Hydrological Summary

for the United Kingdom

November 2013

General

November was typically autumnal but with contrasting synoptic patterns through the month: the first fortnight was mild and cyclonic but thereafter high pressure became dominant with colder and drier conditions prevailing. Correspondingly, most rivers were in spate through early-November and flood alerts were common during the first week. But sustained recessions then became established, leaving runoff rates well below the seasonal average entering December; particularly depressed flows characterised parts of Northern Ireland and eastern Scotland. In much of eastern and southern England winterbournes also remain dry. Replenishment to reservoirs during November was generally below the normal late autumn average but, boosted by the exceptional October inflows, overall stocks for England & Wales remain considerably above average; none of the index reservoirs registered November stocks more than 10% below the monthly average. Relative to the seasonal average, groundwater levels vary substantially across the country reflecting both the spatial variations in soil moisture conditions through the autumn and the varying response times of individual aquifer units. Nonetheless, levels in the great majority of index wells remain within, or above, the normal range. Notwithstanding the dry spell which commenced in the second week of November, the water resources outlook remains healthy.

Rainfall

A sequence of Atlantic frontal systems made for a notably unsettled early-November. The 2nd/3rd was especially wet with notable storm totals in many areas: 24-hour rainfall accumulations included 58mm at Kirkwall (Orkneys) and 43mm at Okehampton (Devon). The wet conditions continued through the second week with significant snow on northern hills - allowing an exceptionally early start to the ski season in the Cairngorms. Thereafter cold, sunny (particularly in Scotland) and dry conditions prevailed. Over the four weeks beginning on the 12th, accumulated rainfall totals barely exceeded 10mm over wide areas. For November as a whole, the UK rainfall total was around three-quarters of the long-term average but with substantial regional and more local variations. Monthly rainfall totals fell below 30mm in some coastal areas of northern and eastern Britain, and only a few spatially restricted areas reported monthly totals appreciably above average. Much of Northern Ireland recorded less than 60% of the November average and, for the UK as a whole, provisional data indicate that it was the second driest November in the last 20 years. The notably wet October ensured that rainfall totals for the autumn are well within the normal range across the great majority of the UK but moderate medium-term deficiencies still persist. Most notably in eastern Scotland where, for many catchments, the January-November rainfall was the second lowest since 1996.

River flows

November began with river flows close to bankfull in many parts of the country. On the 2nd the peak flow on the River Naver in northern Scotland was the third highest in a series from 1977 and flood alerts were widespread. Further heavy frontal rainfall triggered additional alerts on the 3rd, e.g. on the Yorkshire Ouse, Warwickshire Avon, Torridge (Devon) and Vyrnwy (Wales); tidal flood alerts were also common. Some moderate spates occurred during the third week but generally recessions were steep and sustained through much of November. By month-end flows were seasonally modest in most river basins and notably low in some; in Northern Ireland daily mean flows in the Lagan fell marginally below its previous minimum for the time of year. November runoff totals were within the normal range across most of the country but appreciably below average in some northern basins. For the autumn as a whole, runoff totals were close to, or above, average across most of England and Wales (exceptions include much of Gwynedd) but appreciably below in parts of Northern Ireland and much of Scotland where runoff deficiencies since June are notable. For the Spey (at Boat o Brig) the July-November runoff was the third lowest since 1972. Although soils wetted-up rapidly through October and early-November, seasonal recoveries in many groundwater-fed streams remain weak – particularly in eastern England where soil moisture deficits remain appreciable (see page 3).

Groundwater

Commonly, seasonal recoveries in groundwater levels gain momentum through November but differences in rainfall and soil moisture patterns, the thickness of the unsaturated zone and the storage characteristics of individual aquifer units can make for substantial spatial contrasts. November 2013 certainly served to underline this. In the Chalk, levels were within the normal range in almost all index wells but were still declining throughout November in some areas (e.g. the Yorkshire Wolds and parts of the Chilterns). Similarly, levels continued to fall in some Permo-Triassic sandstones outcrop areas, in the Midlands particularly. Nonetheless, levels remain considerably above the seasonal average throughout most outcrop areas and notably high in north-west England (e.g. at Skirwith). Levels in most of the limestone aquifers also exceeded the November average, rising particularly rapidly early in the month at Alstonfield (Peak District) but the responsiveness of the limestone index wells was emphasised by the steep declines in south Wales through the latter half of the month. Overall the groundwater resources outlook was healthy entering the winter but residual soil moisture deficits have delayed the seasonal onset of recharge in a zone from Yorkshire to East Anglia.

Centre for Ecology & Hydrology
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

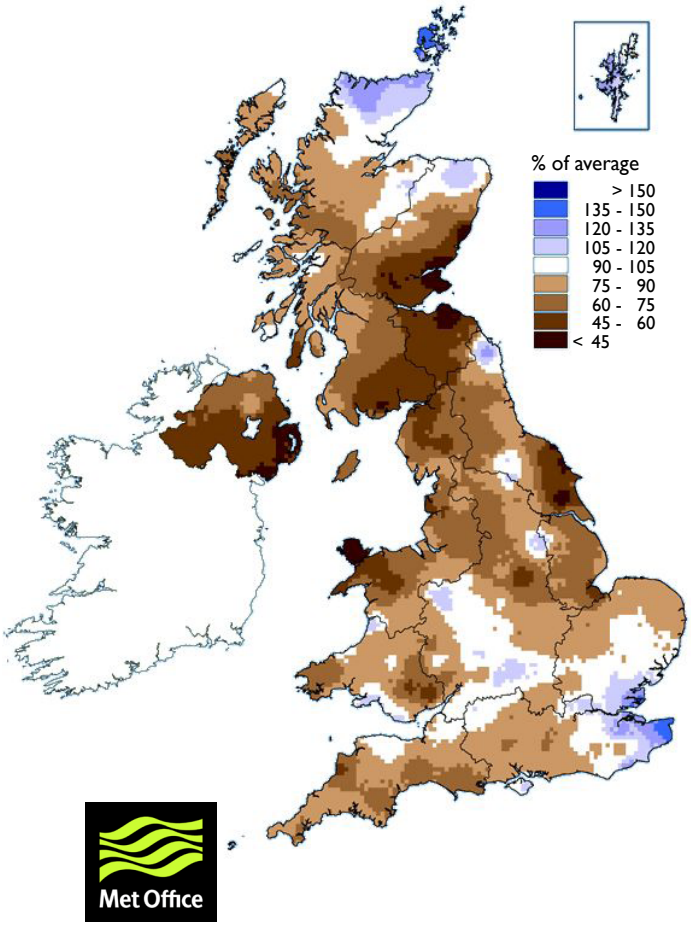
Area	Rainfall	Nov 2013	Sep13 – Nov 13	RP	Jun 13 – Nov 13	RP	Feb 13 – Nov 13	RP	Dec 12 – Nov 13	RP
United Kingdom	mm	**93**	324		510		790		1080	
	%	**81**	100	2-5	94	2-5	93	2-5	100	2-5
England	mm	**67**	261		408		619		847	
	%	**83**	111	2-5	99	2-5	96	2-5	104	2-5
Scotland	mm	**133**	409		640		1010		1373	
	%	**83**	92	2-5	90	2-5	91	2-5	96	2-5
Wales	mm	**117**	420		655		986		1391	
	%	**76**	100	2-5	97	2-5	93	2-5	102	2-5
Northern Ireland	mm	**64**	293		507		853		1129	
	%	**58**	92	2-5	91	2-5	98	2-5	102	2-5
England & Wales	mm	**74**	283		442		669		922	
	%	**81**	109	2-5	98	2-5	95	2-5	103	2-5
North West	mm	**88**	346		611		866		1173	
	%	**71**	98	2-5	101	2-5	94	2-5	100	2-5
Northumbria	mm	**67**	267		460		683		922	
	%	**81**	117	2-5	110	2-5	103	2-5	111	2-5
Midlands	mm	**61**	235		395		610		812	
	%	**86**	113	2-5	103	2-5	101	2-5	107	2-5
Yorkshire	mm	**58**	223		389		594		807	
	%	**74**	100	2-5	96	2-5	92	2-5	99	2-5
Anglian	mm	**49**	188		292		454		601	
	%	**87**	112	2-5	92	2-5	92	2-5	100	2-5
Thames	mm	**62**	237		335		538		721	
	%	**93**	118	2-5	95	2-5	96	2-5	103	2-5
Southern	mm	**81**	290		386		592		831	
	%	**97**	119	2-5	97	2-5	97	2-5	107	2-5
Wessex	mm	**74**	299		410		616		889	
	%	**86**	119	2-5	97	2-5	92	2-5	103	2-5
South West	mm	**105**	401		563		856		1268	
	%	**79**	112	2-5	98	2-5	93	2-5	105	2-5
Welsh	mm	**112**	409		638		959		1348	
	%	**76**	102	2-5	98	2-5	94	2-5	102	2-5
Highland	mm	**184**	479		728		1190		1573	
	%	**91**	88	2-5	87	2-5	90	2-5	92	2-5
North East	mm	**98**	258		435		692		940	
	%	**98**	89	2-5	89	5-10	91	5-10	99	2-5
Tay	mm	**92**	337		511		841		1228	
	%	**70**	89	2-5	85	5-10	87	5-10	97	2-5
Forth	mm	**71**	326		511		772		1091	
	%	**62**	96	2-5	91	2-5	88	5-10	97	2-5
Tweed	mm	**57**	282		486		736		994	
	%	**61**	105	2-5	103	2-5	98	2-5	104	2-5
Solway	mm	**90**	403		669		1048		1421	
	%	**61**	94	2-5	96	2-5	96	2-5	101	2-5
Clyde	mm	**150**	504		783		1191		1645	
	%	**80**	93	2-5	91	2-5	89	2-5	95	2-5

