Hydrological Summary

for the United Kingdom

June 2012

General

The persistent, and seasonally unusual, southerly track of the jet stream contributed to June weather conditions more typical of the late autumn. Record June rainfall totals were recorded in many areas and the reversal in the normal seasonal decline in runoff and aquifer recharge rates, which began in April, was dramatically accentuated. The record April-June rainfall has resulted in an almost complete termination of drought conditions (north-west Scotland aside – see below) and, very unusually for the summer, the focus of hydrological concern has switched decisively to the risk of flooding. Estimated June outflows from Great Britain also exceeded the previous maximum by a considerable margin and flood warnings – relating to both fluvial and flash flood risk – were both common and very widespread. The exceptional runoff rates impacted severely on property, transport, agriculture and leisure activities but the post-March runoff has also transformed the water resources outlook. Overall reservoir stocks for England & Wales registered their highest May-June increase in a series from 1988 and the early July level was appreciably above the previous maximum. Stocks in almost all index reservoirs are close to, or above, the normal early July level. The remarkable temporal contrast in rainfall amounts over the last ten months has caused an unprecedented shift in the aquifer recharge season. After very meagre winter replenishment, groundwater levels in responsive aquifer units have risen healthily through the late spring and early summer – in other areas, levels are set to rise as the recharge currently in the unsaturated zone reaches the water table.

Rainfall

June was a cool, cloudy month with synoptic patterns dominated by low pressure. Slow moving fronts and troughs brought pulses of rain, often intense, at regular intervals throughout the month; sequences of three or more dry days were rare in many areas. There were many notable storm totals, e.g.: a reported 48-hour total of 186mm on the 8/9th east of Aberystwyth; storm totals of around 50mm on the 21/22nd at a number of locations in Northern Ireland; a 24-hour total of 93.8mm at Blencathra (Cumbria) on the 22/23rd. On the 28th, torrential downpours of typically 25mm in 30 minutes resulted in widespread flash-flooding across parts of the Midlands and northern England. Intense convective rainfall made for substantial local variations in June rainfall totals but many areas reported more than twice of average with totals reaching 300% in some areas (e.g. in West Sussex). The UK reported its wettest June in a series from 1910 and accumulated rainfall totals since March are even more exceptional. At a national scale, the April-June rainfall established a new maximum by a considerable margin and, for England, the previous maximum was eclipsed by the equivalent of an extra month's rainfall. Correspondingly, long term rainfall deficiencies have been greatly reduced and 12-month rainfall totals are close to, or above, average (notably so in parts of Scotland). A few longer term deficiencies remain (e.g. in the west Midlands) and, with most frontal systems being deflected to the south, the Western Isles and parts of the Scottish mainland were again relatively dry – resulting in the interruption of whisky production on some islands (e.g. Mull and Islay).

River flows

June began with flows in most index rivers within the typical early summer range but, in contrast to the normal seasonal pattern, runoff rates increased dramatically and by the second week flood alerts were widespread across central and south-west Britain. In Wales, the Rheidol exceeded its previous maximum, on the 9th, in a 30-year record by a wide margin and flows in the neighbouring Ystwyth closely approached the maximum in a series from 1963. With the flooding accentuated by high tide levels, approximately 1000 people were evacuated from the Aberystwyth area. Flooding was widespread again on the 22-24th and further floodplain inundations occurred around the end of the month. The fluvial flooding was most severe in northern England, southern Scotland and the Midlands and was often accompanied by local flash flooding (with associated landslides in some areas) which contributed to severe transport disruption – the east and west coast mainlines to Scotland were both closed on the 28th. Rivers registering new maximum June runoff totals showed a very wide distribution from the Clyde to the Exe and the Bush to the Great Ouse. More notably, estimated outflows from England & Wales were around 30% greater than the previous highest for June in a 62-year series. June flows were however very depressed in some rivers in the western Highlands of Scotland (e.g. the Carron) and remain modest in some spring-fed rivers in southern England but across most of the country runoff rates were more typical of December than the early summer. 2007 provides the only modern parallel to the runoff transformation witnessed since the spring this year.

Groundwater

June rainfall was more than twice the 1971-2000 average across most of the major aquifers and end-of month soil moisture deficits, averaged across the Chalk outcrop, were the lowest in the MORECS series for June. Recharge, normally meagre in June, was substantial. The full impact of this seasonally rare groundwater replenishment will not be evident until the water currently in the unsaturated zone reaches the water table and this, combined with locally intense rainfall continuing into July, means that local groundwater flooding may become an issue in upcoming months. Notable recent high levels have been recorded in the Chalk for the western part of the South Downs and Dorset, with levels above, or approaching, the June maximum at Compton, Chilgrove and Ashton Farm. Last month, Killyglen in Northern Ireland appears to have registered both its lowest and highest June levels. A more muted rise typifies most of the Chalk aquifer, with levels at the slow-responding Lime Kiln Way and Hay Farm remaining very low. All the limestone boreholes showed significant rises, with levels above those previously recorded for June in the Cotswolds and the Peak District; levels at Alstonfield rose by more than 14m to over 3m above the previous June maximum. More muted responses were observed in the Magnesian Limestone and Lincolnshire Limestone where levels remain below the average for the month. In the Permo-Triassic sandstones Bussels and Yew Tree Farm are now approaching maximum levels, although levels continued to fall across some of the slow-responding sandstone boreholes, with a record June minimum being recorded at Heathlanes.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Percentages are from the 1971-2000 average.

