Monthly water situation report

England

Summary – June 2021

For much of England June was a relatively dry month compared with the wet May, with below average rainfall totals recorded across central and northern England in particular; however above average rainfall totals were recorded across south-east England. By the end of the month soils were drier than average across northern England but wetter than average across southern England. River flows decreased at nearly all reported sites, but flows at nearly all sites remain classed as normal or higher for the time of year. At all but one indicator site, end of month groundwater levels were classed as normal or higher for the time of year. Total reservoir stocks for England were at 86% of total capacity at the end of June.

Rainfall

The June rainfall total for England was 48mm, which represents 79% of the 1961-1990 long term average LTA, (or 77% of the 1981-2010 LTA). This is less than half the rainfall total for May but still significantly more than the rainfall total for April which was a very dry month. The lowest rainfall totals for the month were across central and northern England, in contrast to many parts of south-east England where recorded rainfall totals were well above the LTA (Figure 1.1).

Monthly rainfall totals were classed as higher than normal for the time of year in just over two-fifths of catchments – mainly across southern England. However nearly one fifth of catchments received rainfall classed as notably low or exceptionally low for the month – mainly across catchments in north-west and north-east England (Figure 1.2).

The highest rainfall total as a proportion of the LTA was over the Isle of Wight, with 116mm of rainfall representing 231% of the LTA for June. This made it the 3rd wettest June on record in this catchment (records since 1891). In seventeen other catchments in south-east England the June rainfall total ranked in the top ten wettest on record for the month. By contrast the lowest rainfall total as a proportion of the LTA was over the Dumfries Esk catchment, with 18mm of rainfall representing 21% of the LTA for June. This is made it the 3rd driest June on record in this catchment (records since 1891). In ten other catchments in northern England the June rainfall total ranked in the top-ten driest on record for the month. The six and twelve month cumulative rainfall totals across most catchments in England are classed as above normal or higher. In the Cumbrian Esk catchment the 12 month cumulative rainfall total ending in June is the highest on record for this period (Figure 1.2).

At a regional scale, June rainfall totals ranged from 30% of the LTA in north-west England to 155% of the LTA in south-east England (Figure 1.3). The rainfall totals were classed as exceptionally low for the time of year in north-west England, notably low in north-east England and below normal in central England. South-east England was the only region where rainfall was classed as above normal for the time of year. The rainfall totals for the north-west represent not only the fourth driest June on record but also the seventh wettest June to June twelve months on record (records since 1891).

Soil moisture deficit

At the end of June, soils were wetter than the LTA for the time of year across much of southern England but drier than the LTA across much of northern England. Compared with the end of May, soils were drier across most of England apart from along the south coast (Figure 2.1).

At a regional scale, the end of June SMD values were wetter than average for the time of year in south-west and south-east England, close to average in central and east England and drier than average in north-west and north-east England. For all regions the soils were drier than at the end of May (Figure 2.2).

River flows

River flows during June were smaller compared with May at nearly all of the sites reported on; only four sites (all in south-east England) recorded larger flows. However despite this reduction in monthly mean river flows, only five reported sites (all in northern England) were classed as lower than normal for the time of year.

In north-west England monthly mean flows on the River Mersey at Ashton weir changed class from exceptionally high in May to below normal in June, while flows on the River Lune at Caton changed from notably high in May to notably low in June. At Haydon Bridge on the South Tyne (Northumberland) river flows represented the lowest monthly mean flow for June on record (records since 1974) (Figure 3.1).

At the regional index sites monthly mean flows ranged from being classed as exceptionally low on the South Tyne at Haydon Bridge (north-east England) to notably high (naturalised flows) on the Thames at Kingston (south-east England) (Figure 3.2).

Groundwater levels

Groundwater levels decreased at nearly all of the sites reported on during June, as is typical for this time of year. Like the end of May, for all but one indicator site the end of June groundwater levels were classed as normal or higher for the time of year; the exception remains Tilshead (Upper Hampshie Avon Chalk aquifer) where the groundwater levels were classed as below normal (Figure 4.1).

Priors Heyes (West Cheshire sandstone), Coxmoor (Idle and Torne Permotriassic sandstone) and Weir Farm (Bridgnorth sandstone) all recorded the highest end of June levels on record (records go back to 1972, 1969 and 1983 respectively). Levels at Priors Heyes remain high compared to historic levels because the aquifer is recovering from the effects of historic abstraction. For Weir Farm it was the sixth consecutive month with the highest levels on record for the time of year, and the third consecutive month for Coxmoor.

End of month groundwater levels at the major aquifer index sites were exceptionally high in the sandstone aquifers at Weir Farm (central England) and at Skirwith (north-west England), above normal in the Chalk aquifer at Little Bucket (south-east England) and normal everywhere else (Figure 4.2).

