Hydrological Summary
for the United Kingdom

January 2005

General

Hydrologically, January was most notable for an exceptional exaggeration in the normal north-west/south-east rainfall gradient across the UK. In northern and western Britain, this was associated with damaging storms and a number of severe flood events whilst much of the English Lowlands experienced an intensifying winter drought. Provisionally, the November-January rainfall total for England and Wales is the 4th lowest since 1954 – with many lowland catchments reporting little over half their average rainfall. Entering February, most reservoirs in northern Britain were close to capacity and overall stocks for E&W were a little above the late winter average. However, stocks are considerably below average in a number of impoundments across southern England. Exceptionally high flows in many northern and western rivers during early January contrasted with the seasonally depressed runoff rates which characterised many rivers by month end. Aquifer recharge has been notably low through the winter thus far but, except in the more responsive aquifer units, groundwater levels mostly remain in the normal range. However, groundwater resources will decline briskly as the lagged response to the minimal recent infiltration becomes evident. Correspondingly, substantial late winter and spring rainfall is needed is to avoid, potentially significant, drought stress in the coming summer across a substantial proportion of eastern and southern England.

Rainfall

Most Atlantic frontal systems followed tracks remote from the English Lowlands in January. A sequence of very vigorous depressions produced almost continuous rainfall in parts of Scotland over the first fortnight. Accumulated rainfall totals were remarkable: Strathyre (north of Callander) registered 341mm by the 10th (about 20% of the annual average) and Glen Garry (Highland) reported 568mm by the 20th. Orographic enhancement contributed to 2-day (7/8th) totals of 218mm at Honister in the Lake District and 198mm at Capel Curig in North Wales. In the English Lowlands a damp complexion to the weather (cloudy with drizzle and relatively few dry days) tended to obscure the increasing rainfall deficiencies but some London raingauges recorded <15mm in January and many catchments reported less than 50% of average. Thus whilst Scotland recorded its 4th wettest January in 30 years, E&W registered its fourth driest. More importantly from a resources perspective, the sustained anticyclonic conditions – at Wallingford only one storm total of >10mm has been recorded since late-October – have contributed to the 4th driest November-January period since 1954. The three-month deficiencies are most significant in a zone from Yorkshire to the south coast; preliminary data suggest that only 1988/89 was drier than 2004/05 (in a data series from 1961) in the Midland and Yorkshire regions; deficiencies in the South are marginally lower but extend over a broader timeframe.

River flows

2004 ended with flows in most index rivers well within the normal range. This picture changed rapidly in January – a month with very wide temporal and spatial variations in runoff rates. Throughout northern Britain, the sustained heavy rainfall early in the month exhausted the available loch, lake and reservoir storage and further rain brought widespread floodplain inundation; in Scotland, more than 70 Severe Flood Warnings were issued. The River Teith reached its highest level in a series from 1957, Loch Lomond its 2nd highest in 27-year series and the Tay (at Caputh) recorded its 4th highest flow in a record from 1948. In northern England on the 8th very severe flooding in Carlisle necessitated the evacuations of several thousand people as the River Eden recorded the second highest daily flow (provisionally1060 m^3s^{-1}) for any E&W gauging station on the National River Flow Archive. Notable flood events also occurred on the South Tyne (disrupting water supplies to Hexham) and in the Conwy Valley; localized flooding was also reported from Northern Ireland. January runoff totals were exceptionally high across much of Scotland and mostly within the normal range elsewhere. However, flows declined steeply from mid month in most areas, and were well below average in most index rivers by early February – especially in impermeable lowland catchments. A measure of the severity of the winter drought in runoff terms is provided by the Nov-Jan accumulations – the Great Stour, Soar, Otter and Mole are amongst those rivers registering totals among the three or four lowest on record.

Groundwater

Broadly speaking, the lowest January rainfall totals (<50% of average) coincided with the major aquifer outcrop areas – the Chalk especially – and, with modest soil moisture deficits developing across much of southern Britain by early February, infiltration rates were very moderate. Correspondingly, accumulated recharge totals for 2004/05 thus far are substantially below average. This is clearly reflected in the January groundwater levels. In the Chalk winter recoveries are still not evident in some areas (the eastern outcrops particularly) and weak in others. Nonetheless, the residual benefit of 2002/03 recharge and, in some areas, the early onset of recharge last autumn, is still exercising some influence. Thus levels, though generally below average, are well above corresponding drought minima (e.g. in 1976, 1989, 1992 and 1996). This is also true of most limestone aquifers and throughout much the greater part of the Permo-Triassic sandstones outcrops where levels in some slow-responding aquifer units remain above average. However, in the absence of substantial February-April rainfall, the groundwater outlook will deteriorate considerably through the spring. The associated early onset of the seasonal recession would foreshadow depressed groundwater levels in the late summer and autumn. The heavily fissured (and fast-responding) parts of the Chalk outcrop (e.g. the South Downs) are particularly vulnerable to a continuation of dry conditions though March.

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Jan 2005	Nov 04-Jan 05	RP	Aug 04-Jan 05	RP	May 04-Jan 05	RP	Feb 04-Jan 05	RP
England & Wales	**mm**	**65**	**185**		**546**		**728**		**919**	
	%	**72**	**66**	**5-15**	**105**	**2-5**	**102**	**2-5**	**100**	**<2**
North West	mm	**138**	328		862		1076		1310	
	%	**115**	89	2-5	119	5-10	111	2-5	108	2-5
Northumbrian	mm	**98**	182		580		779		965	
	%	**117**	72	5-10	119	5-10	115	5-10	111	2-5
Severn Trent	mm	**37**	120		449		605		775	
	%	**52**	54	20-30	107	2-5	102	2-5	101	2-5
Yorkshire	mm	**60**	135		498		673		872	
	%	**75**	55	20-30	107	2-5	104	2-5	104	2-5
Anglian	mm	**26**	96		341		503		639	
	%	**51**	58	10-20	106	2-5	106	2-5	106	2-5
Thames	mm	**30**	119		381		512		660	
	%	**45**	58	10-20	99	2-5	93	2-5	94	2-5
Southern	mm	**39**	138		411		552		699	
	%	**48**	55	10-20	90	2-5	90	2-5	89	2-5
Wessex	mm	**51**	159		449		595		777	
	%	**56**	59	10-20	91	2-5	90	2-5	91	2-5
South West	mm	**89**	260		677		858		1095	
	%	**64**	64	5-15	96	2-5	93	2-5	92	2-5
Welsh	mm	**110**	344		867		1079		1361	
	%	**77**	78	2-5	107	2-5	102	2-5	101	2-5
Scotland	**mm**	**251**	**562**		**1133**		**1401**		**1730**	
	%	**162**	**120**	**5-10**	**127**	**20-35**	**121**	**20-30**	**118**	**15-25**
Highland	mm	**364**	837		1473		1780		2207	
	%	**201**	146	30-50	139	70-100	131	60-90	127	60-90
North East	mm	**136**	289		699		926		1173	
	%	**133**	95	2-5	118	5-10	114	5-10	114	5-10
Tay	mm	**218**	405		999		1249		1509	
	%	**150**	99	2-5	131	10-20	124	10-20	117	5-15
Forth	mm	**186**	353		852		1100		1330	
	%	**157**	101	2-5	126	10-20	122	10-20	116	5-15
Tweed	mm	**129**	233		699		905		1129	
	%	**128**	79	2-5	122	5-10	114	5-10	113	5-10
Solway	mm	**198**	441		1030		1258		1574	
	%	**130**	98	2-5	118	5-10	111	2-5	110	2-5
Clyde	mm	**273**	645		1322		1641		1990	
	%	**145**	115	2-5	122	5-15	118	5-15	114	5-10
Northern Ireland	**mm**	**123**	**276**		**634**		**855**		**1071**	
	%	**106**	**83**	**2-5**	**99**	**2-5**	**99**	**2-5**	**98**	**2-5**

