Hydrological Summary
for the United Kingdom

May 2009

General

May was a mild and sunny month with high pressure dominating for extended periods in much of southern Britain. Correspondingly, some southern catchments registered less than half the average May rainfall – contributing to the 3rd driest Dec-May period for England & Wales since 1976. Fortunately, the May rainfall patterns generally favoured the gathering grounds of many upland reservoirs and some seasonally notable increases in stocks were registered (e.g. in the Lake District and North Wales). All index reservoirs in Scotland and Northern Ireland reported above average early June stocks and overall stocks for England & Wales are appreciably above the early summer average. The apparent inconsistency with the scale of the recent rainfall deficiencies owes much to the record reservoir stocks registered in the autumn of 2008. River flow patterns were typical of the late spring but depressed runoff rates characterised some impermeable eastern and southern catchments by the end of May. Seasonally high evaporative demands contributed to above average soil moisture deficits across much of the country by month-end, terminating the 2008/09 aquifer recharge season across the greater part of the UK. Groundwater levels are following typical recession patterns across most major aquifers. Overall water resources status is well within the normal early June range but a hot dry summer could impact particularly on flows in responsive rivers.

Rainfall

High pressure extending from the continent was a persistent feature of synoptic patterns during May – ensuring that most Atlantic frontal systems followed relatively northerly tracks. This pattern was established early in the month: whilst Scotland was wet (Tyndrum, in Perthshire, recording >90mm of rain from the 6-8th), much of the English Lowlands experience breezy and dull conditions but with very little rainfall – some localities (e.g. south Oxon) reporting accumulations of <1mm over the first 13 days of May. A low pressure system brought intense downpours to much of the English Lowlands on the 14/15th but stable conditions then became re-established heralding notably dry and warm conditions around month end. The synoptic patterns are directly reflected in the May rainfall totals. In Scotland, parts of the western Highlands recorded >200% of the monthly average whilst rainfall totals were an order of magnitude lower in a catchments in southern and eastern England. The UK May rainfall was near-average but substantial medium-term rainfall deficiencies characterise large parts of the country; a few areas, mostly in eastern Britain, have recorded seven successive months with below average rainfall. Provisional figures indicate that England & Wales experienced its driest spring (March-May) since 1996 and, over the Nov-May period, rainfall accumulations are the lowest since 1989 in much of north east England, extending into eastern Scotland. In this timeframe the Welsh region reported its 2nd lowest rainfall since 1976. Importantly, particularly in a water resources context, 12-month rainfall accumulations are close to, or above, average in all regions of the country.

River Flows

May witnessed typical late-spring river flow patterns – seasonal recessions punctuated by spates, particularly around mid-month. At the national scale, the monthly runoff was very close to the May average but spatial variability in runoff rates was large, reflecting contrasts in both rainfall patterns and the geological characteristics of individual catchments. Moderate spates were common; in Northern Ireland, the Mourne eclipsed its previous May maximum on the 5th and, on the 9th, the Ness registered its 3rd highest May peak flow in a 36-year series. Further spates occurred around the 15th mainly in southern catchments, but these were mostly very modest affairs. By month-end flows were approaching late-May minima in a number of responsive eastern rivers (e.g. the Whiteadder). May runoff totals exhibited wide regional, and more local, variability; generalising broadly, well above average totals typified many western catchments whilst depressed totals characterised much of eastern Britain. Flows generally held up well in most groundwater-fed streams and rivers but runoff totals were well below average in many impermeable catchments; the Tone registered its 2nd lowest May runoff since 1976. Estimated outflows for England & Wales were the lowest since 1990 for the spring (Mar-May) period and the focus of moderate hydrological stress is well captured by Jan-May runoff accumulations – runoff being relatively depressed in a broad swathe from Devon to south-east Scotland.

Groundwater

By the end of May soil moisture deficits were considerably above the late spring average across most major aquifer outcrop areas. Correspondingly, infiltration during May was minimal and groundwater level recessions were entrenched by month-end. The differing storage characteristics (both between and within aquifers) are reflected in the May groundwater levels. In most Chalk index wells levels were within the normal late spring range but relatively low in, for example, the fast-responding Chilgrove well. By contrast, the dry spring has yet to significantly impact on the deep and slow-responding Therfield well. Generally, late-spring groundwater levels were below average in the major limestone aquifers and, exceptionally, in the Middle Jurassic Limestone of the Cotswolds, Ampney Crucis reported its lowest May level since 1976. In the Permo-Triassic sandstones, groundwater levels are mostly in the normal range but healthier in the slow-responding outcrops across the Midlands than in the more northern outcrops; in southern Scotland, Newbridge reported its lowest May level (in a relatively short record). Only localised recharge is now likely to occur until the autumn – when the dryness of the soils will be very influential in determining the onset of seasonal recharge.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