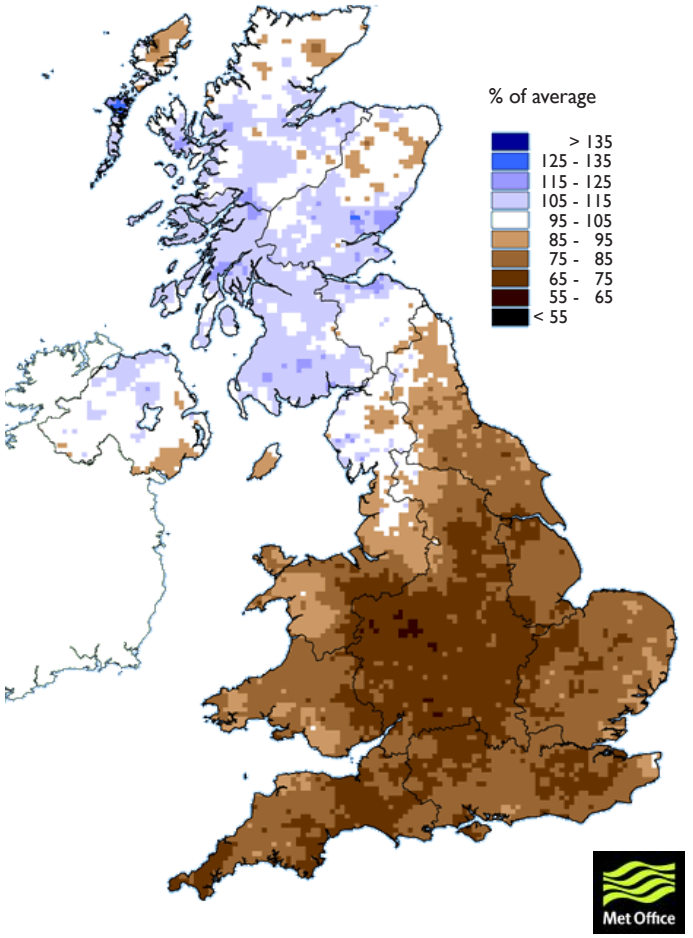
Area	Rainfall	June 2012	Apr12 - Jun12	RP	Jan12 - Jun12	RP	Jul11 - Jun12	RP	Apr10 - Jun12	RP
United Kingdom	mm	**145**	339		540		1222		2429	
	%	**209**	170	>>100	110	5-10	113	5-10	103	2-5
England	mm	**143**	329		446		853		1686	
	%	**232**	192	>>100	118	8-12	104	2-5	93	5-10
Scotland	mm	**129**	334		674		1781		3537	
	%	**164**	144	15-25	104	2-5	124	50-80	114	20-35
Wales	mm	**205**	443		655		1398		2809	
	%	**249**	185	>100	106	2-5	102	2-5	94	2-5
Northern Ireland	mm	**169**	294		494		1261		2556	
	%	**238**	140	10-15	97	2-5	114	8-12	105	2-5
England & Wales	mm	**151**	345		474		928		1841	
	%	**235**	191	>>100	115	5-10	104	2-5	93	5-10
North West	mm	**196**	374		587		1385		2732	
	%	**251**	177	>>100	113	5-10	118	5-10	107	2-5
Northumbria	mm	**164**	380		482		973		1971	
	%	**270**	214	>>100	124	10-15	117	5-10	107	2-5
Midlands	mm	**135**	316		421		730		1457	
	%	**217**	185	>100	117	5-10	96	2-5	86	15-25
Yorkshire	mm	**145**	354		478		899		1733	
	%	**232**	202	>>100	125	10-15	111	2-5	96	2-5
Anglian	mm	**104**	267		350		598		1216	
	%	**192**	183	>>100	124	10-15	99	2-5	90	5-10
Thames	mm	**139**	312		402		703		1371	
	%	**246**	194	>>100	122	10-15	100	2-5	88	5-10
Southern	mm	**130**	309		406		752		1529	
	%	**234**	197	>>100	115	2-5	96	2-5	89	5-10
Wessex	mm	**154**	349		459		872		1671	
	%	**256**	203	>>100	114	5-10	101	2-5	88	8-12
South West	mm	**170**	405		579		1198		2321	
	%	**235**	191	>>100	104	2-5	99	2-5	88	5-10
Welsh	mm	**202**	437		637		1346		2702	
	%	**252**	187	>100	107	2-5	102	2-5	94	5-10
Highland	mm	**76**	300		792		2097		4083	
	%	**85**	115	2-5	103	2-5	122	30-45	111	10-15
North East	mm	**111**	348		490		1136		2449	
	%	**169**	181	>100	113	2-5	120	5-10	117	8-12
Tay	mm	**144**	372		581		1577		3230	
	%	**208**	177	45-65	98	2-5	124	20-30	118	35-50
Forth	mm	**175**	374		566		1439		2925	
	%	**254**	189	>100	109	2-5	127	25-40	119	30-50
Tweed	mm	**190**	398		525		1261		2469	
	%	**292**	209	>>100	119	5-10	132	30-50	118	10-20
Solway	mm	**225**	390		702		1790		3565	
	%	**286**	166	50-80	112	5-10	127	70-100	117	40-60
Clyde	mm	**176**	353		780		2233		4330	
	%	**198**	137	5-10	102	2-5	129	60-90	116	25-40

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

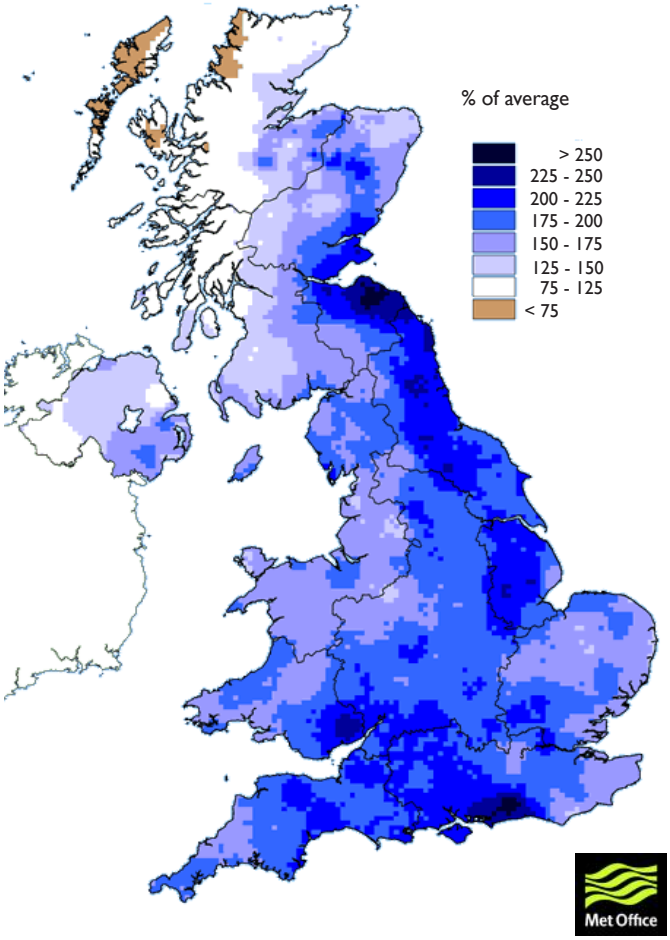
Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect climatic 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. All monthly rainfall totals since December 2011 are provisional.

Rainfall . . . Rainfall . . .

