Hydrological Summary

for the United Kingdom

July 2014

General

July was sunny and dry for much of the UK but high temperatures stimulated some very intense thundery downpours, bringing disruptive flash flooding to many areas. While July was warmer than average (the eighth consecutive month of above average temperatures) it was not exceptional, although a particularly hot spell occurred mid-month and daily maximum temperatures of over 25°C were common through the latter half of the month. Nationally, the July rainfall totals were slightly below average. The monthly totals were substantially above average in some areas (notably eastern England) but much of the rain that fell was concentrated in a few torrential showers. As a result of the persistent warm, dry conditions, soil moisture deficits climbed and were above average at the end of the month across much of the country, appreciably so in some areas (e.g. Wales and south-west England). Correspondingly, river flows and groundwater levels generally declined, as is typical for the time of year, and notably low July flows were registered in some catchments. Groundwater levels remain in the normal range or above, a legacy of the wet winter, which is also keeping river flows elevated in some permeable catchments. Overall reservoir stocks are near-average, but marginally below in some reservoirs in Scotland, Northern Ireland and in northern England (10% below average in the Northern Command Zone). The water resources situation is generally favourable for the time of year. Locally depressed flows could lead to ecological stress, but current low flows are not exceptional and are confined to responsive catchments in which the situation can change very rapidly.

Rainfall

Although frontal systems crossed the British Isles at various times, bringing spells of unsettled weather, July was generally dominated by high pressure and much of the country saw some long dry spells, particularly in southern and central England (no rain fell after the 19th in Wallingford). However, the warmth triggered thunderstorms and localised downpours. Thunderstorms between the 18th and the 20th brought intense rainfall to many areas in the Midlands, the south-east and East Anglia (with 46mm in an hour reported in Norwich on the 20th) leading to flash flooding, which caused localised property damage (e.g. in Canvey Island) and widespread transport disruption. On the 28th torrential downpours (with hourly totals over 20mm widespread in the south-east and 37mm reported in Isfield, Sussex) brought flash flooding to many urban areas in the south and, in combination with damaging hailstorms, caused significant disruption to roads and railways. The July rainfall total for the UK was slightly below average, but there were marked spatial variations: Wales, south-west and central southern England, and parts of northern England were dry (receiving less than half the typical rainfall in some places, e.g. Pembrokeshire and parts of Lincolnshire), while much of eastern England was wet, with double the July average received in parts of Essex and Suffolk. Northern Ireland received 82% of average and while rainfall for Scotland was slightly below average, parts were notably dry. The summer so far (June & July) has been dry but the two-month deficiencies are not exceptional. Rainfall accumulations since the start of spring are generally close to average across the whole of the UK and remain well above average for the year so far.

River flows

In most index rivers, the recessions established in mid-June continued through July along a fairly typical trajectory for the summer, although in some responsive catchments recessions were sharply interrupted during intense rainfall events. There were flood alerts around the 19th in small catchments in the south-east and the Midlands, but no appreciable peak flows were registered and flood incidents were largely associated with surface water flooding in built-up areas. Overall, July river flows were unremarkable in terms of magnitude (the national outflows for July were all below average but not notably so) but display a marked north-west/south-east gradient. In northern and western Britain and Northern Ireland, flows were below average, with notably low flows in some catchments, including both the Conwy and Dee in north Wales. The South Tyne registered its lowest July flow since the 1995 drought (the sixth lowest in a record from 1963). Fish rescues were undertaken in late July on the upper Teme in response to fish becoming stranded in pools. In south-east England, the above average flows reflect a combination of circumstances: higher flows in responsive catchments in the east (e.g. the Colne and the Sussex Ouse) are a consequence of the July storms, whereas in central southern England the higher flows are a residual effect of the winter rainfall in groundwater-fed rivers. This influence can be discerned in the notable runoff accumulations since March, but elsewhere accumulations in this timeframe are generally in the normal range, except in a few western catchments and in the far north of Scotland, where the Deveron registered its second lowest March-July period in a record from 1960.

Groundwater

Soil moisture deficits (SMDs) climbed steeply in July as a result of the dry conditions and high temperatures and are moderately above average (for the time of year) across the Chalk outcrop and substantially higher than average across other aquifers with outcrops in the west. Groundwater levels fell across all major aquifers throughout the UK, as is typical for the time of year. Levels in the Chalk have returned to normal in eastern England and the South Downs, but elsewhere, particularly in the Chilterns, they remain above average (localised groundwater flooding is still apparent on roads in parts of the Chilterns). In the Jurassic and Magnesian limestones, levels are near average apart from at Swan House, where they remain exceptionally high (a response to the wet winter as well as significant rainfall in May). Lime Kiln Way in the Upper Greensand remained at a record high for the time of year. Levels remain above average throughout the Permo-Triassic sandstones, with record July maxima persisting at Bussels No.7a in south-west England and at Skirwith in north-west England; levels at Newbridge, also in the north-west, have fallen into the notably high range. The only index site where levels were below average was in the very responsive Carboniferous Limestone of south-west Wales, at Greenfield Garage, an area that received less than half average July rainfall. Groundwater resources are therefore healthy and although late summer SMDs are likely to ensure that seasonal recessions continue into the autumn, the recharge season is expected to 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.

