Hydrological Summary
for the United Kingdom

November 2008

General

November provided a typical late autumn mix of cold spells and mild, wet interludes but, nationally, temperatures and rainfall totals were well within the normal range. The UK rainfall total fell (modestly) below the monthly average – for only the 2nd time this year – but the spatial variability in the November rainfall totals was considerable. Reservoir stocks at the national scale have remained above average, and displayed remarkably limited variation, throughout 2008. Although stocks in a few reservoirs declined modestly over the month, November ended with notably high overall stocks for England & Wales. Only in 2000 have early winter stocks been appreciably higher in a 21-year national series and, across the UK, all index reservoirs equalled, or exceeded (often by significant margins), the average for the time of year. Spate conditions and flood alerts were common during the 2nd week and notably high November runoff totals were reported for catchments in the Midlands. Nonetheless, river flows generally remained within the normal late-autumn range. By month end, soils in almost all areas were close to saturation, allowing late-autumn infiltration to establish seasonal groundwater recoveries across almost all outcrop areas of the major aquifers. November groundwater levels were generally above, to well above, the seasonal average except in the slowest responding aquifer units. As with surface water, the 2009 outlook for groundwater resources is currently very healthy.

Rainfall

Synoptic patterns during November were particularly variable but airflows from the polar quadrant were unusually common, bringing dull and, occasionally, very cold conditions with attendant snowfall. By contrast, Atlantic influences produced much milder and generally wet spells with some localised convective storms (e.g. at Pershore on the 9th when rainfall totals of 15-40mm were common across southern Britain). Substantially greater totals were registered in parts of Scotland on the 13/14th. Achfary (Highland) reported a 48hr total of 105.7mm. On the 22/23rd significant snow accumulations were recorded, mostly in eastern Britain: Balmoral and Aberdeen Airport both reported around 15cm. Many precipitation types (rain, snow, hail, fog-drip) contributed to the November totals which showed large regional, and more local, variations. Well above average rainfall characterised much of south-eastern Britain (extending to the Midlands) and north-west Scotland. In between, rainfall totals were generally below average, considerably so in parts of the Central Valley of Scotland and in Antrim. Nonetheless, regional rainfall accumulations continue to be notably high across a range of timeframes. Most regions have reported only two or three months with below average rainfall in 2008 and the Jan-Nov totals rank, provisionally, the 2nd highest for Scotland and 3rd highest for England & Wales and Northern Ireland (in time series from 1914).

River Flow

The main features of river flow patterns during November were the widespread notable (rather than extreme) flows over the 9-11th period and, generally more moderate, spates during the final week, in Northern Ireland particularly. During the first high flow episode, flood alerts were common with, generally modest, floodplain inundations. The Warwickshire Avon (at Evesham) registered its 2nd highest November daily flow in a series from 1936. Localised flooding was also reported (e.g. at Guildford, Pontardulais, and many localities in the Midlands) resulting in considerable transport disruption. Catchment runoff totals for November were well within the normal range across most of the country but notably high totals characterised much of the Midlands (the 2nd highest in 25 years on the Teme) and north-west Scotland – the Ewe registered its highest November runoff since 1986. Conversely, runoff totals were relatively depressed in parts of Northern Ireland and south-west Scotland. The current health of water resources reflects notably high accumulated runoff rates (in almost all areas). For the year thus far, runoff appreciably exceeds the average for almost all index rivers and those establishing new long term maxima (in the Jan-Nov timeframe) show a wide distribution, from the Naver to the Exe. In the Pennines, runoff for the Wharfe since Nov 2006 is the highest for any 24-month sequence in a 53-year series.

Groundwater

Some northern aquifer outcrop areas reported well below average November rainfall but, generally, the rainfall distribution favoured the major aquifers; rainfall across much of the South East being in the 100-150% range. With soil moisture deficits largely eliminated by mid-month, infiltration rates increased substantially but within-region variations were wide. For example, effective rainfall in parts of the Cotswolds exceeded twice the November average whereas it fell below 50% in parts of the eastern Chalk (e.g. to the north of London). Most index wells (reporting late in the month) confirm that the 2008 seasonal recovery of groundwater levels is well underway (exceptions include slower-responding Permo-Triassic sandstones in parts of the Midlands). In most areas, this recovery has been generated from above average early-autumn levels. Correspondingly, November groundwater levels were well above the late-autumn average in many areas, and amongst the highest on record in a number of, mostly western and northern, outcrops (e.g. Ashton Farm, Nuttalls Farm and Skirwith). Entering the winter recharge period, the groundwater resources outlook is very encouraging, but, in the event of an exceptionally wet winter, there may be a risk of groundwater flooding in vulnerable localities (see page 3).

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Nov 08	Sep 08- Nov 08	RP	Mar 08- Nov 08	RP	Jan 08- Nov 08	RP	Dec 07- Nov 08	RP
England & Wales	**mm**	**88**	**308**		**831**		**1020**		**1120**	
	%	**96**	**120**	**2-5**	**127**	**20-30**	**126**	**40-60**	**124**	**20-35**
North West	mm	**88**	470		1102		1405		1569	
	%	**70**	127	5-10	123	20-30	129	40-60	129	50-80
Northumbrian	mm	**65**	314		867		1061		1152	
	%	**75**	132	5-10	135	50-80	135	>100	133	>100
Severn Trent	mm	**79**	272		708		866		945	
	%	**110**	134	5-10	126	10-20	126	20-30	123	10-20
Yorkshire	mm	**64**	250		768		985		1073	
	%	**78**	111	2-5	125	10-20	131	70-100	129	30-50
Anglian	mm	**79**	201		578		677		722	
	%	**136**	126	2-5	126	10-20	123	10-20	120	5-10
Thames	mm	**84**	210		655		773		834	
	%	**128**	110	2-5	127	5-15	123	5-10	119	5-10
Southern	mm	**105**	249		671		806		871	
	%	**122**	106	2-5	119	5-10	115	5-10	111	2-5
Wessex	mm	**84**	264		779		945		1042	
	%	**100**	111	2-5	129	10-20	124	10-20	122	5-15
South West	mm	**94**	337		1033		1241		1392	
	%	**73**	100	<2	128	15-25	118	10-20	117	5-15
Welsh	mm	**125**	495		1225		1532		1705	
	%	**87**	124	2-5	130	20-30	129	20-30	127	20-30
Scotland	**mm**	**148**	**495**		**1163**		**1599**		**1741**	
	%	**94**	**107**	**2-5**	**110**	**10-20**	**122**	**35-50**	**118**	**30-40**
Highland	mm	**239**	644		1334		1878		2057	
	%	**121**	115	5-10	108	5-10	121	25-40	118	20-30
North East	mm	**85**	284		822		1072		1157	
	%	**82**	95	2-5	108	2-5	115	10-20	112	5-10
Tay	mm	**91**	354		976		1408		1511	
	%	**72**	92	2-5	107	2-5	122	15-25	117	10-20
Forth	mm	**64**	323		951		1336		1437	
	%	**55**	93	2-5	114	5-10	129	40-60	125	30-50
Tweed	mm	**60**	326		967		1245		1347	
	%	**62**	113	2-5	132	30-45	137	>100	134	>100
Solway	mm	**95**	517		1233		1618		1777	
	%	**65**	116	5 -10	119	10-20	126	40-60	124	40-60
Clyde	mm	**147**	582		1390		1900		2069	
	%	**79**	103	2-5	111	5-15	121	20-30	118	15-25
Northern Ireland	**mm**	**80**	**346**		**943**		**1190**		**1302**	
	%	**75**	**107**	**2-5**	**119**	**10-20**	**120**	**25-40**	**119**	**10-20**

