Hydrological Summary

for the United Kingdom

October 2012

General

October was dull, cool and unsettled for most of the UK – and notably wet in some areas – continuing a pattern that has been prevalent across much of the country since the early spring. Total UK rainfall for the month was slightly above average, but there were marked spatial variations and much of the rainfall was sustained and heavy, but separated by drier interludes. Widespread flood warnings were issued in response to the threat of intense rainfalls occurring on already saturated catchments but, whilst notable monthly runoff totals were registered, flood incidents were much less widespread in comparison with previous months. Reservoir stocks declined very slightly in October but, with the exception of Bewl and Ardingly, were above average in all major reservoirs. Total stocks for England & Wales were 17% above average – the second highest on record (after 2000) for early November. Some of the highest rainfall occurred in the east of England; the relatively drier soils in this area have inhibited infiltration, but the rainfall is likely to promote further recovery in groundwater levels in the coming months. Entering the late autumn/winter period (typically the main season for replenishment, but also when flooding is most likely) the water resource outlook is healthier than at the equivalent time in any of the last 25 years at least, due to the exceptional rainfall accumulated since April. Conversely, with soils already saturated across much of the UK, responsive catchments are vulnerable to fluvial flooding, whilst anomalously high groundwater levels have increased the likelihood of groundwater flooding in susceptible areas (particularly in the southern Chalk).

Rainfall

The month started with a continuation of the wet spell from the end of September, and unsettled conditions persisted while low pressure dominated until around the 20th. A shift to predominantly anticyclonic conditions followed (with a north-easterly Arctic interlude around the 26th/27th) leading to a much drier second half of the month, although there were occasional heavy showers, particularly in northern and western areas in the closing days. The heaviest rainfall occurred during the passage of several vigorous depressions around mid-month: on the 11th/12th, intense rainfall led to flash flooding in parts of south-west England (with 70mm on the 11th at Medden, north Devon, although much of this fell in a few hours) and eastern Scotland (with 54mm on the 12th at Lentran, near Inverness); the 17th/18th was very wet across much of the UK and saw further localised, disruptive flash flooding (e.g. in Southampton). There was significant early snowfall in eastern Scotland and parts of northern England on the 26th. For Scotland, Wales and Northern Ireland, the October rainfall was near average, but England received >130% of average. There were significant regional variations, with >150% along much of the east coast of the UK and across a large area of central and southern England (>175% in some localities); in contrast, parts of the north-west Scottish Highlands and the Western Isles received <70% of average. Accumulated rainfall totals since April are exceptional: the UK rainfall total exceeded the maximum for this period by a significant margin, and Northumbria and the Tweed basin have received almost twice the average. Exceptionally high rainfall accumulations for eastern Scotland can be traced back over the last two and a half years.

River flows

Many responsive index rivers were already running at high flows entering October and flood alerts were common in the first week, particularly in south-west England. Following a brief respite, further flood warnings were issued in response to the passage of low pressure systems on the 11th/12th and the 16th/18th. However, most reported incidents were localised; on the 11th/12th a flash flood in a steep-sided coastal catchment flooded properties in Clovelly, north Devon, whilst tidal flooding along western coasts on the 16th/17th was associated with strong winds and high tides. After the 18th, recessions became established in the majority of index rivers, which persisted until month-end in many southern catchments, although rapid flow responses led to further flood warnings in the last week. Monthly runoff totals for October were above average across most of England (notably so across much of the south and south-west, and in eastern Scotland), with most other index catchments in the normal range. The Coln (Cotswolds) registered its highest October flow in a record from 1963. Notable runoff accumulations continue to develop for the post-April period: exceptional 7-month runoff totals extend across much of the UK, with below average runoff over this timeframe confined to the far north-west of Scotland (which has been dry over this period) and some Chalk catchments, e.g. the Mimram and Lambourn, where the response to the summer rainfall was delayed. Nevertheless, flows in Chalk rivers are very healthy for the time of year: many Chalk rivers register their lowest flows in October, but this year the extension of the stream network (and associated aquatic habitat) through the summer and autumn has been remarkable, and ecologically beneficial.

Groundwater

The anticipated response to the early-autumn rainfall (which began from near-record late-summer groundwater levels) was evident in some parts of the Chalk, primarily in the faster responding southern and western areas of England – levels rose by more than 10m at West Woodyates and 5m at Chilgrove and Compton, and they remain very high elsewhere in the southern Chalk (a record monthly high at Ashton Farm). In the eastern Chalk – where moderate soil moisture deficits persist – recessions continued, with the exception of Wetwang, where they rose above the previous October maximum. Overall, at the end of the month, Chalk levels were at or above average everywhere except Dial Farm and Stonor Park. In the slower-responding Permo-Triassic sandstone, levels continued to rise in response to the summer rainfall, with high levels in the north-west and south-west (with Bussels and Yew Tree Farm both recording new October maxima). In contrast, in north Wales and the Midlands, levels were average or below with Heathlanes (where the lag between surface infiltration and groundwater level response can extend over many months) recording its lowest ever late October level, and falling again after a small recovery. In the Magnesian Limestone levels rose during October, with a new maximum at Swan House. In both the highly responsive Carboniferous Limestone aquifer (with over 10m of rise at Alstonfield) and the Jurassic limestones, levels remain above average, although they fell at Pant y Lladron. Overall, the groundwater resources situation is very healthy but this implies less available storage in the unsaturated zone at a time of year when recharge rates are normally increasing; with notably high levels in the southern Chalk, there is an increased risk of localised groundwater flooding later in the season.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

