Hydrological Summary

for the United Kingdom

February 2013

General

February was a cold and relatively dry month, particularly during the final fortnight when river flow recessions were steep. Precipitation totals fell below 50% in a few areas and, at the national scale, February was the driest month since March 2012. Nonetheless, winter (December-February) rainfall totals were generally above average, and medium term (3-12 months) accumulations remain exceptionally high. Despite modest replenishment over the latter half of the month, reservoir stocks remain very healthy. More than three-quarters of the index reservoirs across the UK were within 5% of capacity in late February. With most rivers still in spate, flood risk remained substantial during the first fortnight but (many groundwater-fed rivers aside) diminished thereafter as runoff rates declined across almost all of the country. February runoff totals were generally above average in Northern Ireland and across much of eastern, central and southern England where, in many rivers, groundwater outflow contributes a substantial proportion of the flow. By contrast, flows in rivers draining impermeable catchments were notably modest by month-end. Groundwater recharge was very limited over the latter half of February but the outstanding November/December rainfall continues to be reflected in the high groundwater levels across most major outcrop areas. Correspondingly, the water resources outlook is very healthy but there is a continuing risk of groundwater flooding in vulnerable areas.

Rainfall

Synoptic patterns were dominated by low pressure early in the month and rain, sleet, hail and snow all contributed to substantial precipitation totals in many areas over the first fortnight. Blizzard conditions were common in Scotland (e.g. on 4th/5th) and significant snowfall extended down to southern areas on 10th/11th. By 13th, snow accumulations had reached 30cm across the higher ground of western Scotland and North Wales. Early in the third week, continental high pressure began to keep rain-bearing frontal systems at bay and much of the country recorded a notably dry interlude. Oxford reported a total of less than 1mm over the last 17 days of the month. A few parts of the UK (e.g. in the Midlands and Northern Ireland) recorded above average February rainfall but most areas reported totals in the 50-90% range. Some localities, mostly in northern Britain, recorded less than 40% but, particularly for upland areas, the totals should be treated with caution – snowfall (which constituted a considerable proportion of the February total) is difficult to measure and totals are normally systematically underestimated. Winter rainfall totals were well below average for northern Scotland but generally above average elsewhere, notably so for England & Wales, where the December-February rainfall was substantially higher than the totals for the preceding four winters (see page 3). With the exception of northern Scotland and Northern Ireland, rainfall accumulations over 8-12 months remain outstandingly high.

River flows

February runoff patterns were remarkable for the range of flows recorded. The month began with flows in many rivers close to late-winter maxima – flood alerts were extensive and many catchments were exceptionally vulnerable to further significant rainfall. Fortunately, flows declined rapidly over the first nine days but with saturated catchments and high baseflow contributions to rivers draining permeable catchments (and appreciable snowmelt in some areas), the generally moderate precipitation totals in mid-month triggered many flood alerts (particularly in the South West). Daily mean flows approached the maximum for the time of year in a substantial number of rivers (e.g. the Nith, Conwy and Lymington). Thereafter, recessions were steep and continued beyond month-end. Previous late-February flow minima were closely matched in a few very responsive rivers, including the Luss Water which drains into Loch Lomond. In contrast, exceptional outflows from springs and seepages kept flows well above average throughout February in many rivers draining permeable catchments. Mean flows over the winter were well below average in parts of western Scotland (e.g. for the River Nevis) but notably high across most of the country – rivers registering new maximum winter runoff totals included the Teme, Coln and Derwent. For England & Wales as a whole, winter runoff was the third highest in a series from 1961; this serves to underline both the current health of water resources and the continuing threat of groundwater flooding.

Groundwater

Rainfall across most aquifer outcrop areas in February was 15-50% below average and soil moisture deficits began to build over the latter half of the month. The very limited recent recharge is not fully reflected in most of the hydrographs featured on page 8 – in all but the most responsive aquifer units, the hydrographs serve to confirm the extraordinary recharge during the early winter (and the post-drought recovery through the summer and autumn of 2012). Relatively steep declines in February were reported for some responsive aquifer units (e.g. Killyglen in Northern Ireland and Alstonfield in the north Midlands) but, generally, late-winter groundwater levels were exceptionally high. In the northern Magnesian Limestone outcrop, the Swan House borehole recorded its highest February level in a series from 1970, and levels were also outstanding in a number of index wells and boreholes in the South West. Levels remain very high across all of the Chalk outcrop areas – with notably high late-winter levels even in the slowest responding aquifer units (e.g. the deep Therfield well). The impact of aquifer characteristics on post-drought recoveries is well illustrated by the hydrograph for Heathlanes in the Permo-Triassic sandstones of the Midlands; February levels were approaching the long-term mean nearly a year after the dramatic change in weather patterns in the spring of 2012.

Centre for Ecology & Hydrology
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British Geological Survey
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Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

