Hydrological Summary

for the United Kingdom

January 2013

General

January was a wintry month with significant snowfall across most of the country. Monthly precipitation totals were mostly within the normal range but the final week was very unsettled; sustained frontal rainfall, often augmented by snowmelt, triggered a further episode of extensive floodplain inundations. Northern Scotland apart, January runoff totals were generally close to, or above, average and most reservoirs benefited from exceptional inflows late in the month. The great majority of index reservoirs were close to capacity in early February but water quality issues (restricting the replenishment of some pumped storage impoundments) and planned maintenance (e.g. at Loch Katrine) have left some reservoir stocks below the late-winter average. With soils remaining close to saturation throughout January, aquifer recharge was again healthy, adding to the remarkable replenishment through much of 2012. Correspondingly, exceptionally high groundwater levels characterise most aquifer outcrop areas, with heavy outflows from many springs and seepages. After the wettest April-January on record for England & Wales, the water resources outlook is very healthy but many areas will remain vulnerable to both fluvial and groundwater flooding through the remainder of the winter at least.

Rainfall

After a damp start, high pressure dominated synoptic patterns – with precipitation largely restricted to fog-drip in many areas – until late in the second week when wintry conditions, with high winds and significant snowfall, affected much of the country (a 26cm accumulation was recorded at Redesdale on the 21st and Oxford recorded 13 days with snow lying in January). The severe weather caused widespread transport disruption and thousands of schools were temporarily closed. The final week of January was very cyclonic with substantial rainfall totals in many areas e.g. Vyrnwy (North Wales) 56mm in 24hrs on 26th/27th; Cassley (North Scotland) 61.8mm on the 30th. The tracks followed by the low pressure systems throughout January were very variable; this is reflected in the spatial variations in monthly precipitation totals (which are likely to be underestimated due to the difficulties in assessing snowfall). Northern Ireland recorded its 2nd wettest January since 1999 and totals for parts of northeast England and southwest Britain were also well above average. In contrast, parts of northern Scotland and a zone from the Lake District to the East Midlands registered less than 70% of the 1971-2000 average. The legacy of the remarkable rainfall over the last nine months of 2012 is very evident in *n*-month rainfall accumulations for most regions. Notwithstanding the below average January total for England & Wales, the April-January rainfall is the highest for *any* 10-month sequence in a rainfall series from 1766 and the total for the winter half-year thus far (Oct-Jan) is exceptional (see page 3).

River flows

The dry weather during most of early January provided a timely respite from the outstanding runoff rates, and extensive flooding, which characterised late December. River flow recessions became established across most of the UK and, with many catchments frozen, they were particularly steep in much of northern Scotland; flows in the Spey and Naver fell below previous mid-January minima. In most areas, the recessions were then decisively reversed and, with saturated soil conditions, very high baseflows in permeable catchments and snowmelt providing a further contribution, runoff rates again increased very smartly. The final week of January witnessed another exceptional runoff episode (the third in three months) with outflows from Britain close to the highest (for late January) in a series from 1961. Sustained floodplain inundations were complemented by many incidents of pluvial, tidal and groundwater flooding, and by the 27th Flood Warnings were operating in all Environment Agency regions (with >300 Flood Alerts) and in many Scottish river basins. Overall, this interlude was notable more for the extent and duration of floodplain inundations, than the direct impact on property and businesses (in part a tribute to the effectiveness of flood alleviation measures). Reflecting the large within-month flow range in most index rivers, January runoff totals were mostly well within the normal monthly range but exceptional baseflow contributions produced notably high flows in many spring-fed streams and rivers; in the Cotswolds, January runoff for the Coln was the highest in a 50-year series. Northern Scotland apart, runoff accumulations over a range of timeframes remain exceptionally high. In the England & Wales runoff series (from 1961) there are only two occasions (in 2000/01 and 1994/95) when 3-month runoff totals have exceeded those registered in November 2012-January 2013.

Groundwater

January rainfall was near average across most major aquifer outcrop areas but the near-saturated soils, exceptionally lengthy 2012/13 recharge season and, in particular, very heavy late-December infiltration contributed to exceptionally high January groundwater levels across most of the country. In the Chalk, levels remained close to, or above, previous monthly maxima at Wetwang, Washpit Farm and Westdean, and are still notably high in the responsive western and southern index wells (despite moderate declines in early January). The majority of the Environment Agency groundwater flooding alerts, many issued in late 2012, remain in place, embracing vulnerable areas mostly in the western and southern Chalk outcrops and the Berkshire Downs. New period-of-record maximum groundwater levels were reported for a number of northern index wells including Brick House Farm and Swan House (both Magnesian Limestone) and Skirwith (Permo-Triassic Sandstones); in the South West, the Bussels borehole (Permo-Triassic Sandstones) also eclipsed its previous maximum level in a 42-year record. Exceptional outflows from high level springs (e.g. in Dorset and Berkshire) confirm both the overall health of groundwater resources and a continuing vulnerability to groundwater flooding.

