Hydrological Summary

for the United Kingdom

February 2014

General

Like much of the previous two months, February was exceptionally wet, thus bringing to a close the wettest winter in the England & Wales rainfall series (from 1766). It was also the stormiest winter the UK has experienced for at least 20 years, with the first half of February seeing a continuation of the relentless sequence of deep depressions – their impacts exacerbated by the lack of any respite, with the storms being separated by a few days at most. Severe gales brought widespread damage and disruption to transport and energy networks, and the associated large waves caused severe flooding and accelerated erosion in coastal districts. Inland, fluvial flooding continued to intensify in the first fortnight, with widespread flood warnings (including severe flood warnings) and extensive floodplain inundation. On the Somerset Levels and the lower reaches of the Thames the flooding had very severe impacts but, overall, flood impacts were localised given the spatial extent and duration of the exceptional runoff. In part this reflects the efficacy of flood alleviation measures, but also the fact that peak river flows, whilst high for February, were generally unremarkable (except on the lower Thames and in some groundwater-dominated catchments). Nevertheless, the duration of floodplain inundation has been exceptional and, accordingly, total runoff for the winter 2013/14 period was unprecedented. Groundwater levels continued to rise across most aquifers, and were exceptionally high across much of the southern Chalk and in western outcrops of the Permo-Triassic sandstones. Widespread groundwater flooding was reported in the Chalk (in some localities, the most severe since the winter of 2000/01) and, in vulnerable areas, is likely to persist through the spring. With plentiful aquifer storage and full reservoirs, the water resources outlook for the spring and summer is very favourable.

Rainfall

The first two weeks of February saw a continuation of the exceptionally stormy conditions that have been prevalent since mid-December. Severe storms on the 4th/5th and 8th/9th caused widespread damage to south-western coasts (including the severing of the main railway line to the south-west at Dawlish) and brought widespread heavy rainfall (with 45mm at Vyrnwy, mid-Wales, on the 5th; and 47mm at Libanus, south Wales, on the 8th). Further depressions on the 12th and 14th brought severe gales to large parts of Britain (with the storm on the 12th being one of the worst to hit Wales and north-west England in recent decades); they caused widespread damage and left tens of thousands of homes without power. The second half of the month saw some respite, but remained unsettled – the 16th to the 23rd was relatively dry, but the final week was wet (particularly in parts of Scotland and northern England). Overall, February was another exceptionally wet month, with twice the monthly average falling over a large swathe of southern England and Wales, north-west England, south-west Scotland and parts of eastern Scotland and Northern Ireland. The month concluded the wettest winter on record for much of the UK: it was the wettest winter in the NCIC record (from 1910) for the UK as a whole by a considerable margin; in Southern region the winter rainfall exceeded the previous maximum (1914/15) by 100mm (>20%). However, some areas have been drier, including parts of eastern England and the far north of Scotland. The winter has also been notably mild; significant snowfalls were restricted to the Highlands of Scotland, where snow cover has been extensive at high elevations.

River flow

River flows were notably high entering February in many index rivers in England and Wales, and the month started with widespread flood warnings and alerts. River flows continued to increase following the storms of the first two weeks, particularly as larger rivers responded to the accumulated rainfall. Flows in the lower reaches of the Thames were the highest since 1974, bringing severe property flooding (e.g. in Datchet and Wraysbury) and widespread transport disruption. Flooding also occurred on the lower Severn, e.g. in Worcester (although damage was mitigated by flood defences), where flows exceeded those reached in 2007. Further evacuations occurred on the Somerset Levels as floodwaters rose early in the month, and villages remained cut off in late February; efforts to alleviate the problems (including, according to the EA, the biggest pumping operation the country has ever seen) continued through the month. Elsewhere, flood risk abated through the latter half of the month, although alerts were still prevalent as river levels receded slowly. February maximum peak flows were registered in 14 index rivers across southern and central England and new period-of-record maxima (for any month) were established in some slowly responding groundwater-fed catchments in southern England, including the Lambourn, Itchen and Coln. New maximum February runoff totals were widespread, and accumulated runoff totals for the winter as a whole were exceptional across most of the UK (with the exception of northern Scotland and parts of eastern England), eclipsing previous maxima in a substantial majority of index catchments. The accumulated winter outflows from Great Britain were the highest on record (from 1961) by a considerable margin, and it was the highest winter runoff total for the Thames and the Severn in lengthy flow records (from 1883 and 1921, respectively).

Groundwater

Exceptional February groundwater levels were recorded over most of the southern Chalk, with monthly maximum levels recorded in the North Downs (Little Bucket Farm and Well House Inn) and at Compton House and Rockley. However, during February, levels stabilised and fell overall across the south-western Chalk and South Downs. Groundwater flooding was widespread across the southern Chalk, from Dorset to Kent, and impacts on property and infrastructure were widely reported – e.g. at Buckskin (Basingstoke), East and West Ilsley (West Berkshire), Patcham (Brighton) and Coulsdon (south London). The situation had improved by the end of the month in many areas, although flooding persists, and may extend into the lower parts of catchments elsewhere. In the northern and eastern Chalk (East Anglia, Lincolnshire and Yorkshire) levels rose but remain at or below average, except at Wetwang. In the Permo-Triassic sandstones levels increased and were above normal in the Midlands and north Wales and exceptionally high elsewhere, with record monthly levels recorded for the second consecutive month at Newbridge, Skirwith and Bussels. In the Magnesian Limestone, water levels rose and approached the maximum monthly level at Swan House. In the Jurassic limestone aquifers, levels remained above average and continued to increase at New Red Lion (Lincolnshire Limestone); in the Cotswolds they decreased slightly from exceptional to notably high levels. In the rapidly responding Carboniferous Limestone, levels were above average and rose at Alstonfield (Peak District) but fell in south Wales (by 9m at Pant y Lladron).

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.

