Hydrological Summary

for the United Kingdom

October 2009

General

October was a mild month with a sub-tropical airflow re-introducing Indian Summer conditions over the last 10 days in south Britain especially. Rainfall for Scotland was modestly above average with very wet conditions in some eastern catchments triggering flooding late in the month. By contrast, most southern regions of the UK were relatively dry, notably so in parts of the English Lowlands where accumulated rainfall deficiencies since February are substantial. Some brisk recoveries in reservoir stocks were reported (e.g. for parts of northern England) and, although at their lowest for two years, overall stocks for England & Wales are well above the late autumn average. However, seasonally low stocks characterise some southern impoundments (e.g. Bewl and Ardingly). Seasonal recoveries in runoff rates became established in many northern and western catchments over the second half of October but modest flows typified many rivers in eastern, southern and central England where extended recessions left flows close to monthly minima in a few areas. Broadly the largest medium-term rainfall deficiencies coincide with the outcrop areas of the Chalk (and some minor aquifers) where continuing recessions produced notably low groundwater levels in some southern outcrops. In such areas the change to much more cyclonic weather patterns at month end was especially welcome.

Rainfall

Westerly airflows, often dominant in October, were relatively infrequent this year although northern and western areas experienced gales on a number of occasions. Anticyclonic conditions in mid-month brought autumnal mist and drizzle and, over the final third of the month, very warm sub-tropical air drawn north on the flank of continental high pressure created balmy and warm late-October weather. In Scotland, a very-slow moving frontal system brought prolonged rainfall to parts of the north-east on the 20th heralding an exceptionally wet interlude: Waterside (Esk catchment) reported 90mm on the 21st, and a 5-day total of 182mm; several other raingauges recorded >150mm. For October as a whole, the highest rainfall anomalies were found in eastern Scotland with some areas (e.g. Aberdeen) exceeding 200%. In England, rainfall totals showed large spatial variations with above average rainfall in some coastal localities contrasting with <50% in a few central localities (including parts of London). Across large parts of the English Lowlands, only July has registered above average rainfall in the last eight months. Correspondingly, accumulated totals are relatively depressed – the provisional March-October total for Southern Region was the 5th lowest in 80 years. By contrast, Scotland registered its wettest May-October in 55 years with the Highland and North East regions being exceptionally wet.

River Flows

Throughout almost the entire country the sustained early autumn recessions continued into October, leaving river flows well below the seasonal average. In Northern Ireland runoff rates were especially depressed during the second week (e.g. in the Faughan) but flow recoveries gathered momentum in south-western Britain and then, more dramatically, in Scotland from mid-month. Notably high flows were recorded on 21-23rd in eastern Scotland: on the Don both the Alford and Parkhill gauging stations registered their 5th highest flow on record whilst the Feugh reported its 2nd highest. The associated floodplain inundation, and surface flooding, caused severe transport disruption (including closure of the Aberdeen-Dundee rail link). In much of southern and eastern Britain however flows continued to decline. Flows in the Lud (Lincs) fell to their lowest since the summer of 1997 and notably low flows characterised many Anglian rivers (including the Colne and Waveney). Estimated October outflows for England & Wales were the third lowest in over 30 years and the great majority of index rivers recorded below average monthly runoff, many registering <50%; for the Little Ouse, October runoff was the 2nd lowest in a series from 1968. Generally, accumulated runoff totals, are well below average in the English Lowlands but exceptionally high in much of Scotland, the east particularly.

Groundwater

Soils were close to saturation at the end of October in much of western and northern Britain – contributing to an enhanced flood risk in parts of eastern Scotland – but remained seasonally dry in most major aquifer outcrop areas. Across much of the southern Chalk soil moisture deficits were around twice the late-October average and in a few areas (e.g. East Sussex) late-October soils were the driest for 30 years. Correspondingly, late-summer and autumn groundwater level recessions have been steep in part of the southern Chalk where Chilgrove is approaching its natural base level. With meagre infiltration in October, commonly <30% of average, groundwater levels are well below average across much of the South East, and extend to a few western wells (e.g. Tilshead). Levels in index wells penetrating the limestone aquifers are mostly below average but well above drought minima whilst near-average autumn levels are found in most Permo-Triassic sandstones aquifer units; groundwater resources are particularly healthy in the most northerly outcrop areas. The wet beginning to November, some parts of the South-East reported >60mm of rainfall in the first week, is particularly timely. An unsettled outlook is also encouraging but much will depend on the actual tracks followed by the low pressure systems.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

