Hydrological Summary *for the United Kingdom*

November 2007

General

Despite a few cold days, November was a notably mild month – in Northern Ireland particularly – and, as is often the case, a transitional month in hydrological terms. The relatively dry episode which began in August continued into November but, by month-end, the seasonal recovery in runoff and recharge rates was well established across much of the country. Substantial reservoir replenishment over the latter half of November ensured that most reservoir stocks were in the normal range for early winter, albeit considerably below the seasonal average in parts of Scotland. Overall stocks for England & Wales are modestly above average. Notably low late autumn river flows were reported for many responsive catchments early in November but spate conditions were widespread by the final week; many catchments were vulnerable to further rainfall. Soil moisture deficits remain relatively high in some eastern areas but significant infiltration is now underway across most major aquifer outcrop areas. Although there were significant regional and more local variations, November groundwater levels were generally in the normal seasonal range. The overall water resources outlook is healthy.

Rainfall

The dominance of anticyclonic conditions provided a relatively dry start to November but, thereafter, the weather was generally unsettled with vigorous frontal systems bringing heavy rainfall, often accompanied by high winds, to most regions. A major storm surge in the North Sea (on the 9th) contributed to exceptional high tide levels (but coastal flooding was very limited) and the 16-23rd was a particularly wet period. Significant snowfall was reported in many upland areas on the 18th – with snow depths up to 45 cms in the Cairngorms and significant falls as far south as central England, resulting in significant transport disruption (e.g. in Bewdley). Most regions recorded November rainfall totals in the normal range but spatial variations were substantial. Parts of eastern Scotland, (Buchan particularly) were notably wet, recording up to twice the monthly average; well above average rainfall characterised much of central southern England also. By contrast, rainfall totals in many western catchments were considerably below average; Wales registered its 2nd driest November since 1988. Highland Region aside, autumn (Sept-Nov) rainfall totals were generally well below average (Northern Ireland registering its driest autumn in 35 years) and four-month regional rainfall totals are very modest across most of the UK; provisionally the equal 2nd lowest in more than 50 years for Wales. However, the counterbalancing effect of the remarkably wet summer means that longer term rainfall accumulations (up to 16 months) are mostly well above average.

River flows

Groundwater-fed rivers apart, November began with flows relatively depressed over wide areas and approaching late autumn minima in many catchments (from eastern Scotland to Devon). Generally, a brisk recovery in runoff rates began in mid month with several flood warnings in operation on the 19th and local flooding in parts of eastern Scotland on the 21/22nd. Spates at month-end heralded more notable high flows in early December (e.g. in Wales). With the exception of a number of spring-fed rivers (e.g. the Lud and Lambourn), and a few rivers in northern Scotland, November runoff totals were below average. Runoff was particularly depressed across much of western Britain. The Severn (at Bewdley) registered its 2nd lowest November runoff since 1942 and, in Wales, the Teifi and Cynon recorded new November runoff minima (in records of around 50 years). The extraordinary nature of the runoff patterns experienced in 2007 is demonstrated by the number of November runoff totals which were only a fraction of those for July; a dramatic contrast to the usual seasonal pattern. Autumn runoff totals reflect those for November but with clearer evidence of the geological control on runoff patterns: very healthy runoff for groundwater-fed rivers contrasting with meagre runoff in many rivers draining impermeable catchments. In the 12-month timeframe, runoff totals are above average in the great majority of index catchments.

Groundwater

Generally, the November rainfall favoured the western and central outcrop areas of the major aquifers; significant parts of the eastern Chalk reported only 50-70% of the monthly average. In most areas, soil moisture deficits declined briskly after the second week but still remained above average by month-end in some eastern areas (e.g. the Chalk of the Lincolnshire and Yorkshire Wolds). Elsewhere, significant groundwater replenishment was recorded over the latter half of the month. Evidence of this recharge is provided by the brisk groundwater level responses in the Jurassic Limestone at Ampney Crucis (Cotswolds) and a seasonal upturn in parts of the southern Chalk (e.g. at Ashton Farm and Chilgrove). Levels in the Chalk remain seasonally very high in some eastern outcrops (e.g. at Washpit Farm and Aylesby) but, with the overlying soils still relatively dry, the autumn recessions are continuing. High groundwater levels also characterise some of the slower responding Permo-Triassic sandstones outcrops (e.g. at Nuttall's Farm). The dry autumn is reflected in the low groundwater levels reported for Alstonfield (Carboniferous limestone) and Newbridge (Permo-Triassic sandstones) but most November levels were within the normal range. The groundwater resources outlook is healthy; a notable contrast with the autumn of 2006.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

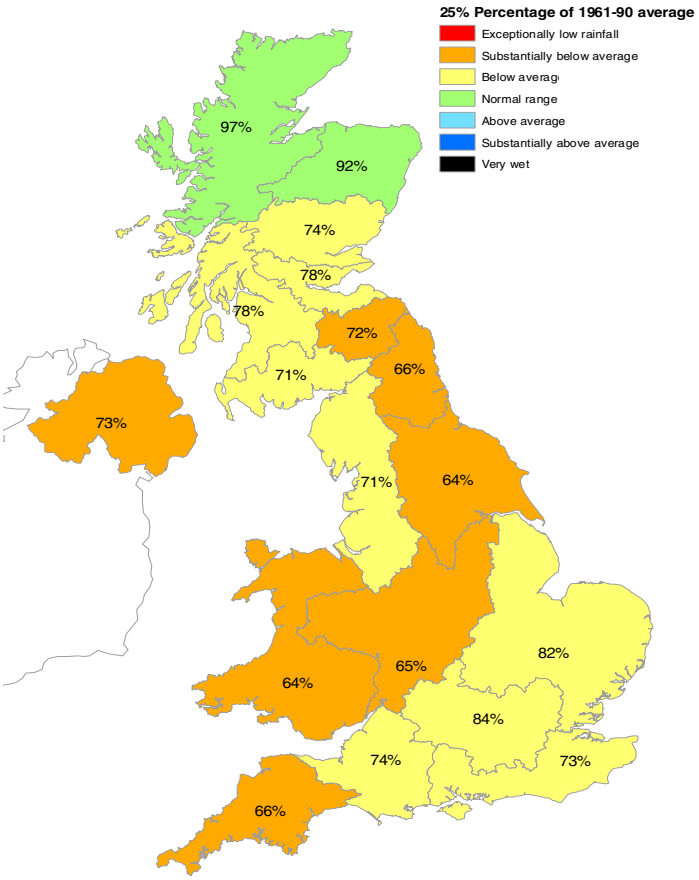
Area	Rainfall	Nov 2007	Aug 07- Nov 07	RP	May 07- Nov 07	RP	Dec 06- Nov 07	RP	Aug 06-Nov 07	RP
England & Wales	**mm**	**74**	**234**		**629**		**1045**		**1438**	
	%	**81**	**70**	**5-15**	**120**	**5-10**	**115**	**5-10**	**116**	**10-20**
North West	mm	**94**	343		765		1354		1895	
	%	**75**	71	5-10	106	2-5	111	5-10	112	5-10
Northumbrian	mm	**76**	212		553		911		1280	
	%	**88**	66	10-20	108	2-5	105	2-5	106	2-5
Severn Trent	mm	**63**	178		620		963		1294	
	%	**88**	65	10-20	139	20-35	125	20-30	124	30-40
Yorkshire	mm	**70**	194		605		961		1333	
	%	**85**	64	10-20	124	5-10	115	5-10	117	5-15
Anglian	mm	**42**	177		507		727		1019	
	%	**72**	82	2-5	138	20-30	120	5-15	124	30-40
Thames	mm	**76**	209		547		856		1195	
	%	**116**	84	2-5	134	5-15	122	5-15	126	20-35
Southern	mm	**87**	216		527		878		1220	
	%	**102**	73	5-10	117	2-5	112	2-5	113	5-10
Wessex	mm	**85**	228		591		989		1357	
	%	**101**	74	5-10	123	2-5	116	5-10	117	5-15
South West	mm	**91**	280		726		1328		1783	
	%	**71**	66	10-20	113	2-5	111	5-10	110	2-5
Welsh	mm	**94**	326		821		1520		2073	
	%	**65**	64	15-25	109	2-5	113	2-5	112	5-10
Scotland	**mm**	**158**	**496**		**867**		**1696**		**2378**	
	%	**101**	**86**	**2-5**	**103**	**2-5**	**115**	**15-25**	**116**	**15-25**
Highland	mm	**213**	669		1073		2151		2960	
	%	**108**	97	2-5	109	5-10	124	30-50	122	40-60
North East	mm	**150**	359		727		1155		1610	
	%	**145**	92	2-5	119	5-15	112	5-10	113	5-15
Tay	mm	**127**	359		741		1510		2125	
	%	**100**	74	5-10	102	2-5	117	10-20	120	15-25
Forth	mm	**107**	349		687		1362		1903	
	%	**92**	78	2-5	102	2-5	119	10-20	120	20-30
Tweed	mm	**86**	270		646		1116		1582	
	%	**89**	72	5-10	109	2-5	111	5-10	115	5-15
Solway	mm	**124**	405		777		1489		2181	
	%	**85**	71	5-10	93	2-5	104	2-5	109	2-5
Clyde	mm	**155**	549		923		1928		2781	
	%	**84**	78	2-5	91	2-5	110	5-10	113	5-15
Northern Ireland	**mm**	**87**	**305**		**656**		**1120**		**1604**	
	%	**81**	**73**	**5-15**	**103**	**2-5**	**102**	**2-5**	**106**	**2-5**

