Hydrological Summary for the United Kingdom

April 2014

General

April was a mild month of sunshine and showers. In a series from 1910, only two previous Aprils have been warmer, and the Central England Temperature series indicates that 2014 marks the third warmest beginning to a year since 1659. Near-average rainfall was registered at the national scale, but the underlying spatial variability was considerable as rainfall anomalies varied by an order of magnitude. Whilst parts of central southern England received more than 200% of the long-term average rainfall, areas of East Anglia recorded less than 20%. Below average rainfall across a large area of England & Wales in April caused flows in many rivers to decline rapidly and fall below average, although most remained within the normal range. The exception to this is an area of groundwater-influenced catchments in central southern England that continue to register notably high flows in response to unprecedented winter rainfall. Conversely, moderate river flow deficiencies have become established in areas of Yorkshire, Lincolnshire and the north-east of Scotland. Although late-April rainfall temporarily reversed the normal seasonal drying trend, soil moisture deficits continued to track near average at the national scale, with the exception of Northern Ireland which was dry in April. Despite falling groundwater levels, ten Environment Agency groundwater flood alerts remained in effect at the end of April in central southern England. There were continued local impacts on property and sewerage systems, but it is unlikely that additional areas will be affected by groundwater flooding. With reservoir stocks mostly above average and the majority of groundwater levels within the normal range or higher, the water resources outlook remains healthy.

Rainfall

The middle of April (8th-19th) was largely fine and dry across much of the country, but this was bookended by very wet and unsettled weather at the beginning and the end of month. The first week was dull and wet, with particularly heavy rainfall on the 5th/6th affecting much of western Britain. Following the dry spell, easterly and southerly airflows became prevalent over the last ten days of April, bringing showers and heavy rain. A particularly intense event on the 20th caused widespread disruption on the motorways of southern England. Further widespread rainfall occurred on the 25th, and the final five days of the month featured a combination of thunder, hail and intense showers. The alternate occurrence of dry and wet weather in April generated near-average rainfall nationally, but there were important spatial variations. Southern areas of England & Wales were wetter than average, especially in central southern England, but below average rainfall was registered for Northern Ireland and most of the rest of England & Wales. East Anglia was particularly dry; a rain gauge at Wattisham (Suffolk) recorded only 12mm of rainfall in April. Further north, much of Scotland was moderately wet, with the exceptions of the north-east and the far north, which were dry. Following the unprecedentedly wet winter of 2013/14, the last two months have been notably dry for much of the UK, particularly so in Northern Ireland and eastern parts of Great Britain. Parts of north-east Scotland, Yorkshire, the Midlands and East Anglia have received less than 70% of long-term average rainfall, with coastal areas of Suffolk registering less than a third of normal rainfall.

River flows

Flows in responsive rivers increased during one or both of the wet periods in April, but spate conditions were generally superimposed upon river flow recessions that are typical for the time of year, exacerbated by the dryness throughout mid-month. High flows were prevalent in many rivers in Wales on the 7th, and maximum daily flows on the Cynon, Tawe, Tywi and Teifi were amongst the highest on record for the month. Thereafter, the majority of rivers in the UK began seasonal recessions, many of which remained unbroken at month-end (e.g. the Clyde, Faughan and Severn). Away from southern areas, some rivers in England & Wales were moderately low by month-end, with a similar pattern in Northern Ireland. Exceptionally low flows characterised some rivers in the north-east of Scotland; the Deveron registered its lowest average April flow in a series from 1959. Conversely, some rivers in southern England & Wales remained above average, exceptionally so in the groundwater-influenced catchments of central southern England. This is the legacy of the unprecedented wetness of winter 2013/14, although flows decreased to moderately above average by month-end (e.g. the Coln). Outflows from Great Britain tracked close to average by the end of April, but a steep decline through mid-month highlights the large spatial footprint of river flow recessions. Accumulated flows over March-April illustrate how quickly rivers have returned to the normal range across Northern Ireland, Wales and England (with the exception of groundwater-influenced catchments in central southern England) since the wettest winter on record.

Groundwater

Despite heavy late-April rainfall across southern England, water levels in the Chalk mostly fell back towards their normal range. The notable exceptions are at Dial Farm, where levels rose, and at Little Bucket Farm, Stonor Park and Therfield Rectory, where levels fell but remain exceptionally high. Conversely, levels in the Chalk in Yorkshire remain below average and are also low in Northern Ireland. An index of total storage in the Chalk aquifer indicates that, although peak levels were similar, they were much less sustained through 2013/14 than in 2000/01. Levels have fallen by more than 20m in parts of the Chalk of the South Downs over the last two months. In the Permo-Triassic sandstones, despite small falls, water levels remained above previously recorded monthly maxima in the north-west (for the fourth consecutive month) and were also very high in the south-west. Levels elsewhere in the Permo-Triassic sandstones were above average and continued rising in the Midlands. In the Upper Greensand at Lime Kiln Way, levels fell slightly but remained above the period of record monthly maximum for the third consecutive month. In the Magnesian Limestone, levels in the indicator boreholes fell but remained above (although closer to) average monthly levels. In the other limestone aquifers, levels were within the normal range, except for Ampney Crucis (Cotswolds) where they rose in the latter part of the month in response to rainfall.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

