Hydrological Summary

for the United Kingdom

June 2013

General

June was a largely dry month, registering as the driest since 2006 for England, in contrast with many of the comparatively wet summer months witnessed in previous years. Rainfall for Scotland and Wales was less than 75% of average and England received barely more than half of that expected in June. Above average rainfall was restricted to Northern Ireland and very localised pockets of Great Britain. With the exception of these areas, there was a significant intensification of soil moisture deficits across the country; whilst this is not unusual for the time of year, it is markedly different to the erratic behaviour of soil moisture levels observed in previous years. Nevertheless, groundwater resources remain healthy, with most of the major aquifers characterised by moderately above average levels. River flows are generally below average across much of the country, although they predominantly fall within the normal range for the time of year. Rainfall deficits since the start of the year over most of Great Britain are reflected in moderate runoff deficiencies over the same timeframe in the responsive catchments of the north and west. With reservoir stocks and groundwater levels predominantly average to above average across the country, the water resources outlook remains healthy, although continued settled weather patterns over the coming months may cause locally depressed summer flows in responsive catchments, and the rapid increase in soil moisture deficits will likely delay the onset of river flow and groundwater recovery in the autumn.

Rainfall

Anticyclonic conditions predominated over the first 10 days and last few days of the month, book-ending an unsettled period mid-month driven by westerly air flows. Following a largely fine and dry beginning to June, mid-month heralded a series of predominantly cloudy and damp days; however, significant downpours over wide areas were rare, and the majority of June's below average rainfall arrived in the form of scattered showers. The exceptions to this were the wet spell across Northern Ireland around mid-month (40mm at Ballypatrick Forest, County Antrim), and some more sustained downpours in western Scotland over the weekend of the 22nd/23rd (47mm was recorded in 48hr at Kinlochewe, Wester Ross). Influenced by the cloudy conditions which predominated in mid-month, temperatures for June were cooler than average; in the Central England Temperature series, temperatures were comparable with 2012 but were otherwise the coldest since 1991. However, in spite of the westerly air flows and significant cloud cover, there was relatively little significant rainfall; less than 40% of average monthly rainfall was recorded widely across Kent, London and East Anglia (Norwich received 11mm of rainfall), and the majority of Great Britain received less than 80% of the long-term average. The relative dryness of June has contributed to the continuing development of rainfall deficiencies since the beginning of the year across wide areas of Great Britain; for the UK, only May has recorded above average rainfall over the first six months of 2013, and the North West has received 75% of its long-term average over the same timeframe.

River flows

In response to the relatively dry weather over the majority of the country, flows in most rivers declined along normal seasonal recessions, with moderate spates limited to responsive catchments in areas affected by localised rainfall during the second half of the month. Whilst localised surface water flooding was reported in Pembrokeshire and the Thames Valley on the 15th and in south-east Scotland and north-east England on the 23rd, there were few examples of the major index rivers experiencing significant high flows. The exception to this was the Faughan in Northern Ireland, which registered its second highest June average daily flow in a series from 1976. June river flows were below average throughout Great Britain, with the exception of those catchments with a significant groundwater influence in East Anglia and central southern England. This reflects the ongoing response to the exceptionally high flows in these catchments over the latter half of 2012, and flows have now returned to the normal range in response to the comparatively dry weather of 2013; the Coln recorded below average daily flows for the first time since the end of April 2012. It should be noted that whilst flows may be returning to the normal range, levels are likely to remain high in Chalk streams due to extensive aquatic plant growth. Outflows for England & Wales were below average for every day after 1st June, the first time prolonged below average flows have occurred since March 2012, and such patterns are set to continue into July in light of persistent fine, dry weather. Moderate runoff deficiencies have developed over a six-month timeframe in the responsive catchments of northern and western Scotland, north-west and north-east England, and north Wales.

Groundwater

Soil moisture deficits intensified in June in response to significantly below average rainfall across the majority of the major aquifers; both of these factors influenced declining groundwater levels across the country. Levels generally remain above average monthly levels in all aquifers, except the Carboniferous Limestone where they are relatively low due to the lack of recent rainfall. In the Chalk, levels fell in all areas and are now generally in the normal range for June, slightly below average in Yorkshire and still well above average in parts of East Anglia and the Chilterns where the unsaturated zone is thickest or concealed by superficial deposits. In the Permo-Triassic sandstones, levels remain high in the north-west. However, in the south-west they have fallen in the last month from exceptionally high to within the normal range. In the slower responding Permo-Triassic sandstones of the Midlands, levels are still rising locally (for example, at Nuttalls Farm). Levels remain exceptionally high in the Upper Greensand of south-west England. In the Magnesian Limestone, levels have fallen but remain high. In the Jurassic limestone aquifers, levels are average at New Red Lion in the Lincolnshire Limestone and at Ampney Crucis in the Cotswolds, whilst in the fast responding Carboniferous Limestone, levels remain below average in the Peak District and south Wales.

