Hydrological Summary *for the United Kingdom*

March 2008

General

Boisterous weather conditions characterised much of March, with damaging gales and significant wintry interludes across many areas of the UK. Precipitation totals for the month were appreciably above average in most areas, with exceptional totals across much of southern and central England as well as western Scotland. Spate conditions were widespread and frequent (occurring on several occasions throughout the month in some localities) and monthly runoff totals were above average in many catchments, contributing to some noteworthy accumulated runoff totals for 2008 so far. March is often a pivotal month in relation to the water resources outlook. This year, substantial replenishment ensured that stocks in most major reservoirs were close to capacity at month end, and overall stocks for E&W are the second highest (for early April) since 1988. Groundwater resources also benefited from a significant late pulse of recharge, leaving groundwater levels in most major aquifers around the average for early spring. The water resources outlook for the summer is therefore healthy, particularly given Met Office long-range forecasts which suggest a "typical British summer". Conversely, the seasonally wet soil conditions, which contributed to several moderate flood episodes during March, have left many catchments vulnerable to further significant spring rainfall.

Rainfall

March was a stormy month with many areas of the UK experiencing very high winds and a wide range of precipitation types: rain, hail, sleet and snow (with significant accumulations in upland catchments, in Scotland particularly). The primary synoptic feature was the passage of vigorous Atlantic frontal systems, with a severe storm on the 10th causing local structural damage and power loss, and coastal flooding in Devon and Cornwall. A slow-moving frontal system brought heavy rain to southern England on the 15th and 16th, triggering spates in responsive catchments: 42 mm was recorded at Oxford on the 15th, and parts of southern Britain had 18 hours of continuous rain (amounting to 60mm in Raunds, Northants). An Arctic airflow later in the month brought blizzards to the Scottish Highlands and wintry conditions eventually extended across the south. March rainfall totals were well above the 1961-90 average in most areas, notably so in southern and eastern regions and western Scotland. Similarly, Northern Ireland registered its 4th wettest March in a record from 1914. Notwithstanding the modest rainfall in February, totals for 2008 thus far are, the South West aside, above average in all regions – outstandingly so in Scotland which reported its 2nd highest Jan-Mar total in a 95-yr series. In the Highland Region, the total for the last six moths has also been exceptional, contrasting with average rainfall over much of England. The 18-month period from Oct 2006 was substantially above average over most of the UK, and Scotland registered its wettest 18-month sequence on record.

River flows

March began with flows in most index rivers within the typical early spring range. In Scotland some moderate spates around the 8th were followed by sustained recessions (runoff from the uplands being inhibited by frozen catchment conditions) until a flow recovery in the final week. By contrast, many rivers in southern Britain registered a sequence of spates through the month with a significant number of flood warnings following storms on the 10th (when localised tidal flooding occurred, e.g. at Selsey). Following further sustained heavy rainfall on the 15th/16th, many lowland rivers were close to, or above, bankfull, causing some localised flooding and some seasonally notable peak flows: the Kennet and Teme registered record March peak flows in 47- and 37-yr records respectively. March runoff totals were mostly near to, or above, average – substantially so in a few western catchments (e.g. the Ewe and Exe). The wet start to 2008 is reflected in very high Jan-Mar runoff totals in many catchments in northern England (the Wharfe registering its highest in a 53-yr record) and Scotland where, following modest autumn flows, runoff climbed to exceptional totals in the Tay and Tweed. Runoff totals over the winter half-year are generally in the normal range but, importantly from a local water resources perspective, monthly flows in the Kenwyn and Warleggan in Cornwall have been below average for seven successive months; the Sept-Mar runoff on the Kenwyn is the 2nd lowest in a 41-yr series. Further east, the last six months has seen above average runoff from some groundwater-fed catchments (e.g. the Lambourn and the Louth); in these, and other, rivers, 11-month runoff totals (since April 2007) are also exceptional as a result of the cumulative effect of recent rainfall and the very wet summer of 2007.

Groundwater

With March rainfall totals well above average in most major aquifer outcrop areas, soil moisture deficits developed falteringly and, generally, soils remained close to saturation at month end. This allowed the 2007/08 aquifer recharge season to be extended and delayed the onset of the spring recessions in groundwater levels. Groundwater resources are healthy throughout much of the Chalk outcrop, with above average levels in the more northerly outcrops (Dalton Holme, Washpit Farm). In contrast, levels in some boreholes in the South Downs (e.g. Chilgrove) dropped below the seasonal average in the early spring. However, some modest recovery may be anticipated following the March rainfall. The same is true of the Bussels borehole in the Permo-Triassic sandstones of Devon. In the PT index wells in the Midlands, groundwater levels were generally within the normal range, with notably high March levels registered at Nutalls Farm. Following the above average rainfall over the last 18 months, some slow-responding boreholes in this area (e.g. Heathlanes and Weeford Flats) are set to begin their seasonal recessions from above average levels for the first time since 2003. With the prospect of further, modest, recharge in April, groundwater resources are generally healthy in advance of the summer recession.

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	Mar 2008	Jan 08- Mar 08	RP	Oct 07- Mar 08	RP	May 07- Mar 08	RP	Oct 06- Mar08	RP
England & Wales	**mm**	**101**	**292**		**514**		**1017**		**1662**	
	%	**138**	**128**	**5-15**	**103**	**2-5**	**120**	**10-20**	**118**	**15-25**
North West	mm	**113**	423		749		1348		2248	
	%	**117**	143	40-60	111	2-5	118	10-20	119	40-60
Northumbrian	mm	**86**	284		483		919		1450	
	%	**120**	132	10-20	105	2-5	114	5-10	109	5-10
Severn Trent	mm	**82**	241		418		935		1451	
	%	**134**	129	5-10	104	2-5	131	35-50	124	30-40
Yorkshire	mm	**87**	306		493		994		1521	
	%	**128**	149	30-40	111	2-5	128	20-30	119	15-25
Anglian	mm	**77**	177		315		726		1078	
	%	**165**	130	5-10	105	2-5	130	15-25	119	5-15
Thames	mm	**86**	206		396		812		1317	
	%	**152**	122	2-5	107	2-5	125	5-15	123	10-20
Southern	mm	**94**	228		420		820		1380	
	%	**149**	115	2-5	94	2-5	112	2-5	112	2-5
Wessex	mm	**108**	269		500		962		1611	
	%	**153**	119	2-5	103	2-5	120	5-10	120	5-15
South West	mm	**125**	320		603		1186		2122	
	%	**124**	94	2-5	83	5-10	106	2-5	111	5-10
Welsh	mm	**153**	474		813		1469		2541	
	%	**140**	134	5-15	103	2-5	116	5-10	119	10-20
Scotland	**mm**	**171**	**625**		**1028**		**1637**		**2902**	
	%	**133**	**161**	**60-90**	**119**	**10-20**	**118**	**25-40**	**124**	**>200**
Highland	mm	**230**	822		1359		2072		3697	
	%	**145**	176	50-80	130	20-30	126	40-60	133	>200
North East	mm	**99**	348		624		1161		1875	
	%	**120**	137	30-50	112	5-10	121	25-40	118	80-120
Tay	mm	**130**	577		871		1408		2559	
	%	**115**	161	50-80	115	5-10	115	5-15	125	>200
Forth	mm	**108**	486		759		1272		2268	
	%	**110**	163	50-80	117	5-10	117	10-20	126	>200
Tweed	mm	**102**	368		601		1119		1837	
	%	**125**	146	30-50	110	2-5	119	10-20	119	70-100
Solway	mm	**164**	565		924		1512		2657	
	%	**138**	151	80-120	112	5-10	111	5-15	117	40-60
Clyde	mm	**212**	749		1211		1855		3386	
	%	**140**	161	40-60	118	5-10	112	5-10	122	80-120
Northern Ireland	**mm**	**137**	**391**		**652**		**1164**		**1885**	
	%	**151**	**136**	**20-30**	**105**	**2-5**	**113**	**5-15**	**110**	**5-15**