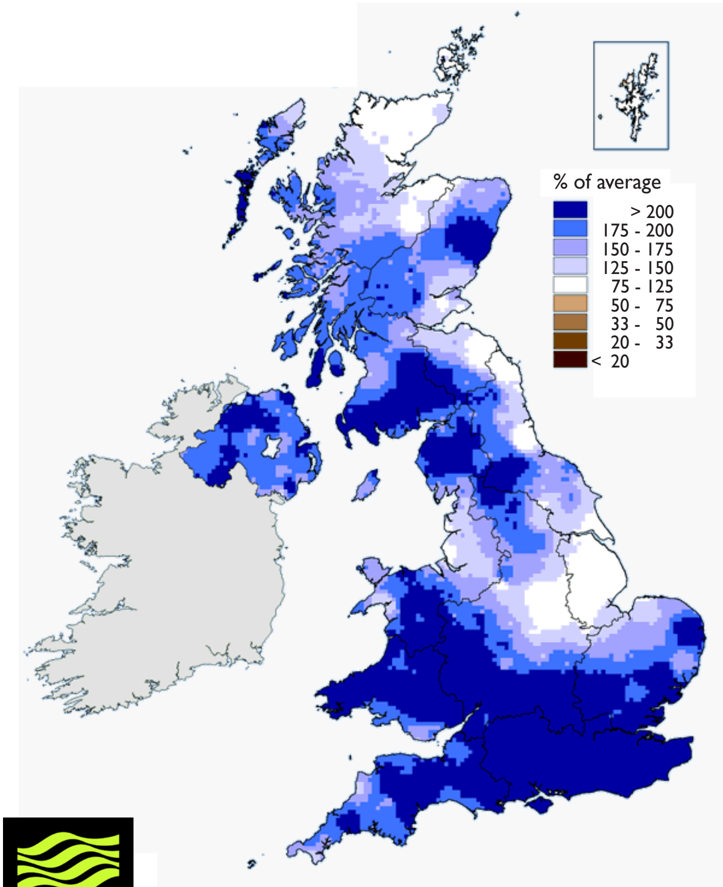
Area	Rainfall	Feb 2014	Dec13 – Feb14	RP	Oct13 – Feb14	RP	Mar13 – Feb14	RP	Sep12 – Feb14	RP
United	mm	**163**	532		785		1264		1988	
Kingdom	%	**195**	167	>>100	145	>>100	117	15-25	116	30-50
England	mm	**121**	396		602		973		1559	
	%	**205**	174	>100	155	80-120	120	8-12	123	20-30
Scotland	mm	**212**	713		1027		1648		2554	
	%	**179**	161	>100	136	>100	115	10-20	110	10-15
Wales	mm	**244**	736		1076		1638		2578	
	%	**223**	175	>100	150	>100	121	10-15	118	10-20
Northern	mm	**168**	476		699		1254		1919	
Ireland	%	**195**	149	>100	129	>100	113	10-20	110	15-25
England &	mm	**138**	443		667		1065		1699	
Wales	%	**210**	174	>100	154	>100	120	10-15	122	20-30
North West	mm	**165**	531		792		1343		2192	
	%	**192**	158	60-90	136	30-50	115	5-10	119	15-25
Northumbrian	mm	**103**	354		554		994		1616	
	%	**176**	157	70-100	145	30-50	121	5-10	128	70-100
Severn-Trent	mm	**103**	330		525		896		1415	
	%	**190**	160	30-50	152	40-60	120	5-10	122	15-25
Yorkshire	mm	**106**	329		507		883		1467	
	%	**183**	145	10-20	134	10-15	110	2-5	118	5-10
Anglian	mm	**63**	213		365		642		1028	
	%	**170**	146	10-20	142	15-25	108	2-5	114	2-5
Thames	mm	**122**	432		612		929		1408	
	%	**261**	232	>>100	192	>100	134	30-50	132	25-40
Southern	mm	**158**	543		781		1088		1672	
	%	**297**	246	>>100	202	>100	142	50-80	137	30-50
Wessex	mm	**157**	536		776		1111		1778	
	%	**233**	208	>>100	182	>100	130	20-30	131	30-50
South West	mm	**211**	629		946		1428		2356	
	%	**200**	161	50-80	147	50-80	120	8-12	122	20-30
Welsh	mm	**236**	710		1040		1590		2500	
	%	**226**	176	>100	152	>100	121	10-20	119	15-25
Highland	mm	**235**	787		1159		1892		2933	
	%	**159**	145	20-30	125	15-25	110	5-10	105	2-5
North East	mm	**123**	457		666		1094		1650	
	%	**186**	181	>>100	148	40-60	116	2-5	112	2-5
Tay	mm	**203**	724		994		1491		2279	
	%	**190**	181	>100	150	>100	118	10-15	113	5-10
Forth	mm	**154**	560		809		1271		2003	
	%	**169**	165	>100	142	>100	113	5-10	112	8-12
Tweed	mm	**135**	493		704		1176		1857	
	%	**192**	181	>>100	153	>100	125	10-20	126	40-60
Solway	mm	**246**	796		1090		1753		2709	
	%	**218**	188	>>100	150	>>100	126	60-90	121	50-80
Clyde	mm	**277**	879		1258		1989		3123	
	%	**194**	164	>100	138	>100	115	10-20	112	10-20

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

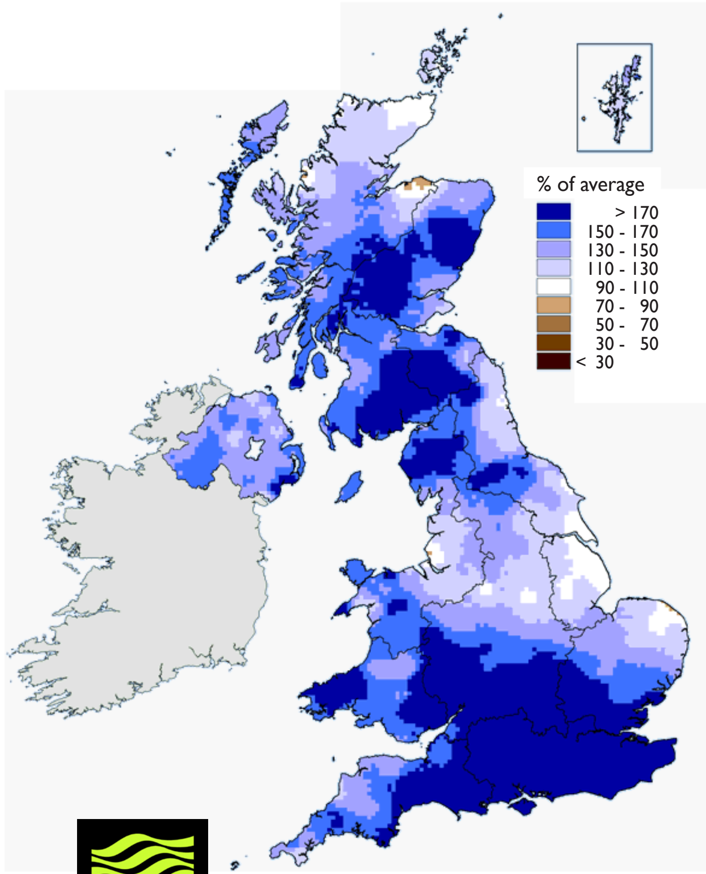
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 2013 are provisional.

Rainfall . . . Rainfall . . .

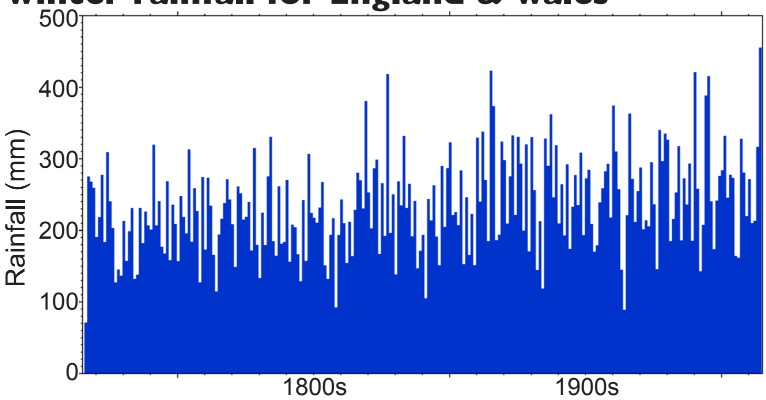
February 2014 rainfall as % of 1971-2000 average



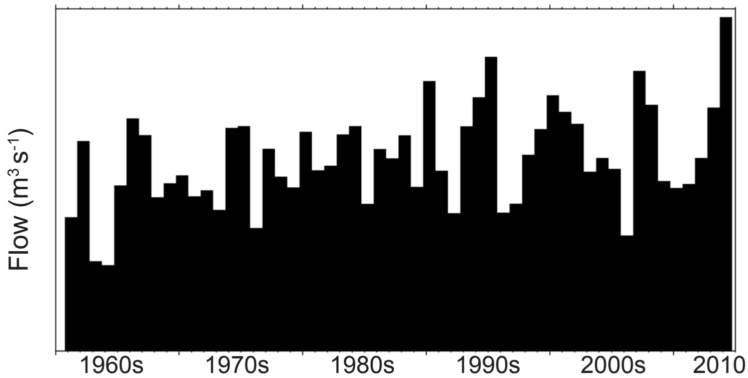
December 2013 - February 2014 rainfall as % of 1971-2000 average



Winter rainfall for England & Wales



Winter outflows from Great Britain



Met Office 3-month outlook Updated: February 2014

Latest predictions for UK precipitation suggest a near-climatological risk of above-average rainfall in March. Similarly, for March-April-May as a whole the risk of either above- or below-average rainfall remains near climatological levels.