% = percentage of 1961-90 average *RP = Return period*

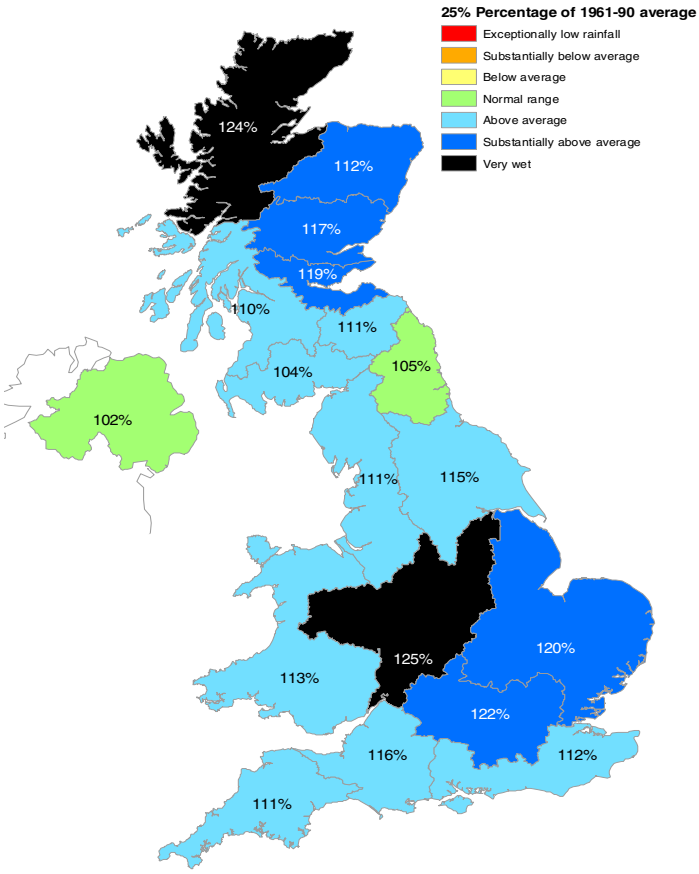
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following the method described in: Tabony, R. C. 1977, *The variability of long duration rainfall over Great Britain*. Met Office Scientific Paper no. 37. The estimates reflect climatic variability since 1913 and assume a stable climate. 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 July 2007 are provisional.

Rainfall . . . Rainfall . . .

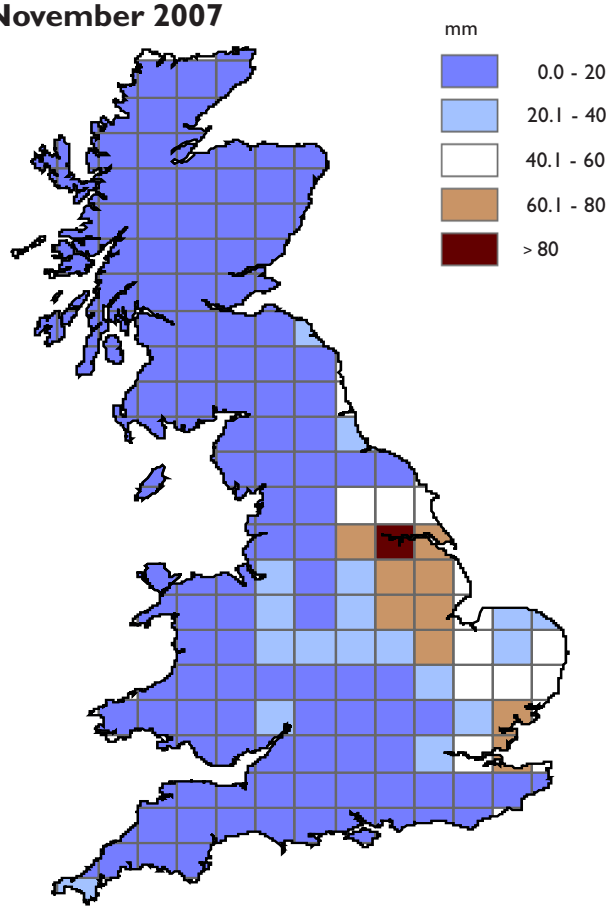
Rainfall
August - November 2007



Rainfall
December 2006 - November 2007



Soil Moisture Deficit
November 2007



Met Office Winter 2007/8 forecast (updated)

Forecast for Winter 2007/8 issued 22 November 2007

This year conditions in the North Atlantic ocean favour a near-neutral winter North Atlantic Oscillation (NAO), rather than the positive phase predicted and observed last winter. However, La Niña conditions – which have widespread impacts across the globe - are now well established in the tropical Pacific Ocean and are expected to persist through the winter period. There is evidence that La Niña has a weak influence on European winter climate, favouring positive NAO in the latter part of winter.