% = percentage of 1961-90 average

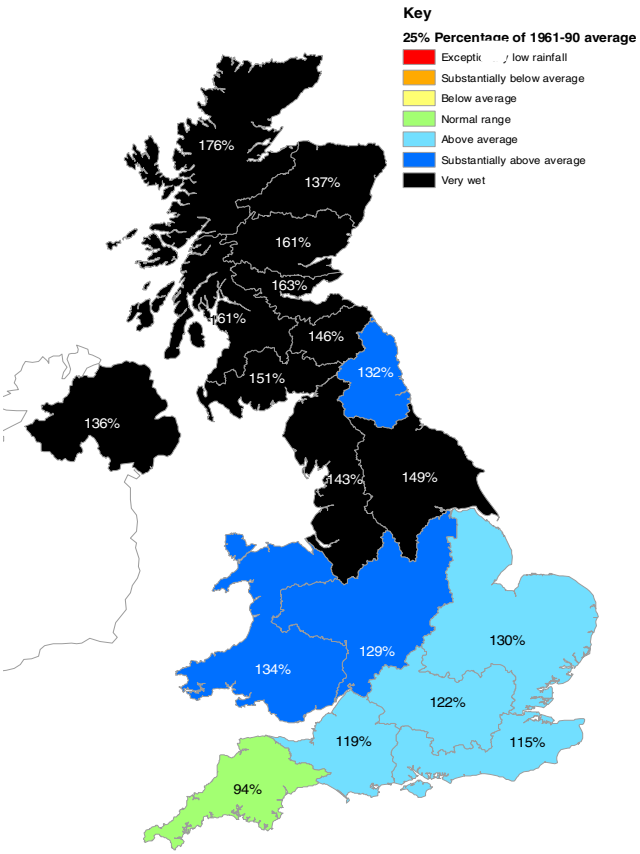
RP = Return period

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.

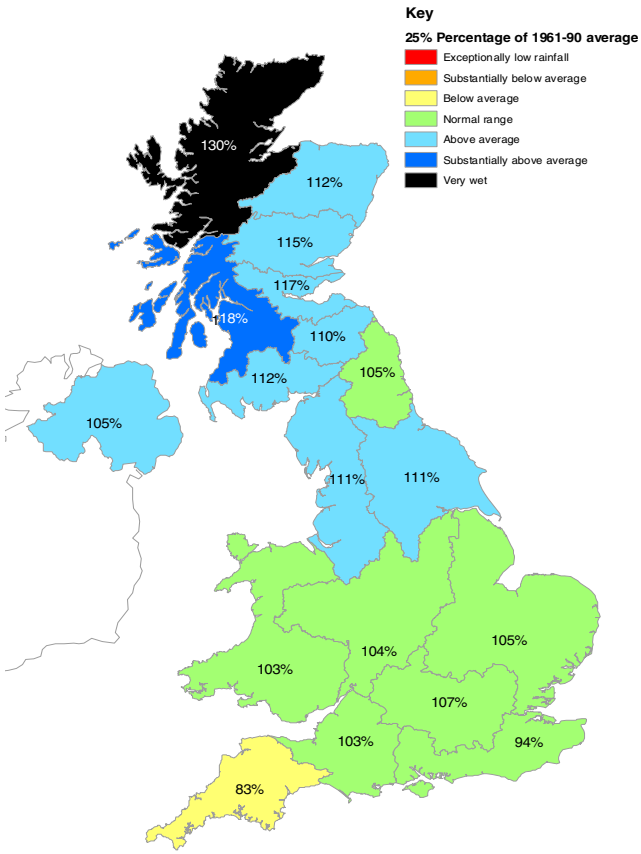
All monthly rainfall totals since October 2007 are provisional.

Rainfall . . . Rainfall . . .

January - March 2008



October 2007- March 2008



Met Office Spring 2008 forecast (updated)

Forecast for Spring 2008 updated 27 March 2008

This forecast for the remainder of Spring 2008 has been derived using a number of global forecasting models and statistical methods. Seasonal trends usually affect quite large geographic areas, so the forecast for the UK is cast in the broader picture for Europe as a whole.

Forecasts are expressed as variations from 1971-2000 averages. Spring, in this context, is defined as the months of March, April and May.

Temperature

Mean temperatures for the remainder of spring are more likely to be either near average or above average over much of the European region, including the UK. However spells of below-average temperatures, as we have seen in March, continue to be likely at first in north-west Europe. For the UK, the remainder of spring is very likely to be cooler than last year.

Precipitation

For much of north-west Europe precipitation is more likely to be either near or below average for the remainder of spring. For the UK, rainfall is more likely to be near average in the south but near or below average in the north.

Updates and reviews of the forecast
An update to the spring forecast will be issued at 10 a.m. on 23 April 2008.
See : http://www.metoffice.gov.uk/weather/seasonal/spring2008/index.html

Met Office Summer 2008 forecast

Forecast for Summer 2008 issued 3 April 2008

The forecast for Summer 2008 has been derived using a number of global forecasting models and statistical methods. Prediction skill for rainfall in particular is quite low at this stage, but the forecast provides an early opportunity to increase awareness so that the Met Office and its customers can plan ahead. It is important to be aware of subsequent updates when new information may change the forecast emphasis.

Forecasts are expressed as variations from 1971-2000 averages. Summer, in this context, is defined as the months of June, July and August. Seasonal trends affect quite large geographic areas, so the forecast for the UK is cast in the broader picture for Europe as a whole.