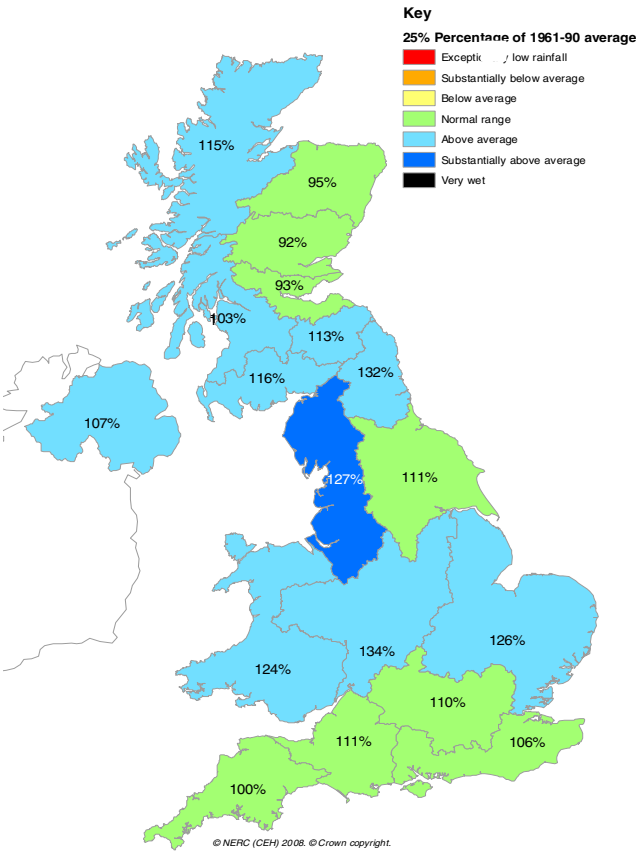
% = percentage of 1961-90 average

RP = Return period

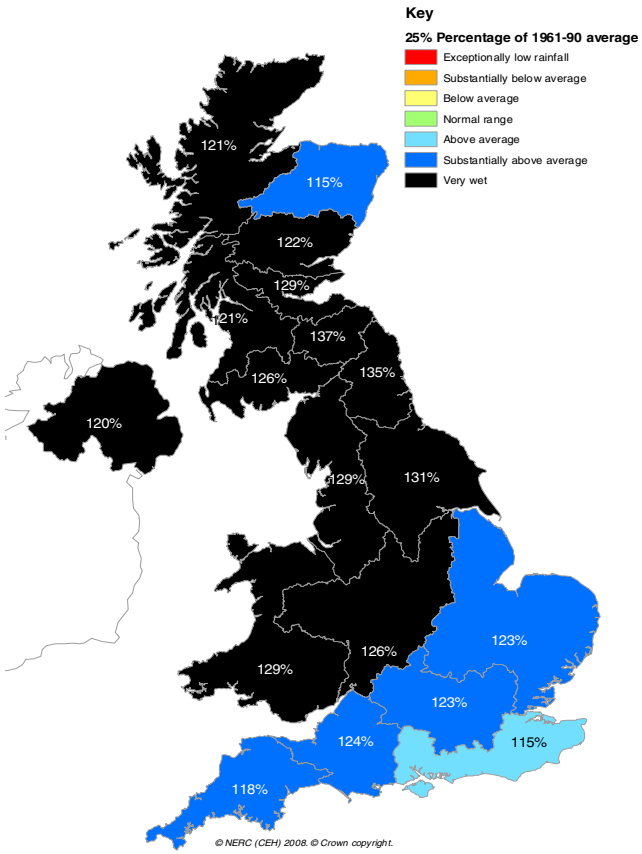
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following 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 April 2008 are provisional.

Rainfall . . . Rainfall . . .

September - November 2008



January- November 2008



Met Office Winter 2008 forecast

Forecast for Winter 2008/9: 25 November 2008

Temperature
Winter temperatures are more likely to be above 1971-2000 averages over northern Europe and parts of southern and eastern Europe. However, over northern Europe, this winter is likely to be less mild than last winter. In other regions the chances for above or below average are evenly balanced. For the winter as a whole, UK mean temperatures are more likely to be near or above average. However, we are likely to have a cold start to the winter with temperatures below average in December.