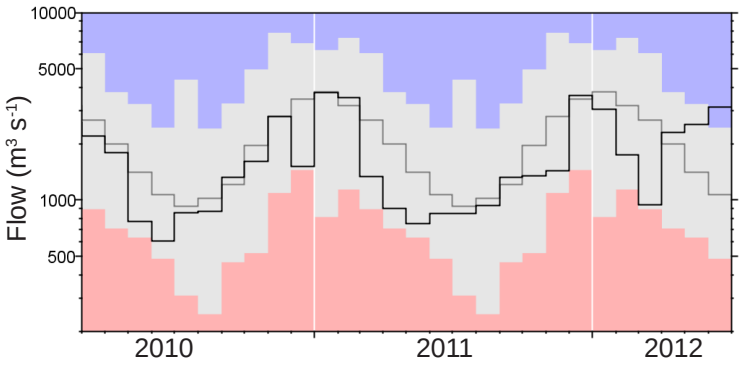
April 2010 - March 2012 rainfall as % of 1971-2000 average



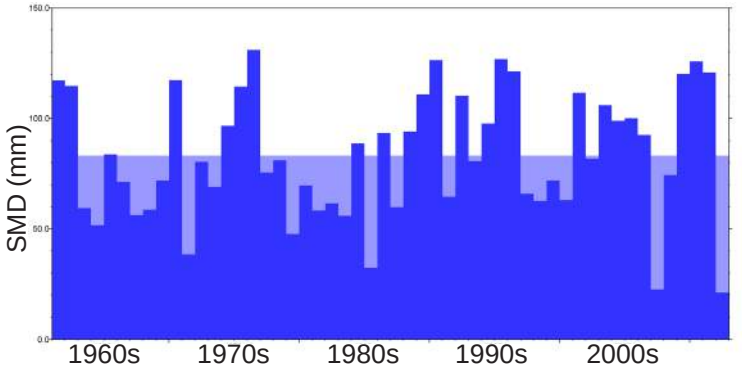
April 2012 - June 2012 rainfall as % of 1971-2000 average



Monthly outflows from England & Wales (with period of record maximima and minima)



MORECS end-of-June SMDs across the Chalk outcrop



Met Office 3-month outlook

Updated: July 2012

For UK-average rainfall, the predicted probabilities slightly favour above normal rainfall during both July and the July-August-September period, although the spread of possible outcomes is large. Consequently, confidence in this prediction is not high, and there is still a significant probability of below normal rainfall.

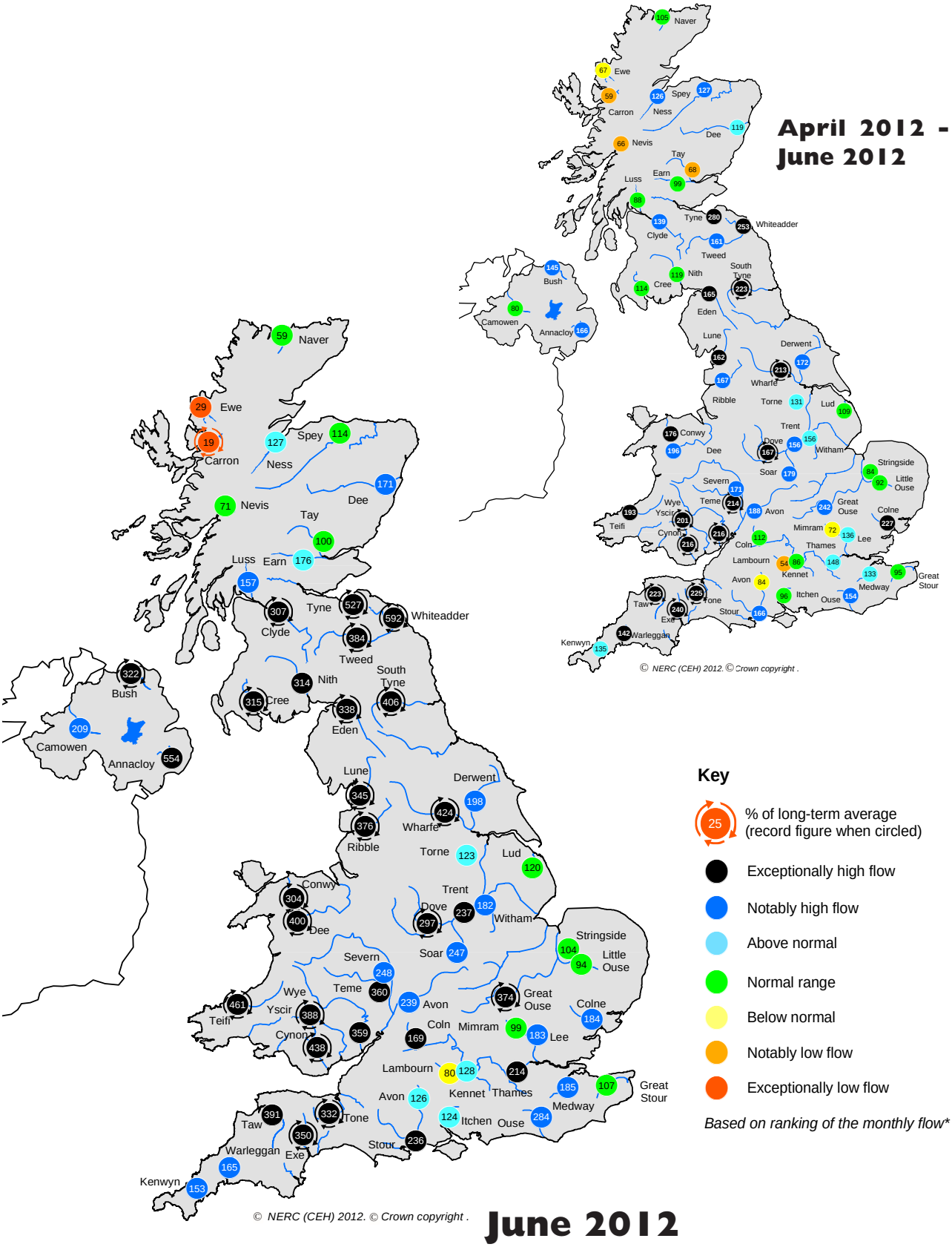
Recent wet weather, which has helped to substantially improve surface and groundwater resources across much of the country, is likely to continue into the first part of July. Indeed the forecast for July includes a significant probability of the monthly accumulation being above normal.

The probability that UK precipitation for July-August-September will fall into the driest of our five categories is around 20% whilst the probability that it will fall into the wettest of our five categories is also around 20% (the 1971-2000 climatological 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.