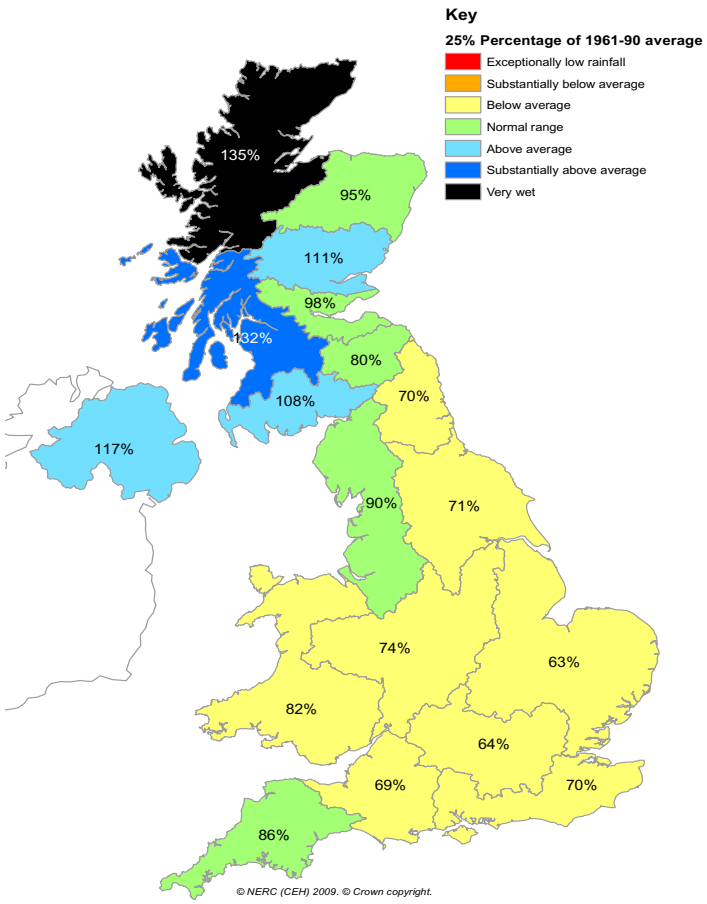
Area	Rainfall	May 2009	Mar 09 - May 09		Jan 09 - May 09		Nov 08 - May 09		Jun 08 - May 09	
England & Wales	**mm**	**58**	**148**		**288**		**439**		**946**	
	%	**92**	**75**	**2-5**	**82**	**5-10**	**82**	**5-10**	**104**	**2-5**
North West	mm	**101**	219		370		559		1325	
	%	**133**	90	2-5	84	2-5	81	5-10	109	2-5
Northumbrian	mm	**55**	135		252		382		977	
	%	**88**	70	2-5	75	5-10	76	5-15	113	5-10
Severn Trent	mm	**56**	132		235		369		795	
	%	**93**	74	2-5	77	5-10	81	5-10	104	2-5
Yorkshire	mm	**62**	133		238		372		882	
	%	**101**	71	2-5	73	5-15	76	5-15	106	2-5
Anglian	mm	**38**	90		188		298		603	
	%	**79**	63	5-10	81	2-5	86	2-5	100	<2
Thames	mm	**39**	105		235		362		699	
	%	**69**	64	5-10	85	2-5	88	2-5	100	<2
Southern	mm	**36**	119		291		436		752	
	%	**67**	70	2-5	95	2-5	92	2-5	96	2-5
Wessex	mm	**40**	127		288		435		867	
	%	**65**	69	5-10	84	2-5	84	2-5	102	2-5
South West	mm	**62**	211		436		618		1266	
	%	**84**	86	2-5	90	2-5	82	5-10	106	2-5
Welsh	mm	**87**	226		419		636		1422	
	%	**103**	82	2-5	81	5-10	77	10-20	106	2-5
Scotland	**mm**	**128**	**358**		**601**		**885**		**1597**	
	%	**149**	**121**	**10-20**	**108**	**2-5**	**102**	**2-5**	**109**	**5-10**
Highland	mm	**155**	468		775		1183		1922	
	%	**165**	135	20-30	119	5-10	113	5-10	110	5-10
North East	mm	**88**	212		372		551		1033	
	%	**120**	95	2-5	94	2-5	92	2-5	100	<2
Tay	mm	**123**	298		499		701		1301	
	%	**142**	111	2-5	97	2-5	91	2-5	101	2-5
Forth	mm	**98**	231		381		526		1207	
	%	**129**	98	2-5	87	2-5	79	5-15	105	2-5
Tweed	mm	**70**	173		328		468		1160	
	%	**96**	80	2-5	85	2-5	81	5-10	116	5-15
Solway	mm	**115**	309		544		778		1661	
	%	**131**	108	2-5	101	2-5	93	2-5	116	10-20
Clyde	mm	**161**	443		704		1013		1889	
	%	**169**	132	10-20	109	2-5	99	2-5	108	5-10
Northern Ireland	**mm**	**96**	**269**		**434**		**596**		**1261**	
	%	**132**	**117**	**5-10**	**102**	**2-5**	**93**	**2-5**	**115**	**10-20**

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

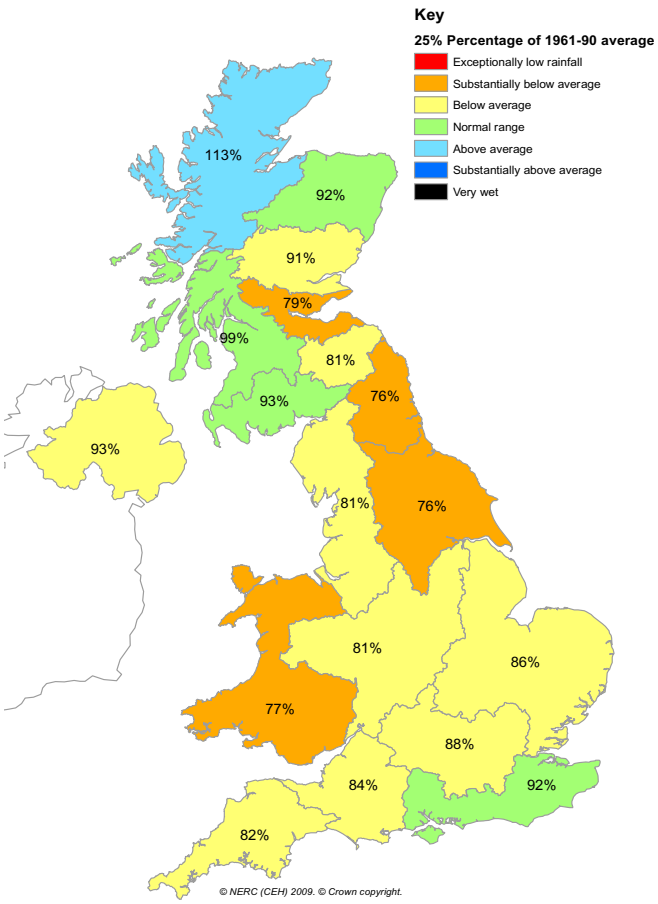
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following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

Rainfall . . . Rainfall . . .

