Hydrological Summary

for the United Kingdom

April 2018

General

April felt like many seasons rolled into one month, encompassing freezing temperatures and snowfall, persistent wet weather and a settled spell with temperatures more typical of the summer. The rainfall pattern, above average for the UK as a whole and below average in northern Scotland and parts of Northern Ireland, reinforced that of March. With a wet start to spring, river flows were notably high in much of England and Wales, and normal or above normal elsewhere. There was a short, sharp spell of unseasonably high temperatures, including the warmest April day since 1949 (29.1°C at St. James' Park, London) and Soil Moisture Deficits (SMDs) began to develop, although soils remained wetter than average in England. Substantial late groundwater recovery has offset the delayed start to the recharge season last winter and levels were in the normal range or higher, and exceptionally high for April in most aquifers in north-east and south-west England, although the risk of groundwater flooding is low. With the recharge season drawing to a close, and reservoir stocks close to average for the time of year, the water resources outlook for summer 2018 is healthy.

Rainfall

The wet weather that dominated March continued into the first two weeks of April, as a low pressure system brought heavy rain that turned to snow over higher ground. Snow accumulations of up to 10cm in northern England, north Wales and Scotland caused travel disruption, including road closures in South Yorkshire and Derbyshire. Unsettled conditions continued for much of the next fortnight, bringing persistent frontal rain and outbreaks of heavy showers. High pressure established a hot, dry spell from the 19th to the 21st that was broken by widespread thunderstorms. More typical spring weather of sunshine and showers followed in Scotland and Northern Ireland whilst unsettled conditions returned elsewhere, with successive rain-bearing frontal systems affecting England and Wales (albeit with modest daily rainfall totals). The total rainfall for April was above average across much of England and Wales but below average in northern Scotland and parts of Northern Ireland. The UK as a whole received 123% of average April precipitation, the wettest regions more than 140% (Anglian, Southern, Yorkshire, Wales and Tweed) and the driest less than 90% (Highlands and North East Scotland) of their respective long term averages. For March-April, the spatial pattern was similar, but exaggerated, with greater rainfall deficits in north-west Scotland that also extended further south into the Lake District; the North West was the only region of England with less than 140% of its long term average rainfall. Wessex region experienced its third wettest start to spring (March-April) in a series from 1910.

River flows

The heavy rain and snow in the first week produced the highest flows of the month for the majority of rivers, and the highest monthly maximum peak flow recorded on the Mersey, Lud, Trent, Tywi and Stour (in records from 1976 or earlier). There were widespread flood alerts and 28 flood warnings by the 3rd of April, and the Foss Barrier in York was activated as levels rose on the Ouse. Flows generally receded for the rest of the month, sharply in responsive catchments during the dry spell, with the recession interrupted by later, usually smaller peaks. By the end of April the UK outflow was close to its long term average. Monthly mean flows were above average for most rivers in England and Wales, notably high in south Wales and central, eastern and south-west England. New maximum monthly mean flows were recorded on the Stour and the Severn, the latter with a record that began in 1921 notable for its longer historical perspective. In north-west Scotland, by contrast, monthly mean flows were less than two-thirds of long term average on the Ewe and the Ness. For March-April river flow accumulations, the spatial pattern echoed that of rainfall, with greater contrast between north and south than for April alone. River flows for March-April were notably low on the Ewe, Carron and Ness but exceptionally high with new maxima on the Kenwyn, Exe and Tone in south-west England, and also on the Teme.

Groundwater

Fuelled by elevated temperatures soils began to dry but remained wetter than average for the time of year across the main aquifer areas and there was significant recharge. Groundwater levels throughout the Chalk rose during the first half of April, although in Yorkshire, Wessex, the South Downs and Berkshire they started to recede later in the month. By the end of April levels were in the normal range or above with the exception of Dial Farm which was below normal. At Aylesby and Wetwang (new April maximum level) in the north-east and at Rockley, Tilshead and West Woodyates Manor in the south-west the levels were exceptionally high, and minor flooding of roads was reported in Dorset mid-month. In the more rapidly responding Magnesian and Jurassic limestones, levels responded to the recharge (falling later in the month, and overall, at Ampney Crucis) and were above normal at month-end. The level in the Upper Greensand at Lime Kiln Way continued to rise and ended the month back in the normal range. In the north-western part of the Permo-Triassic sandstones, groundwater levels fell at Newbridge and Skirwith, but remained above average. In the Midlands and north-east Wales, levels ended April in the normal range but responded differently, rising at Heathlanes, rising and then receding at Llanfair DC and remaining stable at Nuttalls Farm. At Bussels No. 7A, the level rose initially and then fell later in the month, but nonetheless ended the month exceptionally high for the time of year. Levels in the rapidly responding Carboniferous Limestone receded but remained above normal and rose in the Fell Sandstone at Royalty Observatory to a level that was exceptionally high for April.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Met Office

Rainfall accumulations and return period estimates

Percentages are from the 1981-2010 average.

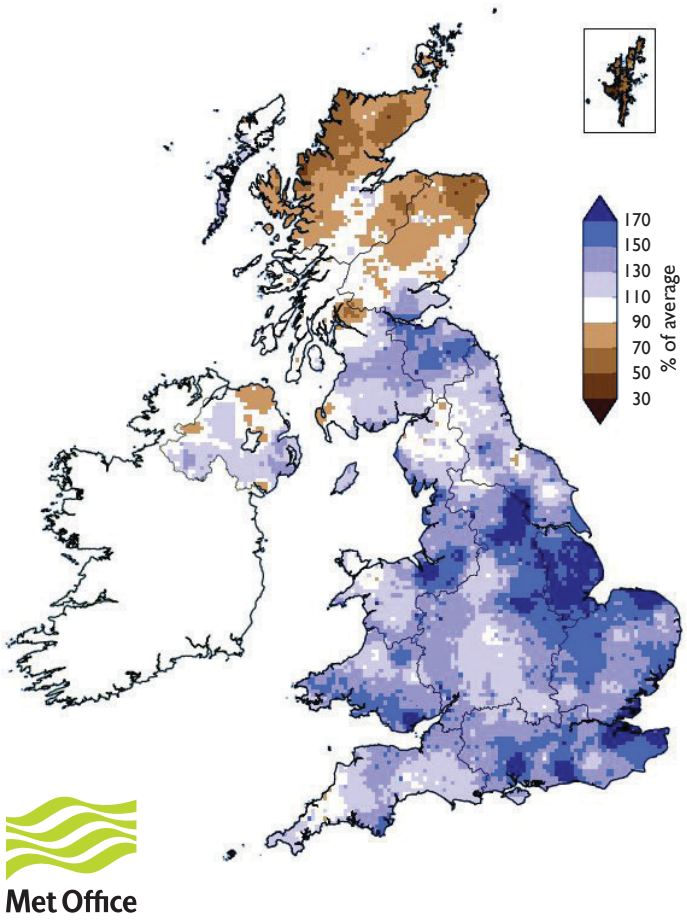
Region	Rainfall	Apr 2018	Mar18 – Apr18	RP	Feb18 – Apr18	RP	Nov17 – Apr18	RP	May17 – Apr18	RP
United Kingdom	mm	**86**	191		255		615		1218	
	%	**123**	117	5-10	102	2-5	101	2-5	108	5-10
England	mm	**81**	183		228		485		947	
	%	**141**	152	20-30	127	5-10	111	2-5	112	5-10
Scotland	mm	**87**	185		276		760		1546	
	%	**100**	83	2-5	79	2-5	90	2-5	102	2-5
Wales	mm	**120**	272		352		874		1618	
	%	**140**	136	8-12	114	2-5	112	5-10	114	8-12
Northern Ireland	mm	**81**	167		241		622		1294	
	%	**107**	98	2-5	95	2-5	104	2-5	114	25-40
England & Wales	mm	**87**	196		245		539		1039	
	%	**140**	149	15-25	124	5-10	112	2-5	112	5-10
North West	mm	**95**	169		239		657		1417	
	%	**134**	100	2-5	93	2-5	102	2-5	115	10-15
Northumbria	mm	**77**	180		239		484		990	
	%	**124**	141	10-15	124	5-10	108	2-5	114	5-10
Severn-Trent	mm	**81**	186		221		451		858	
	%	**139**	162	30-50	132	8-12	116	2-5	110	2-5
Yorkshire	mm	**89**	199		245		462		972	
	%	**145**	158	20-35	131	8-12	106	2-5	115	5-10
Anglian	mm	**72**	145		183		365		717	
	%	**158**	163	15-25	142	10-15	124	5-10	115	5-10
Thames	mm	**72**	164		197		413		789	
	%	**137**	159	15-25	130	5-10	113	2-5	110	2-5
Southern	mm	**84**	183		229		472		876	
	%	**158**	165	20-35	137	5-10	110	2-5	109	2-5
Wessex	mm	**79**	211		250		531		965	
	%	**135**	168	40-60	132	5-10	112	2-5	109	2-5
South West	mm	**95**	280		340		759		1338	
	%	**124**	163	30-50	125	5-10	110	2-5	109	2-5
Welsh	mm	**117**	268		343		844		1553	
	%	**141**	139	10-15	116	2-5	113	5-10	114	5-10
Highland	mm	**85**	164		273		891		1749	
	%	**84**	60	5-10	62	5-10	85	2-5	96	2-5
North East	mm	**56**	161		210		465		1021	
	%	**86**	112	2-5	95	2-5	89	2-5	101	2-5
Tay	mm	**76**	208		270		598		1256	
	%	**102**	108	2-5	89	2-5	81	2-5	94	2-5
Forth	mm	**84**	198		255		580		1237	
	%	**125**	115	5-10	95	2-5	90	2-5	103	2-5
Tweed	mm	**98**	207		272		562		1150	
	%	**155**	144	15-25	123	8-12	105	2-5	112	8-12
Solway	mm	**109**	203		308		798		1713	
	%	**123**	95	2-5	94	2-5	99	2-5	115	30-50
Clyde	mm	**108**	216		334		934		1913	
	%	**108**	81	2-5	81	2-5	92	2-5	105	5-10

