Hydrological Summary

for the United Kingdom

April 2013

General

April was a notably cool month with rainfall close to the long-term average at the national scale – but spatial variations in precipitation totals were large and appreciable deficits have become established in some regions over the first four months of 2013. Notwithstanding the low temperatures, evaporation losses have remained within the normal range and soil moisture deficits exceeded the end-of-April average across many eastern and central areas of the country. In the absence of above average May rainfall, this could signal the termination of the 2012/13 recharge season across much of the outcrop areas of the major aquifers. Except where maintenance programmes were a determining factor (e.g. at Daer in Scotland), reservoir stocks were healthy entering May, exceeding 90% of capacity at the great majority of index reservoirs across the country. April runoff totals were also generally well within the normal late-spring range, but river flow patterns varied markedly across the country, with significant flooding in Scotland around mid-month and seasonally depressed runoff around month-end in a number of rivers draining impermeable catchments to the south. Groundwater levels are still above average in most areas (with a continuing possibility of landslide activity in vulnerable areas and a diminishing risk of groundwater flooding) and the water resources outlook is healthy. Rainfall over the next 4-6 weeks will be particularly influential in determining river flows and the status of groundwater resources through the summer.

Rainfall

Apart from mid-month, high pressure dominated weather patterns across much of southern Britain. To the north, Atlantic frontal systems brought plentiful rainfall (with snow on high ground) to most areas – western Scotland especially. After a notably dry late winter and early spring (with seasonally very dry soils increasing the risk of wildfires), much of northern and western Scotland recorded exceptional precipitation totals in mid-April. Cluanie Inn (Wester Ross) reported 209mm over the six days beginning on 13th and Skye registered 64mm on 17th. Whilst April precipitation totals exceeded twice the monthly average in parts of western Scotland, they fell below two-thirds of average across large parts of England; a few localities in Cheshire and Humberside reported totals of 5mm or less. More significantly, April was the fourth successive month with below average rainfall in some areas e.g. north-west England and North Wales. For the former, the January-April rainfall total was provisionally the 2nd lowest since 1964 and rainfall deficiencies of >20% characterise much of the country. However, despite the relative dryness of the early months of 2013, 12-month rainfall accumulations remain above average in almost all regions and outstanding in some areas – the Tweed basin recorded its highest May-April rainfall on record. The exceptional wetness of 2012 lessens the significance of the shorter-term deficiencies in relation to water resources.

River flows

Across most of southern Britain, the sustained March river flow recessions continued well into April, and throughout almost the entire month in some catchments in the Midlands where, by month-end, flows were seasonally depressed (in the Trent, for example). By contrast, mid-month flow recoveries in the north and west were dramatic, particularly in Scotland where snowmelt contributed to a new maximum April daily flow (on 16th) for the Tay at Ballathie (in a series from 1952); floodplain inundations were common across northern Britain. Many index rivers registered a wide range of flows in April; spatial variability was also marked, particularly in parts of the English Lowlands where very healthy flows in spring-fed rivers contrasted with depressed late-April runoff rates in impermeable catchments (e.g. in Berkshire). Nonetheless, the generality of rivers registered monthly runoff totals within the normal range but mostly below average across England & Wales. This added to a notable recent cluster of modest April runoff totals; with the very notable exception of 2012, they have fallen below the 1971-2000 average in every year since 2001. Generalising for 2013 thus far, accumulated runoff totals across most of southern, central and eastern England (and the Annacloy catchment in Northern Ireland) are well above average – and notably so in many permeable catchments. However, January-April runoff for some important reservoir gathering grounds in north-west England and North Wales was 65-70% of average.

Groundwater

April rainfall totals were 40-70% of average across most major aquifers and month-end soil moisture deficits were generally above average. Correspondingly, infiltration rates were seasonally modest but groundwater levels, though mostly declining, remain above the monthly average in most parts of the country – a legacy of the exceptional 2012 rainfall. In the southern Chalk outcrops the 2013 seasonal recession is generally well established, and commenced 6-8 weeks earlier than normal in the South Downs. In contrast, the seasonal recession is only just commencing in the Chilterns and North Downs, and groundwater levels are still rising at Dial Farm (Suffolk). Levels fell for the second successive month in the Upper Greensand of south-west England (at Lime Kiln Way) but remain above the previous April maximum. In the Permo-Triassic sandstones, water levels remain seasonally high in the south-west and north-west, despite recent falls in levels. In the slower-responding outcrops across the Midlands levels are still rising, and Heathlanes reported it highest level for three years. Levels in all the limestone aquifers fell through April but remain close to monthly maxima in the Magnesian Limestone and well above average in the Lincolnshire Limestone. Reflecting the recent meagre recharge, groundwater levels have fallen below average in the Cotswolds and the Carboniferous Limestone of South Wales, and are seasonally low in the fast-responding Alstonsfield borehole (in the Peak District).

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

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

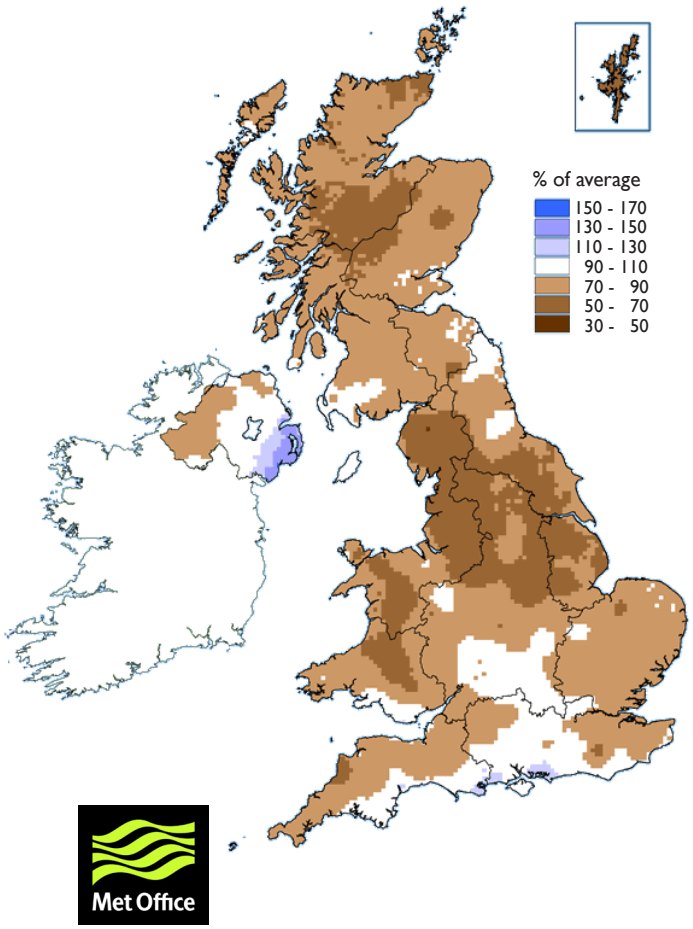
Area	Rainfall	Apr 2013	Mar13 – Apr13	RP	Jan13 – Apr13	RP	Oct12 – Apr13	RP	May12 – Apr13	RP
United Kingdom	mm	**64**	126		293		733		1291	
	%	**96**	79	2-5	81	2-5	104	2-5	120	25-40
England	mm	**30**	95		212		591		1084	
	%	**55**	79	2-5	81	2-5	116	5-10	134	50-80
Scotland	mm	**121**	171		396		914		1533	
	%	**152**	81	2-5	80	2-5	95	2-5	107	2-5
Wales	mm	**50**	137		362		968		1685	
	%	**62**	70	2-5	79	5-10	106	2-5	124	15-25
Northern Ireland	mm	**75**	149		357		683		1253	
	%	**106**	91	2-5	97	2-5	97	2-5	113	10-15
England & Wales	mm	**33**	101		233		643		1167	
	%	**56**	77	2-5	81	5-10	114	2-5	132	40-60
North West	mm	**49**	95		243		746		1506	
	%	**74**	57	10-15	65	15-25	100	2-5	129	30-50
Northumbria	mm	**36**	103		230		608		1206	
	%	**60**	80	2-5	86	2-5	119	5-10	147	>100
Midlands	mm	**17**	79		189		511		991	
	%	**32**	69	2-5	78	5-10	111	2-5	132	20-35
Yorkshire	mm	**19**	80		185		554		1079	
	%	**33**	64	2-5	70	10-15	110	2-5	134	20-35
Anglian	mm	**22**	72		144		411		763	
	%	**47**	79	2-5	79	2-5	118	2-5	128	10-15
Thames	mm	**34**	105		204		533		924	
	%	**66**	100	2-5	92	2-5	126	5-10	133	20-30
Southern	mm	**45**	112		234		611		1016	
	%	**86**	101	2-5	95	2-5	123	5-10	132	10-20
Wessex	mm	**38**	113		259		715		1223	
	%	**67**	90	2-5	91	2-5	129	10-15	143	>100
South West	mm	**42**	153		362		992		1603	
	%	**59**	91	2-5	87	2-5	122	8-12	134	30-50
Welsh	mm	**48**	134		351		939		1641	
	%	**61**	71	2-5	80	2-5	108	2-5	125	15-25
Highland	mm	**167**	205		457		1015		1608	
	%	**180**	80	2-5	76	2-5	86	2-5	93	2-5
North East	mm	**64**	123		246		594		1040	
	%	**100**	87	2-5	81	5-10	101	2-5	110	2-5
Tay	mm	**99**	157		349		829		1408	
	%	**147**	85	2-5	78	2-5	97	2-5	111	2-5
Forth	mm	**81**	138		320		770		1416	
	%	**130**	84	2-5	84	2-5	105	2-5	125	30-50
Tweed	mm	**67**	131		281		706		1398	
	%	**112**	93	2-5	90	2-5	118	5-10	148	>>100
Solway	mm	**111**	176		421		1001		1803	
	%	**139**	87	2-5	89	2-5	108	5-10	129	>100
Clyde	mm	**136**	186		484		1130		1885	
	%	**150**	74	2-5	81	2-5	97	2-5	109	5-10