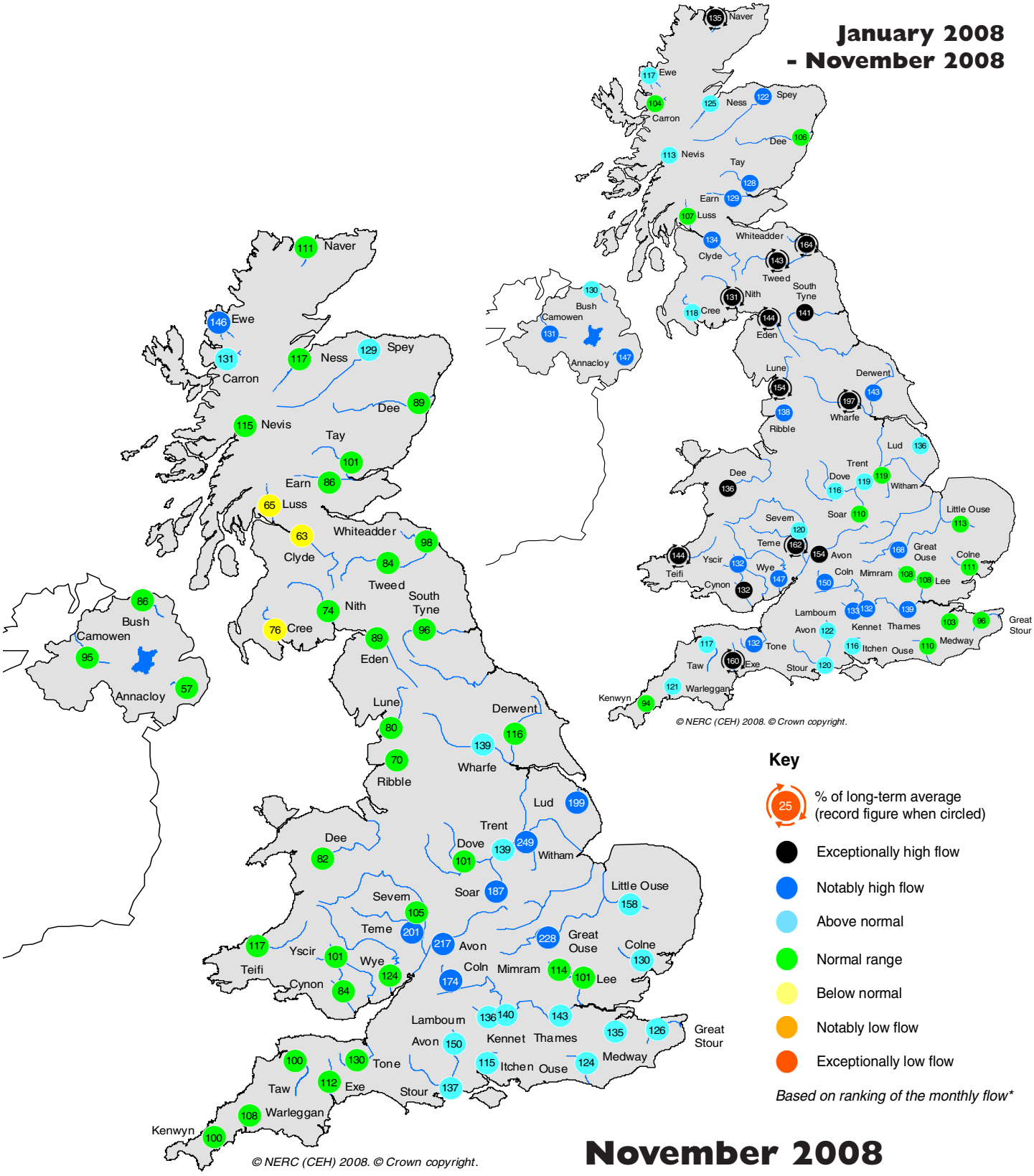
Rainfall
Below-average precipitation is slightly favoured over parts of central Europe; elsewhere the chances of above and below average are more evenly balanced.
For the UK, precipitation is more likely to be average, or below average.

Updates and reviews of the forecast
The winter forecast will next be updated at 10 a.m. on 22 December 2008. For further details please visit:
http://www.metoffice.gov.uk/weather/seasonal/winter2008_9

Risk of groundwater flooding

The wet weather over the past 12 months has led to concerns over a potential repeat of the groundwater flooding events that affected southern England in the late winter and spring of 2000/01, and to a lesser extent in early 2003. Groundwater can play a role, as reservoir or conduit for flood waters, in many floods, but the flooding in 2001 was primarily the result of high water tables in the Chalk aquifer. The probability of a flood event depends on both groundwater levels at the start of the recharge season and on the amount of winter rainfall. The relatively wet autumn has reinforced groundwater recoveries that started in early 2007, and over much of southern England groundwater levels in the Chalk are relatively high, and certainly within the range that might allow flooding (in vulnerable localities) to occur if winter rainfall is high. Historically, groundwater flooding has tended to occur when rainfall is at least 130% of the winter average. Early winter rainfall has been close to the average, supporting the tentative Met Office forecast (opposite) for a winter with near-average rainfall. This makes widespread groundwater flooding appear unlikely, although it may be expected that localised events may follow exceptional storms and, generally, higher than average bourne flow may be anticipated.

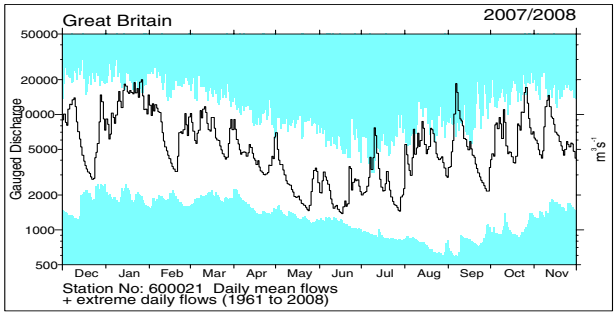
River flow . . . River flow . . .

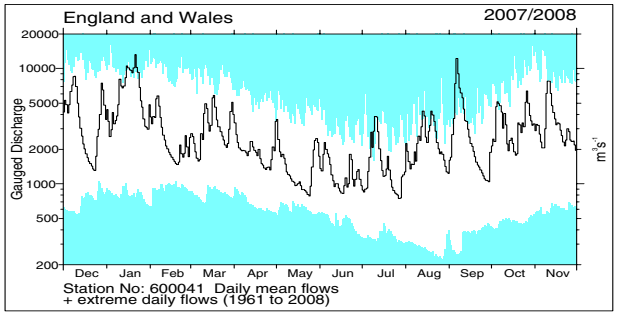


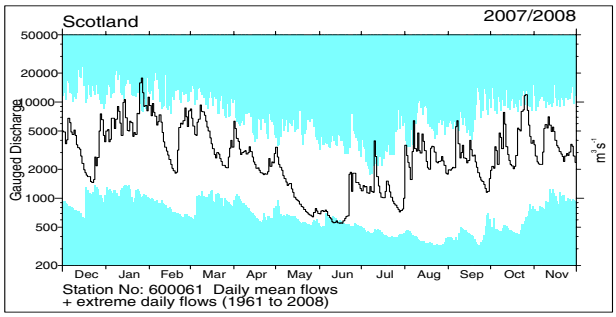
River flows

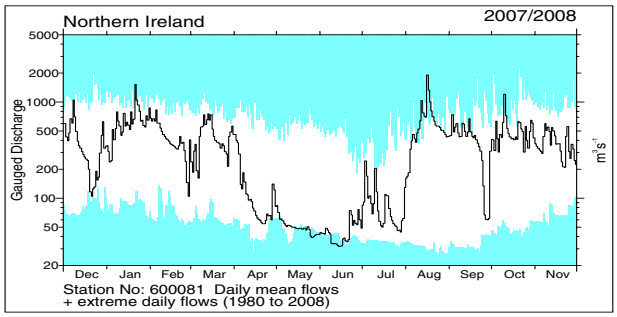
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

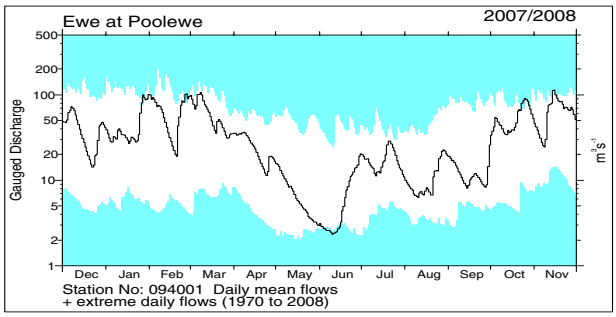
River flow . . . River flow . . .

