Hydrological Summary *for the United Kingdom*

August 2008

General

The autumnal conditions which characterised much of late July continued through a notably dull, windy and wet August. The UK as a whole registered its 4th highest August rainfall since 1962; for Northern Ireland it was the wettest August on record. Seasonally very wet soil conditions encouraged exceptionally high runoff rates (for August) and, locally, some unusual late-summer aquifer recharge was reported. Contrary to the normal seasonal pattern, reservoir levels increased modestly through the late summer and overall stocks for England & Wales are, clearly, the highest on record (in a 21-yr series) for early September. Flood events (both flash and fluvial) were widely reported with particularly exceptional flows in parts of Northern Ireland and Fife. A significant proportion of index rivers registered new maximum August flows (and runoff totals). August groundwater levels in most index wells were above, to well above, the late summer average. A second successive notably wet summer has made for a very healthy water resources outlook but, entering the autumn, many catchments are very vulnerable to further rainfall – with a high short-term risk of more flooding and the prospect of an extended 2008/09 flood season.

Rainfall

With the Jet Stream following an unusually southerly track (as in the summer of 2007), synoptic patterns during August were dominated by the passage of a sequence of vigorous Atlantic frontal systems; late in the month the ingress of a humid sub-tropical airflow triggered considerable convective activity. Exceptional rainfall totals were common: the 9/10th was wet nationwide and a confirmed 101.2mm 24-hr rainfall total was reported for the Fair Isle. More hydrologically significant was the sustained frontal rainfall which generated rainfall totals of 100-120mm in around 24 hrs in parts of Country Antrim on the 15/16th (many raingauges in Northern Ireland registered >50mm); on the 31st, an intense thunderstorm registered 63mm in less than two hours in Chalfont St Peter (Bucks), the associated return period is around 100 years. As in July, below average monthly rainfall was largely confined to the very north of Scotland and, although spatial variability was large, much of the UK registered >150% of average rising to >200% in the wettest area (e.g. Northern Ireland, Fife and Snowdonia). England & Wales reported its 3rd (and Scotland its 5th) wettest August since 1956 and Northern Ireland registered an exceptionally wet late summer; both the August and July/August rainfall totals are unprecedented in a 96-yr series. Summer (Jun-Aug) rainfall totals are well above average in almost all regions and, provisionally, the UK registered its 6th wettest summer on record; three of the nine wettest in a series from 1914 cluster in the last five years. Medium term rainfall accumulations are also notably high; the UK registered its wettest Jan-Aug period on record (just eclipsing 2007).

River Flows

As in 2007, the normal constraint exercised by very dry soil conditions on runoff during the late summer did not apply in August. Flow patterns were more typical of the winter over wide areas; flood warnings were common but notably high wind speeds were beneficial in hastening the passage of some rain-bearing frontal systems (and moderating storm durations). Spate conditions continued from late July and flooding in Ayrshire on the 1st heralded further very high flows around the 7th (e.g. in the North East) and around mid-month when a number of new maximum August flows were established in south-western Britain (e.g. in the Exe and Cynon). More exceptional flows characterised much of Northern Ireland; on the 16/17th, the Lagan and Annacloy were among those index rivers exceeding previous maximum flows; more extreme runoff rates were reported from County Antrim. Further inundations occurred across much of NI causing severe transport disruption and stranding livestock. Elsewhere, moderate floodplain inundations were common in responsive catchments and seasonally high flow typified many groundwater-fed rivers and streams. Estimated total outflows from the UK for August were the 2nd highest since 1965, and many rivers, in south-western Britain and NI particularly, eclipsed previous August runoff maxima. New maximum summer runoff totals were widely reported, some (e.g. Wharfe, Tweed, Dart, Cynon and Lune) with record lengths of around 50 years. With few exceptions, longer term runoff accumulations exceed the average – often by large margins.

Groundwater

All but a few outcrop areas (e.g. in parts of Lincolnshire) of the major aquifers received well above average August rainfall. Correspondingly, soil moisture deficits declined considerably over the month and, for England & Wales as a whole, only 1966 and 2004 have produced appreciably wetter end-of-August soils since 1960. Nonetheless, infiltration was generally modest and late summer increases in groundwater levels were largely confined to responsive Limestone aquifers (e.g. Alstonfield) and, locally, to superficial deposits (e.g. in parts of the Chilterns). However, the exceptional August rainfall in Antrim triggered a steep rise in the Killyglen groundwater levels; the short-lived peak on the 19th was the highest in a 24-yr series. Seasonally exceptional levels were also reported for the Skirwith (Permo-Triassic sandstones) borehole and for some Chalk and Limestone index wells and boreholes (e.g. Ampney Crucis and West Woodyates). Entering September, levels in the great majority of index wells were very healthy and, given typical autumn rainfall patterns, an early onset of general recharge may be anticipated with the prospect of a substantially extended 2008/09 recharge season.

Centre for Ecology & Hydrology
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	August 2008	Jul 08- Aug 08	RP	Jun 08- Aug 08	RP	Jan 08- Aug 08	RP	Sep 07- Aug 08	RP
England & Wales	**mm**	**117**	**226**		**289**		**717**		**987**	
	%	**153**	**162**	**15-25**	**143**	**10-20**	**129**	**>100**	**109**	**2-5**
North West	mm	**155**	299		409		939		1358	
	%	**141**	152	10-20	147	15-25	130	50-80	112	5-15
Northumbrian	mm	**129**	265		356		763		1004	
	%	**155**	178	30-45	168	40-60	140	>100	116	5-10
Severn Trent	mm	**89**	186		231		600		812	
	%	**129**	150	5-10	126	2-5	123	10-20	106	2-5
Yorkshire	mm	**123**	243		319		736		972	
	%	**162**	176	20-30	160	20-30	140	>100	116	5-10
Anglian	mm	**84**	145		192		476		644	
	%	**152**	137	2-5	122	2-5	123	5-15	107	2-5
Thames	mm	**79**	166		219		566		780	
	%	**133**	152	5-10	134	5-10	129	20-35	111	2-5
Southern	mm	**70**	134		172		566		787	
	%	**121**	126	2-5	107	2-5	121	5-15	100	<2
Wessex	mm	**102**	211		258		683		961	
	%	**151**	174	10-20	144	5-10	131	>100	113	2-5
South West	mm	**147**	323		372		888		1235	
	%	**170**	205	>100	164	40-60	125	60-90	104	2-5
Welsh	mm	**192**	330		417		1053		1464	
	%	**181**	177	15-25	156	10-20	134	50-80	109	2-5
Scotland	**mm**	**159**	**268**		**379**		**1116**		**1615**	
	%	**137**	**126**	**5-10**	**127**	**10-20**	**131**	**50-80**	**110**	**10-20**
Highland	mm	**140**	227		345		1276		1937	
	%	**108**	96	2-5	103	2-5	129	20-30	111	10-20
North East	mm	**124**	210		297		787		1126	
	%	**137**	125	2-5	126	2-5	124	25-40	109	5-10
Tay	mm	**172**	279		374		1053		1391	
	%	**172**	153	5-10	145	10-20	137	40-60	108	5-10
Forth	mm	**198**	312		406		1002		1340	
	%	**203**	178	30-40	165	30-40	147	80-120	117	10-20
Tweed	mm	**179**	311		416		922		1210	
	%	**200**	189	50-80	179	60-90	149	>100	121	25-40
Solway	mm	**208**	349		463		1117		1562	
	%	**171**	163	20-30	155	25-40	133	80-120	109	5-10
Clyde	mm	**193**	339		468		1324		1910	
	%	**136**	133	5-10	133	10-20	132	25-40	109	5-10
Northern Ireland	**mm**	**205**	**328**		**400**		**846**		**1160**	
	%	**215**	**197**	**80-120**	**167**	**50-80**	**127**	**30-45**	**106**	**2-5**