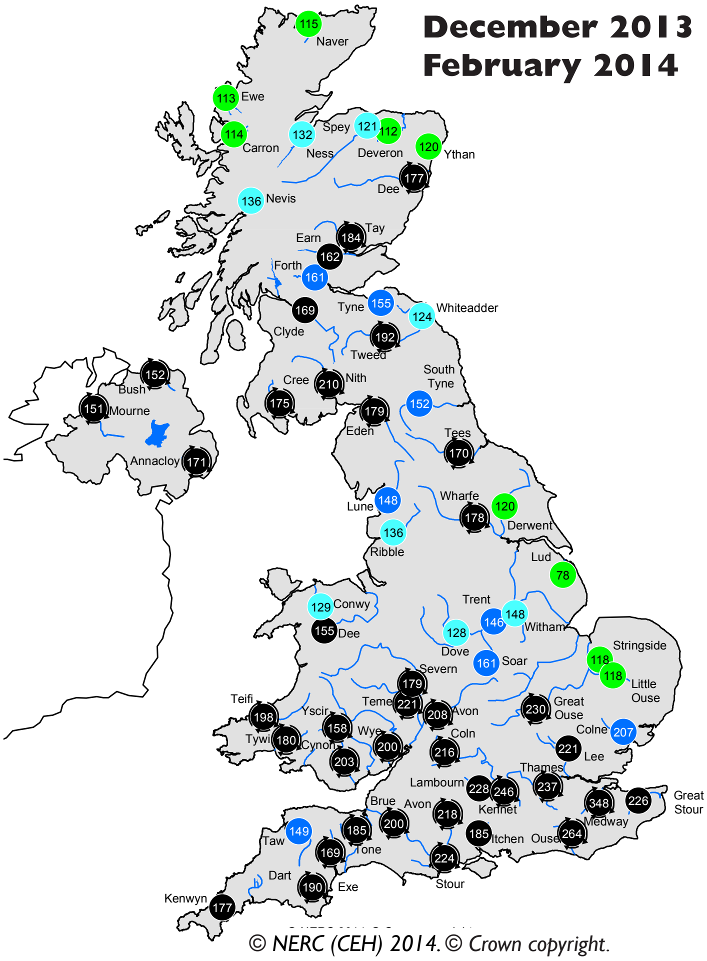
The probability that UK precipitation for March-April-May will fall into the driest of our five categories is 15% and the probability that it will fall into the wettest category is between 15% and 20% (the 1981-2010 probability for each of these categories is 20%).

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.

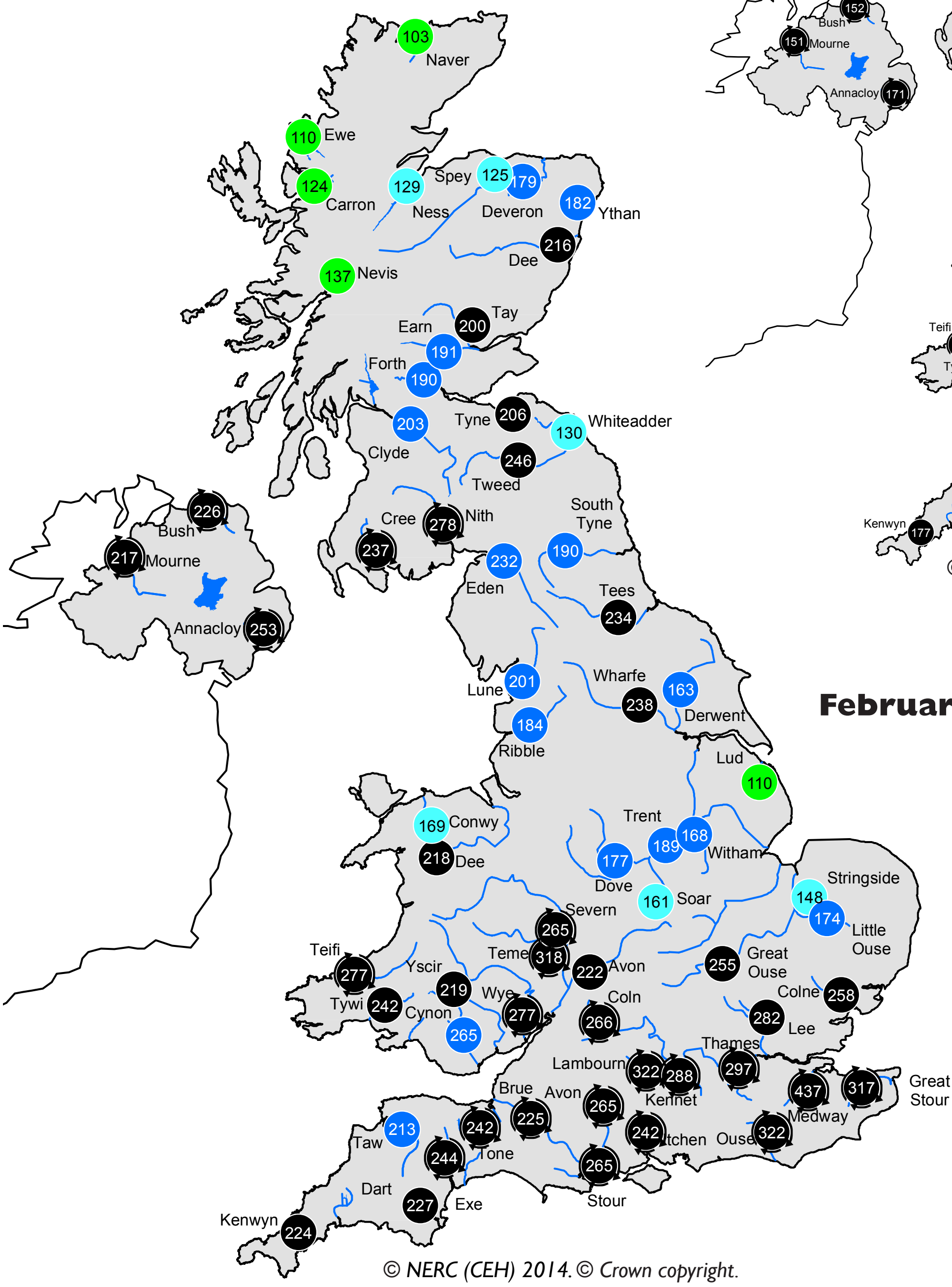
The latest shorter-range forecasts, covering the upcoming 30 days, can be accessed via:
http://www.metoffice.gov.uk/weather/uk/uk_forecast_weather.html
These forecasts are updated very frequently.

River flow ... River flow ...

