Hydrological Summary
for the United Kingdom

January 2012

General

The synoptic patterns which have produced a remarkably sustained exaggeration in the NW-SE rainfall gradient across the UK continued in January. Much of central, eastern and southern England was again relatively dry and the development of the current regional drought now extends across three winter periods with a range of impacts embracing water resources, agriculture and the aquatic environment. Reservoirs were near to capacity in early February across Scotland, Northern Ireland and most of Wales. Stocks have held up well in a number of large pumped-storage impoundments in the drought-affected regions (Farmoor was virtually full entering February) but are seasonally depressed in a number of smaller reservoirs (including farm reservoirs and those supplying canals). Early February stocks were substantially below the previous minimum for Ardingly (West Sussex) and the 2nd lowest in a series from 1998 at Bewl (East Sussex). Flood alerts were common in Scotland during early January but river flows in many central and southern rivers have been notably depressed since the early autumn and the meagre January runoff was accompanied by a further contraction in the stream network. Very limited aquifer recharge since 2009 has left groundwater levels close to period-of-record minima in some parts of the English Lowlands. Measures to moderate the drought's impact are being widely deployed (from groundwater augmentation of low flows to appeals for reduced water usage – contingencies normally associated with an arid summer rather than the late winter). The window of opportunity for further substantial aquifer recharge (before evaporative demands rob the rainfall of much of its hydrological effectiveness) is narrowing rapidly. In the absence of an unusually wet late winter and early spring (as happened in 2000 for example), it is now virtually inevitable that a significant degree of drought stress will be experienced in 2012. The magnitude of that stress, and its spatial extent, will be heavily influenced by rainfall over the next 8-10 weeks.

Rainfall

The maritime synoptic influences which characterised the latter half of December continued into early January when a sequence of vigorous frontal systems brought damaging winds across much of the UK. Conditions were again particularly wet in western Scotland (Cluanie Inn recorded 58mm on the 4th, Kinlochewe 65mm on the 11th) but, with high pressure extending from the continent, opportunities for significant rainfall in the English Lowlands became very restricted – some central areas reported <1mm of rain over the fortnight beginning on the 5th. For the month as a whole, precipitation totals were above average in much of western and northern Scotland and the southern Pennines. Conversely, totals reached only 60-85% of average across the greater part of the drought-affected areas. Accumulated rainfall deficiencies, although locally variable, are exceptional across a wide range of durations. Provisionally, the Anglian region recorded its lowest March-January rainfall in a series from 1910 (over the same 11-month period Scotland established a new maximum precipitation total). As notably, some parts of the Midlands have reported only three months with above average rainfall since November 2009 and the accumulation for the subsequent 26 months is the lowest on record (for periods beginning in December) in a series from 1910; for the Thames basin it was the driest since 1972-74 – such deficiencies were more common in the 19th century. The rainfall maps on page 3 illustrate the extreme regional, and notable local, contrasts in rainfall patterns since late 2009.

River Flow

Spate conditions were common across northern and western Britain in early January, snowmelt often being a contributory factor. Flood warnings were widespread from 3rd-6th and some notable high flows were reported; on the 3rd the Cynon registered its 2nd highest January flow in a record from 1957. The spates were particularly welcome in southern England – the Thames reached its highest flow since February 2011 – but recessions generally became re-established and extended well into February in most catchments. A combination of limited rainfall, residual soil moisture deficits and much diminished baseflows has resulted in the 2011/12 runoff recovery being both weak and faltering across much of the English Lowlands. January mean flows were below those which typify the late summer in many drought-affected catchments and runoff accumulations are exceptionally low. Daily flows in the Little Ouse and Soar tracked close to, or below, previous January minima through much of the month but the drought's impact is most evident in medium-term accumulations. For the Little Ouse and Winterbourne (Berkshire), 5-month runoff accumulations are lower than for *any* 5-month sequence prior to the current drought. For the March-January period mean flows in many lowland rivers including the Soar, Teme, Medway and Little Ouse fell below previous minima. For some, mostly baseflow-dominated, rivers (e.g. Lambourn, Coln, Mimram and Dorset Avon) flows have remained below the monthly average since the middle of 2010 and the currently very depressed flows, often accompanied by low oxygen levels, limited dilution for sewage effluent, contractions in the stream network and stress on wetlands and other aquatic habitats, are very rare this early in the year.

Groundwater

Apart from an area adjacent to the Wash, soil moisture deficits were largely eliminated in early January but thereafter infiltration rates were again seasonally very depressed. In late 2009, overall groundwater resources were notably healthy but three successive recharge seasons with below average replenishment (to many outcrop areas) has seen a very substantial deterioration in the groundwater outlook. Some brisk water-table recoveries were reported for responsive aquifers in January (e.g. in the Carboniferous Limestone at Alstonfield) and seasonally healthy levels characterise a few northern outcrops (e.g. at Killyglen and Newbridge). Generally, however the 2011/12 seasonal recoveries, which needed to be generated from an exceptionally low base, have gathered very little momentum. Mean January levels were the lowest on record in parts of the Lincolnshire Limestone (see New Red Lion hydrograph) and the Chalk (including Stonor in the Chilterns which has a 50-year record) and remain very depressed in the Permo-Triassic sandstones of the west Midlands and north Wales. Estimated January levels for the Chalk outcrop as a whole (based on departures from the average for seven index boreholes) was the 4th lowest in a 60-year series (marginally lower levels were registered in January 1991, 1992 and 1997).

