# Hydrological Summary

## *for the United Kingdom*

May 2020

### General

May was exceptionally dry and sunny (the sunniest for any month since records began in 1929), reducing soil moisture to record-breaking lows, and continuing widespread river flow recessions. Total rainfall was around half the average for the UK as a whole and less than a quarter across much of England and Wales. It was the driest May on record for England & Wales, which concluded the third driest spring (March-May), both in series from 1910. Wildfires were reported in several locations around the UK. River flows were mostly below average and new May monthly minima were established on some rivers, especially in Wales. The continued dry conditions further increased soil moisture deficits (SMDs) to their driest for the end of May for the UK (in a series from 1961). Groundwater levels fell across the UK but at month-end were generally in the normal range or above due to the wet winter. Reservoir stocks fell, and were at their lowest recorded for the end of May for England & Wales as a whole (in a series from 1990). With river flows low and reservoir stocks depleted entering the summer, there is potential for continued agricultural stress, and an increased pressure on water resources in some northern and western areas. Current seasonal outlooks suggest persistence of below normal flows across much of the UK (although early June has been more unsettled with some heavy rainfall).

### Rainfall

Sunshine and showers gave way to building high pressure during the first week of May, heralding a return to the low rainfall that dominated April. Cooler and then changeable spells mid-month brought some rain (although without notable daily totals) particularly to the north-west, but an anticyclonic system spreading in from the south established dry conditions for most. On 22nd-23rd, an Atlantic low pressure system brought heavy rain to western Scotland with some substantial daily totals (e.g. 97mm at Achnagart, Inverness-shire, on 23rd). Thereafter, high pressure returned. As a result of the predominantly dry weather, total rainfall was below average in most parts of the UK (less than 25% across much of England and Wales) making it the fifth driest May for the UK in a series from 1910. The driest regions relative to their average were Thames (7%) and Wessex (9%), with Severn-Trent, Anglian and Southern regions and Wales also registering their driest May (all in series from 1910). Only the Highland region received above average rainfall (132%). As dry conditions persisted, it was the driest April-May for England & Wales on record, and for the UK, total spring rainfall (March-May) was 61% of average, making it the fourth driest spring on record. The Northumbria, Yorkshire and North East (Scotland) regions each recorded their driest spring, also in series from 1910.

### River flows

Across much of the UK, river flows continued the recessions that began in mid-March, steeply at first as responses to moderate rainfall at the end of April receded, and with some interruptions on the 22nd, particularly in the west. Protracted low flows established new daily minima for responsive rivers in northern and western parts of the UK, some for considerable periods including the Teifi (in a series from 1959) and the Taw which was near or below its previous daily minimum for much of the month (in a series from 1958). By contrast, following heavy rain, some catchments in north-west Scotland saw new monthly maxima on the 23rd (the Oykel and the Nevis, in series from 1978 and 1983, respectively). Mean monthly river flows for May were mostly below average (many notably or exceptionally low) and new minima were established in some catchments, including the Tweed, the Cumbrian Derwent and the Tywi (all in series of at least 50 years), with flows on the Tywi eclipsing the previous minimum established in 1984, a notable drought year. The Annacloy recorded just 7% of its average May flow (the second lowest in a series from 1979), and May outflows for Wales were comparable with those of 1984. In north-west Scotland and south-east England, however, May flows were sustained by rainfall and groundwater respectively, and were normal or above normal. The recessions established over the spring resulted in exceptionally low flows across northern and western parts of the UK; numerous catchments recorded less than a quarter of their respective April-May averages. Notable amongst the new minima was the English Leven with a long series from 1939, and an average April-May flow that eclipsed the previous minimum by a wide margin. Outflows from the UK were the second lowest (behind 2017) for the two month period from April to May (in a series from 1980), with three of the four lowest outflows occurring in the last four years.

### Groundwater*

Soils dried markedly during May, remaining drier than average across the UK, and establishing new end-May maximum SMDs for the country as a whole. In the Chalk, groundwater levels receded everywhere, except at Therfield Rectory where they continued to rise slowly due to the delayed response. However, levels varied between below normal (at Redlands Hall) and notably high (at Little Bucket Farm). In the Jurassic limestones, levels fell and at month-end were below normal at Ampney Crucis, and normal at New Red Lion. In the Carboniferous Limestone, data were only available for south Wales, where levels fell and at month-end were notably low. In the Permo-Triassic sandstones, levels fell at all sites but generally remained above average, except at Annan where they were notably low; the other sites varied from above normal at Bussells No.7a and Newbridge to exceptionally high at Skirwith, Weir Farm and Nuttalls Farm. In the Upper Greensand at Lime Kiln Way, levels fell, but remained notably high for the time of year. In the Devonian sandstones of Scotland, levels fell and were in the normal range.

**Note: Due to COVID-19 restrictions, data were unavailable for several sites, including those in the Magnesian Limestone and Fell Sandstone.*

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# Rainfall . . . Rainfall . . .

## Rainfall accumulations and return period estimates

Percentages are from the 1981-2010 average.

