Hydrological Summary

for the United Kingdom

August 2015

General

August was an unsettled month, feeling autumnal at times and lacking many hot summer days. Most areas of the UK received a combination of light showers, persistent rainfall from frontal systems and torrential downpours from thunderstorms. The UK registered 133% of the long-term average rainfall in August, with often stormy wet weather over the last fortnight concluding a wet summer (126% of average rainfall for the UK for June-August). Rainfall anomalies were most significant along the south coast of England, with more than double the average rainfall received across large areas, and approaching three times the average in some locations. Daily rainfall totals that were similar to average monthly totals triggered flash flooding that impacted properties and transport networks in a number of localities. River flows in August were seasonally high in the wettest southern areas of the UK (relative to average), but not of sufficient magnitude to cause extensive fluvial flooding. Despite the wet weather across much of the aquifer outcrop areas of southern England, groundwater levels continued their seasonal recessions in most boreholes in England and Wales. Reservoir stocks increased substantially in Northern Ireland, with overall stocks there, and in western Scotland and northern England registering as significantly above average. Soil moisture deficits generally decreased in August and were below average across the aquifer areas of southern England. As a result, groundwater recharge through autumn is unlikely to be delayed in these areas and, combined with near average reservoir stocks for England and Wales, indicates that the water resources outlook remains healthy.

Rainfall

After a fairly quiet start to the month, the jet stream moved south across the UK around mid-month, driving a succession of frontal systems across southern regions that delivered intense thunderstorm activity, heavy downpours and associated flash flooding. On the 13th, surface water flooding and disruption to road, rail and air travel resulted from torrential rain and thunderstorms across south-east England (Eastbourne recorded 60mm, mostly falling within two hours). On the 14th, Keele received 52mm and a sinkhole opened up beneath the Manchester inner ring road. A particularly intense five-day period from 22nd-26th August saw notable daily rainfall totals across England: 63mm at Bramham (West Yorkshire) on the 22nd/23rd; 46mm at Portsmouth on the 25th; 52mm at Heathrow on the 26th. Over this period, flash flooding, lightning and hail impacted properties, transport networks and power infrastructure in parts of Wales and northern, southern and eastern England. Overall for August, rainfall totals were exceptional in the Southern region of England, the wettest August since 1946 and fourth wettest on record (in a series from 1910). Elsewhere, areas of East Anglia, Yorkshire, south and mid-Wales, and north-east Scotland received more than 150% of the long-term average, whilst below average rainfall was restricted to areas of the Midlands, north Wales, north-west England, and central and north-west Scotland. For the summer overall (June-August), with the exception of pockets of central England and north Wales, rainfall generally was above average throughout the UK. The substantial rainfall totals earlier in the summer for northern Scotland and in August for southern England are reflected in the 150% of average rainfall accumulations for June-August in these areas.

River flows

The quieter weather over the first fortnight of August heralded river flow recessions in catchments throughout the UK. Nevertheless, flood warnings were declared for the Earn on the 5th and for rivers in the Midlands around mid-month. Thereafter, recessions were broken as river flows climbed during the unsettled second half of the month. Seasonally high flows were registered in the last ten days of the month in responsive catchments of southern England. The vigorous storminess led to widespread flood alerts and flood warnings across England and Wales over this period. The Blackwater and Kenwyn registered their largest August daily flows on record, in series from 1952 and 1968, respectively. For the Blackwater, the peak was almost double the previous maximum, and the average August flow was also a new period of record maximum. Daily outflows from the UK for August were near average, although this reflects a balance between a recession in Scottish outflows whilst runoff from England and Wales increased towards month-end. Average flows in August were above normal in responsive catchments of southern England and Wales, and in Northern Ireland and parts of eastern Scotland. Below normal flows were restricted to the Trent basin and the headwaters of the Thames. The pattern of average river flow anomalies for the summer overall (June-August) was similar to that for August, although below normal flows were more prevalent in some coastal catchments of eastern Britain.

Groundwater

The focus of the wet weather in August across southern England significantly reduced soil moisture deficits in this area, and caused temporary interruptions in seasonal recessions for some boreholes. The majority of the index boreholes were within or close to the normal range. In the Chalk, levels generally were near or below average, although Killyglen was above normal and Westdean No.3 was exceptionally high. Seasonal recessions were temporarily halted in localised areas of southern England (Ashton Farm, West Woodyates Manor, Tilshead and Houndean Bottom) by the late August rainfall, although the recessions may have since continued. Levels in the Jurassic limestones fell during August and were also normal or just below; recessions were again briefly halted. In the Magnesian limestone, although levels generally were in the normal range, they fell at Swan House and rose slightly at Brick House Farm. In the slowly responding Permo-Triassic sandstones, with the exception of Llanfair DC, levels were near or above average, with record high August levels recorded at Newbridge (for the third month in succession) and also notably high levels at Nuttalls Farm (although lower than the exceptionally high levels in July). In the fast responding Carboniferous Limestone, levels fell but remained in the normal range in the Peak District, and rose in south Wales to be above normal, reflecting differences in regional rainfall.

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.