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

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

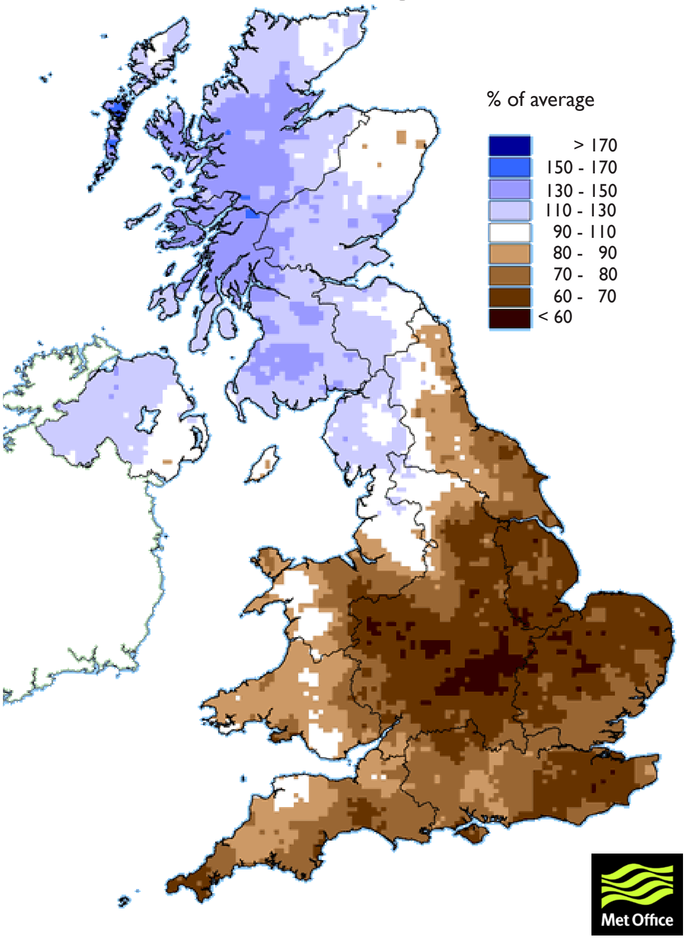
Area	Rainfall	Jan 2012	Sep11 - Jan12	RP	Jun11 - Jan12	RP	Mar11 - Jan12	RP	Dec09 - Jan12	RP
United	mm	**108**	608		875		1063		2332	
Kingdom	%	**92**	108	2-5	113	2-5	106	2-5	97	2-5
England	mm	**63**	333		540		619		1597	
	%	**76**	82	5-10	92	2-5	81	15-20	88	10-20
Scotland	mm	**179**	1022		1385		1761		3423	
	%	**108**	132	>100	134	>100	133	>100	107	5-10
Wales	mm	**123**	688		976		1131		2692	
	%	**80**	94	2-5	98	2-5	90	5-10	88	10-15
Northern	mm	**115**	733		979		1177		2504	
Ireland	%	**96**	132	>100	124	20-35	115	15-20	102	2-5
England &	mm	**71**	382		600		690		1748	
Wales	%	**77**	84	2-5	94	2-5	83	10-20	88	10-20
North West	mm	**122**	686		983		1195		2573	
	%	**101**	113	2-5	115	2-5	110	2-5	99	2-5
Northumbria	mm	**56**	347		631		755		1898	
	%	**68**	87	2-5	108	2-5	98	2-5	104	2-5
Midlands	mm	**58**	276		424		497		1323	
	%	**77**	76	8-12	79	10-15	71	80-120	79	50-80
Yorkshire	mm	**74**	350		564		642		1630	
	%	**91**	89	2-5	98	2-5	85	8-12	91	8-12
Anglian	mm	**38**	174		343		376		1137	
	%	**71**	63	35-50	80	8-12	66	80-120	86	10-15
Thames	mm	**45**	228		422		469		1299	
	%	**66**	67	10-20	85	5-10	72	25-40	84	10-20
Southern	mm	**50**	278		484		525		1552	
	%	**60**	67	10-15	85	2-5	72	25-40	90	5-10
Wessex	mm	**58**	334		560		630		1582	
	%	**62**	75	5-10	91	2-5	79	10-20	82	25-40
South West	mm	**103**	562		812		897		2255	
	%	**73**	87	2-5	94	2-5	81	10-15	83	20-30
Welsh	mm	**115**	654		931		1079		2586	
	%	**79**	93	2-5	97	2-5	89	5-10	88	10-20
Highland	mm	**256**	1309		1678		2164		3954	
	%	**127**	139	>100	136	80-120	138	>100	103	2-5
North East	mm	**89**	471		830		1043		2446	
	%	**91**	99	2-5	122	5-10	118	5-10	117	8-12
Tay	mm	**125**	811		1216		1537		3110	
	%	**79**	120	8-12	135	30-50	132	80-120	110	5-10
Forth	mm	**108**	693		1061		1340		2783	
	%	**85**	118	8-12	131	25-40	129	50-80	111	8-12
Tweed	mm	**67**	513		872		1078		2401	
	%	**66**	108	2-5	129	8-12	122	8-12	114	5-10
Solway	mm	**164**	994		1361		1697		3428	
	%	**105**	133	40-60	134	25-40	131	70-100	109	8-12
Clyde	mm	**219**	1386		1762		2222		4135	
	%	**109**	148	>100	140	>100	140	>100	107	5-10

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

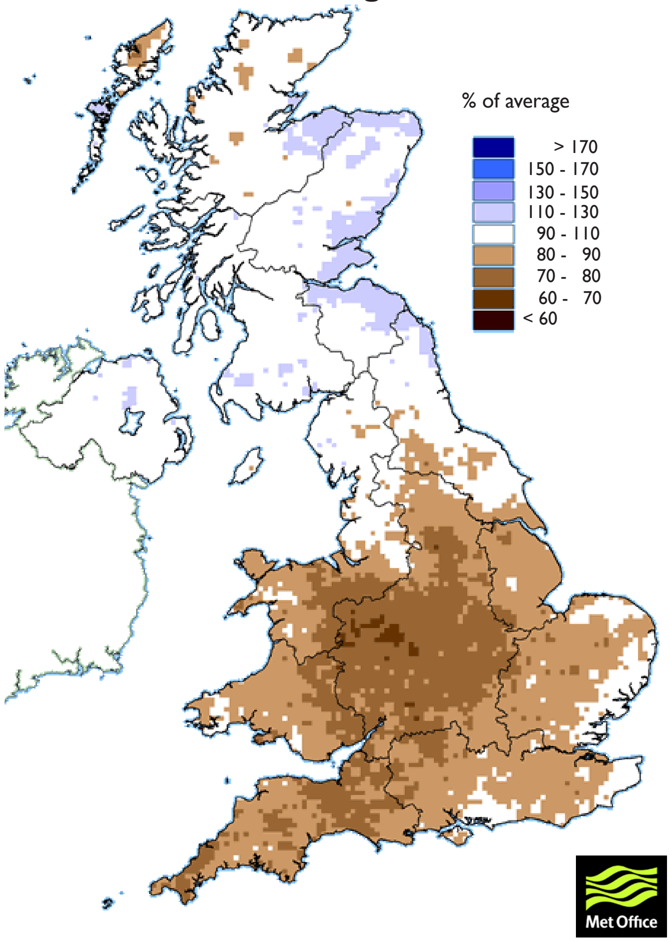
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 September 2011 are provisional.

Rainfall . . . Rainfall . . .

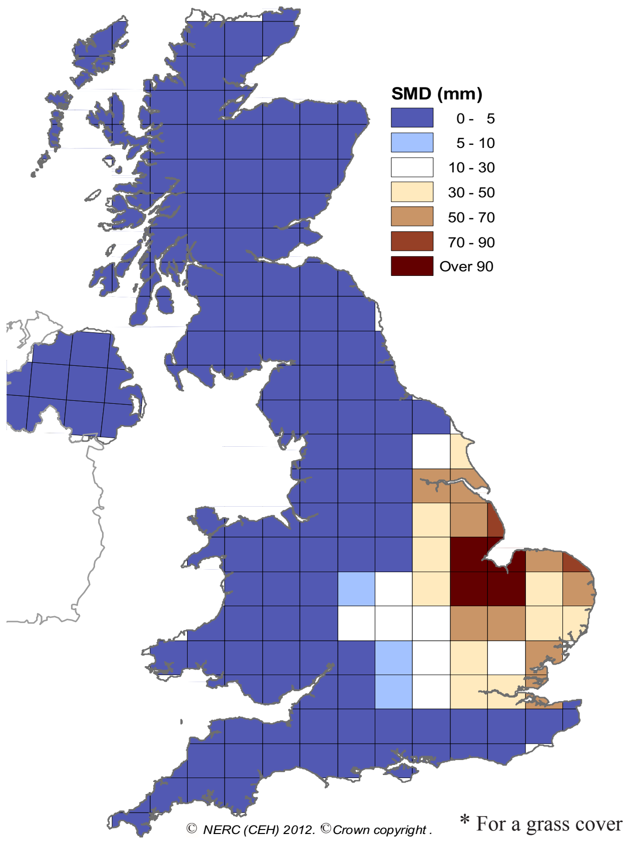
March 2011 - January 2012 rainfall as % of 1971-2000 average



December 2009 - January 2012 rainfall as % of 1971-2000 average



MORECS Soil Moisture Deficits* January 2012



* For a grass cover

Met Office 3-month outlook

Rainfall significantly above average is needed in southern, eastern and central England during the February-March-April period for a full recovery of the water resources situation here – the chances of this happening are low.