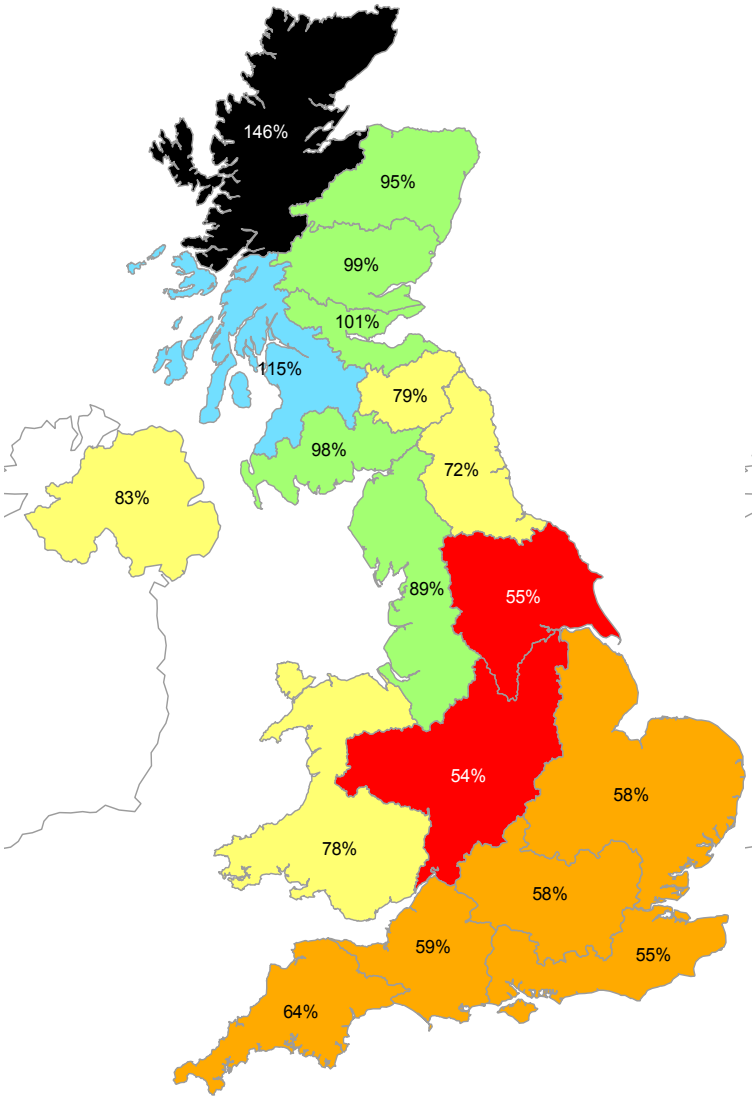
% = percentage of 1961-90 average *RP = Return period*

 All monthly totals since September 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. 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. 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.

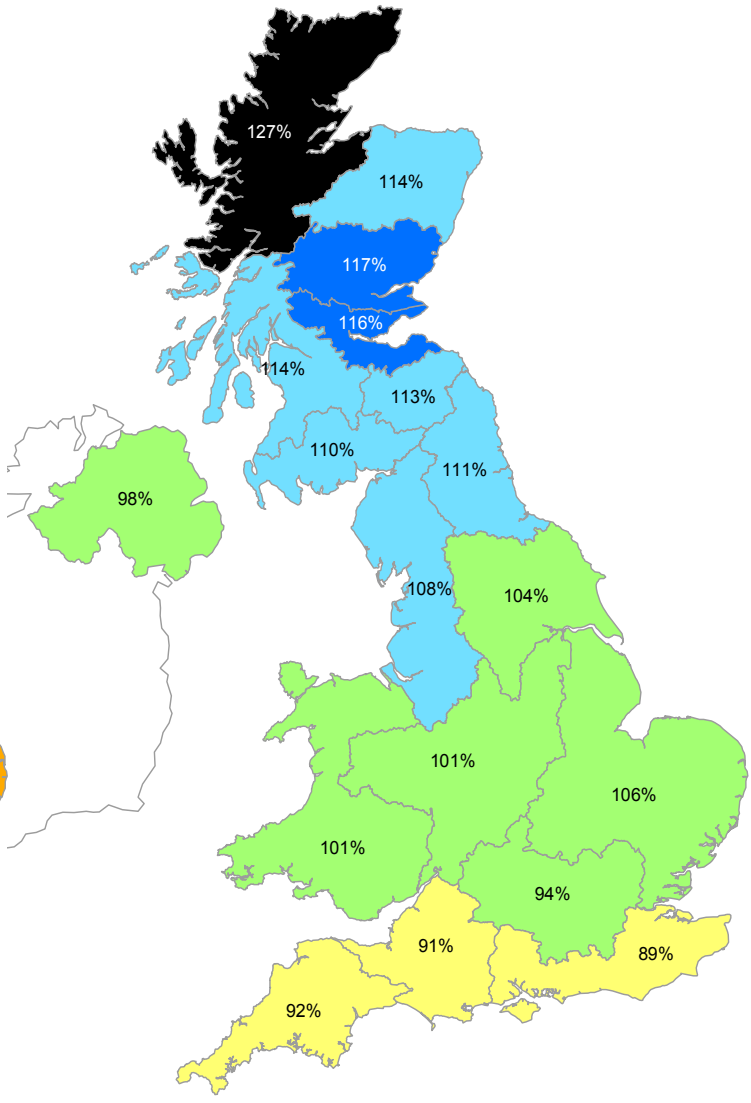
Rainfall . . . Rainfall . .

