Hydrological Summary
for the United Kingdom

September 2008

General

September was a month of contrasts. A remarkably wet start in many areas of England & Wales gave way to a period of high pressure and comparative stability in the latter half of the month. Early in the month, widespread flooding occurred in England & Wales; parts of Northumbria experienced their most severe floods on record. Thereafter, the settled conditions brought a welcome respite, ameliorating the immediate risk of further flooding. Nevertheless, soils in most regions remain wetter than average for the time of year, and many catchments remain vulnerable to further very wet interludes. The early onset of aquifer recharge, together with notably high catchment runoff accumulations (for 2008 thus far) contribute to a very healthy water resources outlook. Overall reservoir stocks for England & Wales eclipsed the previous maximum for early October by a substantial margin.

Rainfall

The cyclonic conditions responsible for a very wet August persisted into early September. On the 5th a low pressure system brought prolonged heavy rainfall to the South West and Wales before moving northeastwards on the 6th. 24hr rainfall totals in excess of 40mm were widely reported in western areas and in the Midlands, but in Northumbria the rainfall was extraordinary. Morpeth recorded 80mm, its highest 24hr total in a record from 1898 and, over 3 days, Goldscleugh (in the Northumbria National Park) recorded > 250mm. By mid-month, high pressure brought a period of stability and the rest of September was relatively dry in most areas; in Wallingford, less than 6mm of rain was recorded between the 12th and 30th. Nevertheless, September was a wet month overall in England & Wales – notably so in Northumbria, the fourth wettest in a 95-year series. Parts of Scotland were relatively dry throughout the month, continuing a 3 - 5 month spell of below average rainfall in the far north. Elsewhere however, rainfall totals over the last three months were exceptionally high (> 70% above average in the South West and North East) and many areas of the UK continue to register notable accumulations over timeframes up to 10 months. For the Jan - Sept period, the England & Wales rainfall total is the highest on record (in a series from 1914).

River Flows

Following an exceptionally wet June - Aug period, there was an elevated, and seasonally unusual, flood risk across many areas of the UK during early September. This vulnerability was underlined following the severe rainfall on the 5-6th, when around 100 flood warnings were issued by the Environment Agency. Flooding was reported across a large swathe of Wales, south-west England, the Midlands and the North East, where the most severe flooding was concentrated. Around 1000 properties were affected in the Morpeth area as the Wansbeck registered a new maximum flow in a record from 1963 (estimated return period exceeds 100 years). New maximum flood levels were established in neighbouring catchments – a flood mark from 1948 in the Till catchment was exceeded by over 2ft. Elsewhere, the Yscir, near Brecon, registered a new period-of-record maximum, and new September maxima were recorded for many index rivers across the Midlands and Wales. Reports of geomorphological impacts included channel redefinition (e.g. in the Till catchment) and mudslides (e.g. in the Cotswolds). New September runoff records were established in a significant minority of index rivers; these contributed to the highest September runoff on record in the 48-year England & Wales series. New maximum Jul - Sept runoff totals were registered in the majority of index catchments in the South West, South Wales and the North East. In many rivers draining permeable catchments (e.g. the Coln, Itchen and Hampshire Avon), early autumn flows were notably high for the 2nd year in succession and, more generally, the last two years have seen significant redefinition of summer high flow regimes. In contrast, in northern Scotland, runoff has been below average (notably so in the Carron) over the last few months. Nonetheless, for the year so far, estimated outflows from Great Britain are the highest in a series from 1961.

Groundwater

The early September rainfall, on the tail of an exceptionally wet summer, ensured that soil moisture deficits were largely eliminated in central and western areas of the UK. In contrast, significant deficits persist in the eastern aquifer outcrop areas and most boreholes in the Chalk of East Anglia had levels in the normal range entering October. In the far north and far south west of the Chalk outcrop (where the early September rainfall was more significant), new September maximum levels were registered for Wetwang (E. Yorks) and Ashton Farm (Dorset). In other aquifers, levels were generally well above average, and a particular feature of the month was the range of major aquifers in which new September maxima were established. Seasonally early replenishment to the Permo-Triassic sandstones contributed to record levels in the more northerly outcrops, and in central England, new maxima were recorded in the Magnesian (Brick House Farm), Carboniferous (Alstonfield) and Jurassic (Ampney Crucis) limestones. Such early replenishment implies a lengthy recharge season, contributing to a very favourable water resources outlook, although in the event of a wet autumn vigilant monitoring will be required in some areas susceptible to groundwater flooding.

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	Sep 08	Jul 08- Sep 08	RP	Mar 08- Sep 08	RP	Jan 08- Sep 08	RP	Oct 07- Sep 08	RP
England & Wales	**mm**	**107**	**332**		**634**		**823**		**1043**	
	%	**136**	**153**	**10-20**	**133**	**70-100**	**130**	**>100**	**115**	**5-10**
North West	mm	**152**	451		788		1091		1415	
	%	**130**	144	10-20	123	20-35	130	80-120	116	10-20
Northumbrian	mm	**144**	409		709		903		1097	
	%	**194**	183	>100	148	>100	145	>100	127	>100
Severn Trent	mm	**109**	295		550		708		882	
	%	**168**	156	10-20	129	20-30	128	35-50	115	5-10
Yorkshire	mm	**106**	349		625		842		1029	
	%	**151**	168	20-35	136	80-120	141	>100	123	20-30
Anglian	mm	**62**	207		440		538		673	
	%	**123**	133	2-5	126	10-20	123	5-15	112	2-5
Thames	mm	**72**	237		519		636		824	
	%	**119**	140	5-10	134	35-50	127	20-30	117	5-10
Southern	mm	**72**	206		504		638		828	
	%	**103**	117	2-5	126	10-20	119	5-10	105	2-5
Wessex	mm	**95**	306		615		780		1020	
	%	**130**	158	10-20	141	50-80	131	80-120	119	5-10
South West	mm	**108**	431		795		1003		1297	
	%	**116**	172	20-35	141	80-120	124	30-45	109	2-5
Welsh	mm	**158**	488		902		1209		1534	
	%	**134**	160	10-20	136	30-45	133	35-50	114	5-10
Scotland	**mm**	**108**	**376**		**781**		**1217**		**1617**	
	%	**75**	**106**	**2-5**	**106**	**5-10**	**122**	**30-45**	**110**	**10-20**
Highland	mm	**107**	334		817		1361		1886	
	%	**63**	82	2-5	96	2-5	118	10-20	108	5-10
North East	mm	**68**	278		599		849		1124	
	%	**73**	107	2-5	108	2-5	117	10-20	109	5-10
Tay	mm	**92**	370		714		1145		1435	
	%	**76**	122	5-10	110	5-10	128	40-60	111	5-10
Forth	mm	**87**	399		712		1097		1376	
	%	**77**	139	5-15	119	5-15	138	>100	120	20-30
Tweed	mm	**120**	431		765		1043		1273	
	%	**130**	168	50-80	142	80-120	147	>100	127	>100
Solway	mm	**141**	490		871		1257		1621	
	%	**98**	137	10-20	120	10-20	128	80-120	113	10-20
Clyde	mm	**142**	481		951		1462		1926	
	%	**78**	110	2-5	109	5-10	123	20-30	110	5-10
Northern Ireland	**mm**	**120**	**448**		**719**		**966**		**1222**	
	%	**120**	**168**	**30-50**	**126**	**20-30**	**126**	**40-60**	**111**	**5-10**