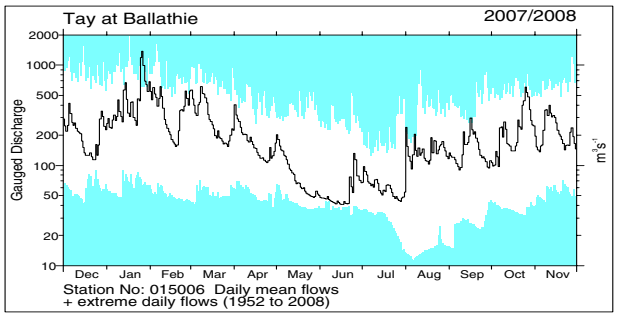


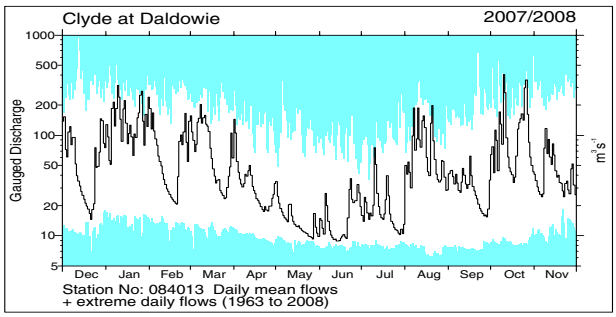


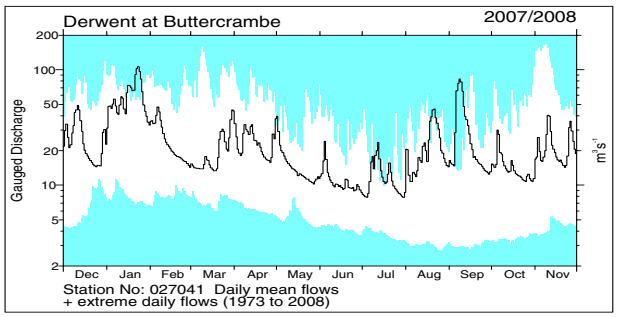


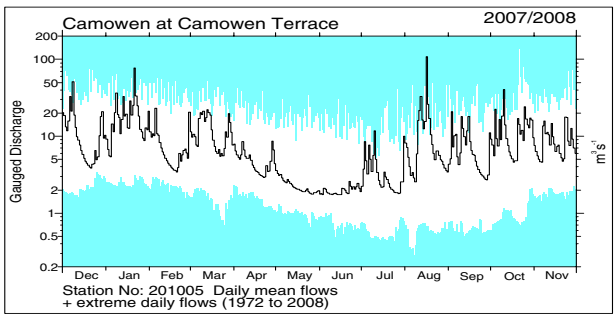


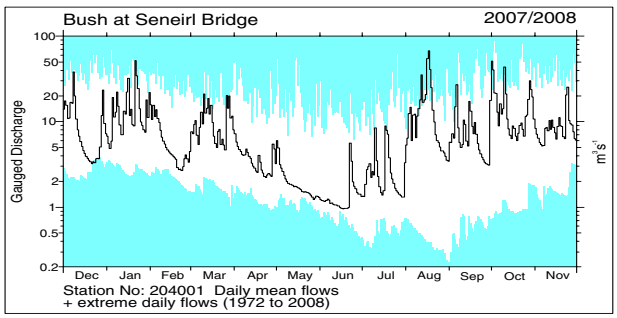








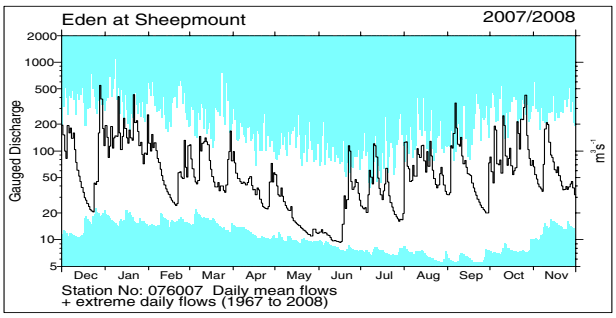


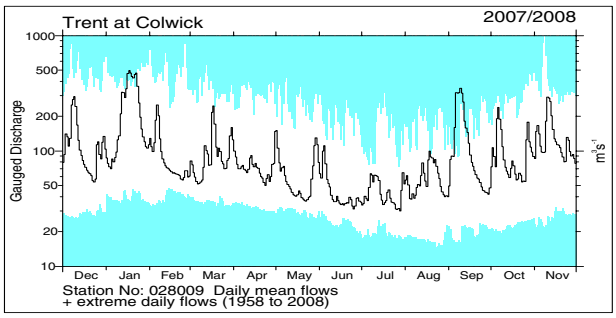


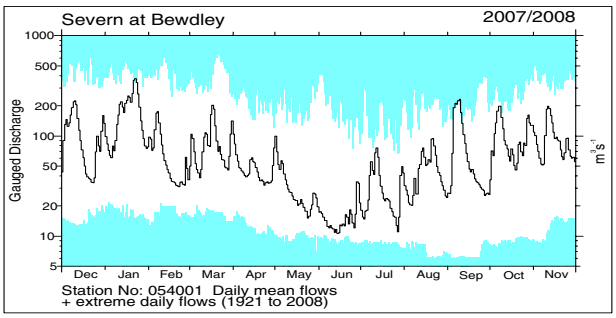
River flow hydrographs

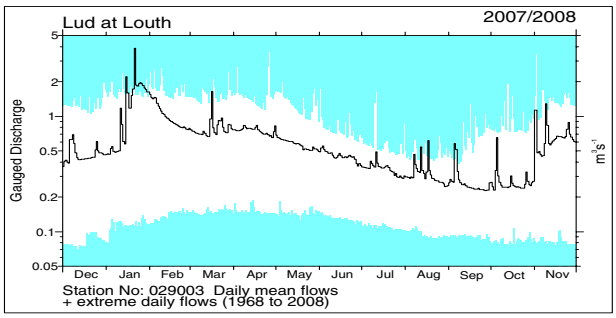
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to December 2007 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

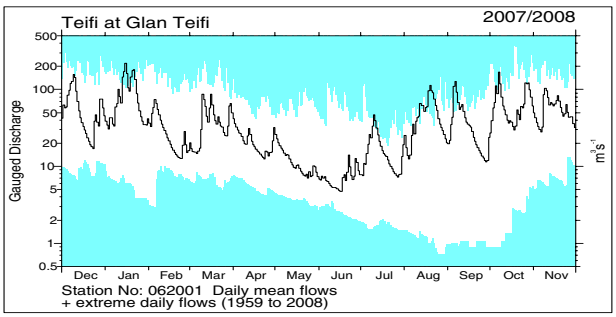
River flow . . . River flow . . .