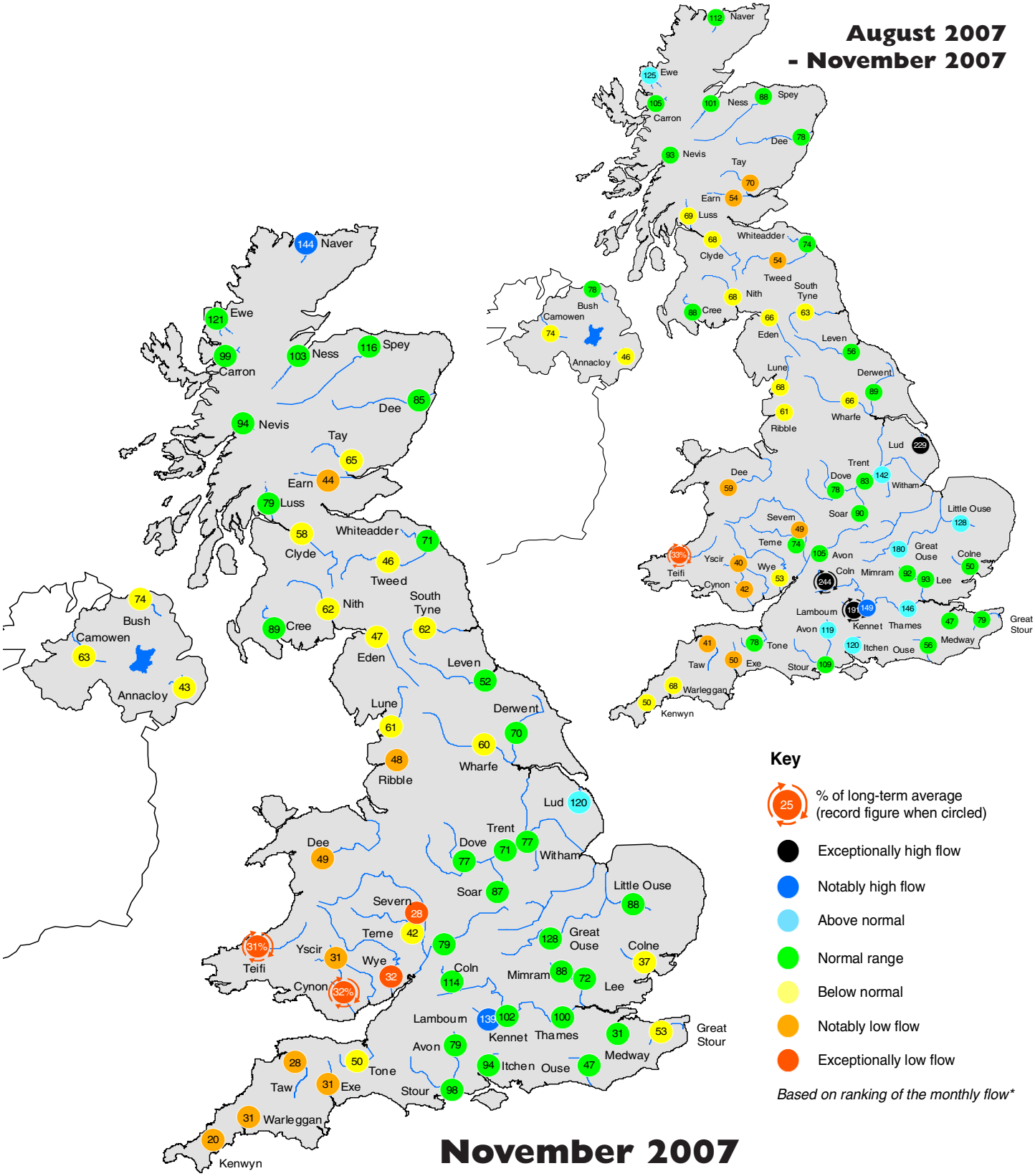
Temperature: We continue to predict that above-normal winter temperatures are more likely than below-normal temperatures over much of the European region. However, this winter is likely to be less mild in most regions than last winter, when exceptionally mild conditions were widespread across Europe. For the UK as a whole, winter-mean temperatures are more likely to be above normal than either near or below normal. Although a winter milder than the 1971-2000 average is favoured, temperatures are likely to be lower than those experienced in the very mild winter last year.

Precipitation: Latest indications suggest that, for northern Europe, above-average winter rainfall is more likely than below-average rainfall. In contrast, for southern Europe below-average rainfall is more likely than above-average. For the UK as a whole, winter rainfall is slightly more likely to be near, or above average, than below average.

The autumn forecast will be next updated on 20 December 2007. For further details please visit:

http://www.metoffice.gov.uk/weather/seasonal/winter2007_8/uk.index

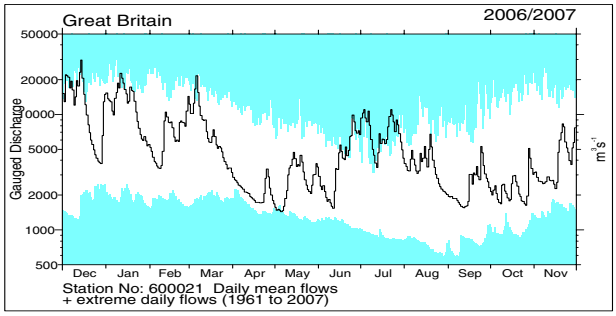
River flow . . . River flow . . .

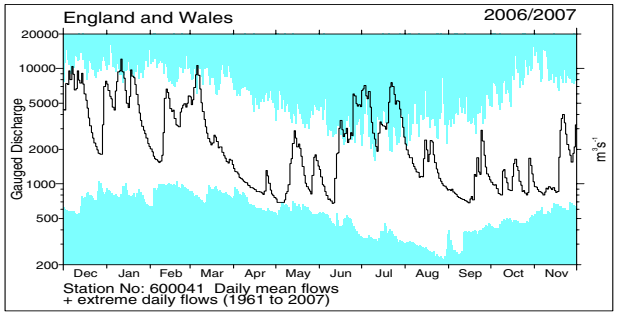


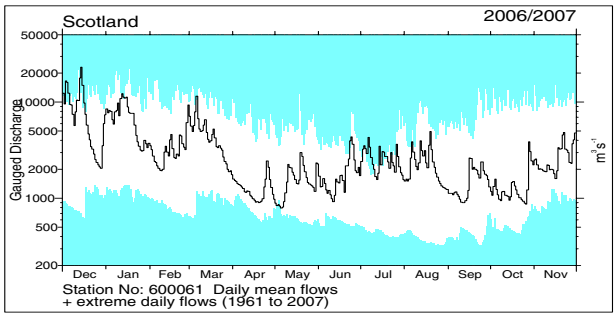
River flows

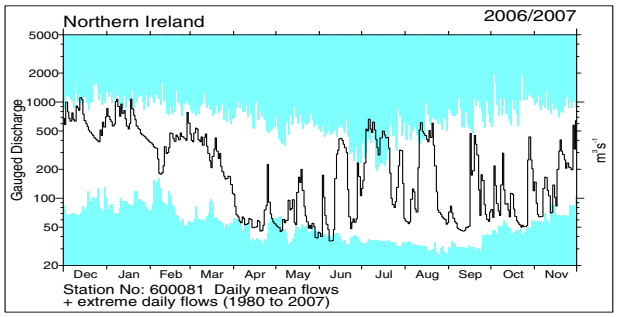
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

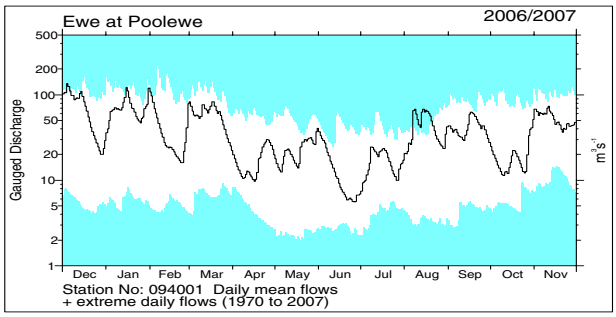
River flow . . . River flow . . .