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

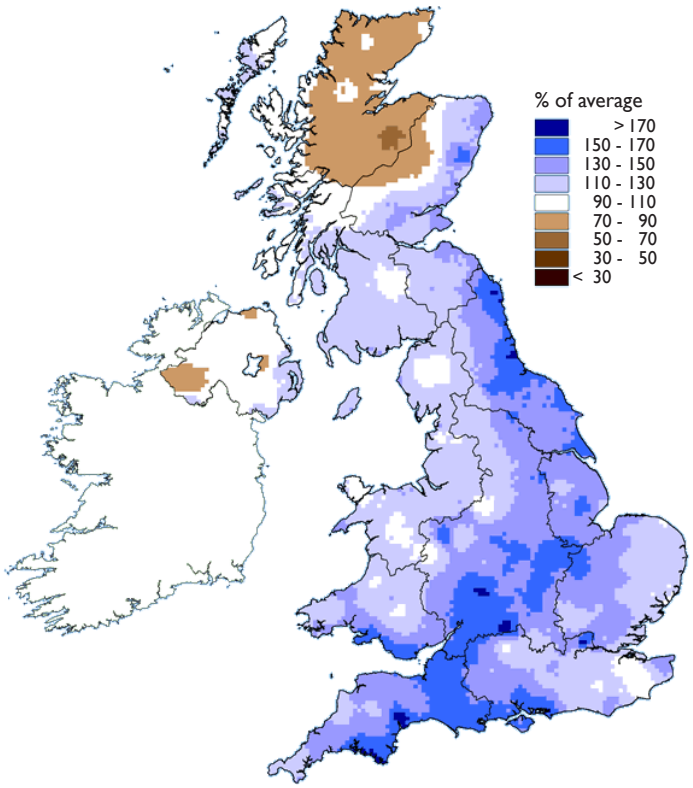
Area	Rainfall	Jan 2013	Nov12 — Jan13	RP	Apr12 — Jan13	RP	Dec11 — Jan13	RP	Feb11 — Jan13	RP
United Kingdom	mm	**108**	422		1235		1611		2513	
	%	**92**	121	8-12	137	>>100	123	>100	117	>100
England	mm	**76**	347		1085		1309		1839	
	%	**91**	138	10-20	159	>>100	134	>100	114	5-10
Scotland	mm	**146**	512		1400		2013		3497	
	%	**88**	106	2-5	118	10-15	115	10-20	122	>100
Wales	mm	**146**	602		1647		2083		3010	
	%	**96**	130	8-12	145	>>100	125	30-45	111	5-10
Northern Ireland	mm	**137**	342		1094		1461		2508	
	%	**114**	100	2-5	118	10-20	109	5-10	114	>100
England & Wales	mm	**85**	382		1162		1416		2001	
	%	**92**	137	10-20	156	>>100	132	>100	113	5-10
North West	mm	**93**	455		1465		1902		2941	
	%	**77**	122	5-10	149	>>100	135	>100	127	>100
Northumbria	mm	**90**	368		1222		1414		2109	
	%	**110**	149	20-35	177	>>100	144	>>100	129	>100
Midlands	mm	**62**	307		1000		1201		1615	
	%	**84**	138	10-15	157	>>100	133	>100	108	2-5
Yorkshire	mm	**65**	344		1113		1339		1900	
	%	**81**	140	10-15	165	>>100	138	>100	118	10-15
Anglian	mm	**41**	224		779		929		1260	
	%	**77**	135	5-10	152	>>100	132	50-80	106	2-5
Thames	mm	**62**	284		915		1079		1475	
	%	**90**	138	5-10	155	>100	130	20-30	107	2-5
Southern	mm	**83**	328		994		1193		1623	
	%	**101**	131	5-10	152	80-120	128	10-20	106	2-5
Wessex	mm	**107**	436		1231		1438		1967	
	%	**116**	157	30-45	172	>>100	138	80-120	116	5-10
South West	mm	**150**	610		1574		1928		2653	
	%	**106**	146	30-50	159	>>100	130	60-90	111	5-10
Welsh	mm	**141**	583		1604		2013		2899	
	%	**96**	131	10-15	147	>>100	125	30-50	111	2-5
Highland	mm	**152**	545		1400		2249		3940	
	%	**75**	91	2-5	99	2-5	107	2-5	115	15-25
North East	mm	**74**	309		1044		1306		2238	
	%	**76**	109	2-5	131	10-20	116	2-5	119	8-12
Tay	mm	**133**	469		1346		1749		3158	
	%	**84**	110	2-5	130	20-30	113	5-10	126	>>100
Forth	mm	**129**	449		1356		1721		2972	
	%	**101**	123	8-12	145	>100	126	40-60	133	>>100
Tweed	mm	**107**	395		1346		1597		2628	
	%	**106**	134	10-15	170	>>100	140	>100	140	>>100
Solway	mm	**162**	574		1658		2200		3710	
	%	**104**	125	8-12	143	>100	129	>100	134	>>100
Clyde	mm	**207**	669		1701		2532		4424	
	%	**103**	115	5-10	119	10-20	120	20-35	129	>>100

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

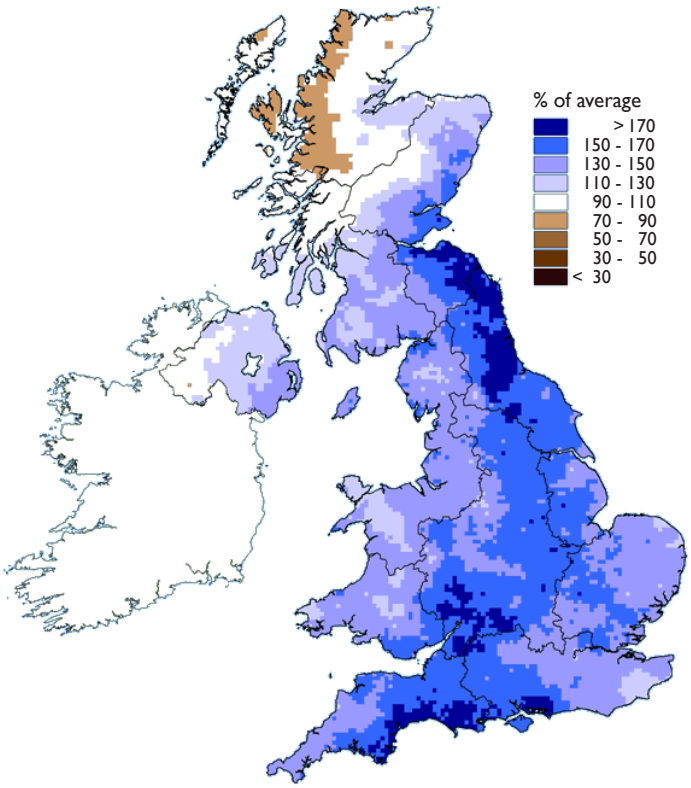
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability since 1910; they also assume a stable climate. The quoted RPs relate to the specific timespans only; for the same timespans, but beginning in any month the RPs would be substantially shorter. The timespans featured do not purport to represent the critical periods for any particular water resource management zone. For hydrological or water resources assessments of drought severity, river flows and/or groundwater levels normally provide a better guide than return periods based on regional rainfall totals. Note that precipitation totals in winter months may be underestimated due to snowfall undercatch. All monthly rainfall totals since August 2012 are provisional.

Rainfall . . . Rainfall . . .

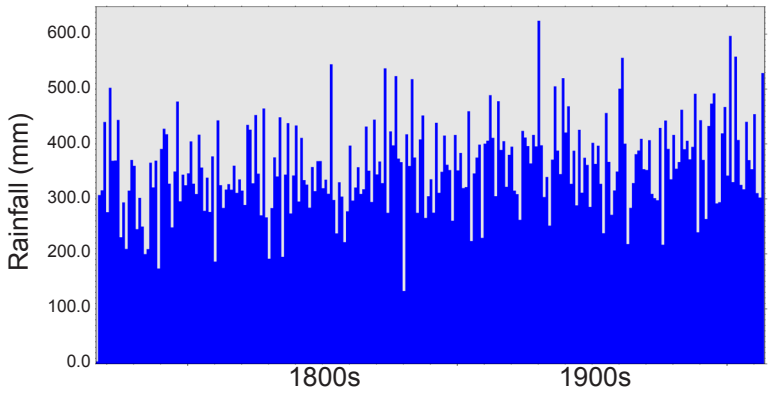
November 2012 - January 2013
rainfall as % of 1971-2000 average



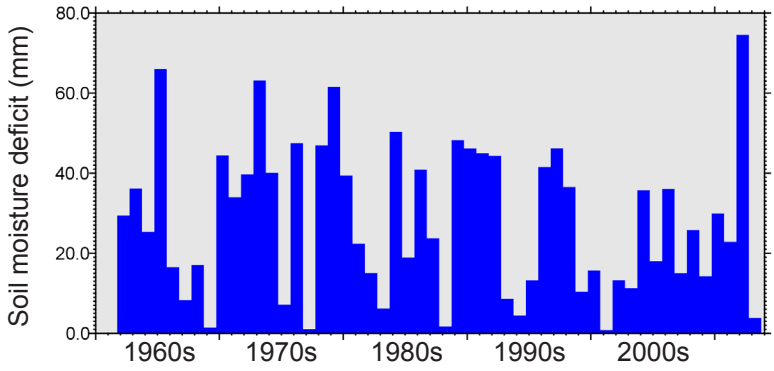
April 2012 - January 2013
rainfall as % of 1971-2000 average



Oct - Jan rainfall for England & Wales



Oct - Jan average SMDs for the English Lowlands



Met Office 3-month outlook Updated: February 2013

Predictions for UK mean precipitation are uncertain; for the February-March-April period as a whole near-to slightly-below-average amounts are most probable.

