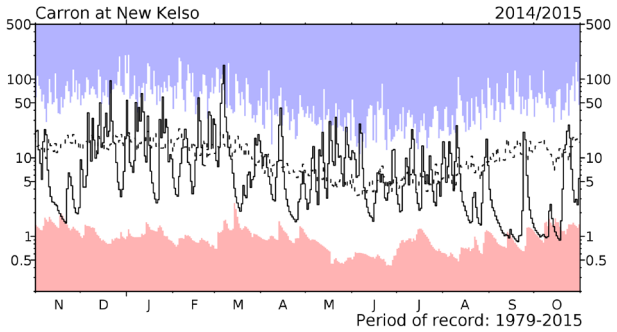


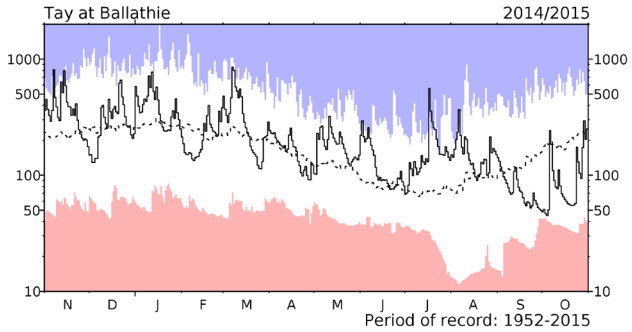


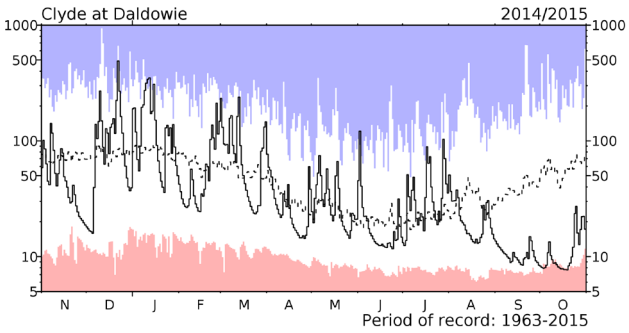


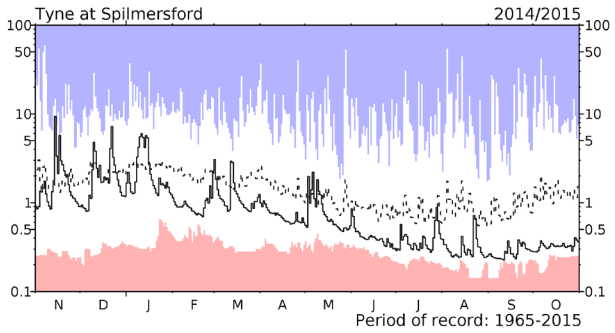








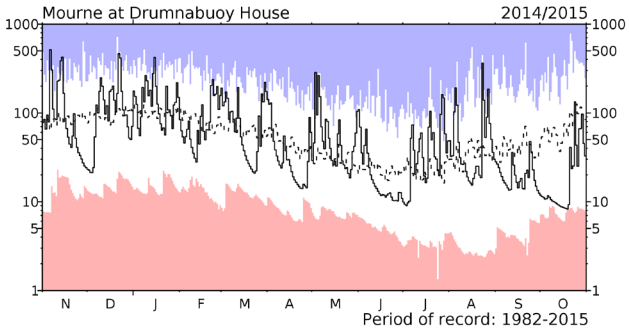


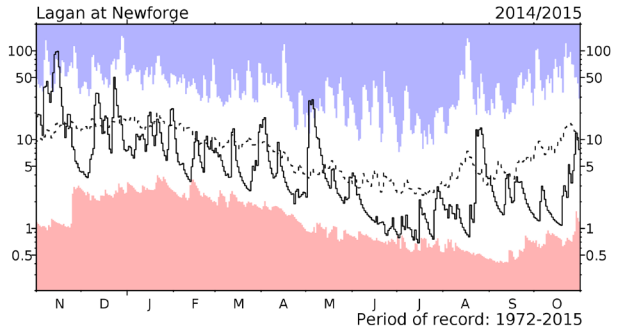


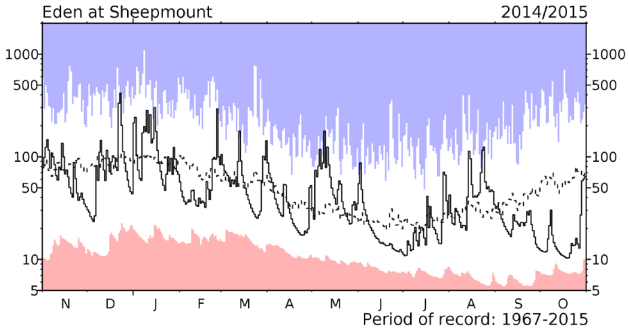
River flow hydrographs

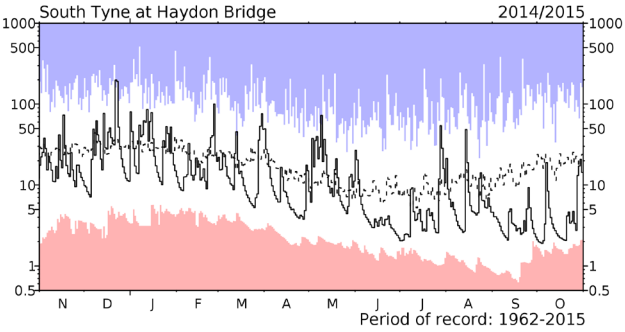
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to November 2014 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the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

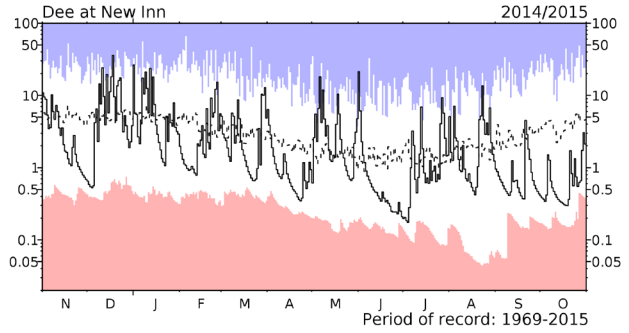
River flow . . . River flow . . .