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

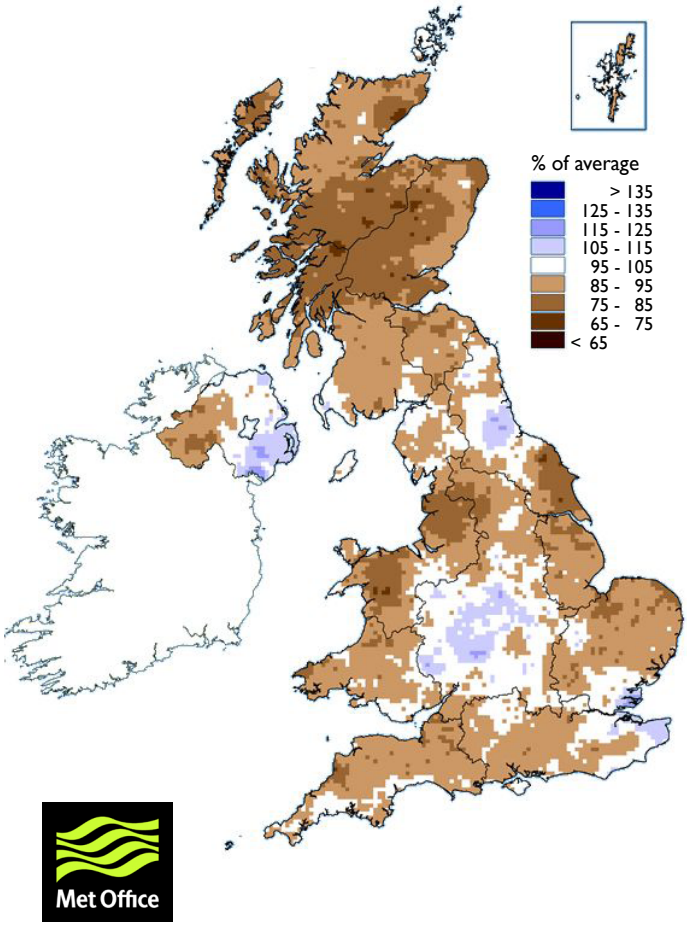
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

Rainfall . . . Rainfall . . .

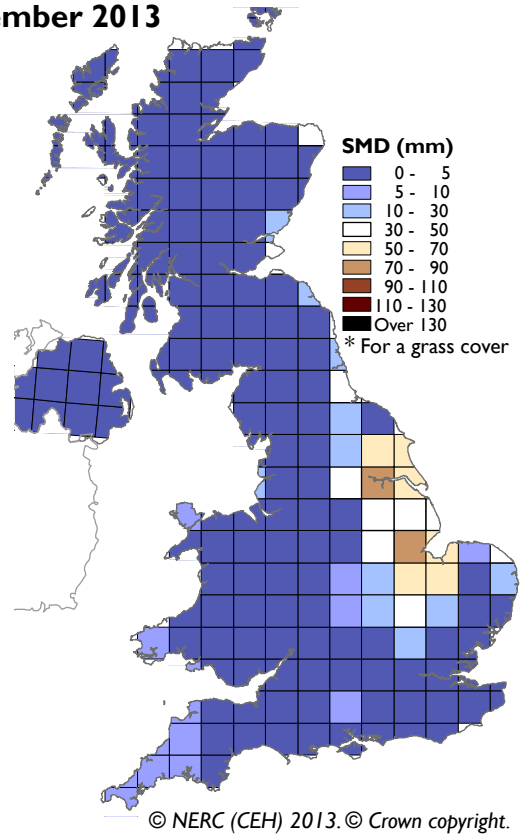
November 2013 rainfall as % of 1971-2000 average



February 2013 - November 2013 rainfall as % of 1971-2000 average



MORECS Soil Moisture Deficits* November 2013



Met Office 3-month outlook Updated: November 2013

Confidence in the forecast for precipitation across the UK over the next three months is relatively low. For the December-January-February period as a whole there is a slight signal for below-average precipitation.