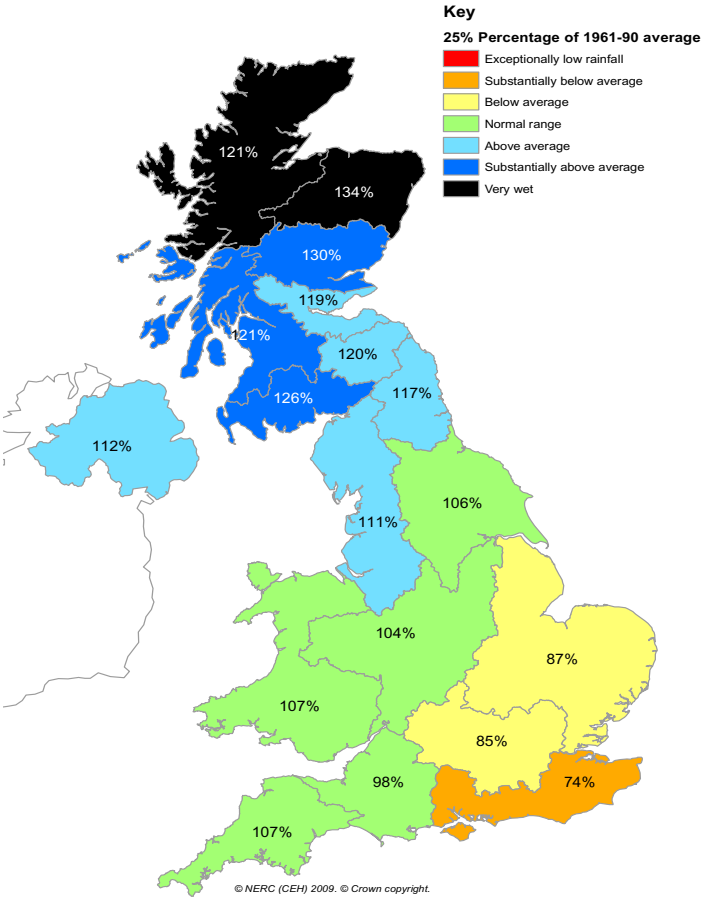
Area	Rainfall	Oct 2009	Aug 09 - Oct 09		May 09 - Oct 09		Feb 09 - Oct 09		Nov 08 - Oct 09	
England & Wales	**mm**	**76**	**175**		**436**		**576**		**821**	
	%	**88**	**73**	**5-10**	**101**	**2-5**	**92**	**2-5**	**91**	**2-5**
North West	mm	**99**	297		666		815		1138	
	%	**77**	84	2-5	111	2-5	96	2-5	94	2-5
Northumbrian	mm	**72**	198		500		626		832	
	%	**93**	85	2-5	117	2-5	102	2-5	96	2-5
Severn Trent	mm	**57**	129		391		501		701	
	%	**87**	65	10-20	104	2-5	92	2-5	91	2-5
Yorkshire	mm	**76**	168		429		543		744	
	%	**102**	76	5-10	106	2-5	92	2-5	89	2-5
Anglian	mm	**46**	101		269		373		531	
	%	**90**	65	5-15	87	2-5	85	5-10	88	5-10
Thames	mm	**44**	120		291		423		614	
	%	**69**	65	5-10	85	2-5	85	2-5	88	2-5
Southern	mm	**67**	128		272		421		672	
	%	**84**	62	5-15	74	5-10	79	5-10	86	5-10
Wessex	mm	**82**	164		385		543		783	
	%	**102**	74	5-10	98	2-5	93	2-5	92	2-5
South West	mm	**110**	212		548		784		1131	
	%	**94**	71	5-10	107	2-5	100	<2	95	2-5
Welsh	mm	**124**	267		654		825		1203	
	%	**90**	74	5-10	107	2-5	92	2-5	89	5-10
Scotland	**mm**	**167**	**496**		**842**		**1156**		**1605**	
	%	**104**	**118**	**5-10**	**122**	**20-35**	**115**	**10-20**	**109**	**5-10**
Highland	mm	**204**	592		956		1388		1962	
	%	**107**	121	5-15	121	20-35	119	10-20	113	10-20
North East	mm	**165**	368		679		887		1146	
	%	**160**	129	5-10	134	30-50	122	20-35	111	5-10
Tay	mm	**152**	430		779		1009		1384	
	%	**112**	121	5-10	130	10-20	114	5-10	107	2-5
Forth	mm	**95**	351		660		839		1123	
	%	**79**	106	2-5	119	5-10	105	2-5	98	2-5
Tweed	mm	**73**	290		596		751		1003	
	%	**74**	103	2-5	120	5-10	106	2-5	100	<2
Solway	mm	**137**	501		864		1118		1573	
	%	**87**	118	5-10	126	10-20	113	5-10	110	5-10
Clyde	mm	**182**	607		1004		1362		1887	
	%	**92**	116	5-10	121	10-20	114	5-15	108	5-10
Northern Ireland	**mm**	**109**	**308**		**591**		**804**		**1100**	
	%	**95**	**99**	**2-5**	**112**	**5-10**	**105**	**2-5**	**100**	**<2**

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

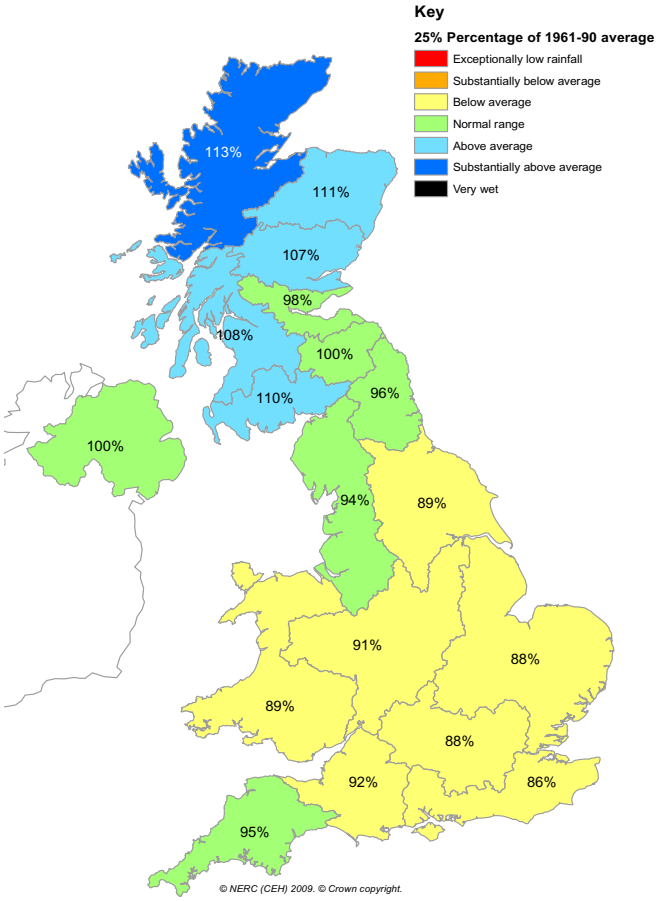
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following 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 April 2009 are provisional.

Rainfall . . . Rainfall . . .

