Hydrological Summary
for the United Kingdom

June 2005

General

Drought conditions eased in much of the Midlands during June but accumulated rainfall deficiencies increased across large parts of the English Lowlands. A very severe drought now effects much of the South-East where Nov-June rainfall totals are <60% of average in some areas. This is reflected in the modest stocks in some southern reservoirs (the 44% of capacity at Weir Wood in East Sussex is, however, exceptional). Overall stocks for England and Wales have fallen only marginally below average but a surge in water demand during the mid-June heatwave – together with the knowledge that stocks can decline by 35-50% over the May-Oct period during extended summer droughts – prompted further measures to moderate water demand. June river flows were seasonally high in much of Scotland and, to the south, some notable flash floods were reported. Nonetheless, the second driest Nov-June period for England and Wales since 1948/49 has resulted in depressed – although not unprecedented – river flows in much of central and southern England. Groundwater levels are similarly depressed in parts of the southern Chalk but still considerably above drought minima throughout most major aquifers. In the absence of an exceptionally wet late summer the hydrological drought will increase in severity into the autumn (at least) with an accompanying focus on reducing water demand and mitigating the drought's impact on the aquatic environment.

Rainfall

Thunderstorms contributed an unusually high proportion of the June rainfall in many parts of southern Britain. Numerous intense – and damaging – storm events were reported, many around the end of the heatwave. On the 19th, a 3-hr rainfall total of 69.4mm (including 59.8mm in an hour) was reported from Hawnby (N. Yorks) whilst Pallinsburn (Tyne and Wear) reported 42.5mm in 40minutes on the 30th. Oxford registered three storms exceeding 20mm in the last week of the month. Large positive rainfall anomalies for June characterized the Scottish Highlands but much of northern England (including some south Pennine gathering grounds) reported <75% of the June average; parts of N Wales were dry also. Some areas in the South-East not afflicted by thunderstorms reported less than 30% and the June rainfall pattern reinforced the drought's focus on a zone from East Sussex to Berkshire (parts of London also). Here, some areas have recorded eight successive months with below average rainfall and, for the Nov-June period, accumulated deficiencies are greater than 40%. For many catchments only 1975/76 has been drier in this timeframe since 1943/44. Very substantial rainfall deficiencies also extend through the Midlands to the Vale of York and, more locally, from south Dorset to the Lizard.

River Flows

June was a month of seasonally healthy flows in much of Scotland with exceptionally high runoff in many rivers draining from the Highlands – the Ness registered a new maximum June runoff. Convective storms triggered a number of flash floods in England – most notably on the 19th when the highest recorded level on the River Rye (N. Yorks) was exceeded by a wide margin; the associated flooding caused significant property damage (e.g. in Hawnby) and livestock loss. Localised urban flooding was also common (e.g. Newcastle on the 30th) as rainfall intensities exceeded drainage capacities. More typically, across most of eastern, central and southern England flow recessions continued and June runoff was substantially below average. The Itchen, Piddle and Dorset Stour were among many rivers recording their 3rd lowest June flows in records of 30-45 years. Many spring-fed rivers have been below average for >24 months but the June runoff was generally greater than in the droughts of 1997, 1992, 1976 (by a substantial margin) and 1965. However, runoff accumulations since October – which capture the severe phase of the drought – are exceptional across southern Britain. The Nov-June total for the Sussex Ouse eclipsed 1975/76 as the lowest in a 41-year record, and many rivers, including the Medway, Exe, Soar, Kenwyn, Tone (and the lower Bann in Northern Ireland) reported their 2nd or 3rd lowest runoff on record.

Groundwater

Soil moisture deficits rose steeply in mid June and exceeded the average at month end across many southern and eastern aquifer outcrops. Infiltration was thus restricted to localized events mostly associated with thunderstorms. June groundwater levels present a very spatially uneven picture – a reflection of both the varying rainfall (over last winter especially) and the contrasting responsiveness of individual aquifer units. Only during the droughts of 1855, 1934 and 1976 have lower June levels been reported in the southern Chalk at Chilgrove but levels in the slower responding Chilterns are less substantially depressed, and mostly in the normal range in the more northerly Chalk outcrops. Seasonally low groundwater levels characterize most Limestone aquifers but, again, few are close to drought minima. This is true also of the Permo-Triassic sandstones but there is considerable spatial variablity – Newbridge reported a new June minima (in a short record) and levels are depressed in parts of the South-West and the Midlands where recessions in some areas extend over three years. Early July soil moisture deficits suggest that, given normal rainfall, groundwater levels in most areas will decline well into the autumn. Groundwater provided a very important mitigating influence both during the 2003 drought, and through 2005 thus far. In the event of a dry winter (2005/06), this buffer against drought stress will be much less effective in 2006.

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

Rainfall accumulations and return period estimates

Area	Rainfall	Jun 2005	Apr 05-Jun 05	RP	Jan 05-Jun 05	RP	Nov 04-Jun 05	RP	Jul 04-Jun 05	RP
England & Wales	**mm**	**55**	**178**		**344**		**464**		**899**	
	%	**85**	**93**	**2-5**	**81**	**5-10**	**76**	**10-20**	**98**	**2-5**
North West	mm	**66**	241		500		713		1320	
	%	**80**	105	2-5	95	2-5	92	2-5	108	2-5
Northumbrian	mm	**55**	206		439		533		1002	
	%	**89**	113	2-5	111	2-5	94	2-5	116	5-10
Severn Trent	mm	**62**	156		293		380		773	
	%	**104**	89	2-5	81	5-10	74	10-20	101	2-5
Yorkshire	mm	**44**	183		358		445		865	
	%	**72**	100	2-5	92	2-5	80	5-10	104	2-5
Anglian	mm	**48**	130		231		300		626	
	%	**92**	88	2-5	82	2-5	76	10-20	104	2-5
Thames	mm	**41**	122		223		309		622	
	%	**75**	75	2-5	67	10-20	66	25-40	89	2-5
Southern	mm	**26**	109		229		325		647	
	%	**48**	67	5-10	64	20-30	62	40-60	82	5-10
Wessex	mm	**60**	175		317		425		781	
	%	**105**	101	2-5	79	5-10	74	10-20	91	2-5
South West	mm	**74**	228		433		599		1090	
	%	**106**	107	2-5	78	5-10	73	10-20	91	2-5
Welsh	mm	**75**	240		509		722		1337	
	%	**92**	97	2-5	85	2-5	80	5-10	99	2-5
Scotland	**mm**	**104**	**338**		**801**		**1114**		**1757**	
	%	**121**	**134**	**10-20**	**125**	**15-25**	**117**	**5-15**	**119**	**20-35**
Highland	mm	**122**	396		1030		1492		2200	
	%	**123**	138	*20-30*	137	*10-20*	130	*20-30*	126	*30-40*
North East	mm	**80**	253		549		704		1172	
	%	**116**	120	5-10	118	5-10	106	2-5	114	5-10
Tay	mm	**98**	332		731		916		1574	
	%	**128**	144	15-25	124	5-15	108	2-5	122	15-25
Forth	mm	**92**	274		646		823		1376	
	%	**128**	130	5-15	127	10-20	111	2-5	120	10-20
Tweed	mm	**62**	240		517		629		1160	
	%	**91**	119	2-5	114	2-5	97	2-5	116	5-10
Solway	mm	**74**	328		683		930		1589	
	%	**87**	130	5-15	109	2-5	101	2-5	111	2-5
Clyde	mm	**126**	383		888		1283		2058	
	%	**130**	136	10-20	119	5-10	115	5-10	117	10-20
Northern Ireland	**mm**	**56**	**243**		**507**		**675**		**1090**	
	%	**76**	**114**	**2-5**	**101**	**2-5**	**94**	**2-5**	**99**	**2-5**

