Hydrological Summary

for the United Kingdom

December 2014

General

For the UK as a whole, temperature and rainfall for December were near-average, but there were marked spatial contrasts and a wide range of weather conditions throughout the month. Westerly airflows brought strong winds and some heavy rain and snowfalls, resulting in a wet December for the north-west, while in southern and eastern areas it was generally dry and sunshine was well-above average. With mild airflows from the Atlantic, temperatures were often high for the time of year, but there were cold spells early in the month and during an anticyclonic episode in the last week, which brought the lowest minimum daily temperatures for 2014. While there were spates mid-month, river flows were fairly typical for December and groundwater levels were also mostly in the normal range or above, with recharge well established at most sites. Reservoir stocks were moderately above average at the national scale, with stocks reduced in a few impoundments due to drawdown for management purposes. The year 2015 thus commences from a near-normal baseline, with a favourable water resources situation. Looking back, 2014 was exceptional in terms of annual averages. December was the eleventh warmer-than-average month in 2014 (only August was below average), contributing to 2014 being the warmest year for the UK in a record from 1910 and, provisionally, in the Central England Temperature series from 1659. It was also the fourth wettest year (since 1910) for the UK; seven out of the ten wettest years have occurred since 1998. The notable annual rainfall total, and corresponding record annual runoff in some regions, reflects a disproportionate contribution from the exceptionally wet start to the year.

Rainfall

With westerly or north-westerly airflows dominant throughout December, much of upland Britain saw unsettled conditions interrupted by some dry and bright spells; southern and eastern areas also experienced unsettled periods but were much drier overall. Between the 9th and the 12th, a vigorous depression brought high winds (particularly on the 10th) and heavy rainfall to many areas. Unsettled conditions persisted through mid-December in northern Britain. An area of deep low pressure off Iceland pushed a cluster of fronts across north-western areas on the 20th-22nd (with 24hour totals of 80mm recorded at Benmore, Argyll, and 94mm at Blencathra in the Lake District). These unsettled spells saw sleet and snowfall on higher ground, while a cold spell after Christmas brought a brief period of snowfall to central England (with 22cm recorded at Middleton, Derbyshire on the 27th). December rainfall totals display a pronounced gradient: some areas in the northern Highlands and south-west Scotland received over 150% of average, while parts of the east coast of Scotland and north-east England saw less than half the typical December rainfall. Southern Britain received below-average rainfall and south-west England was notably dry, with <50% of the average received in some coastal areas. The December rainfall for England & Wales was 85% of average (the driest since 2010), contrasting with 135% of average for Scotland; Northern Ireland received 110%. Rainfall accumulations since March are generally unremarkable in England and Wales, reflecting pronounced month-to-month variations over this period. Exceptional rainfall totals for 2014 in south-east England largely reflect the record-breaking January and February. These months also contribute to the high annual rainfall totals for Scotland, although August-November was also very wet, particularly in northern Scotland.

River flows

A majority of index rivers were in recession during the first week of December, continuing a trend established in late November (since mid-month in many Scottish rivers). Flows increased rapidly in responsive catchments following storms after the 6th and spates were common until just before Christmas, often associated with flood alerts. More than 30 flood warnings were in place across Scotland on the 22nd, and localised impacts were reported – a superstore in Kilmarnock was evacuated as the Irvine burst its banks, and the Glasgow-Carlisle train line was closed temporarily. However, incursions into the high flow envelope were rare and peak flows were modest for the time of year. Average river flows for December were in the normal range for a significant majority of catchments across the UK, and moderately above in some cases. These were typically isolated occurrences rather than reflecting any regional coherence, ranging from the Naver in northern Scotland to the Great Stour in Kent. Runoff totals were notable in a few cases (>150% of average for the Bush in Northern Ireland and the Dee in north Wales) but not exceptional. Flows were below normal in south-west England, with the Kenwyn registering its fourth lowest December runoff (in a record from 1968); the Derwent in East Yorkshire also saw below-normal flows. For 2014 as a whole, many rivers in south-east England registered their highest annual runoff total, including the Thames (in a record from 1883). Correspondingly, the annual outflow from the English Lowlands was the highest on record, while outflows from Scotland were the second highest (both records commence 1961).

Groundwater

Groundwater levels in all indicator boreholes were in the normal range or above for the time of year, apart from the Carboniferous Limestone in west Wales. Levels in the Chalk rose in most of the fast responding boreholes, typically by only a few metres (due to the lower than average rainfall). The exception was Little Bucket Farm in Kent where they rose by 6m to levels that were exceptionally high for the time of year, although still well below the maximum recorded level for December. Levels continued to recede in the some parts of the Chilterns (Stonor Park), Hertfordshire (Therfield Rectory) and East Anglia (Dial Farm) and levels also fell at some of the rapidly responding South Downs sites (Houndean Bottom and Westdean). In the Magnesian limestones levels were average or above and continued to increase. Levels also increased in the Permo-triassic sandstones and were generally at or above the seasonal mean. Nevertheless, levels at Skirwith in the north-west fell into the normal range for the first time since the start of 2014. Levels at Nuttalls Farm in the Midlands and Bussells in Devon fell slightly, but remain above average. Levels at Lime Kiln Way in the Upper Greensand of south-west England also fell slightly and were notably high (after 11 months of being exceptional). A similar response has been observed in the Lower Greensand aquifer of South East England.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

