Hydrological Summary

for the United Kingdom

April 2010

General

High pressure dominated synoptic patterns across most of the country in April which was sunny and dry in most regions. A particularly arid episode, beginning early in the month, has contributed to substantial 4-5 month rainfall deficiencies which now extend across much of the country; the UK registered its 3rd driest January-April period since 1976. Rainfall patterns through the spring can be particularly important in relation to the water resources outlook and recent inflows to most reservoirs have been modest, over the last six weeks in particular. However, the residual benefit of healthy reservoir stocks in the early winter are still evident. Overall stocks for England & Wales are only marginally below the early May average and stocks in most index reservoirs remain within the normal late-spring range but in Scotland, despite some useful snowmelt runoff, stocks are relatively depressed in some major reservoirs (e.g. Lochs Katrine and Thom). After widespread spates, with some modest floodplain inundations early in the month, sustained and steep river flow recessions became established in almost all impermeable catchments. April runoff totals were mostly in the normal range but, approaching month-end, flows were seasonally depressed in many responsive rivers. A brisk rise in soil moisture deficits through April may signal an end to the 2009/10 recharge season at least in eastern aquifer outcrop areas. The medium term rainfall deficiencies have produced some agricultural stress and low summer flows are a likely prospect in many responsive rivers but the overall water resources position remains fairly typical of the late spring.

Rainfall

A persistent high pressure cell to the north-west of the British Isles served to divert most rain-bearing Atlantic frontal systems away from the British Isles during April. Winds were commonly from the north-east quadrant (allowing an Icelandic volcanic ash plume to create severe air transport problems). Such synoptic patterns are rarely associated with high rainfall and although the odd local storm produced locally significant rainfalls, mostly in northern Britain (e.g. 40mm at Tulloch Bridge on the 4th), the most notable characteristic of the April rainfall patterns was the lengthy sequence of dry days – up to 20 in succession in parts of southern Britain. April rainfall totals were near-average in much of Scotland and Northern Ireland but fell below 50% in most of southern Britain. Large parts of East Anglia recorded monthly totals of <10mm, falling to 6mm in a few localities (e.g. Writtle in Essex). Provisionally, England & Wales registered its 4th driest April since 1984 but the accumulated rainfall deficiencies since late in 2009 are of greater water resources significance. Over the January-April period rainfall deficiencies are generally most notable across western Britain: the North West Region and Wales had their driest first four months of the year since 1964 and 1976 respectively. Fortunately, regional 12-month accumulations remain above average in all but the Highland Region of Scotland.

River flows

April witnessed an abnormally wide range of flows in most parts of the country. High spate conditions were common following heavy late March and early April rainfall (boosted by snowmelt in the uplands of northern Britain); moderate floodplain inundations were relatively common (e.g. in eastern Scotland). On the 6th, the Tay and Earn registered their highest April flows (in records of >50 yrs); in Northern Ireland, the Annacloy also exceeded its previous April maximum flow. However, the most significant hydrological feature of the month was the very step and extended recessions which characterised all but the first week. Late-April flows were <50% of average in many, widely distributed, responsive catchments (including the Tweed, Wharfe, Mole and Cynon) and approached monthly minima in a few (e.g. the Ribble). Importantly however the late-April minima were generally appreciably above drought minima (often established in the Aprils of 1984, 1990, 1995 or 2003). In most rivers draining permeable catchments, healthy baseflows enabled flows to hold up well with many (including the Lambourn and Itchen) remaining well above average at month end. North west England excepted, most April runoff totals were within, or above, the normal monthly range – exceptionally so in the Tweed basin. Runoff patterns for the year thus far shows very marked spatial variability, new Jan-April runoff maxima were established in parts of eastern Scotland (e.g. for the Deveron and Whiteadder) whilst new minima were recorded in north Wales (e.g. for the Conwy and Dee). There is much more spatial cohesion in the 12-month (May-April) runoff accumulations: most are well within the normal range.

Groundwater

The generally warm, sunny weather and limited rainfall led to a rapid rise in soil moisture deficits during April. Showery conditions made for significant local variations but end-of-month smds were generally well above average across most major aquifer outcrop areas (but lower than those registered during recent dry Aprils e.g. 2007, 2003, 1997). Thus, despite a very useful pulse early in the month, infiltration totals for April were below, to well below, average across much of the country. Seasonal groundwater level recessions are now well established in all but the slowest responding index wells (e.g. Therfield). April groundwater levels were below average in a few northern outcrop areas – see the hydrographs for Killyglen and Newbridge. Elsewhere, and not withstanding the very erratic recharge patterns in 2010 thus far, April groundwater levels in most aquifer units were within, or above, the normal spring range; a similar broad generalisation applies to the minor aquifers in East Anglia (e.g. the Essex Gravels). Recent years have seen some very unusual late spring and summer recharge but the continuation of anticyclonic weather patterns into May probably implies a seasonal end to significant recharge in the English Lowlands, with an expectation that in some eastern areas the 2010 recessions will follow a similar pattern to those of last year.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