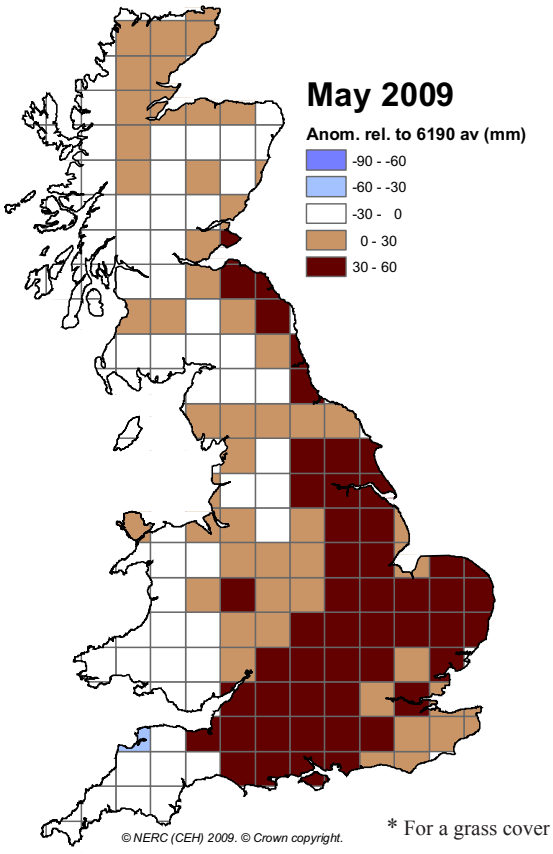
March - May 2009



November 2008 - May 2009



MORECS Soil Moisture Deficits *



* For a grass cover

Met Office Summer 2009 forecast

Forecast for the Summer 2009:
updated 28 May 2009

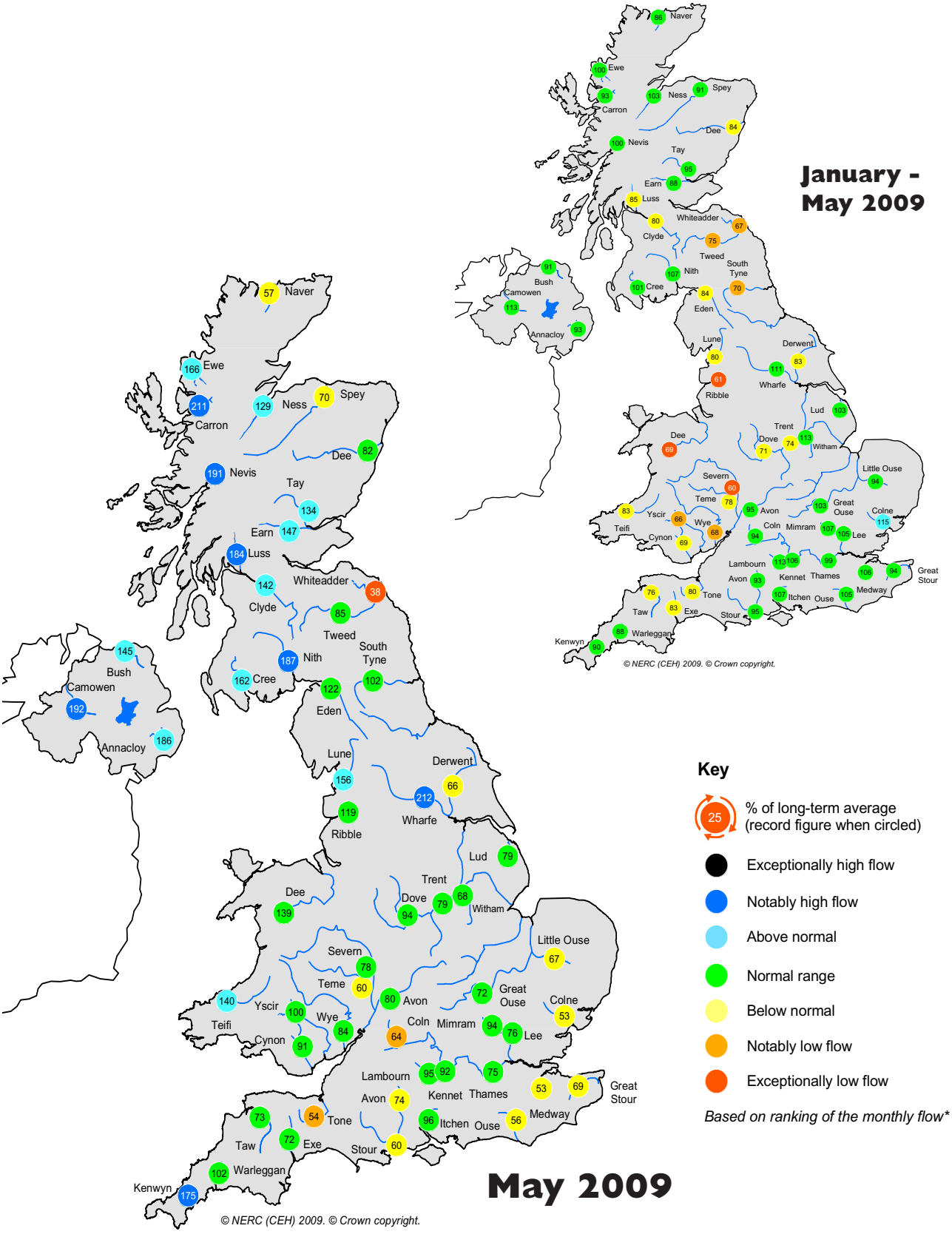
Temperature
For the UK and much of Europe temperatures are likely to be above average.

Rainfall
For the UK and much of western Europe rainfall is likely to be near or below average. A repeat of the very wet summers of 2007 and 2008 is unlikely.

Below-average rainfall is likely over eastern Europe.

Updates and reviews of the forecast
The summer forecast will be updated by 11 a.m. on 30 June 2009.
For further details please visit:
http://www.metoffice.gov.uk/science/creating/monthsahead/seasonal/2009/summer.html

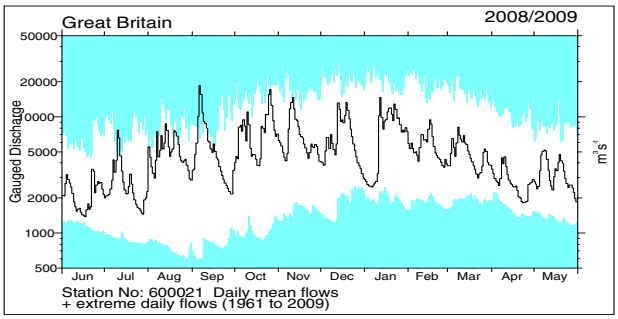
River flow . . . River flow . . .

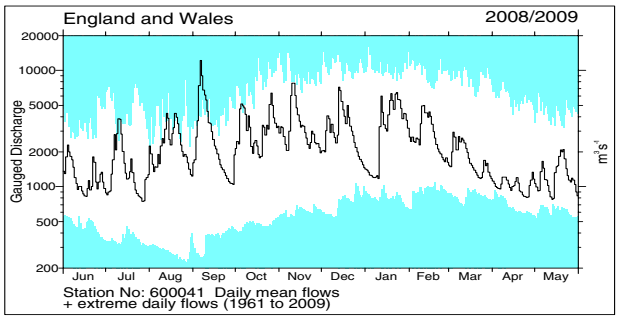


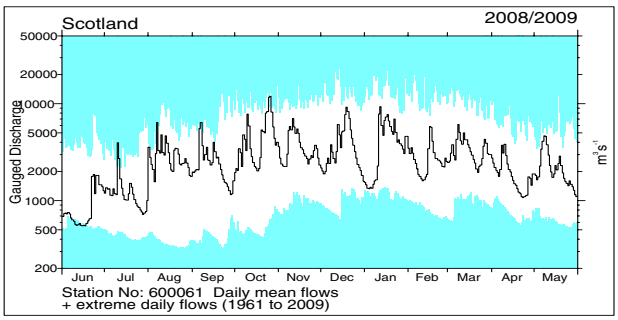
River flows

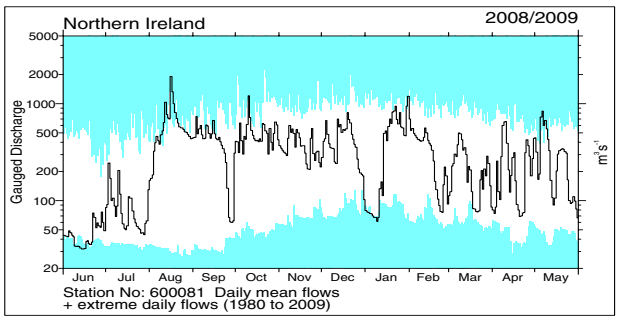
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

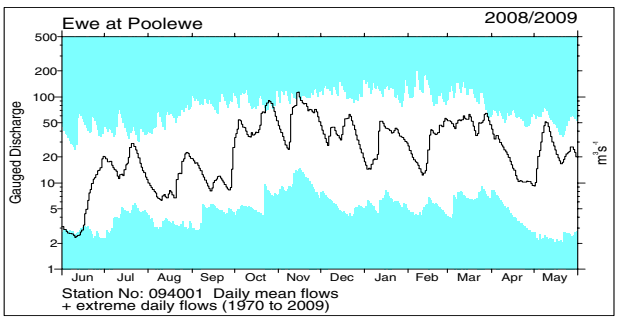
River flow . . . River flow . . .

