Hydrological Summary *for the United Kingdom*

October 2008

General

October was a very cyclonic month but with a notably balmy interlude and a decidedly wintry fourth week. The UK rainfall total was above average for the ninth month this year – correspondingly, the January-October period is the wettest on record (in a series from 1914). A succession of vigorous frontal systems generated spate conditions in most rivers with some, mostly localised, flooding; the month ended with an exceptional flood event in east Devon. The substantial October runoff boosted reservoir stocks – which are above the early November average in almost all index reservoirs across the UK. In some reservoirs in south-east Britain stocks are near-average but overall stocks for England &Wales are the 2nd highest, for the time of year, in a series from 1988. Apart from some low-lying eastern areas, soils remained close to saturation during much of October and significant aquifer recharge ensured that groundwater levels generally remained seasonally high, notably so in a number of northern outcrop areas. The water resources outlook is very encouraging but many catchments remain at-risk to further major storm events and, in the event of a wet winter, the risk of groundwater flooding may be increased in vulnerable areas.

Rainfall

For much of the greater part of October, synoptic patterns encouraged the passage of vigorous Atlantic frontal systems but after a notably warm episode in mid-month, a polar airflow brought snowfall across much of the country; London registered its first significant October snowfall since 1934. Notable storm rainfall totals were relatively common. On the 4/5th 24-hr totals of around 90mm were reported in north Wales, with comparable figures on the 25th; in the Lake District, Honister recorded around 300mm over the three days from the 24th. Near Ottery St Mary (Devon) a remarkable convective event on the 29/30th generated estimated precipitation totals of around 100mm in a few hours – deep drifts of hail contributed to the resulting severe local flooding. Throughout most of western and northern Britain (Northern Ireland also), October rainfall totals were above average, and exceeded 200% in some of the wettest areas (e.g. parts of Cairngorms, Lake District and north Wales – where Capel Curig registered 644mm). Below average October totals were mostly confined to sheltered eastern and southern areas – particularly meagre totals characterised a zone from the Cotswolds to Sussex where monthly totals fell as low as 60% of average. Nonetheless, in most regions, rainfall accumulations over a range of timeframes are outstanding; the UK eclipsed its previous maximum January-October rainfall by an appreciable margin.

River Flows

With soil moisture deficits largely eliminated in most western and northern regions, rivers draining impermeable catchments responded smartly to the October rainfall and spate conditions were common early and late in the month. Flood alerts were widely distributed on the 5th; modest flooding occurred in parts of Wales (e.g. Welshpool) with notably high river flows extending to parts of Cumbria and East Anglia. Further localised flooding occurred on the 9/10th (e.g. in the Cynon Valley) and exceptional autumn flows were registered during the final week (e.g. in northern Scotland and the Lake District. At month-end, the east Devon storm triggered the highest flow on the Otter (at Dotton) for 40 years. Across much of the UK, October runoff totals were notably high. The Welsh Dee (at New Inn) and the Nith established new maximum October runoff totals. Runoff for the Coln, in the Cotswolds, was also unprecedented (exceptional September rainfall being a primary factor) and October flows were also very healthy in most groundwater-fed rivers. By contrast, below average runoff characterised many impermeable catchments in the South East (e.g. the Colne and Medway). Nonetheless, estimated October outflows from the UK were the 6th highest in the last 40 years; much more significantly the accumulated runoff over the first ten months of the year also exceeded previous maxima.

Groundwater

October was a notably wet month but the rainfall's spatial distribution did not favour the major aquifer outcrop areas in the English Lowlands – large parts of the southern Chalk reported below average rainfall; parts of the Chilterns and South Downs were particularly dry. In addition, soil moisture deficits remained significant in some eastern areas – delaying the seasonal onset of recharge. Nonetheless, groundwater levels in most responsive index wells and boreholes increased during October, resulting in new monthly maximum levels in some northern Magnesian Limestone and Permo-Triassic sandstones outcrops. To the south, levels in most index wells are considerably above average but substantial spatial variability may be recognised. In the Chalk, levels in most western wells are seasonally very high; at Rockley (where monitoring began in 1933), higher October mean levels have occurred only in 2007, 1968 and 1958. By contrast, levels in some eastern outcrops remain close to the normal late-autumn range, and below average at the very slow-responding Therfield well. Nonetheless, overall groundwater resources remain very healthy – particularly for this early in the recharge season. The amount, and spatial distribution, of the late-autumn rainfall will be influential in determining the likelihood of groundwater flooding should the winter of 2008/09 be particularly wet.

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	Oct 08	Jul 08- Oct 08	RP	Mar 08- Oct 08	RP	Jan 08- Oct 08	RP	Nov 07- Oct 08	RP
England & Wales	**mm**	**113**	**445**		**746**		**935**		**1108**	
	%	**131**	**147**	**20-30**	**132**	**40-60**	**130**	**>100**	**122**	**20-30**
North West	mm	**230**	682		1021		1324		1585	
	%	**179**	154	40-60	133	60-90	137	>100	130	80-120
Northumbrian	mm	**106**	515		805		1000		1164	
	%	**137**	171	>100	145	>100	143	>100	134	>100
Severn Trent	mm	**84**	380		634		792		931	
	%	**128**	149	15-25	129	15-25	128	30-40	121	10-20
Yorkshire	mm	**81**	429		707		924		1081	
	%	**109**	152	20-30	133	50-80	138	>100	130	70-100
Anglian	mm	**59**	266		501		600		685	
	%	**116**	129	2-5	125	5-15	122	5-15	114	2-5
Thames	mm	**54**	291		573		691		825	
	%	**84**	125	2-5	127	10-20	122	5-15	118	5-10
Southern	mm	**72**	278		572		707		854	
	%	**90**	108	2-5	119	5-10	115	5-10	109	2-5
Wessex	mm	**85**	390		695		860		1049	
	%	**104**	142	5-10	134	20-30	128	20-30	123	5-15
South West	mm	**135**	566		937		1145		1389	
	%	**115**	154	20-35	137	40-60	124	20-35	117	5-10
Welsh	mm	**213**	700		1103		1410		1675	
	%	**153**	158	25-40	138	30-50	135	40-60	124	10-20
Scotland	**mm**	**239**	**615**		**1014**		**1450**		**1750**	
	%	**150**	**119**	**5-15**	**113**	**10-20**	**125**	**40-60**	**119**	**40-60**
Highland	mm	**298**	632		1094		1638		2027	
	%	**155**	106	2-5	105	5-10	121	15-25	116	20-30
North East	mm	**132**	410		733		983		1220	
	%	**128**	113	2-5	112	5-10	119	20-30	119	20-30
Tay	mm	**171**	542		884		1316		1542	
	%	**126**	124	5-10	113	5-10	128	30-45	120	10-20
Forth	mm	**172**	571		889		1274		1482	
	%	**144**	140	20-30	124	15-25	139	>100	129	60-90
Tweed	mm	**146**	577		910		1188		1376	
	%	**148**	162	>100	142	>100	147	>100	137	>100
Solway	mm	**281**	771		1140		1526		1809	
	%	**179**	150	80-120	129	60-90	134	>100	126	60-90
Clyde	mm	**293**	774		1247		1757		2084	
	%	**149**	122	5-15	117	10-20	127	30-45	119	15-25
Northern Ireland	**mm**	**146**	**594**		**860**		**1107**		**1307**	
	%	**127**	**156**	**>100**	**126**	**30-50**	**126**	**60-90**	**119**	**20-30**