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

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

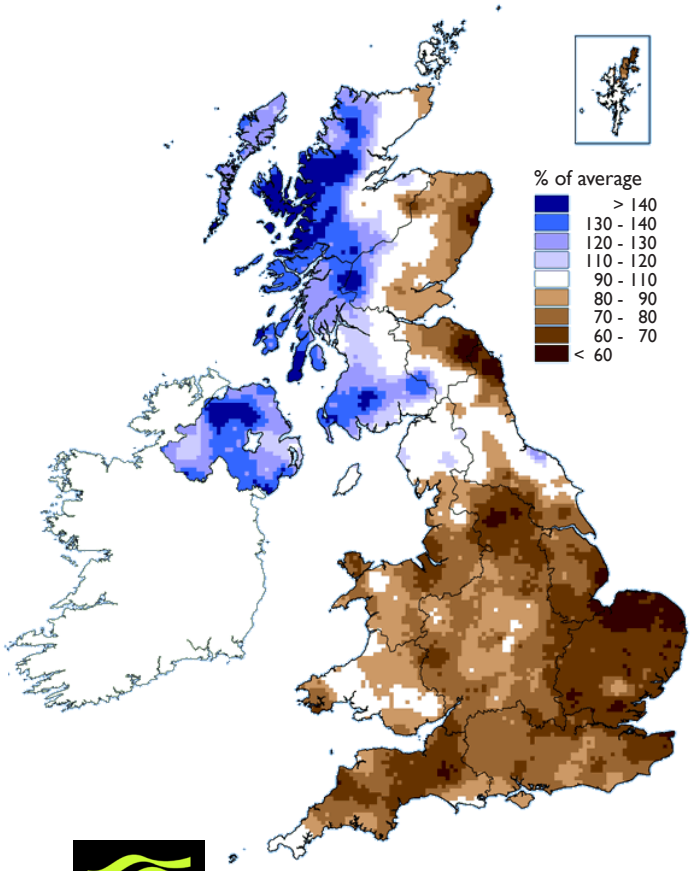
Area	Rainfall	Jun 2013	Apr13 – Jun13	RP	Jan13 – Jun13	RP	Oct12 – Jun13	RP	Jul12 – Jun13	RP
United Kingdom	mm	**47**	201		430		871		1214	
	%	**67**	101	2-5	87	2-5	104	2-5	113	5-10
England	mm	**35**	135		316		692		983	
	%	**56**	78	5-10	84	5-10	111	2-5	121	8-12
Scotland	mm	**56**	295		569		1096		1506	
	%	**71**	127	5-10	88	2-5	98	2-5	105	2-5
Wales	mm	**57**	215		527		1119		1540	
	%	**69**	90	2-5	86	2-5	105	2-5	113	2-5
Northern Ireland	mm	**88**	273		555		894		1222	
	%	**124**	130	5-10	109	5-10	106	2-5	110	5-10
England & Wales	mm	**38**	146		345		751		1060	
	%	**58**	81	2-5	84	5-10	110	2-5	120	8-12
North West	mm	**60**	196		389		892		1371	
	%	**77**	93	2-5	75	10-20	100	2-5	117	5-10
Northumbria	mm	**38**	165		359		725		1079	
	%	**62**	92	2-5	93	2-5	115	5-10	131	25-40
Midlands	mm	**39**	138		309		635		919	
	%	**62**	81	2-5	86	2-5	111	2-5	122	8-12
Yorkshire	mm	**40**	141		306		664		979	
	%	**63**	80	2-5	80	5-10	107	2-5	121	5-10
Anglian	mm	**24**	96		219		484		681	
	%	**44**	66	5-10	78	5-10	108	2-5	114	2-5
Thames	mm	**23**	118		288		613		823	
	%	**40**	73	2-5	87	2-5	115	2-5	119	5-10
Southern	mm	**21**	118		307		688		915	
	%	**38**	75	2-5	87	2-5	114	2-5	119	5-10
Wessex	mm	**30**	129		350		793		1098	
	%	**50**	75	5-10	87	2-5	119	5-10	128	20-30
South West	mm	**43**	163		483		1112		1492	
	%	**59**	77	5-10	87	2-5	117	5-10	125	15-25
Welsh	mm	**55**	208		512		1086		1496	
	%	**68**	89	2-5	86	2-5	106	2-5	114	5-10
Highland	mm	**61**	376		667		1248		1655	
	%	**69**	144	10-15	86	2-5	92	2-5	96	2-5
North East	mm	**43**	188		370		713		985	
	%	**65**	97	2-5	85	5-10	99	2-5	104	2-5
Tay	mm	**37**	235		485		985		1352	
	%	**54**	112	2-5	82	2-5	99	2-5	107	2-5
Forth	mm	**38**	199		438		879		1293	
	%	**55**	101	2-5	84	2-5	101	2-5	115	5-10
Tweed	mm	**44**	184		398		811		1227	
	%	**68**	97	2-5	90	2-5	111	2-5	130	20-30
Solway	mm	**70**	310		619		1187		1699	
	%	**89**	132	5-10	99	2-5	110	5-10	122	20-35
Clyde	mm	**72**	344		692		1344		1853	
	%	**80**	133	5-10	91	2-5	101	2-5	107	2-5

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

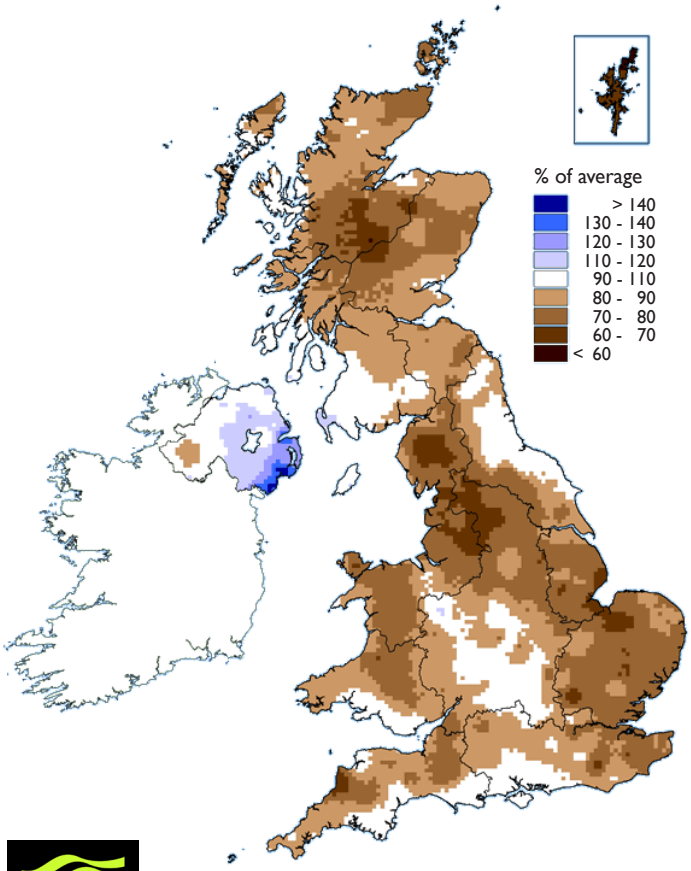
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 December 2012 are provisional.

Rainfall . . . Rainfall . . .

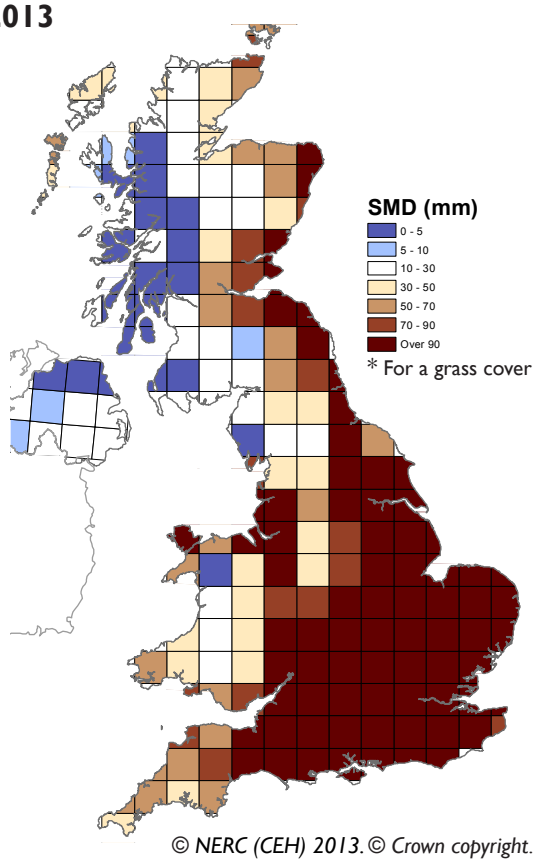
April 2013 - June 2013 rainfall as % of 1971-2000 average