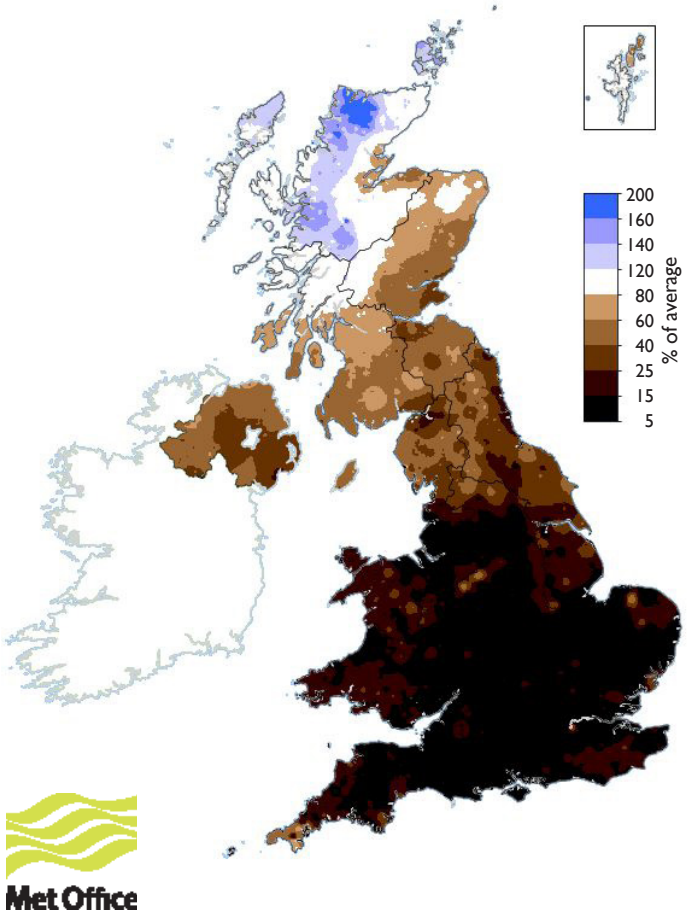
| Region | Rainfall | May 2020 | Apr20– May20 | RP | Mar20 – May20 | RP | Dec19 – May20 | RP | Jun19 – May20 | RP |
|---|---|---|---|---|---|---|---|---|---|---|
| United Kingdom | mm | **33** | 62 | | 140 | | 610 | | 1325 | |
| | % | **48** | 45 | 70-100 | 61 | 40-60 | 109 | 5-10 | 117 | 40-60 |
| England | mm | **10** | 38 | | 87 | | 416 | | 1024 | |
| | % | **17** | 33 | >100 | 49 | 80-120 | 102 | 2-5 | 121 | 10-20 |
| Scotland | mm | **76** | 104 | | 228 | | 905 | | 1751 | |
| | % | **96** | 63 | 10-20 | 75 | 2-5 | 118 | 15-25 | 115 | 25-40 |
| Wales | mm | **14** | 55 | | 149 | | 761 | | 1670 | |
| | % | **17** | 33 | 50-80 | 53 | 30-50 | 108 | 2-5 | 118 | 10-20 |
| Northern Ireland | mm | **31** | 57 | | 125 | | 525 | | 1223 | |
| | % | **42** | 38 | 50-80 | 52 | 40-60 | 94 | 2-5 | 107 | 5-10 |
| England & Wales | mm | **10** | 40 | | 95 | | 463 | | 1112 | |
| | % | **17** | 33 | >100 | 49 | 80-120 | 103 | 2-5 | 120 | 10-20 |
| North West | mm | **21** | 42 | | 128 | | 673 | | 1529 | |
| | % | **29** | 29 | 70-100 | 53 | 40-60 | 114 | 5-10 | 125 | 40-60 |
| Northumbria | mm | **22** | 27 | | 79 | | 350 | | 1030 | |
| | % | **40** | 23 | >>100 | 43 | >>100 | 84 | 2-5 | 118 | 10-15 |
| Severn-Trent | mm | **7** | 33 | | 74 | | 374 | | 1022 | |
| | % | **12** | 28 | >100 | 43 | 80-120 | 100 | 2-5 | 130 | 30-50 |
| Yorkshire | mm | **14** | 24 | | 69 | | 386 | | 1050 | |
| | % | **26** | 21 | >>100 | 38 | >>100 | 95 | 2-5 | 124 | 10-20 |
| Anglian | mm | **5** | 29 | | 51 | | 256 | | 703 | |
| | % | **10** | 30 | >100 | 37 | 80-120 | 90 | 2-5 | 112 | 5-10 |
| Thames | mm | **4** | 45 | | 87 | | 366 | | 832 | |
| | % | **7** | 42 | 25-40 | 55 | 10-20 | 106 | 2-5 | 116 | 5-10 |
| Southern | mm | **6** | 50 | | 102 | | 441 | | 944 | |
| | % | **11** | 47 | 10-20 | 62 | 5-10 | 113 | 2-5 | 118 | 5-10 |
| Wessex | mm | **6** | 56 | | 113 | | 481 | | 1051 | |
| | % | **9** | 47 | 15-25 | 61 | 10-15 | 110 | 2-5 | 119 | 5-10 |
| South West | mm | **13** | 54 | | 143 | | 676 | | 1489 | |
| | % | **17** | 35 | 40-60 | 58 | 10-20 | 108 | 2-5 | 121 | 10-20 |
| Welsh | mm | **13** | 54 | | 143 | | 727 | | 1612 | |
| | % | **16** | 33 | 50-80 | 52 | 40-60 | 107 | 2-5 | 118 | 10-20 |
| Highland | mm | **115** | 154 | | 322 | | 1158 | | 2044 | |
| | % | **132** | 82 | 2-5 | 89 | 2-5 | 123 | 15-25 | 113 | 10-20 |
| North East | mm | **53** | 71 | | 109 | | 422 | | 1086 | |
| | % | **81** | 54 | 20-30 | 52 | >>100 | 88 | 2-5 | 107 | 2-5 |
| Tay | mm | **60** | 82 | | 169 | | 783 | | 1552 | |
| | % | **76** | 53 | 15-25 | 62 | 15-25 | 115 | 5-10 | 116 | 10-20 |
| Forth | mm | **43** | 59 | | 150 | | 708 | | 1454 | |
| | % | **62** | 43 | 50-80 | 62 | 10-20 | 118 | 10-20 | 121 | 40-60 |
| Tweed | mm | **34** | 43 | | 122 | | 547 | | 1263 | |
| | % | **52** | 33 | 80-120 | 58 | 25-40 | 110 | 5-10 | 123 | 30-50 |
| Solway | mm | **46** | 66 | | 166 | | 818 | | 1760 | |
| | % | **56** | 38 | 40-60 | 56 | 15-25 | 111 | 8-12 | 118 | 40-60 |
| Clyde | mm | **75** | 105 | | 265 | | 1148 | | 2182 | |
| | % | **84** | 56 | 10-20 | 75 | 2-5 | 126 | 25-40 | 120 | 40-60 |

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

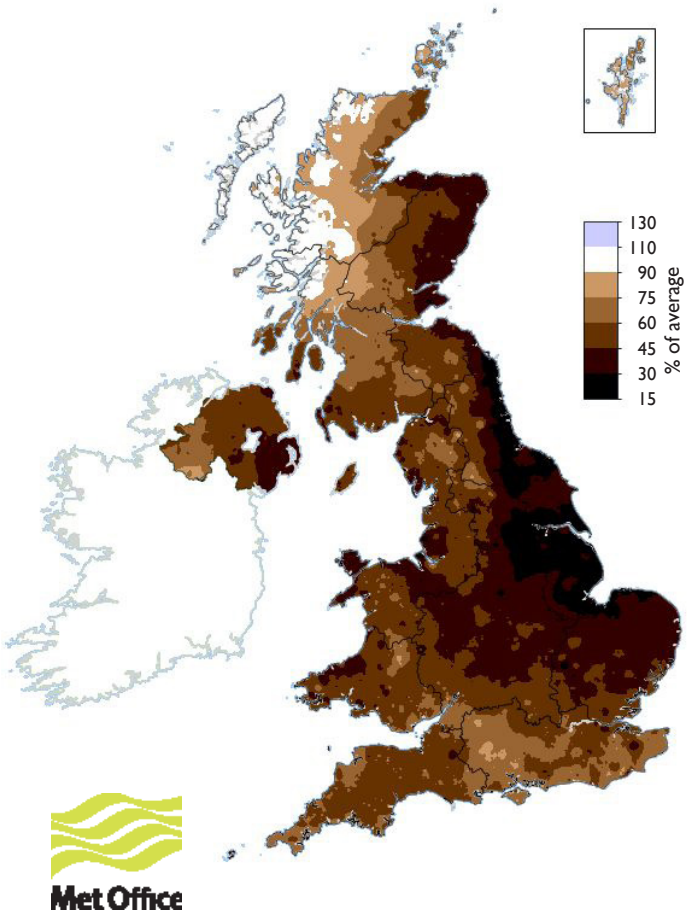
**Important note:** Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and reflect 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 2018 are provisional.

# *Rainfall . . . Rainfall . . .*

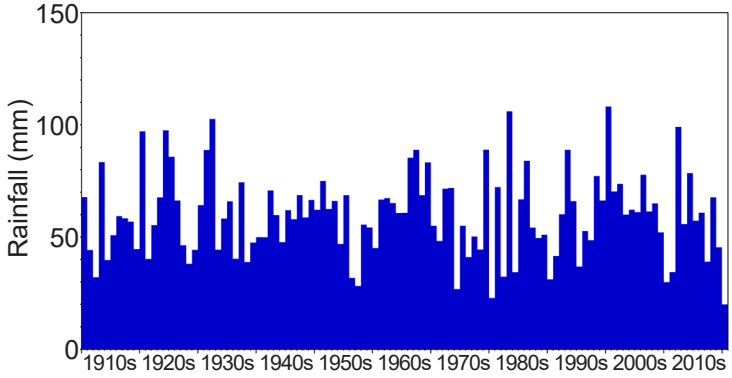
**May 2020 rainfall**
**as % of 1981-2010 average**