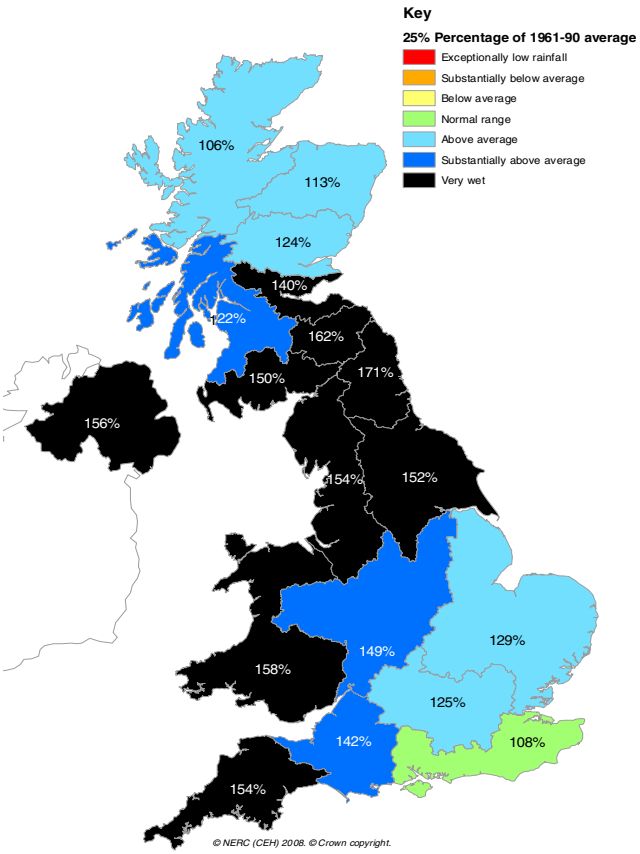
% = percentage of 1961-90 average

RP = Return period

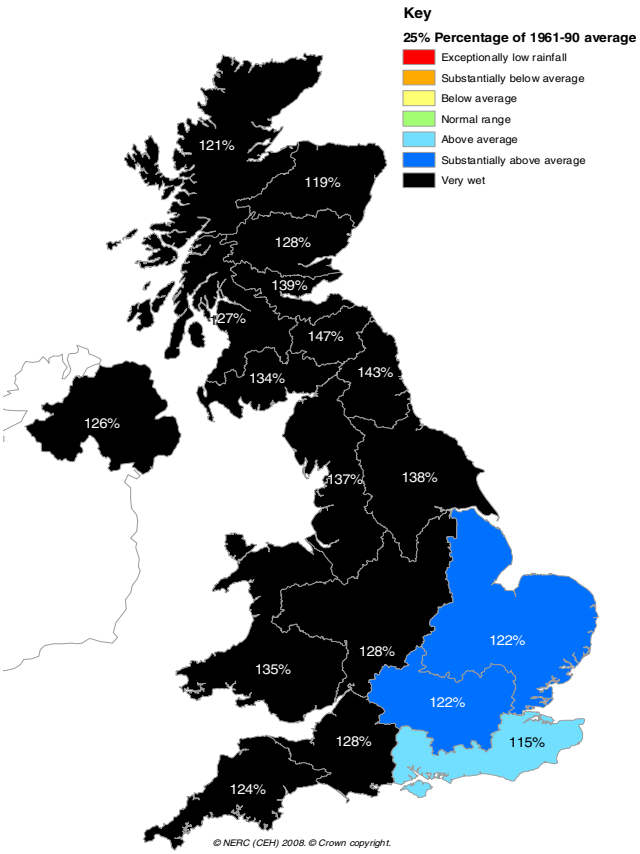
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following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

Rainfall . . . Rainfall . . .

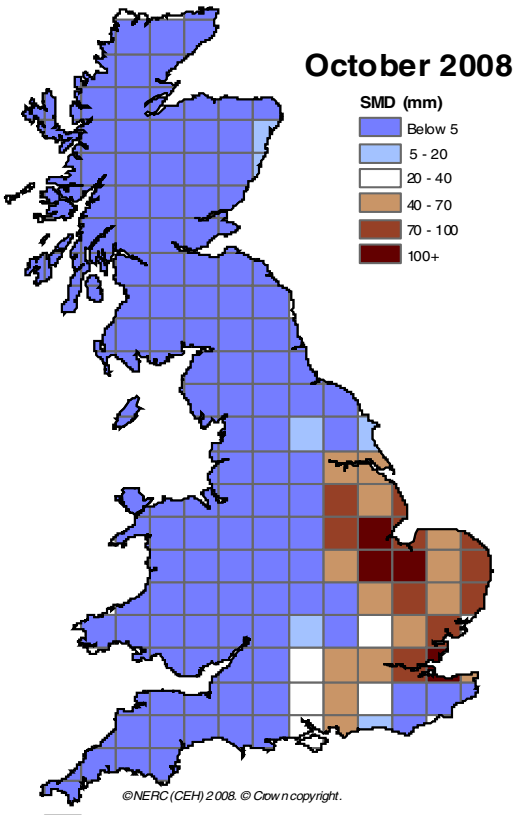
July - October 2008



January- October 2008



MORECS Soil Moisture Deficit



Met Office Winter 2008 forecast

Forecast for Winter 2008/9: 29 October 2008

The latest signals for winter are similar to last month's, and consequently there is little change to the forecast.

Temperature

Winter temperatures are more likely to be above average over much of Europe. However, this winter is likely to be less mild than last winter, when above-average temperatures were widespread.

For the UK as a whole, winter-mean temperatures are more likely to be above average. Although a winter milder than the 1971-2000 average is favoured, temperatures are likely to be lower than those experienced last year.