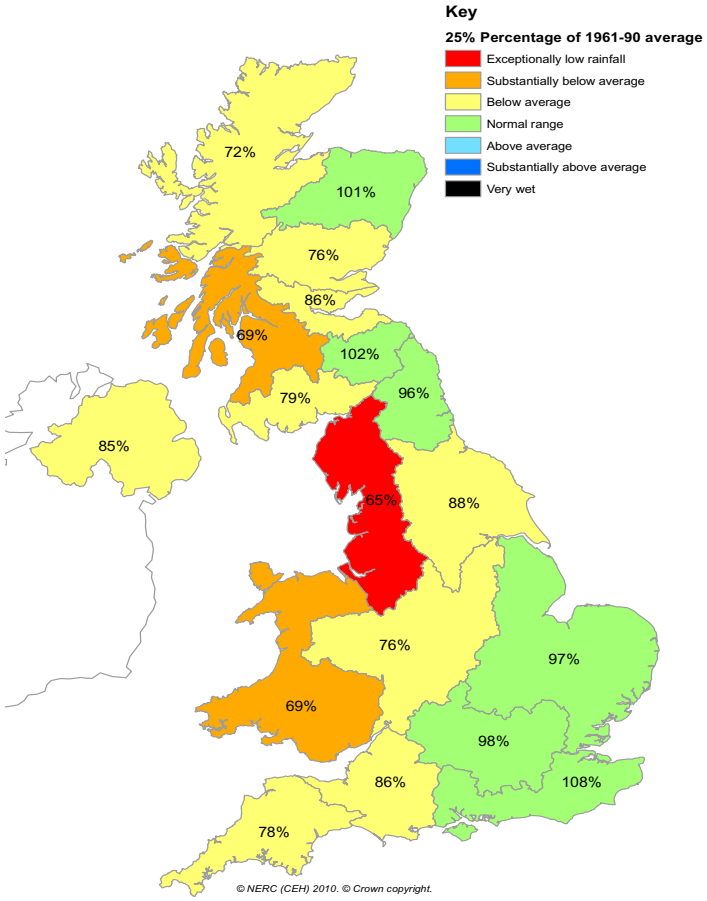
Area	Rainfall	Apr 2010	Jan10 - Apr10		Nov09 - Apr10		Aug09 - Apr10		May09 - Apr10	
				RP		*RP*		*RP*		*RP*
England & Wales	**mm**	**28**	**236**		**529**		**704**		**963**	
	%	**47**	**82**	**2-5**	**111**	**2-5**	**98**	**2-5**	**106**	**2-5**
North West	mm	**33**	237		645		940		1288	
	%	**46**	65	20-30	105	2-5	97	2-5	106	2-5
Northumbrian	mm	**21**	262		554		735		1025	
	%	**36**	96	2-5	125	10-20	109	2-5	118	5-15
Severn Trent	mm	**27**	185		391		523		785	
	%	**48**	76	5-10	99	2-5	88	2-5	102	2-5
Yorkshire	mm	**23**	233		497		656		914	
	%	**39**	88	2-5	116	2-5	101	2-5	109	2-5
Anglian	mm	**19**	178		344		447		619	
	%	**40**	97	2-5	116	2-5	99	2-5	103	2-5
Thames	mm	**23**	215		455		573		742	
	%	**46**	98	2-5	127	5-10	106	2-5	106	2-5
Southern	mm	**23**	271		595		724		868	
	%	**43**	108	2-5	142	10-20	115	2-5	111	2-5
Wessex	mm	**34**	242		532		697		918	
	%	**64**	86	2-5	116	2-5	102	2-5	108	2-5
South West	mm	**38**	320		693		917		1255	
	%	**55**	78	2-5	102	2-5	94	2-5	105	2-5
Welsh	mm	**41**	300		757		1028		1415	
	%	**49**	69	10-20	103	2-5	94	2-5	105	2-5
Scotland	**mm**	**89**	**361**		**711**		**1208**		**1556**	
	%	**111**	**77**	**5-10**	**91**	**2-5**	**100**	**2-5**	**106**	**5-10**
Highland	mm	**110**	403		737		1320		1693	
	%	**118**	72	5-10	78	5-10	92	2-5	97	2-5
North East	mm	**60**	327		573		945		1258	
	%	**89**	101	2-5	109	5-10	117	15-25	122	40-60
Tay	mm	**85**	323		670		1098		1444	
	%	**125**	76	5-10	97	2-5	105	2-5	112	5-10
Forth	mm	**68**	311		616		980		1284	
	%	**109**	86	2-5	104	2-5	106	2-5	112	5-10
Tweed	mm	**38**	321		647		935		1221	
	%	**63**	102	2-5	128	15-25	119	10-20	122	25-40
Solway	mm	**84**	355		808		1325		1696	
	%	**106**	79	2-5	108	2-5	113	10-20	118	30-40
Clyde	mm	**107**	380		820		1438		1828	
	%	**120**	69	5-10	89	2-5	100	<2	104	2-5
Northern Ireland	**mm**	**59**	**302**		**601**		**923**		**1216**	
	%	**89**	**85**	**2-5**	**105**	**2-5**	**105**	**2-5**	**111**	**5-10**

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

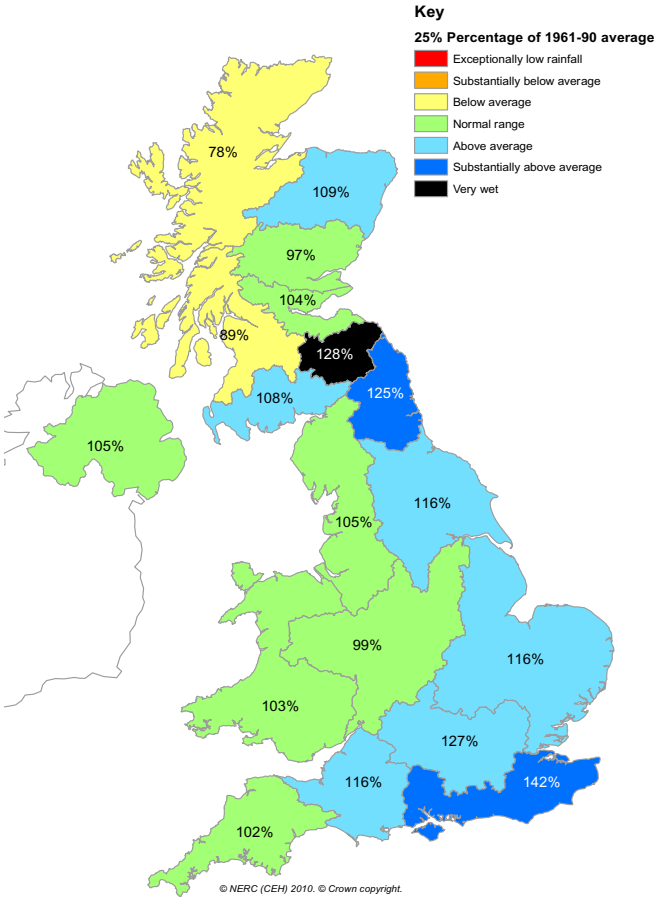
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following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

Rainfall . . . Rainfall . . .