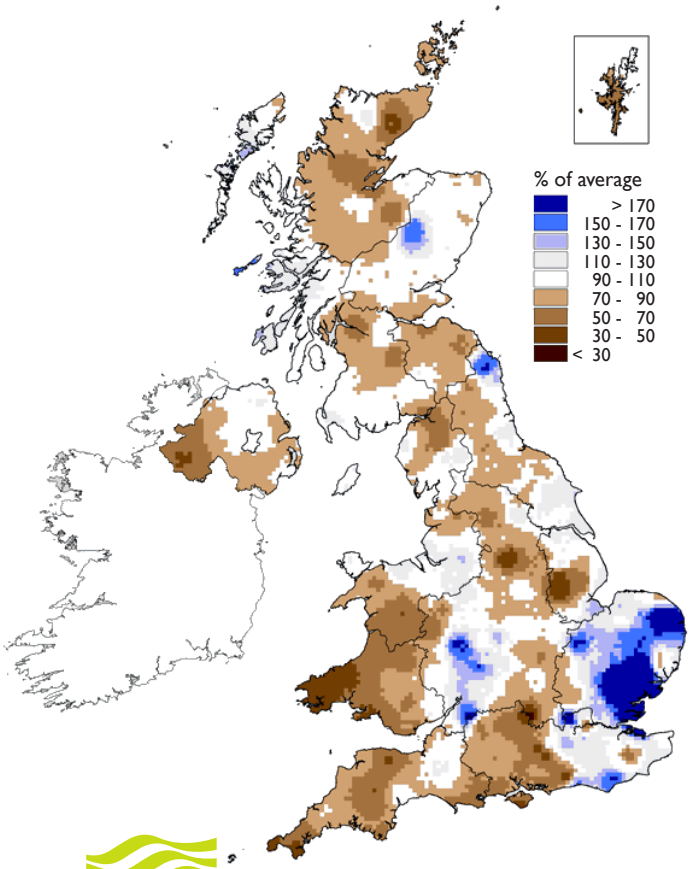
Area	Rainfall	Jul 2014	Jun14 – Jul14	RP	Mar13 – Jul14	RP	Nov13 – Jul14	RP	Aug13 – Jul14	RP
United Kingdom	mm	**64**	120		370		1005		1313	
	%	**97**	88	2-5	103	2-5	127	80-120	122	40-60
England	mm	**53**	99		297		765		1014	
	%	**102**	87	2-5	103	2-5	128	15-25	125	15-25
Scotland	mm	**85**	154		487		1360		1742	
	%	**99**	94	2-5	108	2-5	129	>100	121	30-50
Wales	mm	**54**	115		404		1243		1651	
	%	**73**	74	2-5	94	2-5	124	10-20	121	10-20
Northern Ireland	mm	**61**	119		338		894		1176	
	%	**82**	82	2-5	90	2-5	111	5-10	106	2-5
England & Wales	mm	**53**	102		312		831		1102	
	%	**97**	85	2-5	101	2-5	127	15-25	124	15-25
North West	mm	**76**	120		362		982		1337	
	%	**97**	77	2-5	93	2-5	116	5-10	115	5-10
Northumbrian	mm	**58**	106		318		736		1000	
	%	**102**	90	2-5	104	2-5	120	8-10	121	5-10
Severn-Trent	mm	**49**	101		294		692		922	
	%	**98**	91	2-5	105	2-5	124	8-10	123	8-12
Yorkshire	mm	**52**	96		306		685		911	
	%	**97**	83	2-5	103	2-5	114	2-5	113	2-5
Anglian	mm	**59**	97		239		507		695	
	%	**132**	97	2-5	101	2-5	115	2-5	116	2-5
Thames	mm	**42**	86		264		743		945	
	%	**97**	87	2-5	102	2-5	146	>100	136	80-120
Southern	mm	**45**	72		258		876		1120	
	%	**101**	72	2-5	99	2-5	155	>>100	145	>100
Wessex	mm	**43**	93		320		937		1178	
	%	**92**	87	2-5	111	2-5	148	>>100	137	>100
South West	mm	**45**	121		397		1198		1584	
	%	**73**	91	2-5	107	2-5	134	50-80	133	60-90
Welsh	mm	**54**	116		396		1205		1607	
	%	**76**	77	2-5	96	2-5	125	10-20	123	10-20
Highland	mm	**88**	155		547		1542		1983	
	%	**93**	84	2-5	106	2-5	122	15-25	115	10-15
North East	mm	**73**	151		322		858		1069	
	%	**110**	115	2-5	96	2-5	125	8-12	113	2-5
Tay	mm	**78**	158		434		1316		1627	
	%	**105**	110	2-5	108	2-5	141	70-100	129	30-50
Forth	mm	**62**	140		428		1064		1361	
	%	**88**	100	2-5	115	2-5	129	25-40	121	15-25
Tweed	mm	**58**	123		385		976		1251	
	%	**91**	95	2-5	115	2-5	139	60-90	132	30-50
Solway	mm	**86**	145		490		1406		1834	
	%	**99**	87	2-5	110	2-5	138	>100	132	>100
Clyde	mm	**109**	181		613		1692		2174	
	%	**102**	92	2-5	116	5-10	135	>100	126	80-120

% = 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 March 2014 (inclusive) are provisional.

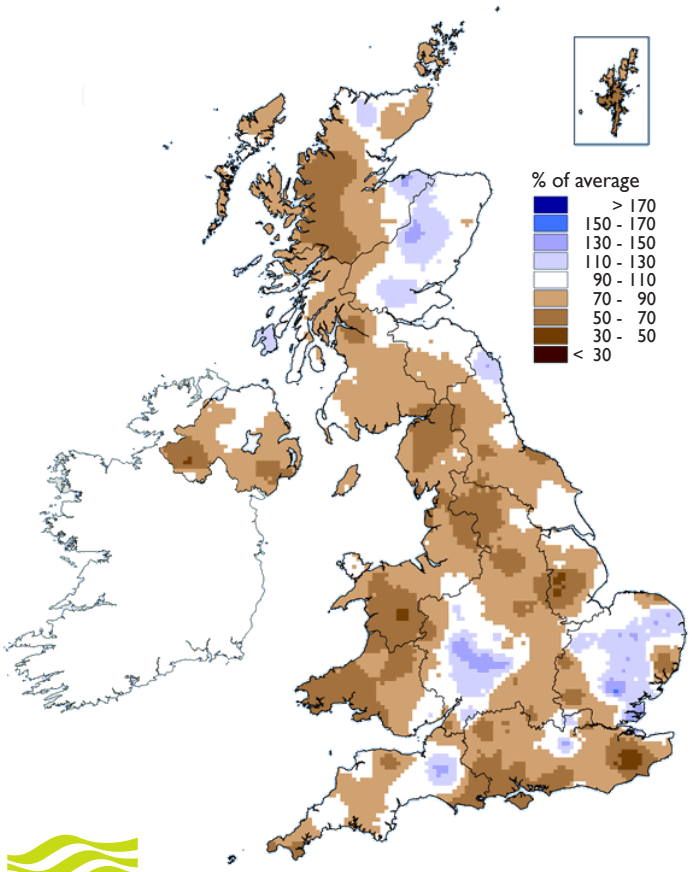
Rainfall . . . Rainfall . . .