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 - January 2005

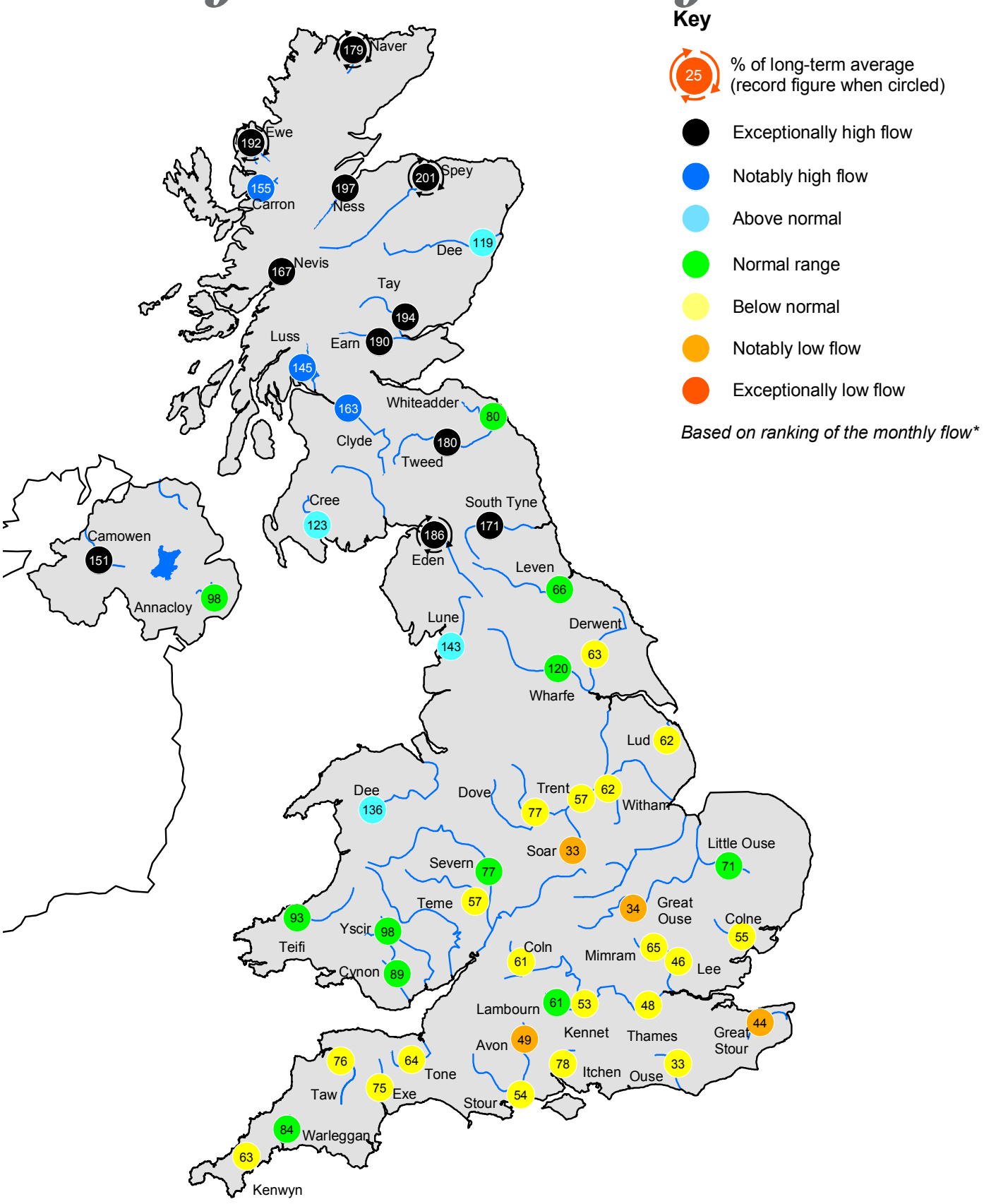


February 2004 - January 2005

Rainfall accumulation maps

Rainfall for the UK as a whole was only modestly below average for the Nov-Jan period but the spatial contrasts were very notable: the Highland Region registered its 3rd highest precipitation total (in a series from 1961)in this timeframe whilst rainfall deficiencies were very substantial across much of England and Wales. (Note: the differing colour coding of the Yorkshire and Southern regions reflects the greater frequency of dry winters in the latter region). Most regional rainfall totals are within 15% of the mean over the last 12 months but the deficiencies in southern England result primarily from limited rainfall during those months when it most hydrologically effective.

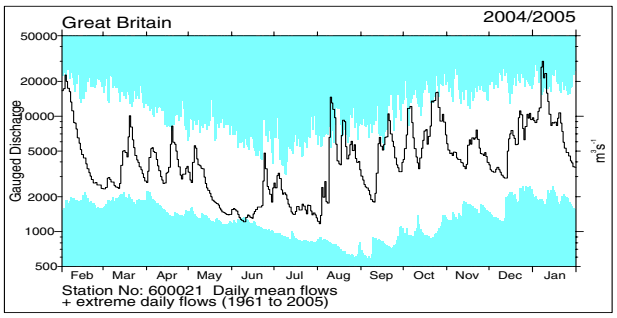
River flow . . . River flow . . .

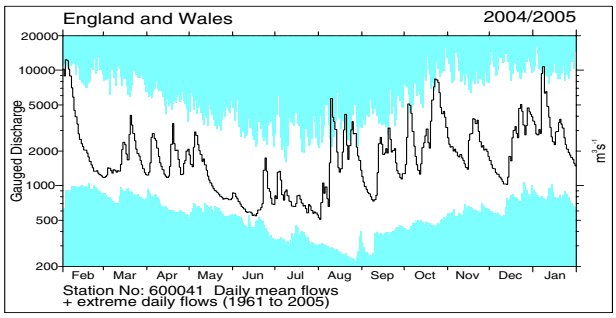


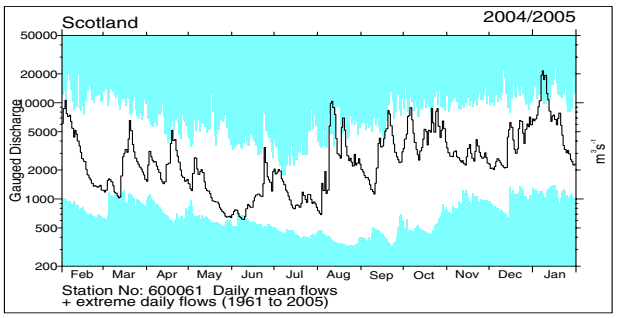
River flows - January 2005

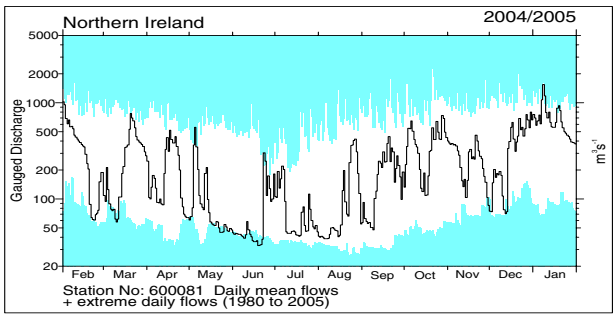
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

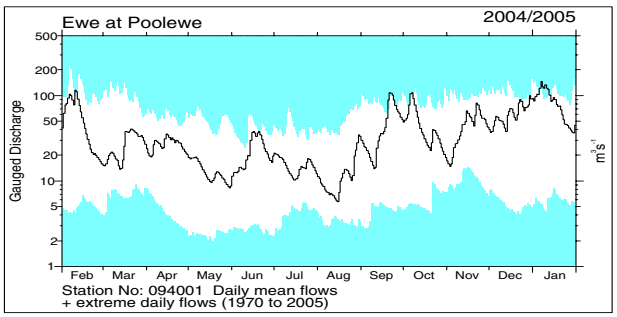
River flow . . . River flow . . .

