Hydrological Summary

for the United Kingdom

April 2005

General

With high pressure continuing to dominate synoptic patterns in early April, drought conditions intensified across southern Britain, triggering the introduction of a sprinkler and unattended hosepipe ban by Sutton and East Surrey Water. Despite an unsettled latter half of the month, April rainfall totals were again below average in many of the drought affected catchments. The provisional Nov-Apr rainfall total for E&W is the 2nd lowest since 1953/54, (1996/97 was similar and 1975/76 was substantially drier) and 6-month rainfall deficiencies are severe across much of the English Lowlands – where, in some areas, the margin between available resources and water demand is particularly narrow. The late April rainfall was very timely, providing a modest boost to reservoir stocks and a late pulse of groundwater recharge in some areas. Stocks in a number of southern reservoirs are appreciably below average (although mostly well above drought minima) but a little above the late spring average for England and Wales as a whole. Groundwater levels are depressed in some responsive southern outcrops but mostly still within the normal range further north. Accelerating evaporation rates are likely to curtail the recharge season very shortly – heralding very low flows, with accompanying environmental stress in spring-fed streams during the coming summer.

Rainfall

Much of the April rainfall was showery or convective in nature and the varying tracks of the frontal systems which crossed the UK also contributed to substantial spatial variability. There were a few notable storms: Newcastle reported 74 mm in around 48 hrs on the 15/16th and rainfall during the 24-27th was especially useful in the South. Nonetheless, April rainfall totals failed to reach the average across most of the English Lowlands with totals <70% in parts of London. To the west and north, rainfall totals were generally much healthier with totals exceeding twice the average in parts of the southern Pennines and Scottish Highlands. Broadly, the result of the April rainfall was to reinforce the regional character of the drought, which is focussed on southern and central England. In these regions many catchments have registered six successive months with below average rainfall. Correspondingly, accumulated deficiencies are notably high over wide areas. The Nov-Apr rainfall for E&W was around 75% of average but totals fall below 65% in parts of the South – provisional data suggest that some southern catchments (mostly from Sussex to Dorset) experienced their second driest winter and early spring on record. The preferred tracks of Atlantic frontal systems over this period may be inferred from the exceptionally high 6-month rainfall total registered by the Highland Region in Scotland.

River Flows

April flow patterns were typical of the spring across most of northern Britain and Northern Ireland, with significant spates in a few catchments – the River Leven (Cleveland) eclipsed its previous maximum April flow on the 16th and in Wales, on the 18th, a Flood Warning was issued on the Vyrnwy. By contrast, recessions continued in the English Lowlands with flows in some responsive southern rivers approaching April minima in mid-month. Despite subsequent modest flow recoveries, April runoff totals were <50% of average in some rivers (e.g. the Sussex Ouse) and the Piddle (Dorset) reported its 3rd lowest April runoff (after 1976 and 1973) in a 42-yr record. The severity of the drought is best characterised by runoff totals over the last 6 months. Several rivers draining to the English Channel – including the Exe and Wallington (Hants), both with records of around 50 yrs – reported their second lowest Nov-Apr runoff after the benchmark drought of 1975/76; for the Sussex Ouse the accumulated runoff total was the lowest on record. The virtual absence of any winter recovery in many southern Chalk streams foreshadows notably depressed summer flows. Elsewhere, some substantial Nov-Apr runoff deficiencies were reported (e.g. for the Yscir and Annacloy) but generally the 6-month totals were in the normal range, and considerably above average in much of Scotland where the Spey registered its 3rd highest total in a 53-yr series.

Groundwater

Although soil moisture deficits began to build in early April, heavy rainfall during the latter half of the month provided a late pulse of infiltration at a time when groundwater levels (in the lowlands) are normally in recession. Minor groundwater level recoveries or, more likely, inflections in the recessions should be evident on some of the May hydrographs for the index boreholes. The April groundwater levels testify to the drought's severity in the South – at Chilgrove they were the lowest, for the month, since 1976 and rank 8th lowest in a 170-yr record. Depressed levels characterize much of the southern Chalk and the Permo-Triassic sandstones in the South-West. To the north, the drought's impact is less severe. A combination of higher rainfall and, in many cases, longer aquifer response times, has left groundwater levels in most areas within the normal range, albeit below average in many areas – the limestone outcrops particularly. In all but the slowest-responding aquifer units, accelerating evaporation rates during May should ensure that that the seasonal recession in groundwater levels becomes well established – having begun from the lowest spring maximum in at least eight years over wide areas.

Centre for Ecology & Hydrology
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Apr 2005	Jan 05-Apr 05	RP	Nov 04-Apr 05	RP	Sep 04-Apr 05	RP	May 04-Apr 05	RP
England & Wales	**mm**	**78**	**243**		**363**		**568**		**906**	
	%	**127**	**83**	**2-5**	**76**	**5-15**	**88**	**2-5**	**99**	**2-5**
North West	mm	**108**	366		580		882		1324	
	%	**152**	100	<2	94	2-5	102	2-5	109	2-5
Northumbrian	mm	**104**	326		420		617		1015	
	%	**181**	120	5-10	95	2-5	104	2-5	117	5-15
Severn Trent	mm	**59**	193		281		460		769	
	%	**106**	79	2-5	71	10-20	88	2-5	100	<2
Yorkshire	mm	**98**	261		347		513		870	
	%	**165**	98	2-5	81	5-10	89	2-5	104	2-5
Anglian	mm	**42**	139		209		333		617	
	%	**91**	76	5-10	71	10-20	84	5-10	102	2-5
Thames	mm	**49**	151		237		387		632	
	%	**97**	69	5-15	66	10-20	80	5-10	90	2-5
Southern	mm	**51**	168		264		427		673	
	%	**97**	67	5-15	63	20-35	75	5-15	86	5-10
Wessex	mm	**75**	209		318		522		760	
	%	**141**	75	5-10	69	10-20	85	2-5	89	2-5
South West	mm	**99**	290		457		726		1058	
	%	**142**	71	5-15	67	15-25	81	5-10	89	2-5
Welsh	mm	**109**	377		590		977		1341	
	%	**132**	87	2-5	80	5-10	98	2-5	100	<2
Scotland	**mm**	**116**	**588**		**901**		**1280**		**1736**	
	%	**144**	**125**	**5-15**	**115**	**5-10**	**118**	**5-15**	**118**	**15-25**
Highland	mm	**135**	796		1257		1713		2187	
	%	**144**	142	*5-15*	132	*15-25*	131	*30-50*	126	*30-50*
North East	mm	**80**	378		533		782		1173	
	%	**118**	117	2-5	102	2-5	109	2-5	114	5-10
Tay	mm	**121**	531		716		1065		1554	
	%	**177**	125	5-10	104	2-5	113	2-5	121	10-20
Forth	mm	**87**	449		626		932		1365	
	%	**141**	125	5-10	106	2-5	113	5-10	119	10-20
Tweed	mm	**98**	368		481		744		1157	
	%	**162**	118	2-5	95	2-5	107	2-5	115	5-10
Solway	mm	**128**	487		734		1100		1550	
	%	**162**	108	2-5	98	2-5	105	2-5	108	2-5
Clyde	mm	**123**	625		1020		1478		2018	
	%	**139**	113	2-5	111	2-5	113	5-10	115	10-20
Northern Ireland	**mm**	**85**	**333**		**500**		**739**		**1074**	
	%	**127**	**94**	**2-5**	**88**	**2-5**	**94**	**2-5**	**98**	**2-5**

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

 All monthly totals since December 2004 are provisional (see page 12). 1961-2003 regional monthly totals were revised by the Met Office in 2004. The figures for England & Wales are derived by the Hadley Centre and are updates of the homogenised series developed by the Climate Research Unit; the other national figures are derived from different raingauge networks to those used to derive the CRU data series. Most of the return period estimates are based on tables provided by the Met Office (see Tabony, R. C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37) and relate to the specified span of months only (return periods may be up to an order of magnitude less if n-month periods beginning in any month are considered); RP estimates for Northern Ireland are based on the tables for north-west England and those for the Highland region take account of ranking positions. The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts, in the Scottish rainfall series in particular, can exaggerate the relative wetness of the recent past. *See page 12.