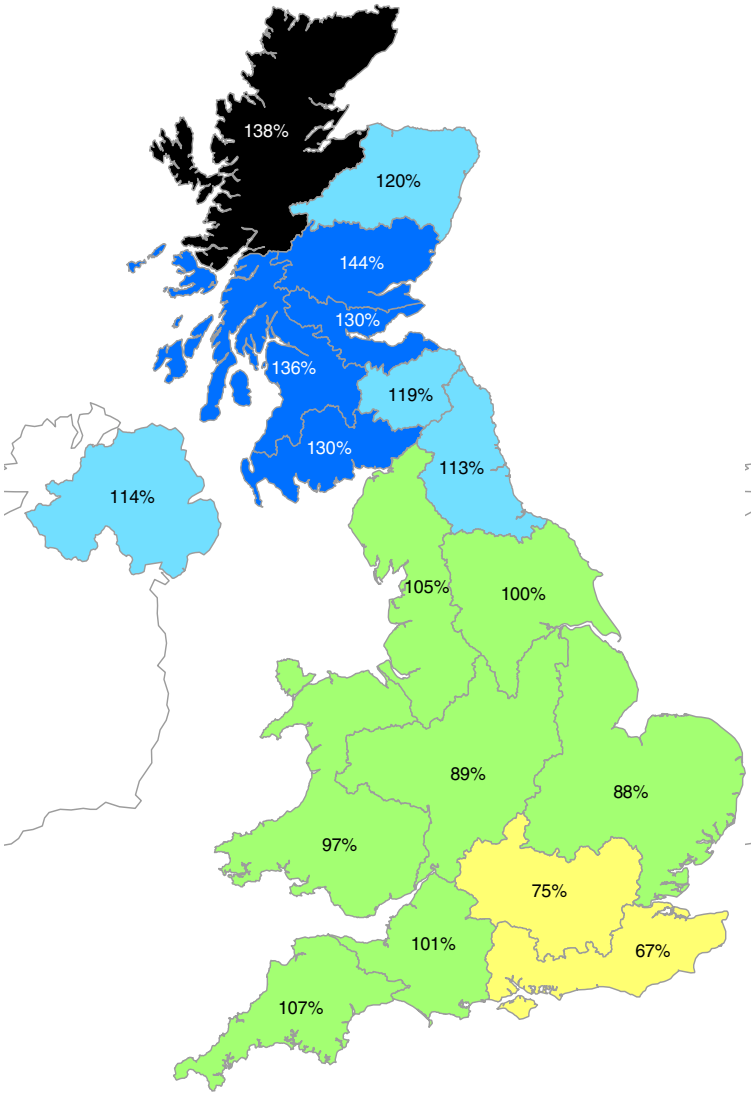
% = percentage of 1961-90 average *RP = Return period*

 All monthly totals since February 2005 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.

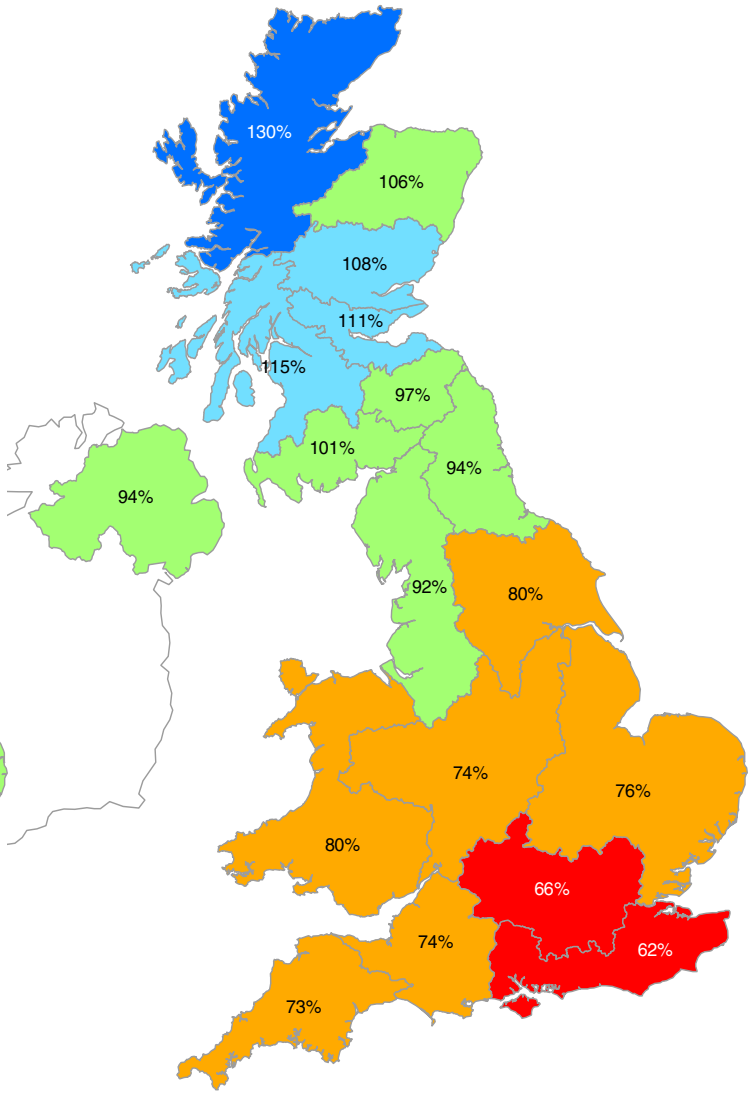
Rainfall . . . Rainfall . .

Key

00%	Percentage of 1961-90 average
	Very wet
	Substantially above average
	Above average
	Normal range
	Below average
	Substantially below average
	Exceptionally low rainfall



