Hydrological Summary
for the United Kingdom

October 2014

General
A prevalence of southerly airflows meant that October was another notably mild month. It was also very unsettled and the rainfall – seven times that for September at the national scale – had a transformative impact, albeit initially moderated by seasonally high soil moisture deficits. Runoff rates entering October were depressed over wide areas, but from the end of the first week flood alerts became increasingly common. Generally, the peak flows were not exceptional and October runoff totals were in the normal range across most of the UK, but substantially above average for many rivers draining the Scottish Highlands. The seasonally arid soils early in the month were close to saturation by the final week across most western and northern areas but significant soil moisture deficits remain in parts of eastern and central England. Stocks in most major reservoirs increased appreciably through October and overall stocks for England & Wales were marginally above the late-October average; however, modest declines in stocks were registered for a few impoundments (e.g. in Yorkshire and Cornwall). The spatially very variable October rainfall and soil moisture patterns, together with contrasting aquifer characteristics, made for regional and local variations in recharge amounts through the month, but groundwater levels across the major aquifer outcrop areas are generally within, or above, the normal late-autumn range (often reflecting exceptionally high levels recorded during the late winter). Seasonal recoveries in groundwater levels should gather momentum through the late autumn and the general water resources outlook is good.

Rainfall
The notably dry episode extending over the previous five weeks ended abruptly during the first week of October as a sequence of vigorous low pressure systems brought high winds and substantial rainfall to many areas (e.g. 75mm at Eskdalemuir, Dumfries and 96mm at Drumburgh, Cumbria on the 3rd). The very unsettled weather then persisted through the rest of the month. Persistent frontal rain occurred in southern England and the Midlands on the 12th/13th, while on the 21st remnants of Hurricane Gonzalo brought strong winds and localised heavy rainfall to the north and west. Subsequently, successive slow-moving frontal systems brought sustained heavy rainfall to western Scotland (106mm was recorded at Kinlochewe on the 26th and three-day totals of over 200mm were recorded in a few places). October rainfall totals were around twice the average in a few areas (e.g. adjacent to the Moray and Solway Firths). Rainfall totals were appreciably above average in all regions and Scotland registered its third wettest October in a series from 1910. Importantly though some areas missed the bulk of the storms and a few (e.g. in Yorkshire) recorded <70% of the monthly average. The exceptional dryness of September contributes to a few regional rainfall deficiencies in the March-October timeframe (e.g. for Wales) but rainfall accumulations for 2014 thus far are above average for all regions, and notably high for accumulations over the last 12 months – the wettest on record for the UK (in the November-October timeframe).

River flows
In the first few days of October, rivers across the UK saw a continuation of the sustained September recessions, but these were interrupted smartly following the intense storms during the first week, particularly in responsive catchments in the north and west. Spate conditions were common throughout the month, and were associated with numerous fluvial flood alerts and some flood warnings (tidal flood warnings were also common). For example, flood warnings were in place in central and eastern England on the 13th/14th and were widespread in Scotland during the storms of the 26th – 28th. Peak river flows were generally not outstanding but in Scotland the Deveron and Ewe reached their highest October flows in records from 1961 and 1970 respectively. Generally, October runoff totals were in the normal range across the majority of the UK, with above-normal totals in parts of northern Scotland (and notably high totals in some rivers draining the western Highlands) and some permeable catchments in England (still benefitting from seasonally high groundwater contibutions), and below-normal in a few which missed the heaviest rainfall (e.g. the Taw in Devon and the Bush in Northern Ireland). Runoff accumulations over the short-term are generally unremarkable, partly reflecting the between-month contrasts since the summer, although the August-October runoff in Scotland was exceptionally high. Accumulations since the late spring generally show a very similar spatial pattern: above-normal runoff in northern Scotland and southeast England contrasting with moderate deficiencies in western England, Wales and southwest Scotland and normal accumulations elsewhere.

Groundwater
Soil moisture deficits generally decreased substantially during October, but remained sufficient throughout much of the month to inhibit recharge to most aquifers. Correspondingly, groundwater levels continued to fall in most index wells and boreholes. Nonetheless, October groundwater levels were generally within, or above, the normal monthly range – notably so in the slowest responding aquifers where the impact of the heavy 2013/2014 winter recharge remains very evident (see the hydrographs for Skirwith and Lime Kiln Way for example). In the Chalk, levels at the index sites have generally fallen with the exception of West Woodyates, Killyglen and Houndean Bottom; these all recorded rises of around 1-2 m. Levels are in the normal range or just above, with the exception of Stonor (in the slower-responding Chilterns) where they remain notably high. In both the Jurassic and Magnesian limestones levels are also in the normal range or slightly above for the time of year; however the levels in the Jurassic limestones levels rose, whilst those in the Magnesian limestone continued to recede. Levels remain above average throughout the Permo-Triassic sandstones and exceptionally high in the Upper Greensand of south-west England. In the Carboniferous Limestone, levels at sites in both South Wales and the Peak District rose during October. The only index sites where October levels were below average are in the responsive Chalk at Compton, Chilgrove (both in the South Downs) and Killyglen (Northern Ireland) and the Carboniferous Limestone at Greenfield Garage (south-west Wales). At the national scale, groundwater resources therefore remain in a healthy situation with the autumn/winter recharge season generally commencing from an average, or above average, baseline.

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.