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



MORECS Soil Moisture Deficits* June 2013



Met Office 3-month outlook Updated: July 2013

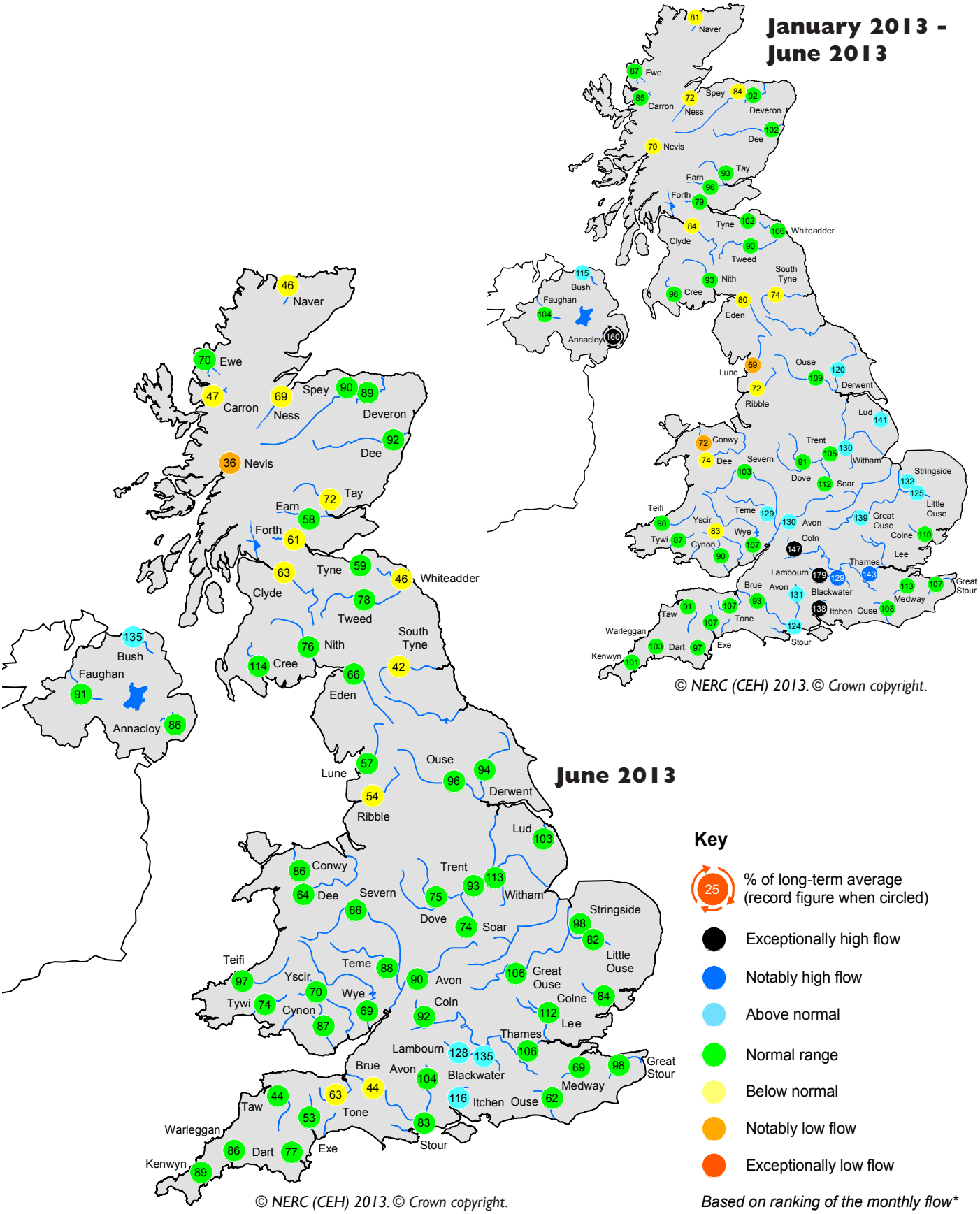
Latest predictions for UK-mean precipitation slightly favour near-to-below-average rainfall for July. However, this is not the case for the July-August-September period as a whole, for which no particular category is favoured.

The probability that UK precipitation for July-August-September will fall into the driest of our five categories is around 20% and the probability that it will fall into the wettest category is around 20% (the 1981-2010 probability for each of these categories is 20%).

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.

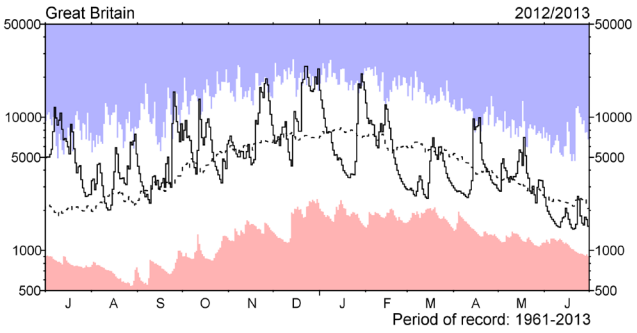
River flow . . . River flow . . .

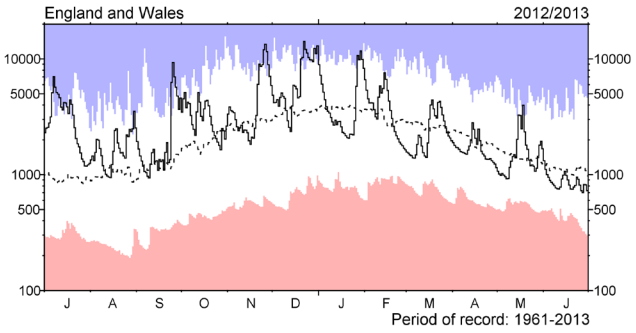


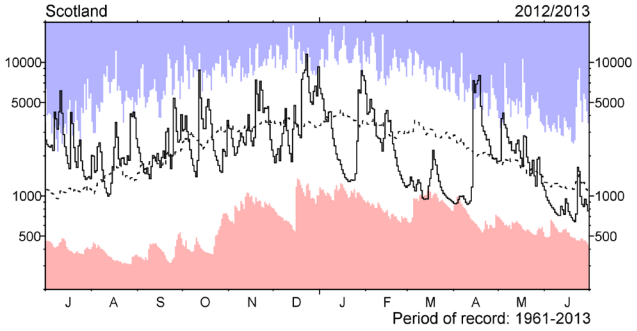
River flows

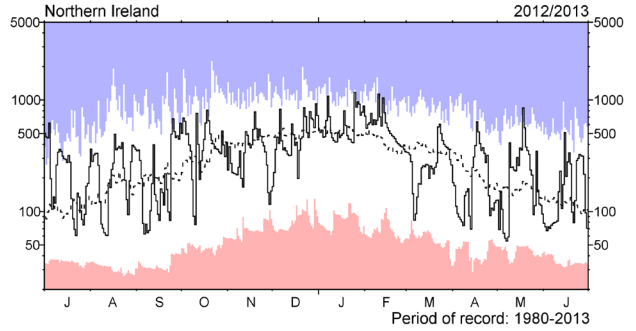
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