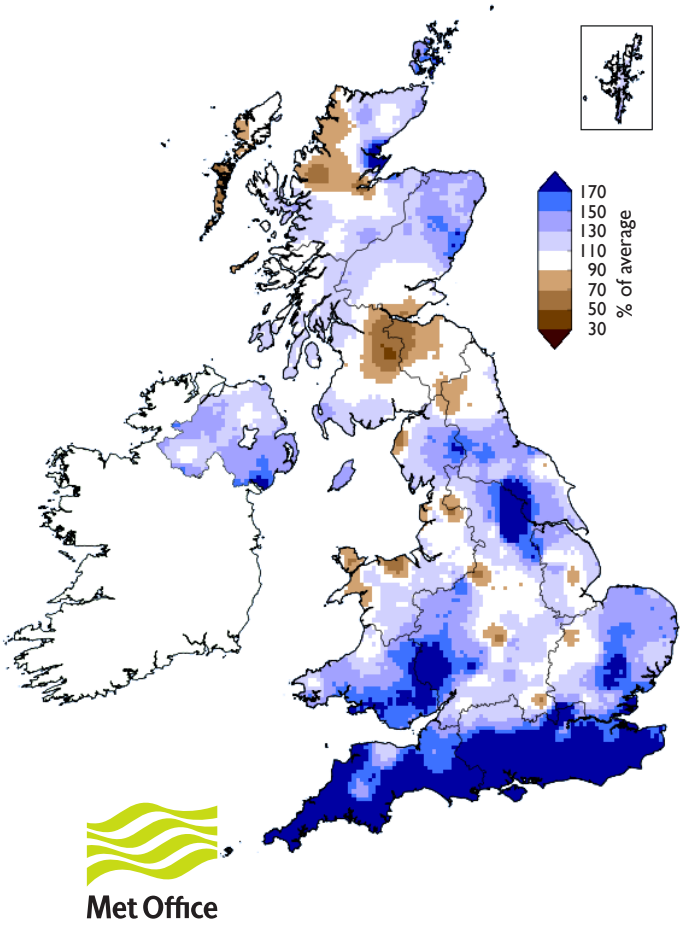
Area	Rainfall	Aug 2015	Jun15 – Aug15	RP	Mar15 – Aug15	RP	Dec14 – Aug14	RP	Sep14 – Aug15	RP
United Kingdom	mm	**107**	272		524		889		1194	
	%	**133**	126	2-5	119	5-10	117	8-12	111	5-10
England	mm	**97**	214		368		586		809	
	%	**150**	120	2-5	104	2-5	101	2-5	100	2-5
Scotland	mm	**115**	359		760		1352		1778	
	%	**116**	136	5-10	138	5-10	136	>100	124	80-120
Wales	mm	**137**	306		575		1008		1354	
	%	**135**	119	2-5	109	2-5	106	2-5	100	2-5
Northern Ireland	mm	**117**	278		563		922		1243	
	%	**129**	118	2-5	120	2-5	117	8-12	113	10-15
England & Wales	mm	**103**	227		397		645		885	
	%	**147**	120	2-5	105	2-5	102	2-5	100	2-5
North West	mm	**113**	271		569		961		1241	
	%	**119**	108	2-5	117	2-5	117	5-10	106	2-5
Northumbrian	mm	**86**	228		426		632		831	
	%	**121**	121	2-5	113	2-5	105	2-5	101	2-5
Severn-Trent	mm	**80**	182		334		520		715	
	%	**127**	104	2-5	98	2-5	95	2-5	95	2-5
Yorkshire	mm	**97**	217		401		594		785	
	%	**147**	119	2-5	111	2-5	101	2-5	97	2-5
Anglian	mm	**66**	168		269		408		585	
	%	**127**	111	2-5	93	2-5	94	2-5	98	2-5
Thames	mm	**81**	174		283		455		666	
	%	**149**	113	2-5	91	2-5	91	2-5	96	2-5
Southern	mm	**125**	212		317		553		833	
	%	**234**	138	2-5	101	10-15	103	2-5	108	2-5
Wessex	mm	**118**	236		363		588		843	
	%	**180**	137	2-5	102	8-12	96	2-5	98	2-5
South West	mm	**168**	335		509		871		1187	
	%	**203**	154	5-10	112	15-25	103	2-5	99	2-5
Welsh	mm	**136**	299		556		963		1300	
	%	**138**	120	2-5	108	2-5	105	2-5	99	2-5
Highland	mm	**127**	381		878		1650		2130	
	%	**116**	129	2-5	140	2-5	141	80-120	124	30-50
North East	mm	**103**	290		510		770		1114	
	%	**147**	144	2-5	126	5-10	117	2-5	118	5-10
Tay	mm	**106**	352		685		1120		1554	
	%	**127**	156	5-10	141	5-10	127	10-15	123	15-25
Forth	mm	**77**	309		621		1034		1320	
	%	**94**	139	2-5	137	5-10	131	15-25	117	10-15
Tweed	mm	**73**	255		504		848		1149	
	%	**98**	125	2-5	123	2-5	124	5-10	121	5-10
Solway	mm	**120**	350		722		1303		1743	
	%	**113**	128	2-5	131	2-5	134	50-80	125	60-90
Clyde	mm	**138**	440		948		1717		2181	
	%	**109**	137	5-10	145	5-10	145	>100	126	>100

% = 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.

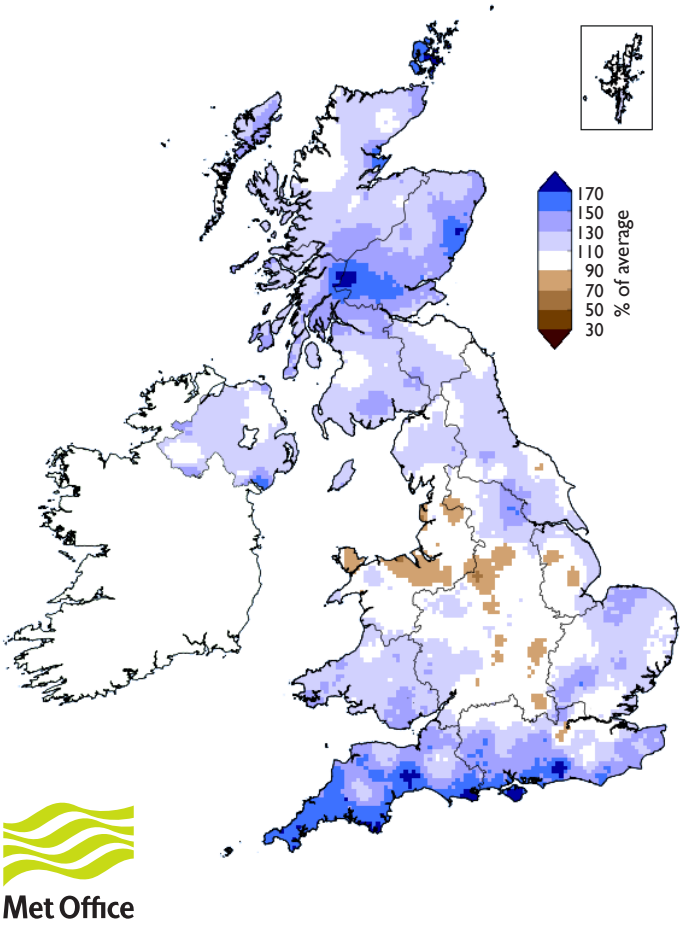
Rainfall . . . Rainfall . . .