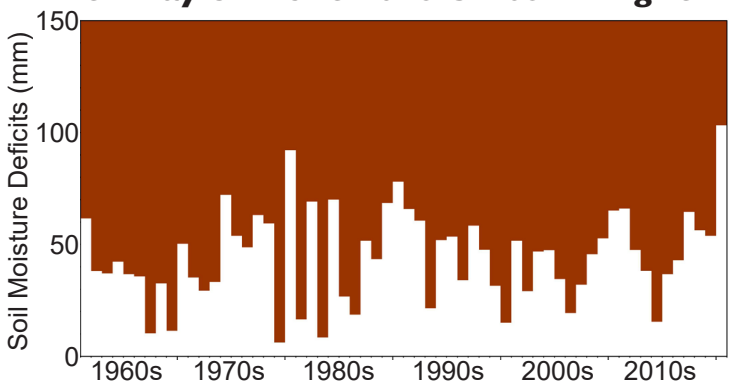

**March 2020 - May 2020 rainfall**
**as % of 1981-2010 average**




**April - May rainfall for England & Wales**




**End of May SMDs for the United Kingdom**




## Hydrological Outlook UK

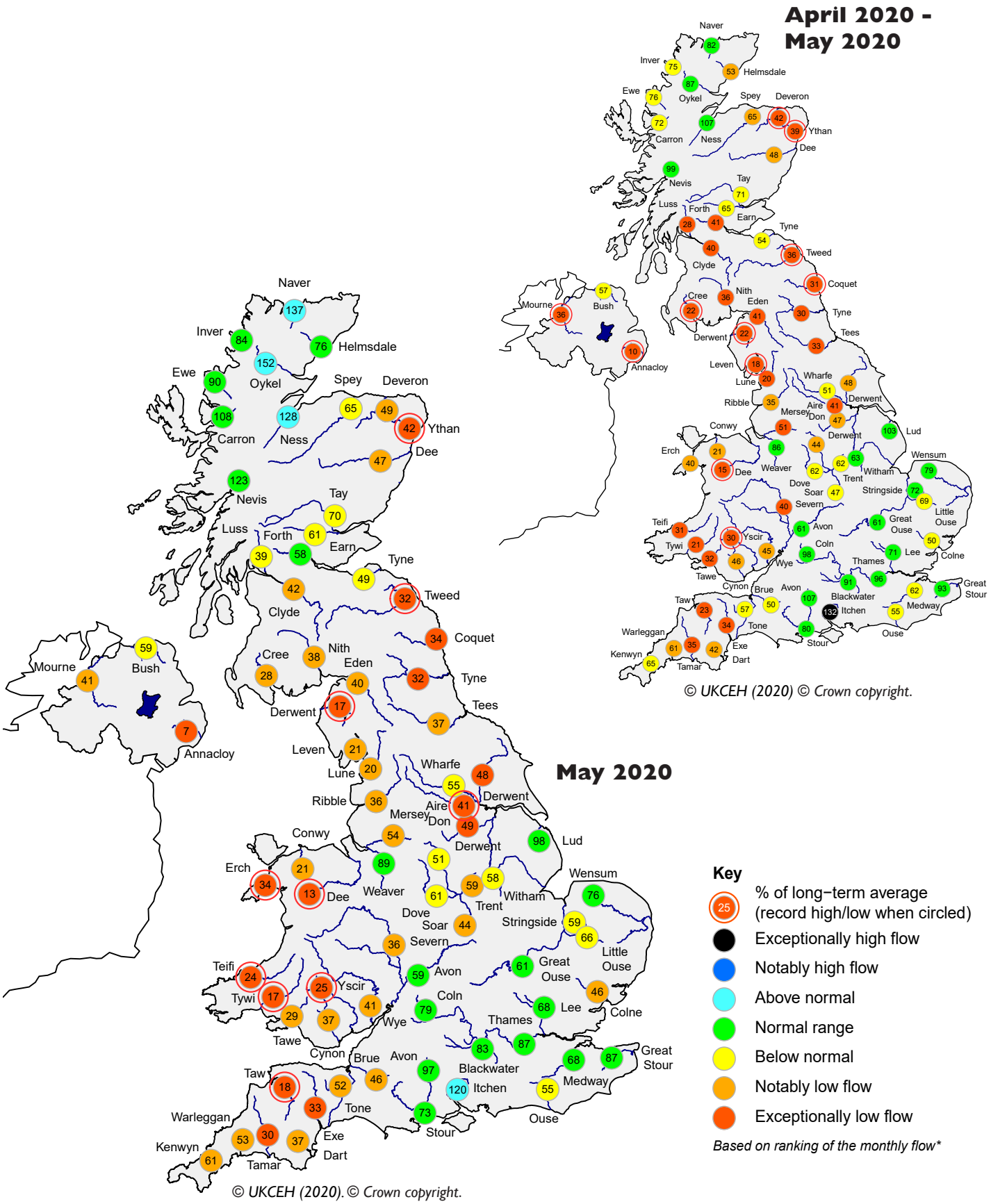
The Hydrological Outlook provides an insight into future hydrological conditions across the UK. Specifically it describes likely trajectories for river flows and groundwater levels on a monthly basis, with particular focus on the next three months.

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

**Period:** **from June 2020**
**Issued:** **08.06.2020**
**using data to the end of May 2020**

River flows across most parts of the UK are likely to be below normal in June and in the three months to August. In places flows may be notably or exceptionally low. The exceptions to this are south-east England and north-west of Scotland where river flows during this period will be normal to below normal. Groundwater levels will generally be normal in June and in the period to August although with significant local variability.

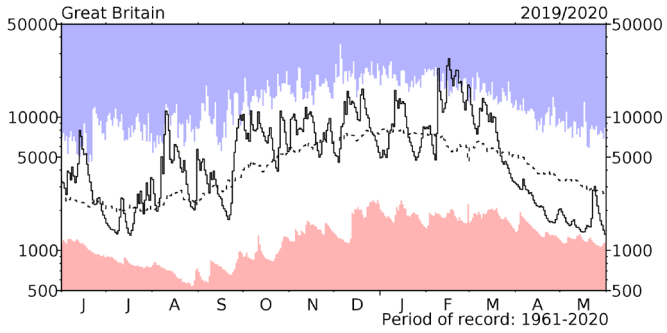
# River flow . . . River flow . . .

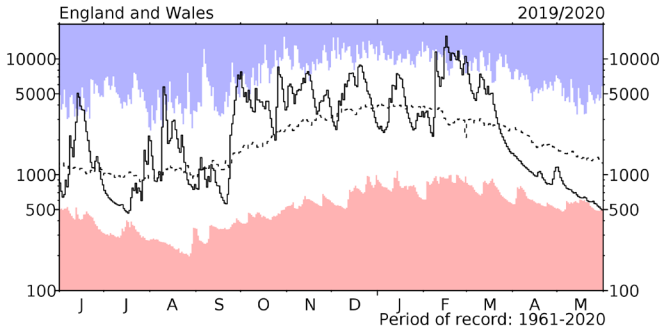


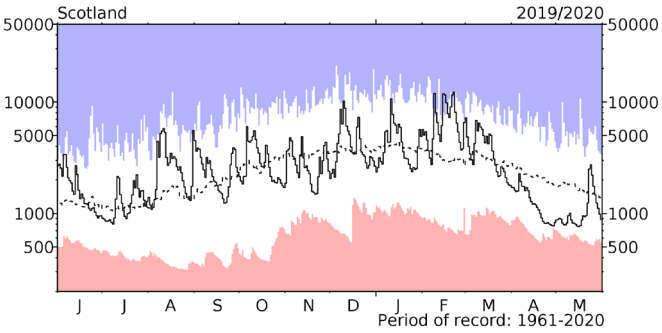

## River flows

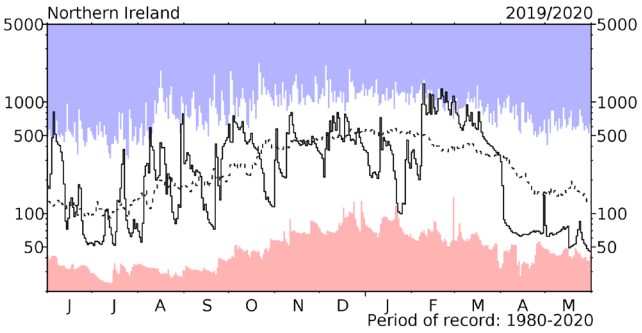
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

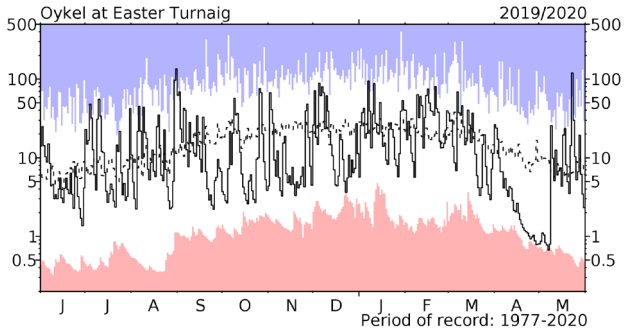
# River flow . . . River flow . . .