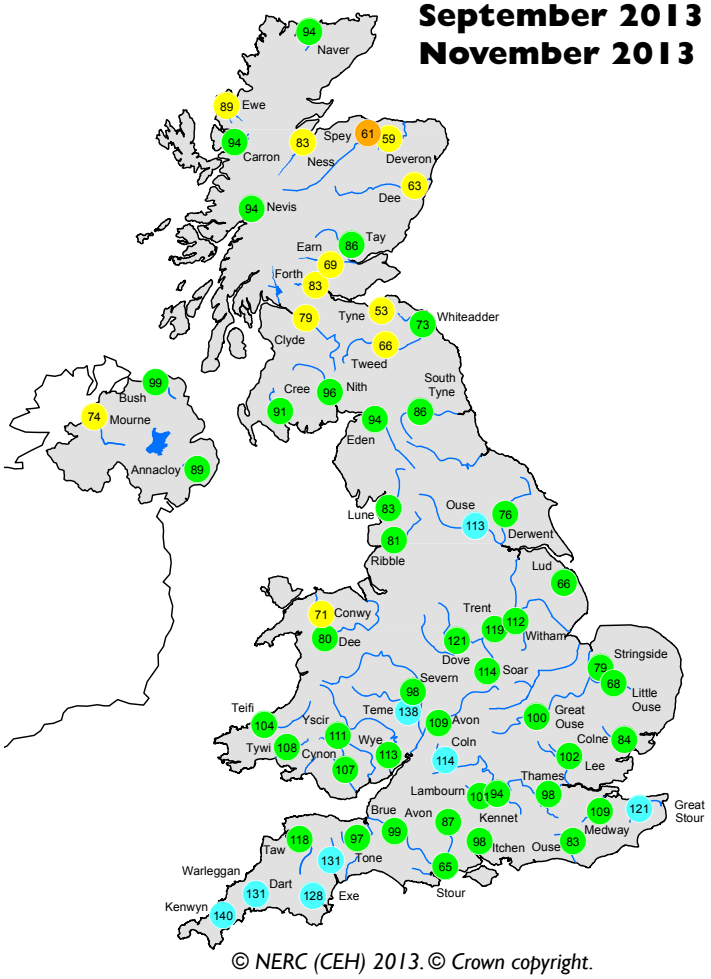
The probability that UK precipitation for December-January-February will fall into the driest of our five categories is around 25% and the probability that it will fall into the wettest category is around 15% (the 1981-2010 probability for each of these categories is 20%).

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 . . .

September 2013 - November 2013



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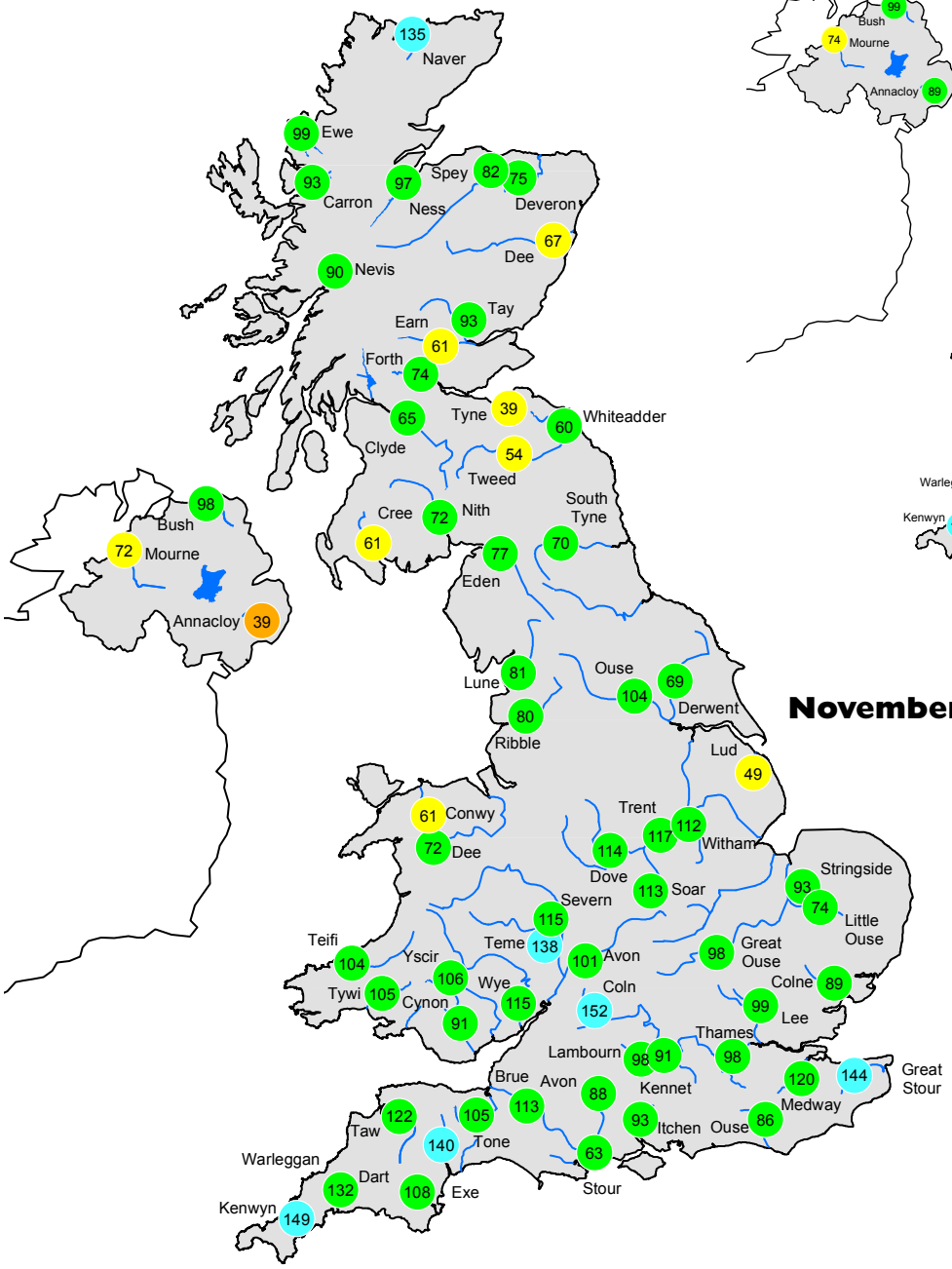

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November 2013

Key

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

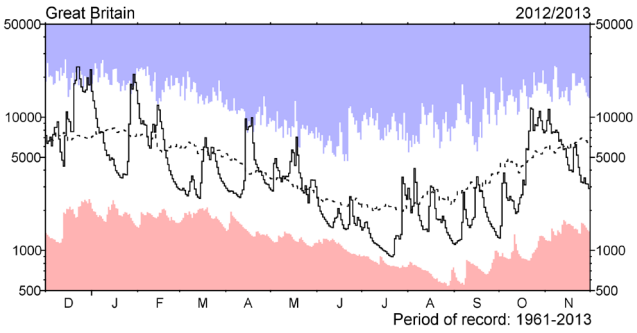
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

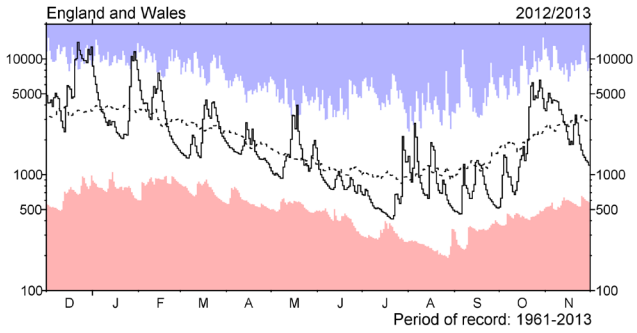
*Based on ranking of the monthly flow**

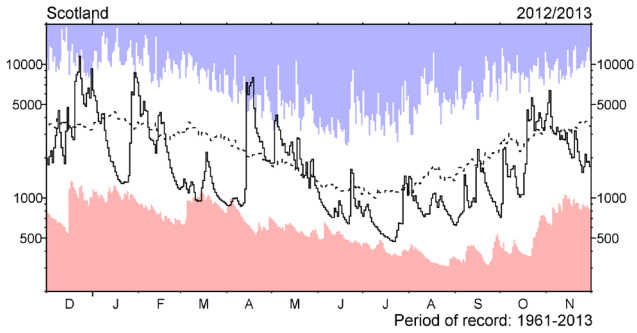
River flows

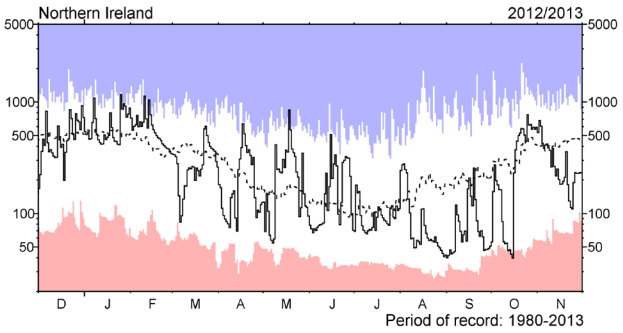
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