December 2013 - February 2014



February 2014



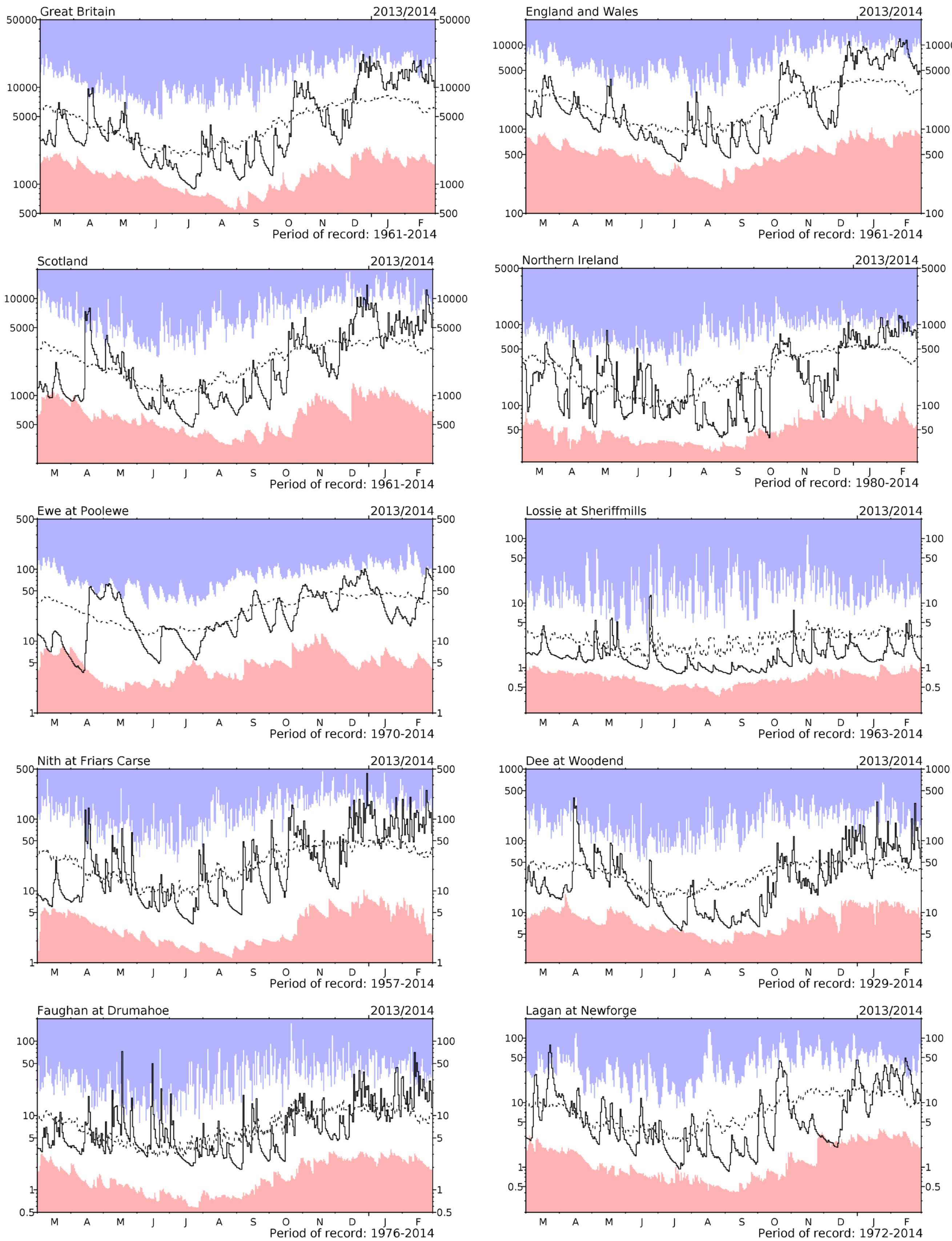
Key

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

*Based on ranking of the monthly flow**

River flows

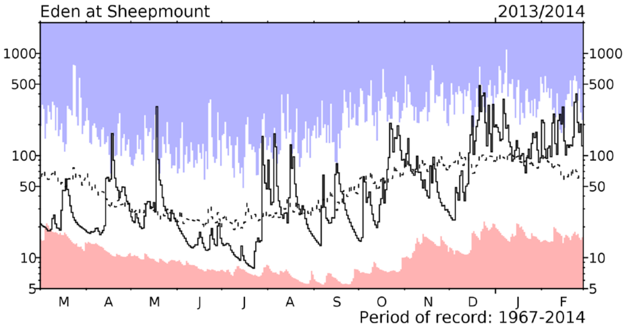
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station. Percentages may be omitted where flows are under review.

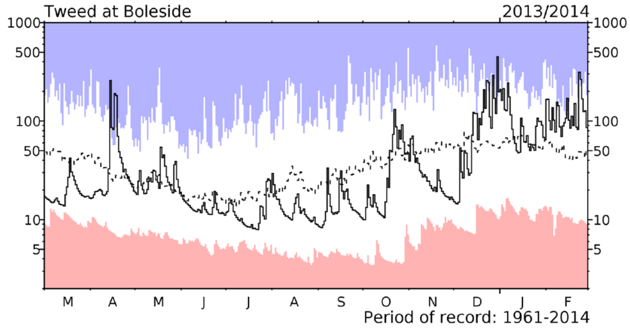


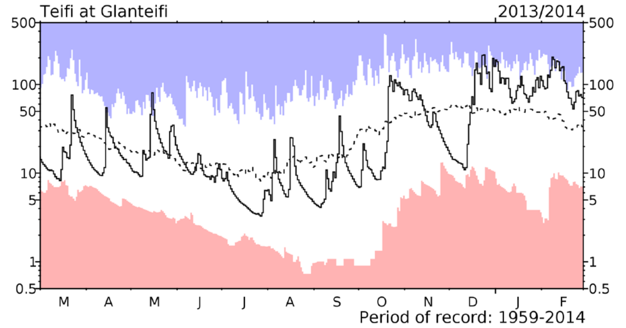
River flow hydrographs

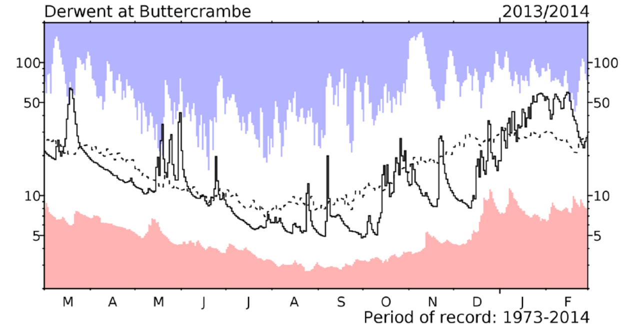
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to March 2013 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed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

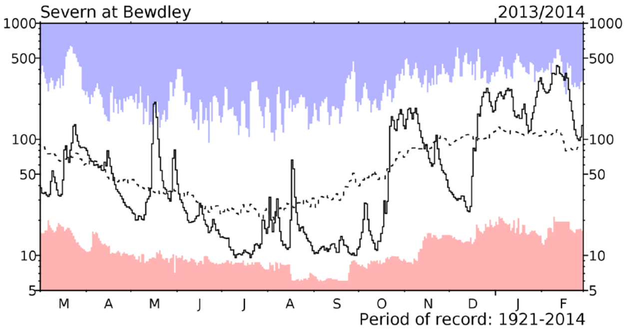
River flow . . . River flow . . .

