Hydrological Summary

for the United Kingdom

February 2009

General

February began with the most sustained and damaging snow episode experienced across large parts of southern Britain for a generation. By contrast, the latter half of the month was largely dry and mild. February precipitation totals in many, mostly western, areas were well below average and reservoir stocks declined considerably in some large impoundments (e.g. in north-west England and western Scotland). Overall stocks for England & Wales fell to within 1% of the long term average for early March. Nonetheless, stocks in almost all index reservoirs exceeded 90% of the early spring average; most remain close to capacity. Frozen catchment conditions resulted in steep recessions in many responsive rivers during early February but sustained frontal rainfall early in the second week, supplemented by a substantial snowmelt contribution, triggered widespread flooding; flood warnings were common around the 9-10th in southern and eastern Britain. In many western catchments however, February runoff totals were well below average. Precipitation patterns during the month generally favoured the major aquifers and groundwater levels, although seasonally below average in some western outcrops, were above, to well above, the late-winter average. Overall water resources have held-up well through the UK's 2nd driest winter since 1996/97; the outlook remains generally healthy but, this year, the amount and distribution of spring rainfall will be particularly influential.

Rainfall

Very wintry conditions characterised early February – exceptionally low temperatures accompanied by the most widespread snowfall since the winter of 1990/91. Accumulated snowfall exceeded 50cm over the first week in some upland areas (e.g. Dartmoor); as remarkably, daily totals exceeded 25cm in some low-lying districts (e.g. Epsom, Surrey). Across the country, thousands of schools closed – partly due to the major transport disruption as snow cover extended over seven days or more. Further substantial precipitation (a mixture of rain, sleet, snow and hail) was recorded across southern England on the 9/10th (the Scilly Isles reported 63mm and many catchments registered >25mm). Thereafter, northern Britain was wet around the 15/16th but high pressure was generally dominant – bringing mild, dull and dry weather. Some areas (e.g. Oxfordshire) registered <2mm of rainfall over the last 16 days of the month. February precipitation patterns reflected the limited influence of Atlantic frontal systems. Monthly totals were well above average in most of eastern Britain – exceeding 150% in parts of eastern Scotland and much of SE England whilst many western catchments reported <50% of the February average. Provisional data indicate that both Northern Ireland and the EA Wales region reported their 2nd lowest February rainfall since 1986. As notably, many western catchments registered their 5th or 6th driest winters in the last 45 years and, nationally, it was the coldest Dec-Feb since 1995/96 – such a combination contrasts dramatically with the generality of winters in the recent past. Longer term regional rainfall accumulations are mostly well above average.

River flows

Sustained late-January river flow recessions continued into February and, with headwater catchments frozen in many areas, river flows were seasonally low during much of the first week. Following the storms on the 8/9th across southern Britain, river flows recovered very briskly (snowmelt was a significant factor). Provisional data indicate that the Kennet, Dorset Stour and Taw were among those rivers establishing new maximum February peak flows. Flood warnings were very widespread on the 10th; tidal blocking was an exacerbating factor in some coastal areas. Floodplain inundations were generally moderate but localised flooding was widely reported (e.g. in Yeovil, Watford and parts of West Berkshire). A week later spates were common across parts of northern Britain; the River Naver registered its 2nd highest February flow on record – in a 30-year series. Recessions became firmly re-established over the latter part of the month but February runoff totals were still considerably above the average throughout the English Lowlands. By contrast, very modest runoff characterised many western catchments – the Luss Water registered its 2nd lowest February runoff for 23 years. A similar, but more muted, geographical contrast may be recognised in the winter (Dec-Feb) runoff totals. Initial estimates indicate that Northern Ireland registered its 5th lowest winter runoff in a series from 1981.

Groundwater

Generally, the February rainfall distribution was very beneficial from a groundwater resources perspective; most of the English Lowlands reported >120% of the monthly average. With soils close to saturation throughout the month, conditions were very favourable for substantial late-winter recharge – but frozen ground restricted infiltration through the coldest part of the month. Modelled estimates of infiltration exceeded twice the average in parts of the Chalk outcrop and observational evidence confirms exceptional groundwater level increases in the southern and eastern Chalk (e.g. in the South Downs and on the Isle of Wight). February groundwater levels in almost all the Chalk index wells and boreholes were considerably above average. Levels in most limestone outcrops were also close to, or above, average. The Permo-Triassic sandstones outcrops present a spatially more varied picture (in part, a consequence of large differences in responsiveness of the index sites). Healthy groundwater levels characterise most slow-responding wells in the Midlands and a steep increase was recorded at Bussels in the South West. By contrast, notably low levels were reported for the Newbridge well in Dumfries and Galloway. With very modest soil moisture deficits and an unsettled start to March, a seasonally early onset of the seasonal recession in groundwater levels is unlikely. Groundwater resources are healthy throughout most major aquifers but rainfall over the next 6-8 weeks will be influential in determining the range of groundwater levels through the summer of 2009.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