For February there is a slightly elevated risk of well-below-average rainfall across the UK as a whole.

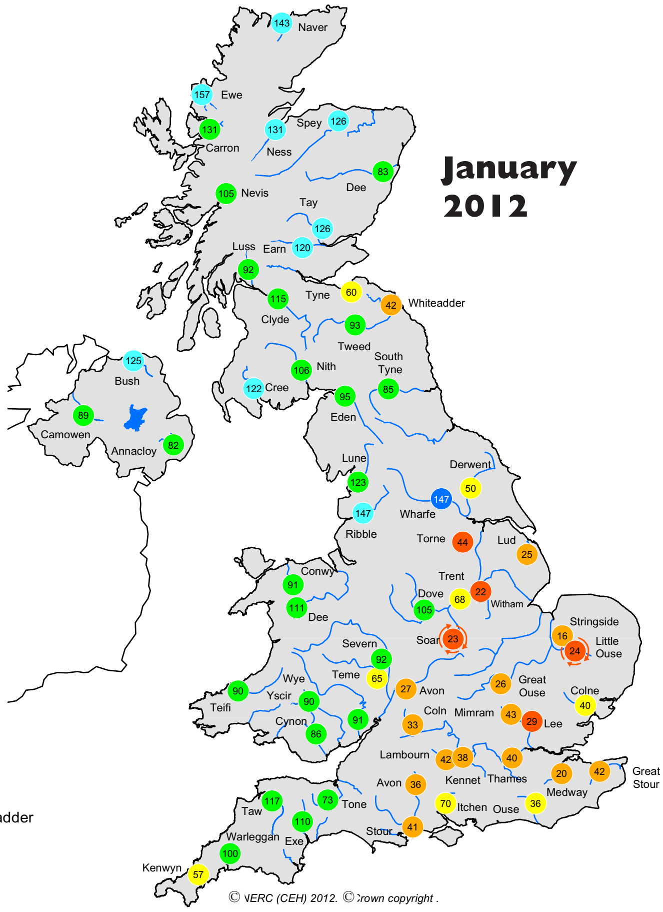
The probability that UK precipitation for February-March-April will fall into the driest of our five categories is about 20%, whilst the probability that it will fall into the wettest of our five categories is about 15% (each of these categories has occurred in 20% of the years between 1971-2000).

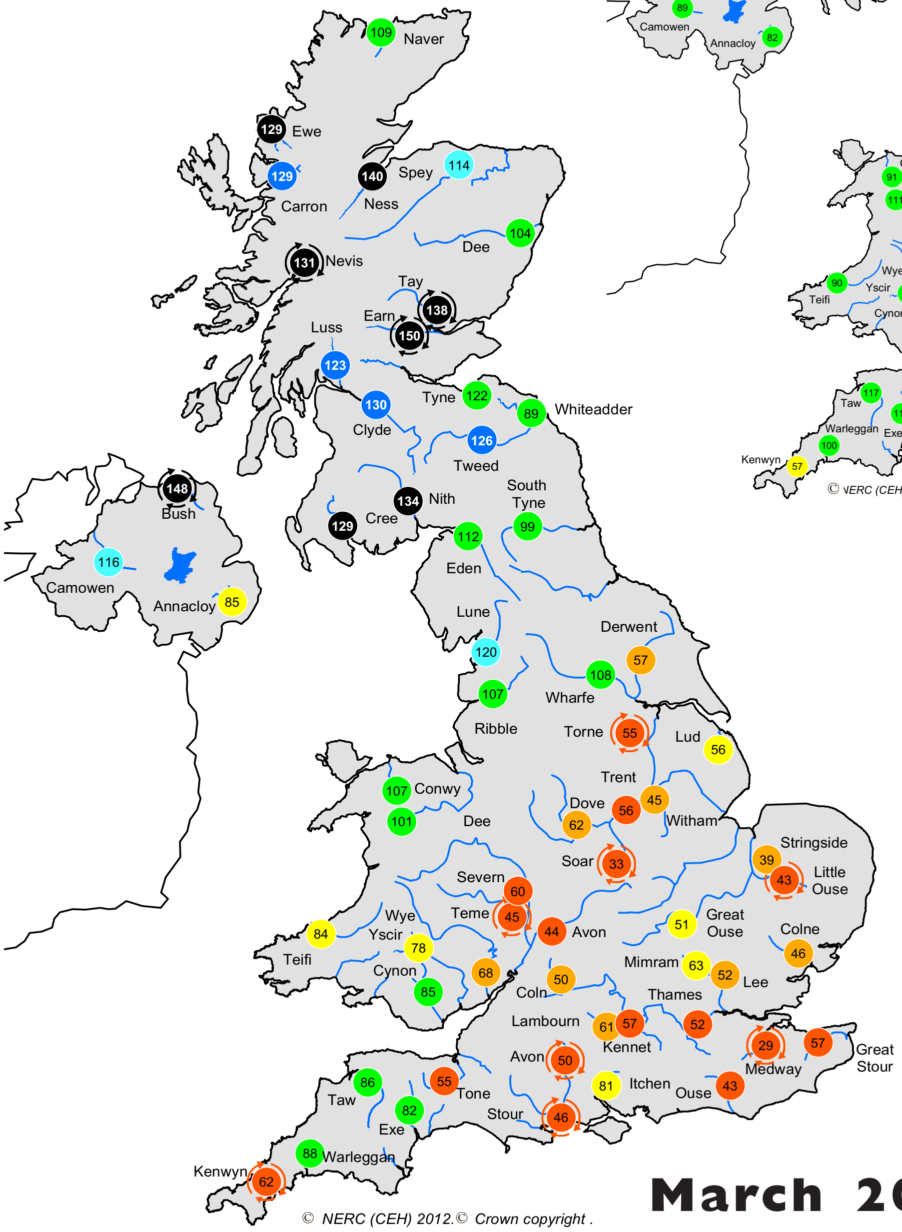
The complete version of the 3-month outlook may be found at:
http://www.metoffice.gov.uk/publicsector/contingency-planners
This outlook is updated towards the end of each calendar month.

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 . . .

January 2012





Key

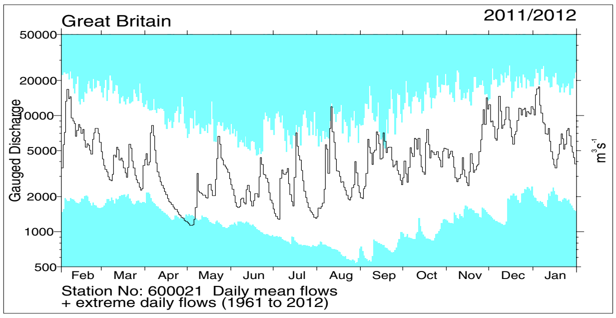
- 25 — % of long-term average (record figure when circled)
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