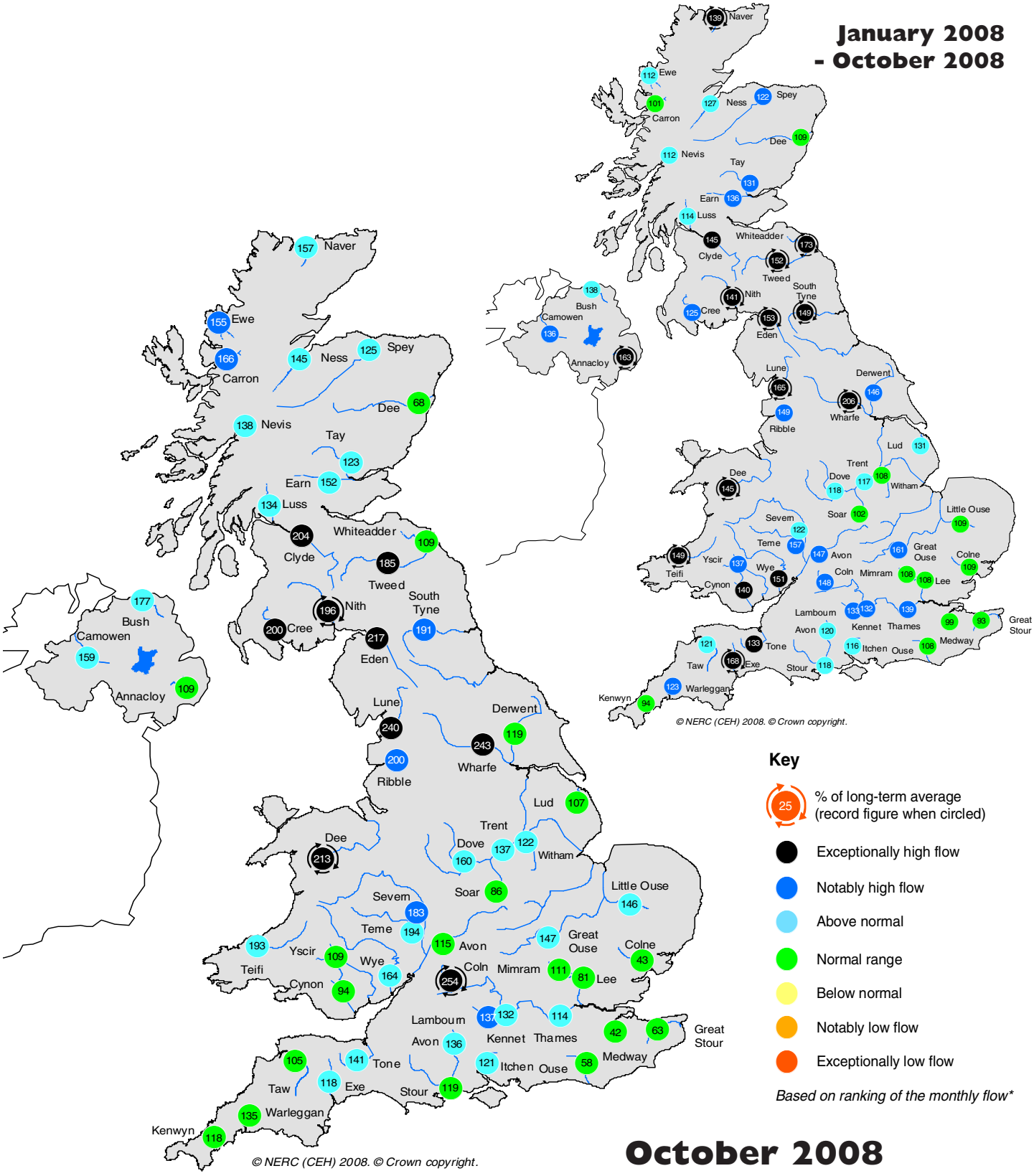
Rainfall

For much of northern Europe, including the UK, precipitation is likely to be lower than observed in last year's relatively wet winter. However, the forecast signal is not sufficient to indicate whether winter precipitation is more likely to be above or below the 1971-2000 average.

Updates and reviews of the forecast

The winter forecast will next be updated at 10 a.m. on 25 November 2008. For further details please visit: http://www.metoffice.gov.uk/weather/seasonal/winter2008_9

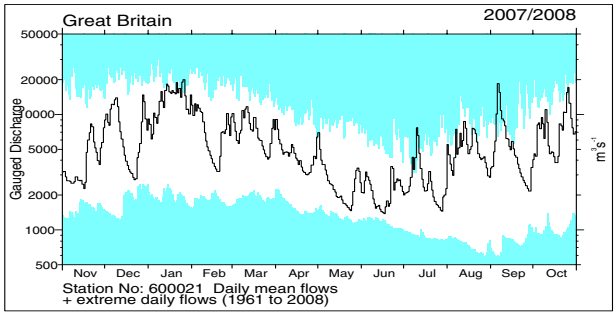
River flow . . . River flow . . .

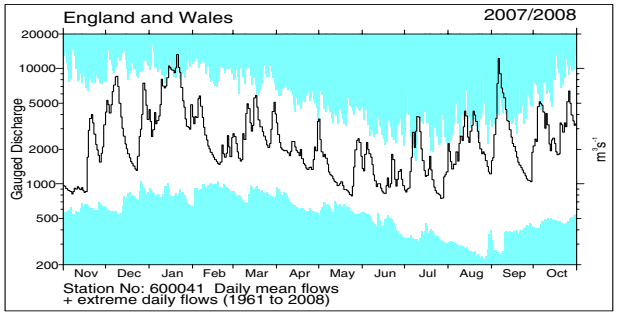


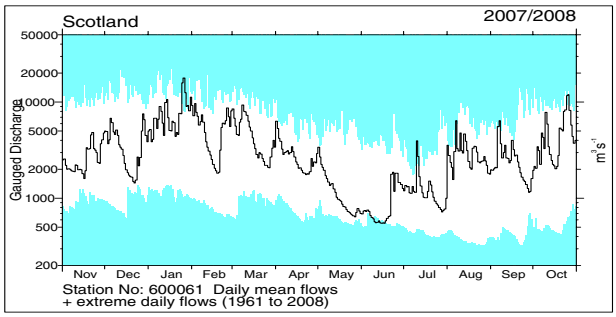
River flows

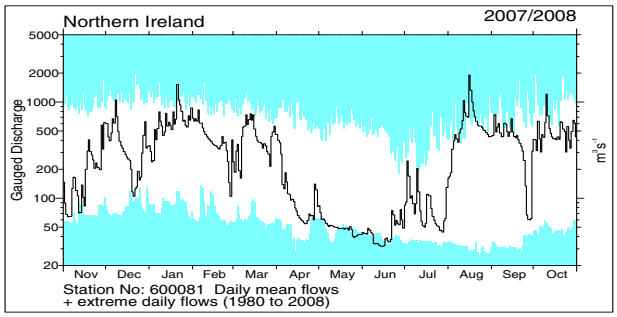
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station. Percentages may be omitted where flows are under review.

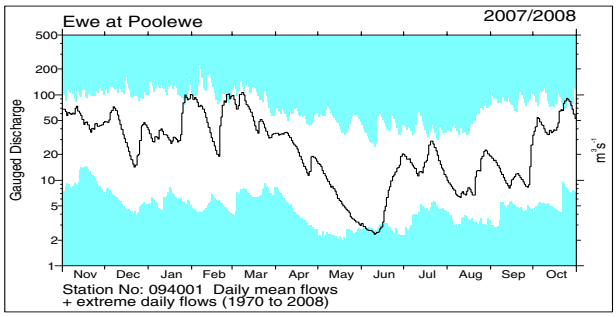
River flow . . . River flow . . .