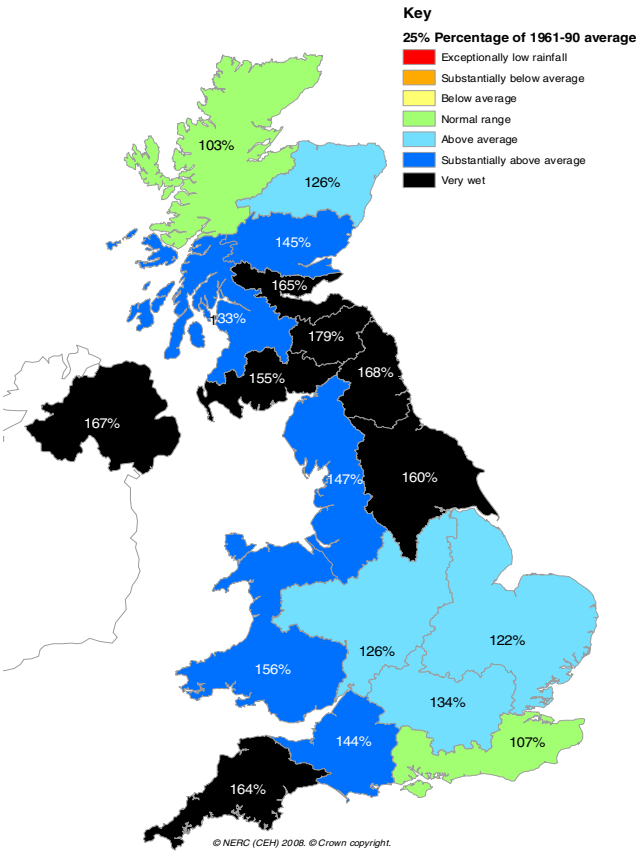
% = percentage of 1961-90 average

RP = Return period

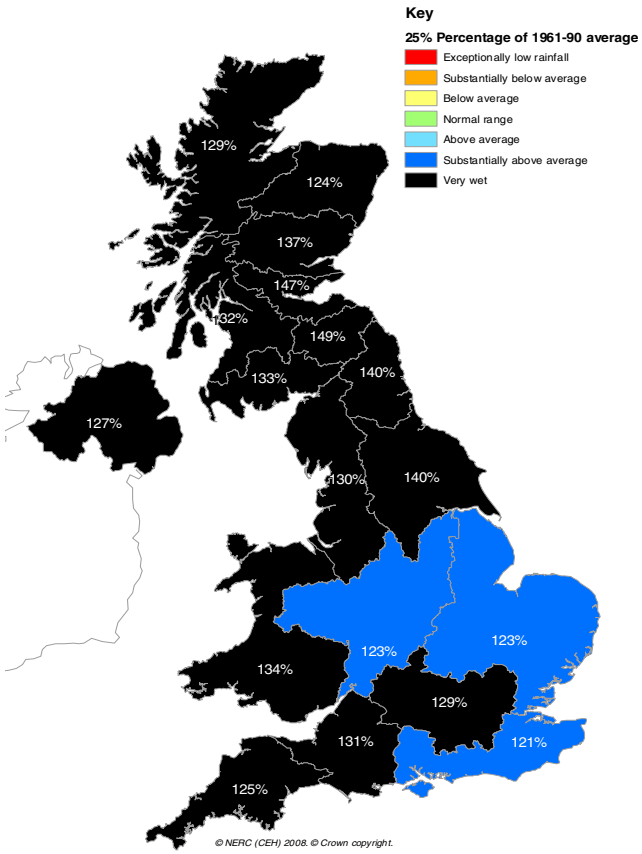
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following the method described in: Tabony, R. C. 1977, *The variability of long duration rainfall over Great Britain*. Met Office Scientific Paper no. 37. The estimates reflect climatic variability since 1913 and assume a stable climate. The timespans featured do not purport to represent the critical periods for any particular water resource management zone. For hydrological or water resources assessments of drought severity, river flows and/or groundwater levels normally provide a better guide than return periods based on regional rainfall totals.
All monthly rainfall totals since January 2008 are provisional.

Rainfall . . . Rainfall . . .

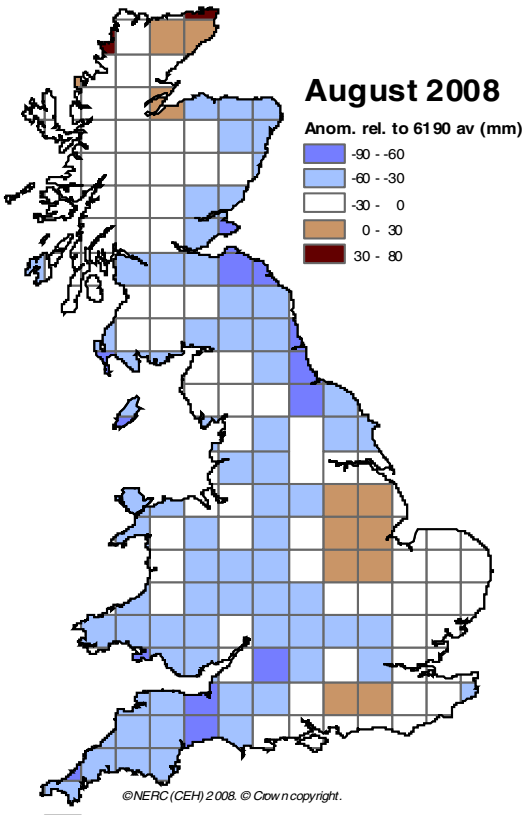
June - August 2008



January- August 2008



MORECS Soil Moisture Deficit Anomaly



Met Office Autumn 2008 forecast

Forecast for Autumn 2008 updated 28 August 2008

Temperature

Temperatures across much of north-western Europe will probably be above average. For the UK temperatures are more likely to be either near average, or above average.

Rainfall

The UK and north-western Europe will probably have below-average amounts of rain this autumn.

Early indications for Winter 2008/9 (Dec - Feb): 10 July 2008

Temperature

Winter temperatures are more likely to be either near, or above average, than below average over much of the European region. For northern Europe, including the UK, Winter 2008/9 is likely to be less mild than last winter.