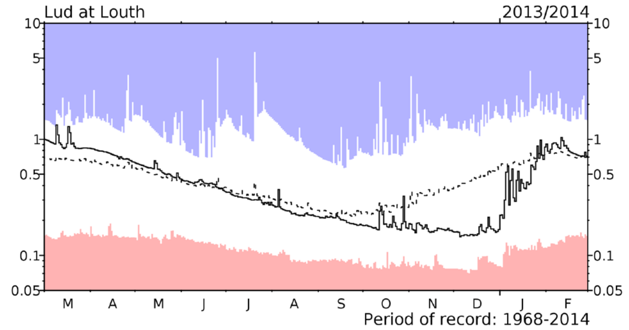


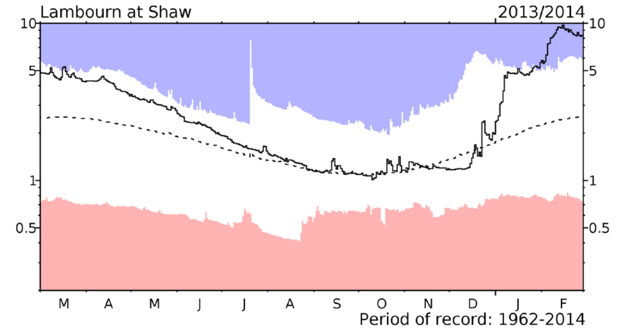


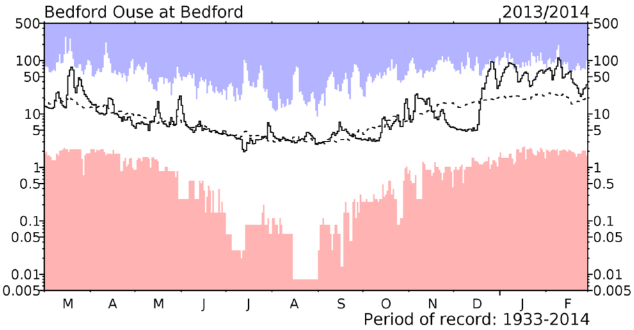


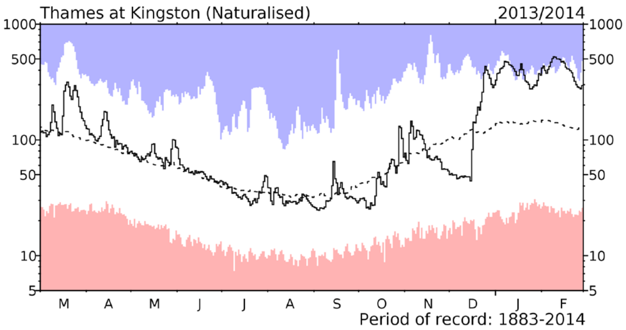


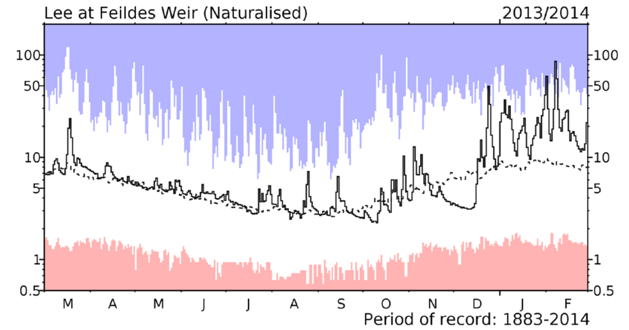


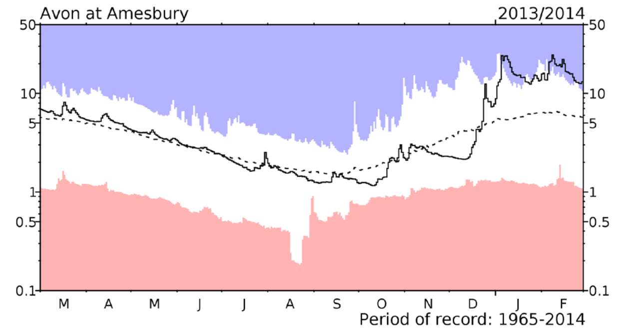


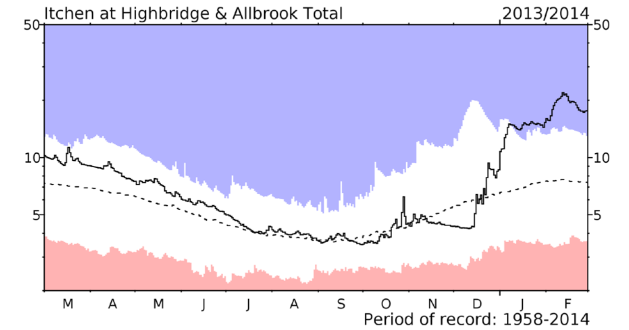




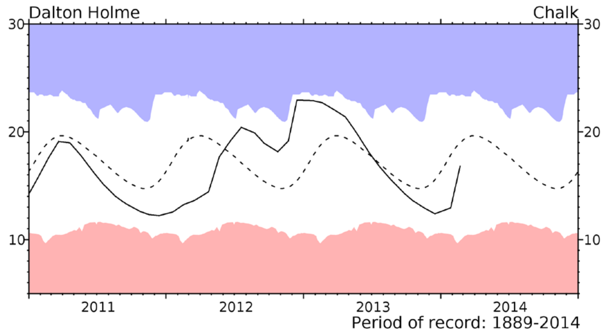


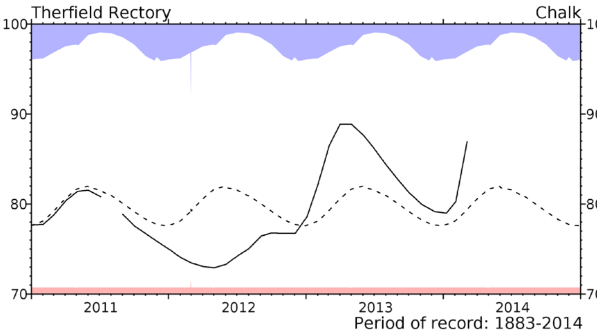


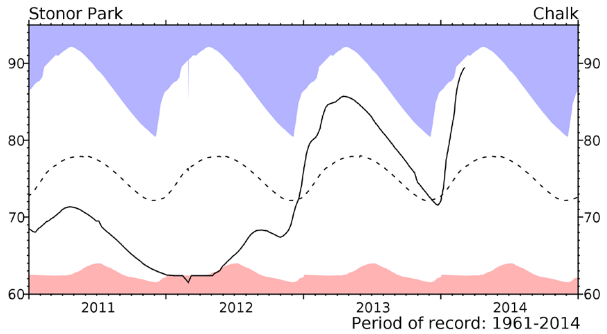


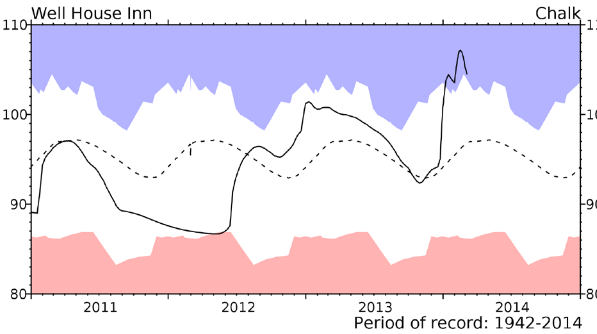