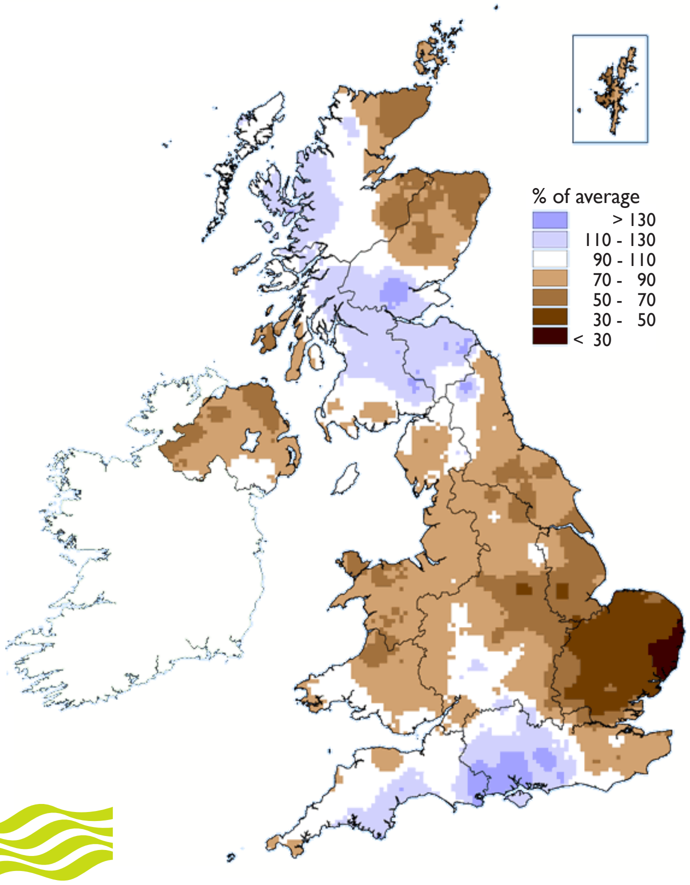
Area	Rainfall	Apr 2014	Mar14 – Apr14	RP	Nov13 – Apr14	RP	Aug13 – Apr14	RP	May13 – Apr14	RP
United	mm	**70**	151		776		1084		1290	
Kingdom	%	**105**	95	2-5	131	>100	123	70-100	120	20-35
England	mm	**55**	104		568		817		979	
	%	**99**	86	2-5	132	15-25	127	15-25	121	5-10
Scotland	mm	**97**	229		1076		1458		1720	
	%	**121**	108	2-5	132	80-120	122	30-50	119	25-40
Wales	mm	**82**	163		1016		1424		1661	
	%	**101**	83	2-5	132	25-40	126	20-35	122	10-20
Northern	mm	**43**	126		675		957		1220	
Ireland	%	**60**	76	2-5	114	10-15	107	5-10	110	5-10
England &	mm	**59**	112		630		901		1073	
Wales	%	**100**	86	2-5	132	20-30	127	15-25	121	8-12
North West	mm	**55**	146		760		1115		1374	
	%	**82**	88	2-5	122	10-15	118	5-10	118	5-10
Northumbrian	mm	**62**	123		535		798		1000	
	%	**105**	96	2-5	123	8-12	123	8-12	122	5-10
Severn-Trent	mm	**48**	94		487		717		913	
	%	**87**	82	2-5	124	8-12	122	8-12	122	5-10
Yorkshire	mm	**42**	98		480		706		890	
	%	**73**	78	2-5	112	2-5	111	2-5	111	2-5
Anglian	mm	**22**	45		308		496		611	
	%	**47**	50	8-12	105	2-5	109	2-5	103	2-5
Thames	mm	**61**	97		585		787		907	
	%	**120**	93	2-5	163	>100	146	70-100	131	15-25
Southern	mm	**80**	117		737		982		1085	
	%	**153**	105	2-5	177	>100	158	>100	141	30-50
Wessex	mm	**88**	139		748		989		1126	
	%	**157**	110	2-5	159	>100	142	60-90	131	15-25
South West	mm	**101**	179		948		1335		1502	
	%	**141**	106	2-5	137	30-50	135	30-50	126	10-20
Welsh	mm	**81**	159		979		1381		1610	
	%	**102**	84	2-5	133	25-40	127	25-40	123	10-20
Highland	mm	**119**	281		1257		1698		1987	
	%	**128**	110	2-5	125	15-25	117	10-15	115	10-15
North East	mm	**62**	112		656		867		1074	
	%	**96**	79	2-5	133	15-25	116	2-5	113	2-5
Tay	mm	**90**	201		1019		1330		1550	
	%	**133**	108	2-5	142	>100	127	30-50	123	15-25
Forth	mm	**90**	208		822		1119		1333	
	%	**145**	126	10-15	133	50-80	122	20-30	118	10-20
Tweed	mm	**88**	182		732		1007		1211	
	%	**146**	129	5-10	145	>100	134	50-80	128	15-25
Solway	mm	**83**	216		1091		1520		1822	
	%	**104**	107	2-5	141	>>100	132	>>100	130	>100
Clyde	mm	**104**	279		1325		1806		2120	
	%	**115**	111	2-5	136	80-120	124	40-60	122	30-50

% = 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 January 2014 (inclusive) are provisional.

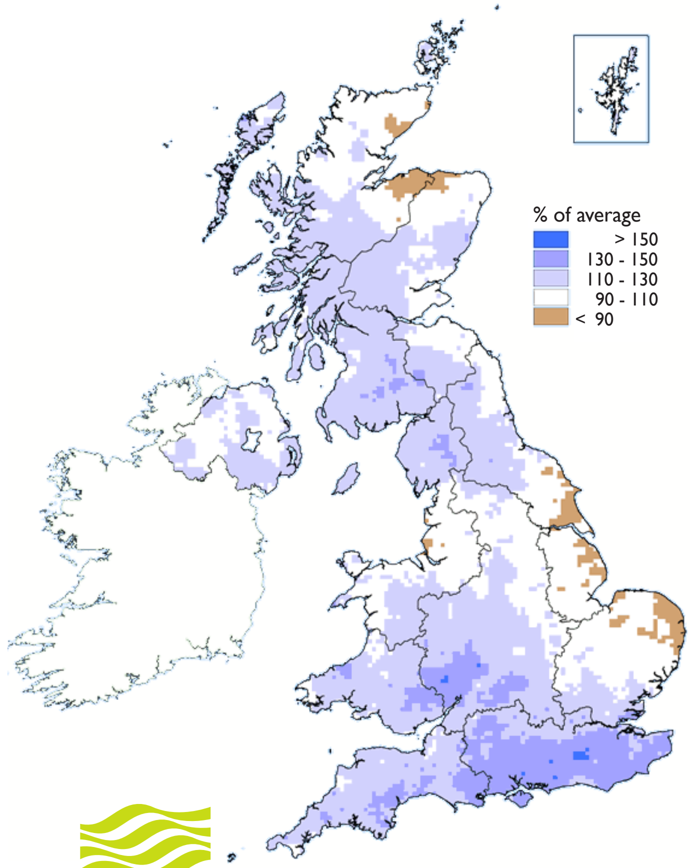
Rainfall . . . Rainfall . . .

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



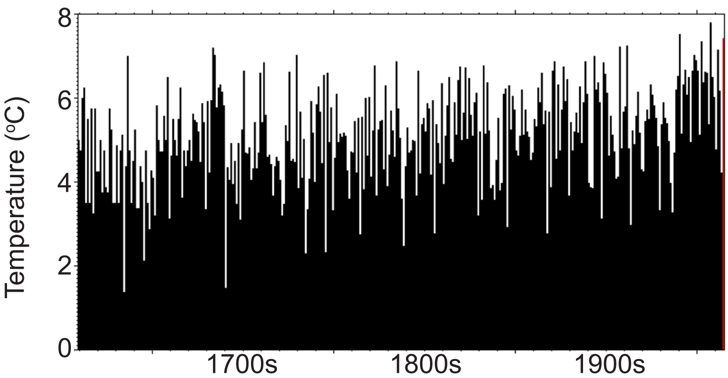
Met Office

May 2013 - April 2014 rainfall as % of 1971-2000 average

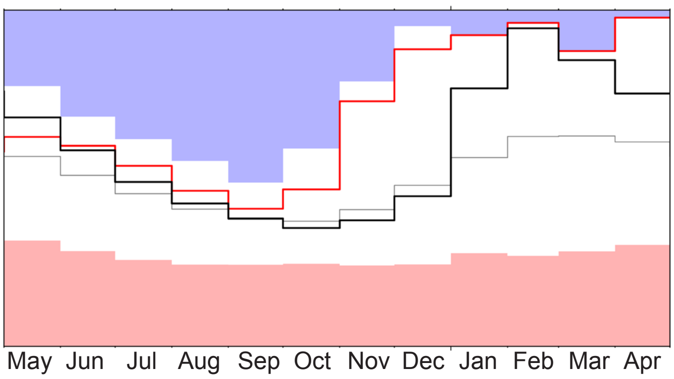


Met Office

Mean Jan - Apr Central England Temperature



Chalk borehole index: 2013/2014 (black); 2000/2001 (red)