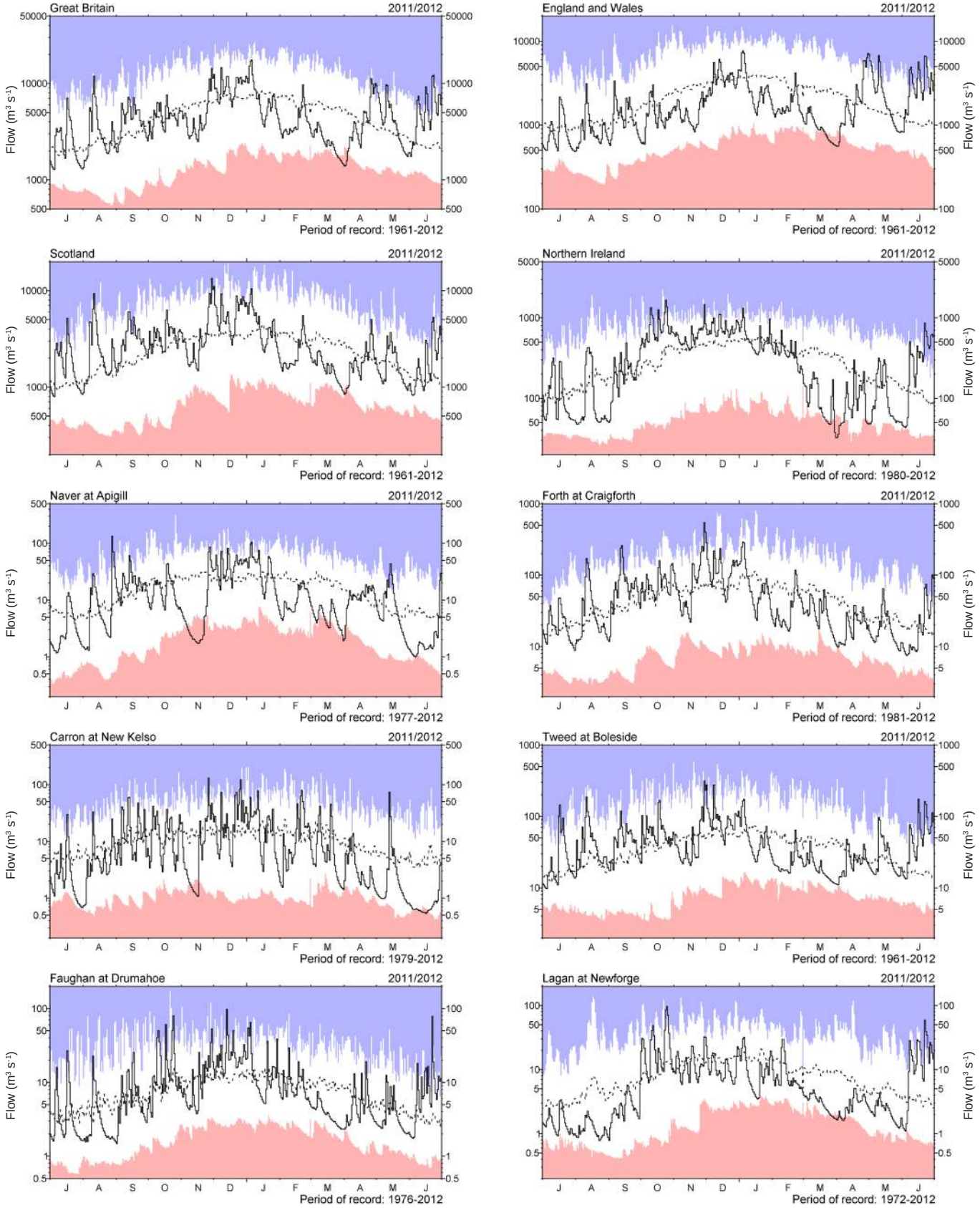
River flow . . . River flow . . .



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.

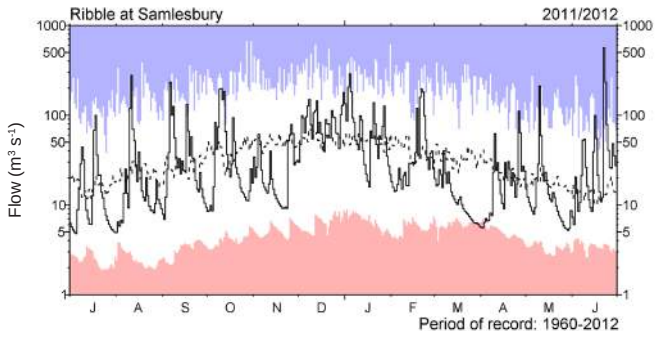
River flow . . . River flow . . .

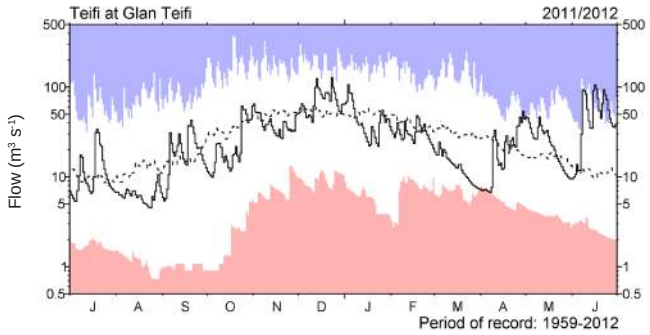


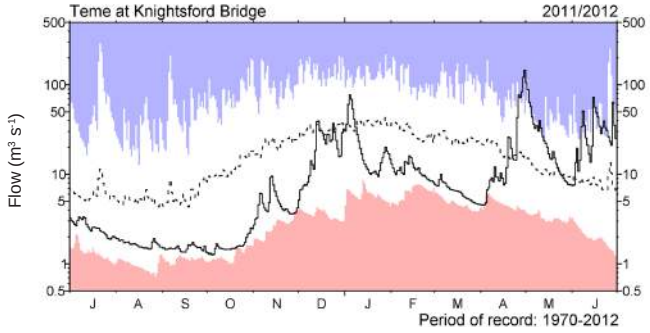
River flow hydrographs

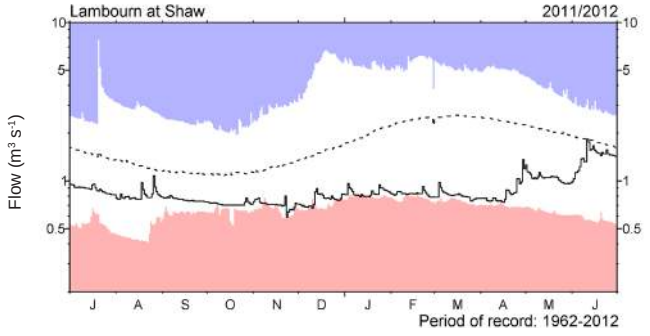
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to July 2011 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. Mean daily flows are shown as the dashed line.

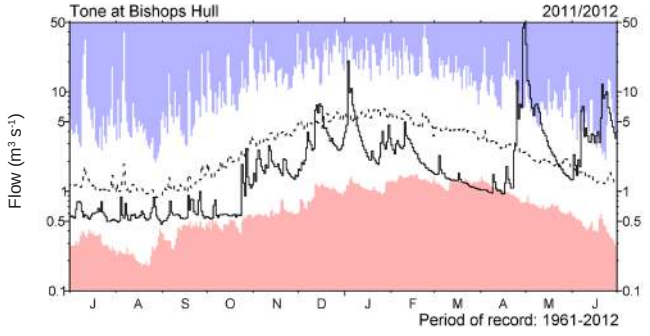
River flow . . .