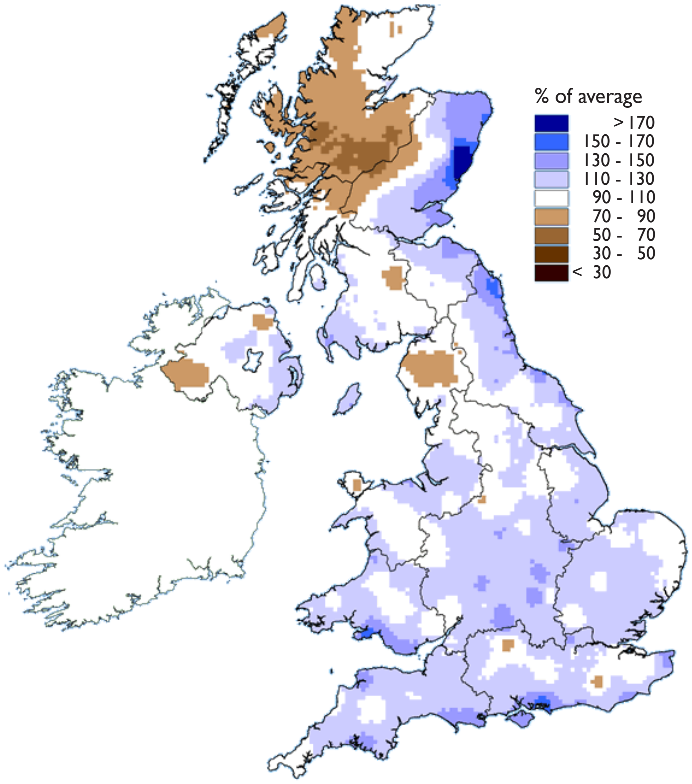
Area	Rainfall	Feb 2013	Dec12 – Feb13	RP	Sep12 – Feb13	RP	Apr12 – Feb13	RP	Mar11 – Feb13	RP
United	mm	**59**	347		722		1295		2458	
Kingdom	%	**70**	109	2-5	113	5-10	132	>>100	115	25-40
England	mm	**42**	268		586		1127		1804	
	%	**71**	118	2-5	128	8-12	152	>>100	112	2-5
Scotland	mm	**79**	438		894		1478		3409	
	%	**67**	99	2-5	101	2-5	113	5-10	119	80-120
Wales	mm	**79**	502		969		1724		2957	
	%	**73**	119	2-5	117	5-10	139	>100	109	2-5
Northern	mm	**71**	335		643		1172		2449	
Ireland	%	**83**	105	2-5	101	2-5	116	10-20	111	20-35
England &	mm	**47**	300		639		1210		1963	
Wales	%	**71**	118	2-5	126	8-12	149	>>100	111	2-5
North West	mm	**54**	354		837		1516		2832	
	%	**63**	105	2-5	122	8-12	142	>>100	122	40-60
Northumbria	mm	**37**	281		646		1254		2039	
	%	**63**	124	5-10	144	35-50	167	>>100	124	60-90
Midlands	mm	**48**	246		512		1051		1599	
	%	**89**	119	2-5	125	5-10	152	>>100	107	2-5
Yorkshire	mm	**39**	254		592		1154		1840	
	%	**68**	112	2-5	134	10-15	157	>>100	115	5-10
Anglian	mm	**31**	172		381		811		1246	
	%	**83**	118	2-5	123	5-10	148	>100	105	2-5
Thames	mm	**38**	221		481		952		1460	
	%	**80**	119	2-5	126	5-10	150	>100	106	2-5
Southern	mm	**39**	272		581		1040		1609	
	%	**72**	123	2-5	127	5-10	147	50-80	105	2-5
Wessex	mm	**40**	317		683		1272		1945	
	%	**59**	123	2-5	136	10-20	162	>>100	114	5-10
South West	mm	**59**	478		926		1632		2612	
	%	**56**	122	5-10	125	8-12	149	>100	110	2-5
Welsh	mm	**77**	483		939		1679		2853	
	%	**73**	120	2-5	118	5-10	140	>>100	109	2-5
Highland	mm	**101**	470		993		1510		3891	
	%	**68**	86	2-5	91	2-5	97	2-5	114	10-20
North East	mm	**50**	295		551		1094		2191	
	%	**75**	117	2-5	103	2-5	126	8-12	116	5-10
Tay	mm	**59**	414		751		1382		3016	
	%	**55**	103	2-5	97	2-5	121	8-12	120	60-90
Forth	mm	**52**	378		762		1404		2847	
	%	**58**	111	2-5	113	5-10	137	>100	127	>100
Tweed	mm	**44**	315		713		1390		2533	
	%	**62**	116	2-5	133	20-30	161	>>100	135	>>100
Solway	mm	**83**	478		987		1722		3564	
	%	**73**	113	2-5	117	8-12	135	>>100	128	>>100
Clyde	mm	**92**	552		1145		1798		4296	
	%	**64**	103	2-5	106	2-5	114	8-12	125	>100

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

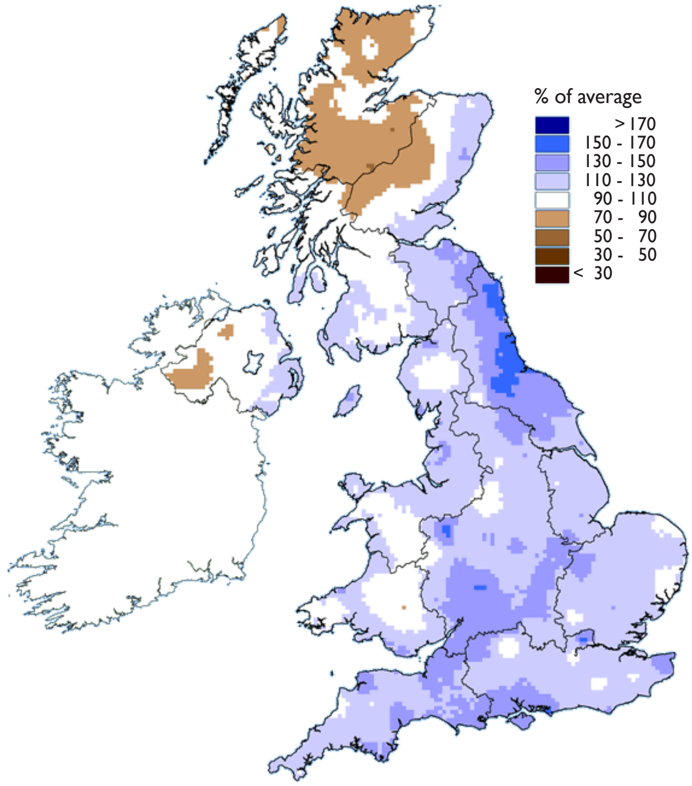
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 September 2012 are provisional.

Rainfall . . . Rainfall . . .

December 2012 - February 2013 rainfall as % of 1971-2000 average



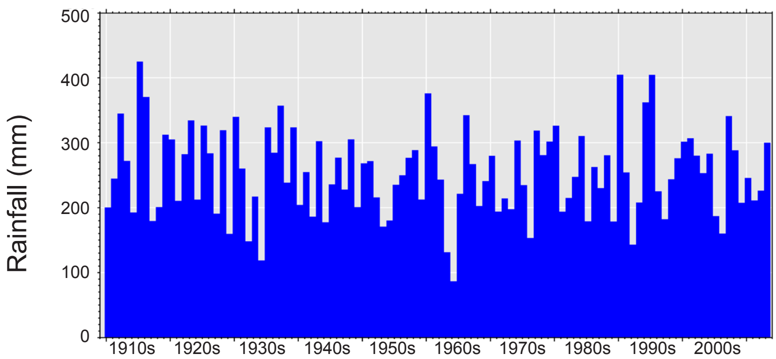
September 2012 - February 2013 rainfall as % of 1971-2000 average