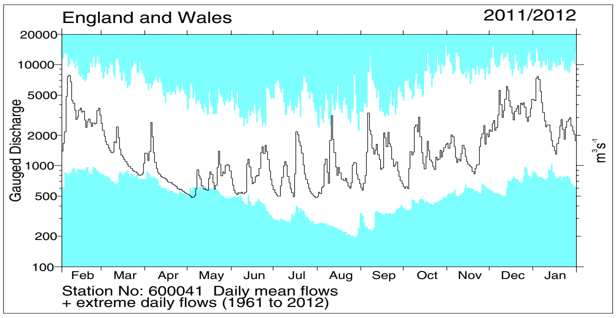
*Based on ranking of the monthly flow**

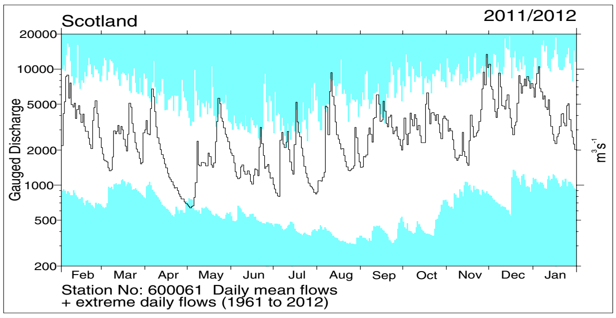
March 2011 - January 2012

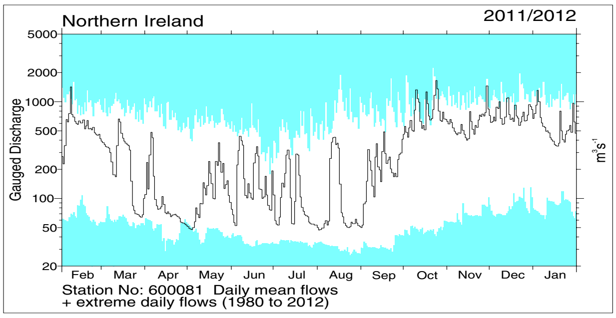
River flows

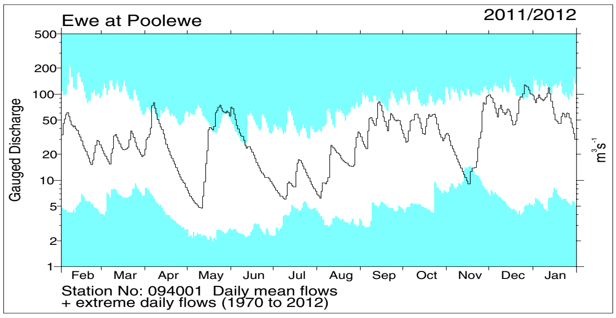
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

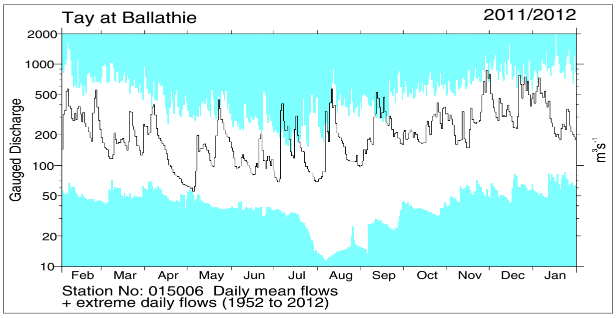


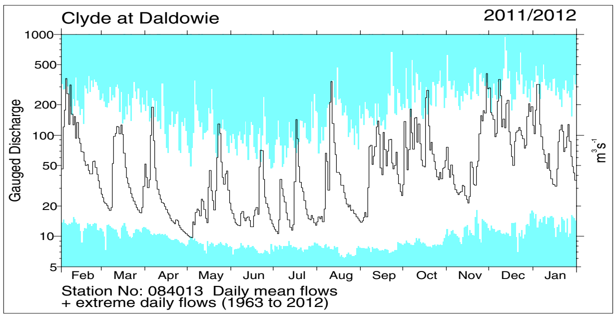


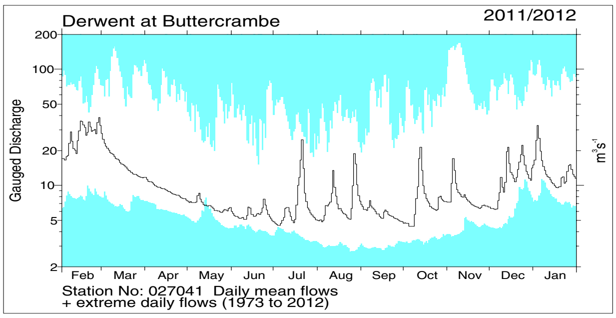


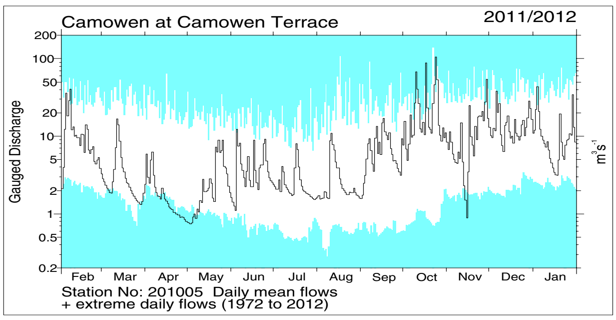


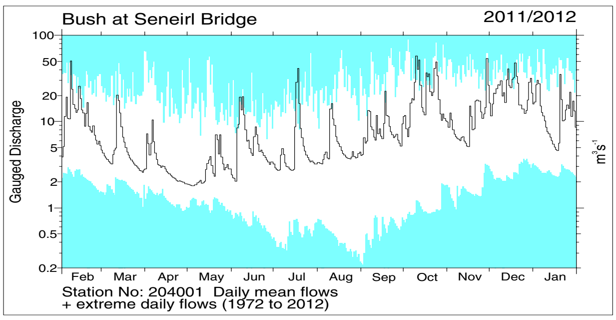








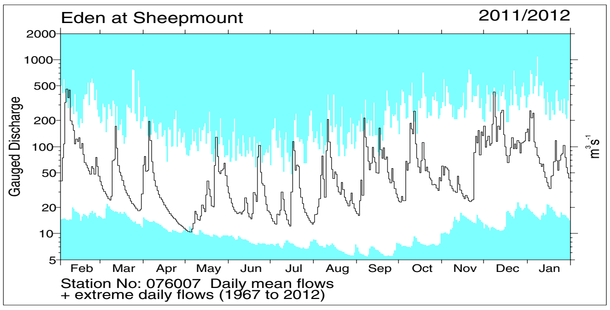


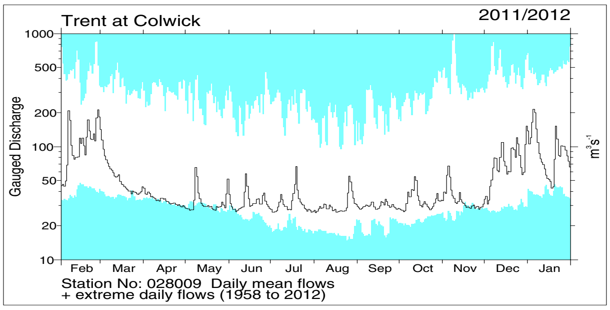


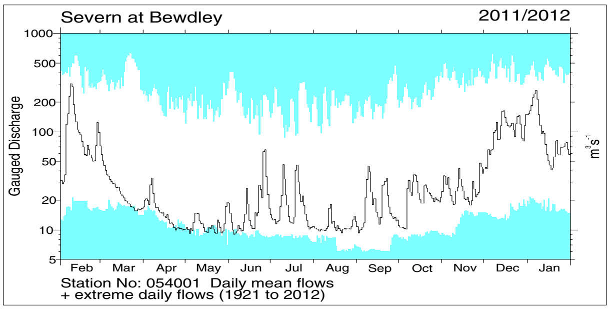
River flow hydrographs

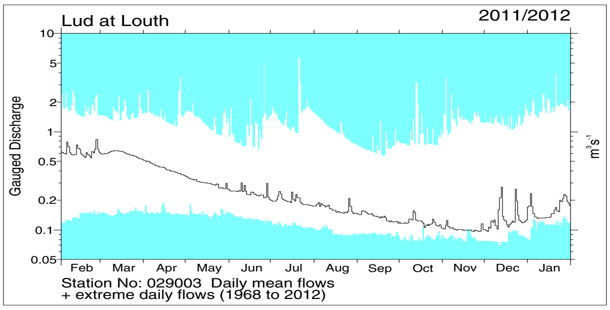
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to February 2011 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