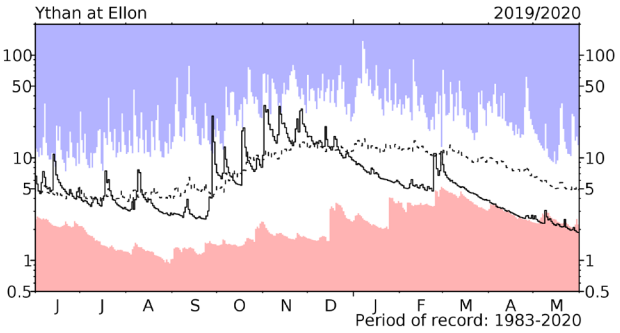


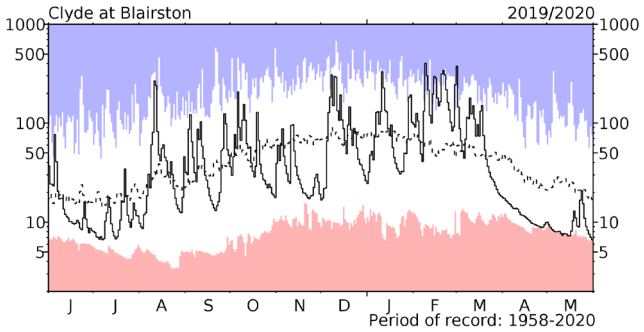



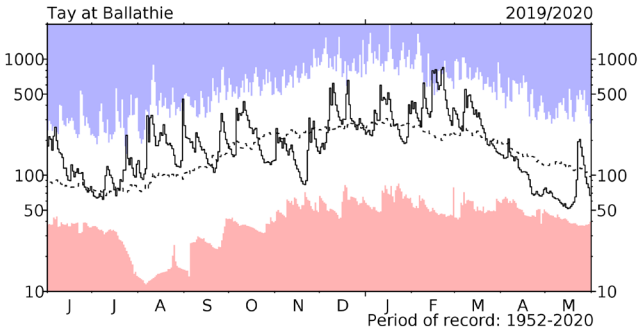



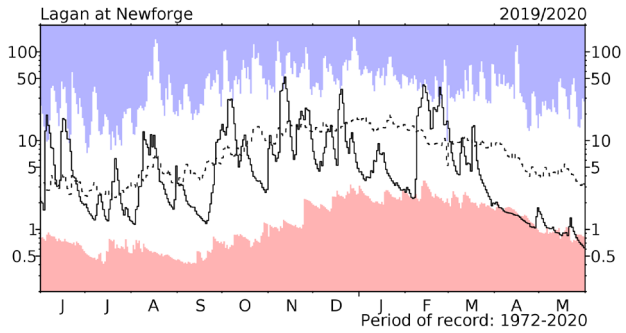



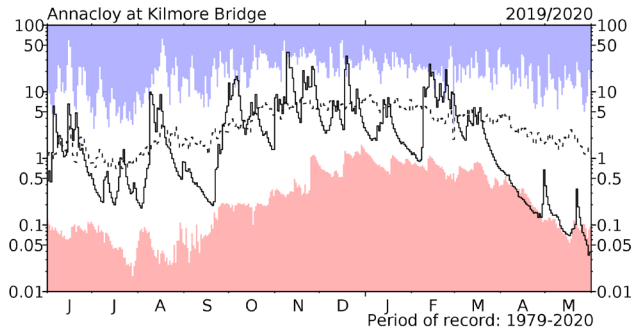



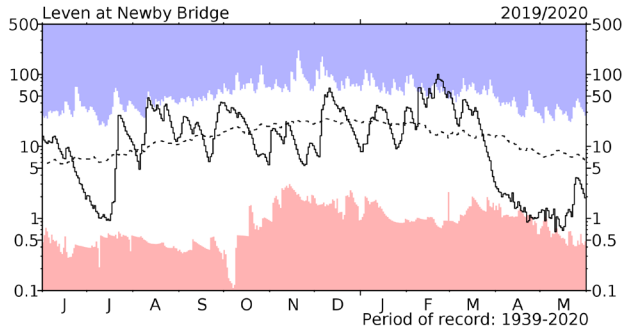



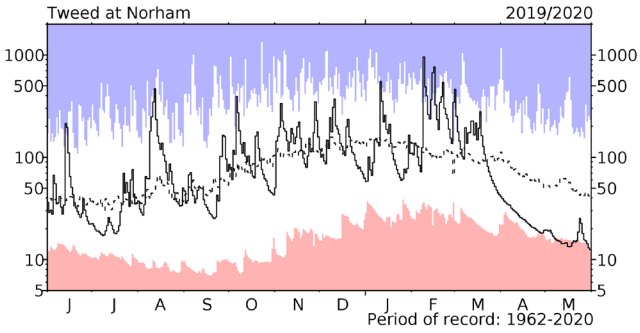



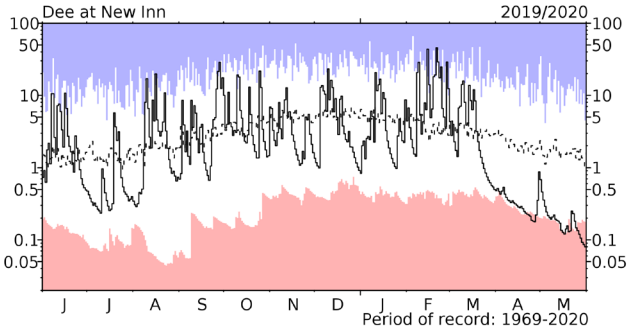

## River flow hydrographs

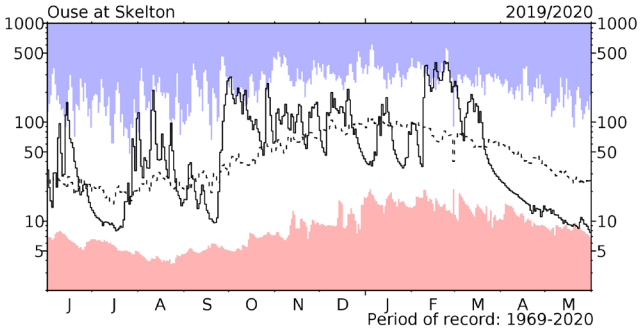
*The river flow hydrographs show the daily mean flows (measured in $m^3s^{-1}$) together with the maximum and minimum daily flows prior to June 2019 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas. The dashed line represents the period-of-record average daily flow.

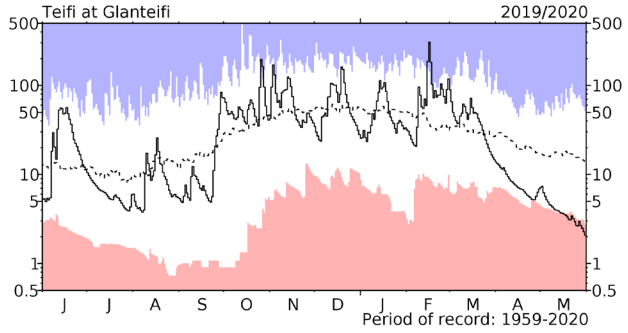
# River flow . . . River flow . . .