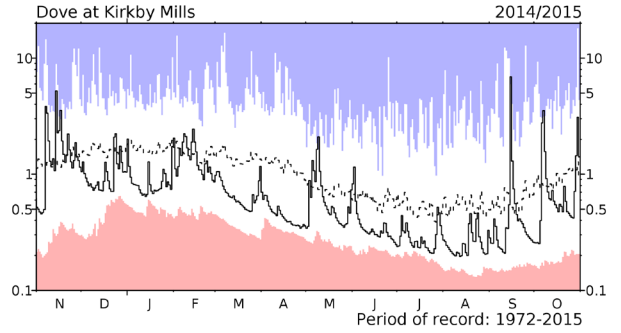


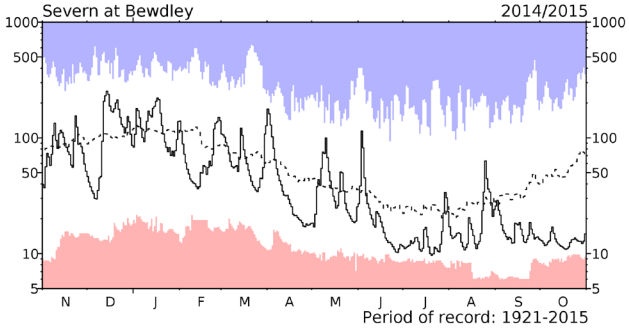


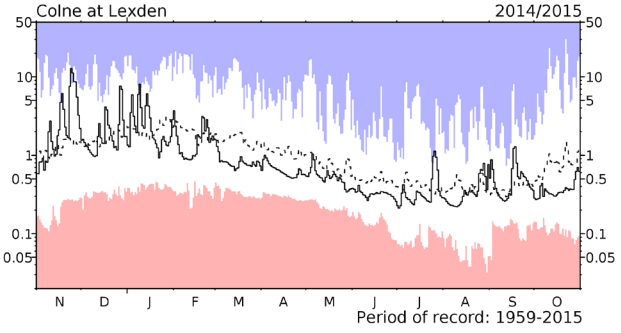


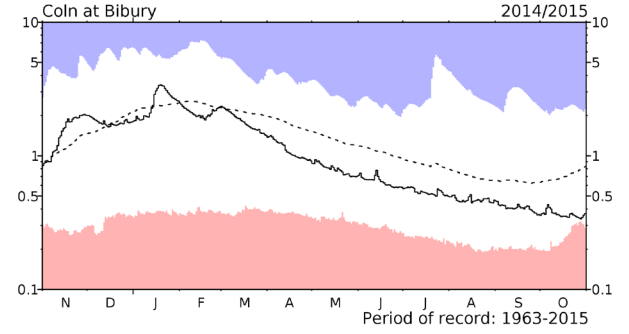


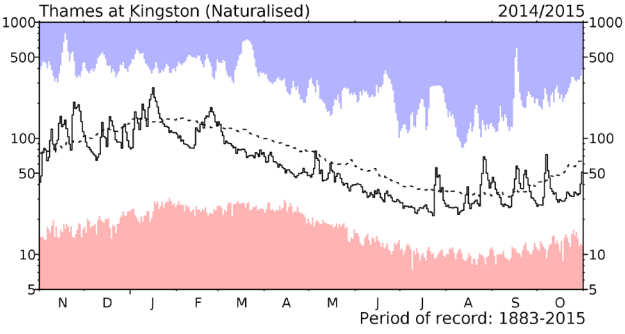


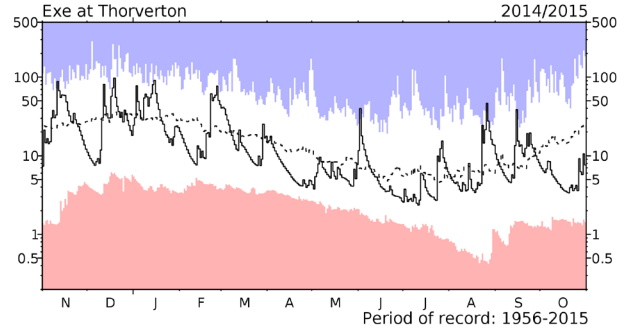