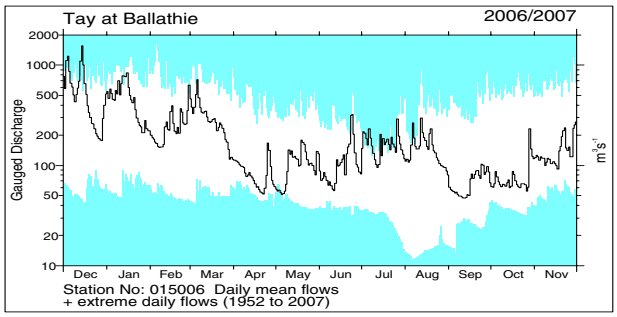


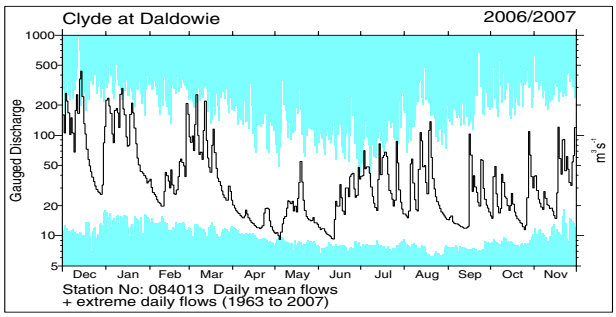


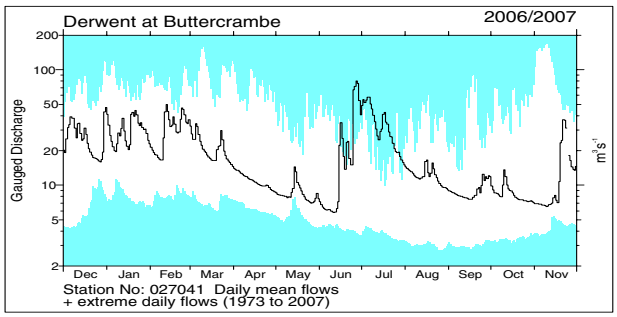


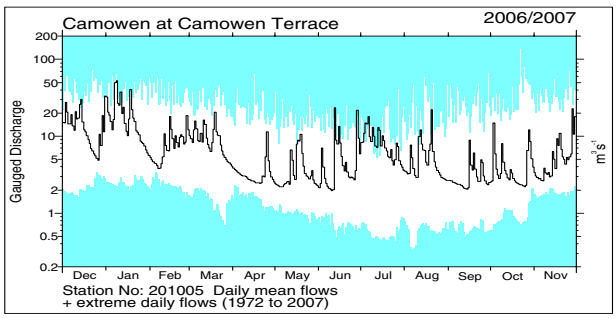


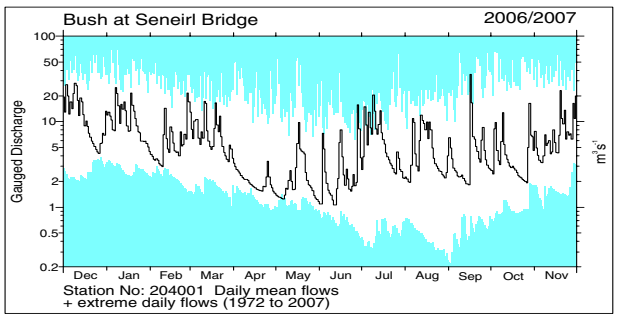








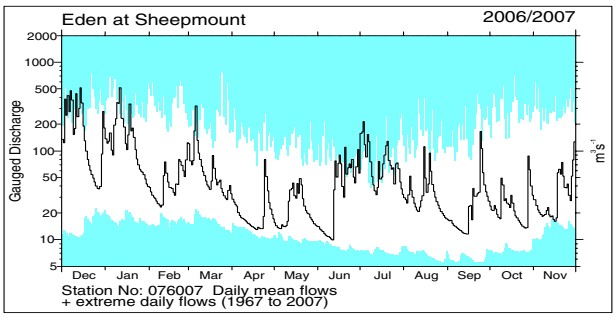


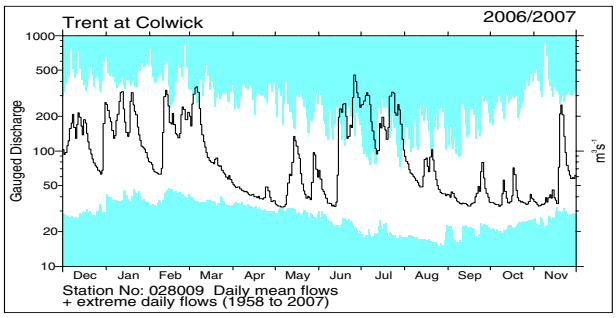


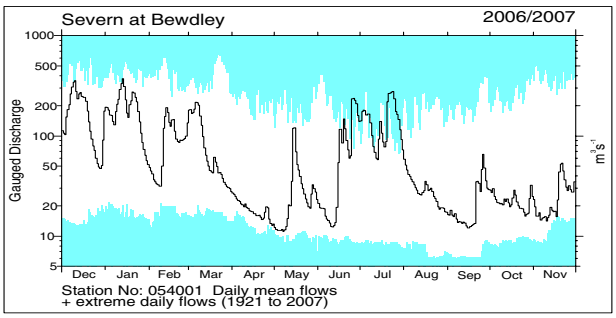
River flow hydrographs

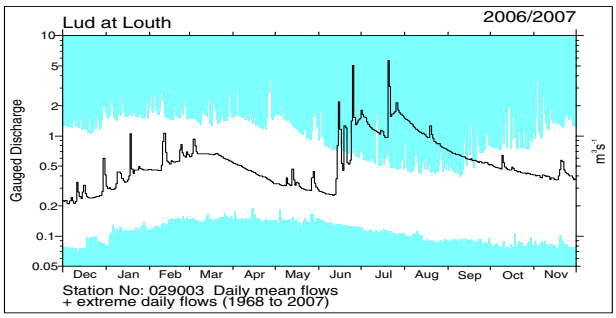
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to December 2006 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

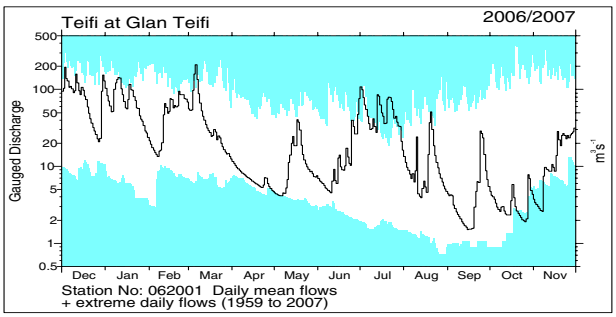
River flow . . . River flow . . .