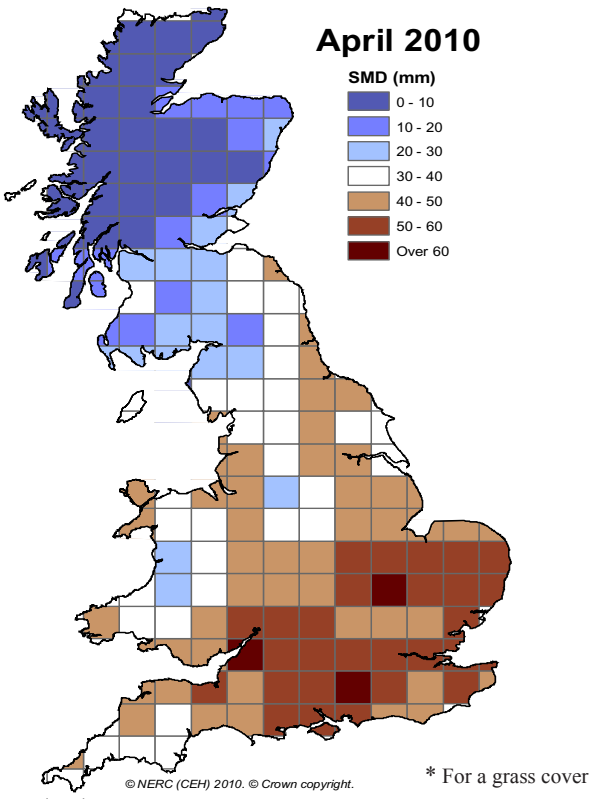
January - April 2010



November 2009 - April 2010



MORECS Soil Moisture Deficits *



* For a grass cover

Met Office Weather forecast

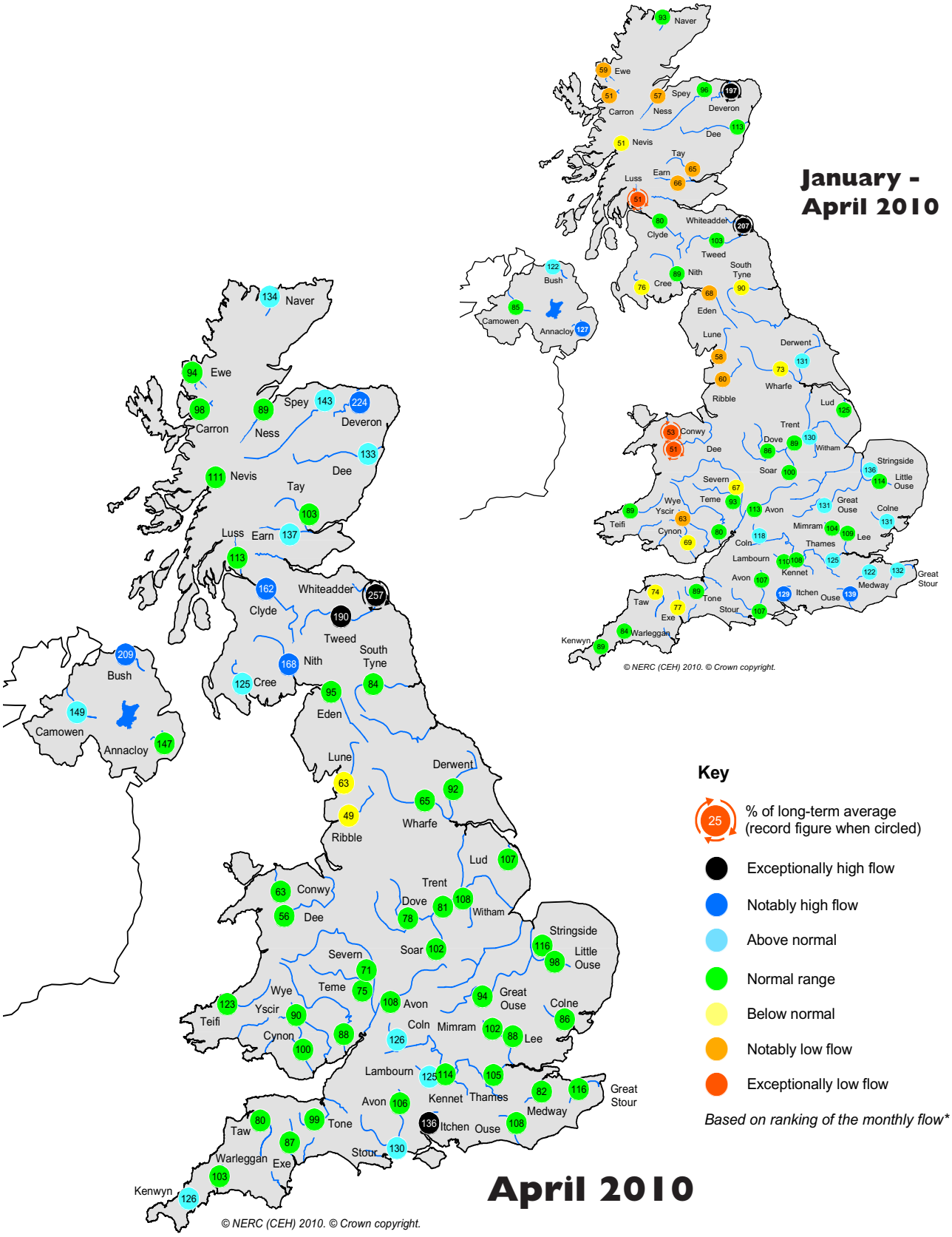
Updated: 1306 on **Thu 13 May 2010**

UK Outlook for 18 May - 27 May 2010:
It will be unsettled in the northwest some sunshine but also with showers or longer periods of rain likely at times. The southeast should have the best of any dry and sunny weather, whilst central areas may have showers or rain at times it will be largely dry here too. However, it is likely to become more generally unsettled across the United Kingdom towards the end of the period. Temperatures are anticipated to be around normal in the north throughout, but with a risk of overnight ground frosts at first, then again later in the month. Southern areas are expected to be warmer than recent weeks, and it may become warm or very warm for a time around the middle of the period.

UK Outlook for 28 May - 11 Jun 2010:
High pressure may build across the UK, with a northwesterly weather type expected to bring some spells of unsettled weather with temperatures starting normal or just below normal for the time of year but becoming rather cool again as we move into June. There are indications of near or slightly above average rainfall amounts during the period, firstly over northern parts of the UK, but later southwestern and central parts appear to be the wettest. Amounts of sunshine should be around or slightly below average.

For further details please visit:
http://www.metoffice.gov.uk/weather/uk/uk_forecast_alltext.html

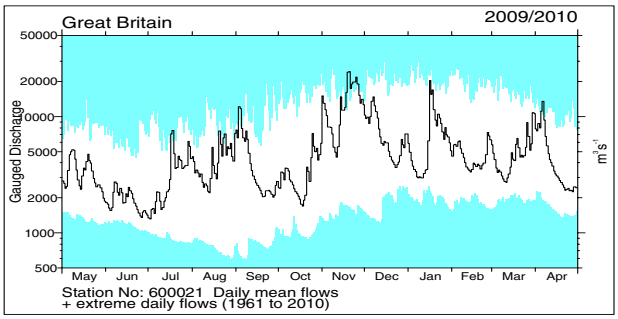
River flow . . . River flow . . .

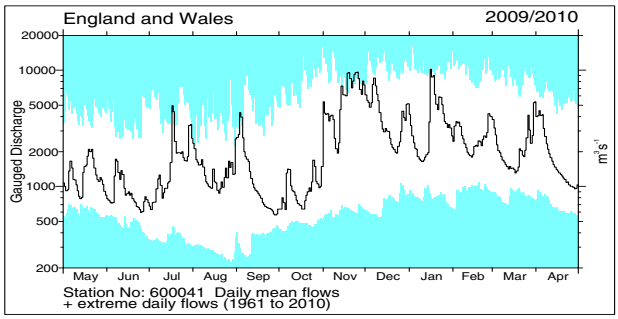


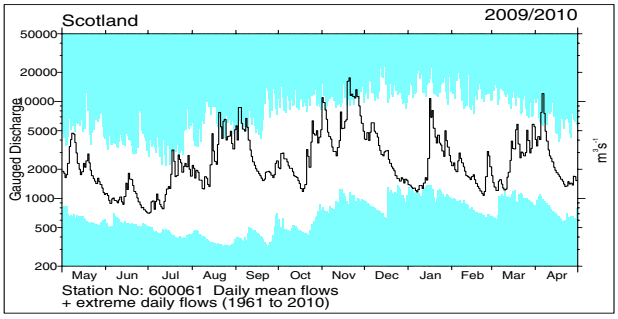
River flows

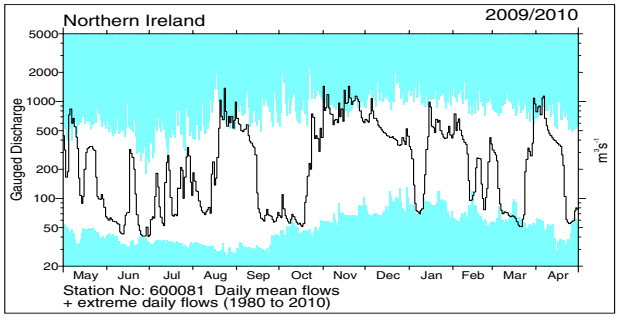
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

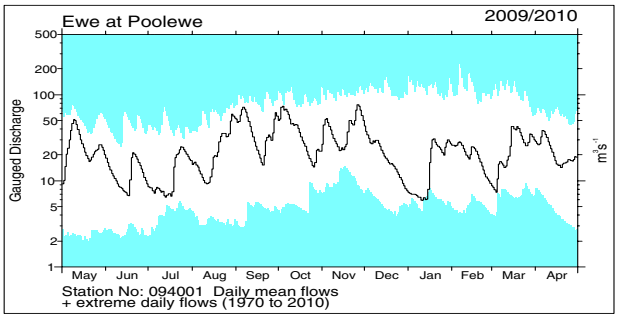
River flow . . . River flow . . .

