Hydrological Summary
for the United Kingdom

February 2005

General
February was initially mild but northerly and easterly airflows brought Arctic conditions with significant snowfall to many areas over the final fortnight. Nonetheless, monthly precipitation totals were modest over much of southern Britain where many catchments registered a 4th successive relatively dry month. For England and Wales, the provisional Nov-Feb rainfall total is the 4th lowest since 1934 and rainfall deficiencies in parts of the English Lowlands are now exceptional. The winter drought has impacted on reservoir replenishment but substantial pumped storage contributions helped ensure that overall stocks for E&W are only marginally below the early March average (and similar to corresponding stocks in 2003 and 2004). However, stocks are well below the seasonal average in many southern impoundments (Ardingly reported its lowest early March level in a 18-yr series). River flows are also seasonally depressed over wide areas and baseflows show little evidence of a normal winter recovery. Correspondingly, groundwater levels in most aquifers units are low for the late winter – but mostly a little above recent drought minima (e.g. of those of 1991 and 1997). Well above average spring rainfall is needed to avoid significant stress on water resources and the aquatic environment during the summer; the outlook is particularly fragile in parts of the South.

Rainfall
High pressure dominated synoptic patterns in February with Atlantic frontal systems making only rare incursions to the south of the Highland region. A few substantial storm totals were reported (e.g. Capel Curig in N. Wales registered 55mm on the 12th) and blizzard conditions were associated with significant snowfall, particularly near the eastern seaboard. In many areas however, February rainfall totals were meagre – less than 30% of average in a band from Cornwall to Sussex. Of greater hydrological and water resources significance are the cumulative deficiencies since mid-October 2004. Whilst Nov-Feb rainfall totals are well above average in the Highland region (adding to a cluster in this timeframe over the last 15 years), most regions of E&W have been exceptionally dry. Southern region reported only a little above half the 61-90 average rainfall with much of English Lowlands registering less than 60%; the South-West has been very dry also. Provisional data suggest that for much of the English Lowlands, rainfall totals for the last four months rank 3rd or 4th lowest in the last 60 years. Reservoir and aquifer replenishment depends heavily on Oct-March rainfall but winter droughts seldom have a high public profile; the generally damp complexion to the weather (dry days have been close to average through the winter) has not been helpful in raising awareness of the drought's severity, in southern England especially.

River flows
A few high spates were reported in February (e.g. around the 12th on the Welsh Dee and the Ribble) but although catchments remained close to saturation and responsive to rainfall, flows remained mostly in recession. In spring-fed southern rivers there is as yet little sign of a belated winter recovery. February runoff totals exceeded the average in a few Highland rivers and in some small catchments draining to the North Sea. Elsewhere, runoff totals were well below average – mostly still within the normal range across much of northern Britain, but depressed in much of southern England, particularly so in impermeable catchments. The Thames reported its 3rd lowest February runoff since 1944 and many rivers registered their lowest mean flow since 1992. The most intense expression of the drought is found in a number of rivers draining to the English Channel. The Sussex Ouse reported a new Feb runoff minimum and the Otter (Devon) and Wallington (Hants) registered their lowest since 1965. In some rivers (e.g. the Gt Stour) above average daily flows have been recorded for less than 10 days since October. Correspondingly, accumulated runoff deficiencies are large: 65-70% below average for some index rivers in Sussex and Hants over the Nov-Feb period; in Northern Ireland, runoff for Annacloy ranks 2nd lowest in a 25-yr record. Many spring-fed streams (e.g. the Lambourn) are flowing at rates typical of the late summer, heralding very depressed autumn flows in the absence of a very wet spring.

Groundwater
Very uneven precipitation patterns in February made for large variations in infiltration rates. Snow contributed significantly to above average groundwater replenishment in some eastern areas - triggering groundwater level increases in some minor aquifers (e.g. the Norfolk Drift). Generally however infiltration was very moderate, below 40% of average across much of the Chalk and very meagre in the most southerly outcrops. The recharge season began very early in the autumn of 2004 but subsequent aquifer replenishment has been modest, less than 50% in most of the Chalk. Fortunately, some residual benefit from pre-2004 recharge can still be identified in all but the fastest responding aquifer units. Thus groundwater levels in the Chalk, though mostly low, remain in the normal range apart from the most southerly outcrops. This is also generally true of the Limestone aquifers though most feature steep recent recessions. Most Permo-Triassic sandstones outcrops are outside the areas of highest winter rainfall deficiencies and also benefit from recharge over several winters – thus, again, levels remain largely in the normal range but declining. Modest but increasing soil moisture deficits in eastern and southern England may signal a very early termination to the recharge season in the absence of sustained spring rainfall. Such a circumstance would imply depressed groundwater levels in the summer and be of particular concern in the South (where a combination of fast responding aquifers and streams makes for enhanced drought vulnerability).

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Feb 2005	Dec 04-Feb 05	RP	Nov 04-Feb 05	RP	Sep 04-Feb 05	RP	Mar 04-Feb 05	RP
England & Wales	**mm**	**44**	**179**		**229**		**434**		**913**	
	%	**68**	**71**	**5-10**	**67**	**10-20**	**85**	**2-5**	**100**	**<2**
North West	mm	**66**	318		394		696		1284	
	%	**83**	98	2-5	88	2-5	100	<2	105	2-5
Northumbrian	mm	**58**	208		240		437		957	
	%	**98**	92	2-5	77	5-10	94	2-5	110	2-5
Severn Trent	mm	**46**	121		166		345		783	
	%	**84**	59	10-20	60	20-30	85	2-5	102	2-5
Yorkshire	mm	**58**	157		194		360		859	
	%	**100**	71	5-10	64	10-20	81	5-10	103	2-5
Anglian	mm	**40**	93		136		261		643	
	%	**106**	64	5-15	67	10-20	86	2-5	107	2-5
Thames	mm	**24**	101		143		293		656	
	%	**52**	55	10-20	57	20-30	78	5-10	94	2-5
Southern	mm	**25**	128		163		325		687	
	%	**45**	59	10-20	54	30-40	72	5-15	88	2-5
Wessex	mm	**25**	145		184		389		762	
	%	**38**	58	10-20	55	25-40	79	5-10	89	2-5
South West	mm	**46**	247		306		575		1073	
	%	**45**	64	5-15	60	20-30	80	5-10	90	2-5
Welsh	mm	**78**	328		422		809		1341	
	%	**77**	82	2-5	77	5-10	101	2-5	100	<2
Scotland	**mm**	**109**	**551**		**670**		**1049**		**1726**	
	%	**103**	**132**	**10-20**	**117**	**5-10**	**120**	**5-15**	**117**	**10-20**
Highland	mm	**147**	803		984		1439		2171	
	%	**116**	160	*10-20*	141	*10-20*	136	*30-40*	125	*30-40*
North East	mm	**90**	306		379		628		1195	
	%	**130**	113	2-5	101	2-5	110	2-5	116	5-15
Tay	mm	**98**	434		502		851		1535	
	%	**99**	115	2-5	99	2-5	112	2-5	119	10-20
Forth	mm	**83**	378		435		742		1344	
	%	**101**	120	5-10	101	2-5	112	2-5	117	5-15
Tweed	mm	**66**	259		299		563		1136	
	%	**94**	97	2-5	82	2-5	101	2-5	113	5-10
Solway	mm	**82**	438		523		889		1567	
	%	**81**	108	2-5	95	2-5	104	2-5	109	2-5
Clyde	mm	**105**	619		750		1208		2003	
	%	**85**	124	5-10	110	2-5	114	2-5	114	5-15
Northern Ireland	**mm**	**57**	**273**		**333**		**571**		**1071**	
	%	**70**	**89**	**2-5**	**80**	**2-5**	**91**	**2-5**	**98**	**2-5**