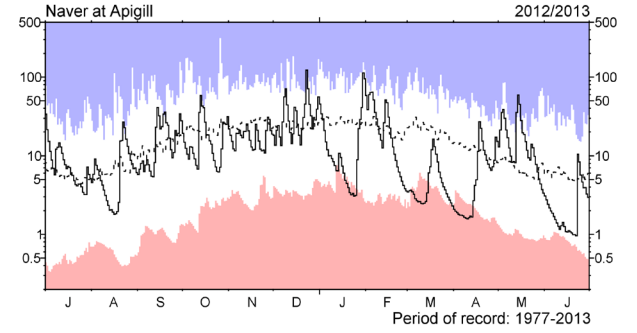
River flow . . . River flow . . .

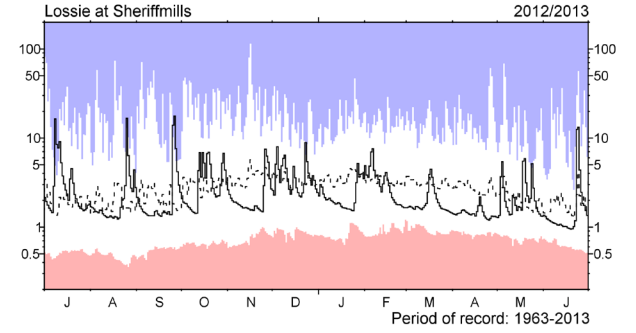


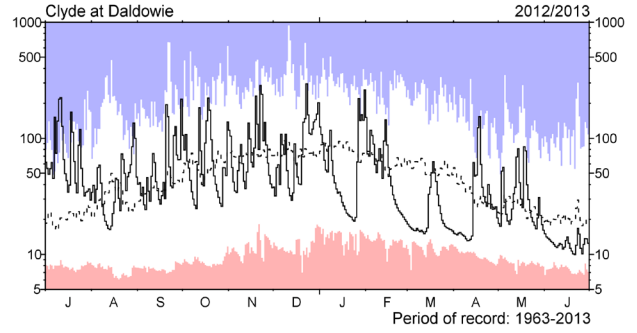


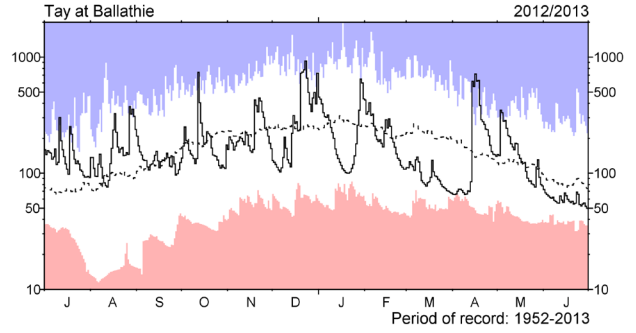


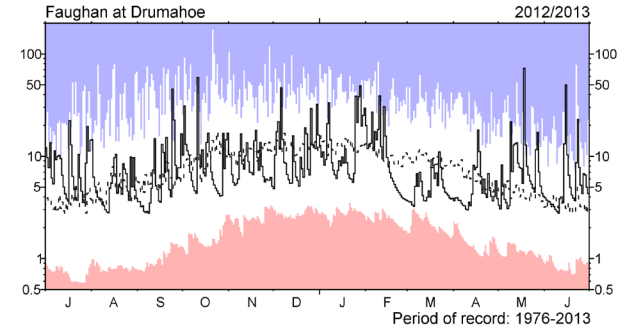


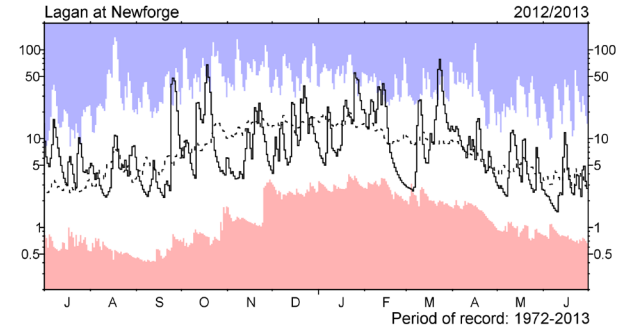








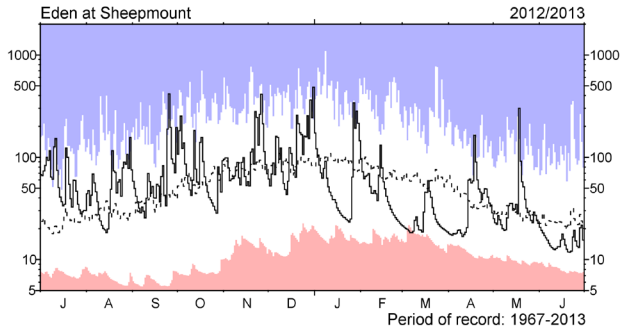


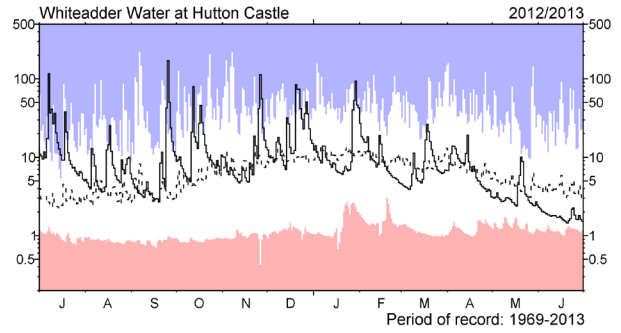


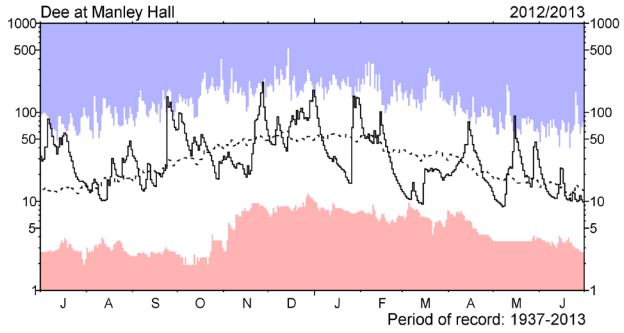
River flow hydrographs

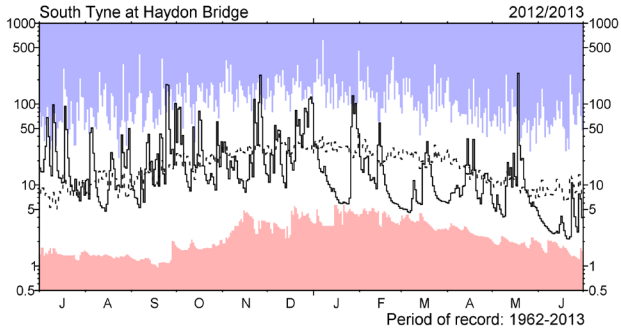
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to July 2012 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed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

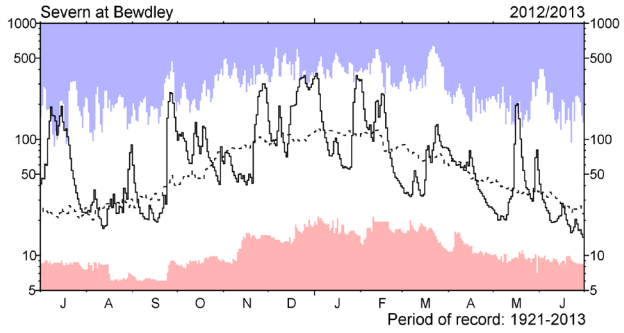
River flow . . . River flow . . .