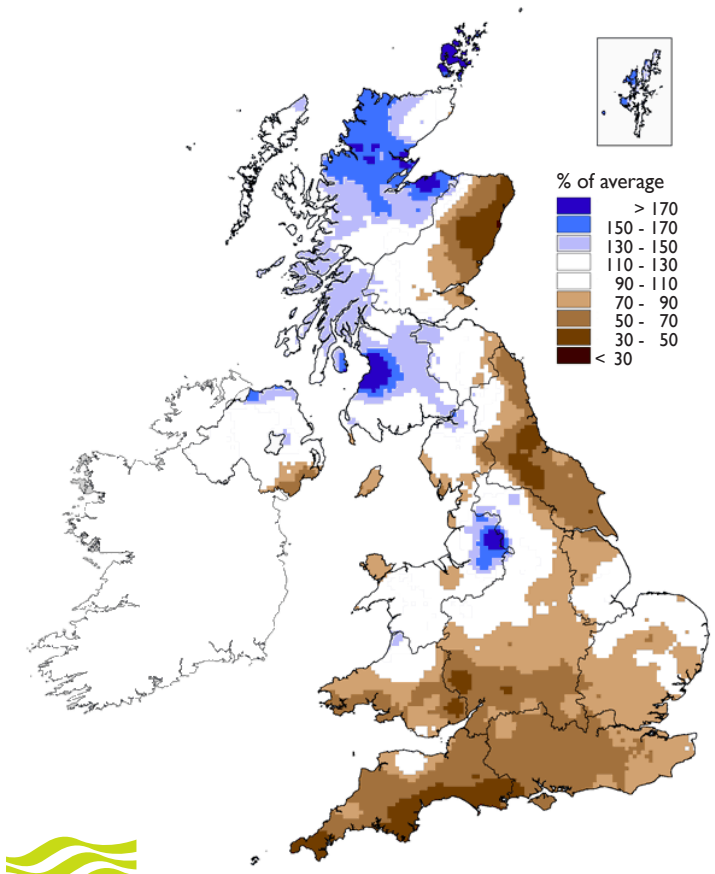
Area	Rainfall	Dec 2014	Oct14 – Dec14	RP	Jul14 – Dec14	RP	Apr13 – Dec14	RP	Jan14 – Dec14	RP
United Kingdom	mm	**130**	411		638		860		1297	
	%	**108**	118	5-10	108	2-5	109	2-5	120	30-50
England	mm	**73**	285		461		656		988	
	%	**82**	113	2-5	104	2-5	107	2-5	121	10-20
Scotland	mm	**218**	597		910		1171		1744	
	%	**135**	126	10-20	115	5-10	114	5-10	121	30-50
Wales	mm	**156**	482		702		969		1549	
	%	**95**	104	2-5	93	2-5	97	2-5	113	5-10
Northern Ireland	mm	**130**	436		660		851		1281	
	%	**110**	127	10-20	110	2-5	105	2-5	115	15-25
England & Wales	mm	**84**	312		494		699		1065	
	%	**85**	111	2-5	102	2-5	105	2-5	119	10-20
North West	mm	**152**	432		663		864		1313	
	%	**115**	113	2-5	101	2-5	99	2-5	112	2-5
Northumbrian	mm	**70**	263		443		642		931	
	%	**81**	107	2-5	100	2-5	103	2-5	112	2-5
Severn-Trent	mm	**73**	250		409		611		912	
	%	**91**	113	2-5	102	2-5	107	2-5	120	10-15
Yorkshire	mm	**79**	259		451		651		944	
	%	**89**	106	2-5	104	2-5	107	2-5	116	5-10
Anglian	mm	**50**	210		374		540		731	
	%	**89**	123	2-5	116	2-5	116	2-5	121	10-15
Thames	mm	**49**	256		411		594		926	
	%	**67**	122	2-5	111	2-5	112	2-5	132	30-50
Southern	mm	**60**	327		494		666		1071	
	%	**68**	126	2-5	115	2-5	114	2-5	137	50-80
Wessex	mm	**59**	312		479		698		1123	
	%	**58**	113	2-5	103	2-5	110	2-5	130	25-40
South West	mm	**90**	393		582		840		1389	
	%	**60**	96	2-5	89	2-5	97	2-5	115	5-10
Welsh	mm	**144**	461		677		940		1501	
	%	**91**	103	2-5	93	2-5	98	2-5	113	5-10
Highland	mm	**294**	703		1099		1396		1987	
	%	**148**	121	8-12	116	5-10	116	5-10	116	10-15
North East	mm	**88**	413		718		908		1251	
	%	**97**	142	10-15	139	10-20	128	5-10	132	50-80
Tay	mm	**144**	517		783		1037		1643	
	%	**103**	127	5-10	116	2-5	117	2-5	130	50-80
Forth	mm	**153**	423		629		869		1310	
	%	**124**	119	5-10	102	2-5	107	2-5	116	8-12
Tweed	mm	**123**	383		586		810		1218	
	%	**118**	131	5-10	114	2-5	115	2-5	128	20-30
Solway	mm	**211**	639		888		1141		1828	
	%	**131**	137	15-25	114	2-5	112	2-5	130	60-90
Clyde	mm	**284**	712		1009		1310		2059	
	%	**145**	124	8-12	104	2-5	107	2-5	119	15-25

% = 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 August 2014 (inclusive) are provisional.

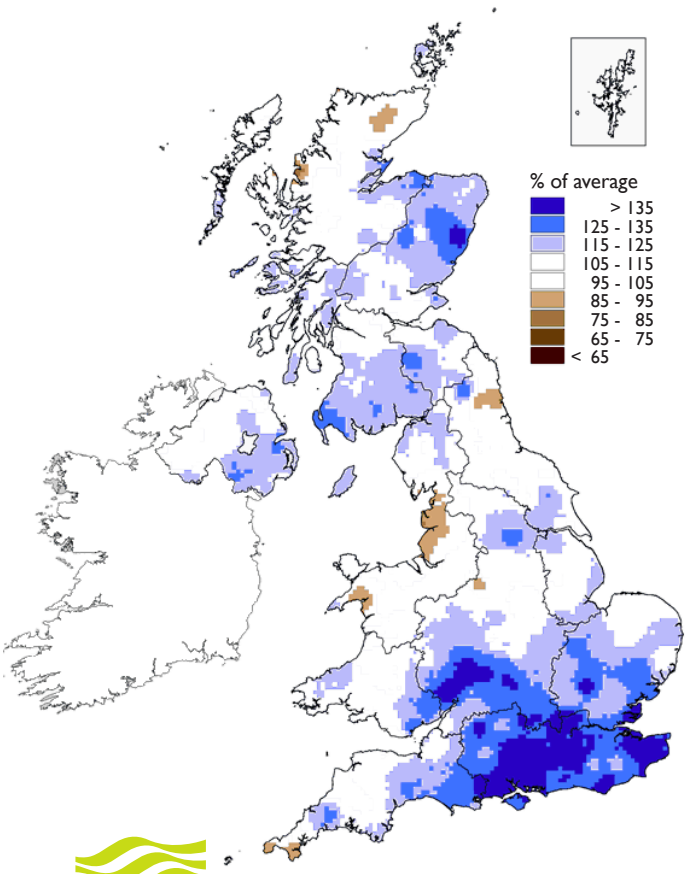
Rainfall . . . Rainfall . . .

