Hydrological Summary

for the United Kingdom

August 2014

General

In a notable contrast with the fine June and July, August was cool (the first month of below-average temperatures since November 2013), unsettled and wet – bringing to a close a near-average summer overall. Several frontal systems – including the remnants of a hurricane – brought strong winds and heavy rainfall to many areas, with northern and eastern Scotland and parts of eastern England being particularly wet for the time of year. The wet weather reversed the typical summer trend of increasing soil moisture deficits, and facilitated sharp flow increases in responsive catchments. The persistent heavy rainfall in northern Scotland caused numerous landslides and significant fluvial flooding (with notable peak flows established in parts of the region), bringing transport disruption and property damage. Elsewhere, however, reported flood incidents were associated with flash flooding in response to intense downpours. August river flows were generally in the normal range, except in southern and eastern England where above-normal flows persisted. Runoff accumulations for the summer were generally in the normal range (the combined summer outflows for Great Britain were very close to the long-term average) or above, and groundwater levels remain in the normal range or above, and were exceptionally high in some slowly-responding aquifers. Reservoir stocks were above-average for the time of year in a majority of reservoirs, and moderately below in a few cases (e.g. Grafham in East Anglia and Celyn & Brenig in Wales). Overall, the water resources situation is favourable entering the autumn.

Rainfall

Across most of the UK, August was an unsettled month, with synoptic conditions dominated by low pressure. In contrast to the warm and dry conditions of late July, the first week of August saw scattered but occasionally heavy and persistent showers in many areas. From the 10th, the remnants of hurricane Bertha dominated weather patterns across the UK for several days. A depression tracked slowly northeastwards across the country on the 10th, bringing strong winds and intense rainfall (57mm was recorded in 6 hours at the Logan Botanic Gardens, Dumfries & Galloway, and 6 hour totals of >25mm were widespread around the Humber), which caused localised flash flooding (e.g. in west London, parts of Lincolnshire and Chelmsford). On the 11th and 12th, the low-pressure system remained off north-east Britain, bringing heavy rainfall to northern Scotland; provisional 24 hour totals of over 100mm were registered at a number of gauges in Moray. Further frontal systems brought heavy rainfall later in the month; the 25th/26th was particularly wet in southern Britain. Overall, the UK received over 170% of the typical August rainfall, but some areas received substantially more: southern region received double the August average, while it was the wettest August on record (from 1910) for the Highlands and north-east Scotland, and the fifth wettest for Scotland as a whole. With the wet August counteracting the dry June and July, rainfall totals for summer 2014 were moderately above average across most of the UK, although below-average summer rainfall was received in Wales and parts of western England. Rainfall accumulations since the start of spring were also near-average or moderately above, while notable accumulations over longer periods still largely reflect the exceptionally wet start to 2014.

River flows

The river flow recessions which had prevailed through much of the summer were interrupted abruptly in the first few days of August, with steep increases in flow in responsive western catchments. Flows in many rivers were above average by the end of the first week and flood alerts (fluvial and tidal) became widespread in England and Wales during the passage of ex-Hurricane Bertha. On the 11th, there were 40 flood warnings in place in northern and eastern Scotland following prolonged heavy rainfall on responsive upland rivers. The resulting flood episode caused widespread disruption (exacerbated by landslides and fallen trees) to road and rail networks across northern Scotland and prompted a major emergency response; in Elgin, 200 homes were evacuated due to the risk of flooding from the Lossie. New August maximum peak flows were registered in five index catchments in northeast Scotland, while provisional data from SEPA suggests period-of-record maximum flows were registered in some catchments. The Dee (at Woodend) registered its third highest flow (for any month) in a record from 1929. Correspondingly, August runoff totals were exceptional across northern Scotland, a dramatic departure from early summer when flows were notably low (e.g. on the Ewe, where July runoff was 56% of average and August runoff 285%). The Bush in Northern Ireland also registered 270% of its August average. August runoff totals were in the normal range across southern Scotland and much of England and Wales, although above-normal in the south-east and in parts of eastern England (notably so in some cases, e.g. the Lud and the Blackwater). Runoff accumulations for the summer as a whole were above normal in southeast England and northern Scotland and generally normal elsewhere, with some moderate deficiencies in north Wales.

Groundwater

Soil moisture deficits decreased sharply due to the wet conditions in August, but groundwater levels continued to fall across the main aquifer areas, as expected for the time of year. Levels in the Chalk were in the normal range or above across most of the aquifer, and were notably high in the slower-responding Chalk of the Chilterns. In the Jurassic limestones, levels were average or moderately above, while in the Magnesian limestones, levels were above average, with increases recorded in several boreholes in Yorkshire in response to the high August rainfall. Levels remain above average throughout the Permo-Triassic sandstones, with exceptionally high levels in the Midlands (Nuttalls Farm) and in southwest (Bussels) and northwest (Skirwith) England; it was the eighth consecutive month of maximum levels at the latter. Lime Kiln Way in the Upper Greensand of southwest England also remained at a record high for the time of year. In these slowly-responding aquifers, levels remain high due to the legacy of the wet winter, although they are slowly declining. The only index site where levels are below average is in the responsive Carboniferous Limestone at Greenfield Garage in southwest Wales, where the summer has been notably dry. At the national scale, groundwater resources are healthy and the autumn/winter recharge season will commence from an average to above-average baseline.

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.