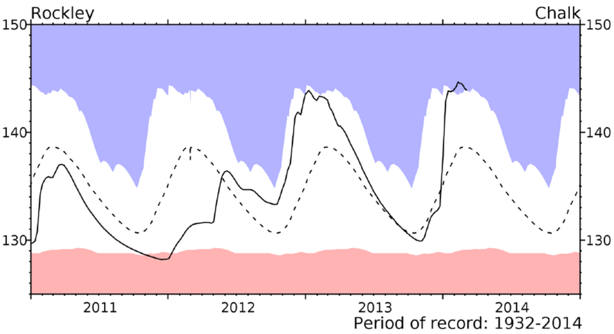
Groundwater . . . Groundwater

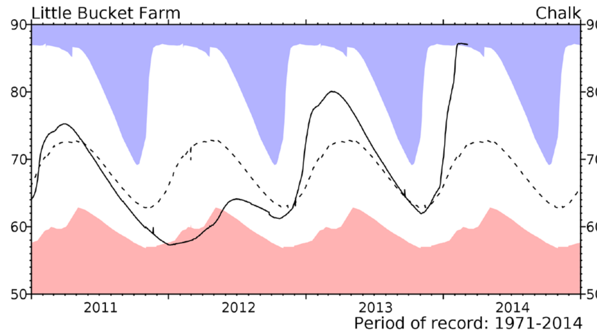


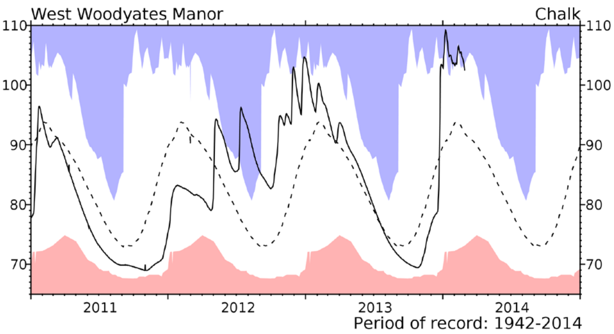


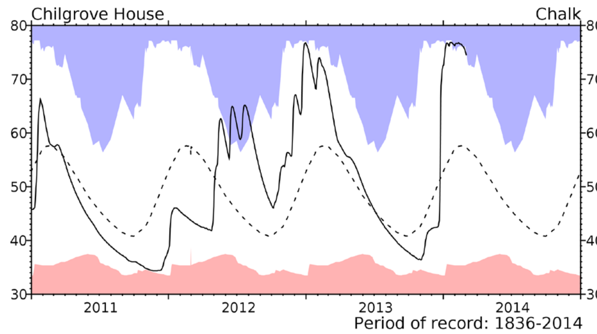


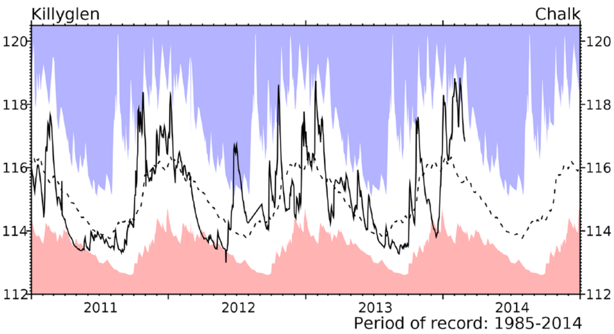


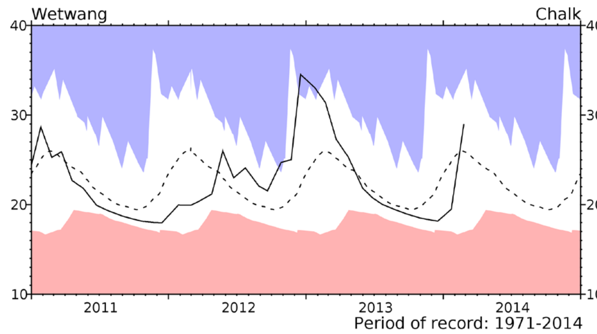






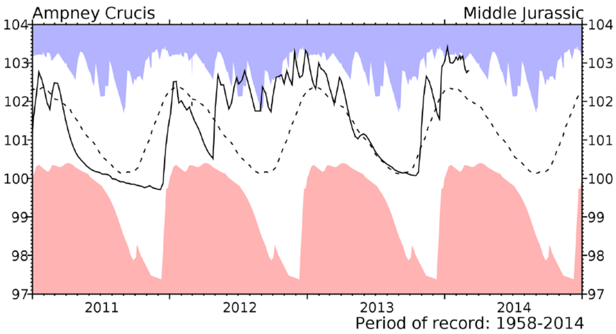


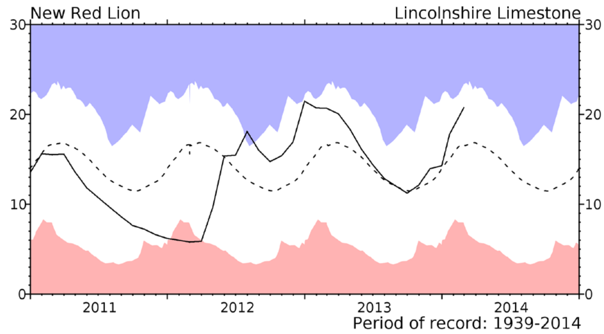


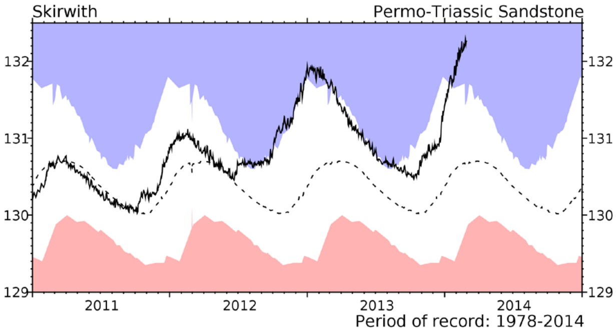


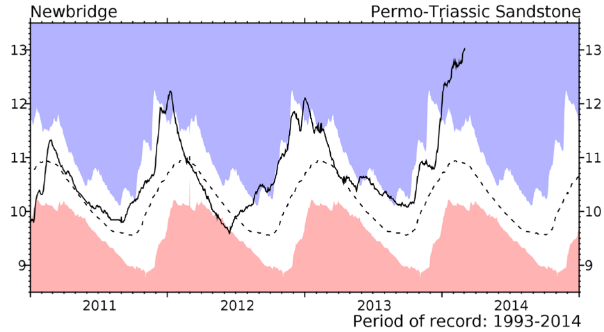
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