Rainfall . . . Rainfall . .

Key

00% Percentage of 1961-90 average

Very wet

Substantially above average

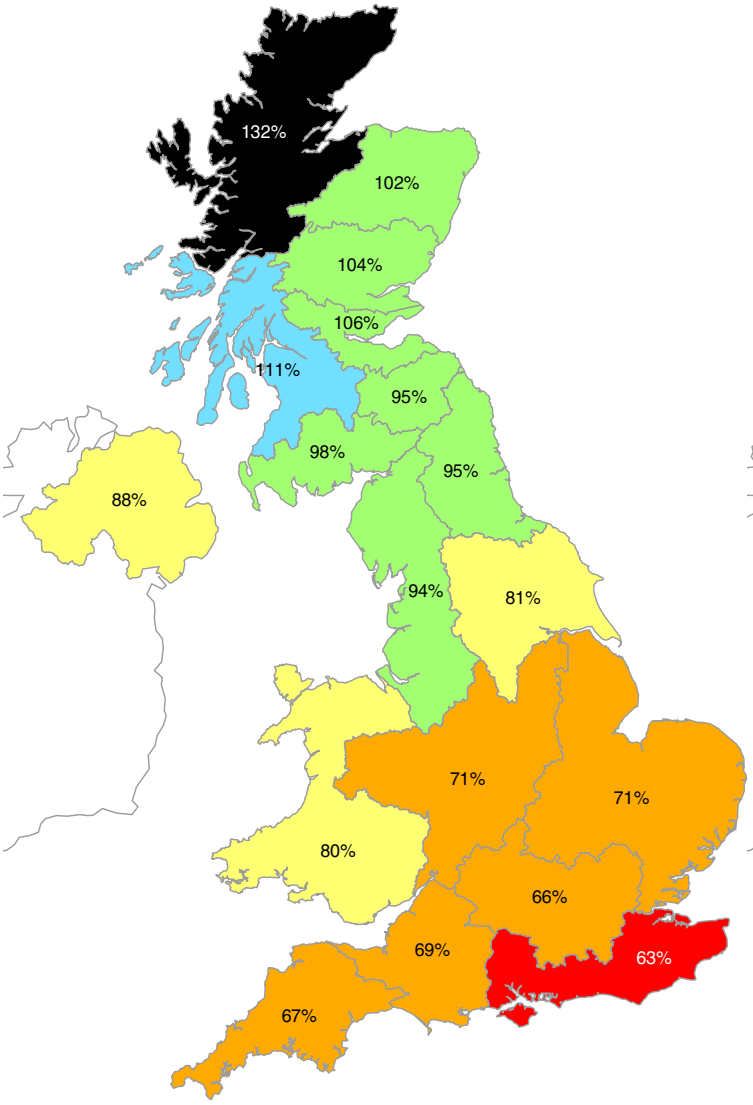
Above average

Normal range

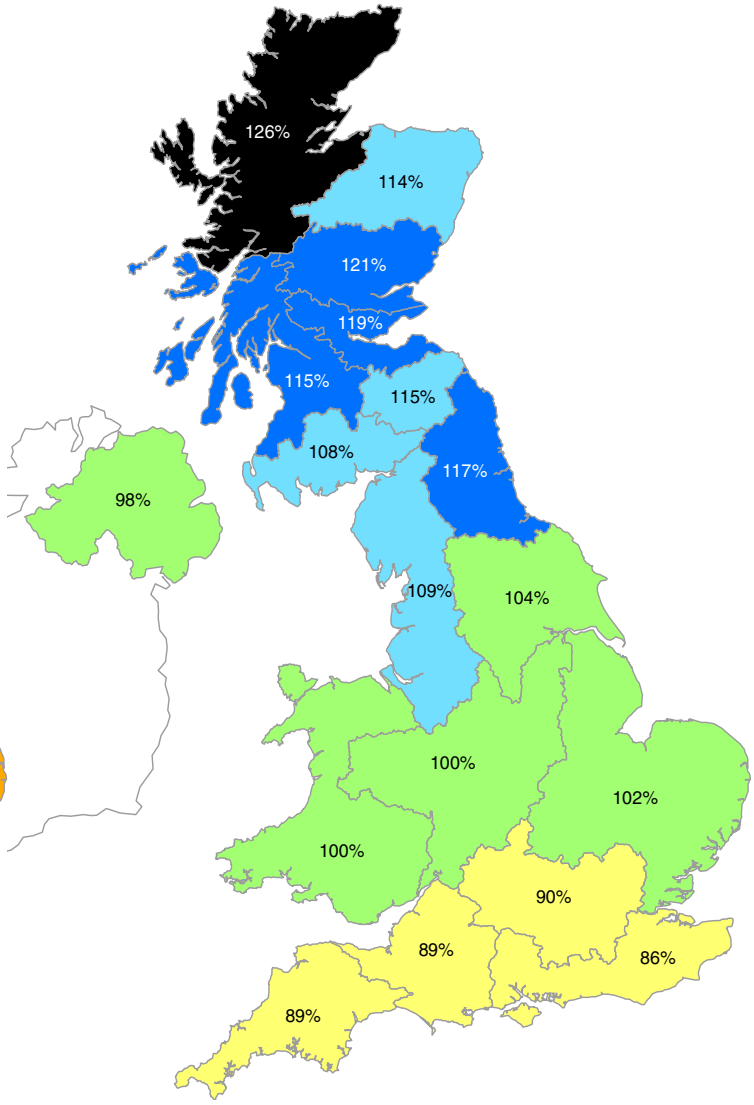
Below average

Substantially below average

Exceptionally low rainfall



November 2004 - April 2005

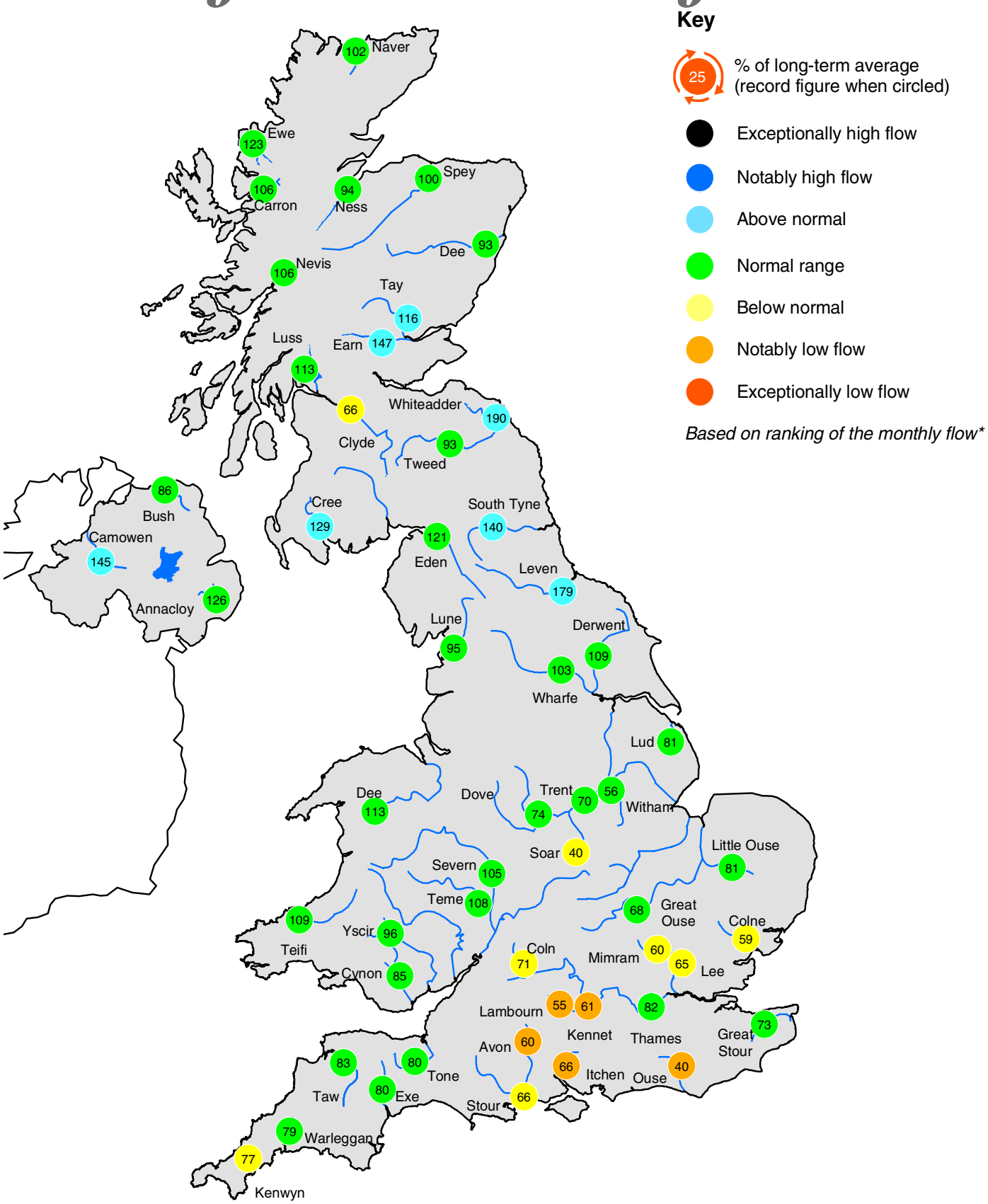


May 2004 - April 2005

Rainfall accumulation maps

The Nov-Apr regional rainfall totals testify to a notable exaggeration in the normal NW-SE rainfall gradient across the UK. Provisional data suggest that, in this timeframe, Southern Region recorded its 2nd lowest