Met Office

Met Office 3-month outlook Updated: April 2014

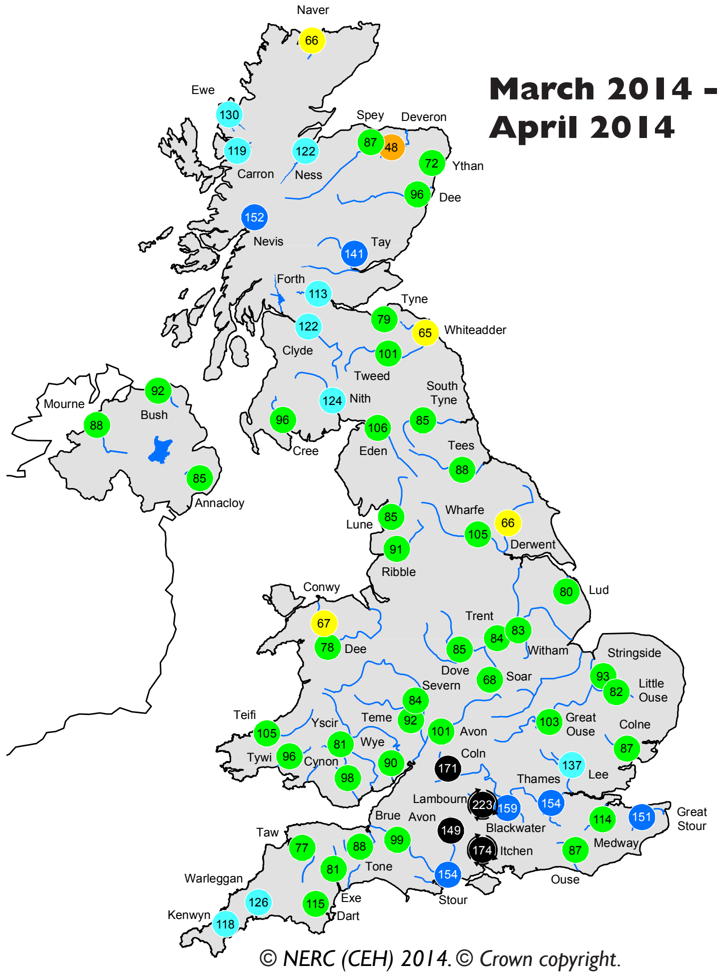
Latest predictions for UK precipitation are largely indistinguishable from climatology for both May and May-June-July as a whole.

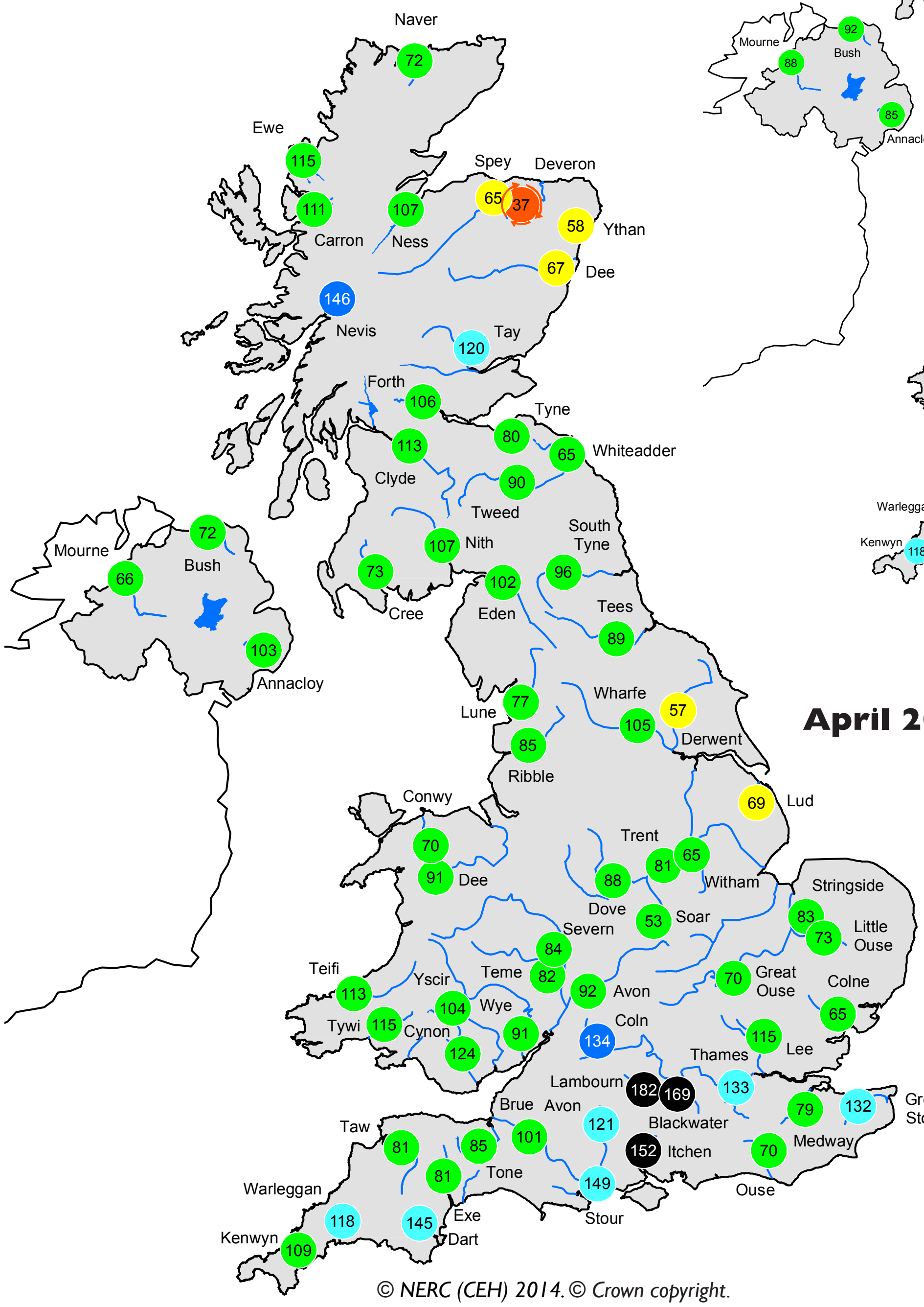
The probability that UK precipitation for May-June-July will fall into the driest of our five categories is between 20% and 25% and the probability that it will fall into the wettest category is close to 25% (the 1981-2010 probability for each of these categories is 20%).

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 ...