August 2015 rainfall
as % of 1971-2000 average



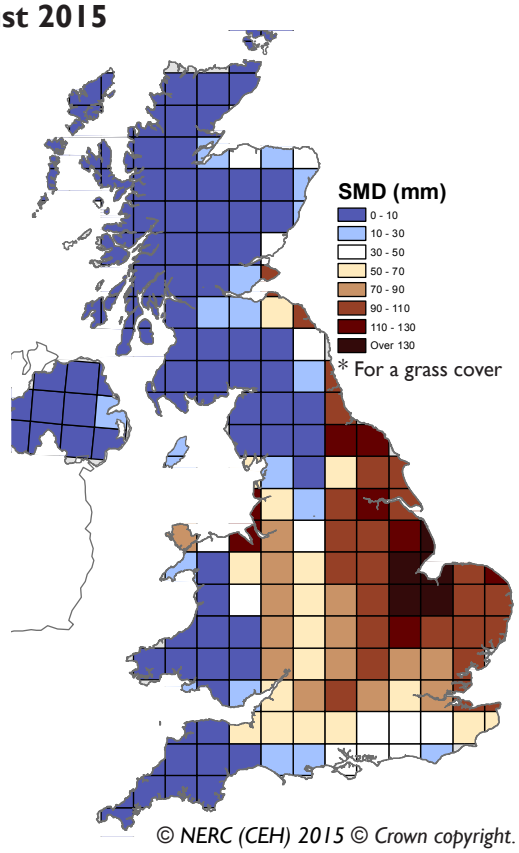
Met Office

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



Met Office

MORECS Soil Moisture Deficits*
August 2015



Met Office

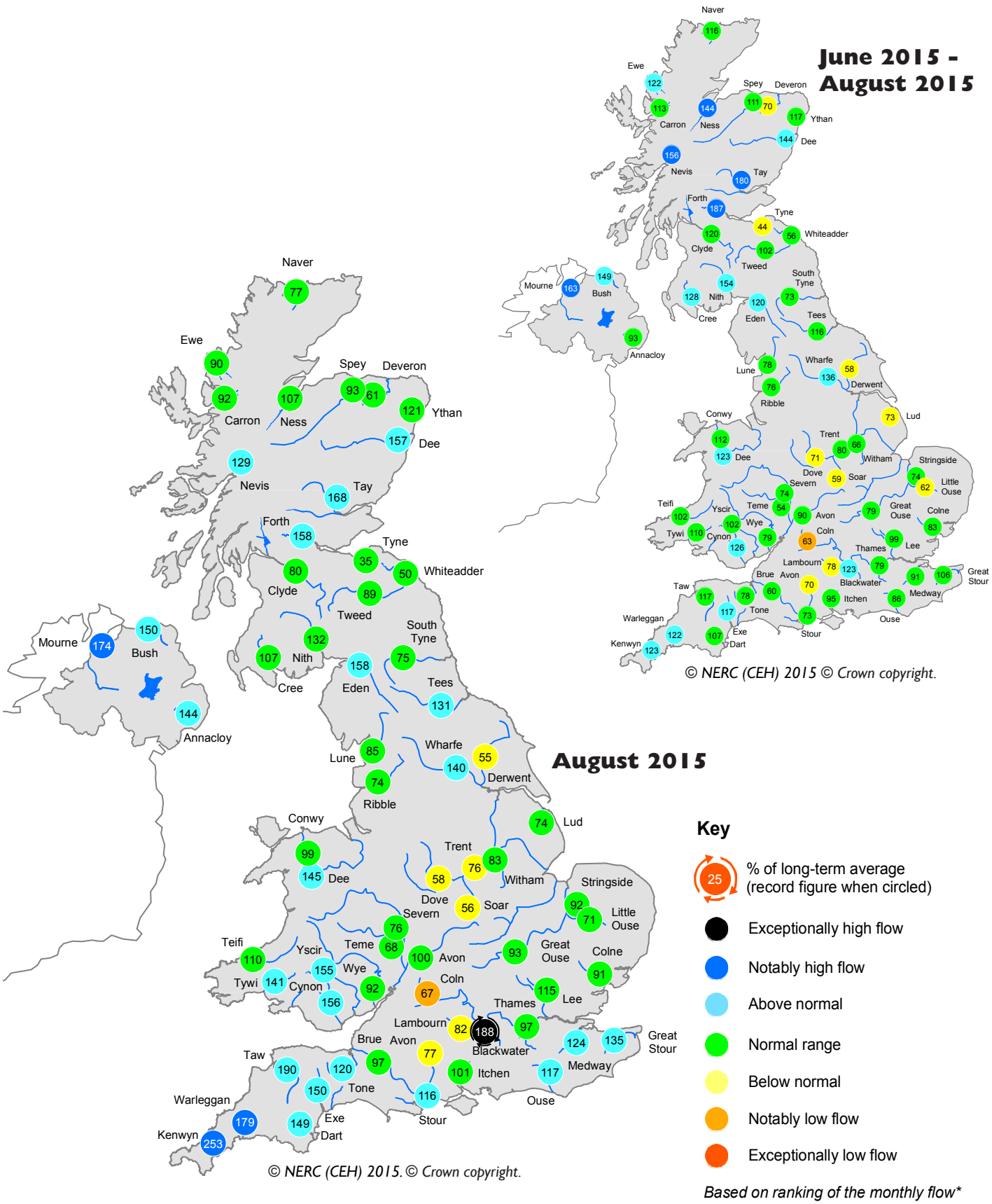
Met Office 3-month outlook Updated: August 2015

For September-October-November as a whole, the forecast for UK precipitation has a wide spread and its distribution is indistinguishable from climatology. The probability that UK precipitation for September-October-November 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 between 20 and 25% (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.

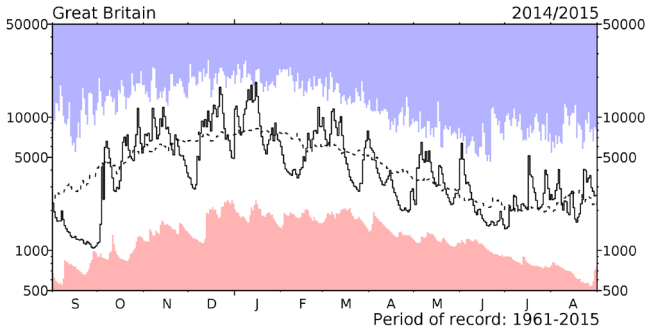
River flow . . . River flow . . .

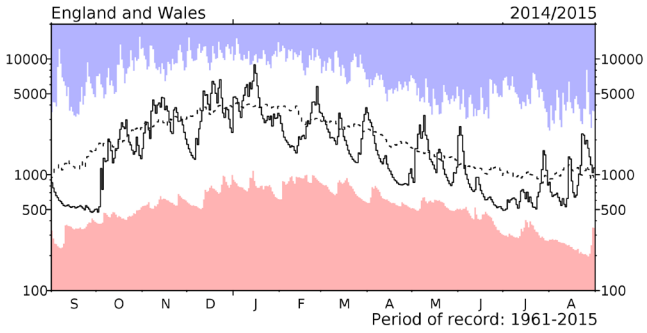


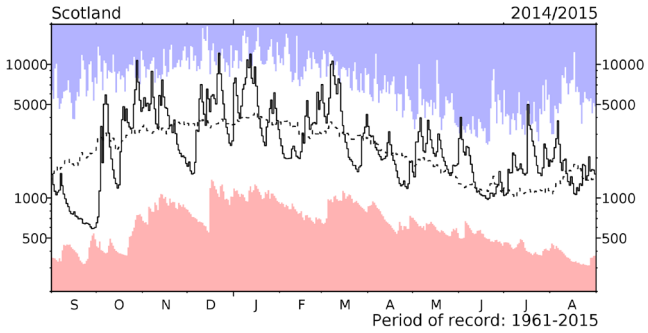
River flows

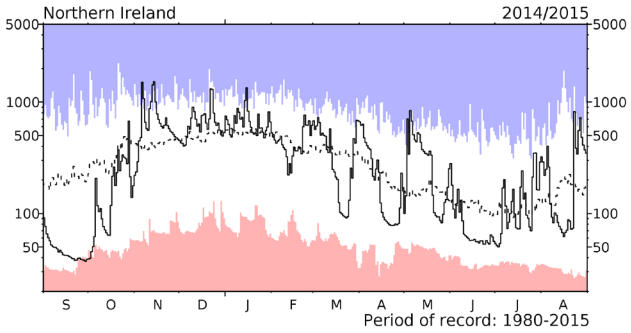
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

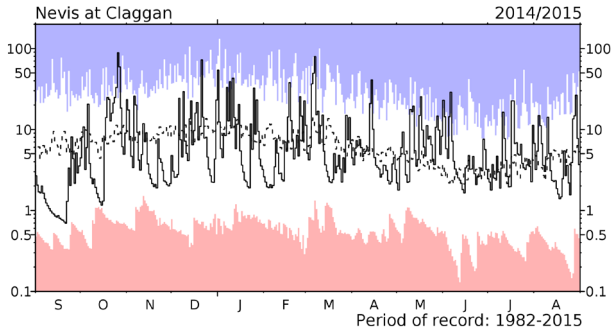
River flow . . . River flow . . .