Reservoir storage

Reservoir stocks decreased compared with the end of May at nearly three-quarters of the reservoirs and reservoir groups we report upon, and only increased at two reservoirs and reservoir groups (both in south-east England). The biggest decrease as a proportion of total capacity was at the strategic Haweswater and Thirlmere group in north-west England. Here, stocks decreased by 14% of capacity, ending the month at 71% full.

Reservoir stocks were classed as normal in three-quarters of the reservoirs and reservoir groups we report on; three were classed as below normal or lower for the time of year (Figure 5.1).

At a regional scale, total reservoir stocks ranged from 81% in north-west England to 93% in east England. Total reservoir stocks for England were at 86% of total capacity at the end of June (Figure 5.2).

Forward look

The beginning of July was characterised by scattered showers and more prolonged periods of rain across most of England, with the south-west and north of England receiving the highest rainfall totals. This unsettled weather is expected to continue for the first two weeks of July, with a mix of sunny spells and scattered showers, and perhaps longer periods of heavy rain affecting most areas. Towards the middle of the month, there is a chance that it will turn increasingly settled, with warmer and drier than average conditions, although there remains the possibility of unsettled spells, particularly in north-west England. The warm and dry weather could continue through to the end of July, although unsettled spells may still affect parts of England, especially in the north-west.

For the 3 month period July to September, there is a higher than normal chance of dry conditions, with the chance of near average or wet conditions being slightly lower than the normal chance[1].

Projections for river flows at key sites[2]

By the end of September 2021, half of the modelled sites have a greater than expected chance of cumulative river flows being above normal or higher for the time of year. By the end of March 2022, half of the modelled sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year.

1 Source: Met Office

2 Information produced by the Hydrological Outlook a partnership between UK Centre for Ecology and Hydrology, British Geological Survey, Met Office, Environment Agency and other devolved agencies

For scenario based projections of cumulative river flows at key sites by September 2021 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2022 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2021 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2022 see Figure 6.4

Projections for groundwater levels in key aquifers[2]
By the end of September 2021, nearly all of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year. By the end of March 2022, half of the modelled sites have a greater than expected chance of groundwater levels being above normal or higher for the time of year.

For scenario based projections of groundwater levels in key aquifers in September 2021 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2022 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2021 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2022 see Figure 6.8