% = percentage of 1971-2000 average *RP = Return period*

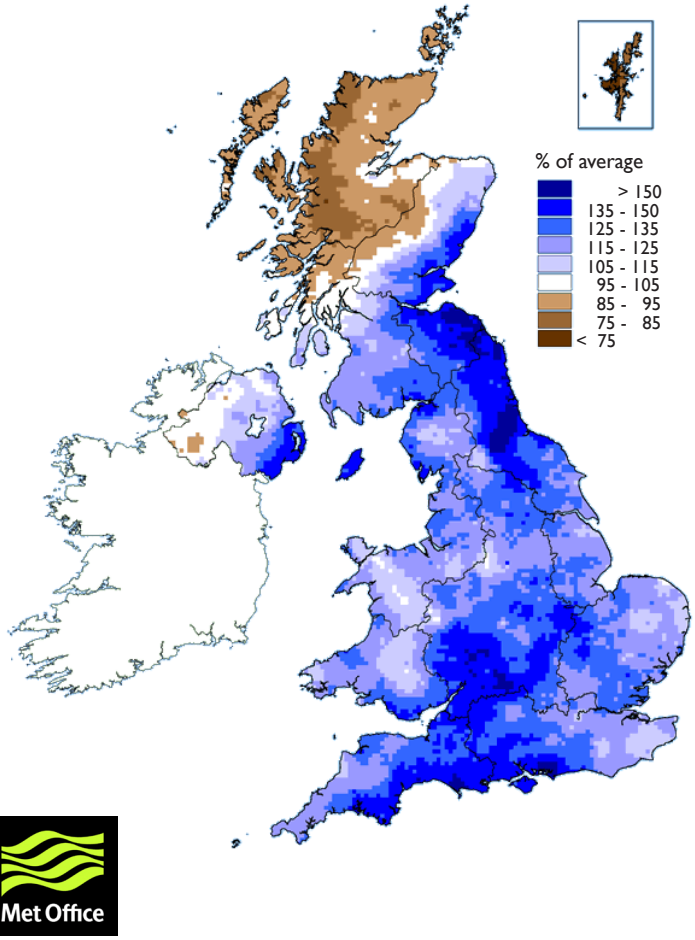
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic variability since 1910; they also assume a stable climate. The quoted RPs relate to the specific timespans only; for the same timespans, but beginning in any month the RPs would be substantially shorter. The timespans featured do not purport to represent the critical periods for any particular water resource management zone. For hydrological or water resources assessments of drought severity, river flows and/or groundwater levels normally provide a better guide than return periods based on regional rainfall totals. Note that precipitation totals in winter months may be underestimated due to snowfall undercatch. All monthly rainfall totals since October 2012 are provisional.

Rainfall . . . Rainfall . . .

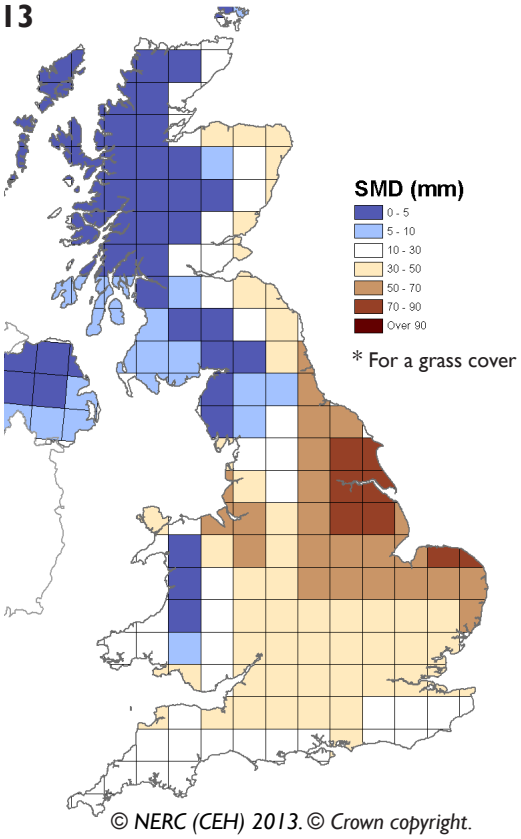
January 2013 - April 2013 rainfall as % of 1971-2000 average