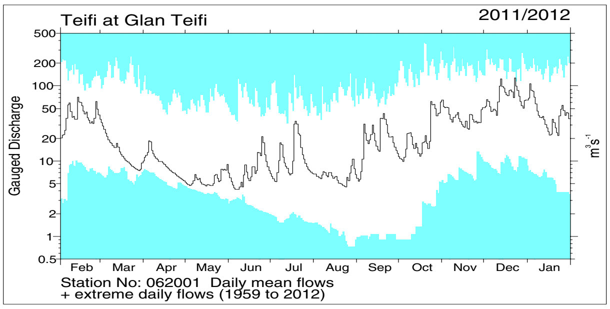
River flow . . . River flow . . .

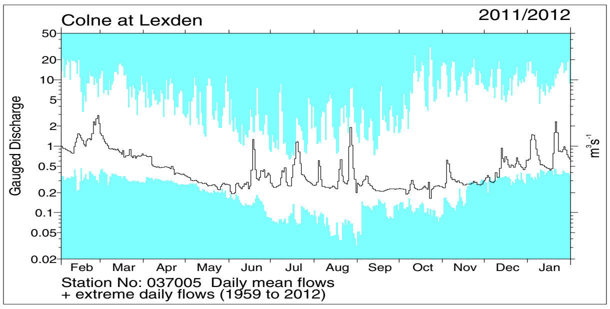


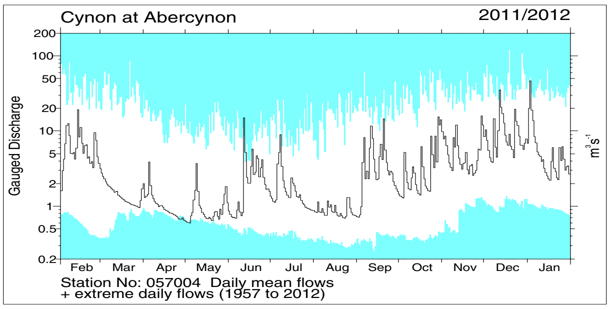


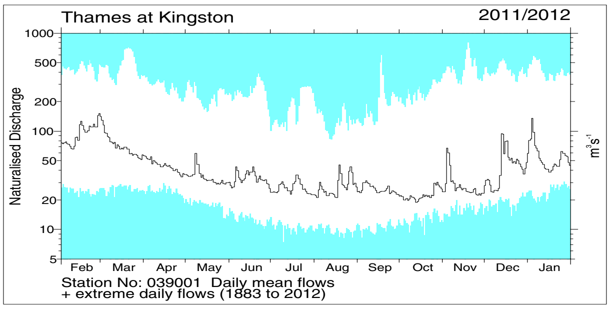


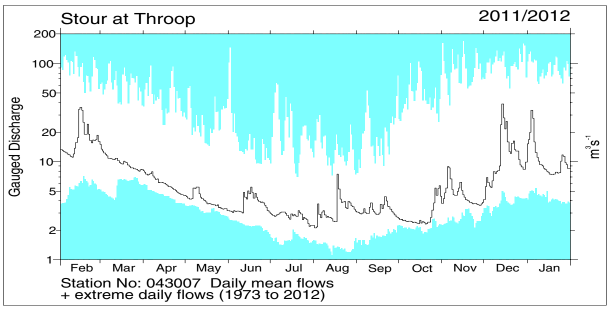


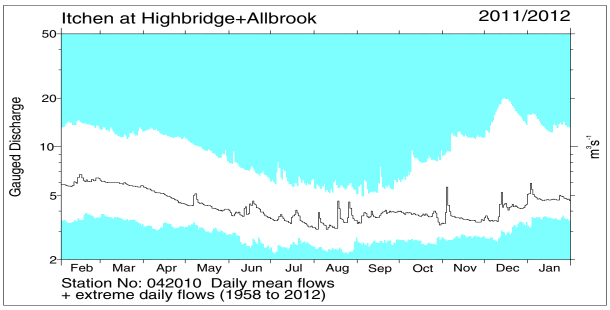












Notable runoff accumulations (a) September 2011 - January 2012, (b) February 2010 - January 2012

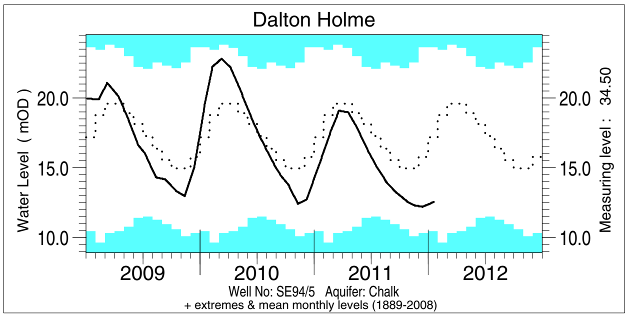
	River	%lta	Rank
a)	Forth	149	31/31
	Lud	34	2/44
	Little Ouse	28	1/42
	Kennet	48	2/50
	Lambourn	55	1/49
	Coln	33	2/48
	Medway	21	1/50
	Great Stour	44	1/47
	Wallington	30	1/57

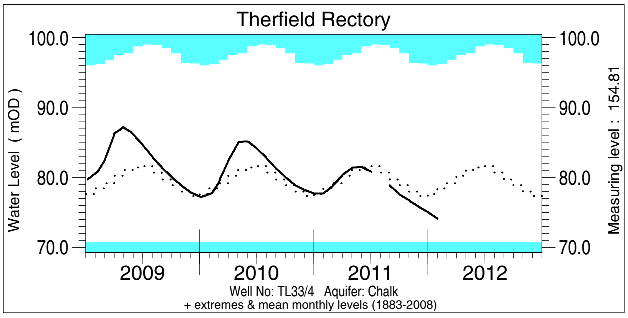
	River	%lta	Rank
a)	Avon (Amesbury)	40	1/47
	Nith	150	54/54
	Cree	142	47/48
	Clyde (Blairston)	157	51/51
	Carron	140	33/33
	Mourne	159	30/30
	Faughan	153	36/36
	Bush	170	38/38

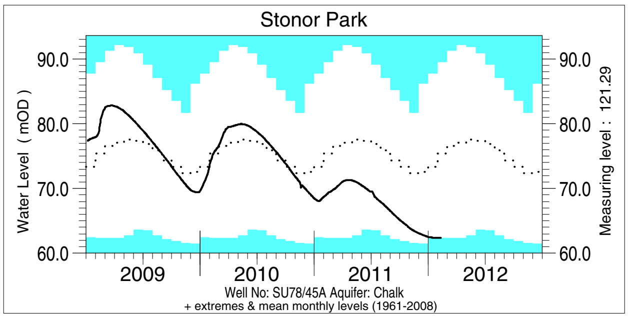
	River	%lta	Rank
b)	Tyne (Spilmersford)	143	44/44
	Soar	57	1/39
	Stour	65	1/38
	Kenwyn	70	1/42
	Tone	62	1/50
	Brue	64	1/44
	Teme	60	1/40