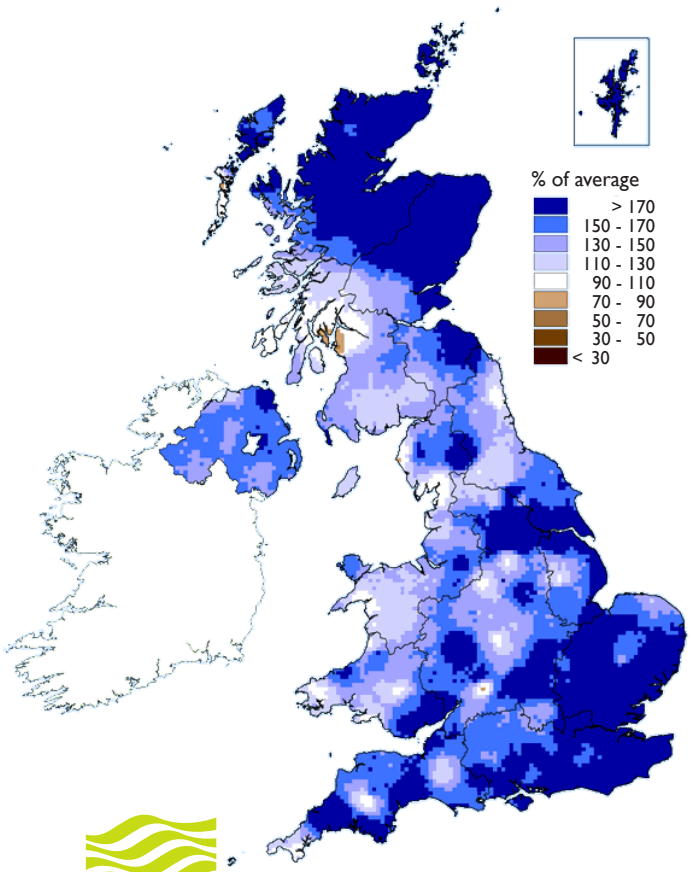
Area	Rainfall	Aug 2014	Jun14 – Aug14	RP	Mar13 – Aug14	RP	Dec13 – Aug14	RP	Sep13 – Aug14	RP
United Kingdom	mm	**140**	259		509		1054		1380	
	%	**173**	120	2-5	116	2-5	139	>>100	128	>>100
England	mm	**109**	208		406		807		1064	
	%	**168**	117	2-5	115	2-5	139	80-120	131	30-50
Scotland	mm	**189**	344		676		1420		1843	
	%	**191**	130	2-5	123	8-12	143	>>100	128	>100
Wales	mm	**146**	261		549		1275		1689	
	%	**144**	102	2-5	104	2-5	134	40-60	124	15-25
Northern Ireland	mm	**141**	260		479		968		1261	
	%	**155**	110	2-5	102	2-5	123	15-25	114	15-25
England & Wales	mm	**114**	216		426		872		1150	
	%	**163**	114	2-5	113	2-5	138	80-120	130	30-50
North West	mm	**144**	263		506		1036		1377	
	%	**151**	105	2-5	104	2-5	126	10-20	118	8-12
Northumbrian	mm	**108**	214		426		781		1030	
	%	**153**	113	2-5	114	2-5	130	15-25	125	10-20
Severn-Trent	mm	**97**	198		391		729		967	
	%	**155**	114	2-5	114	2-5	133	15-25	129	15-25
Yorkshire	mm	**115**	211		421		743		963	
	%	**174**	116	2-5	116	2-5	126	8-12	120	5-10
Anglian	mm	**94**	190		333		551		740	
	%	**181**	126	2-5	116	2-5	127	8-12	124	8-12
Thames	mm	**98**	184		361		782		1004	
	%	**179**	119	2-5	116	2-5	157	>>100	145	>100
Southern	mm	**107**	179		364		902		1184	
	%	**199**	116	2-5	116	2-5	168	>>100	154	>100
Wessex	mm	**108**	201		428		974		1249	
	%	**164**	117	2-5	121	2-5	159	>>100	146	>100
South West	mm	**139**	260		535		1227		1640	
	%	**168**	120	2-5	118	2-5	145	>>100	137	>100
Welsh	mm	**143**	259		539		1241		1644	
	%	**145**	104	2-5	105	2-5	136	50-80	126	20-30
Highland	mm	**254**	410		801		1608		2121	
	%	**231**	139	5-10	128	10-20	137	50-80	124	30-50
North East	mm	**195**	346		518		962		1207	
	%	**280**	172	10-20	128	5-10	146	80-120	128	15-25
Tay	mm	**161**	319		595		1397		1734	
	%	**194**	141	2-5	123	2-5	158	>>100	138	>100
Forth	mm	**126**	266		554		1125		1441	
	%	**153**	120	2-5	122	5-10	142	60-90	128	50-80
Tweed	mm	**130**	253		515		1055		1322	
	%	**175**	124	2-5	126	5-10	155	>100	140	>100
Solway	mm	**148**	292		638		1467		1903	
	%	**139**	107	2-5	116	2-5	151	>>100	136	>>100
Clyde	mm	**157**	338		770		1704		2226	
	%	**124**	105	2-5	118	5-10	143	>100	129	>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 April 2014 (inclusive) are provisional.

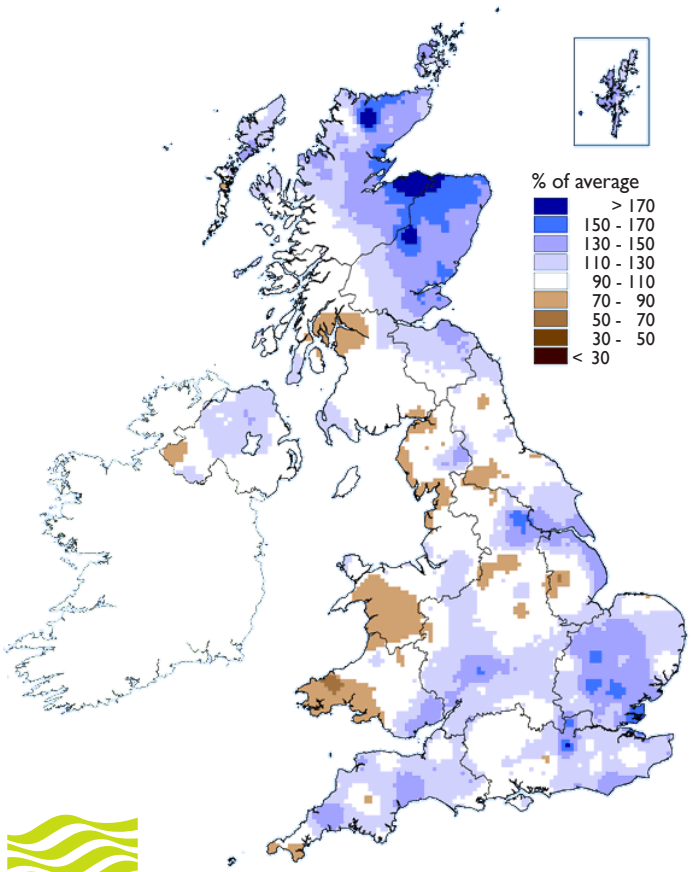
Rainfall . . . Rainfall . . .