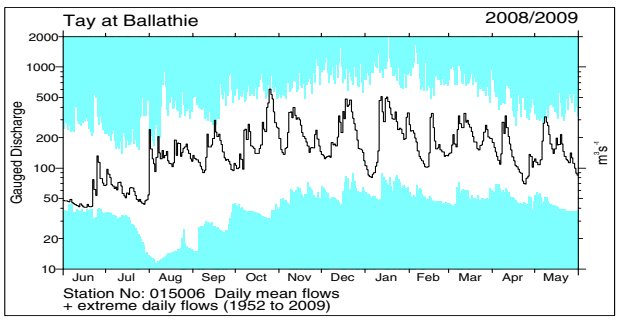


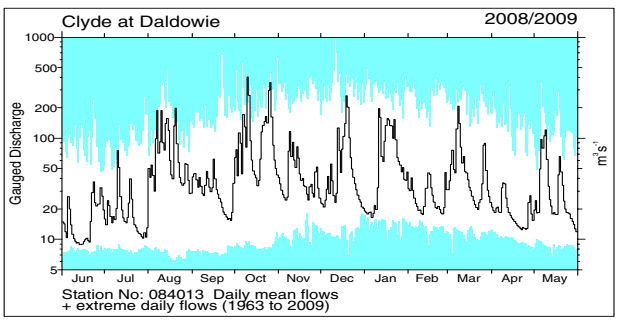


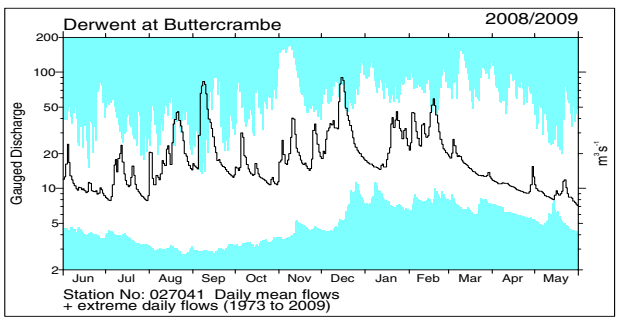


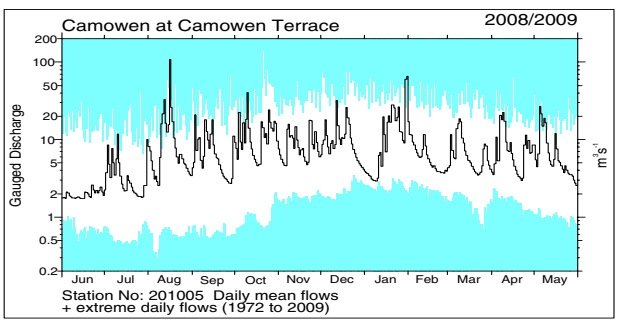


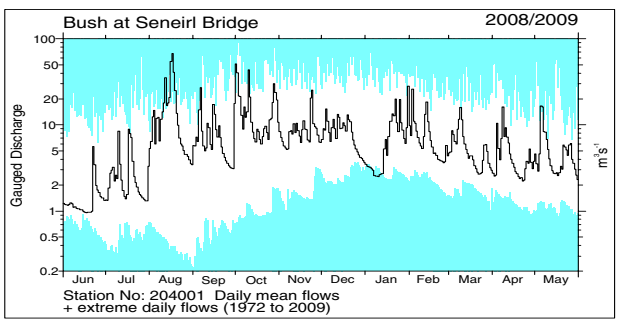








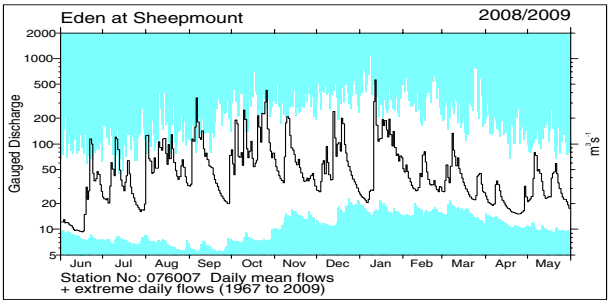


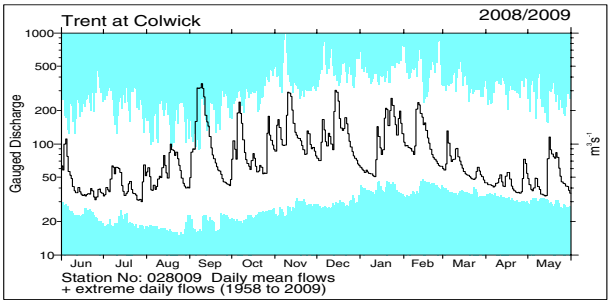


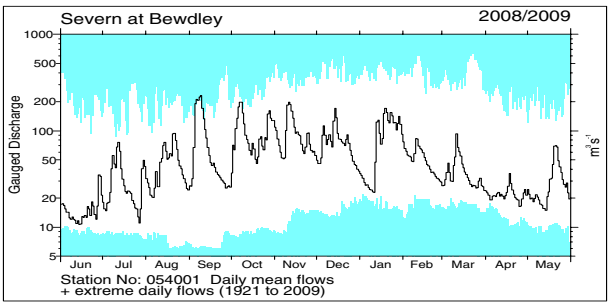
River flow hydrographs

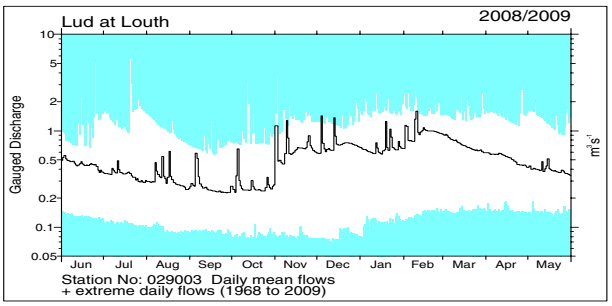
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to June 2008 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

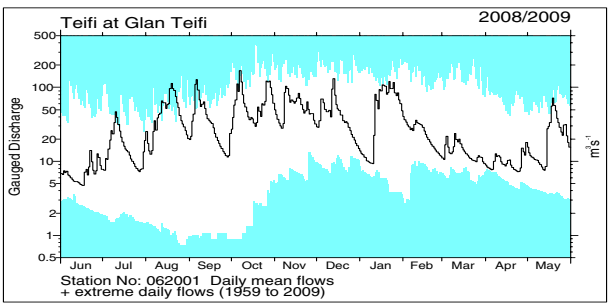
River flow . . . River flow . . .