Temperature

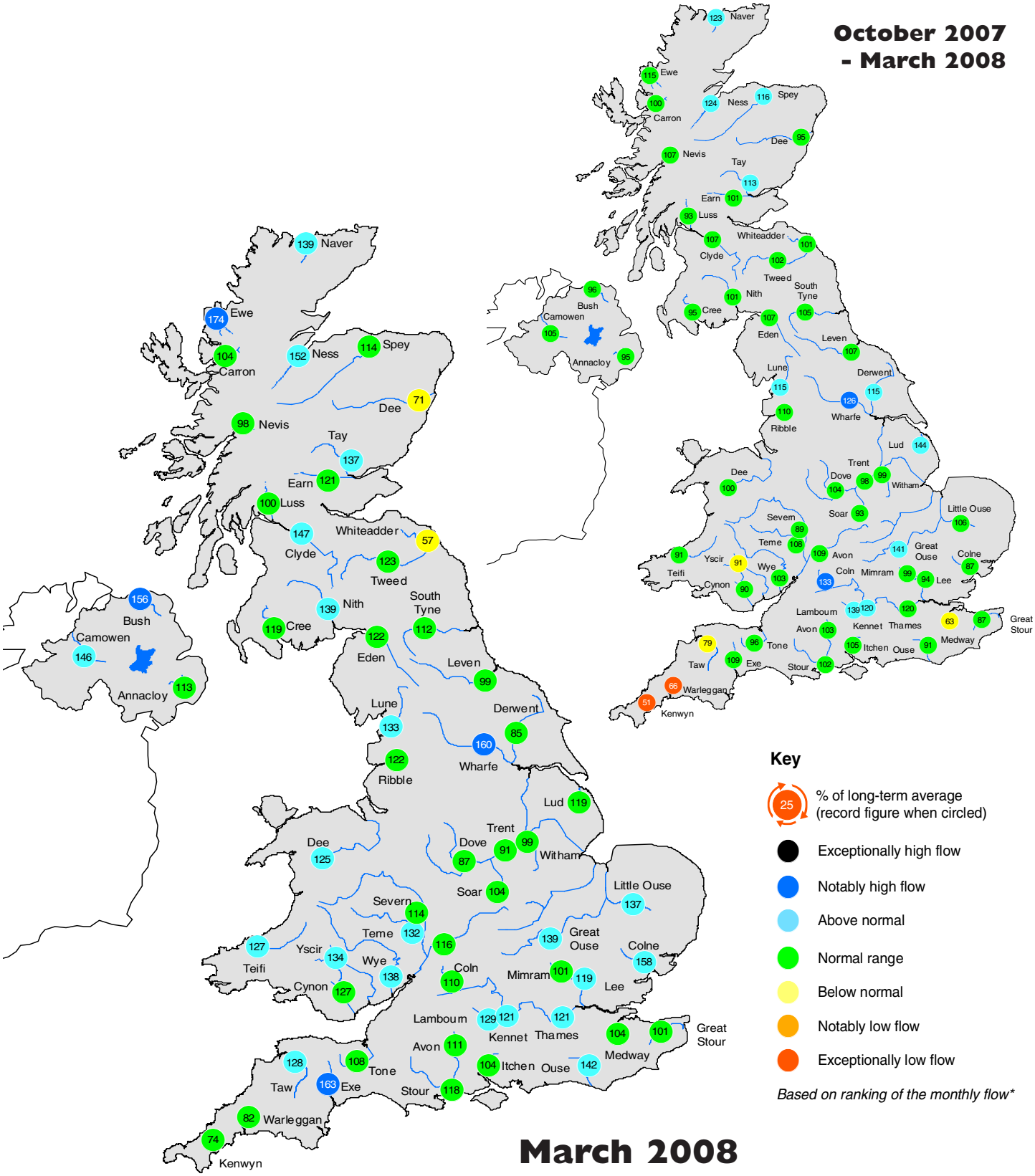
Mean temperatures are more likely to be above the 1971-2000 average. However, there is a slightly enhanced chance of cloudier and cooler spells.

Rainfall

Rainfall is more likely to be either near average or above average. The risk of exceptional rainfall, as seen last summer, is assessed as very low at this stage.

Updates and reviews of the forecast
An update to the summer forecast will be issued at 10 a.m. on 1 May 2008.
See : http://www.metoffice.gov.uk/weather/seasonal/summer2008/index.html

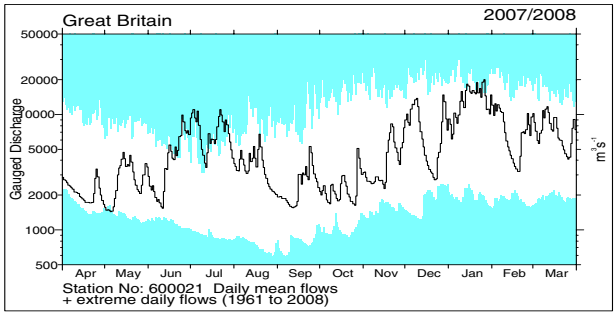
River flow . . . River flow . . .

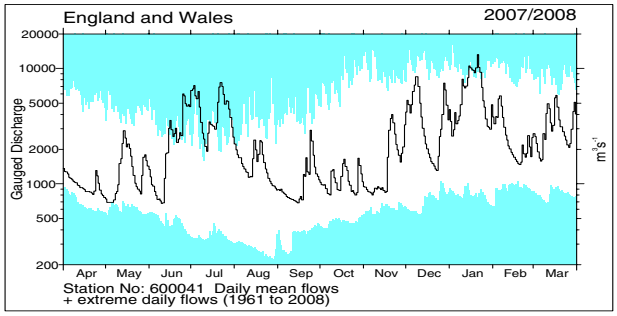


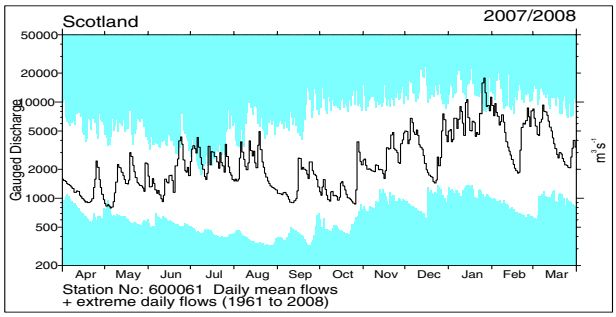
River flows

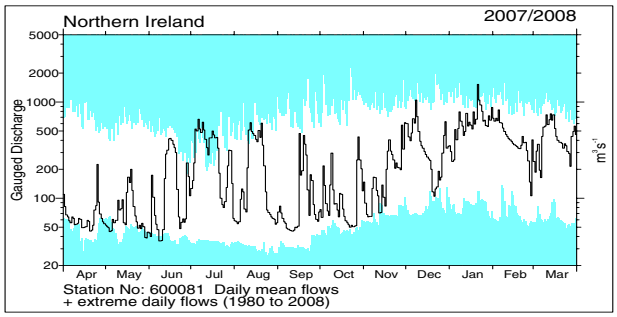
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

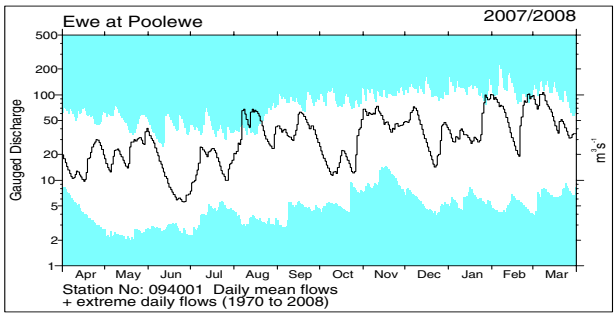
River flow . . . River flow . . .