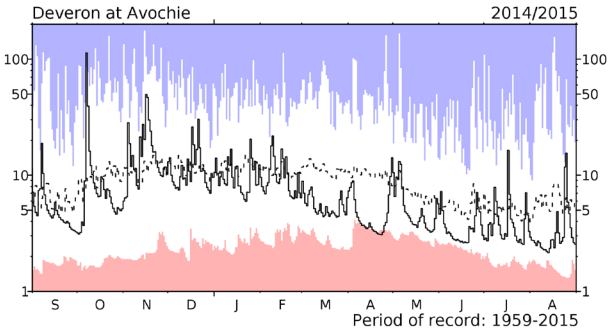


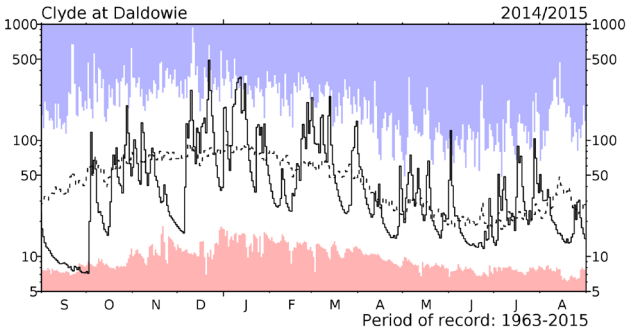


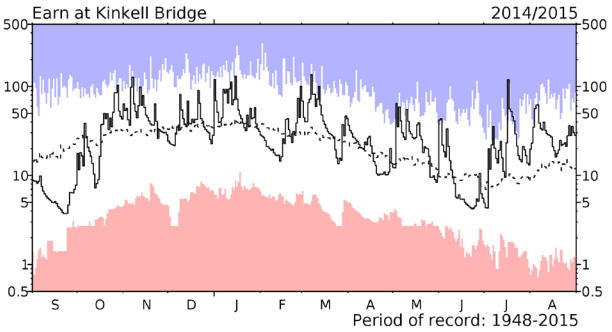


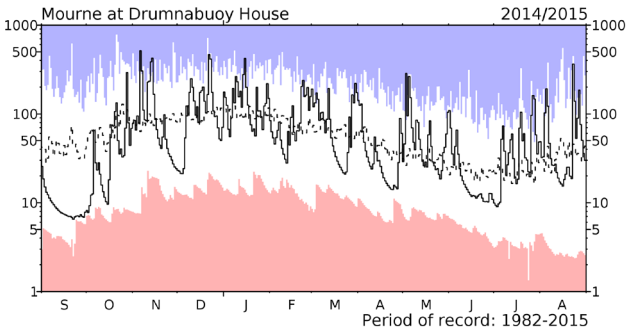


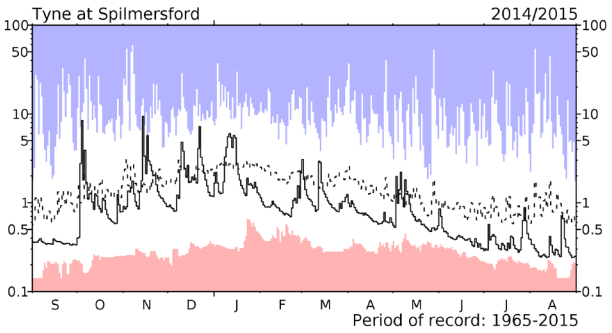








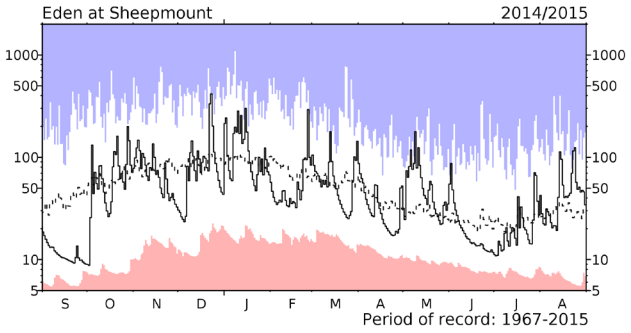


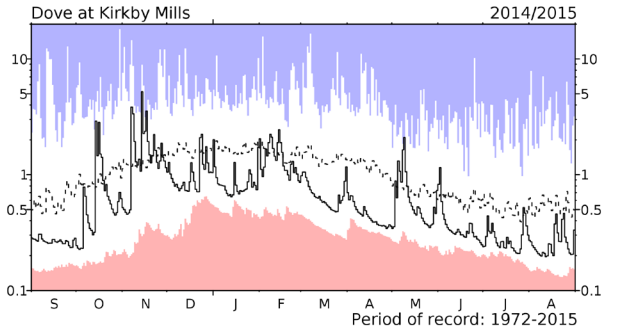


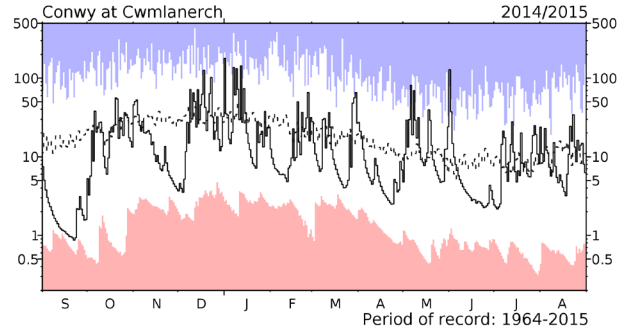
River flow hydrographs

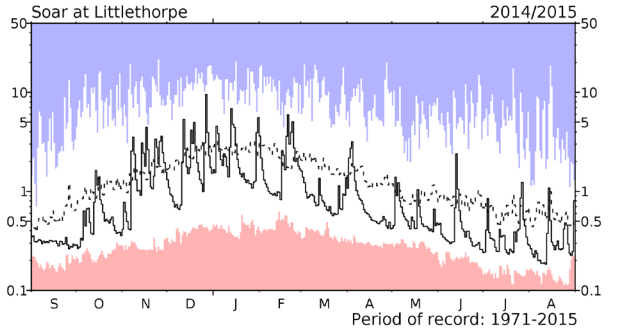
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to September 2014 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the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

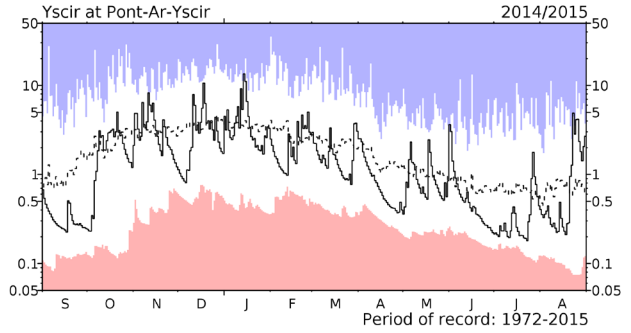
River flow . . . River flow . . .

