Hydrological Summary
for the United Kingdom

June 2014

General

June was a warm and generally dry month, although convective thunderstorm activity accompanied above average temperatures. Scotland experienced its warmest June since 2003, and the Forth region registered its second warmest June on record (from 1910). The UK recorded 80% of the long-term average June rainfall, but some regional totals were significantly lower; Southern and North West England registered 49% and 56% of average, respectively. East Anglia, north Wales and much of western Scotland were also particularly dry. Soil moisture deficits increased as expected for the time of year, but conditions generally remained marginally wetter than average. Soils were drier than average in the north-west owing to rainfall deficiencies over the last four months. The mid-month spell of dry weather triggered steep recessions in river flows across much of the UK. The large spatial footprint of declining river flows is illustrated by the recessions in national outflows. Groundwater levels generally fell across the aquifer outcrop areas, as is normal for the time of year, but remain above average, significantly so in the north-western and south-western Permo-Triassic sandstone. Normal seasonal declines in reservoir stocks have generally begun, although most remain above average for the time of year. At Bewl (East Sussex), end of June reservoir stocks were the largest since 2000. With groundwater levels and reservoir stocks declining but generally remaining above average, the water resources outlook remains healthy for much of the UK.

Rainfall

Over the first ten days of June, low pressure systems to the west of the UK led to unsettled weather, bringing cloudy, showery and often thundery conditions. An east to north-easterly airflow brought particularly cool and damp conditions to eastern areas, notably eastern Scotland. Intense rainfall caused flash flooding in Lincolnshire, Derbyshire and Nottinghamshire on the 9th. Thereafter, high pressure dominated over almost a fortnight around mid-month (14th-26th), heralding a spell of fine, dry weather, although there were occasional localised thunderstorms (e.g. East Anglia on the 23rd). A particularly intense event on the 13th/14th tracked across the south Midlands and south-east England, producing 38mm of rain in less than five hours at Wokingham (Berkshire). The weather became more unsettled towards month-end; 57mm fell in five hours at Boughton-under-Blean (Kent) on the 28th. In contrast, total monthly rainfall in other parts of Kent was less than 30% of the long-term average, illustrating the often localised nature of June rainfall. Raingauges at Goudhurst and Frittenden (both Kent) registered just 6.6mm during June. Pockets of above average rainfall were restricted to south-west England, extending up through the lower Severn catchment, and eastern Scotland (North East, Tay and Forth were the only regions to record above average rainfall in June). Rainfall accumulations since the wet winter have been near-average at the national scale, but this masks the spatial variability in rainfall over a four-month timeframe. Parts of southern Scotland, Yorkshire, the Midlands, and southern and south-western England have been wetter than average. Notably dry areas include East Anglia and Kent (<65% in some areas), Northern Ireland, north-east Scotland and large parts of Wales and north-west England.

River flows

Following unsettled weather from late May into early June, the highest flows of the month typically occurred during the first ten days, although these were only moderate spates. Nevertheless, there were some exceptions; the Scottish Tyne registered its highest June flow on record. From the 10th, recessions were established across the UK; these were particularly steep in responsive northern and western areas. Flows on the Conwy, Carron, Ewe and Lagan barely registered above average flows on any day in June. Recessions continued in central southern England, but groundwater remained influential; although still above average for the time of year, flows continued to fall back towards the long-term mean. Despite the dry spell from mid-month, average flows for June were largely in the normal range, with the exception of above normal flows in south-east England and southern Scotland, and below normal flows across north-western and north-eastern Scotland. Flows in north-west England and north Wales were below average in June but mostly fell within the normal range (with the exception of the Conwy). National outflows in June were marginally above average, with exception of Northern Ireland. Accumulated flows since the end of the winter were predominantly in the normal range across England and Wales. Protracted high flows remained a factor in central southern England and the Thames catchment owing to the wetness of the preceding winter.

Groundwater

In the summer months, groundwater levels normally fall as soil moisture deficits limit the possibility of recharge, and water drains naturally from aquifers towards rivers and the sea. In June, across most aquifers recessions became well established, and groundwater levels continued to fall. The exception to this pattern was found in north-east England, where parts of the Chalk and Magnesian Limestone aquifers responded to the wet conditions in this area during May. Water levels in the Chalk at Wetwang rose slightly, and at Swan House and New Red Lion the recessions were interrupted. Dalton Holme in Yorkshire, where levels have been persistently below average, moved closer to its seasonal norm. The majority of Chalk and limestone aquifers were in their normal range, with higher levels in south-west England (where some localised groundwater flooding was still being reported). Lime Kiln Way remained at a record high for the time of year, a legacy of the wet weather in the spring. Across the Permo-Triassic aquifers, levels remained high, with new records registered in June at Newbridge and Skirwith, although groundwater levels receded in these aquifers as they did elsewhere. In south Wales, water levels were below normal at Greenfield Garage but notably high at Pant y Lladron, reflecting both spatial variability of rainfall and aquifer responsiveness.

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Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

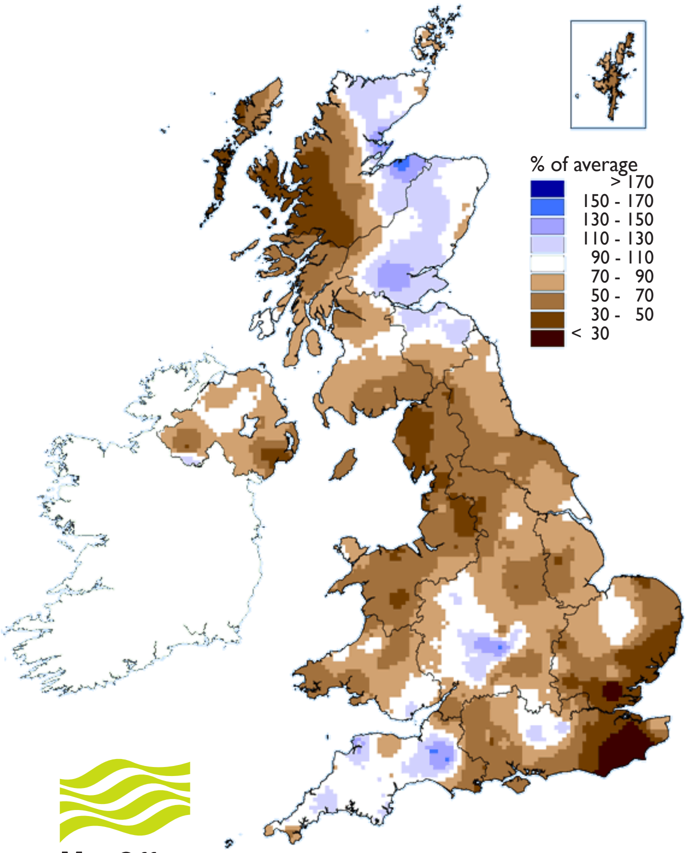
Area	Rainfall	Jun 2014	Mar14 – Jun14	RP	Jan13 – Jun14	RP	Oct13 – Jun14	RP	Jun13 – Jun14	RP
United	mm	**56**	306		663		1105		1315	
Kingdom	%	**80**	105	2-5	135	>100	132	>>100	122	50-80
England	mm	**46**	244		528		849		1016	
	%	**75**	103	2-5	139	>>100	136	>100	125	15-25
Scotland	mm	**69**	403		846		1468		1741	
	%	**88**	111	2-5	131	20-35	131	>100	121	30-50
Wales	mm	**62**	351		851		1416		1661	
	%	**75**	99	2-5	138	>100	132	70-100	122	10-20
Northern	mm	**58**	274		619		987		1186	
Ireland	%	**82**	90	2-5	122	15-25	117	30-50	107	2-5
England &	mm	**48**	259		572		927		1105	
Wales	%	**75**	102	2-5	139	>>100	135	>100	125	15-25
North West	mm	**44**	284		638		1072		1365	
	%	**56**	91	2-5	123	10-20	120	10-20	117	5-10
Northumbrian	mm	**48**	264		496		806		1023	
	%	**78**	107	2-5	128	15-25	128	30-50	124	10-15
Severn-Trent	mm	**53**	246		501		781		945	
	%	**84**	107	2-5	140	>100	136	70-100	126	10-20
Yorkshire	mm	**44**	256		495		752		921	
	%	**71**	105	2-5	130	15-25	121	8-12	114	2-5
Anglian	mm	**37**	179		346		549		671	
	%	**69**	94	2-5	123	8-12	122	8-12	112	2-5
Thames	mm	**44**	223		522		814		943	
	%	**78**	104	2-5	158	>>100	153	>>100	136	60-90
Southern	mm	**27**	212		579		983		1101	
	%	**49**	98	2-5	164	>>100	163	>>100	143	70-100
Wessex	mm	**51**	279		655		1046		1183	
	%	**84**	115	2-5	163	>>100	156	>>100	138	>100
South West	mm	**76**	352		823		1376		1577	
	%	**105**	114	2-5	148	>>100	144	>>100	132	50-80
Welsh	mm	**62**	343		828		1374		1615	
	%	**77**	100	2-5	139	>100	134	80-120	123	15-25
Highland	mm	**67**	463		895		1656		1969	
	%	**75**	109	2-5	116	5-10	122	15-25	114	8-12
North East	mm	**78**	251		545		894		1070	
	%	**119**	93	2-5	126	15-25	124	10-20	113	2-5
Tay	mm	**80**	357		854		1440		1631	
	%	**116**	109	2-5	144	40-60	145	>100	129	30-50
Forth	mm	**78**	373		703		1190		1406	
	%	**112**	124	8-12	136	20-35	137	>100	125	20-35
Tweed	mm	**65**	335		657		1069		1293	
	%	**99**	123	5-10	149	80-120	146	>>100	137	60-90
Solway	mm	**58**	396		944		1551		1846	
	%	**74**	111	2-5	151	>>100	143	>>100	132	>100
Clyde	mm	**72**	505		1082		1828		2164	
	%	**81**	121	5-10	142	70-100	137	>100	125	50-80