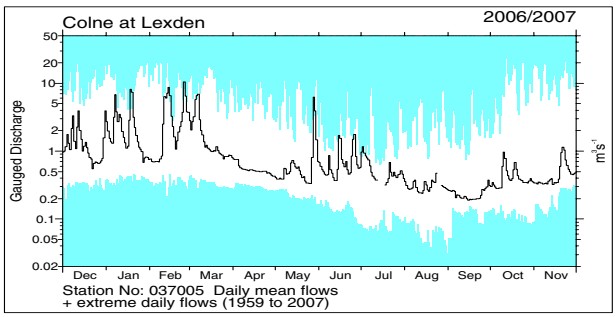


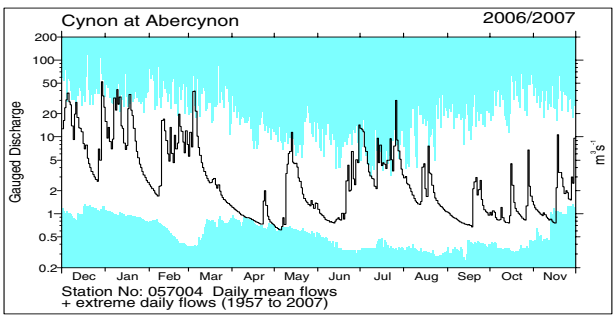


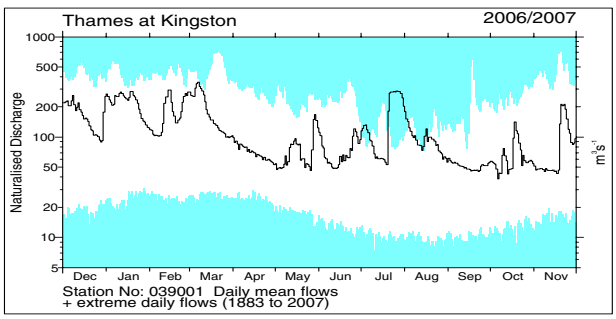


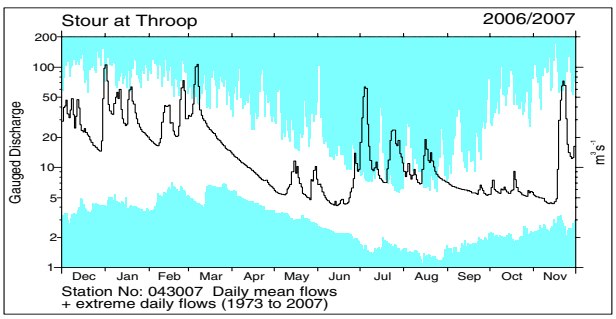


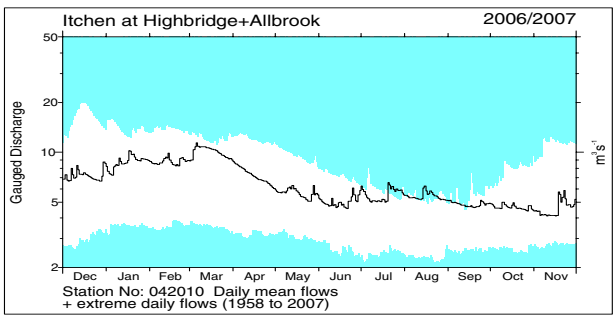












Notable runoff accumulations (a) Aug 2007 - Nov 2007, (b) May 2007 - Nov 2007

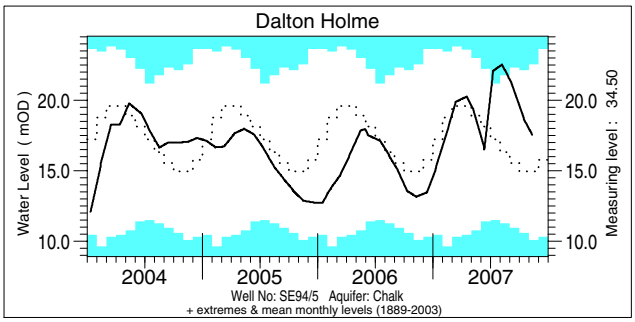
	River	%lta	Rank
a)	Forth	59	3/27
	Tweed (Boleside)	54	5/47
	Lambourn	191	45/45
	Coln	244	44/44
	Yscir	40	2/35
	Teifi	33	1/48
	L Bann	57	3/28

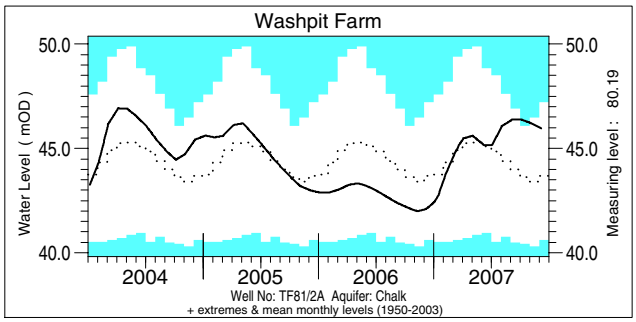
	River	%lta	Rank
b)	Derwent(Buttercrambe)	34	42/46
	Trent	148	47/49
	Dover Beck	259	32/32
	Soar	152	32/36
	Lud	231	39/39
	Witham	250	49/49
	Ouse (Bedford)	243	74/75

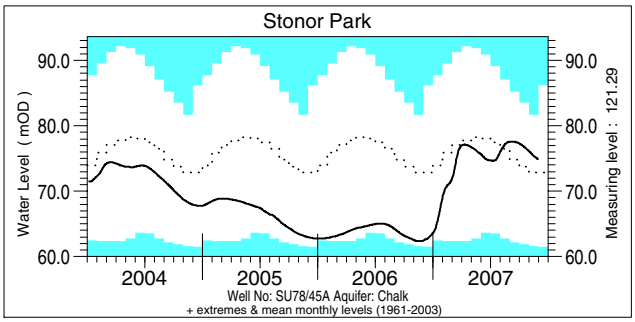
River	%lta	Rank
Stringside	186	39/40
Little Ouse	139	34/37
Thames (nat)	169	120/125
Avon (Evesham)	220	71/71
Teme	218	38/38
Luss	77	3/29
Ewe	123	33/37

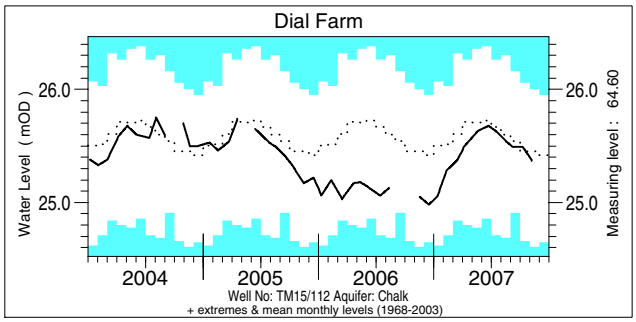
lta = long term average
Rank 1 = lowest on record