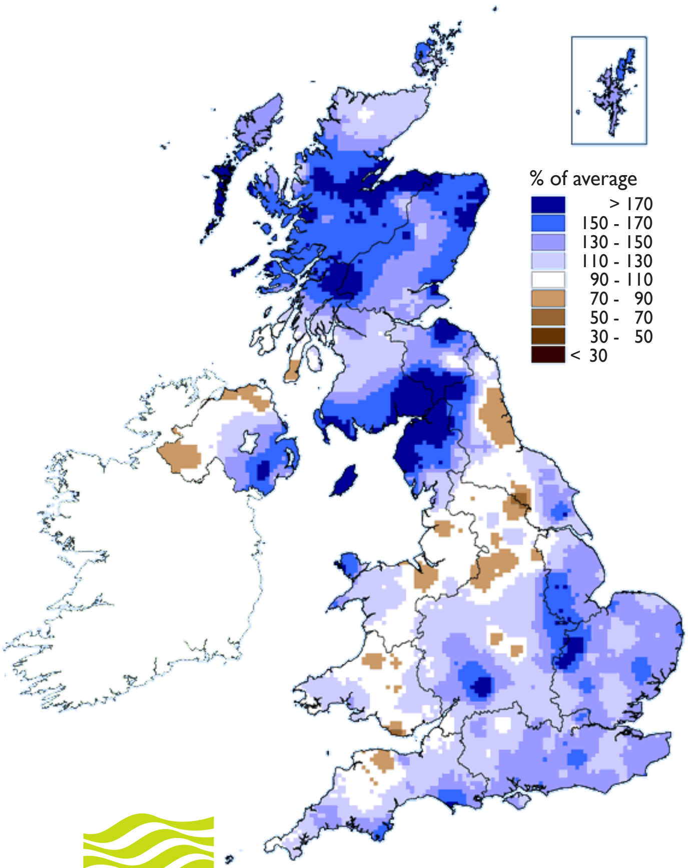
Area	Rainfall	Oct 2014	Sep14 – Oct14	RP	Aug14 – Oct14	RP	Mar 14 – Oct14	RP	Nov13 – Oct14	RP
United	mm	**159**	181		321		688		1323	
Kingdom	%	**141**	86	2-5	111	2-5	106	2-5	122	40-60
England	mm	**106**	121		230		527		995	
	%	**129**	79	2-5	105	2-5	104	2-5	122	10-15
Scotland	mm	**248**	285		474		952		1825	
	%	**161**	100	2-5	123	5-10	114	5-10	127	80-120
Wales	mm	**168**	186		331		736		1575	
	%	**115**	70	2-5	91	2-5	93	2-5	115	5-10
Northern	mm	**132**	143		283		623		1178	
Ireland	%	**115**	68	5-10	95	2-5	92	2-5	106	2-5
England &	mm	**114**	130		244		556		1075	
Wales	%	**126**	77	2-5	102	2-5	102	2-5	120	10-15
North West	mm	**179**	195		338		709		1329	
	%	**142**	85	2-5	104	2-5	99	2-5	113	2-5
Northumbrian	mm	**100**	118		226		542		960	
	%	**132**	81	2-5	104	2-5	104	2-5	116	2-5
Severn-Trent	mm	**83**	95		193		487		884	
	%	**118**	69	2-5	96	2-5	102	2-5	117	5-10
Yorkshire	mm	**85**	105		220		524		902	
	%	**111**	72	2-5	104	2-5	103	2-5	111	2-5
Anglian	mm	**80**	96		189		435		703	
	%	**140**	85	2-5	116	2-5	109	2-5	117	5-10
Thames	mm	**95**	109		207		467		946	
	%	**134**	82	2-5	110	2-5	105	2-5	135	30-50
Southern	mm	**121**	132		239		490		1108	
	%	**136**	83	2-5	112	2-5	103	2-5	142	50-80
Wessex	mm	**112**	128		235		551		1168	
	%	**128**	78	2-5	102	2-5	106	2-5	135	40-60
South West	mm	**145**	159		298		690		1491	
	%	**115**	71	2-5	97	2-5	102	2-5	124	15-25
Welsh	mm	**163**	180		323		720		1529	
	%	**115**	70	2-5	91	2-5	94	2-5	116	5-10
Highland	mm	**299**	349		603		1146		2141	
	%	**165**	103	2-5	135	10-15	119	5-10	125	30-50
North East	mm	**177**	217		413		728		1264	
	%	**175**	115	2-5	159	25-40	122	5-10	134	30-50
Tay	mm	**222**	252		413		844		1726	
	%	**165**	102	2-5	125	2-5	115	2-5	137	>100
Forth	mm	**175**	199		324		740		1375	
	%	**148**	89	2-5	106	2-5	109	2-5	122	10-20
Tweed	mm	**162**	181		311		672		1263	
	%	**170**	103	2-5	124	2-5	115	2-5	133	25-40
Solway	mm	**269**	284		432		914		1830	
	%	**173**	102	2-5	112	2-5	110	2-5	131	60-90
Clyde	mm	**272**	296		453		1048		2128	
	%	**143**	84	2-5	95	2-5	104	2-5	123	20-35

% = 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 May 2014 (inclusive) are provisional.

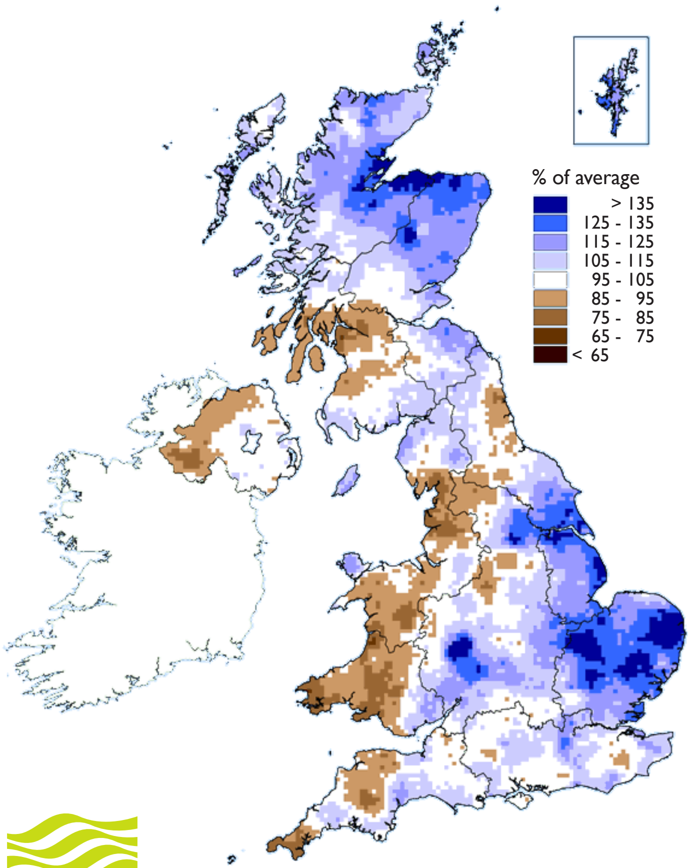
Rainfall . . . Rainfall . . .