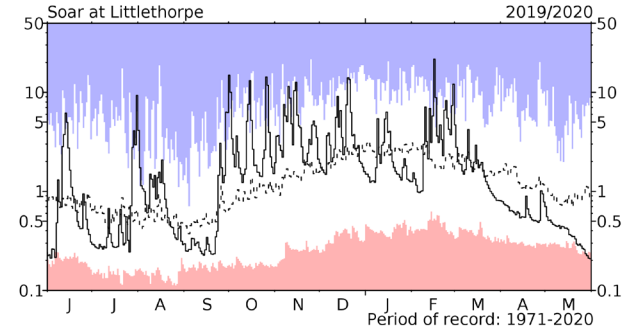


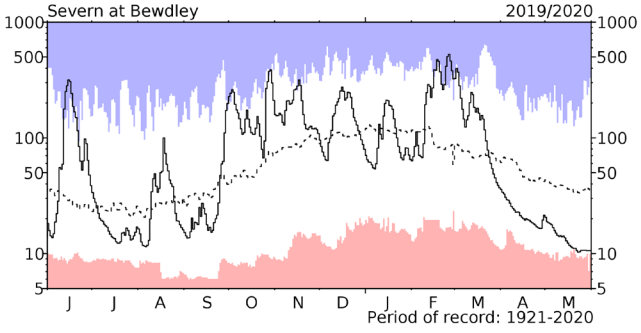



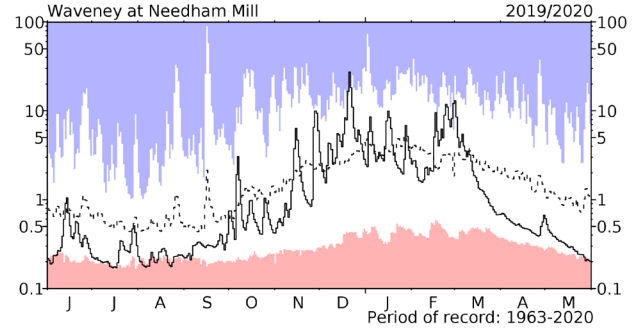



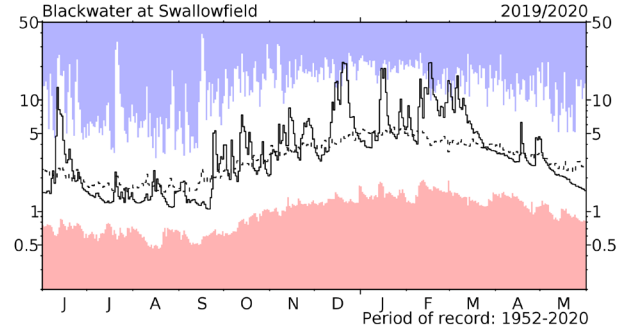



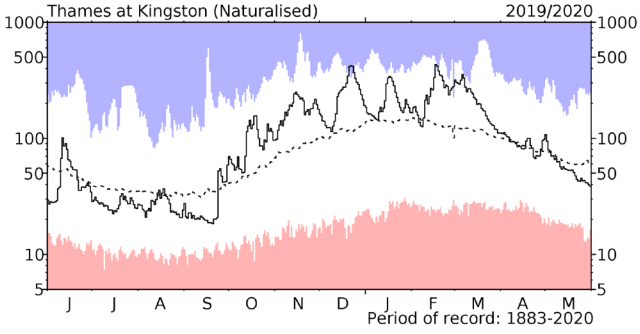



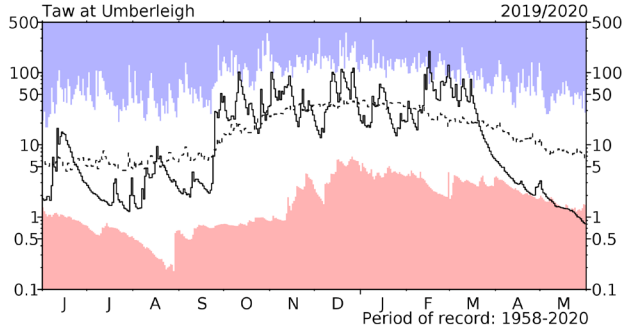



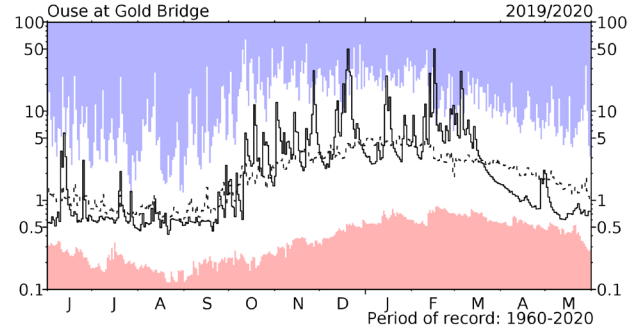



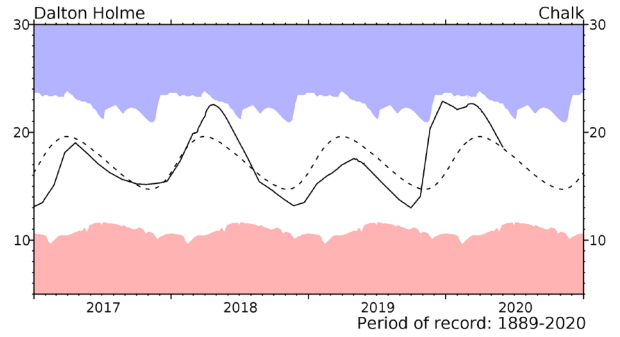



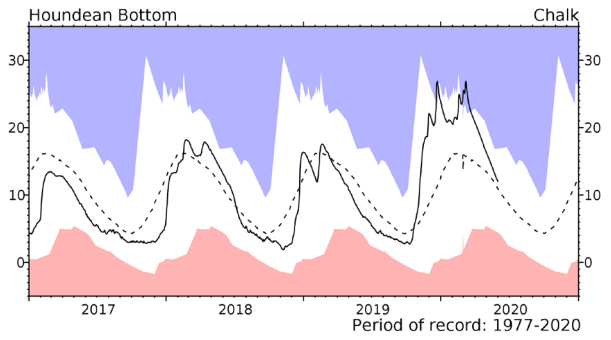



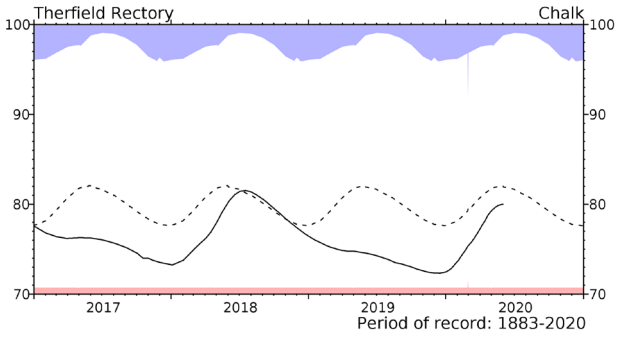



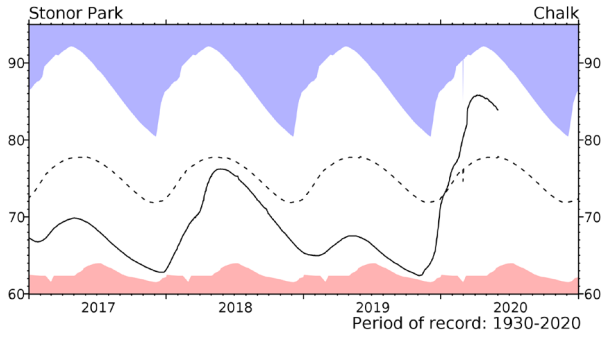



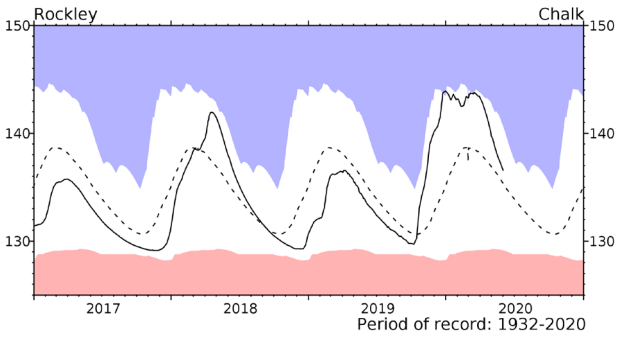
# Groundwater…Groundwater

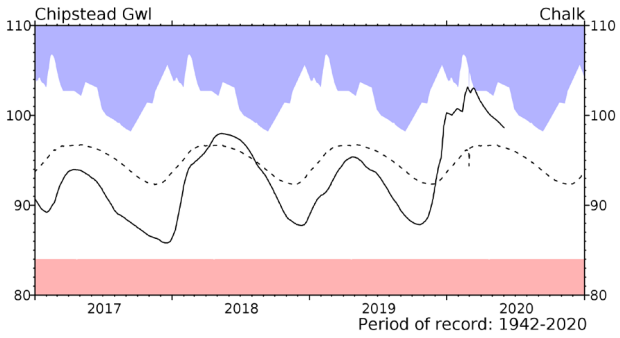