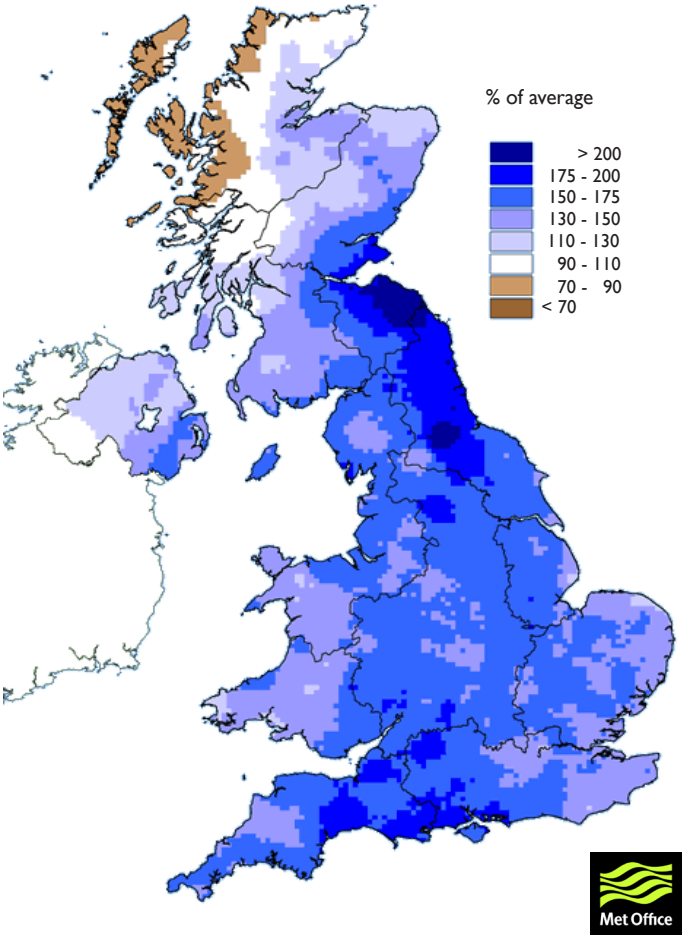
Area	Rainfall	Oct 2012	Apr12 - Oct12	RP	Sep11 - Oct12	RP	Feb11 - Oct12	RP	Mar10 - Oct12	RP
United Kingdom	mm	**128**	806		1514		2084		2982	
	%	**114**	145	>100	117	25-40	115	20-30	106	2-5
England	mm	**109**	725		1115		1479		2144	
	%	**133**	164	>>100	115	5-10	107	2-5	100	2-5
Scotland	mm	**154**	897		2089		2995		4212	
	%	**100**	127	10-20	121	60-90	125	>100	113	25-40
Wales	mm	**156**	1021		1811		2384		3500	
	%	**106**	150	50-80	111	2-5	105	2-5	99	2-5
Northern Ireland	mm	**119**	726		1559		2140		3104	
	%	**104**	124	8-12	118	60-90	114	40-60	107	5-10
England & Wales	mm	**115**	765		1211		1604		2331	
	%	**127**	161	>>100	114	5-10	106	2-5	100	2-5
North West	mm	**140**	995		1802		2471		3452	
	%	**111**	162	>100	128	35-50	125	35-50	113	5-10
Northumbria	mm	**111**	874		1251		1760		2552	
	%	**147**	193	>>100	128	40-60	125	30-40	117	10-20
Midlands	mm	**75**	666		993		1281		1857	
	%	**106**	158	>100	111	2-5	99	2-5	93	8-12
Yorkshire	mm	**92**	766		1160		1553		2211	
	%	**120**	174	>>100	121	8-12	113	2-5	104	2-5
Anglian	mm	**84**	542		775		1022		1535	
	%	**146**	153	>100	108	2-5	98	2-5	96	2-5
Thames	mm	**108**	625		892		1185		1729	
	%	**153**	159	>100	107	2-5	99	2-5	94	2-5
Southern	mm	**138**	655		976		1284		1939	
	%	**155**	158	80-120	104	2-5	98	2-5	95	2-5
Wessex	mm	**133**	775		1151		1511		2150	
	%	**153**	173	>>100	112	2-5	104	2-5	96	2-5
South West	mm	**168**	934		1579		2013		2943	
	%	**133**	160	>100	110	5-10	101	2-5	95	2-5
Welsh	mm	**153**	997		1745		2292		3369	
	%	**108**	152	70-100	111	2-5	104	2-5	99	2-5
Highland	mm	**153**	851		2376		3391		4751	
	%	**85**	106	2-5	116	15-25	120	30-40	108	8-12
North East	mm	**120**	744		1270		1938		2926	
	%	**119**	144	25-40	111	2-5	120	10-15	117	10-15
Tay	mm	**150**	888		1796		2700		3824	
	%	**111**	145	25-40	118	15-25	128	>>100	117	80-120
Forth	mm	**151**	953		1749		2569		3596	
	%	**127**	166	>100	129	>100	135	>>100	122	>100
Tweed	mm	**145**	991		1569		2273		3184	
	%	**152**	196	>>100	139	>100	141	>>100	128	>100
Solway	mm	**183**	1085		2223		3137		4374	
	%	**118**	153	>100	132	>100	134	>>100	120	>100
Clyde	mm	**194**	1055		2717		3777		5186	
	%	**103**	125	8-12	130	>100	131	>100	116	20-35

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

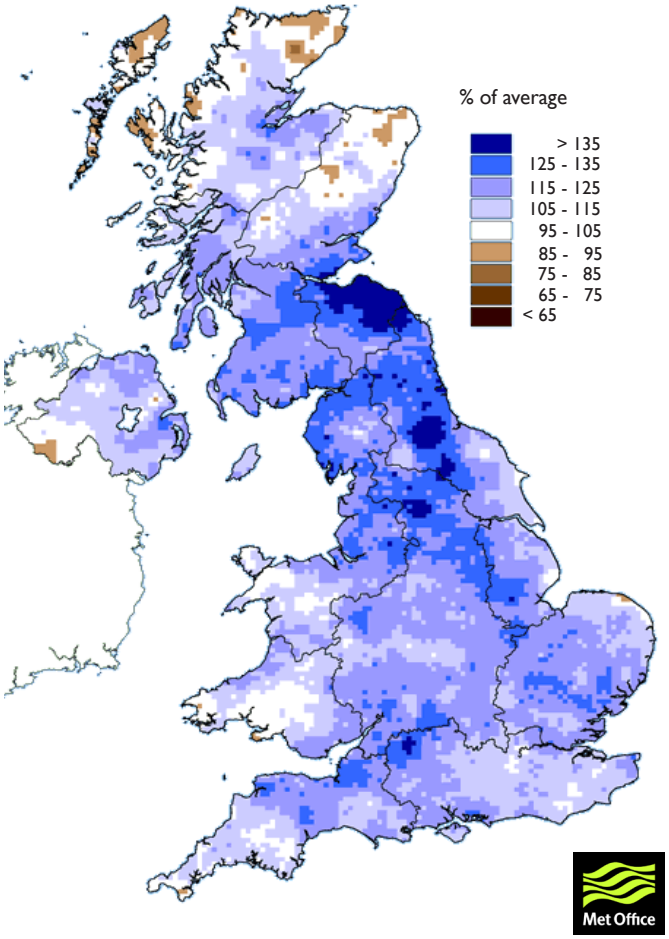
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic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

Rainfall . . . Rainfall . . .