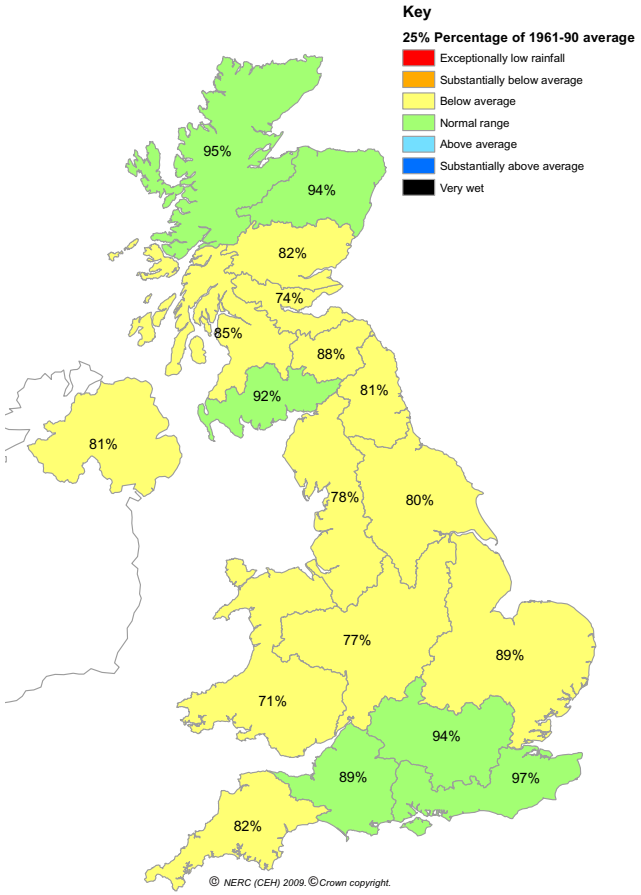
Area	Rainfall	Feb 09	Dec 08- Feb 09	RP	Sep 08- Feb 09	RP	Jun 08- Feb 09	RP	Mar 08- Feb 09	RP
England & Wales	**mm**	**48**	**203**		**511**		**800**		**1029**	
	%	**74**	**81**	**2-5**	**101**	**2-5**	**113**	**2-5**	**114**	**5-10**
North West	mm	**25**	253		723		1122		1344	
	%	**32**	78	5-10	104	2-5	115	5-10	110	5-10
Northumbrian	mm	**46**	182		497		845		1039	
	%	**77**	81	2-5	107	2-5	125	10-20	120	10-20
Severn Trent	mm	**35**	158		431		660		864	
	%	**63**	77	2-5	106	2-5	112	2-5	112	2-5
Yorkshire	mm	**42**	175		425		747		939	
	%	**72**	80	2-5	95	2-5	116	2-5	112	5-10
Anglian	mm	**52**	129		329		519		705	
	%	**137**	89	2-5	108	2-5	112	2-5	117	5-10
Thames	mm	**60**	173		382		597		821	
	%	**130**	94	2-5	102	2-5	111	2-5	117	5-10
Southern	mm	**70**	212		461		633		877	
	%	**130**	97	2-5	102	2-5	103	2-5	112	2-5
Wessex	mm	**66**	224		487		741		1002	
	%	**99**	89	2-5	100	<2	111	2-5	117	5-10
South West	mm	**74**	313		650		1029		1336	
	%	**73**	82	2-5	90	2-5	109	2-5	112	5-10
Welsh	mm	**33**	285		780		1207		1500	
	%	**33**	71	5-10	97	2-5	113	2-5	112	2-5
Scotland	**mm**	**75**	**379**		**874**		**1247**		**1536**	
	%	**71**	**91**	**2-5**	**100**	**<2**	**106**	**2-5**	**104**	**2-5**
Highland	mm	**113**	476		1119		1465		1811	
	%	**89**	95	2-5	106	2-5	105	2-5	104	2-5
North East	mm	**81**	253		537		827		1069	
	%	**117**	94	2-5	94	2-5	103	2-5	104	2-5
Tay	mm	**48**	312		666		1023		1272	
	%	**49**	82	2-5	87	2-5	100	2-5	99	2-5
Forth	mm	**33**	231		554		950		1173	
	%	**41**	74	5-10	84	5-10	104	2-5	102	2-5
Tweed	mm	**52**	235		560		975		1200	
	%	**74**	88	2-5	101	2-5	124	10-20	120	20-30
Solway	mm	**33**	373		890		1354		1606	
	%	**33**	92	2-5	105	2-5	118	10-20	112	5-15
Clyde	mm	**51**	423		1005		1463		1798	
	%	**41**	85	2-5	95	2-5	103	2-5	103	2-5
Northern Ireland	**mm**	**34**	**247**		**593**		**995**		**1193**	
	%	**42**	**81**	**5-10**	**94**	**2-5**	**115**	**5-10**	**109**	**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 July 2008 are provisional.

Rainfall . . . Rainfall . . .

December 2008 - February 2009



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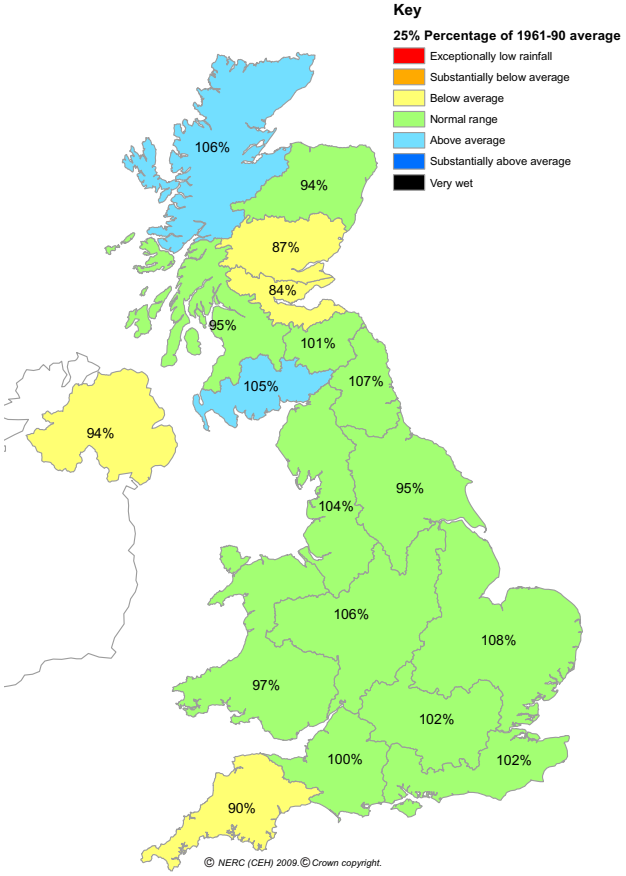

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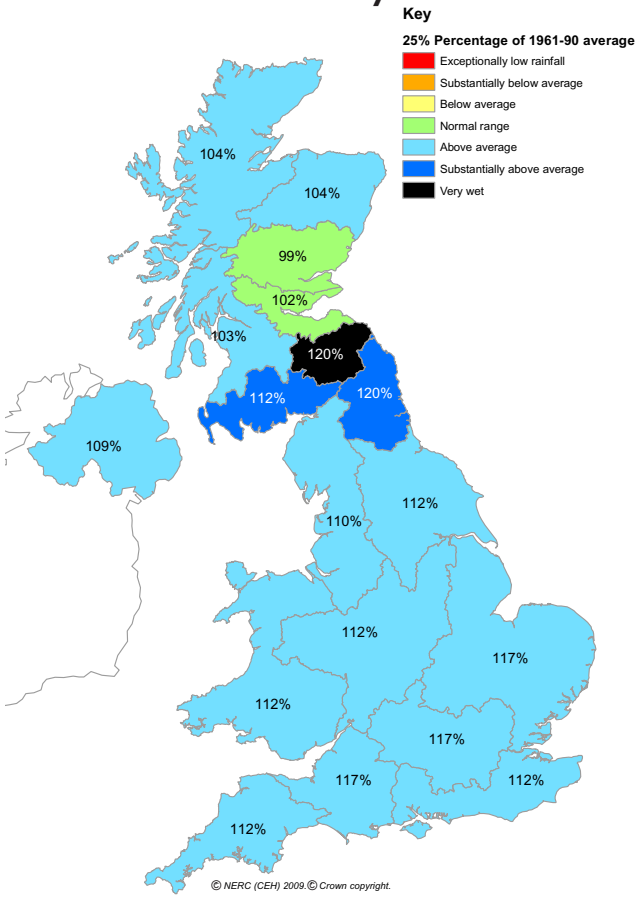


Met Office Spring 2009 forecast

Forecast for the Spring 2009:
issued 25 February 2009

Temperature

For the UK and western Europe spring this year is likely to be cooler than last year, with mean temperatures either near or below average.
In contrast, mean temperatures are likely to be near average or above average over much of eastern Europe.