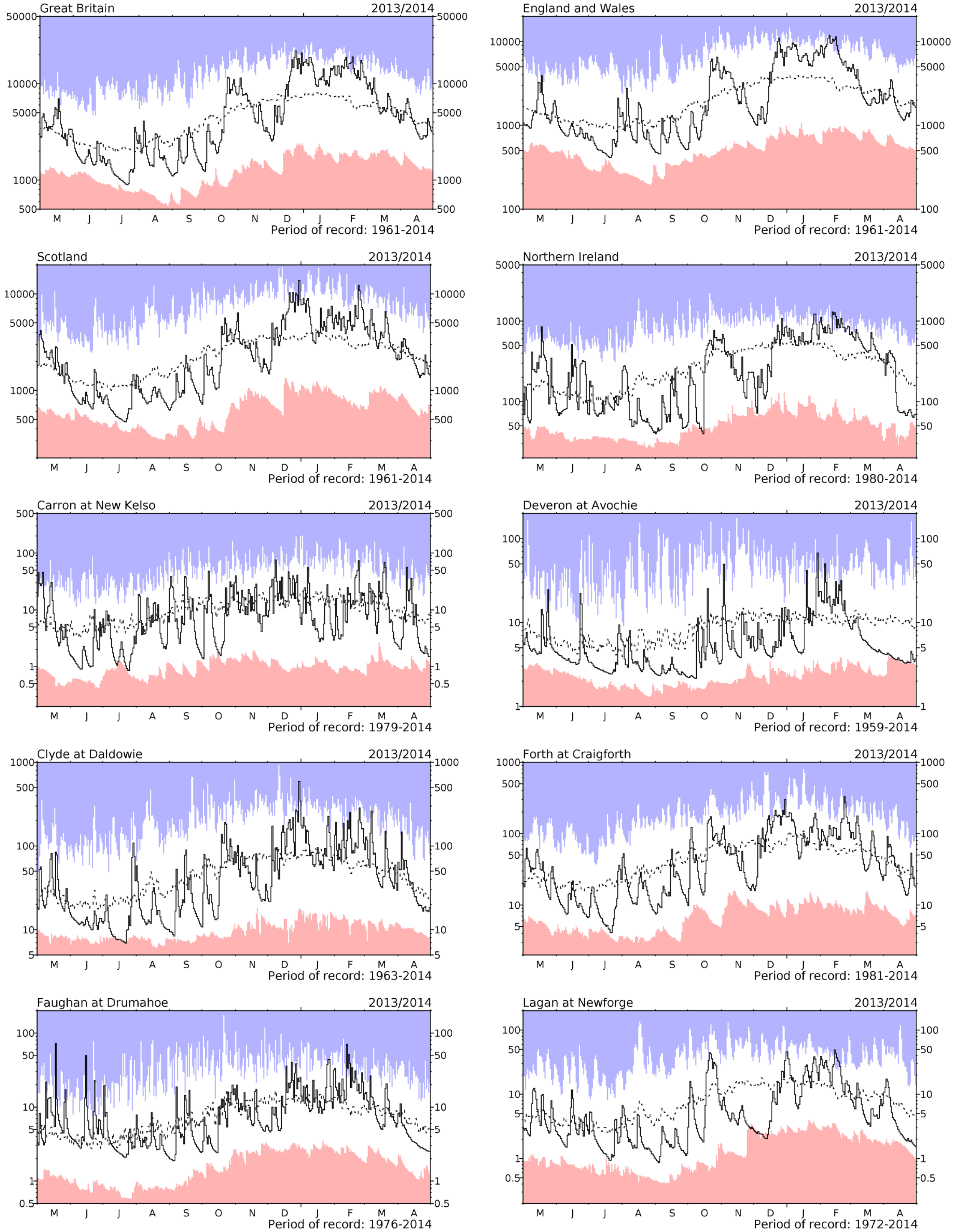
Key

- 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

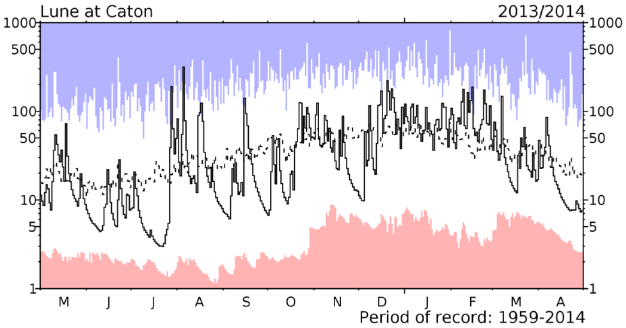
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

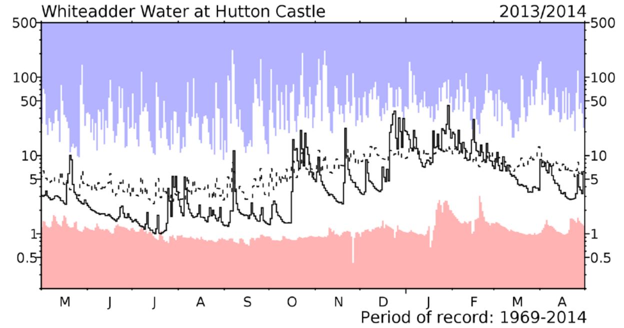


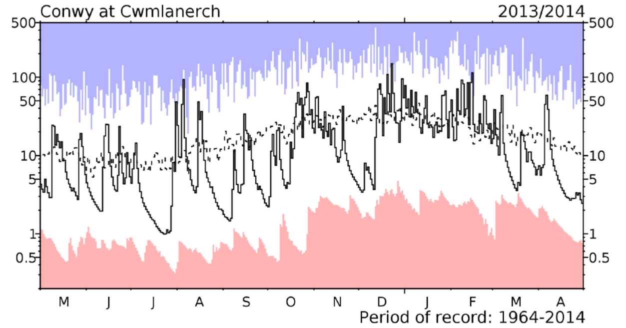
River flow hydrographs

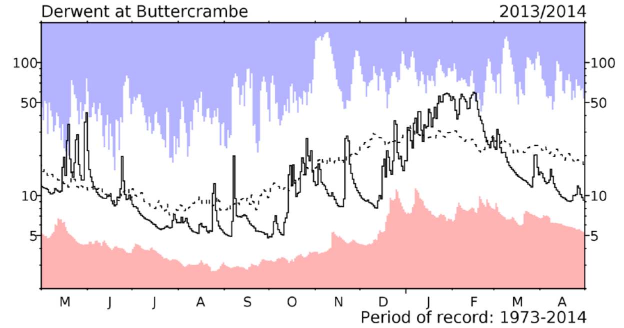
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to May 2013 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed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

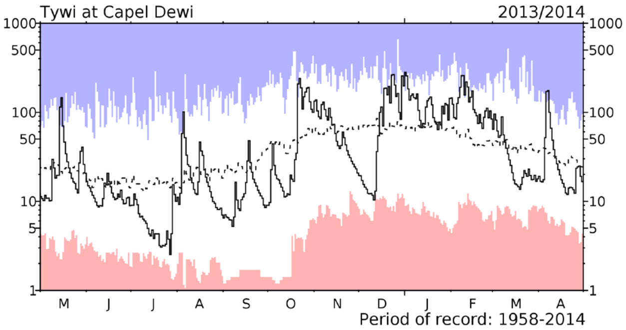
River flow . . . River flow . . .