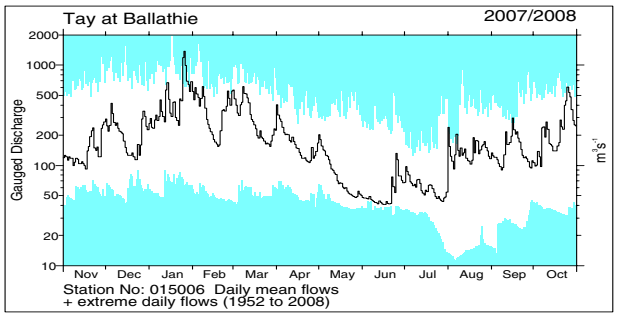


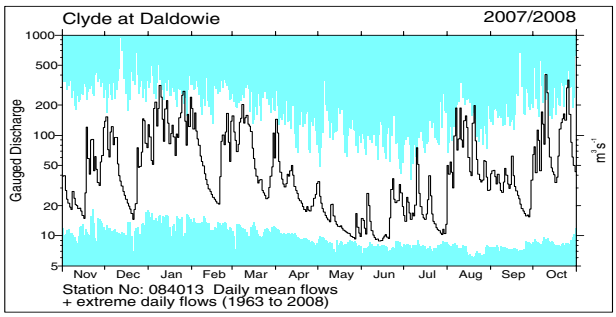


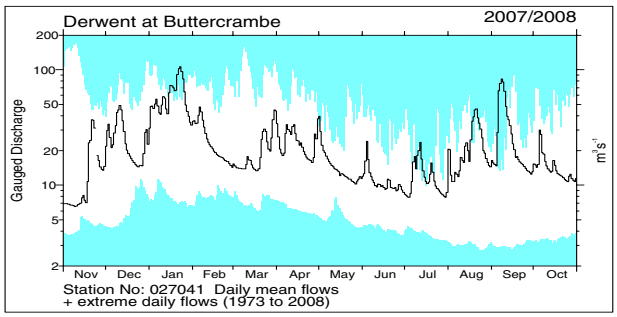


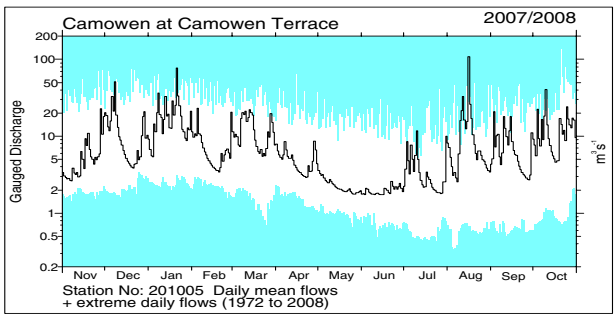


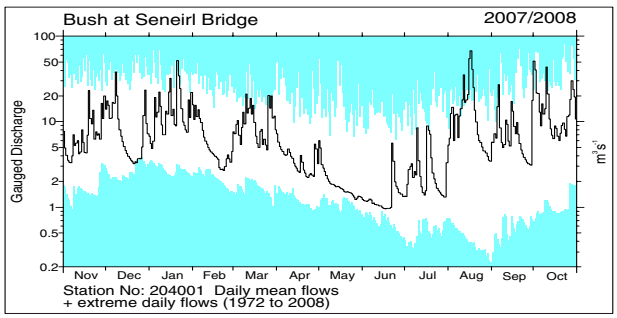








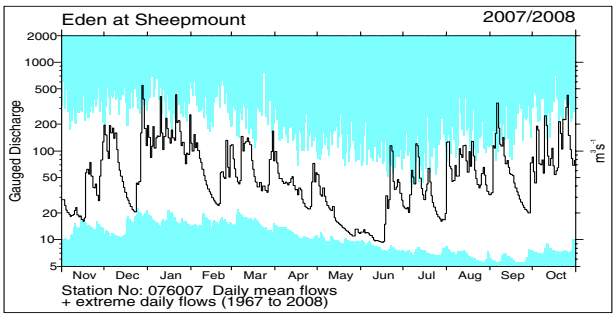


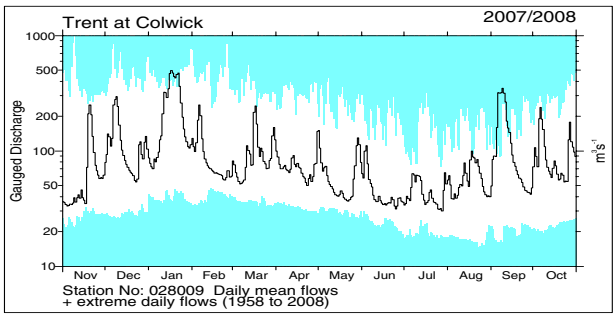


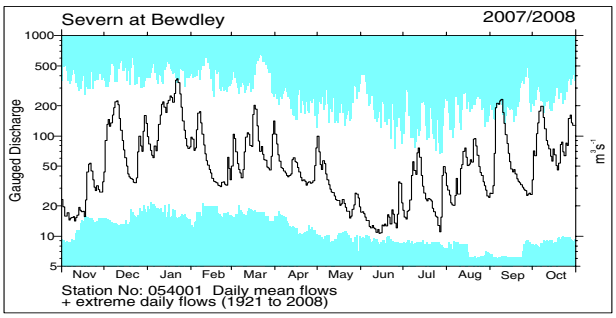
River flow hydrographs

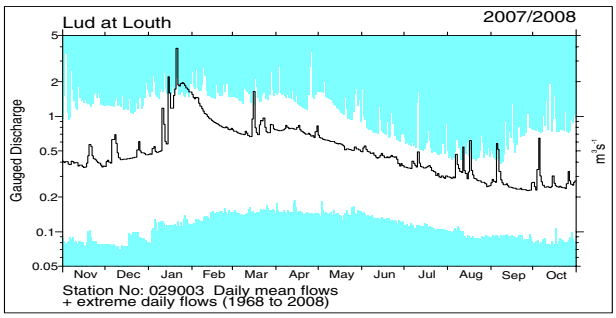
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to November 2007 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

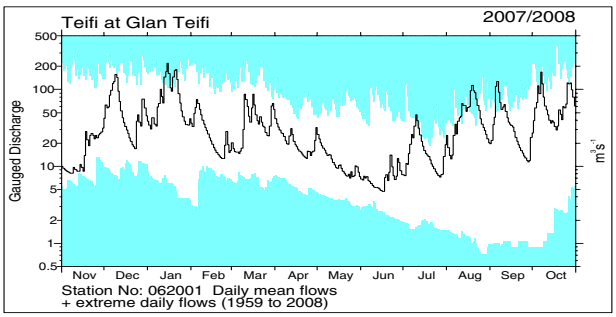
River flow . . . River flow . . .