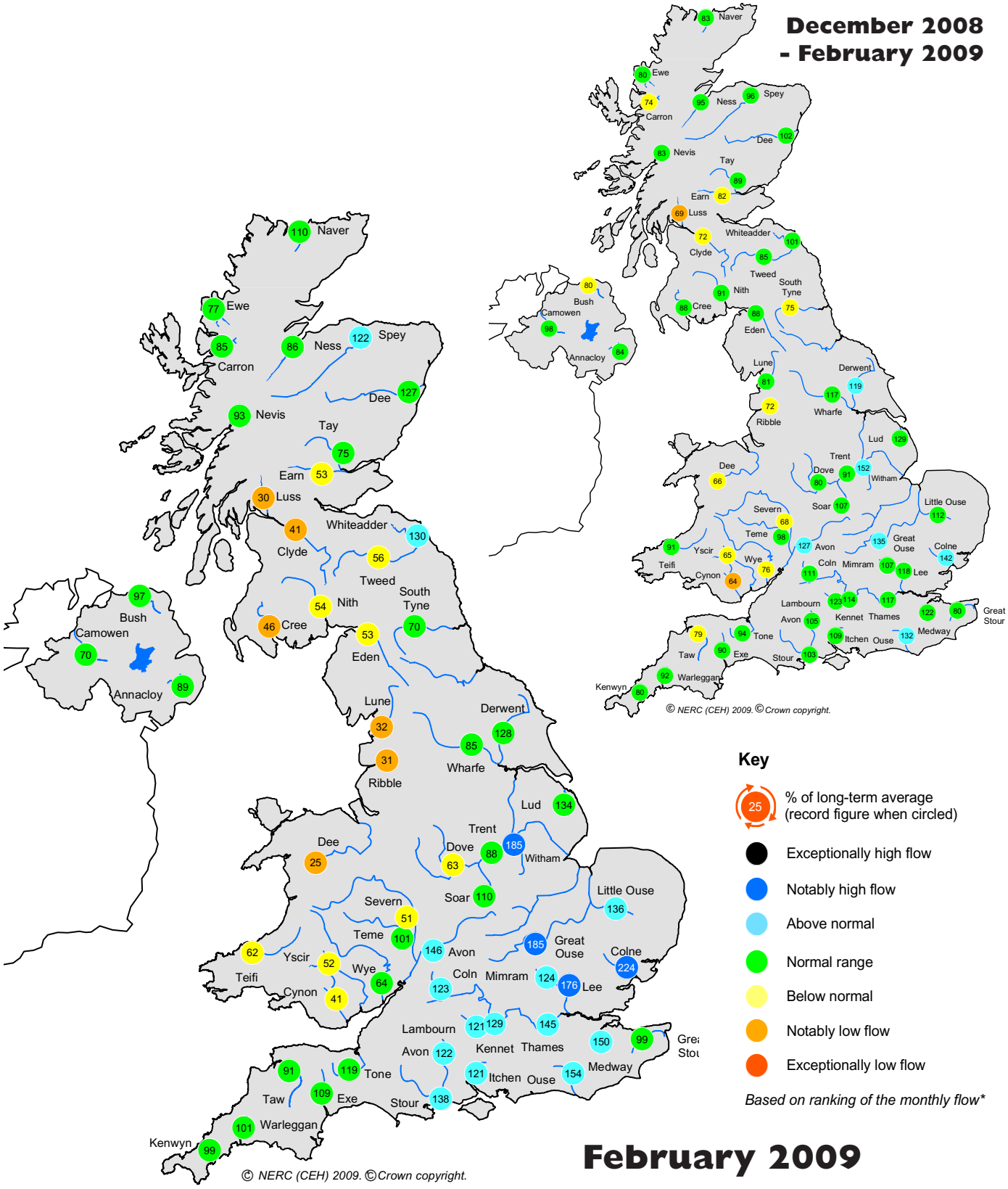
Rainfall

For the UK and much of northern Europe precipitation is likely to be average or below average.
In contrast, average or above-average rainfall is likely over southern Europe and the central Mediterranean.

Updates and reviews of the forecast

The spring forecast will be updated at 10 a.m. on 25 March 2009. For further details please visit:
http://www.metoffice.gov.uk/science/creating/monthsahead/seasonal/2009/spring.html

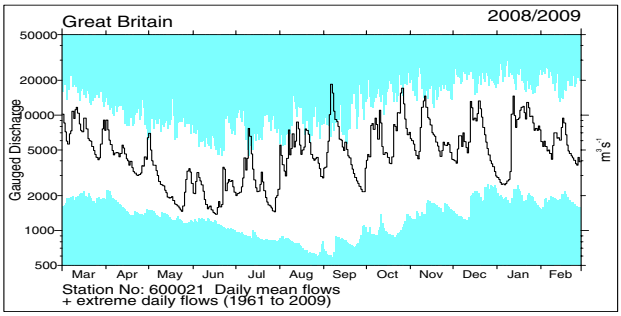
River flow . . . River flow . . .

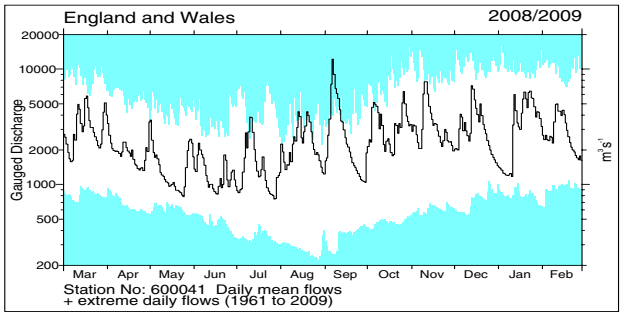


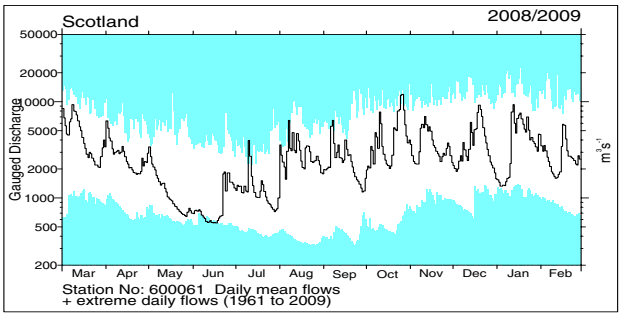
River flows

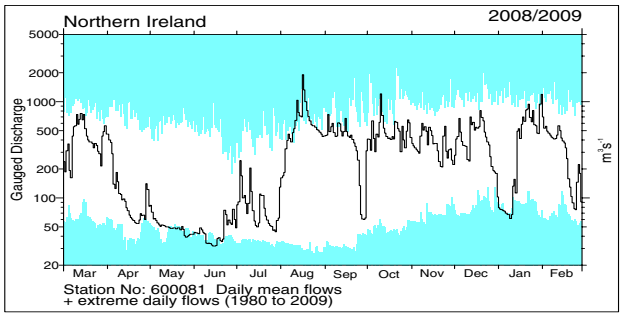
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

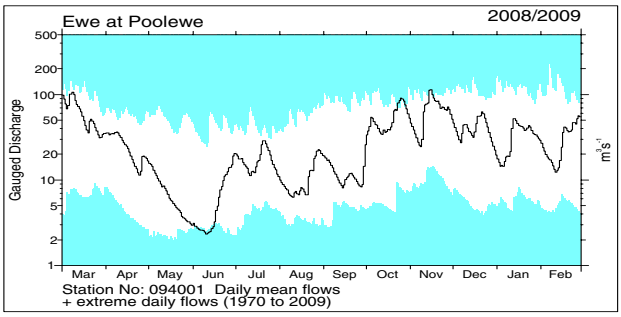
River flow . . . River flow . . .