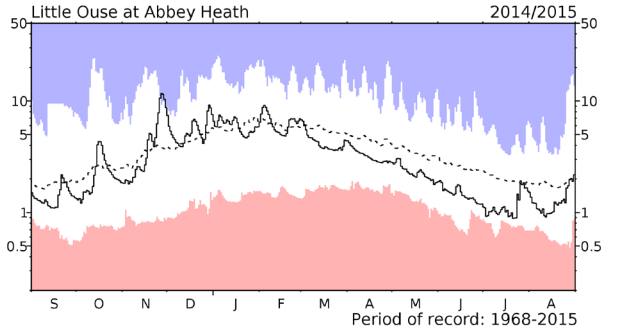


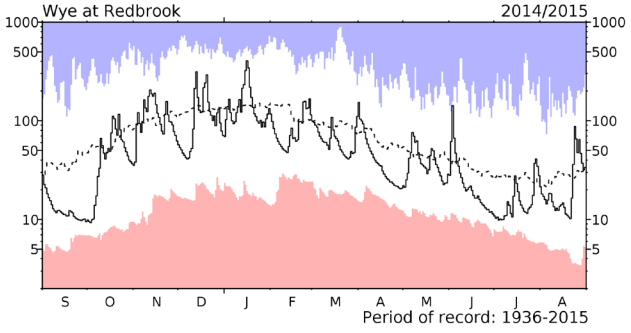


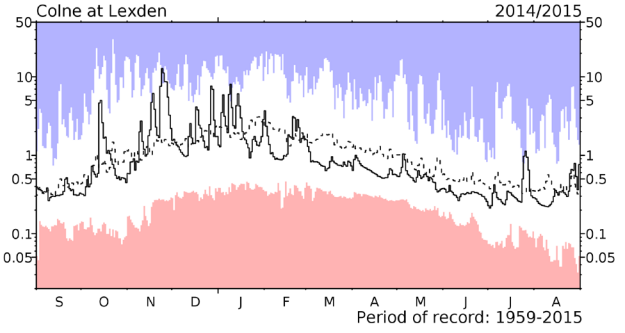


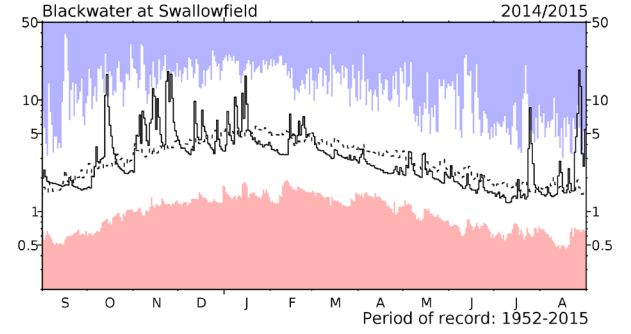


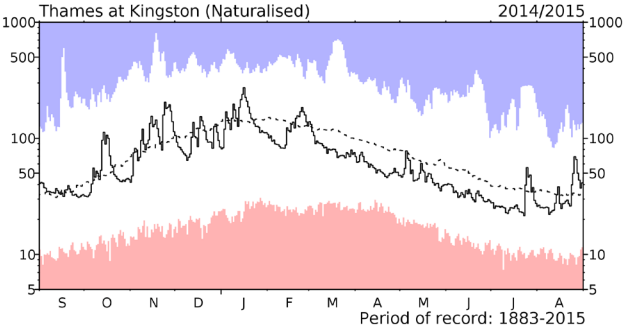


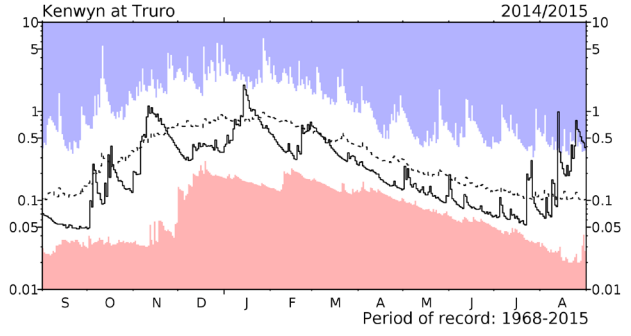


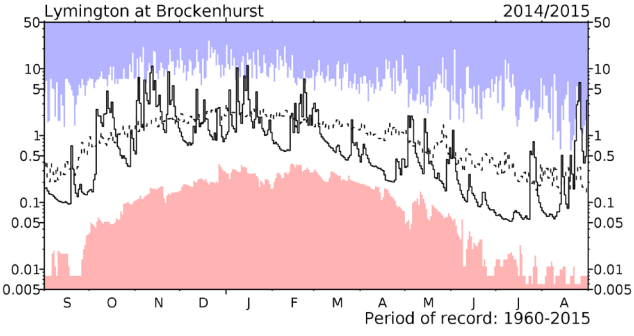




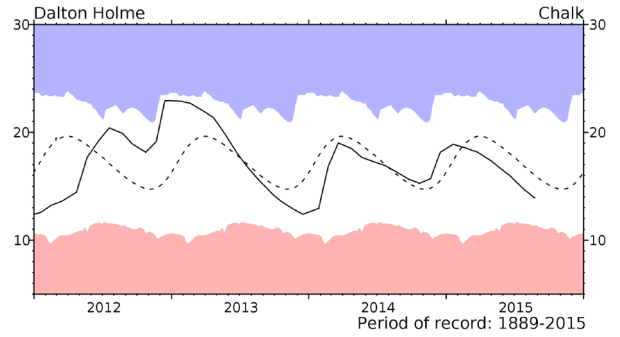


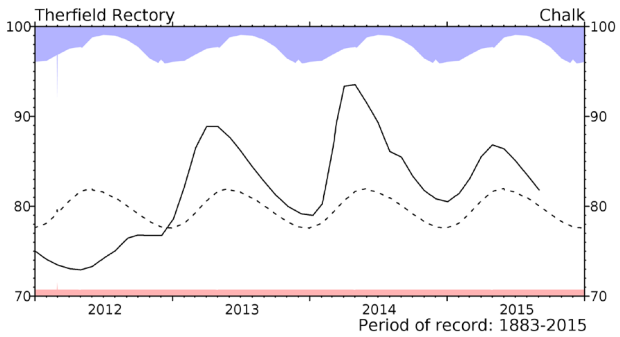


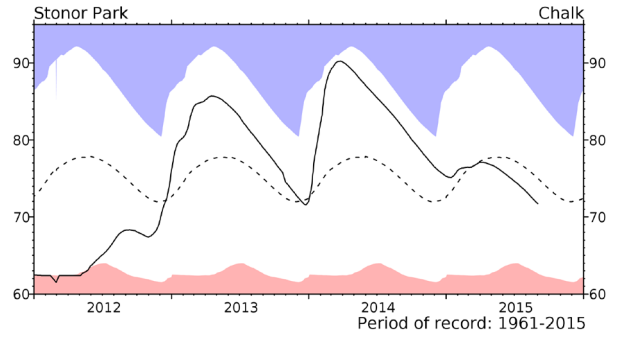


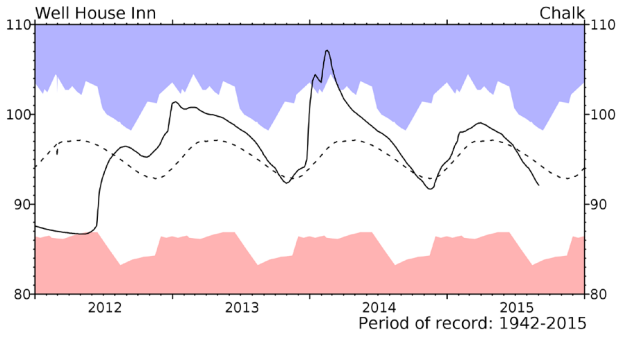