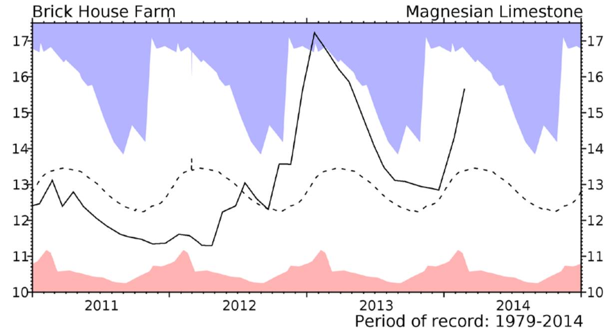
Groundwater ... Groundwater

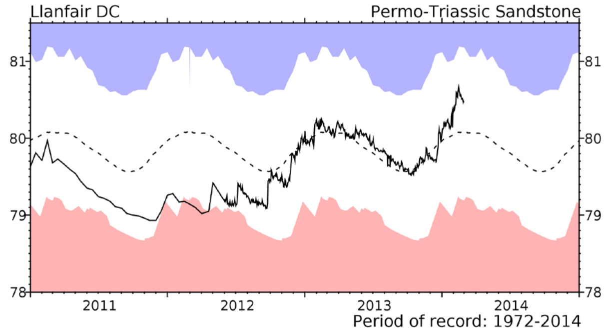


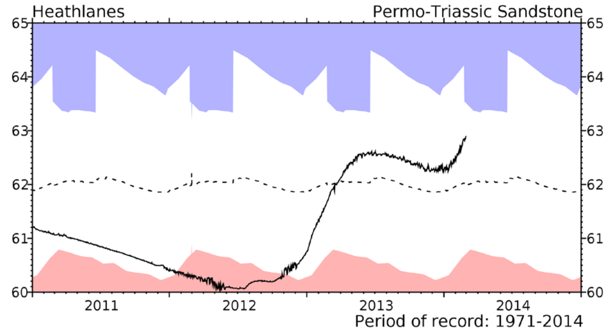


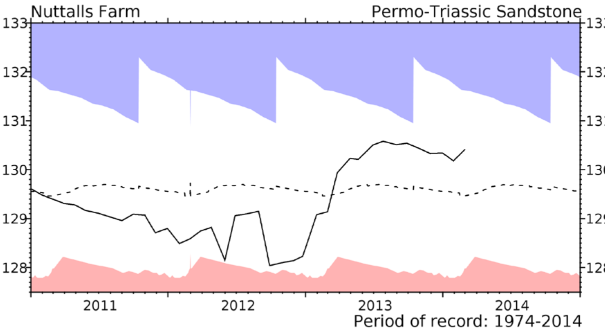


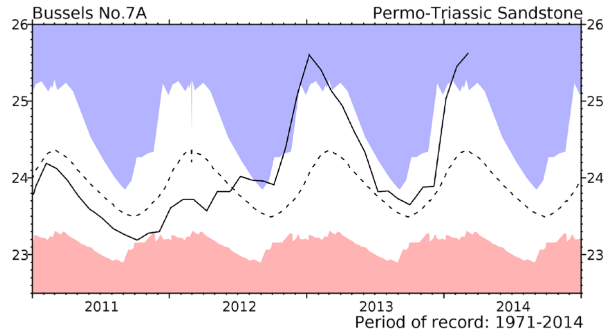


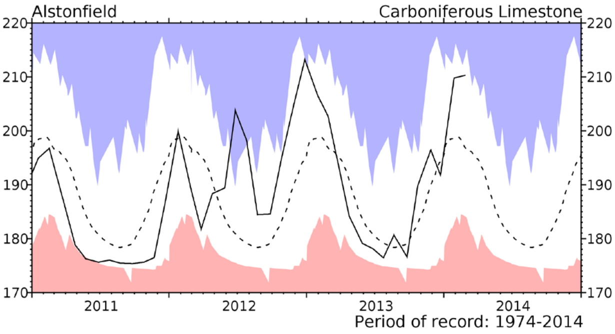










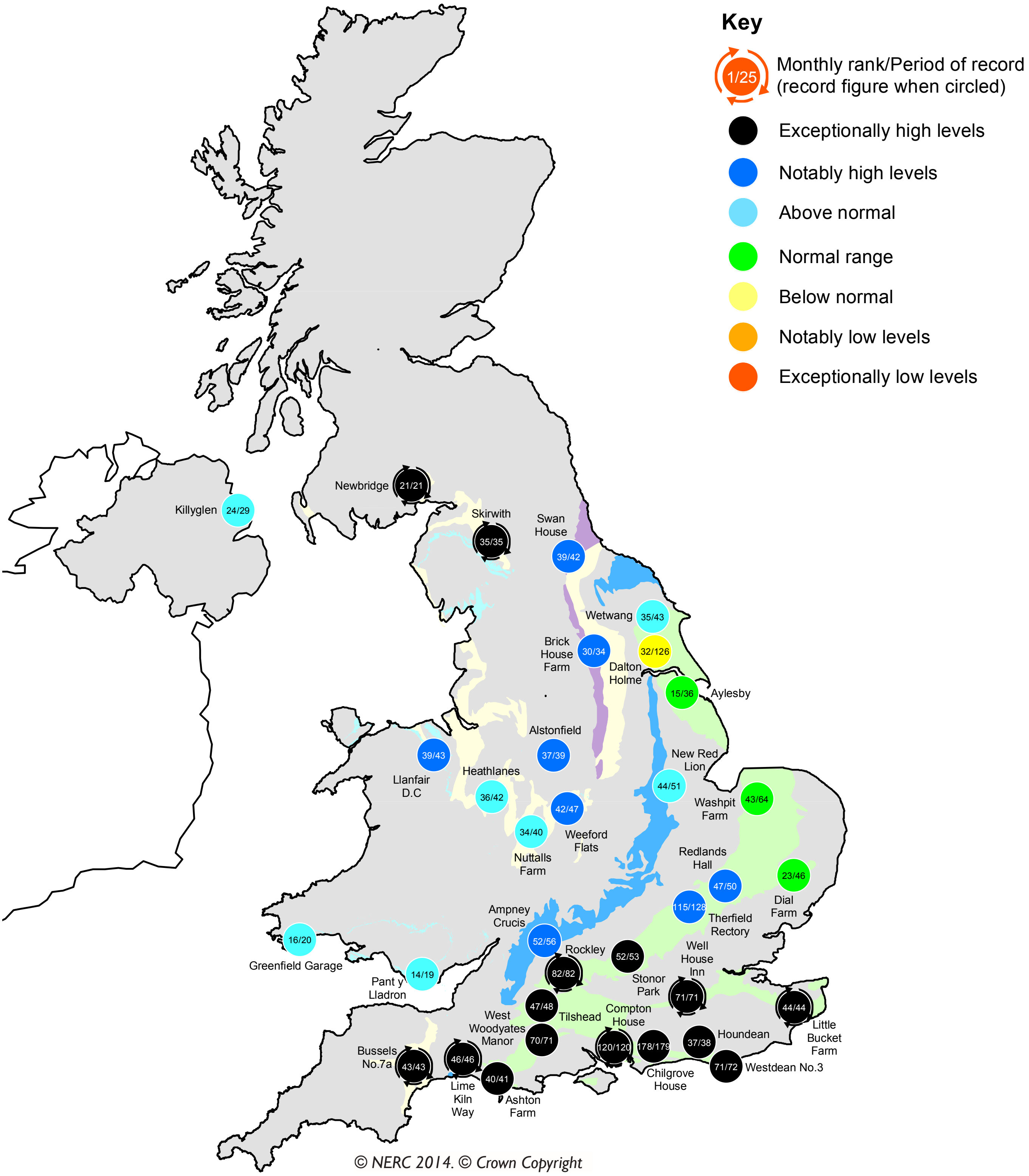


Groundwater levels February / March 2014

Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.	Borehole	Level	Date	Feb av.
Dalton Holme	16.82	21/02	19.48	Chilgrove House	74.40	03/03	55.56	Brick House Farm	15.65	24/02	13.40
Therfield Rectory	86.92	05/03	79.32	Killyglen (NI)	116.84	28/02	115.41	Llanfair DC	80.47	28/02	80.04
Stonor Park	89.42	05/03	76.57	Wetwang	28.92	24/02	25.38	Heathlanes	62.89	28/02	61.93
Tilshead	99.62	28/02	93.77	Ampney Crucis	102.79	05/03	101.99	Nuttalls Farm	130.41	28/02	129.44
Rockley	143.89	05/03	138.41	New Red Lion	20.74	28/02	16.53	Bussels No.7a	25.62	06/03	24.32
Well House Inn	104.52	05/03	96.87	Skirwith	132.25	28/02	130.74	Alstonfield	210.27	26/02	195.35
West Woodyates	102.50	28/02	90.68	Newbridge	13.03	02/03	10.82				