July 2014 rainfall
as % of 1971-2000 average



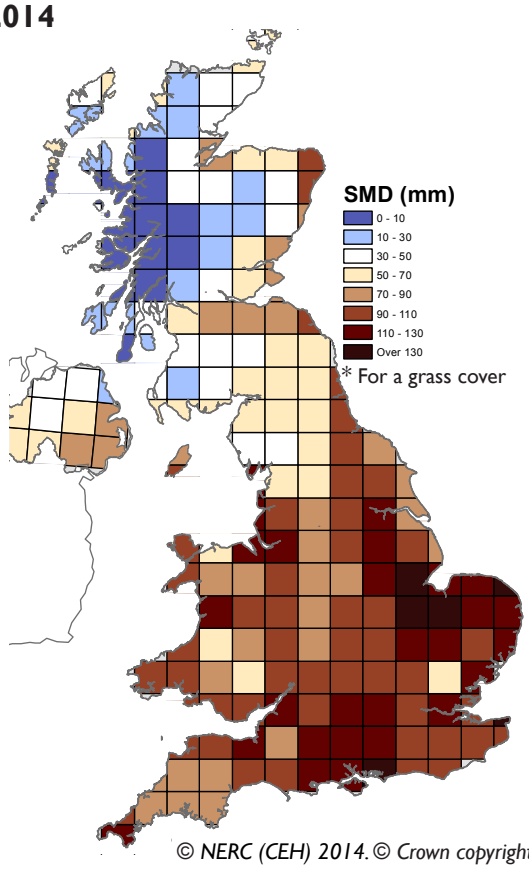
Met Office

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



Met Office

MORECS Soil Moisture Deficits*
July 2014



Met Office
3-month outlook
Updated: July 2014

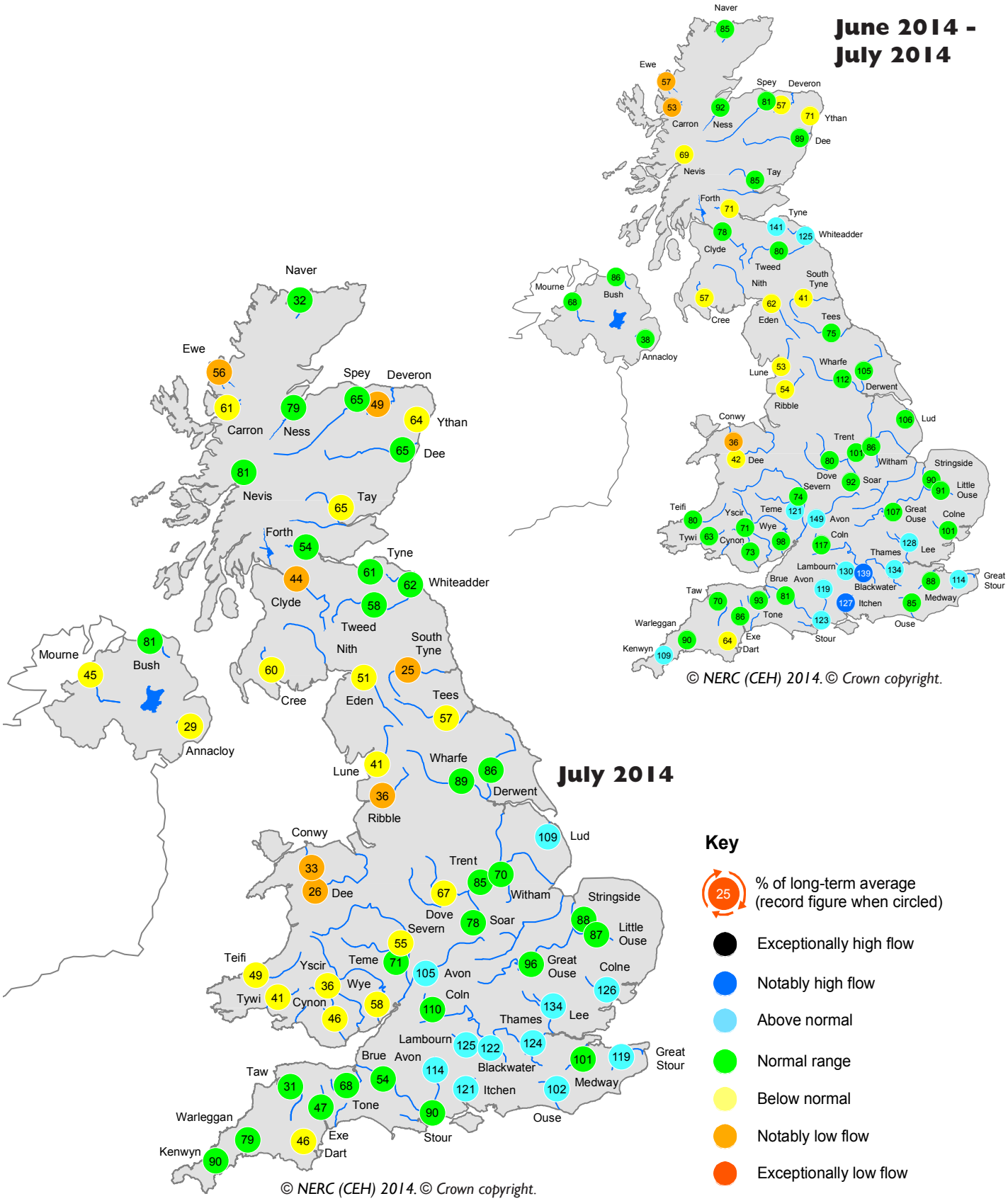
The latest predictions for UK-mean precipitation for August-September-October as a whole slightly favour above-average precipitation, although below-average is almost as likely.

The probability that UK precipitation for August-September-October will fall into the driest of our five categories is around 20% and the probability that it will fall into the wettest category is 25-30% (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.

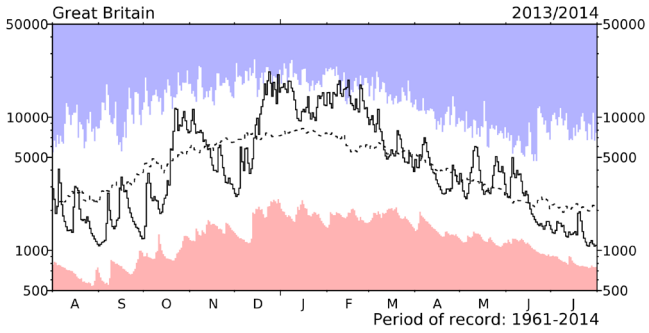
River flow . . . River flow . . .

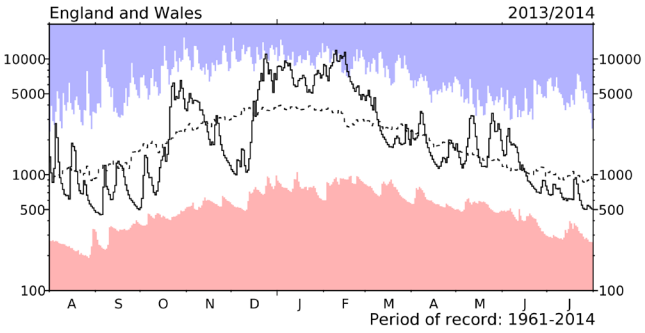


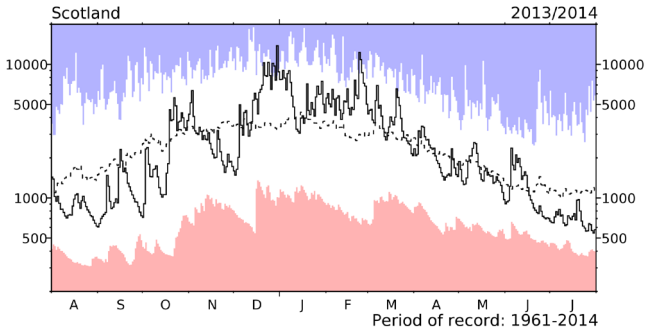
River flows

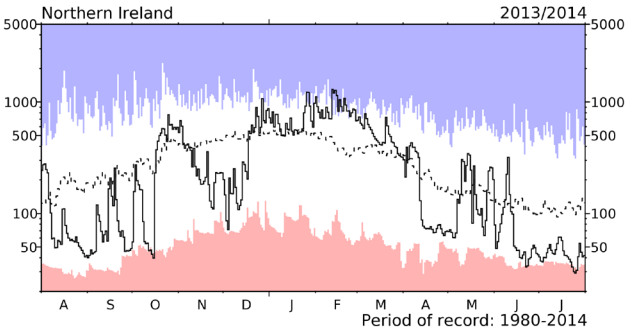
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

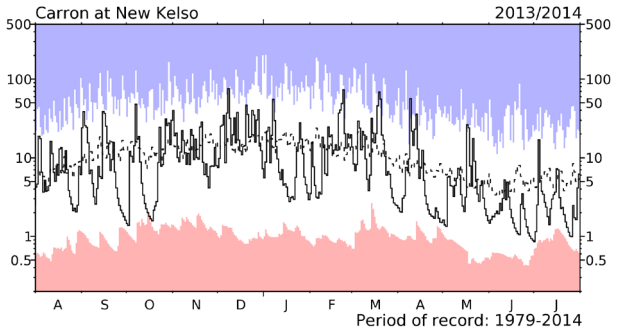
River flow . . . River flow . . .