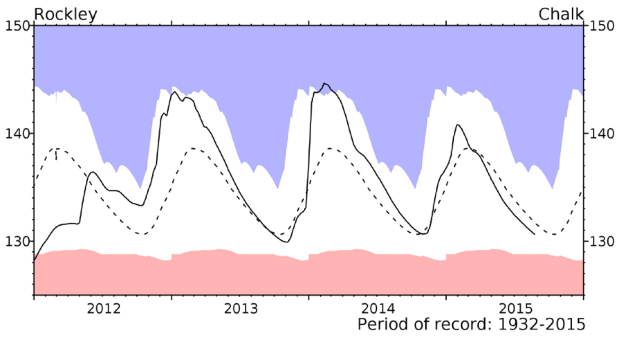
Groundwater…Groundwater

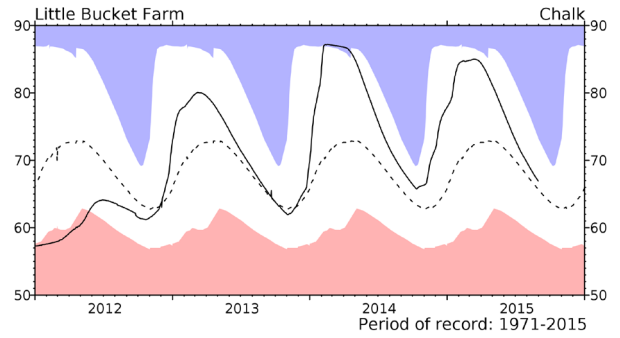


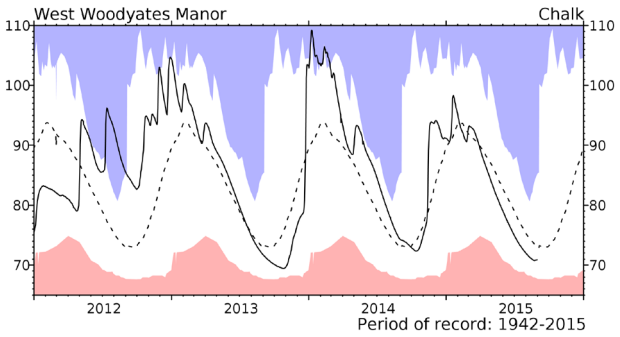


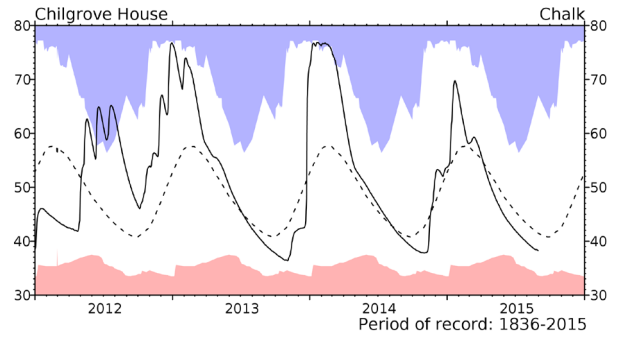


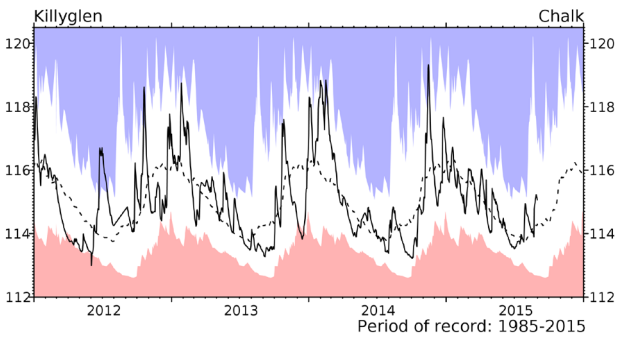


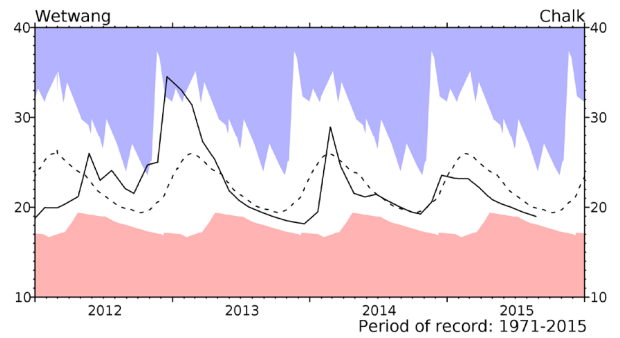






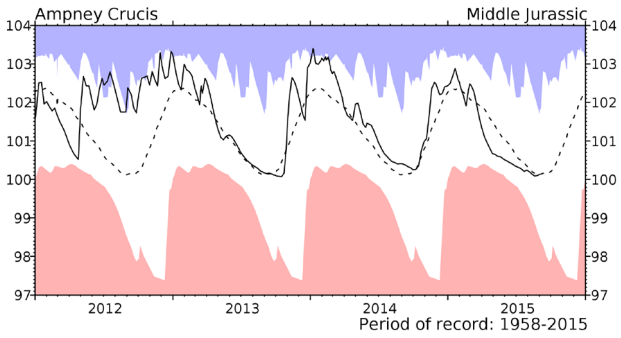


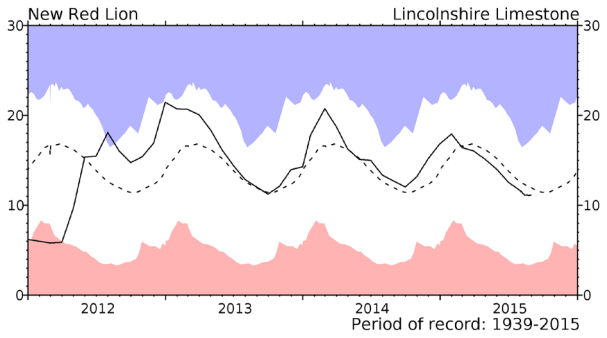


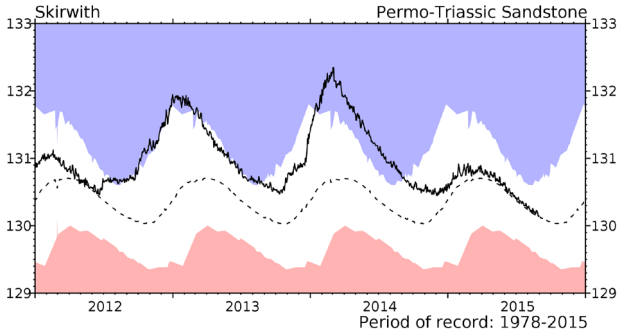


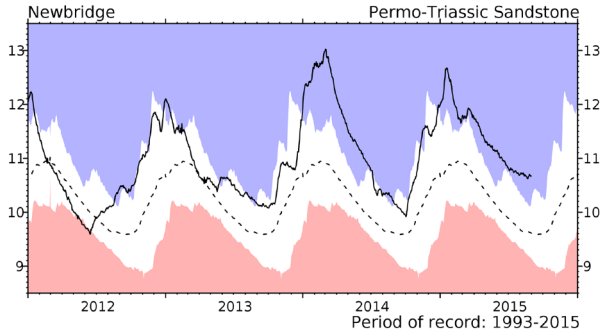
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