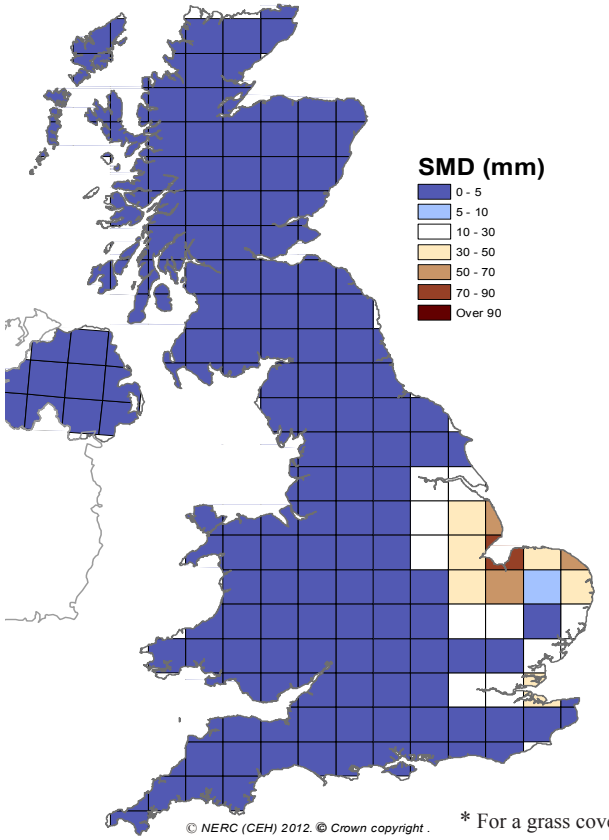
April 2012 - October 2012 rainfall as % of 1971-2000 average



November 2011 - October 2012 rainfall as % of 1971-2000 average



MORECS Soil Moisture Deficits* October 2012



* For a grass cover

Met Office 3-month outlook

Updated: November 2012

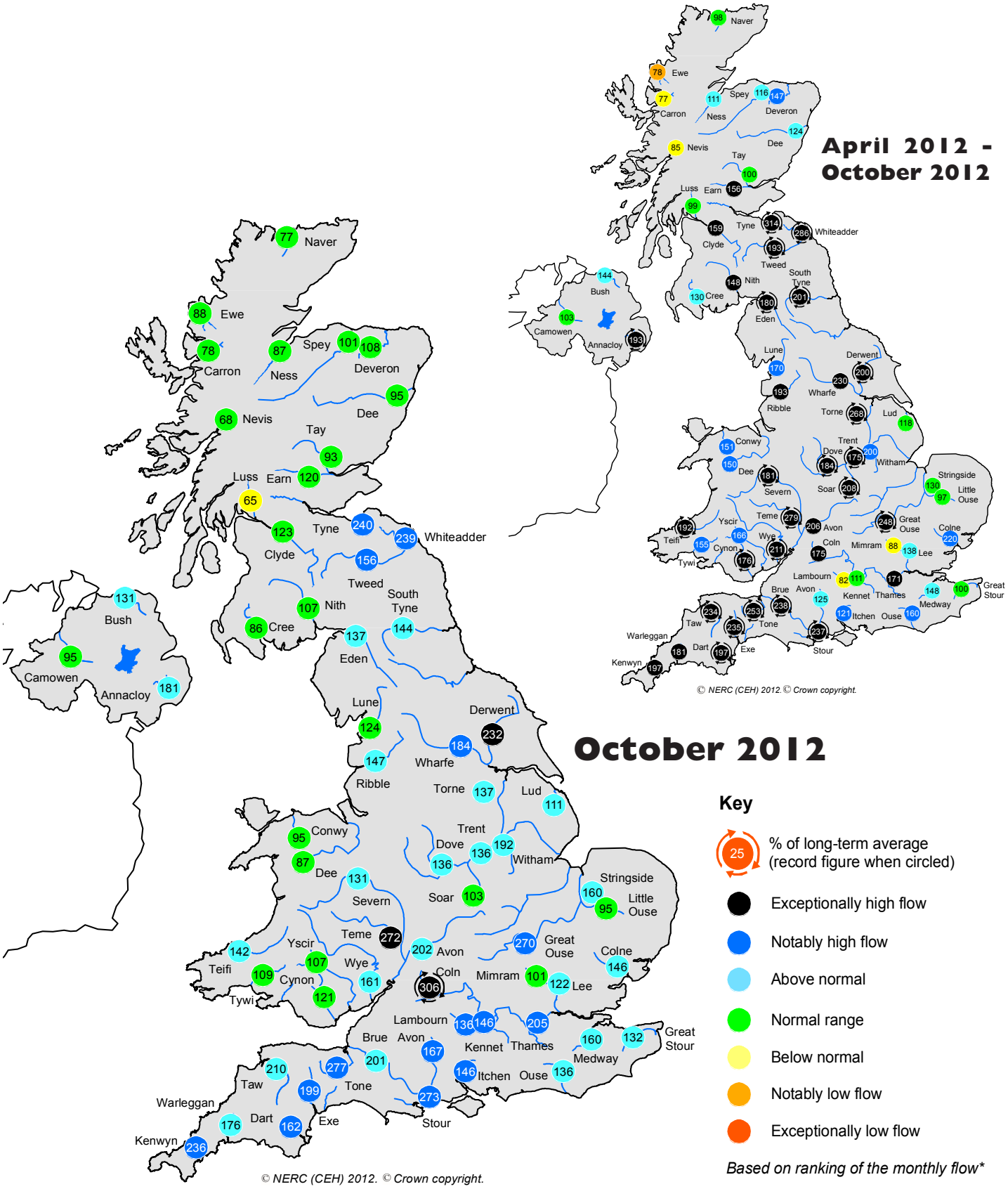
Large scale influences are currently weak and models are in disagreement about the distribution of precipitation across Europe over the next three months, leading to a very broad range of predicted outcomes. Predictions for UK-mean precipitation for both November and the November-December-January period are similar to climatology and show a slight preference for near-normal values.

The probability that UK mean precipitation for November-December-January will fall into the driest quintile category is about 15% and the probability that it will fall into the wettest quintile category is about 20% (the climatological 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.