% = percentage of 1981-2010 average *RP = Return period*

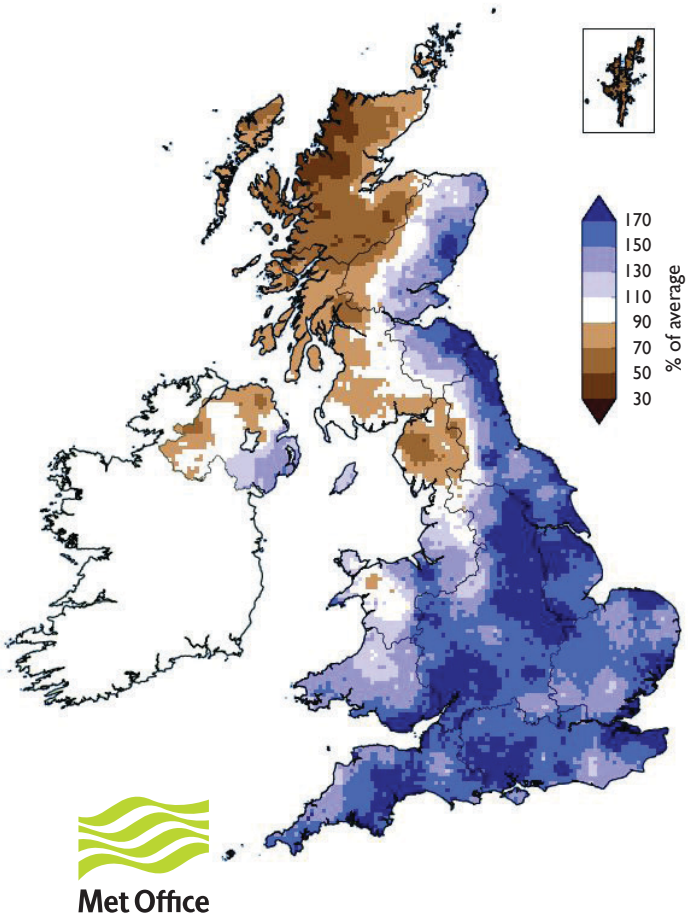
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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 January 2017 are provisional.

Rainfall . . . Rainfall . . .

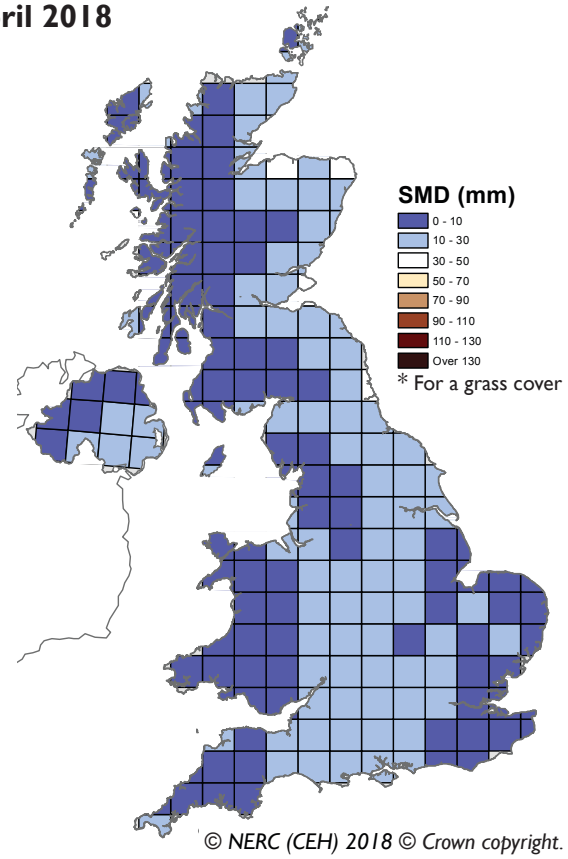
April 2018 rainfall
as % of 1981-2010 average