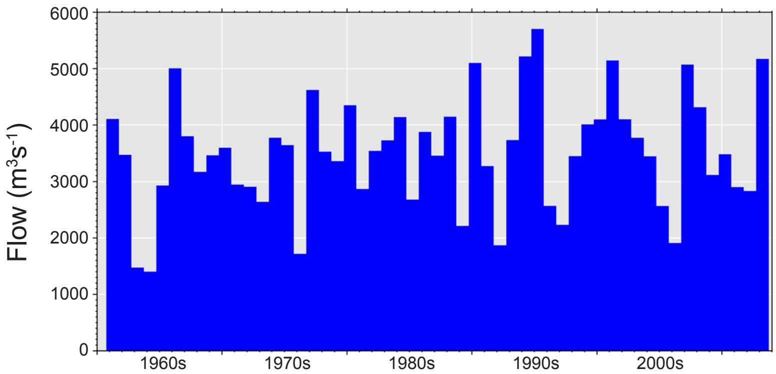
Met Office

Met Office

Winter (Dec-Feb) rainfall for England & Wales



Winter (Dec-Feb) mean outflows for England & Wales



Met Office

Met Office 3-month outlook Updated: March 2013

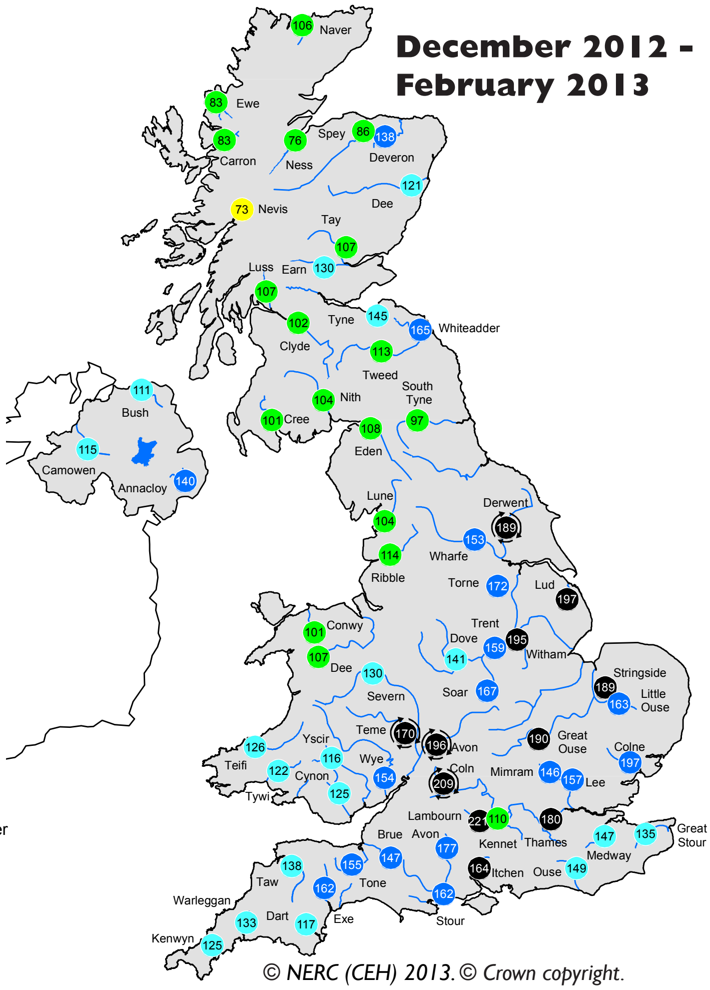
Blocking patterns are favoured across northwestern Europe during the early part of the spring. Typically, such patterns are associated with drier-than-average conditions over northern Europe.

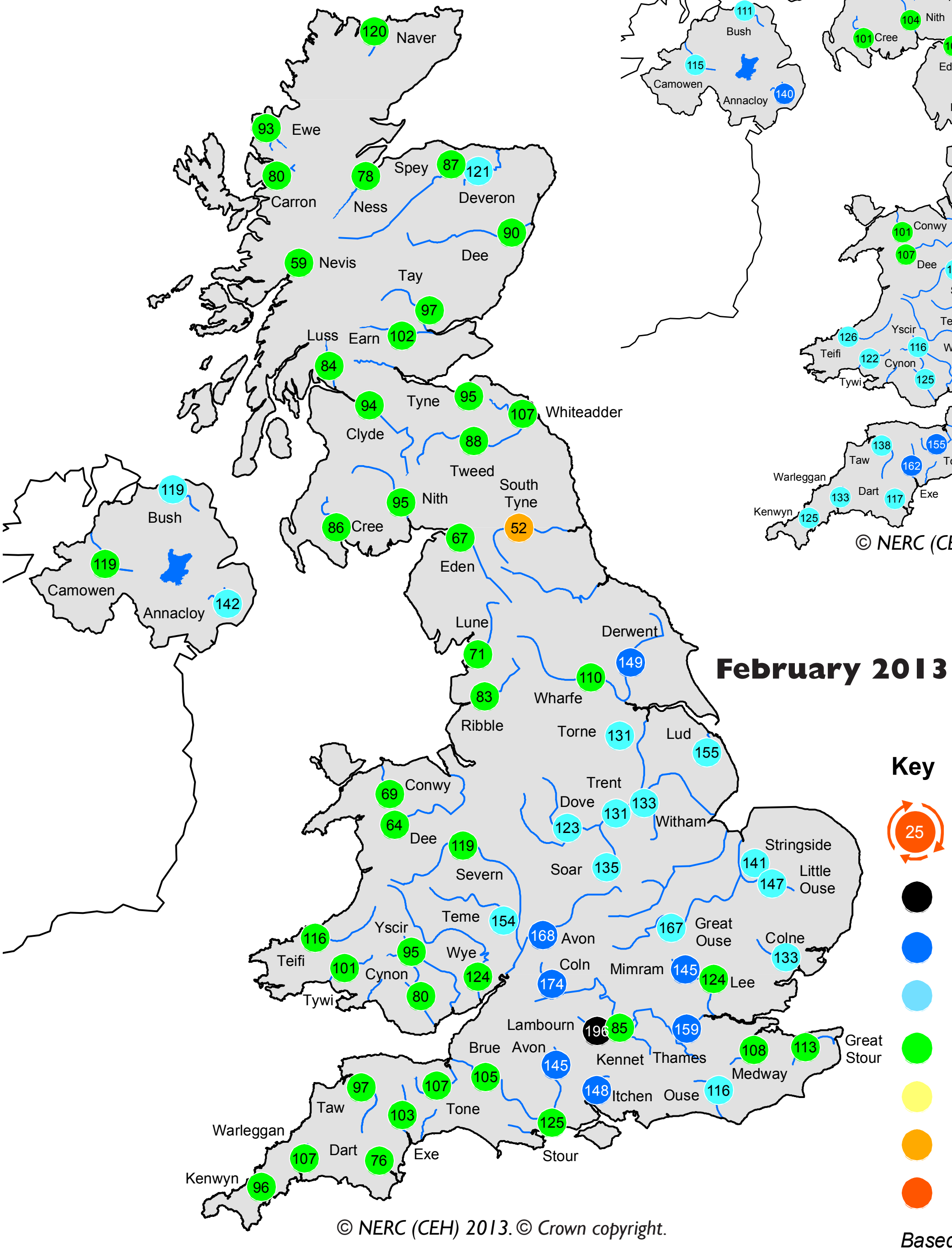
Consistent with below-average temperatures, rainfall during March is more likely to be below average than above average. For the March-April-May period as a whole near- to below-average rainfall amounts are most probable. The probability that UK precipitation for March-April-May will fall into the driest 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 . . .