August 2014 rainfall as % of 1971-2000 average



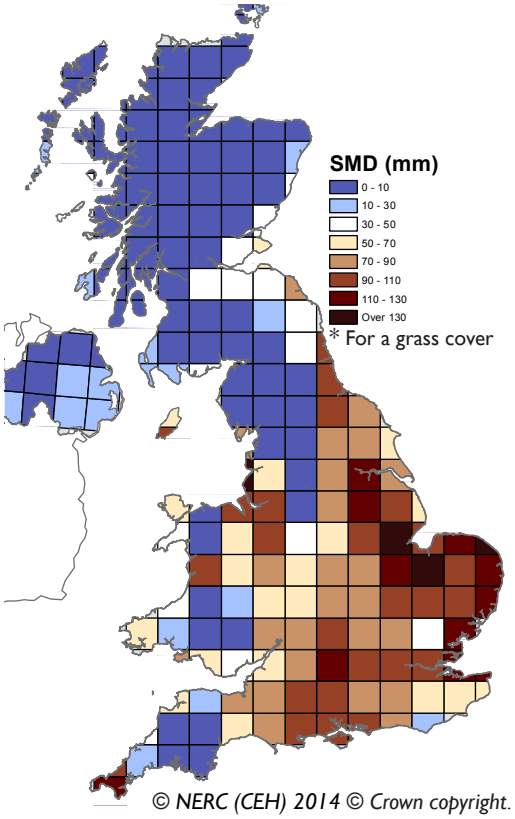
Met Office

June 2014 - August 2014 rainfall as % of 1971-2000 average



Met Office

MORECS Soil Moisture Deficits* August 2014



Met Office

Met Office 3-month outlook Updated: August 2014

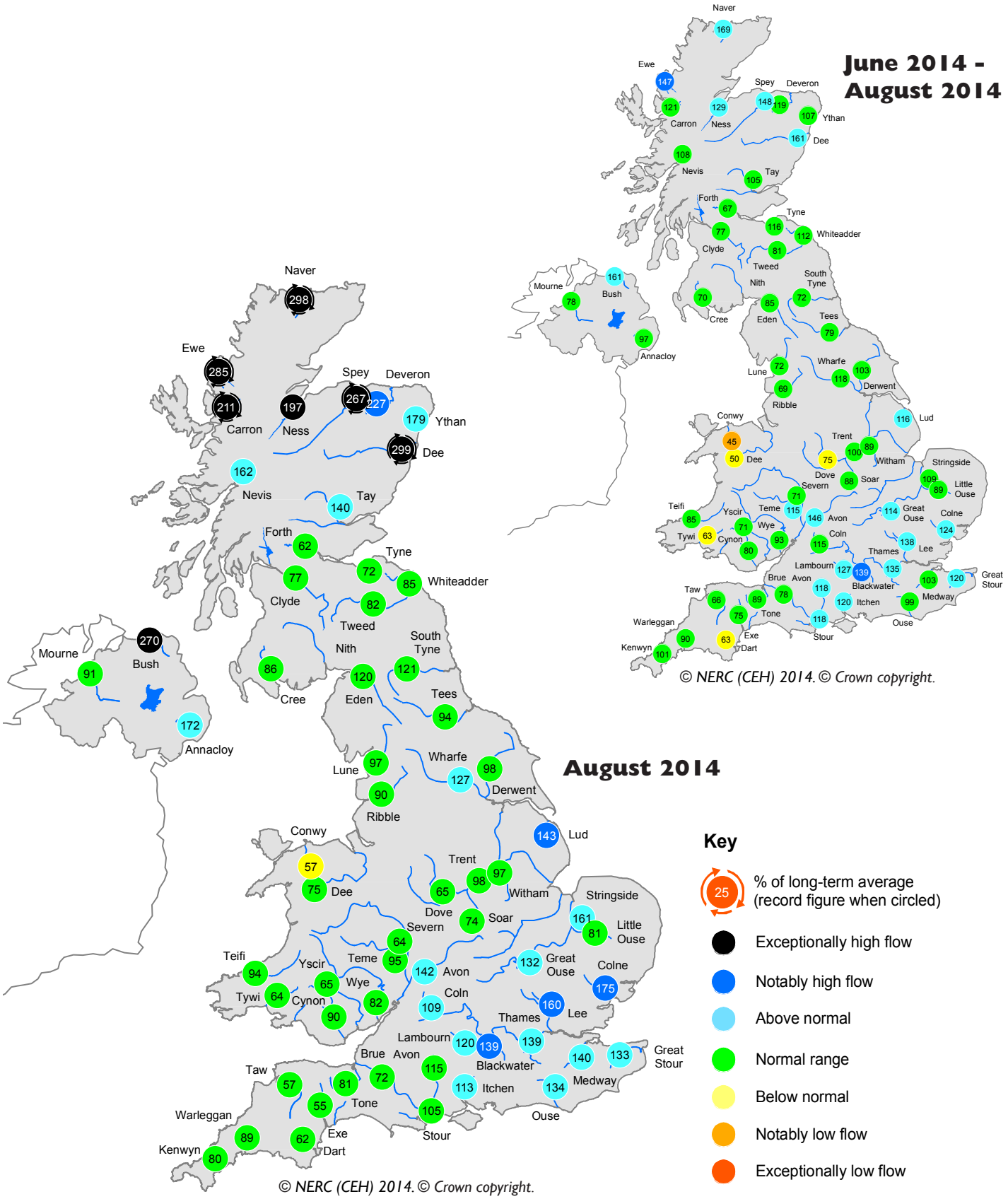
The latest predictions for UK precipitation slightly favour below-average rainfall for September-October-November as a whole.

The probability that UK precipitation for September-October-November will fall into the driest of our five categories is around 30% and the probability that it will fall into the wettest category is 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.

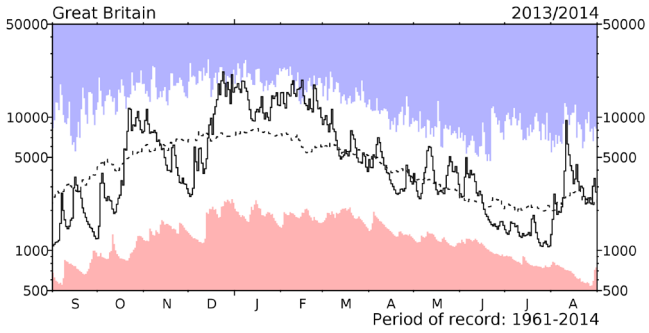
River flow . . . River flow . . .

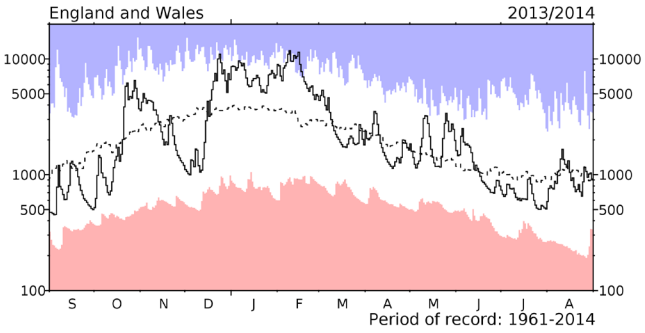


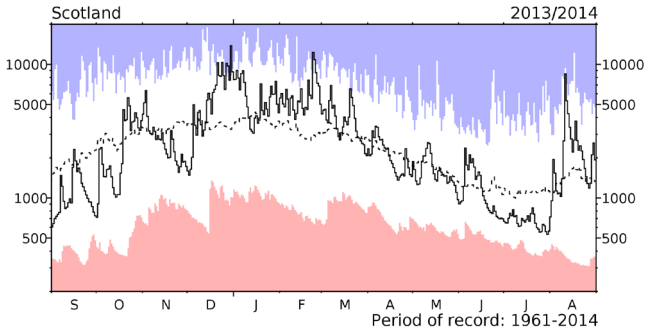
River flows

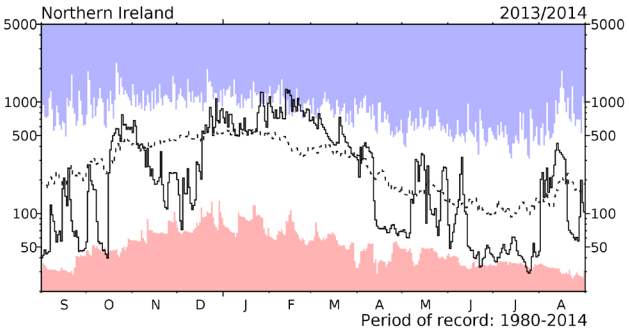
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

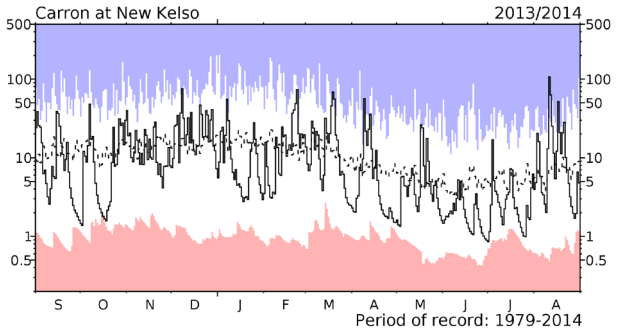
River flow . . . River flow . . .