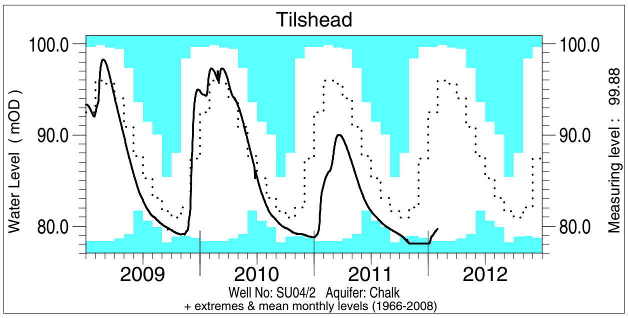
lta = long term average
Rank 1 = lowest on record

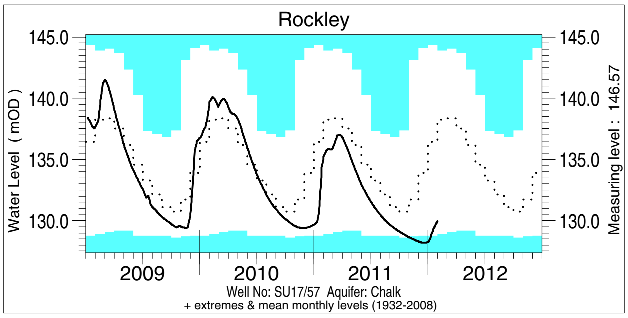
Groundwater . . . Groundwater

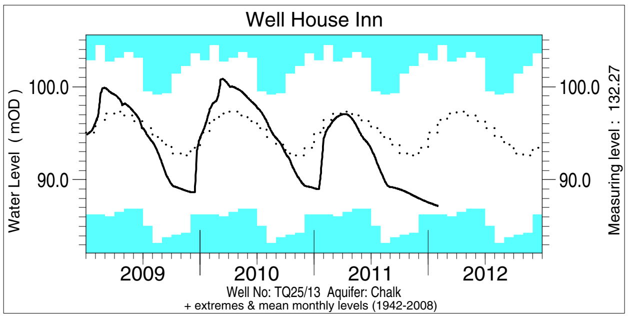


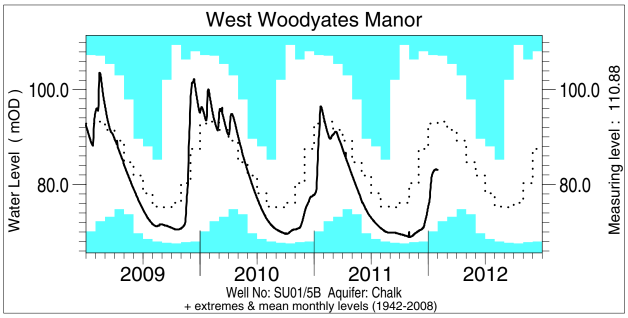


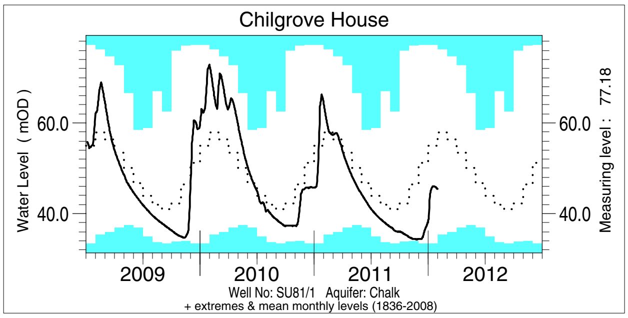


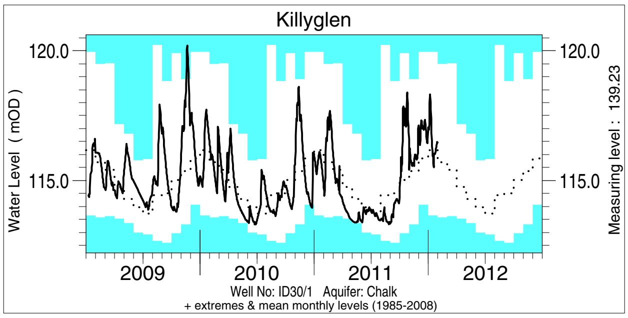


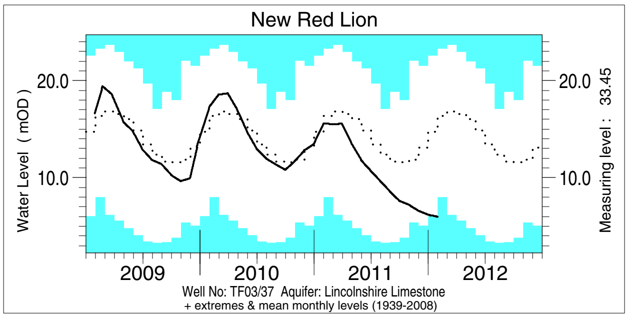






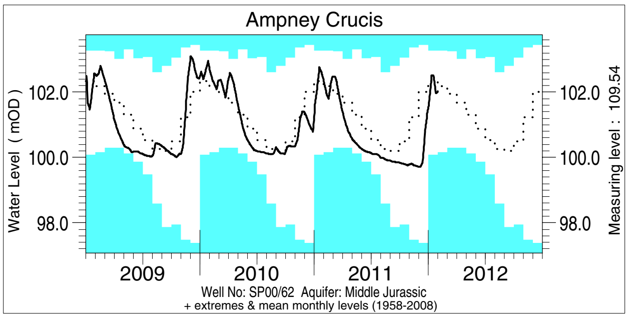


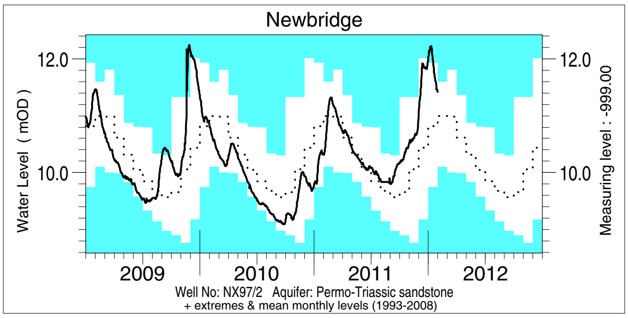


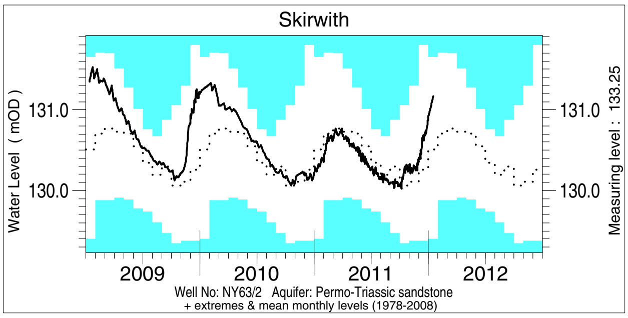


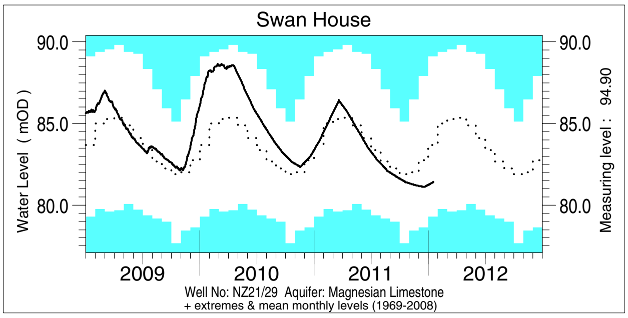
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