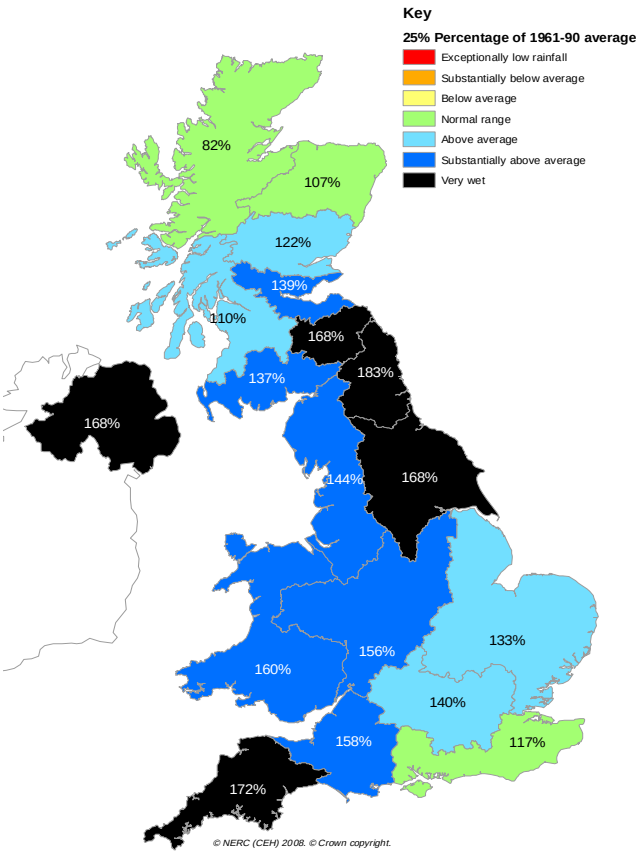
% = percentage of 1961-90 average

RP = Return period

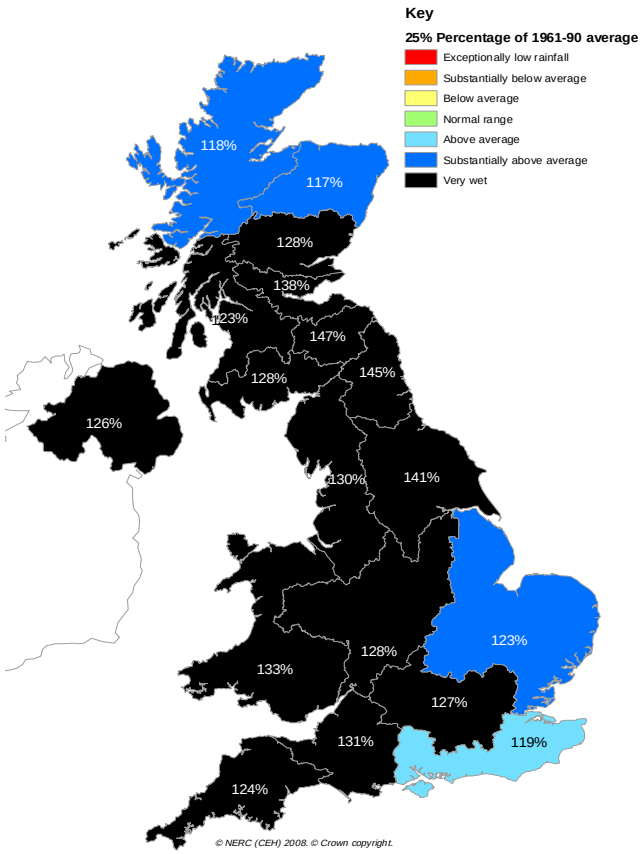
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following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

Rainfall . . . Rainfall . . .

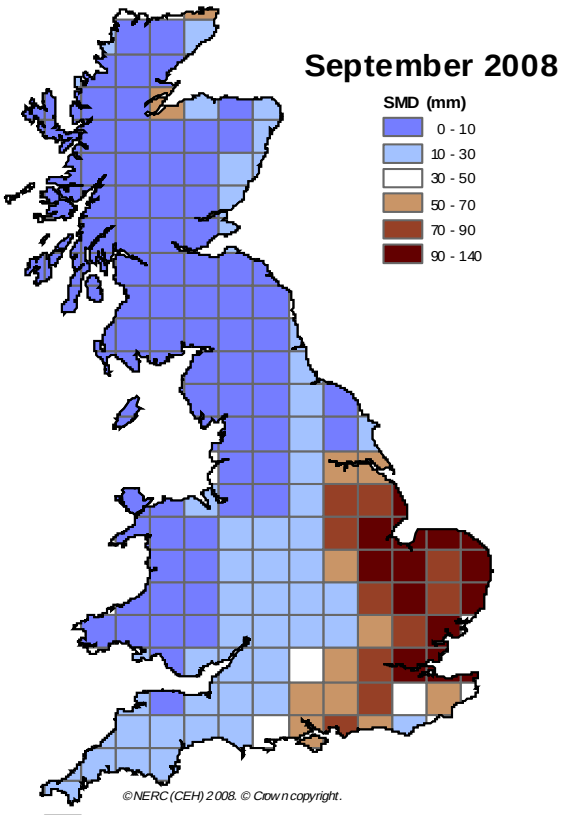
July - September 2008



January- September 2008



MORECS Soil Moisture Deficit



Met Office Autumn 2008 forecast

Forecast for Autumn 2008 updated 24 September 2008

Temperature

The latest forecast indicates that temperatures across much of western Europe will probably be above average rather than below average. For the UK temperatures are more likely to be either near, or above average.

Rainfall

For much of north-western Europe probabilities favour near-average rainfall totals. For the UK, rainfall totals are more likely to be either near, or below average - with the highest chance of prolonged drier spells during the first half of the period.

Forecast for Winter 2008/9: 25 September 2008

Temperature

Winter temperatures are more likely to be above normal over much of the European region. 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 normal. Although a winter milder than the 1971-2000 average is favoured, temperatures are likely to be lower than those experienced last year.