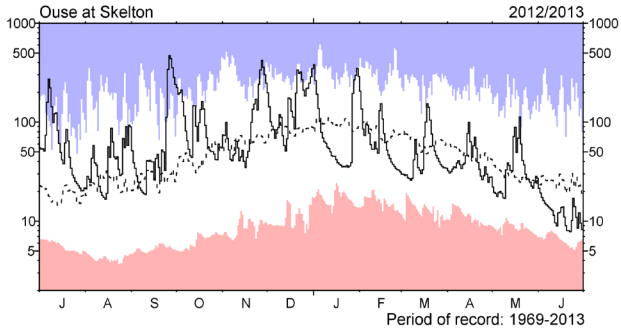


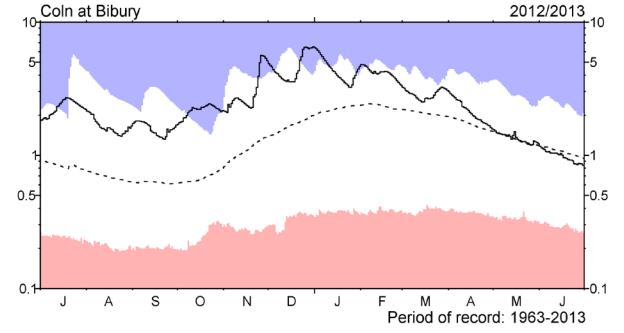


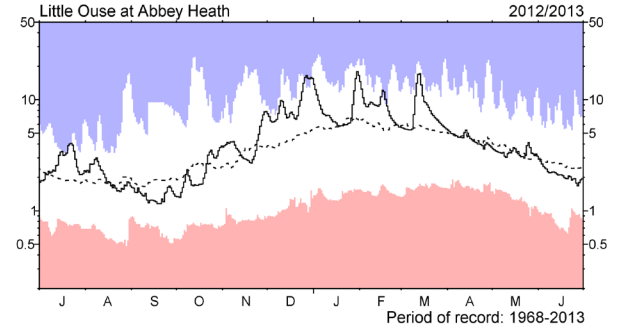


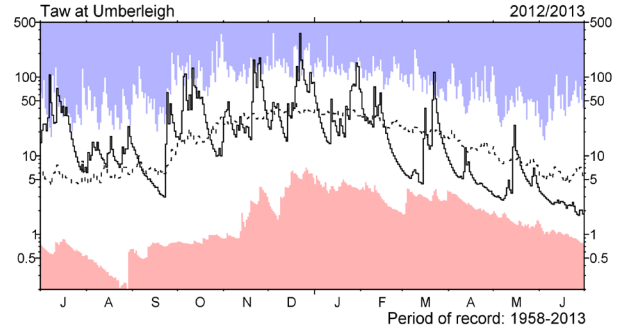


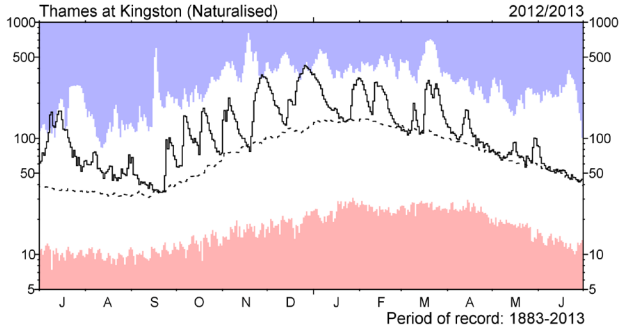


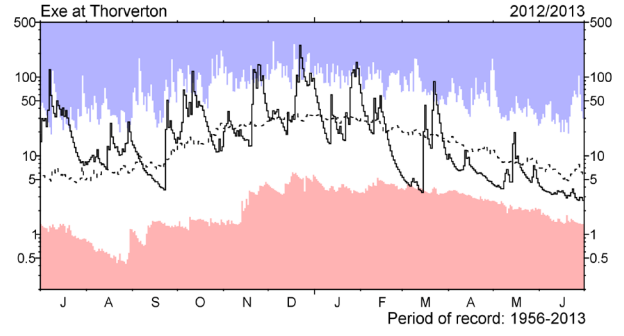


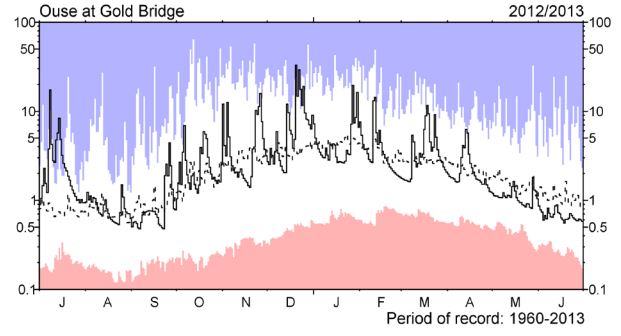