% = percentage of 1971-2000 average *RP = Return period*

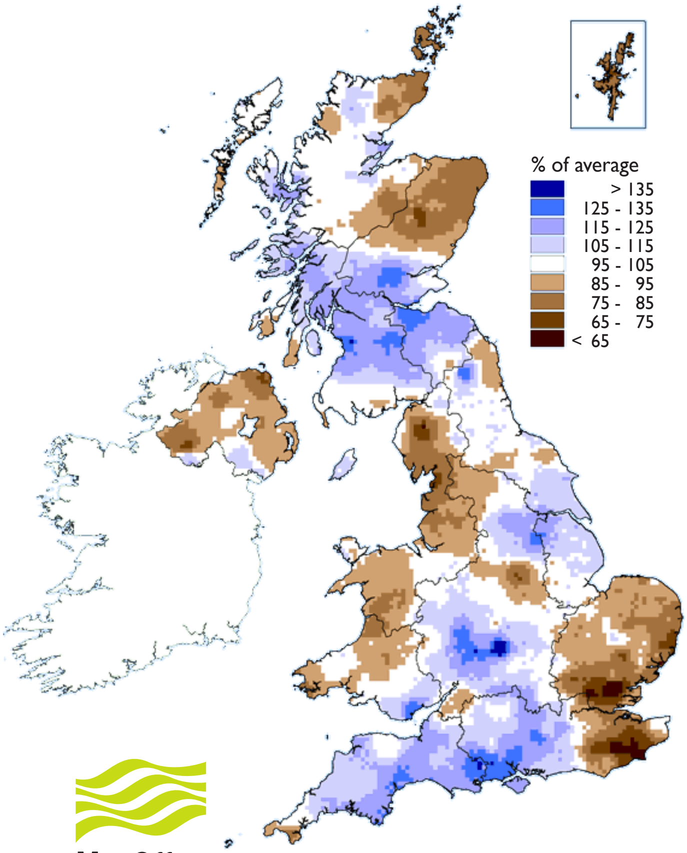
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 February 2014 (inclusive) are provisional.

Rainfall . . . Rainfall . . .

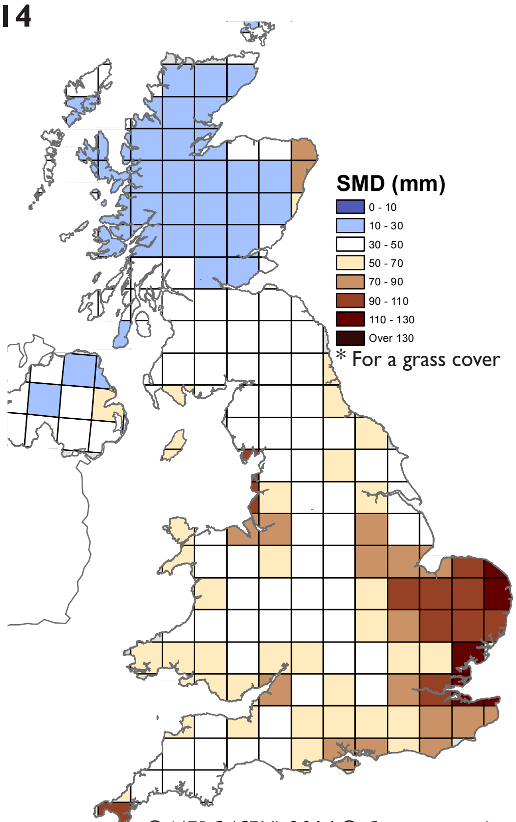
June 2014 rainfall
as % of 1971-2000 average



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



MORECS Soil Moisture Deficits*
June 2014



Met Office 3-month outlook Updated: June 2014

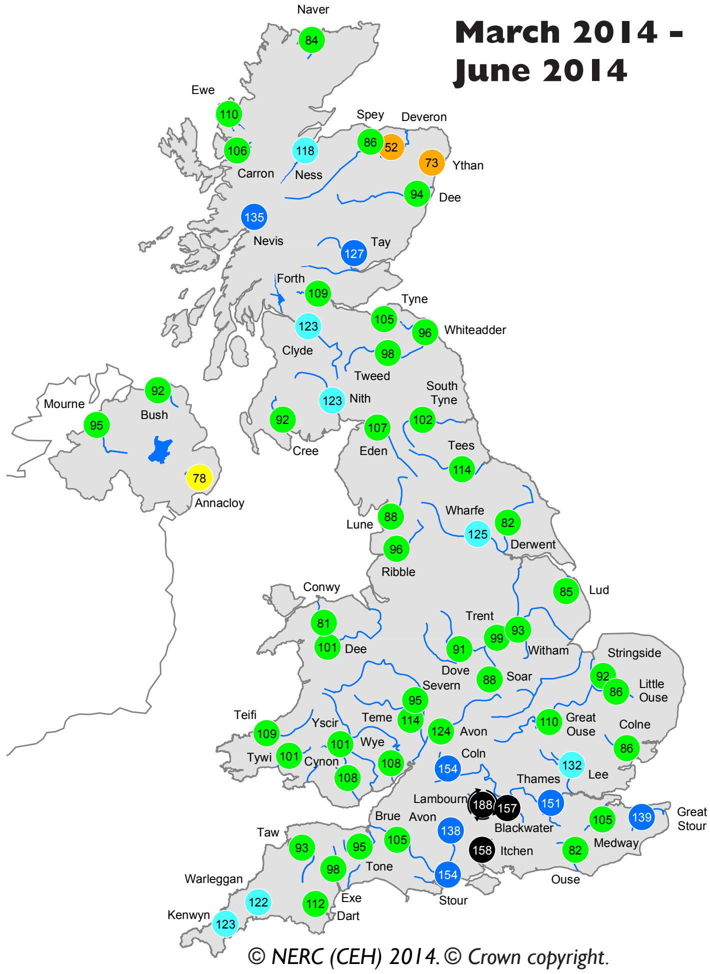
Latest predictions for UK-mean precipitation for July-August-September as a whole are largely indistinguishable from climatology. The probability that UK precipitation for July-August-September will fall into the driest of our five categories is around 20% and the probability that it will fall into the wettest category is around 20% (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 . . .