April 2005 - June 2005

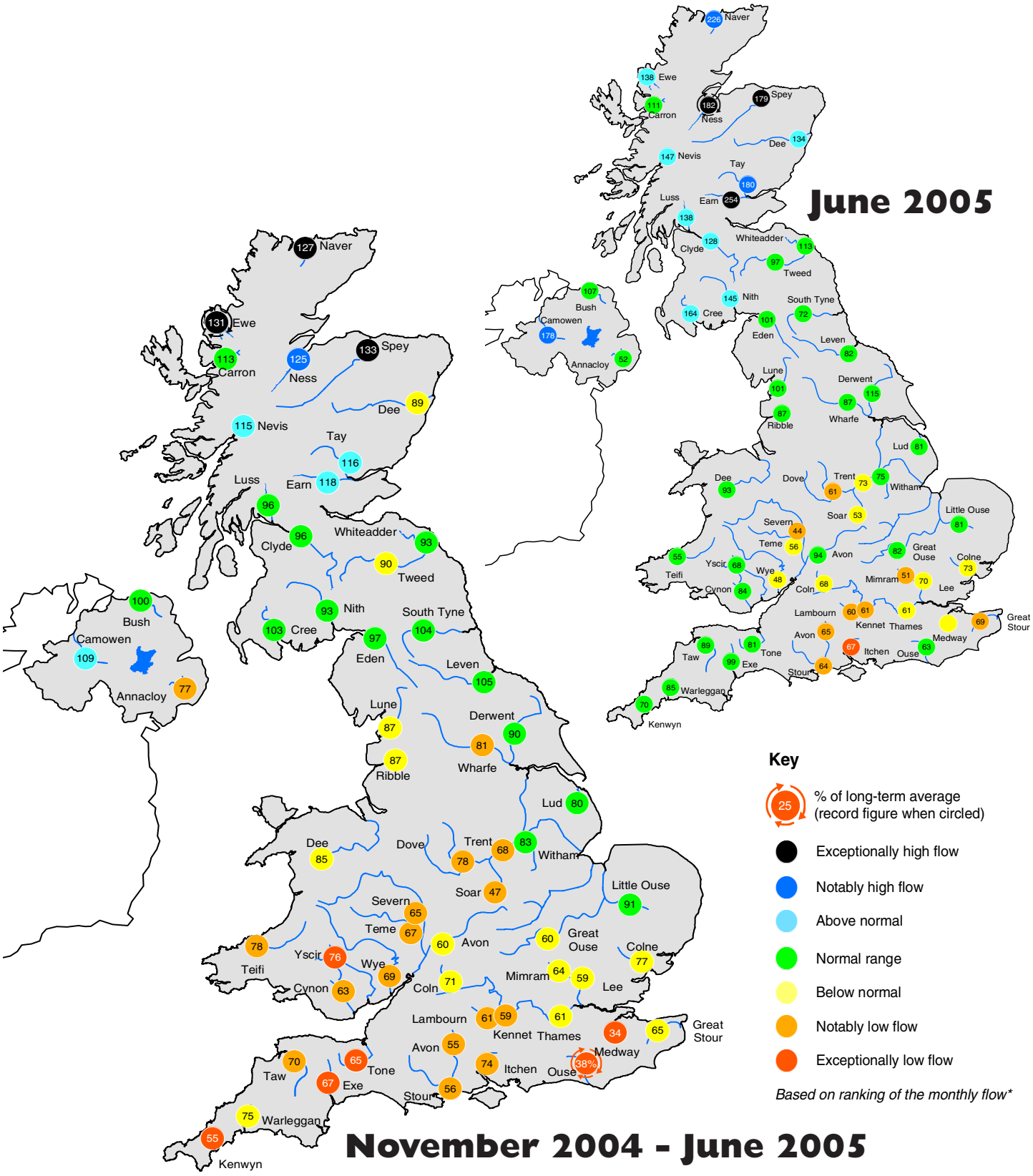


November 2004 - June 2005

Rainfall accumulation maps

The April-June rainfall total for the UK was appreciably above average, in large part due to the wetness of Scotland (provisionally, the 2nd wettest in this timeframe since 1945). However, much of the English Lowlands was again relatively dry with a very substantial rainfall deficiency across the South-East. Over the last 8 months as a whole the NW/SE rainfall gradiant is dramatic with exceptionally high rainfall in NW Scotland contrasting with protracted severe drought conditions in the South-East (and extending into neighbouring regions).

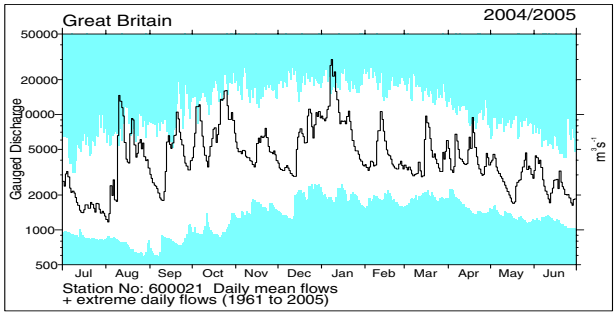
River flow . . . River flow . . .

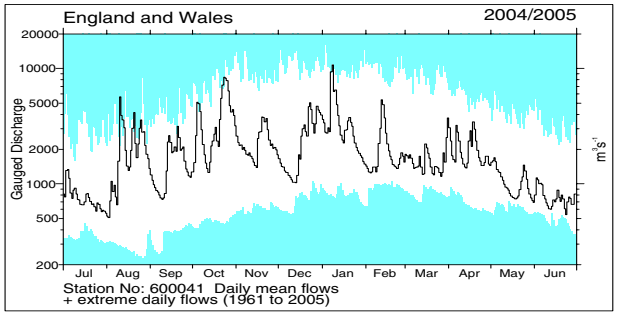


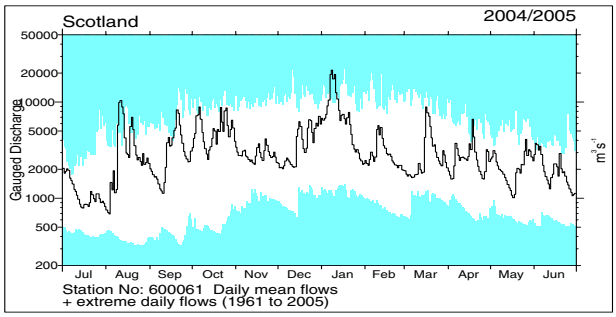
River flows

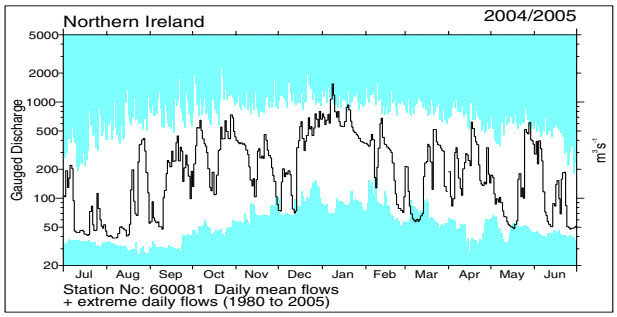
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

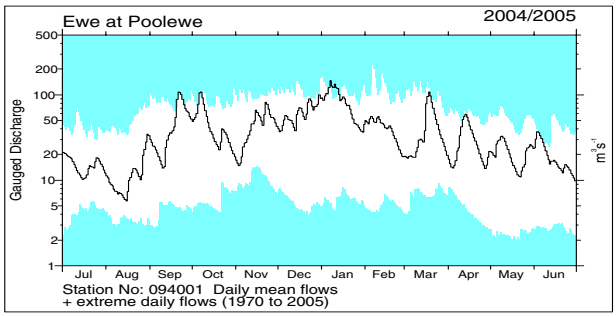
River flow . . . River flow . . .