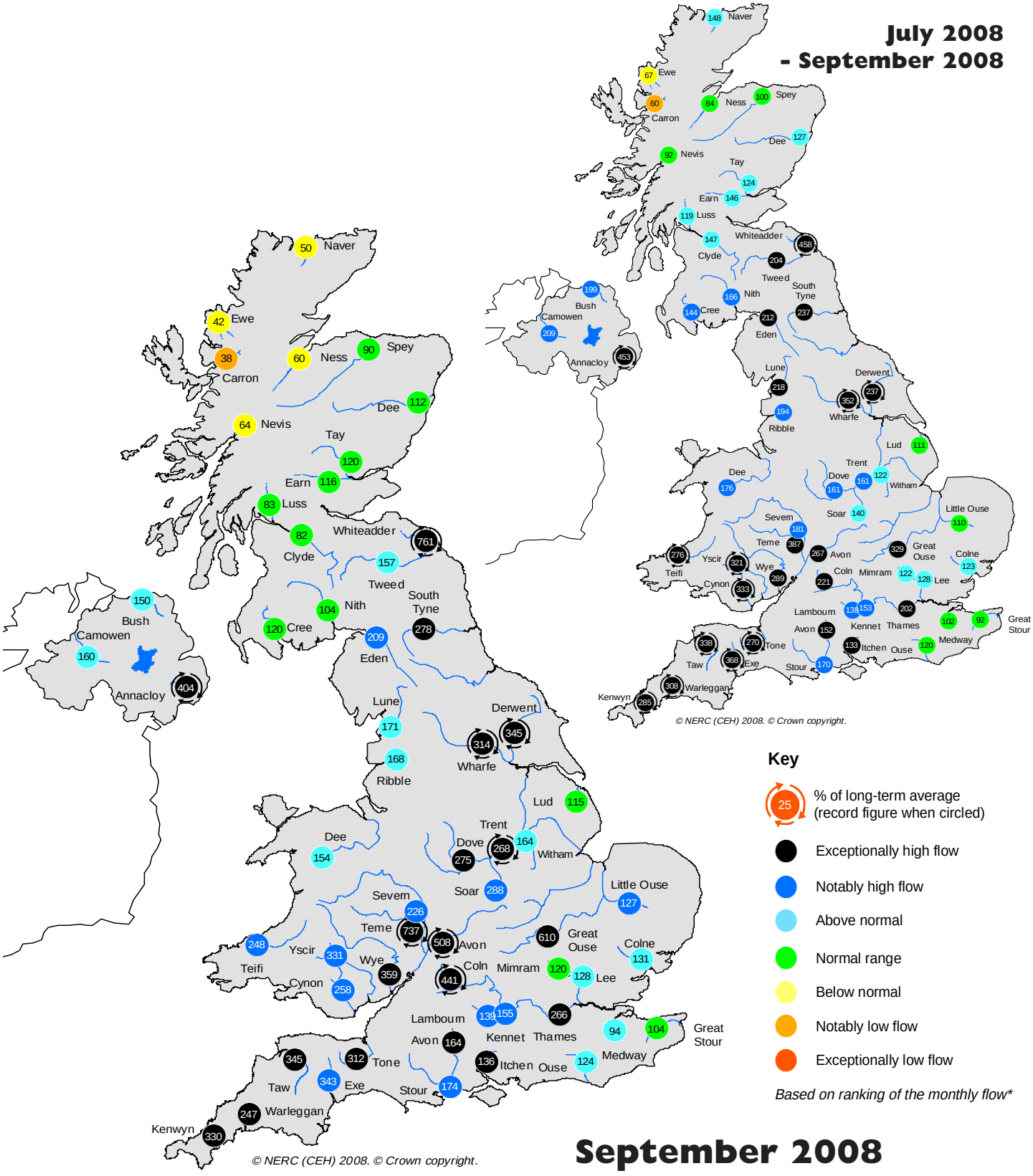
Rainfall

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

Updates and reviews of the forecast

The autumn forecast will next be updated at 10 a.m. on 28 October 2008. For further details please visit:
http://www.metoffice.gov.uk/weather/seasonal/autumn2008

River flow . . . River flow . . .

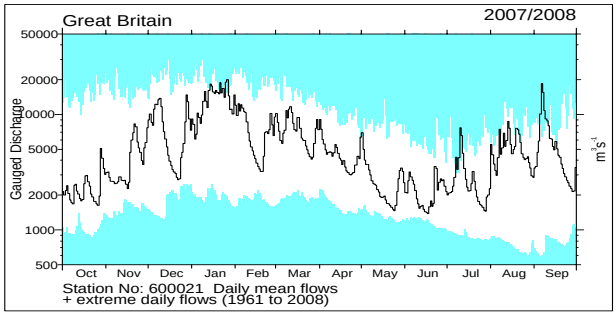


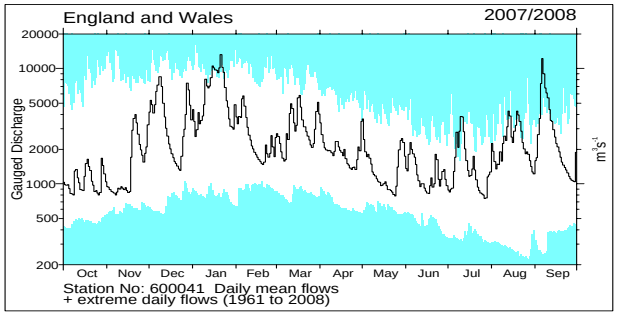
River flows

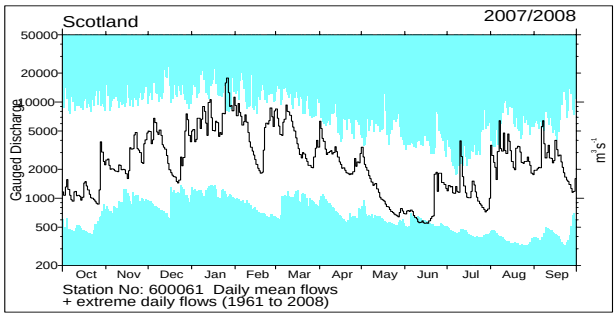
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

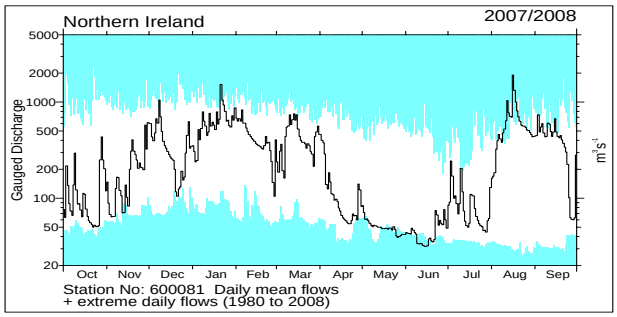
Note: *A report on the exceptional flooding in Northumberland is being prepared by hydrologists in the Environment Agency's North East Region; it should be available early next year.*

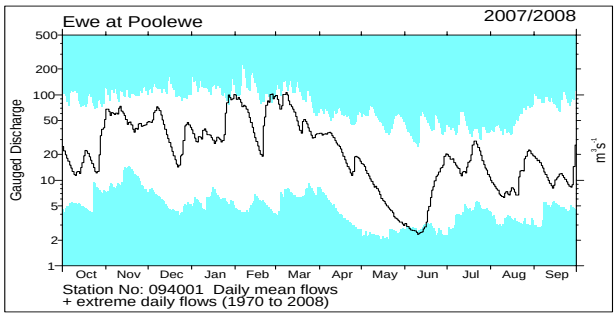
River flow . . . River flow . . .