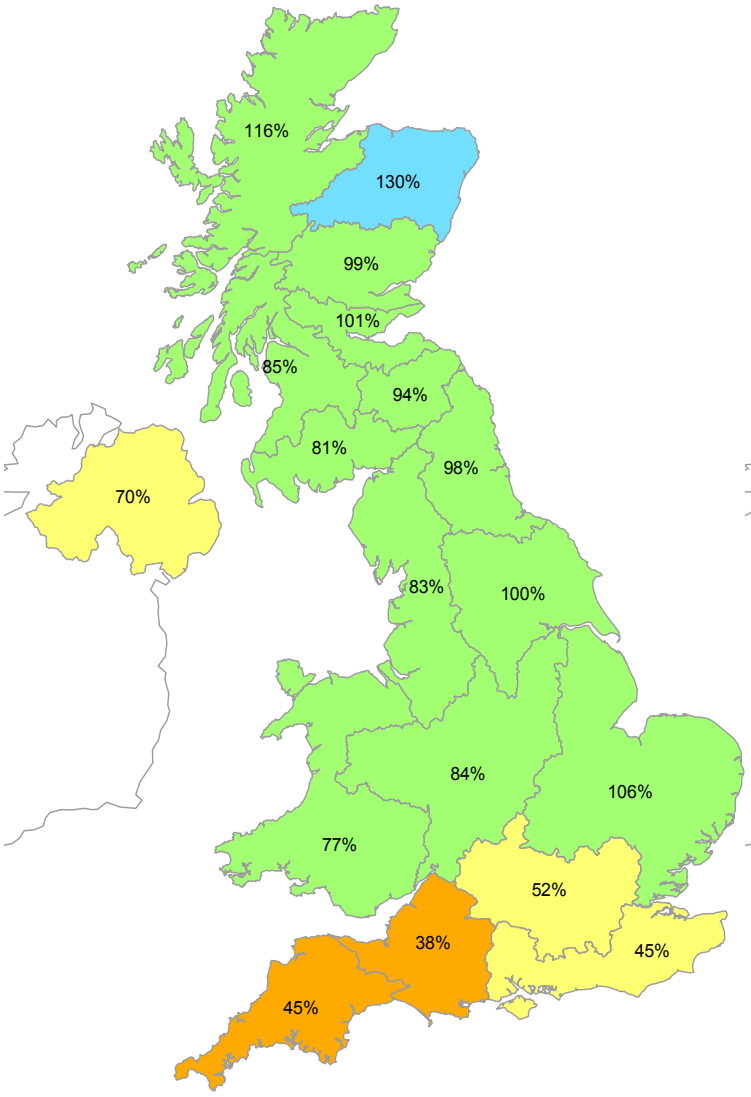
% = percentage of 1961-90 average *RP = Return period*

The monthly rainfall figures* provided by the Met Office are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation. **All monthly totals since October 2004 are provisional (see page 12).** Revised Met Office totals for 1961-2003 have been recently incorporated. 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.

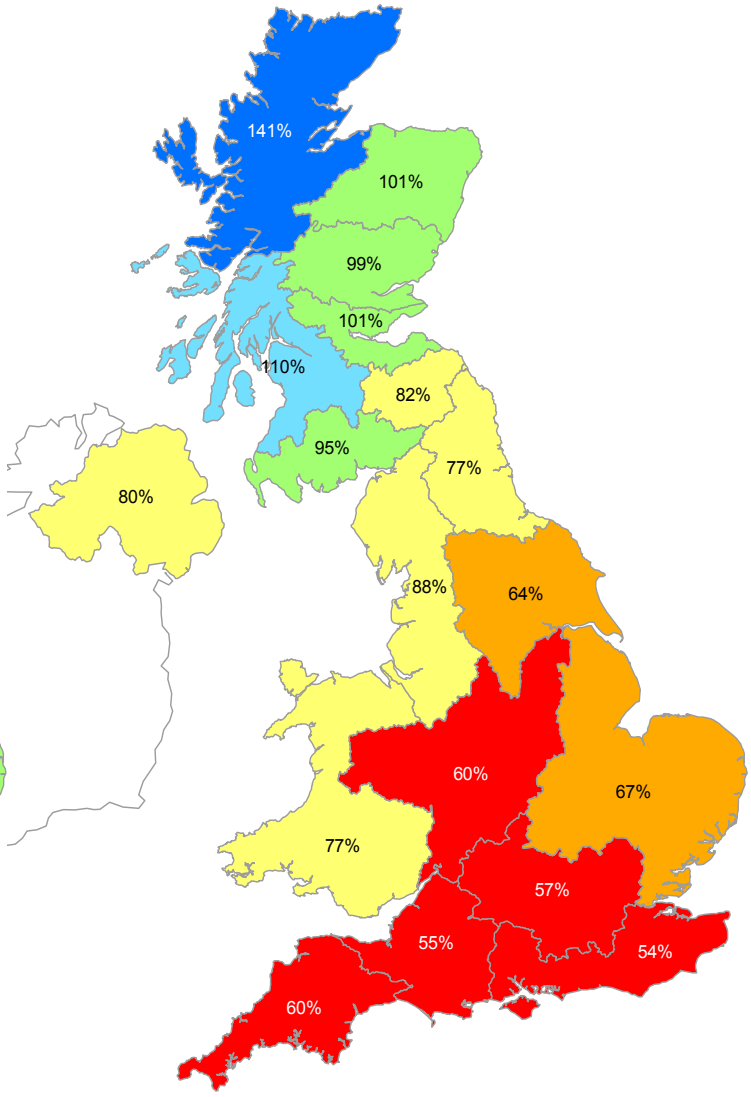
Rainfall . . . Rainfall . .

