Hydrological Summary
for the United Kingdom

July 2008

General

Very unsettled weather patterns across much of the country resulted in the 3rd wettest July for the UK as a whole since 1960. Spates conditions were common (for the summer period) as were localised flash flood events and, in most areas, July runoff totals were notably high. Correspondingly, replenishment to both gravity-fed and pumped storage reservoirs was considerably above the mid-summer average. With a few exceptions (e.g. Loch Katrine) storage in almost all index reservoirs are appreciably above the early August average; overall stocks for England & Wales actually increased over the month (a rare circumstance) and are the 3rd highest in a series from 1988 (but lower than at the same time in 2007). Generally, soil moisture deficits increased only modestly over the month and, entering August, were below average in most aquifer outcrop areas. A little local recharge contributed to above average groundwater levels in most major aquifer outcrop areas and, in some southern catchments, flows in many spring-fed rivers and streams are exceptionally high for the second successive summer. The UK's 4th wettest Jan-July period (in a series from 1914) is reflected in a very healthy water resources outlook for the remainder of the summer and autumn.

Rainfall

July was a month of contrasts: stormy conditions with high winds early in the month – more typical of the autumn than mid summer – gave way to hot and humid weather which triggered convectional storms, particularly during the final week. Anticyclonic conditions predominated in mid-month when some significant dry spells were reported (e.g. 2mm of rainfall at Oxford over 16 days) but in many areas this settled spell was bracketed by substantial frontal rainfall (e.g 72.4mm at Llety Brongu in S. Wales on the 9th) and thunderstorms (Pershore reporting 59mm on 28/29th and Boulmer, in Northumberland, 52.2mm on the 31st). The very unsettled conditions continued into August. A few localities in northern Scotland were notably dry in July but to the south of the Great Glen Fault, Atlantic frontal systems penetrated more frequently and, sheltered eastern catchments aside, monthly rainfall totals generally exceeded the average by a significant margin. Parts of south-west Britain and Northern Ireland registered more than twice the July average rainfall. Most regions of the country have registered only one month with below average rainfall in 2008. Correspondingly, rainfall accumulations in the 4-7 month timeframes are notably high, and exceptional for the Jan-July period. In this timeframe, only 2007 has been wetter since 1937 for England and Wales; Scotland registers its 3rd highest rainfall in a series from 1914.

River flows

River flows in responsive rivers generally exhibited a wide range in July – typically, intermittent spate conditions were experienced over the first 10-12 days followed by sustained recessions and, in many catchments, a notable recovery around month end. For July, flood alerts (mostly Flood Watches) were relatively common (e.g. in South Wales) and localised flash flooding was also widely reported, often associated with significant transport disruption (e.g. in the West Midlands where 30mm rain fell in an hour at Smethwick, on the 28th). Previous July maximum flows were eclipsed in a number of index rivers including the Cynon (on the 5th) and Warleggan (on the 9th, in a series from 1969). Very high flows in northern England and southern Scotland were reported on the 30/31st – the River Garnock burst its banks in Ayrshire. In many rivers and streams draining permeable catchments, seasonally very high flows were maintained throughout July (as in 2007) and, for some, monthly runoff totals have remained above average for 20 months or more (e.g. the Kennet). July runoff totals were moderately below average in northern Scotland and parts of the English Lowlands but notably high in most other index catchments. Provisionally, July outflows from England & Wales were the 3rd highest in a 48-year series with particularly high flows in the South West where the Warleggan established a new July maximum. Accumulated runoff accumulations are generally healthy, or very healthy, over a range of timespans; for the year thus far, runoff totals exceed the average in almost index rivers (Cornwall is an exception) with new period-of-record maxima established for the Wharfe, Exe and Tweed (at Norham).

Groundwater

A few eastern aquifer outcrop areas received around average July rainfall but western outcrops were generally much wetter, more than twice the average in some areas – parts of the Cotswolds for instance. Except in the east, soil moisture deficits were mostly below average but still sufficient to preclude all but localised infiltration (e.g. in the South West). Nothwithstanding the erratic recharge patterns during 2008, and the large variation in lag times (between infiltration and water-table response) between aquifer units across the country, groundwater levels during July were mostly within the normal seasonal range, and generally a little above average. Exceptions include Newbridge (Permo-Triassic sandstones) where July levels were notably low and Ampney Crucis (Jurassic Limestone) and Rockley (Chalk) where levels were seasonally high. As a result in permeable catchments, flows have been maintained in many headwater springs and the stream network is much more extensive than in a typical summer. The seasonally low soil moisture deficits in early August imply that, with normal rainfall patterns, a relatively early start to the 2008/09 recharge season may be anticipated (except in a few eastern outcrop areas).

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL
British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

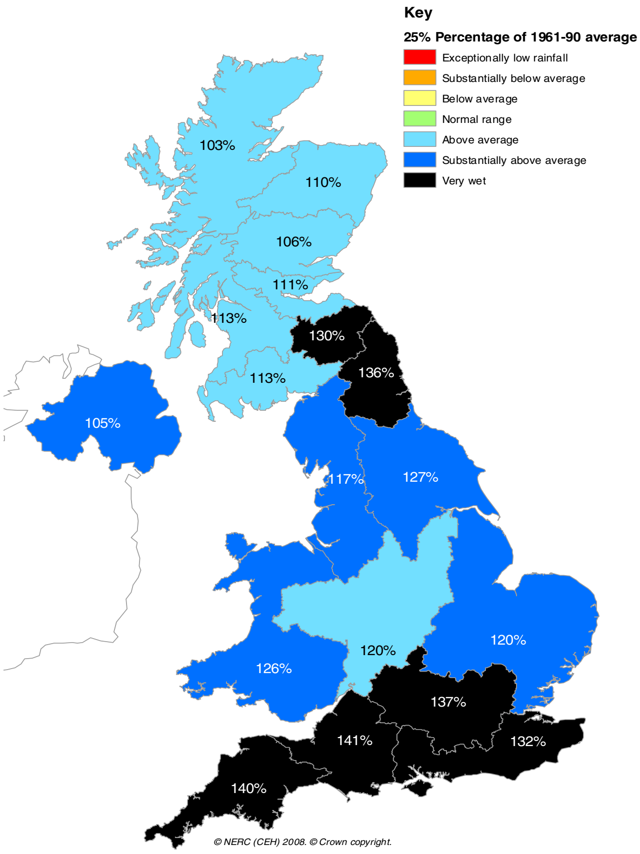
Area	Rainfall	July 2008	Jun 08- Jul 08	RP	Mar 08- Jul 08	RP	Jan 08- Jul 08	RP	Aug 07- Jul 08	RP
England	**mm**	**108**	**172**		**411**		**599**		**927**	
& Wales	%	**174**	**137**	**5-10**	**127**	**20-35**	**126**	**50-80**	**102**	**2-5**
North West	mm	**144**	254		481		784		1285	
	%	**166**	150	15-25	117	5-15	128	30-50	106	2-5
Northumbrian	mm	**137**	227		436		634		924	
	%	**205**	177	40-60	136	20-30	137	>100	107	2-5
Severn Trent	mm	**97**	142		352		511		760	
	%	**175**	124	2-5	120	5-10	122	10-20	99	2-5
Yorkshire	mm	**120**	197		396		613		891	
	%	**194**	159	15-25	127	10-20	136	>100	107	2-5
Anglian	mm	**61**	107		293		392		610	
	%	**121**	105	2-5	120	5-10	118	5-10	101	2-5
Thames	mm	**87**	140		369		487		752	
	%	**174**	134	5-10	137	>100	128	30-40	107	2-5
Southern	mm	**64**	101		362		495		773	
	%	**131**	98	2-5	132	30-40	121	5-15	99	<2
Wessex	mm	**109**	156		418		581		920	
	%	**204**	141	5-10	141	50-80	128	50-80	108	2-5
South West	mm	**176**	225		539		740		1172	
	%	**248**	160	10-20	140	35-50	118	5-15	98	2-5
Welsh	mm	**138**	225		553		861		1347	
	%	**171**	139	5-10	126	5-15	126	10-20	100	2-5
Scotland	**mm**	**109**	**219**		**514**		**956**		**1594**	
	%	**114**	**121**	**5-10**	**108**	**5-10**	**130**	**35-50**	**108**	**5-15**
Highland	mm	**87**	204		570		1135		1968	
	%	**81**	99	2-5	103	2-5	132	20-30	113	10-20
North East	mm	**86**	173		407		662		1107	
	%	**112**	118	2-5	110	2-5	122	30-40	107	5-10
Tay	mm	**107**	202		450		881		1327	
	%	**130**	127	5-10	106	2-5	131	20-30	103	2-5
Forth	mm	**114**	209		427		804		1259	
	%	**148**	140	5-10	111	2-5	137	30-40	110	5-10
Tweed	mm	**132**	237		466		743		1115	
	%	**177**	167	30-40	130	15-25	140	>100	111	5-10
Solway	mm	**141**	256		523		910		1489	
	%	**153**	144	5-15	113	5-10	127	25-40	104	2-5
Clyde	mm	**146**	275		616		1131		1866	
	%	**128**	130	5-10	113	5-10	132	20-30	107	5-10
Northern	**mm**	**124**	**195**		**395**		**641**		**1059**	
Ireland	%	**174**	**135**	**5-10**	**105**	**2-5**	**112**	**2-5**	**96**	**2-5**