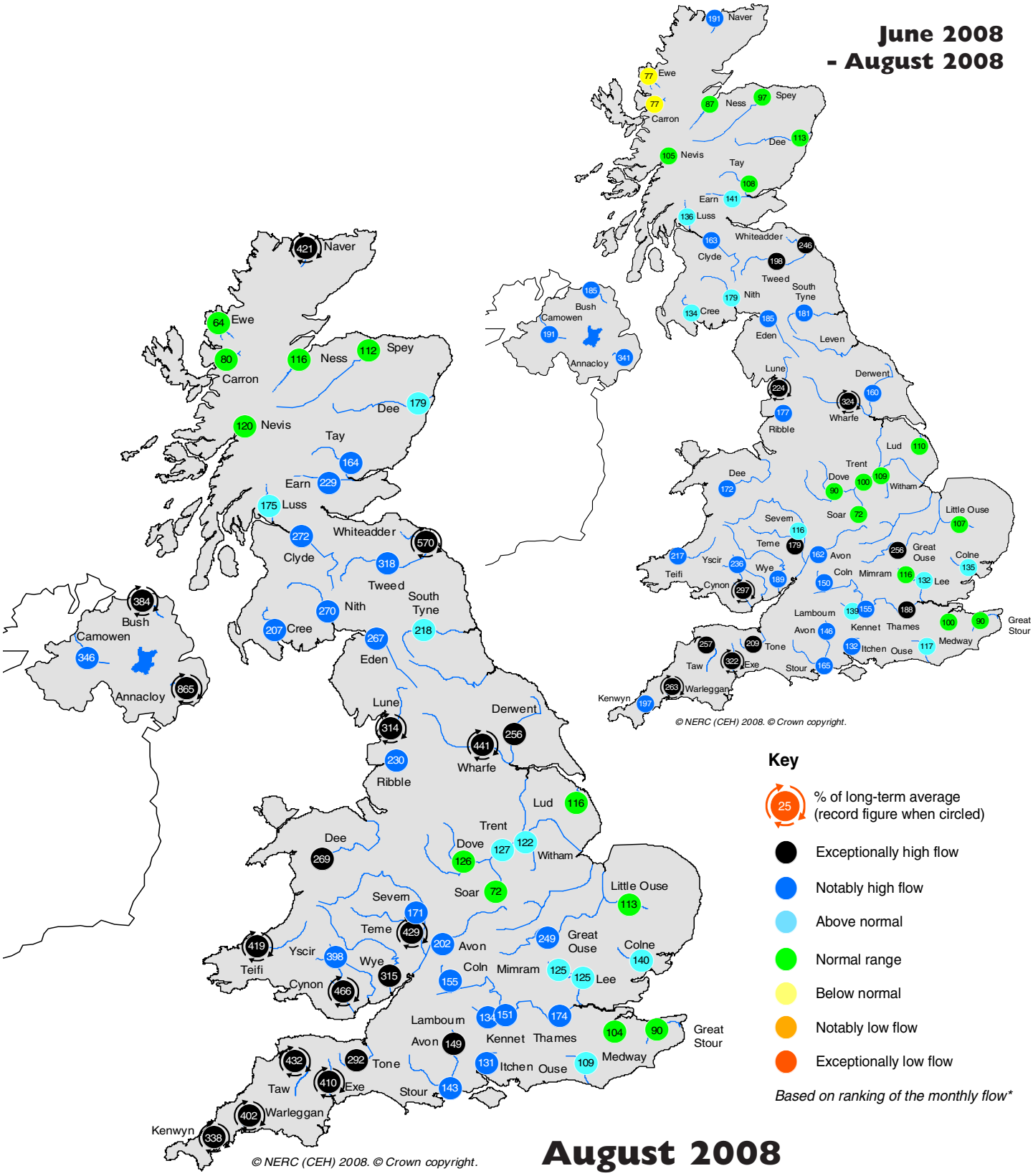
Rainfall

There is currently no clear signal for either above or below-average rainfall. However, for much of northern Europe, including the UK, rainfall is likely to be lower than observed in last year's relatively wet winter.

Updates and reviews of the forecast

The autumn forecast will next be updated at 10 a.m. on 24 September 2008. For further details please visit: http://www.metoffice.gov.uk/weather/seasonal/autumn2008

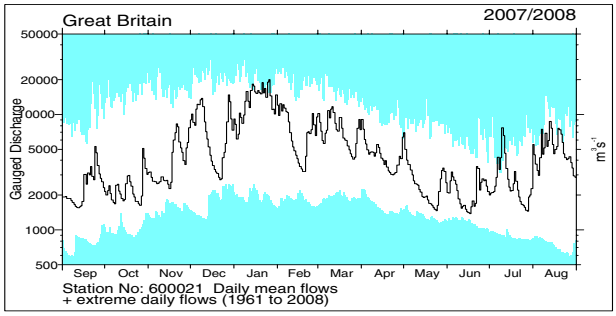
River flow . . . River flow . . .

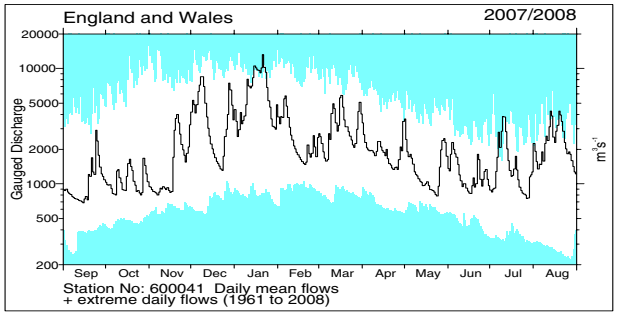


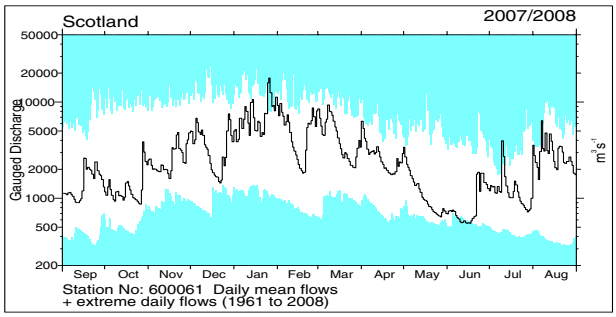
River flows

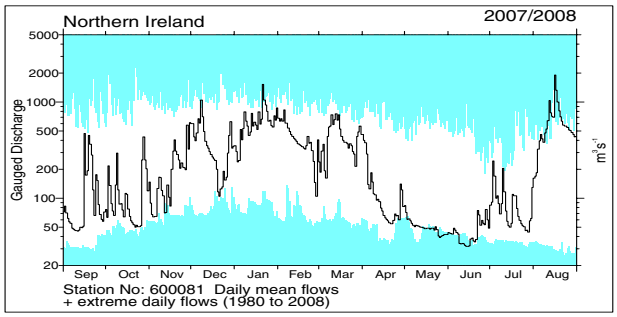
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

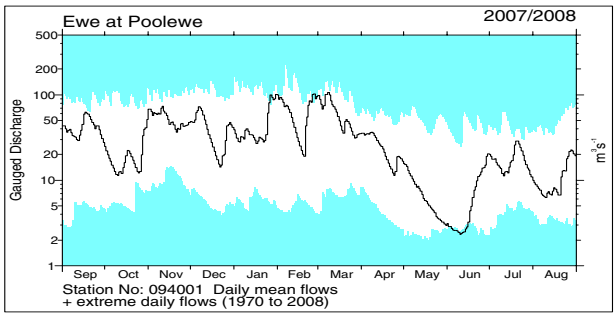
River flow . . . River flow . . .