October 2014 rainfall as % of 1971-2000 average



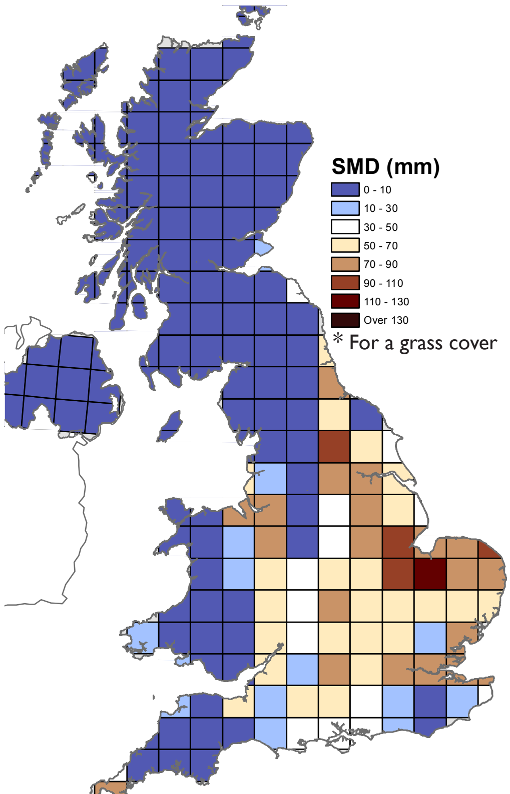
Met Office

May 2014 - October 2014 rainfall as % of 1971-2000 average



Met Office

MORECS Soil Moisture Deficits* October 2014



* For a grass cover

Met Office 3-month outlook Updated: October 2014

Met Office

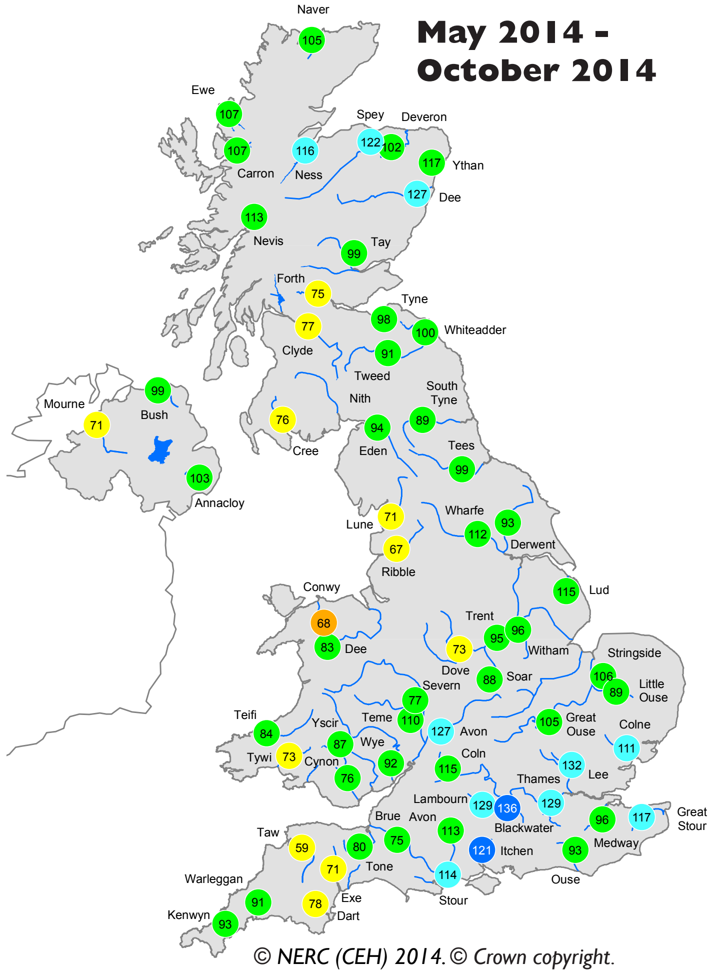
Latest predictions for UK-mean precipitation favour near- or above-average rainfall for November-December-January.

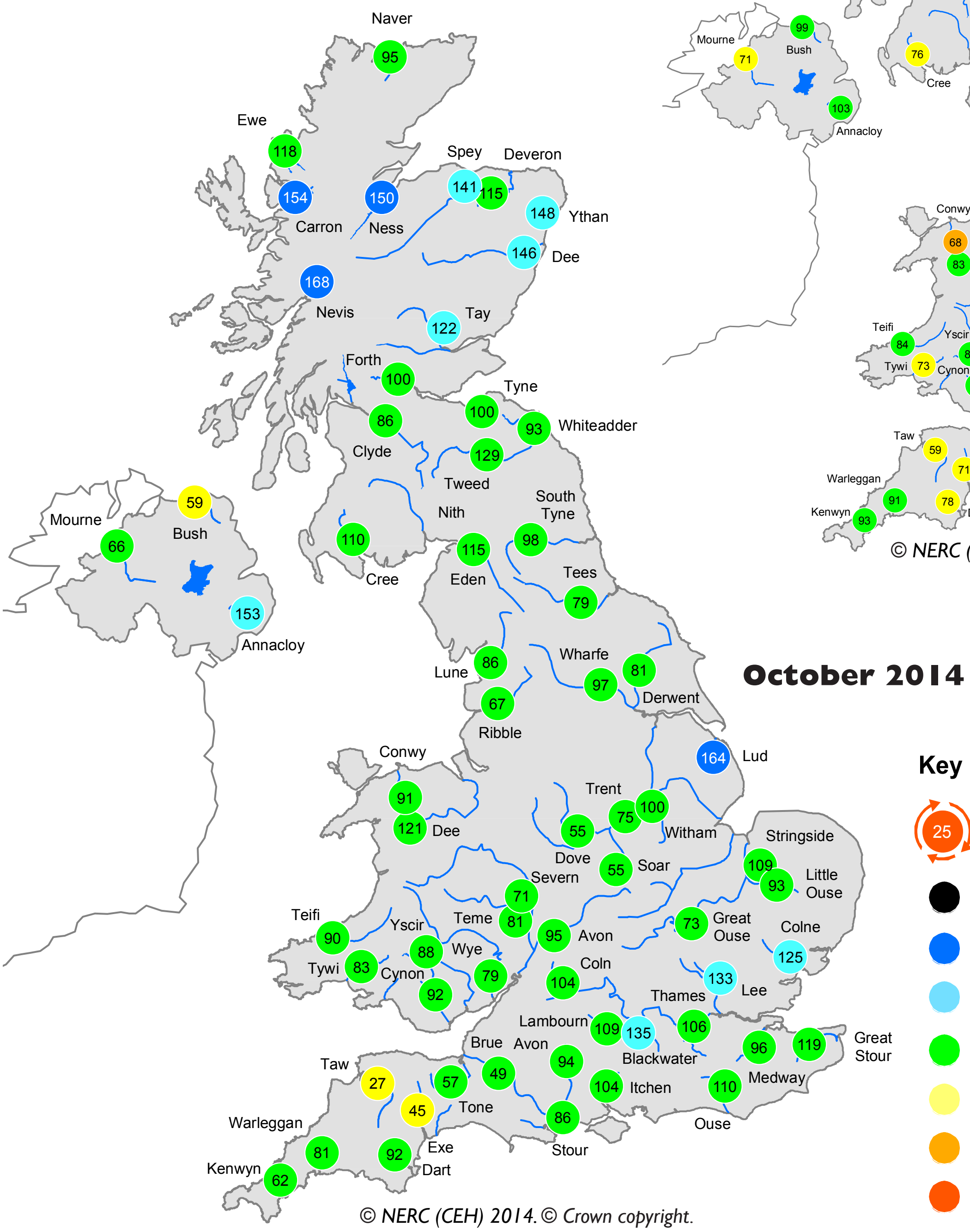
The probability that UK precipitation for November-December-January will fall into the driest of our five categories is around 15% and the probability that it will fall into the wettest category is around 25% (the 1981-2010 probability for each of these categories is 20%).