Authors: National Water Resources Hydrology Team

Rainfall

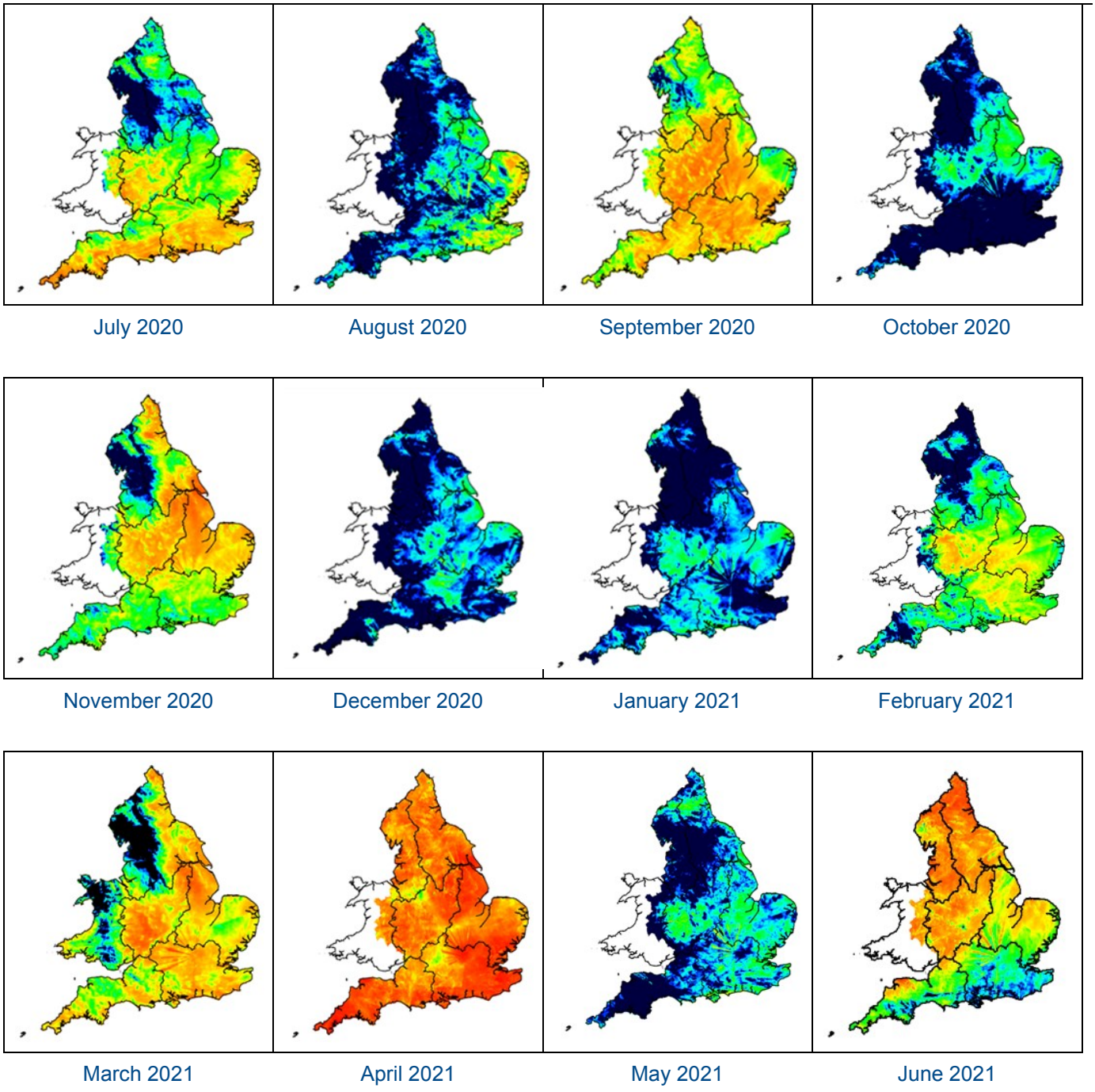


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2021). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