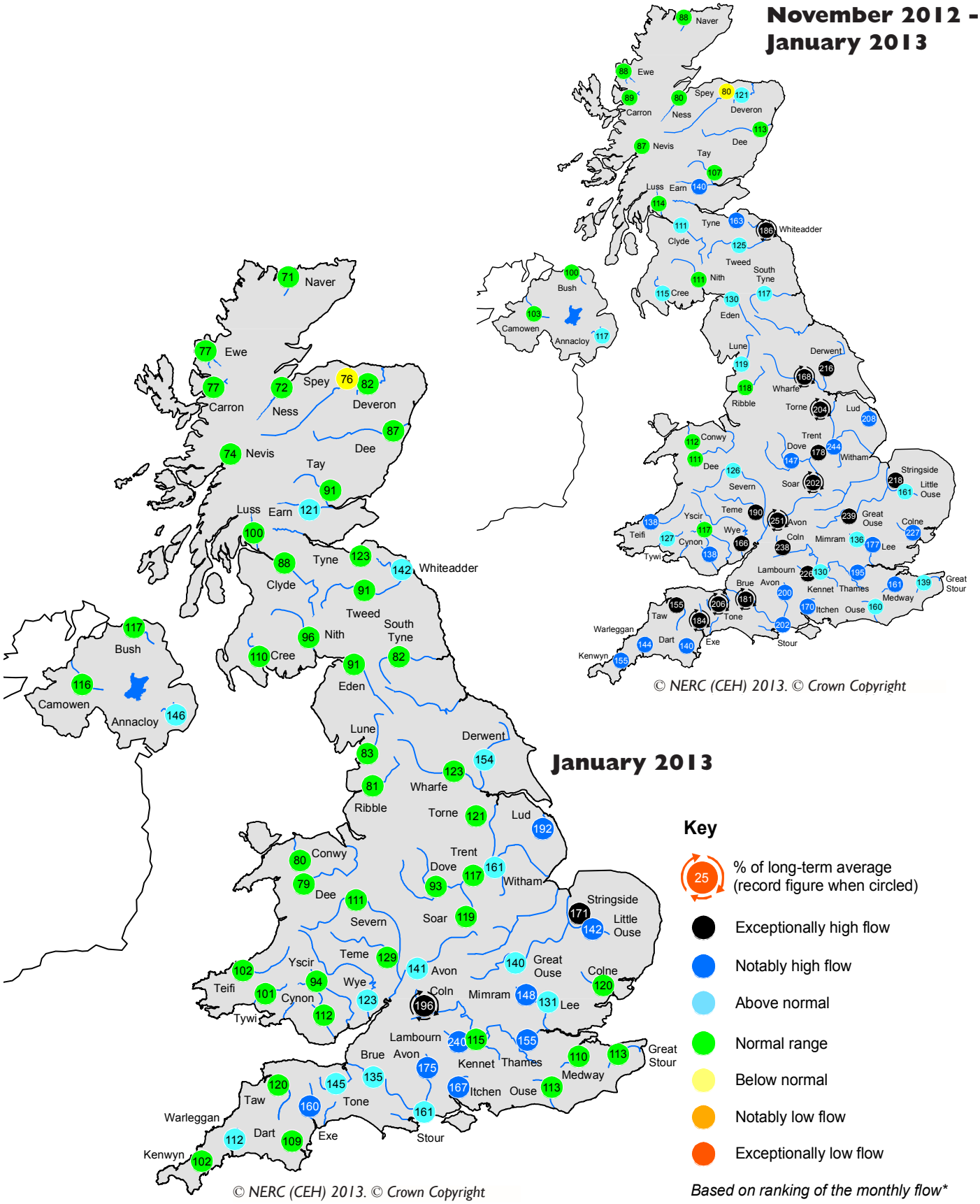
Current model predictions show a weak signal for below-average seasonal precipitation over northern parts of the UK, and the opposite for southern parts. This signal is most evident in the first part of the forecast period, when the risk of below-average temperature is also enhanced; this would imply snow is more likely than usual at this time of year.

The probability that UK precipitation for February-March-April 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 15% (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.

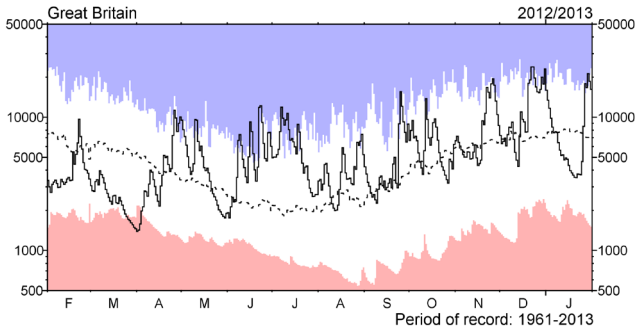
River flow . . . River flow . . .

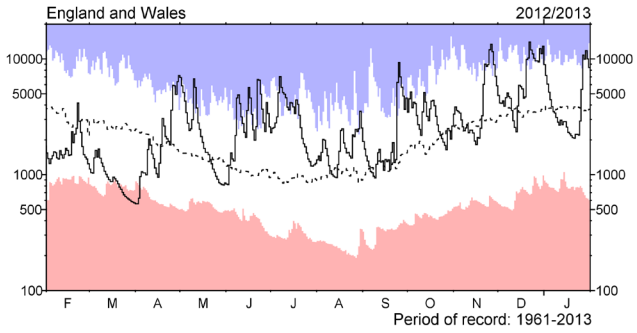


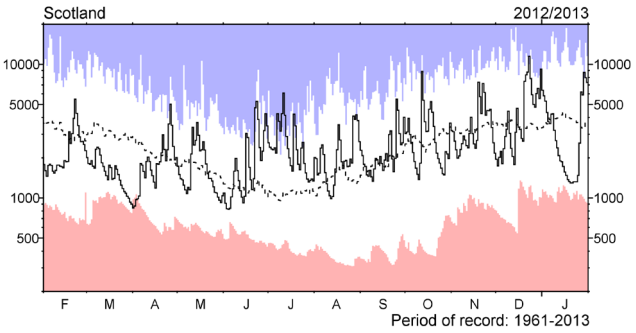
River flows

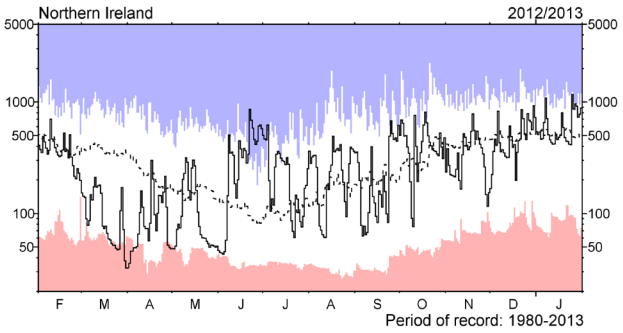
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

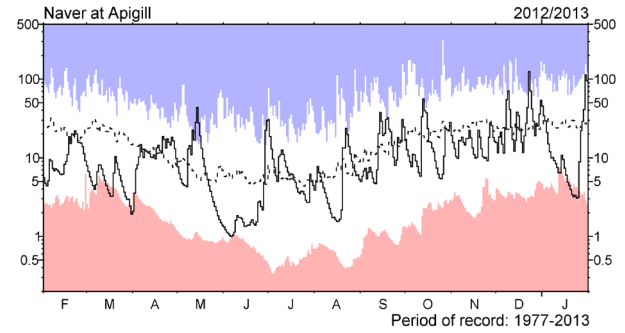
River flow . . . River flow . . .