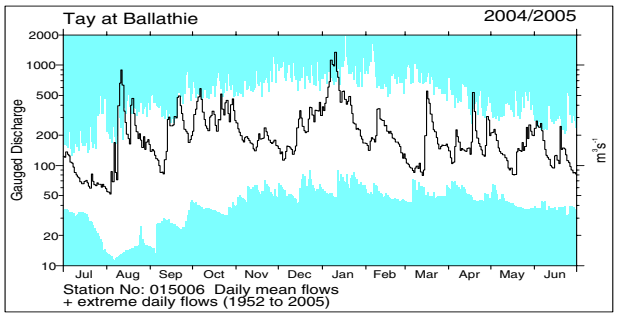


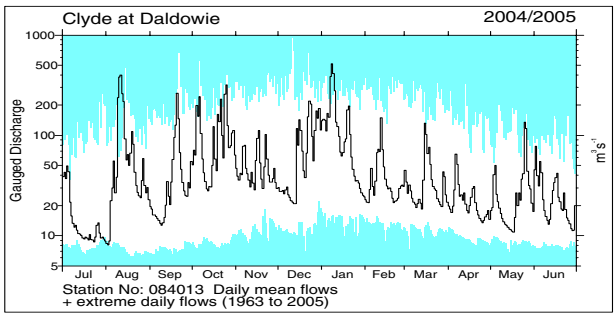


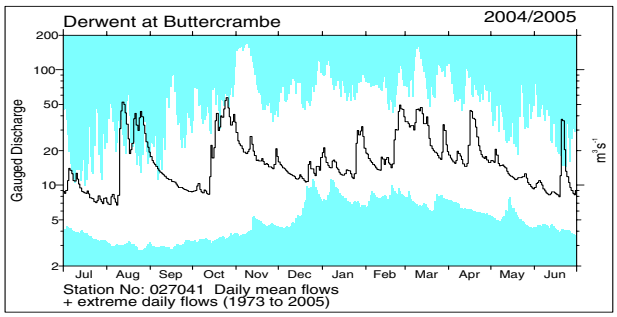


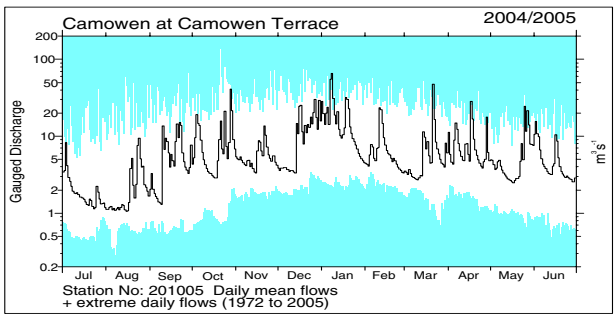


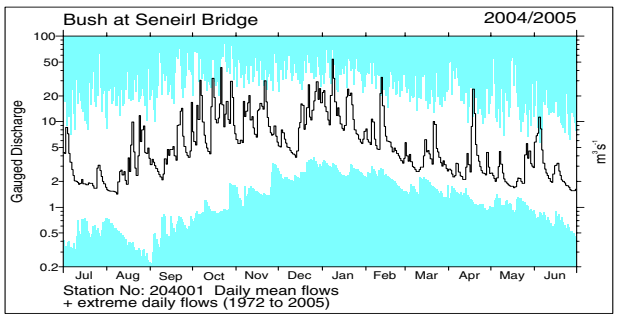








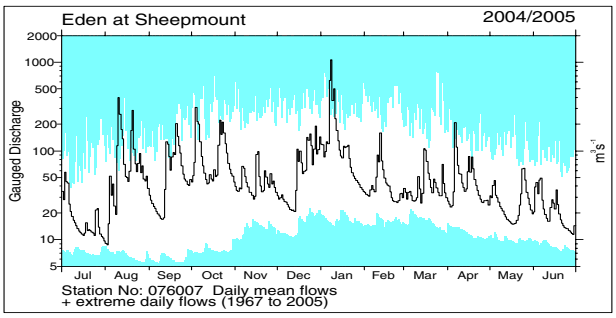


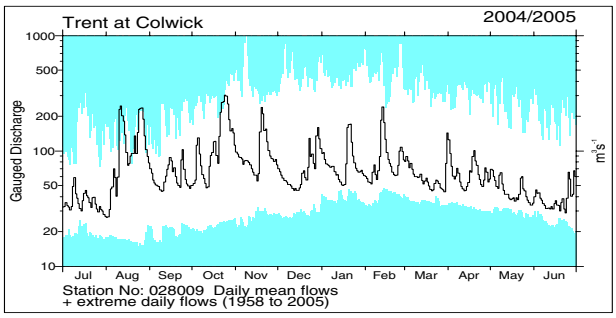


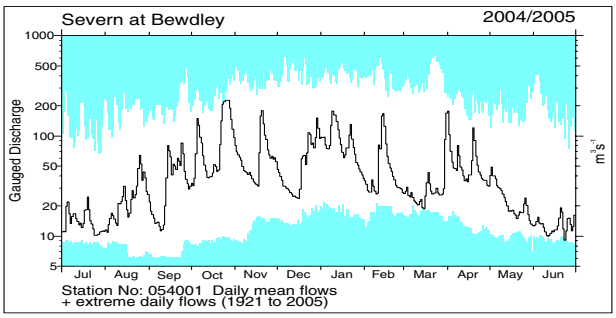
River flow hydrographs

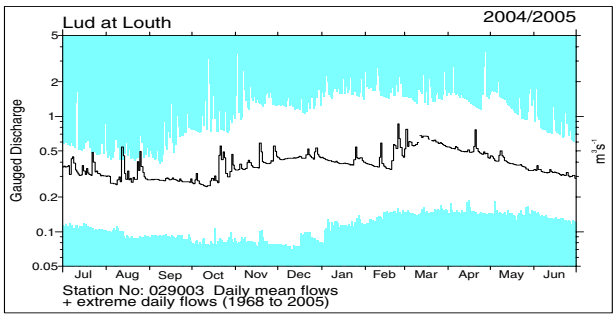
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to July 2004 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The 'national' hydrographs are based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

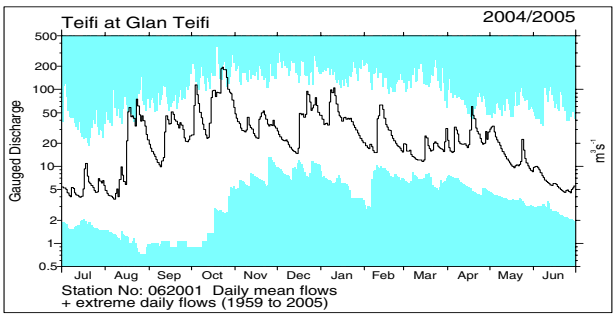
River flow . . . River flow . . .