Key

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



February 2005

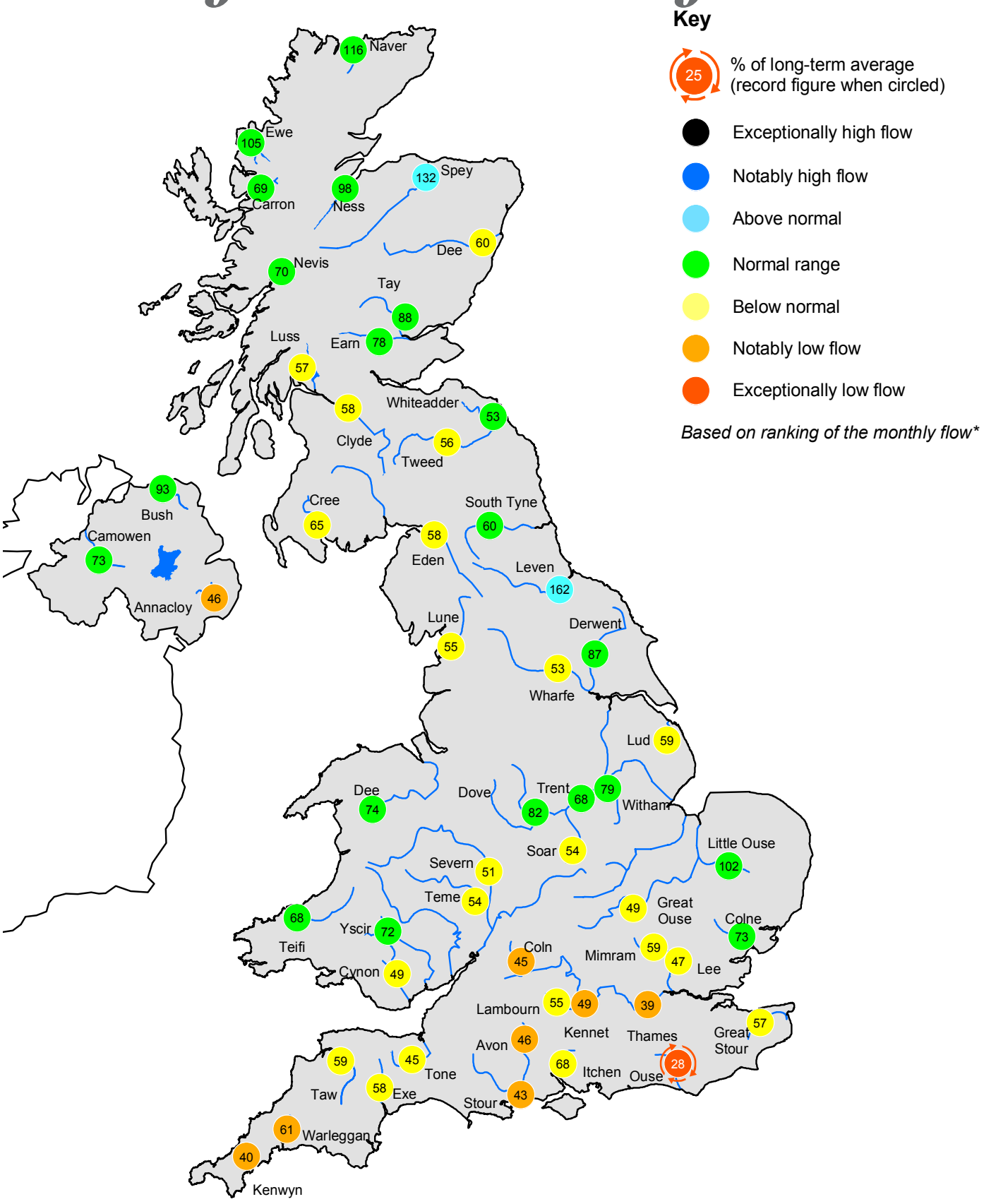


November 2004 - February 2005

Rainfall accumulation maps

The provisional UK rainfall total for February - the second lowest since 1993 - was unexceptional but the dryness of the preceding three months meant that deficiencies over the Nov-Feb period are very substantial. For the Severn-Trent region the 4-month rainfall was the lowest since 1963 and, to the south, comparable recent deficiencies are restricted to 1991/92 1988/89 and 1975/76; the latter two heralding severe summer drought conditions.

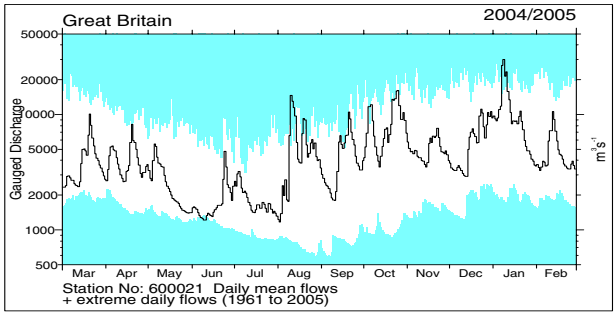
River flow . . . River flow . . .

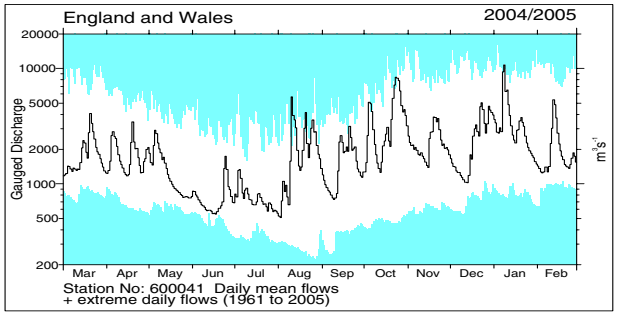


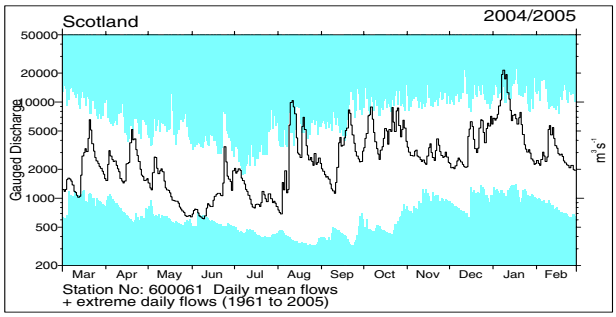
River flows - February 2005

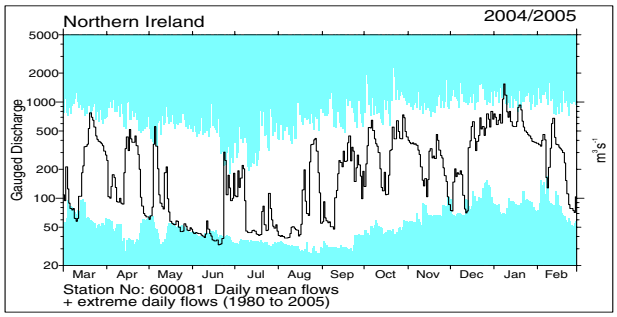
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

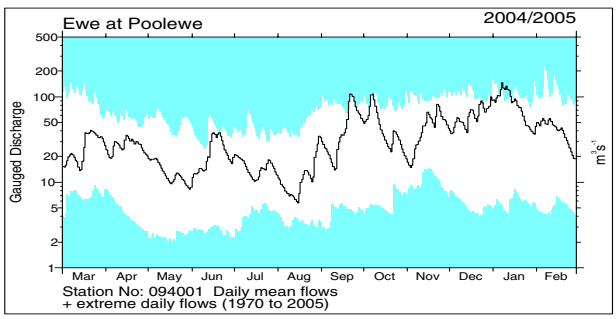
River flow . . . River flow . . .