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)

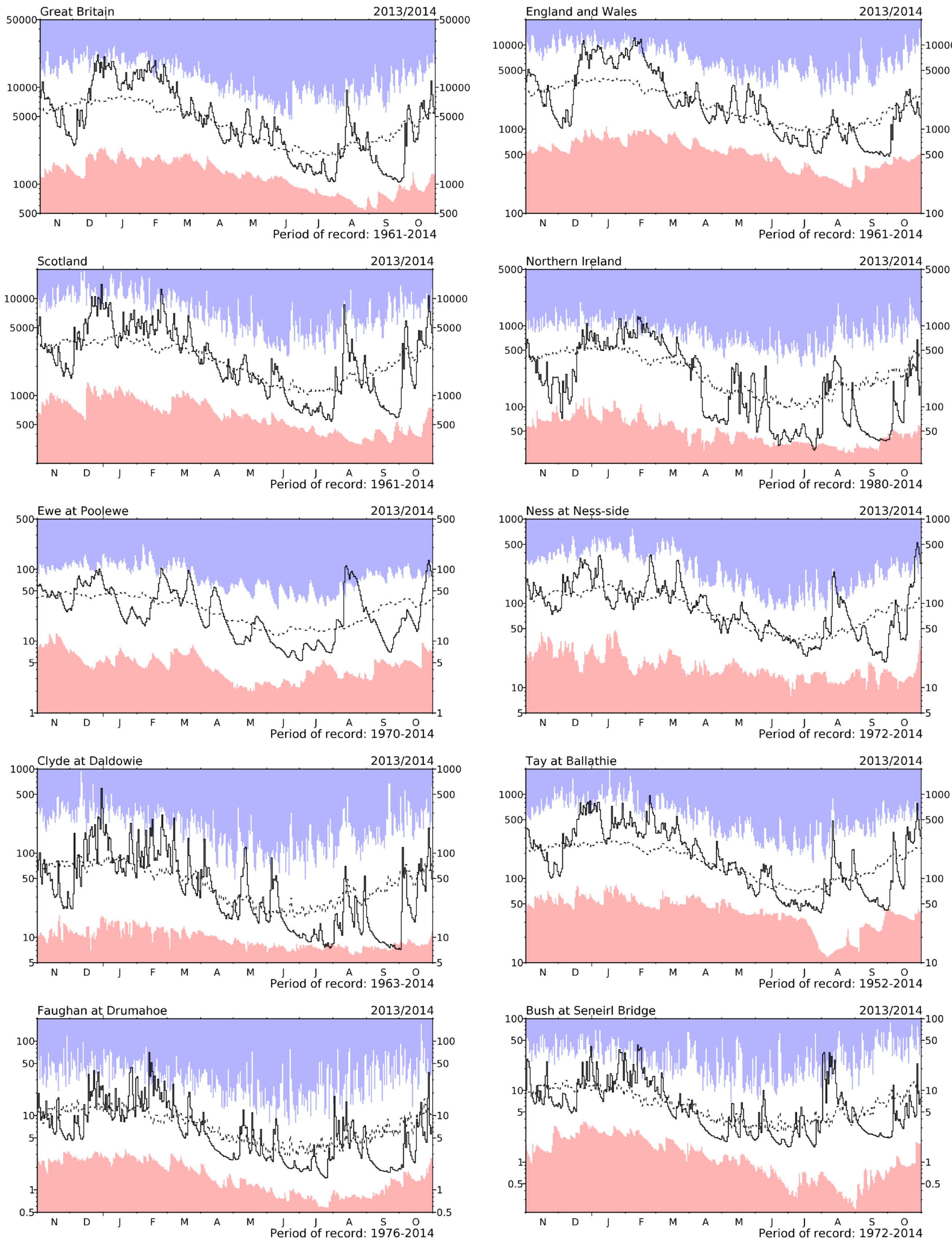
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

*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.

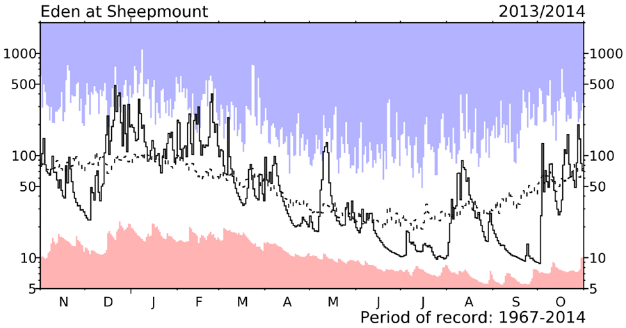
River flow . . . River flow . . .