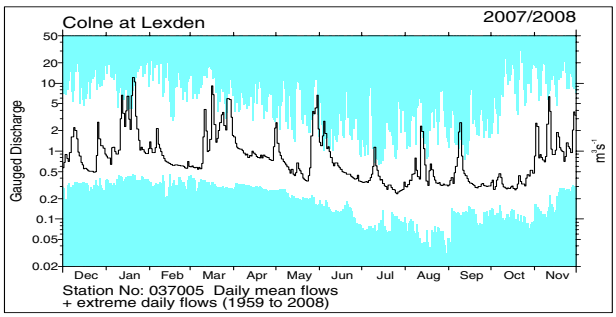


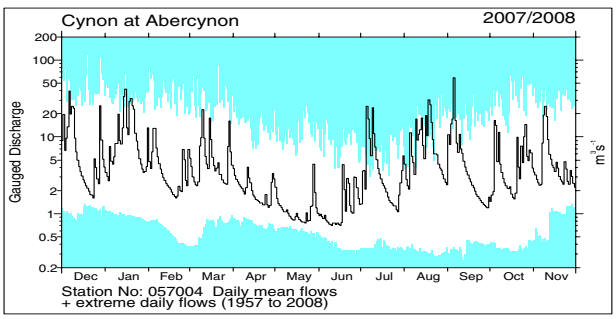


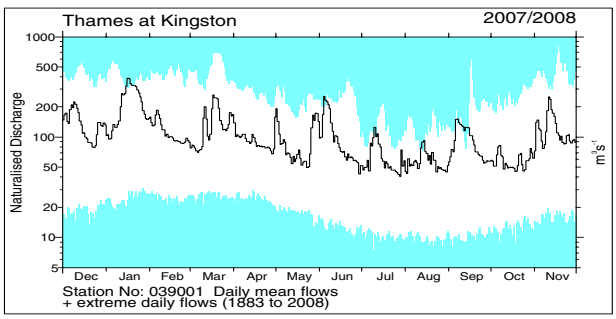


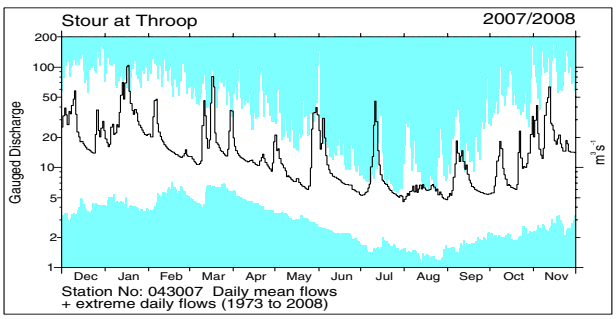


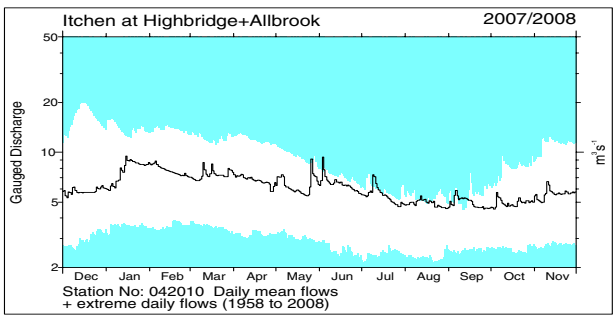












Notable runoff accumulations (a) March - November 2008, (b) January - November 2008

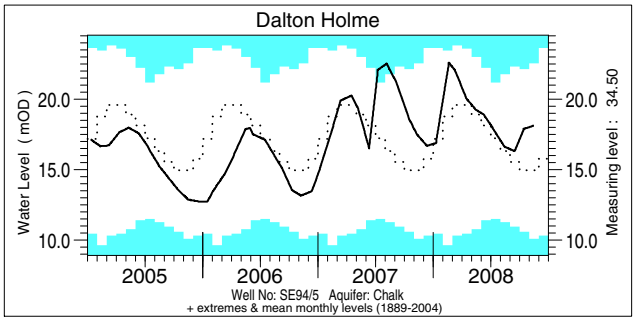
	River	%lta	Rank
a)	Tyne (Bywell)	164	49/49
	Wharfe	205	53/53
	Bedford Ouse	190	75/76
	Coln	154	43/45
	Otter	137	44/46
	Dart	163	50/50
	Warleggan	146	38/39
	Brue	173	42/43

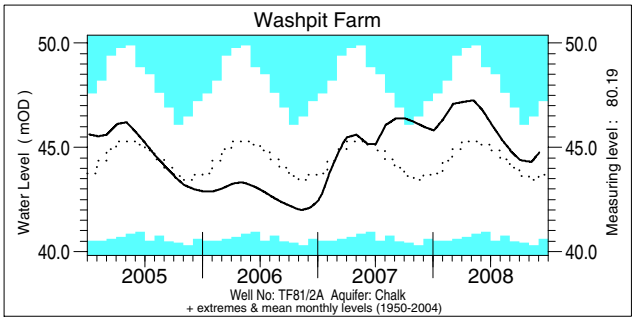
	River	%lta	Rank
b)	Tyne (Spilmersford)	176	43/43
	Tweed (Boleside)	143	48/48
	Whiteadder	164	39/39
	S Tyne	141	44/45
	Exe	160	52/52
	Avon (Evesham)	154	70/72
	Teme	162	38/38
	Teifi	144	48/48

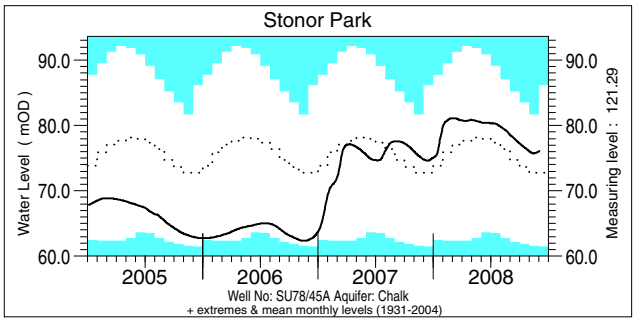
	River	%lta	Rank
b)	Lune	154	48/48
	Eden	144	41/41
	Nith	131	51/51
	Clyde (Blairston)	148	48/48
	Naver	135	31/31
	Camowen	131	34/35
	Annacloy	147	28/29

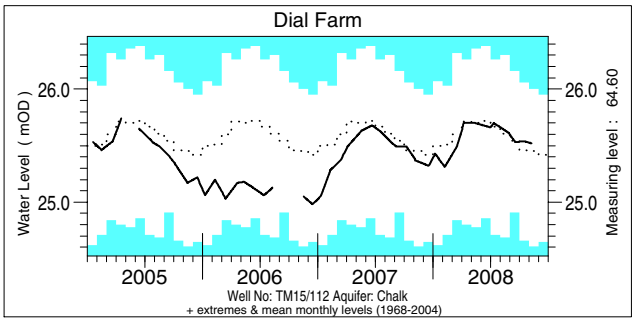
lta = long term average
Rank 1 = lowest on record