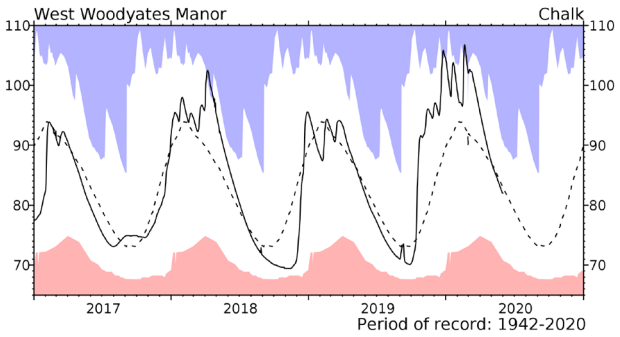



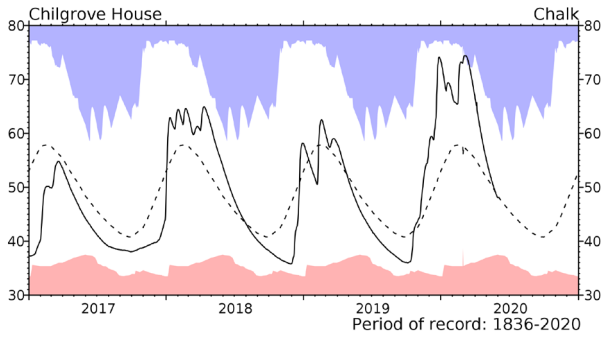



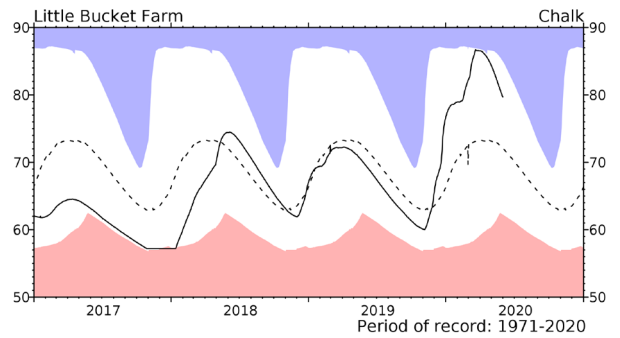



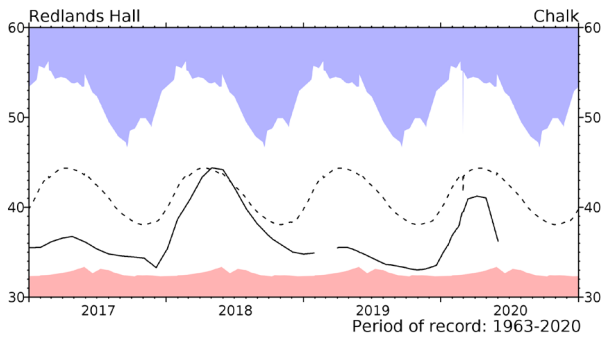



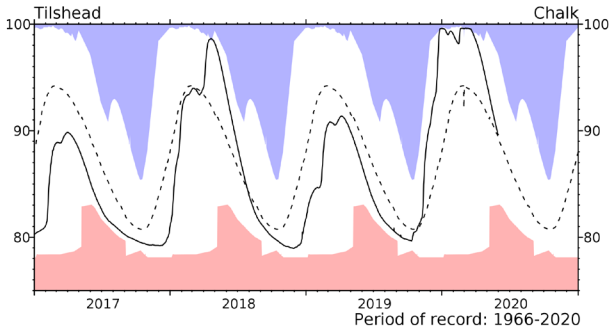



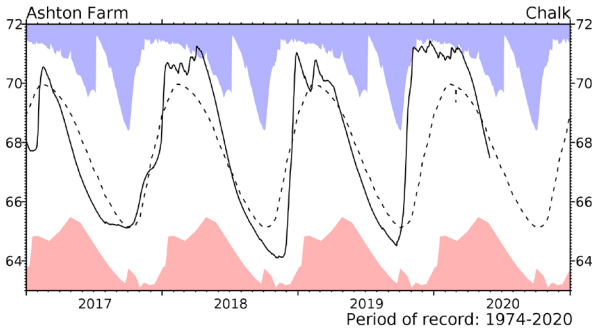



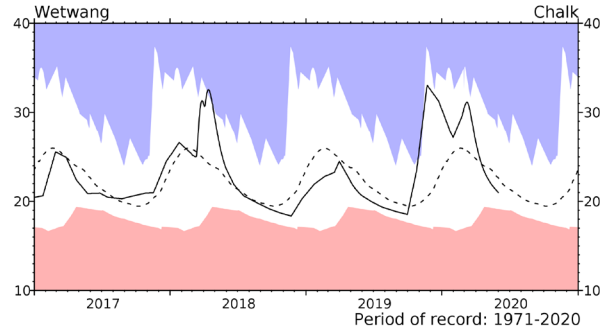



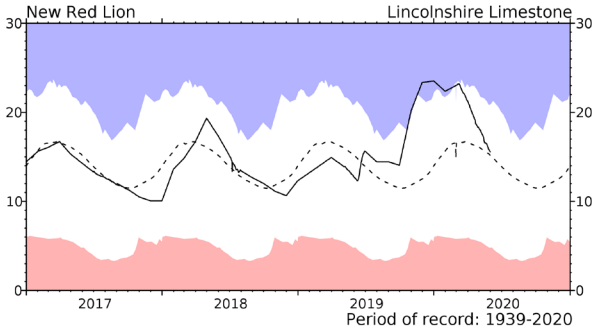

Groundwater levels (measured in metres above ordnance datum) normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is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