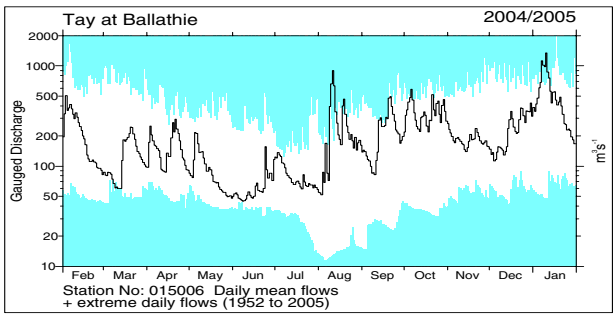


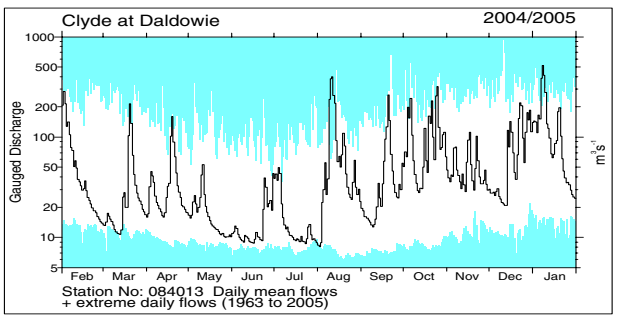


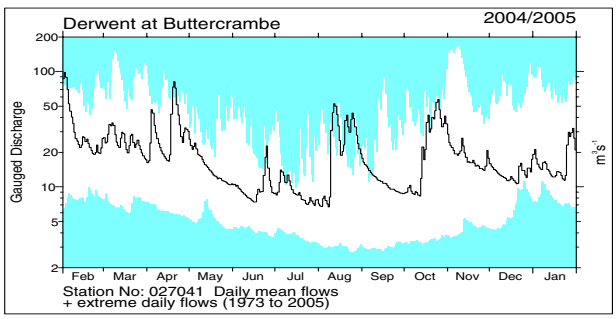


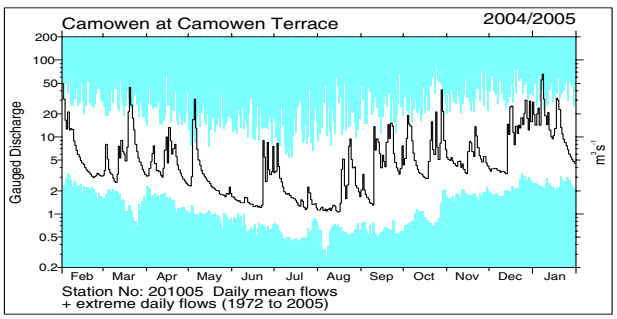


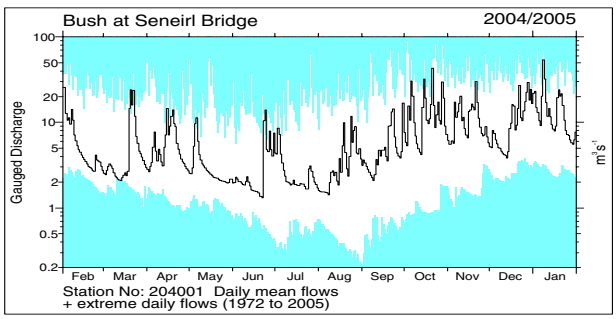








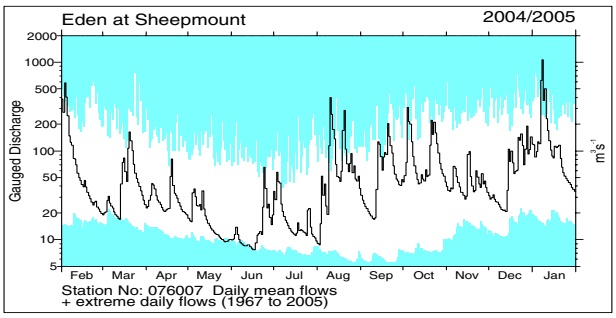


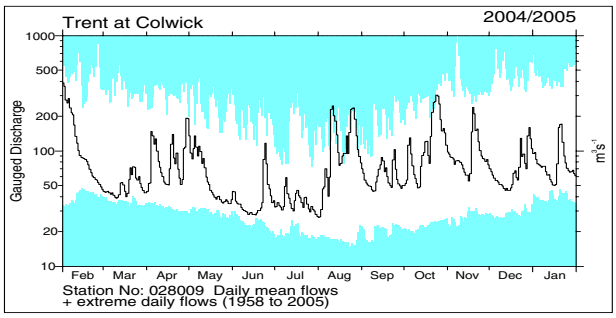


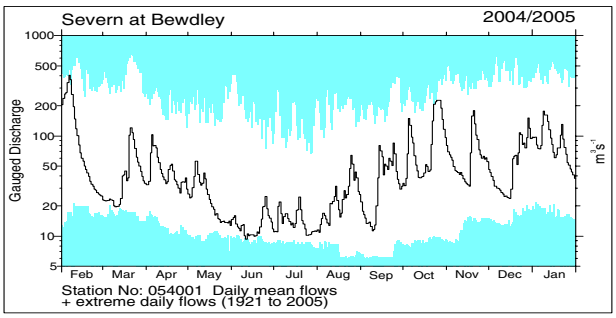
River flow hydrographs

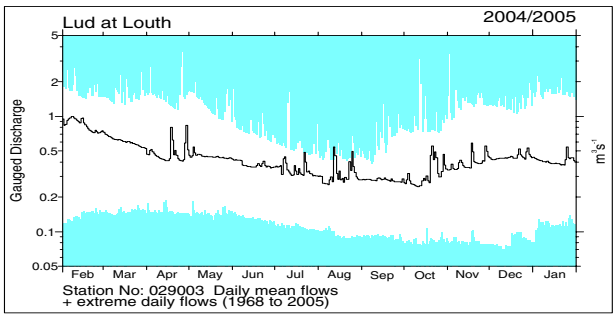
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to February 2004 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The 'national' hydrographs are based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

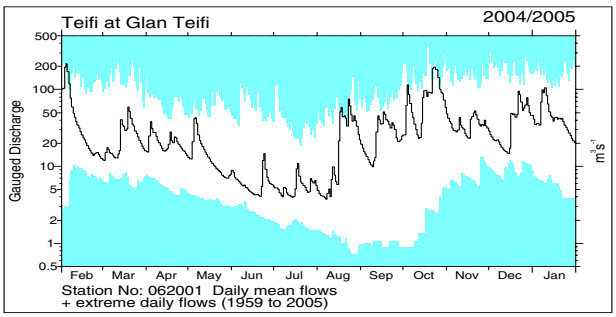
River flow . . . River flow . . .