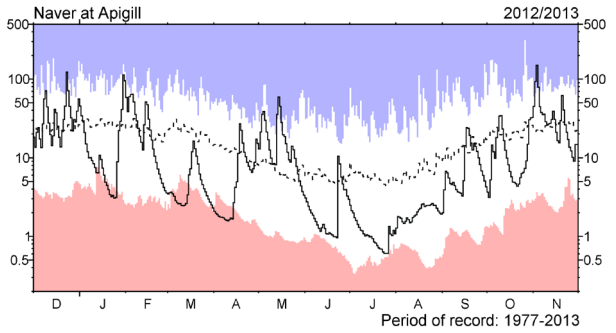
River flow . . . River flow . . .

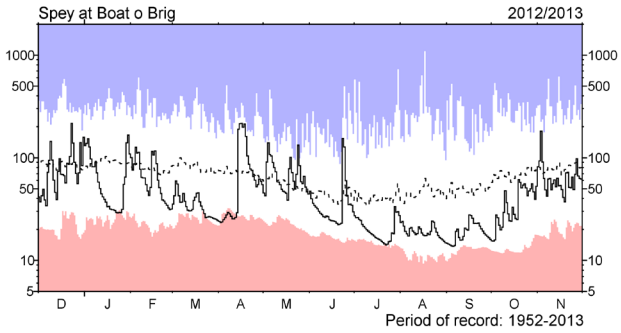


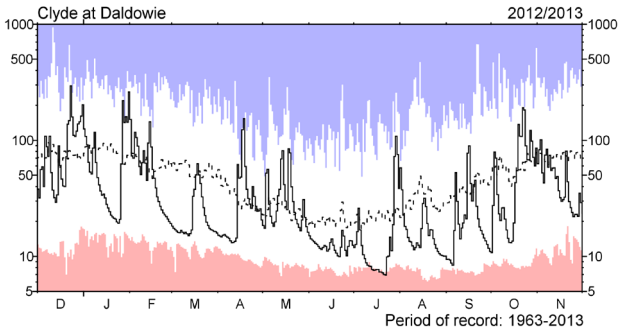


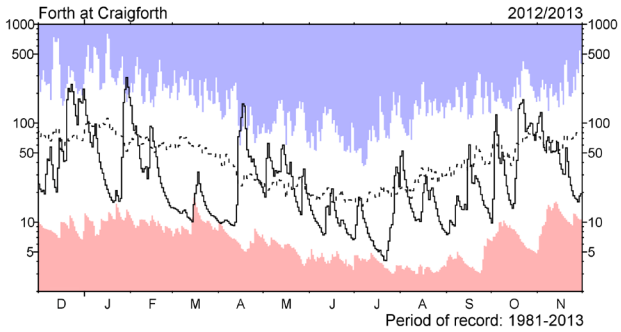


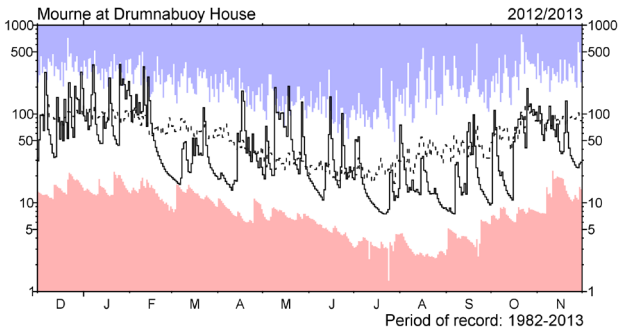


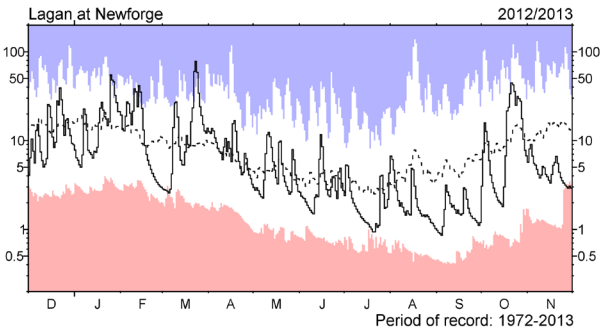








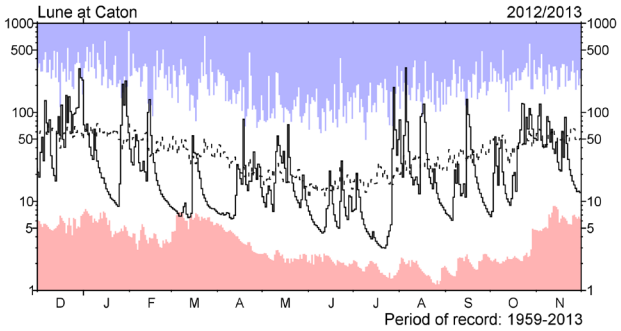


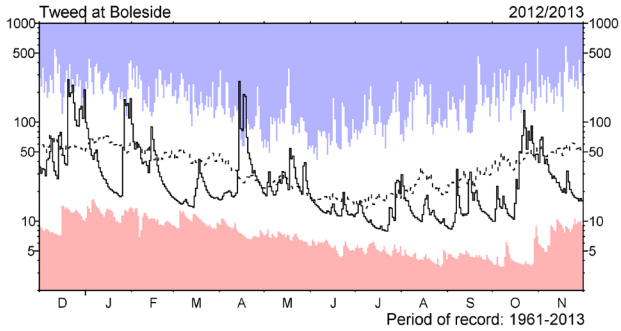


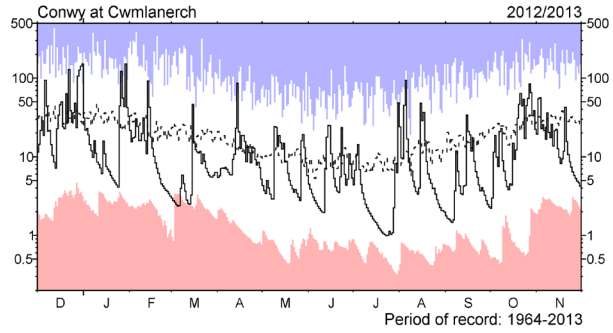
River flow hydrographs

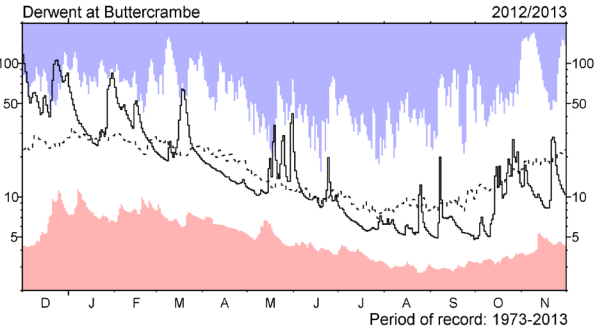
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to December 2012 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the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