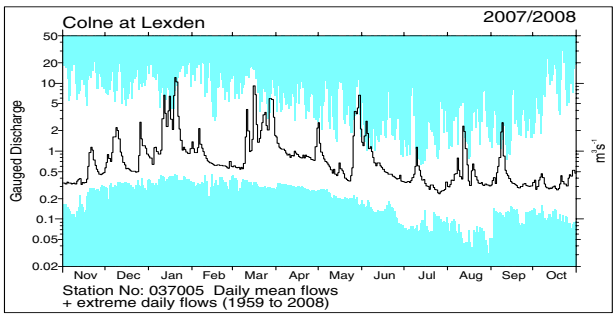


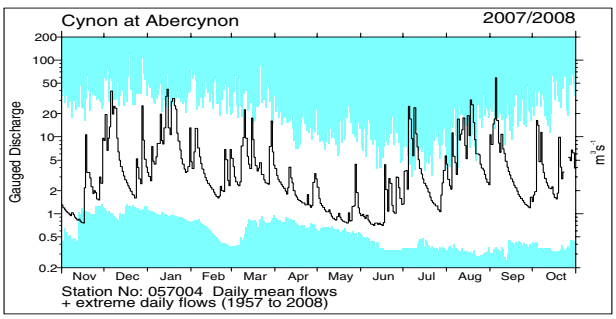


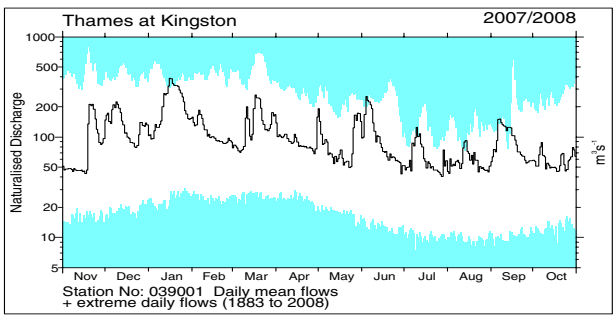


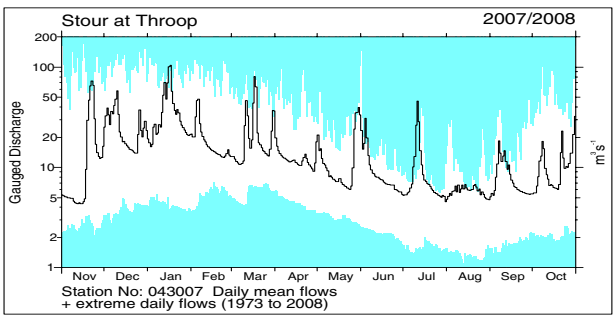


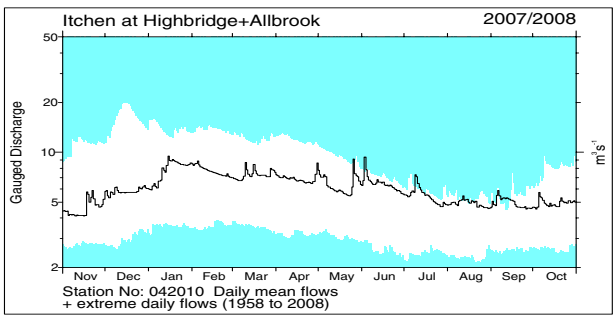












Notable runoff accumulations (a) July - October 2008, (b) January - October 2008

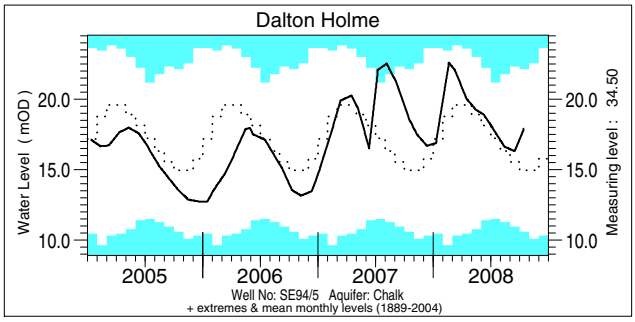
	River	%lta	Rank
a)	Tyne(Spilmersford)	279	43/43
	Whiteadder	320	39/39
	S Tyne	216	45/45
	Derwent	200	47/47
	Otter	207	46/46
	Warleggan	241	39/39
	Tone	220	48/48
	Teme	304	39/39
	Wye	237	72/72

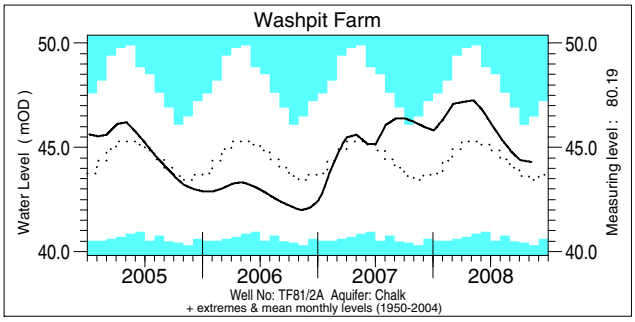
	River	%lta	Rank
a)	Yscir	216	37/37
	Tawe	209	51/51
	Lagan	254	36/36
b)	Tweed (Boleside)	152	48/48
	Tyne (Bywell)	163	49/49
	Wharfe	206	53/53
	Exe	168	52/52
	Dart	149	50/50

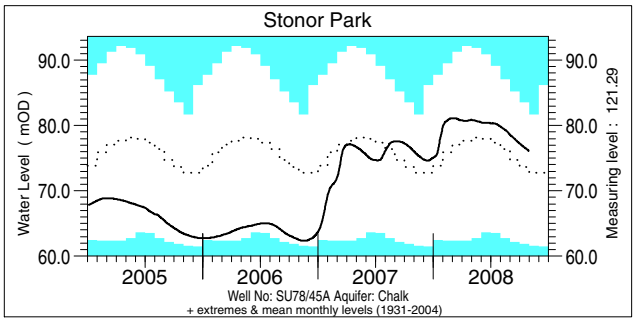
	River	%lta	Rank
b)	Teifi	149	48/48
	Lune	165	48/48
	Eden	153	41/41
	Nith	141	51/51
	Clyde (Blairston)	161	48/48
	Naver	139	31/31
	Annacloy	163	29/29

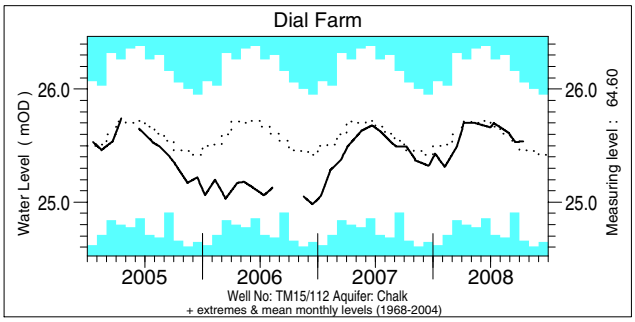
lta = long term average
Rank 1 = lowest on record