% = percentage of 1961-90 average *RP = Return period*

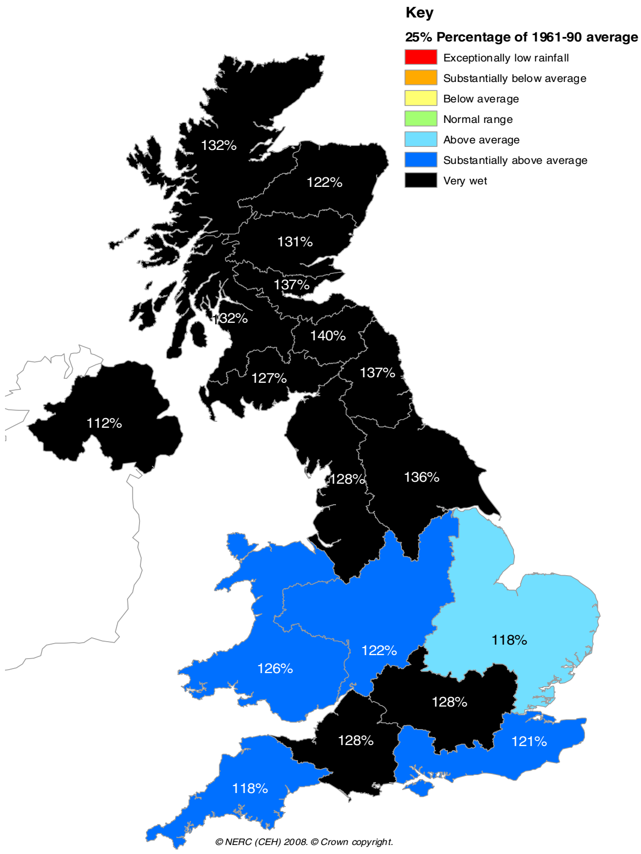
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following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