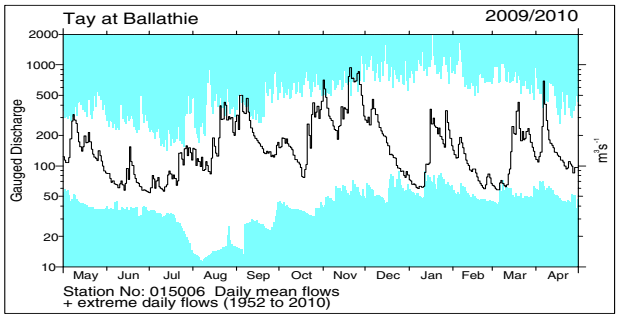


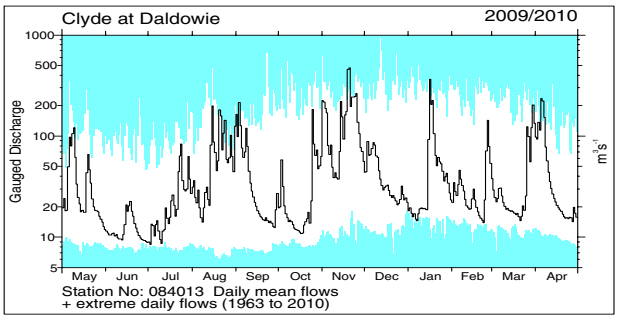


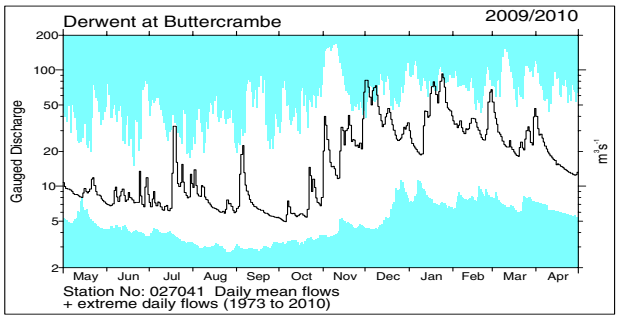


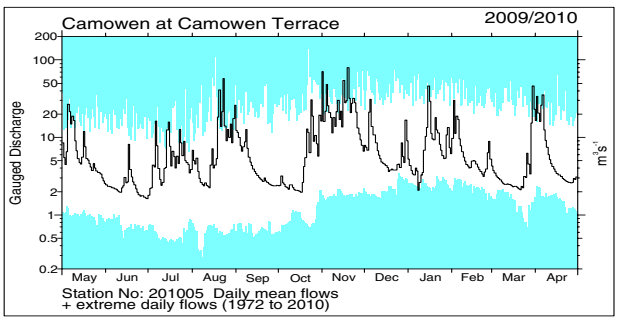


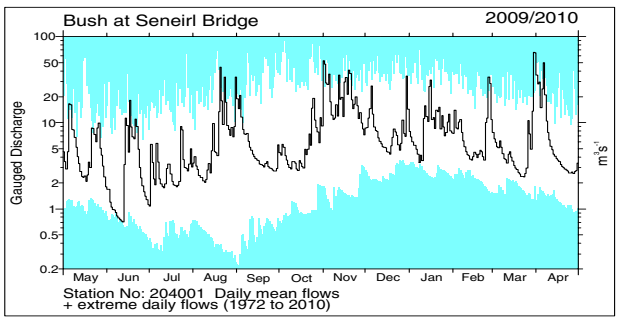








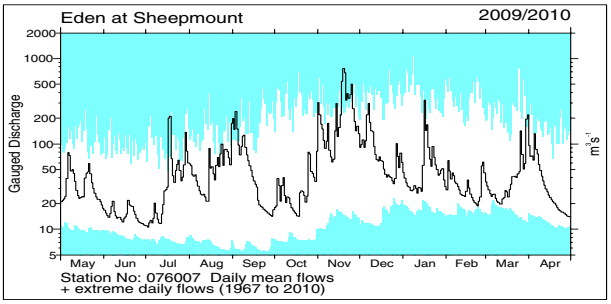


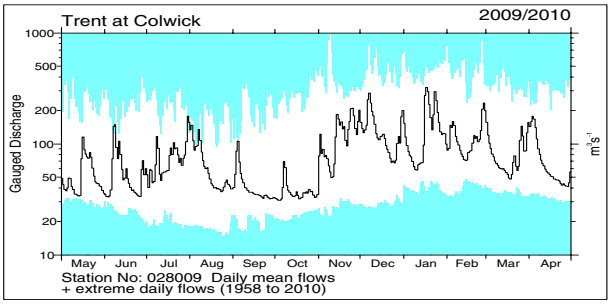


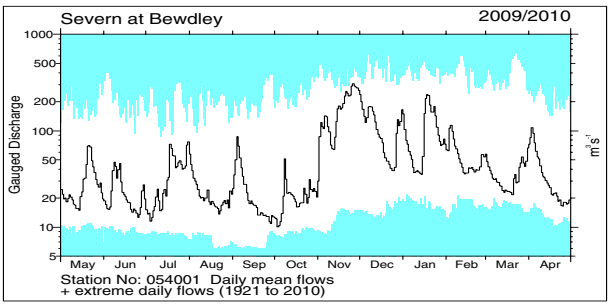
River flow hydrographs

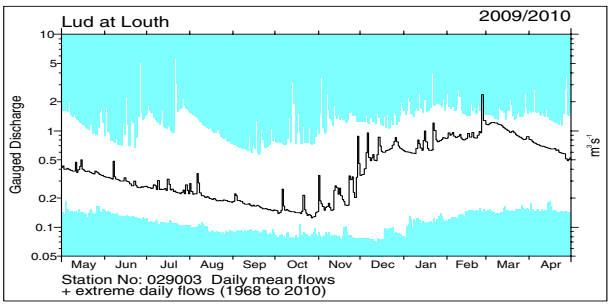
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to May 2009 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

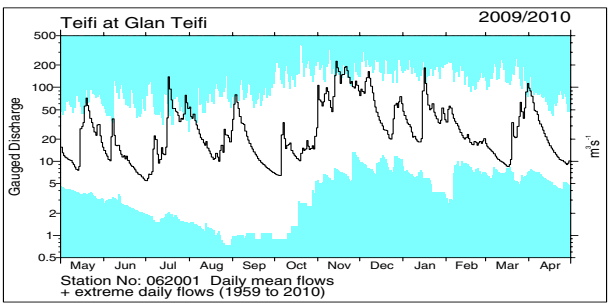
River flow . . . River flow . . .