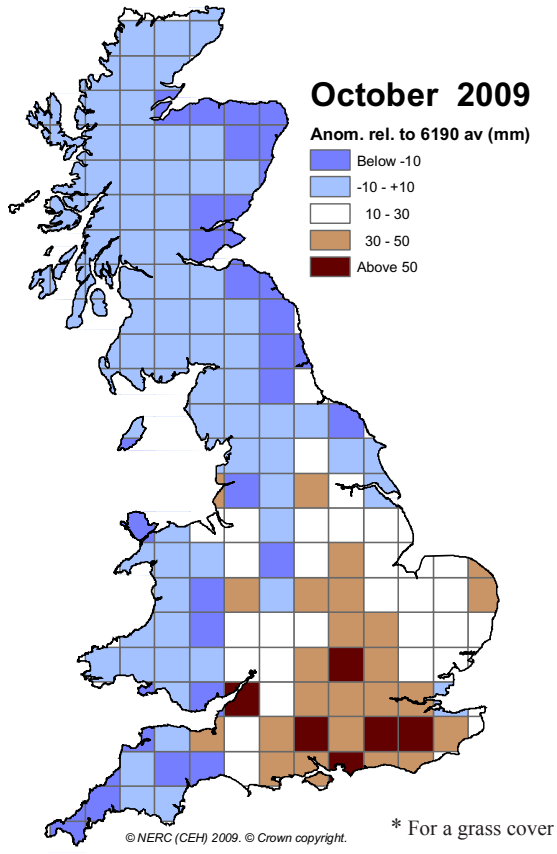
May - October 2009



November 2008 - October 2009



MORECS Soil Moisture Deficits *



* For a grass cover

Met Office

Early indications for Winter 2009/10: Updated 29 September 2009

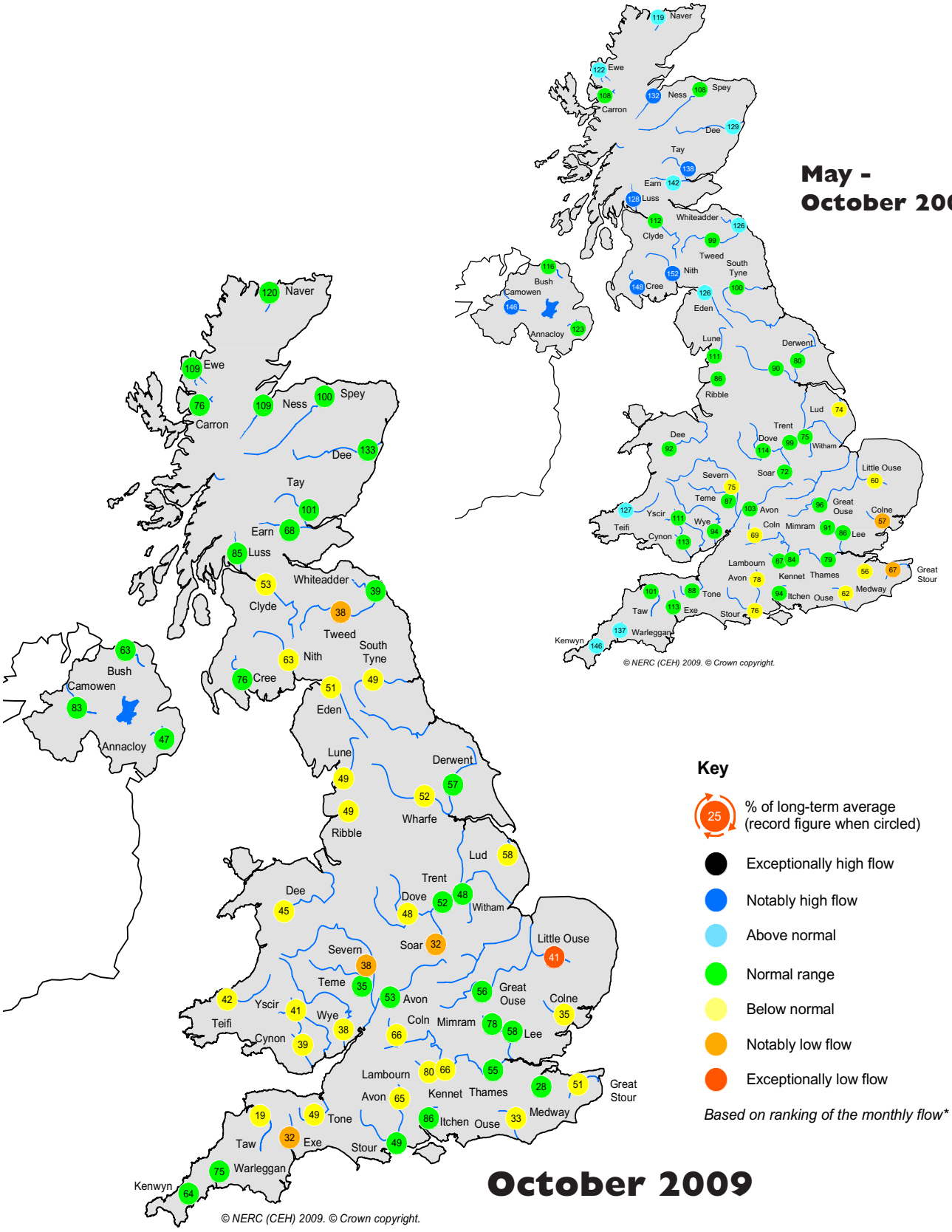
Temperature
Preliminary indications continue to suggest that winter temperatures are likely to be near or above average over much of Europe including the UK. Winter 2009/10 is likely to be milder than last year for the UK, but there is still a 1 in 7 chance of a cold winter.

Rainfall
Signals for precipitation slightly favour near or above average rainfall over much of northern Europe, including the UK.

Updates and reviews of the forecast
The winter forecast will be issued in November.
For further details please visit:

http://www.metoffice.gov.uk/science/creating/monthsahead/seasonal/2009/winter.html

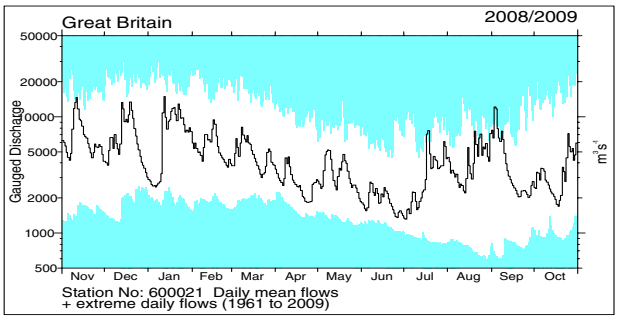
River flow . . . River flow . . .

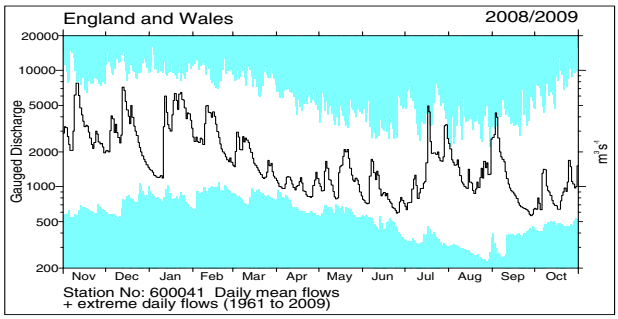


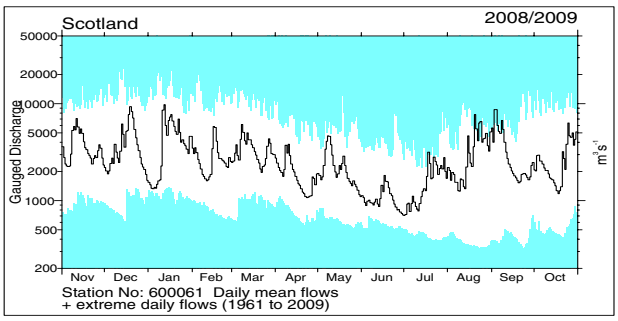
River flows

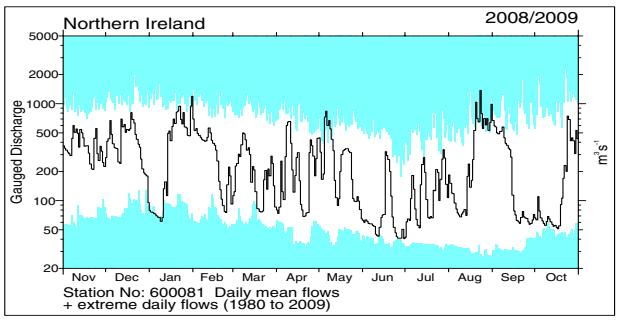
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

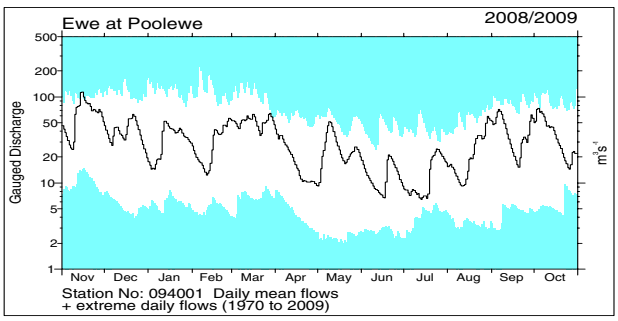
River flow . . . River flow . . .