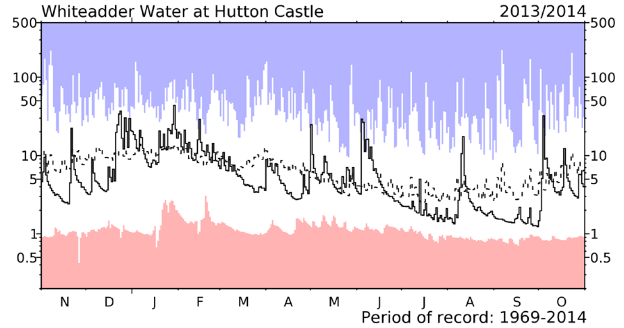


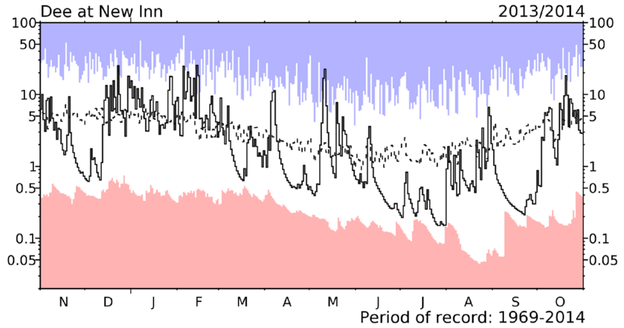
River flow hydrographs

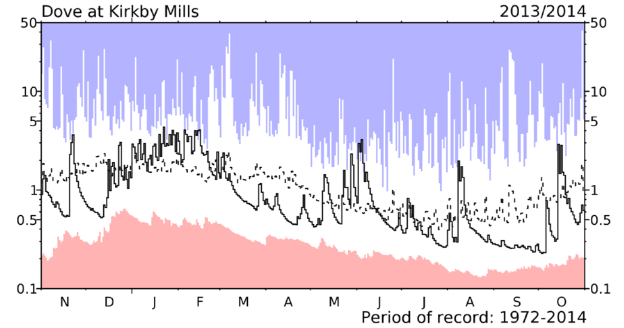
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to November 2013 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the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

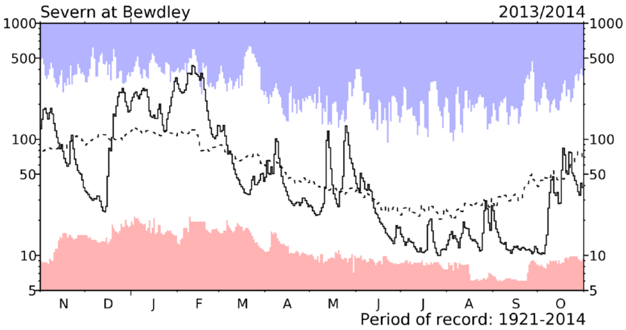
River flow . . . River flow . . .