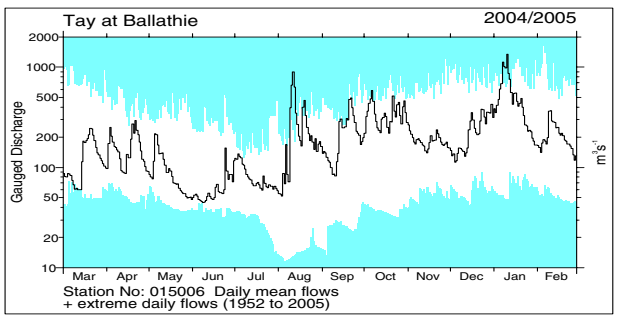


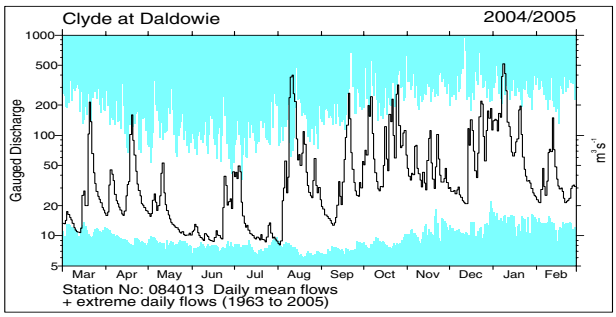


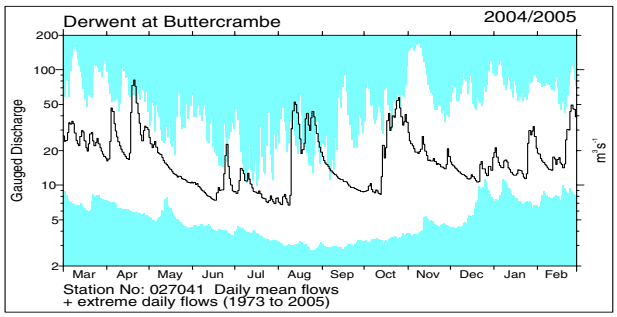


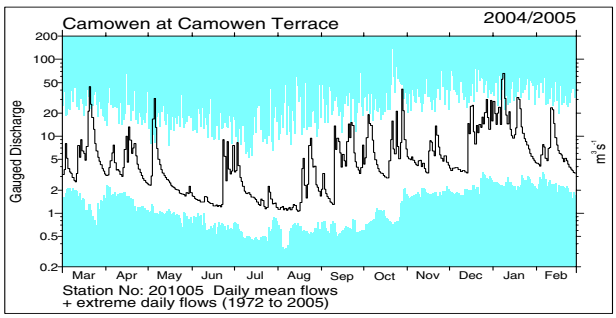


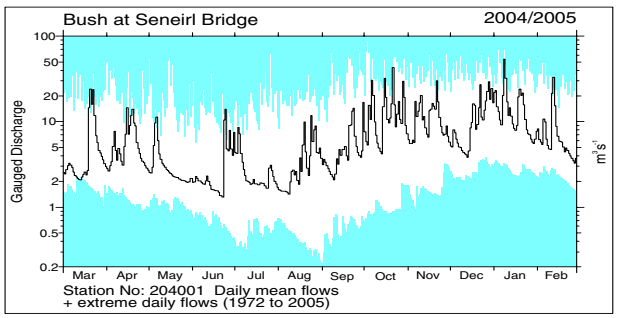








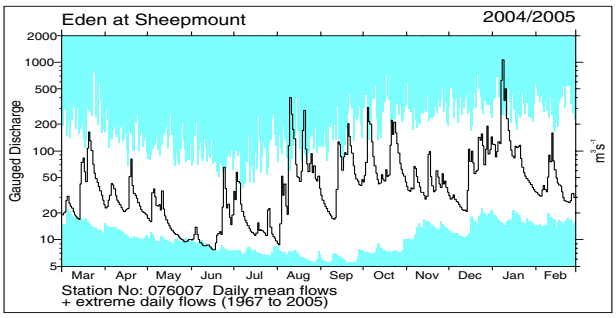


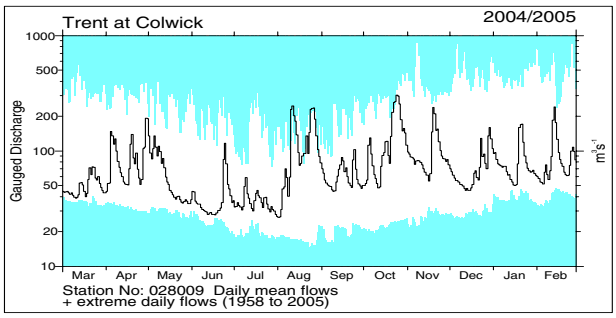


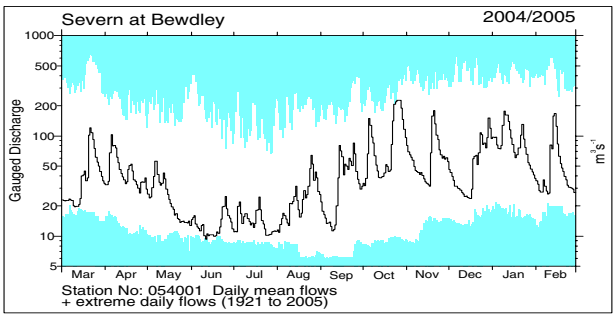
River flow hydrographs

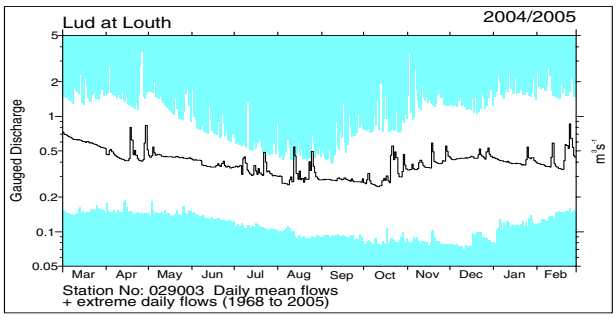
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to March 2004 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The 'national' hydrographs are based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

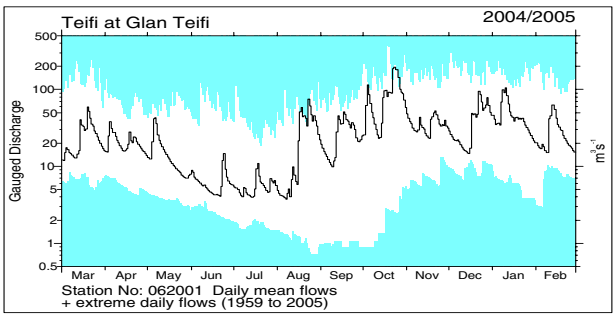
River flow . . . River flow . . .