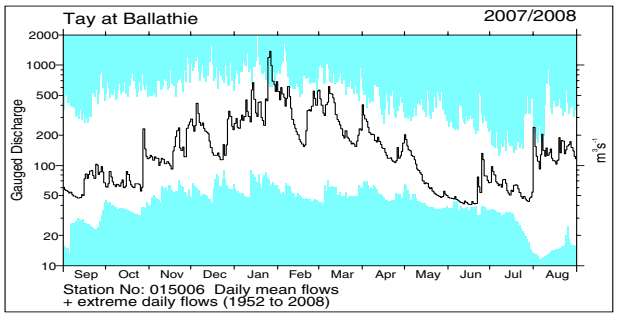


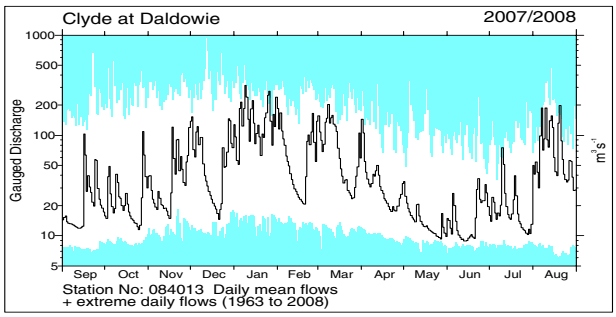


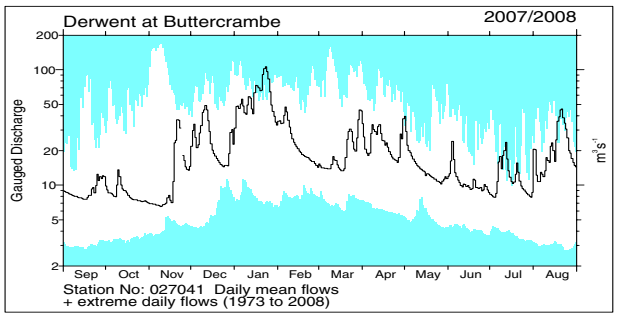


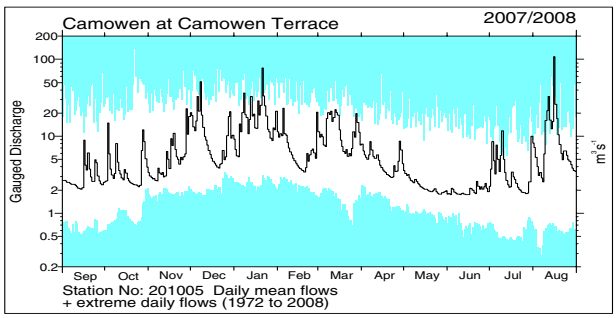


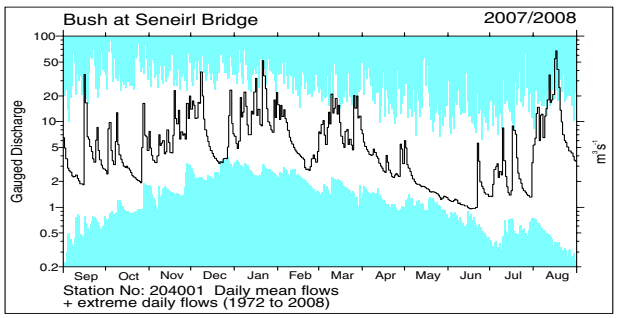








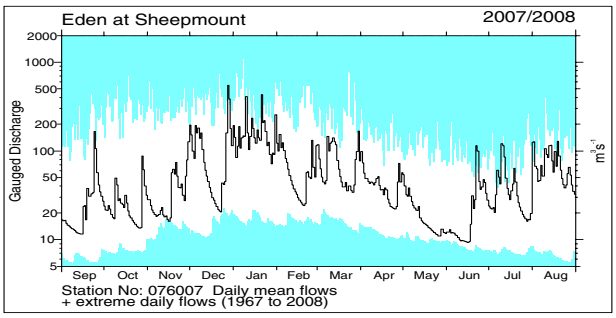


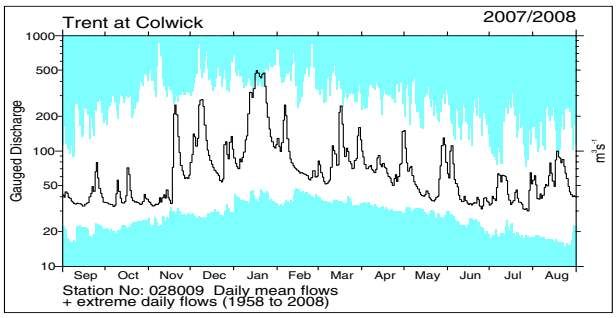


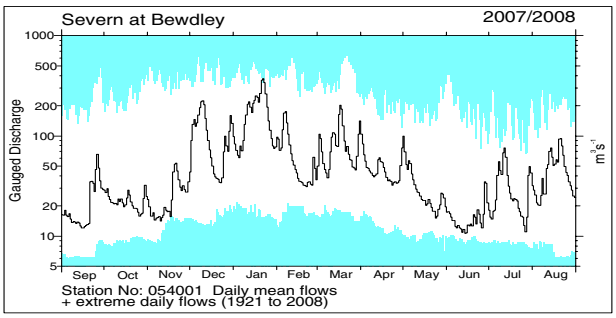
River flow hydrographs

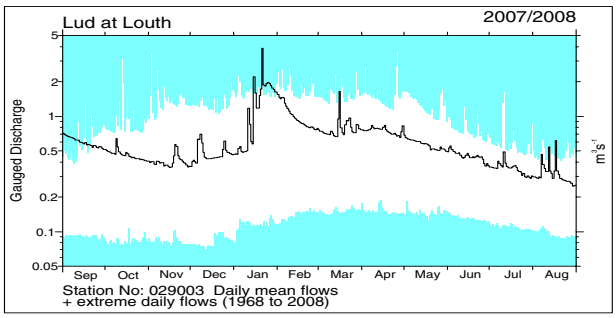
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to September 2007 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

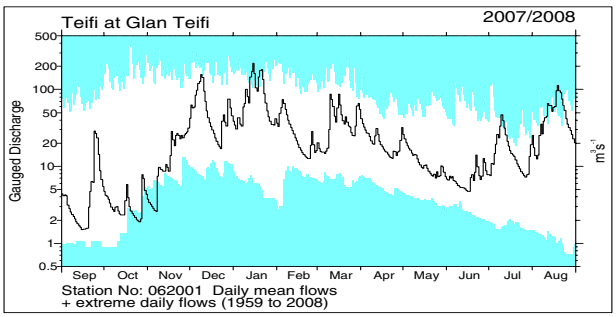
River flow . . . River flow . . .