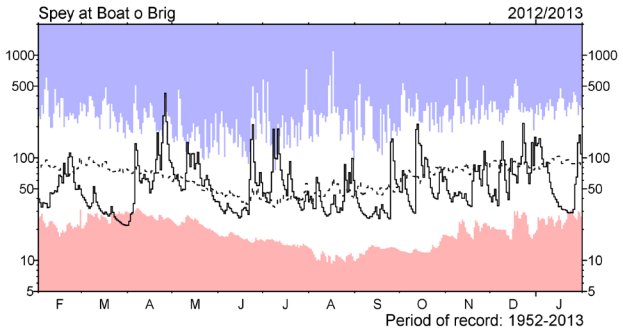


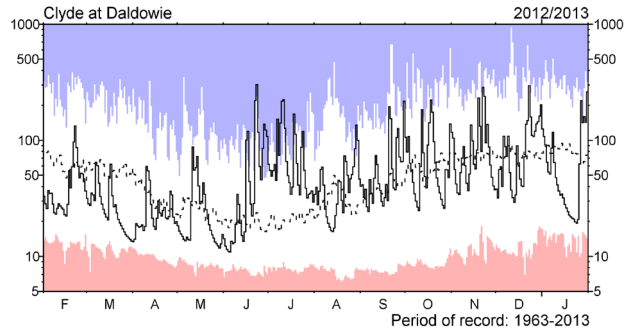


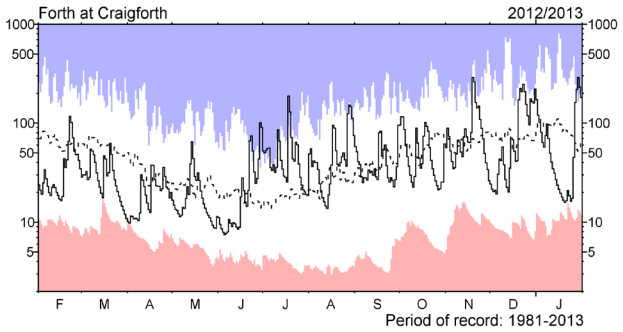


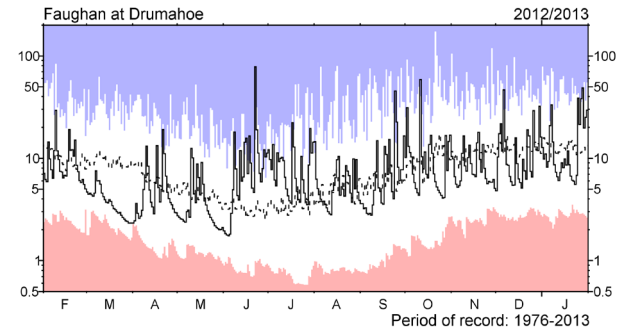


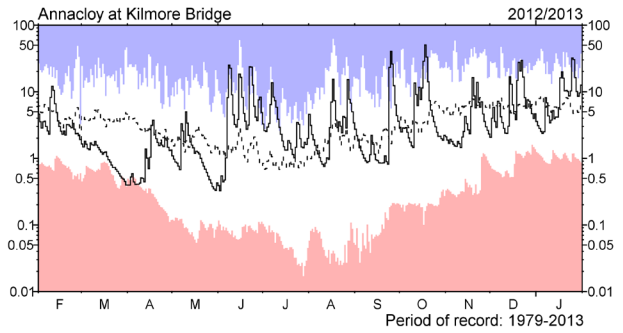








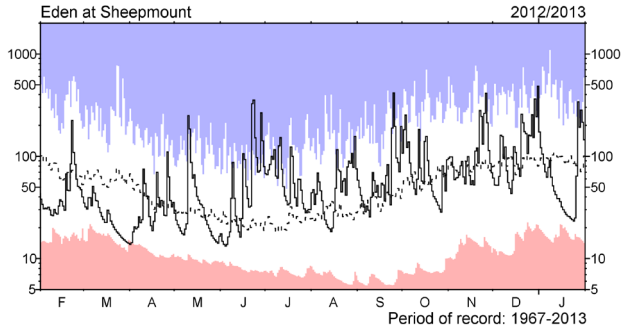


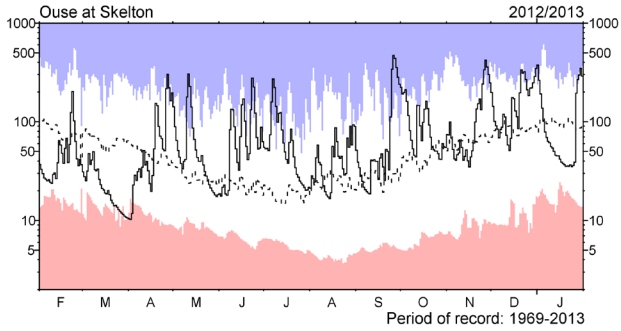


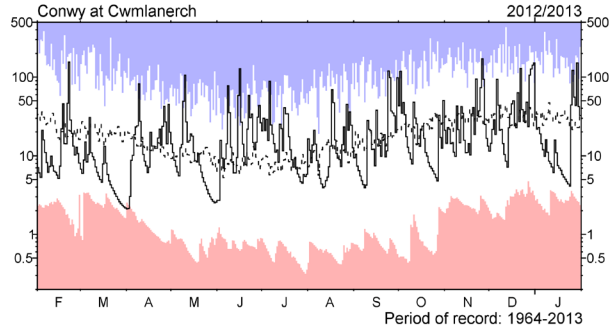
River flow hydrographs

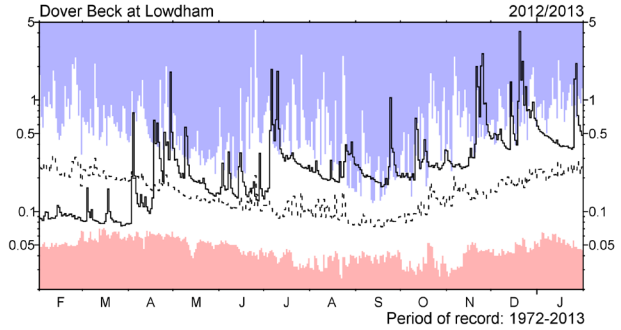
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to February 2012 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed line.