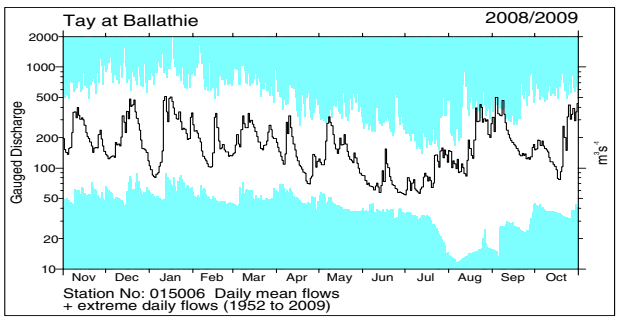


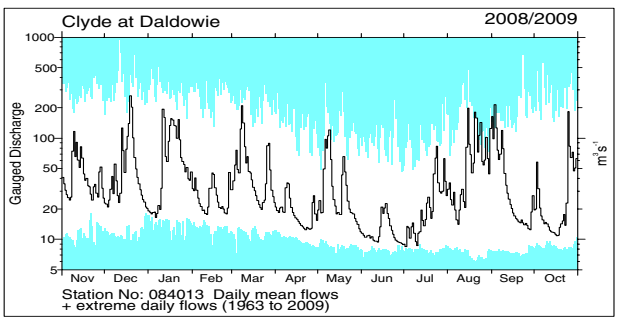


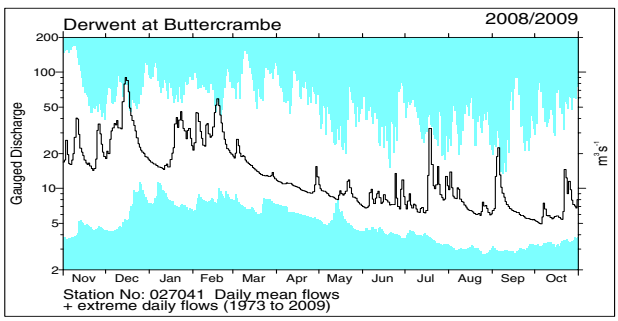


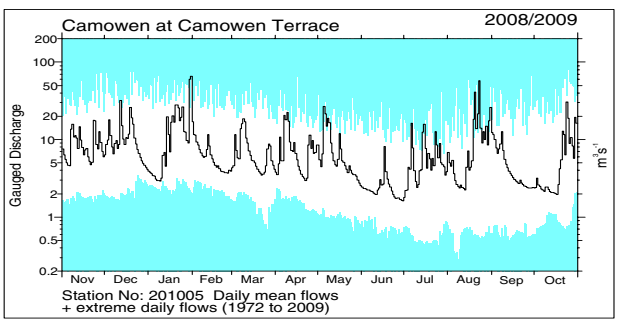


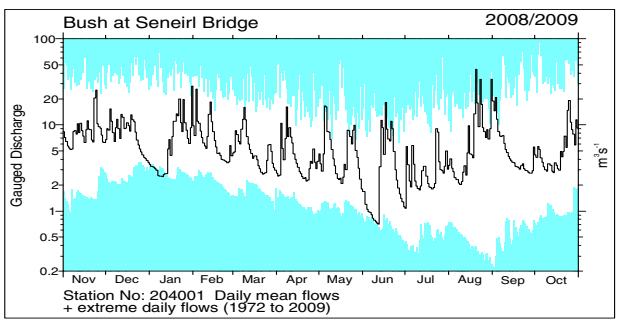








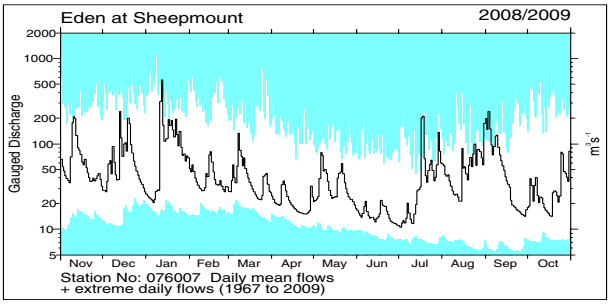


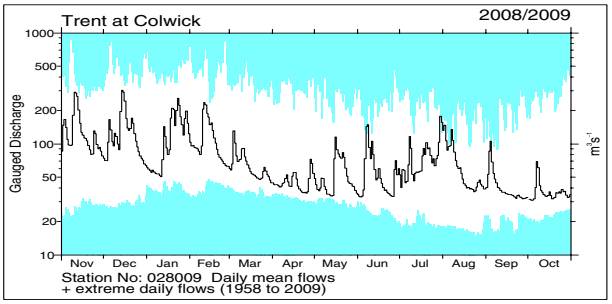


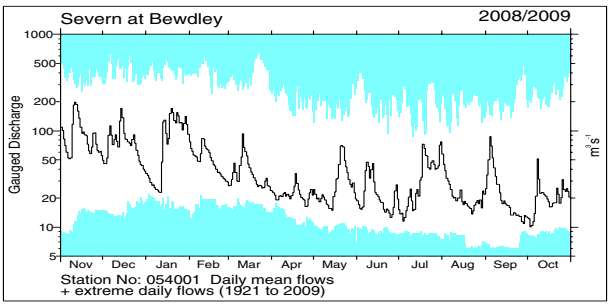
River flow hydrographs

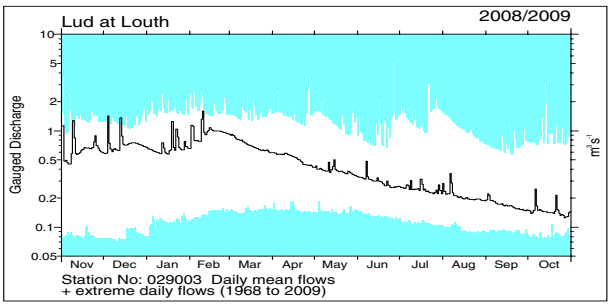
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to November 2008 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

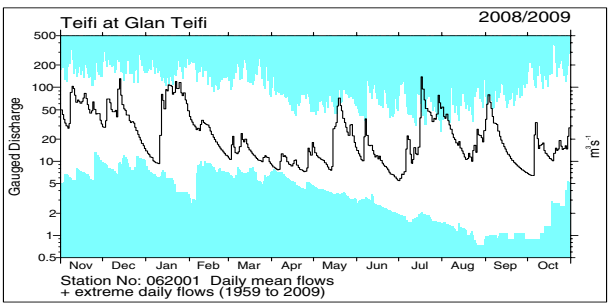
River flow . . . River flow . . .