March 2014 - June 2014



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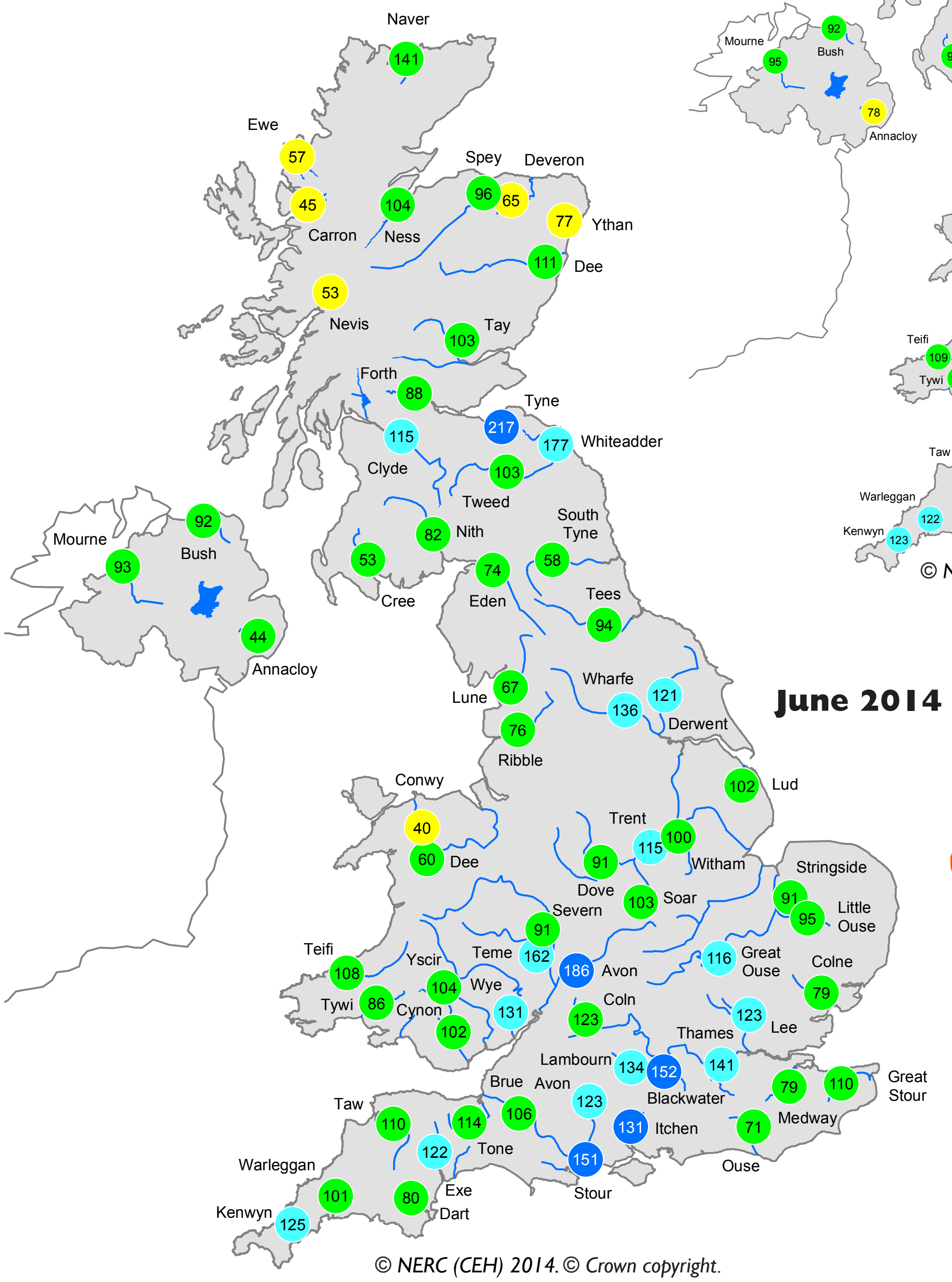
June 2014



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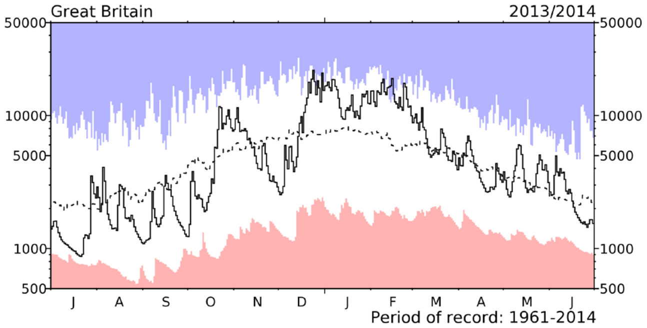
Key

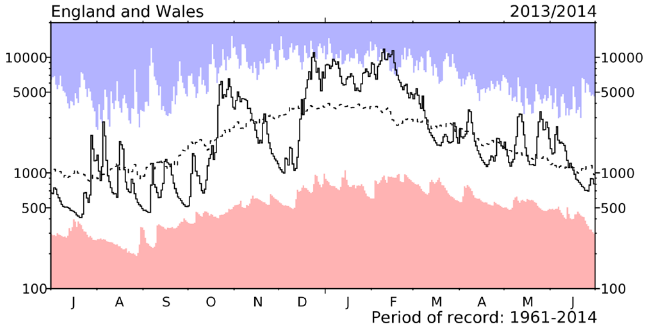
- 25 — % of long-term average (record figure when circled)
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