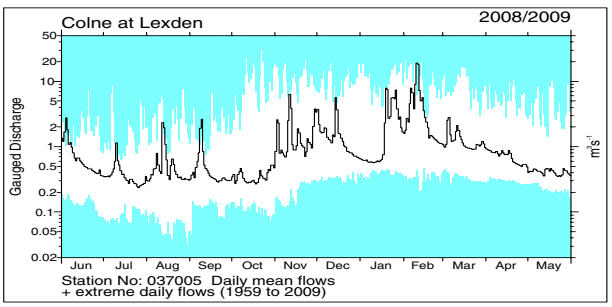


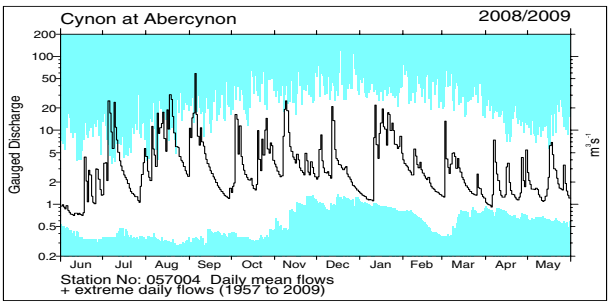


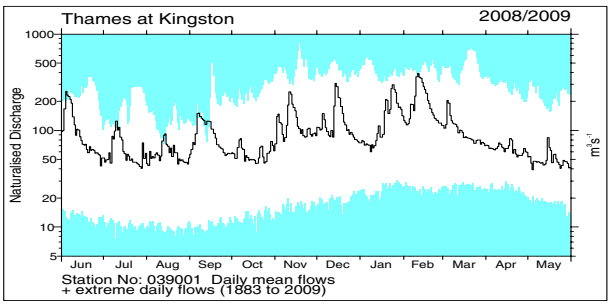


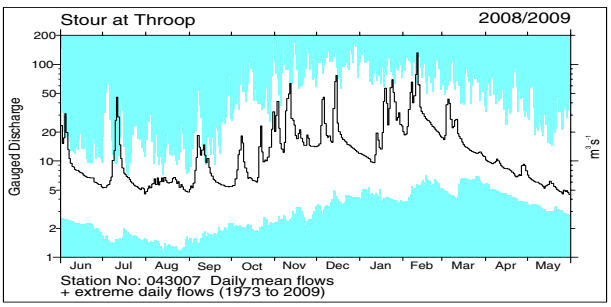


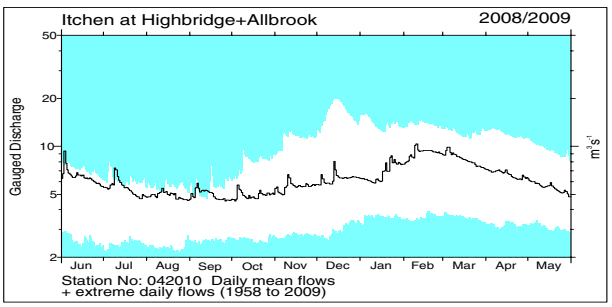












Notable runoff accumulations (a) March - May 2009, (b) January - May 2009, (c) November 2008 - May 2009

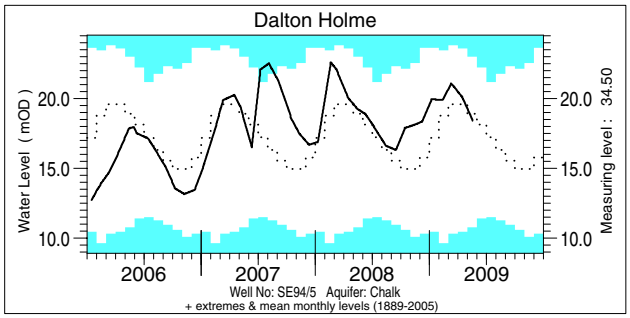
	River	%lta	Rank
a)	Dee (Park)	71	4/37
	Tweed (Norham)	61	4/50
	Whiteadder	43	3/40
	Tyne (Bywell)	61	4/52
	Teme	51	4/39
	Nevis	122	23/27
	Mourne	125	23/27

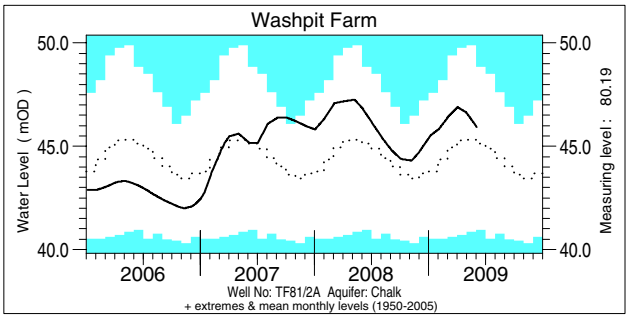
	River	%lta	Rank
b)	Tweed (Boleside)	75	6/49
	Severn	60	4/88
	Wye	68	9/73
	Cynon	69	7/51
	Dee (Manley Hall)	63	3/72
	L Bann	80	5/29

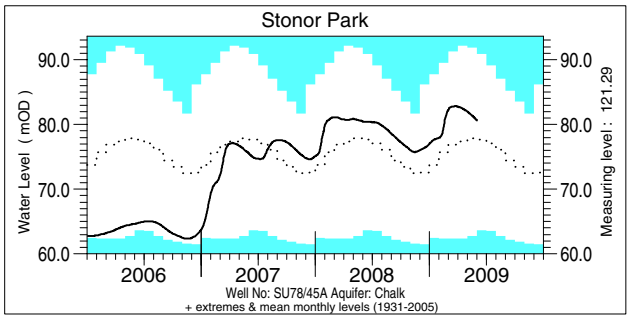
	River	%lta	Rank
c)	S Tyne	75	4/47
	Yscir	69	2/36
	Dee (New Inn)	71	2/40
	Ribble	69	2/49
	Luss	80	4/30
	Lagan	69	3/36

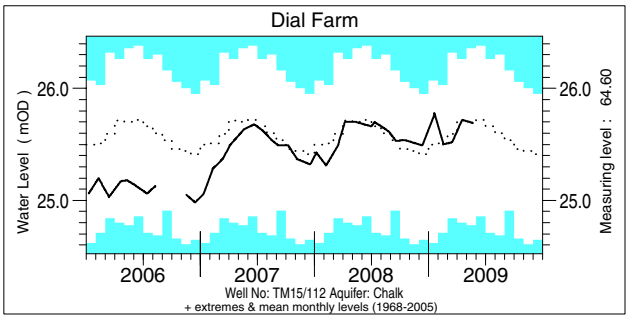
lta = long term average
Rank 1 = lowest on record