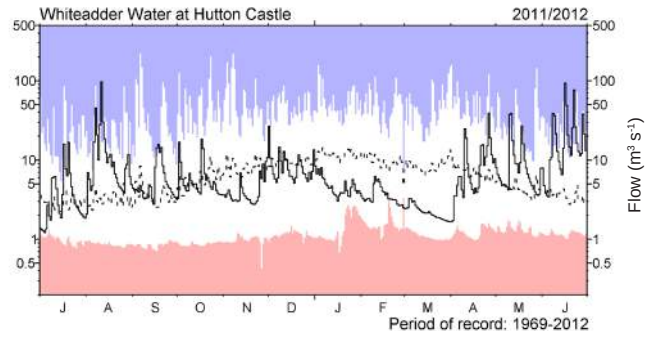


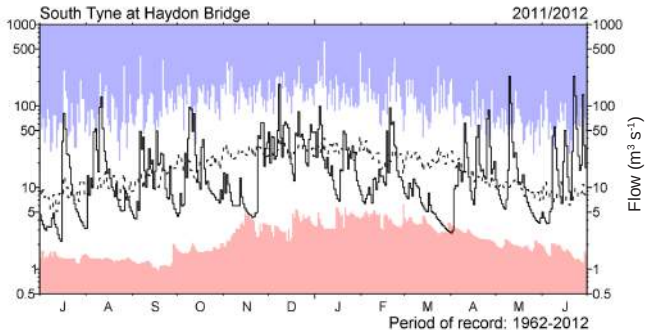


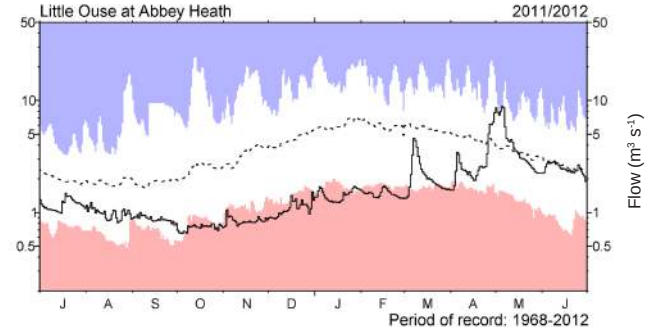


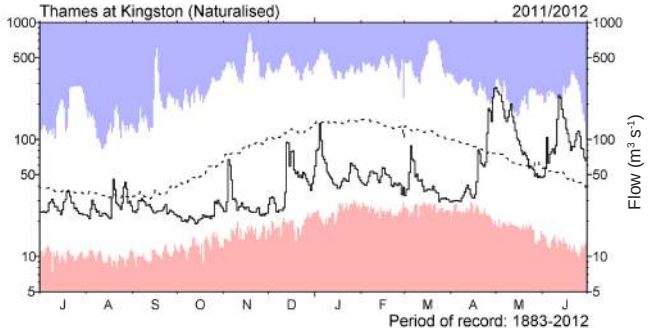


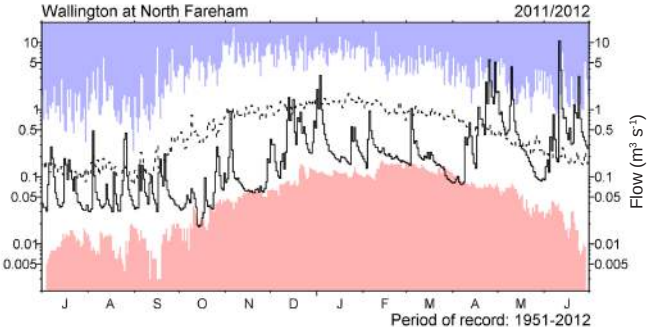












Notable runoff accumulations (a) April 2012 - June 2012, (b) February 2011 - June 2012, (c) May 2010 - June 2012

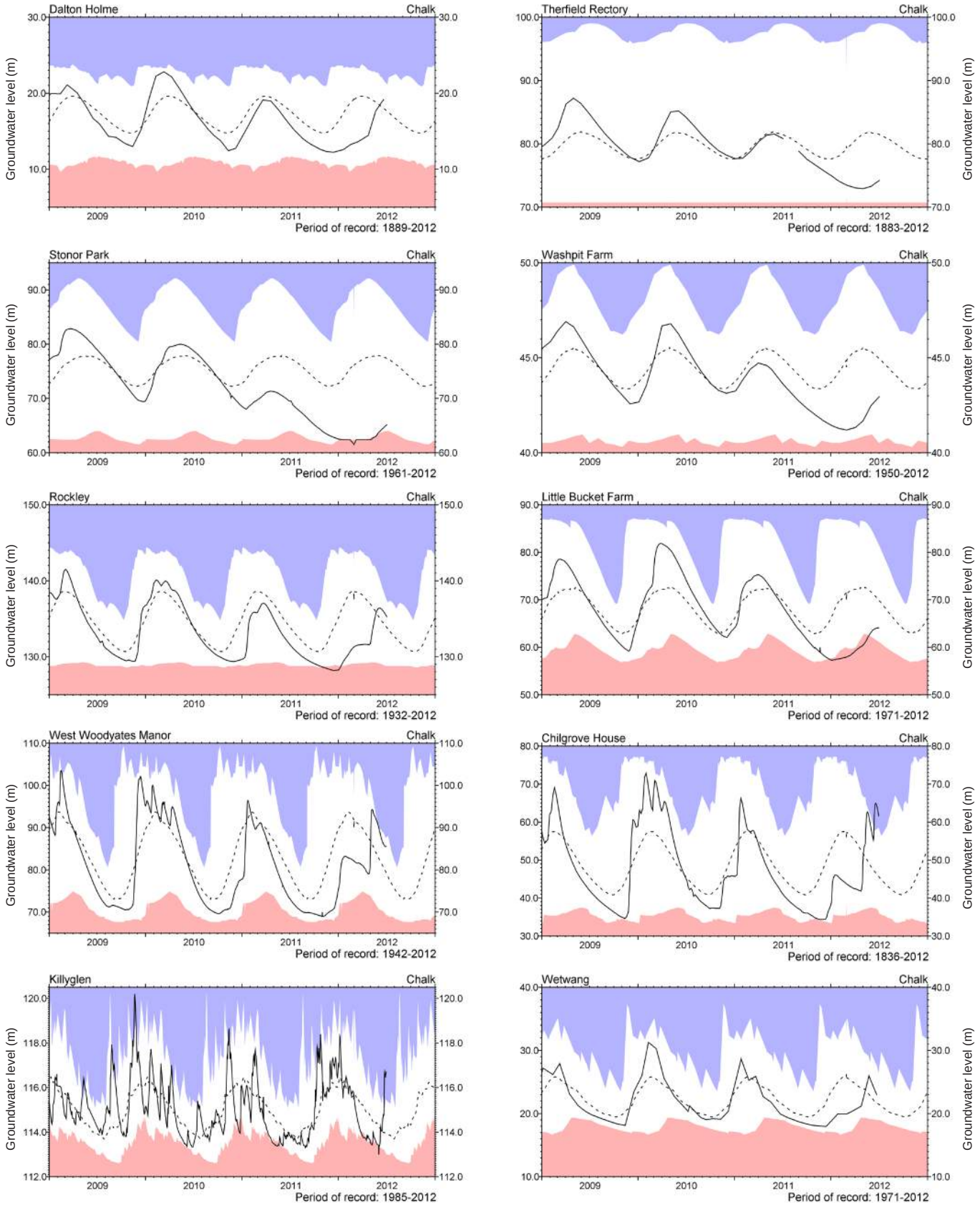
	River	%lta	Rank
a)	Ouse (Skelton)	215	42/42
	Mole	261	39/39
	Wallington	229	60/60
	Lymington	273	52/52
	Otter	188	50/50
	Dart	192	54/54
	Tawe	190	54/54
	Dyfi	230	45/45