rainfall total in at least the last 50 years whilst the Highland Region registered its 3rd highest in a 45-year series. Rainfall totals over the last 12 months confirm that, over this longer timespan, rainfall deficiencies are again most notable in southern England.

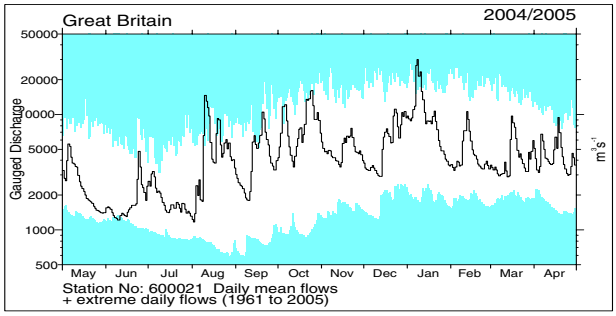
River flow . . . River flow . . .

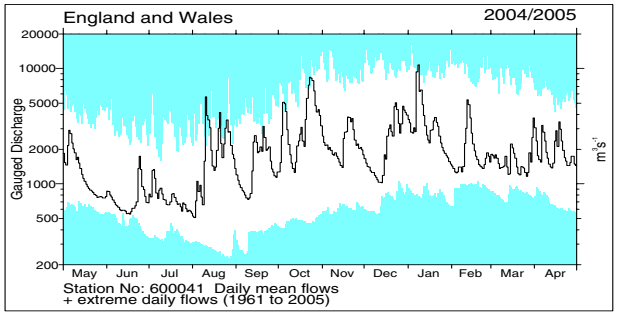


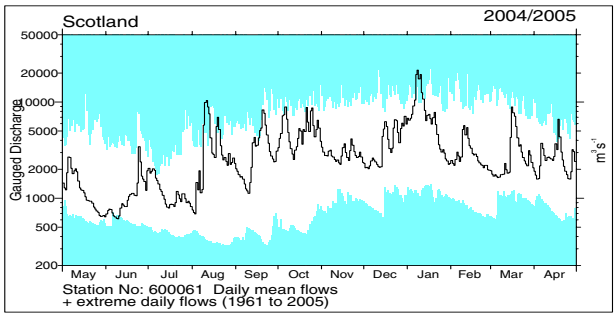
River flows - April 2005

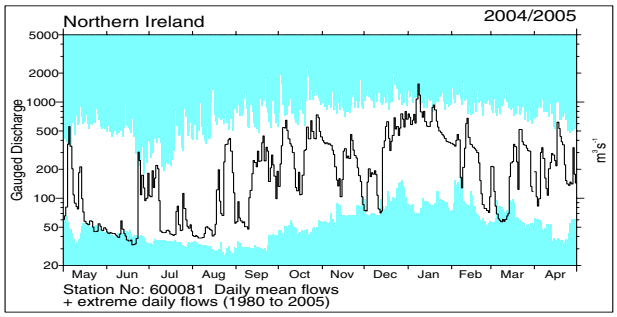
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

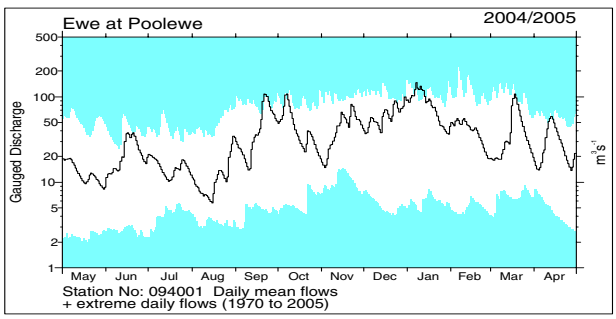
River flow . . . River flow . . .