Key

25 — % of long-term average (record figure when circled)

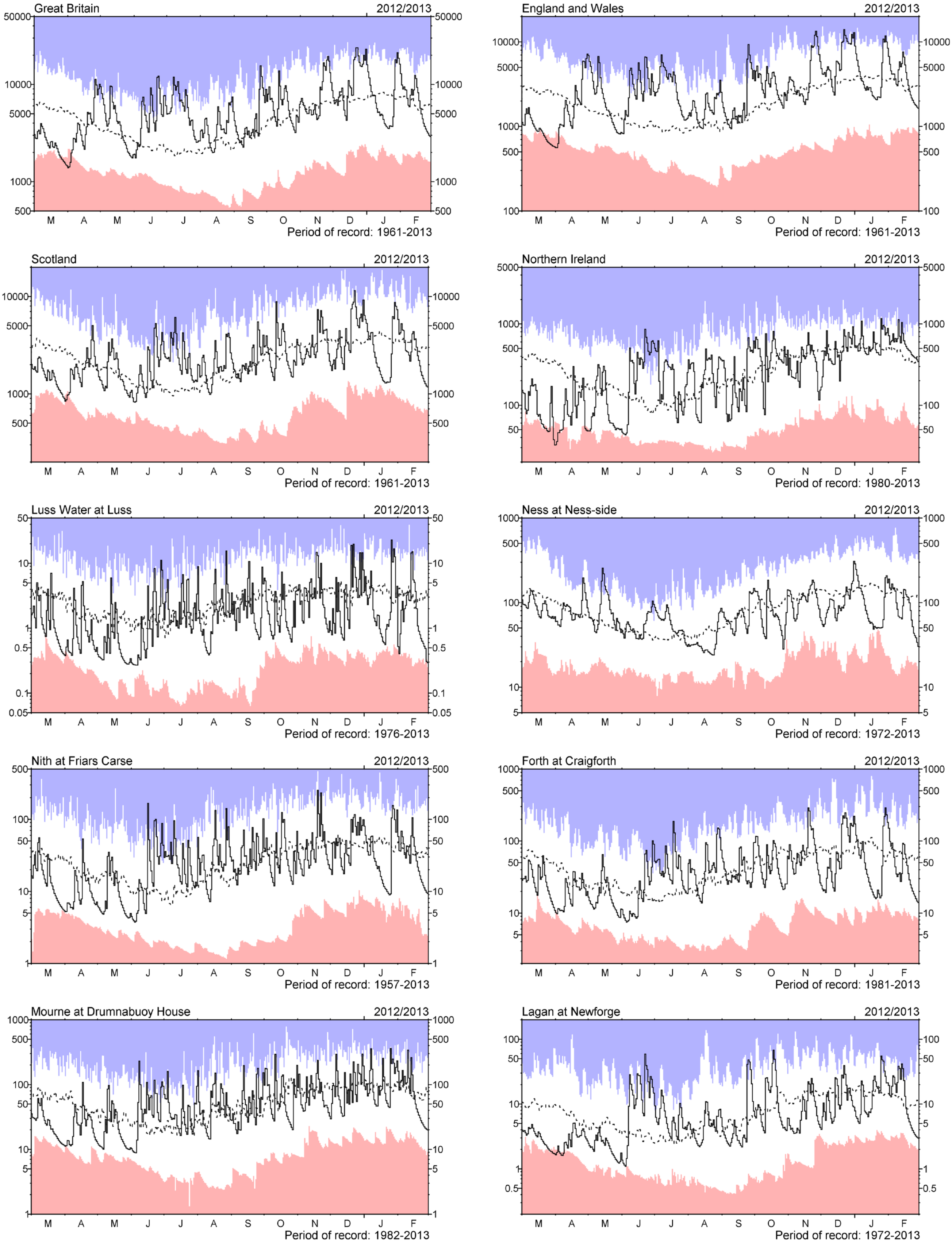
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

*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.