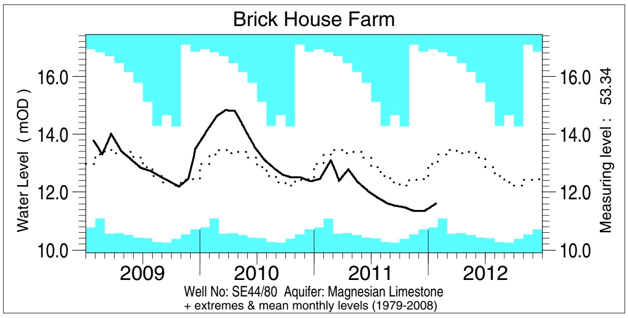
Groundwater . . . Groundwater

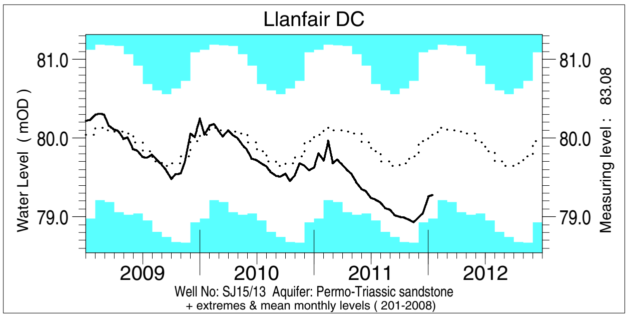


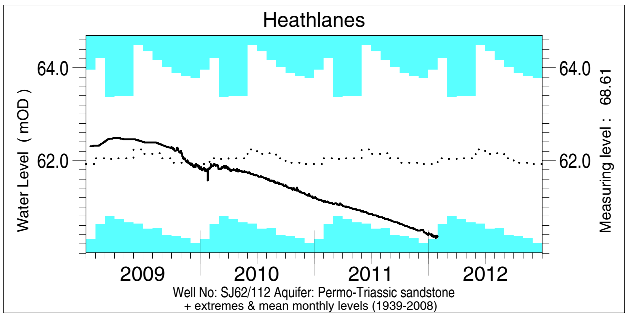


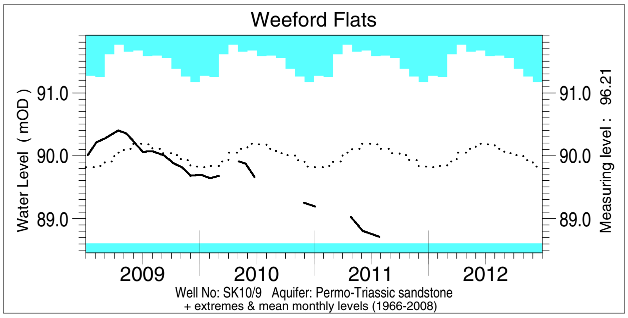


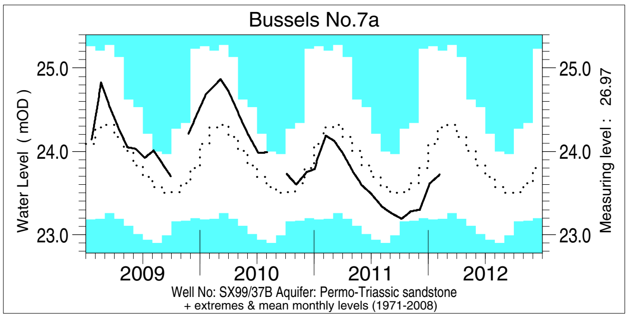


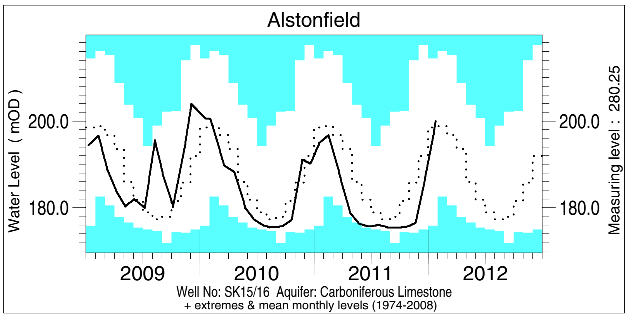








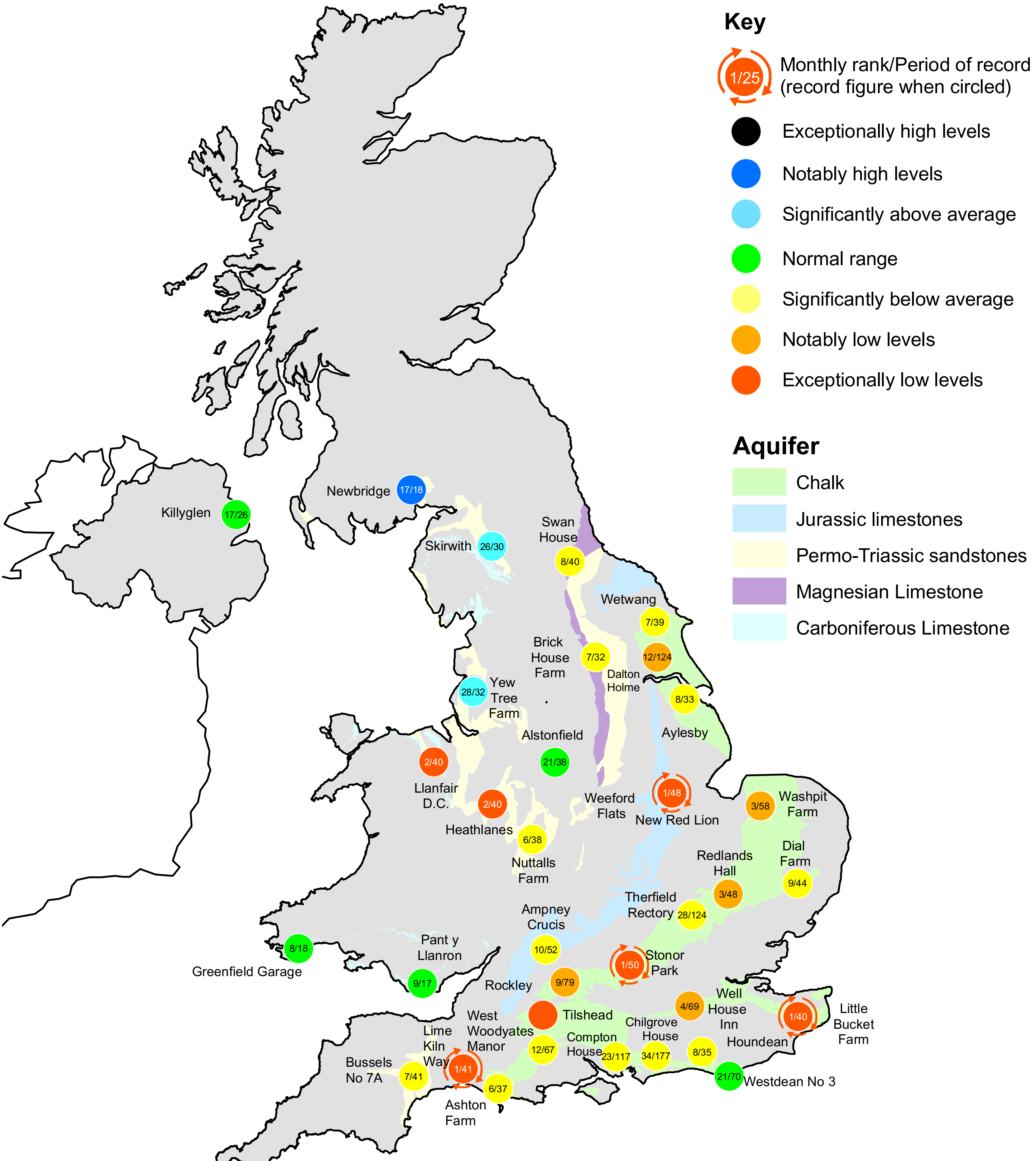




Groundwater levels January / February 2012

Borehole	Level	Date	Jan av.	Borehole	Level	Date	Jan av.	Borehole	Level	Date	Jan av.
Dalton Holme	12.56	19/01	17.17	Chilgrove House	45.39	31/01	56.24	Brick House Farm	11.61	26/01	12.96
Therfield Rectory	74.07	01/02	77.68	Killyglen (NI)	116.45	31/01	116.16	Llanfair DC	79.28	15/01	79.98
Stonor Park	62.41	18/01	73.28	New Red Lion	5.98	31/01	14.96	Heathlanes	60.36	31/01	61.90
Tilshead	79.68	31/01	91.27	Ampney Crucis	102.02	01/02	102.34	Nuttalls Farm	128.49	31/01	129.55
Rockley	129.98	01/02	136.35	Newbridge	11.42	31/01	10.76	Bussels No.7a	23.72	06/02	24.13
Well House Inn	87.20	01/02	94.89	Skirwith	131.17	17/01	130.53	Alstonfield	199.91	25/01	198.36
West Woodyates	83.11	31/01	91.67	Swan House	81.42	17/01	84.02				

Levels in metres above Ordnance Datum



Groundwater levels - January 2012

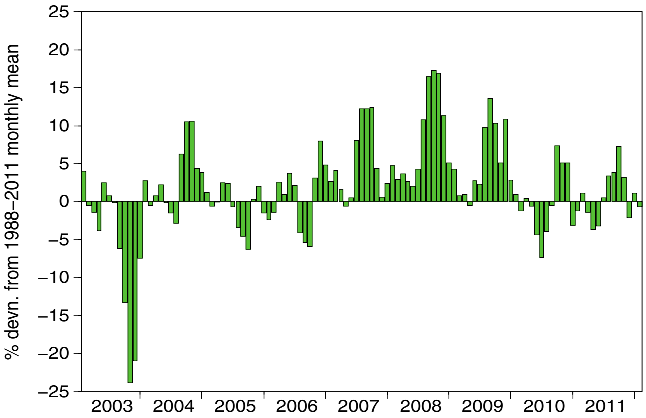
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record. Rankings may be omitted where they are considered misleading.

Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

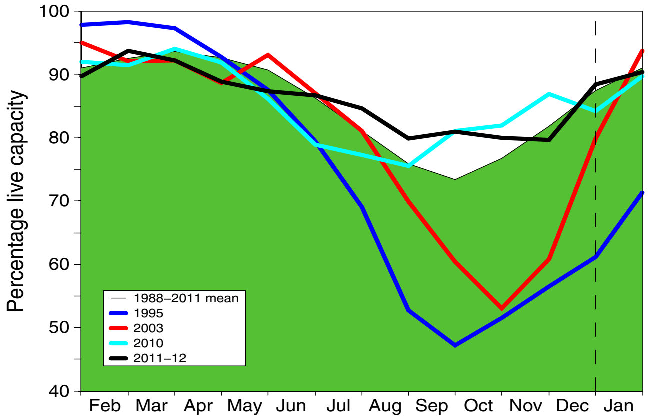
ii. Yew Tree Farm levels are now received quarterly.

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)	2011 Dec	2012 Jan	Feb	Feb Anom.	Min Feb	Year* of min	2011 Feb	Diff 12-11
North West	N Command Zone	•	124929	81	100	**96**	4	63	1996	84	12
	Vyrnwy		55146	80	100	**92**	0	45	1996	95	-3
Northumbrian	Teesdale	•	87936	90	100	**96**	5	51	1996	93	3
	Kielder		(199175)	(89)	95	**91**	-3	85	1989	92	-1
Severn Trent	Clywedog		44922	88	86	**93**	6	62	1996	91	2
	Derwent Valley	•	39525	72	100	**100**	6	15	1996	92	8
Yorkshire	Washburn	•	22035	86	98	**93**	3	34	1996	93	0
	Bradford supply	•	41407	90	100	**100**	7	33	1996	92	8
Anglian	Grafham		(55490)	(82)	84	**90**	4	67	1998	81	9
	Rutland		(116580)	(63)	65	**69**	-17	68	1997	80	-11
Thames	London	•	202828	66	78	**92**	2	70	1997	91	1
	Farmoor	•	13822	86	99	**99**	9	72	2001	77	22
Southern	Bewl		28170	35	37	**43**	-39	37	2006	88	-45
	Ardingly*		4685	14	30	**41**	-53	41	2012	100	-59
Wessex	Clatworthy		5364	65	82	**100**	5	62	1989	86	14
	Bristol WW	•	(38666)	(53)	69	**76**	-10	58	1992	73	3
South West	Colliford		28540	51	63	**70**	-13	52	1997	84	-14