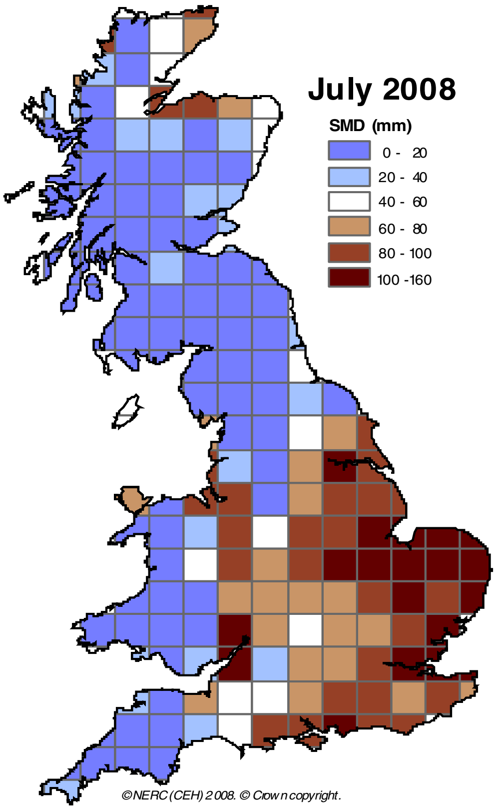
March - July 2008



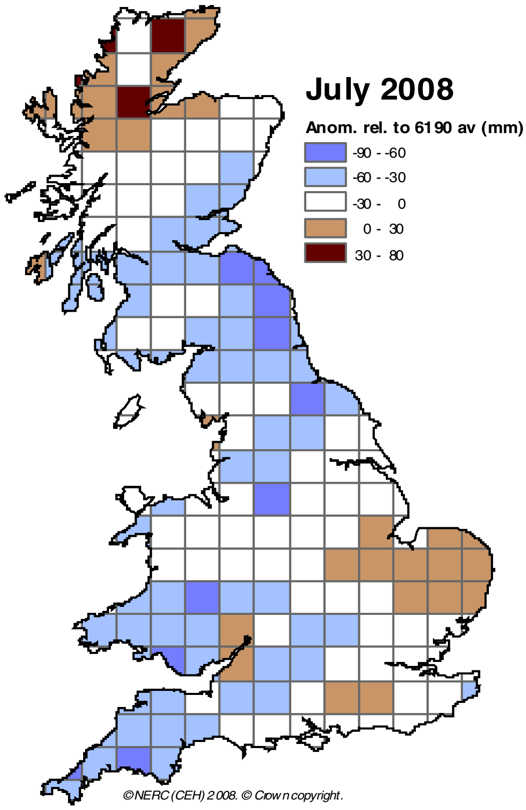
January- July 2008



MORECS Soil Moisture Deficit

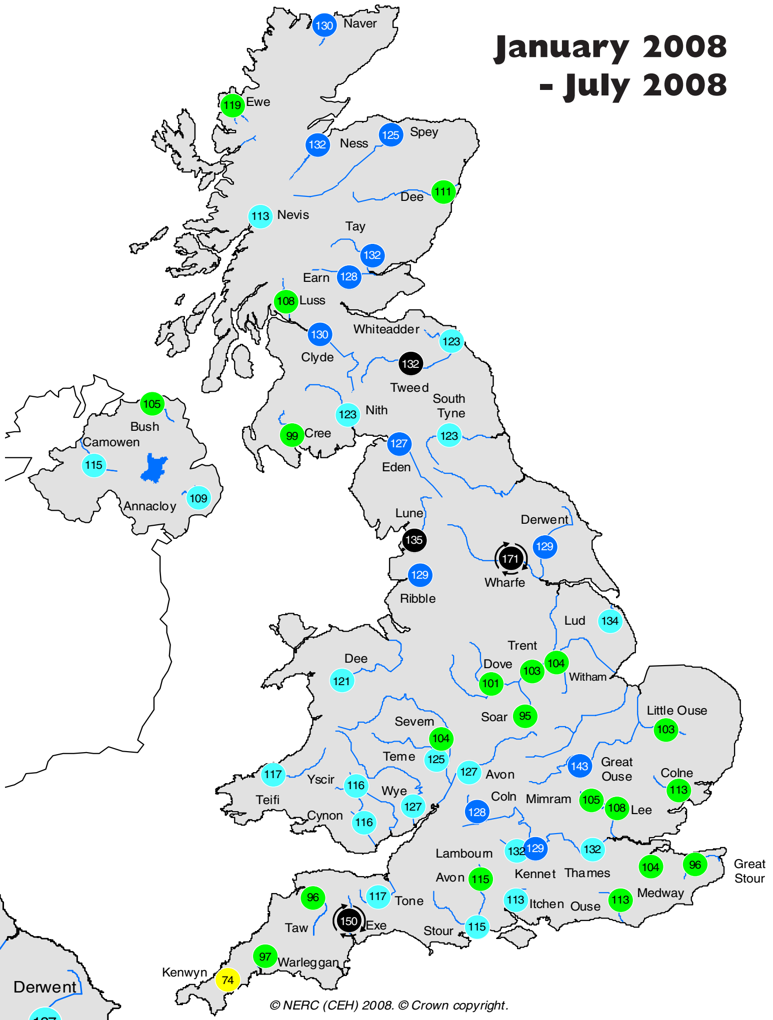


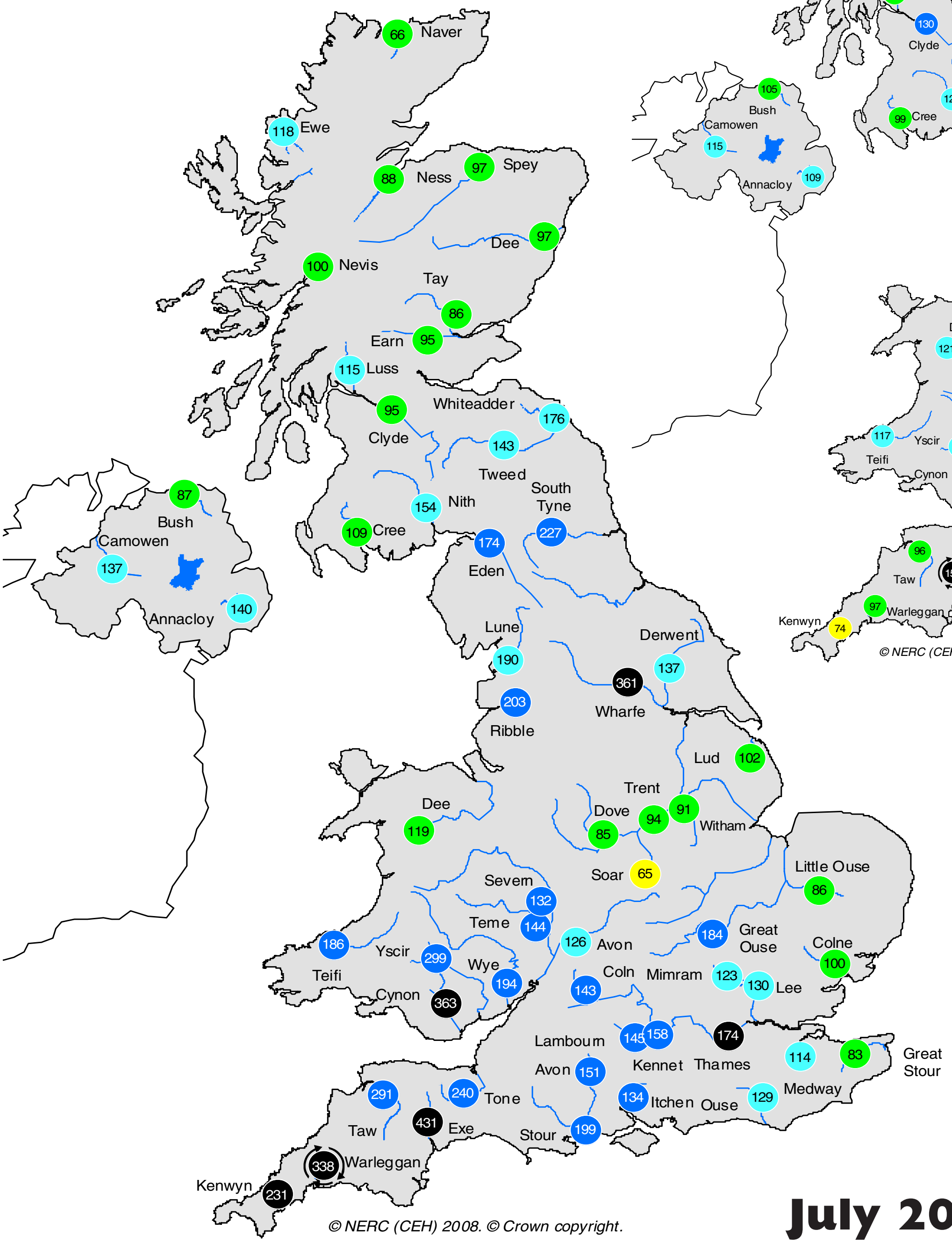
MORECS Soil Moisture Deficit Anomaly



River flow . . . River flow . . .

January 2008 - July 2008





July 2008

Key

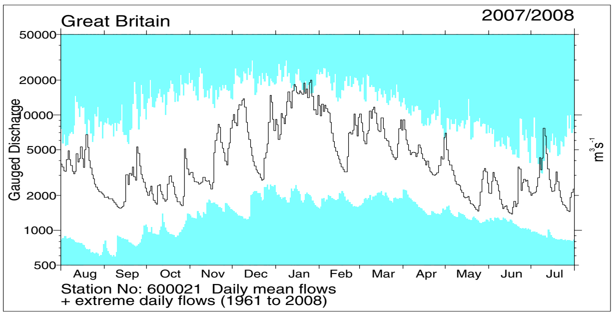
- 25 — % of long-term average (record figure when circled)
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

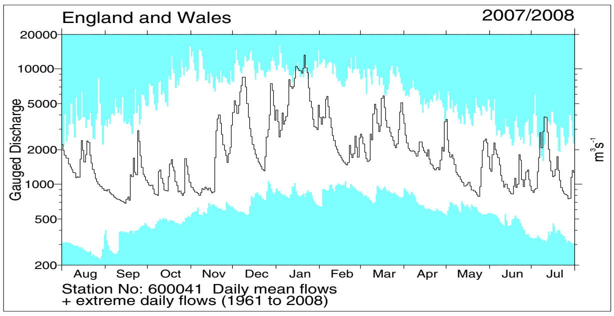
*Based on ranking of the monthly flow**

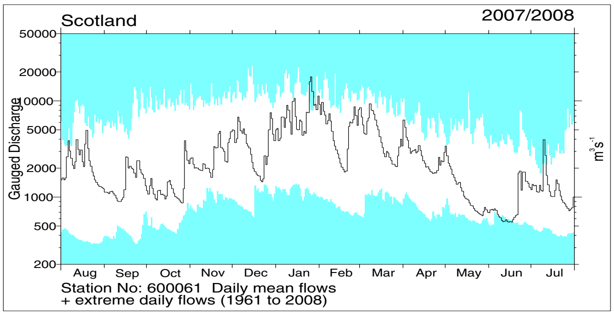
River flows

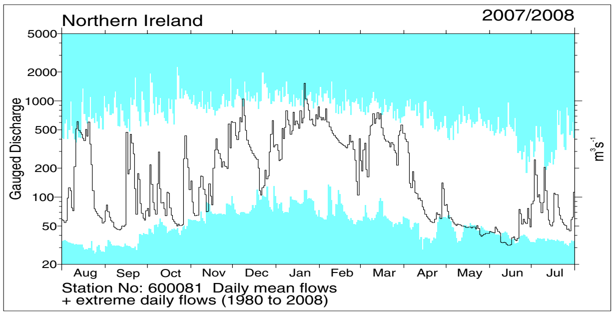
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