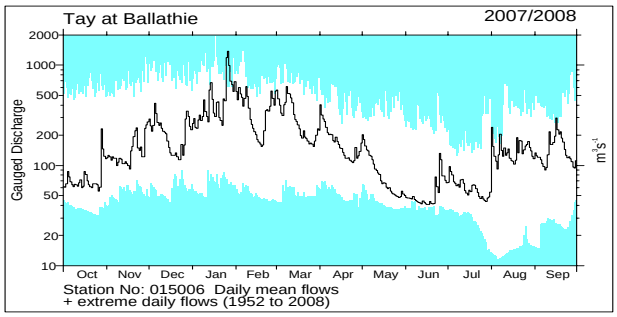


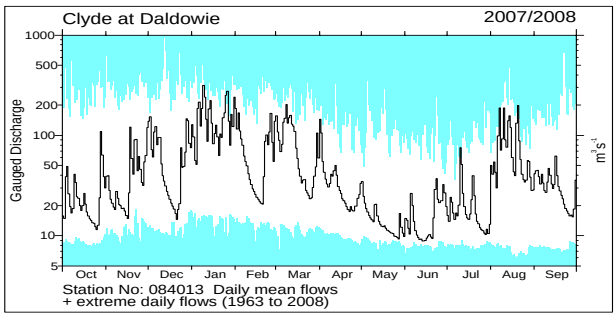


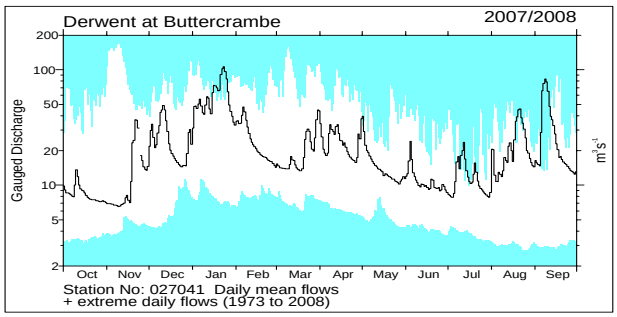


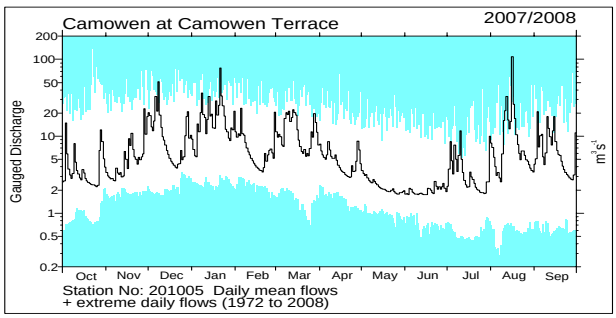


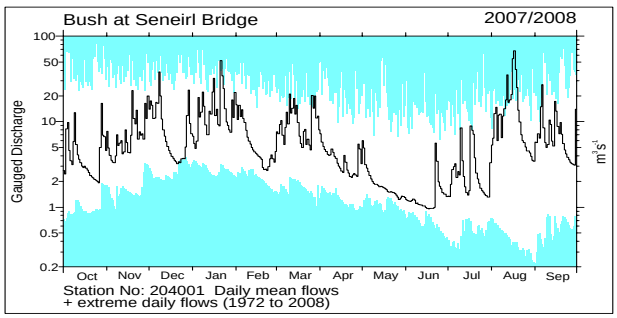








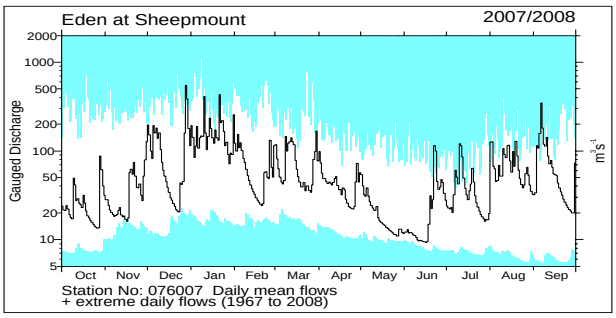


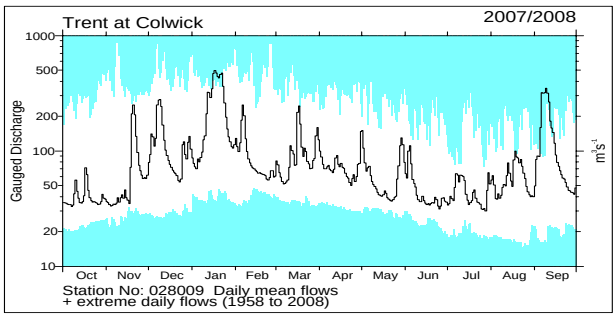


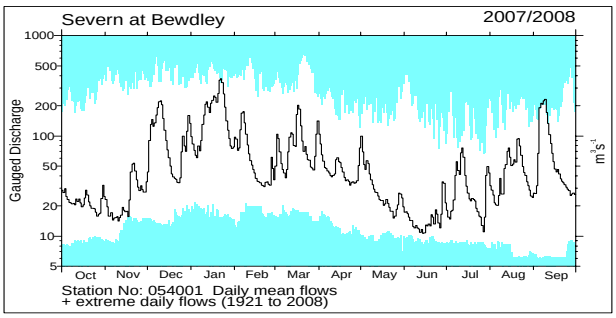
River flow hydrographs

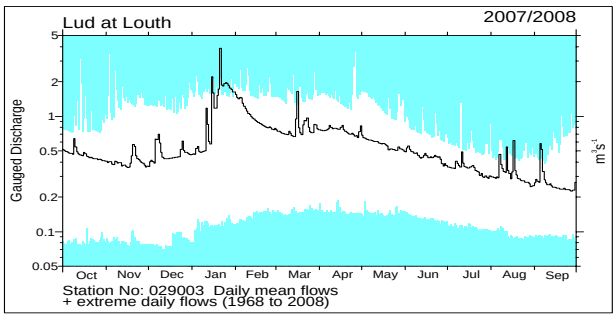
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to October 2007 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

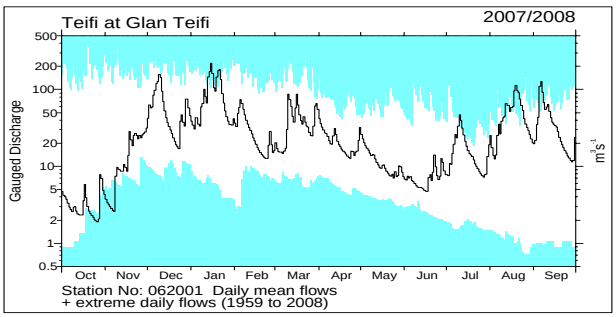
River flow . . . River flow . . .