	Roadford		34500	58	72	**79**	-3	30	1996	78	1
	Wimbleball		21320	49	71	**88**	-2	59	1997	78	10
	Stithians		4967	50	70	**82**	-6	38	1992	100	-18
Welsh	Celyn and Brenig	•	131155	95	98	**98**	3	61	1996	97	1
	Brianne		62140	92	100	**96**	-2	84	1997	93	3
	Big Five	•	69762	97	99	**98**	5	67	1997	95	3
	Elan Valley	•	99106	100	100	**100**	3	73	1996	99	1
Scotland(E)	Edinburgh/Mid Lothian	•	97639	100	100	**99**	5	72	1999	92	7
	East Lothian	•	10206	100	100	**100**	2	68	1990	100	0
Scotland(W)	Loch Katrine	•	111363	97	96	**94**	1	85	2000	87	7
	Daer		22412	99	100	**100**	1	91	1997	97	3
	Loch Thom	•	11840	100	100	**100**	3	90	2004	95	5
Northern Ireland	Total+	•	56920	91	98	**96**	5	75	2002	94	2
	Silent Valley	•	20634	91	96	**96**	10	46	2002	91	5

() 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)[#] is undertaken jointly by the Centre for Ecology & Hydrology (CEH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department for Environment, Food and Rural Affairs (Defra), the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

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.

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.

Rainfall

Most rainfall data are provided by the Met Office (see opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Following the discontinuation of the Met Office's CARP system in July 1998, the areal rainfall figures have been derived using several procedures, including initial estimates based on MORECS[*]. Recent figures have been produced by the Met Office, National Climate Information Centre (NCIC), using a technique similar to CARP. A significant number of additional monthly raingauge totals are provided by the EA and SEPA to help derive the contemporary regional rainfalls. Revised monthly national and regional rainfall totals for the post-1960 period were made available by the Met Office in 2004; these have been adopted by the NHMP. As with all regional figures based on limited raingauge networks the monthly tables and accumulations (and the return periods associated with them) should be regarded as a guide only.
The monthly rainfall figures are provided by the Met Office (National Climate Information Centre) and are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation.

[#] Instigated in 1988
[*]MORECS is the generic name for the Met Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

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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.

02/12