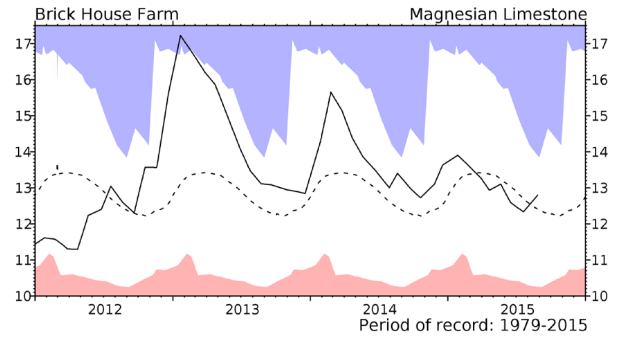
Groundwater ... Groundwater

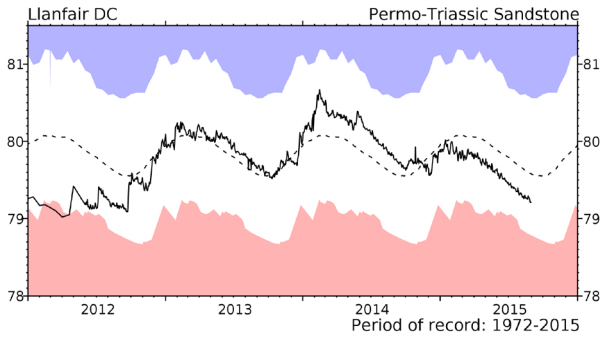


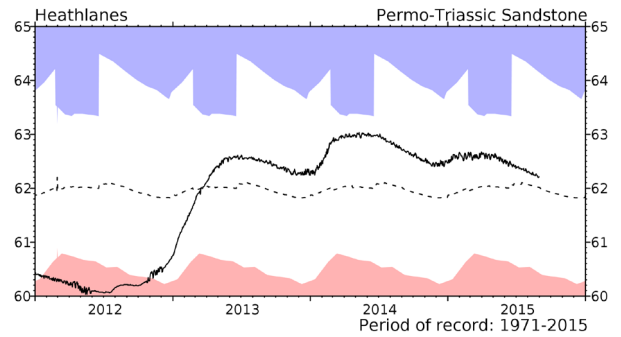


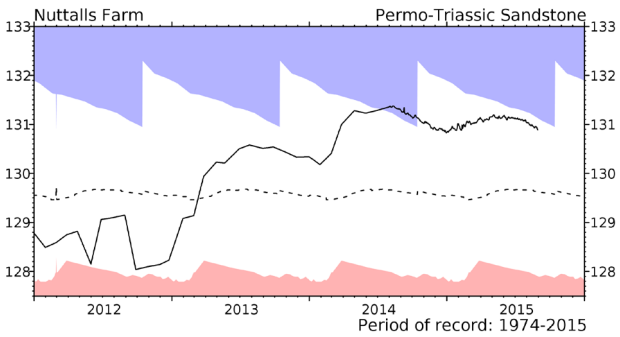


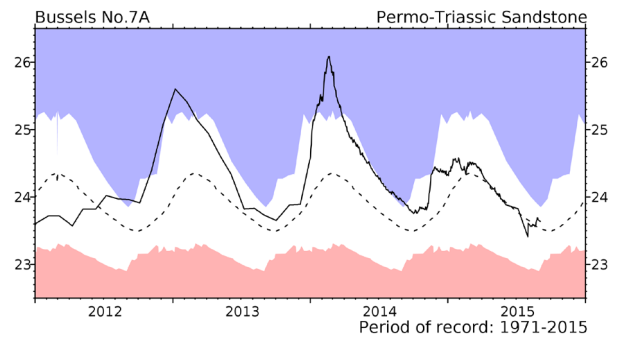


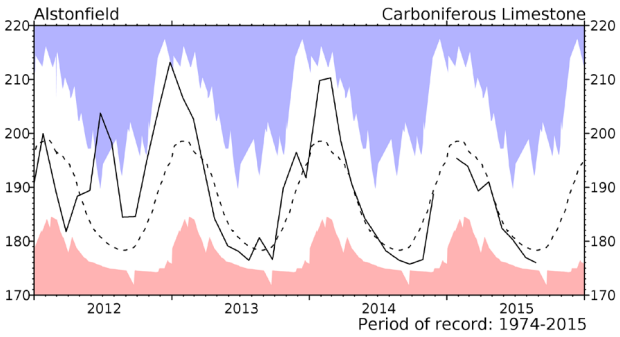








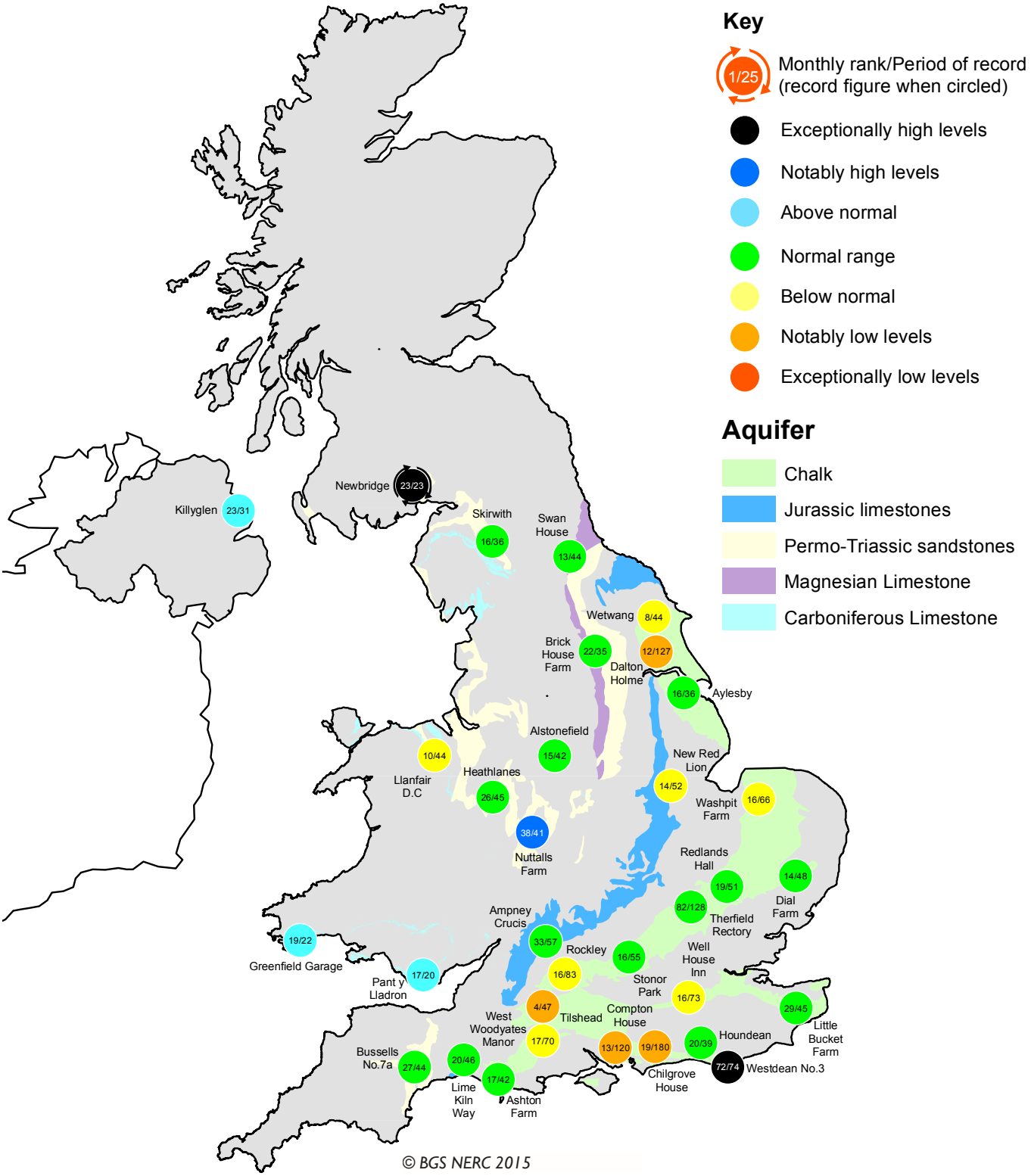




Groundwater levels August / September 2015

Borehole	Level	Date	Aug av.	Borehole	Level	Date	Aug av.	Borehole	Level	Date	Aug av.
Dalton Holme	13.89	25/08	16.28	Chilgrove House	38.20	31/08	41.78	Brick House Farm	12.79	27/08	12.57
Therfield Rectory	81.81	02/09	80.92	Killyglen (NI)	115.06	31/08	114.06	Llanfair DC	79.21	31/08	79.64
Stonor Park	71.73	01/09	75.78	Wetwang	18.96	25/08	20.06	Heathlanes	62.21	31/08	62.04
Tilshead	80.08	31/08	82.95	Ampney Crucis	100.13	01/09	100.25	Nuttalls Farm	130.89	30/08	129.69
Rockley	130.63	24/08	132.09	New Red Lion	11.14	31/08	12.34	Bussells No.7a	23.63	03/09	23.62
Well House Inn	92.12	01/09	94.87	Skirwith	130.14	31/08	130.25	Alstonefield	175.99	25/08	178.58
West Woodyates	70.87	31/08	74.22	Newbridge	10.67	31/08	9.73				

Levels in metres above Ordnance Datum

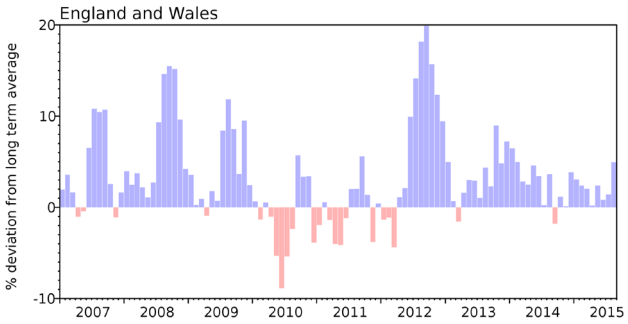


Groundwater levels - August 2015

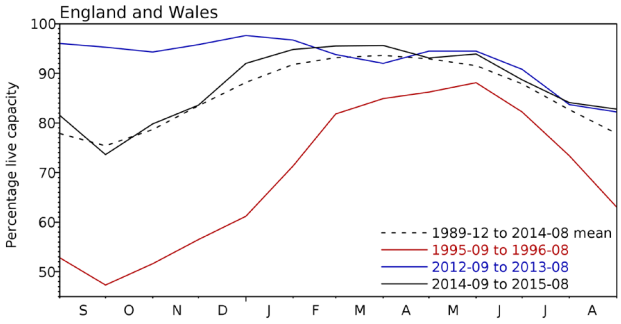
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Jun	2015 Jul	2015 Aug	Aug Anom.	Min Aug	Year* of min	2014 Aug	Diff 15-14
North West	N Command Zone	•	124929	81	70	71	13	15	1984	60	11
	Vyrnwy		55146	91	86	87	17	36	1995	71	16
Northumbrian	Teesdale	•	87936	83	82	81	10	38	1995	84	-3
	Kielder		(199175)	90	95	92	4	66	1989	91	1
Severn-Trent	Clywedog		44922	97	94	91	15	27	1976	90	1
	Derwent Valley	•	39525	90	79	66	-1	34	1995	66	0