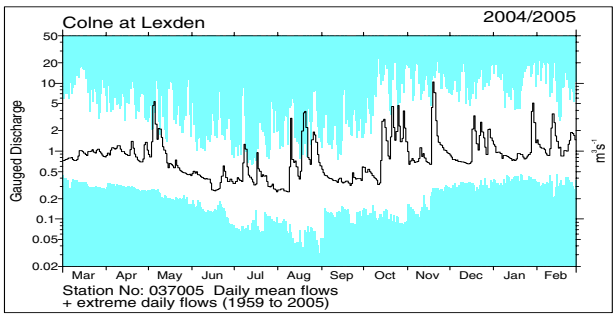


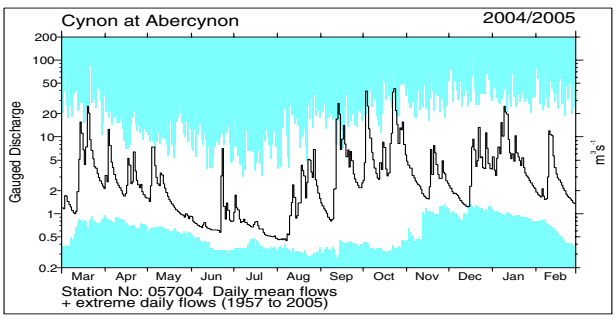


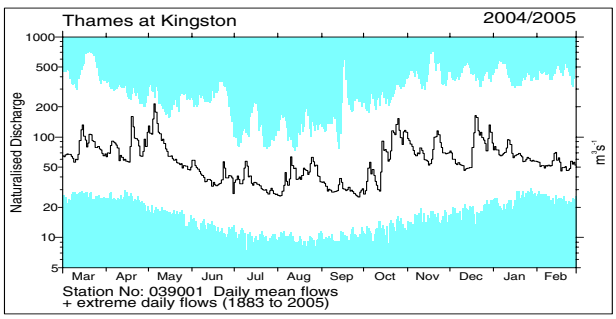


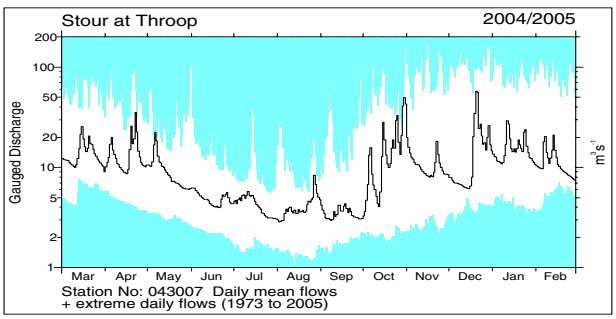


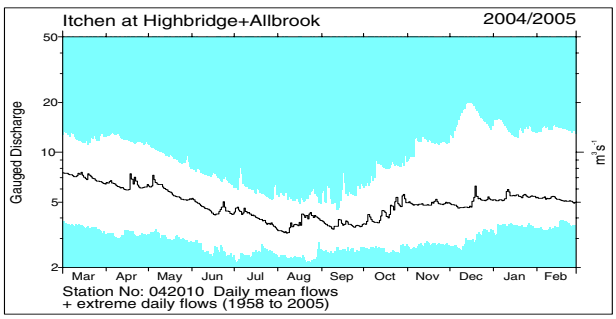










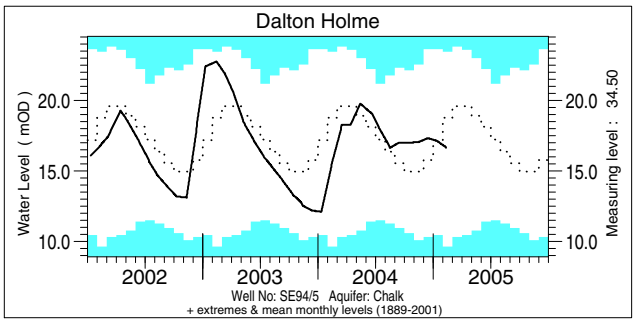


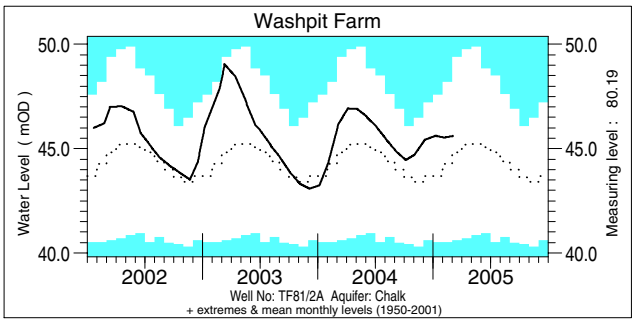
Notable runoff accumulations (a) November 2004 - February 2005, (b) March 2004 - February 2005

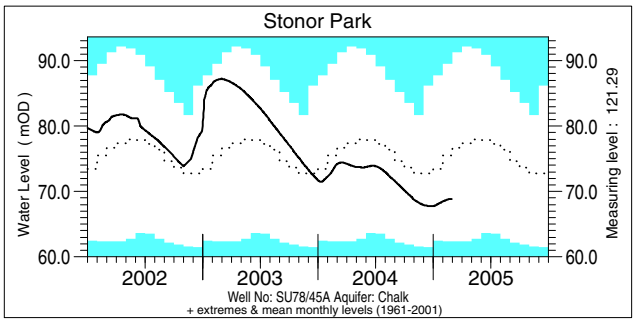
	River	%lta	Rank	River	%lta	Rank		River	%lta	Rank
a)	Whiteadder	64	7/36	Dart	66	5/47	b)	Spey (Boat o'Brig)	126	51/52
	Torne	57	5/33	Tone	63	5/44		Medway	45	1/42
	Soar	47	5/34	Severn	65	8/84		Otter	62	2/42
	Mole	42	2/30	Teme	61	5/35		Kenwyn	69	2/36
	Gt Stour	53	4/40	Cynon	62	4/47		Ewe	123	32/34
	Ouse (Gold Bridge)	34	2/42	Lagan	73	4/32		Naver	125	27/27
	Wallington	39	4/52	Annacloy	65	2/25		Lower Bann	79	5/24
	Avon (Amesbury)	52	5/40							

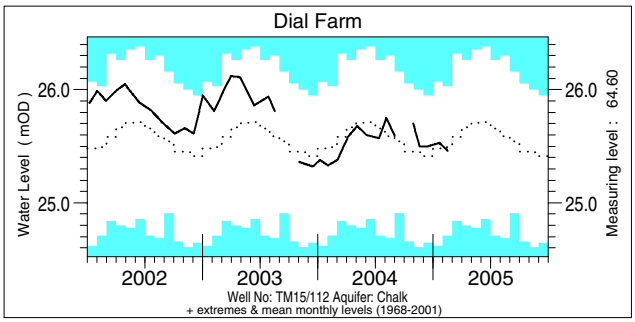
lta = long term average
Rank 1 = lowest on record