March 2018 - April 2018 rainfall
as % of 1981-2010 average



MORECS Soil Moisture Deficits*
April 2018



Hydrological Outlook UK

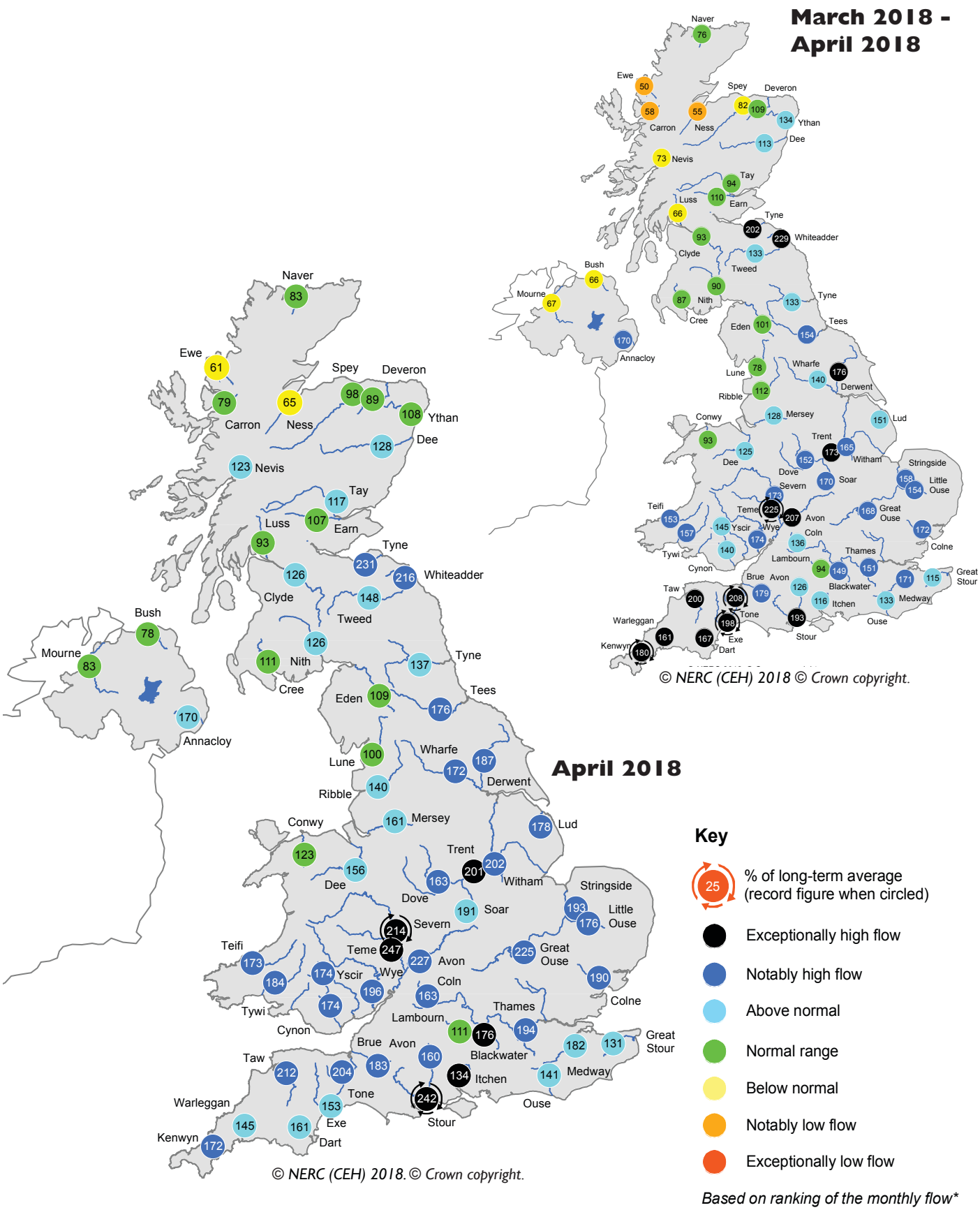
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

The complete version of the Hydrological Outlook UK can be found at: www.hydoutuk.net/latest-outlook/

Period: **from May 2018**
Issued: **09.05.2018**
using data to the end of April 2018

The one- and three-month outlooks for river flows are for normal to above normal flows in the English lowlands and flows within the normal range elsewhere. The outlooks for groundwater levels over both the one- and three-month timeframes are for above normal levels in southern Scotland, north-east England and central southern England, with normal to above normal levels most likely elsewhere.

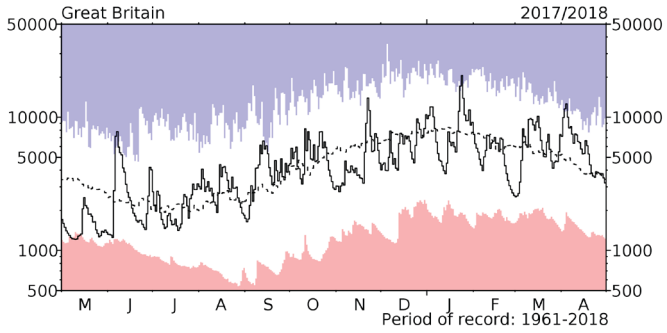
River flow . . . River flow . . .

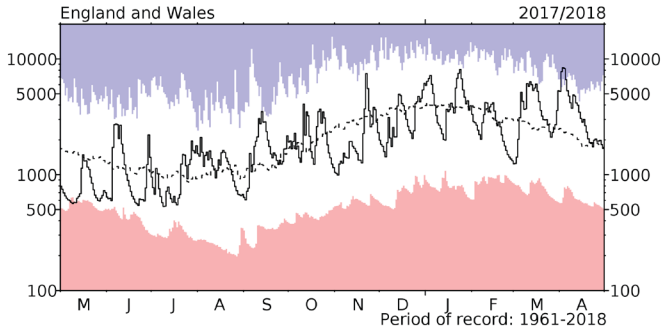


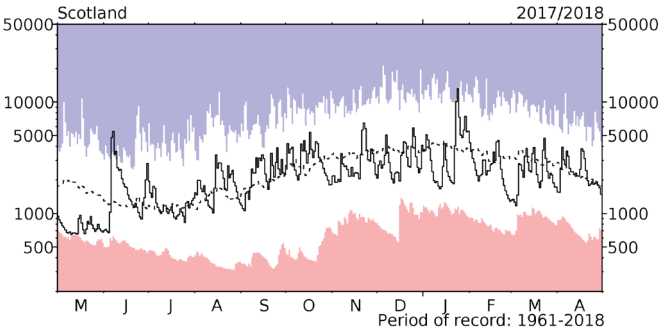
River flows

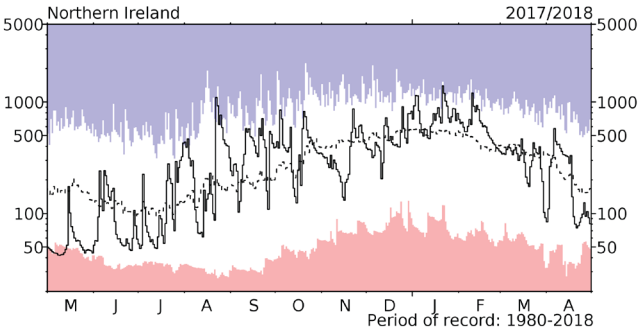
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the averaging period on which these percentages are based is 1981-2010. Percentages may be omitted where flows are under review.

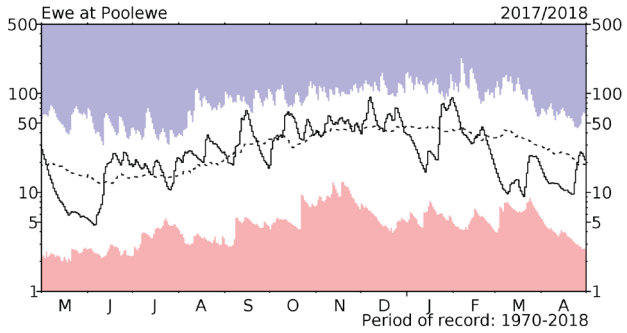
River flow . . . River flow . . .