December 2014 rainfall as % of 1971-2000 average



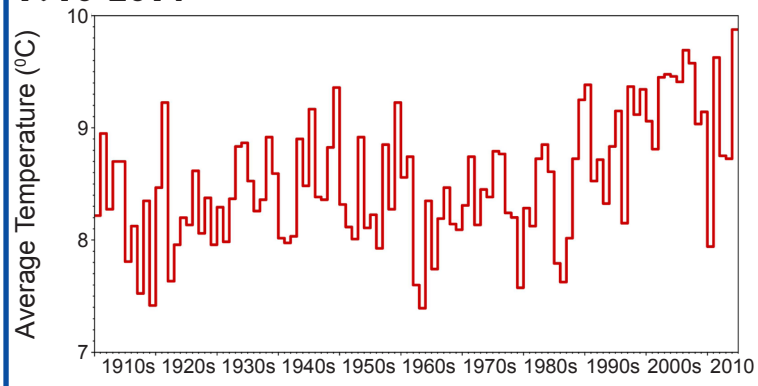
Met Office

January 2014 - December 2014 rainfall as % of 1971-2000 average

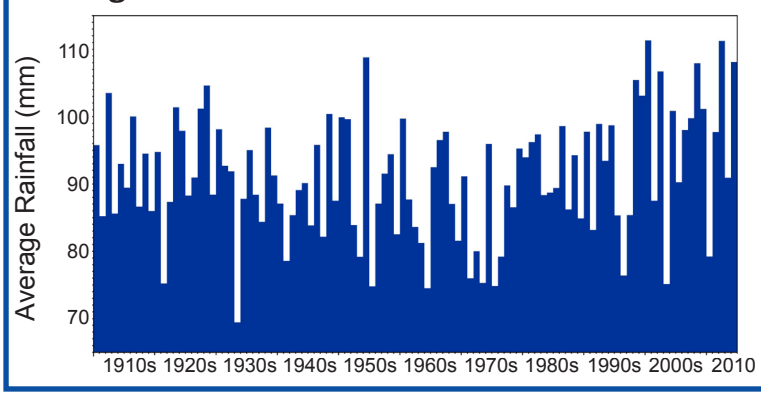


Met Office

Average Annual Temperature for the UK 1910-2014



Average Annual Rainfall for the UK 1910-2014



Met Office

Met Office 3-month outlook Updated: December 2014

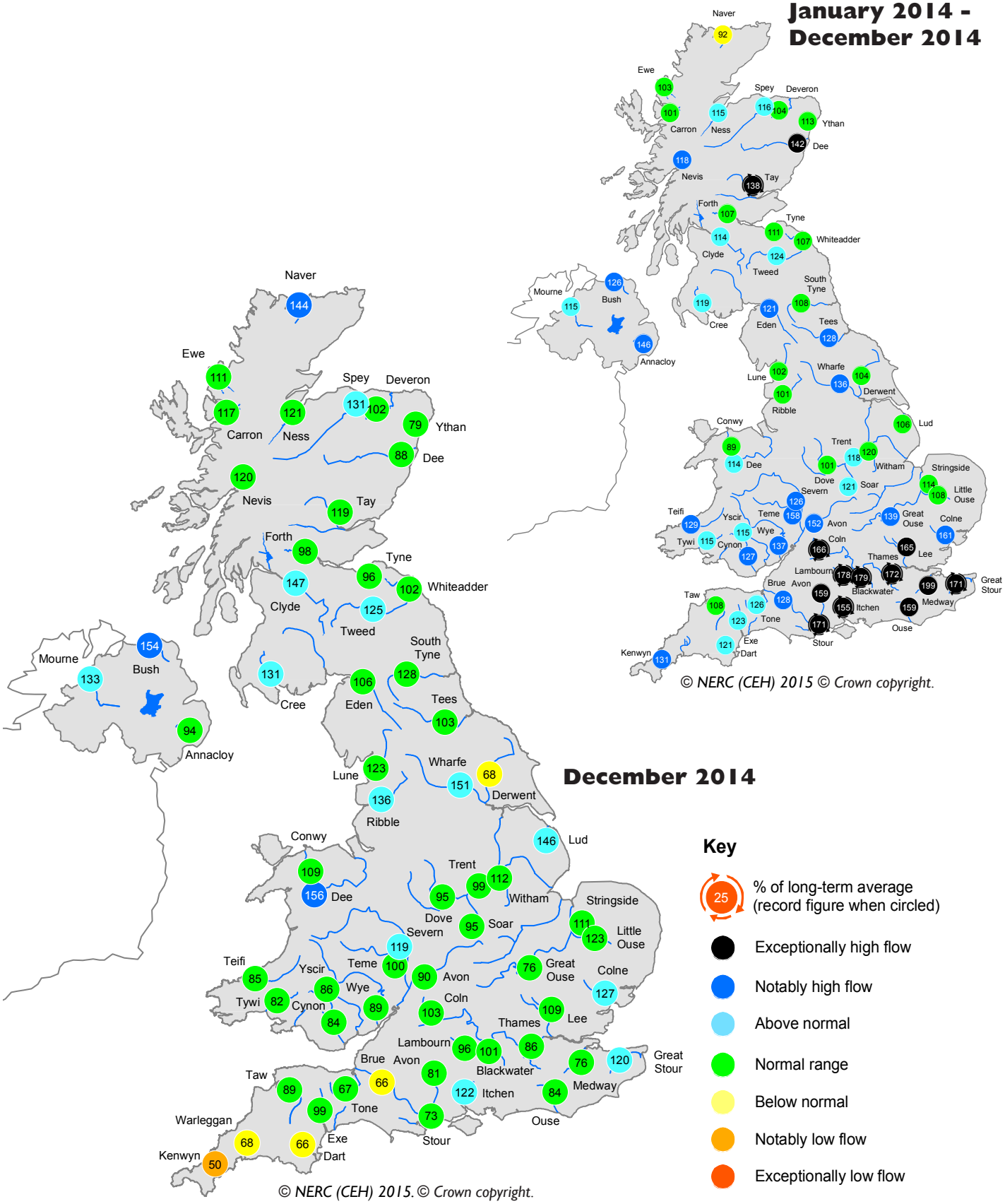
For January-February-March as a whole, although uncertainty is large, there is a slight preference for near- to above-average precipitation.

The probability that UK precipitation for January-February-March will fall into the driest of our five categories is between 15% and 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.

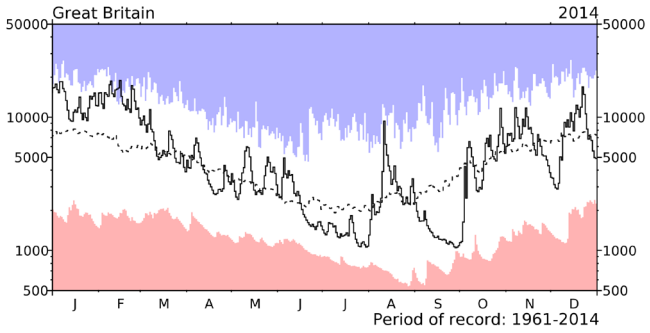
River flow . . . River flow . . .

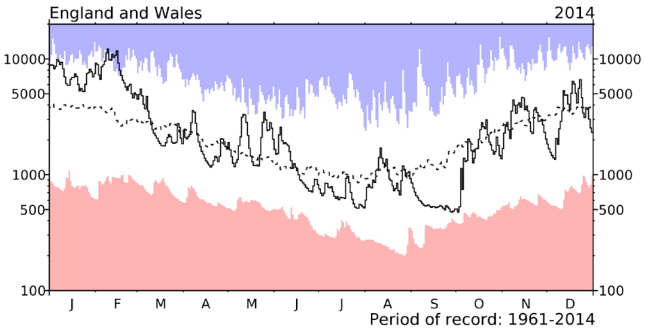


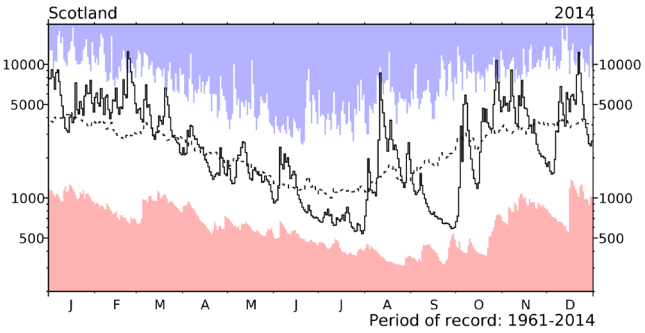
River flows

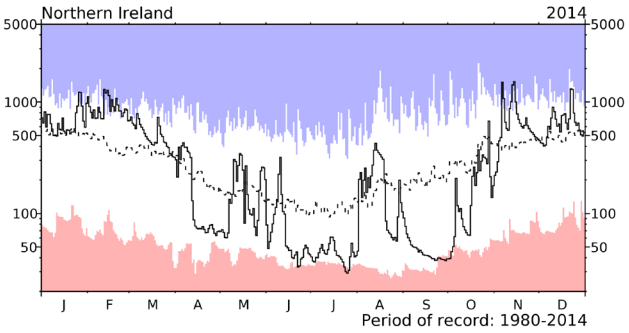
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

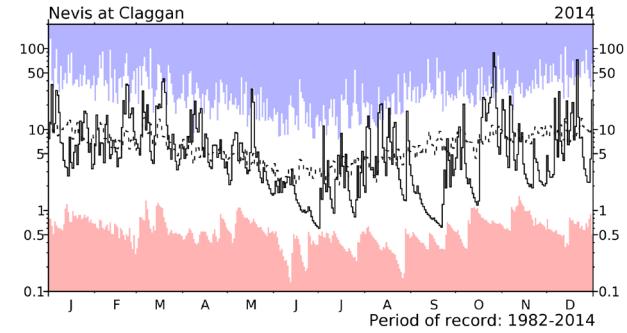
River flow . . . River flow . . .