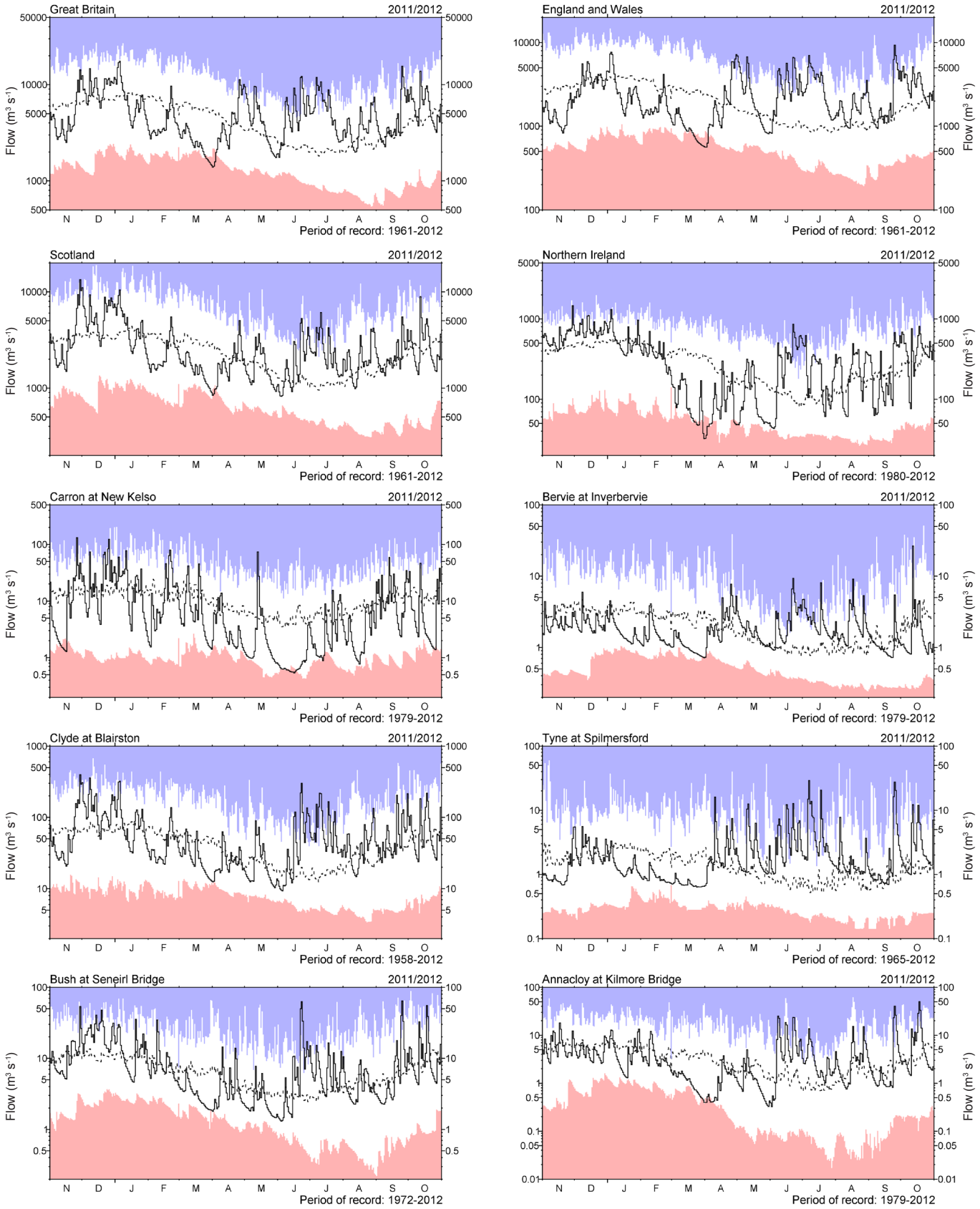
River flow . . . River flow . . .



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.

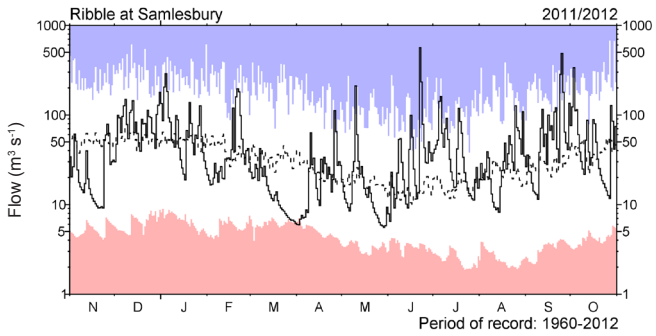
River flow . . . River flow . . .

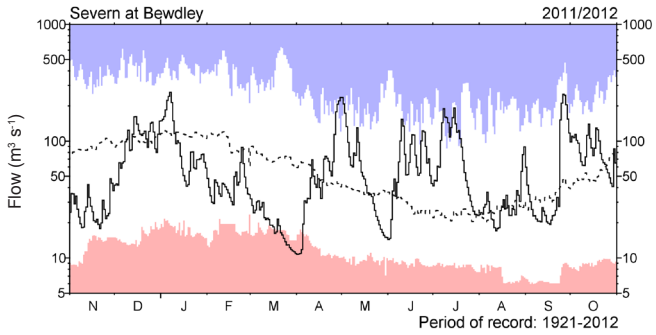


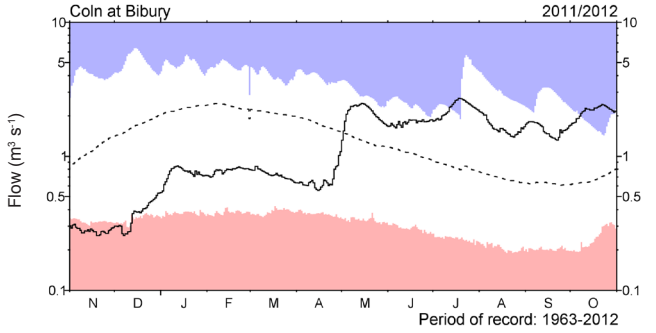
River flow hydrographs

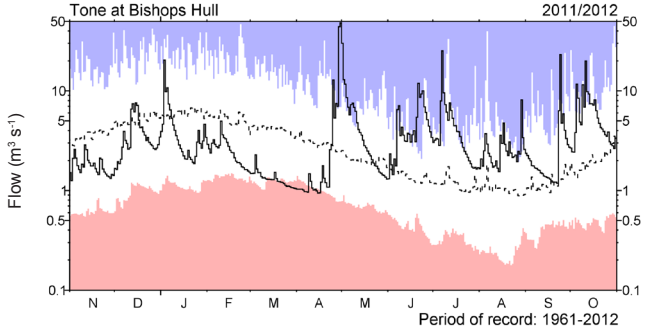
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to November 2011 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed line.

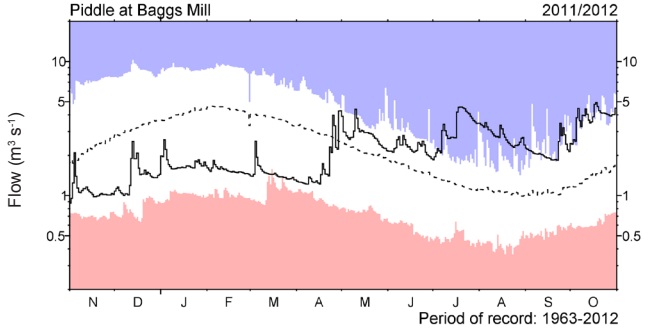
River flow . . .