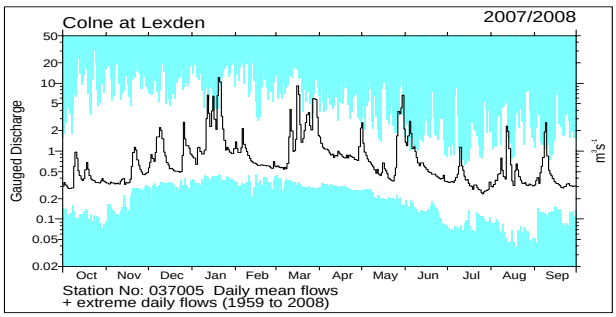


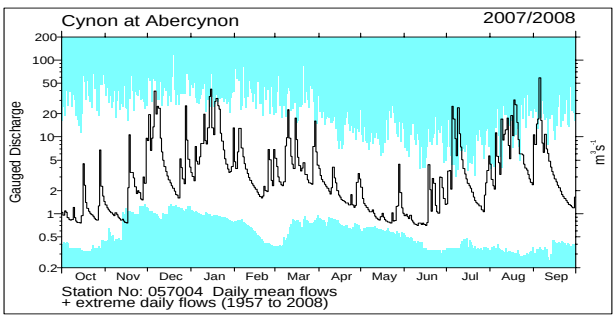


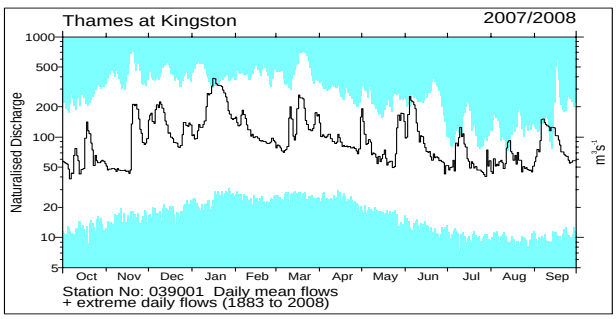


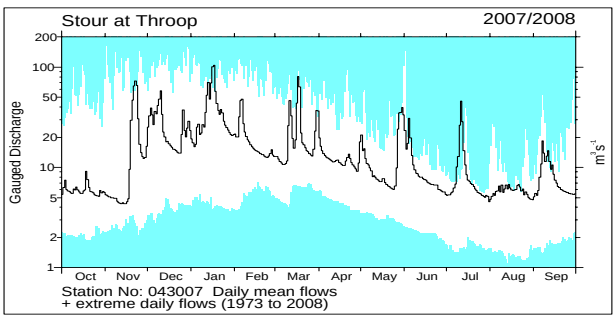


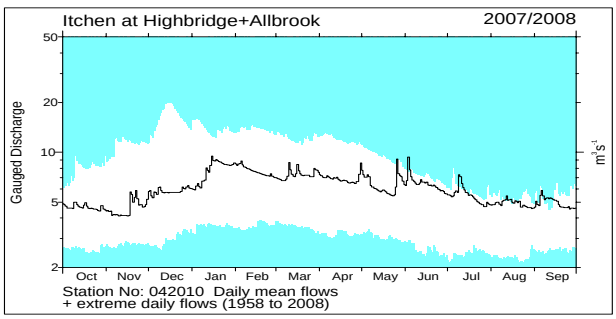












Notable runoff accumulations (a) July - September 2008, (b) January - September 2008

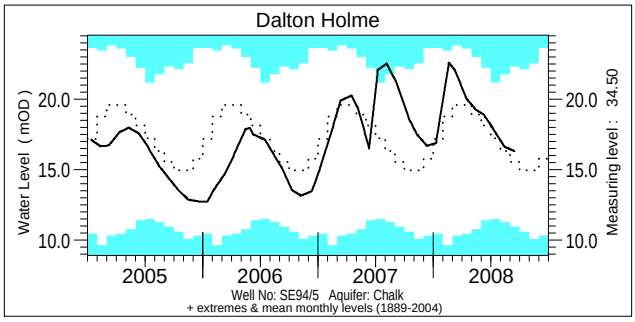
	River	%lta	Rank
a)	Tyne(Spilmersford)	368	43/43
	Whiteadder	458	39/39
	Wharfe	352	53/53
	Derwent	237	47/47
	Exe	363	53/53
	Otter	216	46/46
	Dart	373	50/50
	Warleggan	308	39/39
	Kenwyn	285	40/40

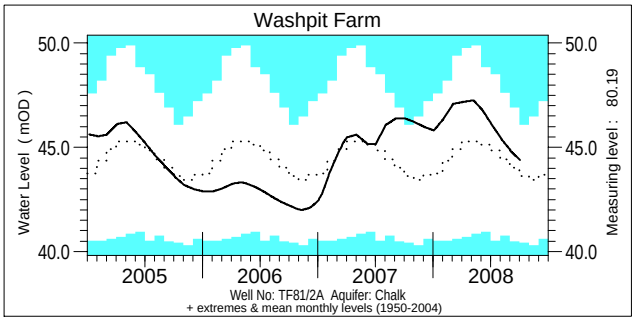
	River	%lta	Rank
a)	Taw	333	50/50
	Tone	270	48/48
	Yscir	321	37/37
	Cynon	333	50/50
	Tawe	256	51/51
	Teifi	276	49/49
	Lagan	365	36/36
	Annacloy	453	29/29

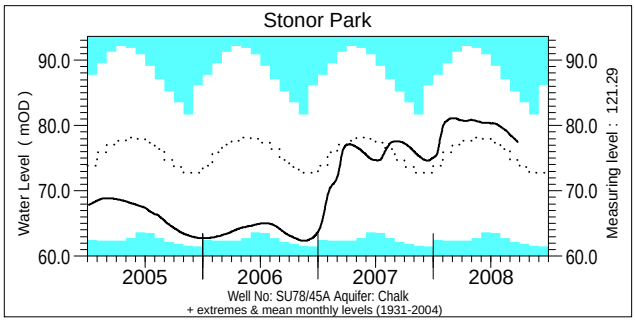
	River	%lta	Rank
b)	Tweed (Norham)	171	49/49
	Tyne (Bywell)	157	49/49
	S Tyne	144	45/45
	Lune	154	48/48
	Eden	142	41/41
	Clyde (Blairston)	151	48/48

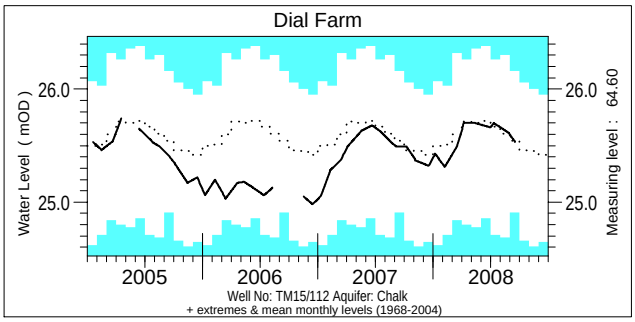
lta = long term average
Rank 1 = lowest on record