	River	%lta	Rank
b)	Earn	131	63/64
	Medway	41	1/47
	Avon (Amesbury)	55	1/47
	Kenwyn	69	1/43
	Nith	125	53/54
	Clyde (Blairston)	135	49/49
	Mourne	124	29/29
	Bush	140	37/37

	River	%lta	Rank
c)	Kennet	65	2/49
	Coln	62	1/47
	Pang	58	2/42
	Stour	62	2/38
	Piddle	67	1/45
	Tone	69	2/50
	Brue	66	2/44
	Usk (Chain Bridge)	75	2/54

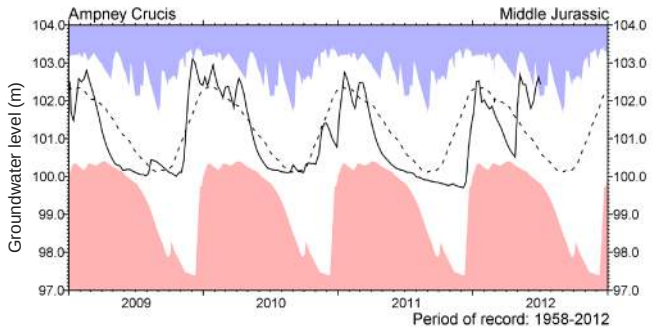
lta = long term average; Rank 1 = lowest on record

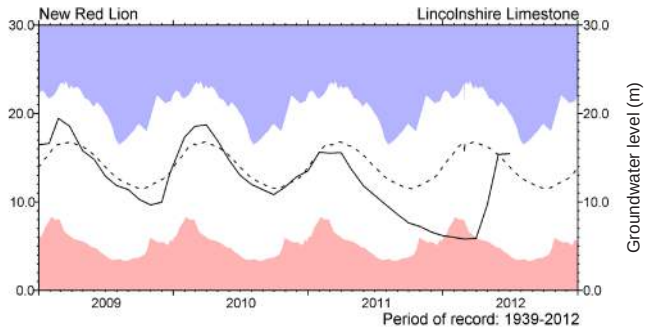
Groundwater . . . Groundwater

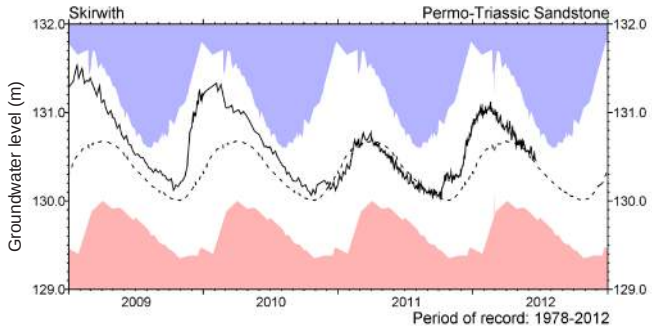


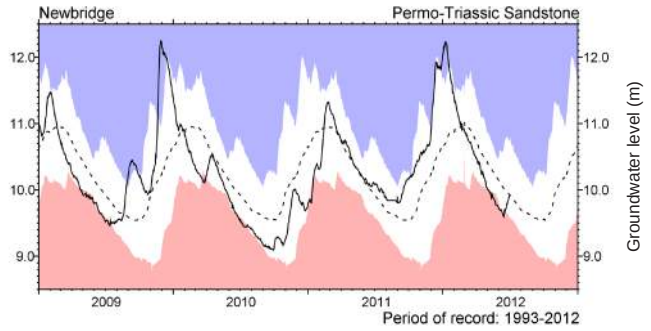
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