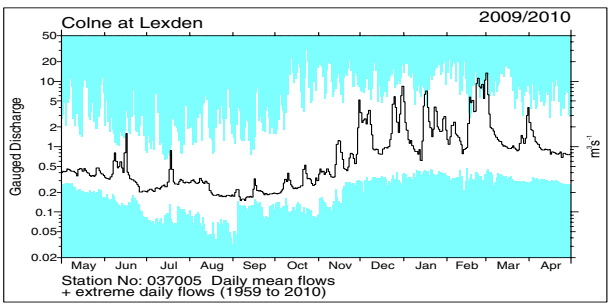


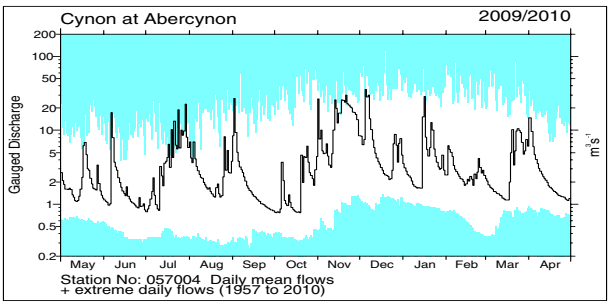


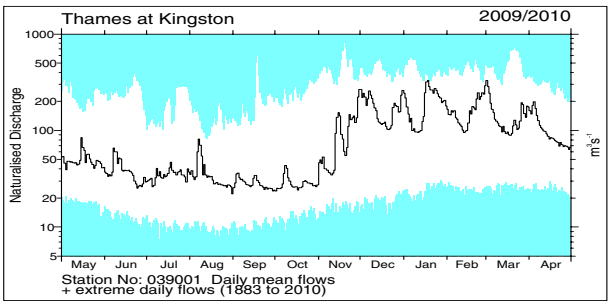


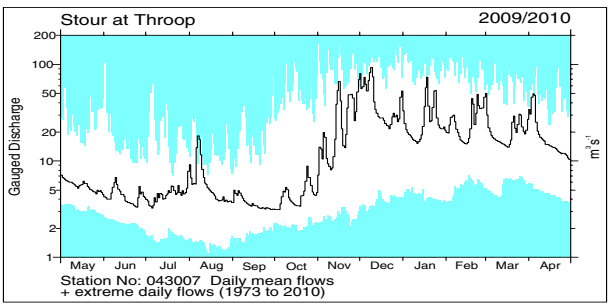


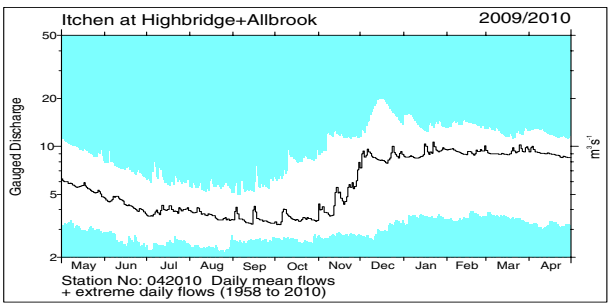












Notable runoff accumulations (a) January - April 2010, (b) November 2009 - April 2010

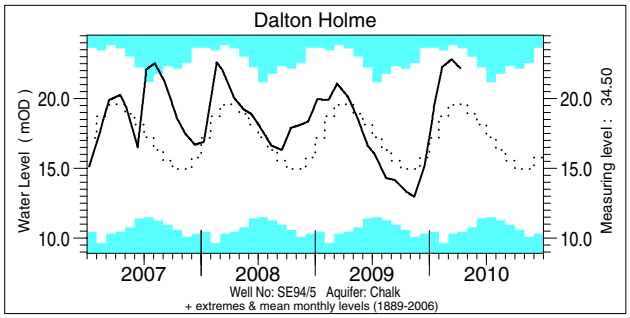
	River	%lta	Rank
a)	Ness	57	4/38
	Deveron	197	50/50
	Forth	51	2/29
	Tyne (Spilmersford)	204	46/46
	Whiteadder	207	41/41
	Blackwater	141	55/58
	Mole	141	33/36
	Ouse (Gold Bridge)	139	44/47
	Yscir	63	3/38

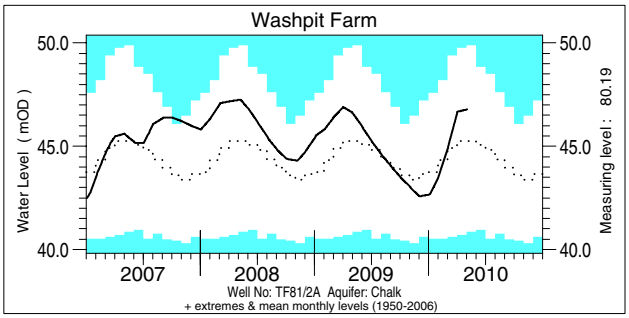
	River	%lta	Rank
a)	Conwy	53	1/43
	Dee (New Inn)	51	1/41
	Ribble	60	4/50
	Lune	58	3/50
	Eden	68	4/43
	Luss	51	1/33
	Annacloy	127	28/31

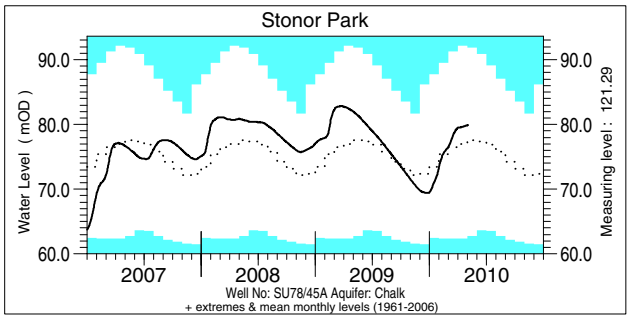
	River	%lta	Rank
b)	Dee (Park)	123	36/38
	Tweed (Norham)	140	50/50
	Tyne (Bywell)	131	51/53
	Nevis	64	3/28
	Carron	54	3/31
	Bush	131	36/36

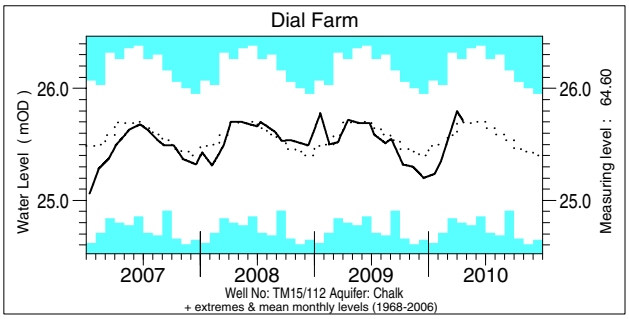
lta = long term average
Rank 1 = lowest on record