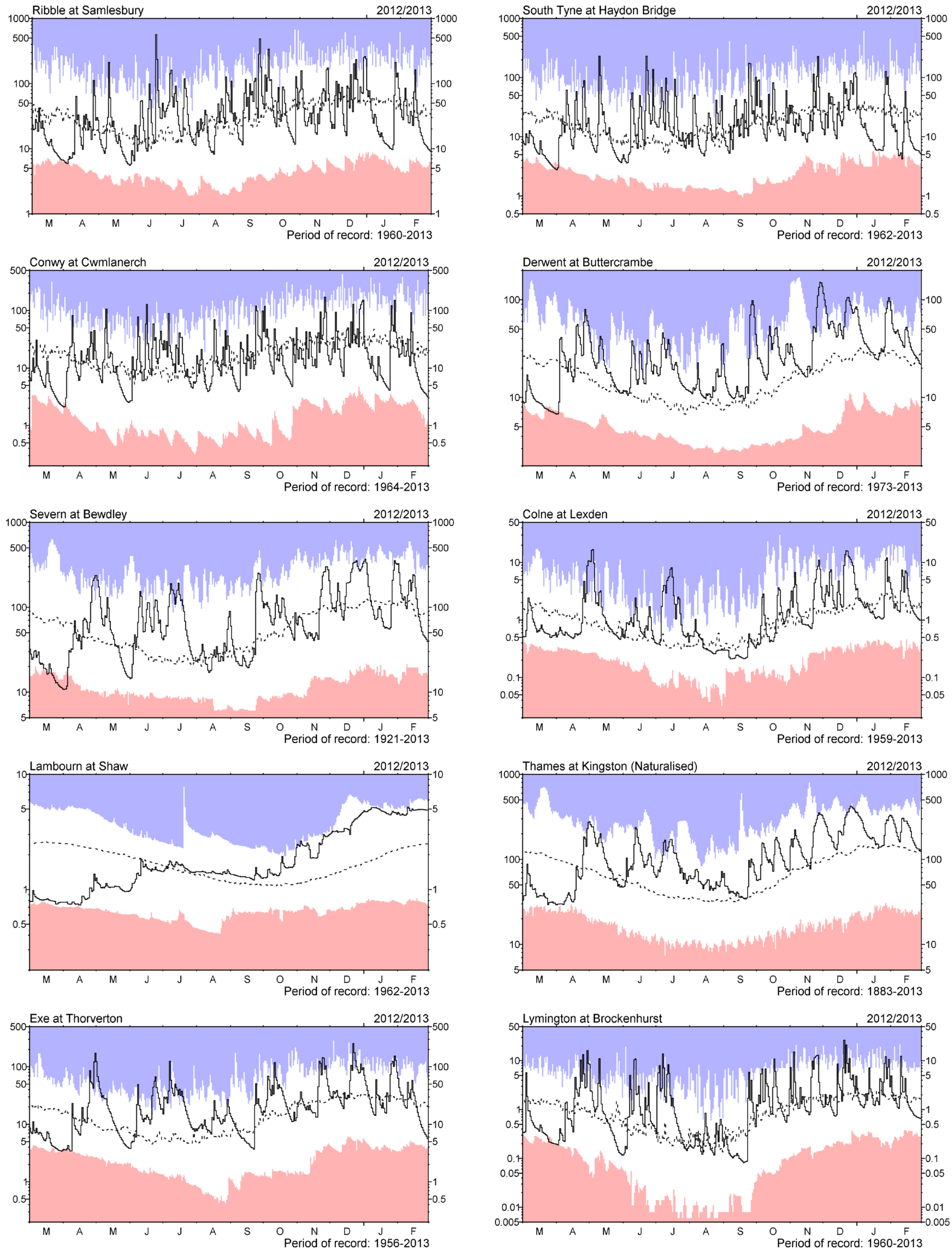
River flow . . . River flow . . .



River flow hydrographs

The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to March 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 . . .

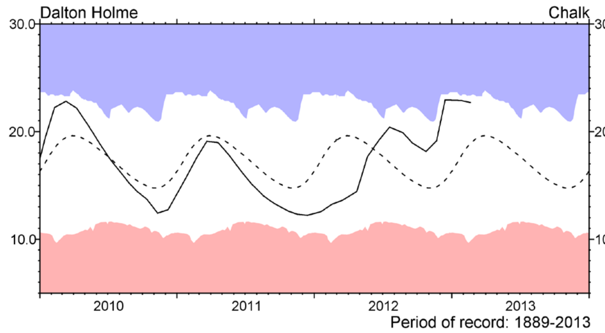


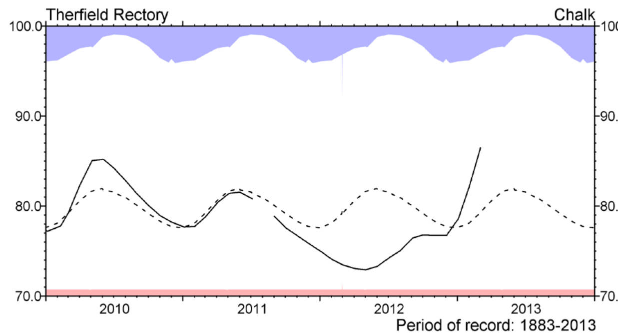
Notable runoff accumulations (a) April 2012 - February 2013

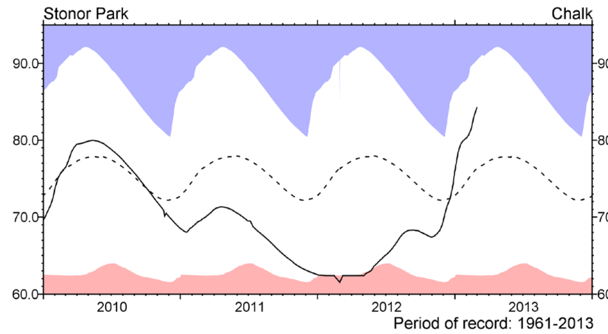
	River	%lta	Rank		River	%lta	Rank		River	%lta	Rank
a)	Earn	143	62/63	a)	Thames (Kingston)	180	127/130	a)	Severn (Bewdley)	160	89/91
	Tweed (Norham)	172	50/50		Lymington	231	50/50		Avon (Evesham)	220	76/76
	Tyne (Bywell)	169	53/53		Exe	193	56/56		Wye	178	75/76
	South Tyne	147	50/50		Otter	192	50/50		Tawe	142	51/51
	Trent	171	54/54		Dart	154	54/54		Teifi	158	52/52
	Dove (Marston on Dove)	161	51/51		Taw	173	54/54		Ribble	149	52/52
	Witham	206	53/53		Tone	209	52/52		Lune	136	51/51
	Bedford Ouse (Bedford)	232	80/80						Clyde (Blairston)	143	51/51

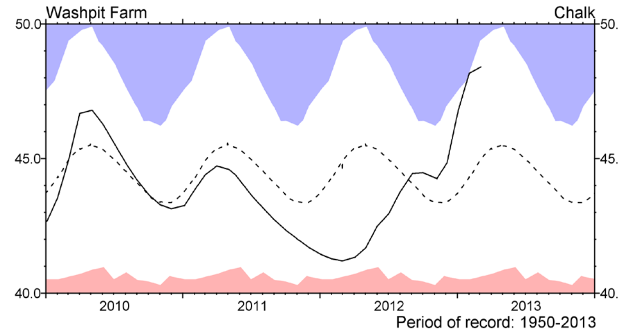
lta = long term average; Rank 1 = lowest on record