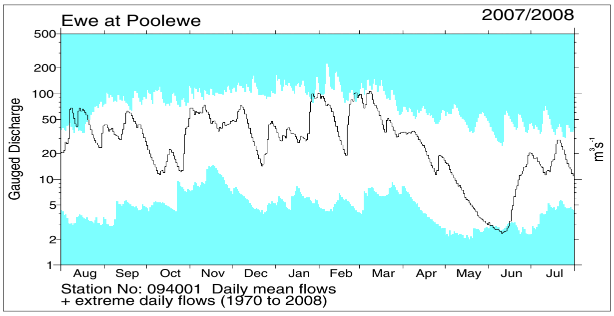
River flow . . . River flow . . .

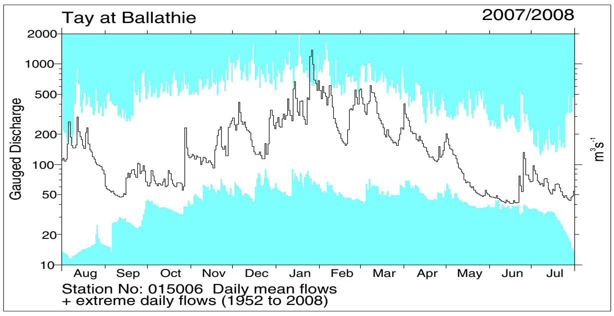


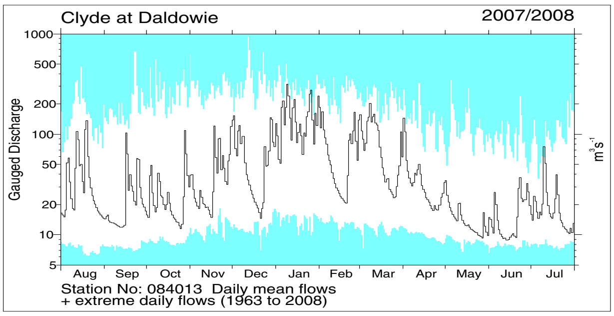


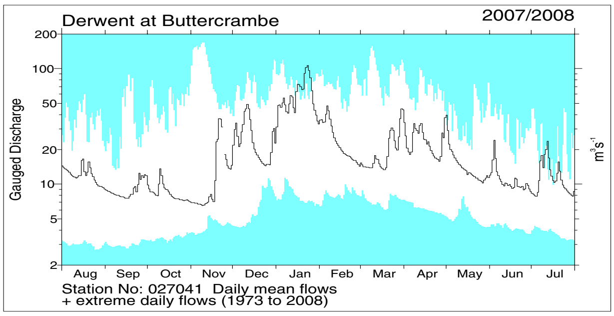


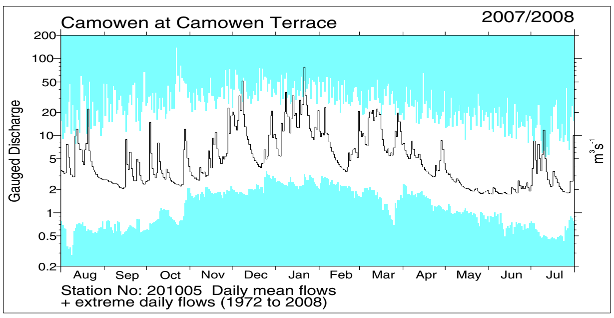


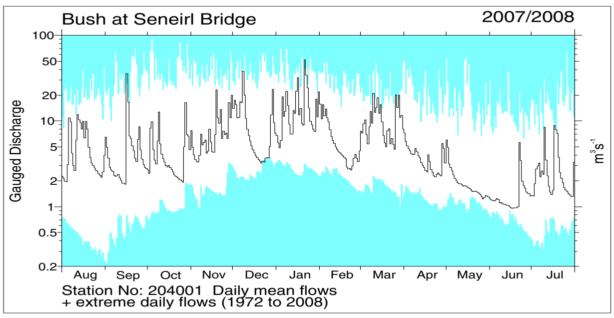






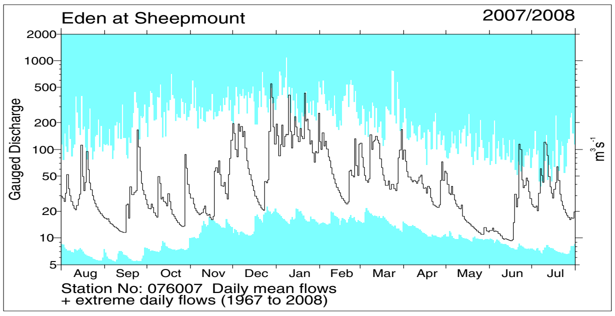


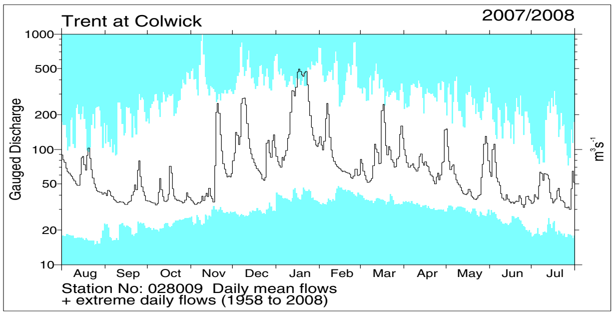


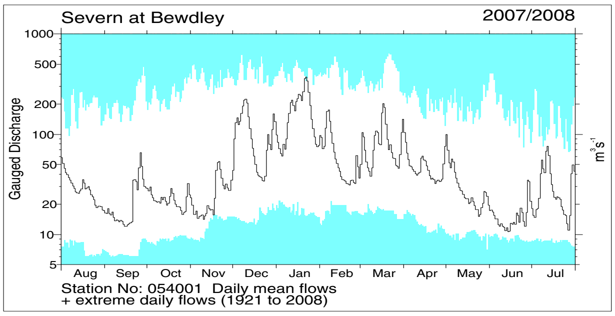


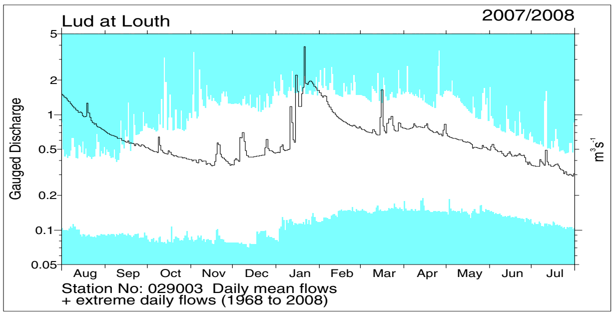
River flow hydrographs

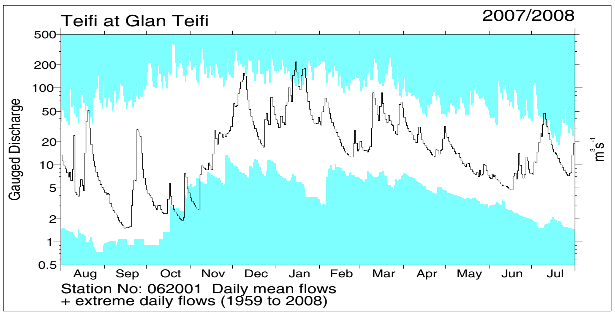
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to August 2007 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