Yorkshire	Washburn	•	22035	74	69	69	-1	34	1995	63	6
	Bradford Supply	•	41407	85	73	72	4	21	1995	72	0
Anglian	Grafham		(55490)	95	93	94	8	59	1997	78	16
	Rutland		(116580)	90	87	84	3	66	1995	89	-5
Thames	London	•	202828	86	80	80	-2	62	1995	92	-12
	Farmoor	•	13822	95	99	99	6	64	1995	89	10
Southern	Bewl		28170	84	74	68	-2	38	1990	79	-11
	Ardingly		4685	89	72	62	-12	47	1996	77	-15
Wessex	Clatworthy		5364	76	67	67	2	31	1995	75	-8
	Bristol	•	(38666)	81	72	71	2	43	1990	79	-8
South West	Colliford		28540	85	78	77	5	43	1997	79	-3
	Roadford		34500	87	79	77	4	40	1995	80	-2
	Wimbleball		21320	87	76	72	1	40	1995	78	-6
	Stithians		4967	76	66	68	6	30	1990	66	2
Welsh	Celyn & Brenig	•	131155	99	92	90	7	49	1989	75	15
	Brianne		62140	97	97	100	13	55	1995	93	7
	Big Five	•	69762	87	77	81	9	29	1995	78	3
	Elan Valley	•	99106	91	86	85	9	37	1976	84	1
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	89	88	85	6	45	1998	84	1
	East Lothian	•	10206	98	93	94	9	63	1989	96	-2
Scotland(W)	Loch Katrine	•	111363	85	94	91	20	50	2000	69	22
	Daer		22412	88	97	92	15	41	1995	82	10
	Loch Thom	•	11840	100	100	100	18	58	1997	91	9
Northern Ireland	Total+	•	56800	86	86	92	17	40	1995	82	10
	Silent Valley	•	20634	86	87	97	25	33	2000	82	15

( ) 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

Some of the features displayed on the maps contained in this report are based on the following data with permission of the controller of HMSO.

i. Ordnance Survey data. © Crown copyright and/or database right 2005. Licence no. 100017897.
ii. Land and Property Services data. © Crown copyright and database right, S&LA 145.
iii. Met Office rainfall data. © Crown copyright.