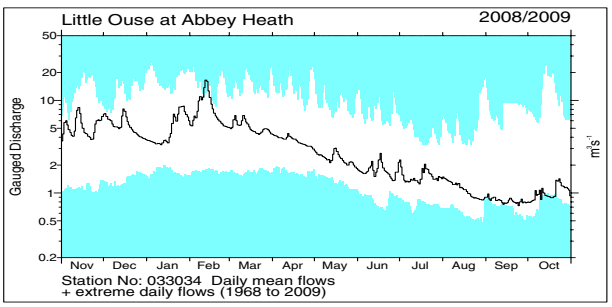


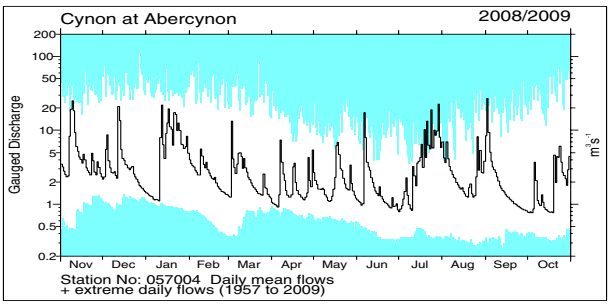


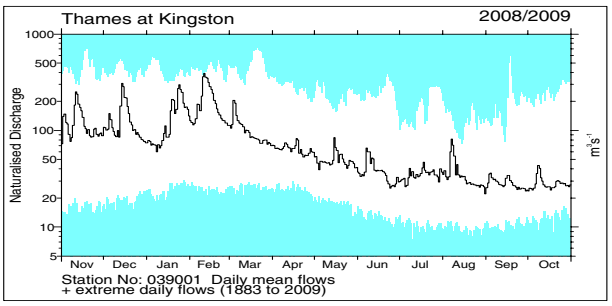


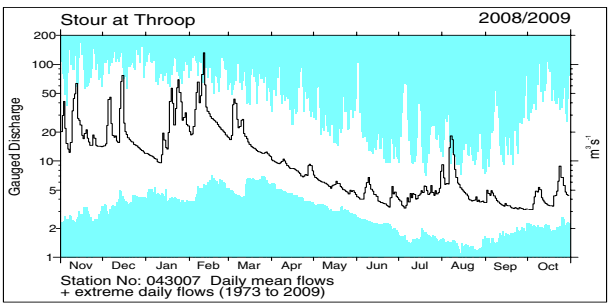


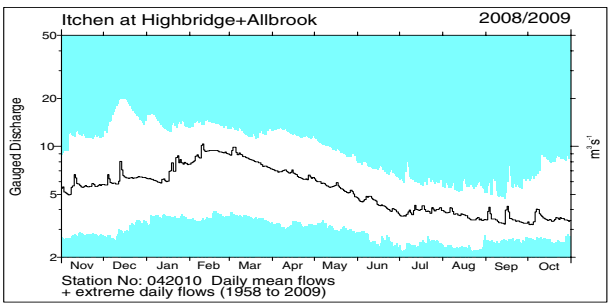












Notable runoff accumulations (a) August - Oct 2009, (b) May - Oct 2009, (c) November 2008 - Oct 2009

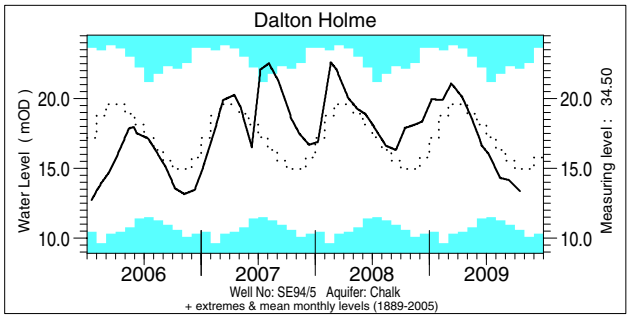
	River	%lta	Rank
a)	Ness	140	35/37
	Deveron	185	49/49
	Dover Beck	140	31/34
	Little Ouse	48	2/40
	Colne	44	6/50
	Camowen	135	33/38

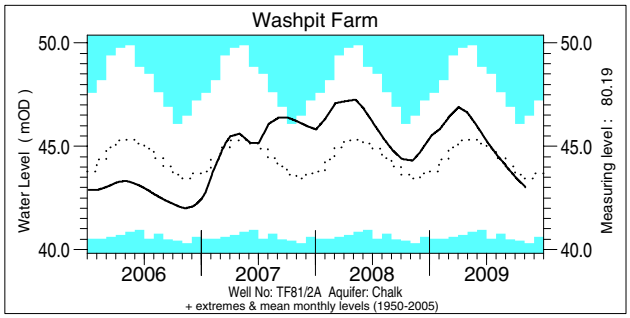
	River	%lta	Rank
b)	Tay	138	53/57
	Forth	139	26/28
	Gt Stour	67	5/45
	Lymington	44	4/47
	Nith	152	50/52
	Cree	148	42/46
	Luss	128	29/31
	Mourne	141	25/27

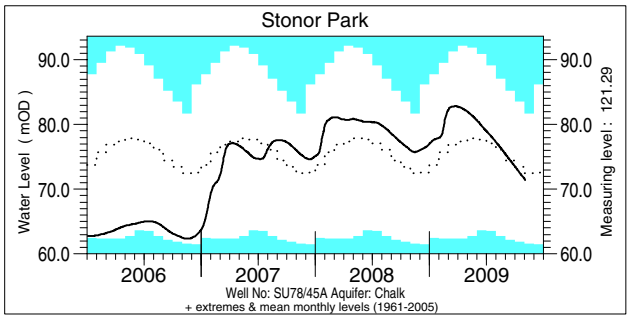
	River	%lta	Rank
c)	Severn	71	7/88
	Yscir	79	5/36
	Dee (New Inn)	75	3/40
	Ribble	73	6/49
	Lagan	72	3/36

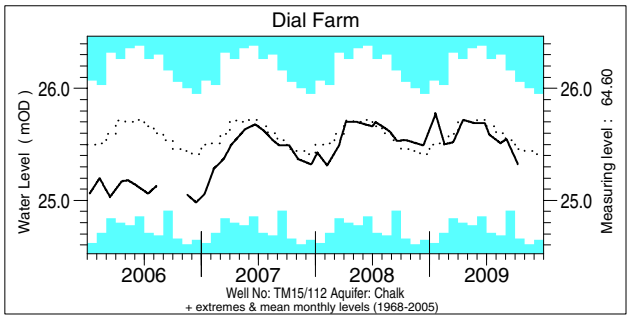
lta = long term average
Rank 1 = lowest on record