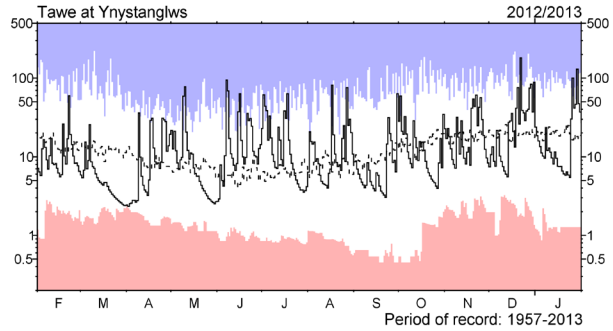
River flow . . . River flow . . .

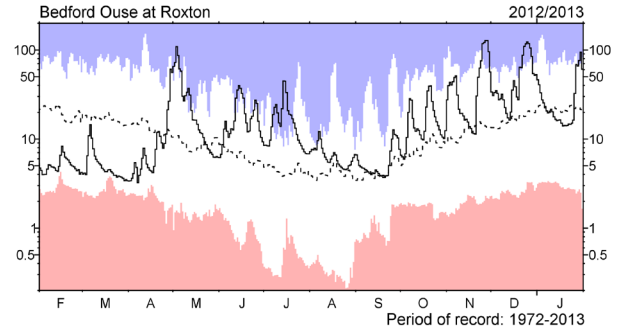


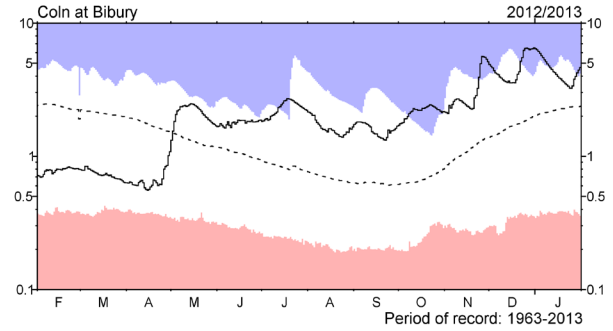


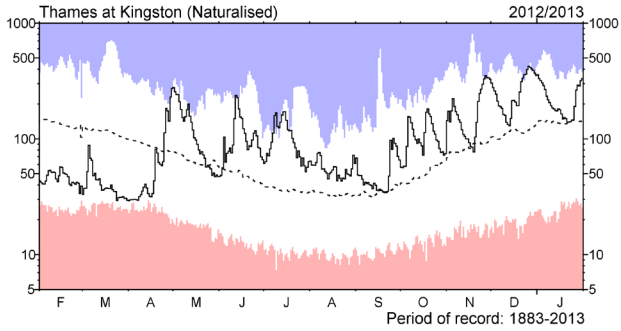


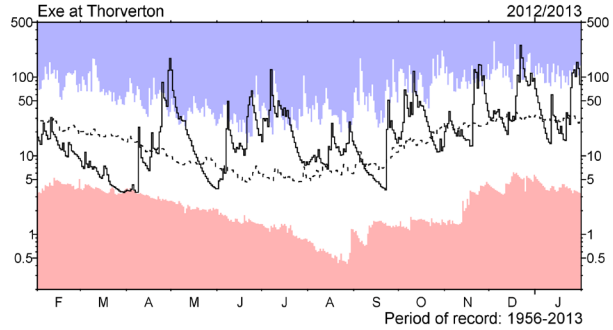


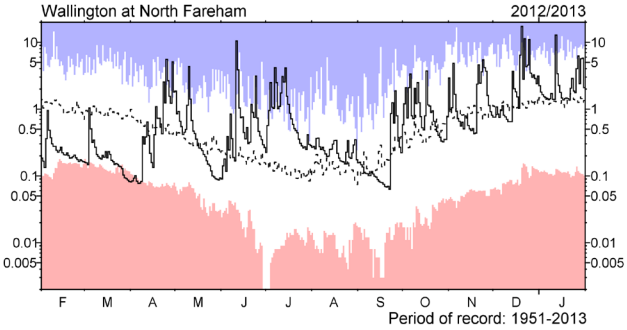












Notable runoff accumulations (a) April 2012 - January 2013

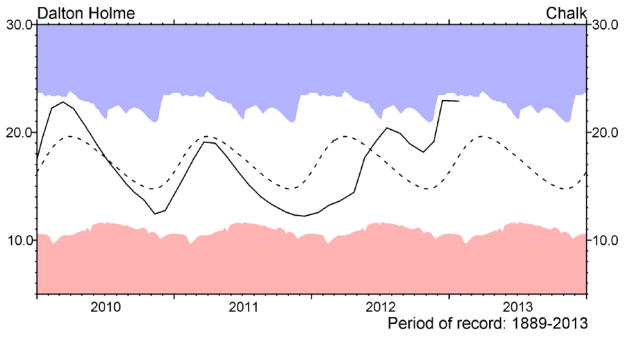
	River	%lta	Rank
a)	Tyne (Spilmersford)	242	43/43
	Whiteadder	238	43/43
	Ouse (Skelton)	202	36/36
	Derwent	207	39/39
	Witham	218	53/53
	Trent	176	54/54
	Dover Beck	265	38/38

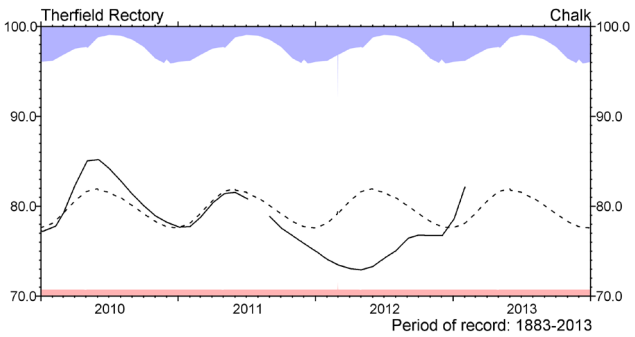
	River	%lta	Rank
a)	Bedford Ouse (Bedford)	245	80/80
	Thames (Kingston)	183	129/130
	Coln (Bibury)	202	49/49
	Lymington	250	50/50
	Stour (Throop)	217	40/40
	Tone	227	52/52

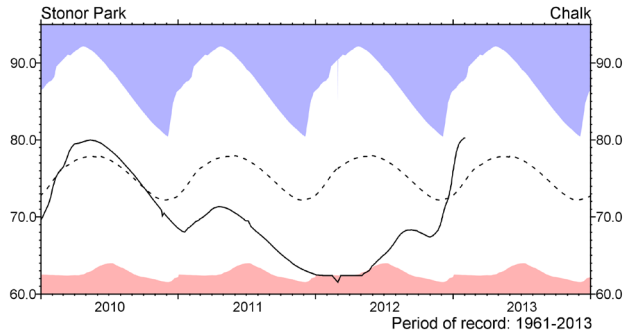
	River	%lta	Rank
a)	Exe	206	56/56
	Severn (Bewdley)	164	91/92
	Avon (Evesham)	229	76/76
	Teme	228	43/43
	Cynon	154	52/52
	Eden	153	44/44
	Clyde (Blairston)	148	51/51