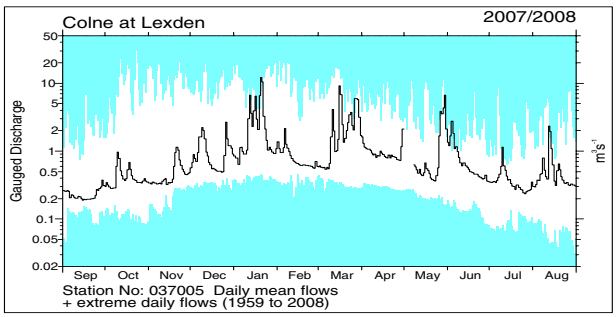


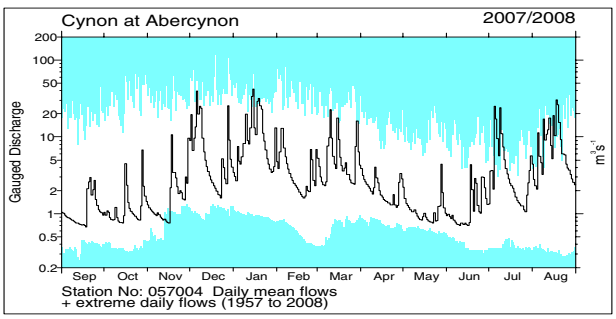


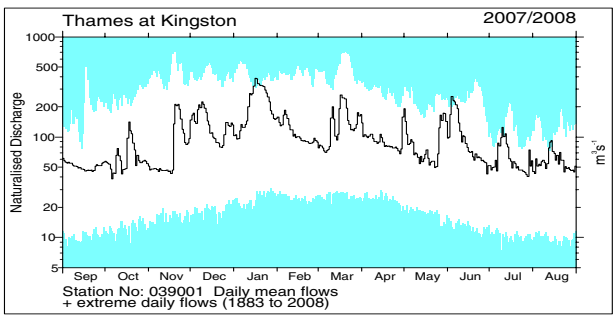


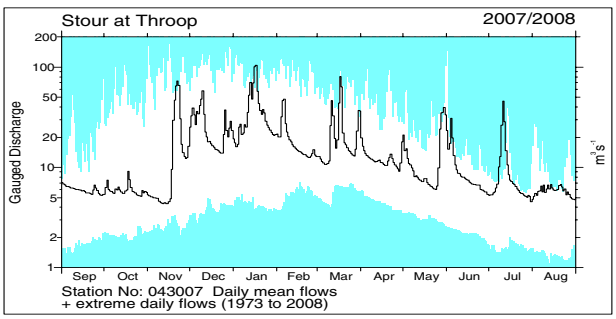


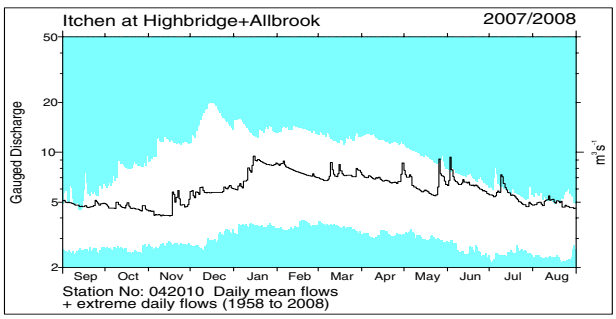












Notable runoff accumulations (a) June - August 2008, (b) January - August 2008

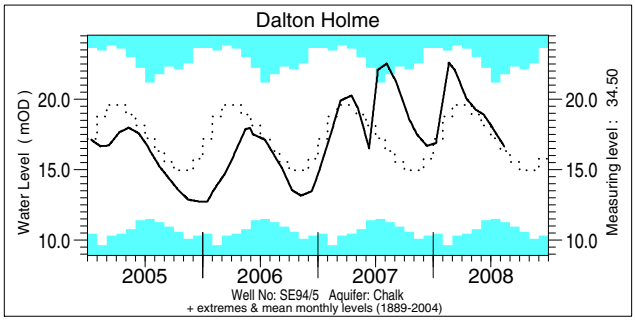
	River	%lta	Rank
a)	Tweed (Norham)	239	49/49
	Wharfe	324	53/53
	Exe	322	53/53
	Dart	330	50/50
	Warleggan	263	39/39
	Cynon	297	50/50
	Lune	224	48/48
	L Bann	235	28/28
	Lagan	319	36/36

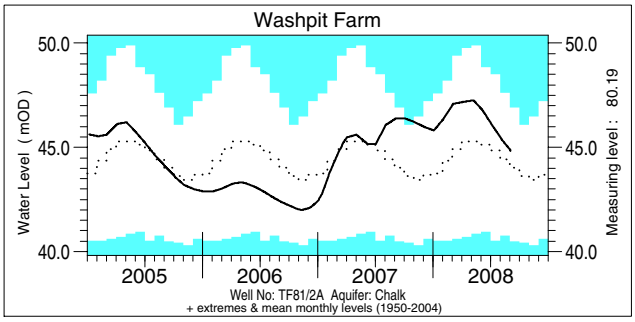
	River	%lta	Rank
b)	Tyne (Spilmersford)	179	43/43
	Whiteadder	148	38/39
	Tyne (Bywell)	142	49/49
	S Tyne	131	45/45
	Lymington	142	45/46
	Wye	136	70/72
	Tawe	141	47/48

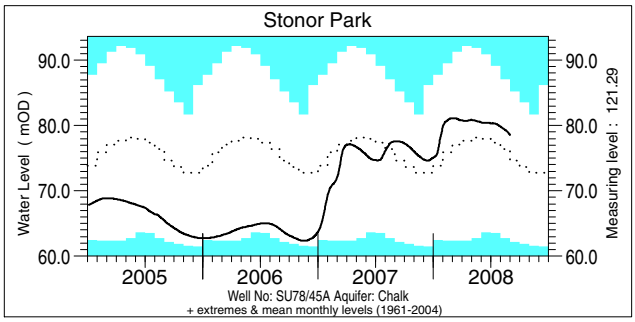
	River	%lta	Rank
b)	Dee (New Inn)	132	39/39
	Eden	136	40/41
	Nith	135	49/51
	Clyde (Blairston)	157	47/48
	Naver	147	31/31
	Annacloy	155	29/29

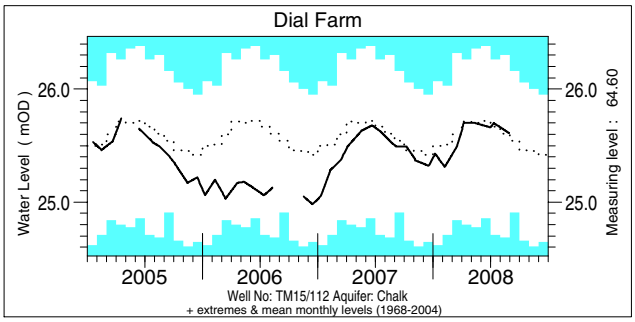
lta = long term average
Rank 1 = lowest on record