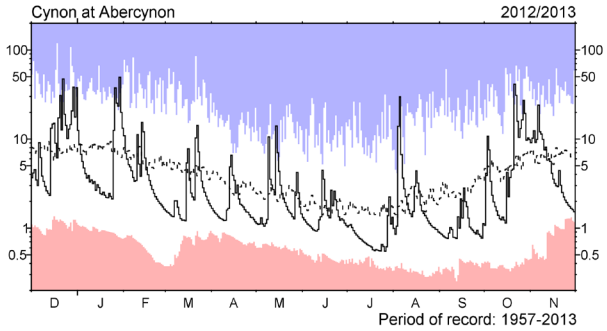
River flow . . . River flow . . .

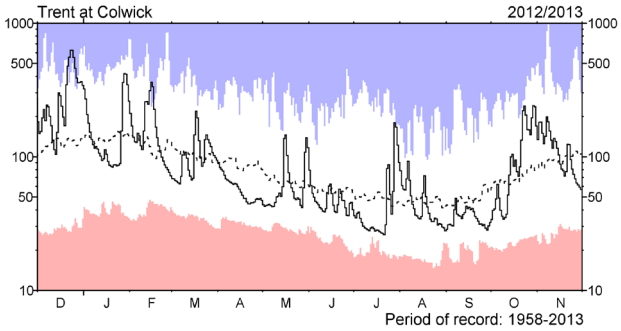


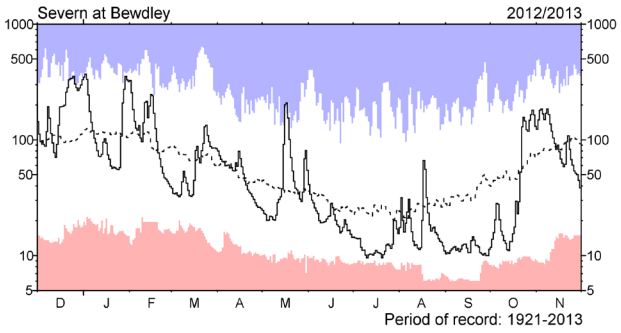


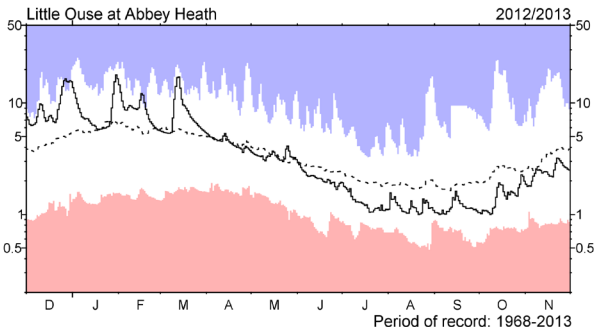


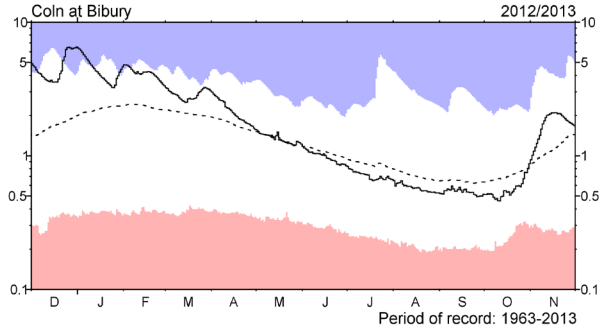


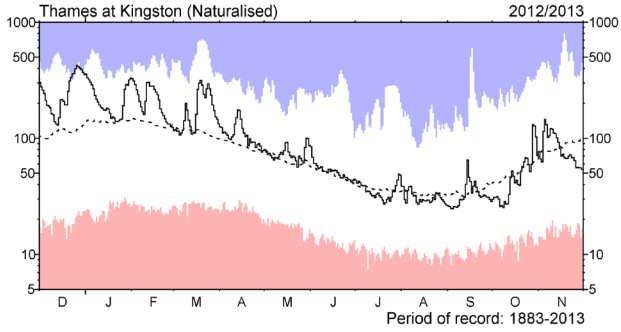


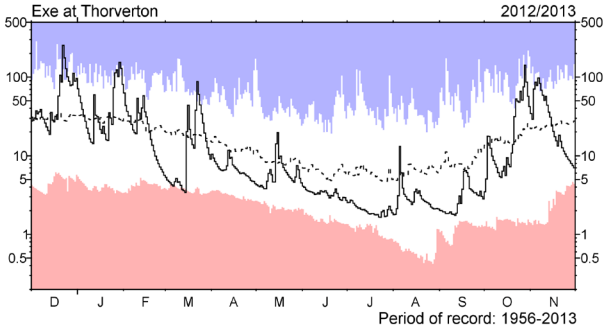


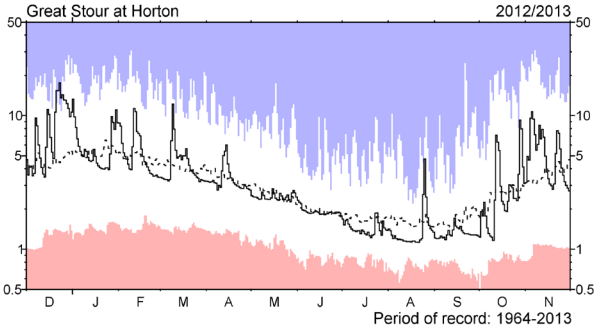




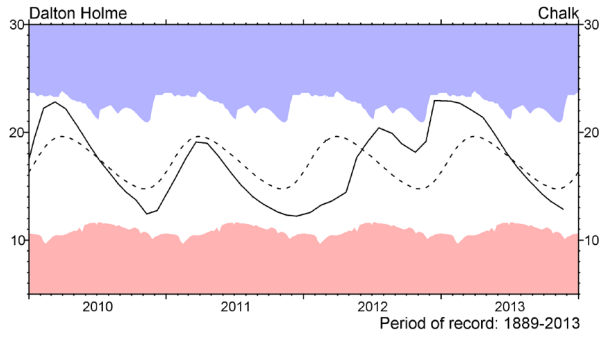


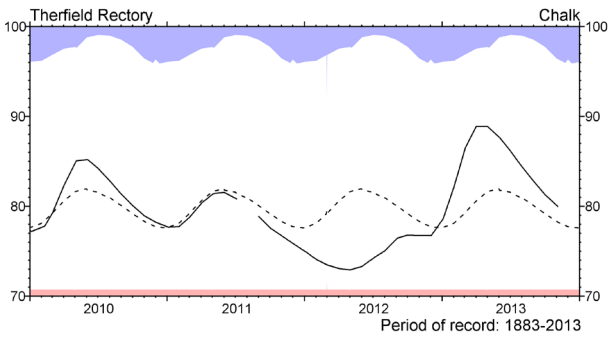


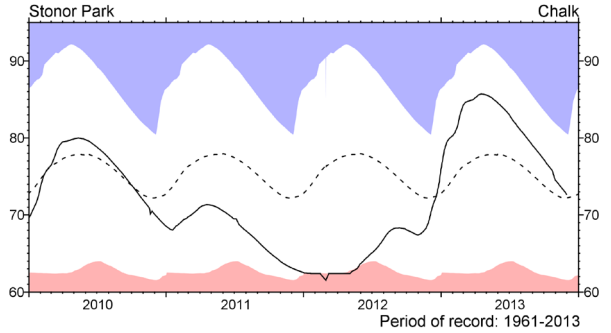


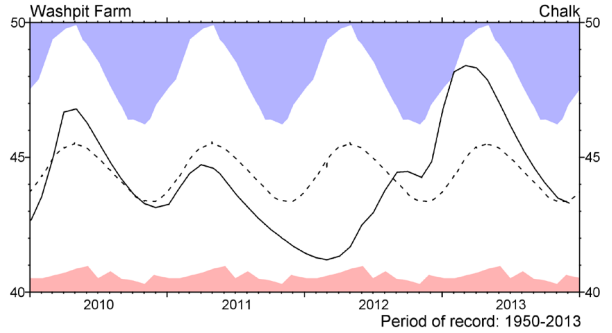