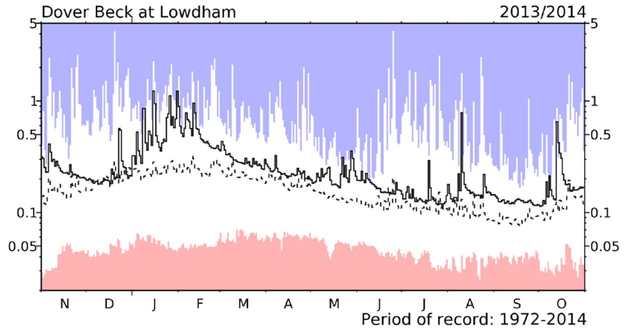


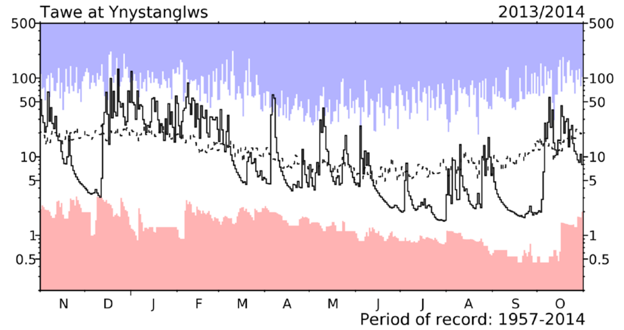


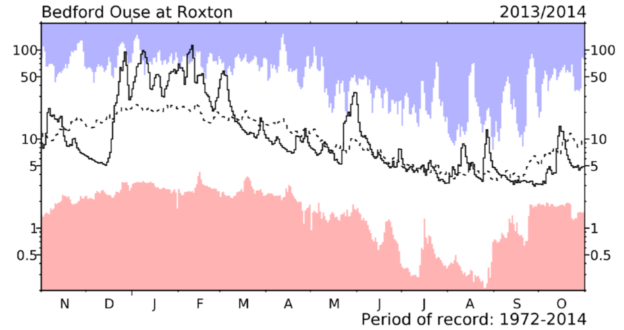


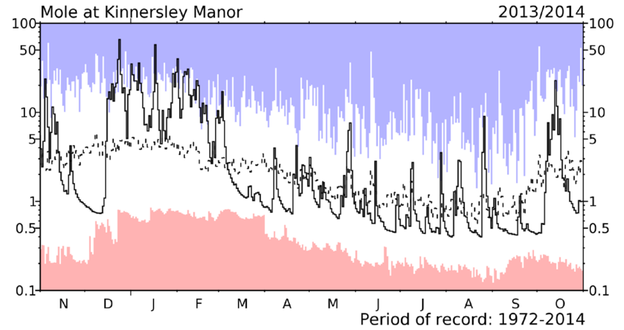


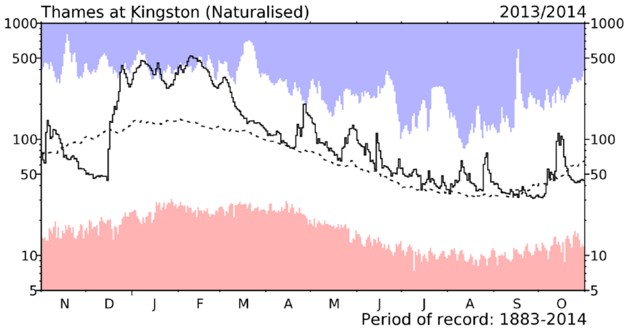


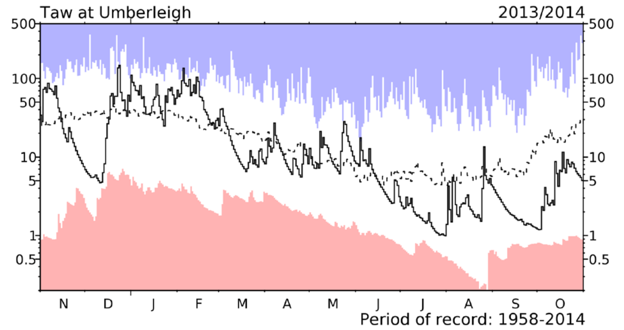


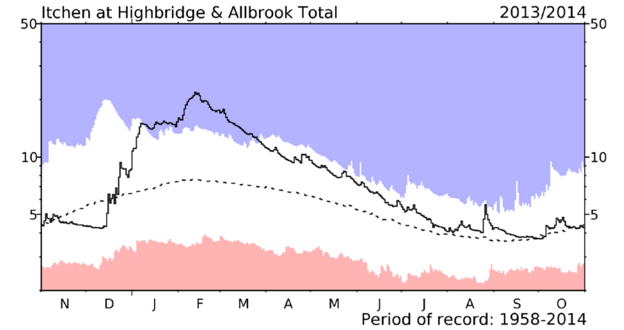




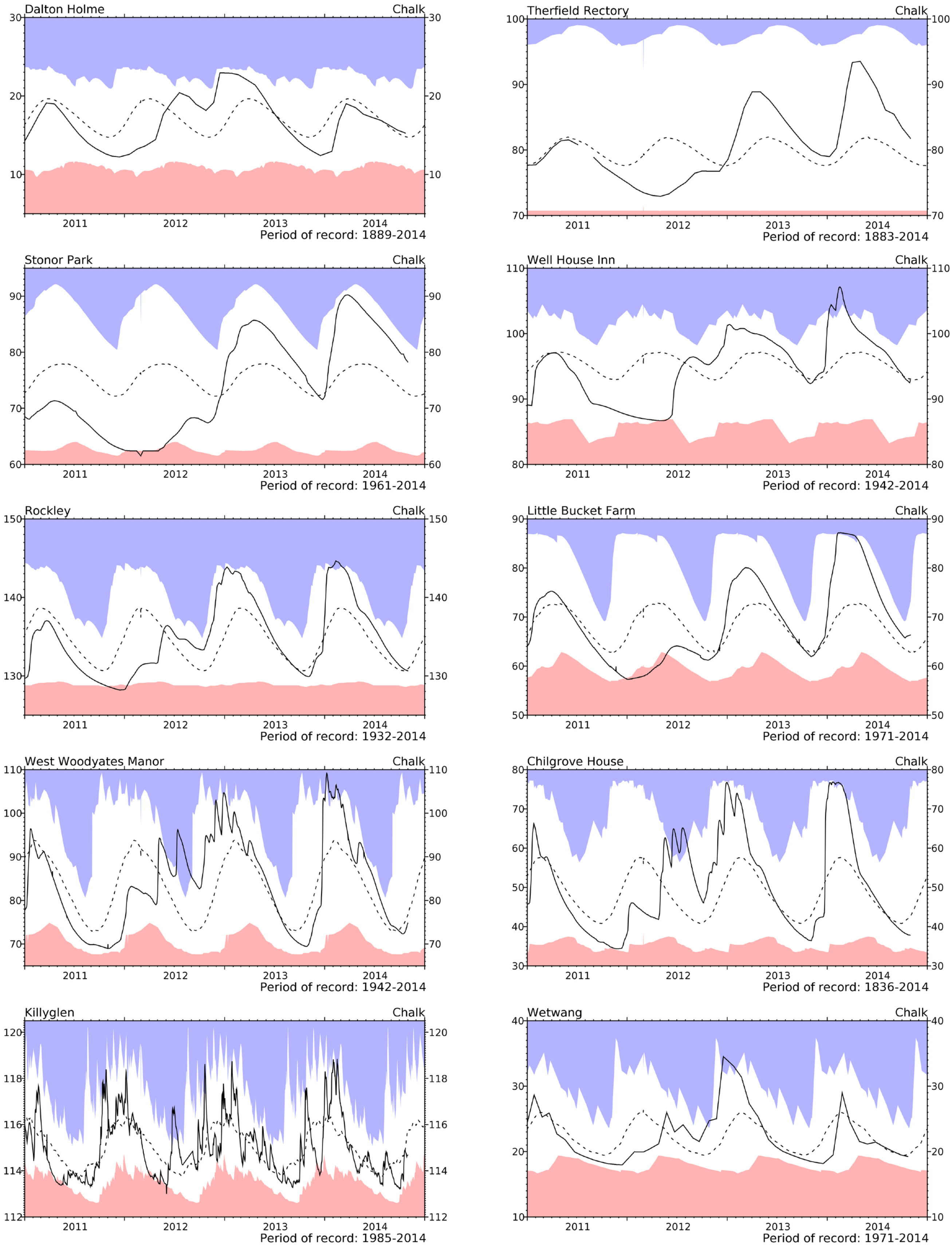






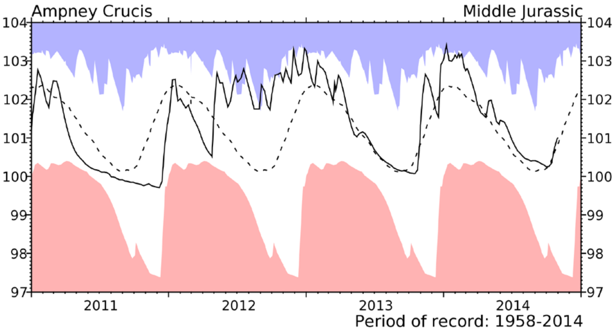


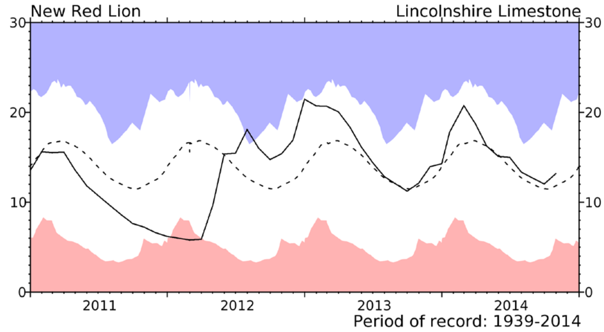
Groundwater…Groundwater

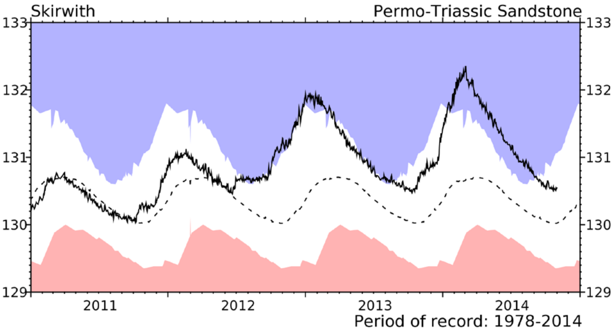


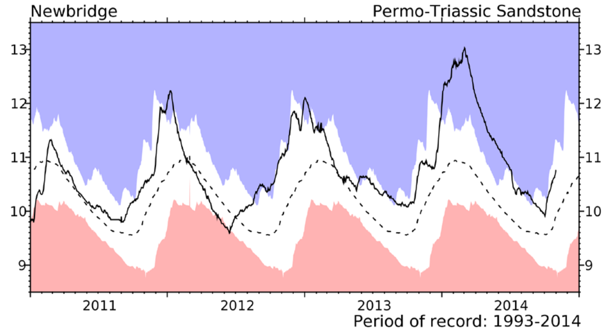
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