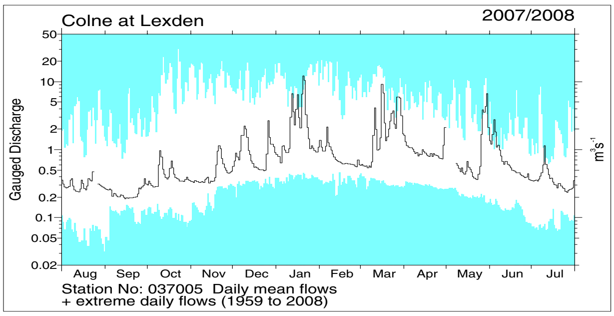


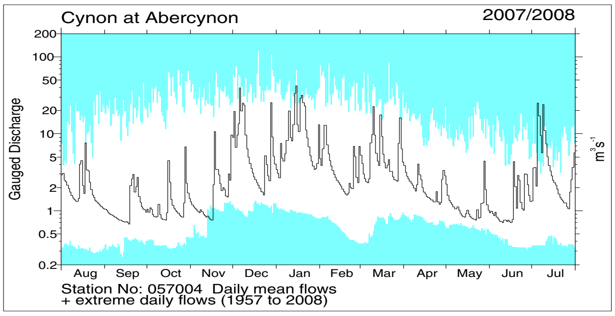


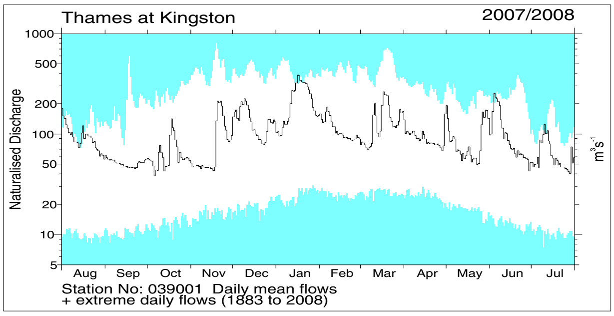


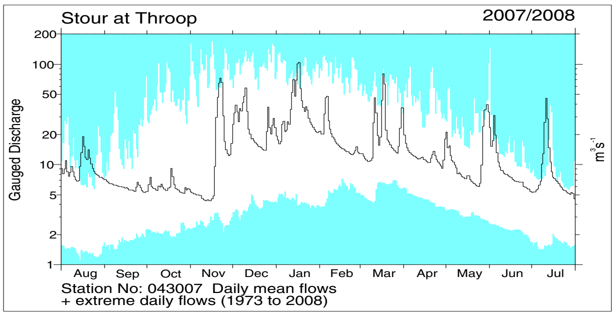


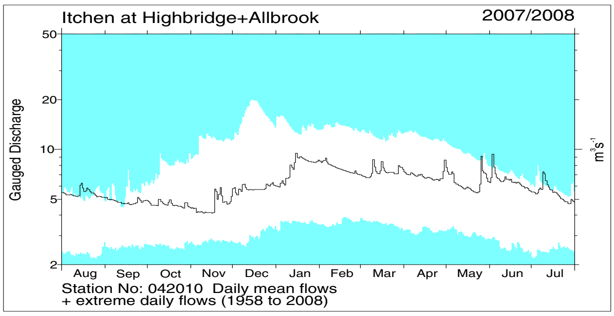










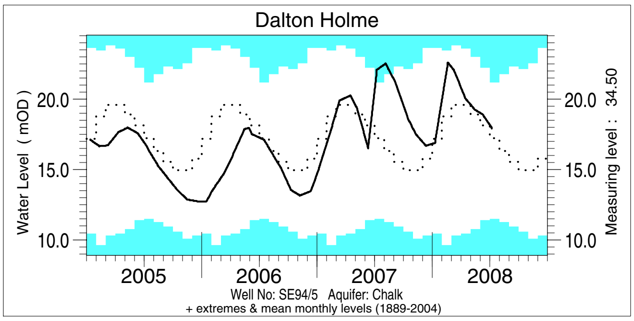


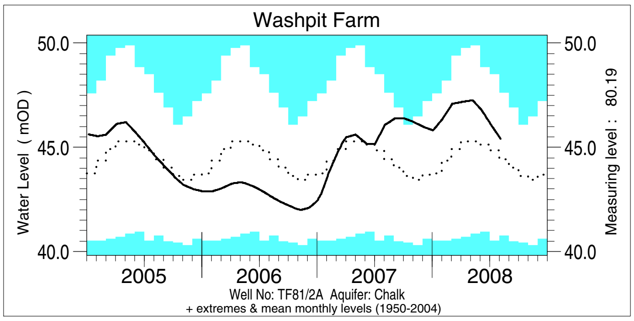
Notable runoff accumulations (a) June - July 2008, (b) January - July 2008

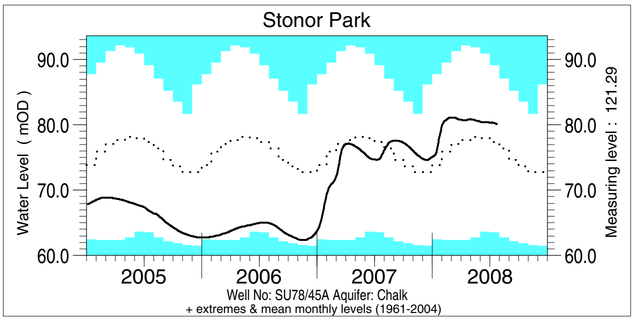
	River	%lta	Rank
a)	Bedford Ouse	260	75/76
	Lee	135	106/123
	Thames	194	122/126
	Blackwater	150	52/56
	Kennet	157	45/47
	Itchen	133	48/50
	Avon (Amesbury)	146	41/44
	Stour	173	34/36
a)	Dart	279	50/50
	Warleggan	211	38/39
	Tone	180	46/48
	Brue	222	40/44
	Cynon	208	49/50
	L Bann	51	3/28
b)	Tyne (Spilmersford)	147	43/44
	Tweed (Norham)	138	49/49
	Wharfe	171	53/53
	Lymington	143	47/48
	Exe	150	52/52
	Lune	135	47/48
	Clyde (Blairston)	145	47/48

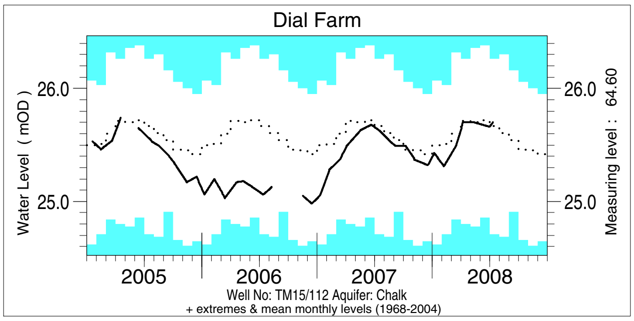
lta = long term average
Rank 1 = lowest on record