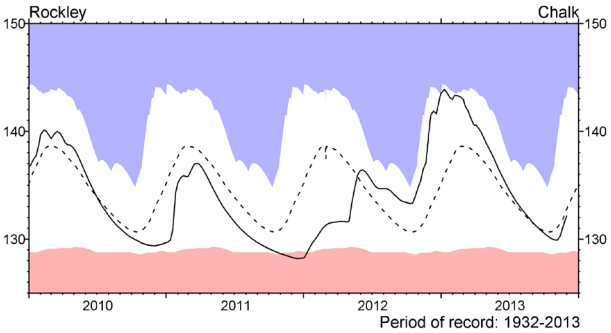
Groundwater…Groundwater

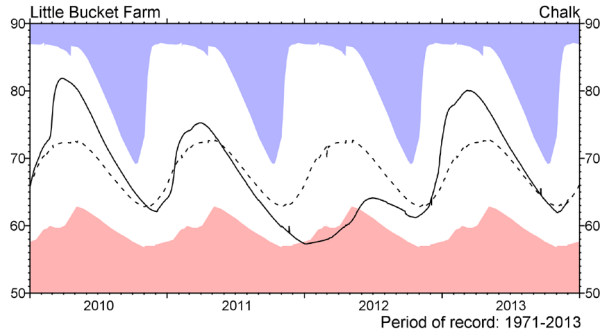


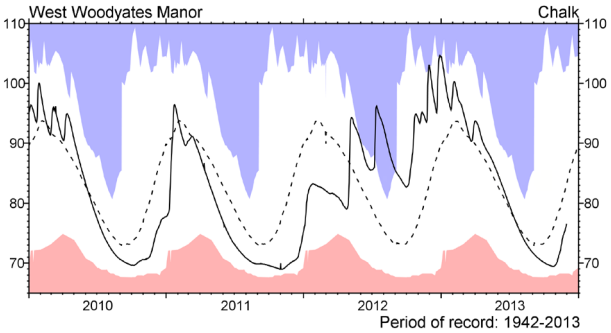


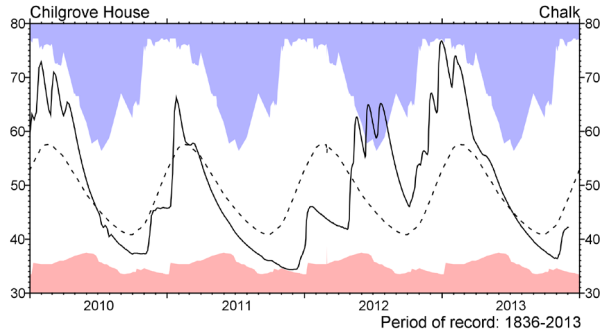


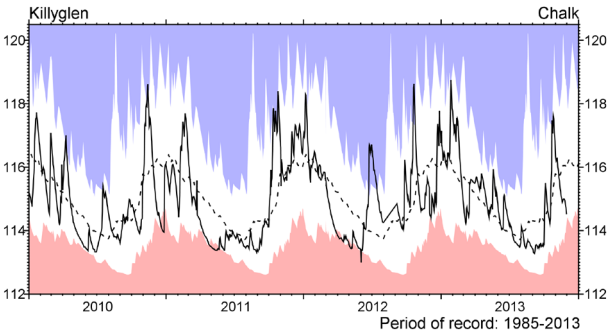


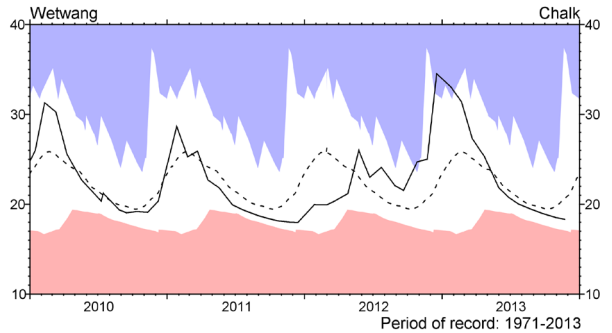






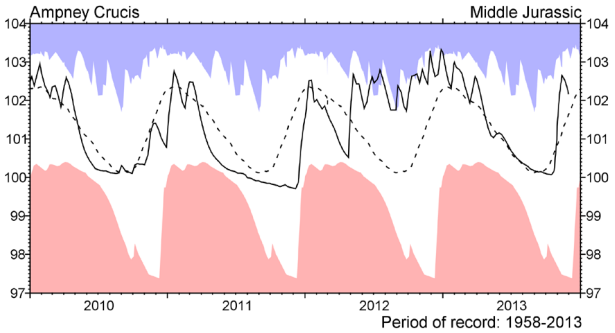


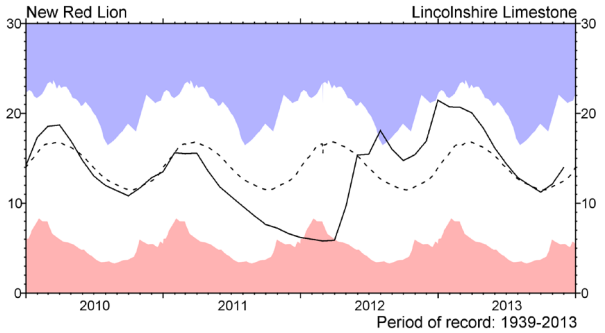


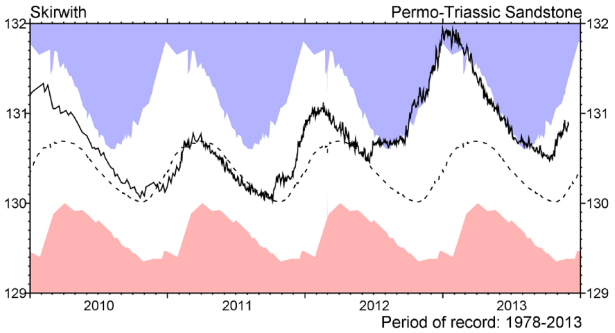


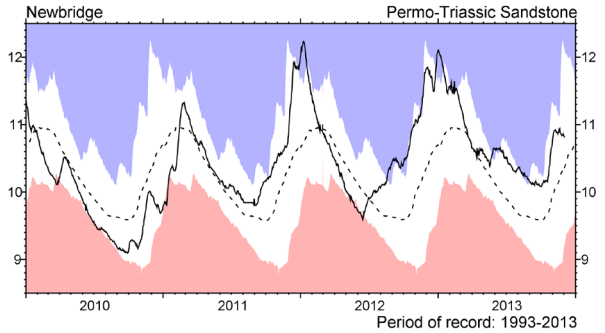
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