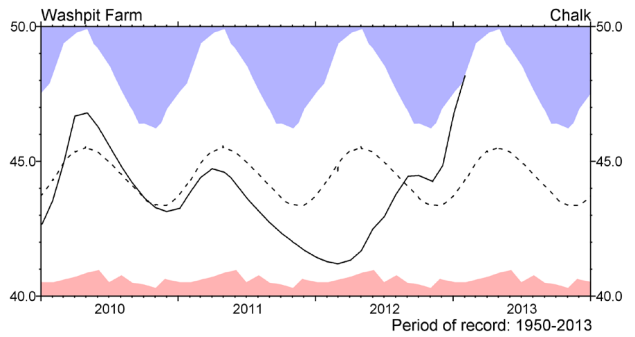
lta = long term average; Rank 1 = lowest on record

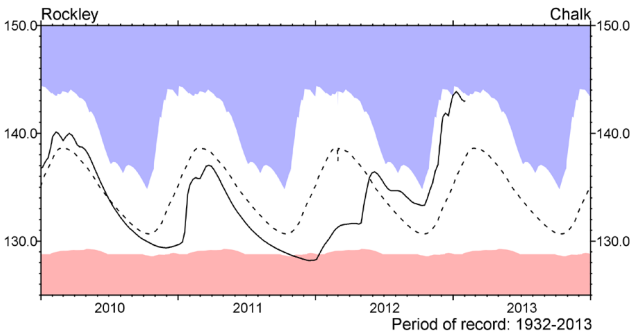
Groundwater…Groundwater

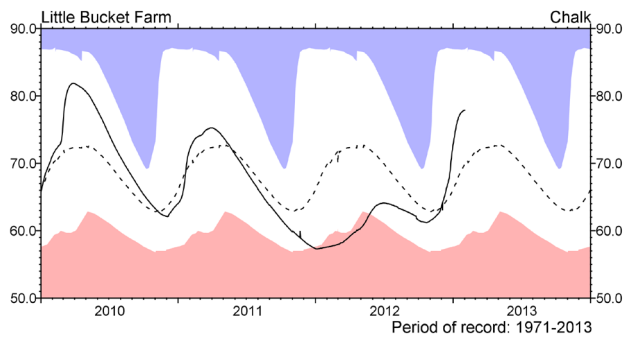


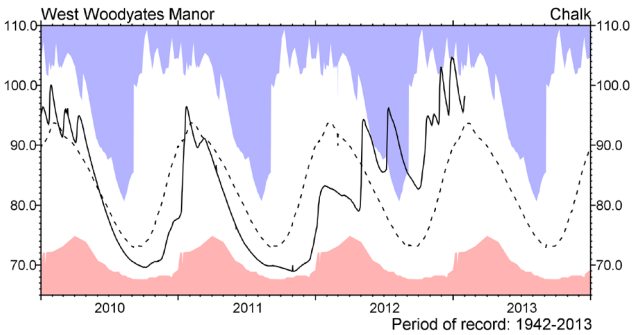


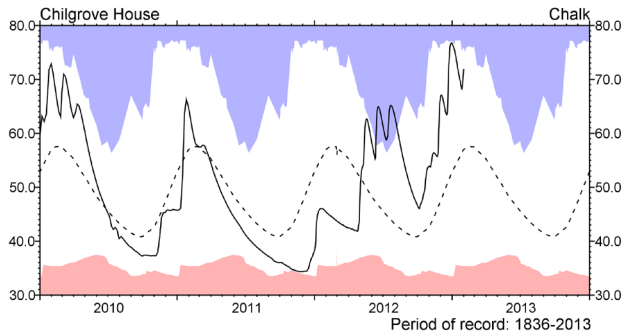


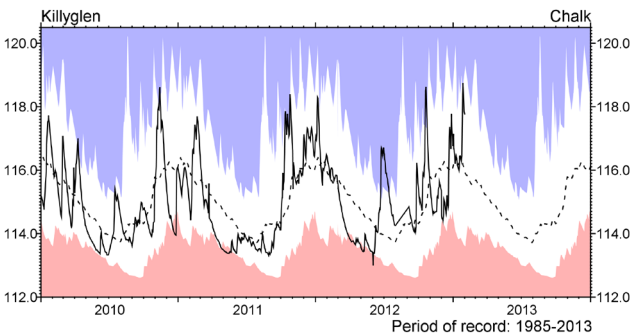


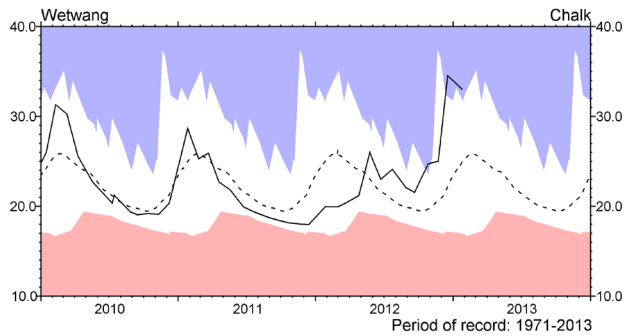






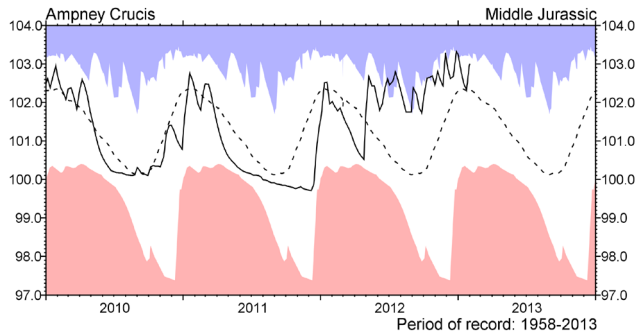


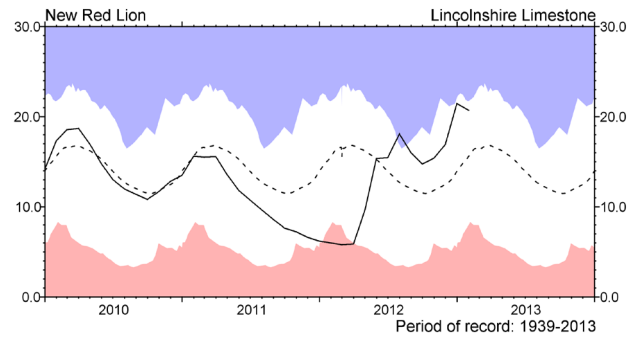


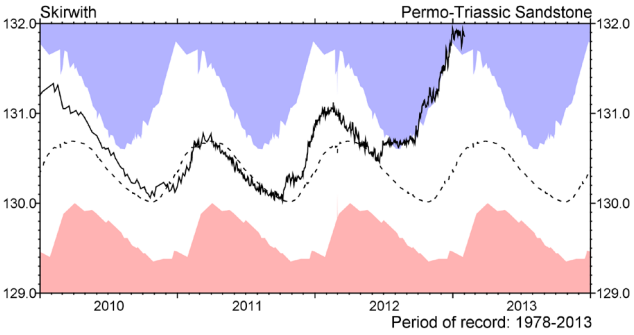


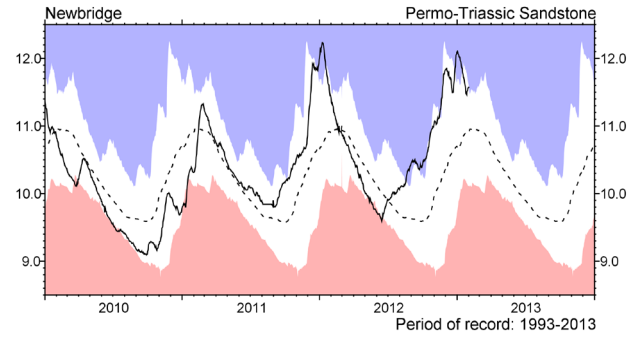
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