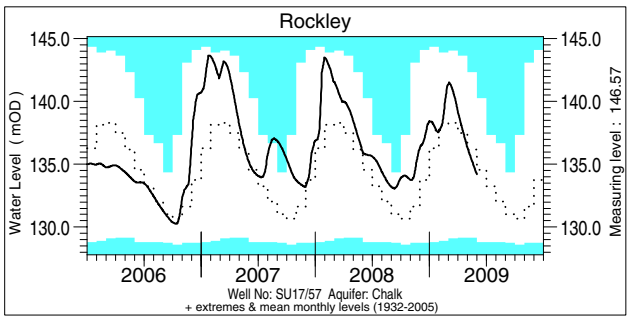
Groundwater . . . Groundwater

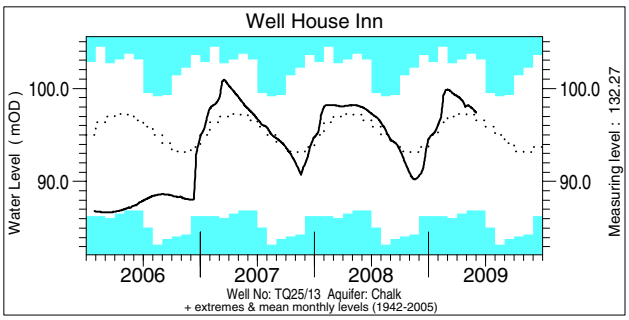


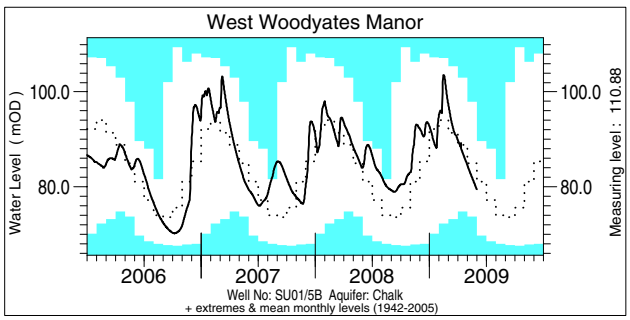


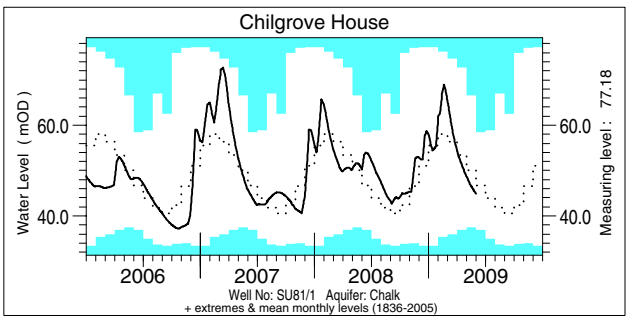


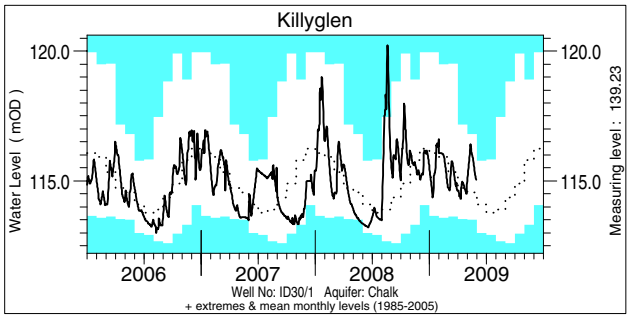


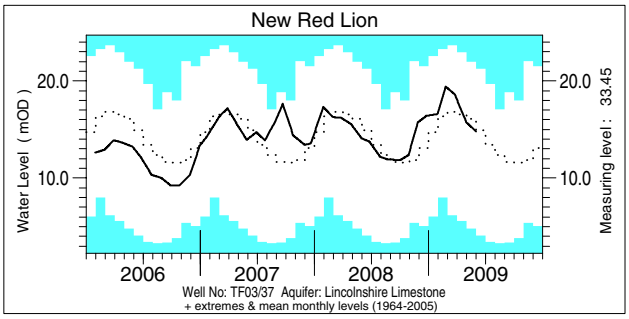






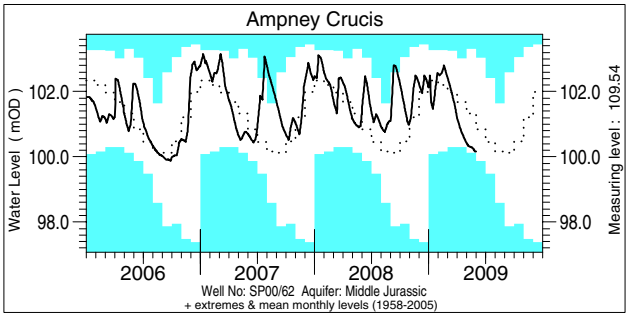


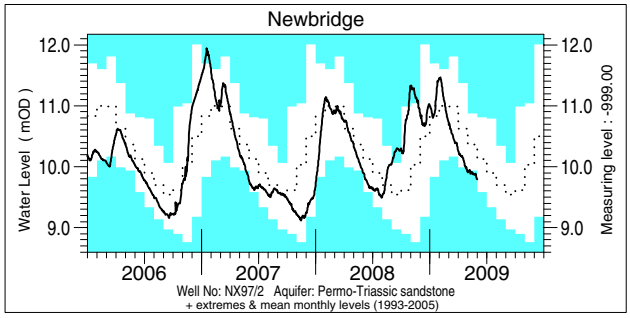


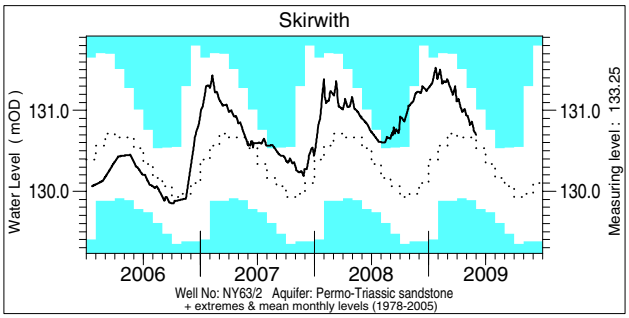


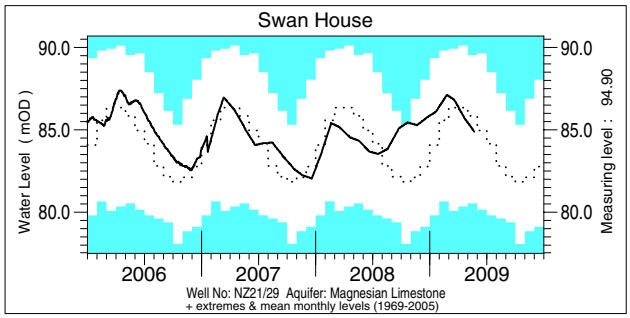
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