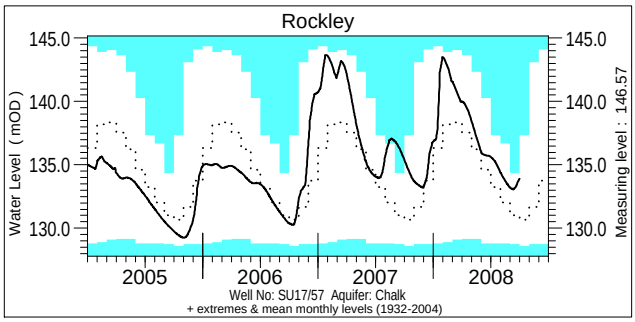
Groundwater . . . Groundwater

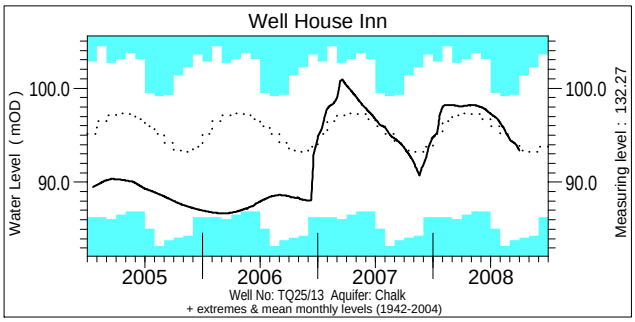


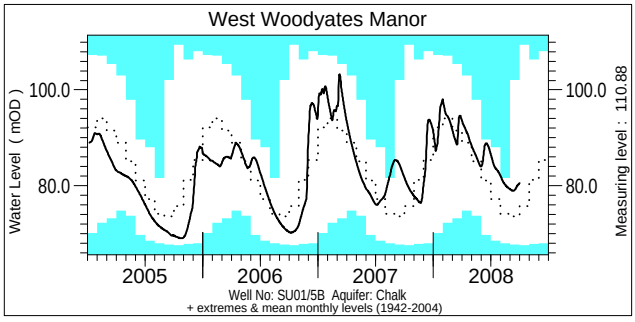


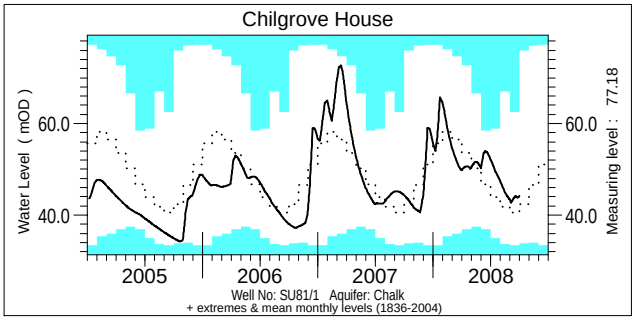


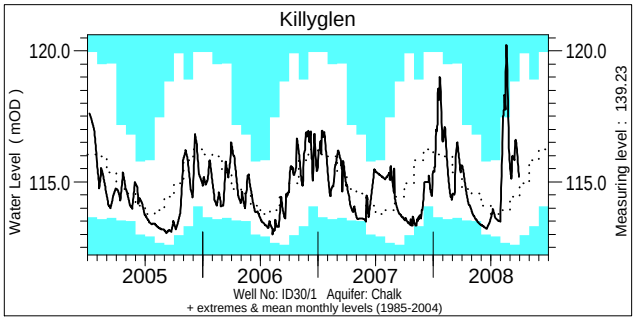


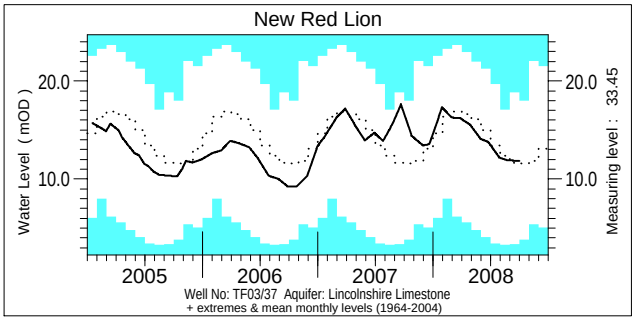






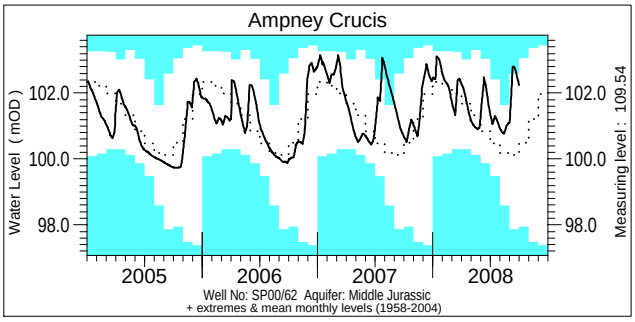


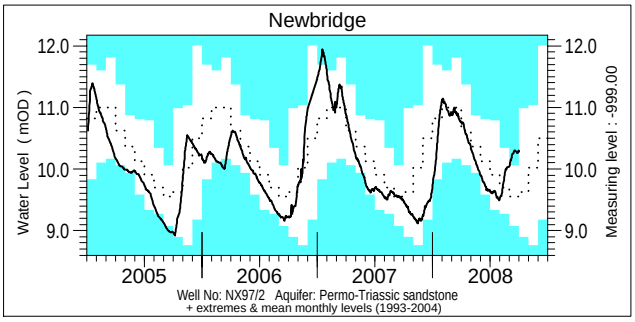


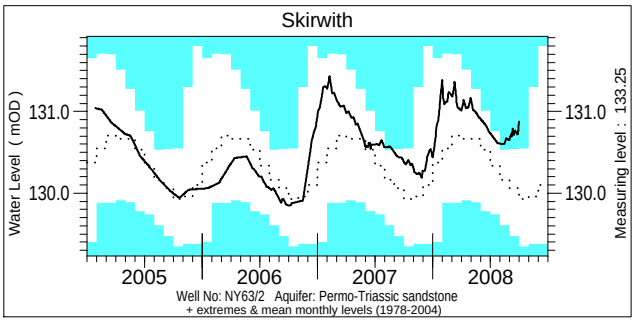


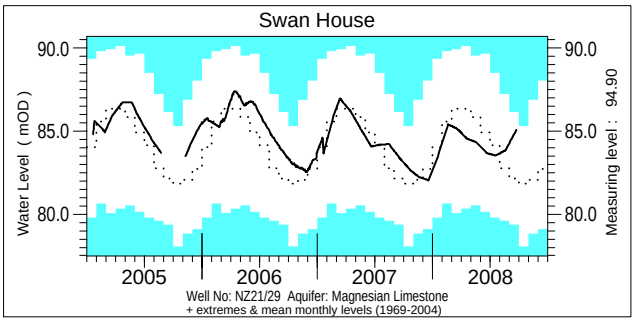
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