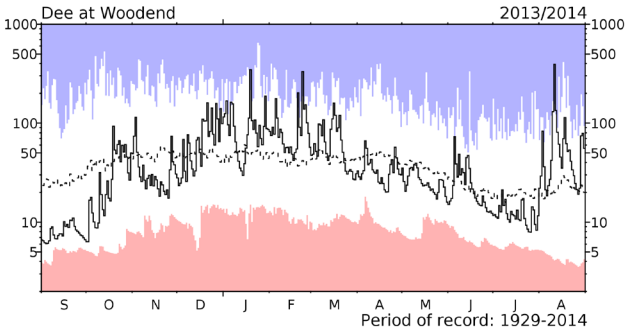


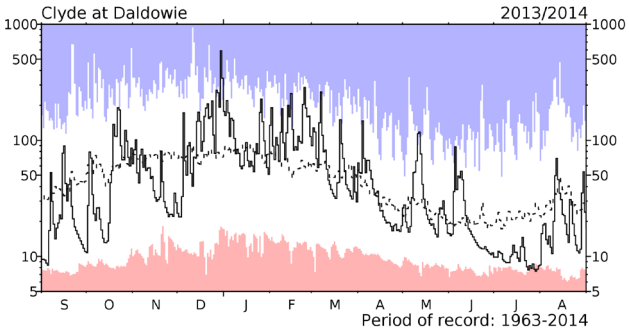


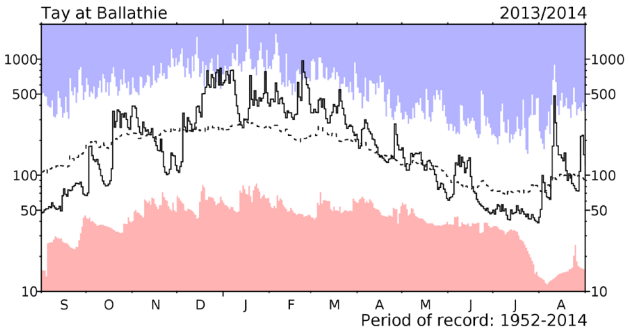


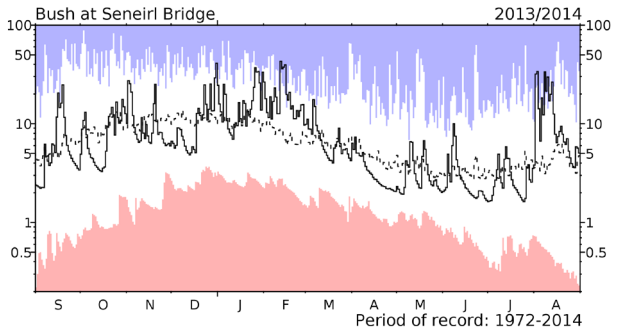


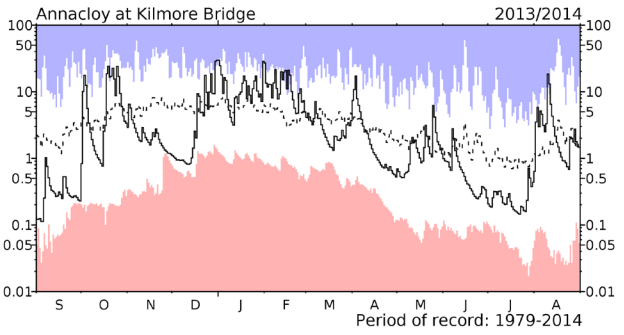








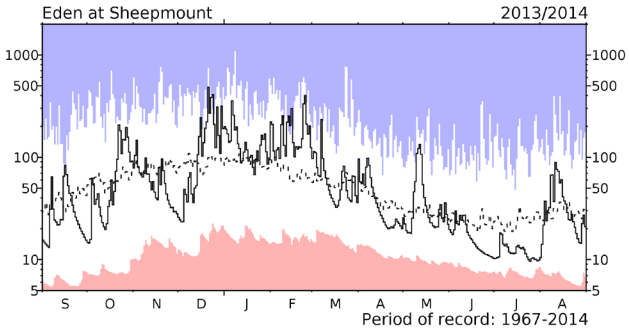


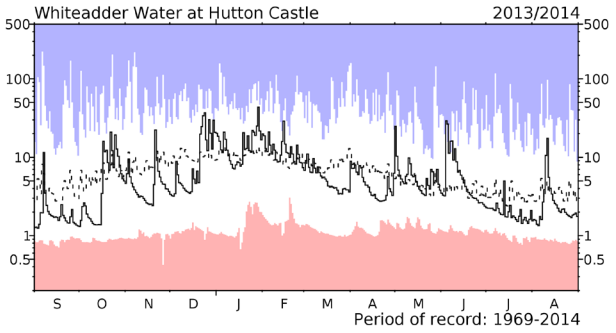


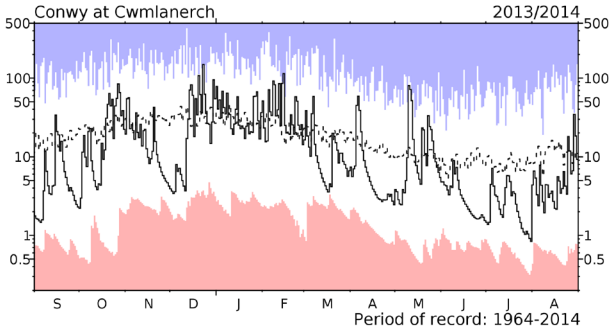
River flow hydrographs

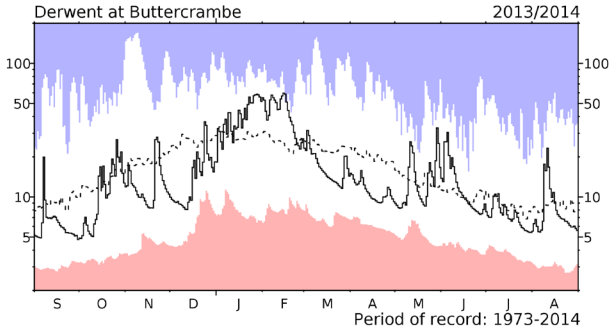
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to September 2013 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed line.

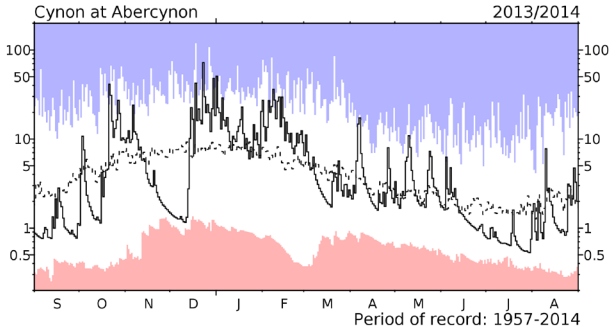
River flow . . . River flow . . .