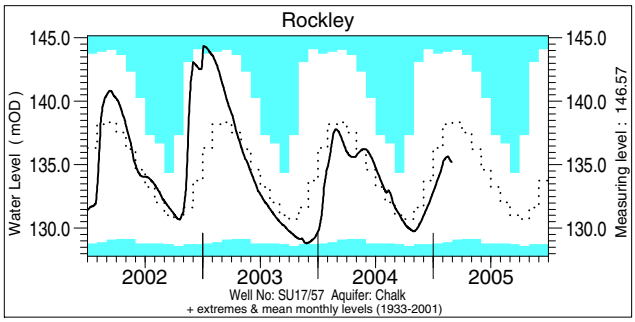
Groundwater . . . Groundwater

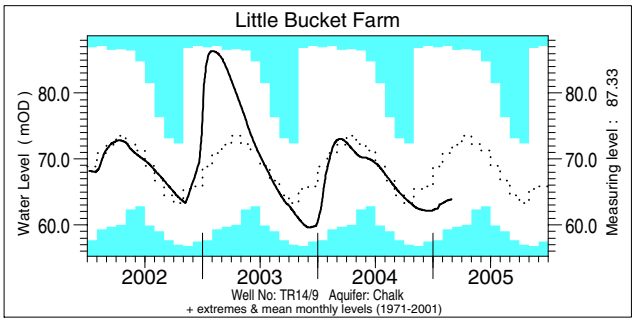


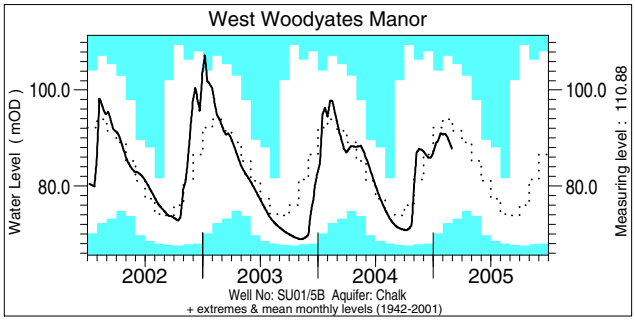


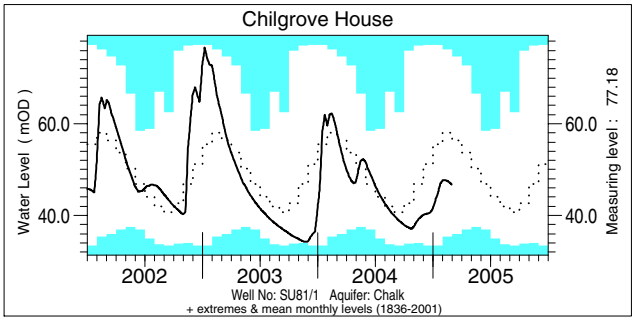


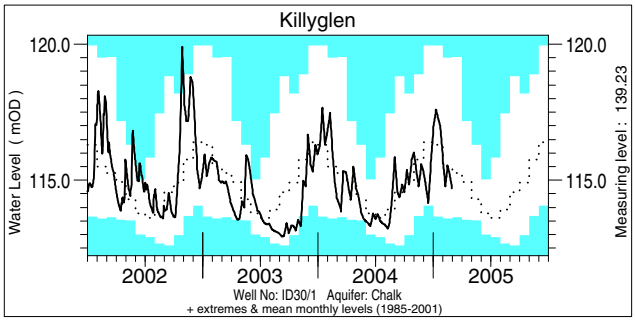


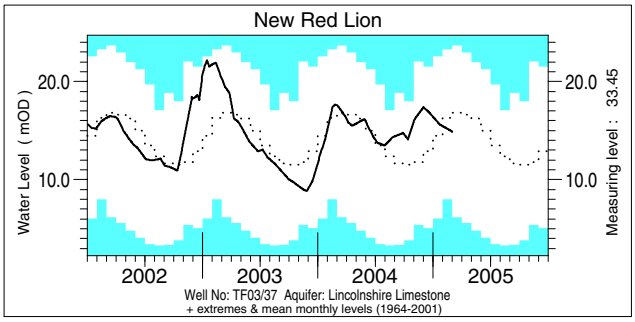






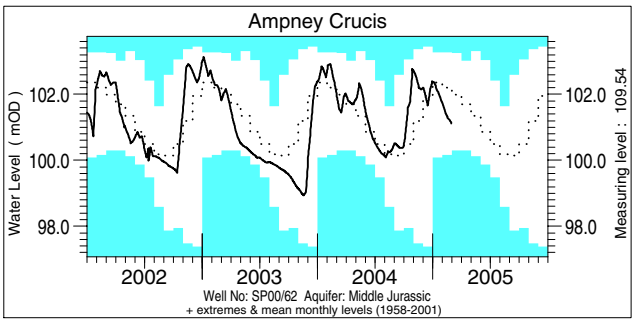


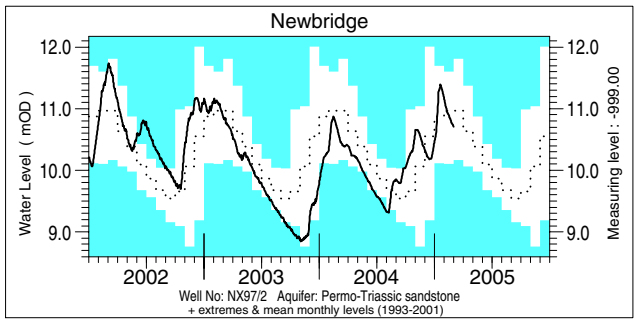


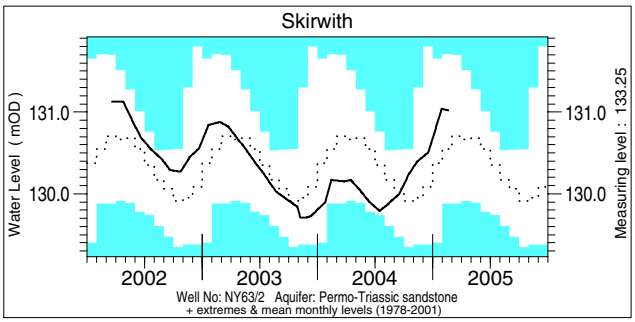


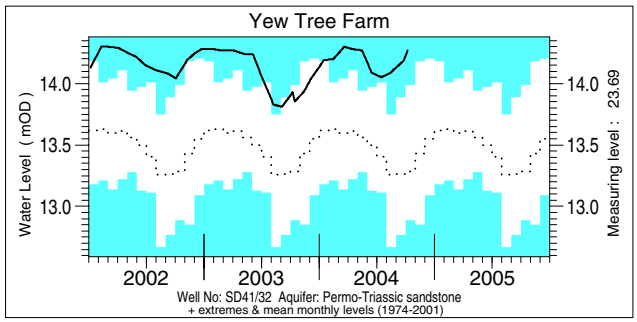
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