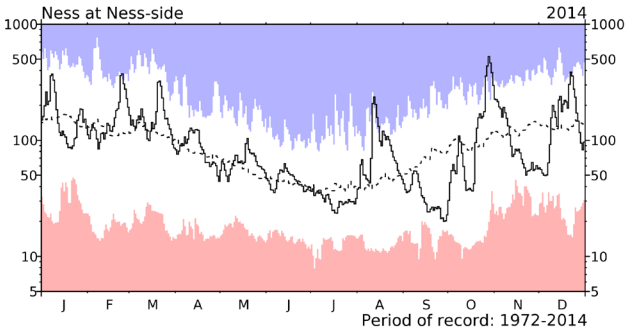


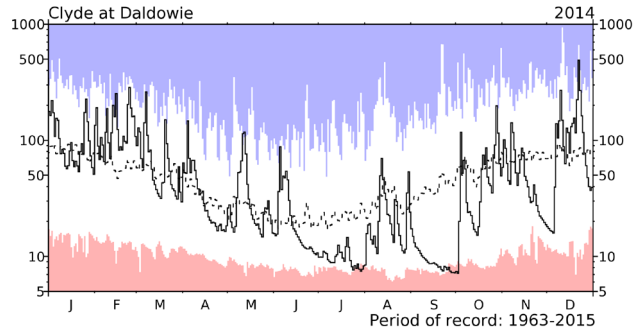


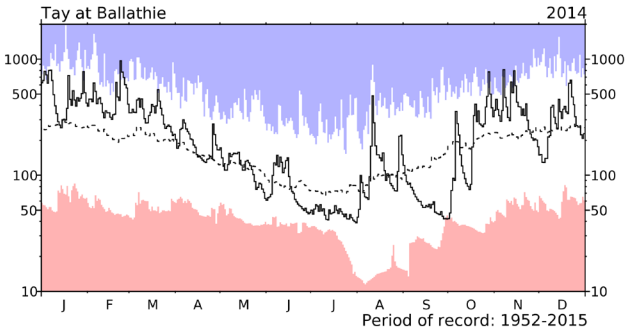


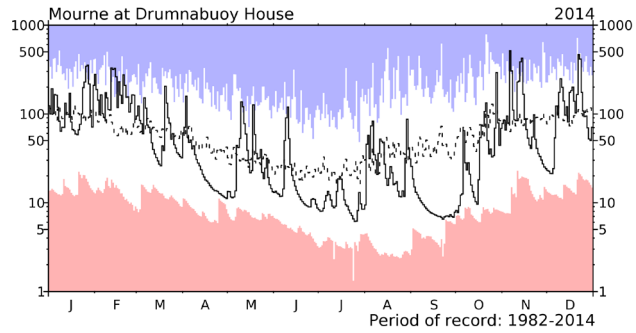


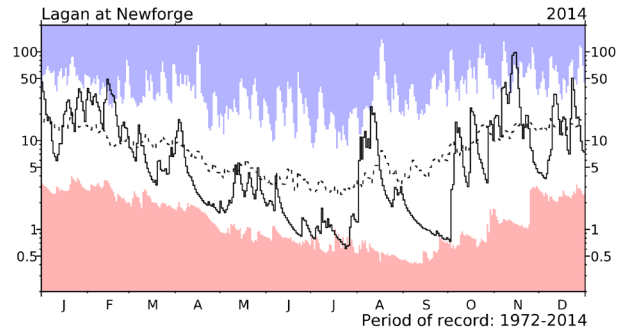








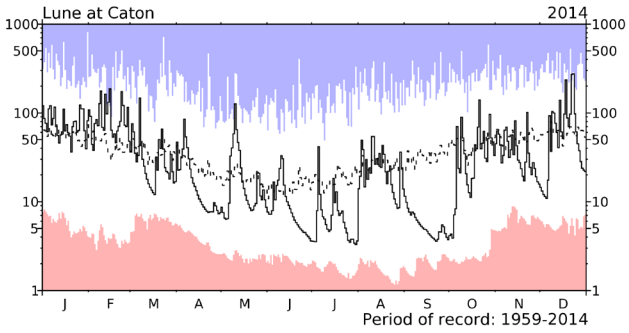


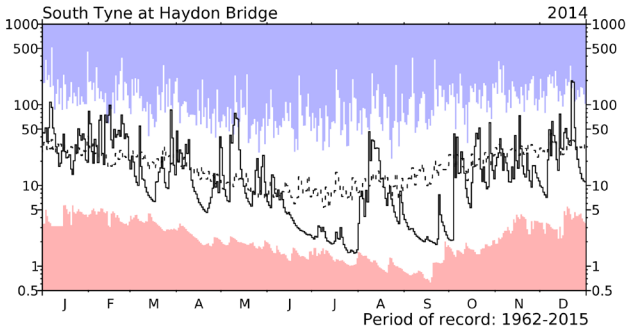


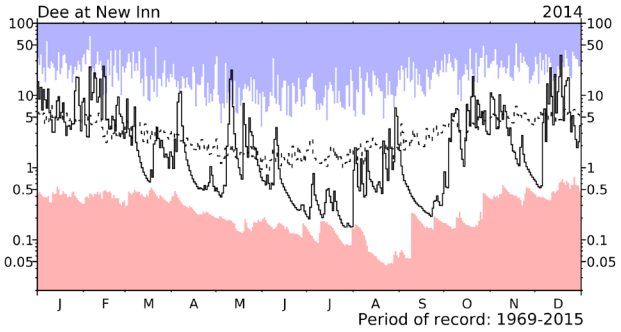
River flow hydrographs

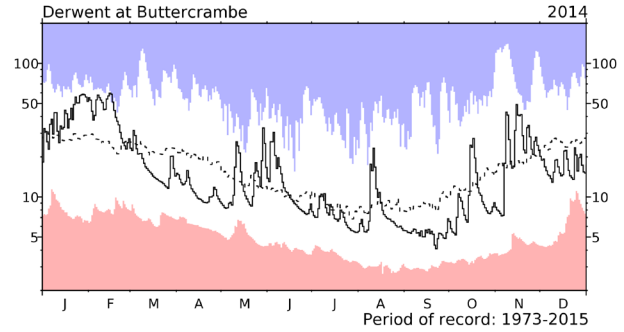
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to January 2014 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the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

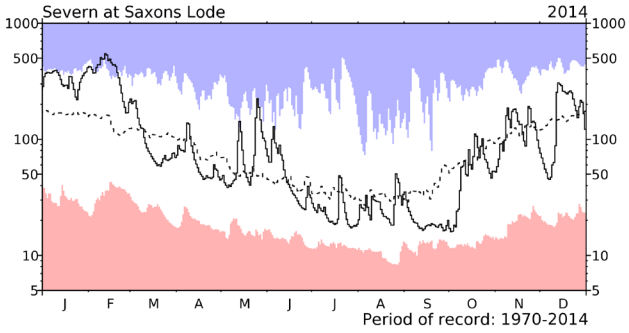
River flow . . . River flow . . .