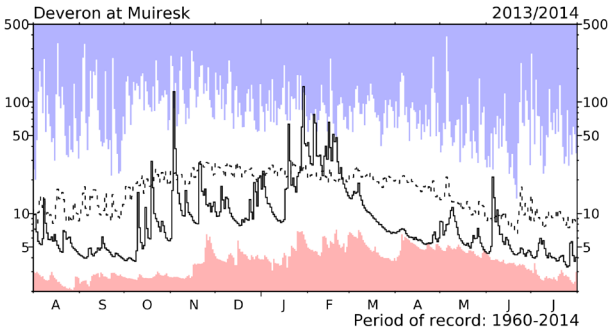


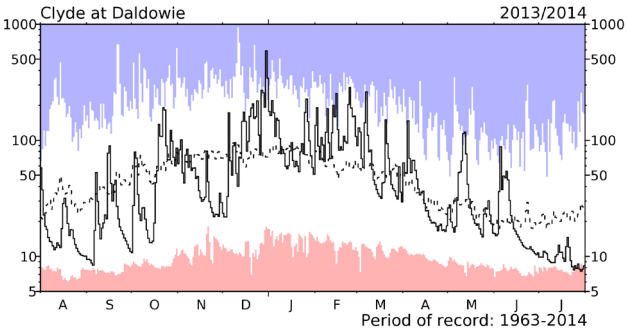


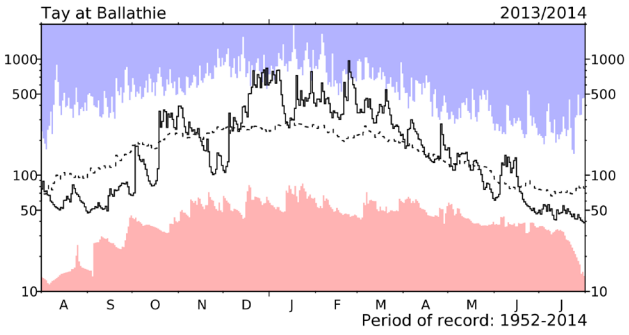


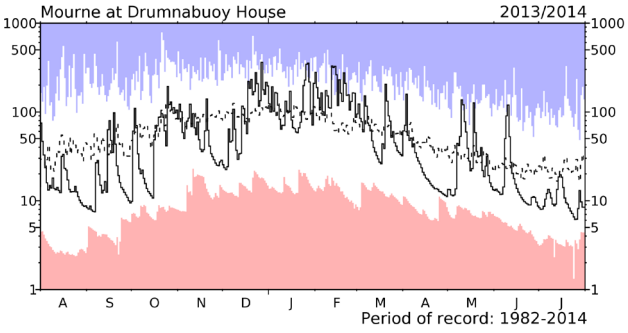


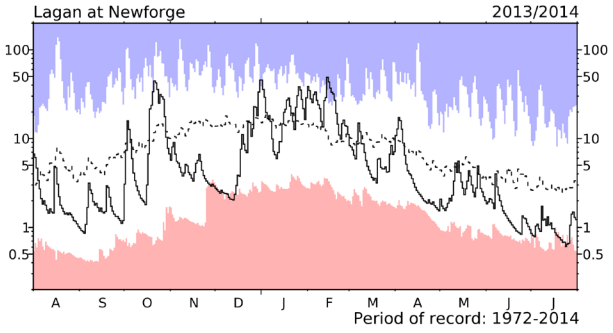








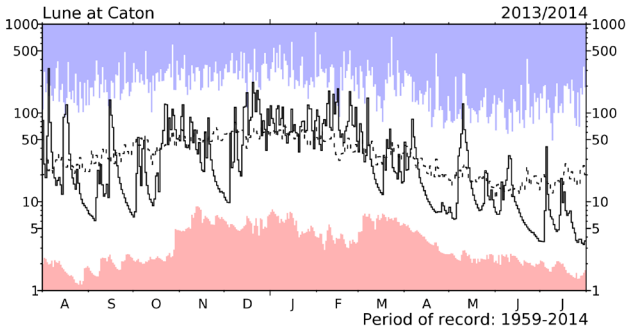


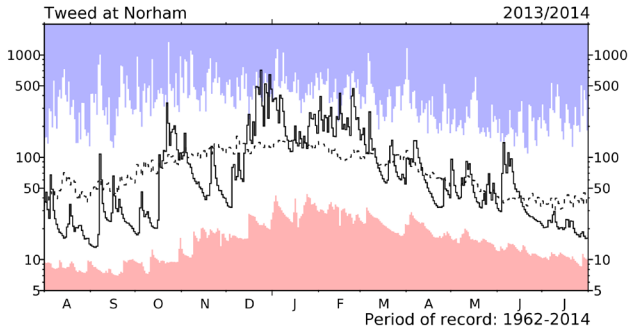


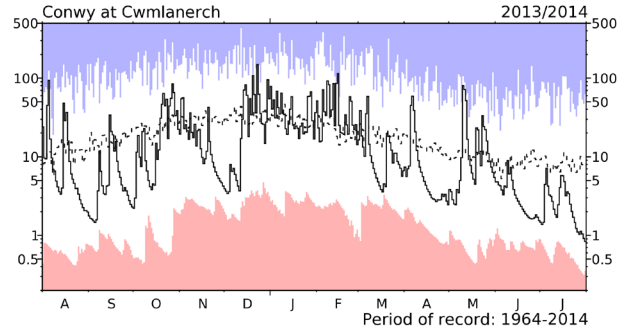
River flow hydrographs

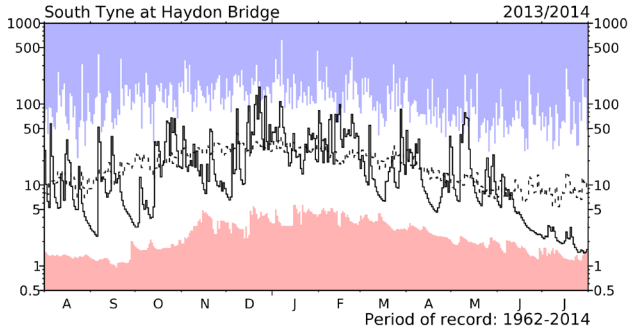
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to August 2013 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the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

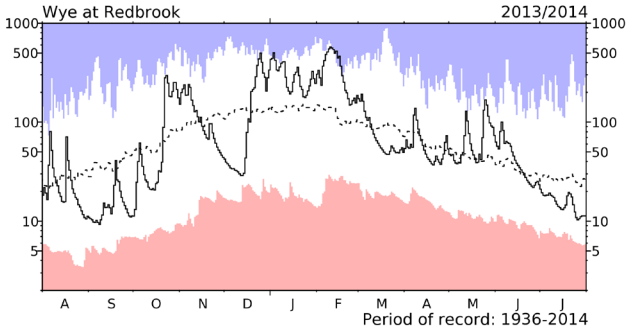
River flow . . . River flow . . .