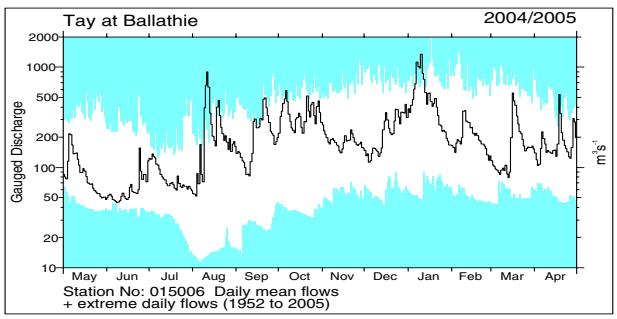


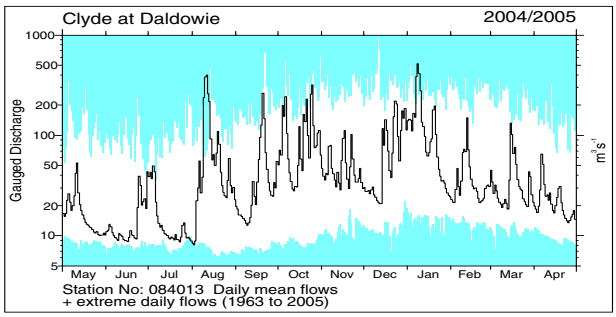


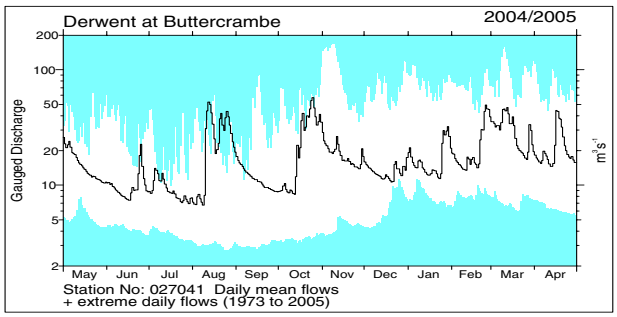


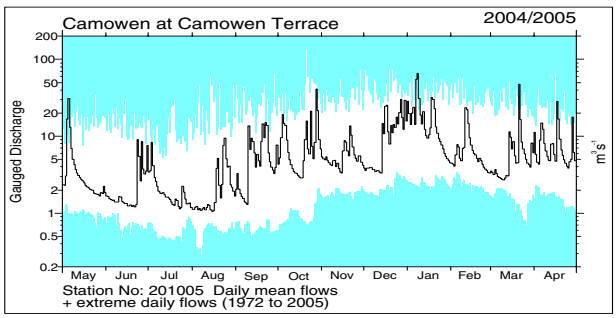


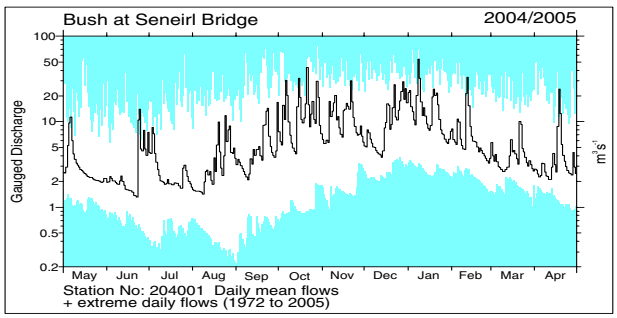








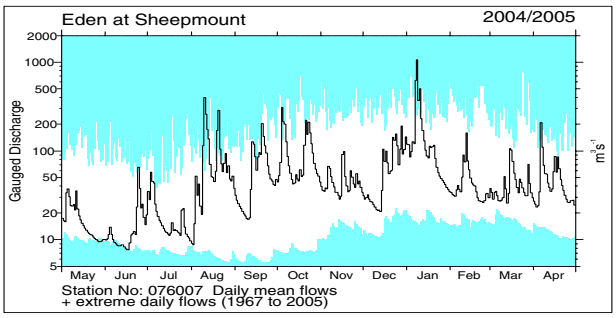


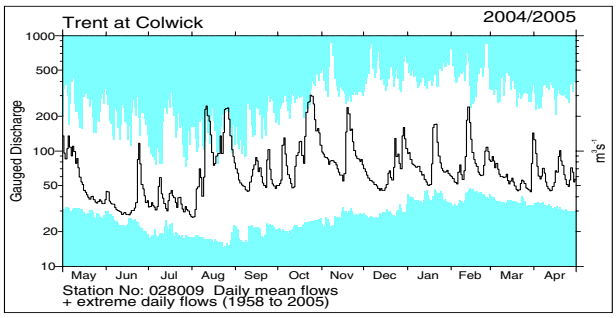


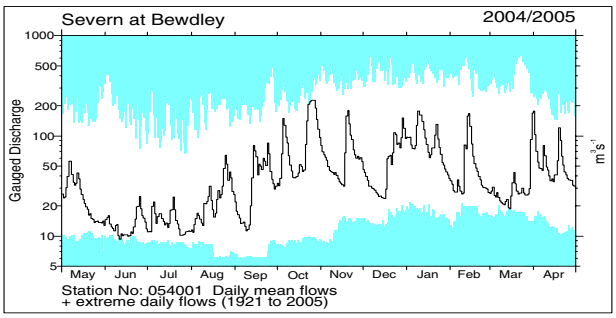
River flow hydrographs

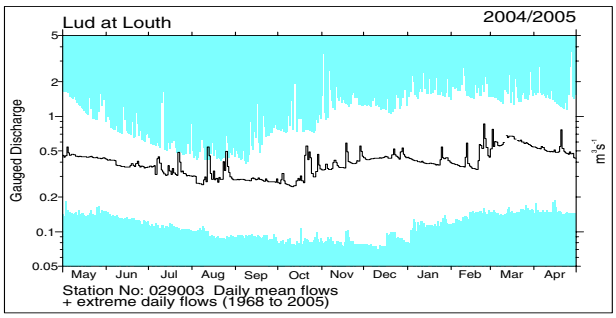
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to May 2004 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The 'national' hydrographs are based on representative networks of gauging stations commanding relatively large catchments.

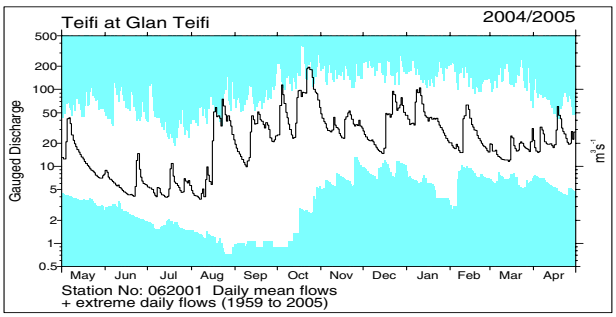
River flow . . . River flow . . .