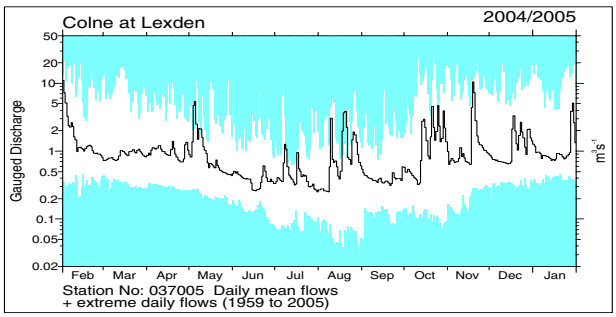


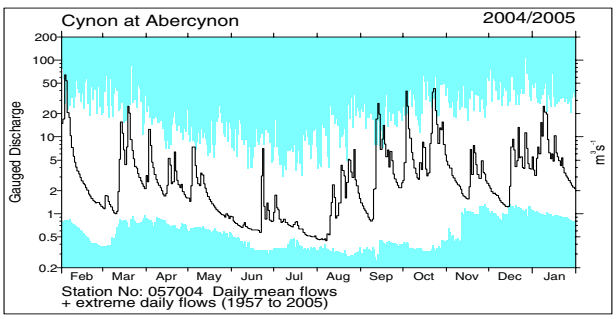


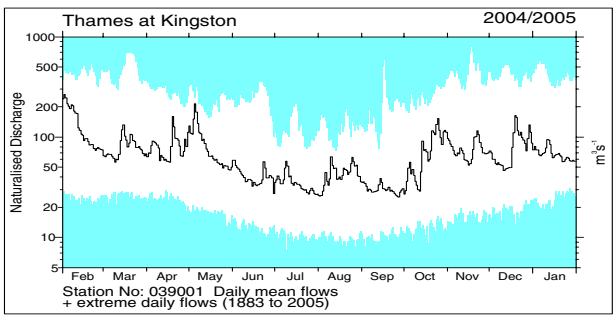


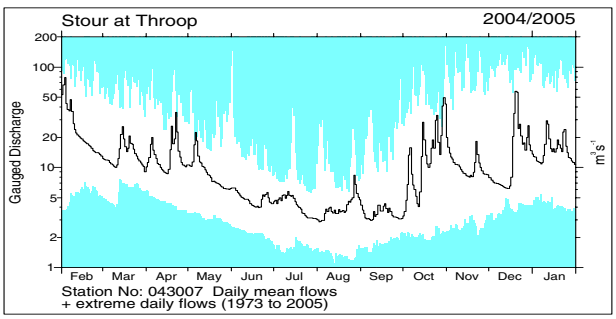


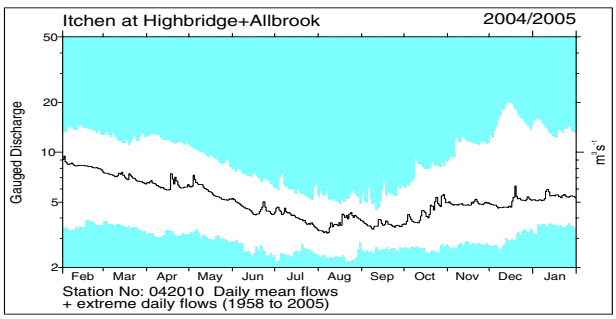










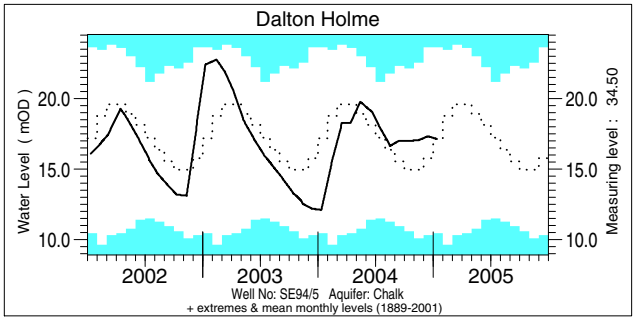


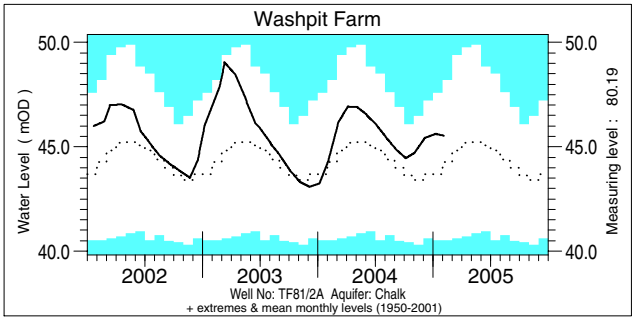
Notable runoff accumulations (a) January 2005, (b) November 2004 - January 2005

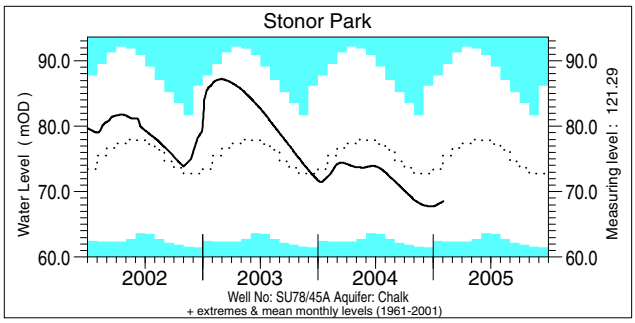
	River	%lta	Rank
a)	Ness	197	32/33
	Spey (Boat o'Brig)	201	53/53
	Earn	190	57/58
	Tyne(Spilmersford)	261	41/41
	Tweed (Boleside)	180	44/45
	Tyne (Bywell)	177	48/49
	S Tyne	171	41/43
	Soar	33	3/34
	Eden	186	38/38
	Leven (Linnbrane)	184	42/42
	Nevis	167	22/23
	Ewe	192	35/35
	Naver	179	28/28
	Camowen	150	31/32
	Mourne	144	22/23
b)	Torne	59	5/33
	Soar	44	4/34
	Mole	45	3/30
	Medway	28	4/46
	Gt Stour	52	5/40
	Otter	52	4/43
	Annacloy	69	4/25

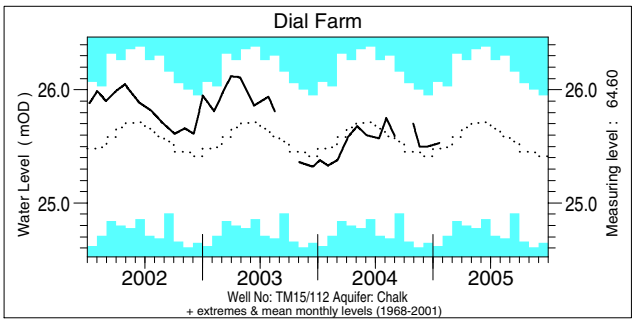
lta = long term average
Rank 1 = lowest on record