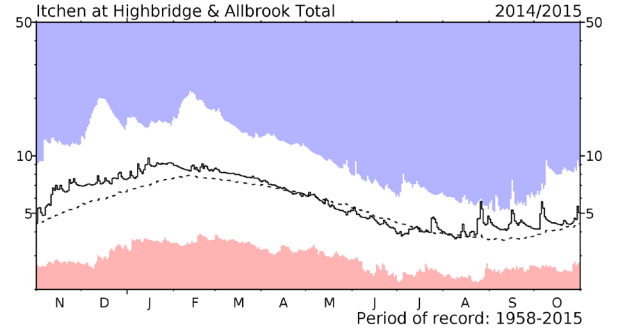




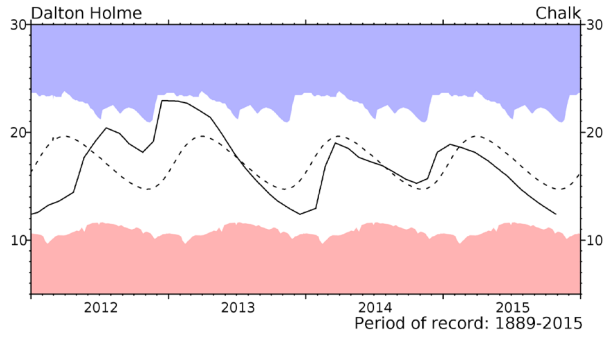


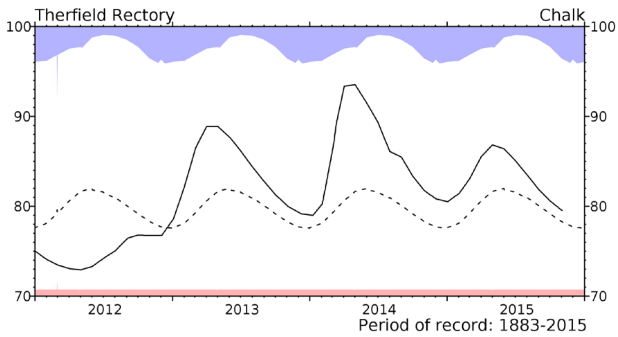


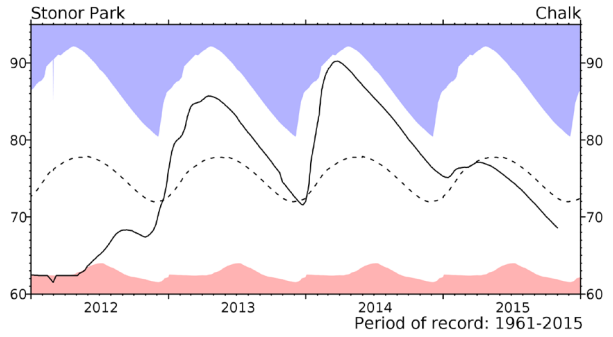


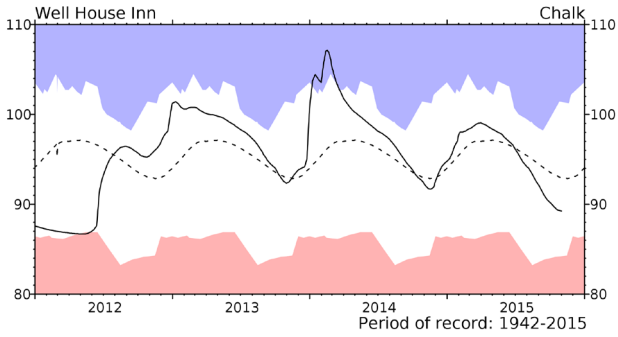