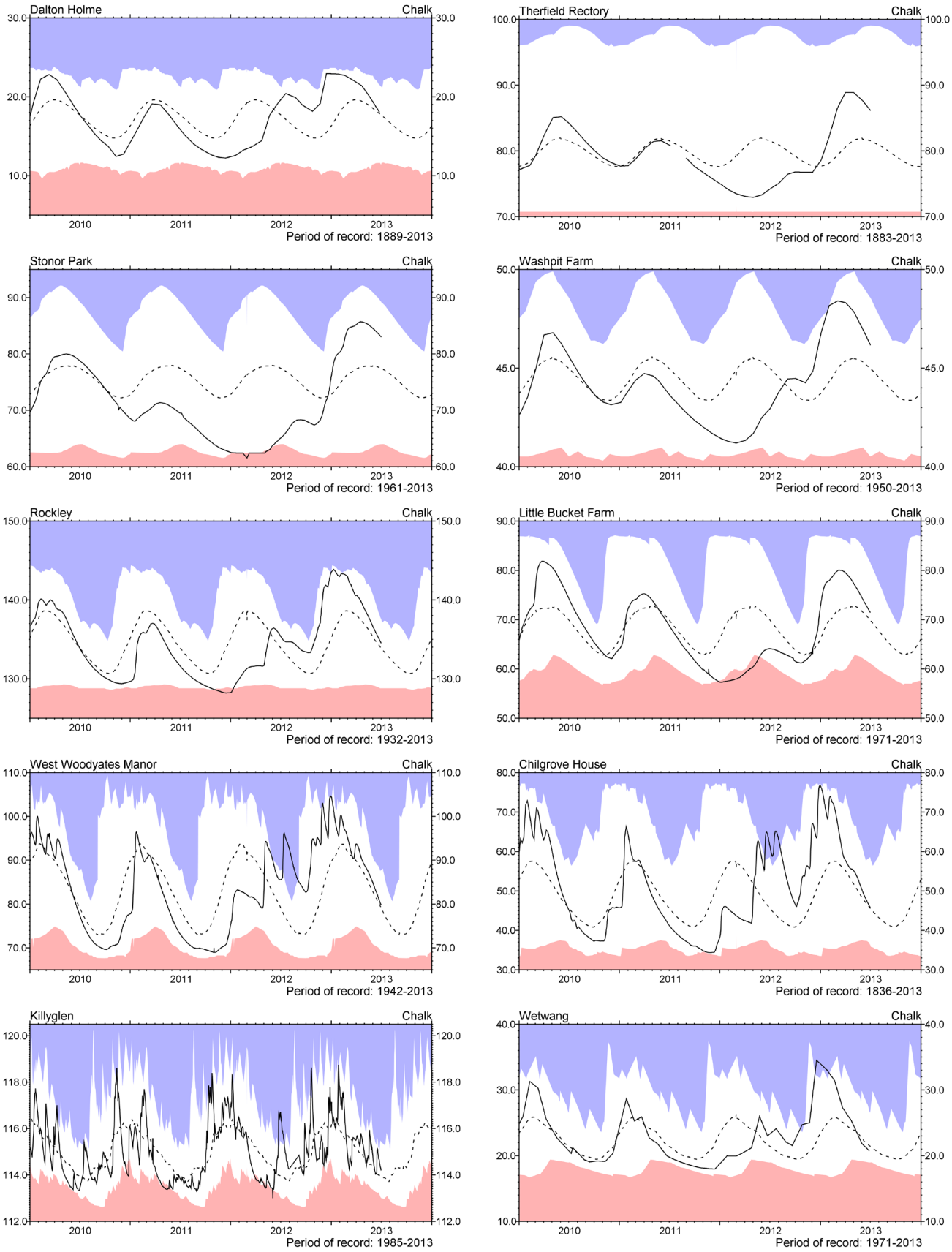






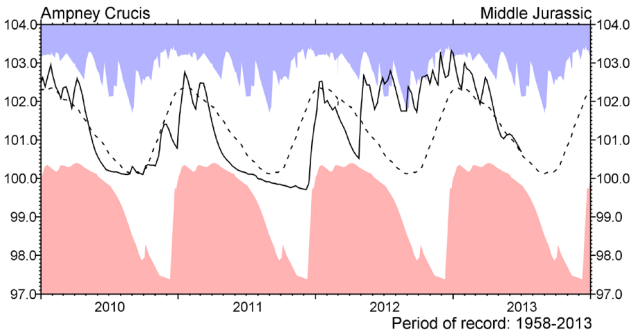


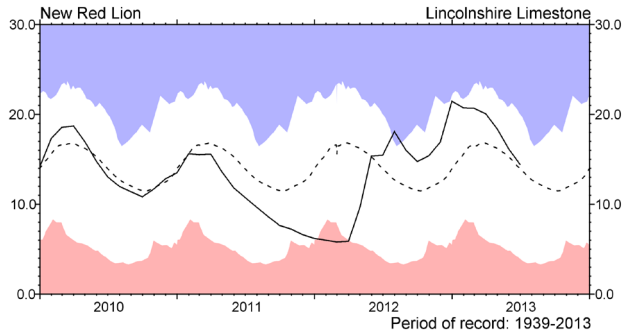
Groundwater…Groundwater

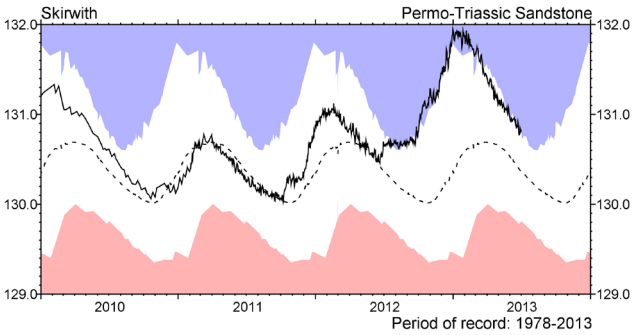


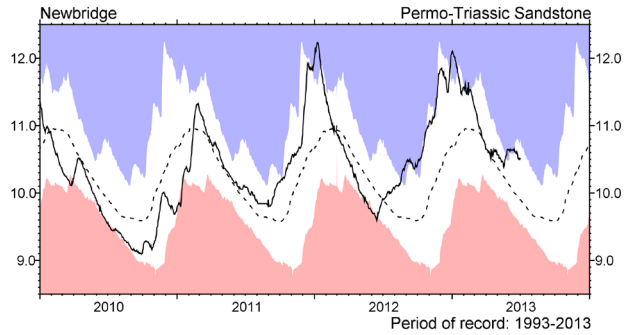
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