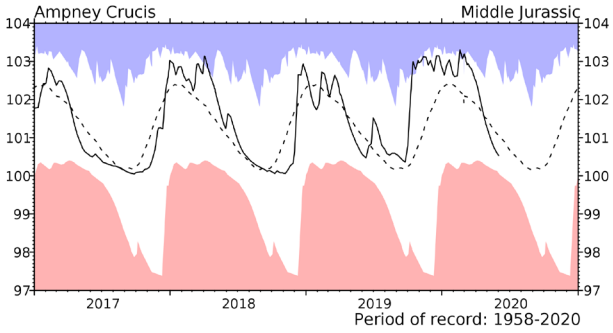
# Groundwater… Groundwater

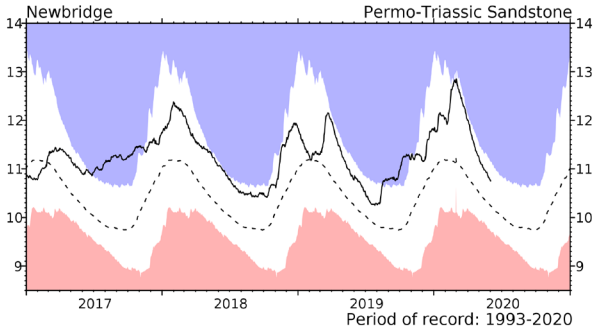


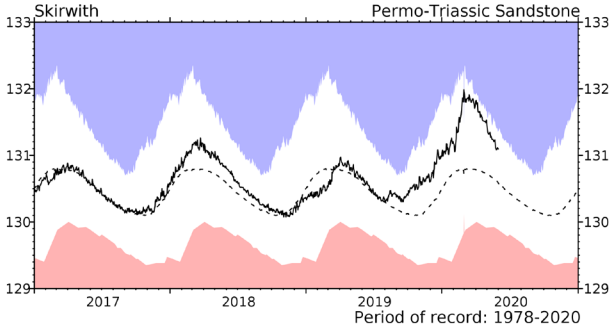



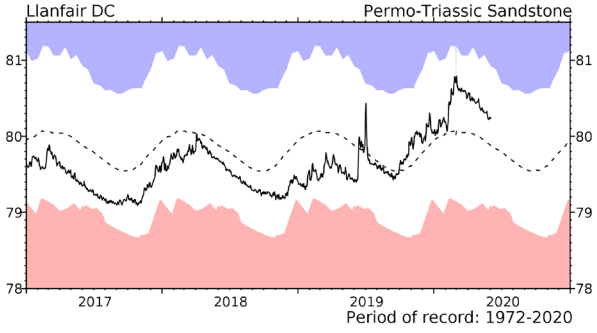



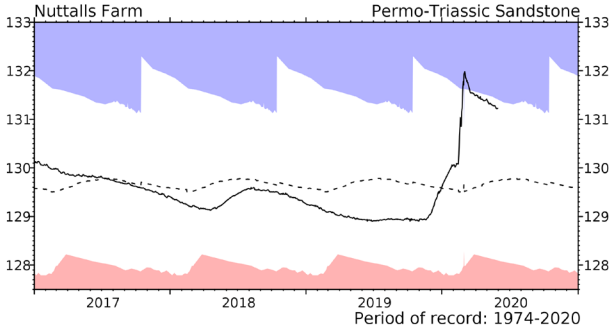



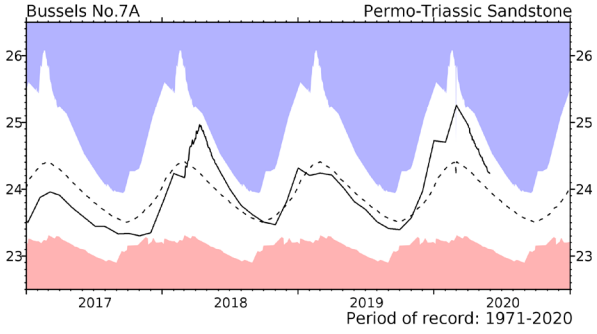



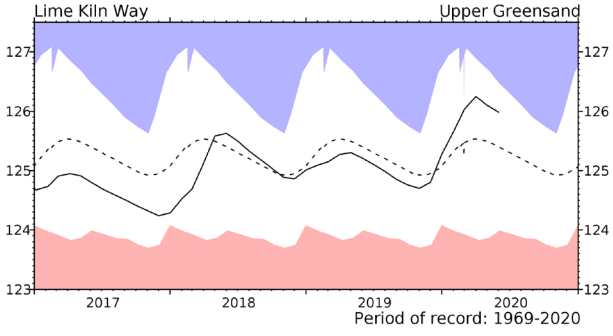



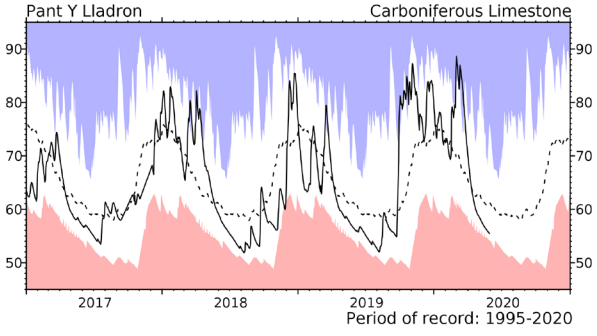



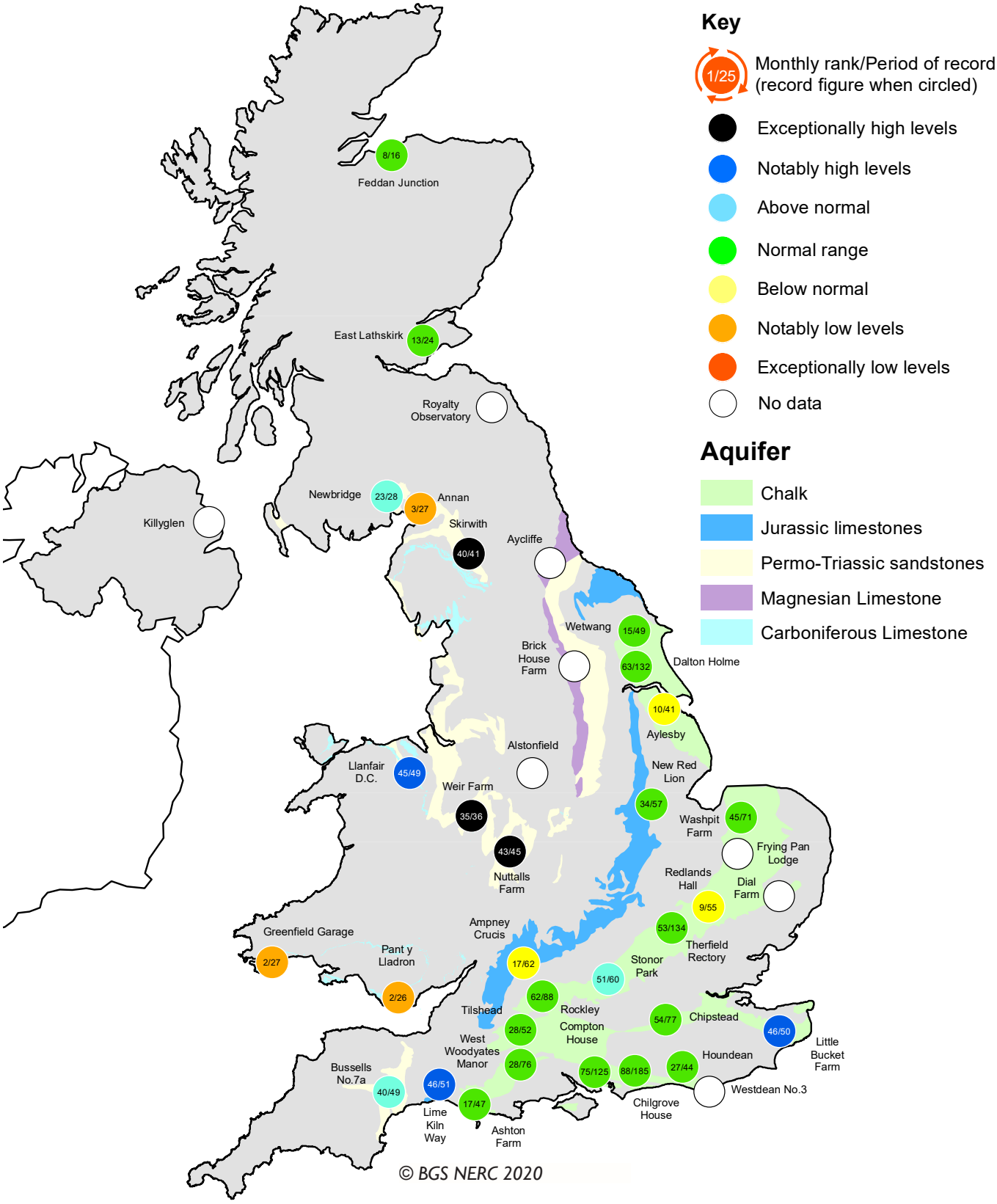



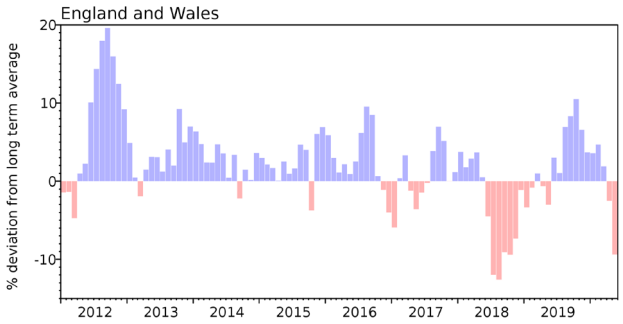



## Groundwater levels - May 2020

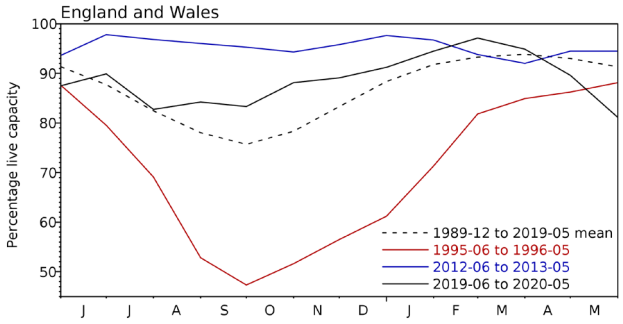
The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. 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) | 2020 Mar | 2020 Apr | 2020 May | May Anom. | Min May | Year* of min | 2019 May | Diff 20-19 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| North West | N Command Zone | • | 124929 | 93 | 77 | 61 | -19 | 50 | 1984 | 67 | -6 |
| | Vyrnwy | | 55146 | 98 | 90 | 80 | -9 | 69 | 1984 | 97 | -17 |
| Northumbrian | Teesdale | • | 87936 | 88 | 73 | 62 | -24 | 62 | 2020 | 85 | -23 |
| | Kielder | | (199175) | 92 | 89 | 85 | -7 | 85 | 1989 | 91 | -5 |
| Severn-Trent | Clywedog | | 49936 | 97 | 97 | 91 | -6 | 83 | 1989 | 100 | -9 |
| | Derwent Valley | • | 46692 | 96 | 82 | 68 | -20 | 56 | 1996 | 77 | -9 |
| Yorkshire | Washburn | • | 23373 | 94 | 84 | 71 | -16 | 71 | 2020 | 84 | -13 |
| | Bradford Supply | • | 40942 | 97 | 85 | 68 | -18 | 68 | 2020 | 73 | -5 |
| Anglian | Grafham | | (55490) | 88 | 96 | 94 | 1 | 72 | 1997 | 90 | 5 |
| | Rutland | | (116580) | 95 | 97 | 94 | 3 | 75 | 1997 | 94 | 1 |
| Thames | London | • | 202828 | 95 | 95 | 92 | -2 | 83 | 1990 | 88 | 4 |
| | Farmoor | • | 13822 | 99 | 98 | 99 | 1 | 90 | 2002 | 98 | 1 |
| Southern | Bewl | | 31000 | 99 | 98 | 94 | 6 | 57 | 1990 | 92 | 2 |
| | Ardingly | | 4685 | 100 | 100 | 96 | -2 | 89 | 2012 | 95 | 1 |
| Wessex | Clatworthy | | 5662 | 100 | 90 | 78 | -8 | 67 | 1990 | 89 | -11 |