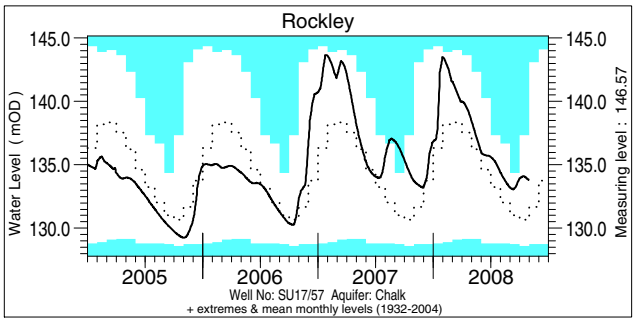
Groundwater . . . Groundwater

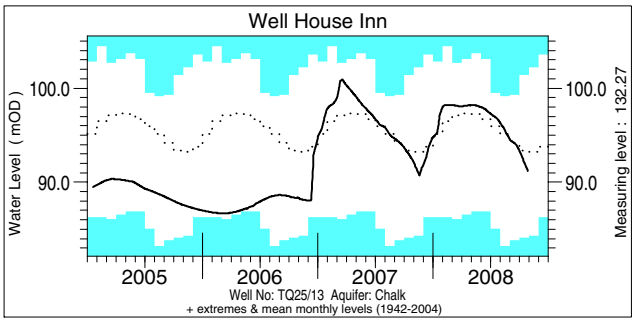


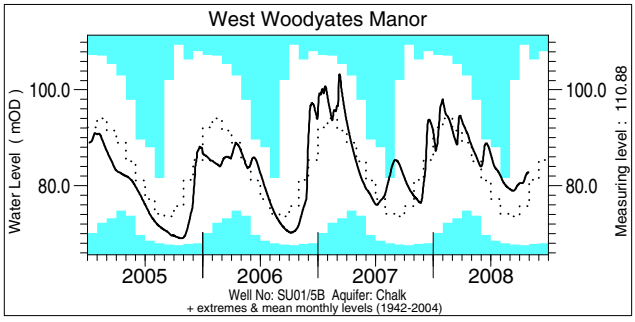


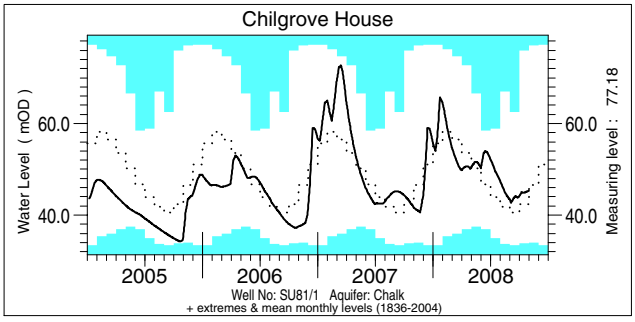


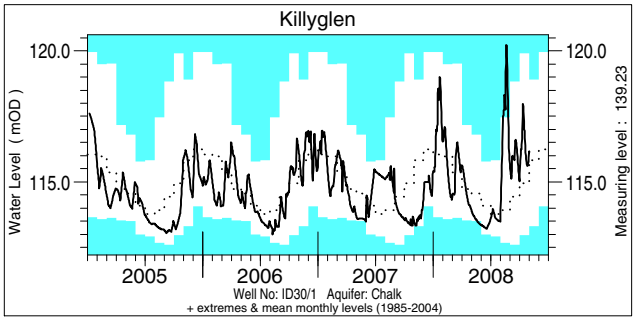


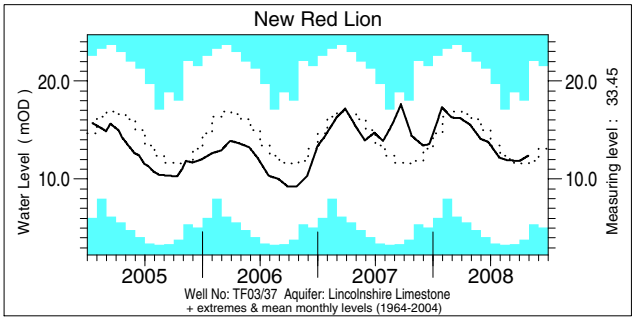






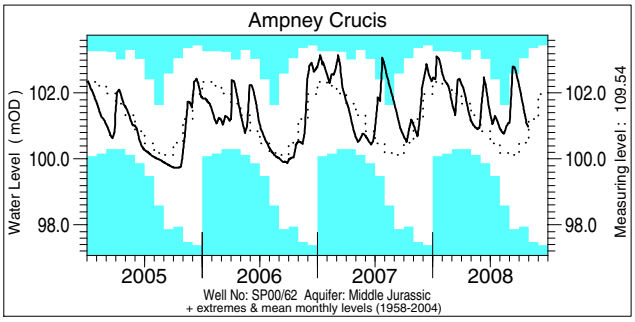


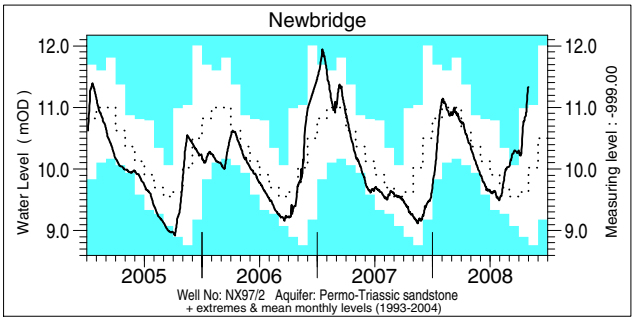


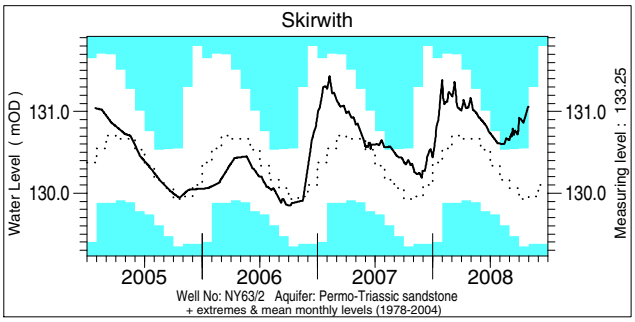


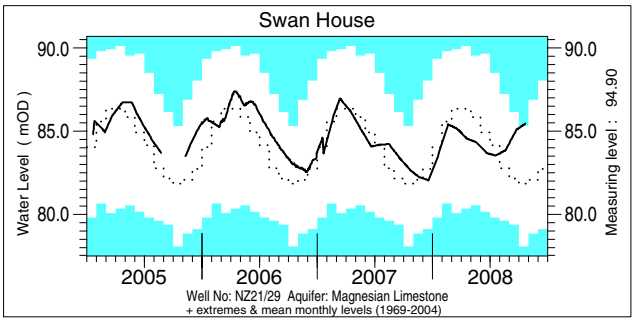
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