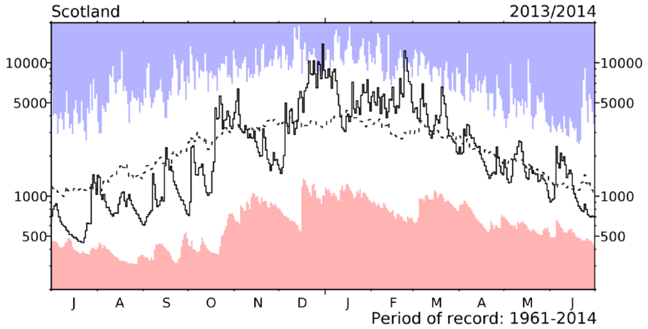
*Based on ranking of the monthly flow**

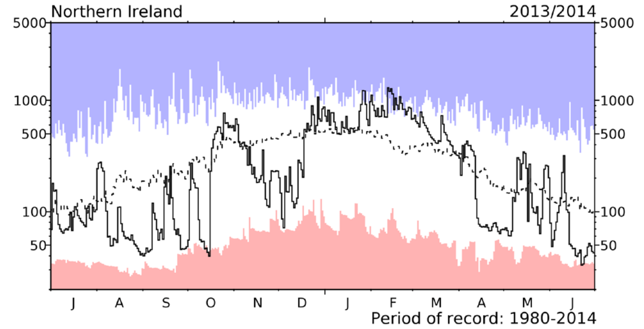
River flows

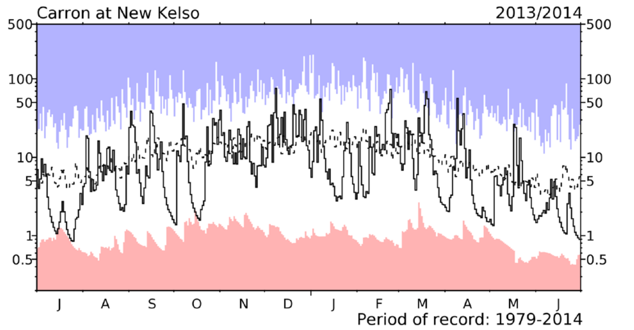
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

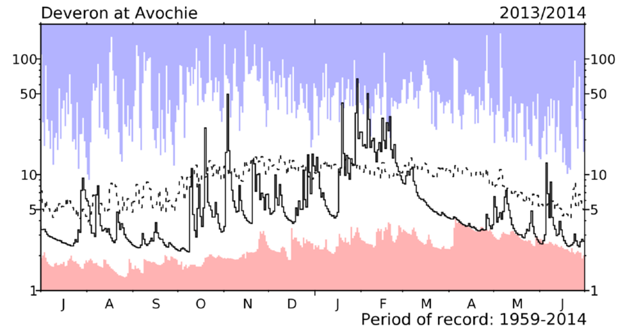


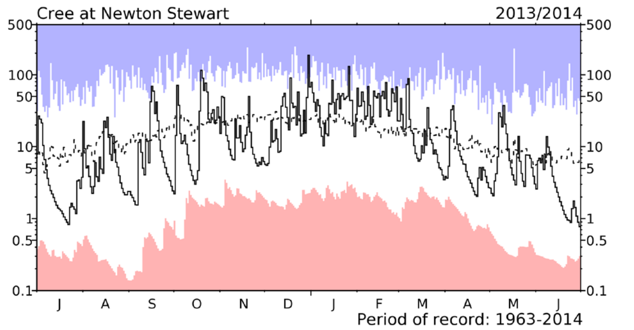


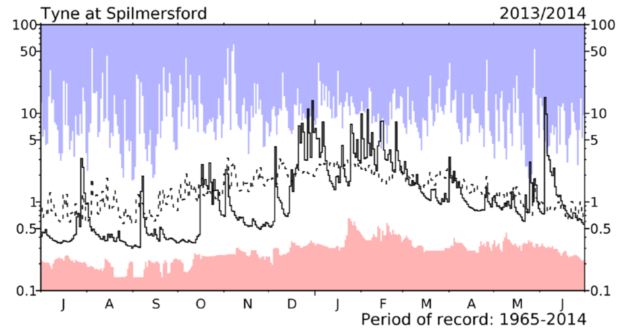


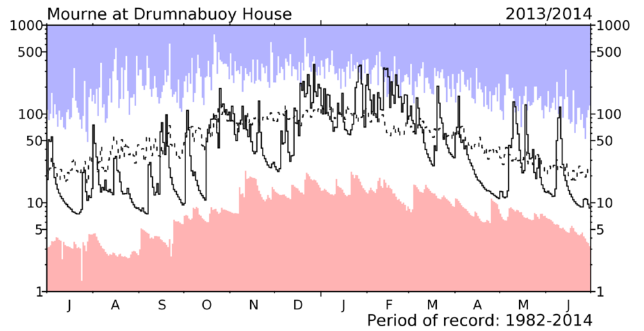


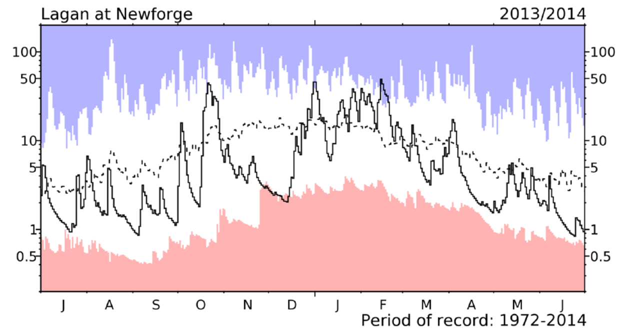






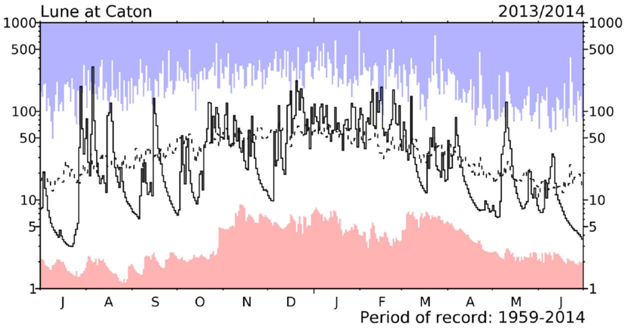


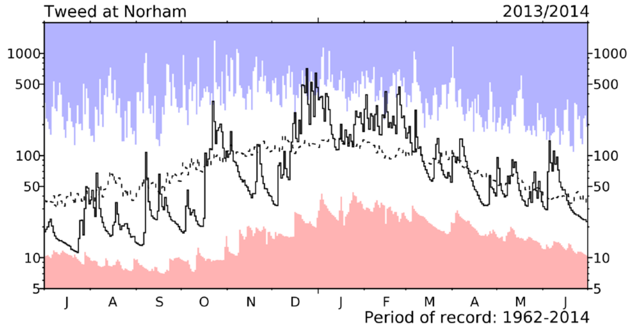


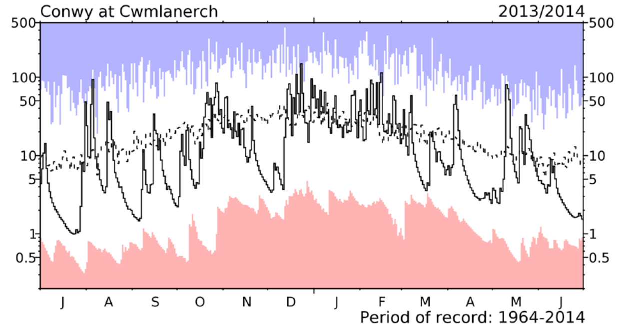


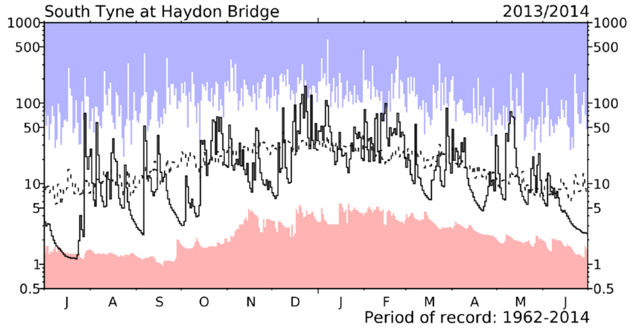
River flow hydrographs

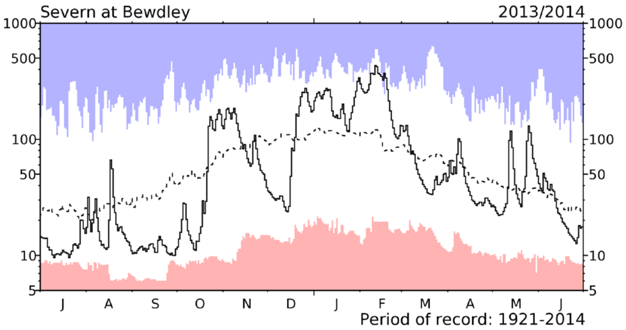
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to July 2013 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed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