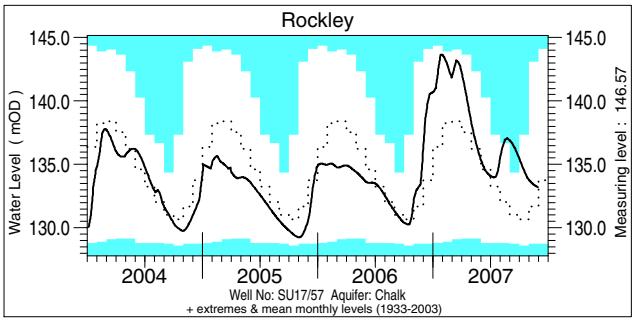
Groundwater . . . Groundwater

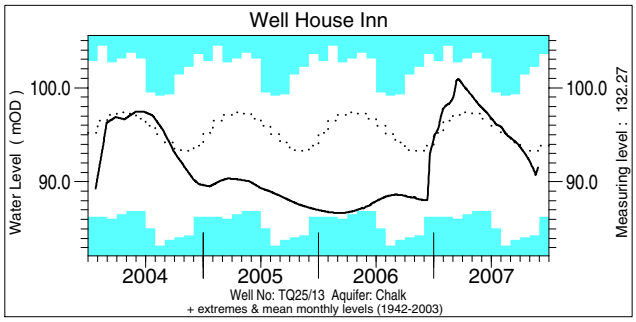


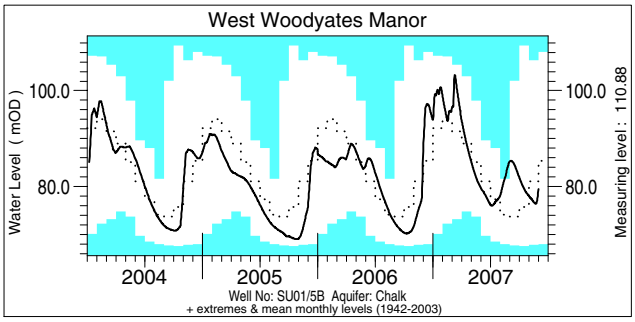


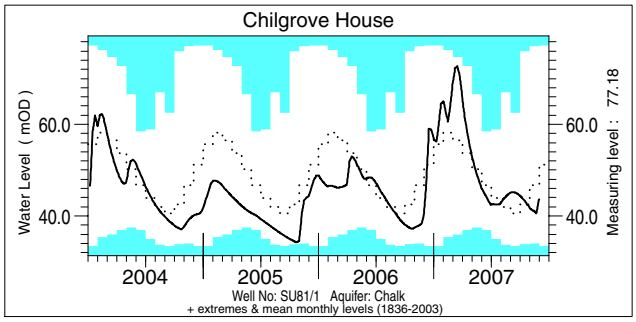


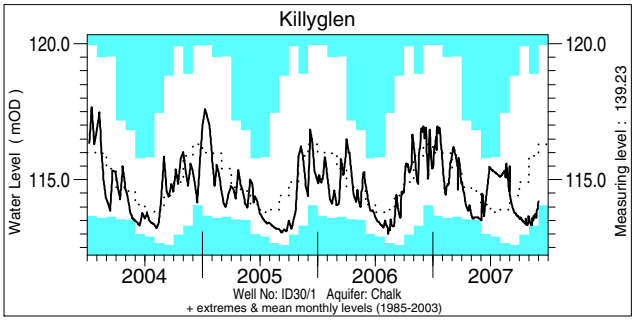


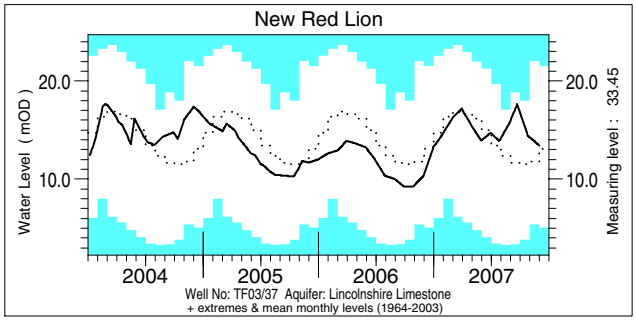






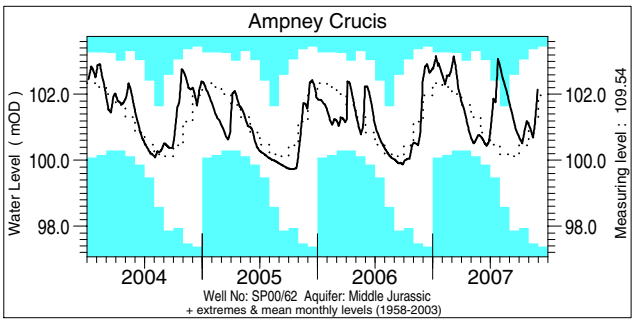


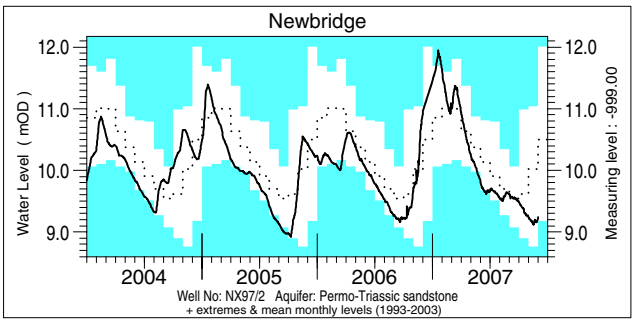


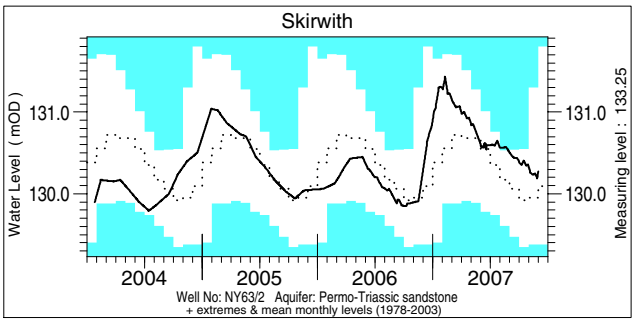


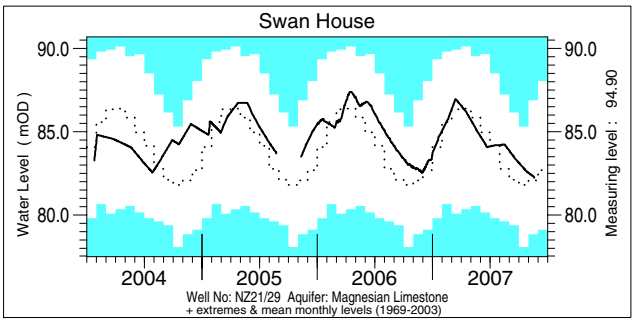
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