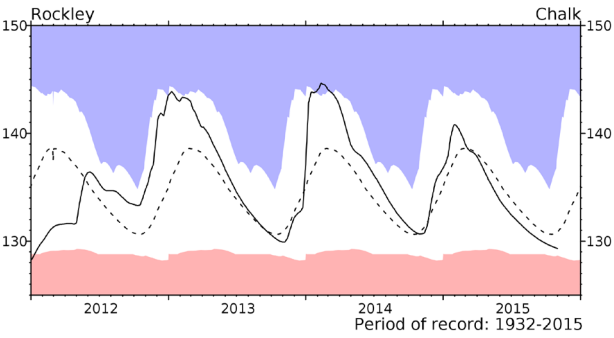
Groundwater…Groundwater

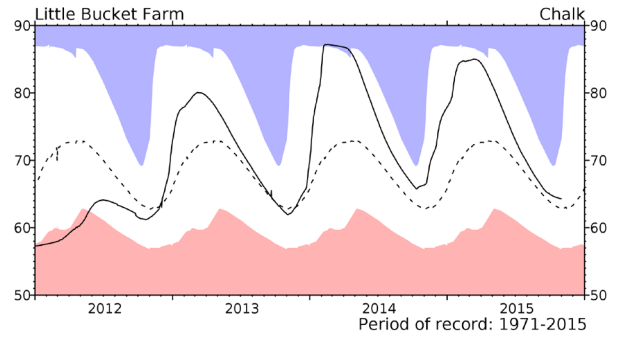


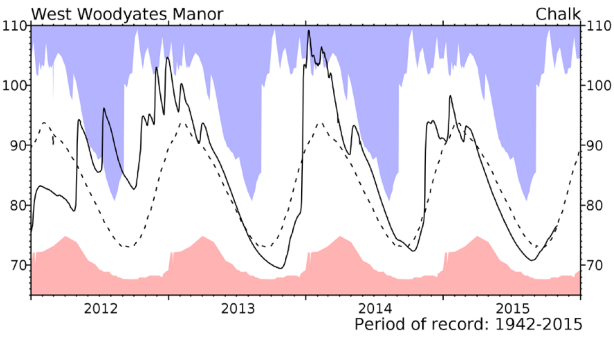


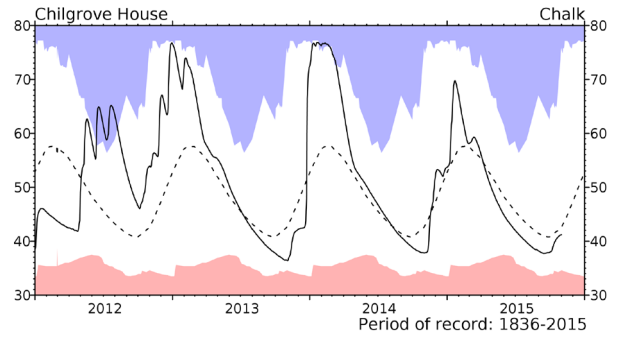


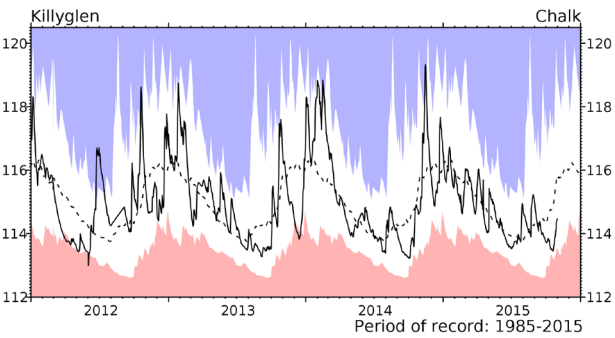


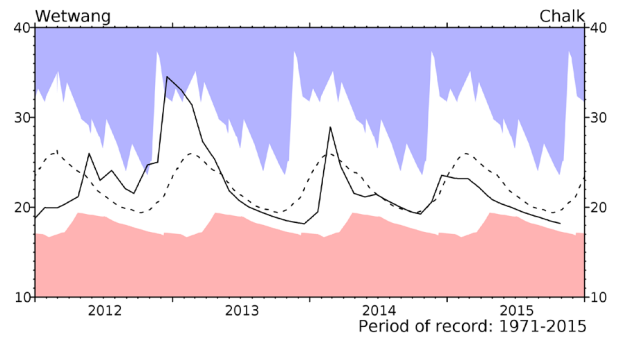