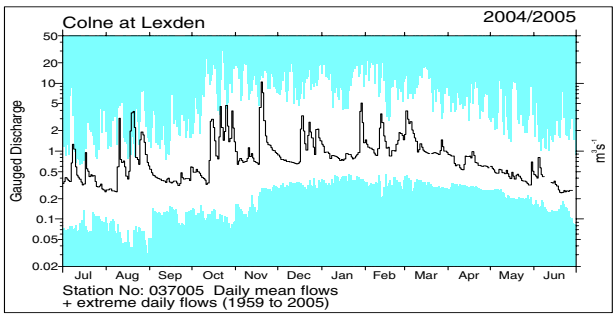


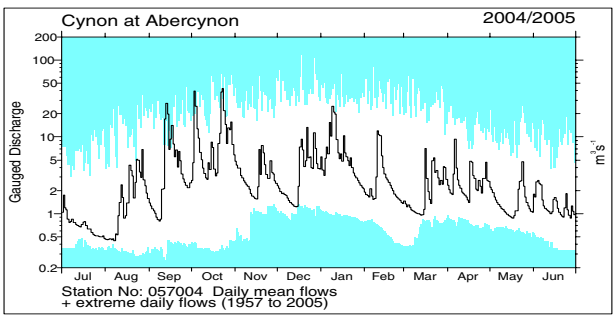


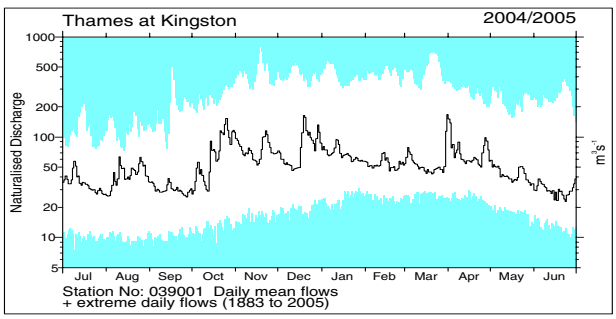


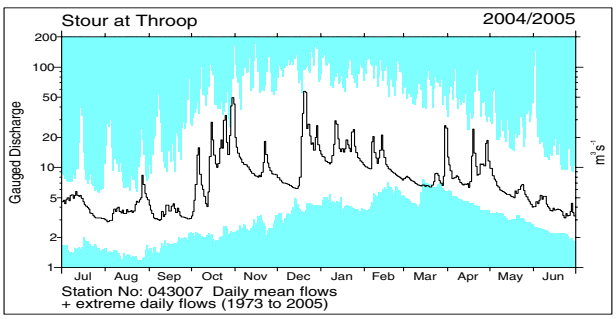


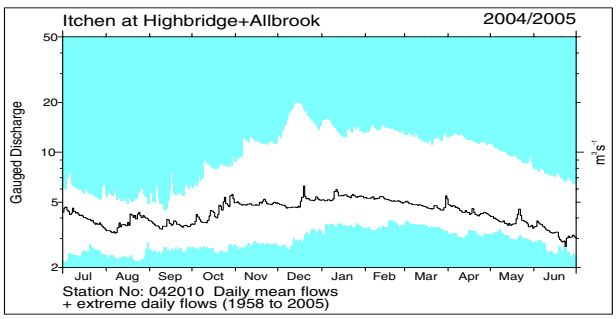












Notable runoff accumulations (a) June 2005, (b) November 2004 - June 2005

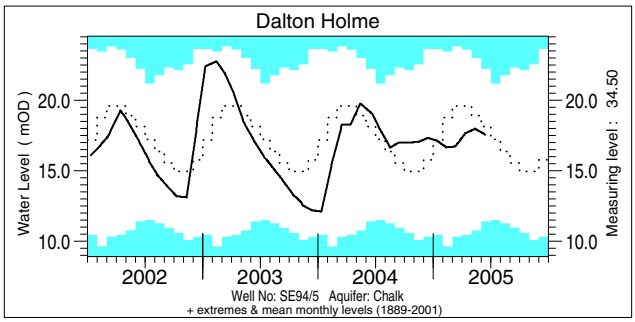
	River	%lta	Rank
a)	Ness	182	33/33
	Spey (Boat o'Brig)	179	51/53
	Earn	254	57/58
	Forth	198	24/25
	Itchen	67	3/47
	Stour (Throop)	64	3/33
	Piddle	67	3/42
	Leven(Linnbrane)	230	40/42

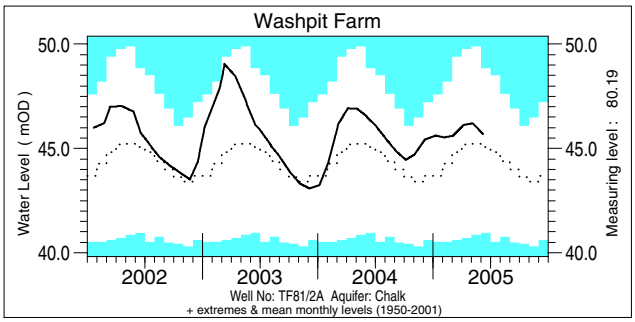
	River	%lta	Rank
b)	Soar	47	3/34
	Medway	34	2/44
	Ouse (Gold Bridge)	38	1/41
	Wallington	38	2/51
	Exe	67	2/49
	Otter	58	3/43
	Dart	72	4/47

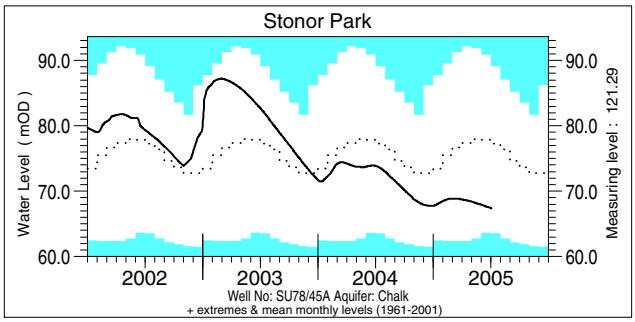
River	%lta	Rank
Kenwyn	55	2/37
Taw	70	4/47
Tone	65	3/44
Yscir	76	2/32
Ewe	131	35/35
Naver	127	27/28
L Bann	77	3/25

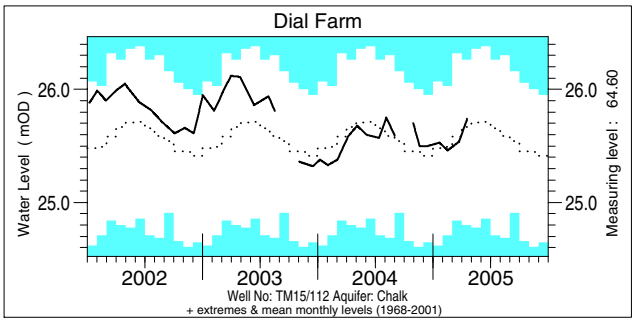
lta = long term average
Rank 1 = lowest on record