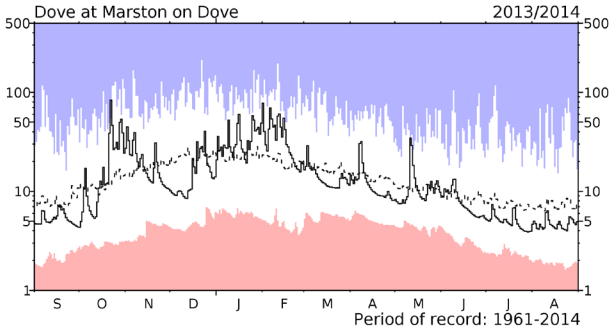


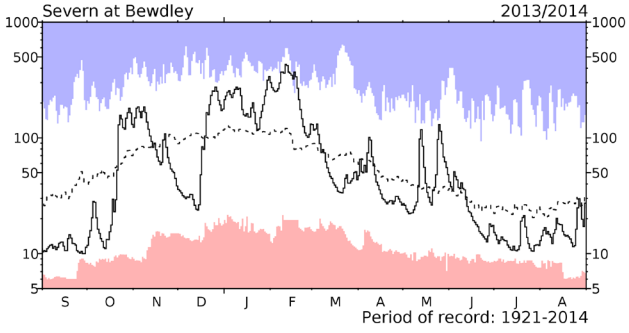


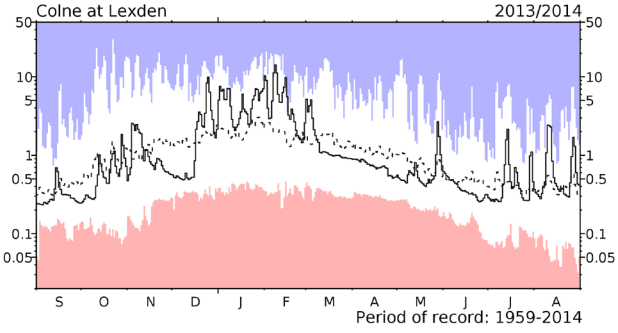


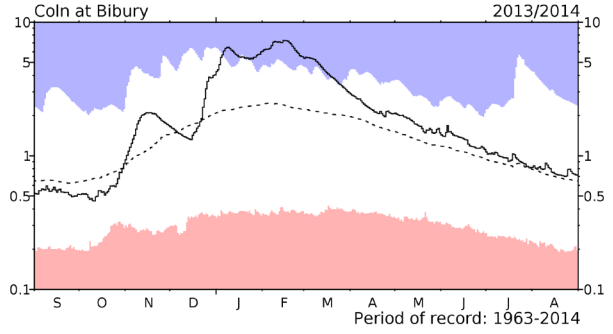


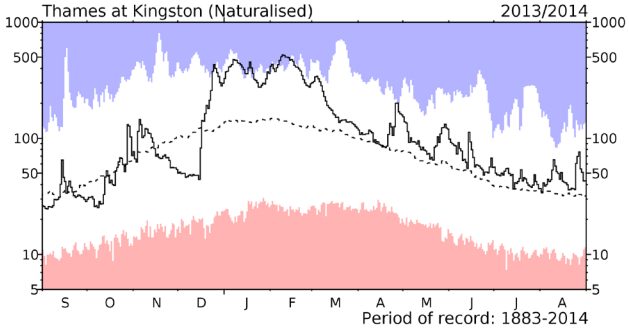


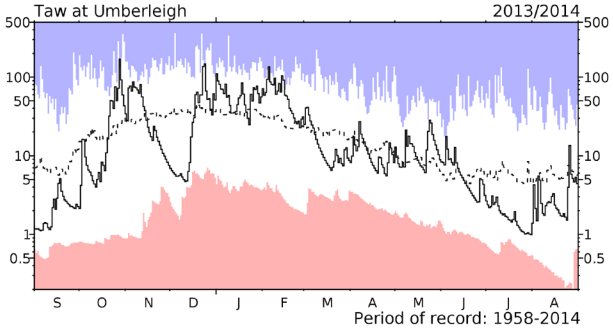


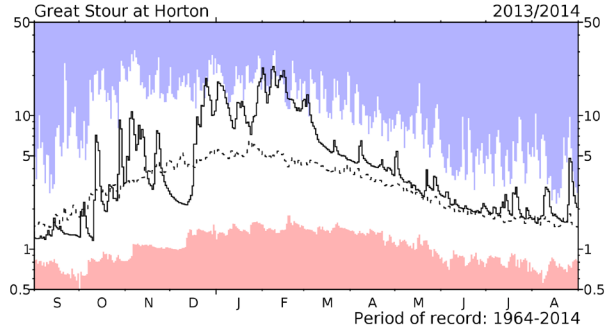




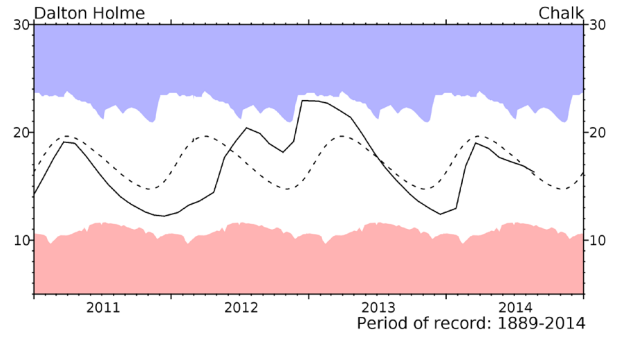


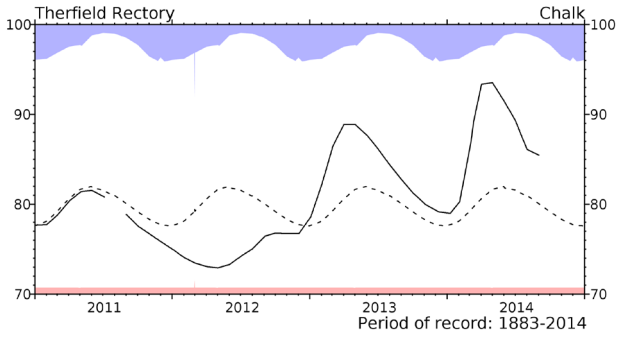


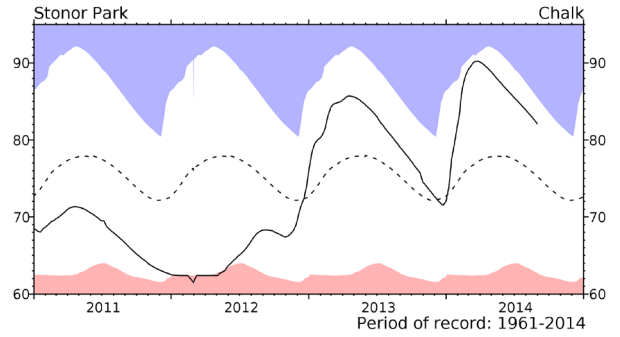


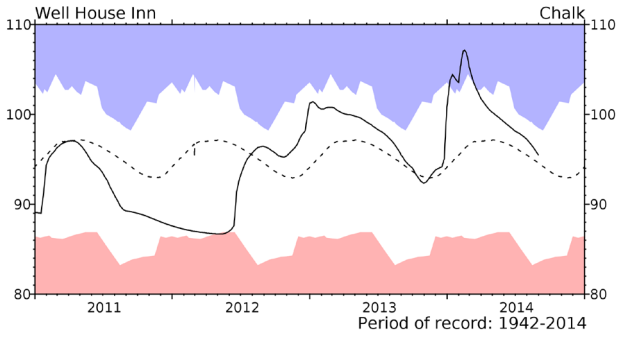