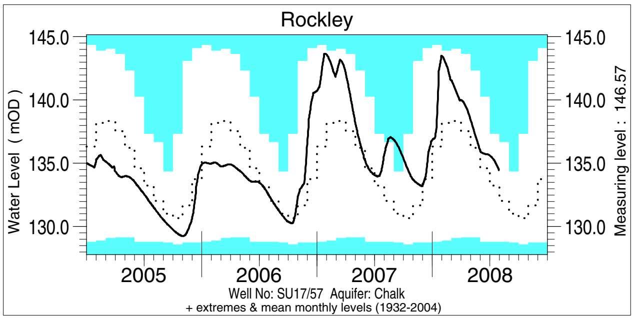
Groundwater . . . Groundwater

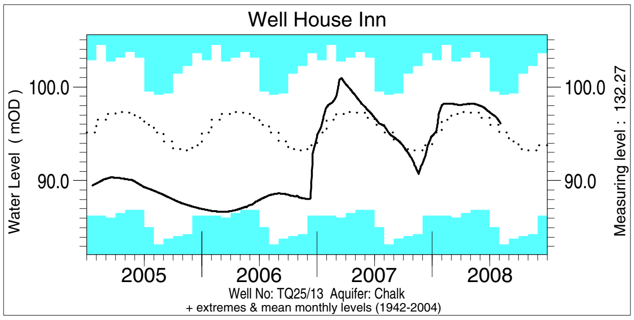


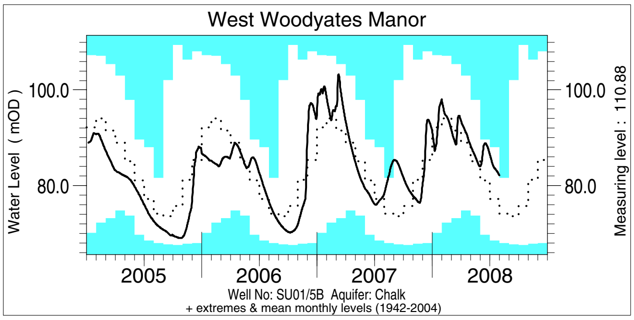


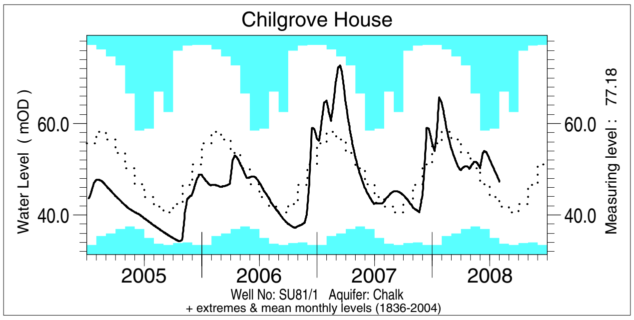


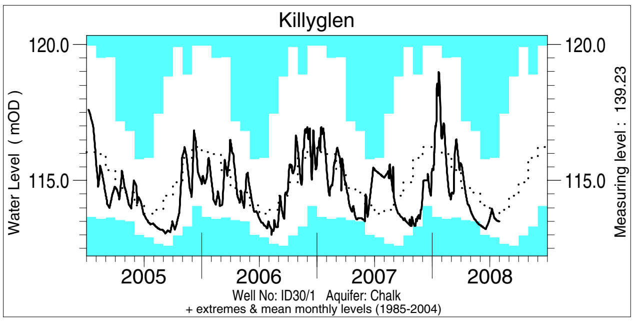


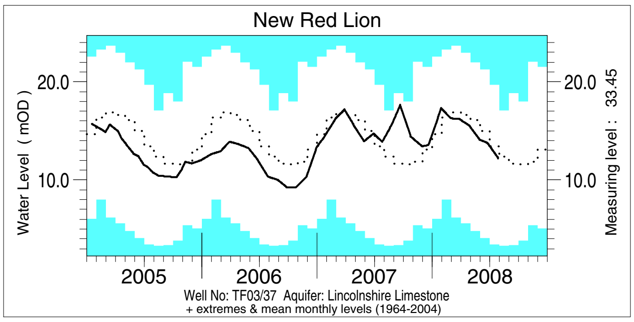






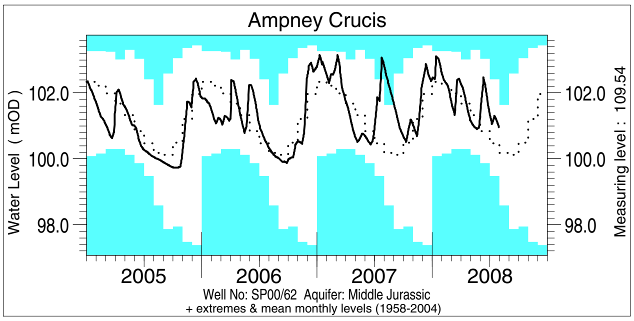


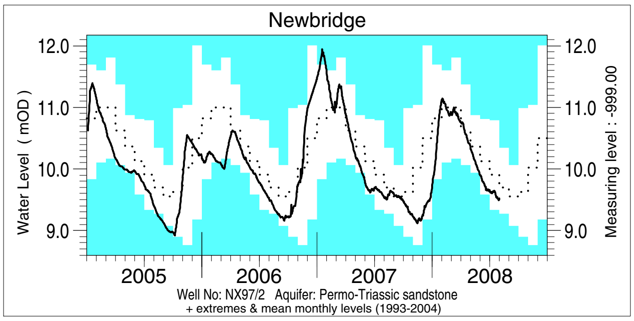


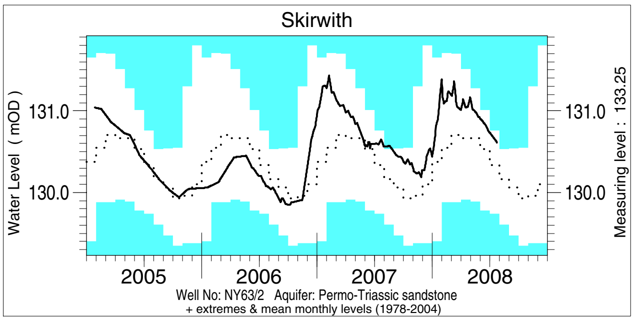


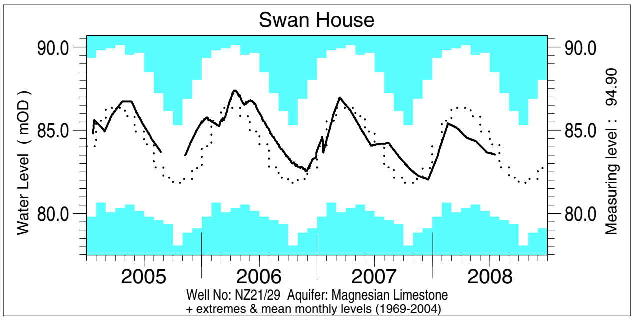
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