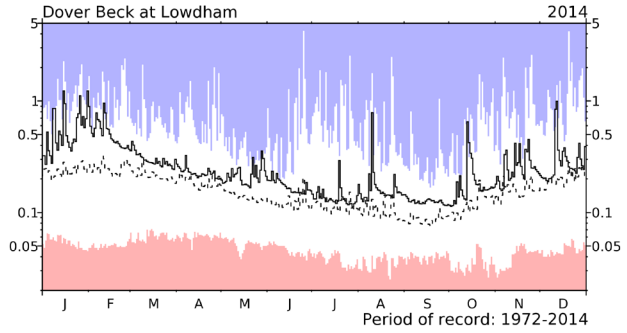


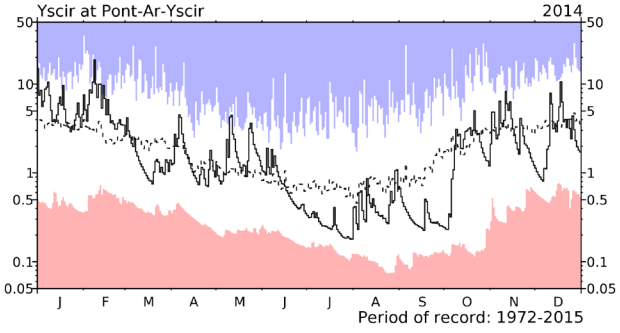


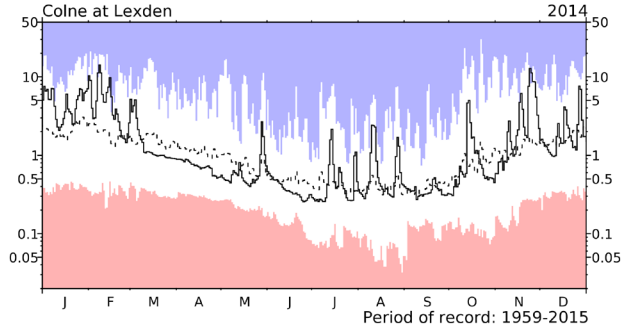


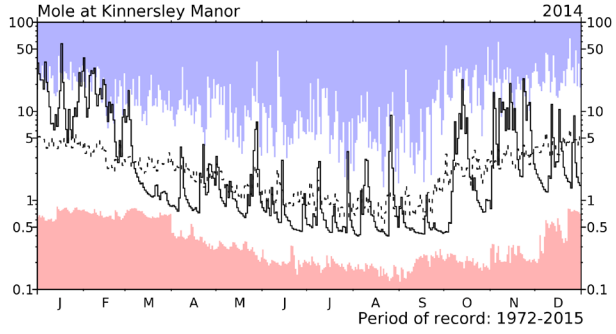


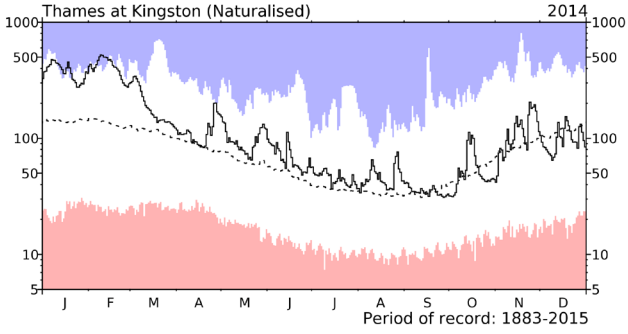


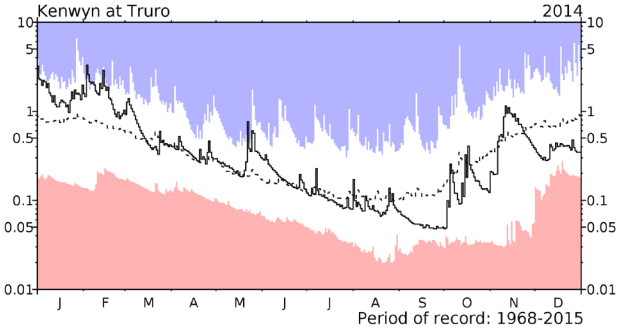


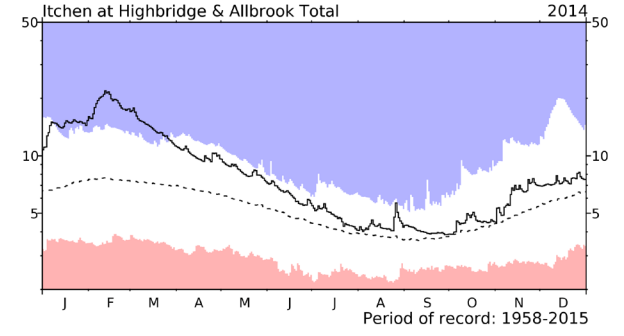




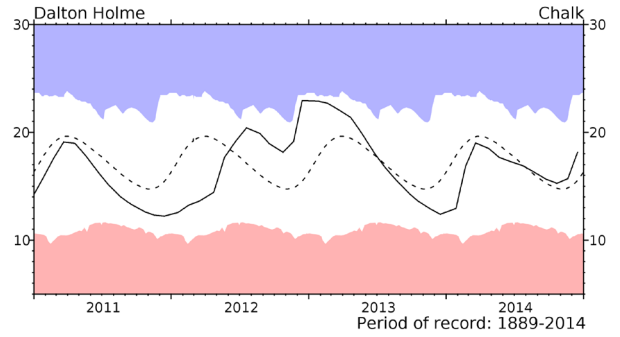


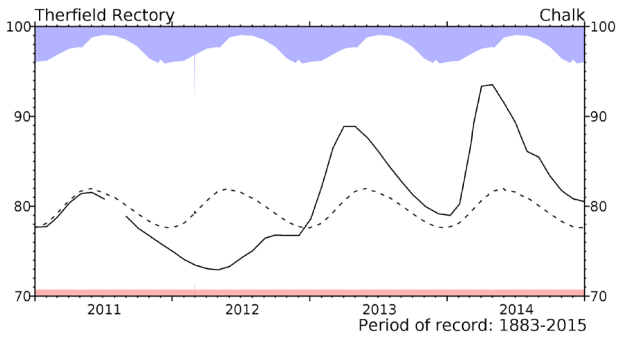


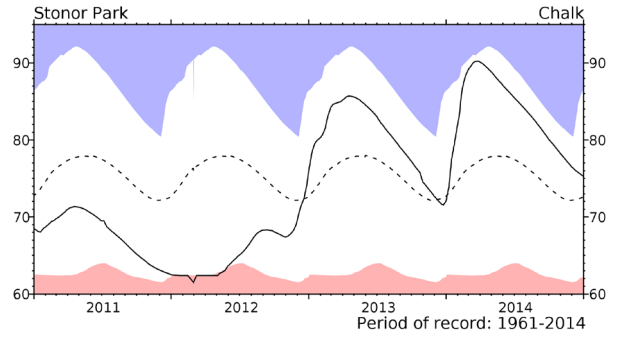


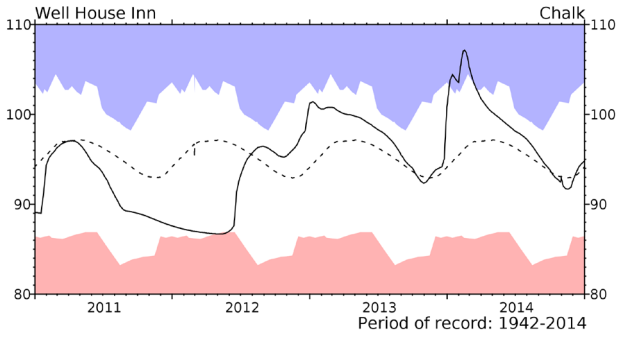