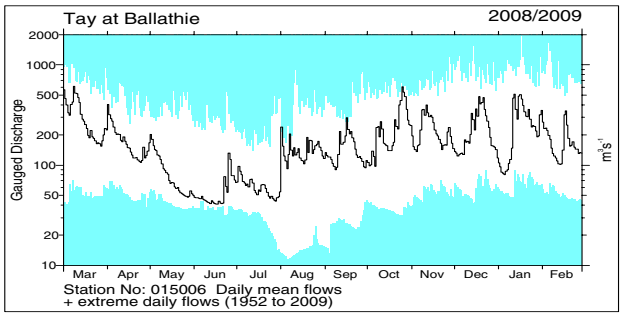


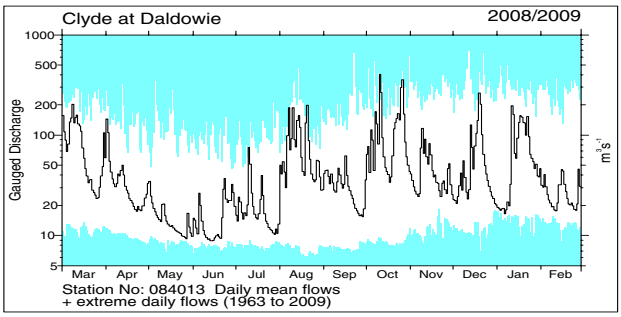


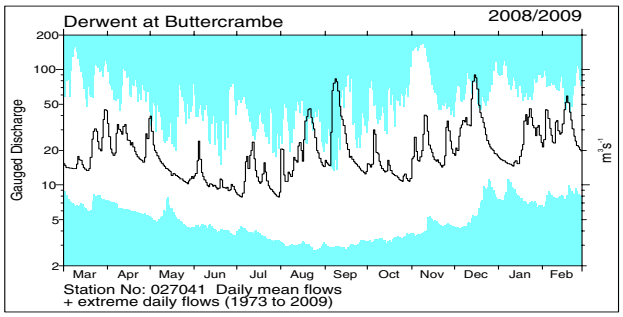


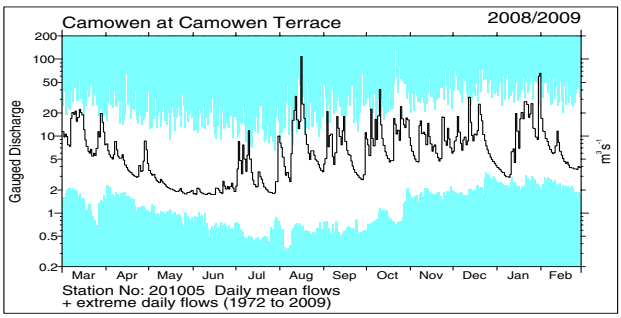


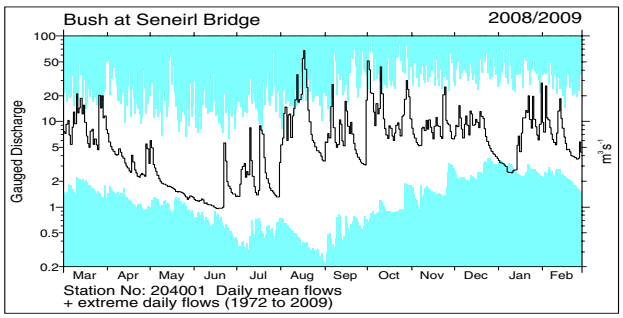








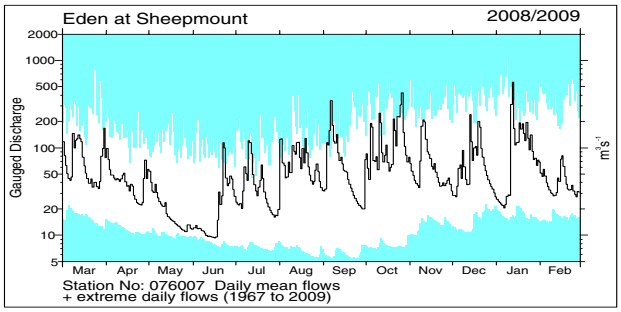


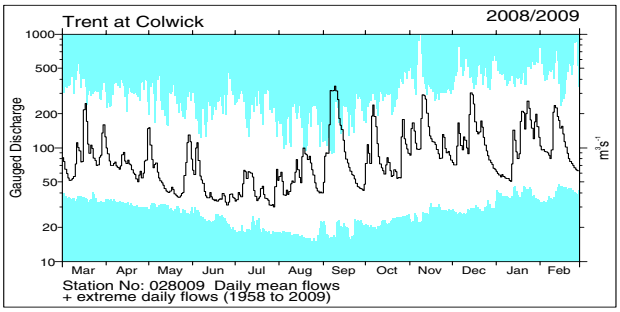


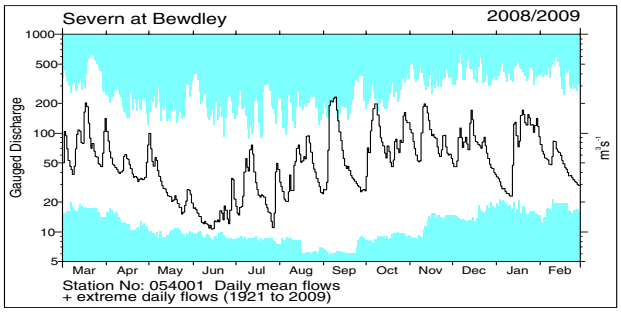
River flow hydrographs

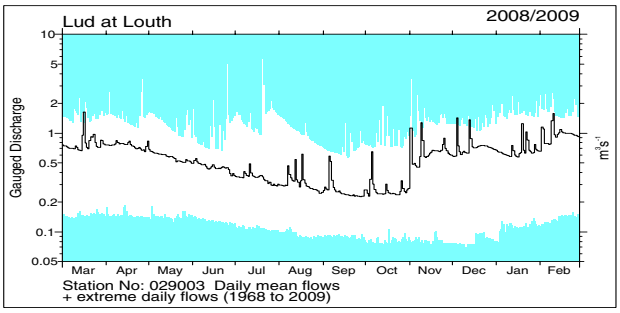
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to March 2008 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

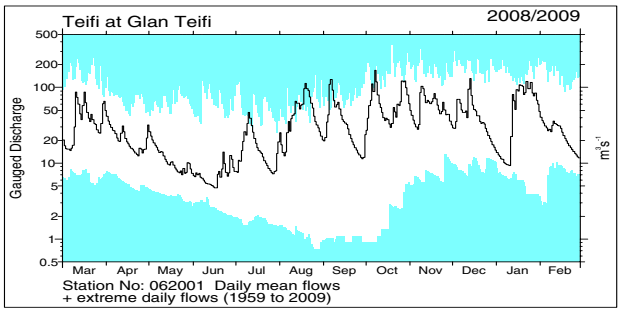
River flow . . . River flow . . .