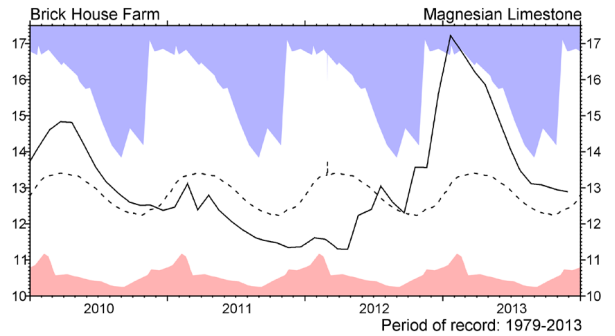
Groundwater ... Groundwater

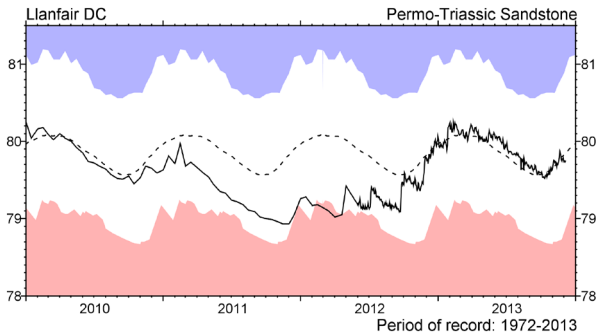


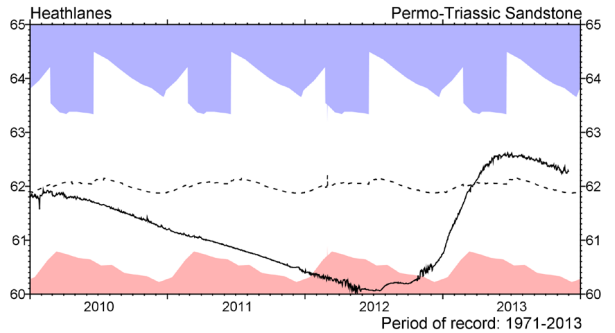


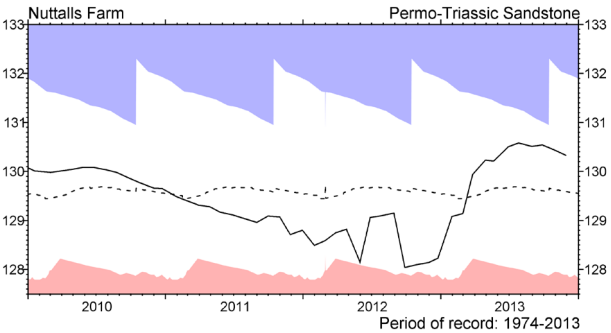


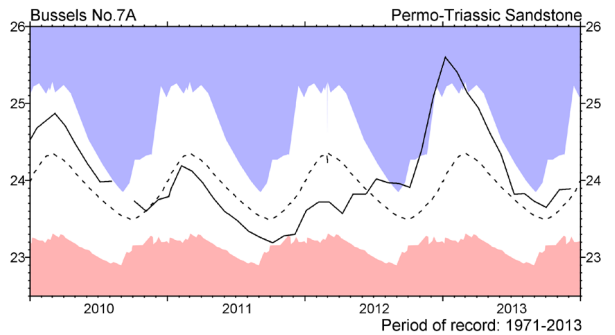


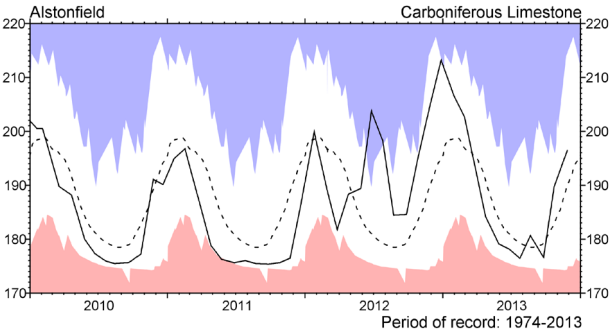








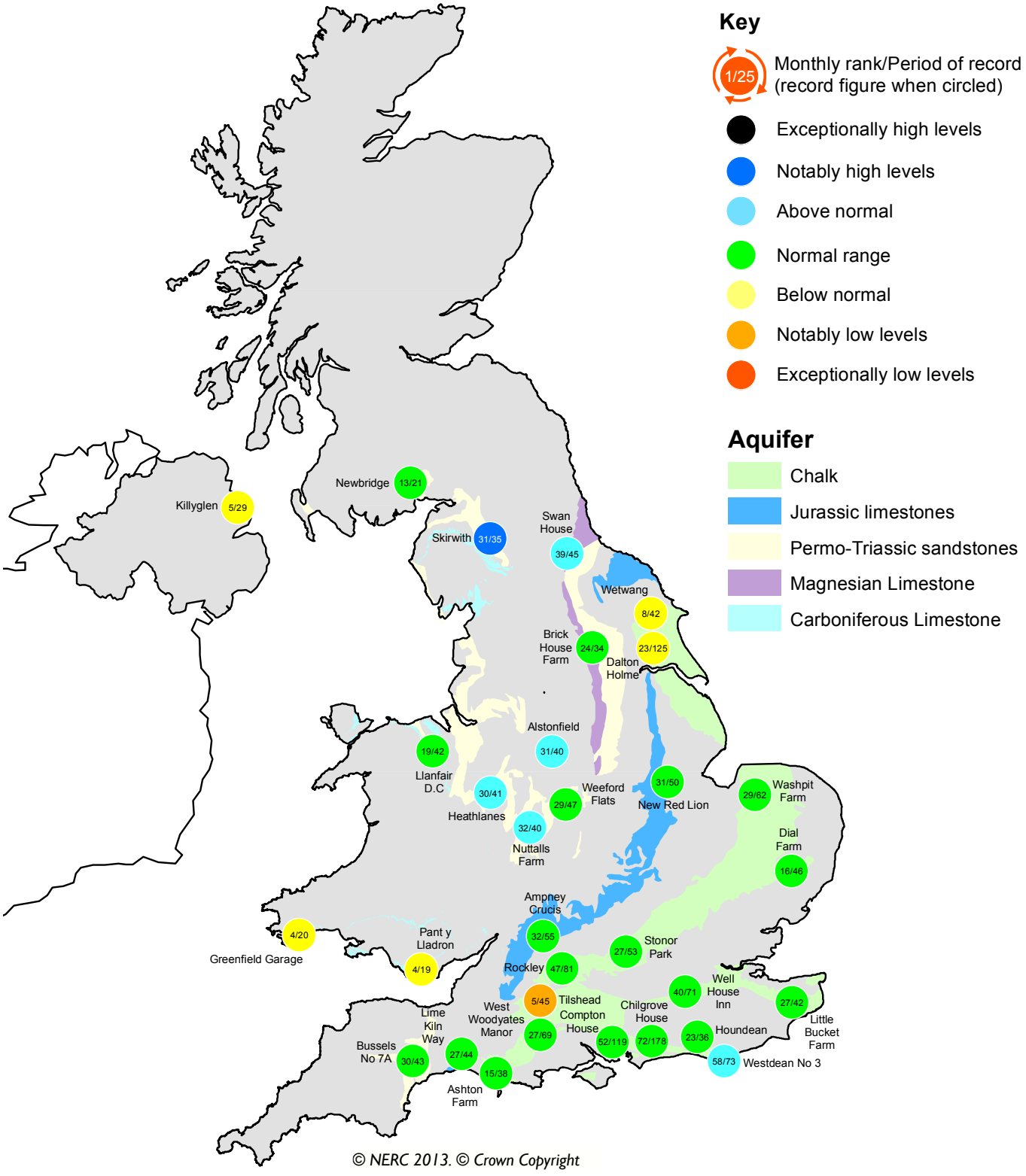




Groundwater levels November / December 2013

Borehole	Level	Date	Nov av.	Borehole	Level	Date	Nov av.	Borehole	Level	Date	Nov av.
Dalton Holme	12.86	21/11	14.90	Chilgrove House	42.17	1/12	42.28	Brick House Farm	12.89	21/11	12.28
Washpit Farm	43.30	4/12	43.57	Killyglen (NI)	114.53	30/11	114.89	Llanfair DC	79.74	5/12	79.56
Stonor Park	72.68	30/11	72.88	Wetwang	18.31	22/11	19.46	Heathlanes	62.28	30/11	61.86
Tilshead	79.32	30/11	80.86	Ampney Crucis	102.17	30/11	100.47	Nuttalls Farm	130.33	28/11	129.61
Rockley	132.12	30/11	130.72	New Red Lion	13.94	30/11	11.57	Bussels No.7a	23.89	5/12	23.52
Well House Inn	93.77	30/11	93.05	Skirwith	130.86	30/11	130.06	Alstonfield	196.45	27/11	181.51
West Woodyates	76.46	30/11	75.01	Newbridge	10.81	2/12	9.76				

Levels in metres above Ordnance Datum

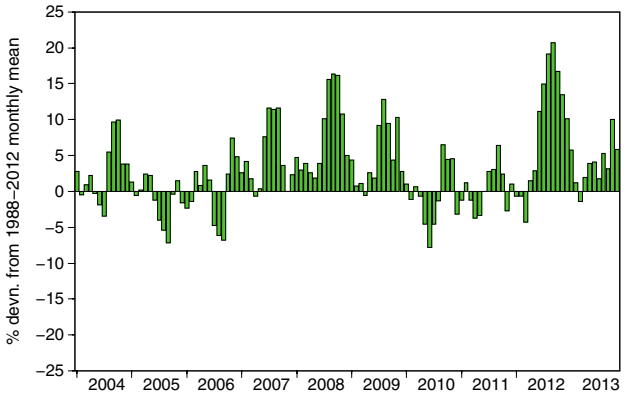


Groundwater levels - November 2013

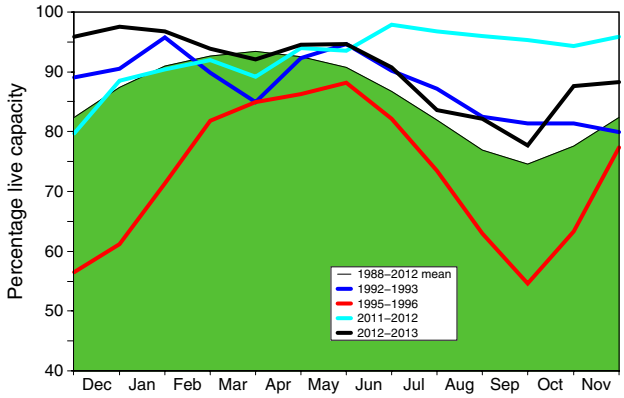
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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.

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)	2013 Sep	2013 Oct	2013 Nov	Nov Anom.	Min Nov	Year* of min	2012 Nov	Diff 13-12
North West	N Command Zone	•	124929	63	86	81	2	44	1993	94	-13
	Vyrnwy		55146	70	95	83	1	33	1995	98	-15
Northumbrian	Teesdale	•	87936	91	100	97	16	39	1995	98	-1
	Kielder		(199175)	85	95	89	3	55	2007	96	-7
Severn Trent	Clywedog		44922	90	85	87	6	43	1995	90	-3
	Derwent Valley	•	39525	55	79	89	11	9	1995	100	-11
Yorkshire	Washburn	•	22035	62	83	92	16	16	1995	97	-5