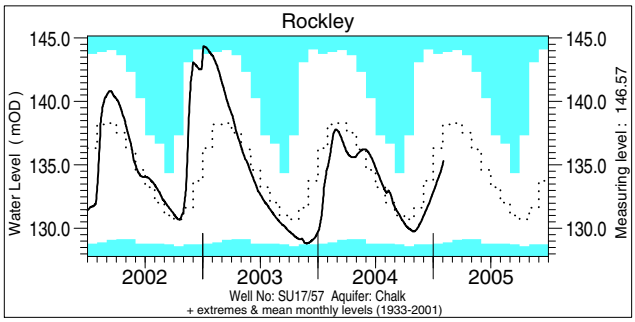
Groundwater . . . Groundwater

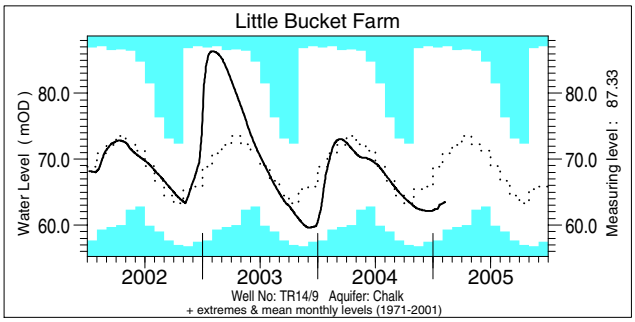


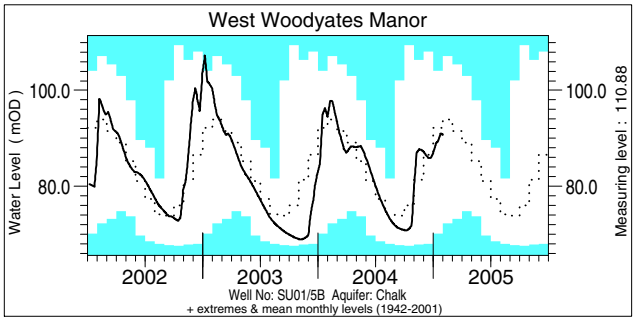


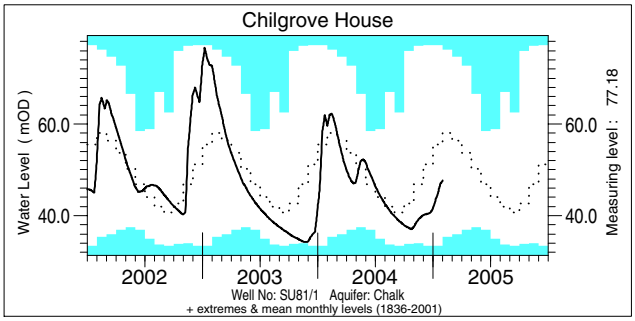


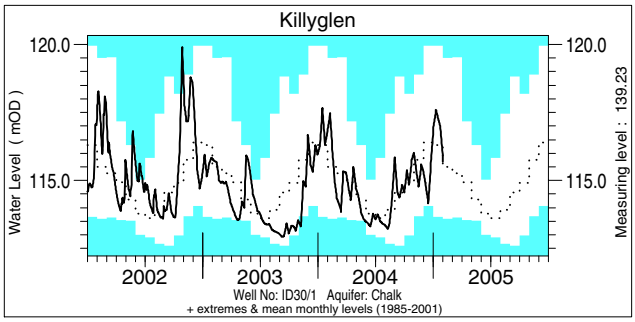


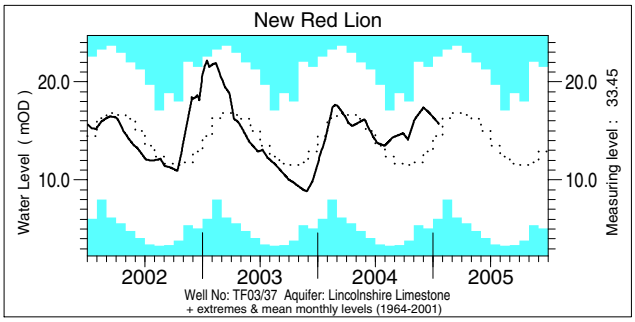






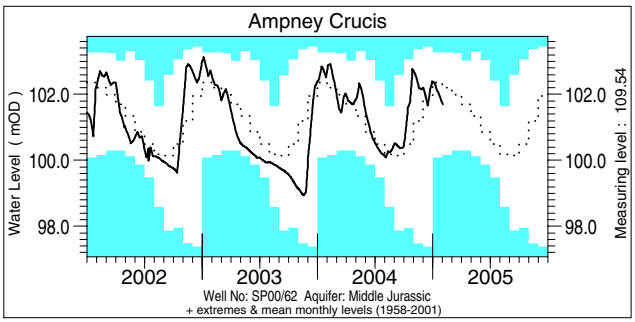


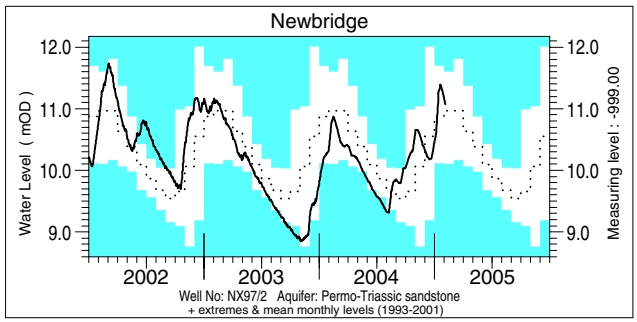


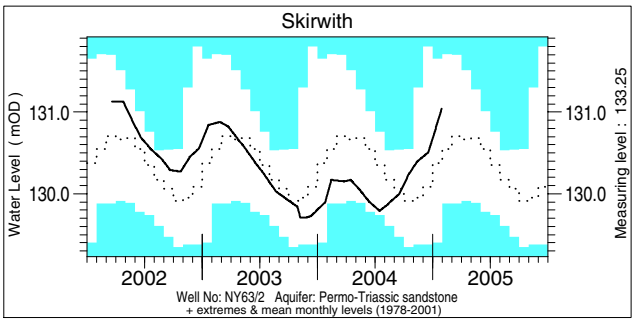


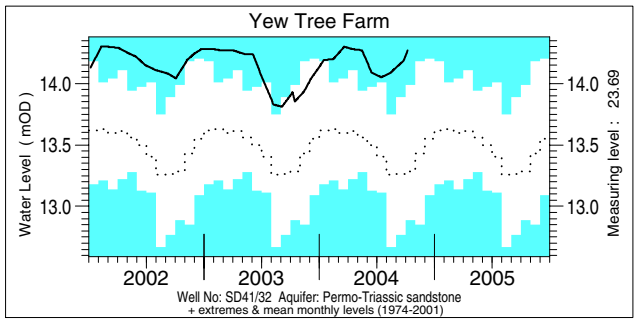
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