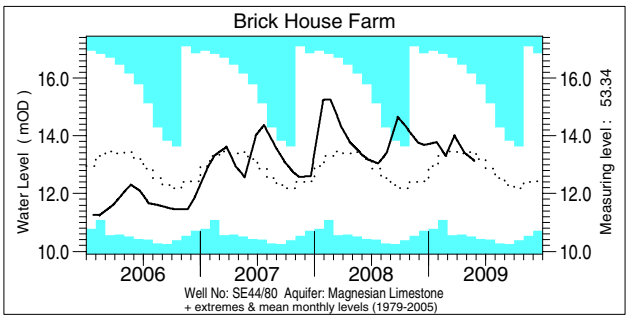
Groundwater . . . Groundwater

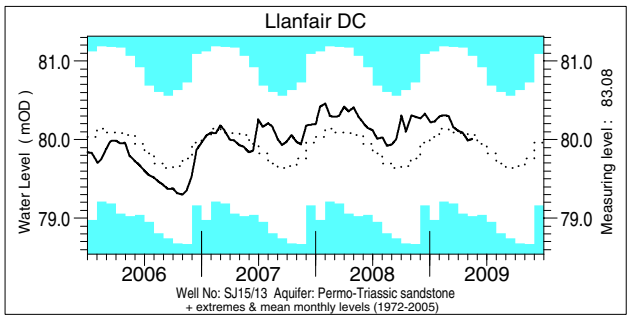


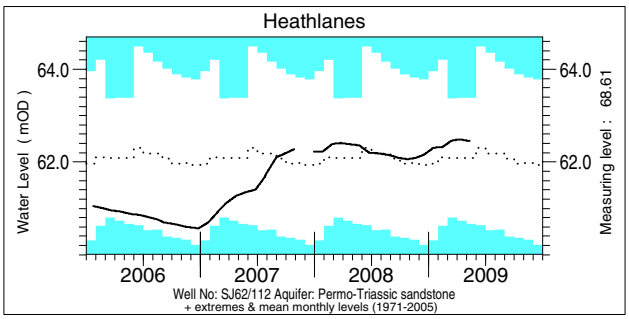


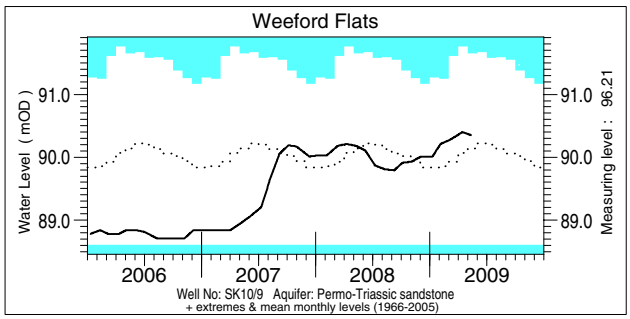


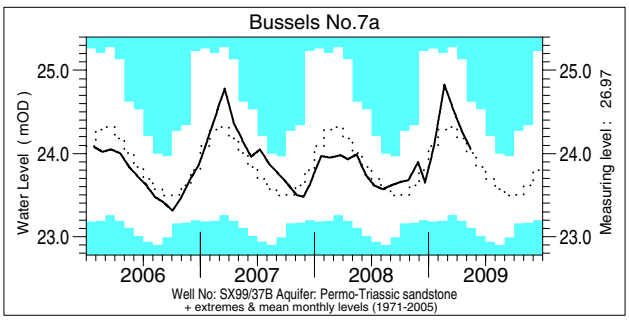


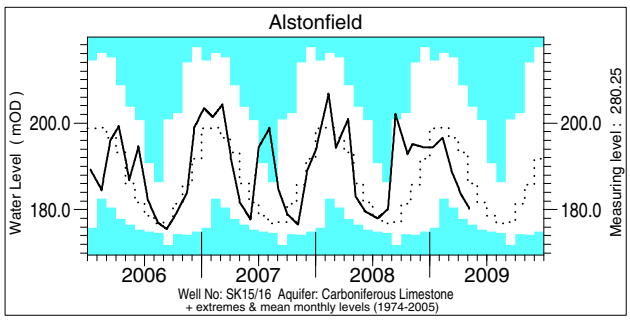












Groundwater levels May / June 2009

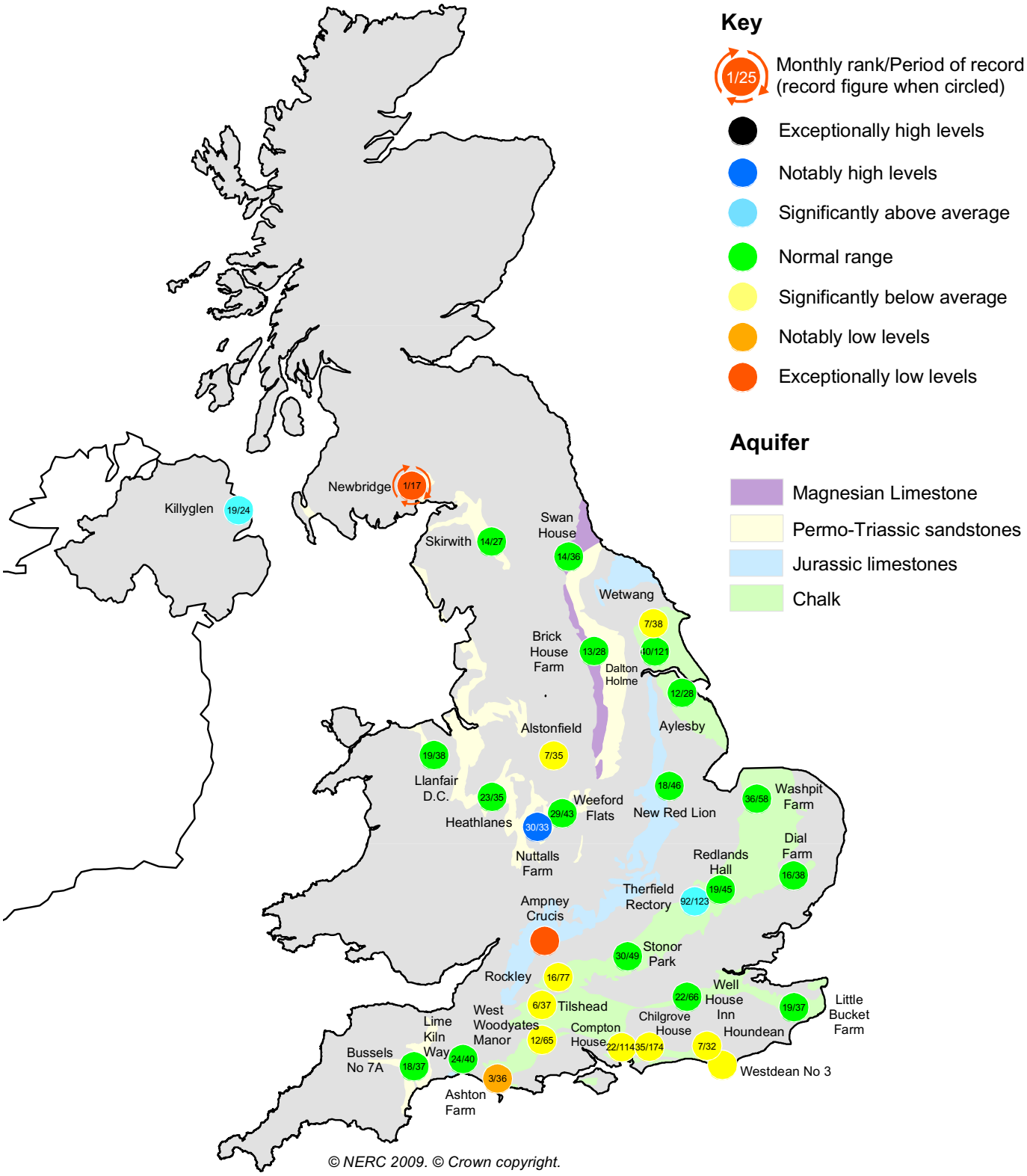
Borehole	Level	Date	May. av.
Dalton Holme	18.40	18/05	18.95
Washpit Farm	45.93	02/06	45.49
Stonor Park	80.58	01/06	77.95
Dial Farm	25.69	22/05	25.69
Rockley	134.19	01/06	136.19
Well House Inn	97.36	01/06	97.03
West Woodyates	79.48	31/05	84.60