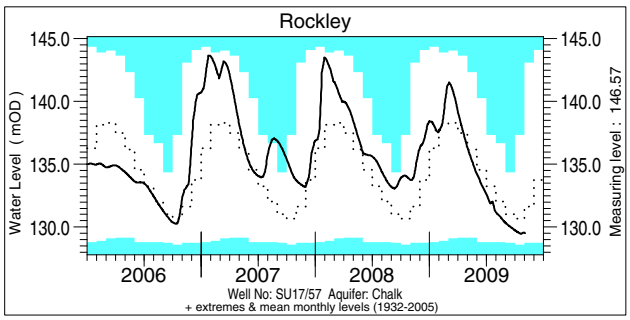
Groundwater . . . Groundwater

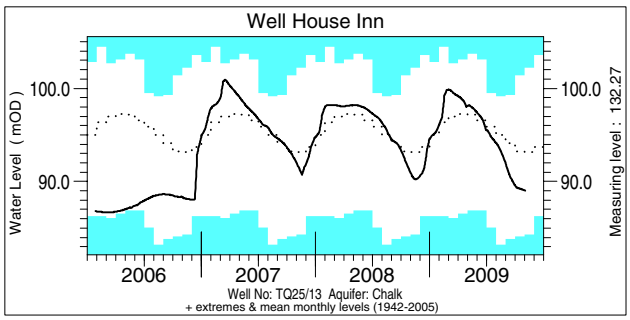


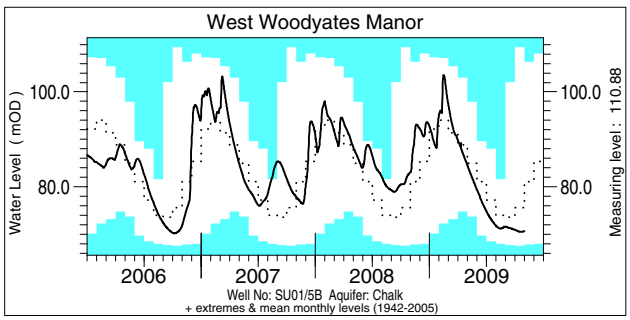


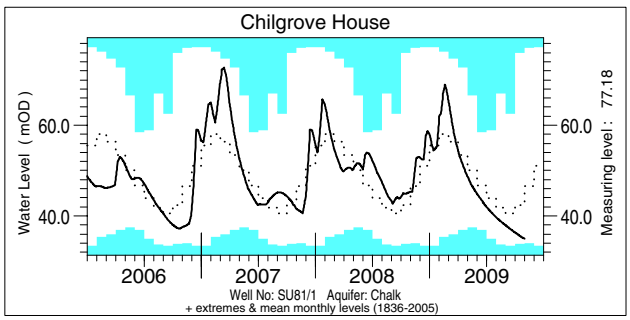


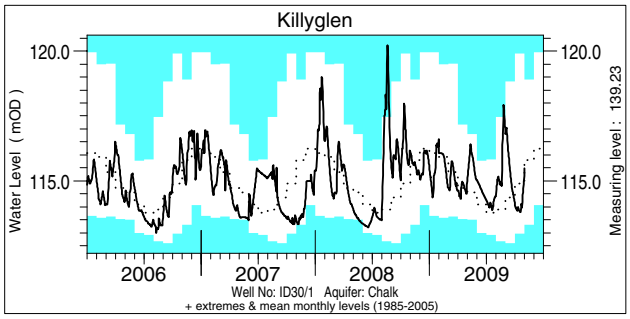


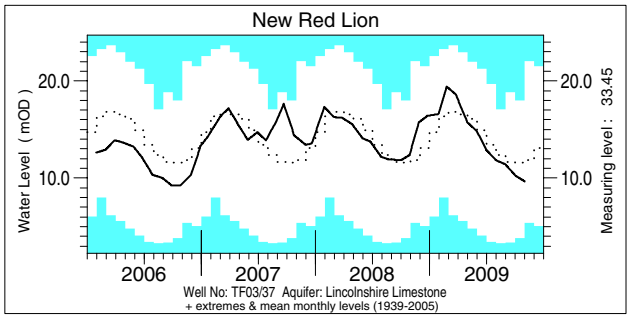






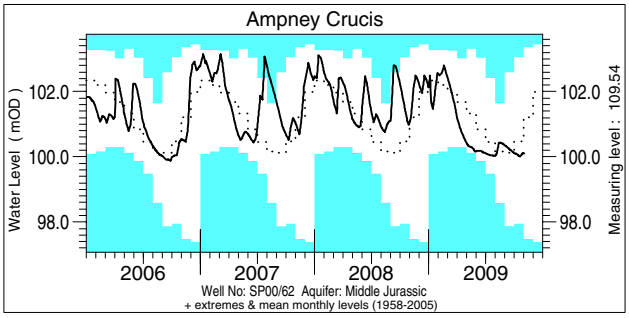


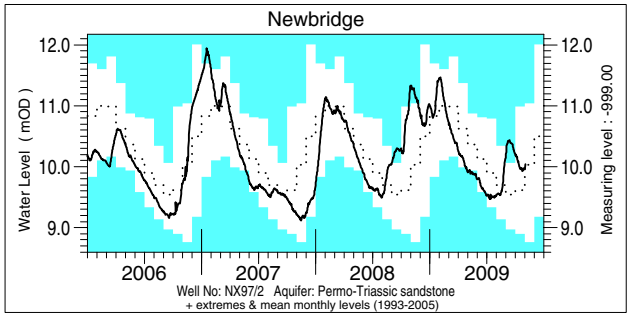


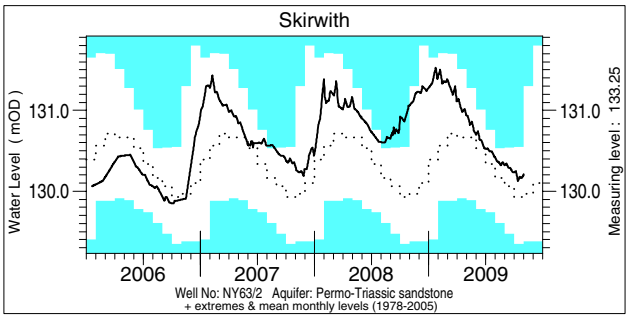


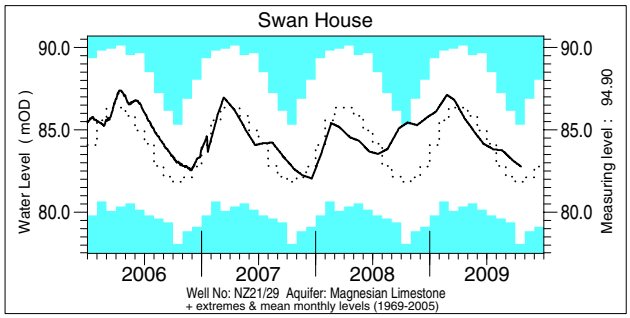
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