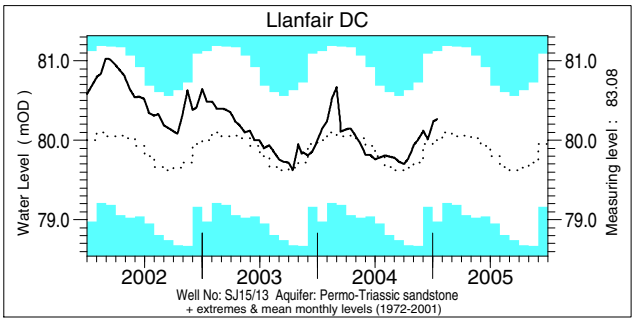
Groundwater . . . Groundwater

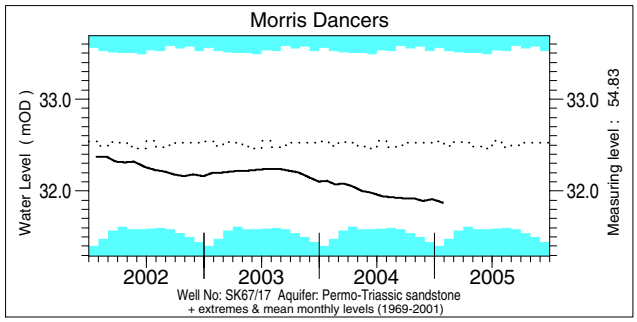


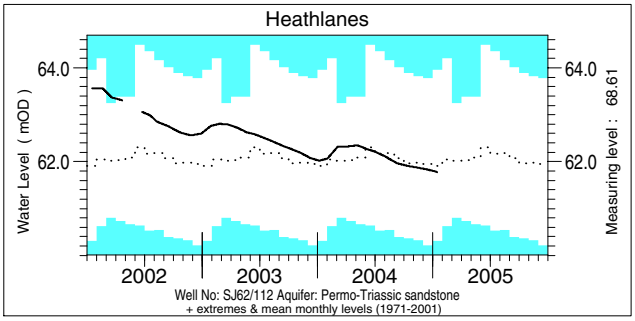


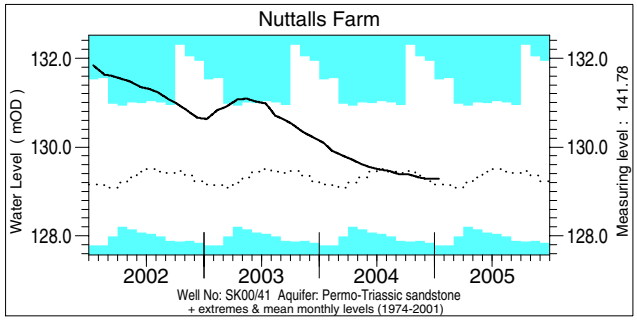


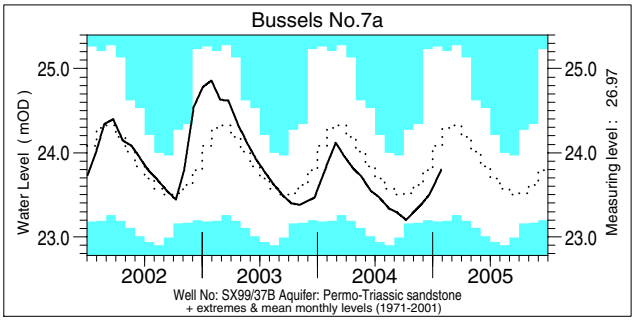


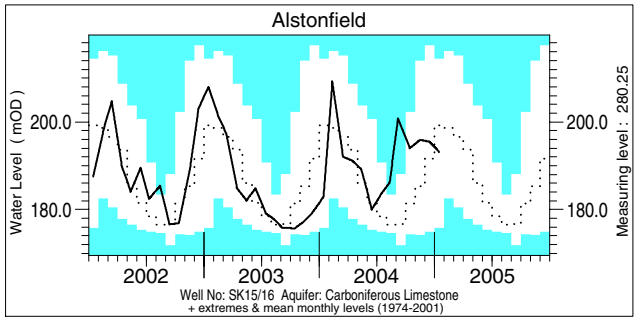












Groundwater levels January / February 2005

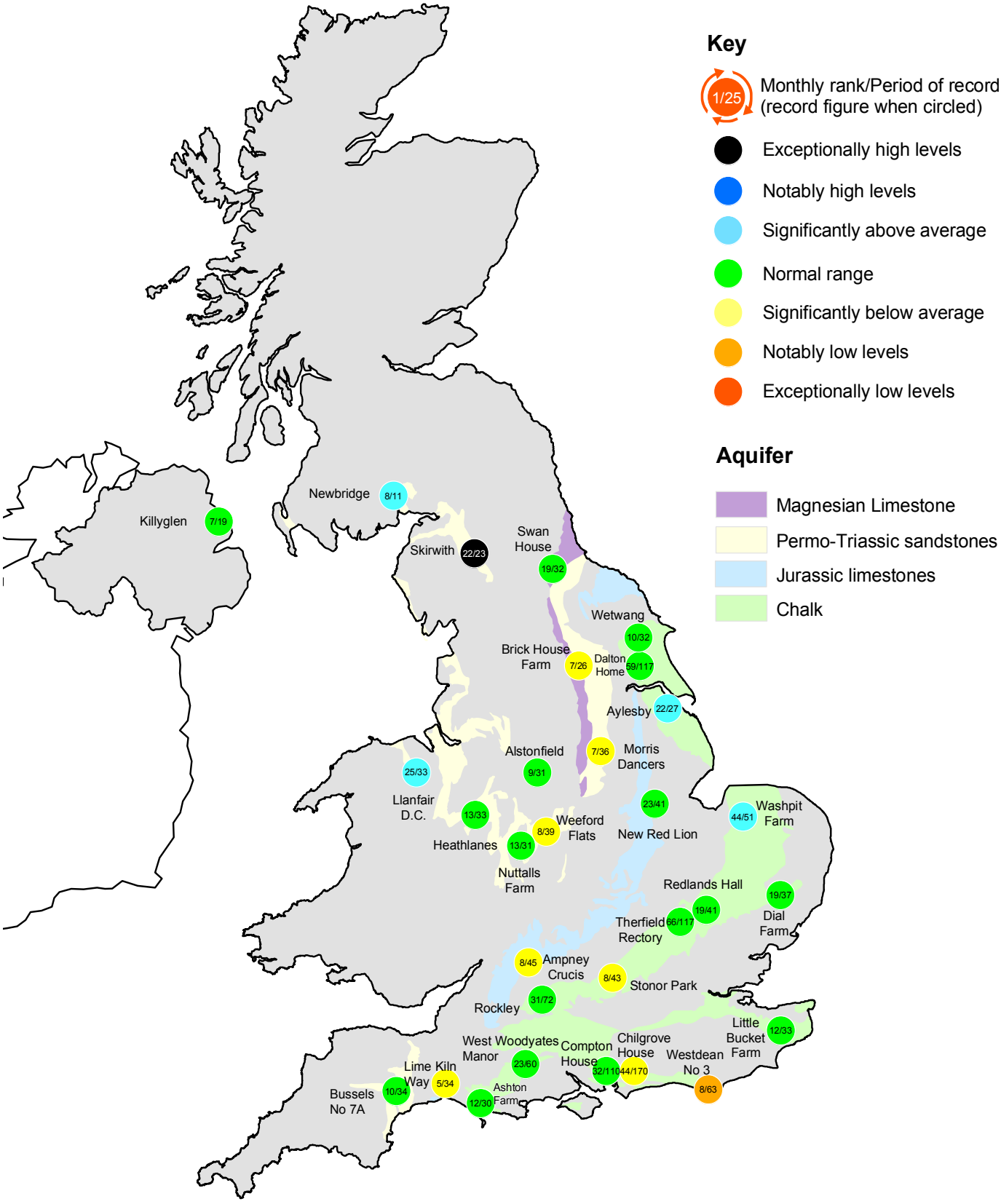
Borehole	Level	Date	Jan. av.
Dalton Holme	17.12	13/01	17.19
Washpit Farm	45.53	04/02	43.76
Stonor Park	68.52	01/02	73.80
Dial Farm	25.53	20/01	25.50
Rockley	135.30	01/02	136.29
Little Bucket Farm	63.54	08/02	68.46
West Woodyates	90.75	31/01	91.67

Borehole	Level	Date	Jan. av.
Chilgrove House	47.72	31/01	56.23
Killyglen	115.70	31/01	116.18
New Red Lion	15.69	18/01	14.84
Ampney Crucis	101.70	01/02	102.34
Newbridge	11.07	03/02	10.73
Skirwith	131.04	28/01	130.42
Yew Tree Farm	14.27	06/10	13.73

Borehole	Level	Date	Jan. av.
Llanfair DC	80.27	15/01	79.96
Morris Dancers	31.87	27/01	32.38
Heathlanes	61.78	14/01	61.97
Nuttalls Farm	129.28	13/01	129.52
Bussels No.7a	23.80	27/01	24.13
Alstonfield	193.12	14/01	198.98

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater



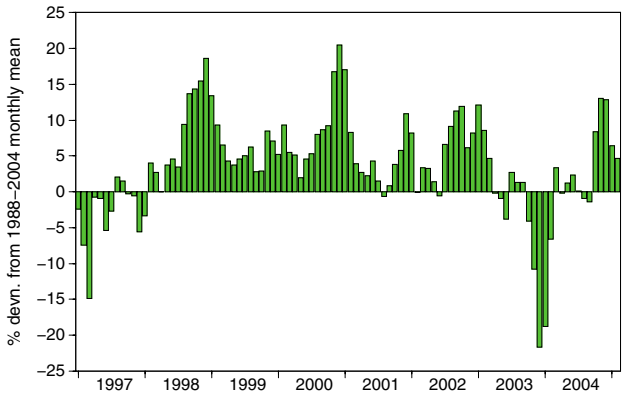
Groundwater levels - January 2005

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.