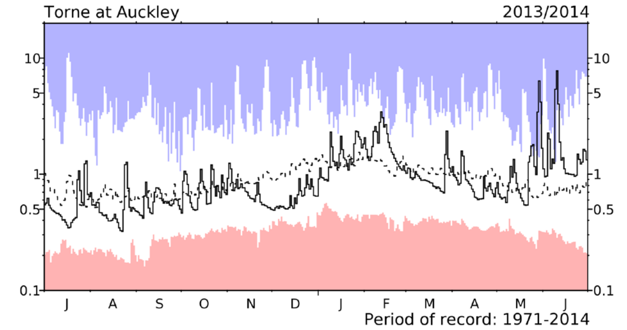

Lune at Caton
2013/2014
J A S O N D J F M A M J
Period of record: 1959-2014

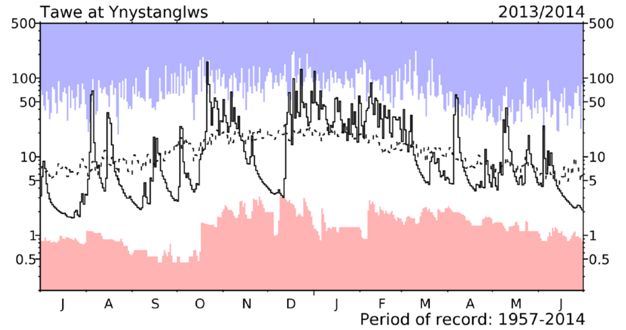

Tweed at Norham
2013/2014
J A S O N D J F M A M J
Period of record: 1962-2014

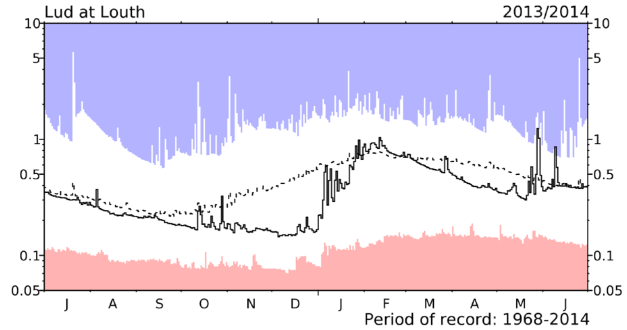

Conwy at Cwmlanerch
2013/2014
J A S O N D J F M A M J
Period of record: 1964-2014

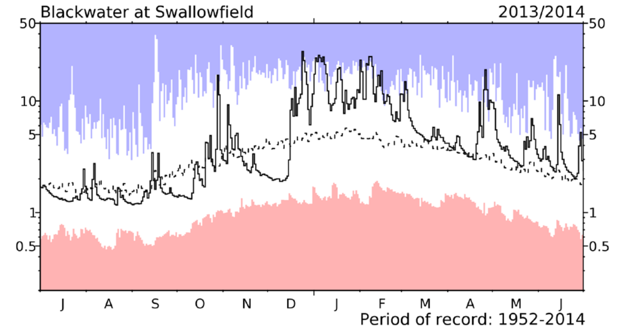

South Tyne at Haydon Bridge
2013/2014
J A S O N D J F M A M J
Period of record: 1962-2014

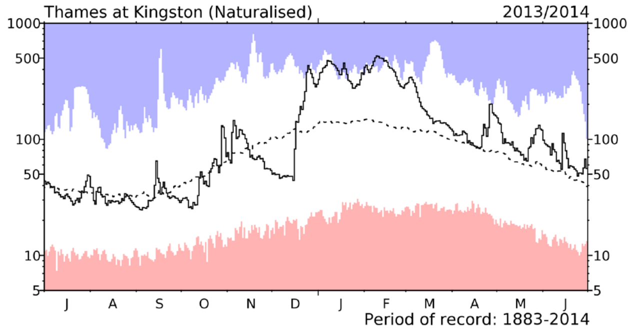

Severn at Bewdley
2013/2014
J A S O N D J F M A M J
Period of record: 1921-2014

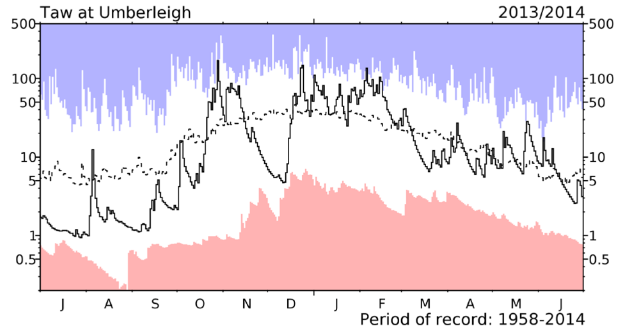

Torne at Auckley
2013/2014
J A S O N D J F M A M J
Period of record: 1971-2014

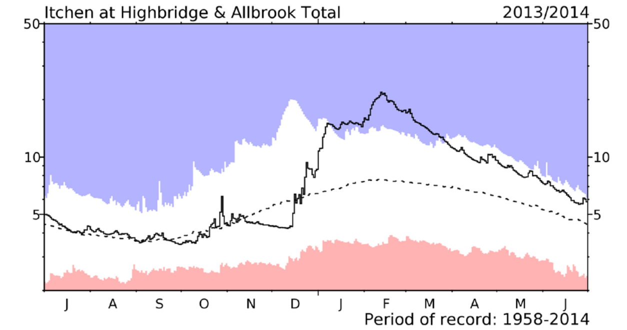

Tawe at Ynystanglws
2013/2014
J A S O N D J F M A M J
Period of record: 1957-2014


Lud at Louth
2013/2014
J A S O N D J F M A M J
Period of record: 1968-2014

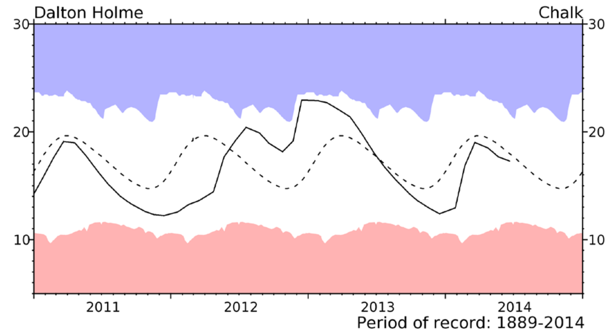

Blackwater at Swallowfield
2013/2014
J A S O N D J F M A M J
Period of record: 1952-2014