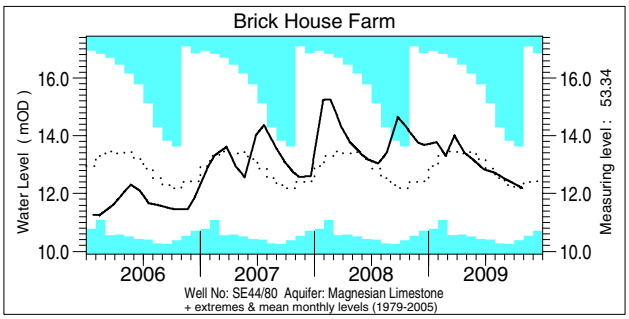
Groundwater . . . Groundwater

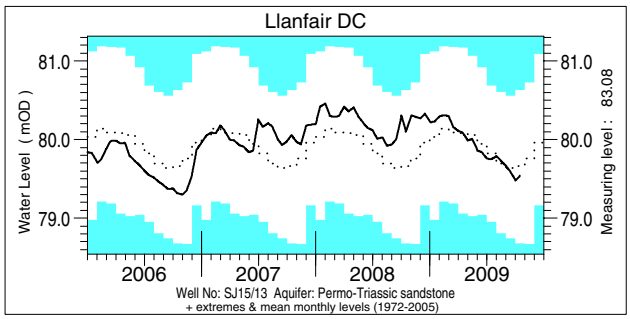


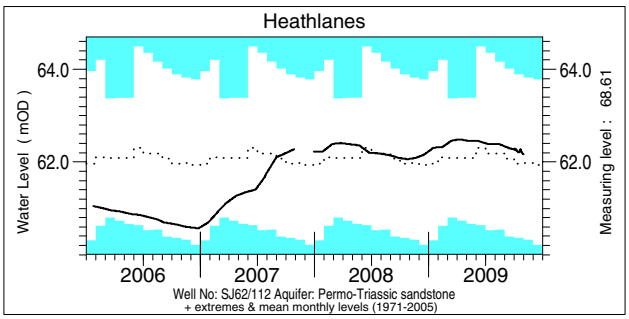


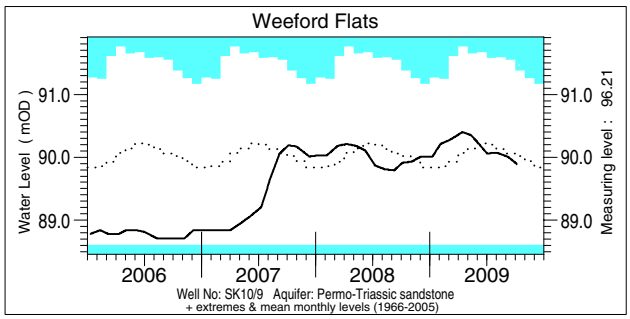


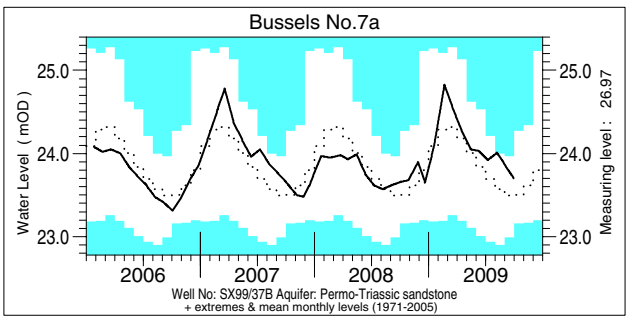


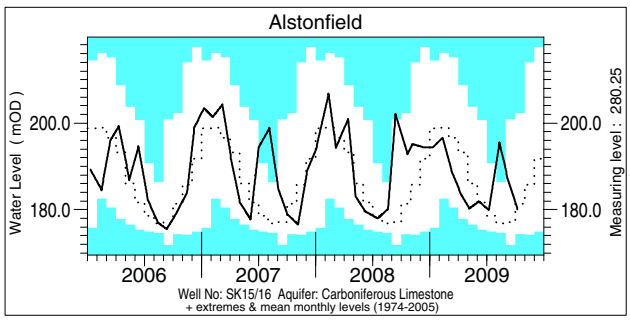












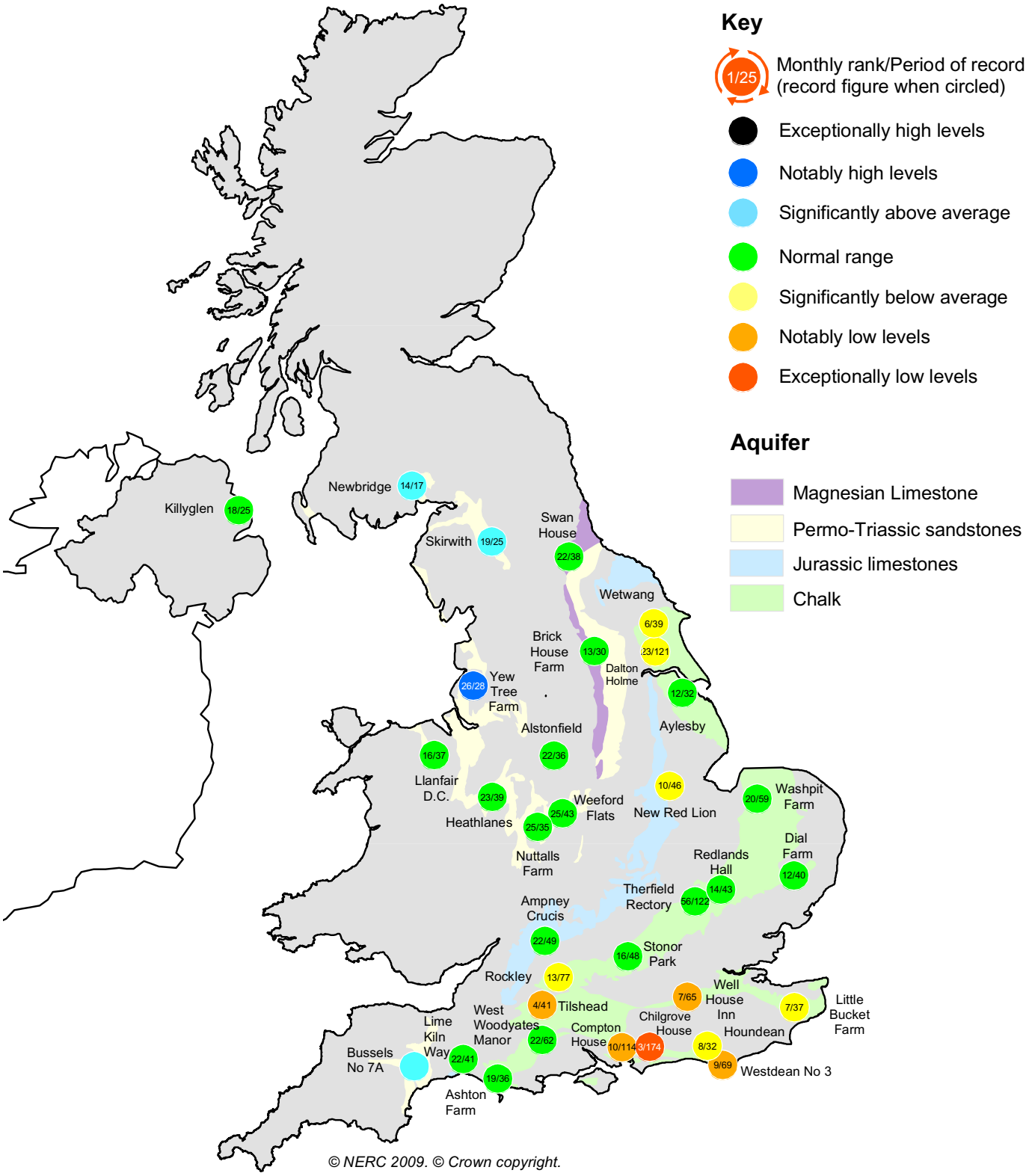
Groundwater levels October / November 2009