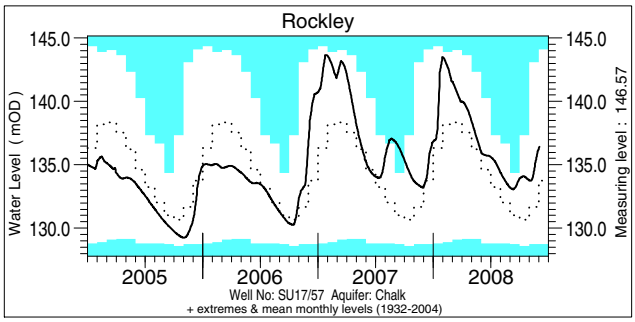
Groundwater . . . Groundwater

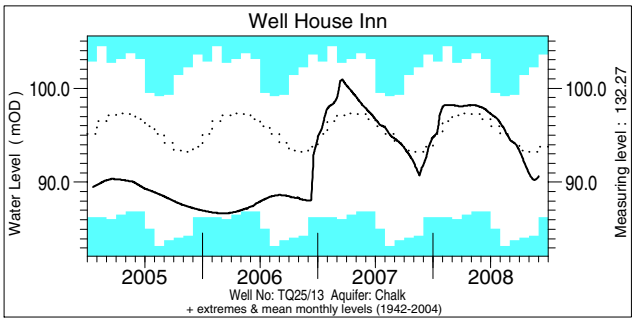


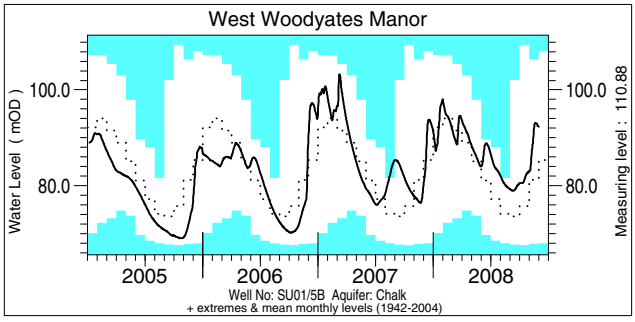


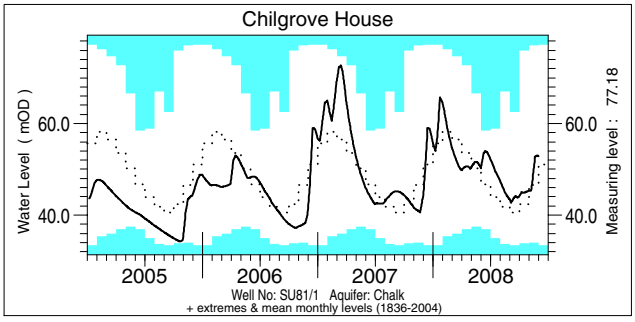


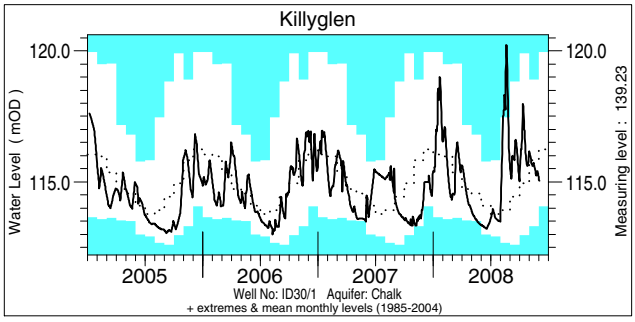


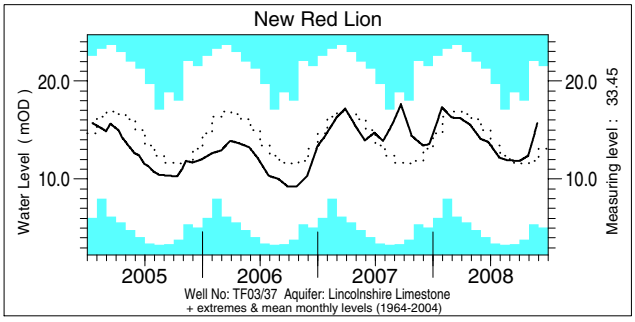






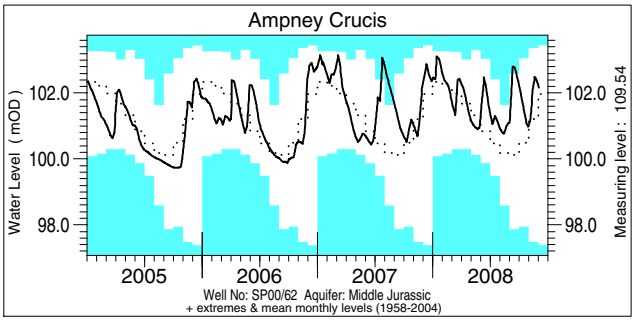


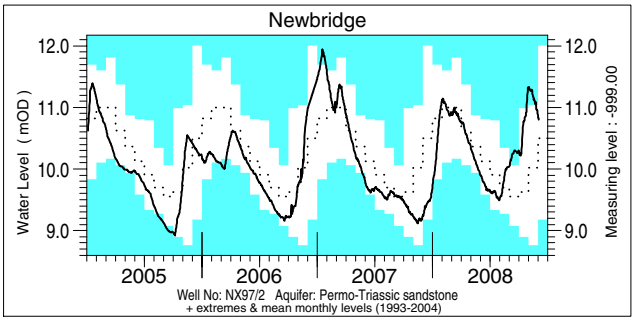


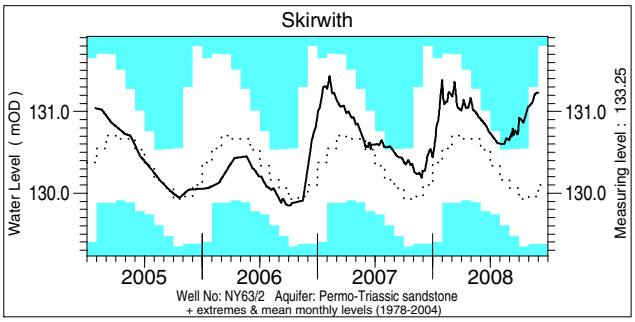


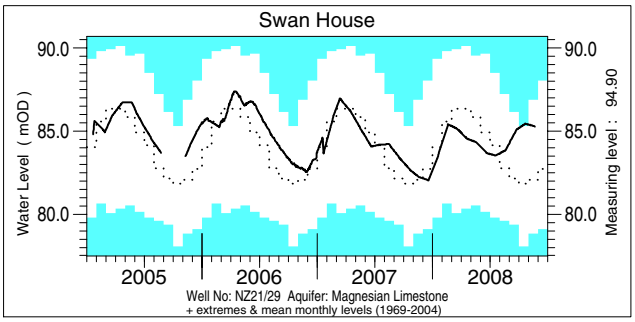
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