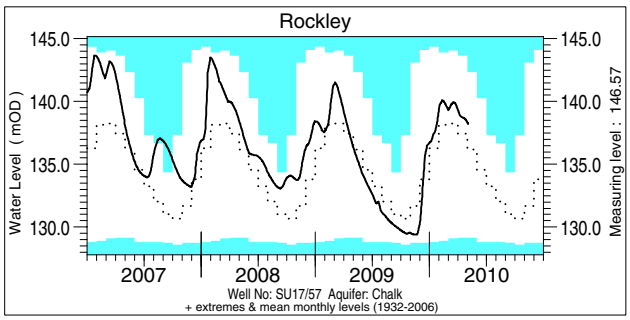
Groundwater . . . Groundwater

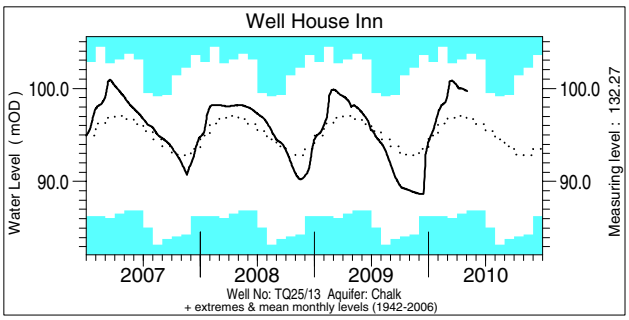


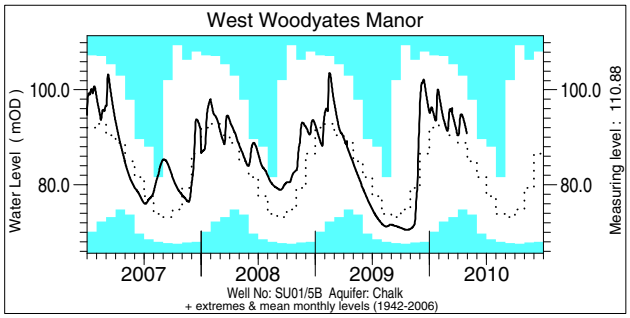


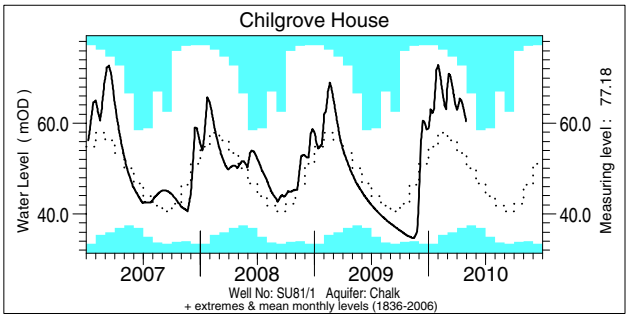


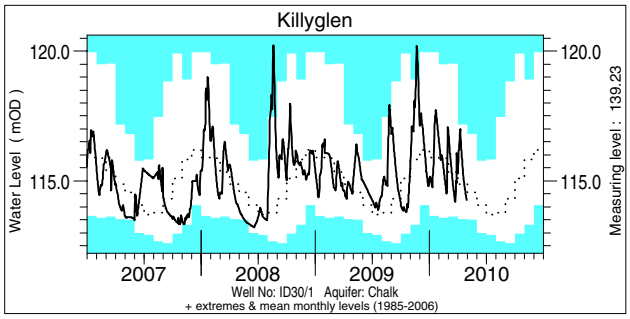


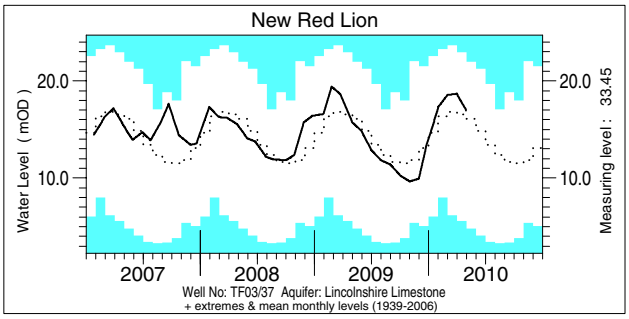






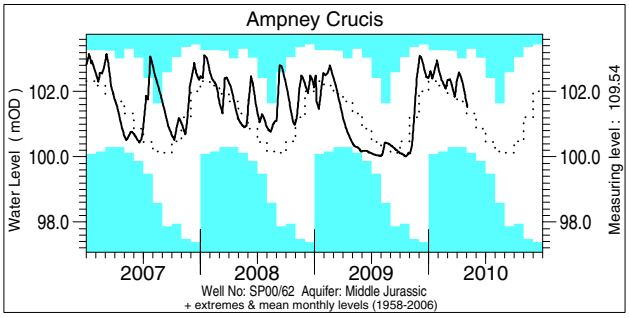


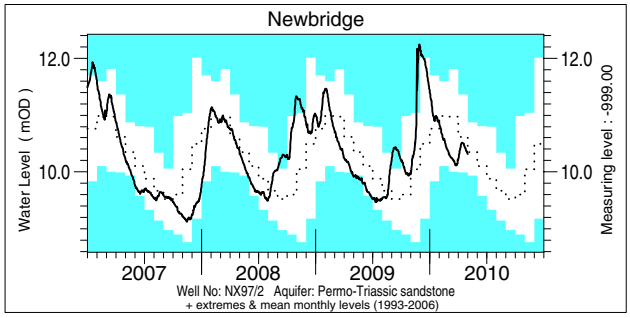


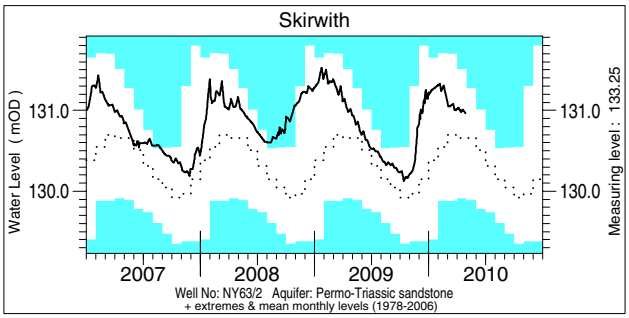


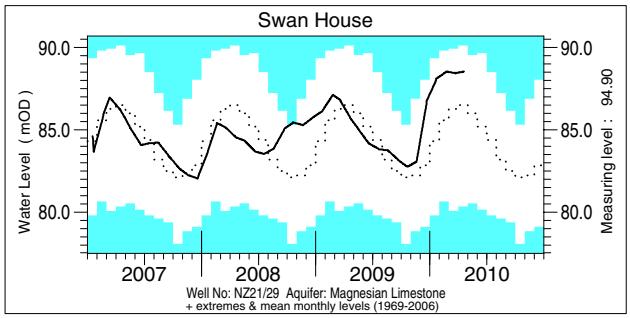
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