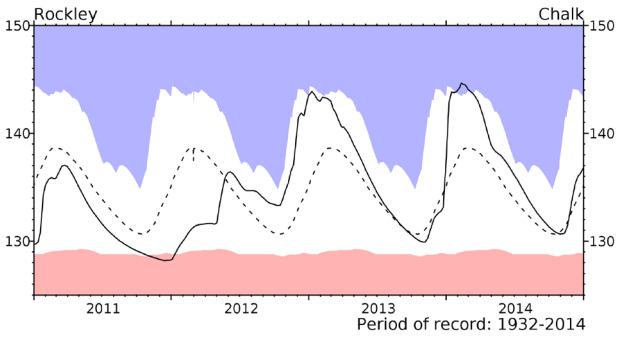
Groundwater…Groundwater

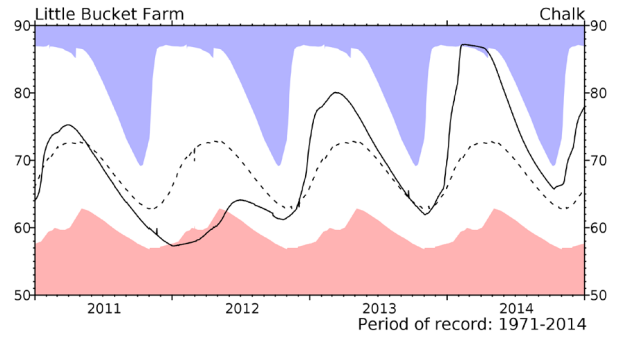


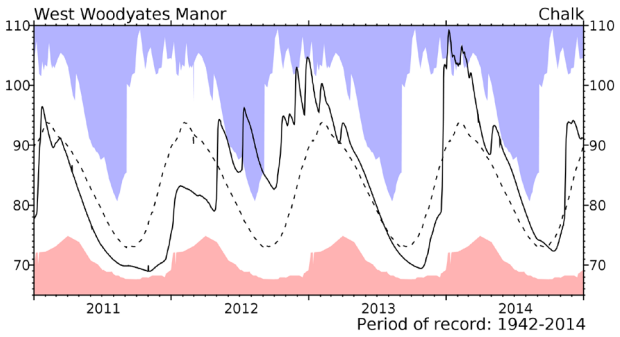


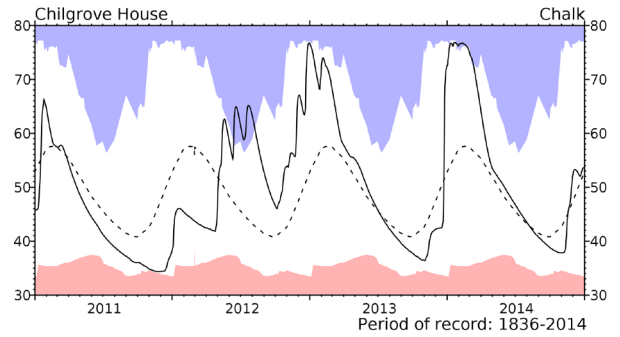


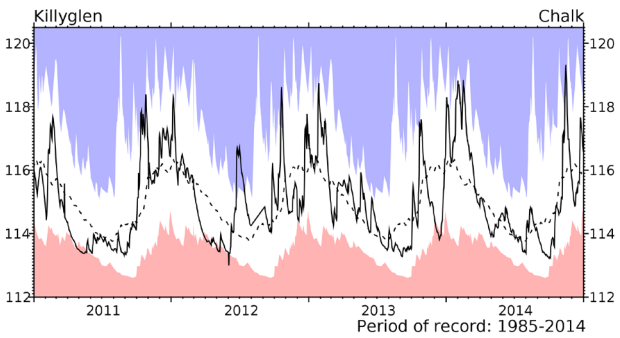


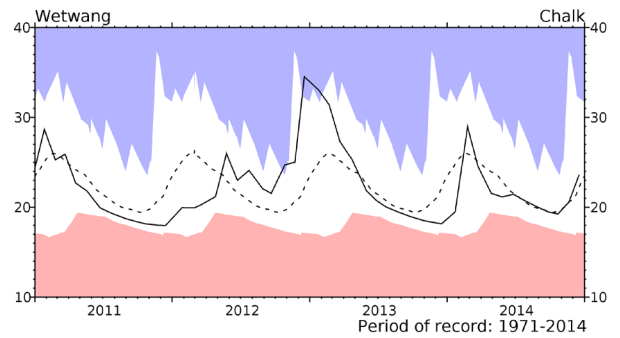






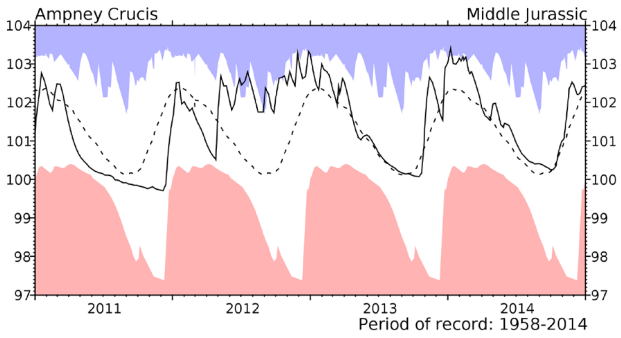


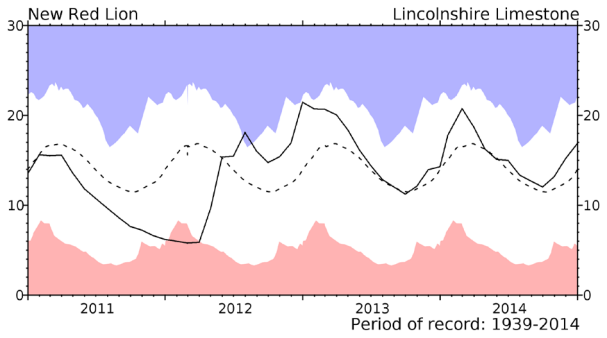


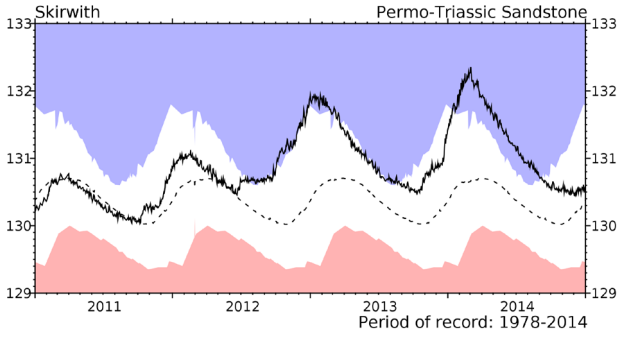


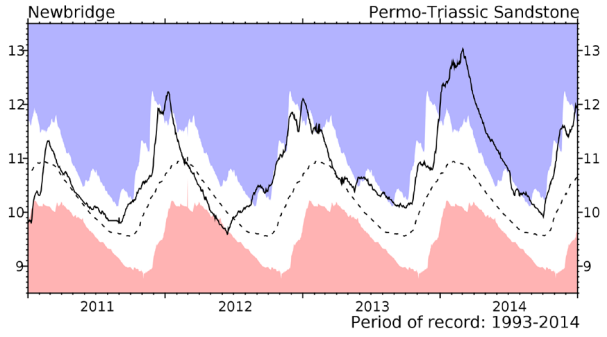
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