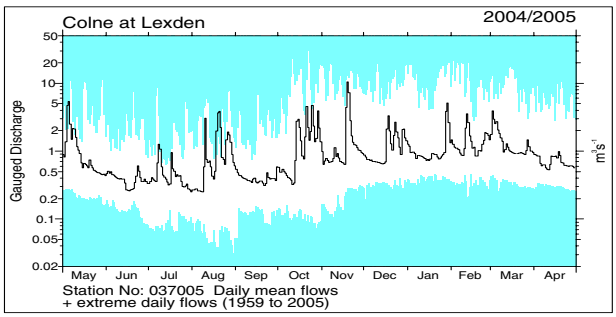


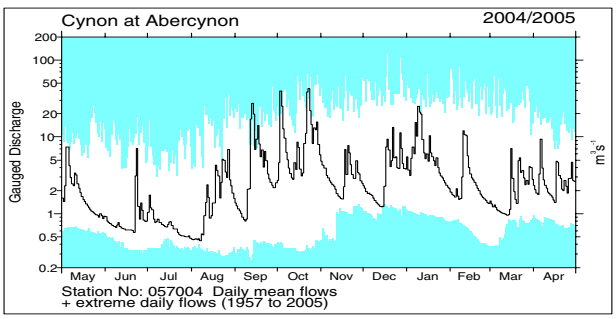


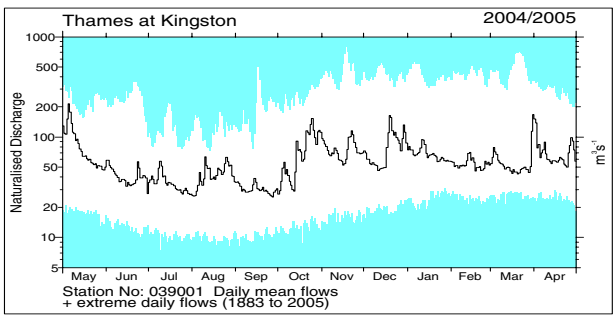


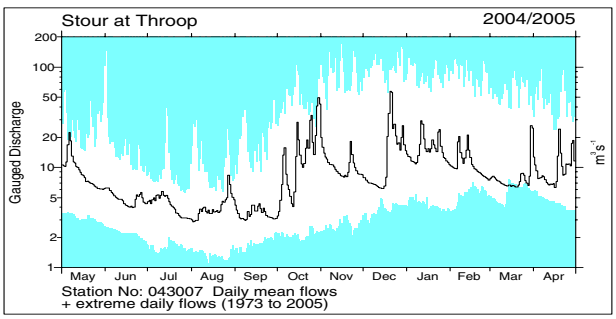


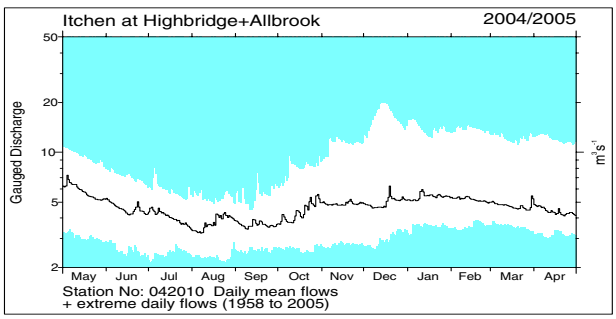












Notable runoff accumulations

(a) January 2005 - April 2005, (b) November 2004 - April 2005

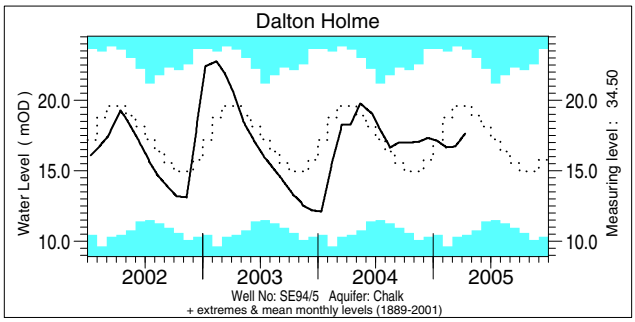
	River	%lta	Rank
a)	Ness	129	30/33
	Tyne (Spilmersford)	164	41/41
	Dover Beck	54	4/29
	Kennet	55	5/44
	Coln	55	5/42
	Piddle	52	3/41
	Warleggan	69	3/36
	Naver	133	24/28

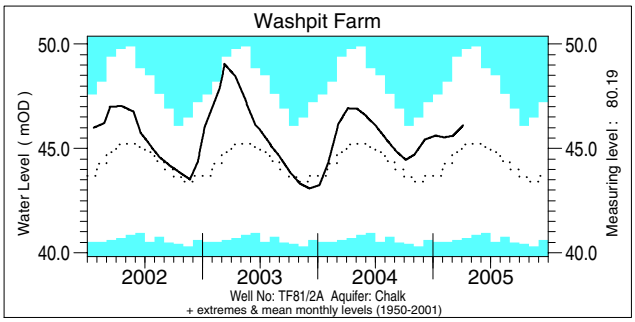
	River	%lta	Rank
b)	Spey (Boat o'Brig)	131	51/53
	Trent	67	5/47
	Soar	46	3/34
	Mole	48	1/30
	Medway	32	2/45
	Ouse (Gold Bridge)	37	1/41
	Wallington	38	2/52

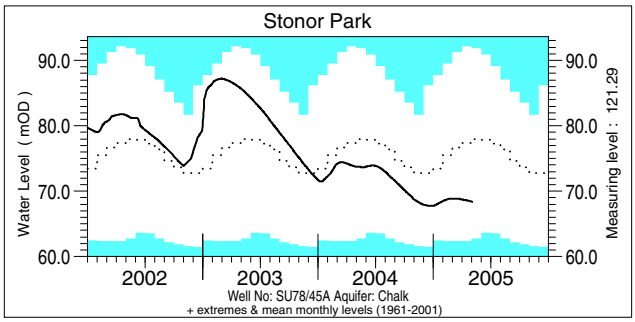
River	%lta	Rank
Stour	55	3/32
Exe	65	2/49
Dart	67	3/47
Kenwyn	52	2/37
Taw	69	4/47
Yscir	78	4/32
Annacloy	73	3/25

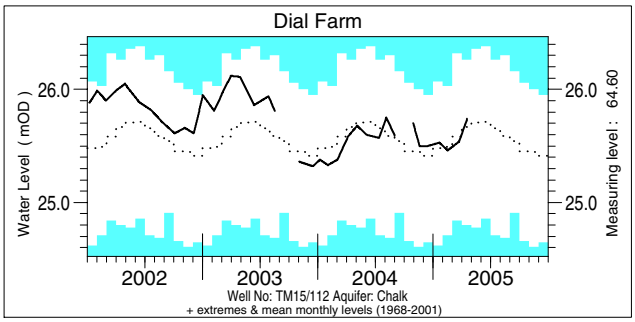
lta = long term average
Rank 1 = lowest on record