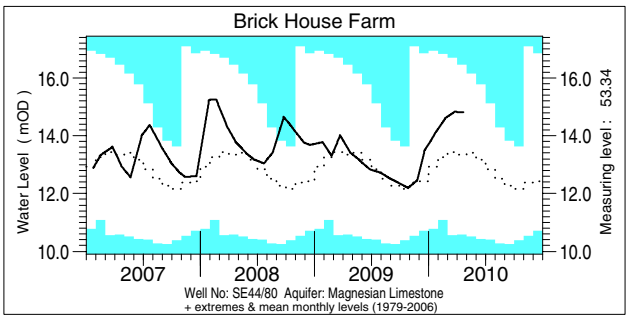
Groundwater . . . Groundwater

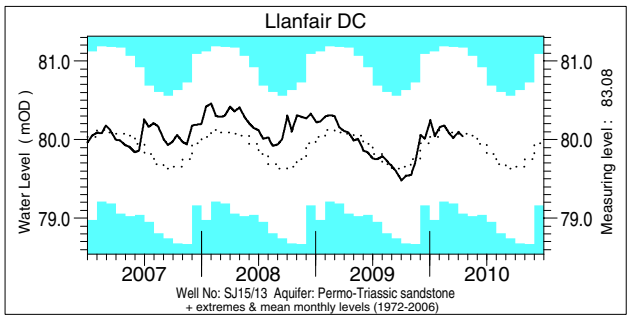


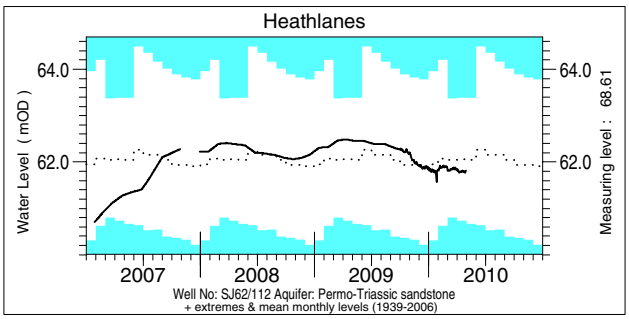


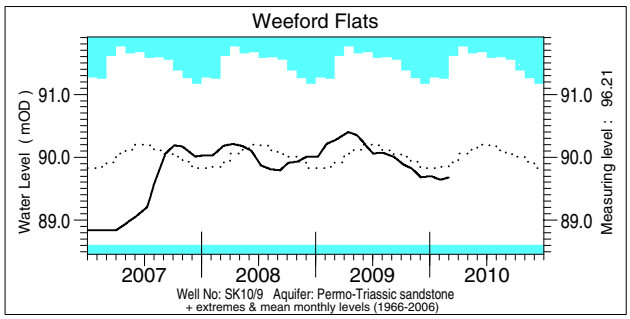


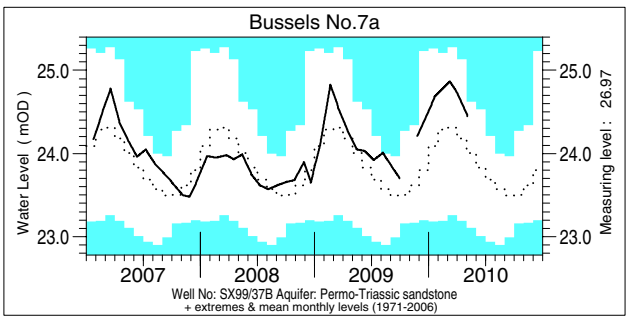


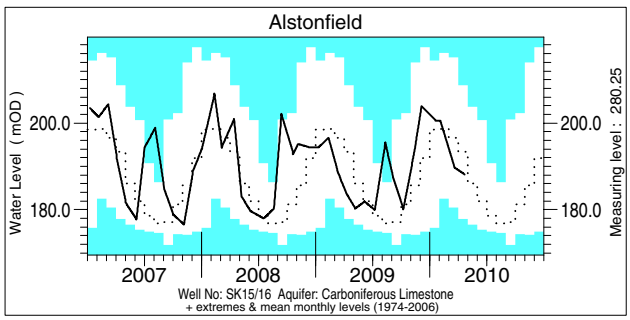






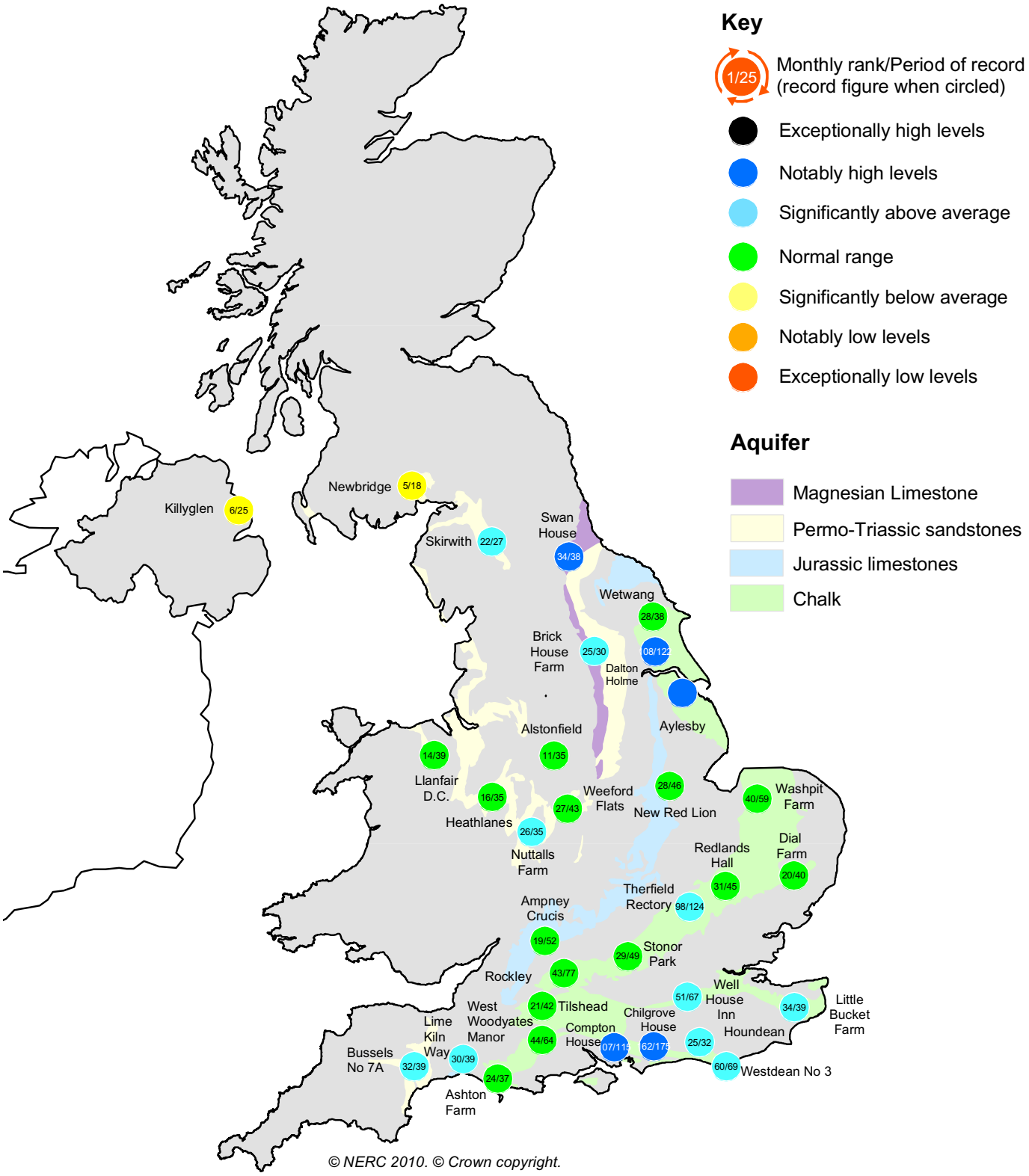






Groundwater levels April / May 2010

Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.
Dalton Holme	22.16	09/04	19.49	Chilgrove House	60.45	30/04	52.24	Brick House Farm	14.81	22/04	13.34
Washpit Farm	46.79	04/05	45.45	Killyglen (NI)	114.26	29/04	114.91	Llanfair DC	80.04	15/04	80.06
Stonor Park	79.91	04/05	77.59	New Red Lion	16.96	30/04	16.32	Heathlanes	61.81	30/04	62.05
Dial Farm	25.71	20/04	25.67	Ampney Crucis	101.53	04/05	101.70	Weeford Flats	89.91	04/05	89.87
Rockley	138.19	04/05	137.55	Newbridge	10.32	01/05	10.53	Bussels No.7a	24.45	04/05	24.17
Well House Inn	99.68	04/05	97.15	Skirwith	130.96	28/04	130.67	Alstonfield	188.16	21/04	193.06
West Woodyates	90.86	30/04	88.41	Swan House	88.53	20/04	85.67	*Levels in metres above Ordnance Datum*			



Groundwater levels - April 2010

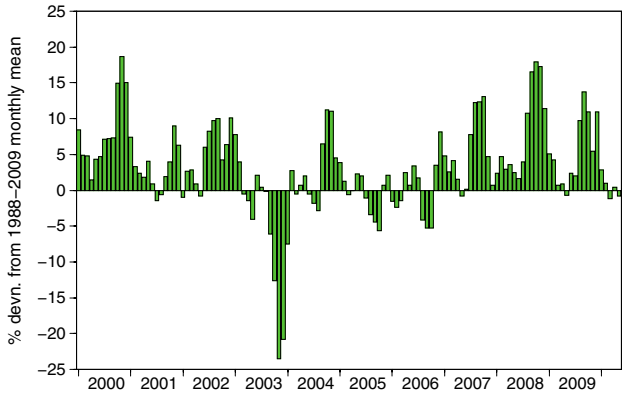
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing 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.

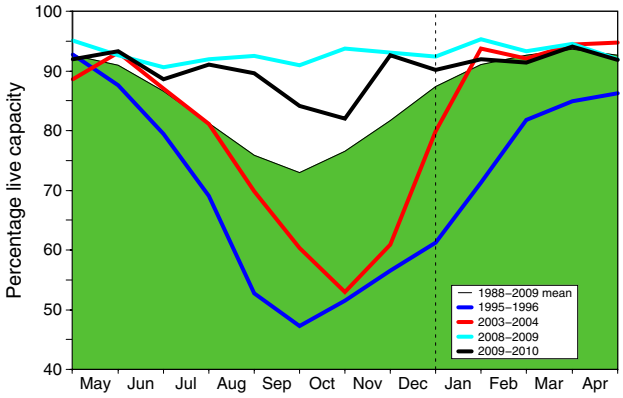
ii. Yew Tree Farm levels are now received quarterly.

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)	2010 Mar	Apr	May	May Anom.	Min May	Year* of min	2009 May	Diff 10-09
North West	N Command Zone	•	124929	80	82	**82**	-7	74	2003	80	2
	Vyrnwy		55146	93	92	**90**	-3	70	1996	85	5
Northumbrian	Teesdale	•	87936	82	96	**85**	-7	74	2003	95	-10
	Kielder		(199175)	(90)	(93)	**(88)**	-3	85	1990	(90)	-2
Severn Trent	Clywedog		44922	87	92	**96**	-1	85	1988	97	-1
	Derwent Valley	•	39525	100	100	**94**	2	54	1996	84	10
Yorkshire	Washburn	•	22035	98	95	**87**	-3	76	1996	86	1
	Bradford supply	•	41407	99	99	**89**	-2	60	1996	85	4
Anglian	Grafham		(55490)	(90)	(92)	**(93)**	-1	73	1997	(95)	-2