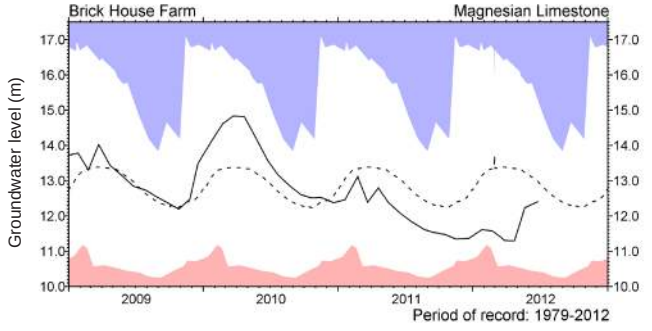
Groundwater . . . Groundwater

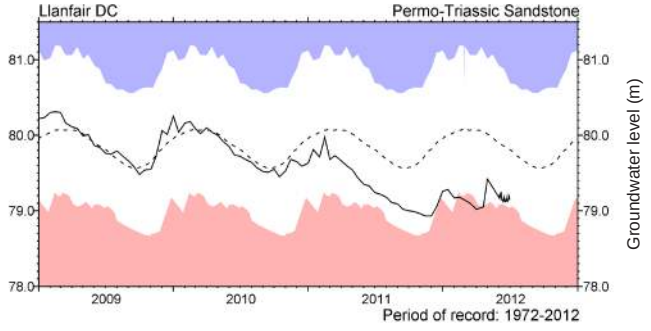


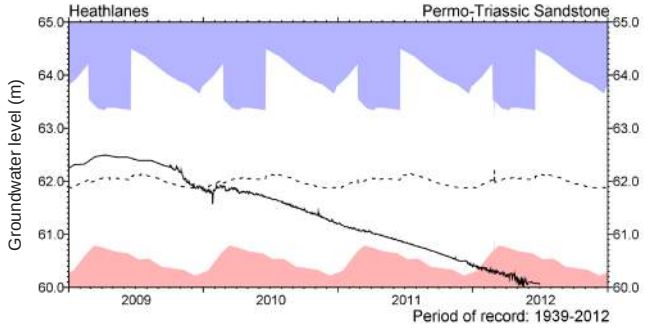


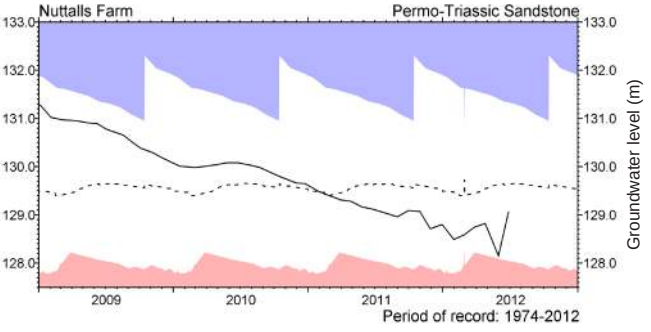


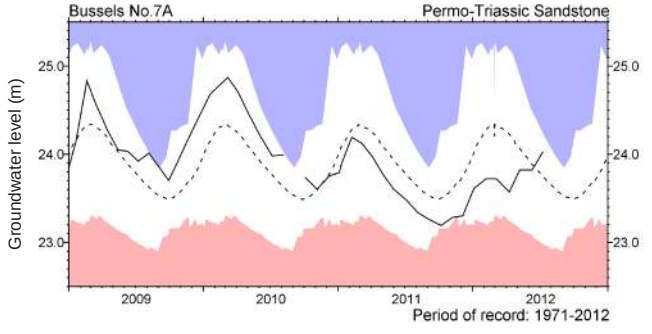


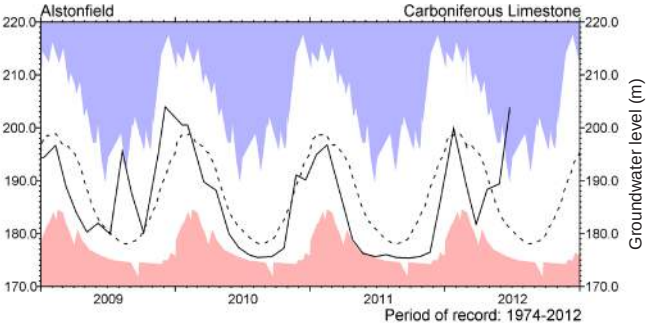










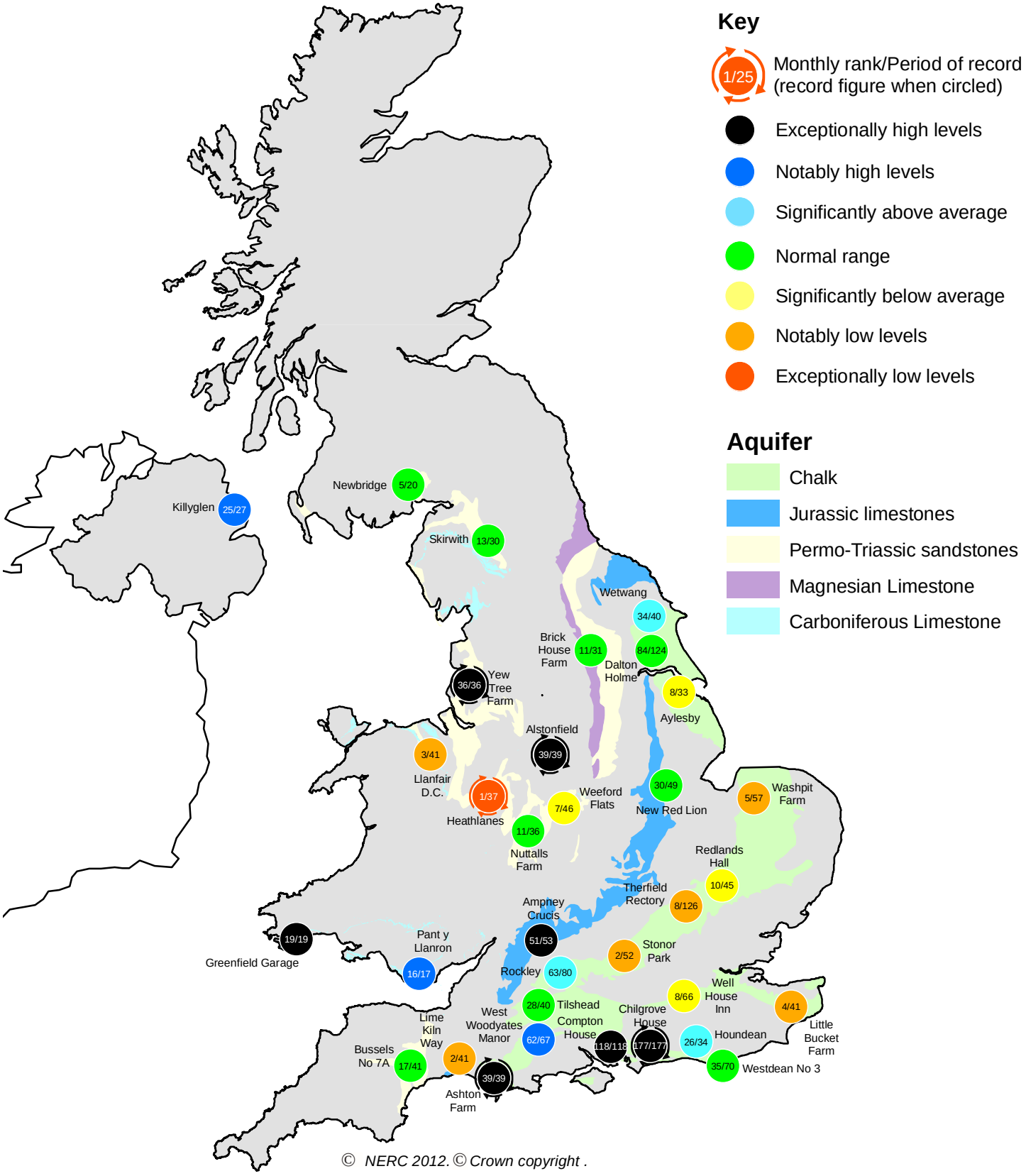


Groundwater levels June / July 2012

Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.	Borehole	Level	Date	Jun av.
Dalton Holme	19.16	20/06	18.10	Chilgrove House	61.40	30/06	46.01	Brick House Farm	12.40	25/06	13.10
Therfield Rectory	74.21	02/07	81.87	Killyglen (NI)	116.71	30/06	113.98	Llanfair DC	79.15	30/06	79.86
Stonor Park	65.12	02/07	77.63	New Red Lion	15.44	30/06	14.34	Heathlanes	60.06	30/06	62.15
Tilshead	88.24	30/06	87.64	Ampney Crucis	102.45	02/07	100.84	Nuttalls Farm	129.06	27/06	129.65
Rockley	135.27	02/07	134.55	Newbridge	9.91	30/06	9.99	Bussels No.7a	24.02	08/07	23.86
Well House Inn	93.37	02/07	96.45	Skirwith	130.44	20/06	130.51	Alstonfield	203.70	25/06	181.39
West Woodyates	85.54	30/06	80.87	Morris Dancers	30.68	26/06	32.11				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