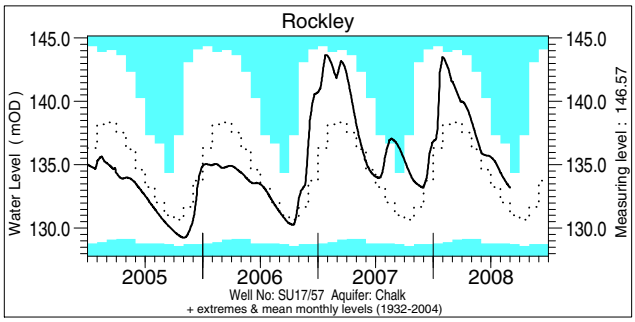
Groundwater . . . Groundwater

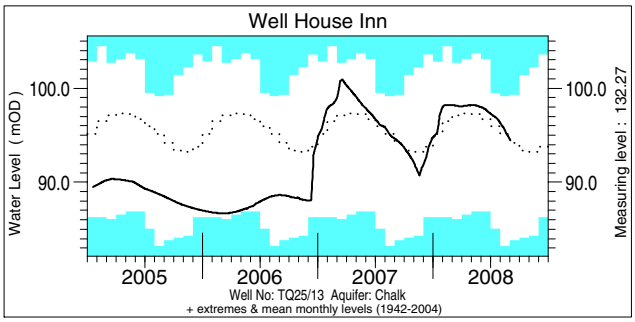


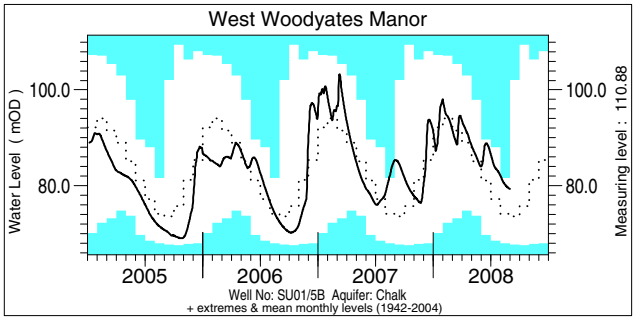


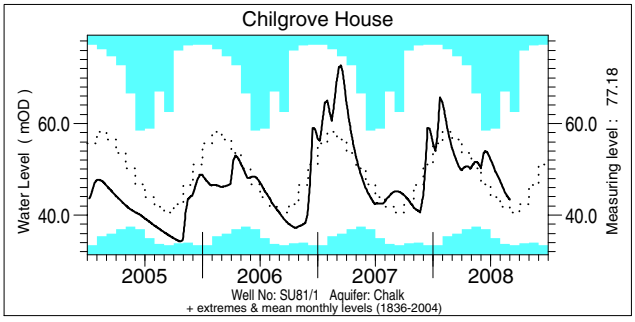


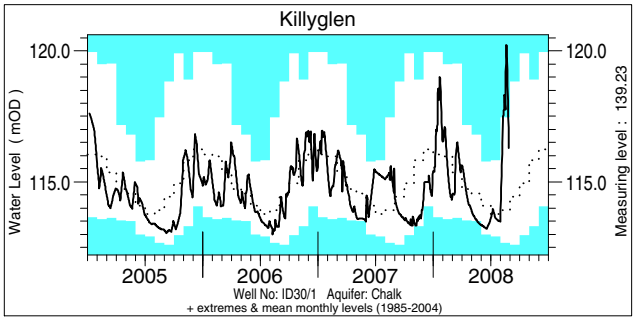


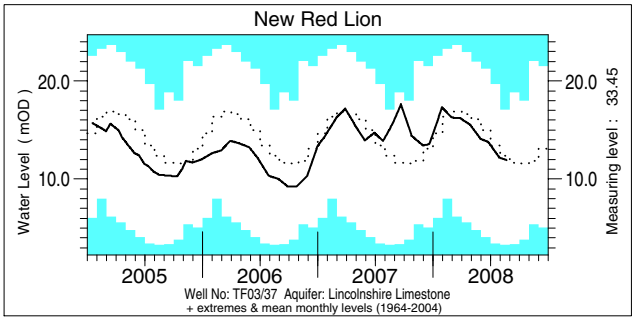






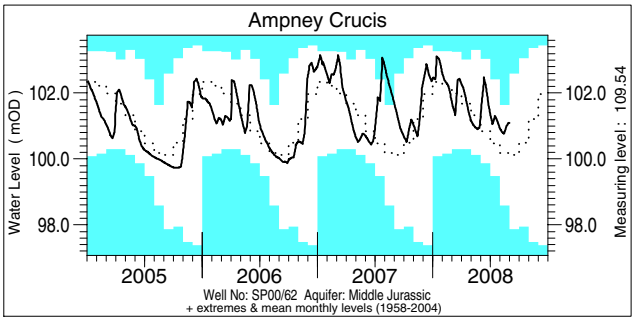


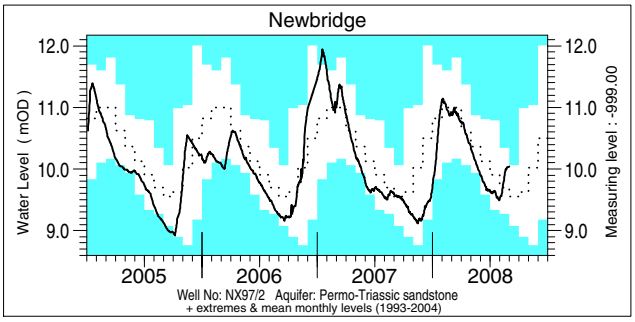


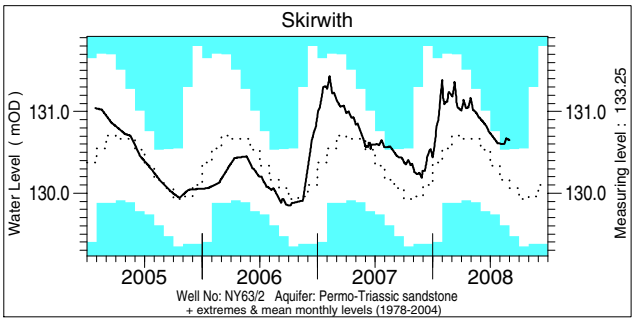


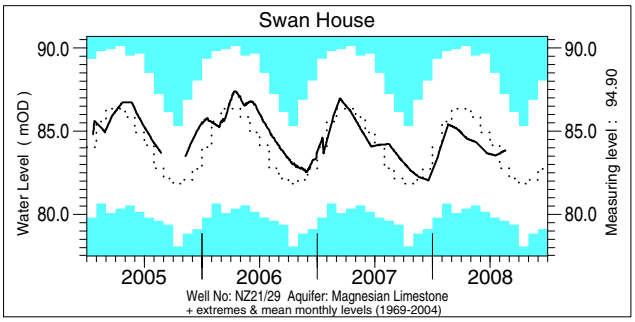
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