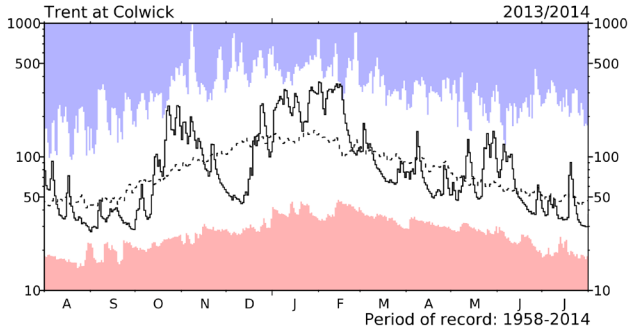


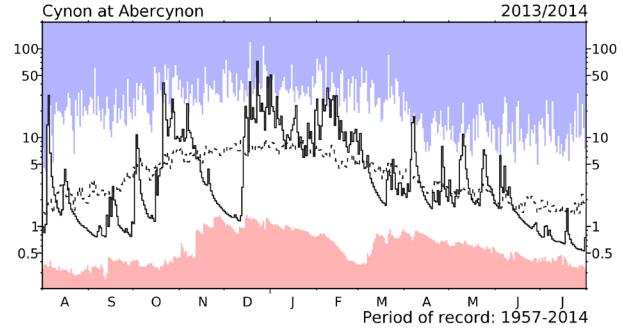


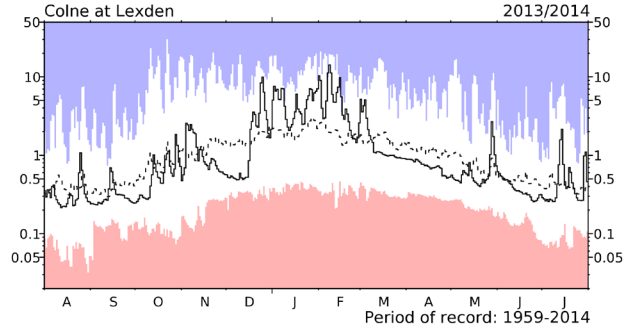


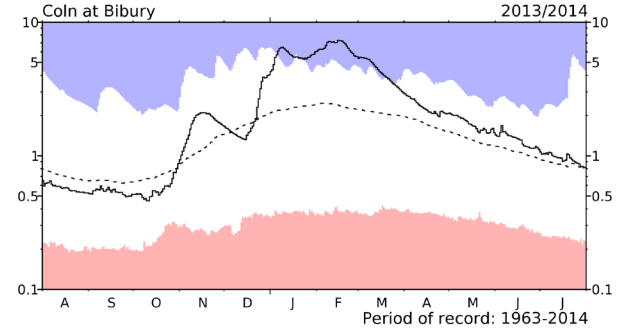


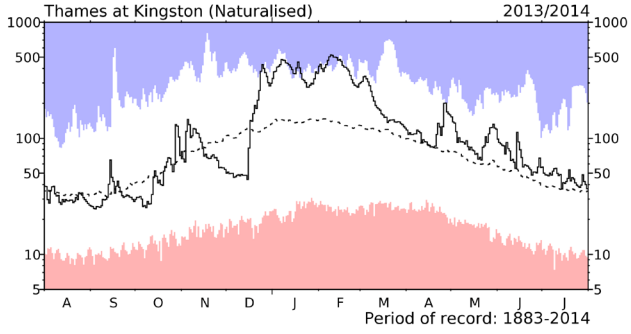


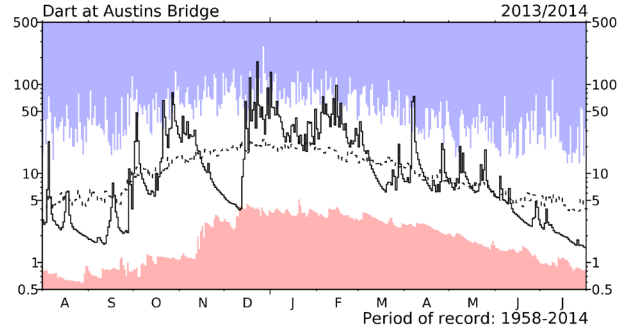


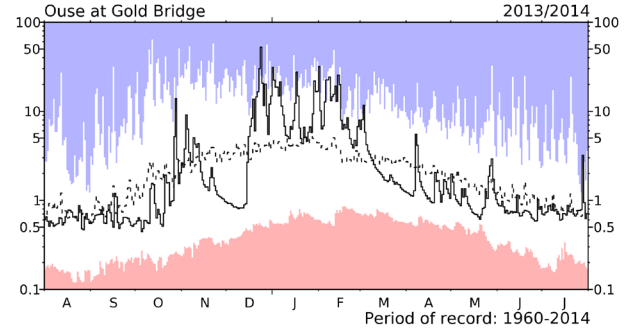




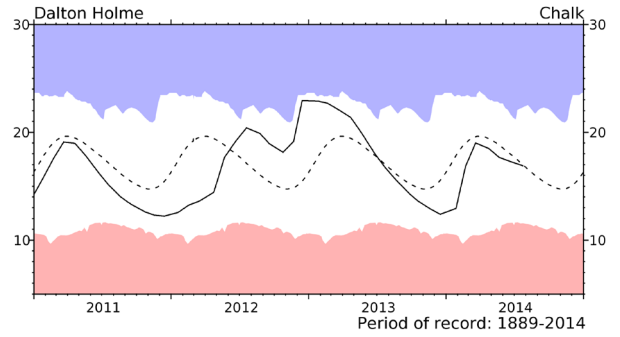


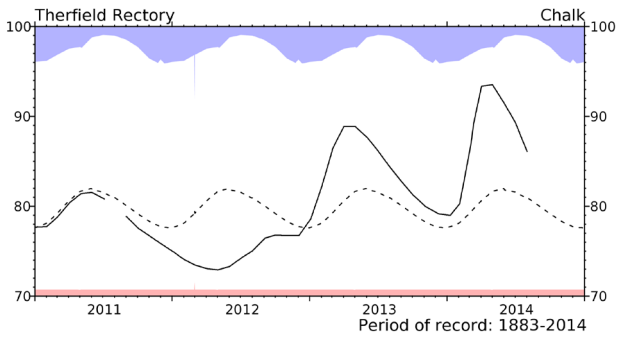


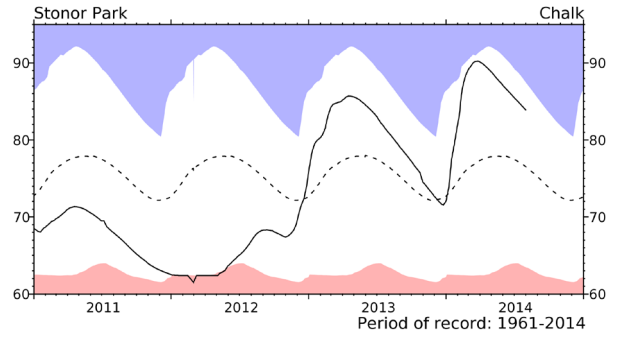


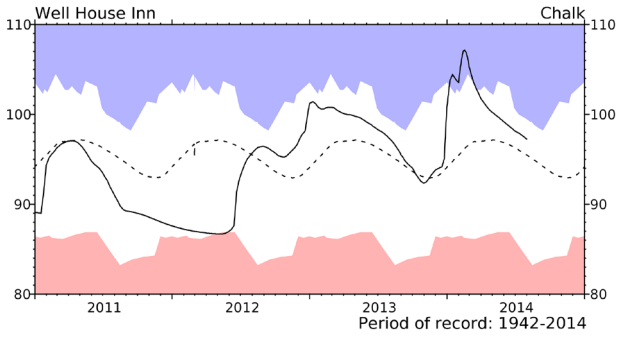