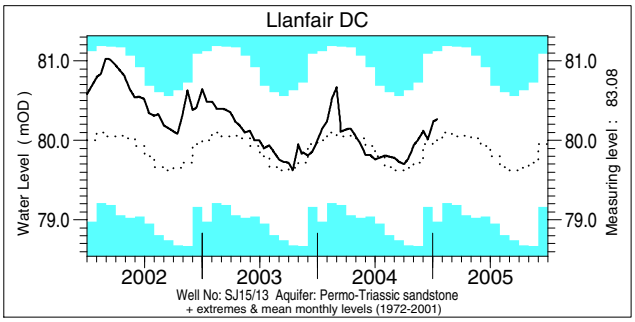
Groundwater . . . Groundwater

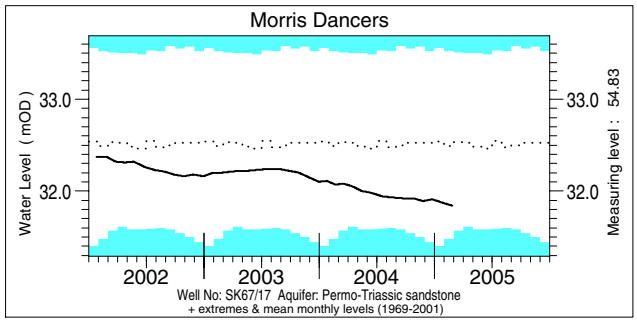


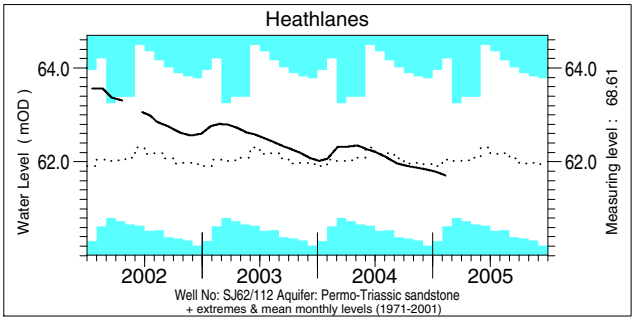


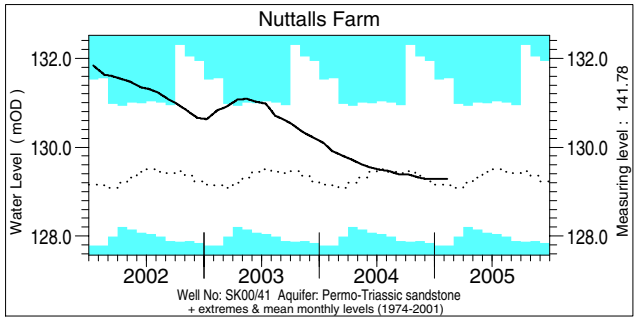


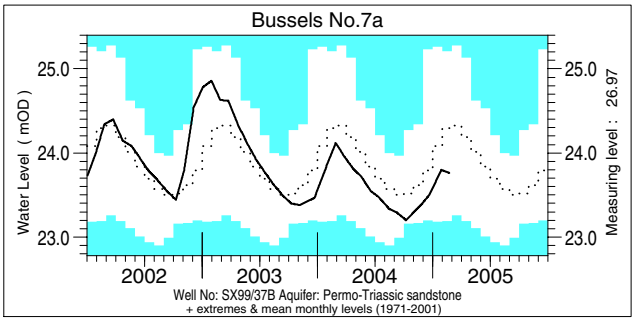


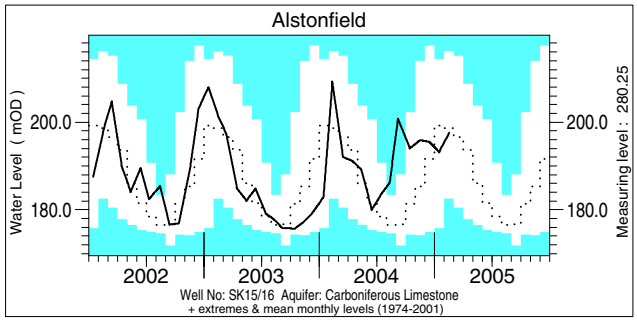










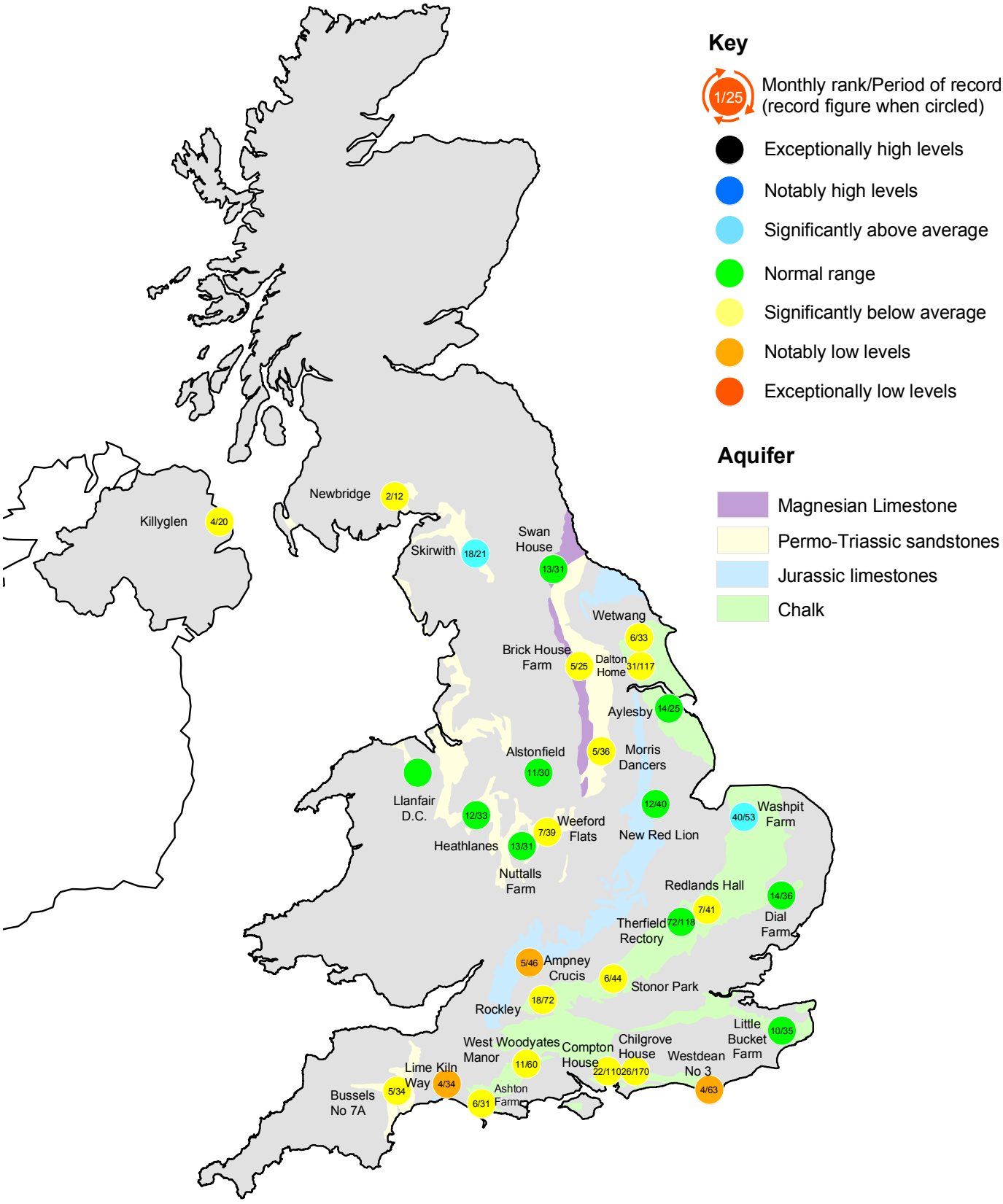


Groundwater levels February / March 2005

Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.	Borehole	Level	Date	Feb. av.
Dalton Holme	16.66	10/02	18.72	Chilgrove House	46.67	28/02	57.65	Llanfair DC	80.27	15/01	80.06
Washpit Farm	45.61	04/03	44.40	Killyglen	114.70	28/02	115.75	Morris Dancers	31.84	25/02	32.37
Stonor Park	68.87	28/02	75.96	New Red Lion	14.87	02/03	16.41	Heathlanes	61.71	09/02	62.05
Dial Farm	25.46	15/02	25.51	Ampney Crucis	101.12	28/02	102.24	Nuttalls Farm	129.28	09/02	129.48
Rockley	135.21	28/02	138.32	Newbridge	10.71	01/03	10.99	Bussels No.7a	23.76	22/02	24.32
Little Bucket Farm	63.86	28/02	70.65	Skirwith	131.02	18/02	130.60	Alstonfield	197.55	15/02	199.08
West Woodyates	87.75	28/02	93.30	Yew Tree Farm	14.27	06/10	13.75				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

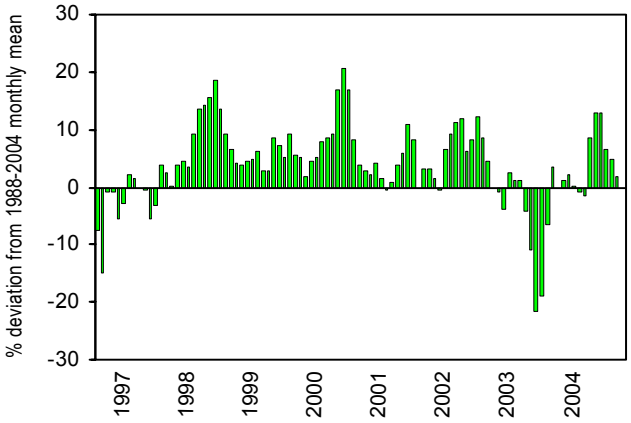


Groundwater levels - February 2005

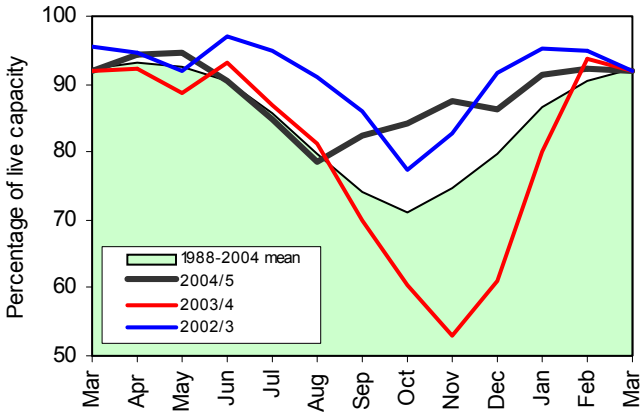
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing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

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.