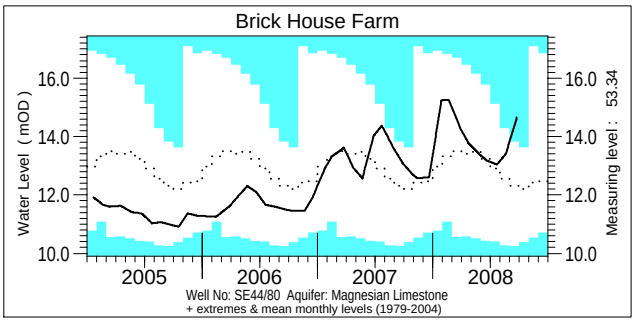
Groundwater . . . Groundwater

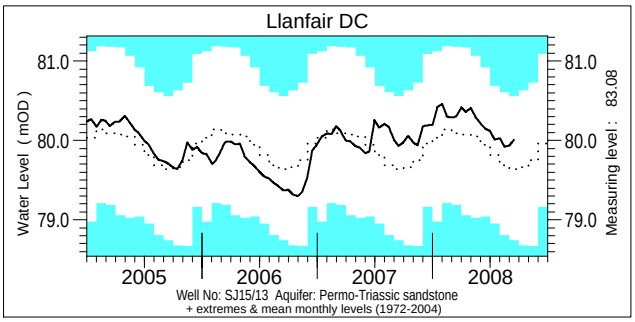


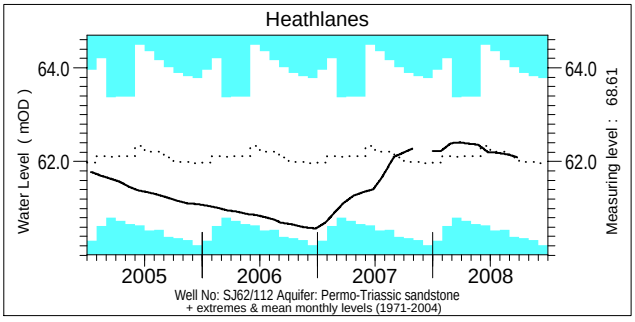


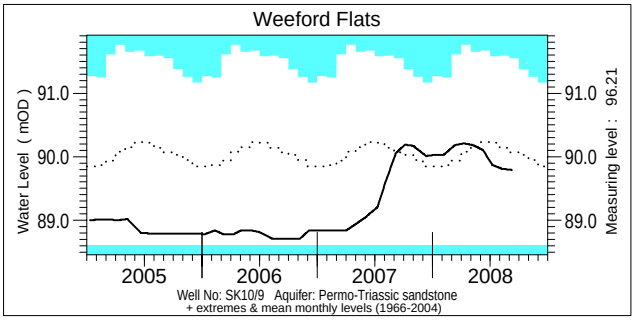


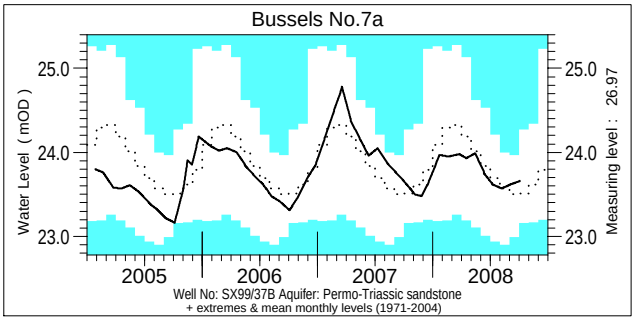


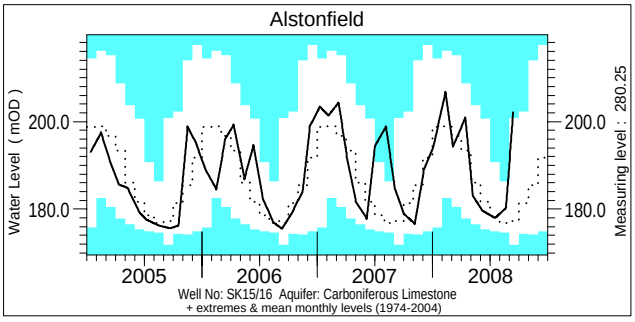










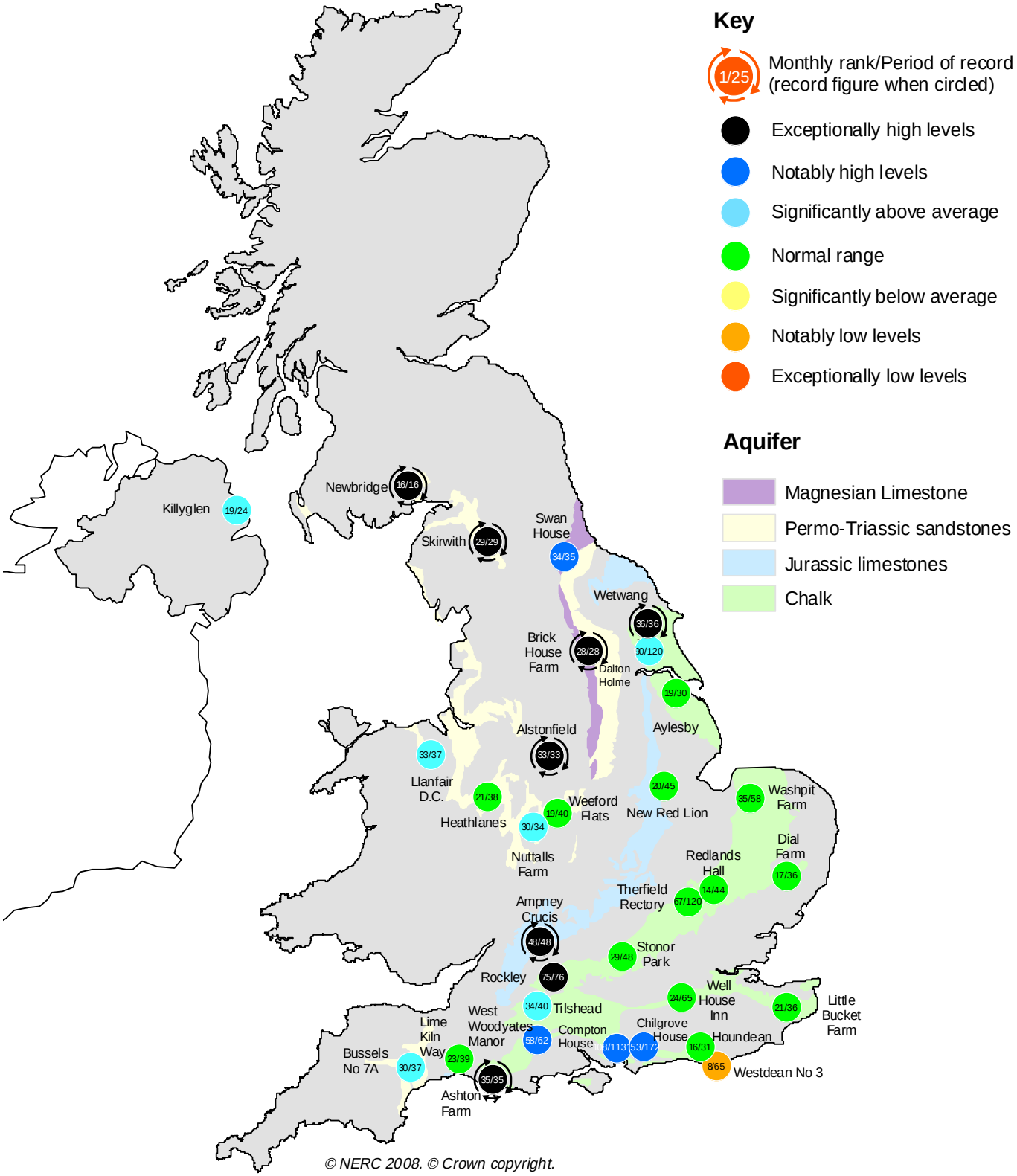


Groundwater levels September / October 2008

Borehole	Level	Date	Sep. av.	Borehole	Level	Date	Sep. av.	Borehole	Level	Date	Sep. av.
Dalton Holme	16.31	15/09	15.46	Chilgrove House	44.13	30/09	40.75	Brick House Farm	14.65	23/09	12.27
Washpit Farm	44.39	02/10	44.02	Killyglen (NI)	115.18	29/09	114.31	Llanfair DC	80.01	15/09	79.56
Stonor Park	77.50	24/09	74.50	New Red Lion	11.83	30/09	11.74	Heathlanes	62.09	25/09	62.01
Dial Farm	25.53	17/09	25.55	Ampney Crucis	102.25	30/09	100.09	Weeford Flats	89.79	08/09	89.79
Rockley	133.92	30/09	131.07	Newbridge	10.28	01/10	9.51	Bussels No.7a	23.66	03/10	23.51
Well House Inn	93.34	30/09	94.00	Skirwith	130.88	30/09	130.08	Alstonfield	202.13	12/09	177.66
West Woodyates	80.49	30/09	73.07	Swan House	85.06	22/09	82.41				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



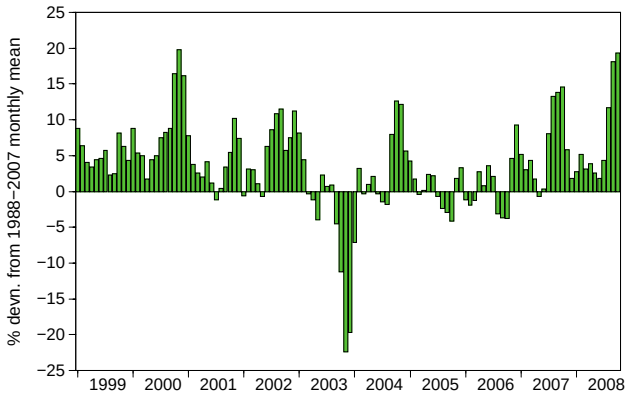
Groundwater levels - September 2008

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.

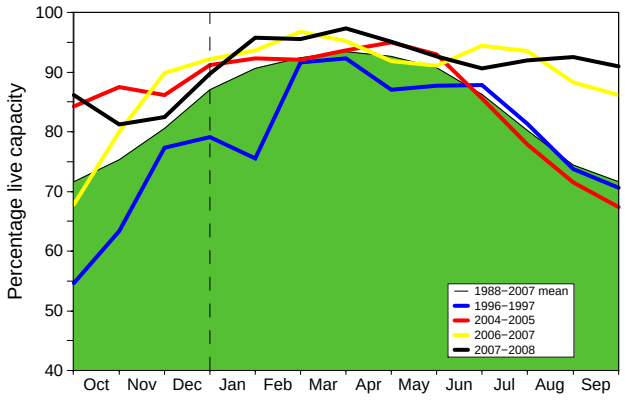
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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 Aug	Sep	Oct	Oct Anom.	Min. Oct	Year* of min.	2007 Oct	Diff 08-07
North West	N Command Zone	• 124929	72	79	**82**	29	13	1995	72	10
	Vyrnwy	55146	90	94	**91**	24	26	1995	90	1
Northumbrian	Teesdale	• 87936	92	91	**87**	23	31	1995	88	-1
	Kielder	(199175)	(99)	(91)	**(89)**	5	(59)	1989	(82)	7
Severn Trent	Clywedog	44922	98	98	**89**	21	24	1989	88	1
	Derwent Valley	• 39525	85	88	**94**	32	24	1989	86	8
Yorkshire	Washburn	• 22035	91	97	**91**	28	24	1995	81	10
	Bradford supply	• 41407	95	99	**95**	31	15	1995	87	8
Anglian	Grafham	(55490)	(96)	(95)	**(95)**	14	(46)	1997	(93)	2