| | Bristol | • | (38666) | 98 | 95 | 85 | -5 | 70 | 1990 | 90 | -5 |
| South West | Colliford | | 28540 | 92 | 89 | 80 | -7 | 52 | 1997 | 83 | -4 |
| | Roadford | | 34500 | 99 | 94 | 86 | 3 | 48 | 1996 | 73 | 13 |
| | Wimbleball | | 21320 | 100 | 93 | 81 | -10 | 74 | 2011 | 94 | -13 |
| | Stithians | | 4967 | 100 | 93 | 84 | -3 | 66 | 1990 | 93 | -8 |
| Welsh | Celyn & Brenig | • | 131155 | 96 | 93 | 79 | -18 | 79 | 2020 | 93 | -14 |
| | Brianne | | 62140 | 97 | 91 | 82 | -14 | 82 | 2020 | 90 | -8 |
| | Big Five | • | 69762 | 97 | 89 | 74 | -16 | 70 | 1990 | 85 | -11 |
| | Elan Valley | • | 99106 | 100 | 88 | 76 | -18 | 76 | 2020 | 93 | -17 |
| Scotland(E) | Edinburgh/Mid-Lothian | • | 97223 | 97 | 89 | 82 | -9 | 52 | 1998 | 88 | -6 |
| | East Lothian | • | 9317 | 100 | 100 | 97 | 0 | 84 | 1990 | 100 | -3 |
| Scotland(W) | Loch Katrine | • | 110326 | 95 | 83 | 79 | -8 | 66 | 2001 | 88 | -9 |
| | Daer | | 22494 | 95 | 80 | 69 | -20 | 69 | 2020 | 85 | -16 |
| | Loch Thom | | 10721 | 83 | 76 | 70 | -22 | 70 | 2020 | 88 | -18 |
| Northern Ireland | Total+ | • | 56800 | 98 | 88 | 75 | -11 | 69 | 2008 | 93 | -18 |
| | Silent Valley | • | 20634 | 96 | 85 | 70 | -12 | 56 | 2000 | 96 | -27 |

( ) figures in parentheses relate to gross storage

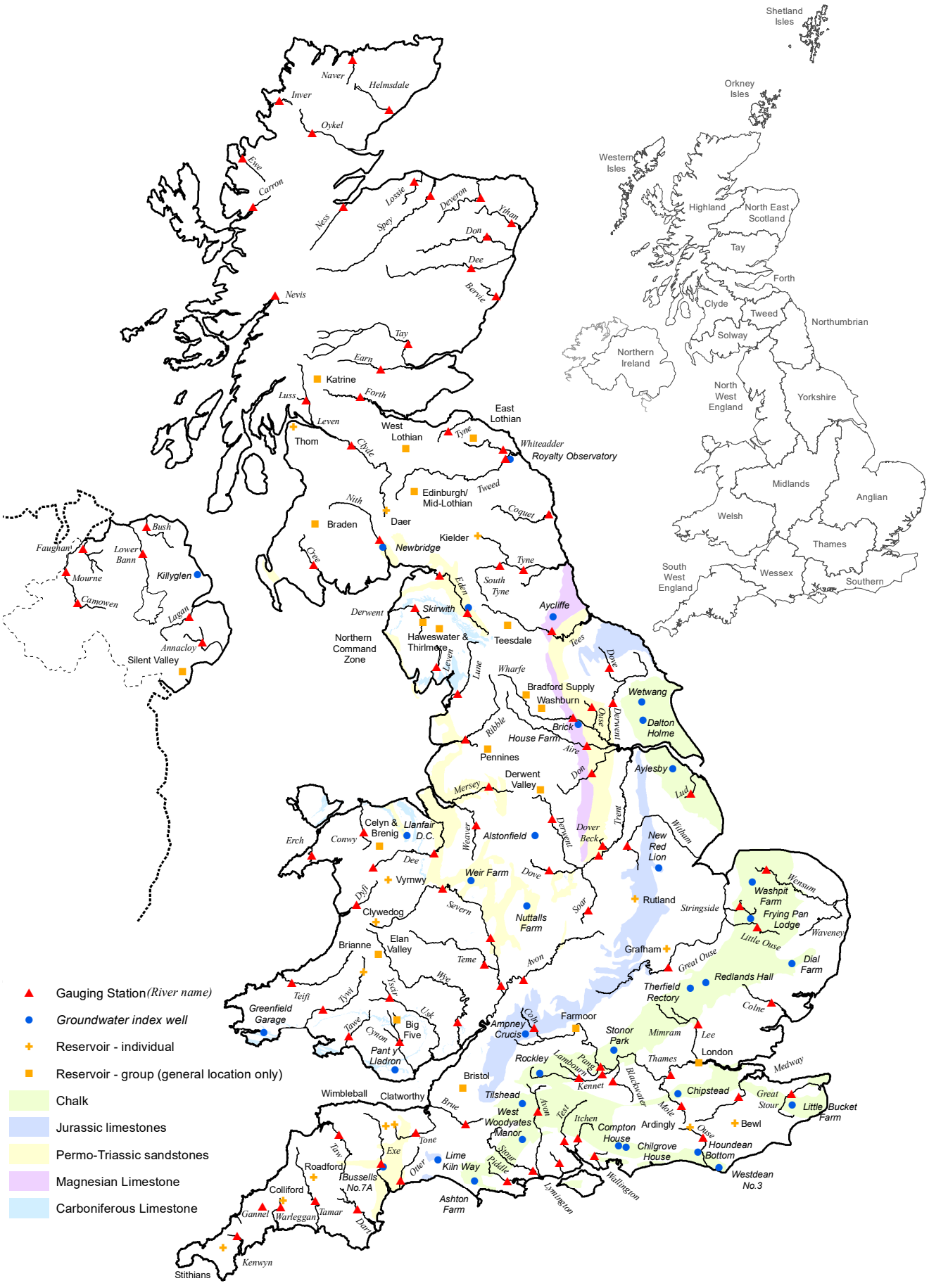
• denotes reservoir groups

*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 UK Centre for Ecology & Hydrology (UKCEH) 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 UKCEH) and National Groundwater Level Archive (NGLA; maintained by BGS), including rainfall, river flows, borehole levels, and reservoir stocks.

The Hydrological Summary is supported by the Natural Environment Research Council award number NE/R016429/1 as part of the UK-SCAPE programme delivering National Capability.

## 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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