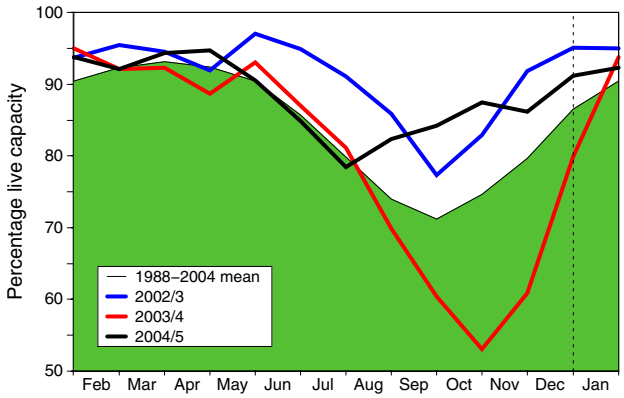
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

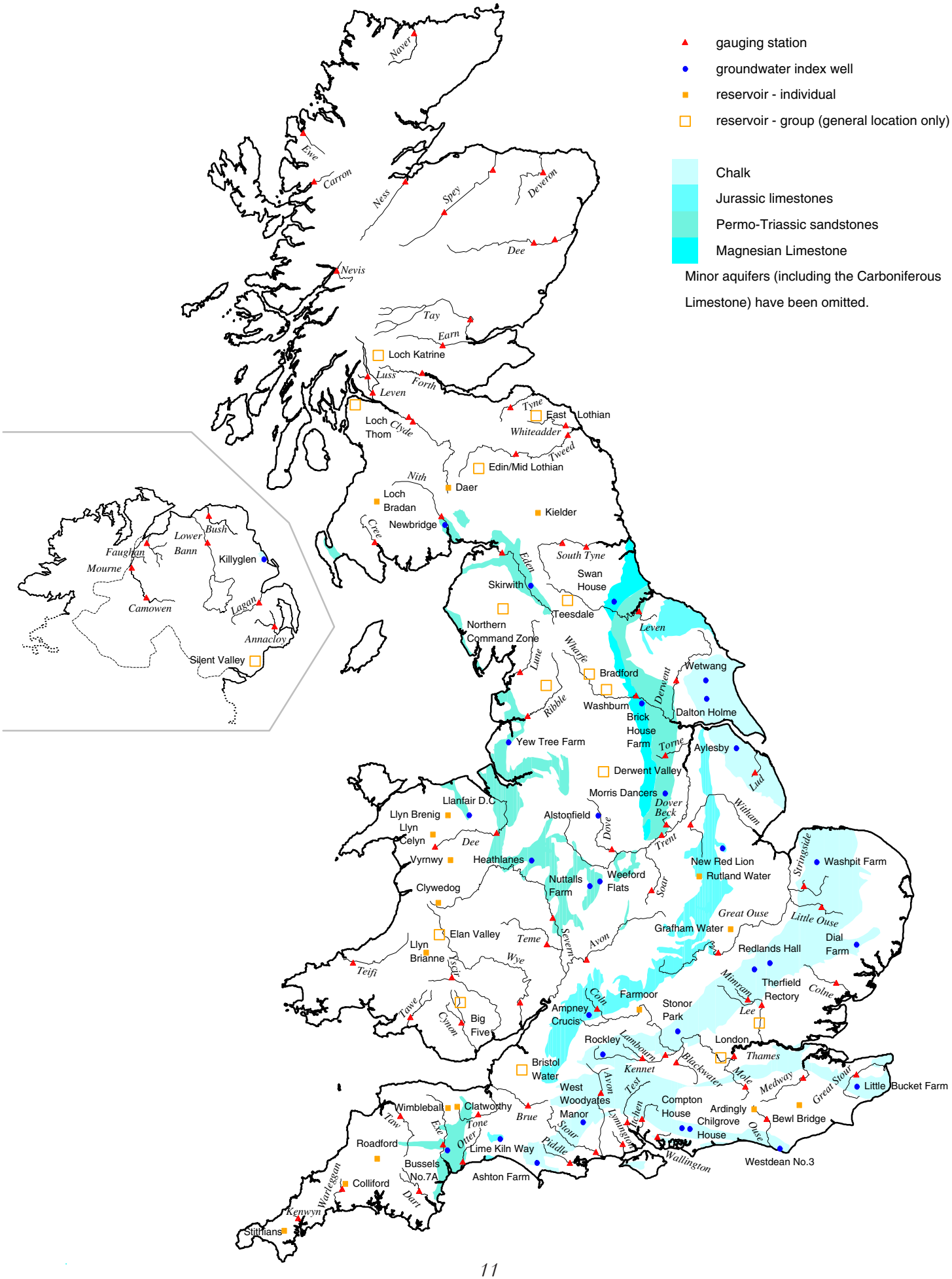
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2004 Oct	Nov	Dec	2005 Jan	Feb	Avg. Feb	Min. Feb	Year* of min.
North West	N Command Zone	• 124929	86	91	85	91	**100**	91	63	1996
	Vyrnwy	55146	78	94	85	100	**99**	91	45	1996
Northumbrian	Teesdale	• 87936	97	98	94	90	**93**	91	51	1996
	Kielder	(199175)	(93)	(96)	(86)	(98)	**(91)**	(94)	(85)	1989
Severn Trent	Clywedog	44922	80	82	78	83	**79**	87	62	1996
	Derwent Valley	• 39525	93	95	100	100	**99**	93	15	1996
Yorkshire	Washburn	• 22035	85	89	89	90	**86**	89	34	1996
	Bradford supply	• 41407	91	100	98	99	**99**	92	33	1996
Anglian	Grafham	(55490)	(74)	(78)	(86)	(92)	**(92)**	(85)	(67)	1998
	Rutland	(116580)	(81)	(78)	(86)	(93)	**(95)**	(85)	(68)	1997
Thames	London	• 202340	76	81	83	87	**91**	89	70	1997
	Farmoor	• 13830	99	96	92	98	**99**	91	72	2001
Southern	Bewl	28170	74	68	63	60	**70**	83	47	1990
	Ardingly	4685	60	60	60	69	**79**	95	68	1997
Wessex	Clatworthy	5364	56	65	89	100	**100**	94	62	1989
	Bristol WW	• (38666)	(57)	(56)	(58)	(64)	**(77)**	(85)	(58)	1992
South West	Colliford	28540	50	60	62	66	**70**	84	52	1997
	Roadford	34500	55	57	58	69	**71**	82	30	1996
	Wimbleball	21320	63	73	76	79	**86**	89	59	1997
	Stithians	5205	50	60	61	60	**68**	88	38	1992
Welsh	Celyn and Brenig	• 131155	92	97	95	97	**97**	94	61	1996
	Brianne	62140	100	99	93	98	**94**	98	84	1997
	Big Five	• 69762	82	87	92	97	**98**	92	67	1997
	Elan Valley	• 99106	100	100	99	100	**99**	97	73	1996
Scotland(E)	Edinburgh/Mid Lothian	• 97639	94	87	88	87	**98**	92	72	1999
	East Lothian	• 10206	100	100	100	100	**100**	97	68	1990
Scotland(W)	Loch Katrine	• 111363	94	97	94	100	**89**	93	85	2000
	Daer	22412	100	100	100	100	**100**	99	91	1997
	Loch Thom	• 11840	100	100	100	100	**100**	98	90	2004
Northern Ireland	Total+	• 67270	73	85	88	88	**86**	89	75	2002
	Silent Valley	• 20634	64	73	72	69	**78**	83	46	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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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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