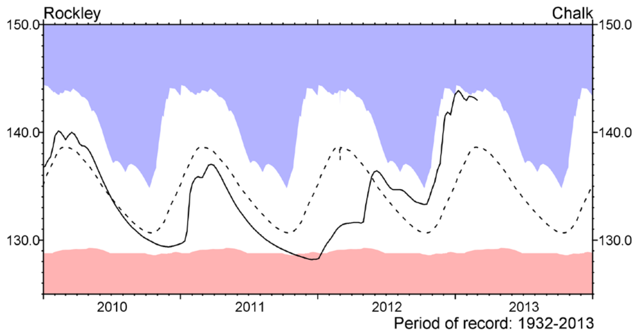
Groundwater . . . Groundwater

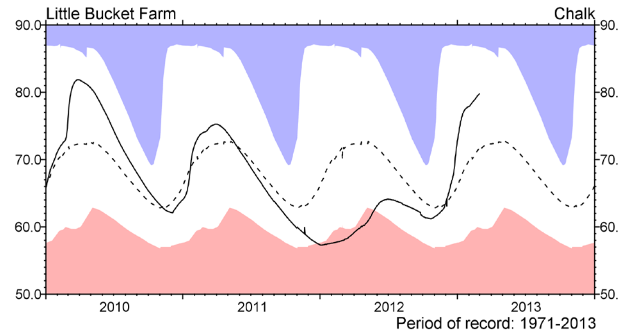


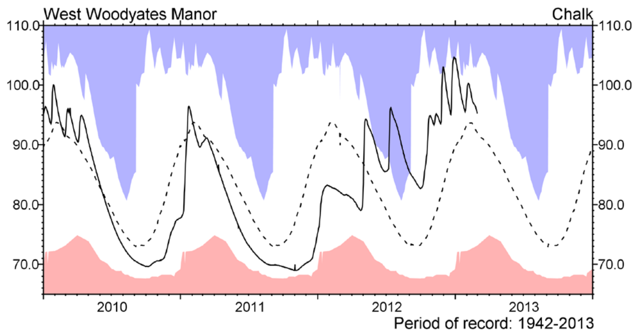


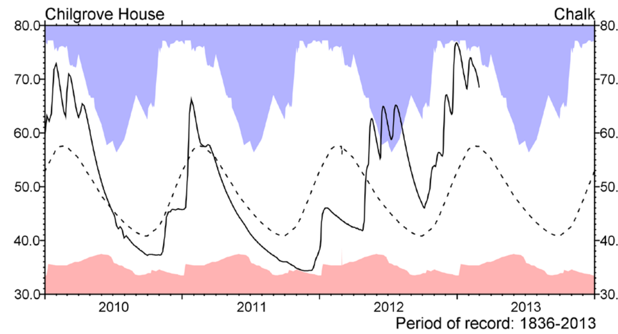


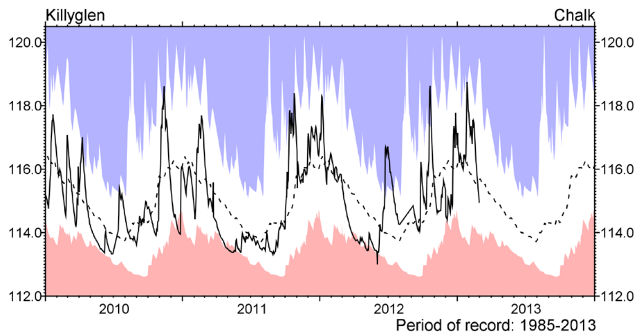


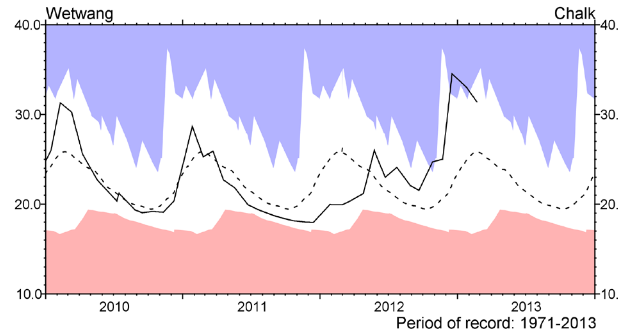






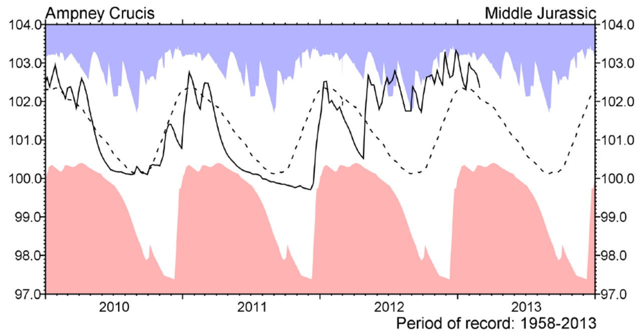


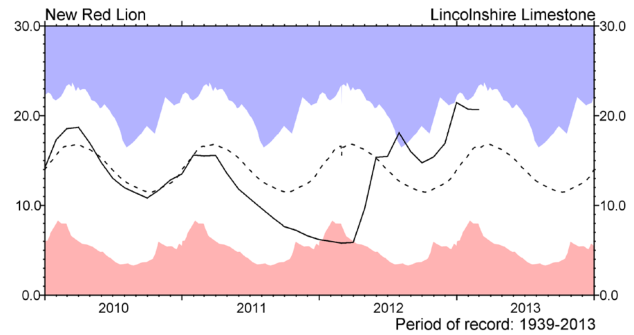


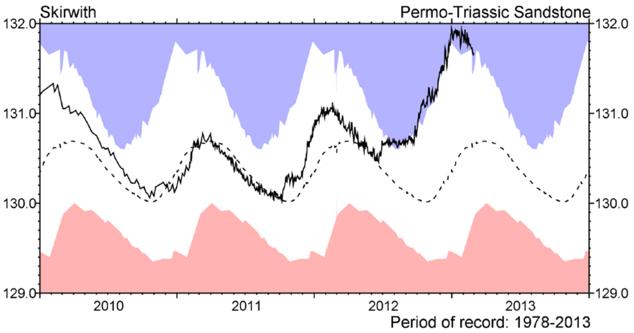


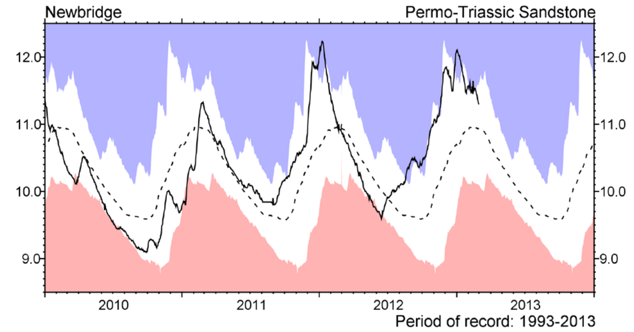
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