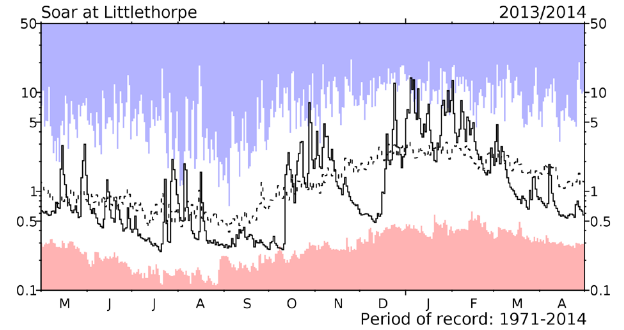


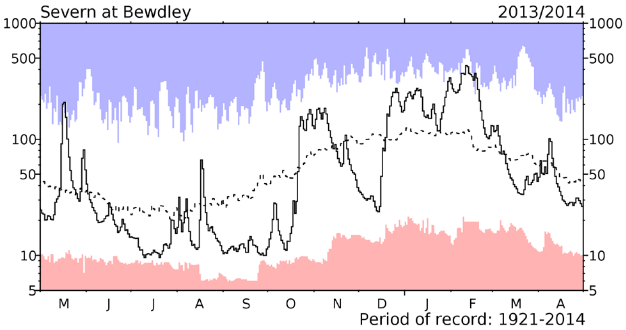


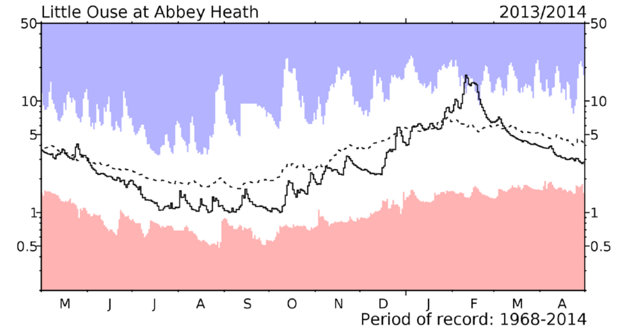


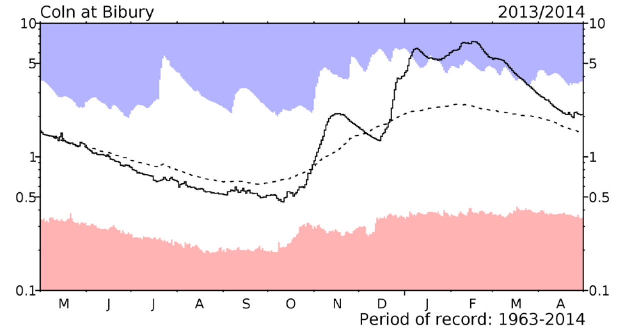


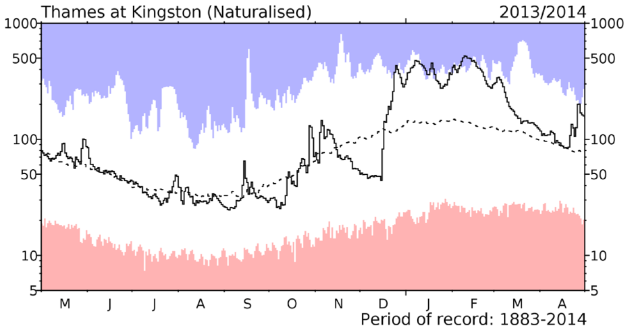


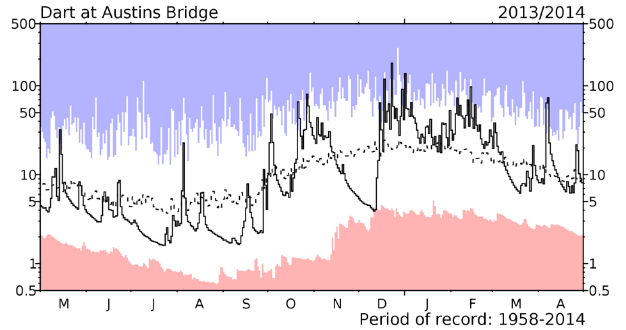


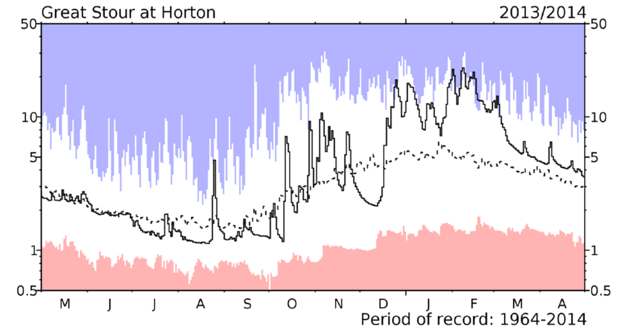




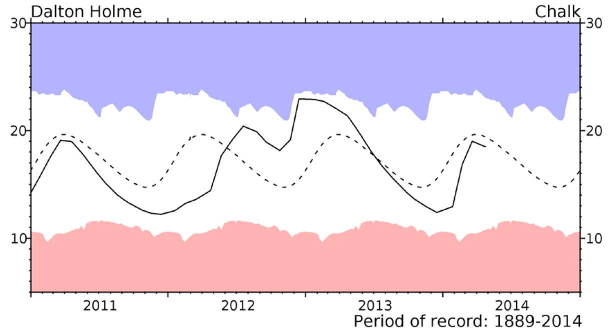


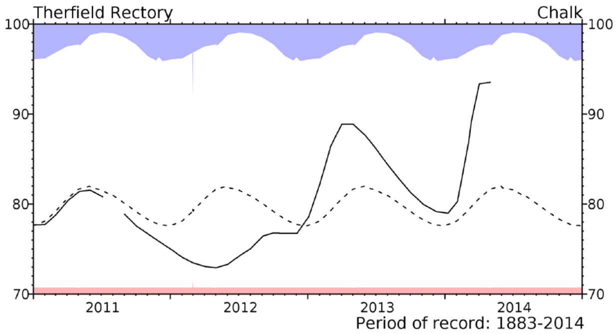


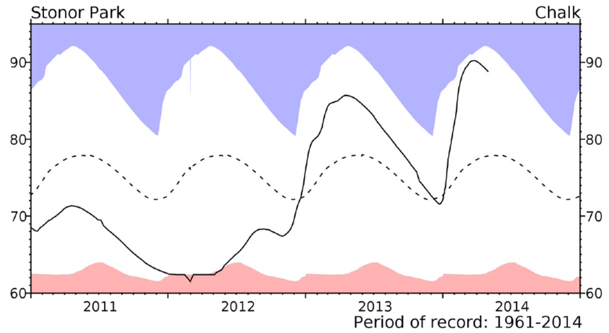


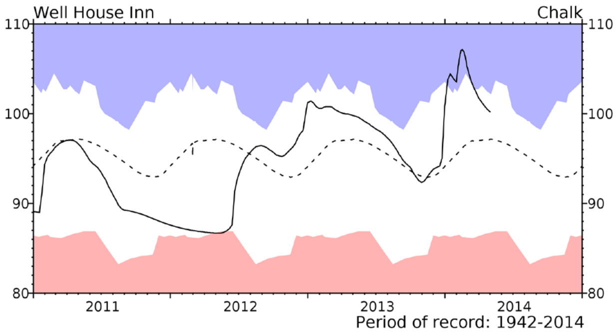