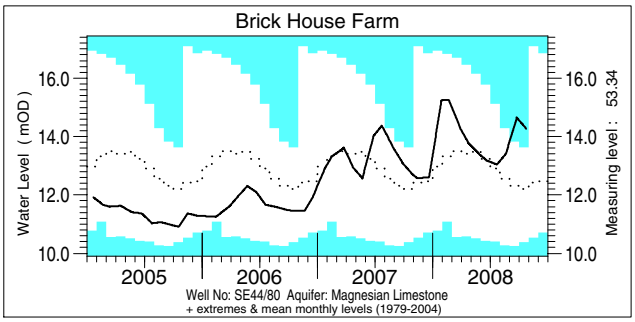
Groundwater . . . Groundwater

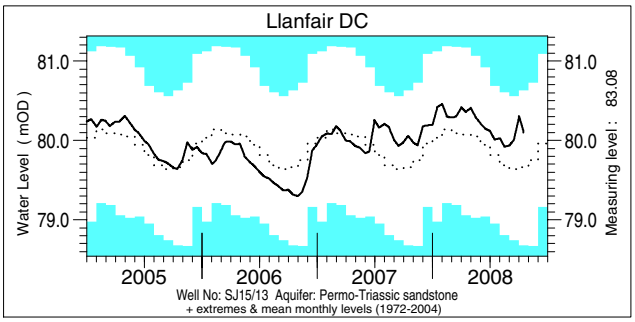


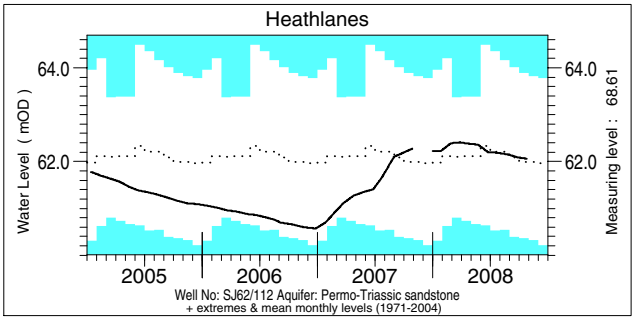


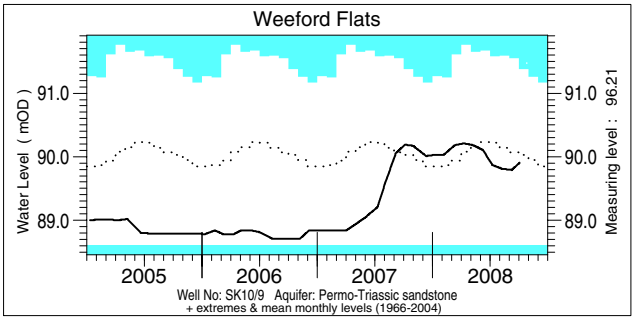


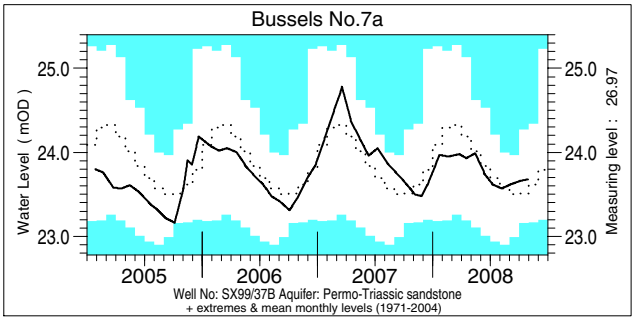


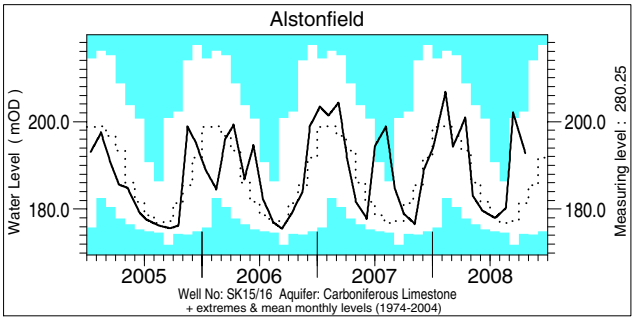










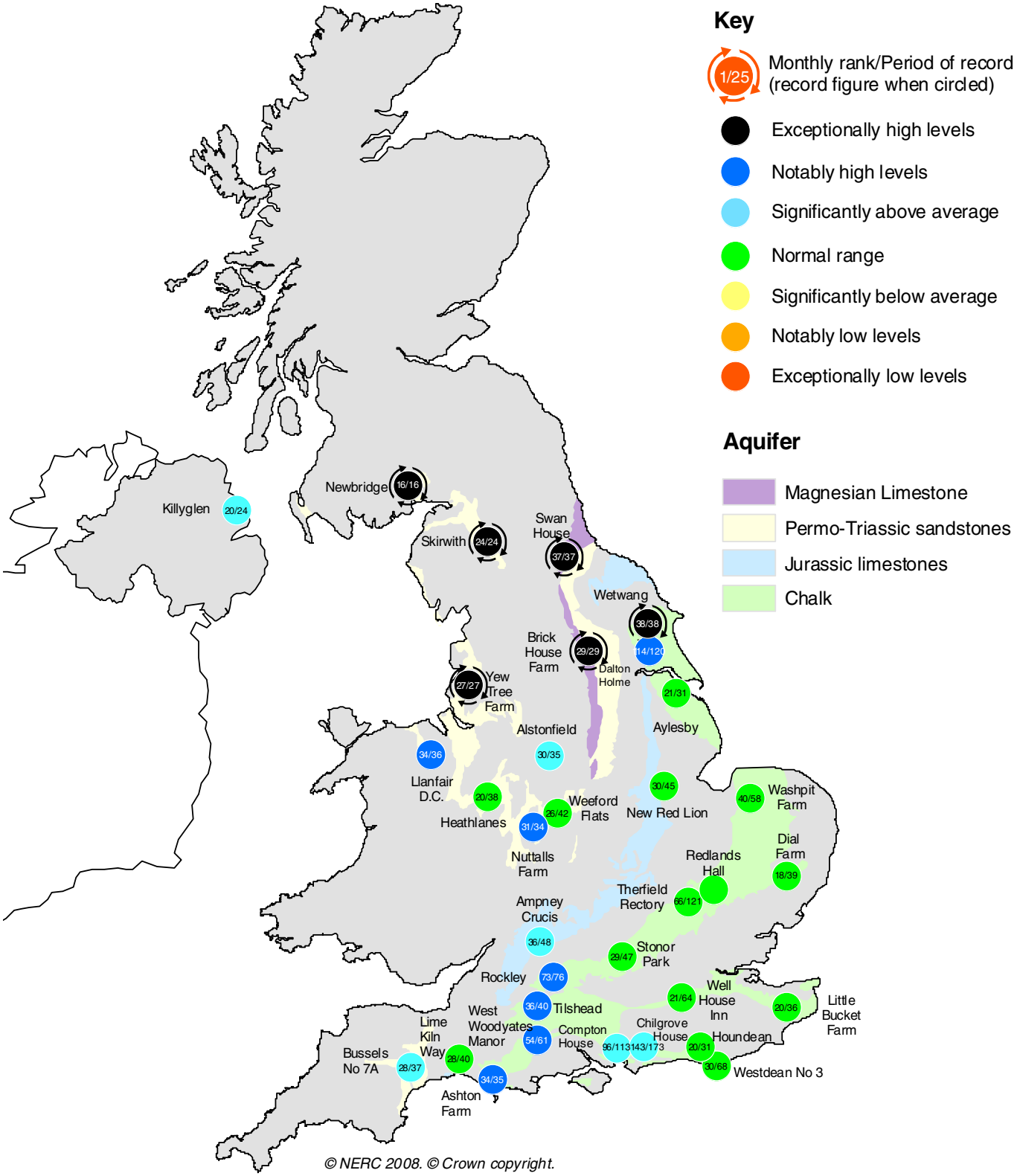


Groundwater levels October / November 2008

Borehole	Level	Date	Oct. av.	Borehole	Level	Date	Oct. av.	Borehole	Level	Date	Oct. av.
Dalton Holme	17.89	13/10	14.89	Chilgrove House	45.37	31/10	42.33	Brick House Farm	14.27	22/10	12.19
Washpit Farm	44.30	07/11	43.57	Killyglen (NI)	116.12	31/10	114.75	Llanfair DC	80.10	15/10	79.56
Stonor Park	76.10	29/10	73.10	New Red Lion	12.40	28/10	11.60	Heathlanes	62.06	24/10	61.93
Dial Farm	25.54	13/10	25.47	Ampney Crucis	100.97	29/10	100.43	Weeford Flats	89.91	03/10	89.73
Rockley	133.79	29/10	130.69	Newbridge	11.33	31/10	9.61	Bussels No.7a	23.68	28/10	23.51
Well House Inn	91.21	27/10	93.18	Skirwith	131.06	31/10	129.96	Alstonfield	192.79	20/10	181.13
West Woodyates	82.87	28/10	74.92	Swan House	85.44	20/10	82.15				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



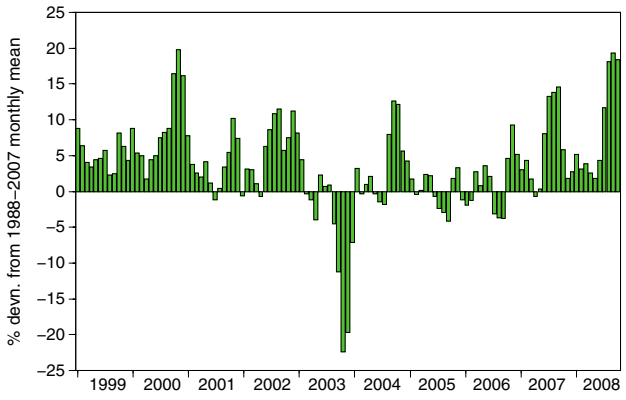
Groundwater levels - October 2008

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.

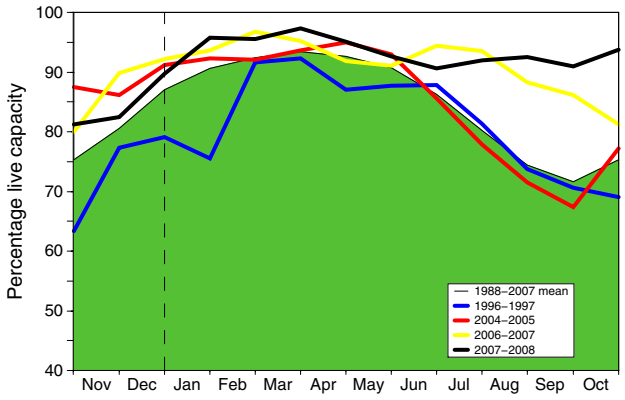
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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 Sep	Oct	Nov	Nov Anom.	Min. Nov	Year* of min.	2007 Nov	Diff 08-07
North West	N Command Zone	• 124929	79	82	**98**	35	33	2003	69	29
	Vyrnwy	55146	94	91	**100**	27	25	1995	75	25