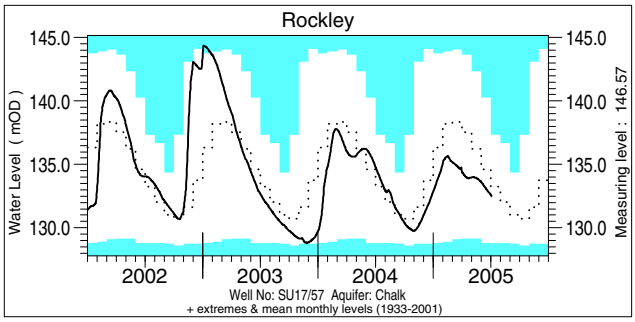
Groundwater . . . Groundwater

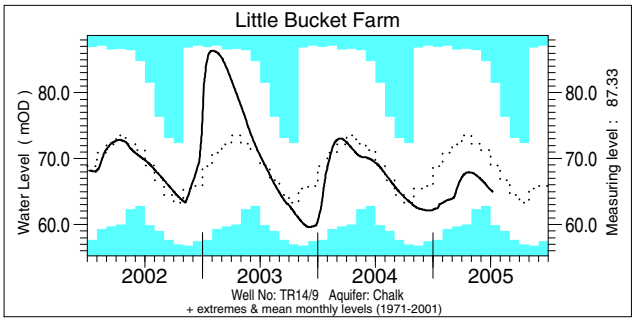


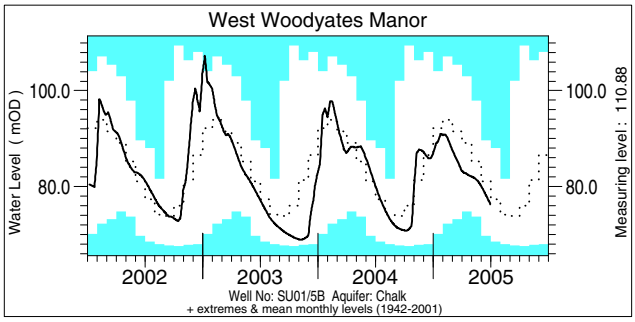


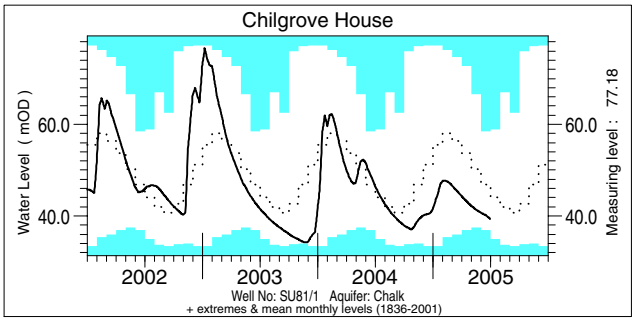


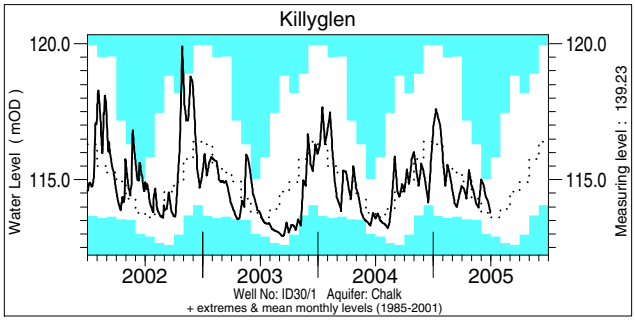


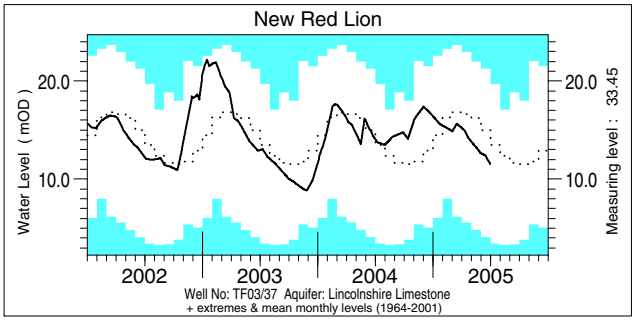






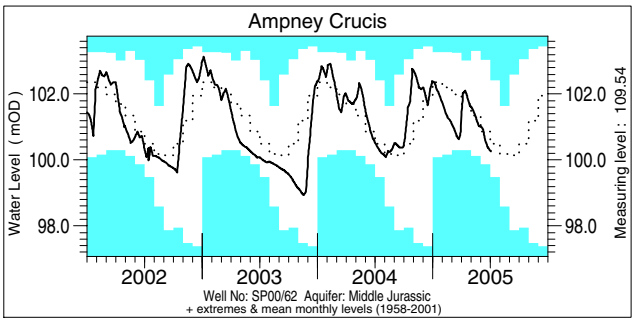


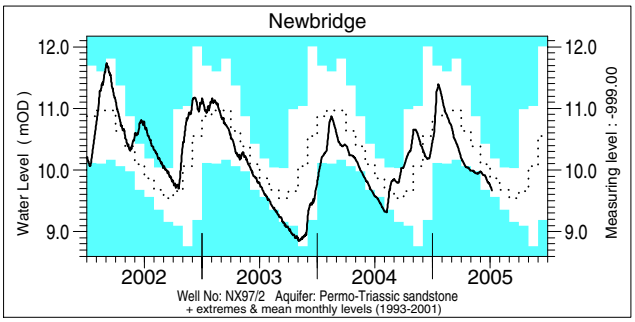


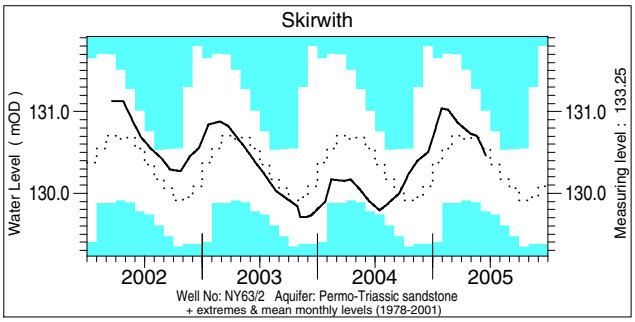


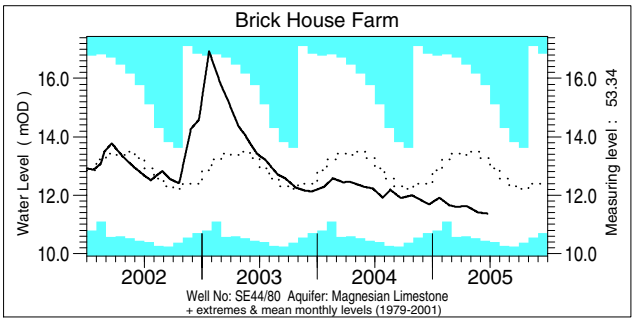
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