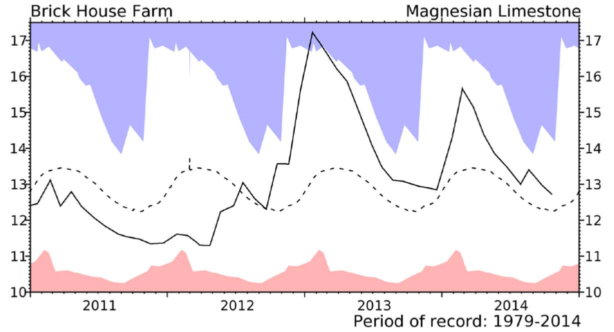
Groundwater ... Groundwater

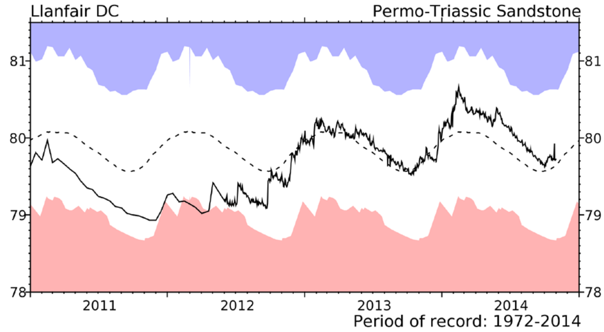


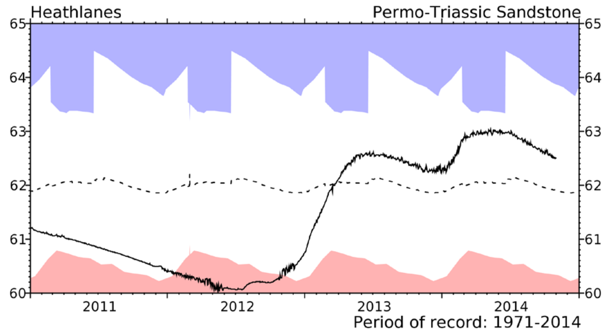


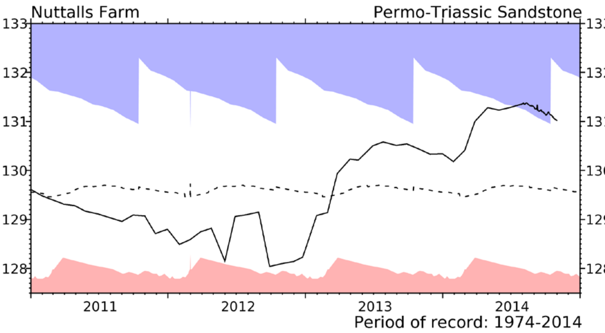


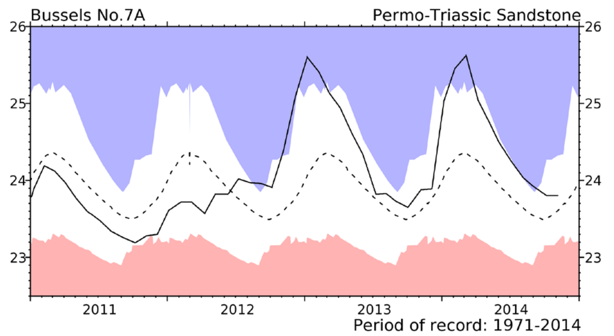


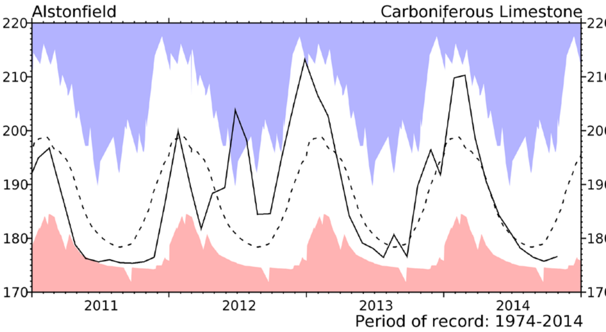










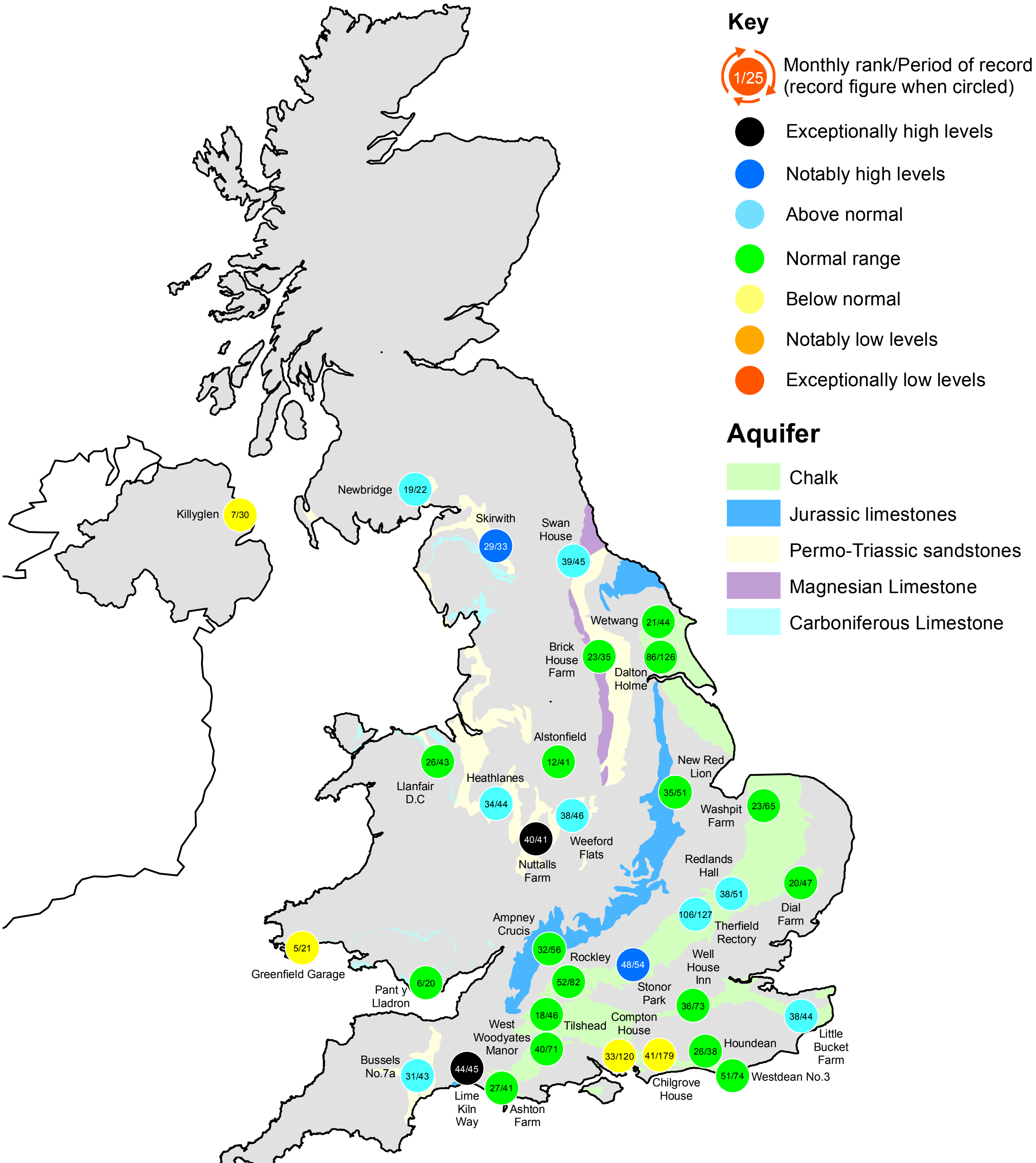


Groundwater levels October / November 2014

Borehole	Level	Date	Oct av.	Borehole	Level	Date	Oct av.	Borehole	Level	Date	Oct av.
Dalton Holme	15.26	22/10	14.79	Chilgrove House	37.79	30/10	46.39	Brick House Farm	12.72	20/10	12.36
Therfield Rectory	81.77	31/10	78.23	Killyglen (NI)	114.68	31/10	115.91	Llanfair DC	79.72	31/10	79.67
Stonor Park	78.23	31/10	72.03	Wetwang	19.23	22/10	20.26	Heathlanes	62.50	31/10	61.82
Tilshead	79.87	31/10	82.55	Ampney Crucis	101.00	31/10	101.23	Nuttalls Farm	131.02	31/10	129.57
Rockley	130.65	31/10	131.64	New Red Lion	13.18	31/10	12.29	Bussels No.7a	23.80	05/11	23.66
Well House Inn	92.90	31/10	92.88	Skirwith	130.56	31/10	130.14	Alstonfield	176.58	29/10	187.50
West Woodyates	74.79	31/10	80.60	Newbridge	10.75	31/10	10.24				

Levels in metres above Ordnance Datum

Groundwater...Groundwater

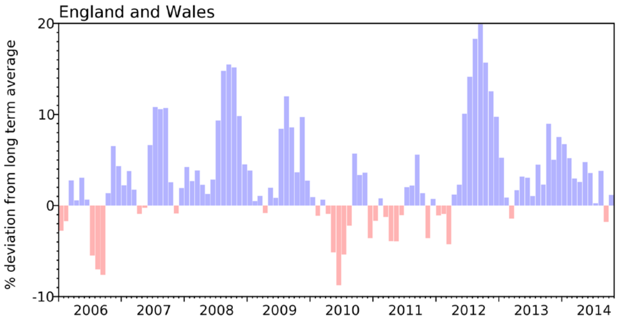


Groundwater levels - October 2014

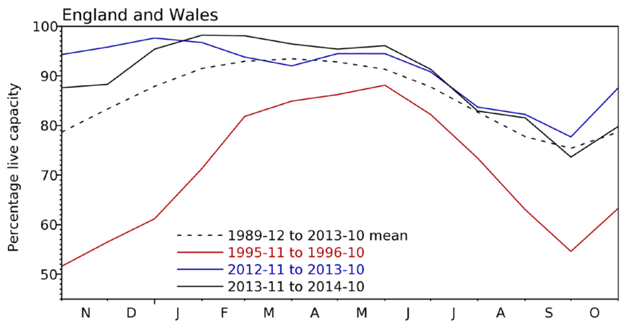
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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 Aug	2014 Sep	2014 Oct	Oct Anom.	Min Oct	Year* of min	2013 Oct	Diff 14-13
North West	N Command Zone	•	124929	60	49	68	0	33	2003	86	-18
	Vyrnwy		55146	71	60	71	-4	25	1995	95	-24
Northumbrian	Teesdale	•	87936	84	74	89	13	33	1995	100	-11
	Kielder		(199175)	91	83	89	2	63	1989	95	-6