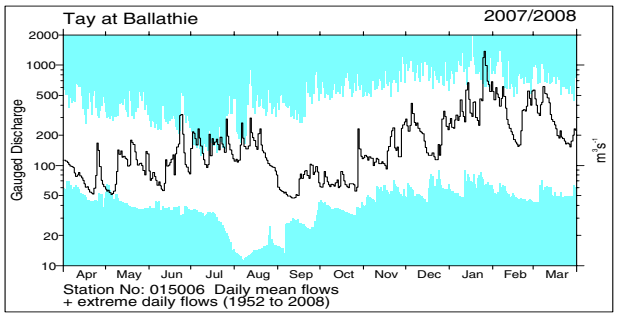


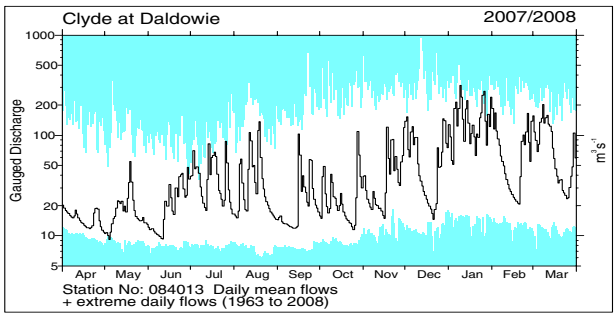


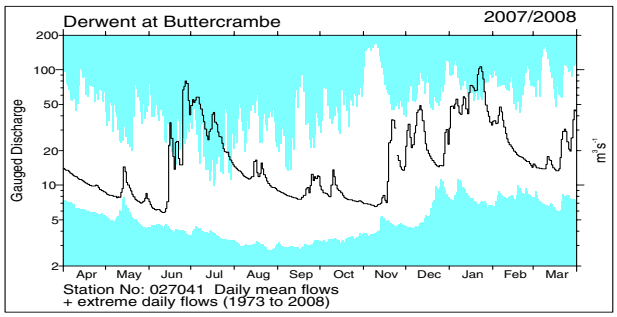


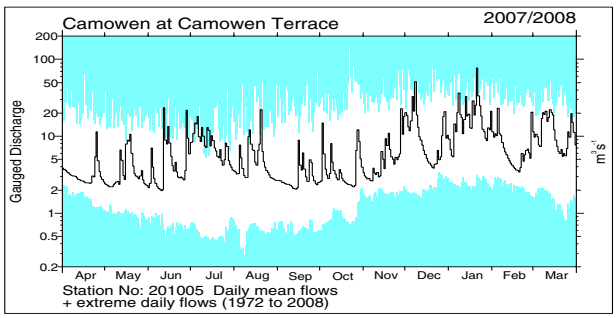


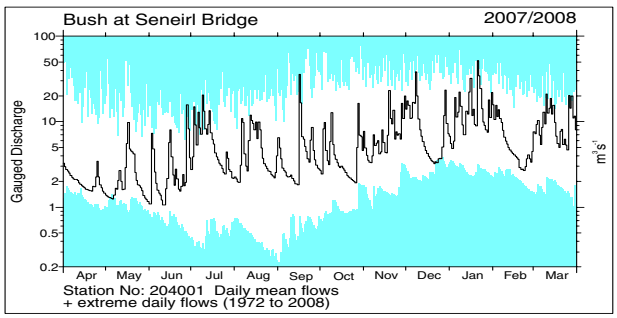








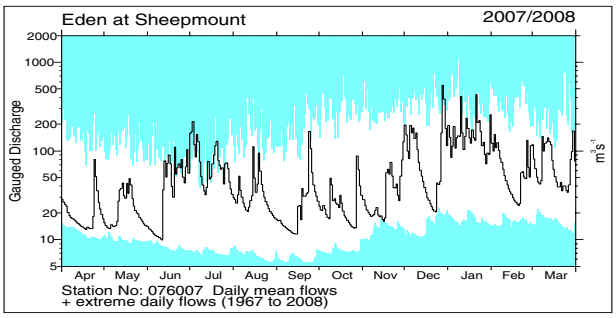


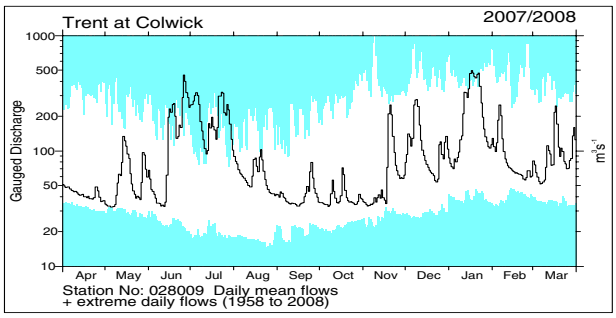


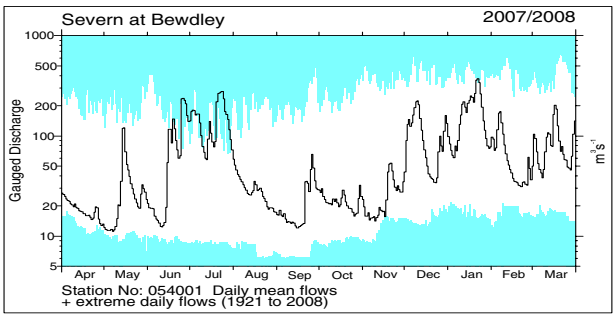
River flow hydrographs

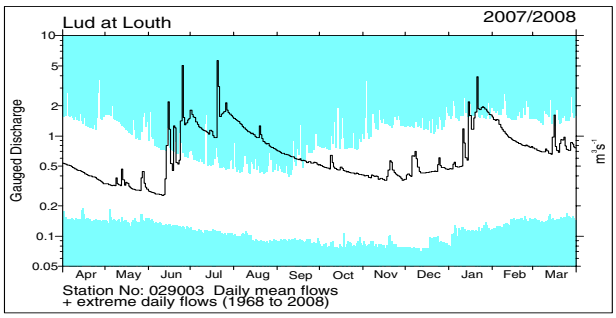
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to April 2007 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

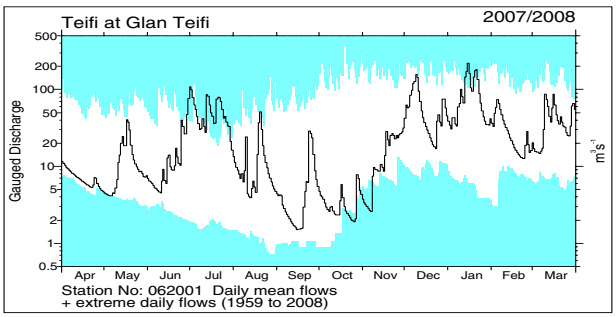
River flow . . . River flow . . .