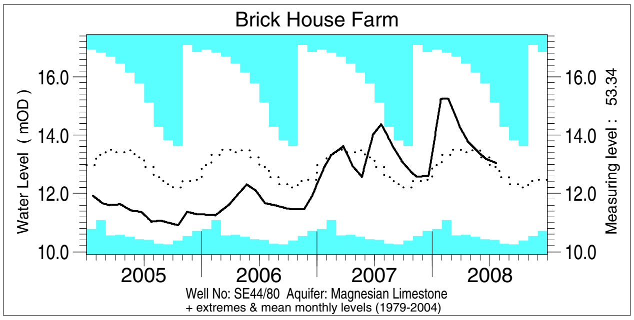
Groundwater . . . Groundwater

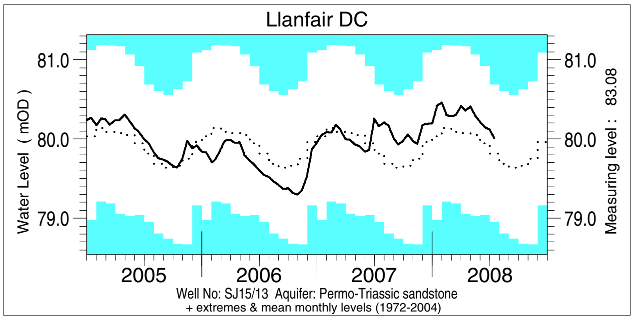


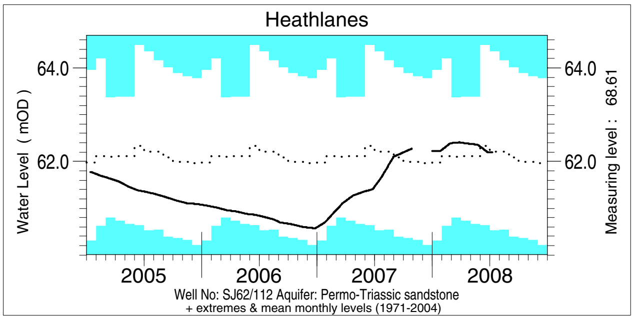


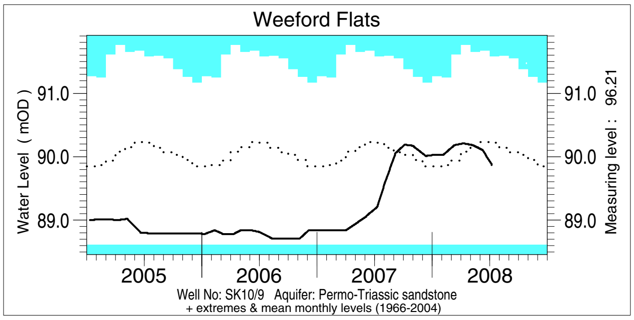


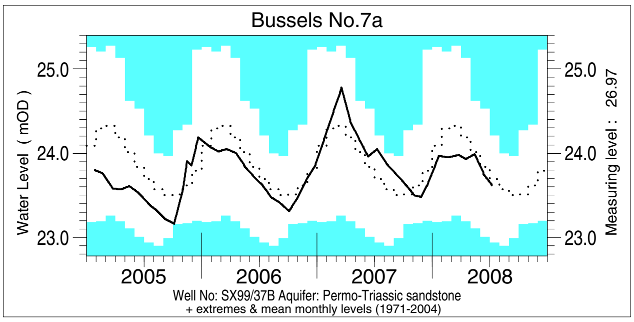


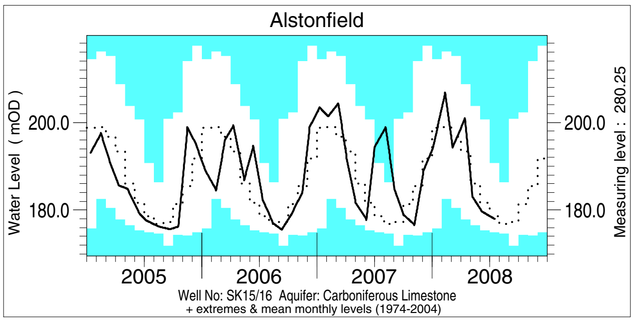








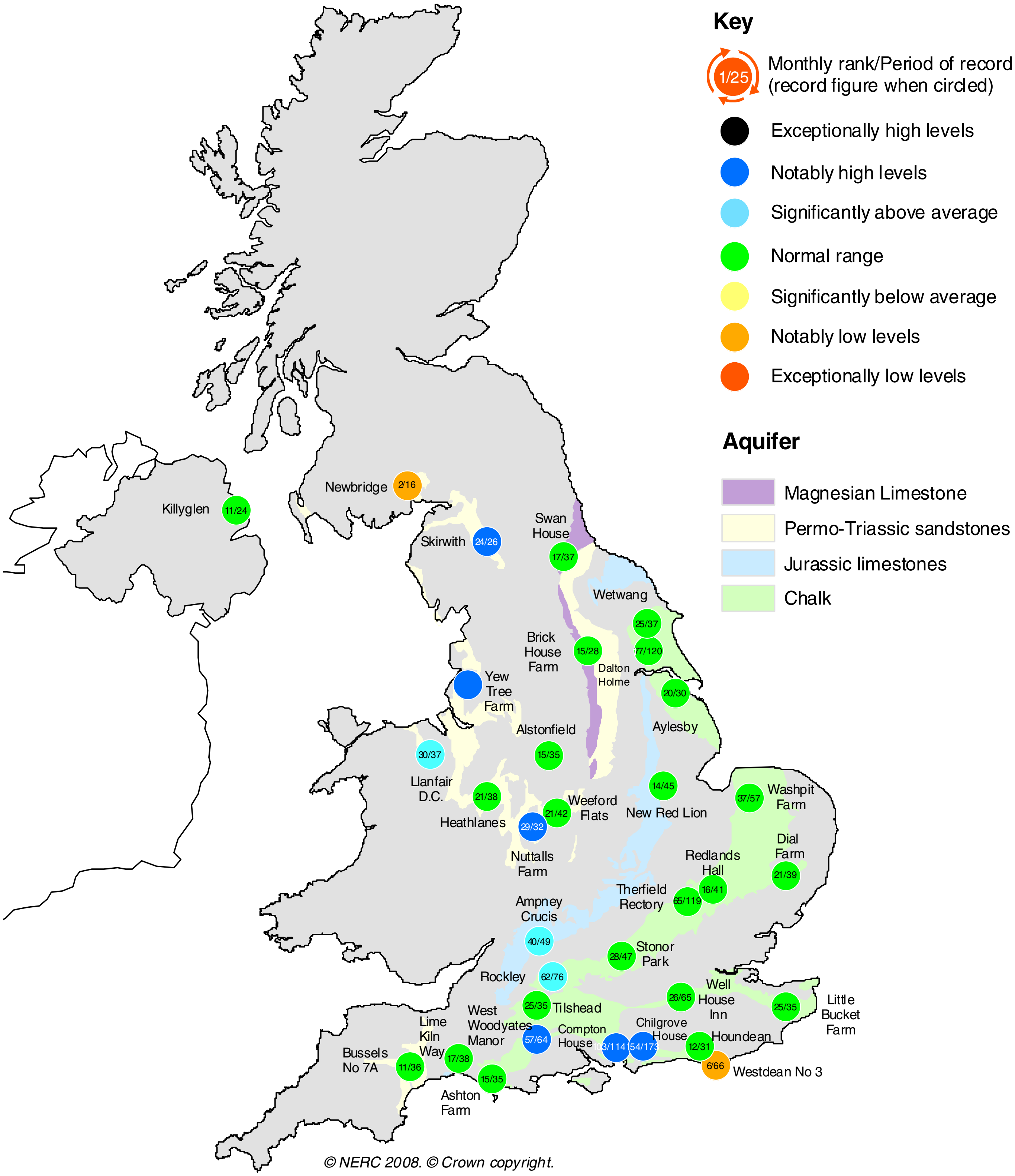




Groundwater levels July / August 2008

Borehole	Level	Date	Jul. av.	Borehole	Level	Date	Jul. av.	Borehole	Level	Date	Jul. av.
Dalton Holme	17.92	08/07	17.23	Chilgrove House	47.23	01/08	43.56	Brick House Farm	13.04	22/07	12.82
Washpit Farm	45.40	04/08	44.88	Killyglen (NI)	113.49	31/07	113.80	Llanfair DC	80.01	15/07	79.76
Stonor Park	80.10	23/07	77.10	New Red Lion	12.19	28/07	13.28	Heathlanes	62.20	10/07	62.13
Dial Farm	25.70	11/07	25.65	Ampney Crucis	100.95	30/07	100.47	Weeford Flats	89.87	08/07	89.88
Rockley	134.46	30/07	133.22	Newbridge	9.52	01/08	9.82	Bussels No.7a	23.62	08/07	23.72
Well House Inn	96.10	04/08	95.76	Skirwith	130.61	24/07	130.27	Alstonfield	177.95	17/07	179.69
West Woodyates	82.11	31/07	76.97	Swan House	83.52	18/07	83.64				

Levels in metres above Ordnance Datum



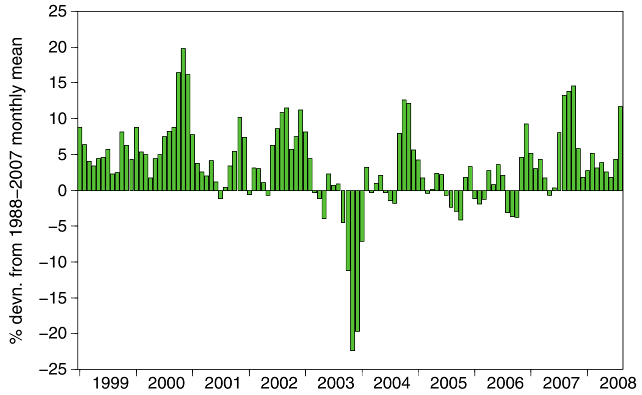
Groundwater levels - July 2008

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.

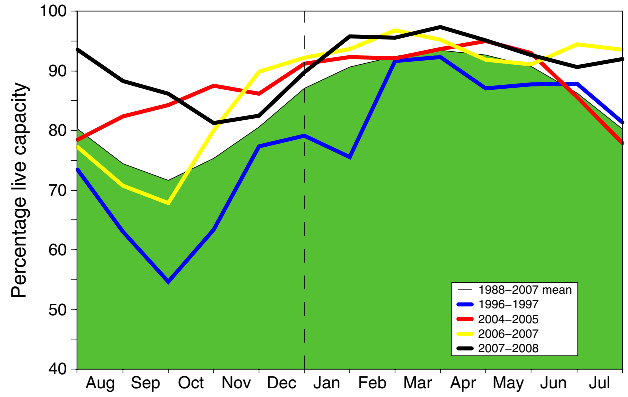
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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 Jun	Jul	Aug	Aug Anom.	Min. Aug	Year* of min.	2007 Aug	Diff 08-07
North West	N Command Zone	• 124929	79	74	**72**	10	38	1989	85	-13
	Vyrnwy	55146	90	89	**90**	14	56	1996	96	-6
Northumbrian	Teesdale	• 87936	87	88	**92**	22	45	1989	98	-6
	Kielder	(199175)	(92)	(94)	**(99)**	11	(66)	1989	(94)	5
Severn Trent	Clywedog	44922	100	100	**98**	14	57	1989	100	-2
	Derwent Valley	• 39525	92	84	**85**	12	43	1996	100	-15
Yorkshire	Washburn	• 22035	88	85	**91**	18	50	1995	95	-4
	Bradford supply	• 41407	89	85	**95**	25	38	1995	97	-2
Anglian	Grafham	(55490)	(96)	(95)	**(96)**	7	(66)	1997	(94)	2
	Rutland	(116580)	(93)	(91)	**(84)**	-1	(74)	1995	(94)	-10
Thames	London	• 202828	98	96	**94**	9	73	1990	82	12
	Farmoor	• 13822	93	95	**98**	2	84	1990	94	4
Southern	Bewl	28170	99	95	**88**	12	45	1990	83	5
	Ardingly	4685	100	99	**94**	8	65	2005	100	-6
Wessex	Clatworthy	5364	90	99	**99**	27	43	1992	100	-1
	Bristol WW	• (38666)	(89)	(87)	**(87)**	13	(53)	1990	(96)	-9
South West	Colliford	28540	93	92	**98**	22	47	1997	82	16
	Roadford	34500	90	88	**93**	15	46	1996	99	-6
	Wimbleball	21320	100	96	**97**	20	53	1992	100	-3
	Stithians	5205	80	72	**71**	2	39	1990	90	-19
Welsh	Celyn and Brenig	• 131155	99	96	**96**	9	65	1989	100	-4
	Brianne	62140	96	89	**98**	10	67	1995	100	-2
	Big Five	• 69762	90	90	**95**	20	41	1989	98	-3
	Elan Valley	• 99106	94	89	**95**	13	63	1989	99	-4
Scotland(E)	Edinburgh/Mid Lothian	• 97639	93	89	**90**	9	51	1998	91	-1