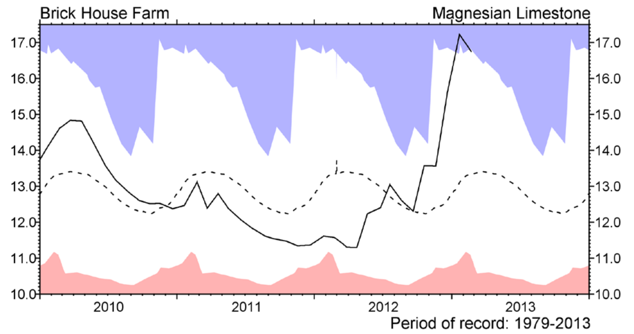
Groundwater … Groundwater

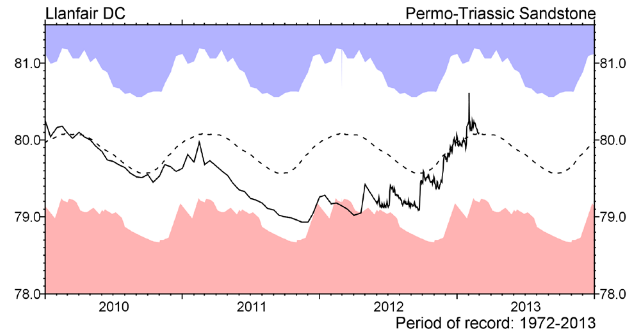


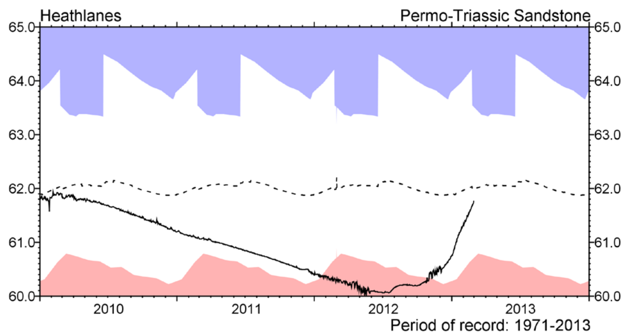


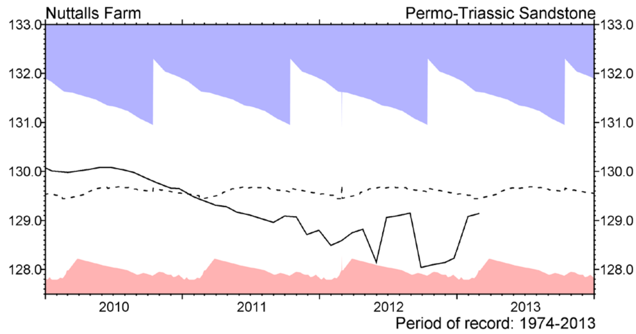


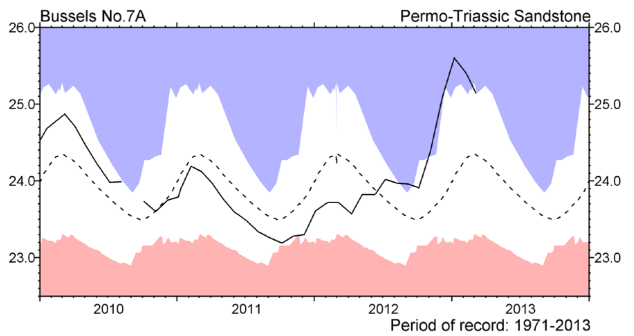


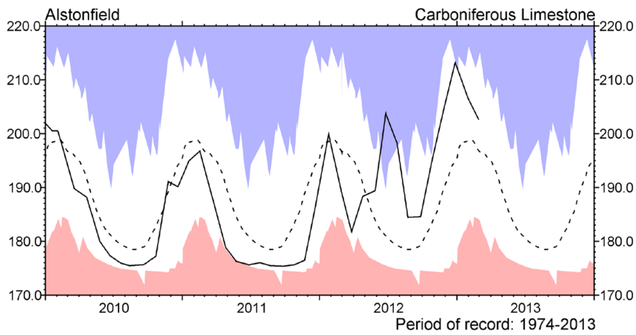










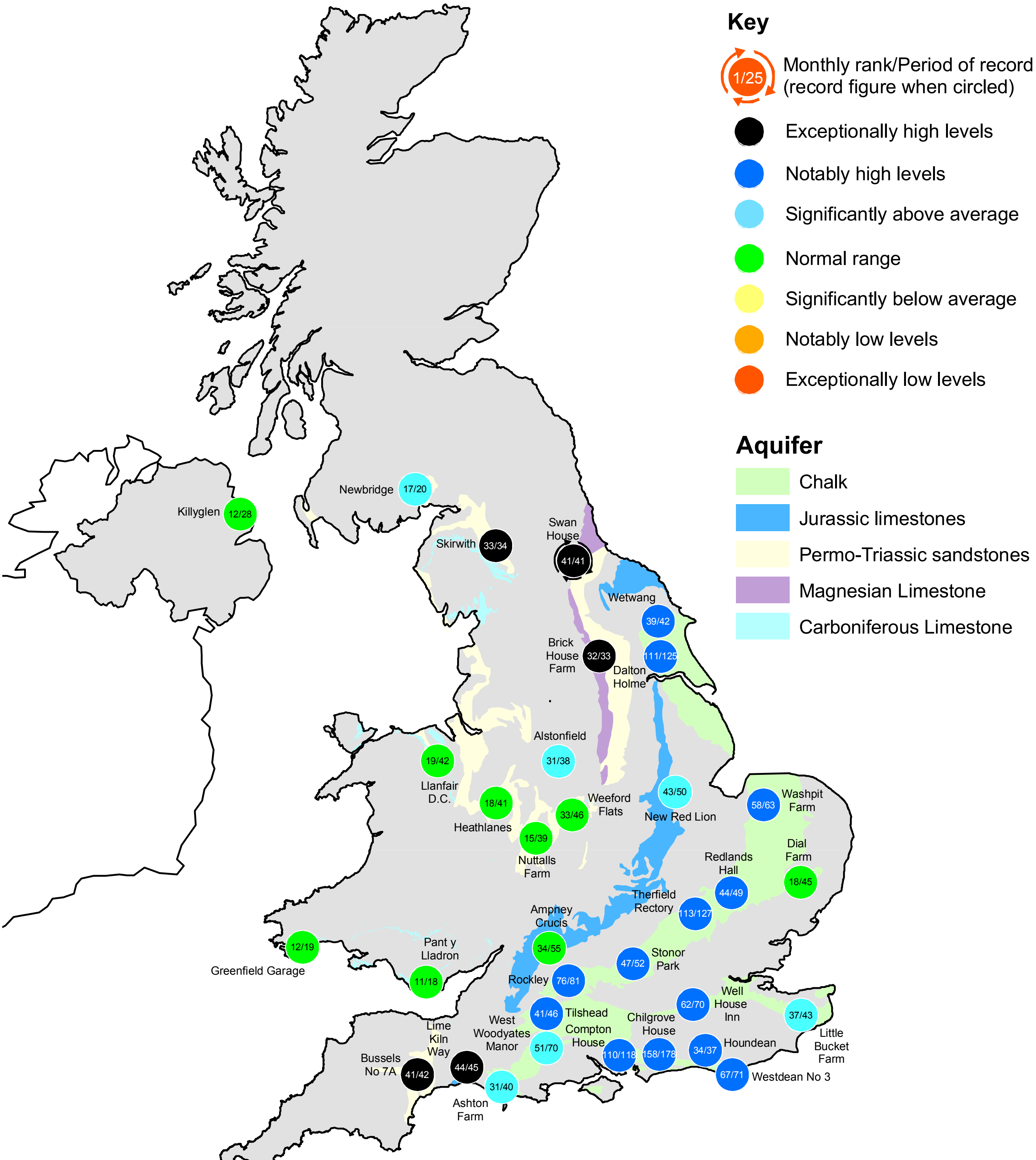


Groundwater levels February / March 2013

Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.
Dalton Holme	22.69	19/02	18.67	Chilgrove House	68.32	28/02	57.60	Brick House Farm	16.75	21/02	13.24
Therfield Rectory	86.46	03/03	78.20	Killyglen (NI)	114.95	28/02	115.65	Llanfair DC	80.09	28/02	80.04
Stonor Park	84.24	28/02	75.22	Wetwang	31.38	21/02	25.46	Heathlanes	61.76	28/02	61.93
Tilshead	98.65	28/02	93.84	Ampney Crucis	102.37	28/02	102.21	Nuttalls Farm	129.14	28/02	129.48
Rockley	142.99	28/02	138.25	New Red Lion	20.66	28/02	16.26	Bussels No.7a	25.14	06/03	24.29
Well House Inn	100.77	28/02	96.20	Skirwith	131.67	28/02	130.71	Alstonfield	202.64	27/02	198.57
West Woodyates	95.31	28/02	93.09	Newbridge	11.30	28/02	10.94				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater



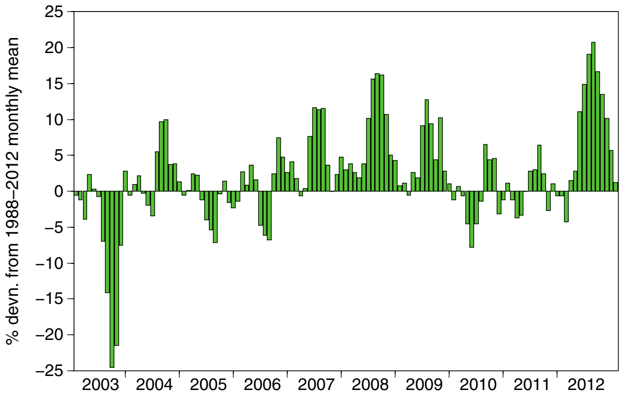
Groundwater levels - February 2013

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.

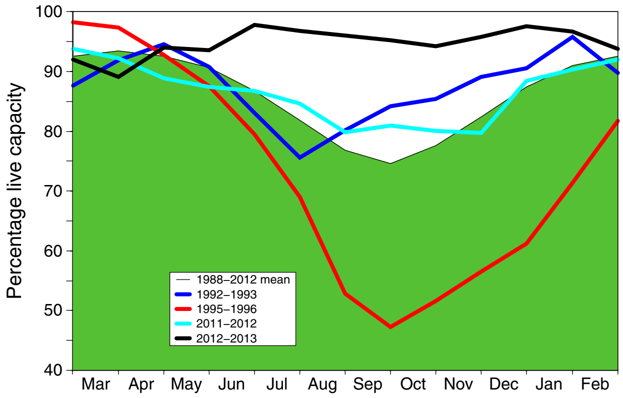
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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 end of month

Area	Reservoir		Capacity (Ml)	2012 Dec	2013 Jan	2013 Feb	Feb Anom.	Min Feb	Year* of min	2012 Feb	Diff 13-12
North West	N Command Zone	•	124929	97	96	88	-5	78	1996	93	-5
	Vyrnwy		55146	100	99	96	2	59	1996	96	0
Northumbrian	Teesdale	•	87936	100	97	90	-1	72	1996	98	-8