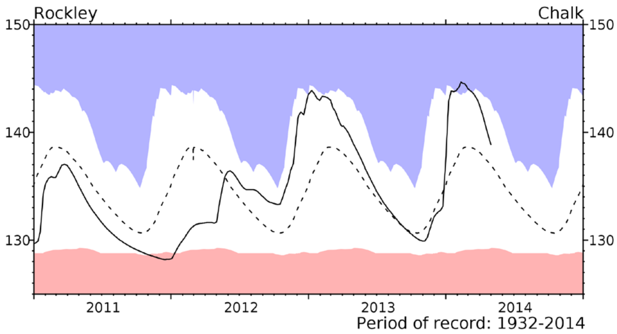
Groundwater . . . Groundwater

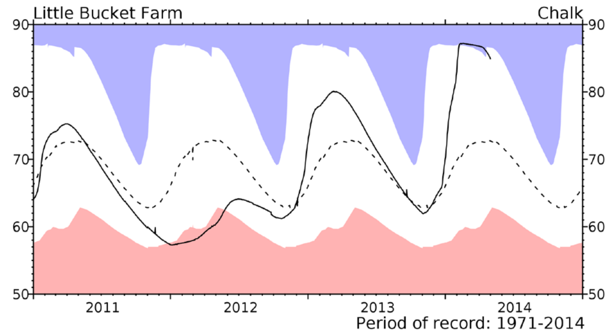


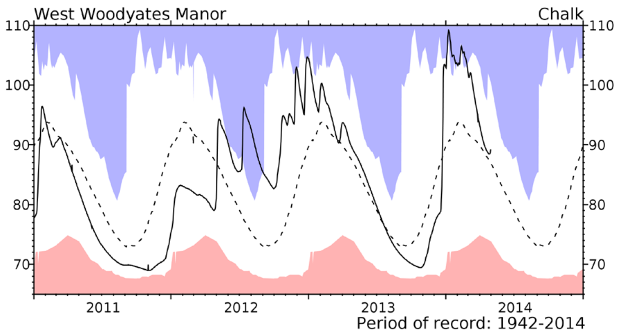


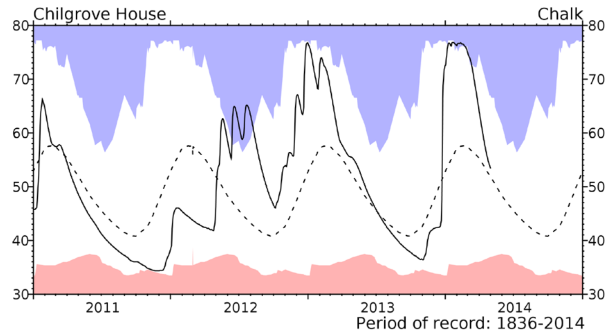


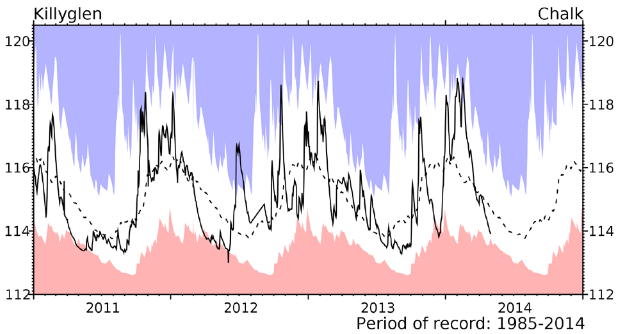


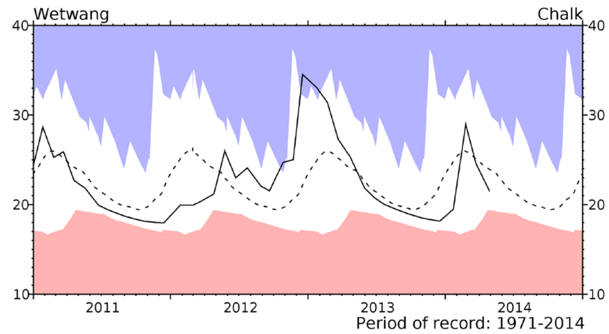






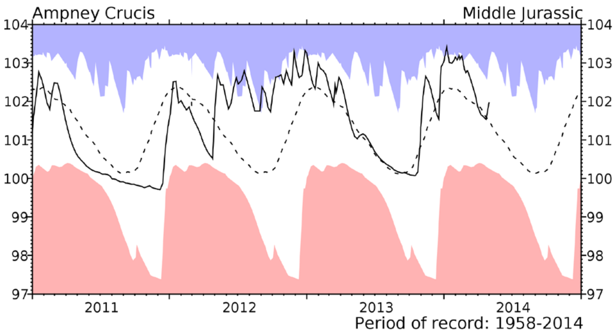


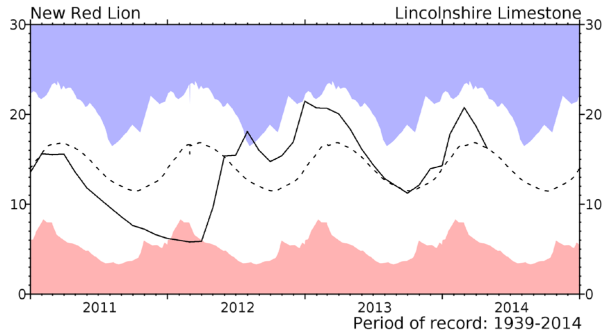


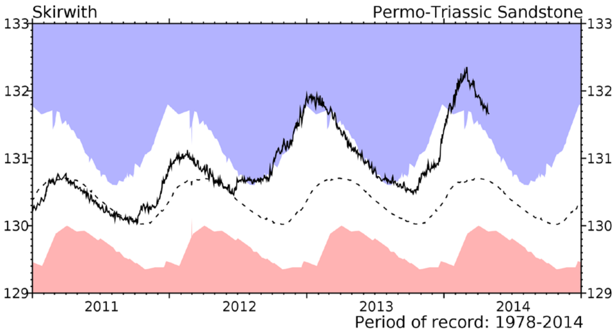


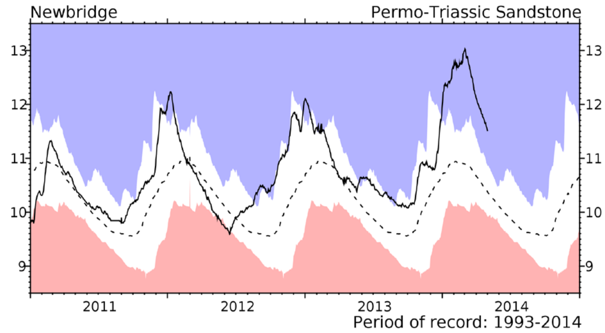
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