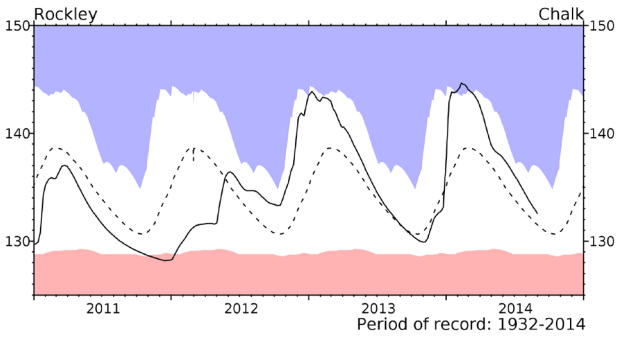
Groundwater…Groundwater

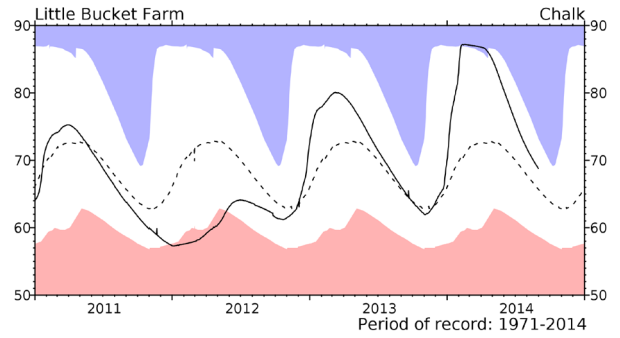


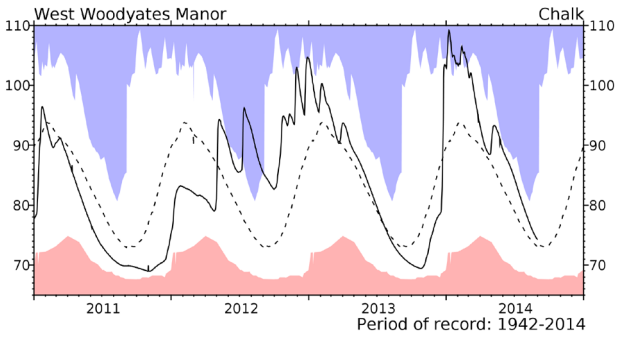


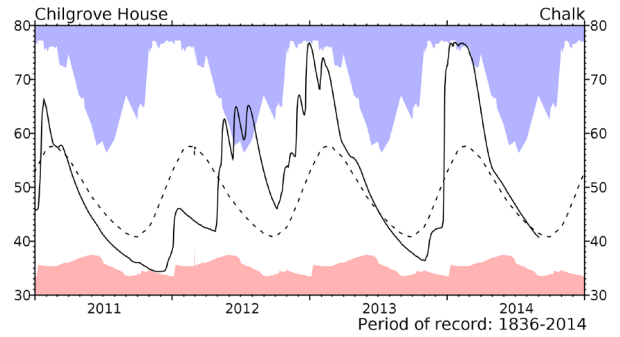


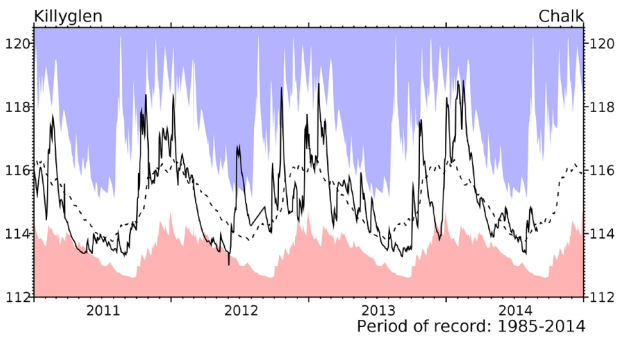


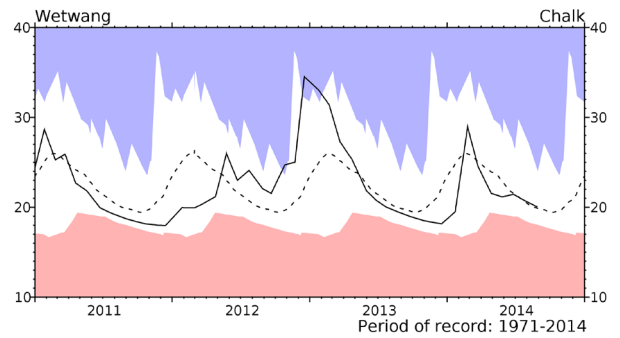






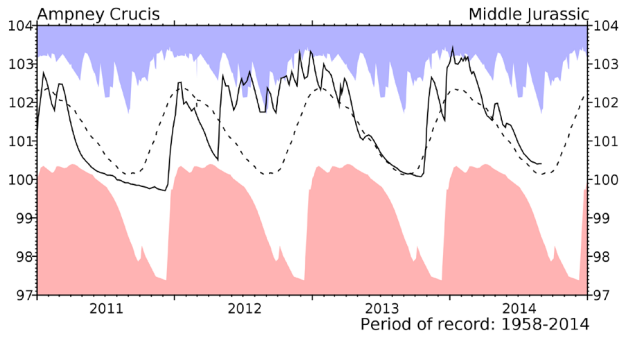


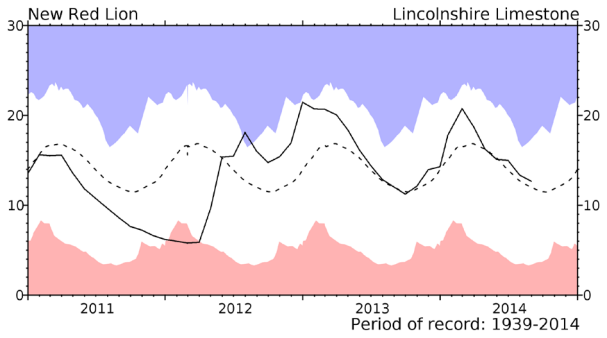


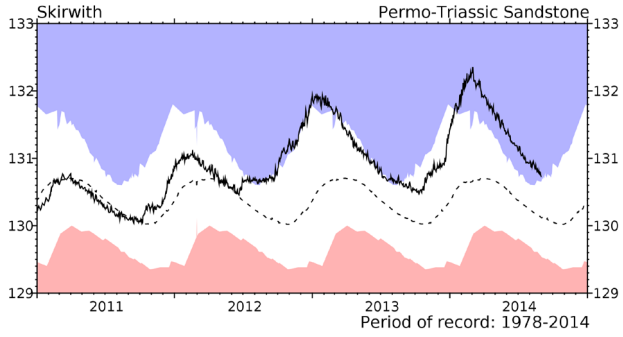


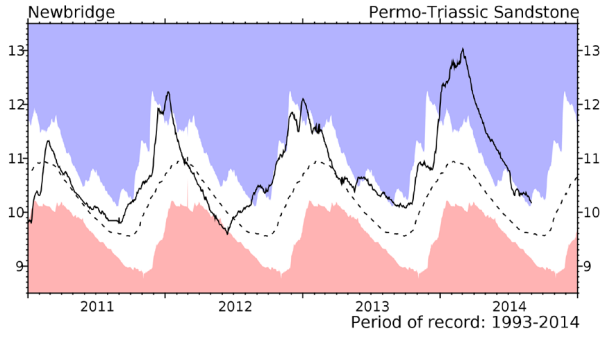
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