	East Lothian	• 10206	100	99	**98**	11	72	1992	100	-2
Scotland(W)	Loch Katrine	• 111363	74	68	**63**	-11	53	2000	70	-7
	Daer	22412	85	80	**90**	12	58	1994	100	-10
	Loch Thom	• 11840	88	81	**80**	-2	59	2000	71	9
Northern	Total+	• 67270	69	61	**68**	-8	54	1995	86	-18
Ireland	Silent Valley	• 20634	66	58	**71**	2	42	2000	92	-21

() figures in parentheses relate to gross storage • denotes reservoir groups +excludes Lough Neagh *last occurrence

Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2006 period except for West of Scotland and Northern Ireland where data commence in the mid-1990's. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map

National Hydrological Monitoring Programme

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

Data Sources

River flow and groundwater level data are provided by the Environment Agency, the Environment Agency Wales, the Scottish Environment Protection Agency and, for Northern Ireland, the Rivers Agency and the Northern Ireland Environment Agency. In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision). Reservoir level information is provided by the Water Service Companies, the EA, Scottish Water and Northern Ireland Water.

The National River Flow Archive (maintained by CEH Wallingford) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

Rainfall

Most rainfall data are provided by the Met Office (see opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Following the discontinuation of the Met Office's CARP system in July 1998, the areal rainfall figures have been derived using several procedures, including initial estimates based on MORECS*. Recent figures have been produced by the Met Office, National Climate Information Centre (NCIC), using a technique similar to CARP. A significant number of additional monthly raingauge totals are provided by the EA and SEPA to help derive the contemporary regional rainfalls. Revised monthly national and regional rainfall totals for the post-1960 period (together with revised 1961-90 averages) were made available by the Met Office in 2004; these have been adopted by the NHMP. As with all regional figures based on limited raingauge networks the monthly tables and accumulations (and the return periods associated with them) should be regarded as a guide only.

NATURAL ENVIRONMENT RESEARCH COUNCIL

*MORECS is the generic name for the Met Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

The Met Office
FitzRoy Road
Exeter
Devon
EX1 3PB

Tel.: 0870 900 0100 Fax: 0870 900 5050
E-mail: enquiries@metoffice.com

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:

Hydrological Summaries
National Water Archive
CEH Wallingford
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB

Tel.: 01491 838800
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

08/08