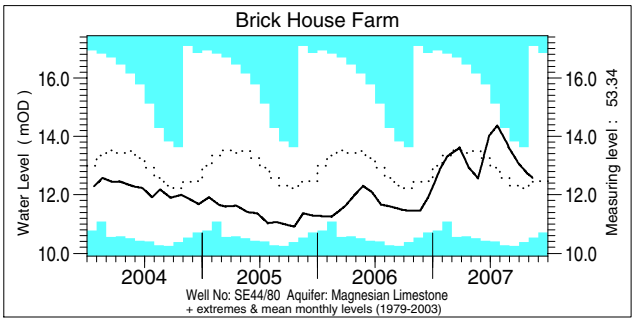
Groundwater . . . Groundwater

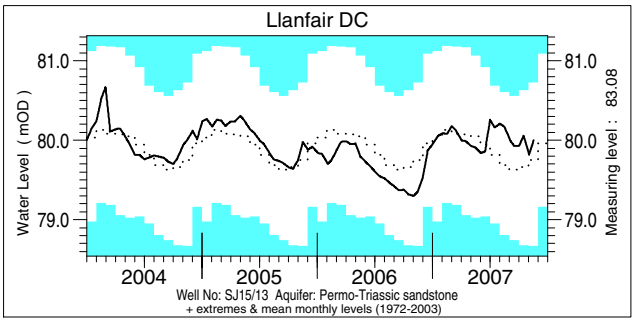


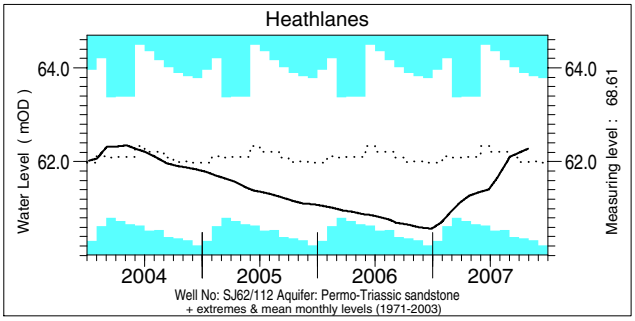


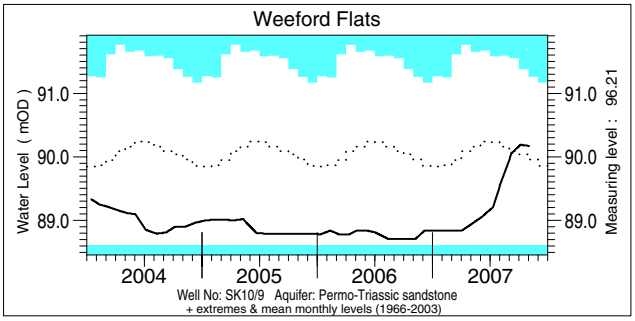


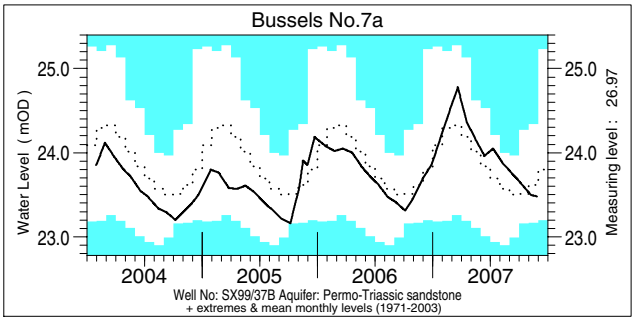


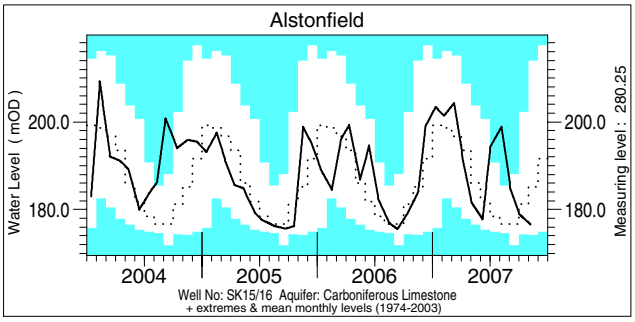










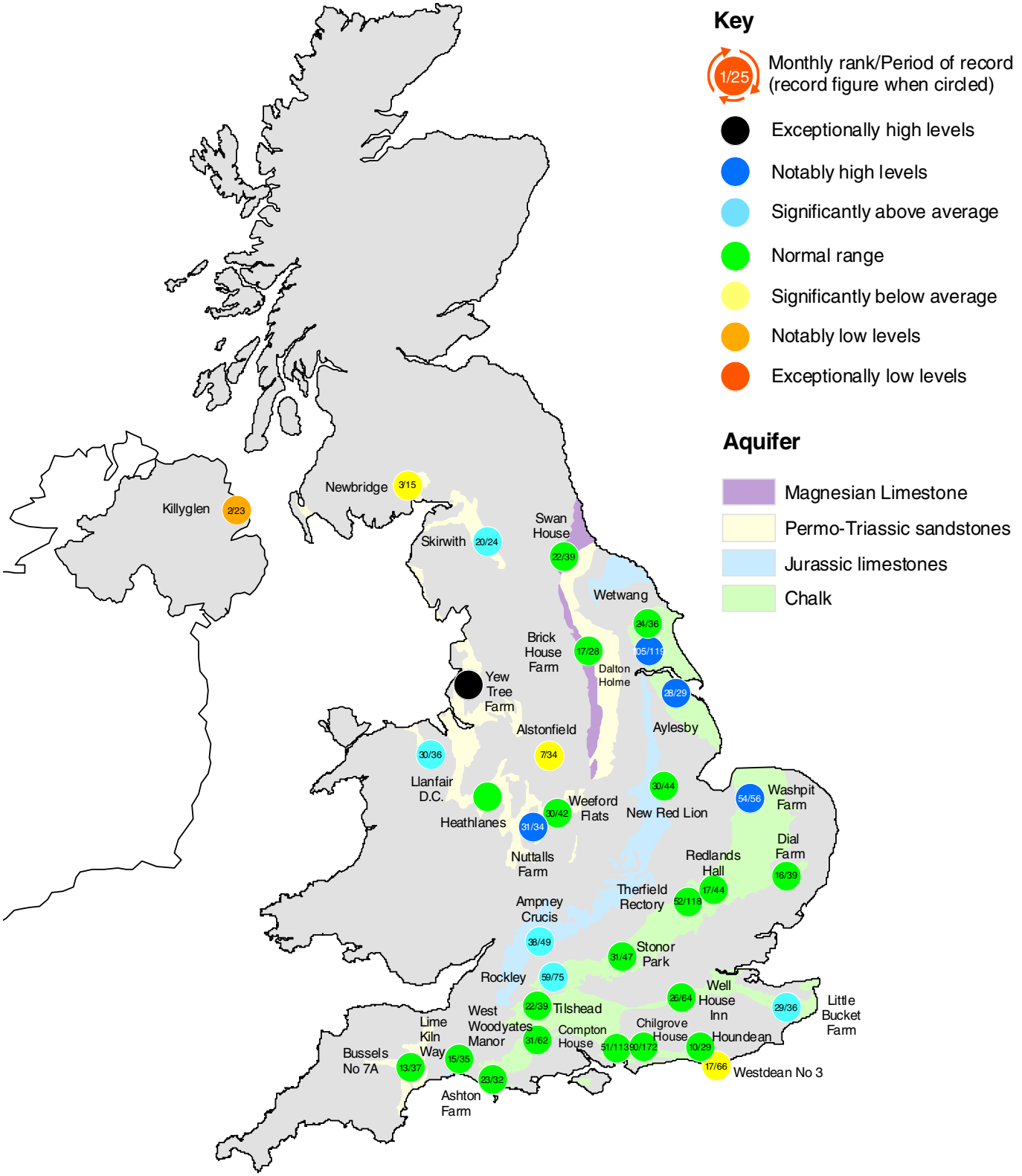


Groundwater levels November / December 2007

Borehole	Level	Date	Nov. av.	Borehole	Level	Date	Nov. av.	Borehole	Level	Date	Nov. av.
Dalton Holme	17.55	09/11	14.78	Chilgrove House	43.60	30/11	46.52	Brick House Farm	12.57	13/11	12.27
Washpit Farm	45.97	06/12	43.27	Killyglen	114.21	30/11	115.94	Llanfair DC	80.00	15/11	79.67
Stonor Park	74.89	28/11	72.17	New Red Lion	13.42	30/11	12.21	Heathlanes	62.28	29/10	61.89
Dial Farm	25.37	06/11	25.43	Ampney Crucis	102.15	28/11	101.19	Weeford Flats	90.17	01/11	89.68
Rockley	133.21	28/11	131.61	Newbridge	9.24	01/12	10.09	Bussels No.7a	23.48	27/11	23.63
Well House Inn	91.54	26/11	93.06	Skirwith	130.27	30/11	129.99	Alstonfield	176.56	06/11	186.78
West Woodyates	79.44	30/11	80.79	Swan House	82.23	19/11	82.39				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



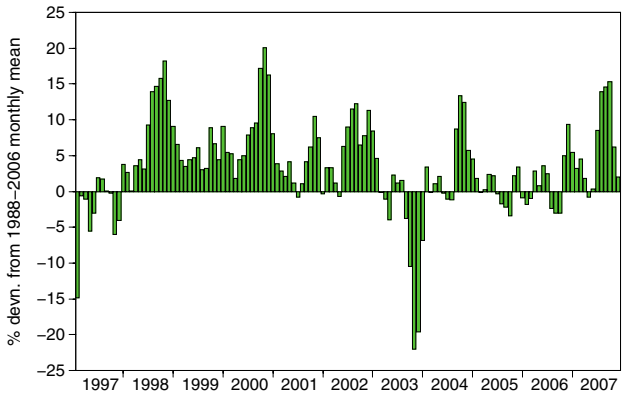
Groundwater levels - November 2007

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.

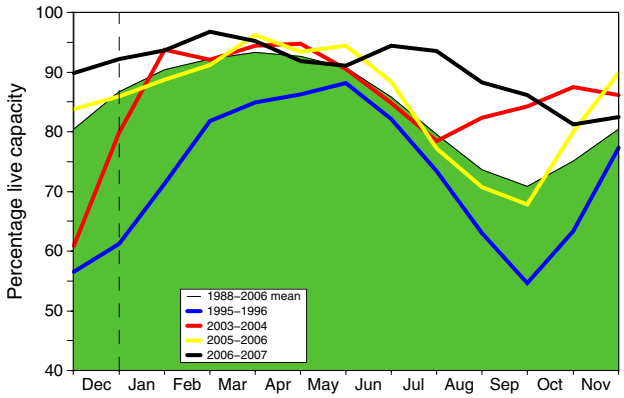
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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)	2007 Oct	Nov	Dec	Dec Anom.	Min. Dec	Year* of min.	2006 Dec	Diff **07-06**
North West	N Command Zone	• 124929	72	69	**73**	-2	44	1993	97	-24
	Vyrnwy	55146	90	75	**83**	3	33	1995	95	-12
Northumbrian	Teesdale	• 87936	88	87	**95**	18	39	1995	100	-5
	Kielder*	(199175)	(82)	(66)	**(55)**	-31	(55)	2007	(94)	-39
Severn Trent	Clywedog	44922	88	83	**87**	8	43	1995	82	5
	Derwent Valley*	• 39525	86	77	**86**	9	9	1995	91	-5
Yorkshire	Washburn	• 22035	81	72	**76**	5	16	1995	94	-18
	Bradford supply	• 41407	87	76	**89**	10	20	1995	97	-8
Anglian	Grafham	(55490)	(93)	(94)	**(93)**	12	(47)	1997	(88)	5
	Rutland	(116580)	(86)	(85)	**(84)**	5	(57)	1995	(75)	9
Thames	London	• 202406	84	87	**89**	9	52	1990	95	-6
	Farmoor	• 13822	93	98	**87**	-3	52	1990	84	3
Southern	Bewl	28170	72	66	**66**	2	34	1990	62	4
	Ardingly	4685	81	65	**75**	1	23	2003	88	-13