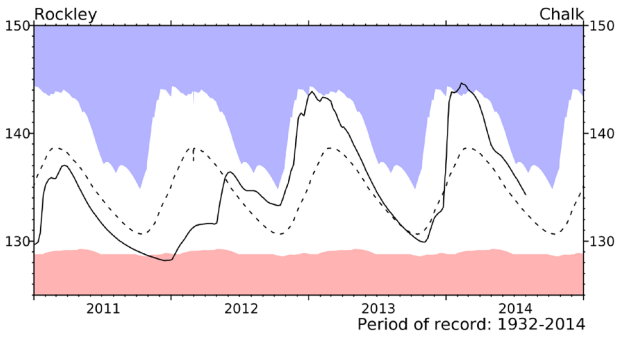
Groundwater…Groundwater

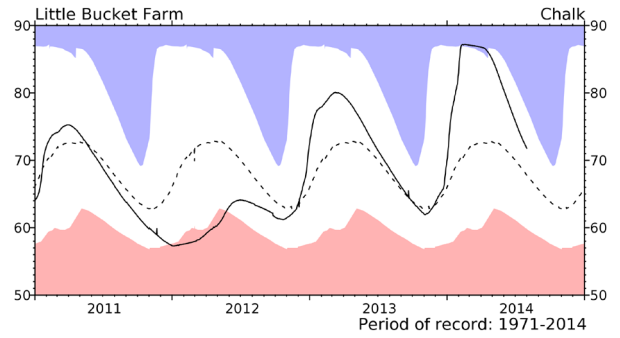


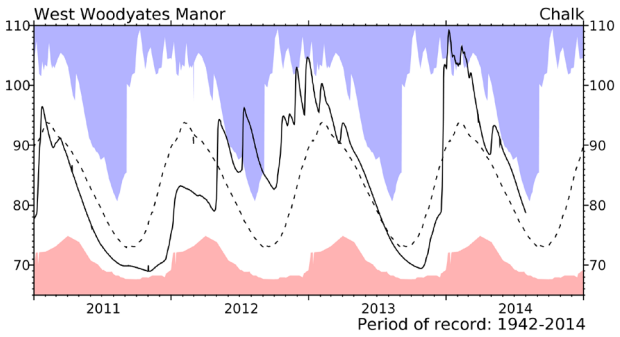


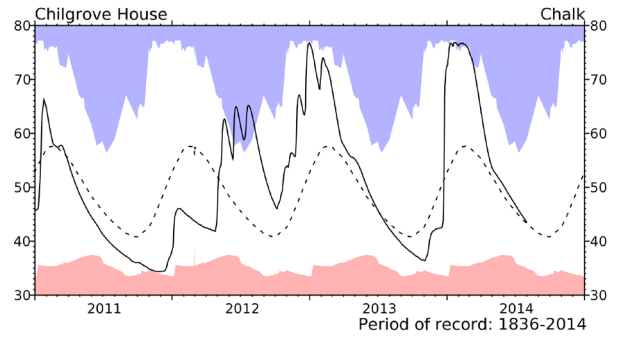


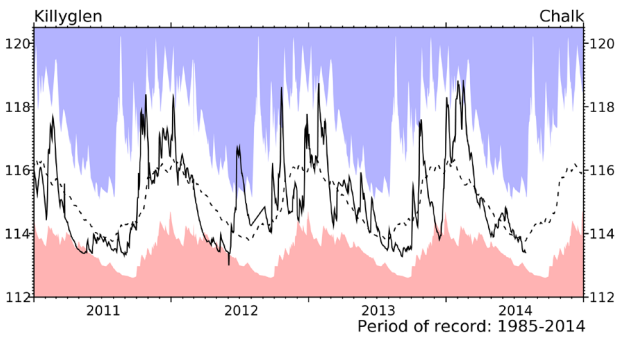


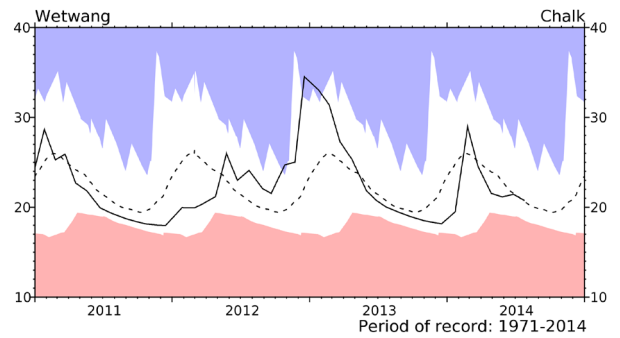






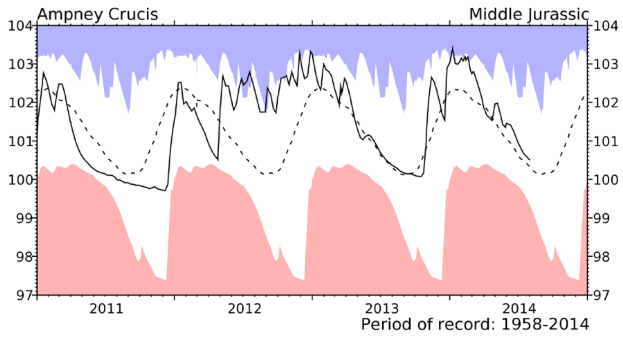


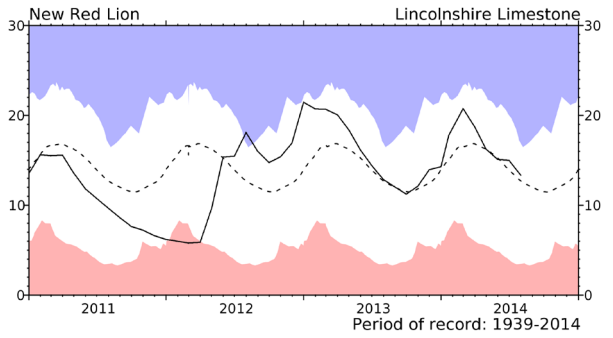


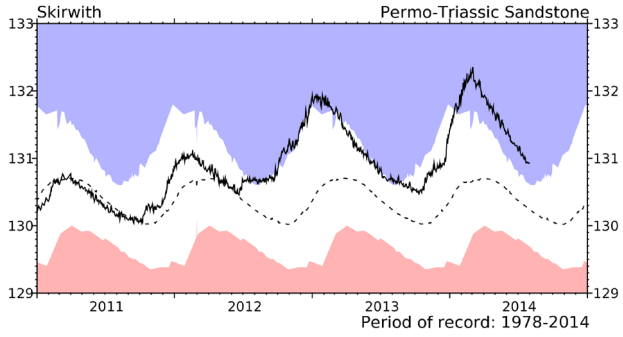


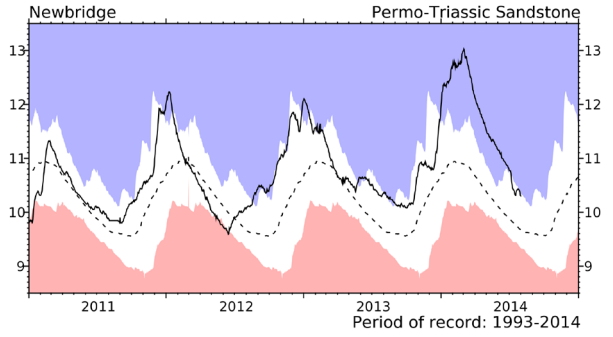
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