Levels in metres above Ordnance Datum

Groundwater...Groundwater

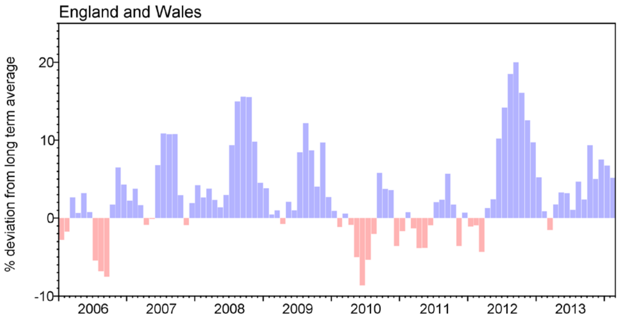


Groundwater levels - February 2014

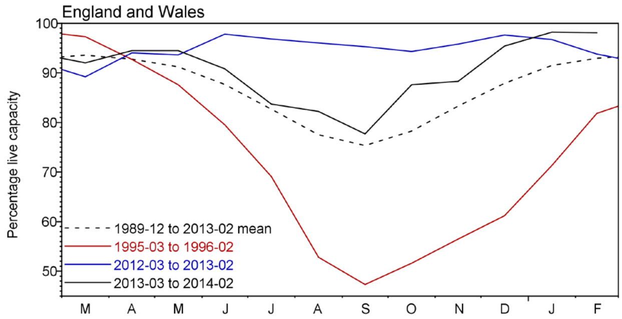
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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)	2013 Dec	2014 Jan	2014 Feb	Feb Anom.	Min Feb	Year* of min	2013 Feb	Diff 14-13
North West	N Command Zone	•	124929	94	100	100	8	78	1996	88	12
	Vyrnwy		55146	100	100	100	6	59	1996	96	4
Northumbrian	Teesdale	•	87936	100	100	100	9	72	1996	90	10
	Kielder		(199175)	100	97	99	6	81	1993	88	11
Severn-Trent	Clywedog		44922	87	92	91	0	77	1996	95	-4
	Derwent Valley	•	39525	98	101	99	4	46	1996	94	5
Yorkshire	Washburn	•	22035	95	98	96	3	53	1996	94	2
	Bradford Supply	•	41407	91	100	100	5	53	1996	96	4
Anglian	Grafham		(55490)	89	93	95	7	72	1997	80	15
	Rutland		(116580)	89	95	95	7	71	2012	95	0
Thames	London	•	202828	96	96	95	2	83	1988	96	-1
	Farmoor	•	13822	84	100	97	5	64	1991	97	0
Southern	Bewl		28170	91	100	100	15	40	2012	100	0
	Ardingly**		4685	100	100	100	4	46	2012	100	0
Wessex	Clatworthy		5364	100	100	100	2	82	1992	100	0
	Bristol	•	(38666)	83	100	99	8	65	1992	96	3
South West	Colliford		28540	83	98	100	15	57	1997	99	1
	Roadford		34500	91	100	99	16	35	1996	95	4
	Wimbleball		21320	76	100	100	5	72	1996	100	0
	Stithians		4967	100	100	100	7	45	1992	100	0
Welsh	Celyn & Brenig	•	131155	100	100	100	2	69	1996	99	2
	Brianne		62140	100	100	100	2	92	2004	96	4
	Big Five	•	69762	98	100	99	3	85	1988	98	1
	Elan Valley	•	99106	100	100	100	2	88	1993	98	2
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	100	100	100	5	73	1999	99	1
	East Lothian	•	10206	100	100	100	1	91	1990	100	0
Scotland(W)	Loch Katrine	•	111363	94	95	97	3	76	2010	91	6
	Daer		22412	100	98	100	1	94	2004	97	3
	Loch Thom	•	11840	100	100	100	2	90	2004	100	0
Northern Ireland	Total+	•	56800	89	93	94	3	81	2004	95	-2
	Silent Valley	•	20634	89	100	100	14	57	2002	94	6

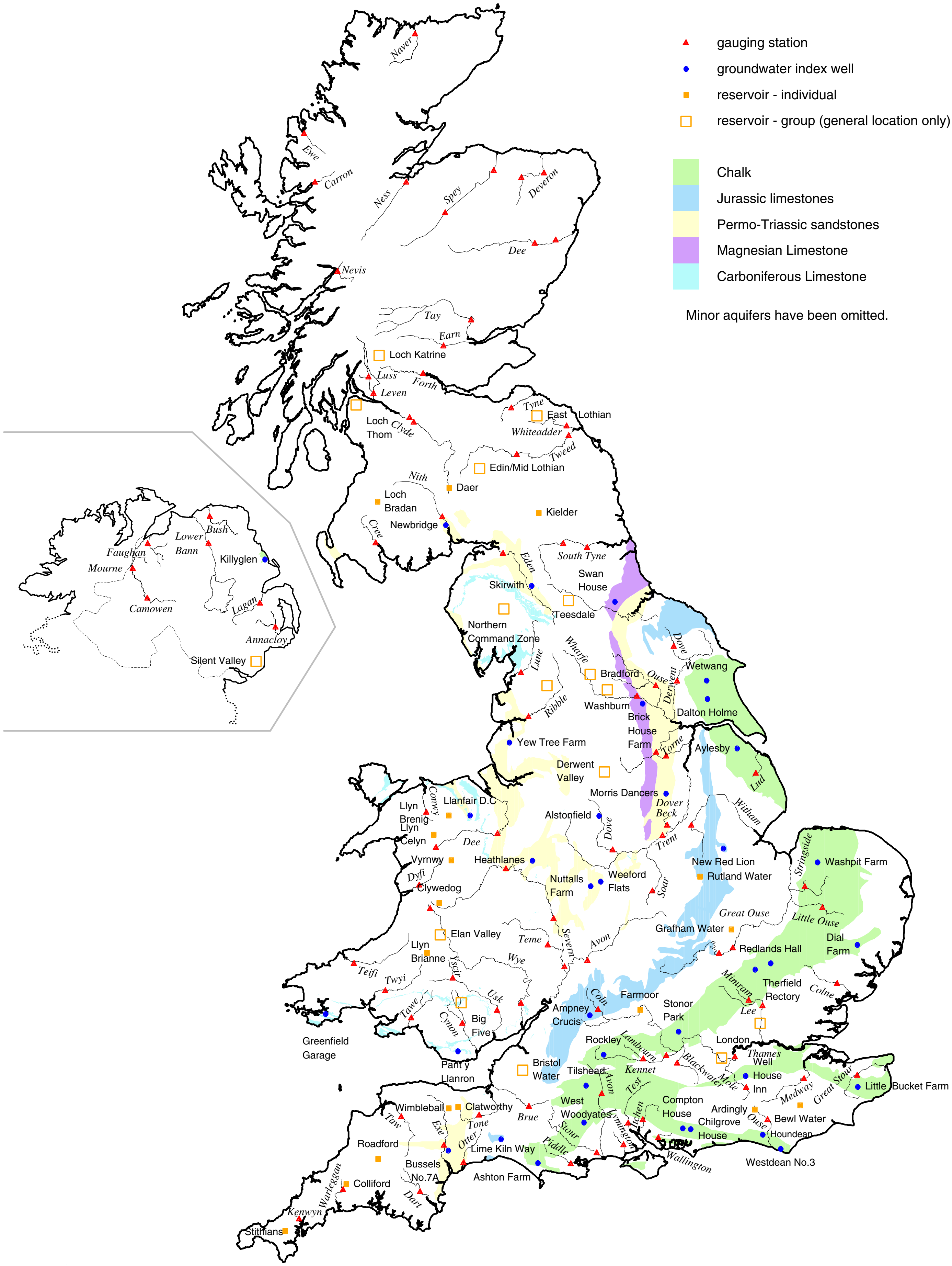
( ) figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence

** 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:

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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

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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

03/2014

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