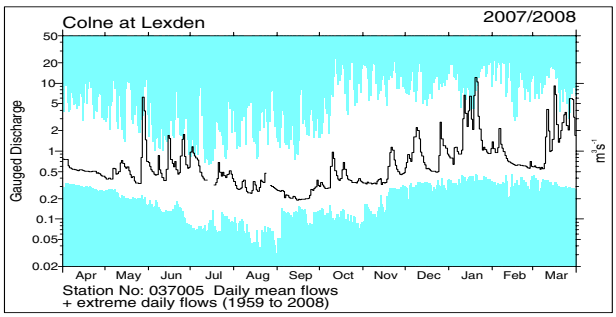


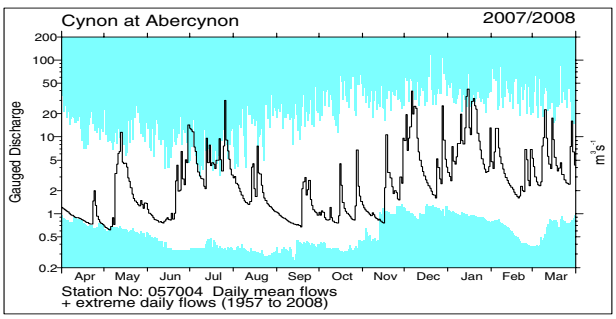


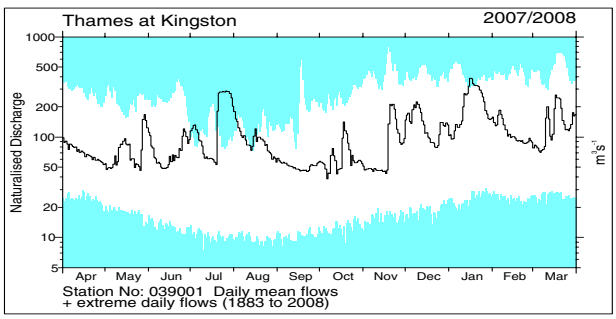


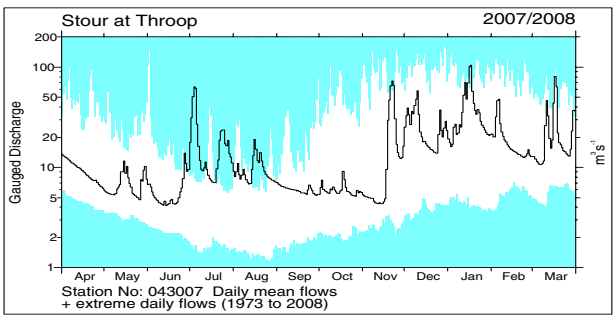


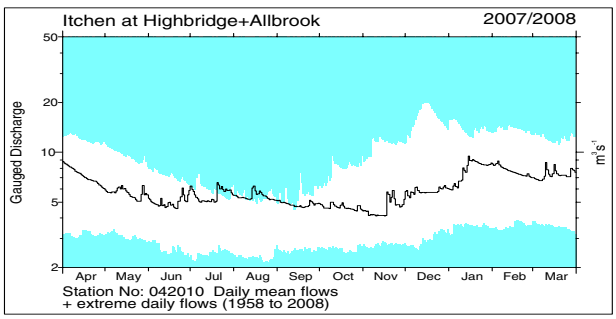












Notable runoff accumulations (a) Jan - March 2008, (b) Oct 2007 - March 2008, c) May 2007- March 2008

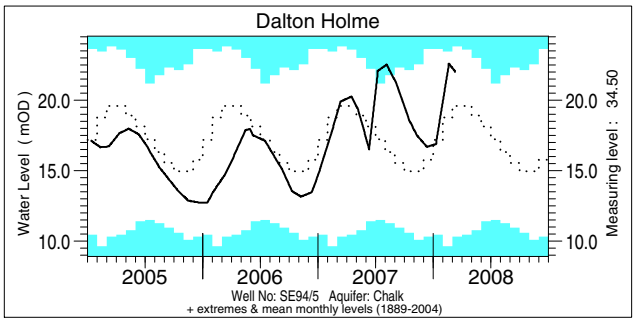
	River	%lta	Rank
a)	Tay	158	55/56
	Earn	150	59/61
	Tyne (Spilmersford)	161	43/44
	Tweed (Boleside)	147	47/48
	Wharfe	169	53/53
	Clyde (Blairston)	168	48/49
	Naver	145	30/31

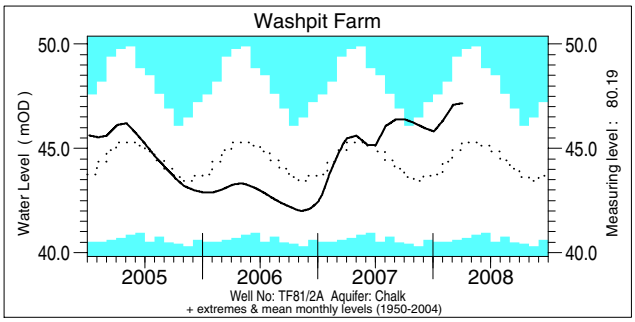
	River	%lta	Rank
b)	Warleggan	66	2/39
	Kenwyn	51	2/40
	L Bann	76	4/28

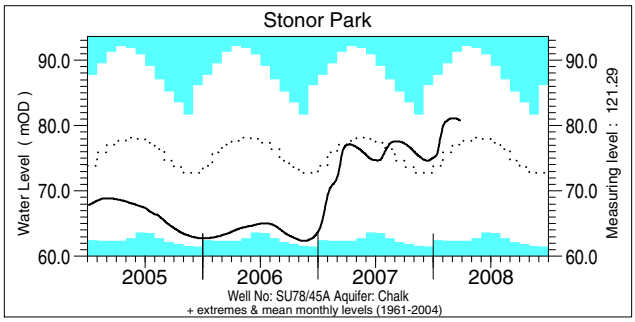
	River	%lta	Rank
c)	Dover Beck	196	32/32
	Lud	187	39/39
	Witham	166	48/49
	Lambourn	147	44/45
	Coln	164	43/44
	Avon (Evesham)	159	69/71
	Teme	158	37/38

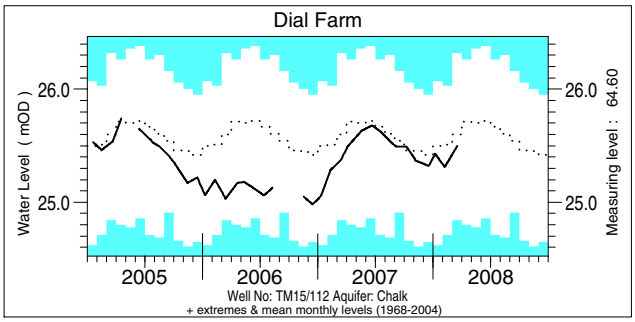
lta = long term average
Rank 1 = lowest on record