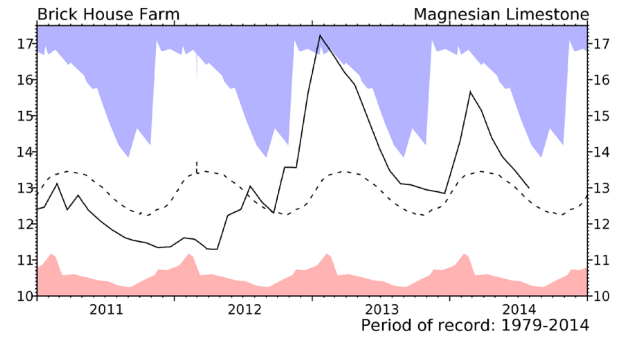
Groundwater ... Groundwater

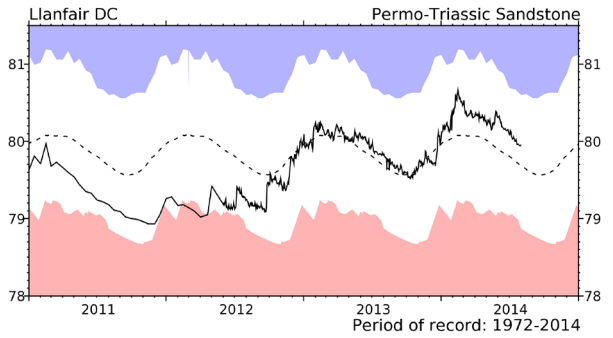


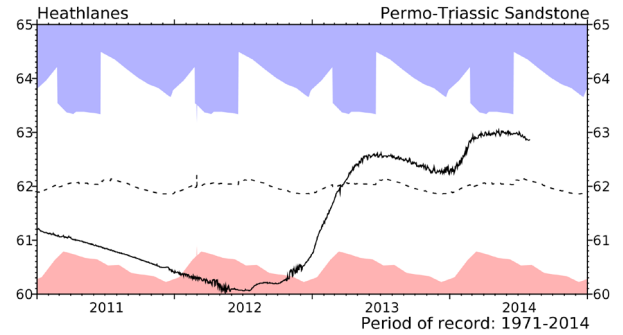


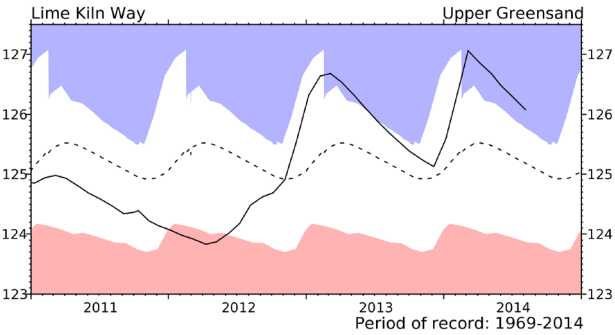


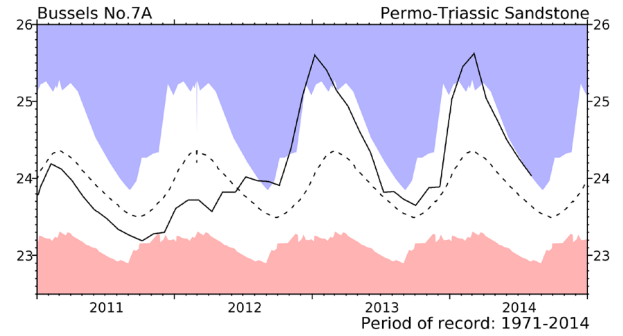


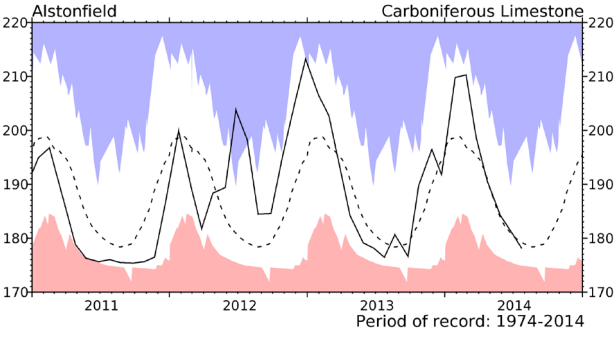








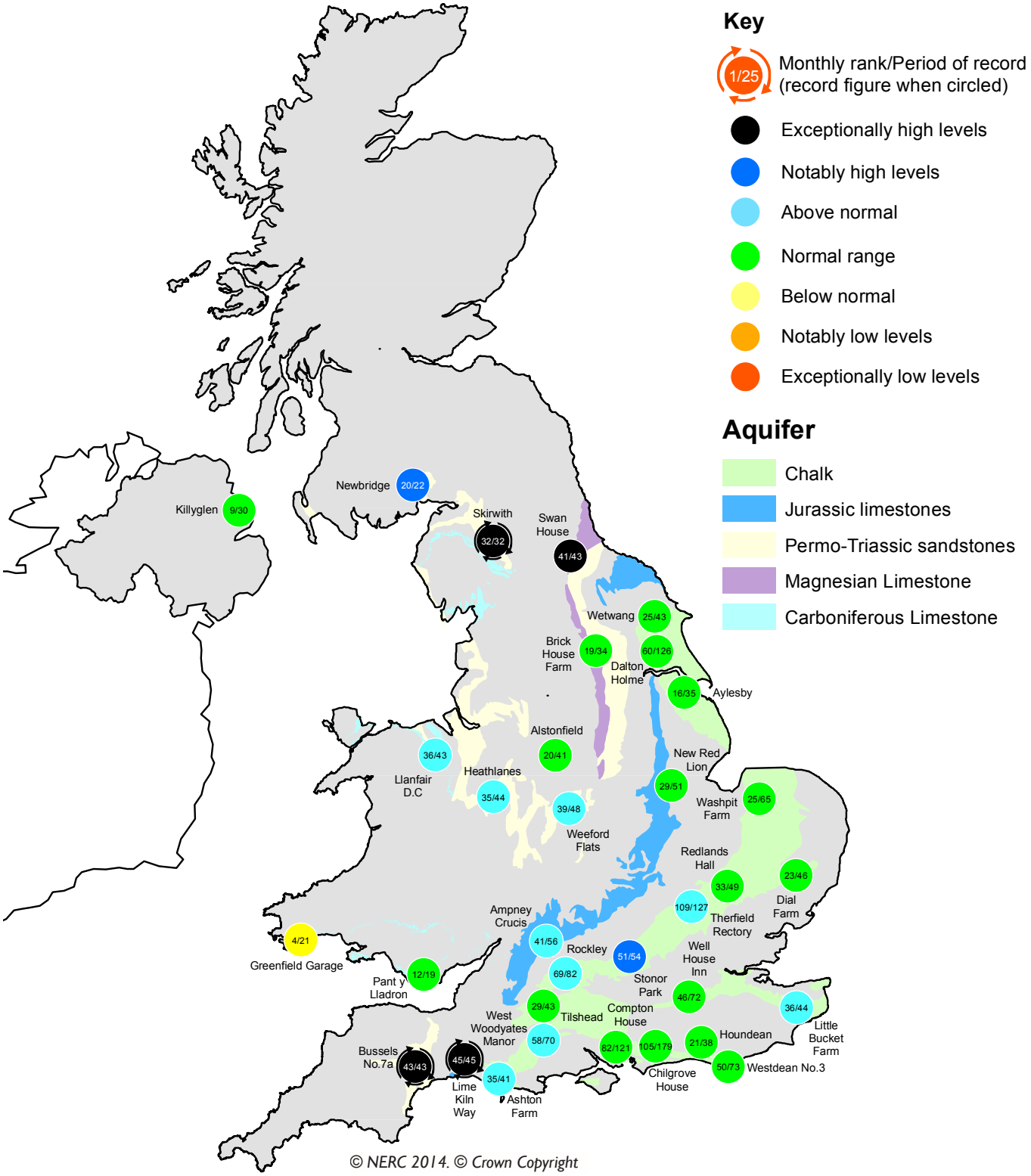




Groundwater levels July / August 2014

Borehole	Level	Date	Jul av.	Borehole	Level	Date	Jul av.	Borehole	Level	Date	Jul av.
Dalton Holme	16.90	23/07	17.23	Chilgrove House	43.46	31/07	43.66	Brick House Farm	13.00	29/07	12.83
Therfield Rectory	86.09	01/08	81.46	Killyglen (NI)	113.39	31/07	113.88	Llanfair DC	79.95	31/07	79.74
Stonor Park	83.90	31/07	76.91	Wetwang	20.76	24/07	20.96	Heathlanes	62.86	31/07	62.06
Tilshead	84.94	31/07	84.99	Ampney Crucis	100.51	31/07	100.50	Lime Kiln Way	126.08	05/08	125.22
Rockley	134.31	31/07	133.22	New Red Lion	13.34	31/07	13.22	Bussels No.7a	24.04	05/08	23.73
Well House Inn	97.23	31/07	95.74	Skirwith	130.94	31/07	130.32	Alstonfield	178.17	23/07	179.85
West Woodyates	78.74	31/07	77.14	Newbridge	10.30	31/07	9.82				

Levels in metres above Ordnance Datum

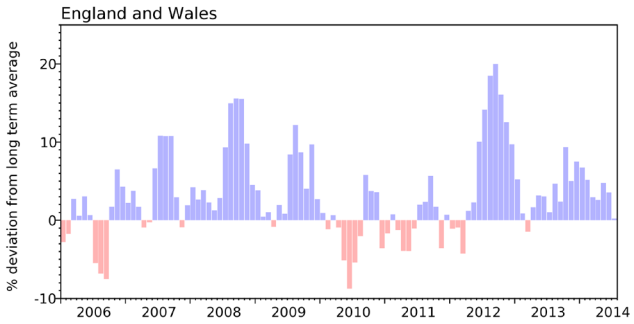


Groundwater levels - July 2014

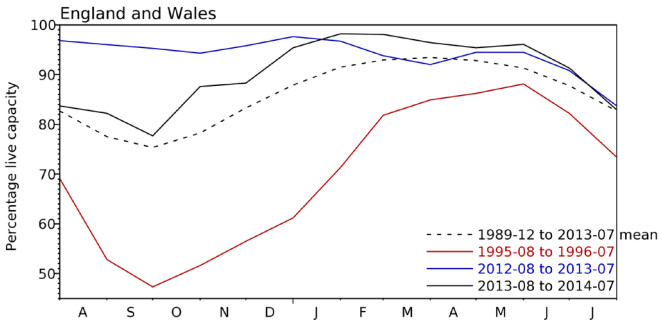
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 May	2014 Jun	2014 Jul	Jul Anom.	Min Jul	Year* of min	2013 Jul	Diff 13-14
North West	N Command Zone	•	124929	79	66	54	-10	23	1984	64	-11
	Vyrnwy		55146	100	90	75	-1	45	1984	82	-8
Northumbrian	Teesdale	•	87936	93	92	77	3	45	1989	83	-6
	Kielder		(199175)	99	92	88	-1	66	1989	89	-1