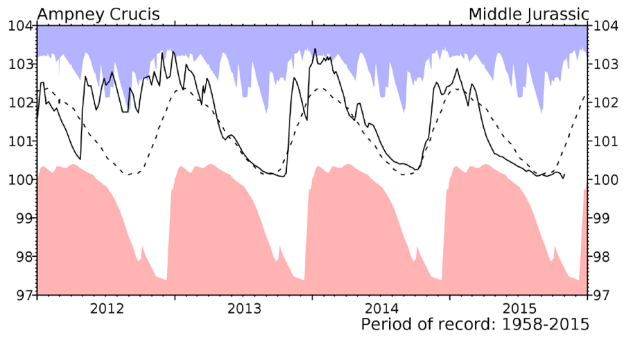


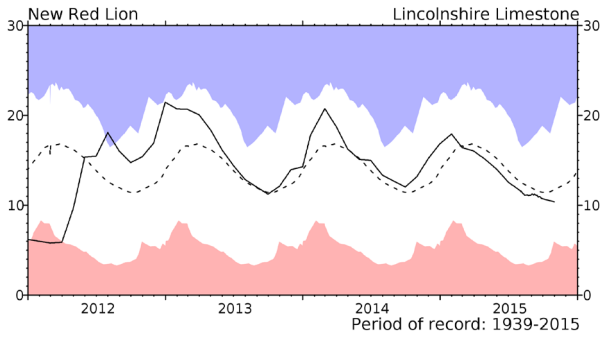


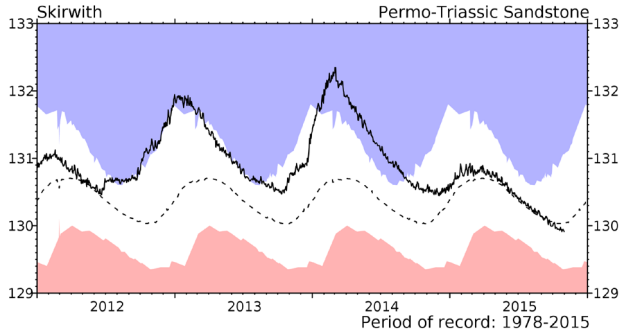


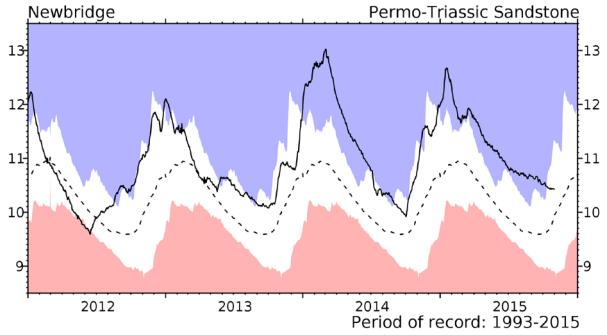
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