May 2012 - April 2013 rainfall as % of 1971-2000 average



MORECS Soil Moisture Deficits* April 2013



Met Office 3-month outlook Updated: May 2013

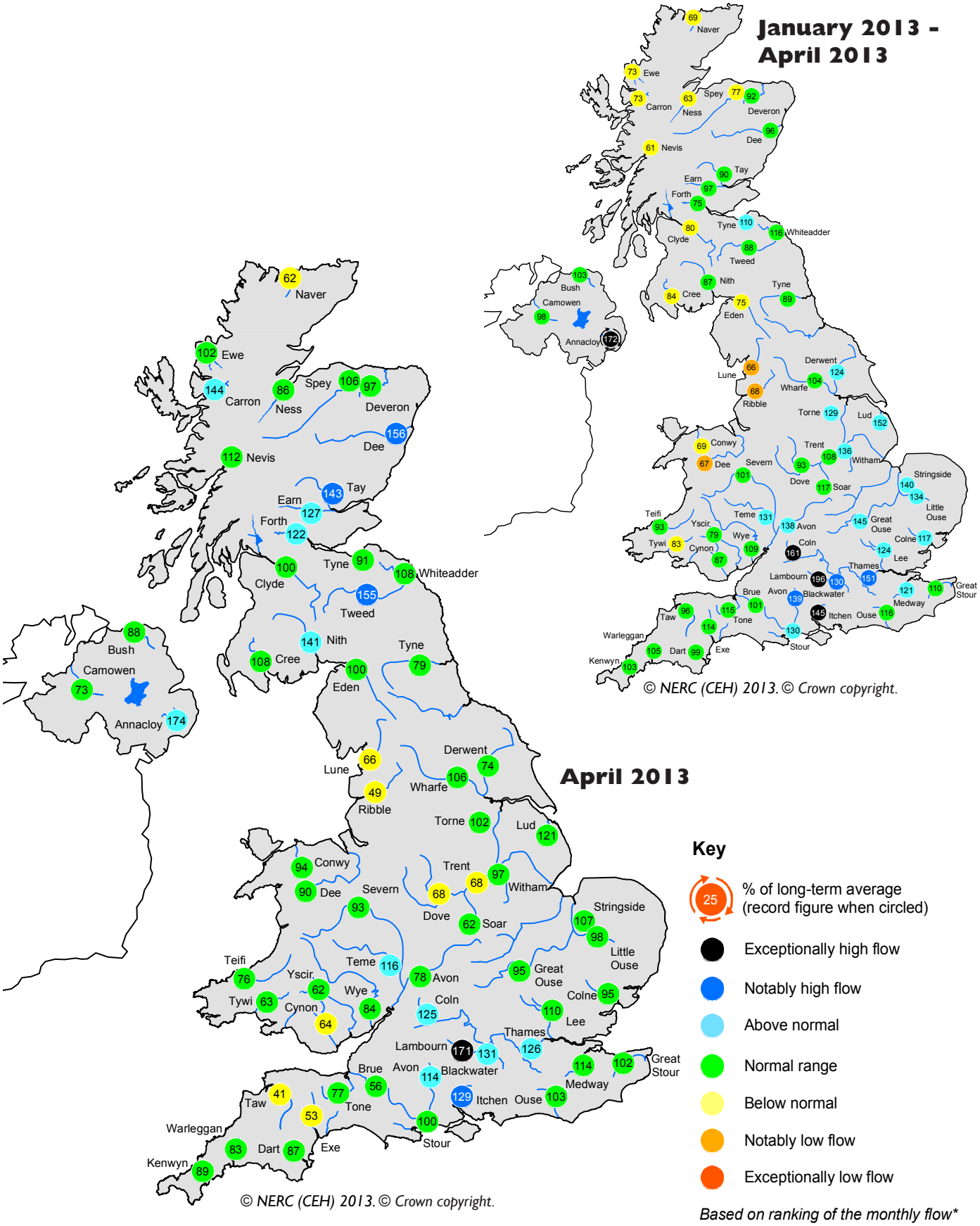
For May below-average precipitation for the UK as a whole is considered more likely than above-average. For the May-June-July period the probability that precipitation will be in the driest of our five categories is around 20% and the probability that it will be in the wettest category is also approximately 20%.

The late spring and early summer are, on average, the driest parts of the year and rainfall at this time of year becomes increasingly difficult to predict due to the likelihood of localised convective rainfall dominating the rainfall distribution and leading to marked regional variability.

The complete version of the 3-month outlook may be found at:
http://www.metoffice.gov.uk/publicsector/contingency-planners
This outlook is updated towards the end of each calendar month.

The latest shorter-range forecasts, covering the upcoming 30 days, can be accessed via:
http://www.metoffice.gov.uk/weather/uk/uk_forecast_weather.html
These forecasts are updated very frequently.

River flow . . . River flow . . .



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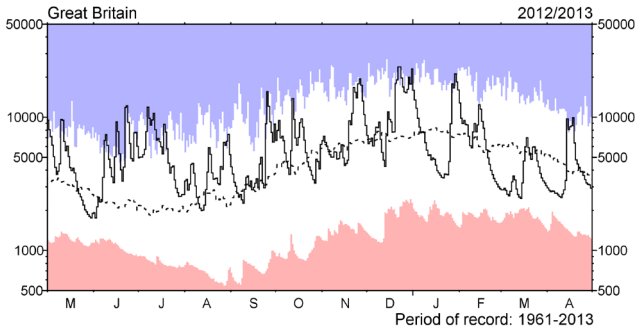
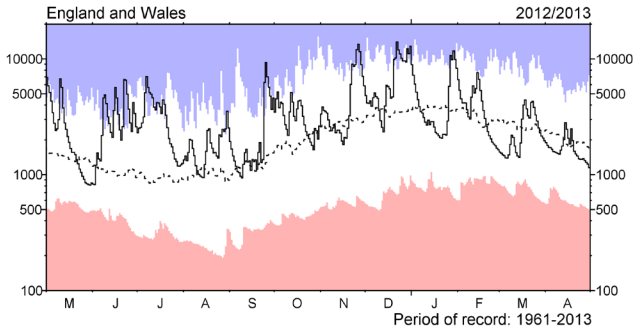
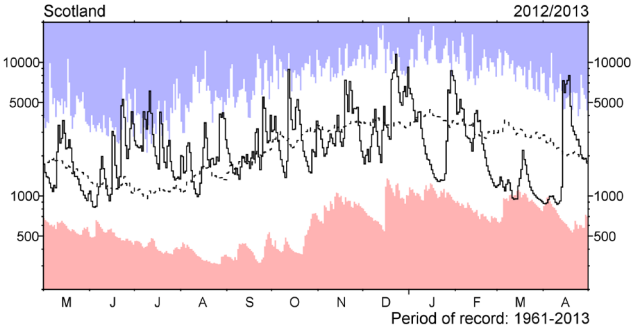
River flows

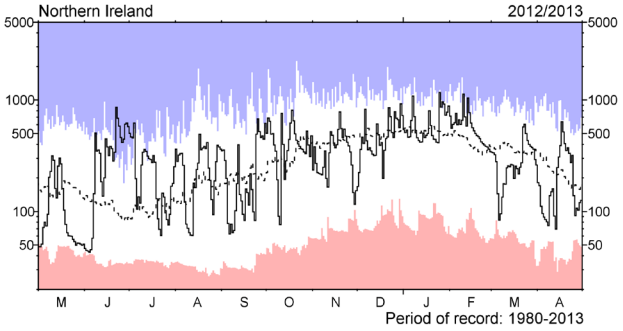
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station. Percentages may be omitted where flows are under review.

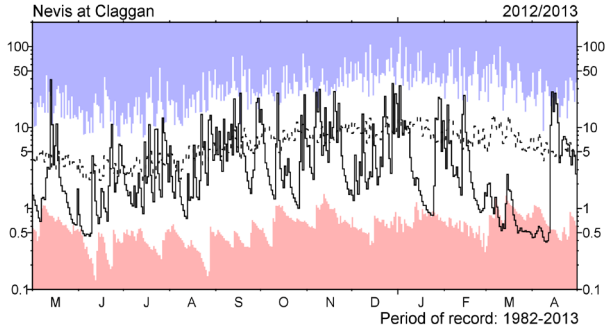
River flow . . . River flow . . .