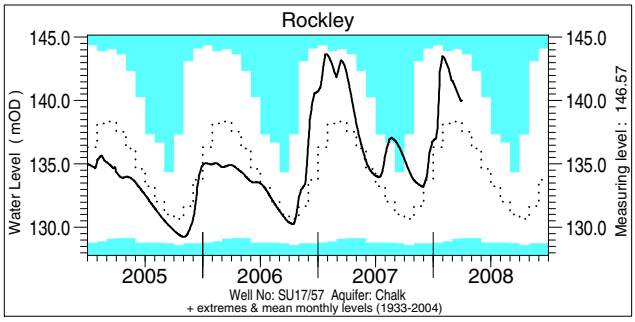
Groundwater . . . Groundwater

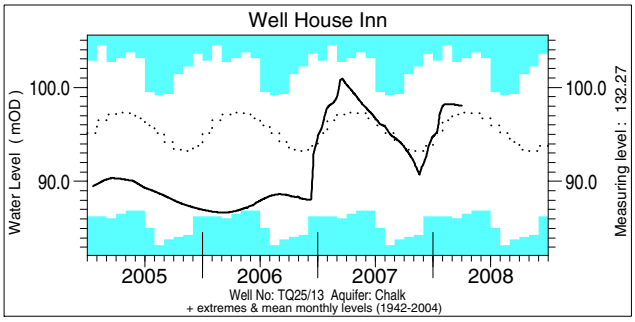


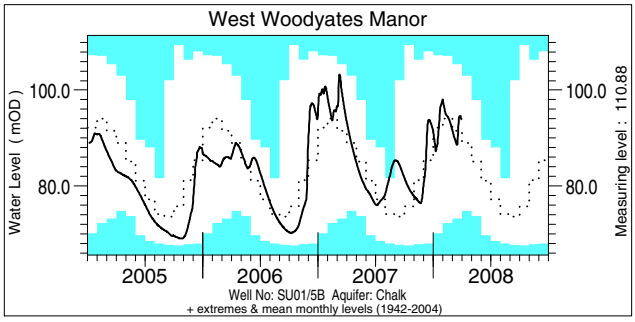


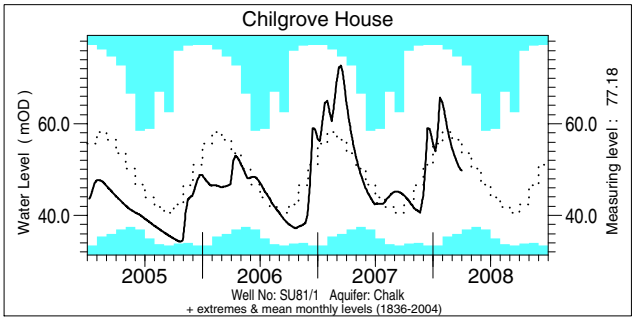


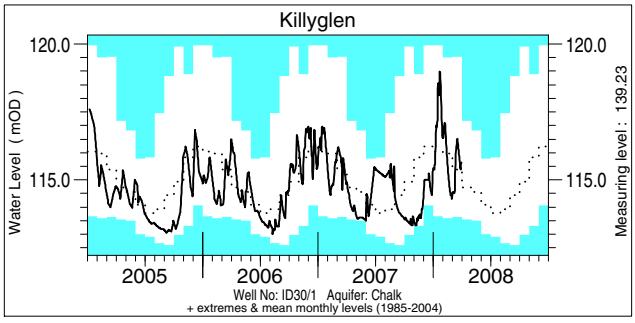


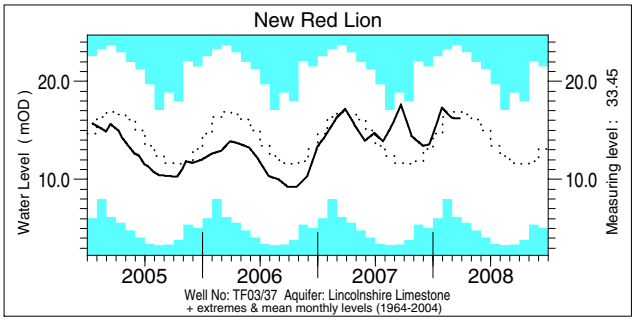






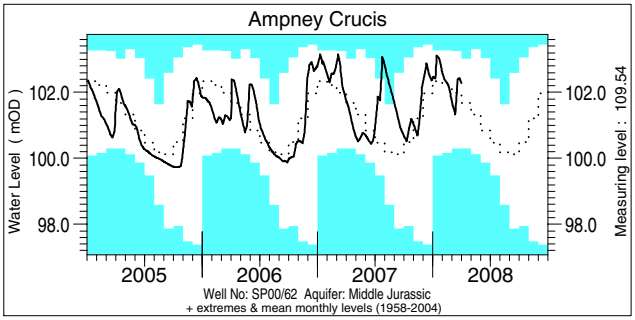


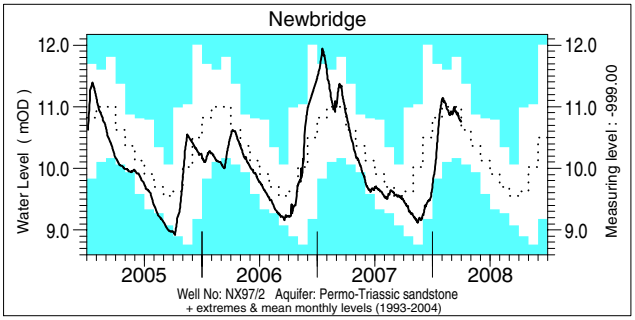


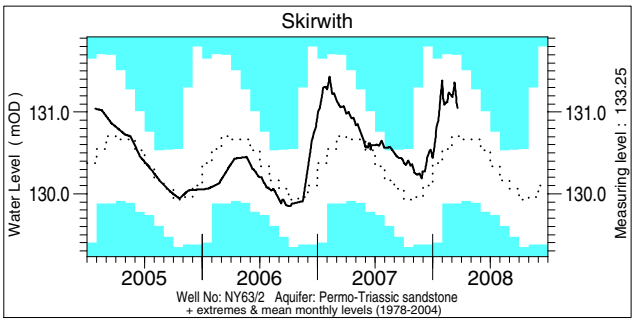


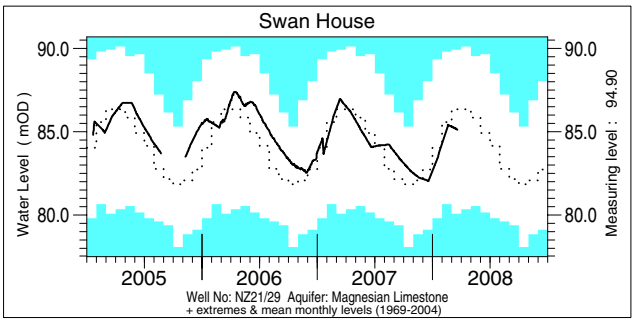
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