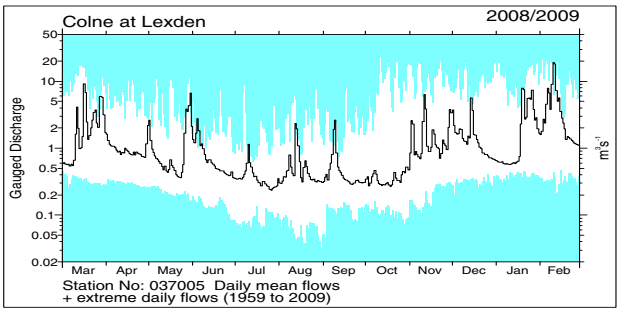


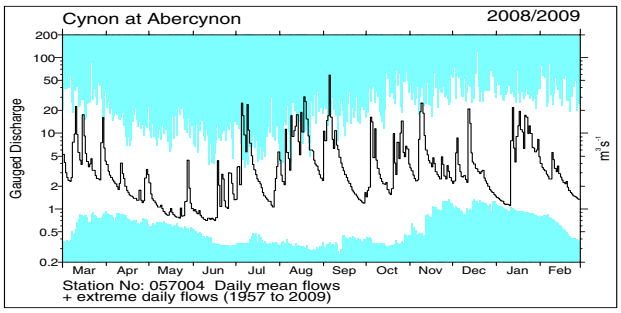


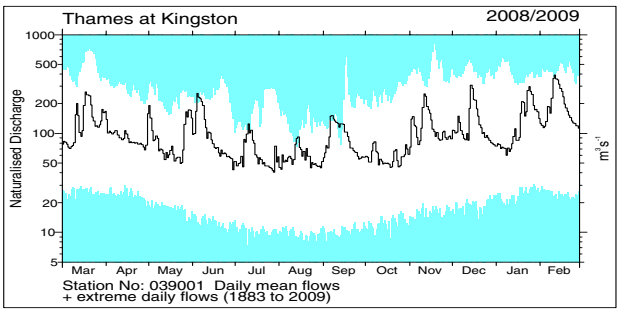


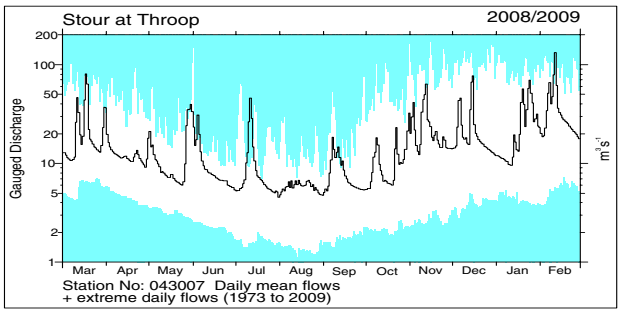


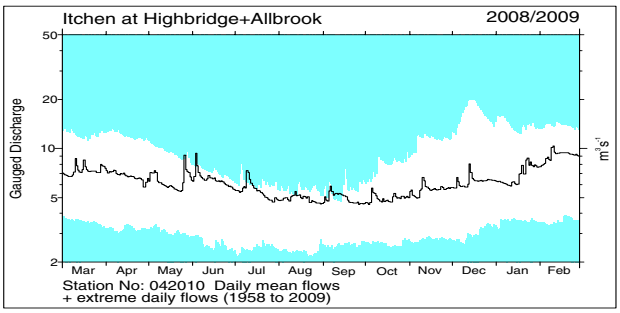












Notable runoff accumulations (a) December 2008 - February 2009, (b) June 2008 - February 2009

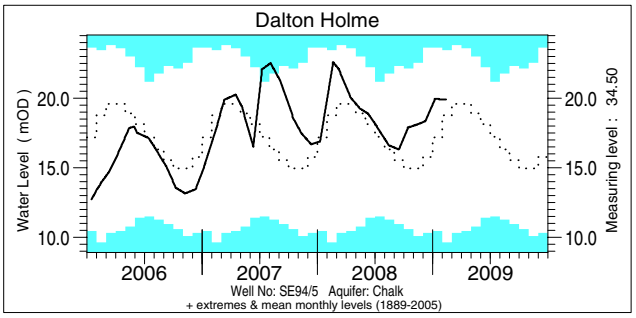
	River	%lta	Rank
a)	Colne	142	43/49
	Mole	143	30/35
	Yscir	65	5/36
	Cynon	64	6/51
	Luss	69	4/30
	L. Bann	78	5/29
	Lagan	67	3/36

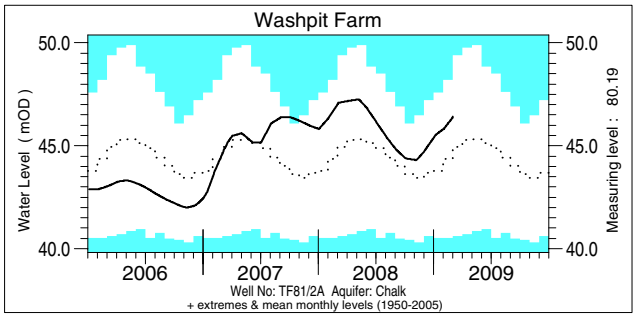
	River	%lta	Rank
b)	Tweed (Norham)	143	49/49
	Whiteadder	159	37/39
	Tyne (Bywell)	142	49/50
	Wharfe	181	53/53
	Coln	151	43/45
	Exe	137	50/53

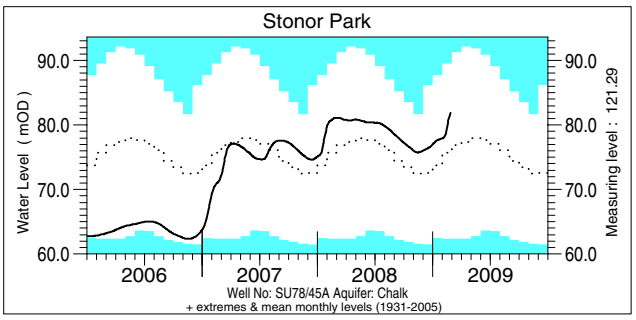
	River	%lta	Rank
b)	Dart	139	47/50
	Warleggan	134	36/39
	Brue	147	40/43
	Teifi	133	47/48
	Lune	132	45/47
	Mourne	117	23/26
	Annacloy	133	26/29

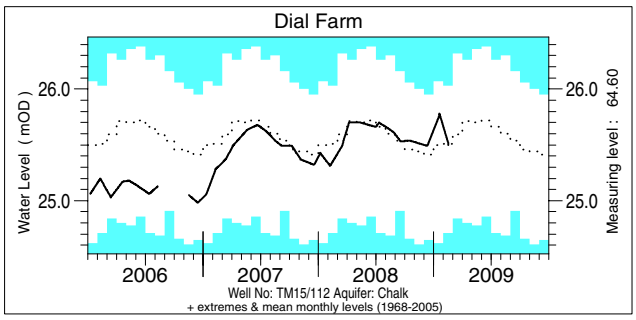
lta = long term average
Rank 1 = lowest on record