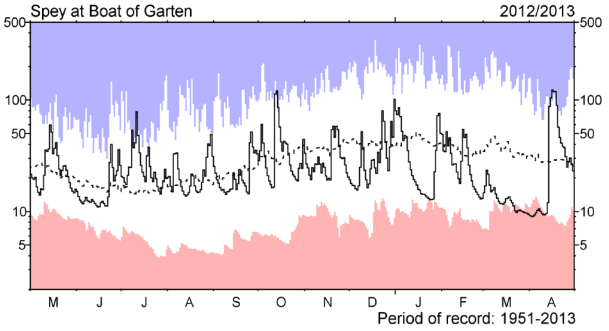


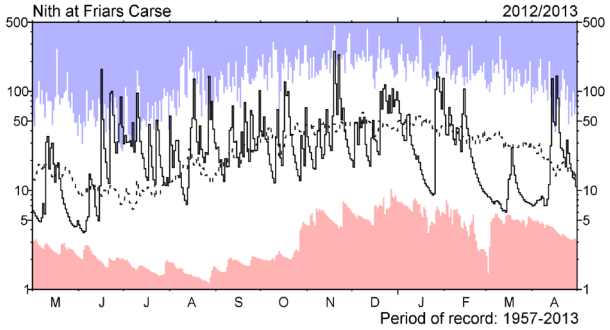


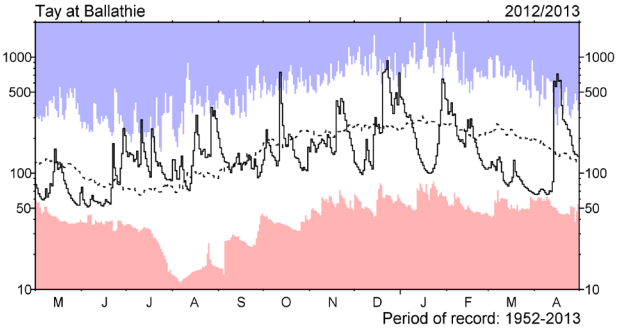


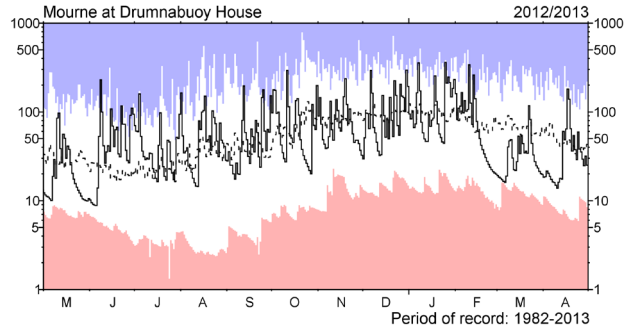


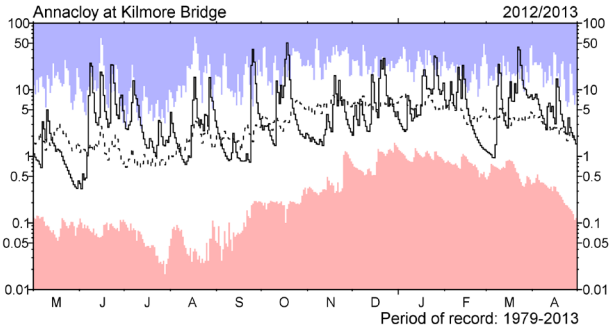








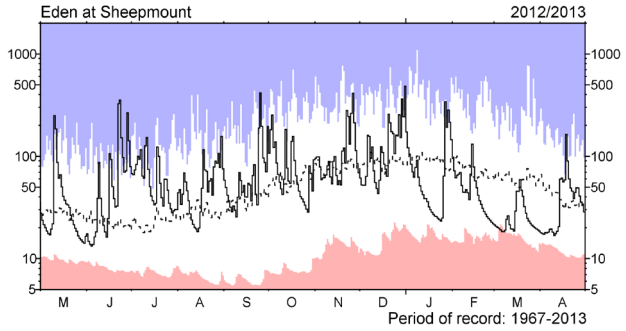


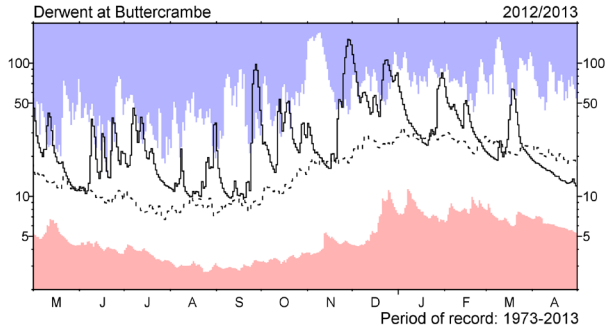


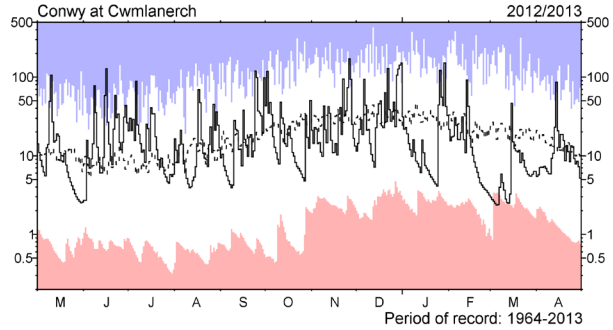
River flow hydrographs

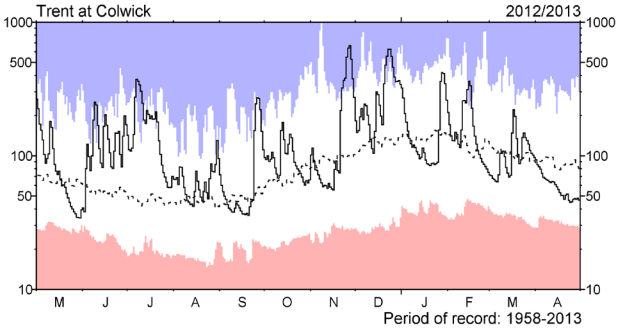
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to May 2012 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed line.

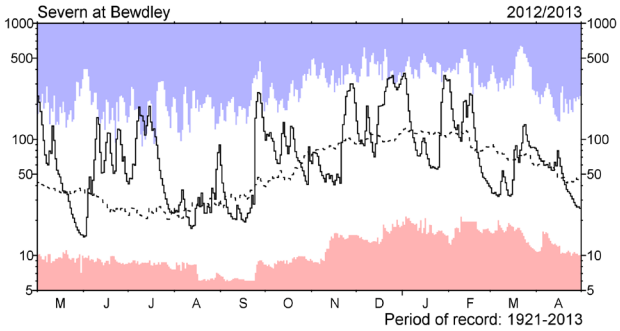
River flow . . . River flow . . .