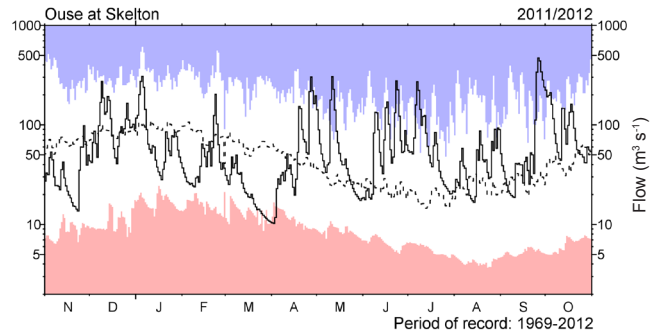


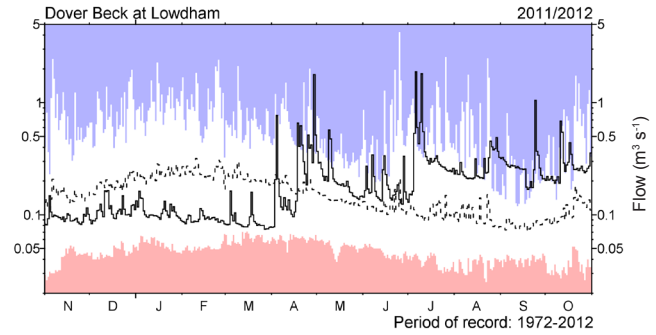


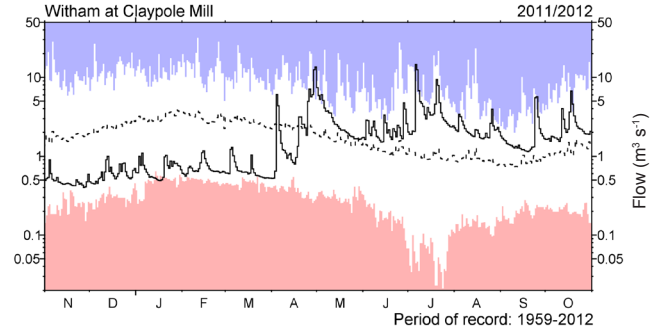


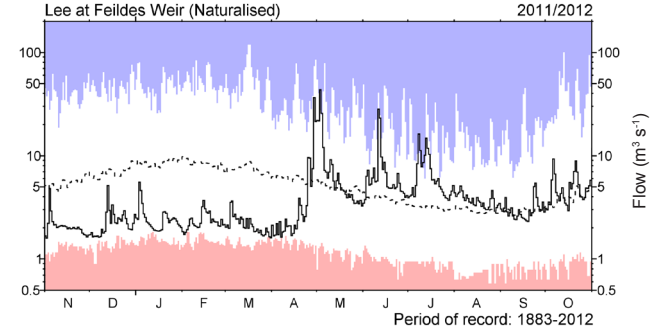


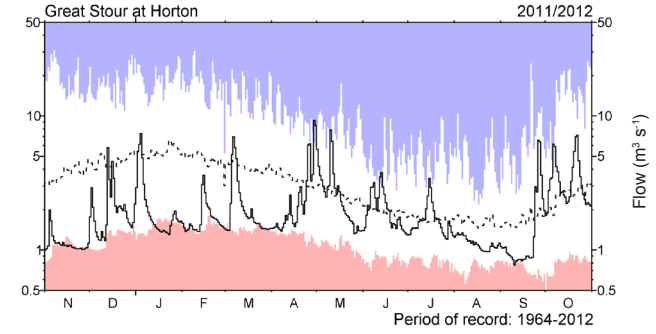
River flow . . .