	Rutland	(116580)	(84)	(79)	**(79)**	1	(61)	1995	(86)	-7
Thames	London	• 202828	94	93	**94**	20	53	1997	84	10
	Farmoor	• 13822	98	97	**94**	5	54	2003	93	1
Southern	Bewl	28170	88	82	**74**	11	32	1990	72	2
	Ardingly	4685	94	89	**91**	27	32	2003	81	10
Wessex	Clatworthy	5364	99	89	**100**	46	25	2003	88	12
	Bristol WW	• (38666)	(87)	(100)	**(90)**	29	(31)	1990	(87)	3
South West	Colliford	28540	98	100	**100**	35	38	2006	80	20
	Roadford	34500	93	97	**98**	29	26	1995	91	7
	Wimbleball	21320	97	100	**100**	37	30	1995	91	9
	Stithians	5205	71	76	**79**	26	22	1990	73	6
Welsh	Celyn and Brenig	• 131155	96	100	**97**	19	39	1989	96	1
	Brianne	62140	98	100	**97**	14	48	1995	98	-1
	Big Five	• 69762	95	98	**95**	32	19	1995	82	13
	Elan Valley	• 99106	95	99	**96**	22	34	1995	94	2
Scotland(E)	Edinburgh/Mid Lothian	• 97639	90	94	**94**	19	43	1998	84	10
	East Lothian	• 10206	98	99	**99**	21	52	1989	100	-1
Scotland(W)	Loch Katrine	• 111363	63	77	**80**	8	43	1995	61	19
	Daer	22412	90	99	**98**	26	32	1995	88	10
	Loch Thom	• 11840	80	95	**96**	18	56	1995	68	28
Northern Ireland	Total+	• 67270	68	87	**90**	20	29	1995	78	12
	Silent Valley	• 20634	71	97	**96**	34	27	1995	82	14

() 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. Maintenance work during the summer has affected Rutland Water levels.

Location map . . . Location map

National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme (NHMP) was instigated in 1988 and is undertaken jointly by the Centre for Ecology and Hydrology Wallingford (formerly the Institute of Hydrology - IH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department for Environment, Food and Rural Affairs (Defra), the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

Data Sources

River flow and groundwater level data are provided by the Environment Agency, the Environment Agency Wales, the Scottish Environment Protection Agency and, for Northern Ireland, the Rivers Agency and the 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: nwamail@ceh.ac.uk

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

10/08