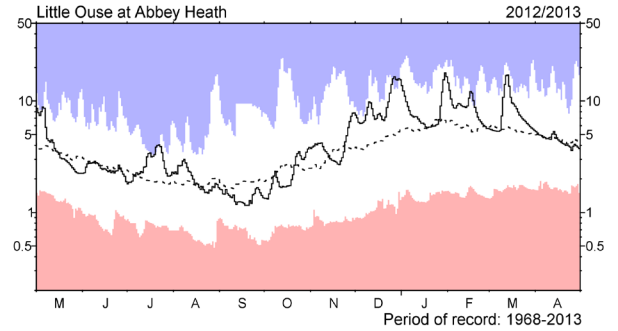


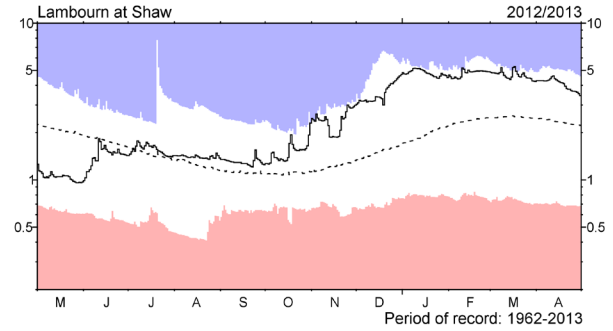


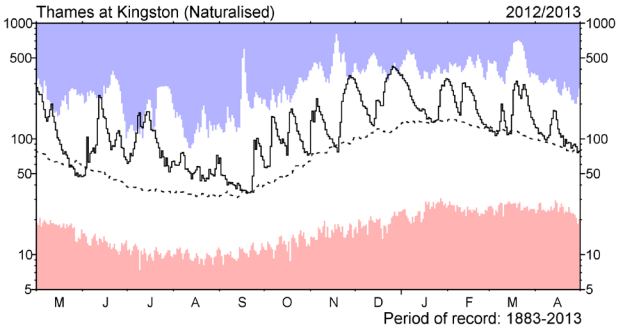


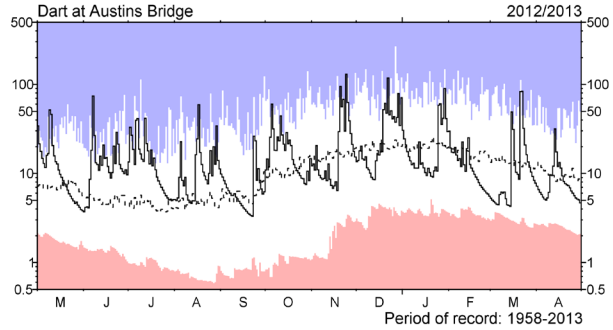


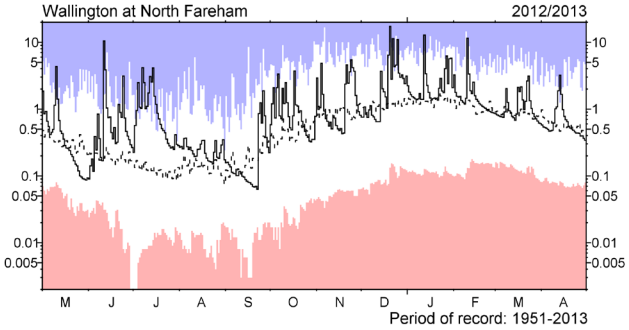










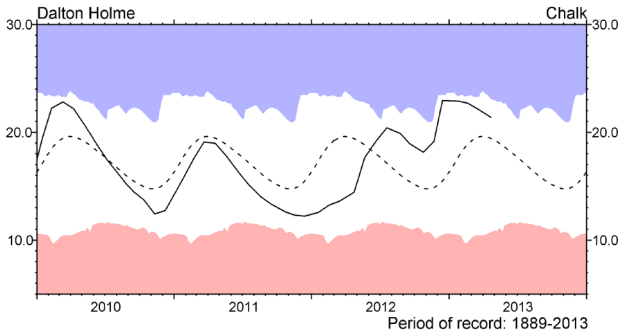


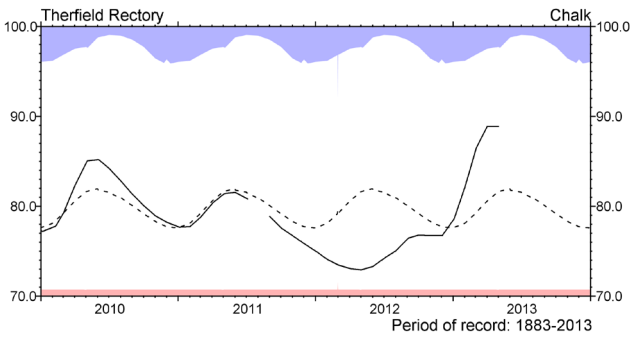
Notable runoff accumulations (a) January 2013 - April 2013

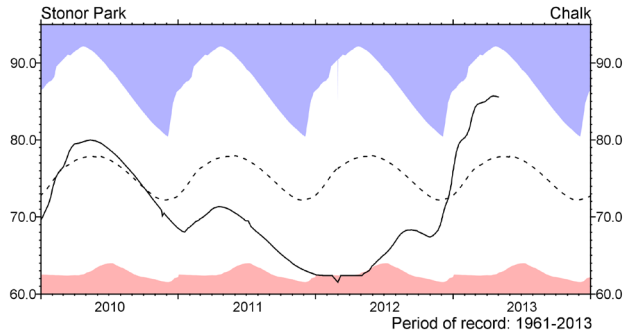
	River	%lta	Rank		River	%lta	Rank		River	%lta	Rank
(a)	Dover Beck	194	37/37	(a)	Pang	171	43/45	(a)	Avon (Amesbury)	139	44/48
	Little Ouse	134	38/43		Test	151	54/56		Piddle	152	47/49
	Lambourn	196	50/51		Itchen	145	54/55		Dee (New Inn)	67	4/44
	Coln (Bibury)	160	49/50		Lymington	136	49/53		Annacloy	172	34/34

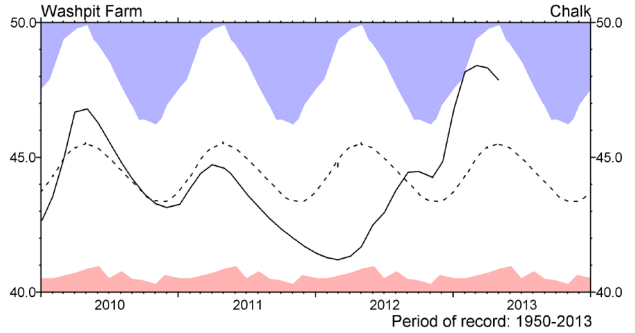
lta = long term average; Rank 1 = lowest on record