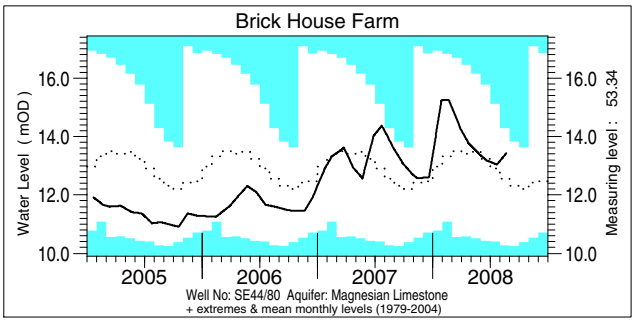
Groundwater . . . Groundwater

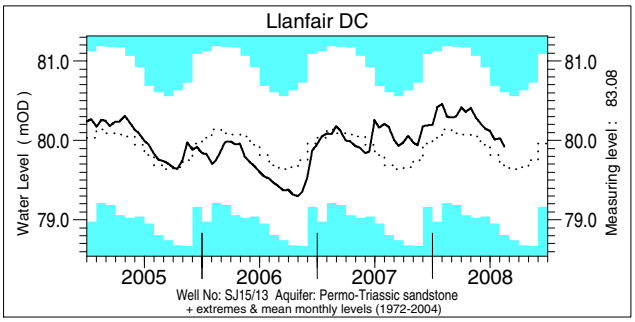


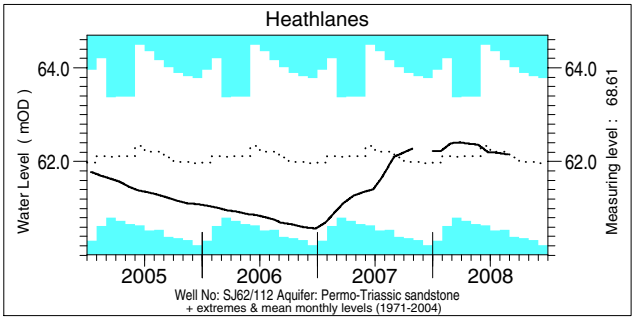


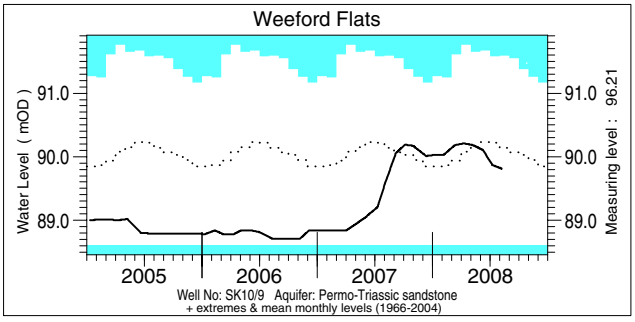


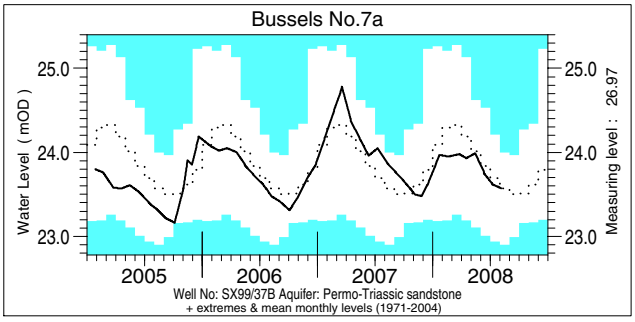


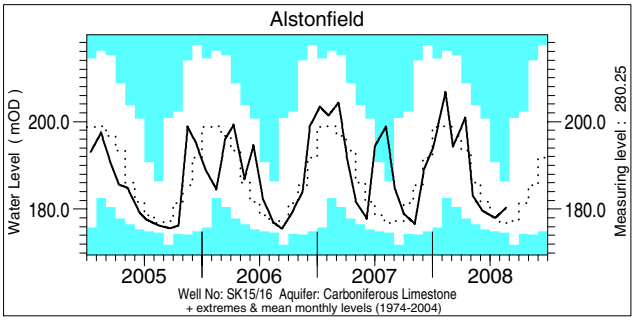










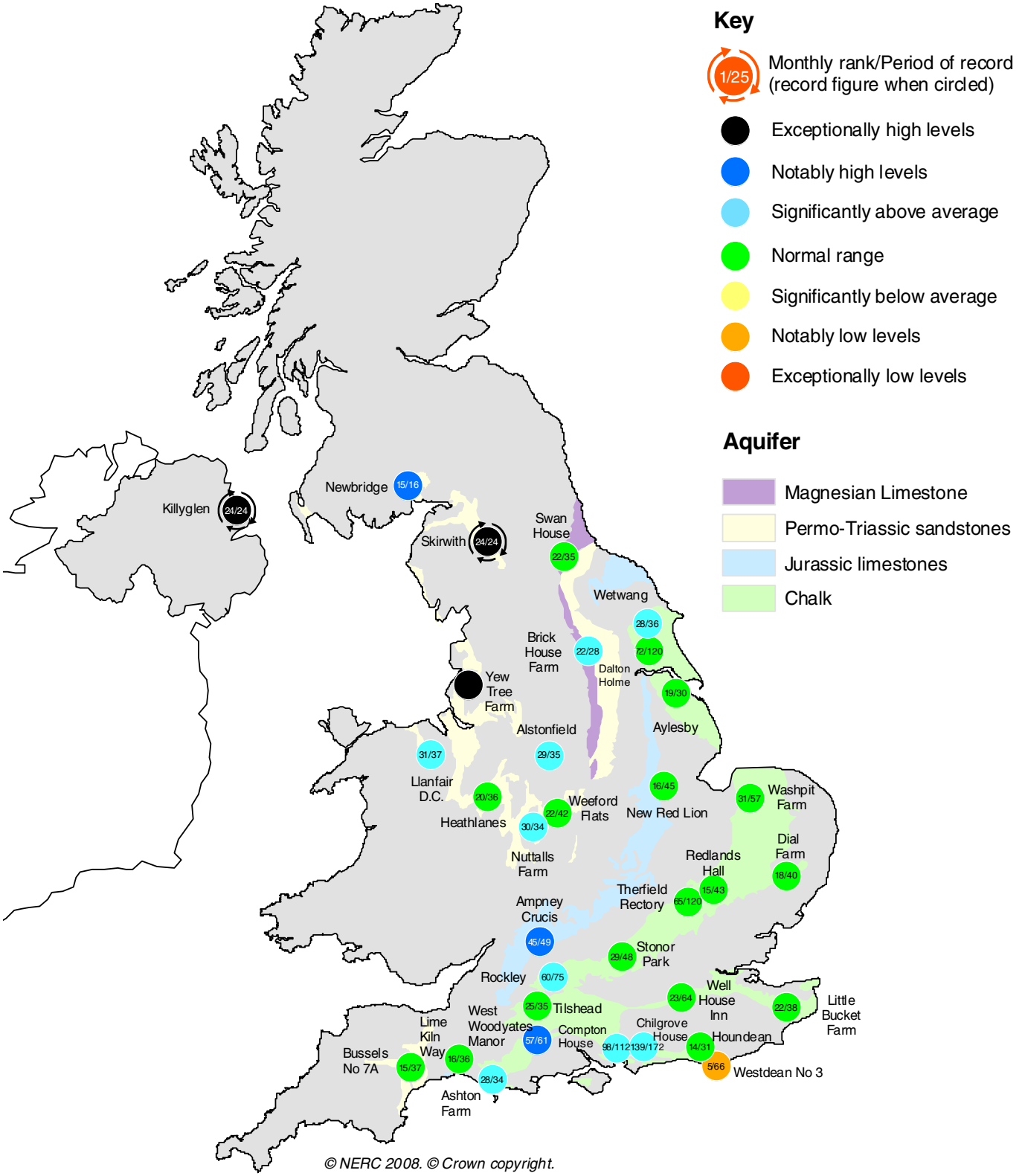


Groundwater levels August / September 2008

Borehole	Level	Date	Aug. av.	Borehole	Level	Date	Aug. av.	Borehole	Level	Date	Aug. av.
Dalton Holme	16.64	12/08	16.29	Chilgrove House	43.31	31/08	41.72	Brick House Farm	13.43	20/08	12.51
Washpit Farm	44.82	03/09	44.49	Killyglen (NI)	116.29	28/08	113.85	Llanfair DC	79.92	15/08	79.64
Stonor Park	78.53	01/09	75.79	New Red Lion	11.94	20/08	12.40	Heathlanes	62.15	27/08	62.10
Dial Farm	25.61	28/08	25.58	Ampney Crucis	101.10	01/09	100.21	Weeford Flats	89.81	07/08	89.82
Rockley	133.18	01/09	132.08	Newbridge	10.04	31/08	9.63	Bussels No.7a	23.57	05/08	23.59
Well House Inn	94.47	01/09	94.89	Skirwith	130.65	31/08	130.17	Alstonfield	180.31	20/08	178.04
West Woodyates	79.28	31/08	74.02	Swan House	83.85	19/08	83.05				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



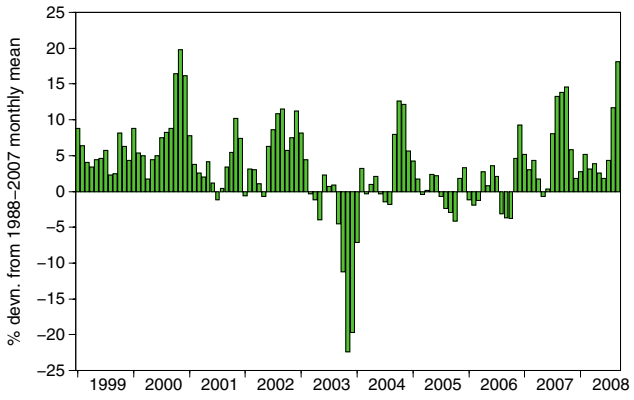
Groundwater levels - August 2008

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.

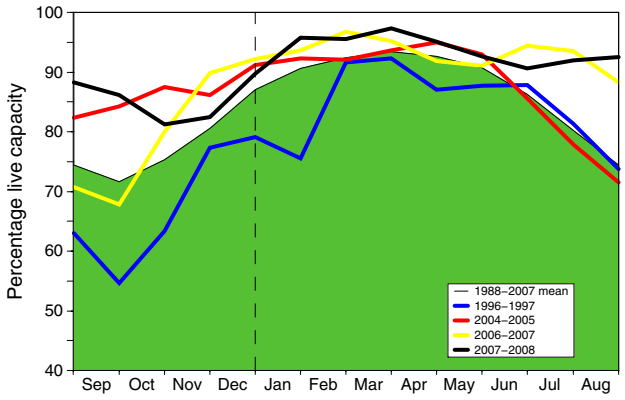
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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 Jul	Aug	Sep	Sep Anom.	Min. Sep	Year* of min.	2007 Sep	Diff 08-07
North West	N Command Zone	• 124929	74	72	**79**	24	24	1995	77	2
	Vyrnwy	55146	89	90	**94**	24	36	1995	95	-1
Northumbrian	Teesdale	• 87936	88	92	**91**	26	38	1995	87	4
	Kielder	(199175)	(94)	(99)	**(91)**	5	(66)	1989	(87)	4