Wessex	Clatworthy	5364	88	77	**68**	-9	16	2003	70	-2
	Bristol WW	• (38666)	(87)	(83)	**(79)**	14	(27)	1990	(69)	10
South West	Colliford	28540	80	76	**73**	3	42	1995	46	27
	Roadford	34500	91	87	**84**	13	19	1995	61	23
	Wimbleball	21320	91	86	**83**	11	34	1995	73	10
	Stithians	5205	73	62	**52**	-11	29	2001	43	9
Welsh	Celyn and Brenig	• 131155	96	92	**95**	9	50	1995	96	-1
	Brianne	62140	98	95	**96**	1	72	1995	100	-4
	Big Five	• 69762	82	77	**79**	-1	49	1990	89	-10
	Elan Valley	• 99106	94	89	**100**	7	47	1995	100	0
Scotland(E)	Edinburgh/Mid Lothian	• 97639	84	77	**79**	-5	45	2003	93	-14
	East Lothian	• 10206	100	93	**100**	15	38	2003	78	22
Scotland(W)	Loch Katrine	• 111363	61	59	**65**	-26	66	2003	100	-35
	Daer	22412	88	77	**98**	2	73	2003	100	-2
	Loch Thom	• 11840	68	66	**74**	-20	72	2003	97	-23
Northern Ireland	Total+	• 67270	78	71	**76**	-7	59	2003	90	-14
	Silent Valley	• 20634	82	72	**76**	1	43	2001	93	-17

() 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 1988-2006 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. * Scheduled drawdown is affecting Kielder and Ladybower (Derwent Valley) levels.

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 and Hydrology Wallingford (formerly the Institute of Hydrology - IH) 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 Department of the Environment (NI). 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 the Northern Ireland Water Service.

The National River Flow Archive (maintained by CEH Wallingford) 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 (together with revised 1961-90 averages) 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.

NATURAL ENVIRONMENT RESEARCH COUNCIL

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.

*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.

Subscription

Subscription to the Hydrological Summaries costs £48 per year. Orders should be addressed to:

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Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB

Tel.: 01491 838800
Fax: 01491 692424
E-mail: nwamail@ceh.ac.uk

Selected text and maps are available on the WWW at
http://www.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

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12/07