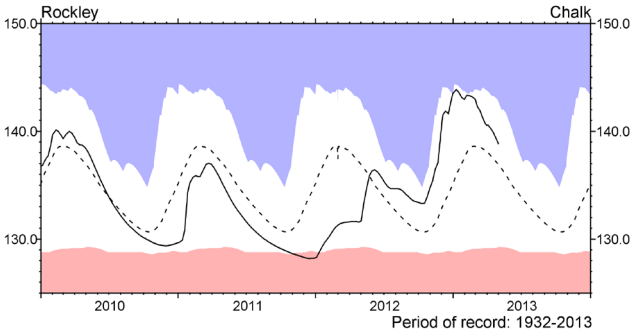
Groundwater…Groundwater

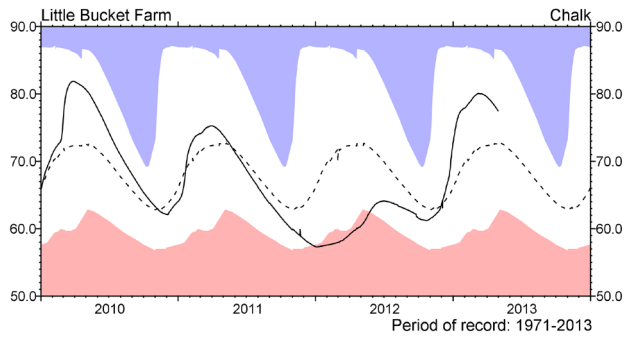


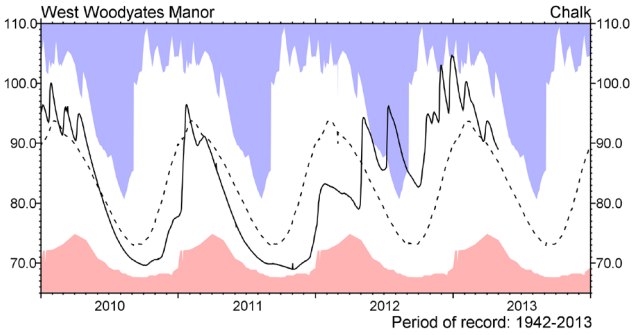


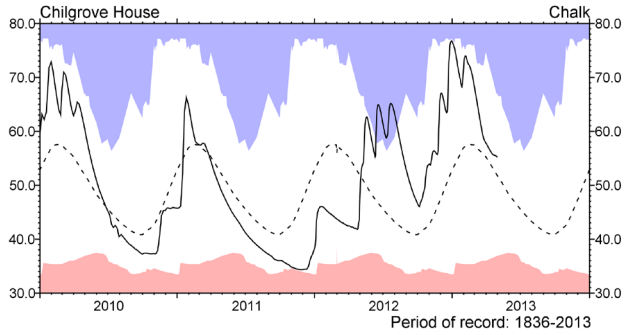


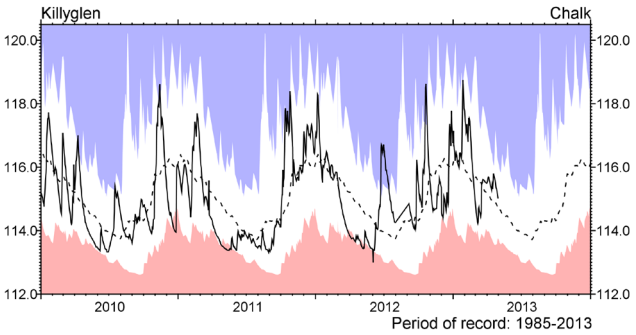


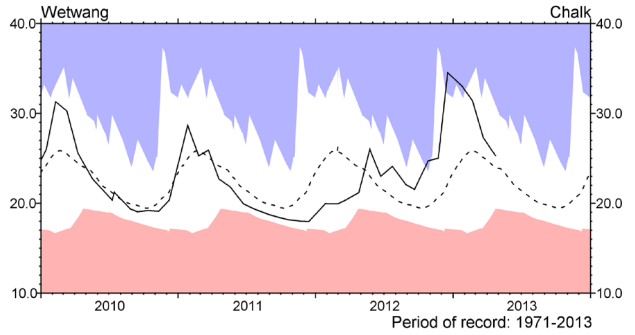






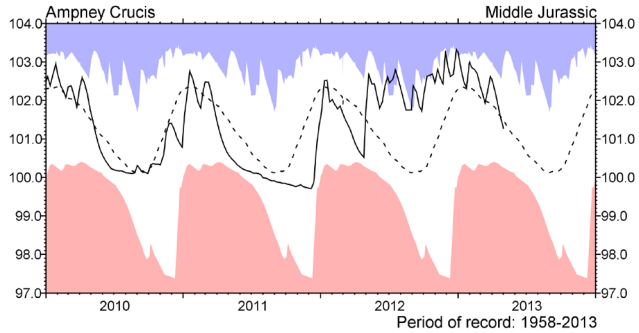


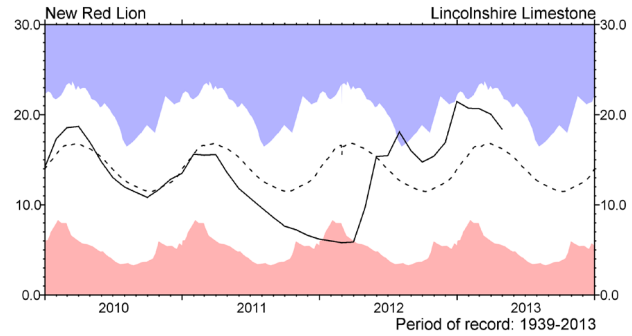


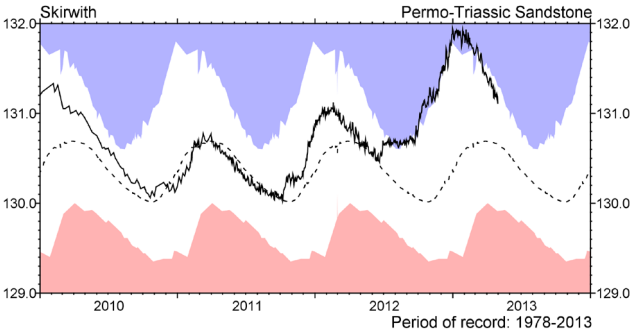


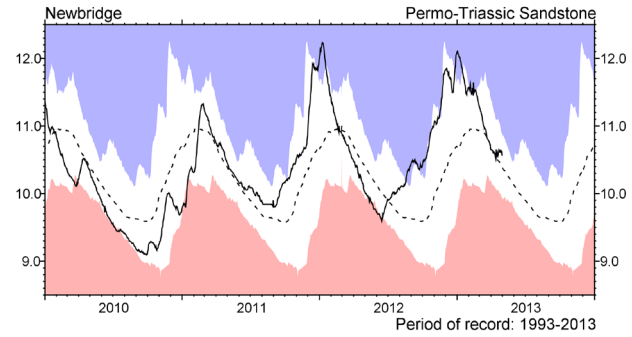
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly mean and the highest and lowest levels recorded for each month are displayed in a similar style to the river flow hydrographs. Note that most groundwater levels are not measured continuously and, for some index wells, the greater frequency of contemporary measurements may, in itself, contribute to an increased range of variation. The latest recorded levels are listed overleaf.