	Rutland		(116580)	(91)	(94)	**(92)**	0	72	1997	(90)	2
Thames	London	•	202828	90	92	**93**	-1	86	1990	98	-5
	Farmoor	•	13822	79	85	**97**	0	81	2000	95	2
Southern	Bewl		28170	100	100	**100**	10	63	1990	90	10
	Ardingly		4685	100	100	**100**	0	98	2005	100	0
Wessex	Clatworthy		5364	95	100	**99**	6	81	1990	84	15
	Bristol WW	•	(38666)	(100)	(96)	**(95)**	2	85	2005	(92)	3
South West	Colliford		28540	99	99	**99**	13	56	1997	100	-1
	Roadford		34500	94	92	**92**	7	41	1996	92	0
	Wimbleball		21320	100	99	**98**	4	79	1992	96	2
	Stithians		4967	99	100	**95**	4	65	1992	96	-1
Welsh	Celyn and Brenig	•	131155	99	100	**99**	1	75	1996	99	0
	Brianne		62140	96	99	**97**	0	86	1997	95	2
	Big Five	•	69762	92	98	**93**	0	85	1997	89	4
	Elan Valley	•	99106	97	95	**94**	-3	87	2003	94	0
Scotland(E)	Edinburgh/Mid Lothian	•	97639	98	94	**97**	4	62	1998	98	-1
	East Lothian	•	10206	100	100	**100**	2	89	1992	100	0
Scotland(W)	Loch Katrine	•	111363	76	74	**80**	-13	**80**	**2010**	93	-13
	Daer		22412	95	94	**97**	1	87	2007	97	0
	Loch Thom	•	11840	95	83	**83**	-12	**83**	**2010**	96	-13
Northern Ireland	Total+	•	56920	94	99	**92**	5	77	2007	92	0
	Silent Valley	•	20634	91	100	**91**	9	58	2000	84	7

() 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 1988-2009 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 202828 Ml as of April 2010.

Location map . . . Location map

National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme (NHMP)[#] is undertaken jointly by the Centre for Ecology & Hydrology (CEH) 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) 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.
[#] Instigated in 1988

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The National Hydrological Monitoring Programme depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged.

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Selected text and maps are available on the WWW at
http://www.ceh.ac.uk/data/nrfa/index.html
Navigate via Water Watch

05/10