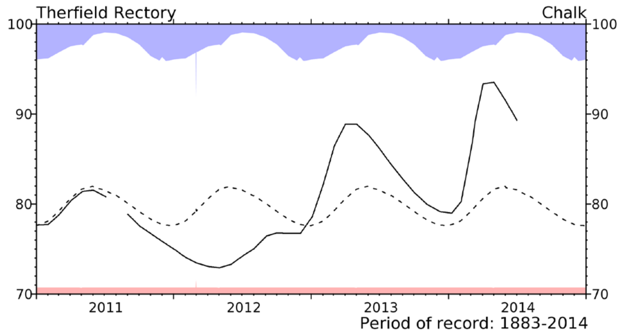

Thames at Kingston (Naturalised)
2013/2014
J A S O N D J F M A M J
Period of record: 1883-2014

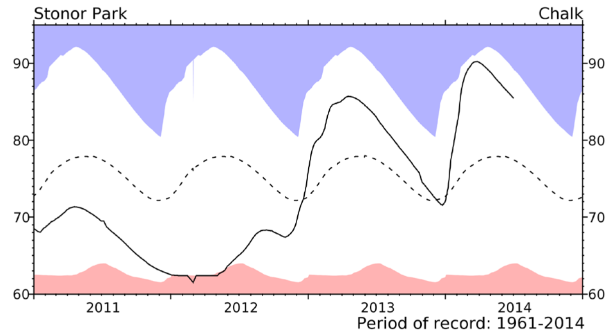

Taw at Umberleigh
2013/2014
J A S O N D J F M A M J
Period of record: 1958-2014

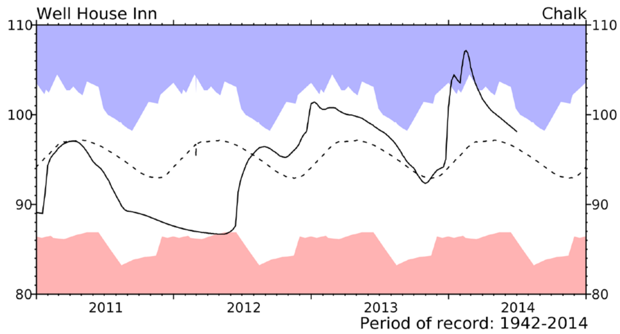

Itchen at Highbridge & Allbrook Total
2013/2014
J A S O N D J F M A M J
Period of record: 1958-2014