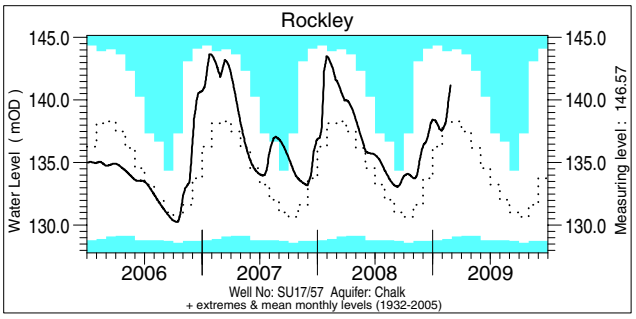
Groundwater . . . Groundwater

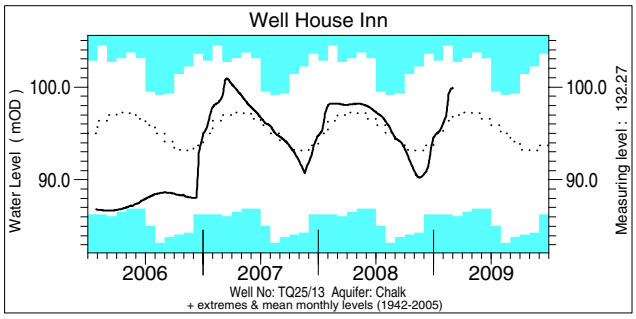


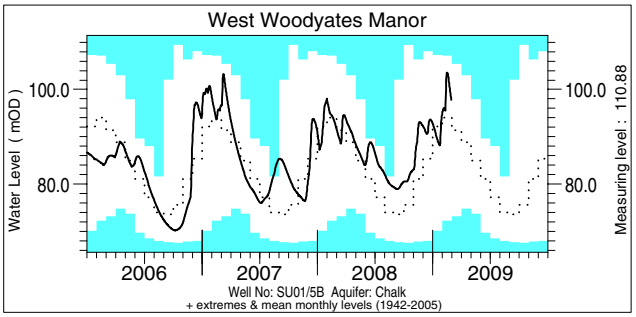


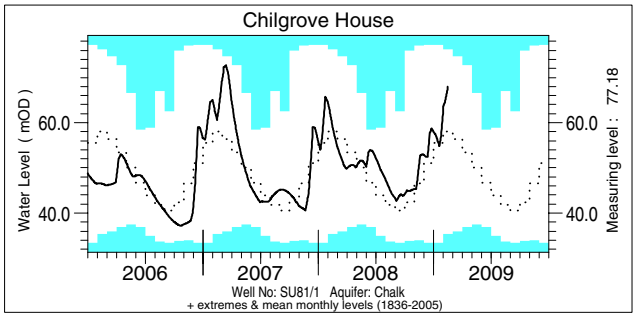


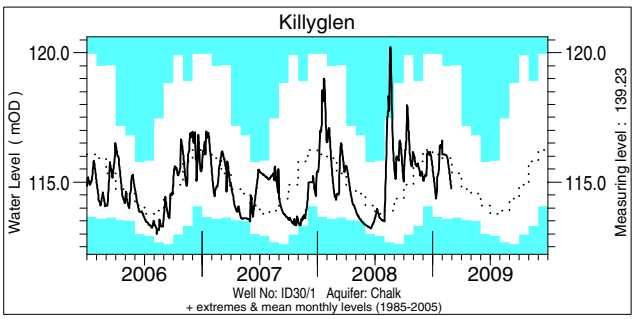


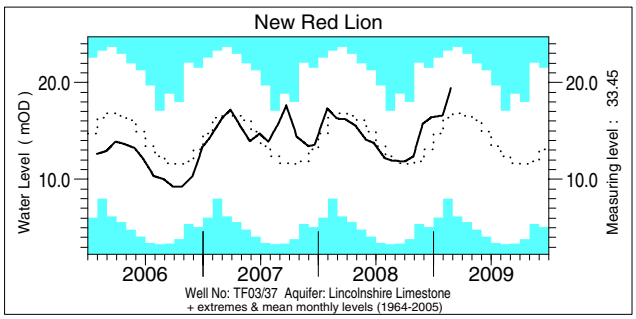






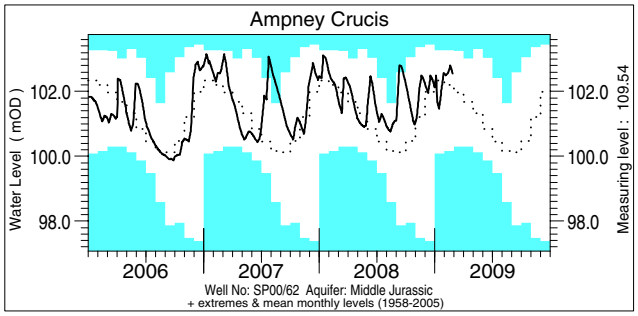


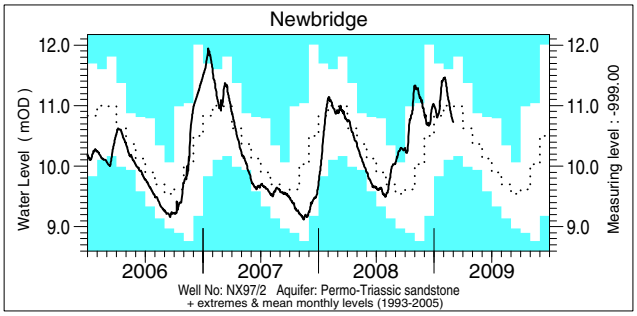


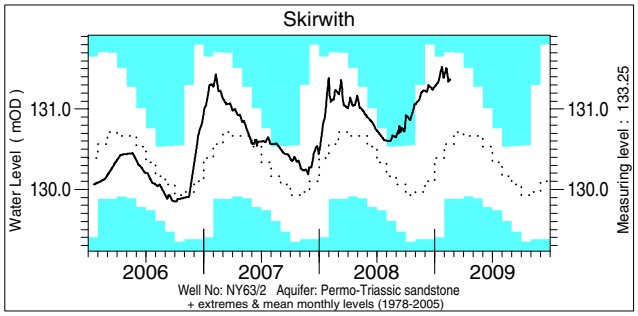


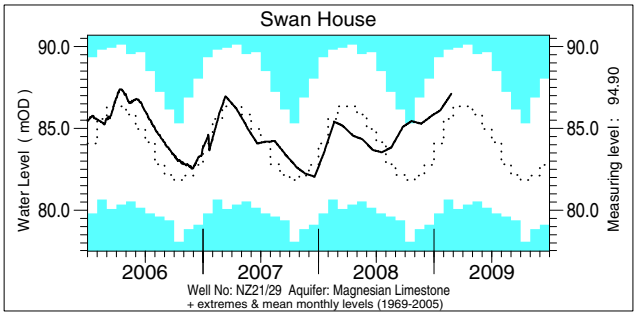
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