Severn Trent	Clywedog	44922	100	98	**98**	23	38	1989	93	5
	Derwent Valley	• 39525	84	85	**88**	22	34	1995	90	-2
Yorkshire	Washburn	• 22035	85	91	**97**	30	34	1995	87	10
	Bradford supply	• 41407	85	95	**99**	35	21	1995	92	7
Anglian	Grafham	(55490)	(95)	(96)	**(95)**	11	(59)	1997	(95)	0
	Rutland	(116580)	(91)	(84)	**(79)**	-3	(66)	1995	(89)	-10
Thames	London	• 202828	96	94	**93**	15	62	1995	77	16
	Farmoor	• 13822	95	98	**97**	5	64	1995	100	-3
Southern	Bewl	28170	95	88	**82**	13	38	1990	79	3
	Ardingly	4685	99	94	**89**	17	47	1996	93	-4
Wessex	Clatworthy	5364	99	99	**89**	27	31	1995	100	-11
	Bristol WW	• (38666)	(87)	(87)	**(100)**	34	(43)	1990	(95)	5
South West	Colliford	28540	92	98	**100**	31	43	1997	83	17
	Roadford	34500	88	93	**97**	26	40	1995	95	2
	Wimbleball	21320	96	97	**100**	31	40	1995	98	2
	Stithians	5205	72	71	**76**	17	30	1990	83	-7
Welsh	Celyn and Brenig	• 131155	96	96	**100**	20	49	1989	97	3
	Brianne	62140	89	98	**100**	16	55	1995	98	2
	Big Five	• 69762	90	95	**98**	31	29	1995	90	8
	Elan Valley	• 99106	89	95	**99**	24	46	1995	93	6
Scotland(E)	Edinburgh/Mid Lothian	• 97639	89	90	**94**	18	45	1998	88	6
	East Lothian	• 10206	99	98	**99**	17	63	1989	100	-1
Scotland(W)	Loch Katrine	• 111363	68	63	**77**	10	50	2000	67	10
	Daer	22412	80	90	**99**	28	41	1995	96	3
	Loch Thom	• 11840	81	80	**95**	18	58	1997	72	23
Northern Ireland	Total+	• 67270	61	68	**87**	14	40	1995	89	-2
	Silent Valley	• 20634	58	71	**97**	32	33	2000	97	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. 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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Selected text and maps are available on the WWW at http://www.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

09/08