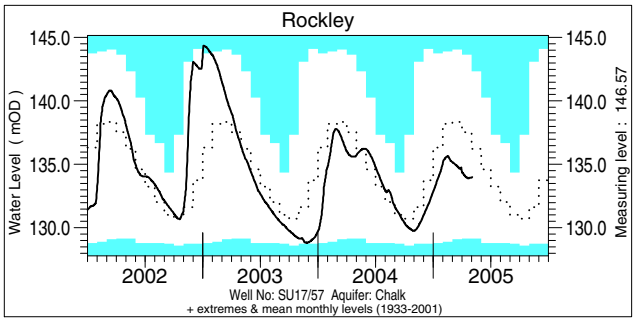
Groundwater . . . Groundwater

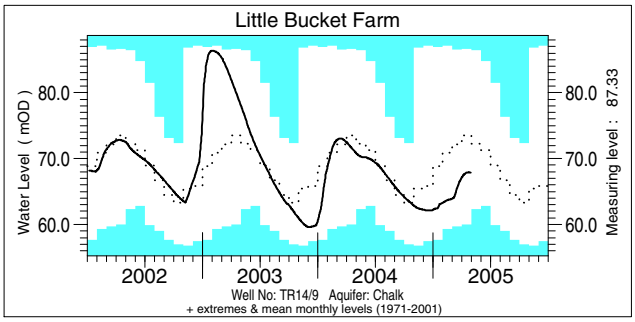


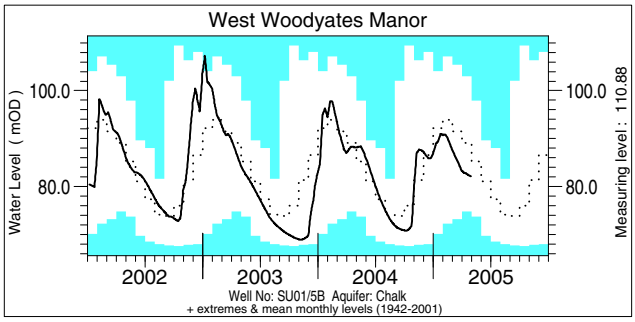


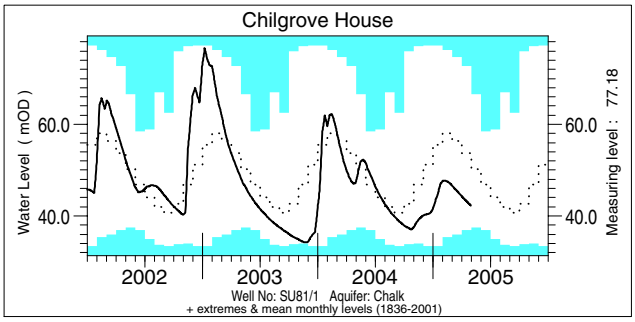


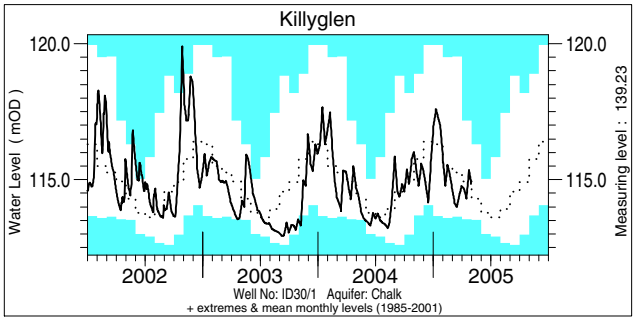


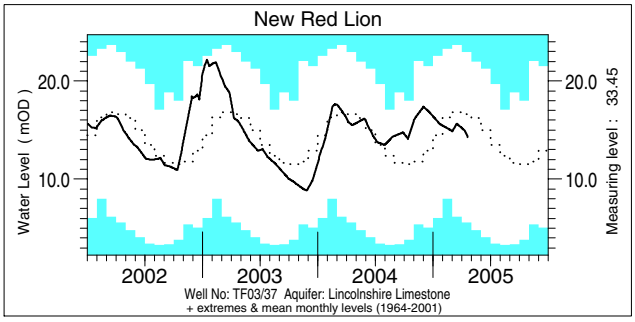






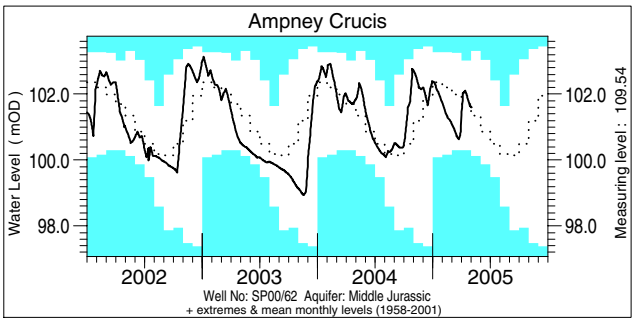


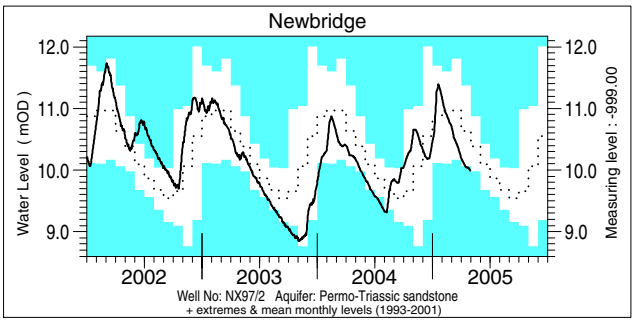


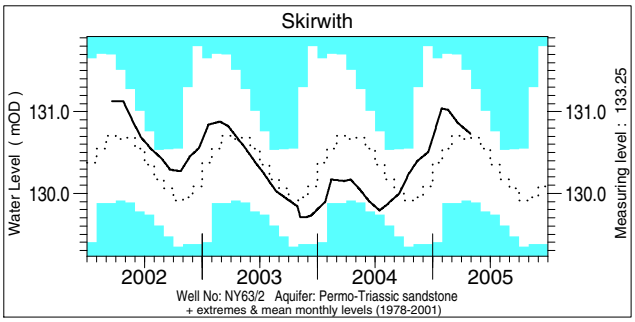


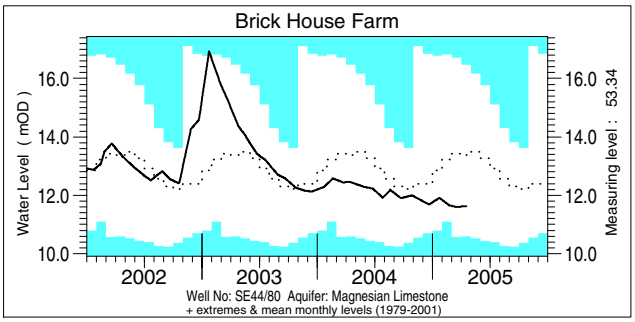
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