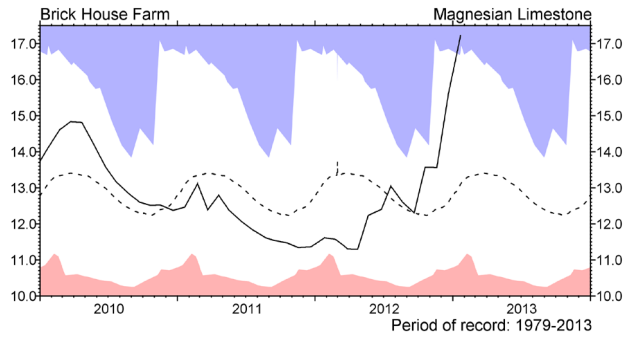
Groundwater... Groundwater

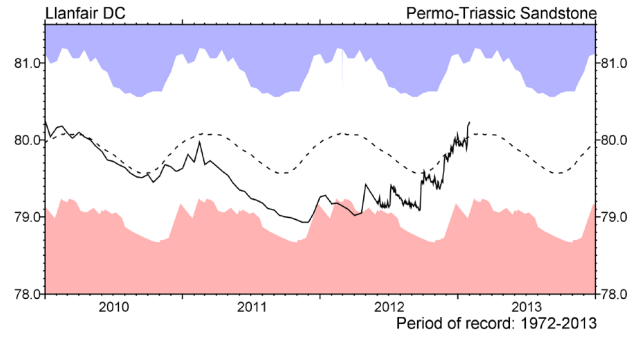


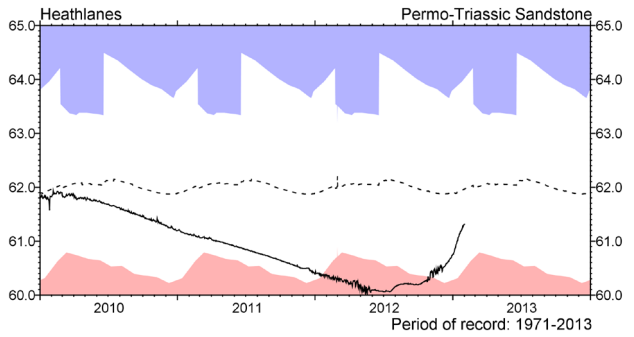


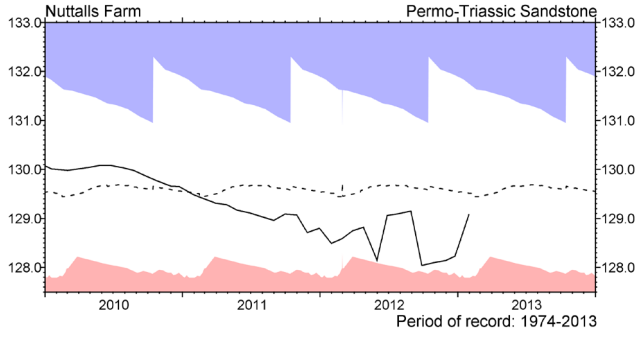


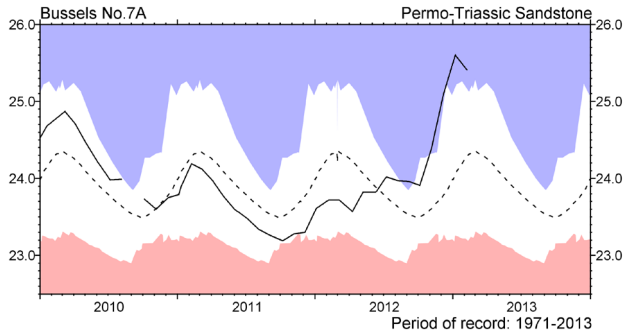


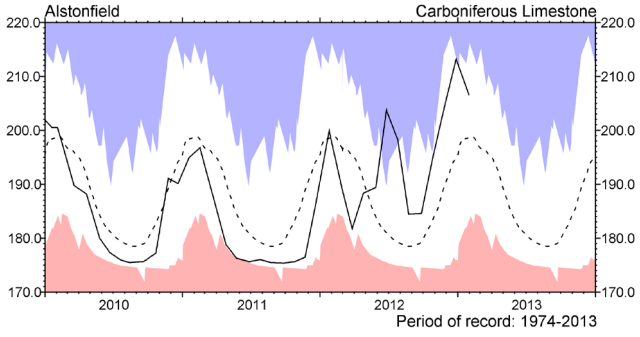








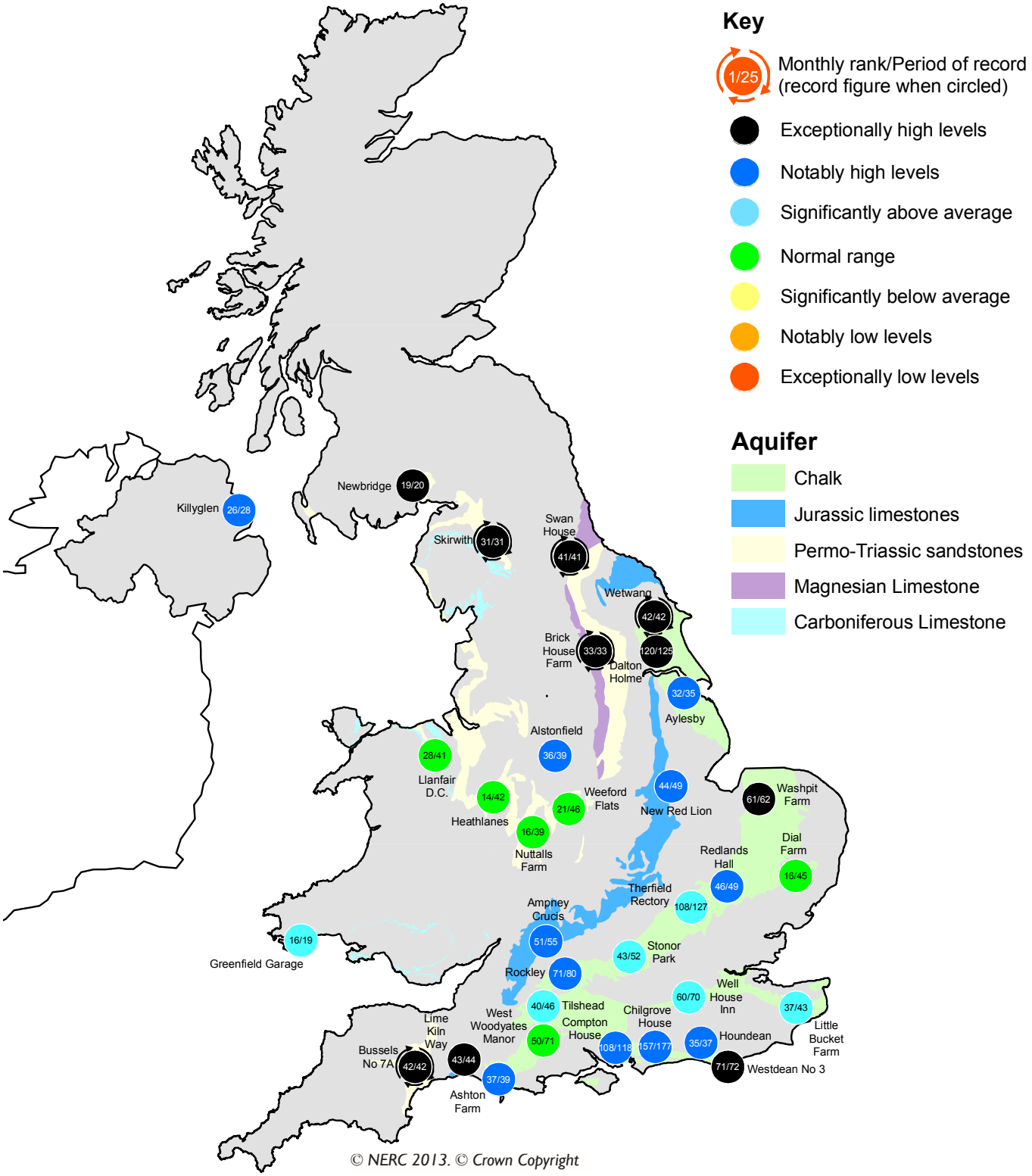




Groundwater levels January / February 2013

Borehole	Level	Date	Jan av.	Borehole	Level	Date	Jan av.	Borehole	Level	Date	Jan av.
Dalton Holme	22.88	25/01	17.13	Chilgrove House	72.36	31/01	56.17	Brick House Farm	17.22	21/01	12.92
Therfield Rectory	82.12	01/02	77.65	Killyglen (NI)	117.77	31/01	116.18	Llanfair DC	80.23	31/01	79.96
Stonor Park	80.26	31/01	73.06	Wetwang	33.03	24/01	24.13	Heathlanes	61.31	31/01	61.86
Tilshead	99.15	31/01	90.99	Ampney Crucis	102.99	31/01	102.34	Nuttalls Farm	129.08	30/01	129.52
Rockley	142.99	31/01	136.26	New Red Lion	20.70	31/01	14.77	Bussels No.7a	25.41	07/02	24.11
Well House Inn	100.59	31/01	94.78	Skirwith	131.86	31/01	130.55	Alstonfield	206.58	30/01	198.40
West Woodyates	98.12	31/01	91.51	Newbridge	11.57	31/01	10.83				

Levels in metres above Ordnance Datum



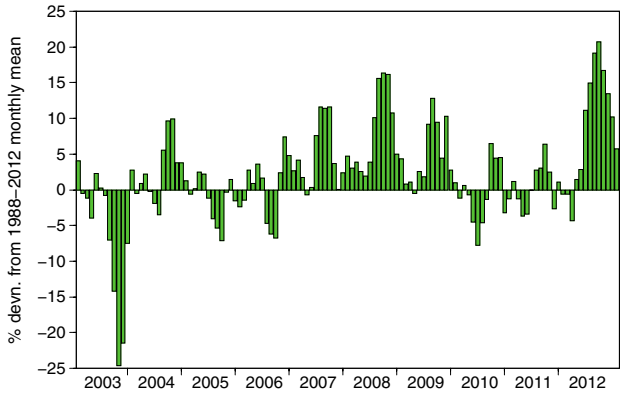
Groundwater levels - January 2013

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.

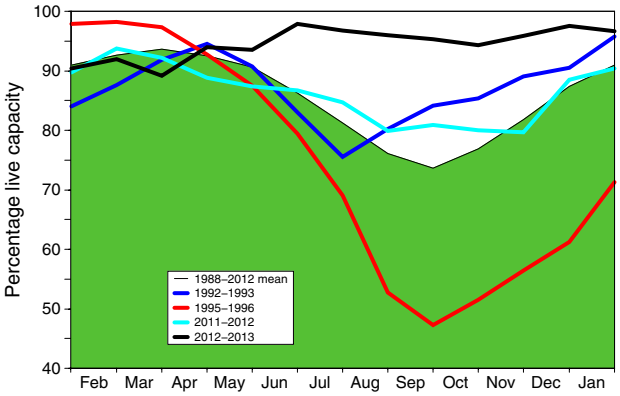
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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



These plots are based on the England and Wales figures listed below.

Percentage live capacity of selected reservoirs at start of month

Area	Reservoir		Capacity (Ml)	2012 Dec	Jan	2013 Feb	Feb Anom.	Min Feb	Year* of min	2012 Feb	Diff 13-12
North West	N Command Zone	•	124929	94	97	96	4	63	1996	96	0
	Vyrnwy		55146	98	100	99	7	45	1996	92	7
Northumbrian	Teesdale	•	87936	98	100	97	5	51	1996	96	1
	Kielder		(199175)	96	100	98	5	85	1989	91	7