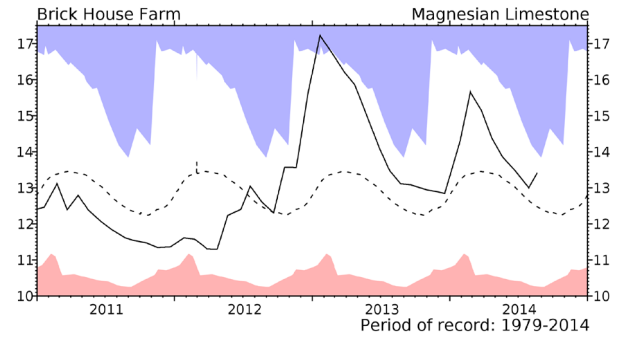
Groundwater... Groundwater

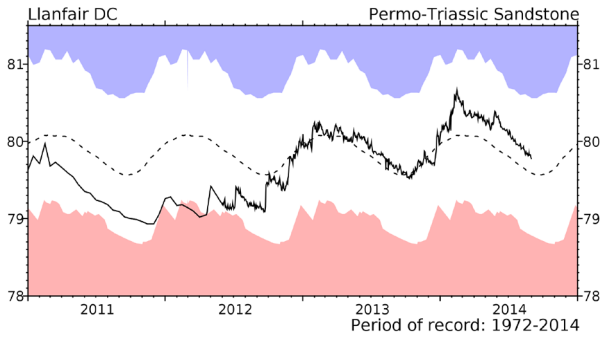


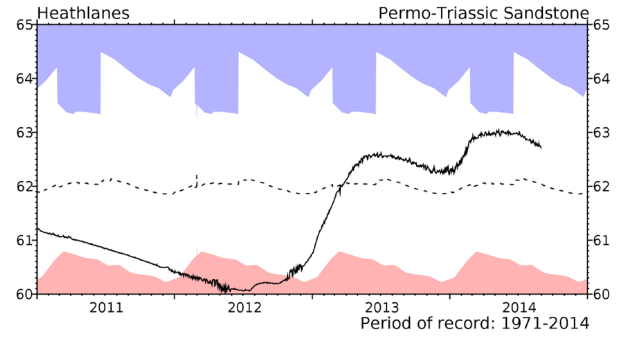


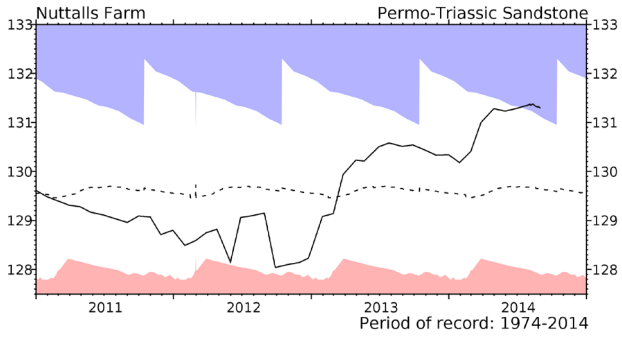


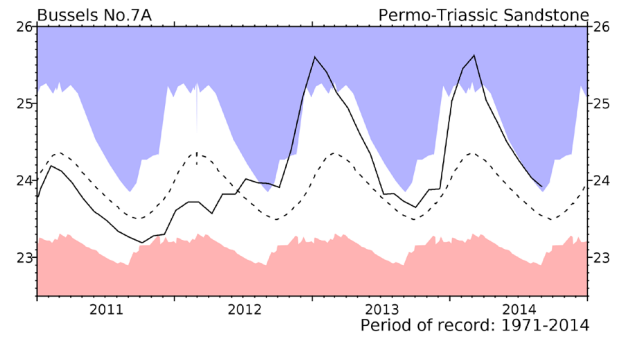


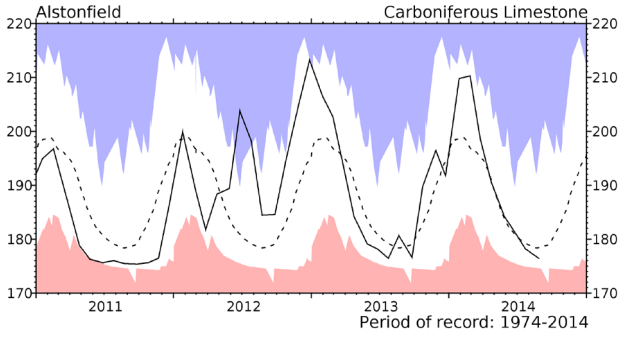








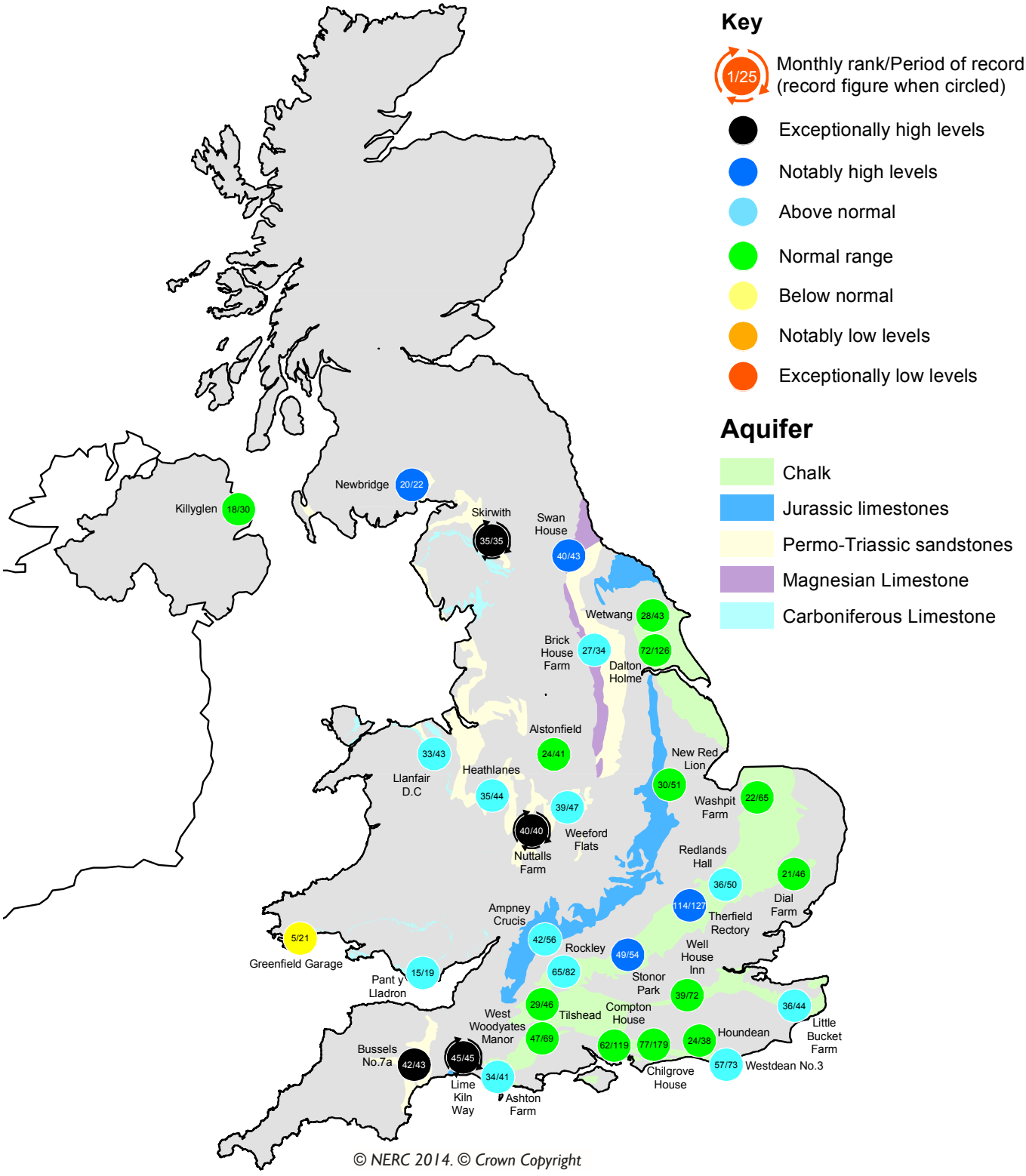




Groundwater levels August / September 2014

Borehole	Level	Date	Aug av.	Borehole	Level	Date	Aug av.	Borehole	Level	Date	Aug av.
Dalton Holme	16.31	22/08	16.28	Chilgrove House	40.68	01/09	41.77	Brick House Farm	13.40	20/08	12.54
Therfield Rectory	85.45	01/09	80.88	Killyglen (NI)	114.08	31/08	114.05	Llanfair DC	79.78	31/08	79.63
Stonor Park	82.07	31/08	75.65	Wetwang	20.04	27/08	20.06	Heathlanes	62.71	31/08	62.02
Tilshead	82.22	31/08	82.94	Ampney Crucis	100.41	31/08	100.24	Nuttalls Farm	131.29	31/08	129.64
Rockley	132.57	31/08	132.08	New Red Lion	12.66	31/08	12.34	Bussels No.7a	23.92	01/09	23.61
Well House Inn	95.47	31/08	94.85	Skirwith	130.73	31/08	130.23	Alstonfield	176.44	27/08	178.63
West Woodyates	74.32	31/08	74.19	Newbridge	10.18	31/08	9.70				

Levels in metres above Ordnance Datum

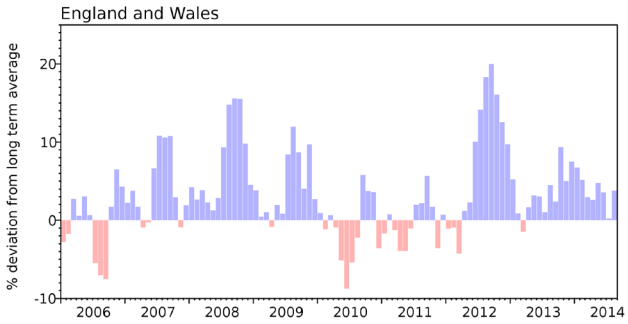


Groundwater levels - August 2014

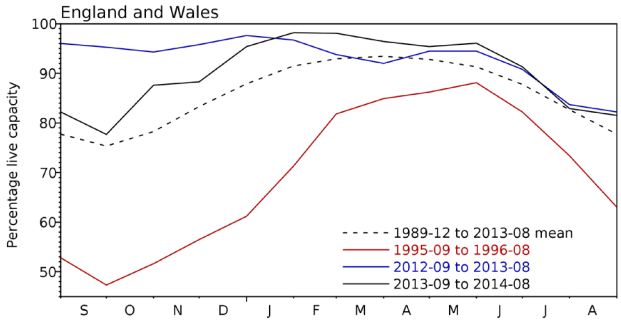
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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)	2014 Jun	2014 Jul	2014 Aug	Aug Anom.	Min Aug	Year* of min	2013 Aug	Diff 14-13
North West	N Command Zone	•	124929	66	54	60	2	15	1984	67	-7
	Vyrnwy		55146	90	75	71	1	36	1995	80	-9
Northumbrian	Teesdale	•	87936	92	77	84	14	38	1995	93	-9
	Kielder		(199175)	92	88	91	3	66	1989	86	5
Severn-Trent	Clywedog		44922	98	89	90	14	27	1976	90	0
	Derwent Valley	•	39525	83	69	66	-1	34	1995	65	1
Yorkshire	Washburn	•	22035	77	68	63	-7	34	1995	69	-6
	Bradford Supply	•	41407	87	76	72	4	21	1995	62	10
Anglian	Grafham		(55490)	92	83	78	-8	59	1997	91	-13
	Rutland		(116580)	93	91	89	8	66	1995	80	9
Thames	London	•	202828	97	94	92	11	62	1995	90	2
	Farmoor	•	13822	100	97	89	-4	64	1995	96	-7
Southern	Bewl		28170	99	86	79	9	38	1990	77	2
	Ardingly**		4685	95	84	77	3	47	1996	66	11
Wessex	Clatworthy		5364	93	73	75	10	31	1995	56	19
	Bristol	•	(38666)	93	84	79	10	43	1990	60	19
South West	Colliford		28540	96	86	79	7	43	1997	72	7
	Roadford		34500	93	87	80	7	40	1995	73	6
	Wimbleball		21320	97	88	78	7	40	1995	60	17
	Stithians		4967	88	75	66	4	30	1990	66	1
Welsh	Celyn & Brenig	•	131155	97	86	75	-8	49	1989	89	-14
	Brianne		62140	96	88	93	6	55	1995	99	-6
	Big Five	•	69762	94	84	78	6	29	1995	84	-6
	Elan Valley	•	99106	94	83	84	8	37	1976	83	1
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	94	86	84	5	45	1998	67	17
	East Lothian	•	10206	99	98	96	12	63	1989	87	9
Scotland(W)	Loch Katrine	•	111363	86	73	69	-2	50	2000	65	4
	Daer		22412	86	76	82	6	41	1995	60	22