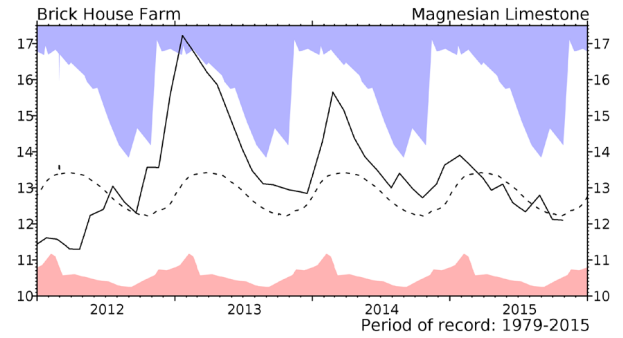
Groundwater ... Groundwater

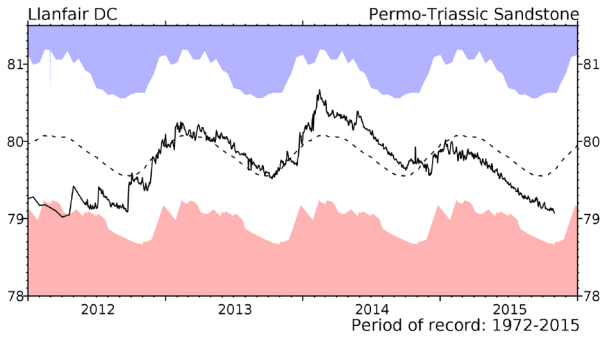


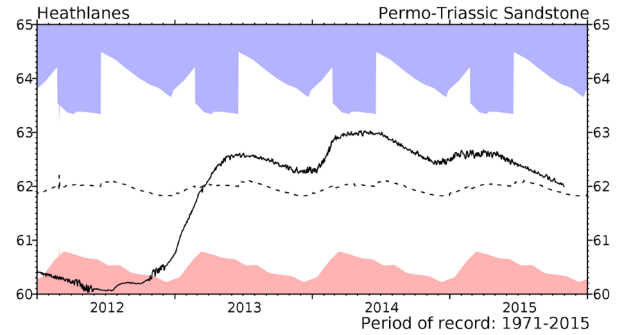


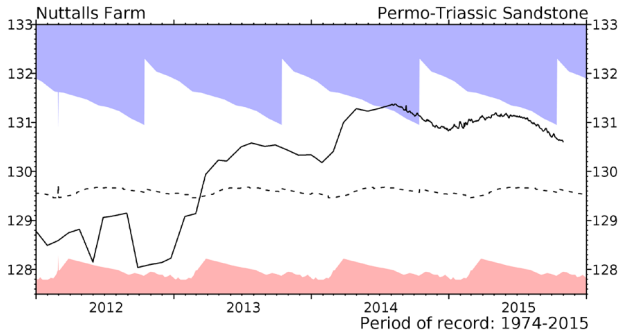


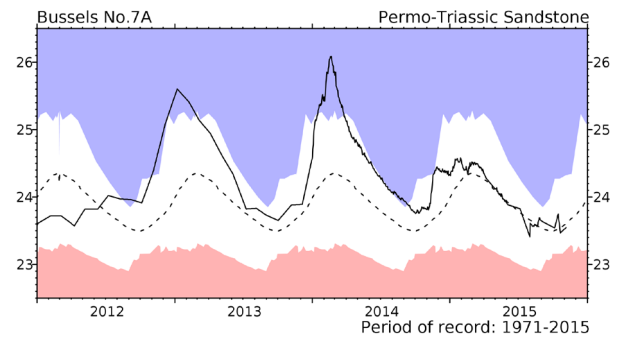


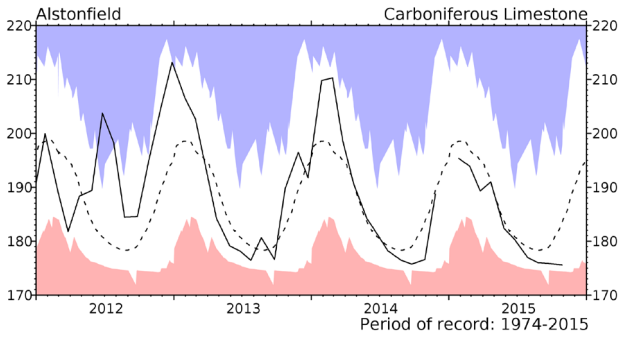








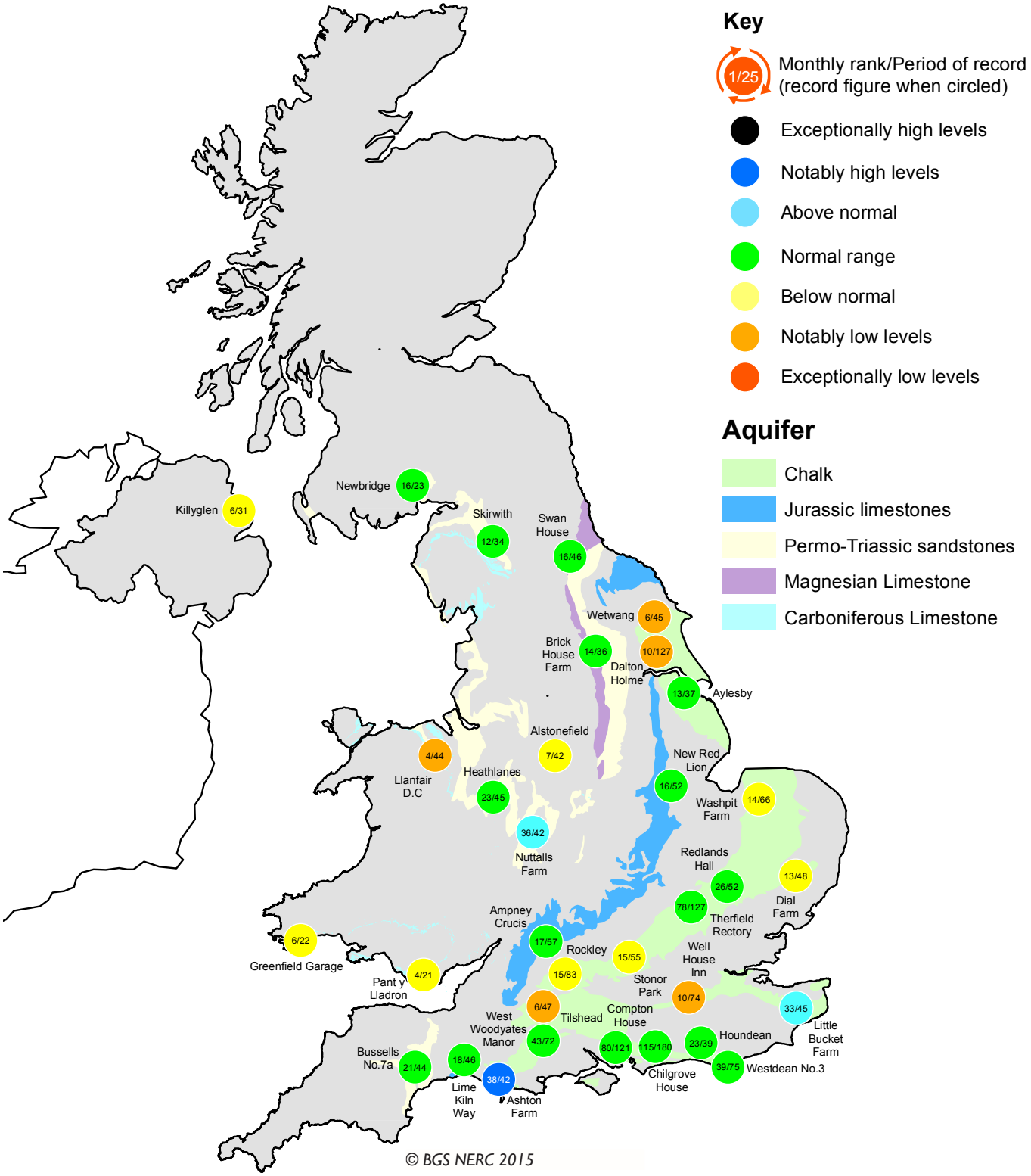




Groundwater levels October / November 2015

Borehole	Level	Date	Oct av.	Borehole	Level	Date	Oct av.	Borehole	Level	Date	Oct av.
Dalton Holme	12.40	27/10	14.90	Chilgrove House	41.20	01/11	42.23	Brick House Farm	12.10	27/10	12.32
Therfield Rectory	79.51	02/11	79.12	Killyglen (NI)	114.46	31/10	114.89	Llanfair DC	79.07	31/10	79.56
Stonor Park	68.57	01/11	73.05	Wetwang	18.18	28/10	19.43	Heathlanes	61.99	31/10	61.88
Tilshead	79.14	31/10	80.82	Ampney Crucis	100.13	01/11	100.47	Nuttalls Farm	130.60	31/10	129.67
Rockley	129.31	01/11	130.72	New Red Lion	10.37	31/10	11.61	Bussells No.7a	23.54	05/11	23.53
Well House Inn	89.24	01/11	93.05	Skirwith	129.90	31/10	130.09	Alstonefield	175.57	28/10	181.59
West Woodyates	76.55	31/10	74.90	Newbridge	10.43	31/10	9.81				