Severn Trent	Clywedog		44922	90	97	96	9	62	1996	93	3
	Derwent Valley	•	39525	100	100	100	5	15	1996	100	0
Yorkshire	Washburn	•	22035	97	99	97	7	34	1996	93	4
	Bradford supply	•	41407	99	100	99	6	33	1996	100	-1
Anglian	Grafham		(55490)	83	74	73	-13	67	1998	90	-17
	Rutland		(116580)	92	92	96	11	68	1997	69	27
Thames	London	•	202828	97	99	96	5	70	1997	92	4
	Farmoor	•	13822	80	79	95	5	72	2001	99	-4
Southern	Bewl		28170	85	95	99	18	37	2006	43	56
	Ardingly**		4685	100	100	100	8	41	2012	41	59
Wessex	Clatworthy		5364	100	100	100	5	62	1989	100	0
	Bristol WW	•	(38666)	96	98	96	11	58	1992	76	20
South West	Colliford		28540	98	100	100	18	52	1997	70	30
	Roadford		34500	99	100	99	17	30	1996	79	20
	Wimbleball		21320	100	100	100	10	59	1997	88	12
	Stithians		4967	100	100	100	12	38	1992	82	18
Welsh	Celyn and Brenig	•	131155	96	100	99	4	61	1996	98	1
	Brianne		62140	100	100	99	2	84	1997	96	3
	Big Five	•	69762	99	100	96	3	67	1997	98	-2
	Elan Valley	•	99106	100	100	100	3	73	1996	100	0
Scotland(E)	Edinburgh/Mid Lothian	•	97639	100	100	97	3	72	1999	99	-2
	East Lothian	•	10206	100	100	100	2	68	1990	100	0
Scotland(W)	Loch Katrine	•	111363	91	91	87	-6	85	2000	94	-7
	Daer		22412	100	99	90	-9	91	1997	100	-10
	Loch Thom	•	11840	100	100	100	2	90	2004	100	0
Northern Ireland	Total+	•	56920	98	100	100	9	75	2002	96	4
	Silent Valley	•	20634	98	100	100	13	46	2002	96	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.

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), the Environment Agency Wales, 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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Wallingford
Oxfordshire
OX10 8BB

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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

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iii. Met Office rainfall data. © Crown copyright.

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02/2013