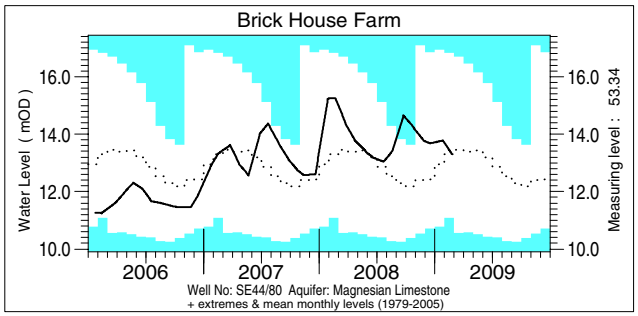
Groundwater . . . Groundwater

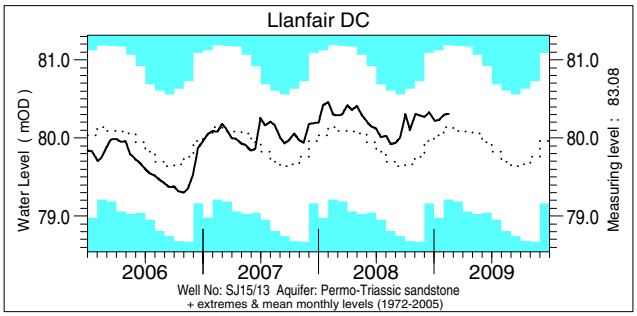


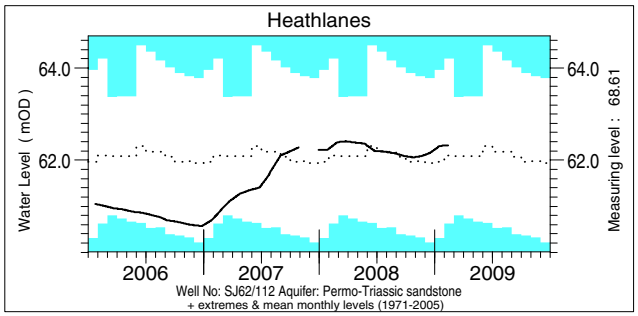


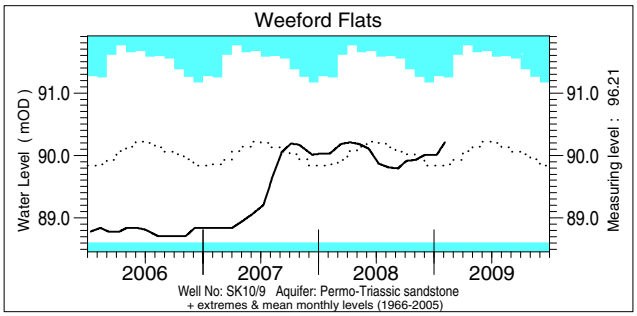


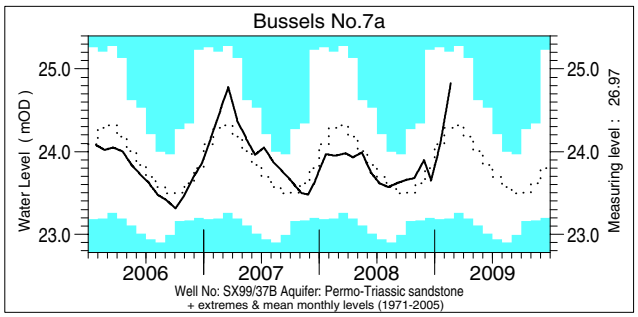


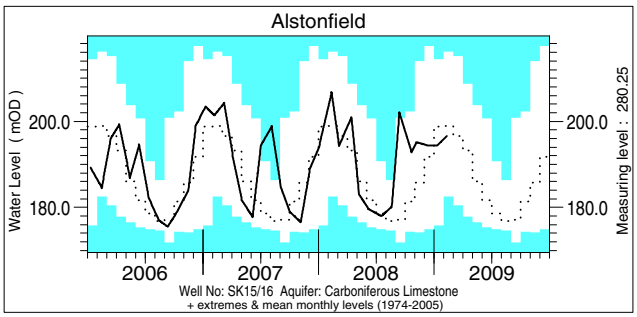












Groundwater levels February / March 2009

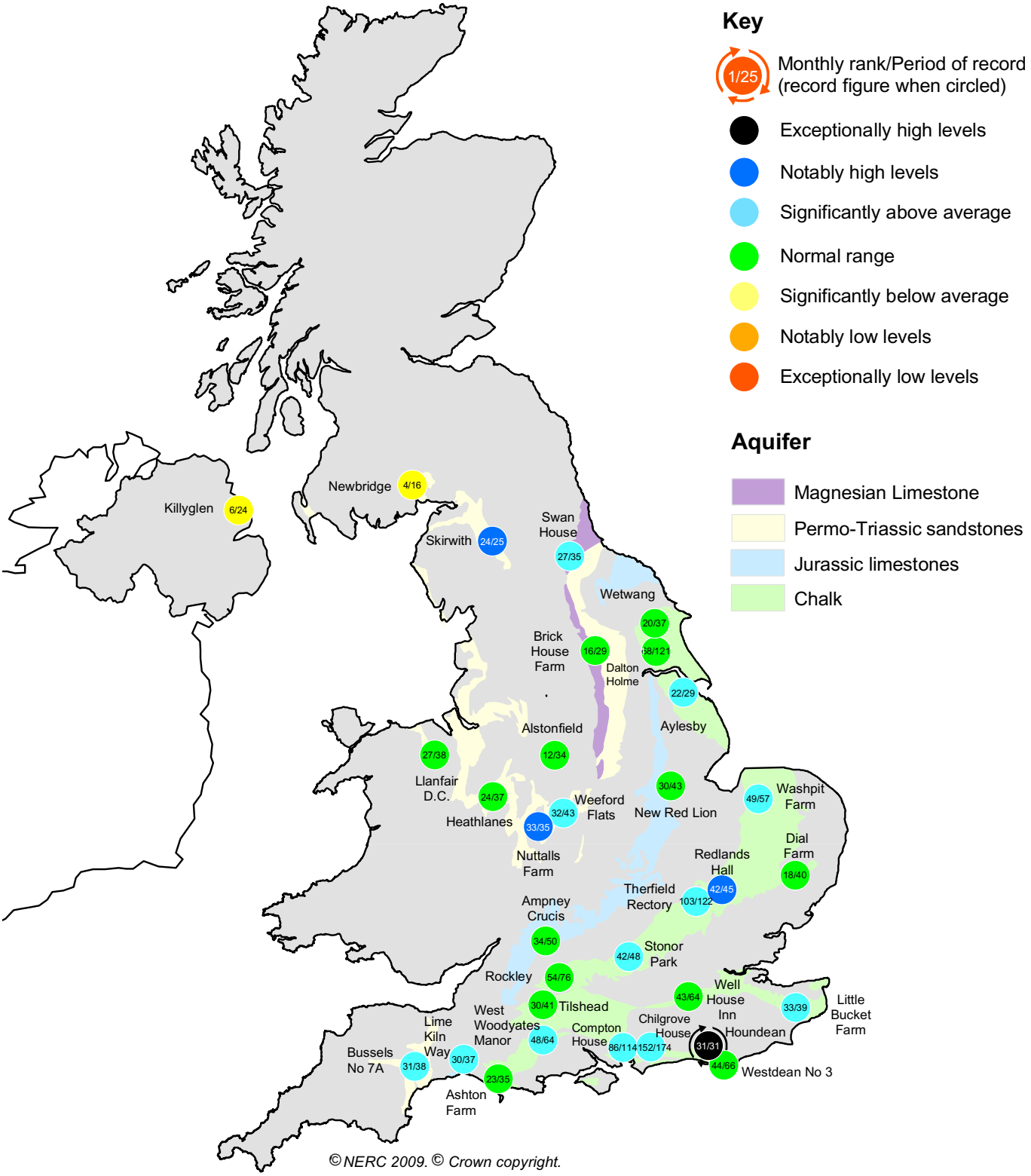
Borehole	Level	Date	Feb. av.
Dalton Holme	19.91	12/02	18.69
Washpit Farm	46.41	02/03	44.42
Stonor Park	81.88	25/02	75.52
Dial Farm	25.50	16/02	25.49
Rockley	141.20	25/02	138.35
Well House Inn	99.87	02/03	96.29
West Woodyates	97.82	28/02	93.16