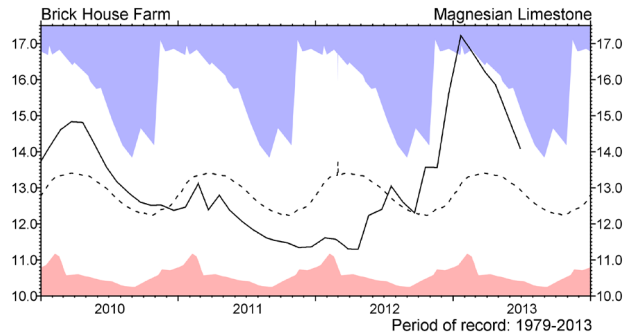
Groundwater... Groundwater

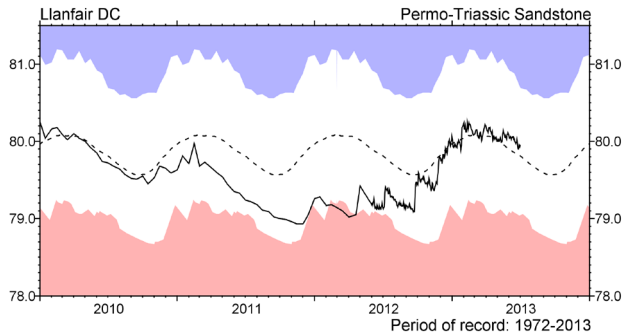


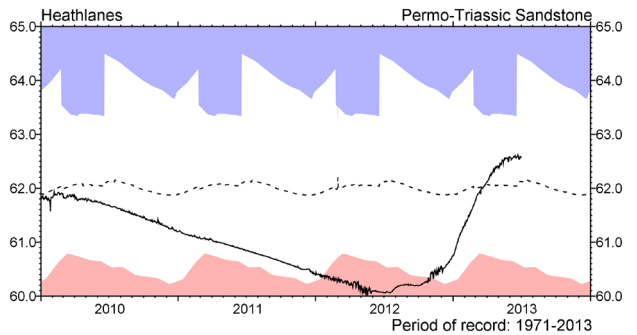


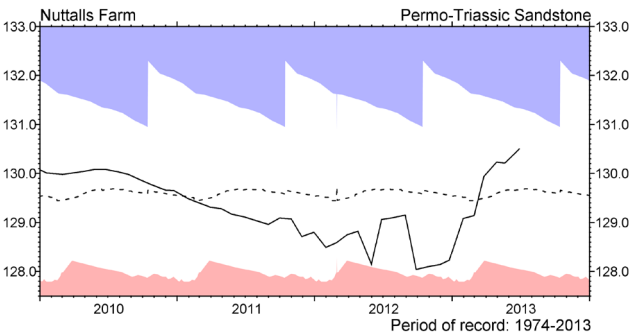


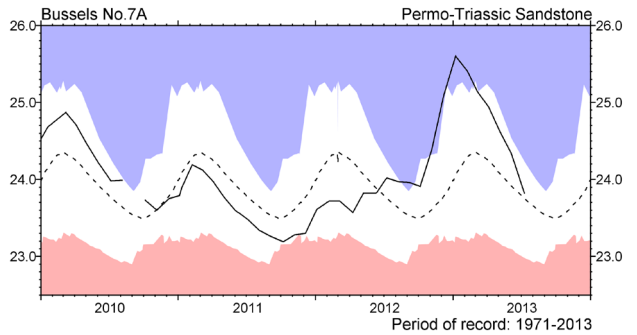


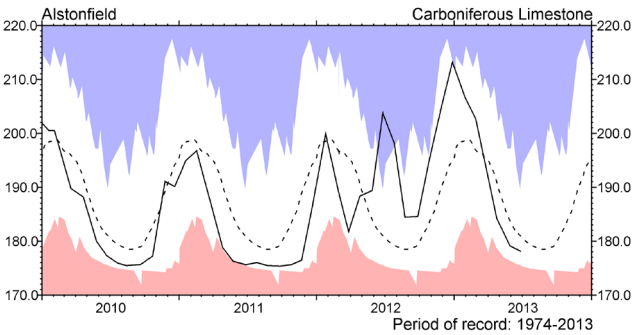








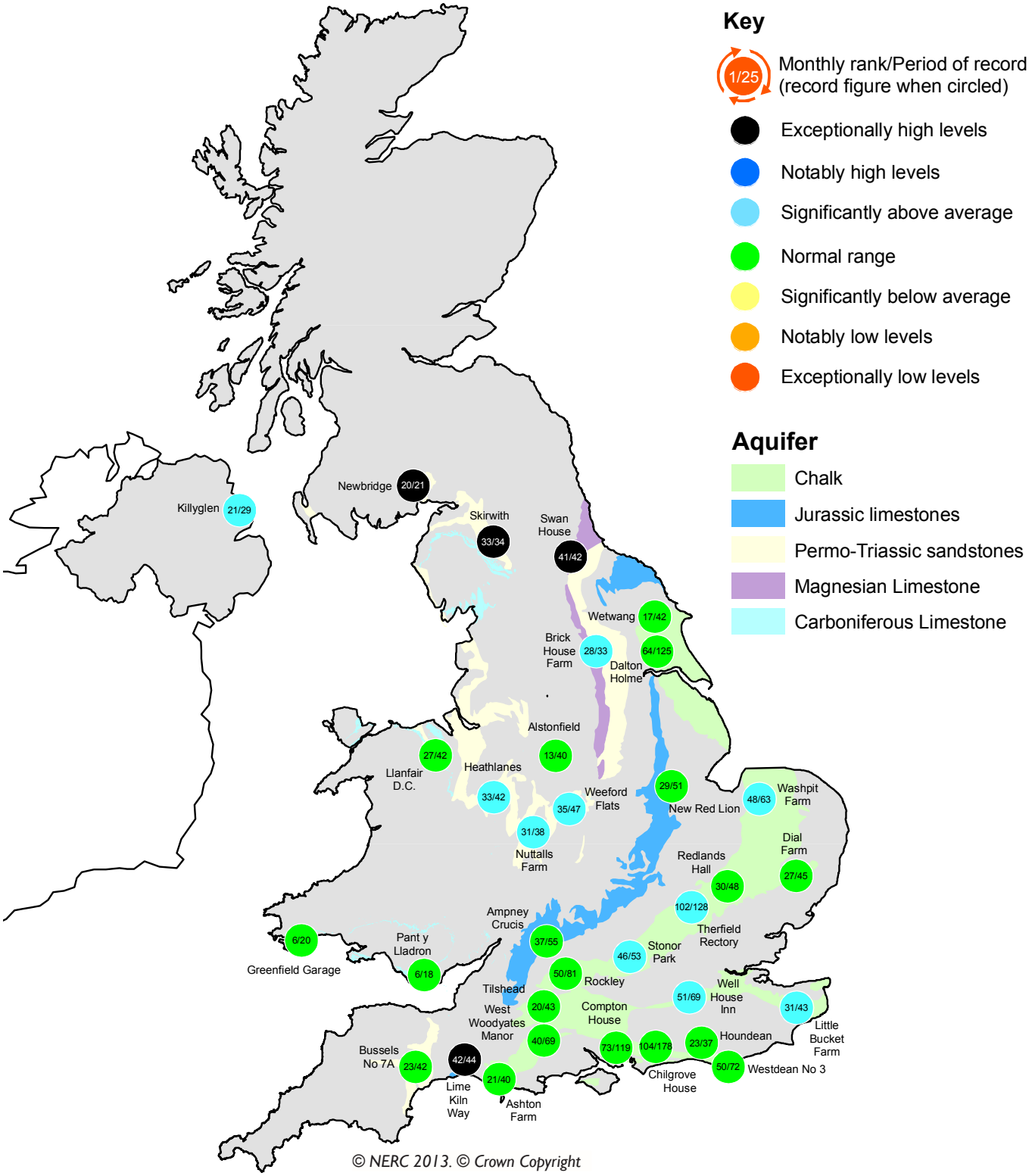




Groundwater levels June / July 2013

Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.
Dalton Holme	18.06	24/06	18.10	Chilgrove House	45.74	30/06	16.10	Brick House Farm	14.09	28/06	13.08
Therfield Rectory	86.14	01/07	81.80	Killyglen (NI)	114.21	30/06	114.01	Llanfair DC	79.95	30/06	79.84
Stonor Park	83.05	30/06	77.38	Wetwang	20.76	26/06	21.76	Heathlanes	62.58	30/06	62.09
Tilshead	86.20	30/06	87.67	Ampney Crucis	100.70	30/06	100.86	Nuttalls Farm	130.50	28/06	129.63
Rockley	134.55	30/06	134.57	New Red Lion	14.41	30/06	14.37	Bussels No.7a	23.82	09/07	23.86
Well House Inn	98.30	30/06	96.35	Skirwith	130.84	30/06	130.51	Alstonfield	178.12	26/06	181.96
West Woodyates	79.82	30/06	80.96	Newbridge	10.51	30/06	9.98				

Levels in metres above Ordnance Datum



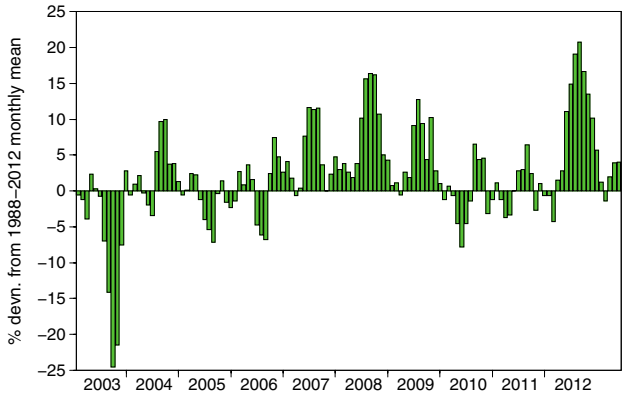
Groundwater levels - June 2013

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.

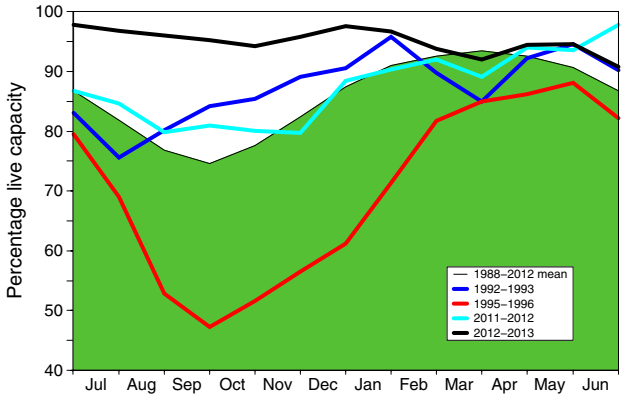
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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 Apr	2013 May	2013 Jun	Jun Anom.	Min Jun	Year* of min	2012 Jun	Diff 13-12
North West	N Command Zone	•	124929	87	83	73	2	38	1984	95	-22
	Vyrnwy		55146	100	98	94	12	58	1984	99	-5
Northumbrian	Teesdale	•	87936	94	95	90	10	58	1989	100	-10