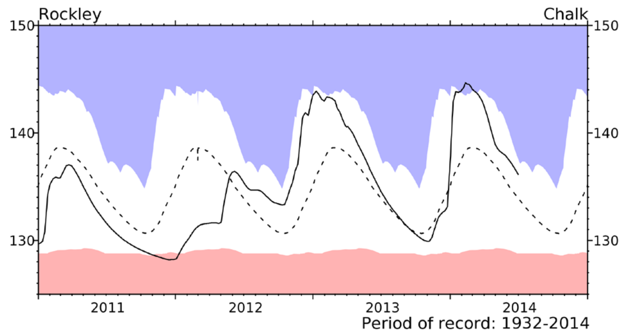
Groundwater . . . Groundwater

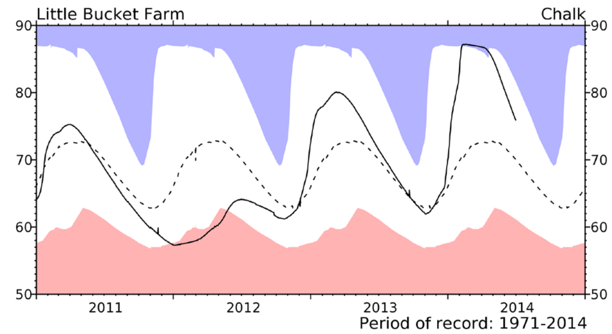


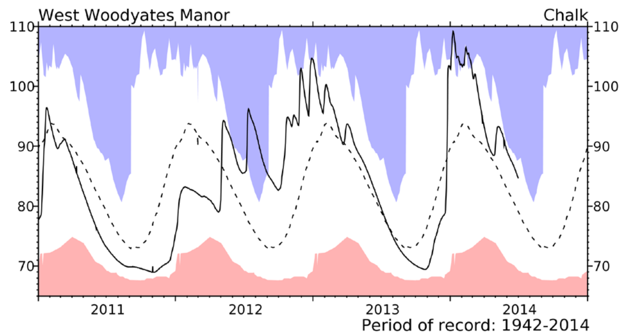


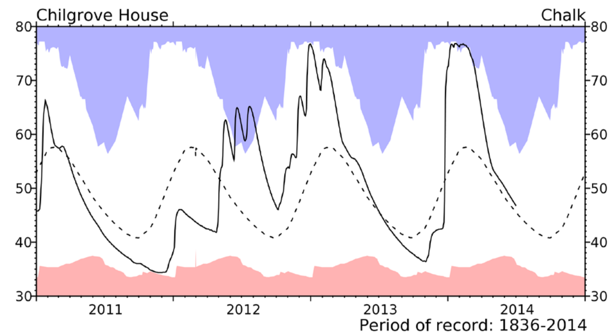


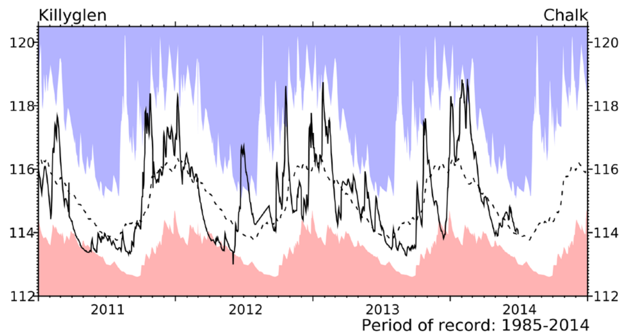


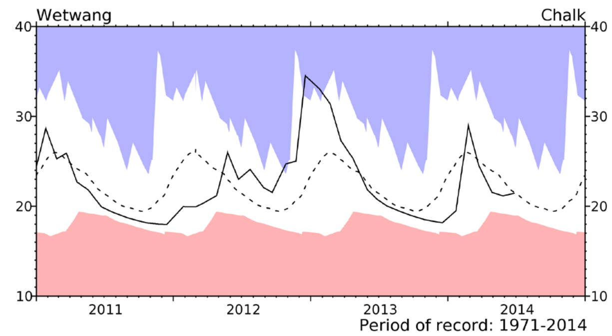






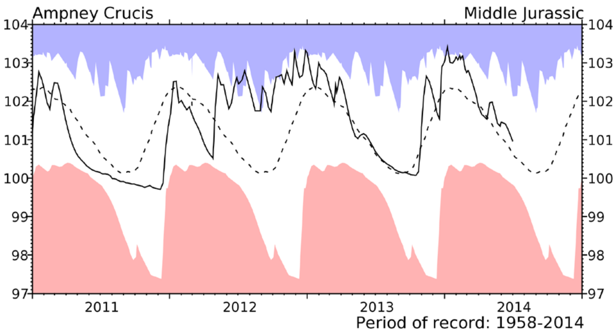


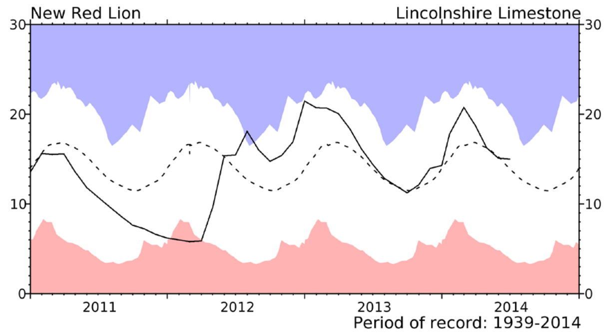


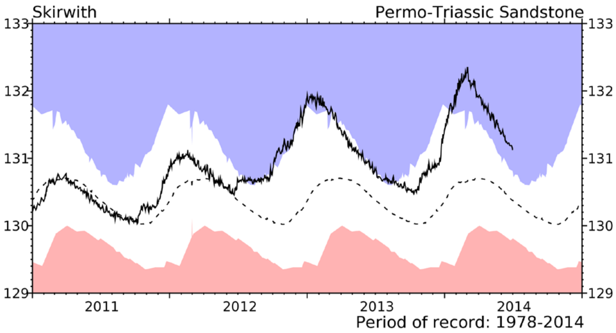


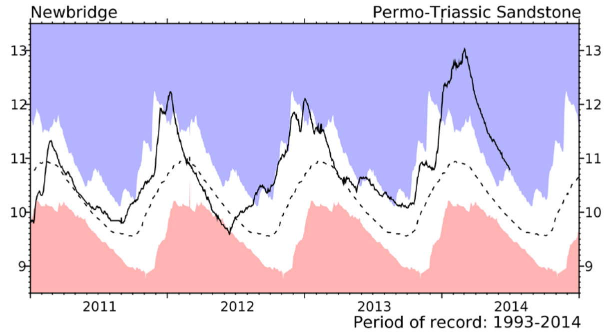
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly mean and the highest and lowest levels recorded for each month are displayed in a similar style to the river flow hydrographs. Note that most groundwater levels are not measured continuously and, for some index wells, the greater frequency of contemporary measurements may, in itself, contribute to an increased range of variation. The latest recorded levels are listed overleaf.