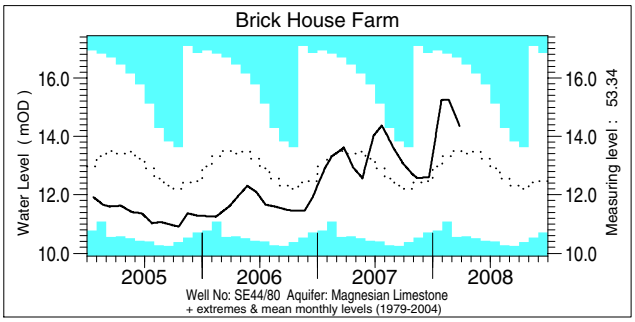
Groundwater . . . Groundwater

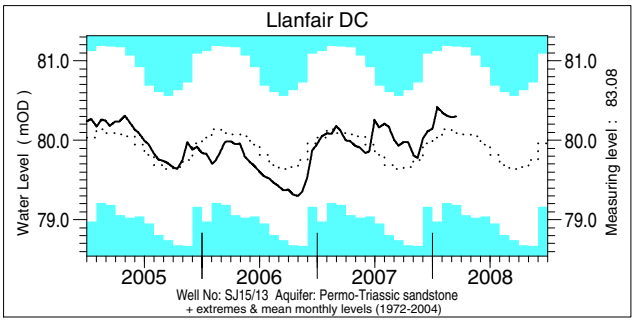


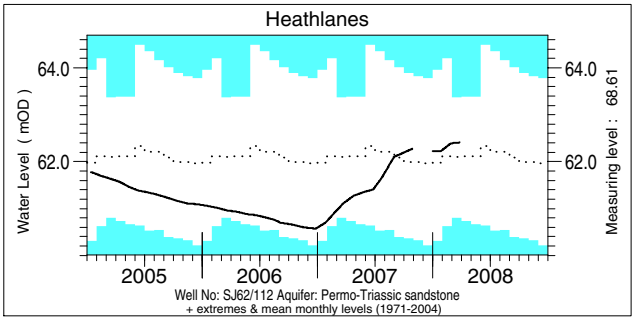


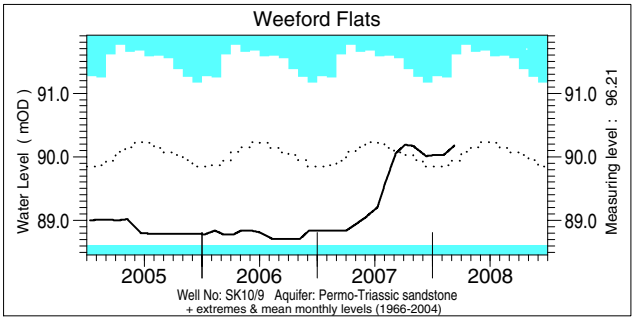


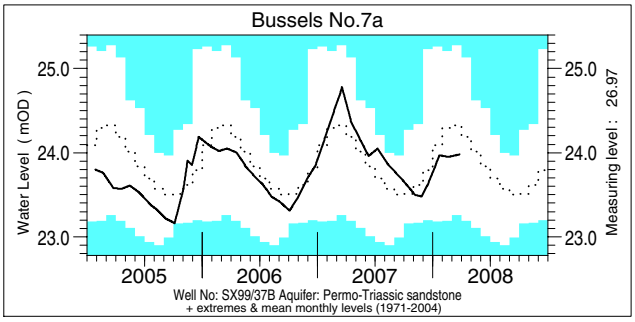


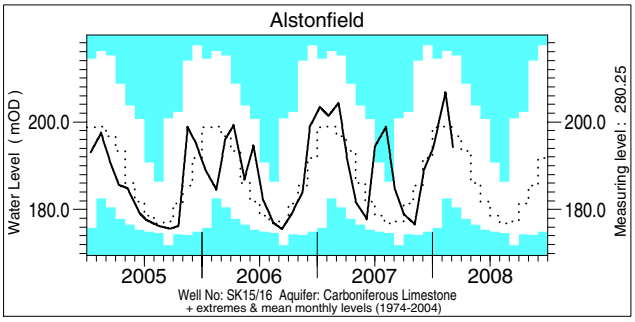










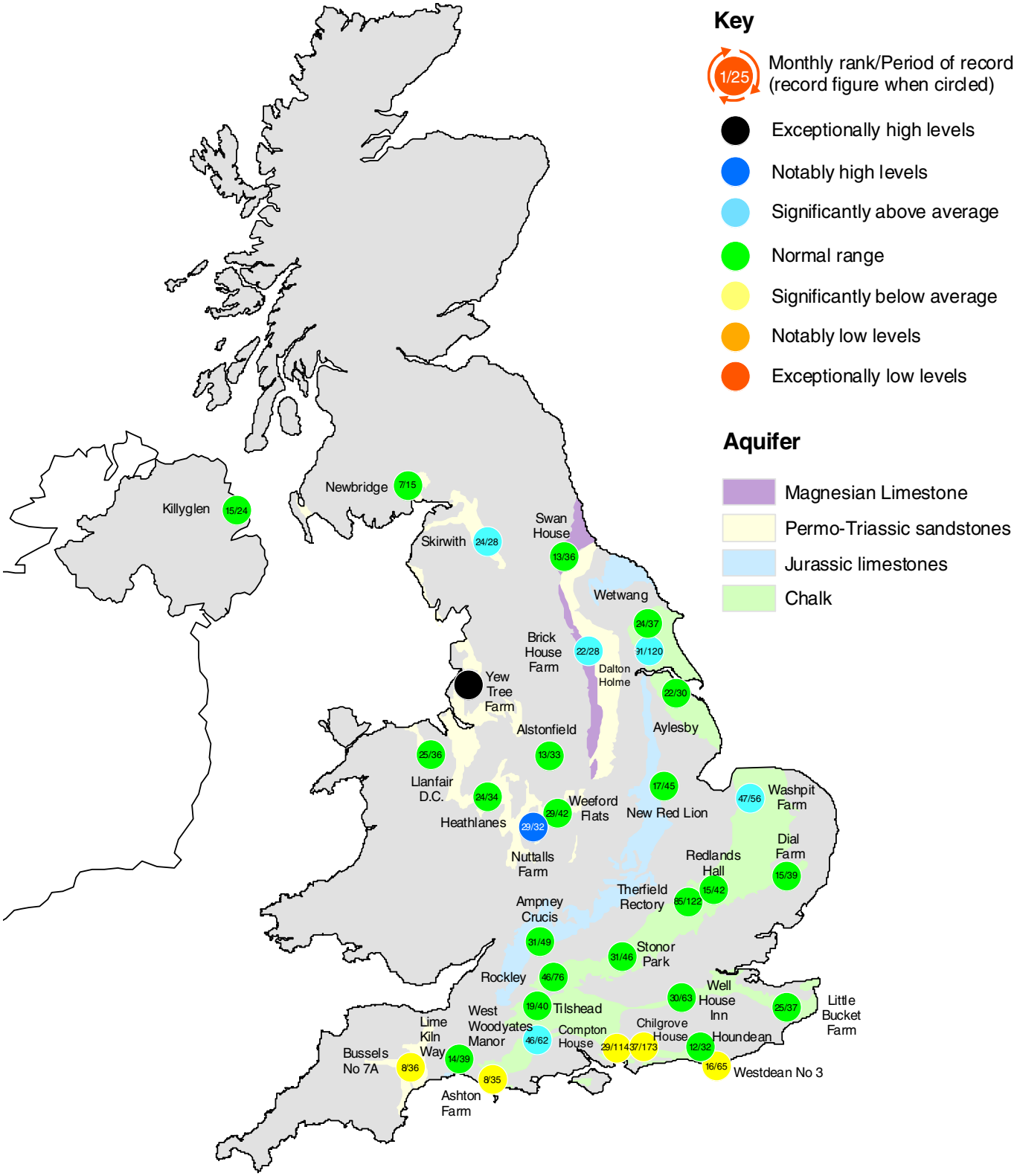


Groundwater levels March / April 2008

Borehole	Level	Date	Mar. av.	Borehole	Level	Date	Mar. av.	Borehole	Level	Date	Mar. av.
Dalton Holme	22.01	10/03	19.45	Chilgrove House	49.84	31/03	55.53	Brick House Farm	14.35	25/03	13.30
Washpit Farm	47.17	02/04	44.98	Killyglen	115.64	31/03	115.51	Llanfair DC	80.30	15/03	80.06
Stonor Park	80.78	25/03	76.58	New Red Lion	16.22	26/03	16.63	Heathlanes	62.41	26/03	61.98
Dial Farm	25.50	17/03	25.57	Ampney Crucis	102.27	01/04	102.00	Weeford Flats	90.18	10/03	89.75
Rockley	140.02	01/04	138.41	Newbridge	10.76	31/03	10.87	Bussels No.7a	23.98	25/03	24.32
Well House Inn	98.07	01/04	96.86	Skirwith	131.05	19/03	130.67	Alstonfield	194.24	05/03	196.48
West Woodyates	93.87	31/03	90.71	Swan House	85.12	19/03	85.75				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



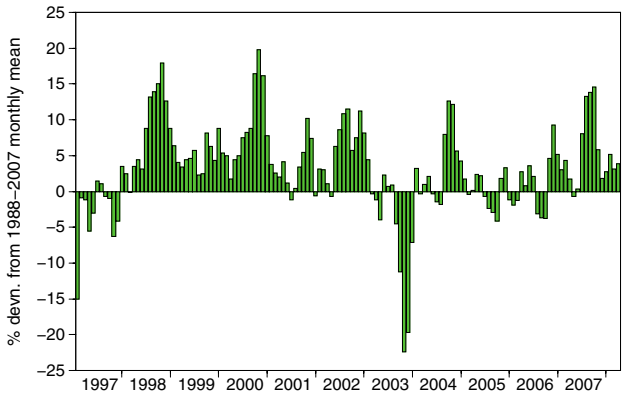
Groundwater levels - March 2008

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.

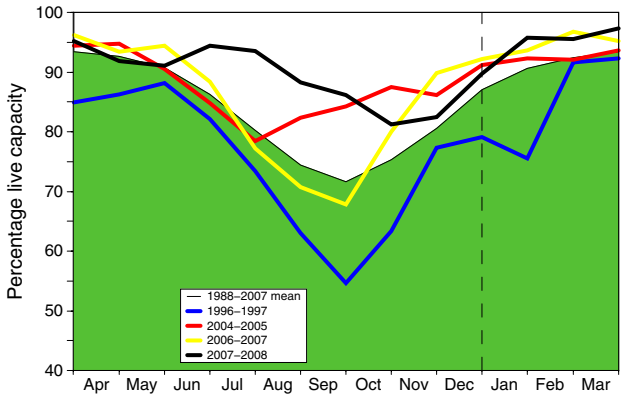
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Recent levels for Houndean Bottom are under review.
iii. Llanfair DC levels are under review.

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 Feb	2008 Mar	2008 Apr	Apr Anom.	Min. Apr	Year* of min.	2007 Apr	Diff 08-07
North West	N Command Zone	• 124929	100	96	98	5	77	1993	94	4
	Vyrnwy	55146	100	100	100	5	64	1996	97	3