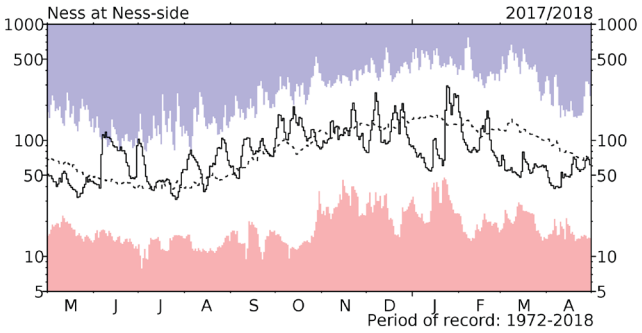


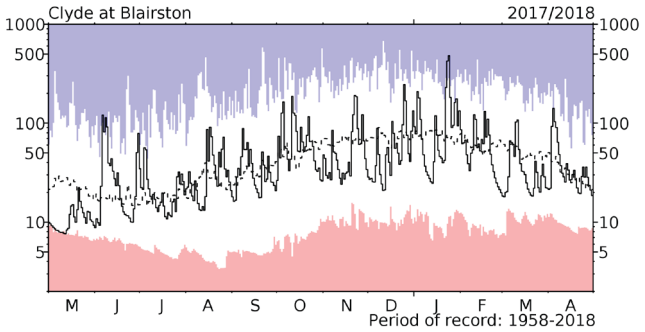


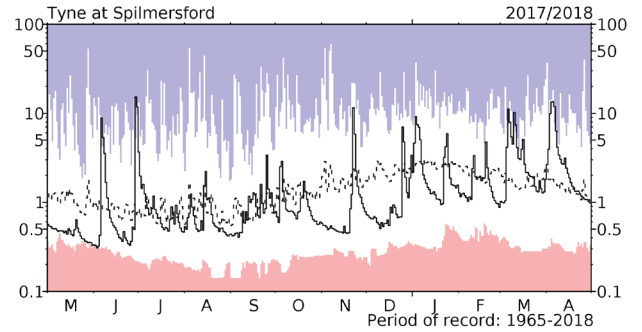


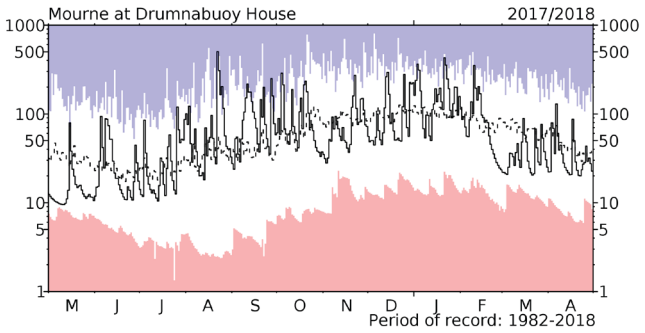


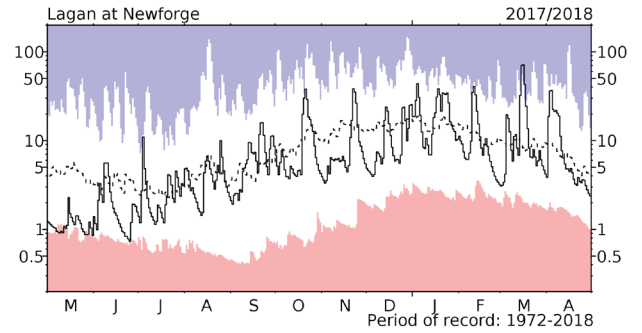








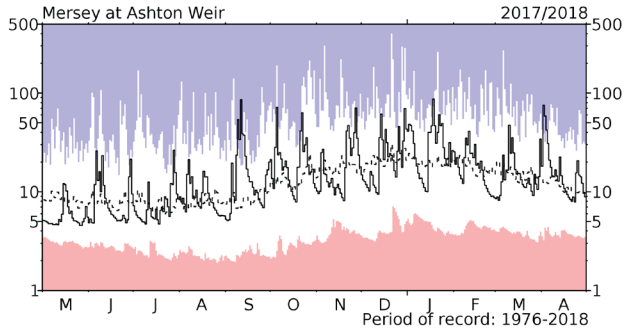


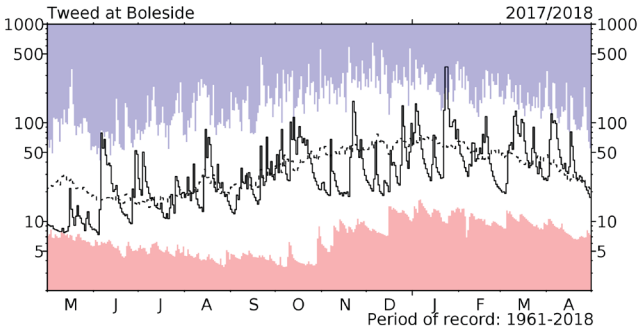


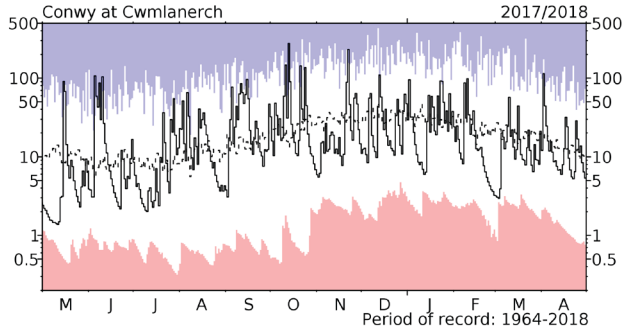
River flow hydrographs

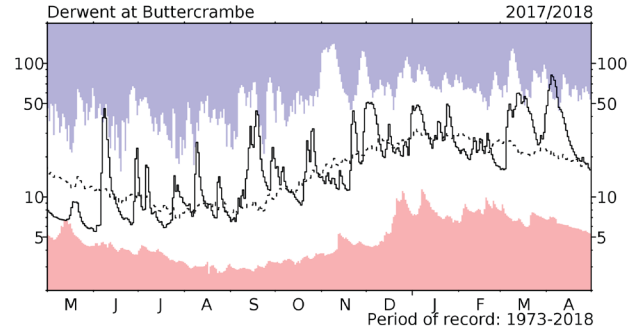
*The river flow hydrographs show the daily mean flows (measured in m^3s^{-1}) together with the maximum and minimum daily flows prior to May 2017 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

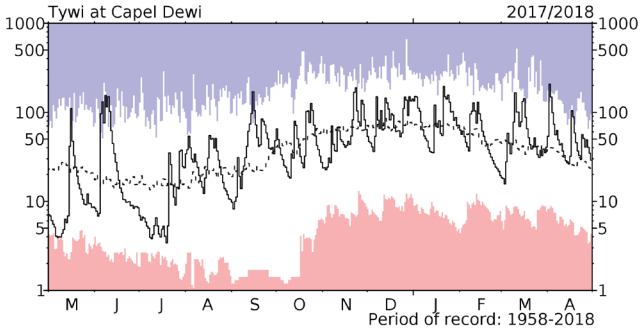
River flow . . . River flow . . .