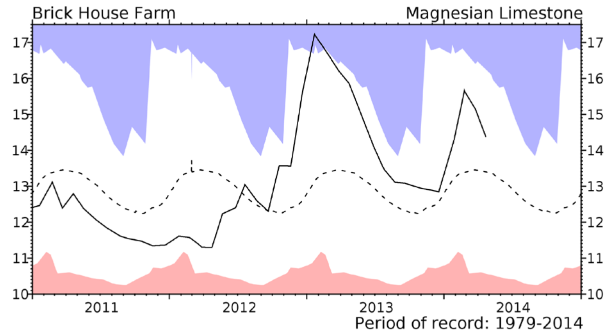
Groundwater ... Groundwater

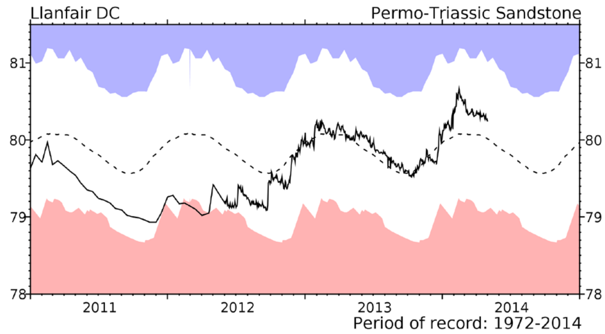


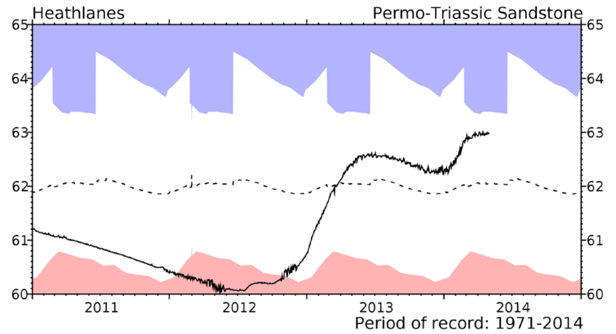


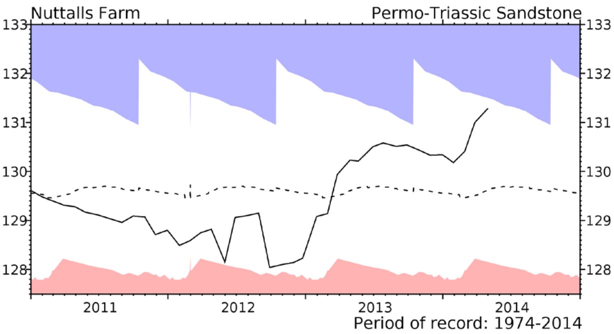


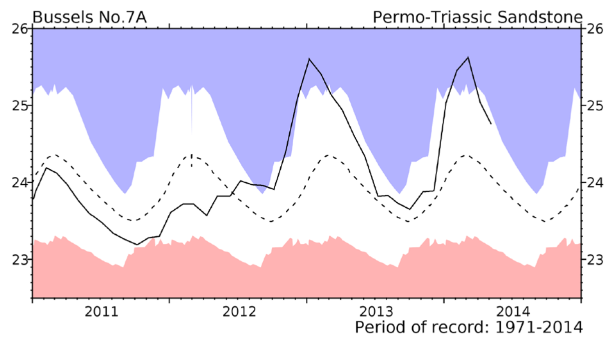


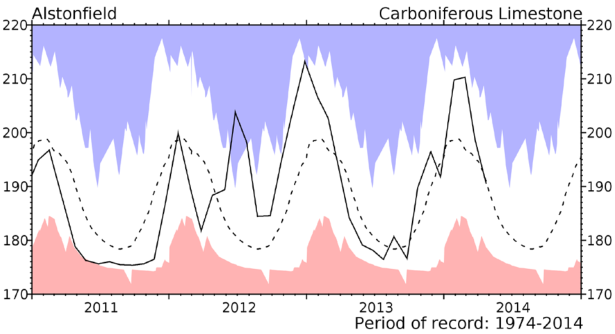










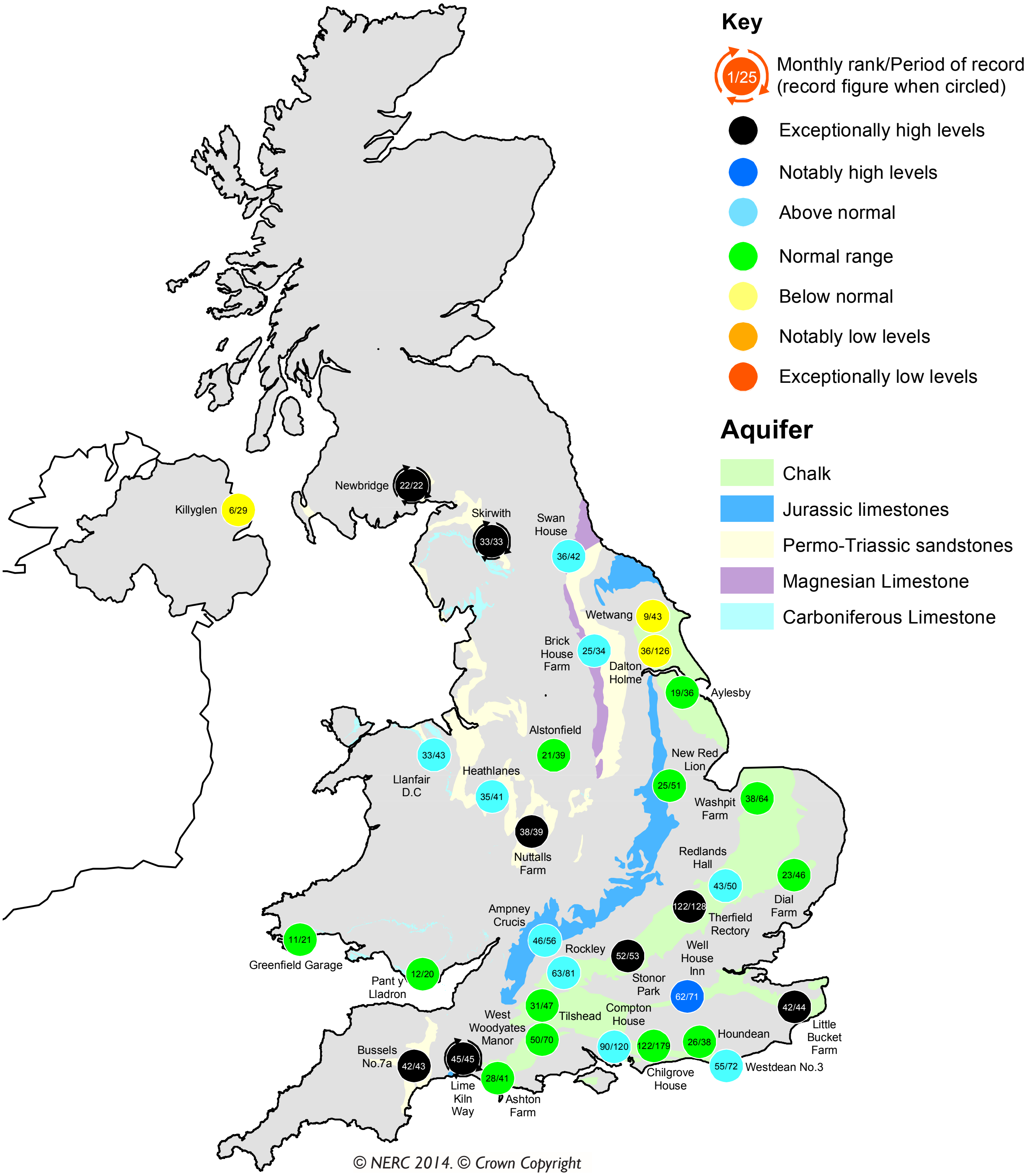


Groundwater levels April / May 2014

Borehole	Level	Date	Apr av.	Borehole	Level	Date	Apr av.	Borehole	Level	Date	Apr av.
Dalton Holme	18.49	24/04	19.48	Chilgrove House	53.38	01/05	52.26	Brick House Farm	14.38	22/04	13.38
Therfield Rectory	93.51	01/05	80.65	Killyglen (NI)	113.93	30/04	114.87	Llanfair DC	80.25	01/05	80.03
Stonor Park	88.83	01/05	77.36	Wetwang	21.53	28/04	23.99	Heathlanes	62.97	30/04	61.98
Tilshead	93.48	30/04	92.42	Ampney Crucis	101.96	01/05	101.68	Nuttalls Farm	131.28	30/04	129.53
Rockley	138.87	01/05	137.50	New Red Lion	16.23	30/04	16.18	Bussels No.7a	24.76	06/05	24.18
Well House Inn	100.20	01/05	97.07	Skirwith	131.67	30/04	130.70	Alstonfield	190.62	23/04	192.19
West Woodyates	89.14	30/04	88.35	Newbridge	11.51	01/05	10.52				

Levels in metres above Ordnance Datum

Groundwater...Groundwater



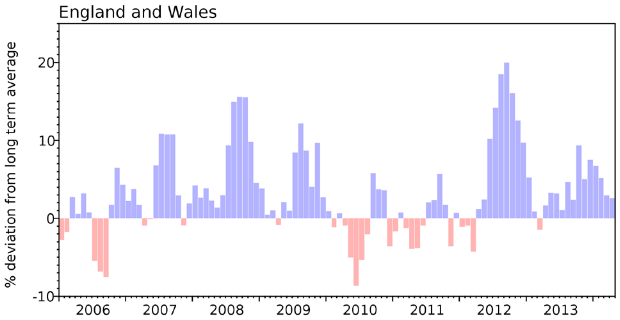
© NERC 2014. © Crown Copyright

Groundwater levels - April 2014

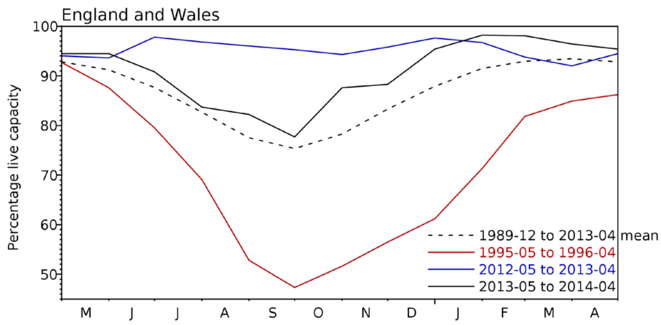
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Feb	2014 Mar	2014 Apr	Apr Anom.	Min Apr	Year* of min	2013 Apr	Diff 14-13
North West	N Command Zone	•	124929	100	93	88	0	65	1984	87	1
	Vyrnwy		55146	100	99	96	4	70	1996	100	-4
Northumbrian	Teesdale	•	87936	100	100	93	2	74	2003	94	-1
	Kielder		(199175)	99	93	93	2	85	1990	90	3
Severn-Trent	Clywedog		44922	91	96	99	2	85	1988	99	0
	Derwent Valley	•	39525	99	94	89	-4	54	1996	83	6
Yorkshire	Washburn	•	22035	96	92	85	-5	76	1996	93	-8
	Bradford Supply	•	41407	100	100	93	2	60	1996	93	0
Anglian	Grafham		(55490)	95	95	96	2	73	1997	95	1
	Rutland		(116580)	95	96	96	5	72	1997	95	1
Thames	London	•	202828	95	95	97	3	86	1990	96	1
	Farmoor	•	13822	97	99	96	-1	81	2000	98	-2
Southern	Bewl		28170	100	100	100	10	60	2012	100	0