Borehole	Level	Date	May. av.
Chilgrove House	44.88	31/05	48.97
Killyglen (NI)	115.04	29/05	114.44
New Red Lion	14.79	31/05	15.74
Ampney Crucis	100.17	01/06	101.26
Newbridge	9.79	31/05	10.28
Skirwith	130.70	31/05	130.60
Swan House	84.89	21/05	85.22

Borehole	Level	Date	May av.
Brick House Farm	13.13	26/05	13.30
Llanfair DC	80.01	15/05	79.98
Heathlanes	62.45	12/05	62.04
Weeford Flats	90.35	12/05	89.93
Bussels No.7a	24.05	14/05	24.00
Alstonfield	180.25	06/05	186.51

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



Groundwater levels - May 2009

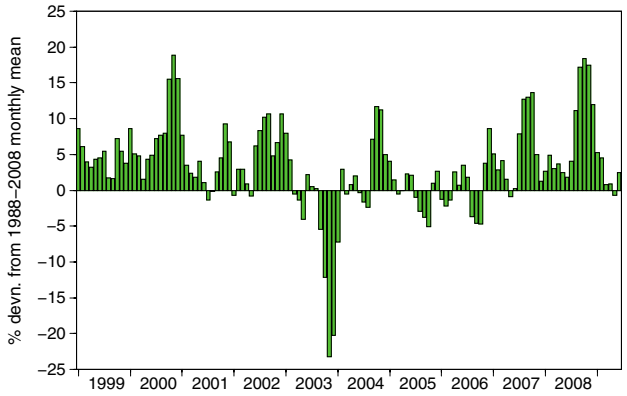
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record. Rankings may be omitted where they are considered misleading.

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

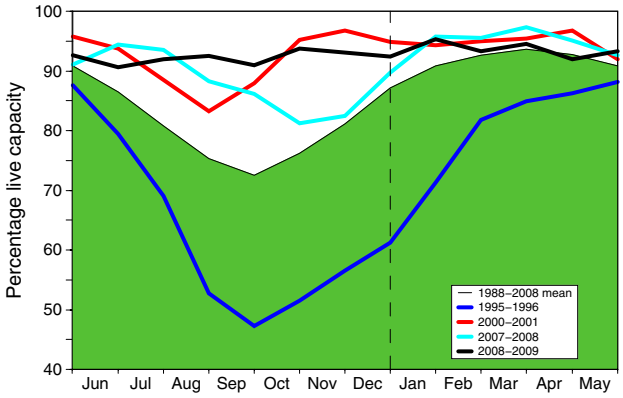
ii. Yew Tree Farm levels are now received quarterly.

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)	2009 Apr	May	Jun	Jun Anom.	Min Jun	Year* of min	2008 Jun	Diff 09-08
North West	N Command Zone	•	124929	85	80	**89**	6	72	1991	79	10
	Vyrnwy		55146	94	85	**85**	-4	72	1990	90	-5
Northumbrian	Teesdale	•	87936	96	95	**92**	6	64	1991	87	5
	Kielder		(199175)	(90)	(90)	**(94)**	2	(85)	1989	(92)	2
Severn Trent	Clywedog		44922	95	97	**100**	3	83	1989	100	0
	Derwent Valley	•	39525	95	84	**84**	-5	56	1996	92	-8
Yorkshire	Washburn	•	22035	93	86	**88**	1	72	1990	88	0
	Bradford supply	•	41407	94	85	**87**	1	70	1996	89	-2
Anglian	Grafham		(55490)	(95)	(95)	**(94)**	0	(72)	1997	(96)	-2
	Rutland		(116580)	(93)	(90)	**(87)**	-4	(75)	1997	(93)	-6
Thames	London	•	202828	97	98	**99**	6	83	1990	98	1
	Farmoor	•	13822	100	95	**95**	-2	90	2002	93	2
Southern	Bewl		28170	92	90	**84**	-4	57	1990	99	-15
	Ardingly		4685	100	100	**98**	-1	96	1990	100	-2
Wessex	Clatworthy		5364	98	84	**78**	-9	67	1990	90	-12
	Bristol WW	•	(38666)	(97)	(92)	**(85)**	-4	(70)	1990	(89)	-4
South West	Colliford		28540	100	100	**100**	16	52	1997	93	7
	Roadford		34500	95	92	**91**	7	48	1996	90	1
	Wimbleball		21320	100	96	**90**	-1	76	1992	100	-10
	Stithians		5205	96	96	**94**	8	66	1990	80	14
Welsh	Celyn and Brenig	•	131155	100	99	**100**	3	82	1996	99	1
	Brianne		62140	97	95	**99**	3	85	1995	96	3
	Big Five	•	69762	95	89	**90**	0	70	1990	90	0
	Elan Valley	•	99106	98	94	**99**	4	85	1990	94	5
Scotland(E)	Edinburgh/Mid Lothian	•	97639	100	98	**97**	7	52	1998	93	4
	East Lothian	•	10206	99	100	**97**	1	84	1990	100	-3
Scotland(W)	Loch Katrine	•	111363	98	93	**98**	11	66	2001	74	24
	Daer		22412	99	97	**99**	8	70	1994	85	14
	Loch Thom	•	11840	96	96	**96**	6	74	2001	88	8
Northern Ireland	Total+	•	61600	87	92	**95**	11	69	2008	69	26
	Silent Valley	•	20634	82	84	**91**	2	56	2000	66	25

() 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 1988-2008 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.

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

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