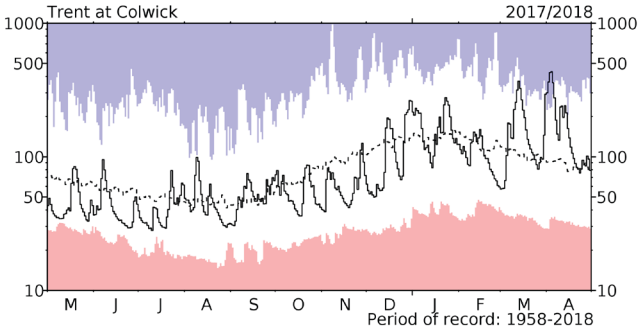


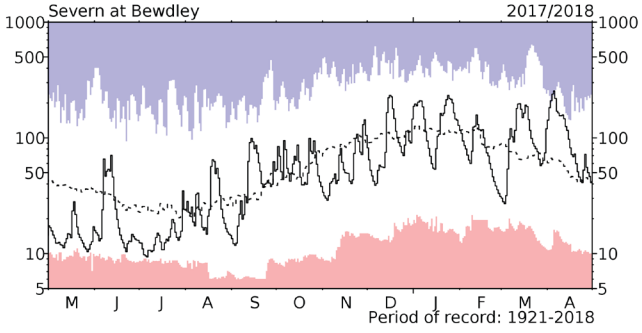


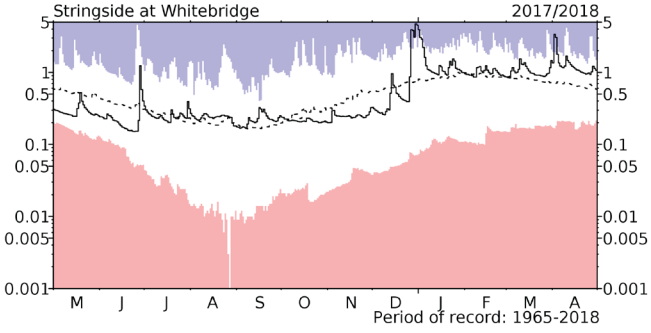


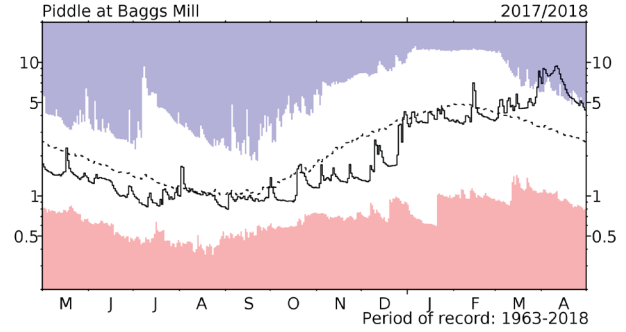


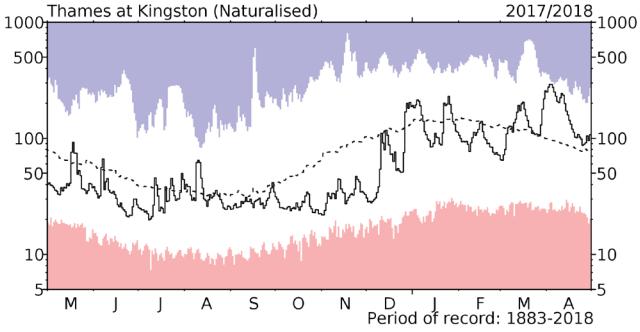


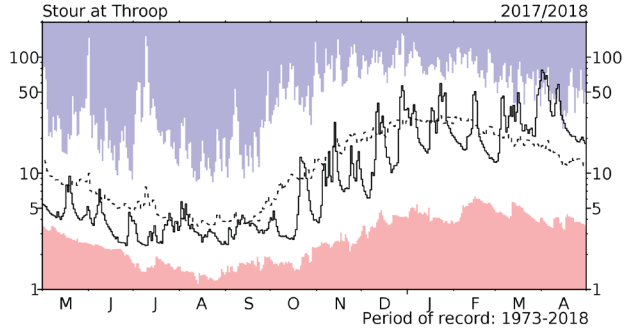


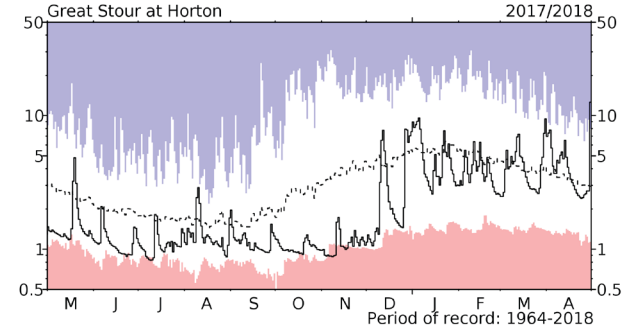




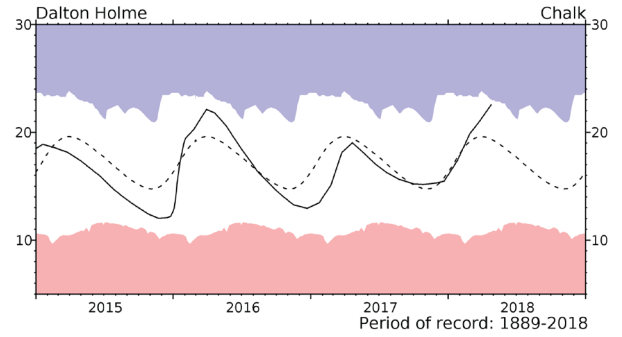


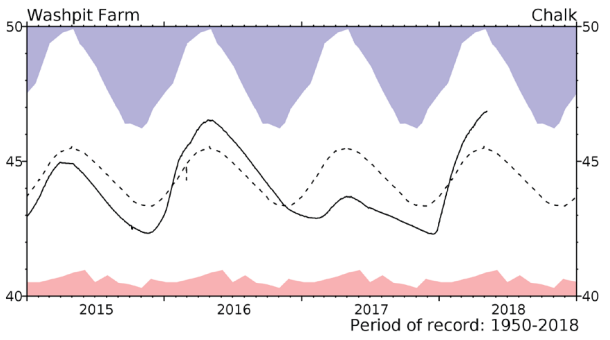


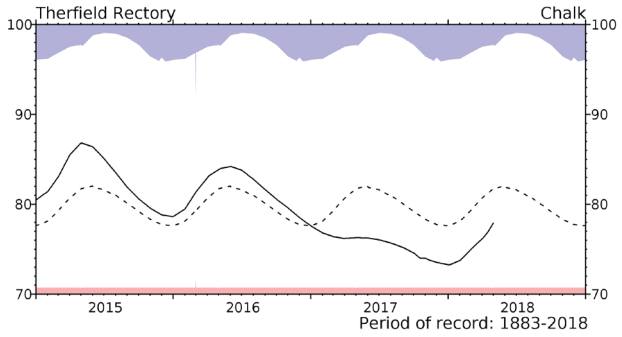


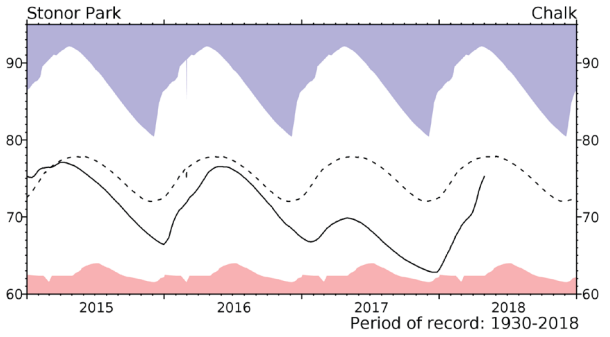