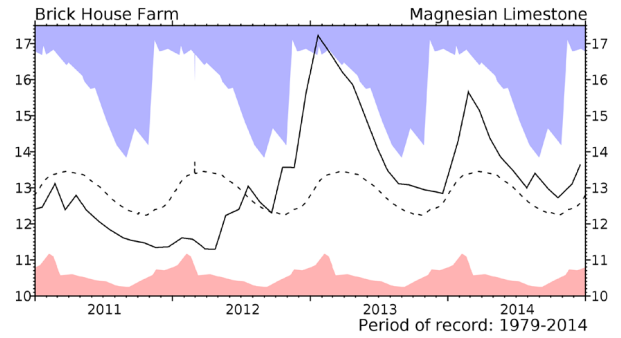
Groundwater ... Groundwater

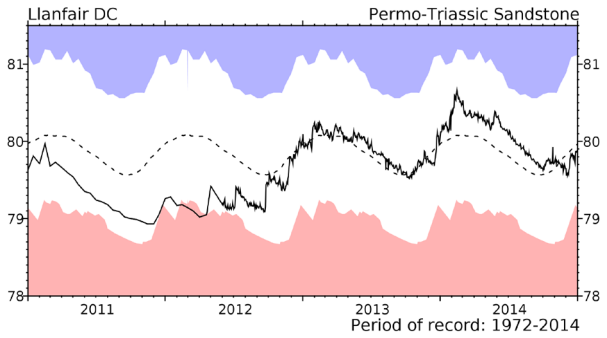


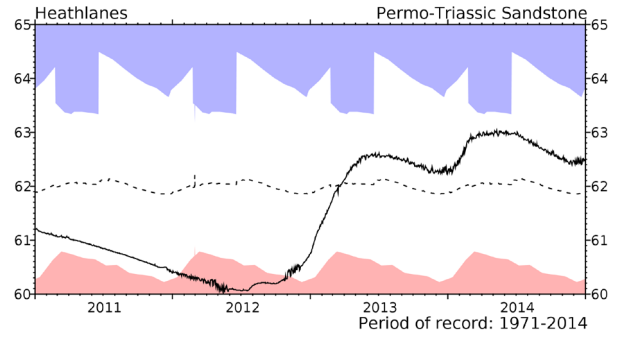


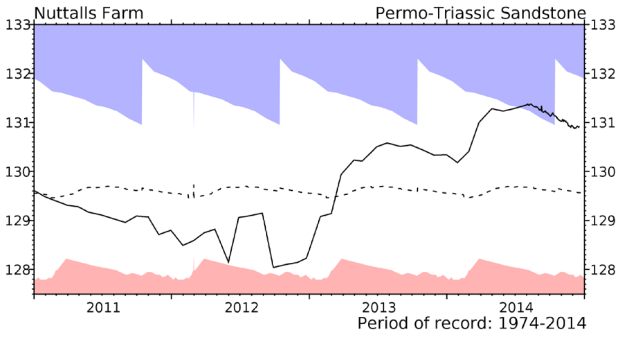


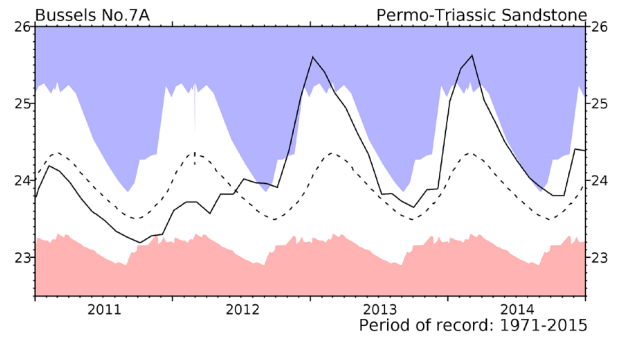


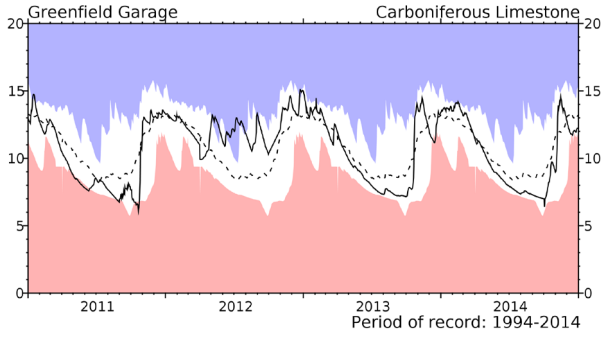








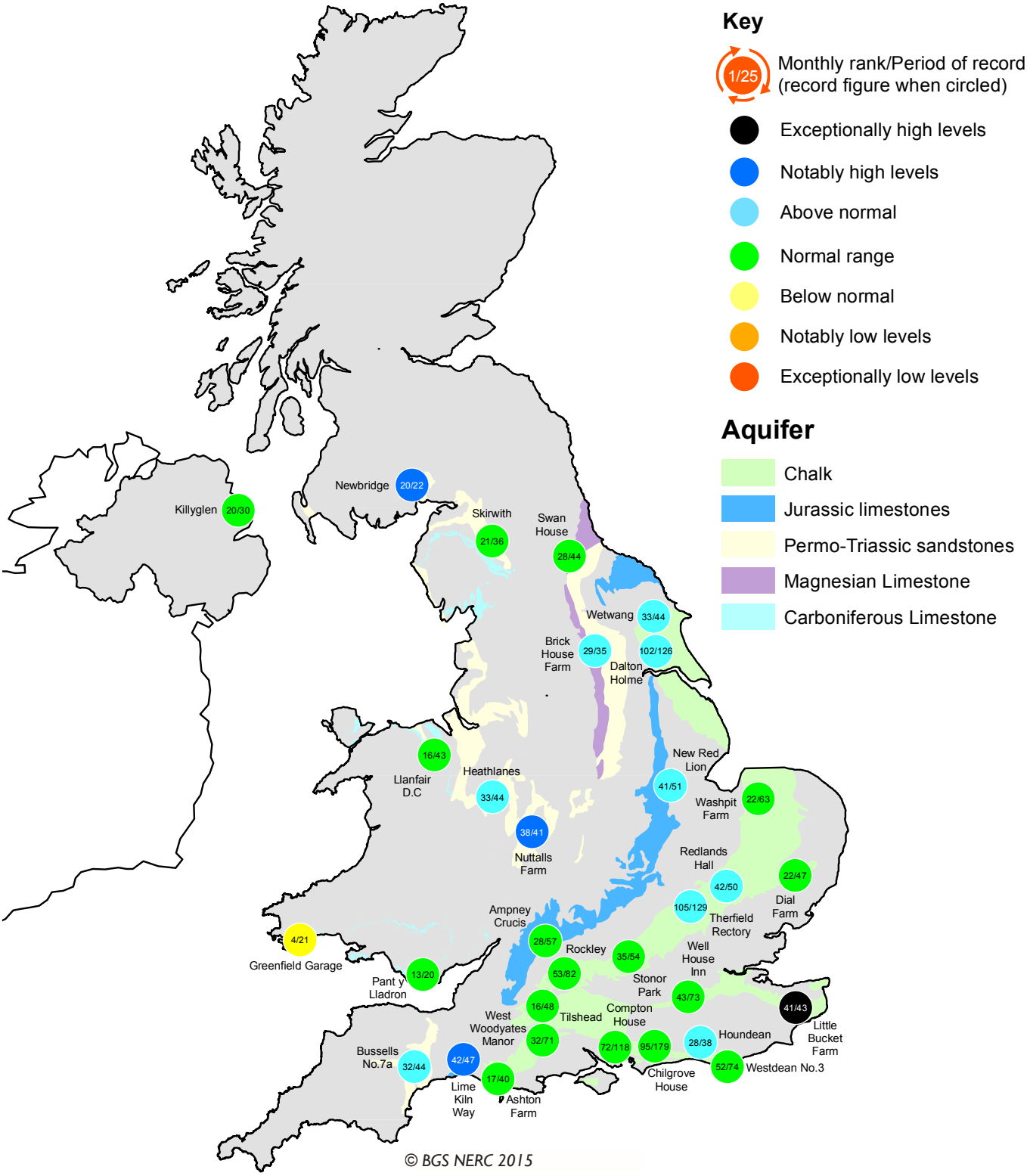




Groundwater levels December 2014 / January 2015

Borehole	Level	Date	Dec av.	Borehole	Level	Date	Dec av.	Borehole	Level	Date	Dec av.
Dalton Holme	18.14	16/12	15.57	Chilgrove House	53.69	31/12	51.90	Brick House Farm	13.63	18/12	12.55
Therfield Rectory	80.49	02/01	77.72	Killyglen (NI)	116.60	31/12	116.03	Llanfair DC	79.88	31/12	79.86
Stonor Park	75.29	31/12	72.15	Wetwang	23.54	17/12	21.77	Heathlanes	62.47	30/12	61.82
Tilshead	84.24	31/12	86.72	Ampney Crucis	102.43	31/12	101.99	Nuttalls Farm	130.91	18/12	129.55
Rockley	136.74	31/12	133.89	New Red Lion	16.83	31/12	13.11	Bussells No.7a	24.38	05/01	23.85
Well House Inn	94.77	31/12	93.52	Skirwith	103.59	31/12	130.38	Greenfield Garage	12.21	31/12	13.11
West Woodyates	91.16	31/12	86.99	Newbridge	11.98	31/12	10.66				

Levels in metres above Ordnance Datum

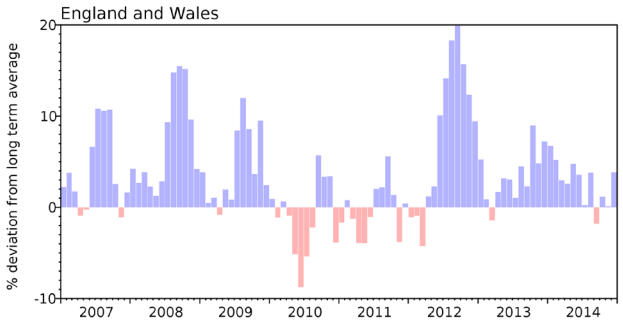


Groundwater levels - December 2014

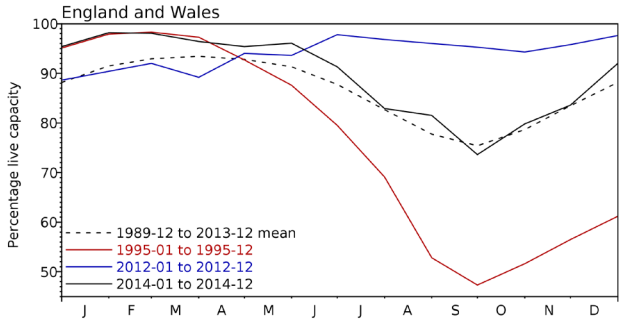
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Oct	2014 Nov	2014 Dec	Dec Anom.	Min Dec	Year* of min	2013 Dec	Diff 14-13
North West	N Command Zone	•	124929	68	74	93	6	51	1995	94	-1
	Vyrnwy		55146	71	74	99	8	35	1995	100	-1
Northumbrian	Teesdale	•	87936	89	88	99	10	41	1995	100	-1
	Kielder		(199175)	89	95	98	7	70	1989	100	-2