Levels in metres above Ordnance Datum

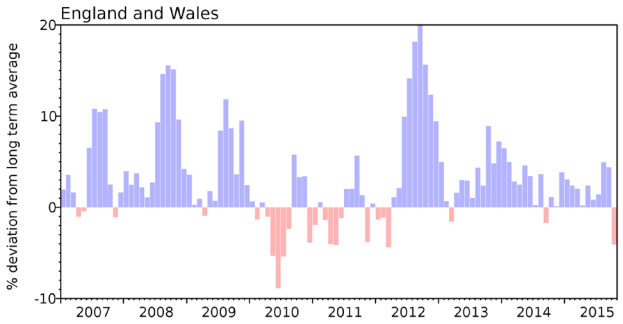


Groundwater levels - October 2015

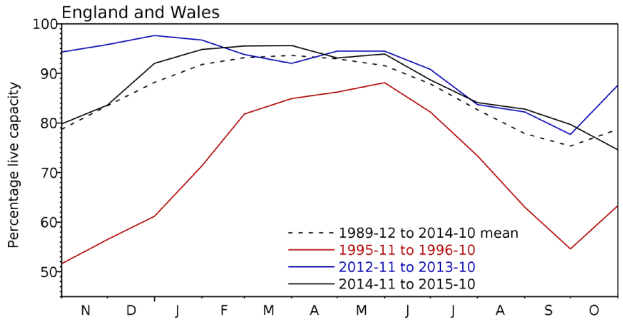
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Aug	2015 Sep	2015 Oct	Oct Anom.	Min Oct	Year* of min	2014 Oct	Diff 15-14
North West	N Command Zone	•	124929	71	58	50	-18	33	2003	68	-18
	Vyrnwy		55146	87	78	75	0	25	1995	71	4
Northumbrian	Teesdale	•	87936	81	78	68	-8	33	1995	89	-21
	Kielder		(199175)	92	85	81	-6	63	1989	89	-8
Severn-Trent	Clywedog		44922	91	90	80	4	38	1995	84	-5
	Derwent Valley	•	39525	66	57	50	-21	15	1995	56	-6
Yorkshire	Washburn	•	22035	69	67	69	0	15	1995	52	17
	Bradford Supply	•	41407	72	70	59	-14	16	1995	66	-7
Anglian	Grafham		(55490)	94	96	96	13	44	1997	75	21
	Rutland		(116580)	84	83	81	3	59	1995	84	-3
Thames	London	•	202828	80	82	81	3	46	1996	88	-6
	Farmoor	•	13822	99	98	93	5	43	2003	78	15
Southern	Bewl		28170	68	64	59	-1	33	1990	67	-8
	Ardingly		4685	62	59	57	-10	15	2003	76	-19
Wessex	Clatworthy		5364	67	69	61	-2	14	2003	62	-1
	Bristol	•	(38666)	71	71	66	4	24	1990	66	0
South West	Colliford		28540	77	77	77	7	38	2006	71	6
	Roadford		34500	77	79	80	8	18	1995	74	6
	Wimbleball		21320	72	70	65	-2	26	1995	63	2
	Stithians		4967	68	67	64	7	18	1990	44	20
Welsh	Celyn & Brenig	•	131155	90	86	79	-5	48	1989	74	4
	Brianne		62140	100	100	96	4	57	1995	100	-4
	Big Five	•	69762	81	84	76	-1	38	2003	80	-4
	Elan Valley	•	99106	85	79	68	-17	37	1995	90	-22
Scotland(E)	Edinburgh/Mid-Lothian	•	96518	85	74	68	-13	48	2003	71	-3
	East Lothian	•	9374	94	89	83	-1	38	2003	98	-15
Scotland(W)	Loch Katrine	•	110326	91	81	80	-6	40	2003	89	-9
	Daer		22412	92	81	83	-7	42	2003	92	-9
	Loch Thom	•	10798	100	100	100	11	66	2007	76	24
Northern Ireland	Total+	•	56800	92	88	87	6	39	1995	84	3
	Silent Valley	•	20634	97	91	89	14	34	1995	82	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.

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

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