Severn-Trent	Clywedog		44922	99	98	89	4	50	1976	87	2
	Derwent Valley	•	39525	94	83	69	-5	43	1996	69	0
Yorkshire	Washburn	•	22035	86	77	68	-7	50	1995	72	-5
	Bradford Supply	•	41407	98	87	76	5	38	1995	63	14
Anglian	Grafham		(55490)	96	92	83	-7	66	1997	92	-10
	Rutland		(116580)	97	93	91	6	74	1995	86	5
Thames	London	•	202828	98	97	94	8	73	1990	93	2
	Farmoor	•	13822	98	100	97	1	84	1990	93	4
Southern	Bewl		28170	99	99	86	9	45	1990	86	-1
	Ardingly**		4685	100	95	84	-2	65	2005	82	3
Wessex	Clatworthy		5364	100	93	85	11	43	1992	70	15
	Bristol	•	(38666)	99	93	84	9	53	1990	71	13
South West	Colliford		28540	100	96	86	9	47	1997	82	5
	Roadford		34500	95	93	87	10	46	1996	76	11
	Wimbleball		21320	99	97	86	8	53	1992	74	12
	Stithians		4967	95	88	75	5	39	1990	72	4
Welsh	Celyn & Brenig	•	131155	100	97	86	-3	65	1989	90	-5
	Brianne		62140	100	96	88	-2	67	1995	94	-6
	Big Five	•	69762	98	94	84	6	41	1989	83	1
	Elan Valley	•	99106	99	94	83	1	53	1976	84	-1
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	96	94	86	3	51	1998	82	4
	East Lothian	•	10206	98	99	98	9	72	1992	88	10
Scotland(W)	Loch Katrine	•	111363	94	86	73	-1	53	2000	66	7
	Daer		22412	90	86	76	-5	56	2013	56	20
	Loch Thom	•	11840	100	99	90	6	59	2000	85	5
Northern Ireland	Total+	•	56800	87	79	73	-4	54	1995	85	-12
	Silent Valley	•	20634	91	79	69	-5	42	2000	82	-13

( ) 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:

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Centre for Ecology & Hydrology
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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.

08/2014