Severn-Trent	Clywedog		44922	84	86	86	2	54	1995	87	-1
	Derwent Valley	•	39525	56	66	96	7	10	1995	98	-2
Yorkshire	Washburn	•	22035	52	67	87	1	23	1995	95	-9
	Bradford Supply	•	41407	66	84	96	6	22	1995	91	5
Anglian	Grafham		(55490)	75	66	70	-14	57	1997	89	-19
	Rutland		(116580)	84	82	83	1	60	1990	89	-6
Thames	London	•	202828	88	88	94	8	60	1990	96	-2
	Farmoor	•	13822	78	69	89	-2	71	1990	84	5
Southern	Bewl		28170	67	71	73	0	34	2005	91	-19
	Ardingly**		4685	76	100	100	16	30	2011	100	0
Wessex	Clatworthy		5364	62	84	100	9	54	2003	100	0
	Bristol	•	(38666)	66	74	78	0	40	1990	83	-5
South West	Colliford		28540	71	76	79	1	46	1995	83	-4
	Roadford		34500	74	78	82	4	20	1989	91	-9
	Wimbleball		21320	63	75	83	0	46	1995	76	7
	Stithians		4967	44	52	57	-21	33	2001	100	-43
Welsh	Celyn & Brenig	•	131155	74	81	96	2	54	1995	100	-5
	Brianne		62140	100	93	98	1	76	1995	100	-2
	Big Five	•	69762	80	86	93	3	67	1995	98	-5
	Elan Valley	•	99106	90	99	100	4	56	1995	100	0
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	71	79	83	-8	60	1998	100	-17
	East Lothian	•	10206	98	99	100	4	48	1989	100	0
Scotland(W)	Loch Katrine	•	111363	89	90	96	6	75	2007	94	2
	Daer		22412	92	99	99	2	83	1995	100	-1
	Loch Thom	•	11840	76	100	100	3	80	2007	100	0
Northern Ireland	Total+	•	56800	84	93	92	4	61	2001	89	3
	Silent Valley	•	20634	82	97	85	0	39	2001	89	-4

( ) 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 of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes. Monthly figures may be artificially low due to routine maintenance or turbidity effects in feeder rivers.

Location map…Location map

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.

01/2015