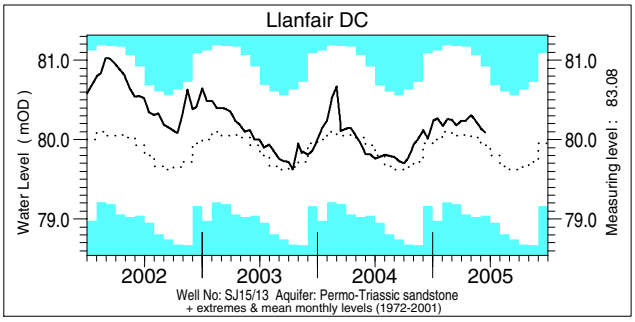
Groundwater . . . Groundwater

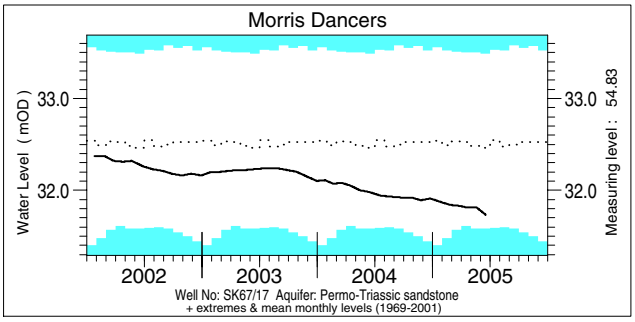


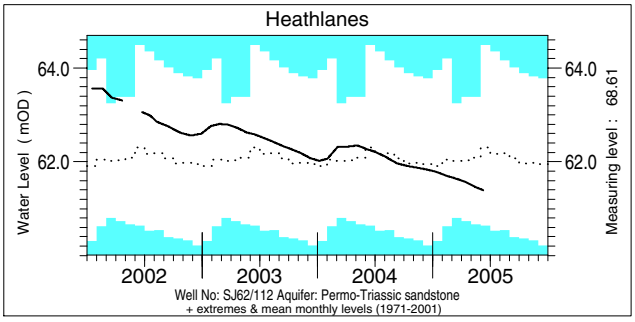


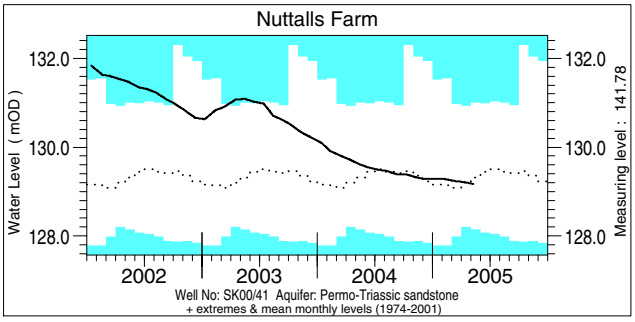


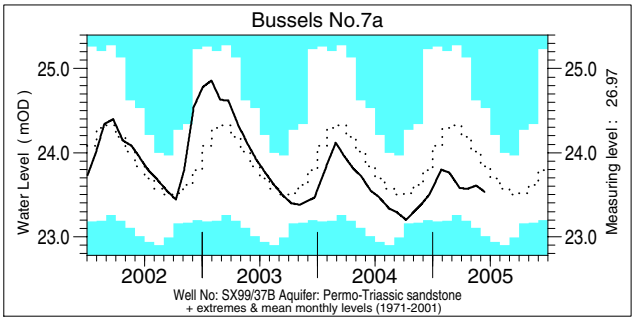


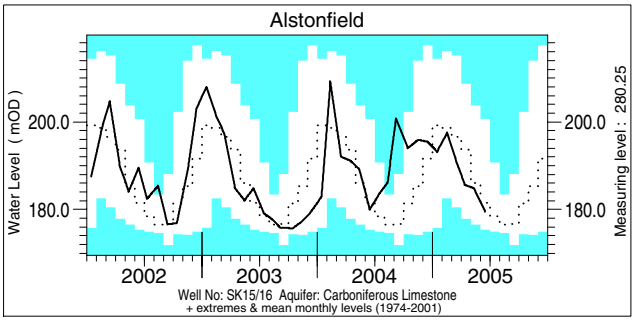












Groundwater levels June/July 2005

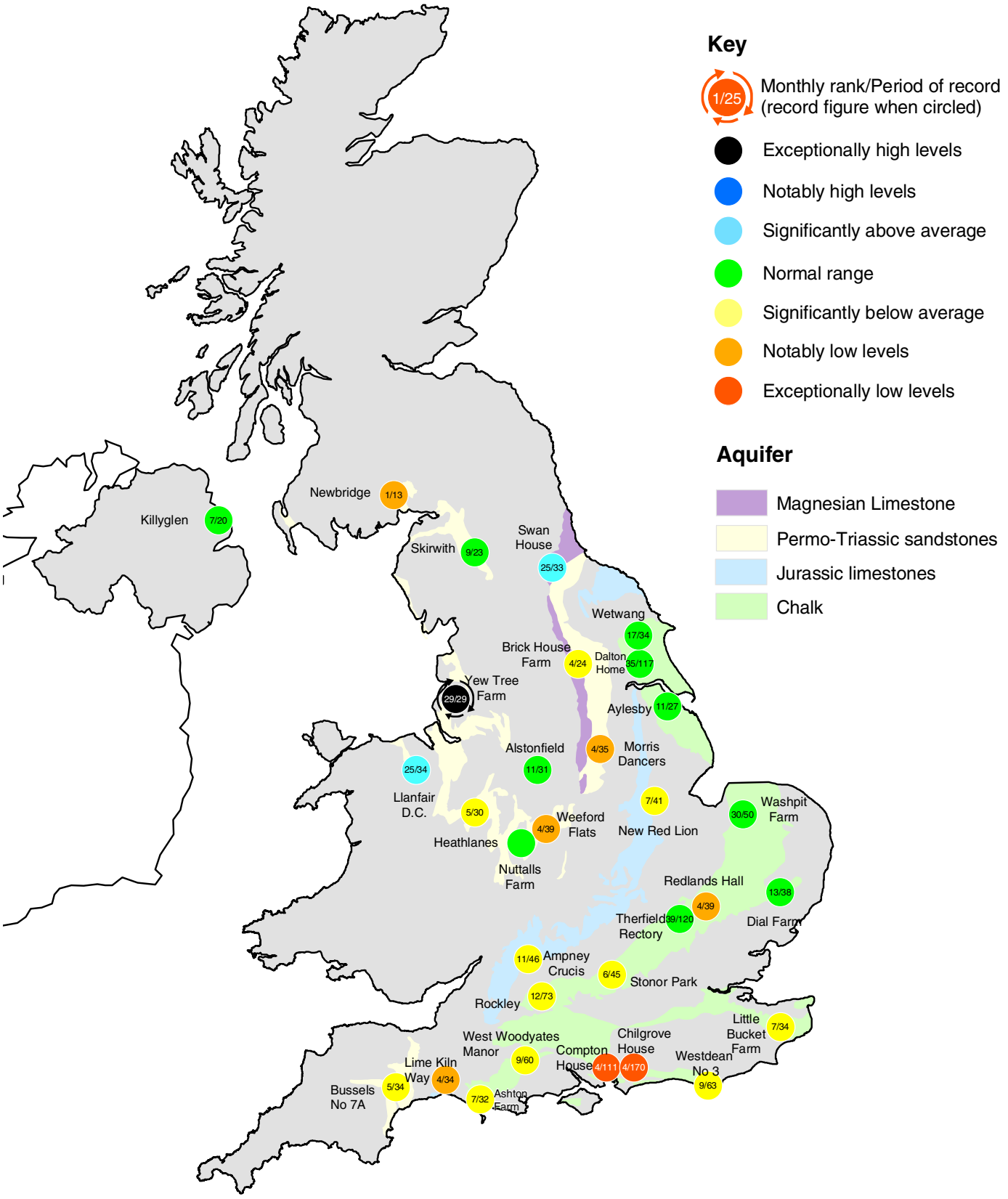
Borehole	Level	Date	Jun. av.
Dalton Holme	17.56	13/06	18.14
Washpit Farm	45.68	07/06	45.20
Stonor Park	67.37	04/07	78.23
Dial Farm	25.65	14/06	25.71
Rockley	132.51	04/07	134.60
Little Bucket Farm	65.73	22/06	71.49
West Woodyates	76.31	30/06	80.97

Borehole	Level	Date	Jun. av.
Chilgrove House	39.35	30/06	46.03
Killyglen	113.78	30/06	113.98
New Red Lion	11.54	30/06	14.66
Ampney Crucis	100.26	04/07	100.84
Newbridge	9.67	07/07	10.10
Skirwith	130.46	17/06	130.50
Brick House Farm	11.37	23/06	13.22

Borehole	Level	Date	Jun. av.
Llanfair DC	80.09	15/06	79.86
Morris Dancers	31.73	17/06	32.35
Heathlanes	61.39	09/06	62.29
Nuttalls Farm	129.17	09/05	129.63
Bussels No.7a	23.53	14/06	23.87
Alstonfield	179.41	15/06	181.55

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater



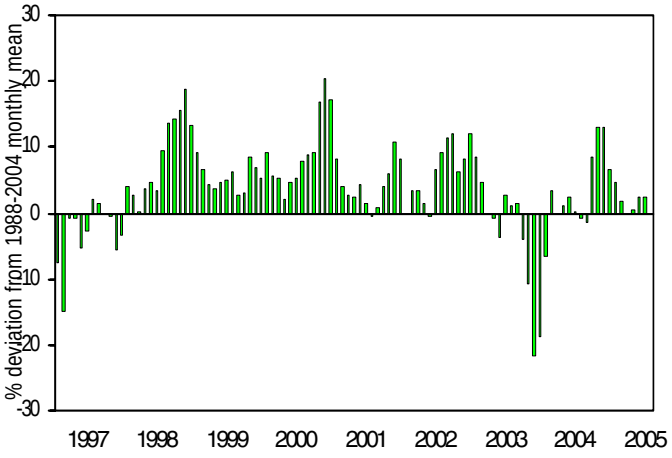
Groundwater levels - June 2005

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.