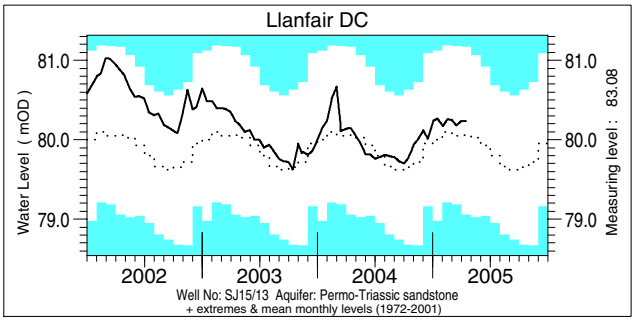
Groundwater . . . Groundwater

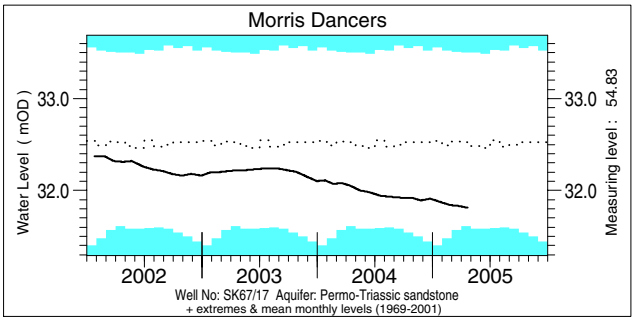


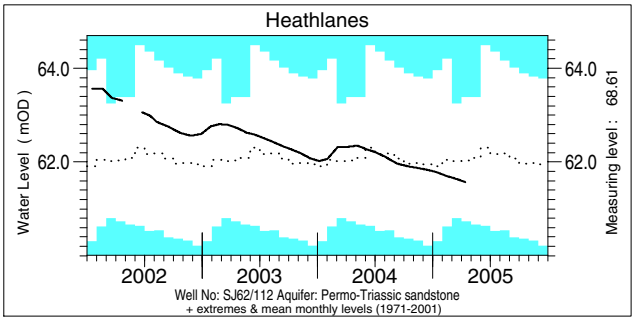


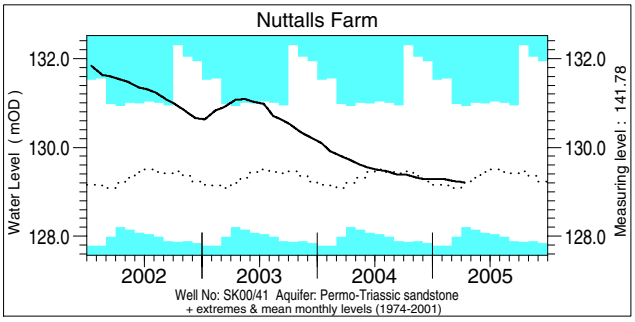


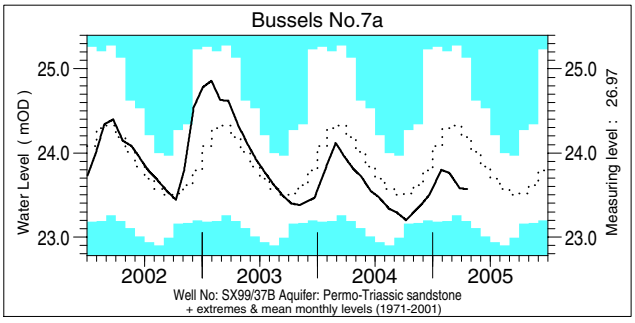


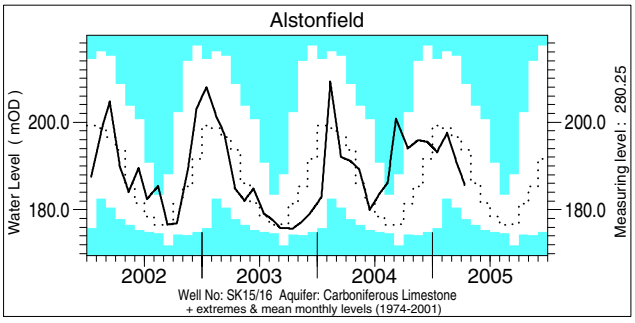










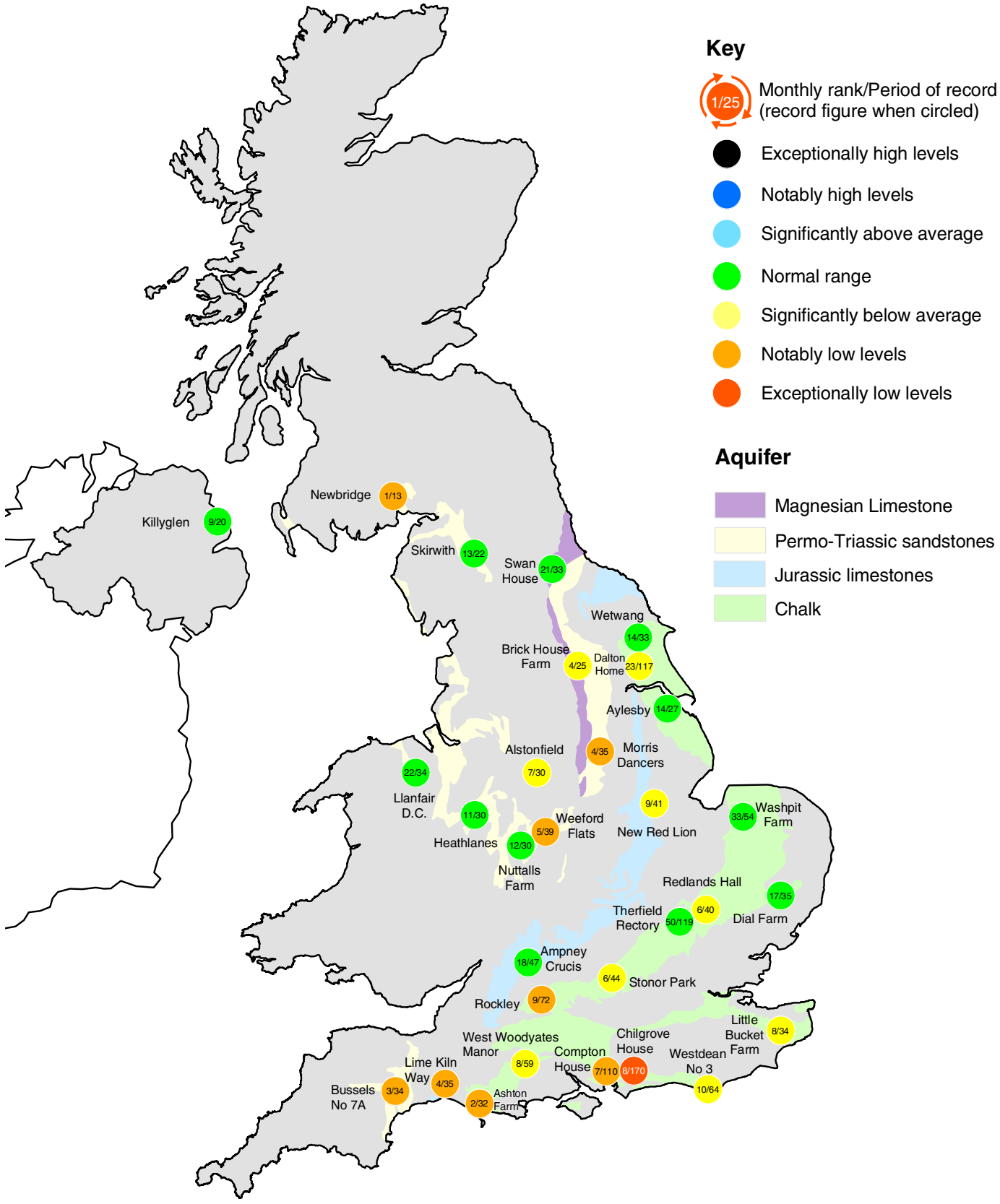


Groundwater levels April/May 2005

Borehole	Level	Date	Apr. av.
Dalton Holme	17.65	11/04	19.52
Washpit Farm	46.12	05/04	45.41
Stonor Park	68.39	03/05	77.94
Dial Farm	25.74	18/04	25.69
Rockley	133.99	03/05	137.56
Little Bucket Farm	67.88	30/04	72.61
West Woodyates	82.12	30/04	88.47
Chilgrove House	42.26	30/04	52.28
Killyglen	114.84	30/04	114.94
New Red Lion	14.28	20/04	16.49
Ampney Crucis	101.59	03/05	101.72
Newbridge	9.99	30/04	10.60
Skirwith	130.73	29/04	130.62
Brick House Farm	11.63	18/04	13.46
Llanfair DC	80.24	15/04	80.05
Morris Dancers	31.81	21/04	32.38
Heathlanes	61.57	14/04	62.11
Nuttalls Farm	129.21	12/04	129.51
Bussels No.7a	23.57	20/04	24.19
Alstonfield	185.62	12/04	193.18

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater



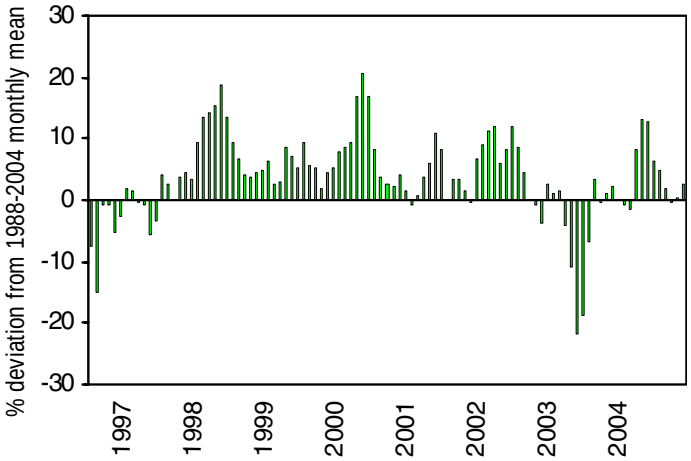
Groundwater levels - April 2005

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.