Borehole	Level	Date	Oct. av.
Dalton Holme	13.35	16/10	14.92
Washpit Farm	43.02	02/11	43.58
Stonor Park	71.44	02/11	73.17
Dial Farm	25.32	09/10	25.47
Rockley	129.50	02/11	130.73
Well House Inn	89.01	02/11	93.16
West Woodyates	70.67	31/10	75.03

Borehole	Level	Date	Oct. av.
Chilgrove House	34.97	31/10	42.35
Killyglen (NI)	115.48	31/10	114.81
New Red Lion	9.64	31/10	11.62
Ampney Crucis	100.10	02/11	100.45
Newbridge	10.04	01/11	9.68
Skirwith	130.21	31/10	130.00
Swan House	82.74	19/10	82.24

Borehole	Level	Date	Oct. av.
Brick House Farm	12.19	26/10	12.26
Llanfair DC	79.54	15/10	79.58
Heathlanes	62.17	31/10	61.93
Weeford Flats	89.89	05/10	89.73
Bussels No.7a	23.70	29/09	23.51
Alstonfield	180.11	07/10	181.47

Levels in metres above Ordnance Datum



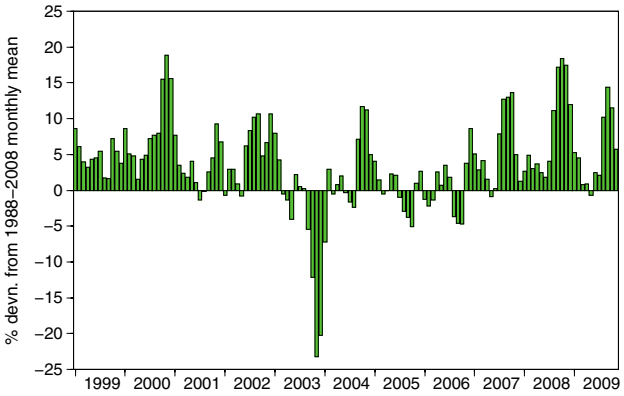
Groundwater levels - October 2009

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.

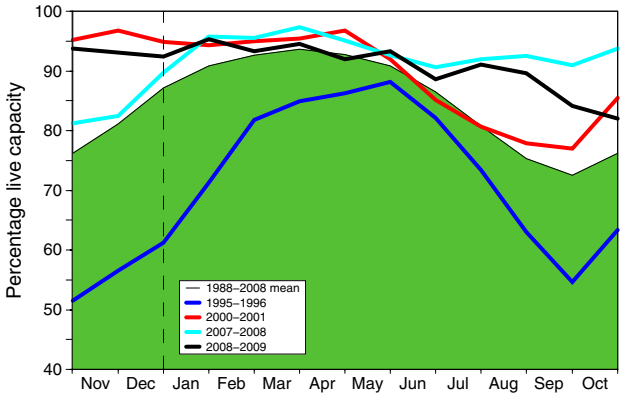
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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 Sep	Oct	Nov	Nov Anom.	Min Nov	Year* of min	2008 Nov	Diff 09-08
North West	N Command Zone	•	124929	92	87	**90**	26	33	2003	98	-8
	Vyrnwy		55146	77	75	**72**	-2	25	1995	100	-28
Northumbrian	Teesdale	•	87936	95	81	**92**	20	33	1995	93	-1
	Kielder		(199175)	(97)	(87)	**(88)**	2	(63)	1989	(94)	-6
Severn Trent	Clywedog		44922	93	87	**79**	4	38	1995	80	-1
	Derwent Valley	•	39525	79	76	**67**	-4	15	1995	100	-33
Yorkshire	Washburn	•	22035	81	78	**77**	10	15	1995	98	-21
	Bradford supply	•	41407	79	76	**74**	3	16	1995	99	-25
Anglian	Grafham		(55490)	(89)	(84)	**(81)**	-1	(44)	1997	(95)	-14
	Rutland		(116580)	(78)	(73)	**(69)**	-9	(59)	1995	(80)	-11
Thames	London	•	196628	91	84	**80**	4	46	1996	92	-12
	Farmoor	•	13822	98	84	**85**	-3	43	2003	95	-10
Southern	Bewl		28170	57	51	**45**	-17	33	1990	61	-16
	Ardingly		4685	75	64	**55**	-12	15	2003	75	-20
Wessex	Clatworthy		5364	93	83	**72**	9	14	2003	100	-28
	Bristol WW	•	(38666)	(74)	(65)	**(57)**	-5	(24)	1990	(90)	-33
South West	Colliford		28540	95	94	**95**	27	38	2006	100	-5
	Roadford		34500	89	89	**86**	16	18	1995	97	-11
	Wimbleball		21320	93	87	**81**	14	26	1995	100	-19
	Stithians		4967	82	78	**75**	20	18	1990	84	-9
Welsh	Celyn and Brenig	•	131155	89	88	**85**	2	48	1989	98	-13
	Brianne		62140	100	96	**95**	5	57	1995	100	-5
	Big Five	•	69762	96	91	**89**	16	38	2003	99	-10
	Elan Valley	•	99106	98	96	**93**	9	37	1995	99	-6
Scotland(E)	Edinburgh/Mid Lothian	•	97639	94	88	**92**	13	48	2003	97	-5
	East Lothian	•	10206	100	100	**97**	16	38	2003	99	-2
Scotland(W)	Loch Katrine	•	111363	100	94	**93**	9	40	2003	91	2
	Daer		22412	98	97	**93**	4	42	2003	99	-6
	Loch Thom	•	11840	96	95	**95**	7	66	2007	96	-1
Northern Ireland	Total⁺	•	56920	96	91	**96**	18	39	1995	91	5
	Silent Valley	•	20634	97	92	**95**	25	34	1995	95	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 1988-2008 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.
The London total has been revised to 196628 Ml as of November 2009.

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.

For further details please contact:

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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

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