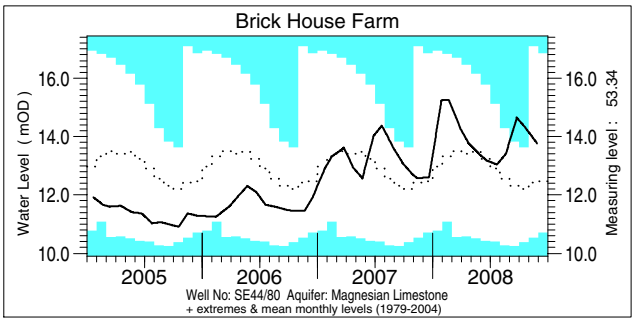
Groundwater . . . Groundwater

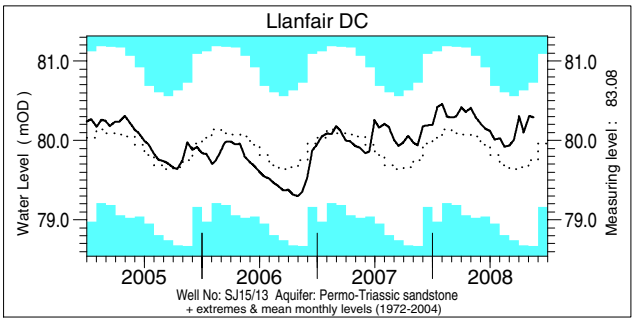


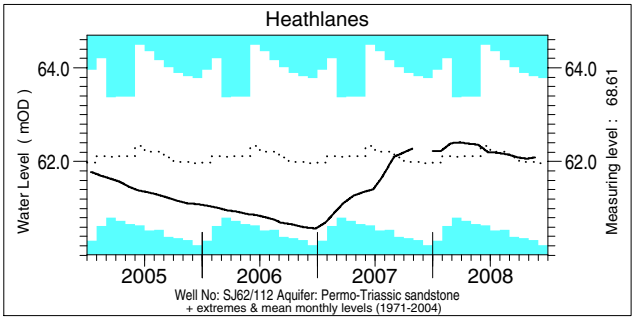


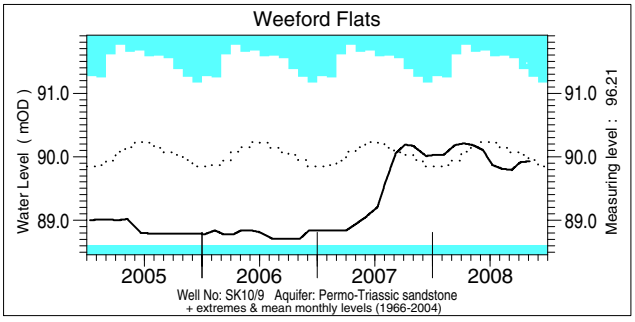


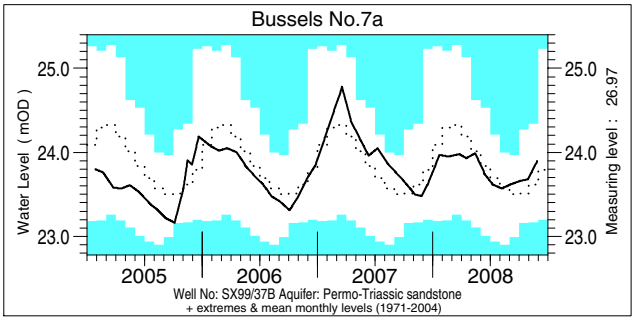


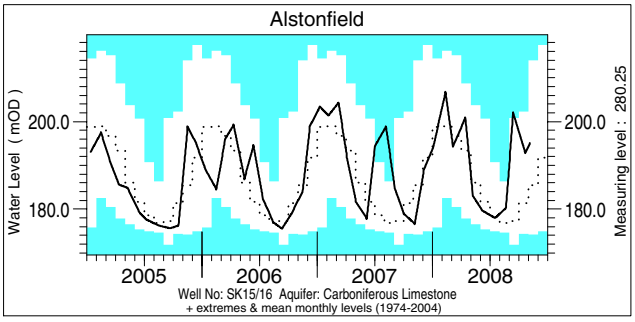










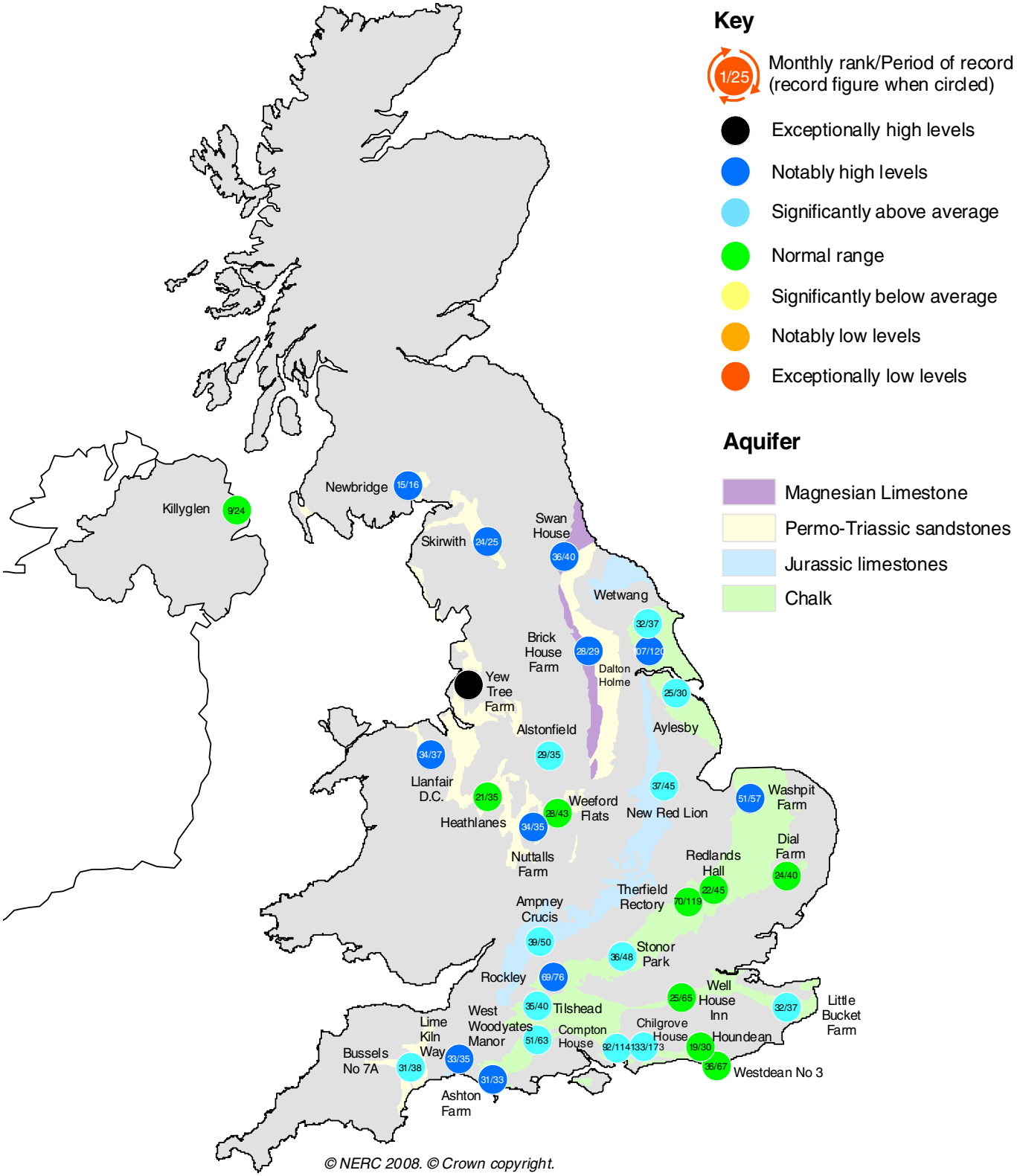


Groundwater levels November / December 2008

Borehole	Level	Date	Nov. av.	Borehole	Level	Date	Nov. av.	Borehole	Level	Date	Nov. av.
Dalton Holme	18.12	13/11	14.80	Chilgrove House	52.88	30/11	46.50	Brick House Farm	13.77	26/11	12.28
Washpit Farm	44.75	02/12	43.33	Killyglen (NI)	115.04	02/12	115.84	Llanfair DC	80.29	15/11	79.68
Stonor Park	76.08	02/12	72.24	New Red Lion	15.72	26/11	12.24	Heathlanes	62.09	20/11	61.89
Dial Farm	25.52	07/11	25.43	Ampney Crucis	102.17	02/12	101.19	Weeford Flats	89.93	03/11	89.70
Rockley	136.45	02/12	131.64	Newbridge	10.80	03/12	10.03	Bussels No.7a	23.90	27/11	23.62
Well House Inn	90.64	01/12	93.04	Skirwith	131.23	30/11	130.00	Alstonfield	195.18	04/11	186.48
West Woodyates	92.34	30/11	80.73	Swan House	85.27	20/11	82.39				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



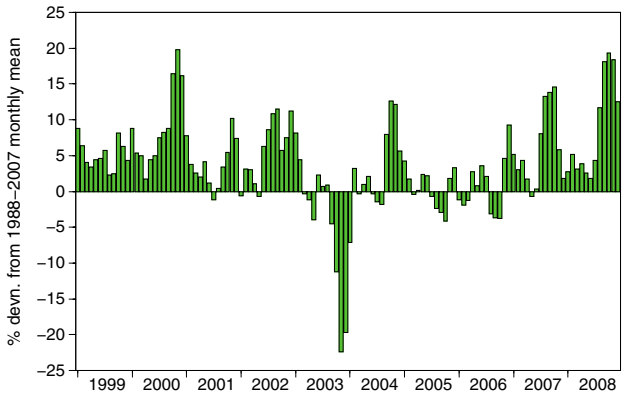
Groundwater levels - November 2008

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.

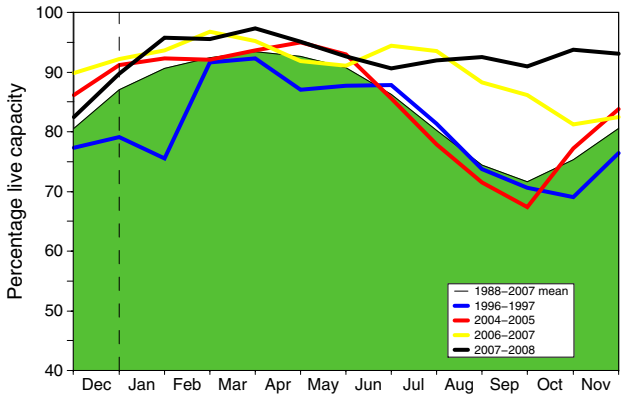
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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)	2008 Oct	Nov	Dec	Dec Anom.	Min. Dec	Year* of min.	2007 Dec	Diff 08-07
North West	N Command Zone	• 124929	82	98	**95**	20	44	1993	73	22
	Vyrnwy	55146	91	100	**93**	13	33	1995	83	10
Northumbrian	Teesdale	• 87936	87	93	**91**	13	39	1995	95	-4
	Kielder	(199175)	(89)	(94)	**(88)**	4	(55)	2007	(55)	33
Severn Trent	Clywedog	44922	89	80	**79**	0	43	1995	87	-8