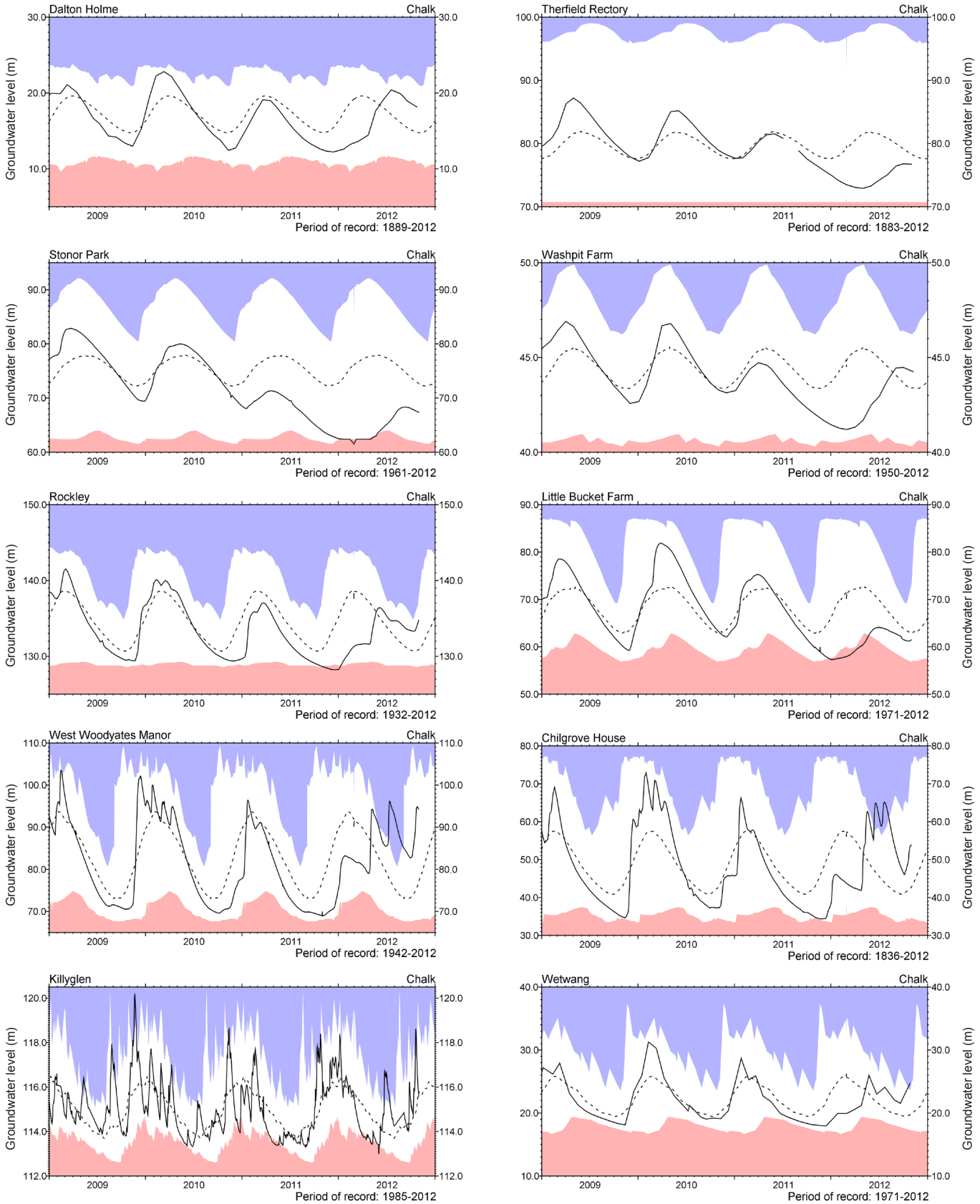


Notable runoff accumulations (a) April 2012 - October 2012

	River	%lta	Rank	River	%lta	Rank	River	%lta	Rank
a)	Don	155	41/43	a) Thames (Kingston)	171	127/130	a) Otter	215	50/50
	Tyne (Bywell)	223	53/53	Blackwater	151	58/60	Severn (Bewdley)	182	90/92
	Ouse (Skelton)	249	37/37	Wallington	258	58/58	Usk (Chain Bridge)	166	54/55
	Dove (Kirkby Mills)	182	40/41	Lymington	295	50/50	Tawe	161	52/53
	Dover Beck	228	37/38	Piddle	166	49/49	Dyfi	185	44/44

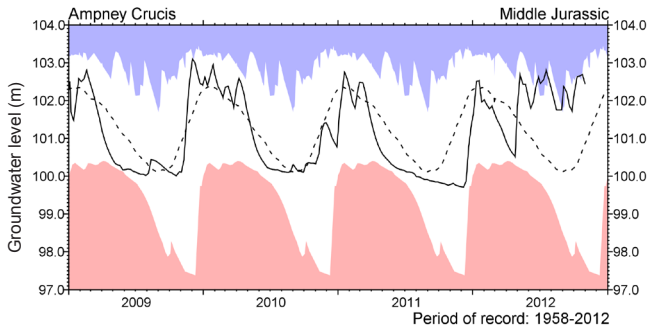
lta = long term average; Rank 1 = lowest on record

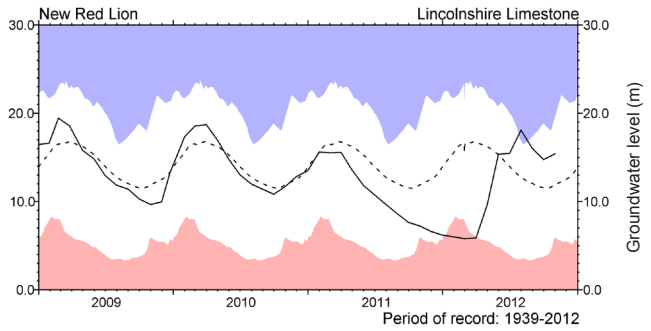
Groundwater . . . Groundwater

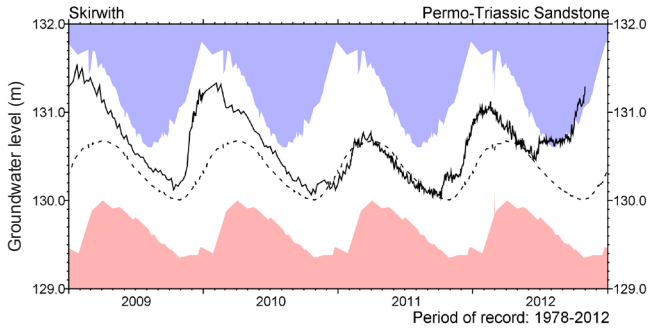


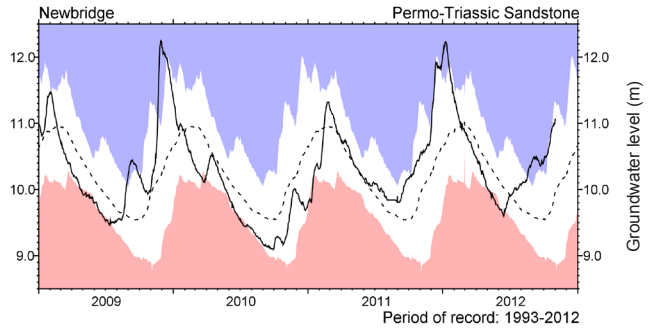
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