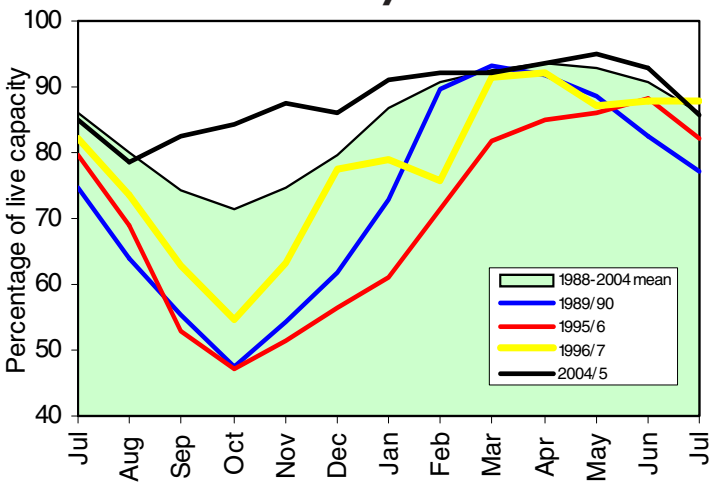
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

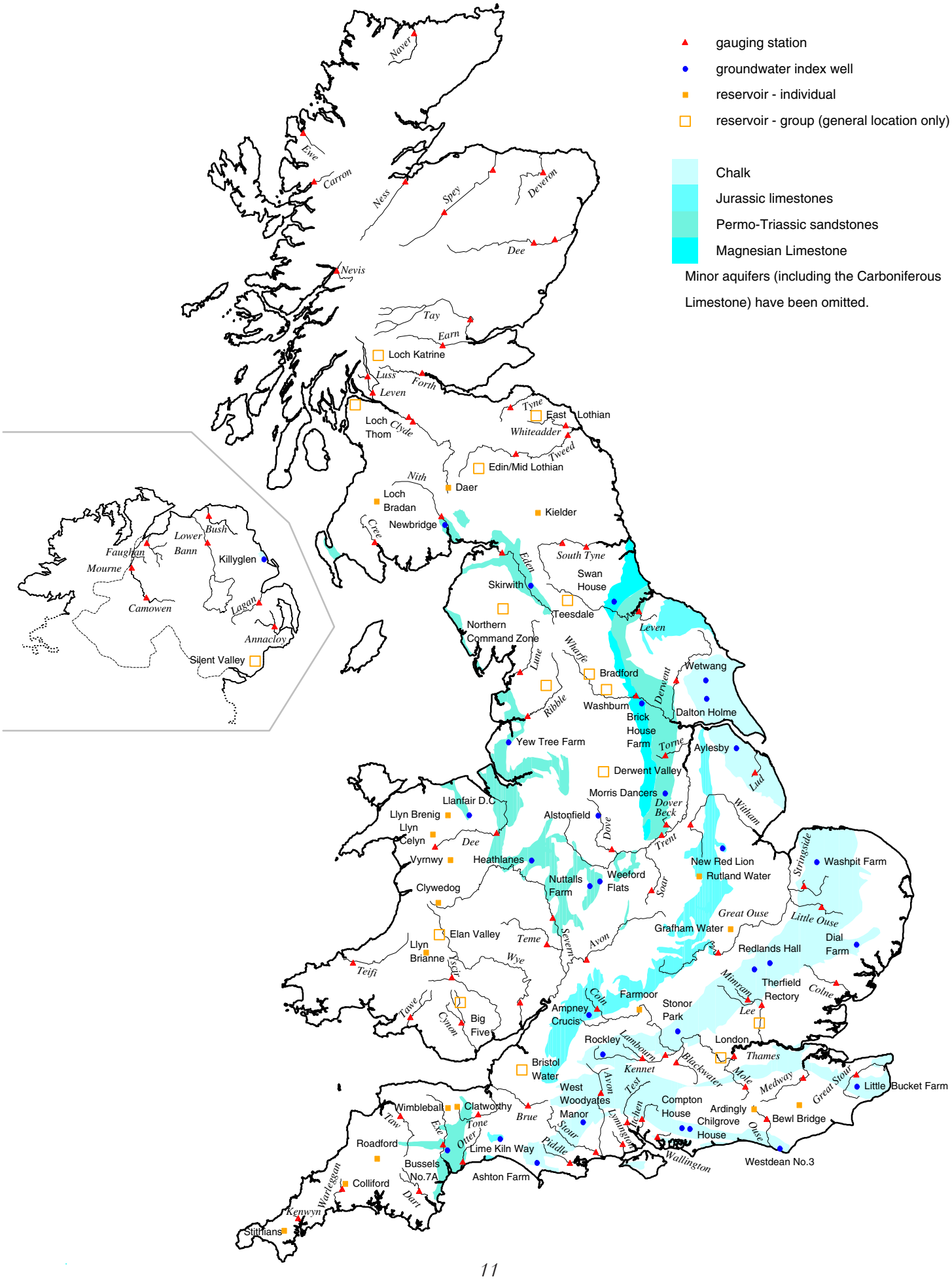
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2005 Mar	Apr	May	Jun	Jul	Avg. Jul	Min. Jul	Year* of min.
North West	N Command Zone	• 124929	91	90	90	86	**72**	71	58	1995
	Vyrnwy	55146	97	97	98	94	**84**	82	65	1990
Northumbrian	Teesdale	• 87936	89	95	98	95	**87**	77	58	1989
	Kielder	(199175)	(90)	(91)	(93)	(94)	**(90)**	(90)	(71)	1989
Severn Trent	Clywedog	44922	89	94	100	100	**97**	93	72	1989
	Derwent Valley	• 39525	95	99	100	92	**83**	79	53	1996
Yorkshire	Washburn	• 22035	83	80	85	77	**69**	80	63	1995
	Bradford supply	• 41407	94	98	100	93	**80**	77	54	1995
Anglian	Grafham	(55490)	(94)	(96)	(96)	(93)	**(89)**	(92)	(70)	1997
	Rutland	(116580)	(94)	(94)	(94)	(95)	**(89)**	(88)	(75)	1997
Thames	London	• 202340	95	96	99	98	**89**	91	85	1990
	Farmoor	• 13830	98	97	98	99	**99**	98	94	1995
Southern	Bewl	28170	75	86	85	78	**69**	83	52	1990
	Ardingly	4685	83	93	98	98	**82**	96	82	2005
Wessex	Clatworthy	5364	100	94	100	94	**87**	82	61	1995
	Bristol WW	• (38666)	(83)	(82)	(85)	(82)	**(75)**	(81)	(64)	1990
South West	Colliford	28540	71	70	71	71	**67**	82	51	1997
	Roadford	34500	73	72	75	73	**71**	82	49	1996
	Wimbleball	21320	90	96	96	93	**88**	84	63	1992
	Stithians	5205	75	78	84	87	**79**	78	53	1990
Welsh	Celyn and Brenig	• 131155	98	100	100	100	**96**	93	77	1996
	Brianne	62140	96	97	100	100	**94**	92	76	1995
	Big Five	• 69762	96	97	96	91	**82**	83	61	1989
	Elan Valley	• 99106	98	99	99	94	**83**	89	75	1989
Scotland(E)	Edinburgh/Mid Lothian	• 97639	99	99	99	99	**96**	85	54	1998
	East Lothian	• 10206	100	100	100	100	**96**	92	81	1992
Scotland(W)	Loch Katrine	• 111363	86	91	97	100	**94**	81	61	2001
	Daer	22412	97	95	100	100	**94**	81	62	1994
	Loch Thom	• 11840	100	100	100	100	**100**	83	69	2000
Northern Ireland	Total+	• 67270	83	84	89	89	**86**	84	65	1995
	Silent Valley	• 20634	73	73	89	93	**86**	76	54	1995

() 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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