	Bradford Supply	•	41407	54	77	79	-4	20	1995	99	-20
Anglian	Grafham		(55490)	91	88	89	6	47	1997	83	6
	Rutland		(116580)	78	78	86	8	57	1995	92	-6
Thames	London	•	202828	86	92	94	12	52	1990	97	-3
	Farmoor	•	13822	98	83	92	3	52	1990	80	12
Southern	Bewl		28170	69	70	80	17	34	1990	85	-5
	Ardingly**		4685	56	68	84	10	14	2011	100	-17
Wessex	Clatworthy		5364	47	83	100	22	16	2003	100	0
	Bristol	•	(38666)	52	56	69	2	27	1990	96	-27
South West	Colliford		28540	65	71	75	2	42	1995	98	-23
	Roadford		34500	69	77	81	7	19	1995	99	-18
	Wimbleball		21320	48	54	66	-9	34	1995	100	-34
	Stithians		4967	60	68	81	15	29	2001	100	-19
Welsh	Celyn & Brenig	•	131155	79	88	89	1	50	1995	96	-8
	Brianne		62140	99	100	91	-4	72	1995	100	-9
	Big Five	•	69762	76	89	92	9	49	1990	99	-7
	Elan Valley	•	99106	78	100	100	7	47	1995	100	0
Scotland(E)	Edinburgh/Mid-Lothian	•	97639	74	77	81	-5	45	2003	100	-19
	East Lothian	•	10206	83	82	73	-16	38	2003	100	-27
Scotland(W)	Loch Katrine	•	111363	60	87	87	-4	65	2007	91	-4
	Daer		22412	58	75	100	3	73	2003	100	0
	Loch Thom	•	11840	81	83	100	6	72	2003	100	0
Northern Ireland	Total+	•	56800	71	92	87	2	59	2003	98	-11
	Silent Valley	•	20634	64	92	85	5	43	2001	98	-13

( ) 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:

The Met Office
FitzRoy Road
Exeter
Devon
EX1 3PB

Tel.: 0870 900 0100
Email: enquiries@metoffice.gov.uk

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

Enquiries

Enquiries should be addressed to:

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Crowmarsh Gifford
Wallingford
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A full catalogue of past Hydrological Summaries can be accessed and downloaded at:
http://www.ceh.ac.uk/data/nrfa/nhmp/nhmp.html

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iii. Met Office rainfall data. © Crown copyright.

12/2013