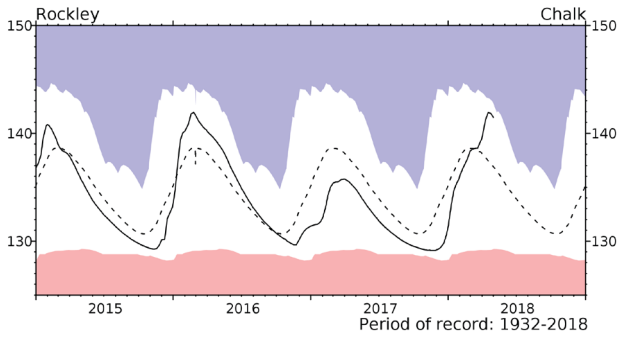
Groundwater…Groundwater

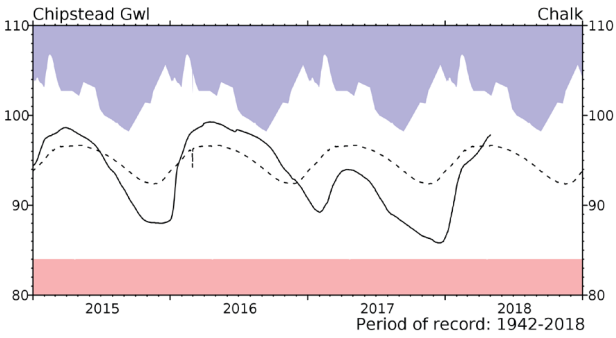


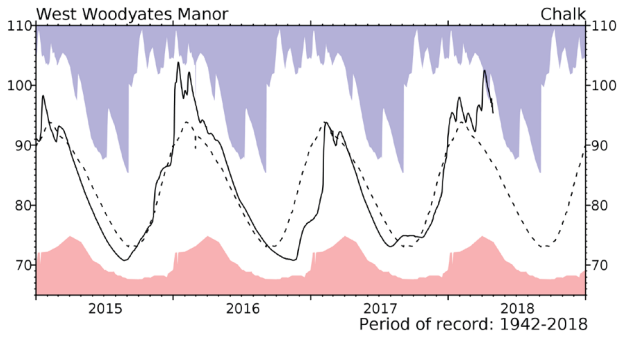


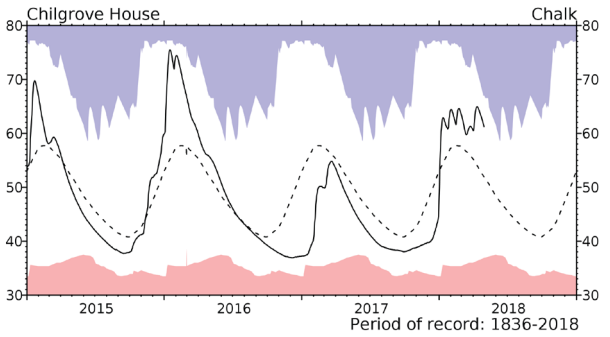


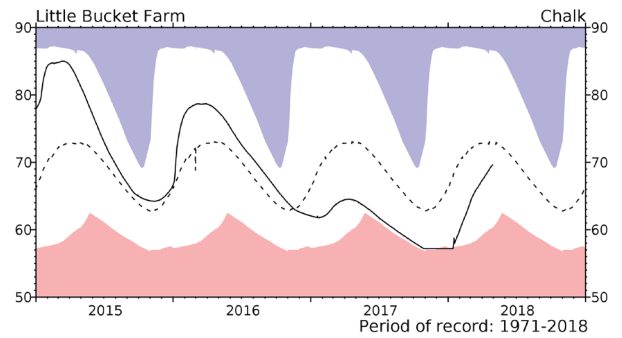


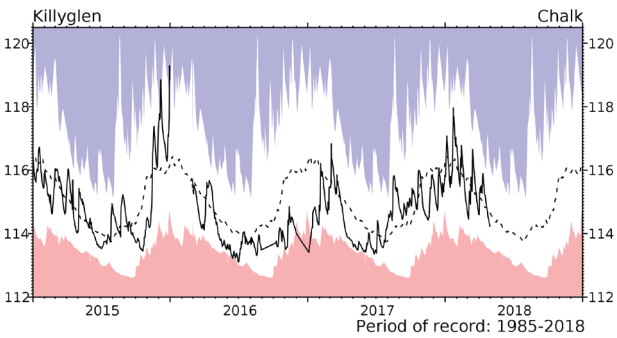






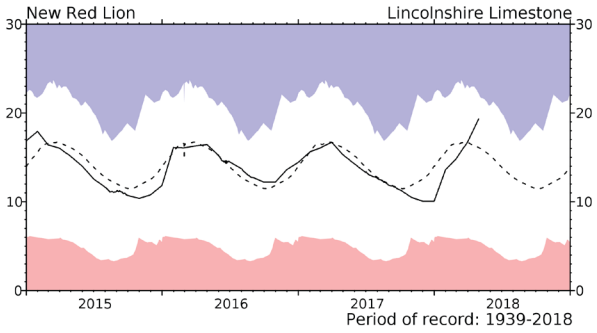


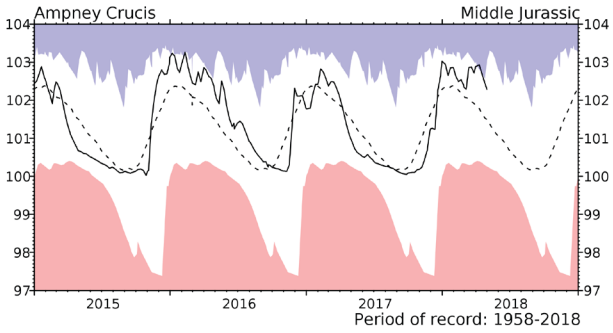


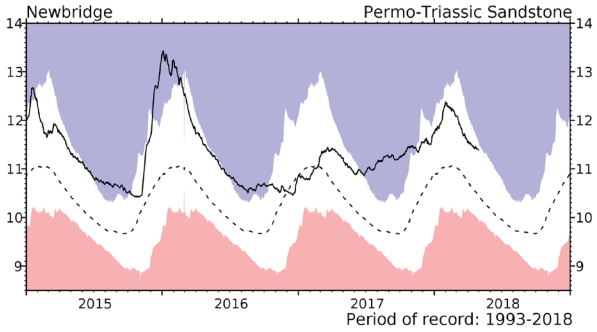


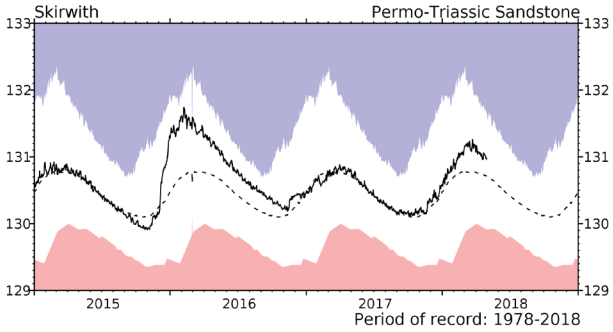
Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