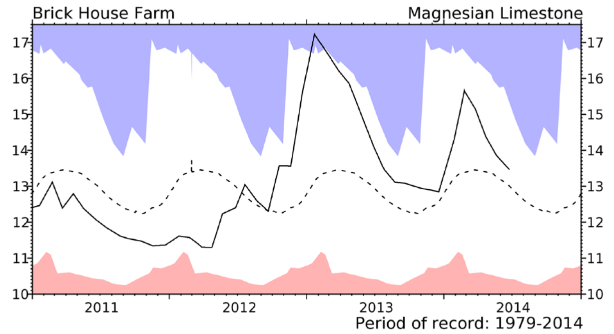
Groundwater... Groundwater

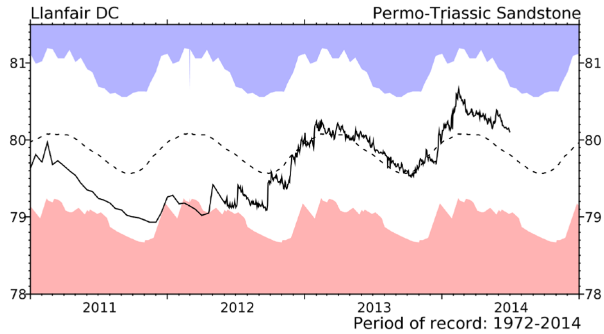


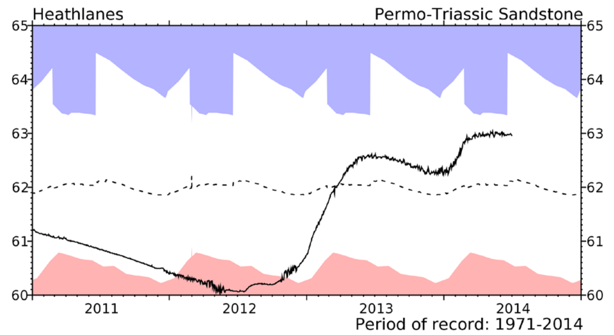


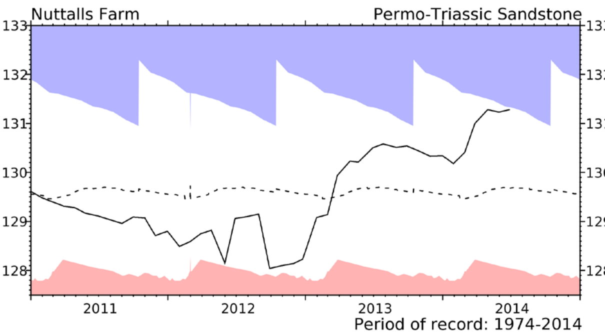


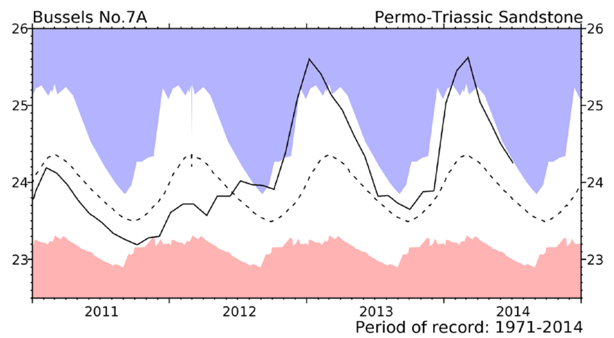


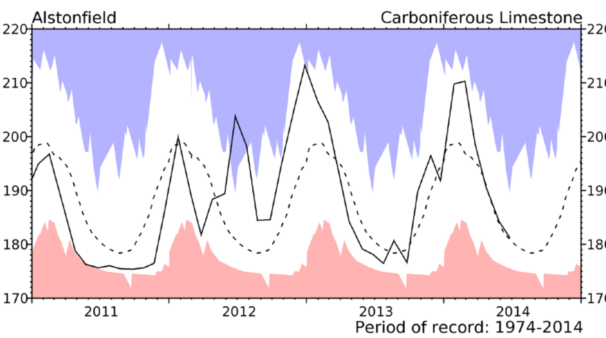










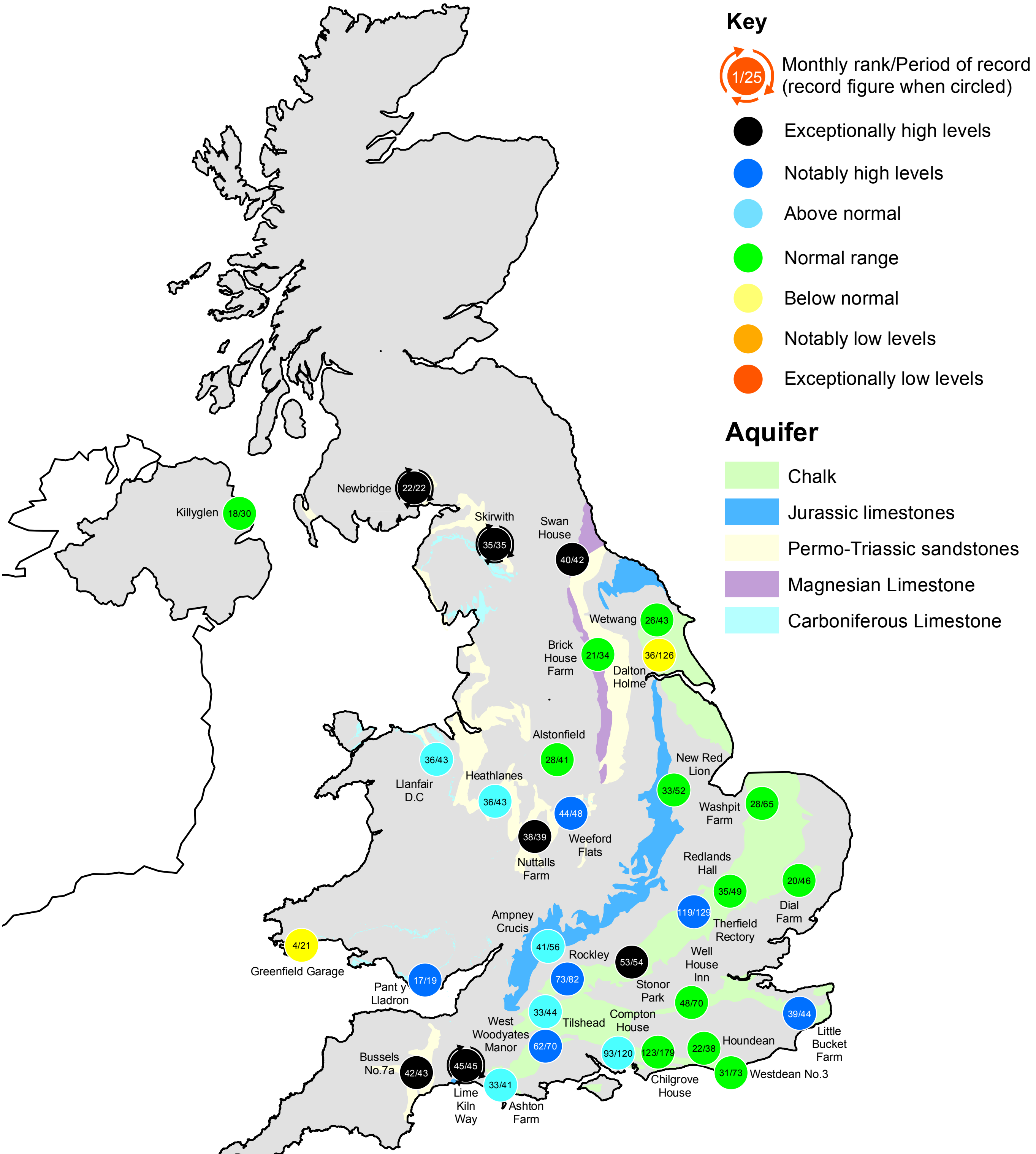


Groundwater levels June / July 2014

Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.
Dalton Holme	17.28	20/06	18.10	Chilgrove House	46.74	30/06	46.11	Brick House Farm	13.47	23/06	13.11
Therfield Rectory	89.30	01/07	81.85	Killyglen (NI)	113.96	30/06	114.03	Llanfair DC	80.10	30/06	79.85
Stonor Park	85.50	30/06	77.50	Wetwang	21.43	26/06	21.74	Heathlanes	62.96	30/06	62.10
Tilshead	88.34	30/06	87.68	Ampney Crucis	100.97	30/06	100.86	Nuttalls Farm	131.28	27/06	129.65
Rockley	136.14	30/06	134.58	New Red Lion	14.98	30/06	14.37	Bussels No.7a	24.26	03/07	23.87
Well House Inn	98.12	30/06	96.38	Skirwith	131.12	30/06	130.52	Alstonfield	181.24	25/06	181.86
West Woodyates	84.71	30/06	80.98	Newbridge	10.79	30/06	10.01				

Levels in metres above Ordnance Datum

Groundwater...Groundwater

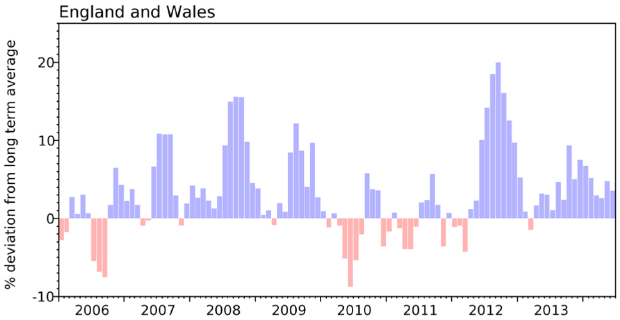


Groundwater levels - June 2014

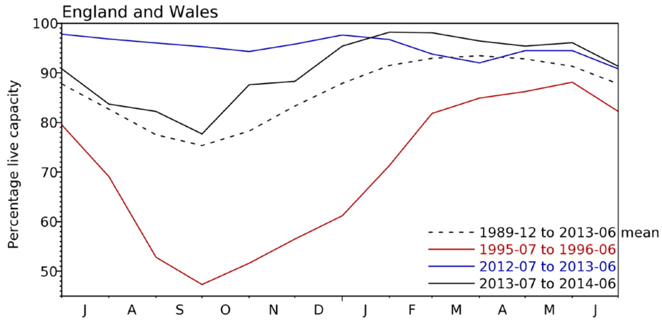
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Apr	2014 May	2014 Jun	Jun Anom.	Min Jun	Year* of min	2013 Jun	Diff 14-13
North West	N Command Zone	•	124929	88	79	66	-6	38	1984	73	-7
	Vyrnwy		55146	96	100	90	8	58	1984	94	-4
Northumbrian	Teesdale	•	87936	93	93	92	11	58	1989	90	2
	Kielder		(199175)	93	99	92	2	71	1989	90	2
Severn-Trent	Clywedog		44922	99	99	98	6	32	1976	99	-1
	Derwent Valley	•	39525	89	94	83	3	53	1996	76	7
Yorkshire	Washburn	•	22035	85	86	77	-4	63	1995	83	-6
	Bradford Supply	•	41407	93	98	87	8	54	1995	77	11
Anglian	Grafham		(55490)	96	96	92	-1	70	1997	94	-2
	Rutland		(116580)	96	97	93	5	75	1997	92	1
Thames	London	•	202828	97	98	97	5	85	1990	97	0
	Farmoor	•	13822	96	98	100	2	94	1995	98	2
Southern	Bewl		28170	100	99	99	16	52	1990	93	6
	Ardingly**		4685	100	100	95	0	82	2005	98	-3
Wessex	Clatworthy		5364	94	100	93	11	61	1995	78	15
	Bristol	•	(38666)	99	99	93	11	64	1990	83	10
South West	Colliford		28540	100	100	96	14	51	1997	91	5
	Roadford		34500	96	95	93	13	49	1996	86	7
	Wimbleball		21320	99	99	97	12	63	2011	85	12
	Stithians		4967	100	95	88	8	53	1990	82	6
Welsh	Celyn & Brenig	•	131155	100	100	97	2	77	1996	99	-2
	Brianne		62140	100	100	96	4	76	1995	99	-3
	Big Five	•	69762	97	98	94	9	61	1989	95	-1
	Elan Valley	•	99106	97	99	94	6	68	1976	95	-1
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	97	96	94	7	54	1998	92	2
	East Lothian	•	10206	99	98	99	5	81	1992	98	1
Scotland(W)	Loch Katrine	•	111363	91	94	86	6	55	2010	78	8
	Daer		22412	86	90	86	2	62	1994	65	21
	Loch Thom	•	11840	100	100	99	13	69	2000	85	14
Northern Ireland	Total+	•	56800	87	87	79	-3	61	2008	91	-12
	Silent Valley	•	20634	92	91	79	0	54	1995	93	-14

( ) 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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A full catalogue of past Hydrological Summaries can be accessed and downloaded at:
http://www.ceh.ac.uk/data/nrfa/nhmp/nhmp.html

NERC SCIENCE OF THE ENVIRONMENT

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