	Derwent Valley	• 39525	94	100	**95**	18	9	1995	86	9
Yorkshire	Washburn	• 22035	91	98	**94**	23	16	1995	76	18
	Bradford supply	• 41407	95	99	**97**	18	20	1995	89	8
Anglian	Grafham	(55490)	(95)	(95)	**(93)**	11	(47)	1997	(93)	0
	Rutland	(116580)	(79)	(80)	**(88)**	9	(57)	1995	(84)	4
Thames	London	• 202828	94	92	**95**	14	52	1990	89	6
	Farmoor	• 13822	94	95	**93**	3	52	1990	87	6
Southern	Bewl	28170	74	61	**75**	11	34	1990	66	9
	Ardingly	4685	91	75	**93**	19	23	2003	75	18
Wessex	Clatworthy	5364	100	100	**100**	24	16	2003	68	32
	Bristol WW	• (38666)	(90)	(90)	**(94)**	28	(27)	1990	(79)	15
South West	Colliford	28540	100	100	**100**	30	42	1995	72	28
	Roadford	34500	98	97	**97**	25	19	1995	83	14
	Wimbleball	21320	100	100	**100**	27	34	1995	82	18
	Stithians	5205	79	84	**88**	25	29	2001	52	36
Welsh	Celyn and Brenig	• 131155	97	98	**96**	10	50	1995	95	1
	Brianne	62140	97	100	**98**	3	72	1995	96	2
	Big Five	• 69762	95	99	**96**	16	49	1990	79	17
	Elan Valley	• 99106	96	99	**100**	7	47	1995	100	0
Scotland(E)	Edinburgh/Mid Lothian	• 97639	94	97	**97**	14	45	2003	79	18
	East Lothian	• 10206	99	99	**99**	13	38	2003	100	-1
Scotland(W)	Loch Katrine	• 111363	80	91	**95**	6	65	2007	65	30
	Daer	22412	98	99	**99**	3	73	2003	98	1
	Loch Thom	• 11840	96	96	**96**	4	72	2003	74	22
Northern Ireland	Total+	• 67270	90	91	**90**	8	59	2003	76	14
	Silent Valley	• 20634	96	95	**89**	14	43	2001	76	13

() 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.

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 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 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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Fax: 01491 692424
E-mail: nrfa@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

12/08