Borehole	Level	Date	Feb. av.
Chilgrove House	68.00	14/02	57.56
Killyglen (NI)	114.76	28/02	115.62
New Red Lion	19.43	23/02	16.40
Ampney Crucis	102.55	25/02	102.21
Newbridge	10.73	01/03	10.95
Skirwith	131.37	18/02	130.65
Swan House	87.12	23/02	85.47

Borehole	Level	Date	Feb. av.
Brick House Farm	13.30	23/02	13.25
Llanfair DC	80.31	15/02	80.06
Heathlanes	62.32	12/02	61.99
Weeford Flats	90.21	03/02	89.66
Bussels No.7a	24.83	19/02	24.30
Alstonfield	196.65	10/02	198.90

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



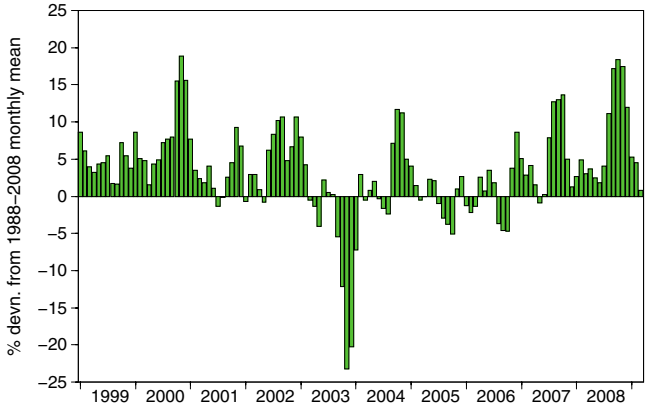
Groundwater levels - February 2009

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.

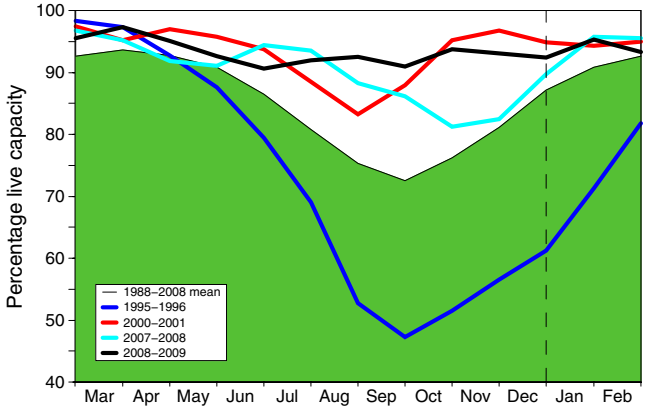
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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 Jan	2009 Feb	2009 Mar	Mar Anom.	Min. Mar	Year* of min.	2008 Mar	Diff 09-08
North West	N Command Zone	• 124929	92	99	**87**	-6	78	1996	96	-9
	Vyrnwy	55146	90	100	**92**	-2	59	1996	100	-8
Northumbrian	Teesdale	• 87936	83	89	**91**	0	72	1996	91	0
	Kielder	(199175)	(90)	(94)	**(90)**	-3	(81)	1993	(92)	-2
Severn Trent	Clywedog	44922	83	86	**87**	-3	77	1996	92	-5
	Derwent Valley	• 39525	99	100	**94**	-1	46	1996	98	-4
Yorkshire	Washburn	• 22035	94	97	**95**	3	53	1996	98	-3
	Bradford supply	• 41407	99	100	**97**	3	53	1996	100	-3
Anglian	Grafham	(55490)	(92)	(93)	**(94)**	6	(72)	1997	(88)	6
	Rutland	(116580)	(90)	(91)	**(91)**	3	(71)	1992	(95)	-4
Thames	London	• 202828	96	96	**95**	3	83	1988	97	-2
	Farmoor	• 13822	96	78	**86**	-8	64	1991	100	-14
Southern	Bewl	28170	80	80	**88**	3	50	2006	91	-3
	Ardingly	4685	100	100	**100**	3	77	2006	100	0
Wessex	Clatworthy	5364	100	100	**100**	2	82	1992	99	1
	Bristol WW	• (38666)	(96)	(98)	**(98)**	6	(65)	1992	(98)	0
South West	Colliford	28540	98	100	**100**	16	57	1997	85	15
	Roadford	34500	96	99	**97**	14	35	1996	91	6
	Wimbleball	21320	100	100	**100**	6	72	1996	99	1
	Stithians	5205	95	100	**100**	8	45	1992	82	18
Welsh	Celyn and Brenig	• 131155	94	97	**99**	2	69	1996	100	-1
	Brianne	62140	92	98	**96**	-2	92	2004	99	-3
	Big Five	• 69762	92	94	**93**	-3	85	1988	97	-4
	Elan Valley	• 99106	97	100	**97**	-1	88	1993	99	-2
Scotland(E)	Edinburgh/Mid Lothian	• 97639	97	100	**99**	4	73	1999	100	-1
	East Lothian	• 10206	99	99	**99**	0	91	1990	100	-1
Scotland(W)	Loch Katrine	• 111363	98	100	**89**	-7	86	2005	99	-10
	Daer	22412	99	99	**99**	0	94	2004	99	0
	Loch Thom	• 11840	96	96	**94**	-5	90	2004	96	-2
Northern Ireland	Total+	• 61600	90	99	**93**	4	81	2004	90	3
	Silent Valley	• 20634	91	100	**91**	7	57	2002	93	-2

() 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.

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.

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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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Wallingford
Oxfordshire
OX10 8BB

Tel.: 01491 838800
Fax: 01491 692424
E-mail: nrfa@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

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03/09