Groundwater levels - June 2012

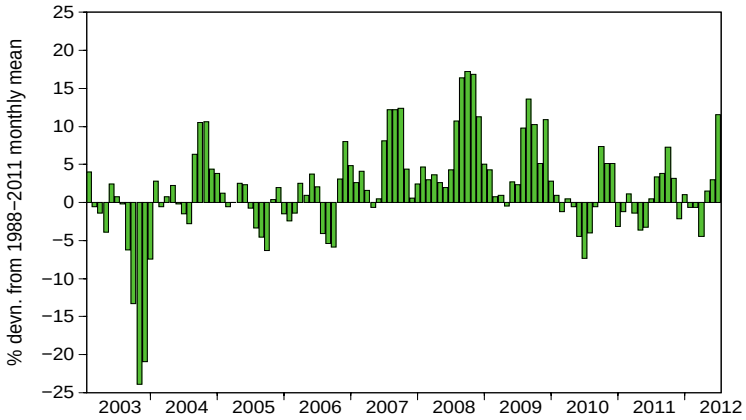
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. Rankings – and the designation of period of record maxima and minima – need to be interpreted with caution; where the latest monthly mean values are based on one or two level measurements only, their recording dates can be very influential, particularly during periods of relatively rapid change. Rankings may be omitted where they are considered misleading.

Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

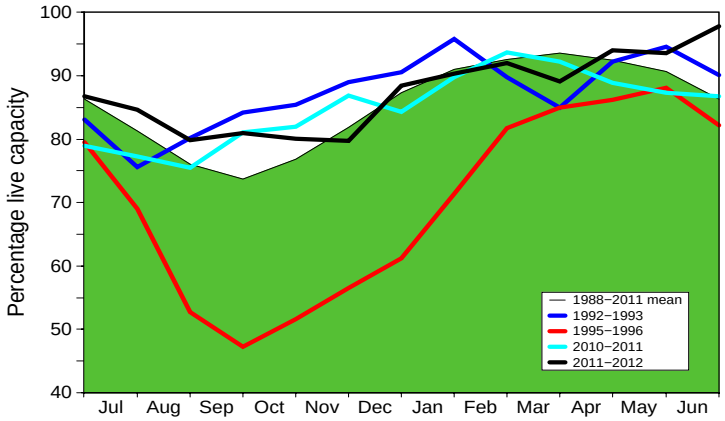
ii. Yew Tree Farm levels are now received quarterly.

Reservoirs . . . Reservoirs . . .

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

Percentage live capacity of selected reservoirs at start of month

Area	Reservoir		Capacity (Ml)	2012 May	June	July	July Anom.	Min July	Year* of min	2011 July	Diff 12-11
North West	N Command Zone	•	124929	83	80	**95**	23	52	2010	83	12
	Vyrnwy		55146	100	94	**99**	17	65	1990	86	13
Northumbrian	Teesdale	•	87936	100	90	**100**	21	58	1989	93	7
	Kielder		(199175)	91	93	**99**	9	71	1989	94	5
Severn Trent	Clywedog		44922	99	100	**98**	4	72	1989	100	-2
	Derwent Valley	•	39525	99	96	**100**	21	53	1996	63	37
Yorkshire	Washburn	•	22035	100	94	**96**	15	63	1995	72	24
	Bradford supply	•	41407	98	92	**99**	21	54	1995	73	26
Anglian	Grafham		(55490)	96	95	**96**	3	70	1997	93	3
	Rutland		(116580)	85	95	**98**	10	75	1997	81	17
Thames	London	•	202828	98	98	**98**	6	85	1990	95	3
	Farmoor	•	13822	97	99	**98**	1	94	1995	100	-2
Southern	Bewl		28170	60	79	**91**	9	52	1990	73	18
	Ardingly*		4685	69	89	**100**	5	82	2005	84	16
Wessex	Clatworthy		5364	100	96	**100**	18	61	1995	71	29
	Bristol WW	•	(38666)	91	96	**97**	15	64	1990	73	24
South West	Colliford		28540	79	80	**83**	2	51	1997	66	17
	Roadford		34500	85	85	**89**	8	49	1996	60	29
	Wimbleball		21320	100	99	**100**	15	63	2011	63	37
	Stithians		4967	90	93	**95**	16	53	1990	71	24
Welsh	Celyn and Brenig	•	131155	100	100	**100**	6	77	1996	97	3
	Brianne		62140	100	98	**100**	8	76	1995	89	11
	Big Five	•	69762	100	96	**100**	16	61	1989	87	13
	Elan Valley	•	99106	100	95	**100**	11	75	1989	85	15
Scotland(E)	Edinburgh/Mid Lothian	•	97639	95	94	**97**	11	54	1998	91	6
	East Lothian	•	10206	100	100	**100**	6	81	1992	94	6
Scotland(W)	Loch Katrine	•	111363	89	80	**73**	-7	55	2010	95	-22
	Daer		22412	100	98	**100**	16	62	1994	99	1
	Loch Thom	•	11840	97	93	**93**	7	69	2000	100	-7
Northern Ireland	Total+	•	56920	84	82	**96**	14	61	2008	82	14
	Silent Valley	•	20634	80	76	**100**	23	54	1995	78	22

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

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 1988-2011 period except for West of Scotland and Northern Ireland where data commence in the mid-1990's. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

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

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. 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, the Environment Agency Wales, the Scottish Environment Protection Agency and, for Northern Ireland, the Rivers Agency and the Northern Ireland Environment Agency. In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).
Reservoir level information is provided by the Water Service Companies, the EA, Scottish Water and 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 Fax: 0870 900 5050
E-mail: enquiries@metoffice.com

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

Enquiries

Enquiries should be addressed to:

Hydrological Summaries for the UK
Centre for Ecology & Hydrology
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB

Tel.: 01491 838800
Fax: 01491 692424
E-mail: nrfa@ceh.ac.uk

Selected text and maps are available on the WWW at
http://www.ceh.ac.uk/data/nrfa/nhmp/nhmp.html
Navigate via Hydrological Summary for the UK.

NATURAL ENVIRONMENT RESEARCH COUNCIL

07/12