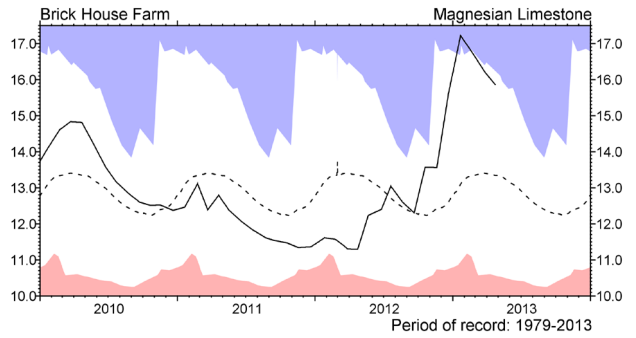
Groundwater... Groundwater

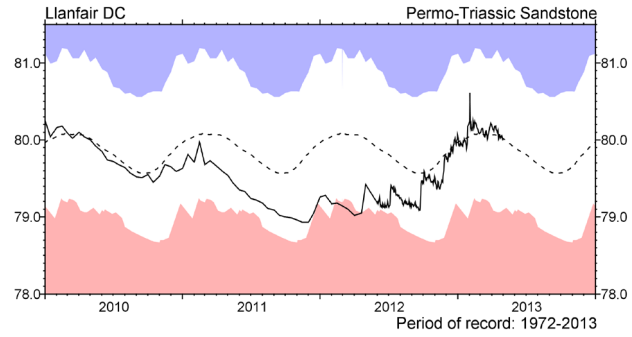


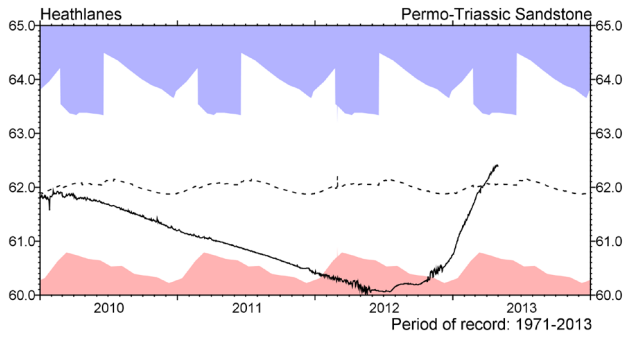


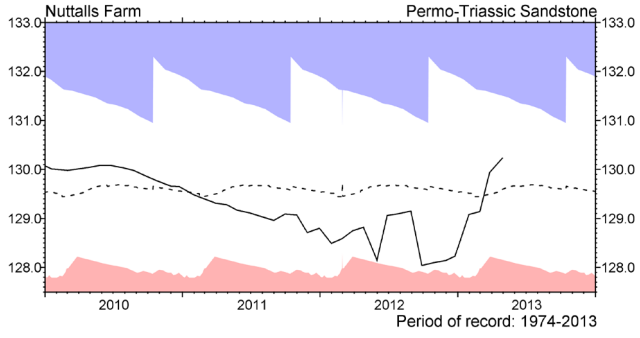


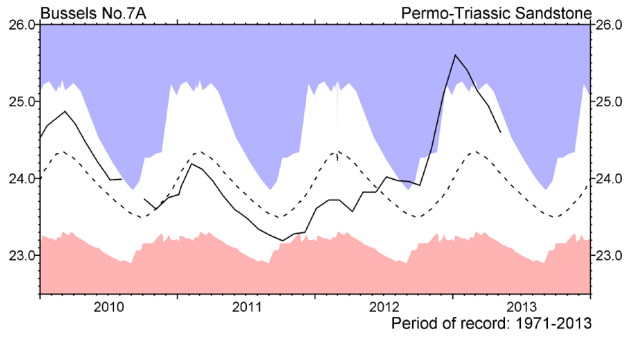


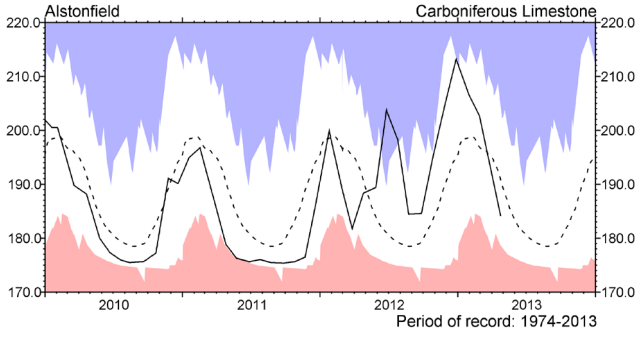








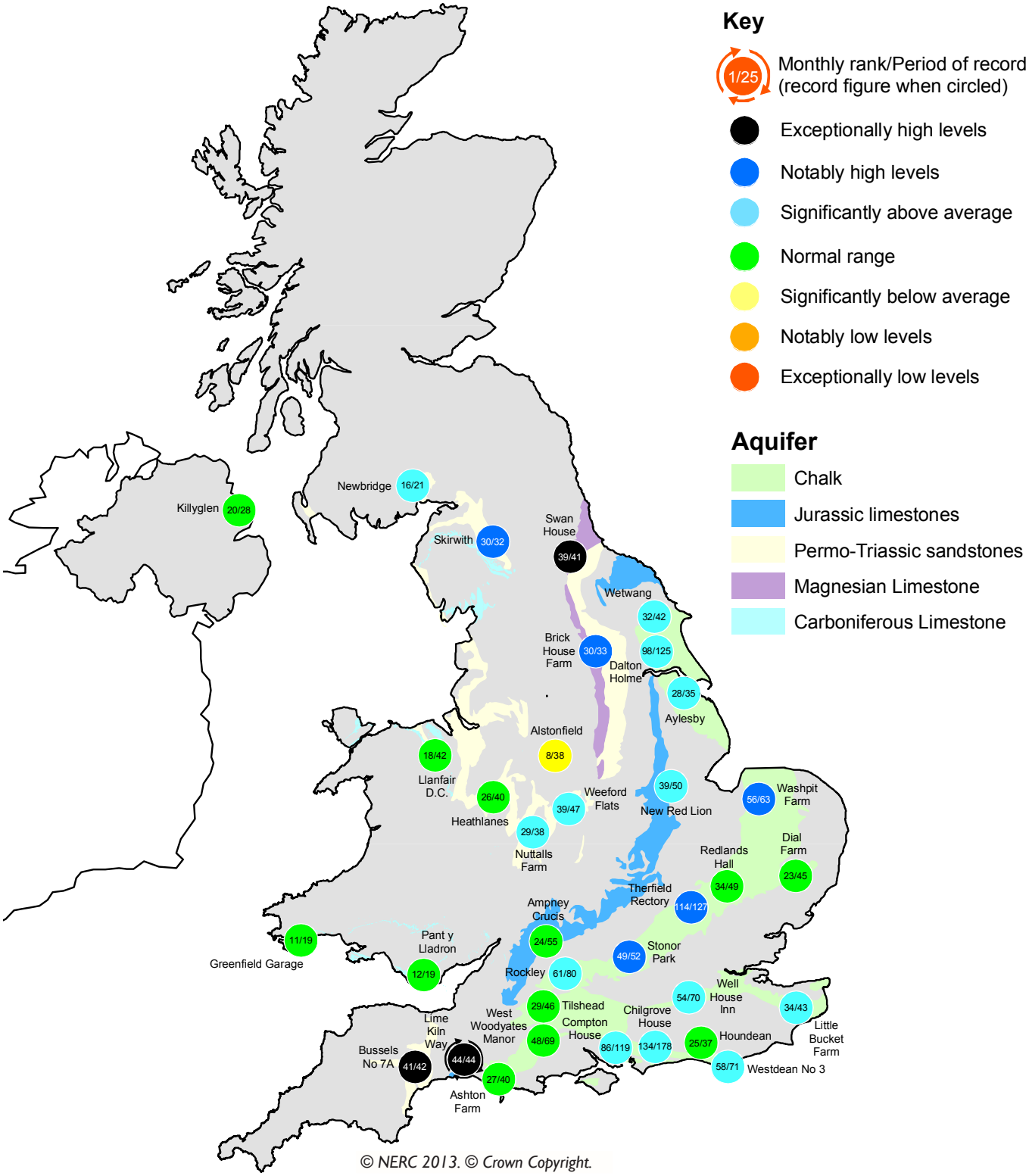




Groundwater levels April / May 2013

Borehole	Level	Date	Apr av.	Borehole	Level	Date	Apr av.	Borehole	Level	Date	Apr av.
Dalton Holme	21.37	22/04	19.47	Chilgrove House	55.19	30/04	52.24	Brick House Farm	15.86	23/04	13.31
Therfield Rectory	88.86	01/05	80.59	Killyglen (NI)	115.02	30/04	114.85	Llanfair DC	80.00	30/04	80.03
Stonor Park	85.56	01/05	77.20	Wetwang	25.29	23/04	23.96	Heathlanes	62.29	30/04	61.97
Tilshead	93.09	30/04	92.37	Ampney Crucis	101.28	01/05	101.67	Nuttalls Farm	130.23	29/04	129.52
Rockley	138.85	01/05	137.47	New Red Lion	18.39	30/04	16.14	Bussels No.7a	24.60	07/05	24.16
Well House Inn	99.78	01/05	97.03	Skirwith	131.12	30/04	130.68	Alstonfield	184.18	24/04	192.41
West Woodyates	89.03	30/04	88.30	Newbridge	10.57	30/04	10.52				