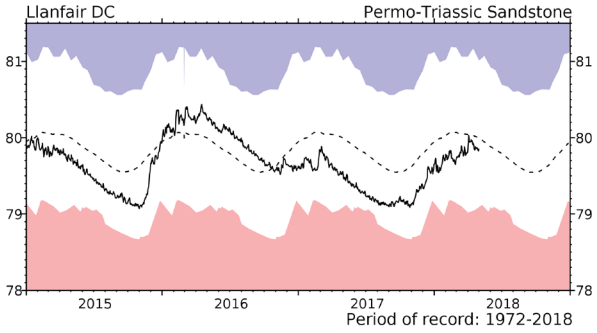
Groundwater … Groundwater

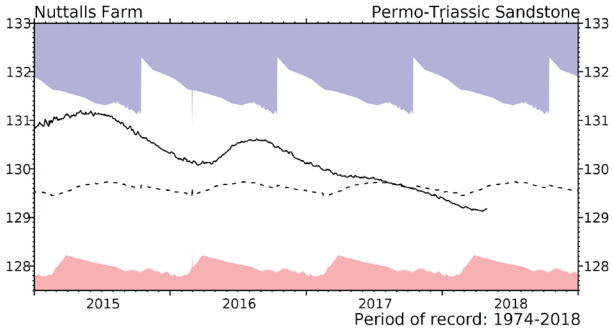


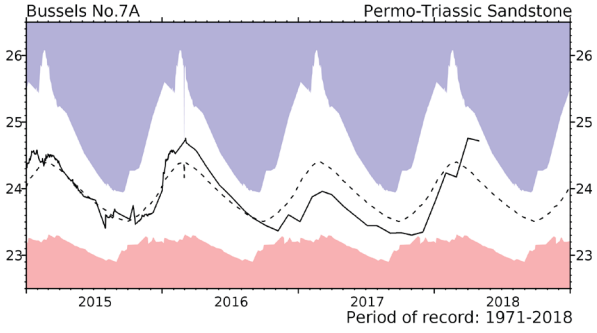


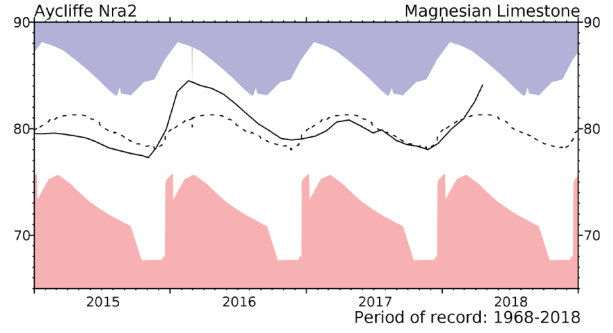


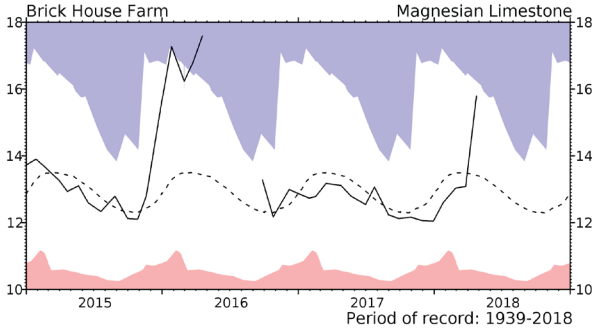


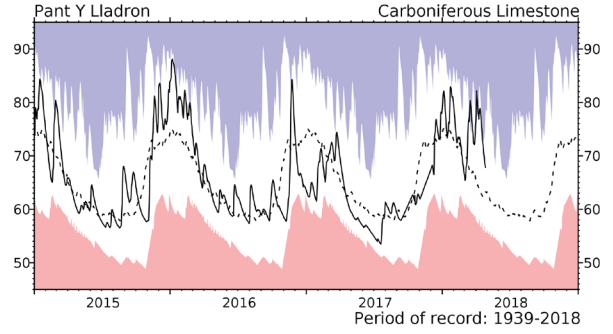


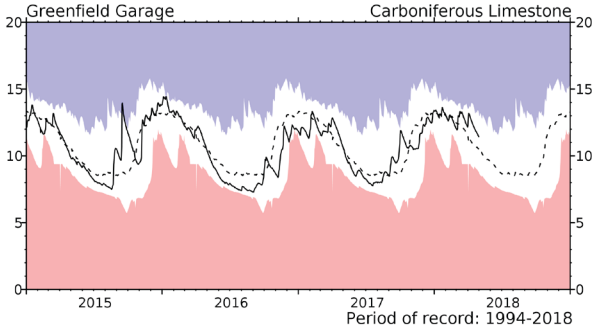


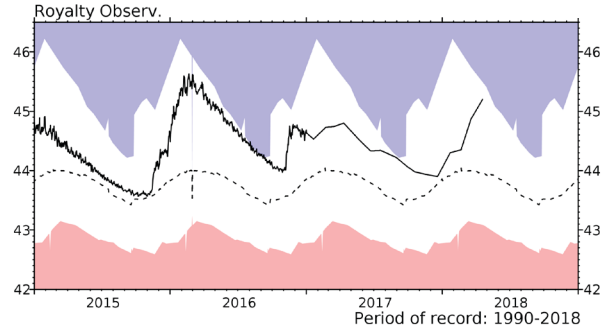


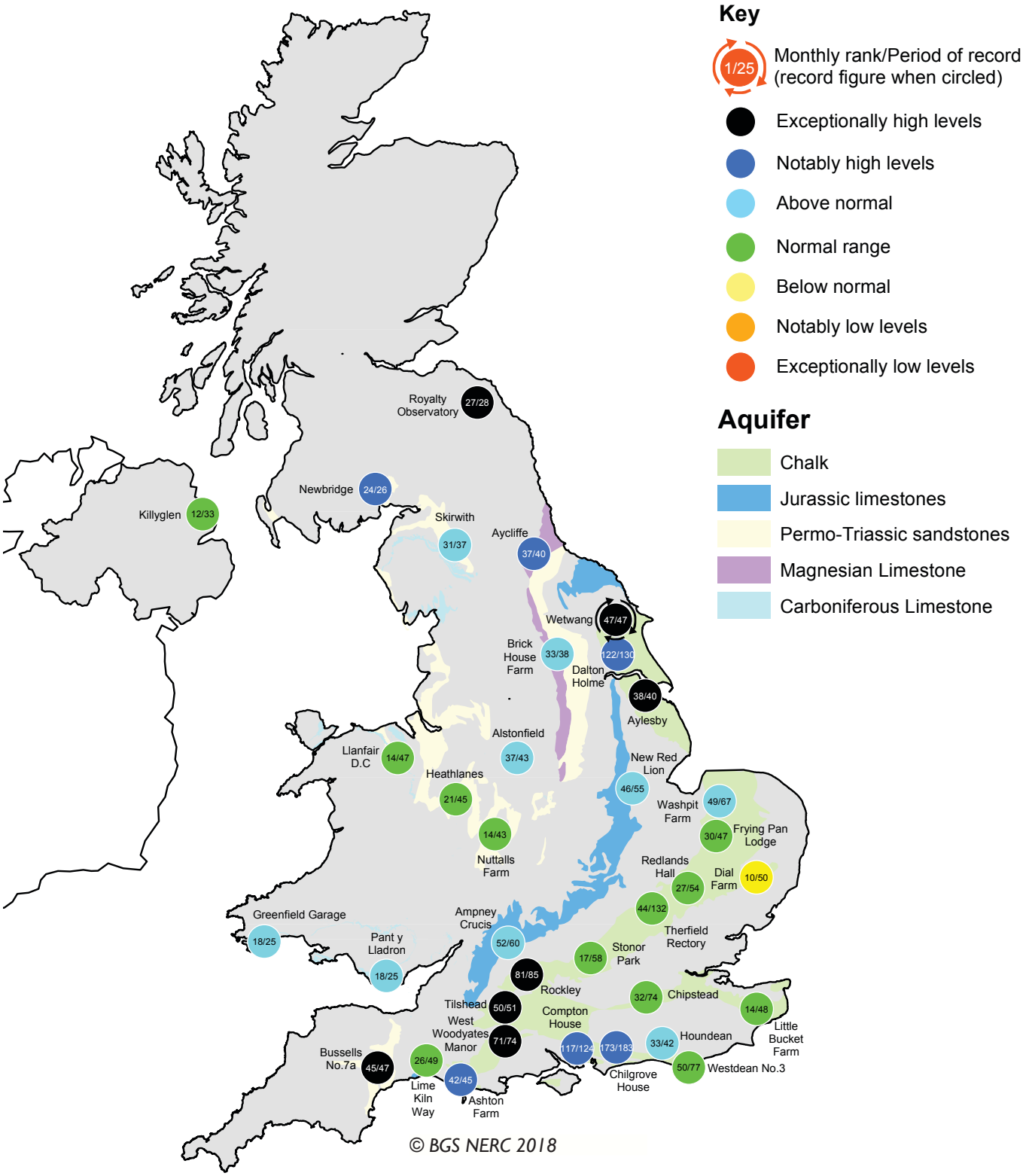










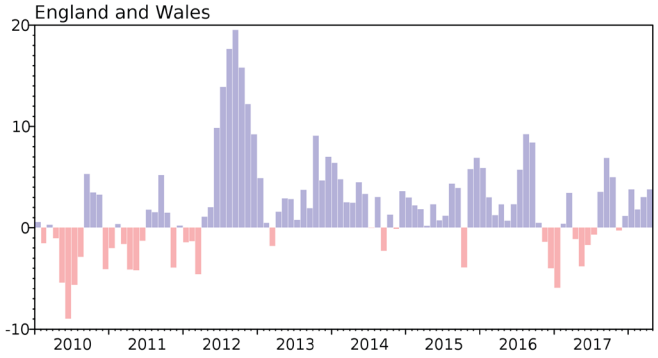


Groundwater levels - April 2018

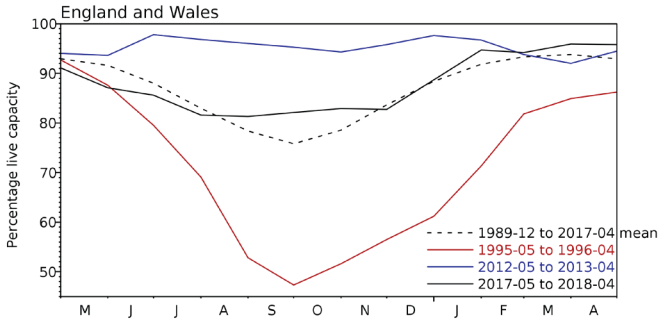
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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.