	Loch Thom	•	11840	99	90	91	9	58	1997	82	9
Northern Ireland	Total+	•	56800	79	73	82	7	40	1995	76	6
	Silent Valley	•	20634	79	69	82	11	33	2000	73	9

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

** the monthly record of Ardingly reservoir stocks is under review.

+ excludes Lough Neagh

Details of the individual reservoirs in each o 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

National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme (NHMP) was instigated in 1988 and is undertaken jointly by the Centre for Ecology & Hydrology (CEH) and the British Geological Survey (BGS) – both are component bodies of the Natural Environment Research Council (NERC). The National River Flow Archive (maintained by CEH) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

Data Sources

River flow and groundwater level data are provided by the Environment Agency (EA), Natural Resources Wales - Cyfoeth Naturiol Cymru, 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).

Reservoir level information is provided by the Water Service Companies, the EA, Scottish Water and Northern Ireland Water.

Most rainfall data are provided by the Met Office (address opposite).

To allow better spatial differentiation the monthly rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA.

The monthly, and n-month, rainfall figures have been produced by the Met Office, National Climate Information Centre (NCIC) and are based on gridded data from raingauges. They include a significant number of monthly raingauge totals provided by the EA and SEPA. The Met Office NCIC monthly rainfall series extends back to 1910 and forms 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/Monthly_gridded_datasets_UK.pdf

The regional figures for the current month are based on limited raingauge networks so these (and the return periods associated with them) should be regarded as a guide only.

The Met Office NCIC monthly rainfall series are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation.

From time to time the Hydrological Summary may also refer to evaporation and soil moisture figures. These are obtained from MORECS, the Met Office services involving the routine calculation of evaporation and soil moisture throughout the UK.

For further details please contact:

The Met Office
FitzRoy Road
Exeter
Devon
EX1 3PB

Tel.: 0870 900 0100
Email: enquiries@metoffice.gov.uk

The National Hydrological Monitoring Programme depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged.

Enquiries

Enquiries should be addressed to:

Hydrological Summaries for the UK
Centre for Ecology & Hydrology
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB

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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iii. Met Office rainfall data. © Crown copyright.

09/2014