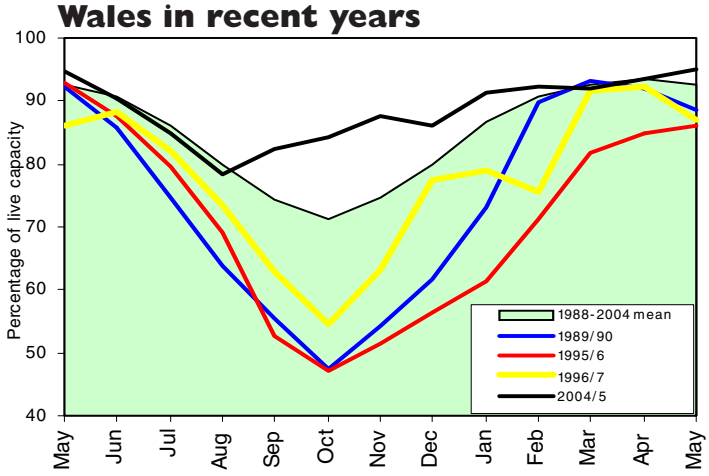
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

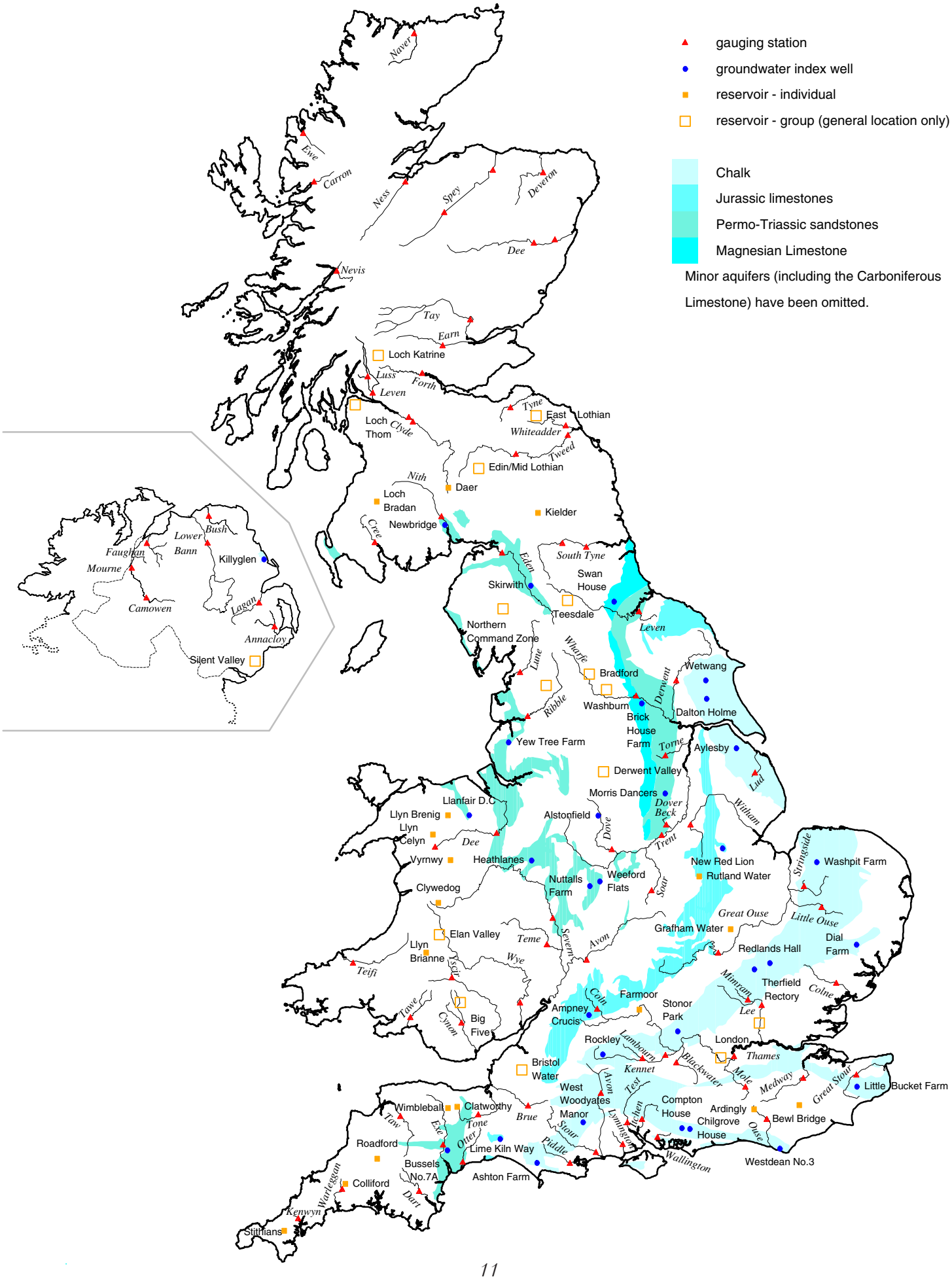
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2005 Jan	Feb	Mar	Apr	May	Avg. May	Min. May	Year* of min.
North West	N Command Zone	• 124929	91	100	91	90	**90**	89	74	2003
	Vyrnwy	55146	100	99	97	97	**98**	92	70	1996
Northumbrian	Teesdale	• 87936	90	93	89	95	**98**	91	74	2003
	Kielder	(199175)	(98)	(91)	(90)	(91)	**(93)**	(91)	(85)	1990
Severn Trent	Clywedog	44922	83	79	89	94	**100**	96	85	1988
	Derwent Valley	• 39525	100	99	95	99	**100**	92	54	1996
Yorkshire	Washburn	• 22035	90	86	83	80	**85**	90	76	1996
	Bradford supply	• 41407	99	99	94	98	**100**	90	60	1996
Anglian	Grafham	(55490)	(92)	(92)	(94)	(96)	**(96)**	(93)	(73)	1997
	Rutland	(116580)	(93)	(95)	(94)	(94)	**(94)**	(91)	(72)	1997
Thames	London	• 202340	87	91	95	96	**99**	94	86	1990
	Farmoor	• 13830	98	99	98	97	**98**	97	81	2000
Southern	Bewl	28170	60	70	75	86	**85**	90	63	1990
	Ardingly	4685	69	79	83	93	**98**	100	98	2005
Wessex	Clatworthy	5364	100	100	100	94	**100**	93	81	1990
	Bristol WW	• (38666)	(64)	(77)	(83)	(82)	**(85)**	(94)	(85)	2005
South West	Colliford	28540	66	70	71	70	**71**	87	56	1997
	Roadford	34500	69	71	73	72	**75**	85	41	1996
	Wimbleball	21320	79	86	90	96	**96**	94	79	1992
	Stithians	5205	60	68	75	78	**84**	91	65	1992
Welsh	Celyn and Brenig	• 131155	97	97	98	100	**100**	97	75	1996
	Brianne	62140	98	94	96	97	**100**	97	86	1997
	Big Five	• 69762	97	98	96	97	**96**	93	85	1997
	Elan Valley	• 99106	100	99	98	99	**99**	97	87	2003
Scotland(E)	Edinburgh/Mid Lothian	• 97639	87	98	99	99	**99**	92	62	1998
	East Lothian	• 10206	100	100	100	100	**100**	98	89	1992
Scotland(W)	Loch Katrine	• 111363	100	89	86	91	**97**	93	83	2001
	Daer	22412	100	100	97	95	**100**	96	89	2003
	Loch Thom	• 11840	100	100	100	100	**100**	94	88	2003
Northern Ireland	Total+	• 67270	88	86	83	84	**89**	88	80	2003
	Silent Valley	• 20634	69	78	73	73	**89**	81	58	2000

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

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each region; this can be particularly important during droughts. The storage figures relate to the 1988-2005 period only (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 Department of the Environment (NI). 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 the Northern Ireland Water Service.

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.

*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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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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