Severn-Trent	Clywedog		44922	90	79	84	8	38	1995	85	0
	Derwent Valley	•	39525	66	54	56	-15	15	1995	79	-24
Yorkshire	Washburn	•	22035	63	54	52	-18	15	1995	83	-30
	Bradford Supply	•	41407	72	61	66	-7	16	1995	77	-11
Anglian	Grafham		(55490)	78	79	75	-8	44	1997	88	-13
	Rutland		(116580)	89	87	84	7	59	1995	78	6
Thames	London	•	202828	92	87	88	10	46	1996	92	-5
	Farmoor	•	13822	89	88	78	-10	43	2003	83	-5
Southern	Bewl		28170	79	70	67	7	33	1990	70	-3
	Ardingly**		4685	77	67	76	9	15	2003	68	8
Wessex	Clatworthy		5364	75	61	62	-1	14	2003	83	-21
	Bristol	•	(38666)	79	77	66	4	24	1990	56	10
South West	Colliford		28540	79	71	71	1	38	2006	71	0
	Roadford		34500	80	74	74	3	18	1995	77	-3
	Wimbleball		21320	78	66	63	-4	26	1995	54	9
	Stithians		4967	66	54	44	-13	18	1990	68	-24
Welsh	Celyn & Brenig	•	131155	75	65	74	-10	48	1989	88	-13
	Brianne		62140	93	84	100	8	57	1995	100	0
	Big Five	•	69762	78	68	80	4	38	2003	89	-9
	Elan Valley	•	99106	84	73	90	5	37	1995	100	-10
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	84	66	71	-10	48	2003	77	-6
	East Lothian	•	10206	96	92	98	14	38	2003	82	16
Scotland(W)	Loch Katrine	•	111363	69	55	89	3	40	2003	87	2
	Daer		22412	82	72	92	2	42	2003	75	17
	Loch Thom	•	11840	91	73	76	-13	66	2007	83	-7
Northern Ireland	Total+	•	56800	82	73	84	3	39	1995	92	-9
	Silent Valley	•	20634	82	72	82	7	34	1995	92	-9

( ) 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.

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.

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

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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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