Northumbrian	Teesdale	• 87936	97	91	100	7	77	2003	94	6
	Kielder	(199175)	(97)	(92)	(92)	-1	(81)	1993	(89)	3
Severn Trent	Clywedog	44922	88	92	100	6	86	1996	98	2
	Derwent Valley	• 39525	100	98	100	5	54	1996	98	2
Yorkshire	Washburn	• 22035	98	98	99	7	70	1996	91	8
	Bradford supply	• 41407	100	100	100	6	59	1996	96	4
Anglian	Grafham	(55490)	(92)	(88)	(90)	-1	(77)	1997	(97)	-7
	Rutland	(116580)	(95)	(95)	(96)	6	(74)	1992	(95)	1
Thames	London	• 202828	90	97	97	3	88	1990	97	0
	Farmoor	• 13822	83	100	98	3	84	1992	99	-1
Southern	Bewl	28170	89	91	100	11	58	1989	100	0
	Ardingly	4685	100	100	94	-5	88	2006	100	-6
Wessex	Clatworthy	5364	100	99	100	3	82	1992	100	0
	Bristol WW	• (38666)	(99)	(98)	(98)	5	(71)	1992	(95)	3
South West	Colliford	28540	83	85	91	6	58	1997	79	12
	Roadford	34500	92	91	95	11	37	1996	91	4
	Wimbleball	21320	100	99	100	4	78	1996	99	1
	Stithians	5205	76	82	93	0	52	1992	97	-4
Welsh	Celyn and Brenig	• 131155	99	100	100	2	72	1996	100	0
	Brianne	62140	100	99	100	2	90	1993	96	4
	Big Five	• 69762	95	97	99	3	78	1993	97	2
	Elan Valley	• 99106	99	99	100	2	89	1993	98	2
Scotland(E)	Edinburgh/Mid Lothian	• 97639	100	100	100	6	71	1998	98	2
	East Lothian	• 10206	100	100	100	1	95	1990	100	0
Scotland(W)	Loch Katrine	• 111363	98	99	93	-1	88	2001	83	10
	Daer	22412	100	99	99	1	93	2001	98	1
	Loch Thom	• 11840	96	96	96	-2	93	2001	98	-2
Northern Ireland	Total+	• 67270	94	90	90	19	83	2002	87	3
	Silent Valley	• 20634	99	93	93	10	57	2000	93	0

() 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 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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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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04/08