	Kielder		(199175)	100	98	88	-5	81	1993	92	-4
Severn Trent	Clywedog		44922	97	96	95	4	77	1996	96	-1
	Derwent Valley	•	39525	100	100	94	-2	46	1996	99	-5
Yorkshire	Washburn	•	22035	99	97	94	1	53	1996	97	-3
	Bradford supply	•	41407	100	99	96	1	53	1996	99	-3
Anglian	Grafham		(55490)	74	73	80	-8	72	1997	95	-15
	Rutland		(116580)	92	96	95	7	71	2012	71	24
Thames	London	•	202828	99	96	96	4	83	1988	96	0
	Farmoor	•	13822	79	95	97	5	64	1991	100	-3
Southern	Bewl		28170	95	99	100	15	40	2012	40	60
	Ardingly**		4685	100	100	100	5	46	2012	46	54
Wessex	Clatworthy		5364	100	100	100	2	82	1992	100	0
	Bristol WW	•	(38666)	98	96	96	5	65	1992	79	17
South West	Colliford		28540	100	100	99	14	57	1997	76	23
	Roadford		34500	100	99	95	12	35	1996	81	14
	Wimbleball		21320	100	100	100	5	72	1996	94	6
	Stithians		4967	100	100	100	7	45	1992	90	10
Welsh	Celyn and Brenig	•	131155	100	100	99	1	69	1996	100	-2
	Brianne		62140	100	99	96	-2	92	2004	98	-2
	Big Five	•	69762	100	96	98	2	85	1988	98	0
	Elan Valley	•	99106	100	100	98	0	88	1993	100	-2
Scotland(E)	Edinburgh/Mid Lothian	•	97639	100	97	99	4	73	1999	99	0
	East Lothian	•	10206	100	100	100	1	91	1990	99	1
Scotland(W)	Loch Katrine	•	111363	91	87	91	-3	76	2010	95	-4
	Daer		22412	99	90	97	-2	94	2004	100	-3
	Loch Thom	•	11840	100	100	100	2	90	2004	99	1
Northern Ireland	Total+	•	55540	100	100	95	5	81	2004	98	-3
	Silent Valley	•	20634	100	100	94	8	57	2002	98	-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.

03/2013

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

Enquiries

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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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