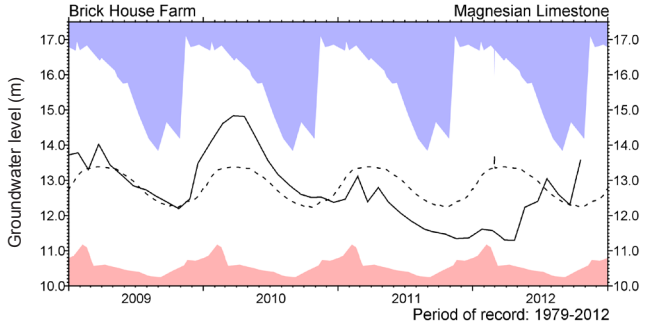
Groundwater . . . Groundwater

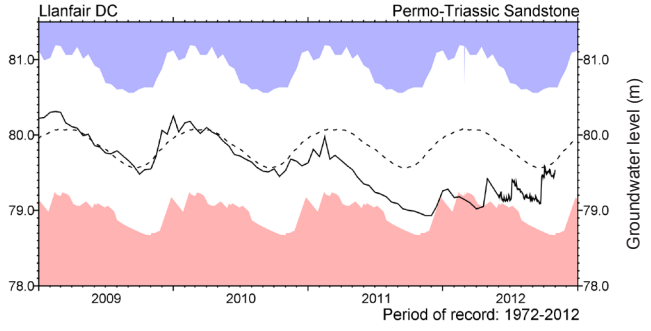


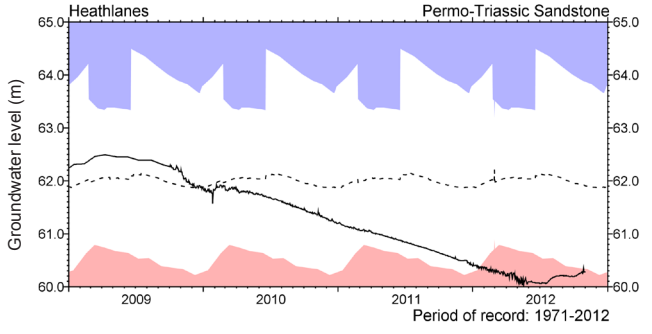


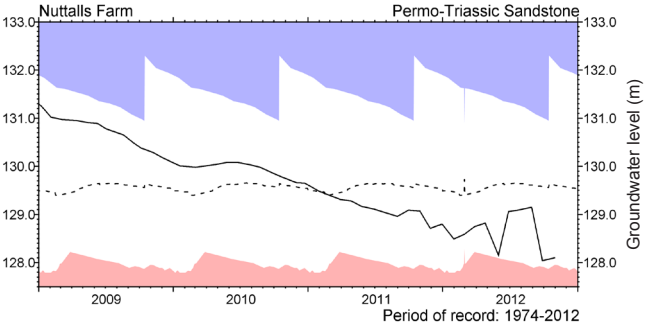


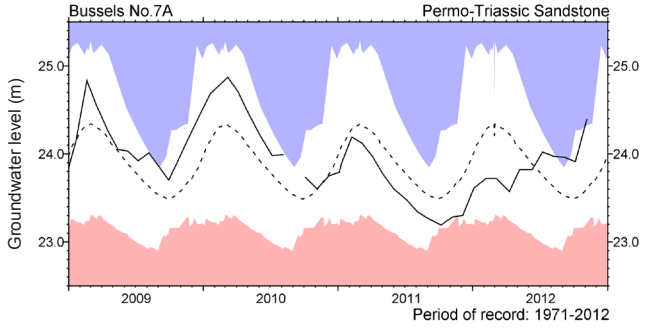


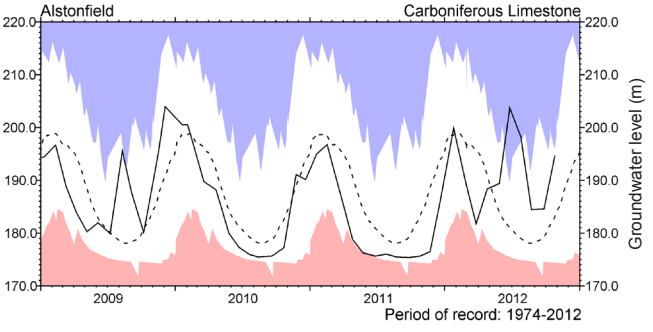








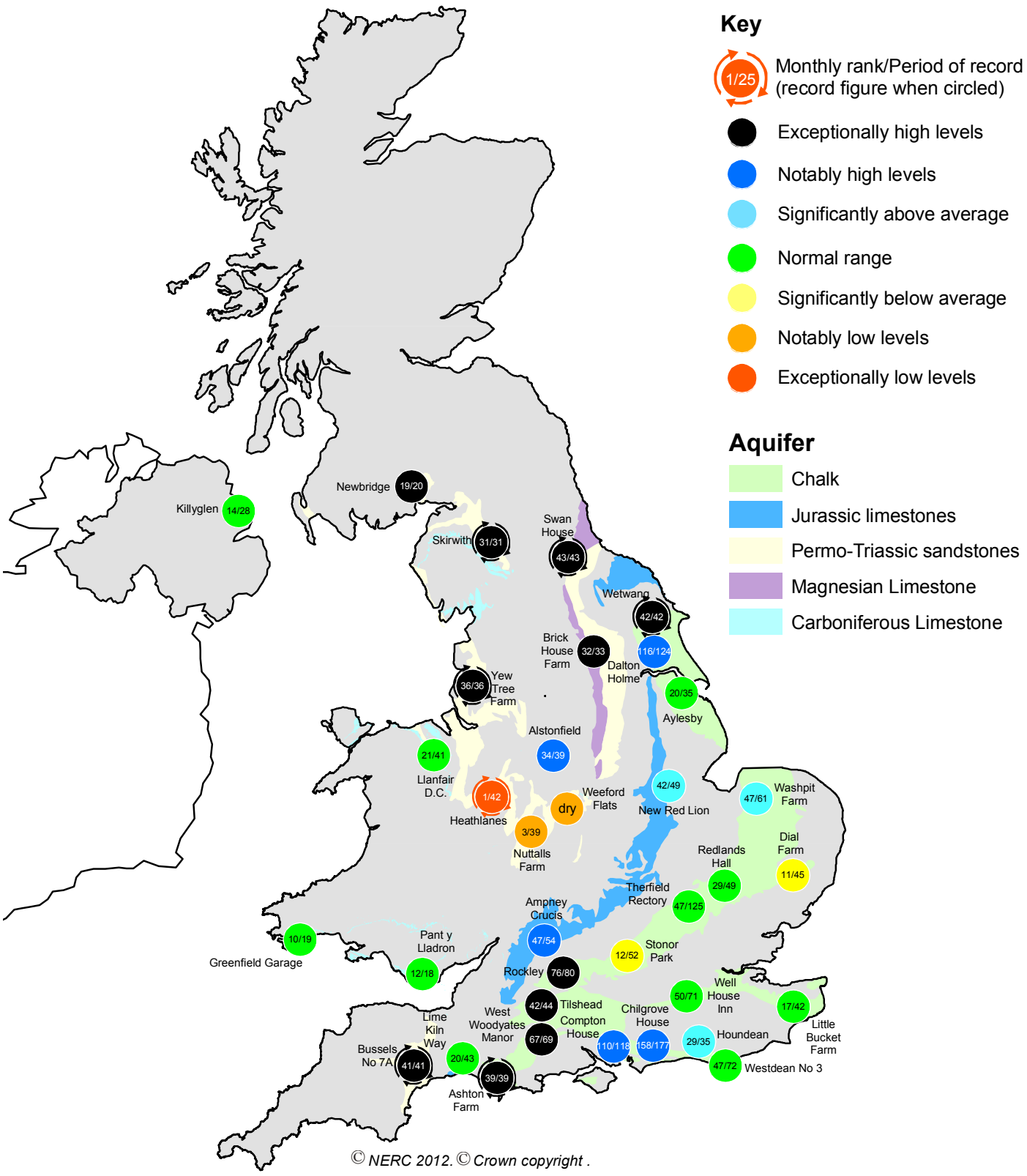




Groundwater levels October / November 2012

Borehole	Level	Date	Oct av.	Borehole	Level	Date	Oct av.	Borehole	Level	Date	Oct av.
Dalton Holme	18.14	24/10	14.88	Chilgrove House	53.89	31/10	42.24	Brick House Farm	13.57	19/10	12.24
Therfield Rectory	76.72	01/11	79.09	Killyglen (NI)	115.58	31/10	114.85	Llanfair DC	79.53	31/10	79.56
Stonor Park	67.39	31/10	72.98	Wetwang	24.69	26/10	19.33	Heathlanes	60.28	31/10	61.90
Tilshead	86.21	31/10	80.75	Ampney Crucis	102.45	31/10	100.43	Nuttalls Farm	128.10	30/10	129.65
Rockley	134.75	31/10	130.68	New Red Lion	15.39	31/10	11.49	Bussels No.7a	24.39	05/11	23.51
Well House Inn	95.36	31/10	93.02	Skirwith	131.29	31/10	130.02	Alstonfield	194.57	25/10	181.17
West Woodyates	94.21	31/10	74.79	Newbridge	11.06	01/11	9.71				