	Kielder		(199175)	90	92	90	-1	71	1989	99	-9
Severn Trent	Clywedog		44922	99	99	99	7	32	1976	98	1
	Derwent Valley	•	39525	83	85	76	-4	53	1996	100	-24
Yorkshire	Washburn	•	22035	93	91	83	2	63	1995	96	-13
	Bradford supply	•	41407	93	91	77	-2	54	1995	99	-23
Anglian	Grafham		(55490)	95	96	94	1	70	1997	96	-2
	Rutland		(116580)	95	95	92	4	75	1997	98	-6
Thames	London	•	202828	96	97	97	5	85	1990	98	-1
	Farmoor	•	13822	98	97	98	0	94	1995	98	-1
Southern	Bewl		28170	100	99	93	10	52	1990	91	2
	Ardingly**		4685	100	100	98	3	82	2005	100	-2
Wessex	Clatworthy		5364	93	85	78	-4	61	1995	100	-22
	Bristol WW	•	(38666)	95	90	83	1	64	1990	97	-14
South West	Colliford		28540	99	97	91	10	51	1997	83	8
	Roadford		34500	91	88	86	6	49	1996	89	-3
	Wimbleball		21320	100	94	85	0	63	2011	100	-15
	Stithians		4967	93	86	82	3	53	1990	95	-13
Welsh	Celyn and Brenig	•	131155	100	100	99	5	77	1996	100	-1
	Brianne		62140	99	100	99	7	76	1995	100	-1
	Big Five	•	69762	96	96	95	11	61	1989	100	-5
	Elan Valley	•	99106	95	100	95	7	68	1976	100	-5
Scotland(E)	Edinburgh/Mid Lothian	•	97639	98	96	92	6	54	1998	97	-5
	East Lothian	•	10206	100	100	98	4	81	1992	100	-2
Scotland(W)	Loch Katrine	•	111363	92	92	78	-2	55	2010	73	5
	Daer		22412	78	77	65	-20	62	1994	100	-35
	Loch Thom	•	11840	89	91	85	-1	69	2000	93	-8
Northern Ireland	Total+	•	55540	98	95	91	9	61	2008	96	-5
	Silent Valley	•	20634	99	96	93	15	54	1995	100	-7

( ) 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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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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07/2013