Northumbrian	Teesdale	• 87936	91	87	**93**	22	33	1995	87	6
	Kielder	(199175)	(91)	(89)	**(94)**	9	(63)	1989	(66)	28
Severn Trent	Clywedog	44922	98	89	**80**	5	38	1995	83	-3
	Derwent Valley	• 39525	88	94	**100**	31	15	1995	77	23
Yorkshire	Washburn	• 22035	97	91	**98**	32	15	1995	72	26
	Bradford supply	• 41407	99	95	**99**	29	16	1995	76	23
Anglian	Grafham	(55490)	(95)	(95)	**(95)**	14	(44)	1997	(94)	1
	Rutland	(116580)	(79)	(79)	**(80)**	2	(59)	1995	(85)	-5
Thames	London	• 202828	93	94	**92**	17	46	1996	87	5
	Farmoor	• 13822	97	94	**95**	7	43	2003	98	-3
Southern	Bewl	28170	82	74	**61**	-1	33	1990	66	-5
	Ardingly	4685	89	91	**75**	9	15	2003	73	2
Wessex	Clatworthy	5364	89	100	**100**	39	14	2003	77	23
	Bristol WW	• (38666)	(100)	(90)	**(90)**	29	(24)	1990	(83)	7
South West	Colliford	28540	100	100	**100**	33	38	2006	76	24
	Roadford	34500	97	98	**97**	28	18	1995	87	10
	Wimbleball	21320	100	100	**100**	34	26	1995	86	14
	Stithians	5205	76	79	**84**	30	18	1990	62	22
Welsh	Celyn and Brenig	• 131155	100	97	**98**	16	48	1989	92	6
	Brianne	62140	100	97	**100**	10	57	1995	95	5
	Big Five	• 69762	98	95	**99**	28	38	2003	77	22
	Elan Valley	• 99106	99	96	**99**	15	37	1995	89	10
Scotland(E)	Edinburgh/Mid Lothian	• 97639	94	94	**97**	19	48	2003	77	20
	East Lothian	• 10206	99	99	**99**	19	38	2003	93	6
Scotland(W)	Loch Katrine	• 111363	77	80	**91**	7	40	2003	59	32
	Daer	22412	99	98	**99**	10	42	2003	77	22
	Loch Thom	• 11840	95	96	**96**	9	66	2007	66	30
Northern Ireland	Total+	• 67270	87	90	**91**	14	39	1995	71	20
	Silent Valley	• 20634	97	96	**95**	26	34	1995	72	23

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

11/08