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



Percentage live capacity of selected reservoirs at end of month

Area	Reservoir		Capacity (Ml)	2018 Feb	2018 Mar	2018 Apr	Apr Anom.	Min Apr	Year* of min	2017 Apr	Diff 18-17
North West	N Command Zone	•	124929	86	83	86	-2	65	1984	86	0
	Vyrnwy		55146	96	100	100	7	70	1996	94	6
Northumbrian	Teesdale	•	87936	97	99	92	1	74	2003	78	14
	Kielder		(199175)	90	91	93	3	85	1990	89	5
Severn-Trent	Clywedog		49936	94	100	100	3	85	1988	100	0
	Derwent Valley	•	46692	91	100	98	6	54	1996	86	12
Yorkshire	Washburn	•	23373	96	99	95	5	76	1996	89	6
	Bradford Supply	•	40942	99	99	96	5	60	1996	84	12
Anglian	Grafham		(55490)	96	96	94	0	73	1997	96	-2
	Rutland		(116580)	93	95	97	5	72	1997	97	0
Thames	London	•	202828	95	96	98	3	86	1990	96	2
	Farmoor	•	13822	97	96	92	-5	81	2000	98	-5
Southern	Bewl		31000	88	100	99	10	60	2012	72	28
	Ardingly		4685	100	100	100	1	69	2012	100	0
Wessex	Clatworthy		5364	100	100	100	7	81	1990	91	9
	Bristol	•	(38666)	98	99	97	4	83	2011	93	4
South West	Colliford		28540	99	100	99	11	56	1997	84	15
	Roadford		34500	90	95	96	11	41	1996	74	22
	Wimbleball		21320	94	100	100	5	79	1992	91	9
	Stithians		4967	100	95	100	9	65	1992	94	6
Welsh	Celyn & Brenig	•	131155	99	100	100	2	75	1996	99	1
	Brianne		62140	98	100	97	0	86	1997	96	1
	Big Five	•	69762	94	96	95	2	85	2011	90	5
	Elan Valley	•	99106	98	99	99	3	83	2011	94	5
Scotland(E)	Edinburgh/Mid-Lothian	•	96518	97	99	98	5	62	1998	87	11
	East Lothian	•	9374	100	100	100	1	89	1992	99	1
Scotland(W)	Loch Katrine	•	110326	98	94	96	5	80	2010	88	8
	Daer		22412	99	91	92	-2	78	2013	79	13
	Loch Thom		10798	100	100	100	6	83	2010	87	13
Northern Ireland	Total+	•	56800	98	98	95	7	77	2007	87	8
	Silent Valley	•	20634	98	100	95	11	58	2000	82	14

( ) figures in parentheses relate to gross storage

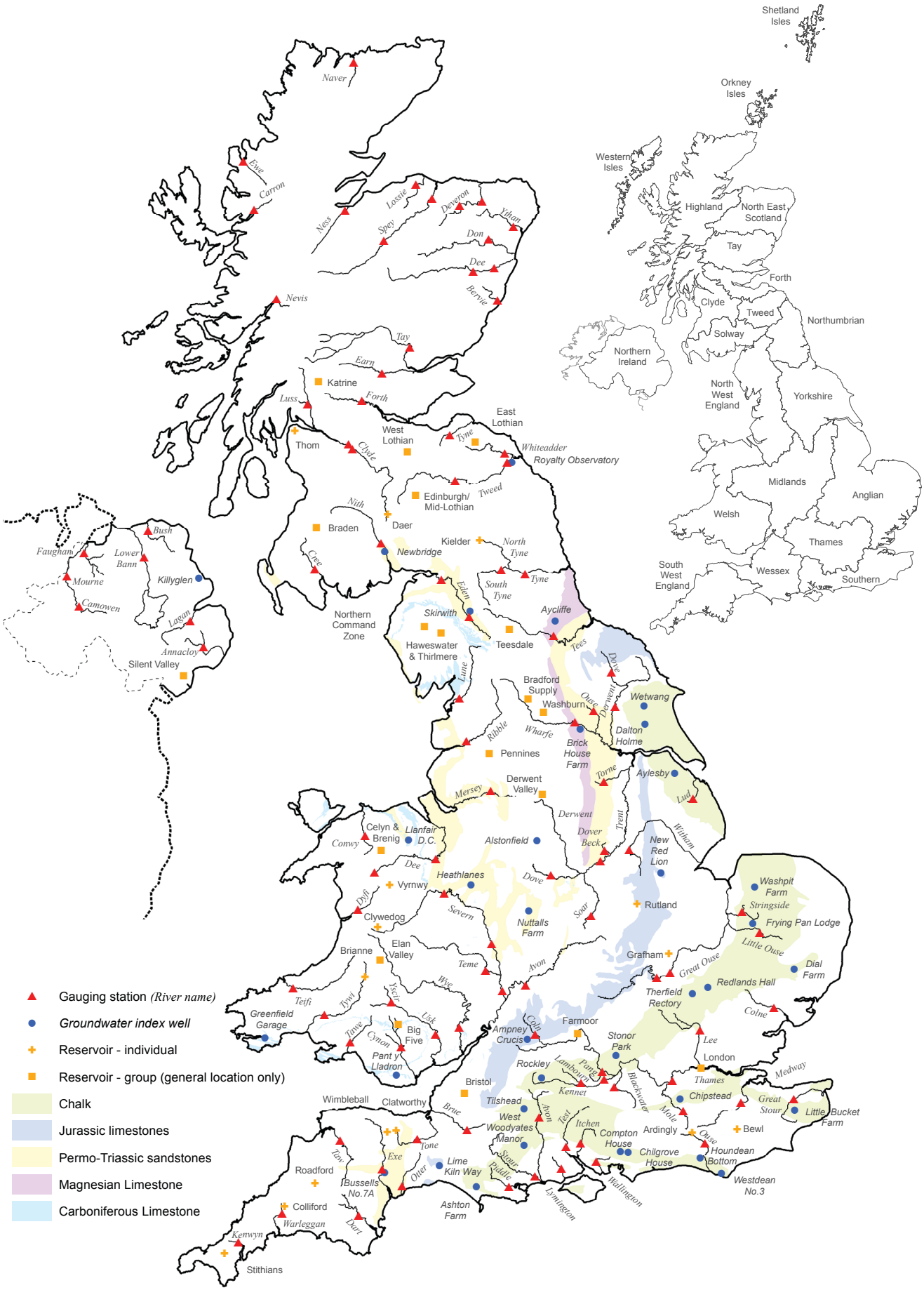
• denotes reservoir groups

*last occurrence

+ 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



NHMP

The National Hydrological Monitoring Programme (NHMP) was started in 1988 and is undertaken jointly by the Centre for Ecology & Hydrology (CEH) and the British Geological Survey (BGS). The NHMP aims to provide an authoritative voice on hydrological conditions throughout the UK, to place them in a historical context and, over time, identify and interpret any emerging hydrological trends. Hydrological analysis and interpretation within the Programme is based on the data holdings of the National River Flow Archive (NRFA; maintained by CEH) and National Groundwater Level Archive (NGLA; maintained by BGS), including rainfall, river flows, borehole levels, and reservoir stocks.

Data Sources

The NHMP depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged. River flow and groundwater level data are provided by the Environment Agency (EA), Natural Resources Wales - Cyfoeth Naturiol Cymru (NRW), the Scottish Environment Protection Agency (SEPA) and, for Northern Ireland, the Department for Infrastructure - Rivers 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).

Details of reservoir stocks are provided by the Water Service Companies, the EA, Scottish Water and Northern Ireland Water.

The Hydrological Summary and other NHMP outputs may also refer to and/or map soil moisture data for the UK. These data are provided by the Meteorological Office Rainfall and Evaporation Calculation System (MORECS). MORECS provides estimates of monthly soil moisture deficit in the form of averages over 40 x 40 km grid squares over Great Britain and Northern Ireland. The monthly time series of data extends back to 1961.

Rainfall data are provided by the Met Office. To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA, NRW and SEPA. The areal rainfall figures have been produced by the Met Office National Climate Information Centre (NCIC), and are based on 5km resolution gridded data from rain gauges. The majority of the full rain gauge network across the UK is operated by the EA, NRW, SEPA and Northern Ireland Water; supplementary rain gauges are operated by the Met Office. The Met Office NCIC monthly rainfall series extend back to 1910 and form 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/methods

Long-term averages are based on the period 1981-2010 and are derived from the monthly areal series.

The regional figures for the current month in the hydrological summaries are based on a limited rain gauge network so these (and the associated return periods) should be regarded as a guide only.

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

For further details on rainfall or MORECS data, please contact the Met Office:

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

Enquiries

Enquiries should be directed to the NHMP:

Tel: 01491 692599
Email: nhmp@ceh.ac.uk

A full catalogue of past Hydrological Summaries can be accessed and downloaded at:

http://nrfa.ceh.ac.uk/monthly-hydrological-summary-uk

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