	Ardingly**		4685	100	100	100	1	69	2012	100	0
Wessex	Clatworthy		5364	100	98	94	1	81	1990	93	1
	Bristol	•	(38666)	99	99	99	6	83	2011	95	4
South West	Colliford		28540	100	100	100	13	56	1997	99	1
	Roadford		34500	99	97	96	12	41	1996	91	5
	Wimbleball		21320	100	99	99	4	79	1992	100	-1
	Stithians		4967	100	100	100	9	65	1992	93	7
Welsh	Celyn & Brenig	•	131155	100	100	100	2	75	1996	100	-1
	Brianne		62140	100	97	100	3	86	1997	99	1
	Big Five	•	69762	99	98	97	4	85	2011	96	1
	Elan Valley	•	99106	100	98	97	1	83	2011	95	2
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	100	99	97	4	62	1998	98	-1
	East Lothian	•	10206	100	100	99	1	89	1992	100	-1
Scotland(W)	Loch Katrine	•	111363	97	92	91	0	80	2010	92	-1
	Daer		22412	100	94	86	-9	78	2013	78	8
	Loch Thom	•	11840	100	100	100	6	83	2010	89	11
Northern Ireland	Total+	•	56800	94	92	87	-1	77	2007	98	-11
	Silent Valley	•	20634	100	96	92	9	58	2000	99	-7

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

** the monthly record of Ardingly reservoir stocks is under review.

+ excludes Lough Neagh

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

© NERC (CEH) 2014.

Location map…Location map

© NERC (CEH, BGS) 2014. © Crown copyright.

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:

Hydrological Summaries for the UK
Centre for Ecology & Hydrology
Maclean Building
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

Some of the features displayed on the maps contained in this report are based on the following data with permission of the controller of HMSO.

i. Ordnance Survey data. © Crown copyright and/or database right 2005. Licence no. 100017897.
ii. Land and Property Services data. © Crown copyright and database right, S&LA 145.
iii. Met Office rainfall data. © Crown copyright.

All rights reserved. Unauthorised reproduction infringes crown copyright and may lead to prosecution or civil proceedings.

Text and maps in this document are © NERC (CEH) 2014 unless otherwise stated and may not be reproduced without permission.

05/2014

NERC SCIENCE OF THE ENVIRONMENT