Levels in metres above Ordnance Datum



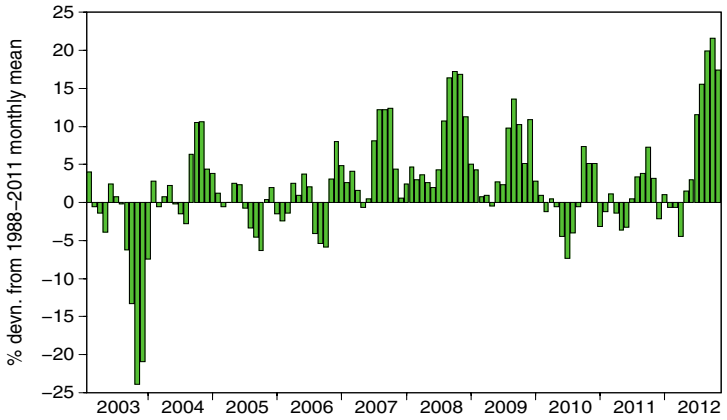
Groundwater levels - October 2012

The calculation of ranking has been modified from previous summaries. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. The rankings are designed as a qualitative indicator, and ranks at extreme levels, and when levels are changing rapidly, need to be interpreted with caution.

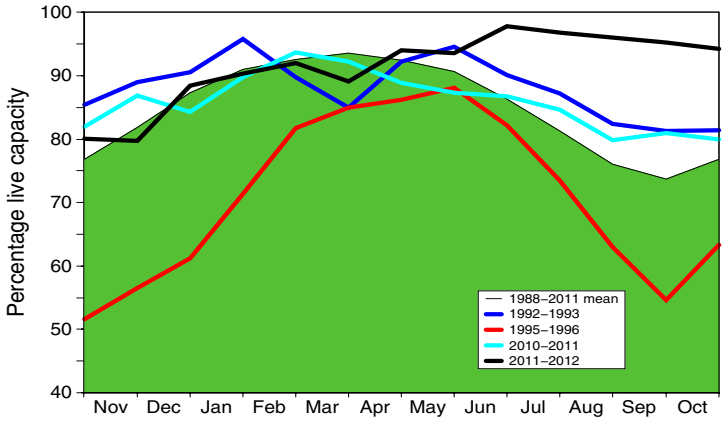
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

Reservoirs . . . Reservoirs . . .

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

Percentage live capacity of selected reservoirs at start of month

Area	Reservoir		Capacity (Ml)	2012 Sep	Oct	Nov	Nov Anom.	Min Nov	Year* of min	2011 Nov	Diff 12-11
North West	N Command Zone	•	124929	92	97	**96**	30	33	2003	80	16
	Vyrnwy		55146	100	98	**93**	19	25	1995	75	18
Northumbrian	Teesdale	•	87936	95	97	**96**	22	33	1995	91	5
	Kielder		(199175)	95	93	**90**	4	63	1989	90	0
Severn Trent	Clywedog		44922	91	90	**87**	11	38	1995	86	1
	Derwent Valley	•	39525	95	100	**98**	27	15	1995	75	23
Yorkshire	Washburn	•	22035	94	98	**97**	28	15	1995	81	16
	Bradford supply	•	41407	97	100	**100**	28	16	1995	86	14
Anglian	Grafham		(55490)	95	95	**92**	10	44	1997	84	8
	Rutland		(116580)	98	98	**95**	18	59	1995	66	29
Thames	London	•	202828	96	88	**95**	19	46	1996	69	26
	Farmoor	•	13822	93	92	**83**	-6	43	2003	85	-2
Southern	Bewl		28170	83	79	**58**	-2	33	1990	43	15
	Ardingly*		4685	100	100	**100**	35	15	2003	34	66
Wessex	Clatworthy		5364	98	91	**100**	39	14	2003	33	67
	Bristol WW	•	(38666)	98	97	**98**	37	24	1990	53	45
South West	Colliford		28540	89	89	**92**	23	38	2006	49	43
	Roadford		34500	94	92	**98**	28	18	1995	56	42
	Wimbleball		21320	100	100	**100**	34	26	1995	44	56
	Stithians		4967	95	93	**100**	45	18	1990	39	61
Welsh	Celyn and Brenig	•	131155	99	100	**94**	10	48	1989	93	1
	Brianne		62140	100	100	**99**	8	57	1995	100	-1
	Big Five	•	69762	98	99	**99**	24	38	2003	93	6
	Elan Valley	•	99106	100	100	**100**	15	37	1995	100	0
Scotland(E)	Edinburgh/Mid Lothian	•	97639	100	100	**100**	19	48	2003	100	0
	East Lothian	•	10206	100	100	**100**	17	38	2003	100	0
Scotland(W)	Loch Katrine	•	111363	90	91	**92**	6	40	2003	95	-3
	Daer		22412	100	100	**99**	8	42	2003	100	-1
	Loch Thom	•	11840	99	100	**100**	11	66	2007	100	0
Northern Ireland	Total+	•	56920	97	98	**97**	16	39	1995	93	4
	Silent Valley	•	20634	100	99	**95**	22	34	1995	88	7

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

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 1988-2011 period except for West of Scotland and Northern Ireland where data commence in the mid-1990's. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

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

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. 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, the Environment Agency Wales, the Scottish Environment Protection Agency and, for Northern Ireland, the Rivers Agency and the Northern Ireland Environment Agency. In all cases the data are subject to revision following validation (flood and drought 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 Fax: 0870 900 5050
E-mail: enquiries@metoffice.com

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

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Selected text and maps are available on the WWW at http://www.ceh.ac.uk/data/nrfa/nhmp/nhmp.html
Navigate via Hydrological Summary for the UK.

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11/12