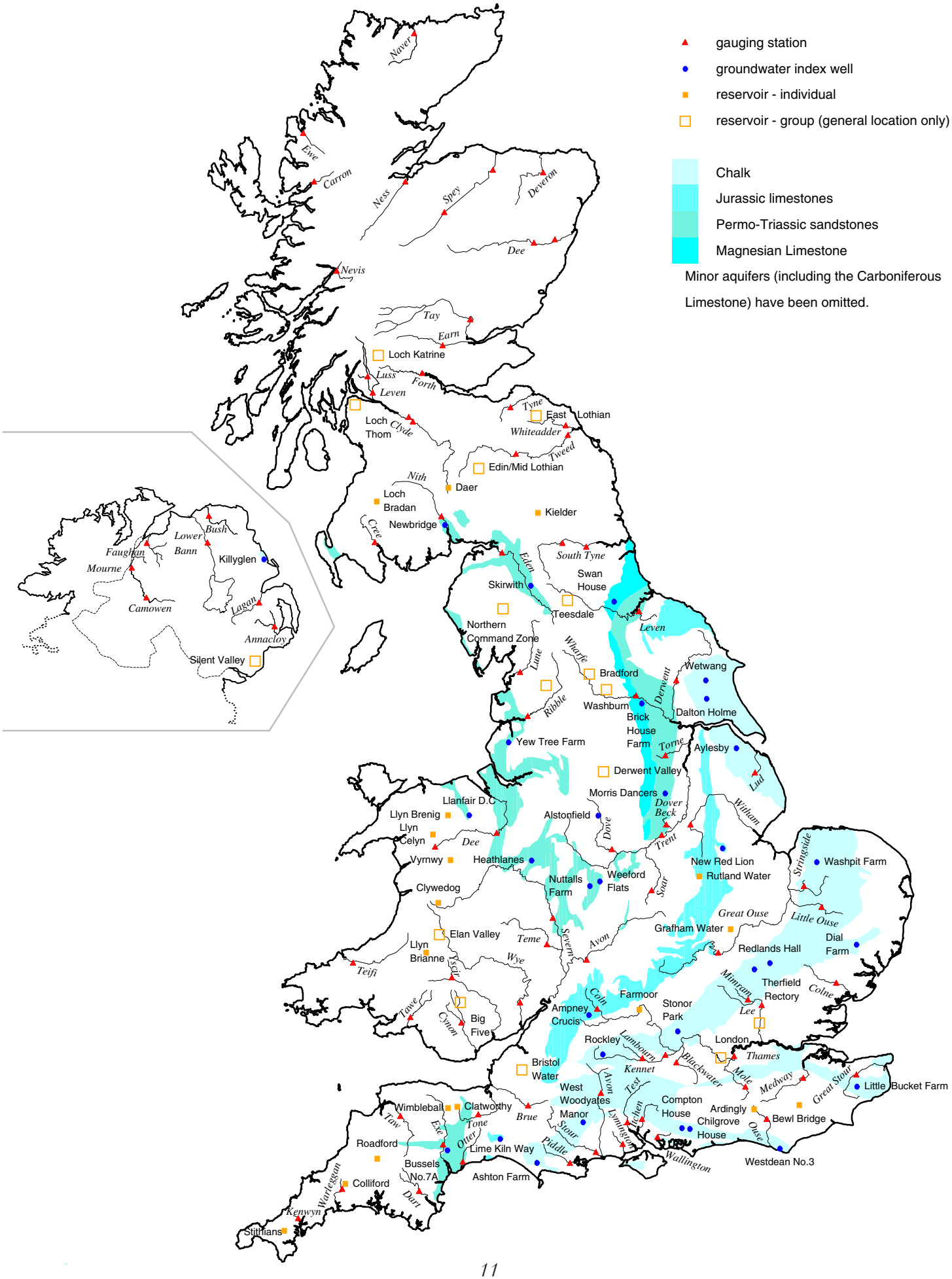
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2004 Nov	2005 Dec	Jan	Feb	Mar	Avg. Mar	Min. Mar	Year* of min.
North West	N Command Zone	• 124929	91	85	91	100	**91**	93	78	1996
	Vyrnwy	55146	94	85	100	99	**97**	94	59	1996
Northumbrian	Teesdale	• 87936	98	94	90	93	**89**	90	72	1996
	Kielder	(199175)	(96)	(86)	(98)	(91)	**(90)**	(93)	(81)	1993
Severn Trent	Clywedog	44922	82	78	83	79	**89**	90	77	1996
	Derwent Valley	• 39525	95	100	100	99	**95**	94	46	1996
Yorkshire	Washburn	• 22035	89	89	90	86	**83**	92	53	1996
	Bradford supply	• 41407	100	98	99	99	**94**	94	53	1996
Anglian	Grafham	(55490)	(78)	(86)	(92)	(92)	**(94)**	(87)	(72)	1997
	Rutland	(116580)	(78)	(86)	(93)	(95)	**(94)**	(88)	(71)	1992
Thames	London	• 202340	81	83	87	91	**95**	91	83	1988
	Farmoor	• 13830	96	92	98	99	**98**	93	64	1991
Southern	Bewl	28170	68	63	60	70	**75**	87	50	1989
	Ardingly	4685	60	60	69	79	**83**	99	83	2005
Wessex	Clatworthy	5364	65	89	100	100	**100**	97	82	1992
	Bristol WW	• (38666)	(56)	(58)	(64)	(77)	**(83)**	(92)	(65)	1992
South West	Colliford	28540	60	62	66	70	**71**	86	57	1997
	Roadford	34500	57	58	69	71	**73**	84	35	1996
	Wimbleball	21320	73	76	79	86	**90**	94	72	1996
	Stithians	5205	60	61	60	68	**75**	93	45	1992
Welsh	Celyn and Brenig	• 131155	97	95	97	97	**98**	97	69	1996
	Brianne	62140	99	93	98	94	**96**	98	92	2004
	Big Five	• 69762	87	92	97	98	**96**	95	85	1988
	Elan Valley	• 99106	100	99	100	99	**98**	98	88	1993
Scotland(E)	Edinburgh/Mid Lothian	• 97639	87	88	87	98	**99**	94	73	1999
	East Lothian	• 10206	100	100	100	100	**100**	99	91	1990
Scotland(W)	Loch Katrine	• 111363	97	94	100	89	**86**	96	86	2005
	Daer	22412	100	100	100	100	**97**	99	94	2004
	Loch Thom	• 11840	100	100	100	100	**100**	99	90	2004
Northern Ireland	Total+	• 67270	85	88	88	86	**83**	89	81	2004
	Silent Valley	• 20634	73	72	69	78	**73**	82	57	2002

() 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 ans regional rainfall totals for the post-1960 period (together with revised 1961-90 averages) were made available 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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Oxfordshire
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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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