Levels in metres above Ordnance Datum



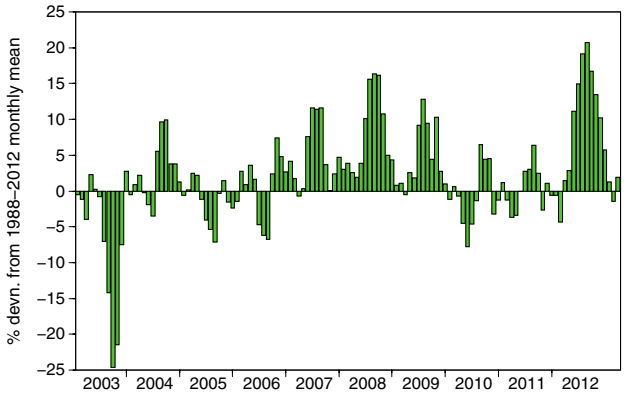
Groundwater levels - April 2013

The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. The rankings are designed as a qualitative indicator, and ranks at extreme levels, and when levels are changing rapidly, need to be interpreted with caution.

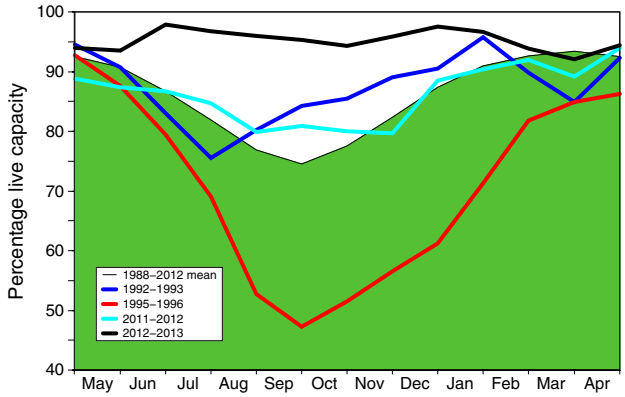
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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 end of month

Area	Reservoir		Capacity (Ml)	2013 Feb	2013 Mar	2013 Apr	Apr Anom.	Min Apr	Year* of min	2012 Apr	Diff 13-12
North West	N Command Zone	•	124929	88	81	87	0	65	1984	83	4
	Vyrnwy		55146	96	92	100	8	70	1996	100	0
Northumbrian	Teesdale	•	87936	90	83	94	3	74	2003	100	-6
	Kielder		(199175)	88	86	90	-1	85	1990	91	-1
Severn Trent	Clywedog		44922	95	97	99	2	85	1988	99	0
	Derwent Valley	•	39525	94	90	83	-10	54	1996	99	-16
Yorkshire	Washburn	•	22035	94	95	93	3	76	1996	100	-7
	Bradford supply	•	41407	96	91	93	2	60	1996	98	-5
Anglian	Grafham		(55490)	80	88	95	1	73	1997	96	-1
	Rutland		(116580)	95	96	95	4	72	1997	85	10
Thames	London	•	202828	96	96	96	2	86	1990	98	-3
	Farmoor	•	13822	97	80	98	1	81	2000	97	1
Southern	Bewl		28170	100	100	100	11	60	2012	60	40
	Ardingly**		4685	100	100	100	1	69	2012	69	31
Wessex	Clatworthy		5364	100	100	93	0	81	1990	100	-7
	Bristol WW	•	(38666)	96	96	95	2	83	2011	91	4
South West	Colliford		28540	99	100	99	13	56	1997	79	20
	Roadford		34500	95	93	91	7	41	1996	85	6
	Wimbleball		21320	100	100	100	6	79	1992	100	0
	Stithians		4967	100	100	93	2	65	1992	90	3
Welsh	Celyn and Brenig	•	131155	99	99	100	2	75	1996	100	0
	Brianne		62140	96	96	99	2	86	1997	100	-1
	Big Five	•	69762	98	96	96	3	85	2011	100	-4
	Elan Valley	•	99106	98	92	95	-1	83	2011	100	-5
Scotland(E)	Edinburgh/Mid Lothian	•	97639	99	93	98	5	62	1998	95	3
	East Lothian	•	10206	100	100	100	2	89	1992	100	0
Scotland(W)	Loch Katrine	•	111363	91	81	92	1	80	2010	89	3
	Daer		22412	97	77	78	-18	78	2013	100	-22
	Loch Thom	•	11840	100	90	89	-5	83	2010	97	-8
Northern Ireland	Total+	•	55540	95	100	98	11	77	2007	84	14
	Silent Valley	•	20634	94	100	99	17	58	2000	80	19

( ) figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence

** the monthly record of Ardingly reservoir stocks is under review.

+ excludes Lough Neagh

Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2012 period except for West of Scotland and Northern Ireland where data commence in the mid-1990s. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes. Monthly figures may be artificially low due to routine maintenance or turbidity effects in feeder rivers.

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 & Hydrology (CEH) and the British Geological Survey (BGS) – both are component bodies of the Natural Environment Research Council (NERC). The National River Flow Archive (maintained by CEH) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

Data Sources

River flow and groundwater level data are provided by the Environment Agency (EA), Natural Resources Wales - Cyfoeth Naturiol Cymru, the Scottish Environment Protection Agency (SEPA) and, for Northern Ireland, the Rivers Agency and the Northern Ireland Environment Agency. In all cases the data are subject to revision following validation (high flow and low flow data in particular may be subject to significant revision).

Reservoir level information is provided by the Water Service Companies, the EA, Scottish Water and Northern Ireland Water.

Most rainfall data are provided by the Met Office (address opposite).

To allow better spatial differentiation the monthly rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA.

The monthly, and n-month, rainfall figures have been produced by the Met Office, National Climate Information Centre (NCIC) and are based on gridded data from raingauges. They include a significant number of monthly raingauge totals provided by the EA and SEPA. The Met Office NCIC monthly rainfall series extends back to 1910 and forms the official source of UK areal rainfall statistics which have been adopted by the NHMP. The gridding technique used is described in Perry MC and Hollis DM (2005) available at http://www.metoffice.gov.uk/climate/uk/about/Monthly_gridded_datasets_UK.pdf

The regional figures for the current month are based on limited raingauge networks so these (and the return periods associated with them) should be regarded as a guide only.

The Met Office NCIC monthly rainfall series are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation.

From time to time the Hydrological Summary may also refer to evaporation and soil moisture figures. These are obtained from MORECS, the Met Office services involving the routine calculation of evaporation and soil moisture throughout the UK.

For further details please contact:

The Met Office
FitzRoy Road
Exeter
Devon
EX1 3PB

Tel.: 0870 900 0100
Email: enquiries@metoffice.gov.uk

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

Enquiries

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Email: nhmp@ceh.ac.uk

A full catalogue of past Hydrological Summaries can be accessed and downloaded at:
http://www.ceh.ac.uk/data/nrfa/nhmp/nhmp.html

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05/2013