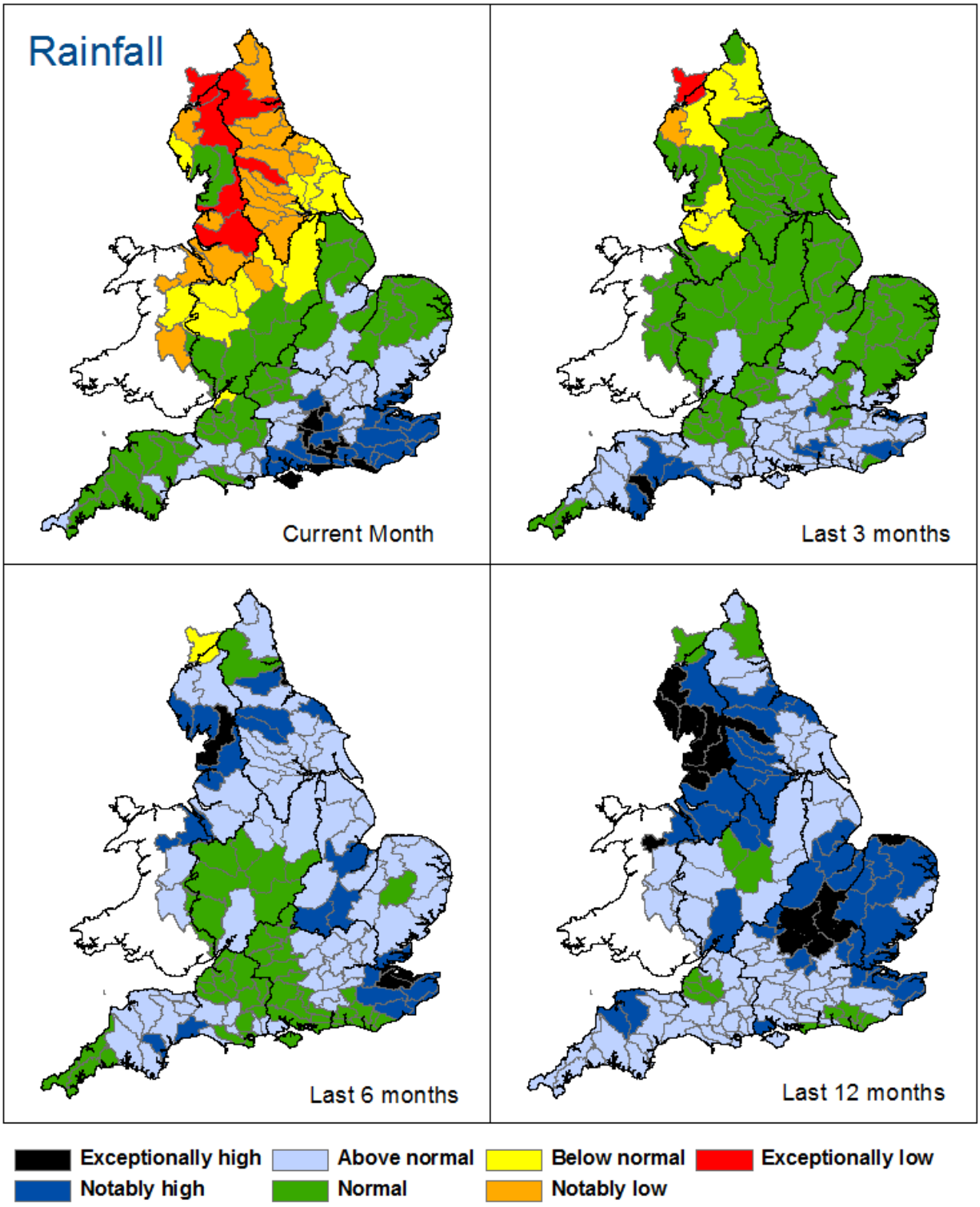


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 30 June), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2021).* Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

Rainfall charts

Above average rainfall

Below average rainfall

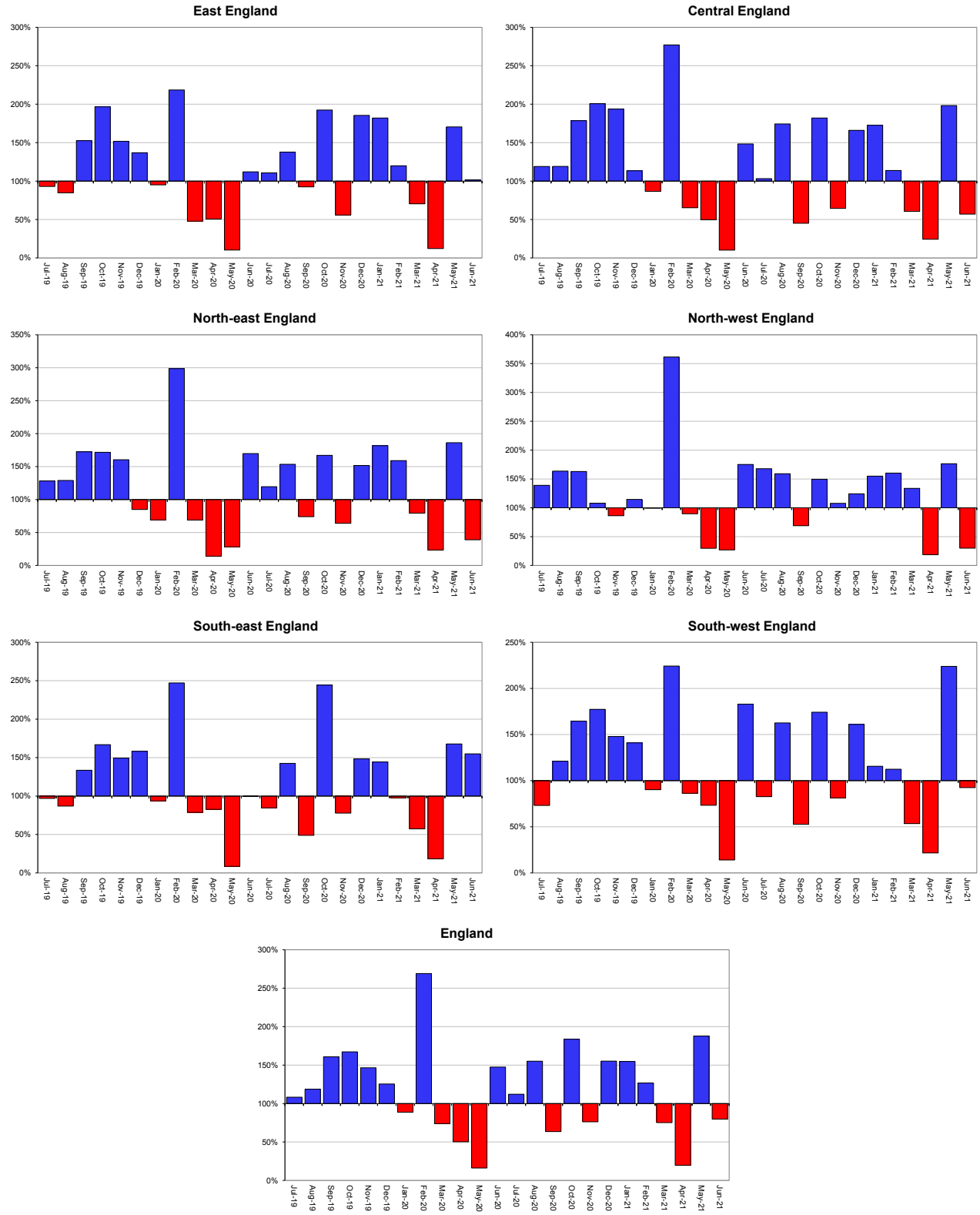


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2021).

Soil moisture deficit

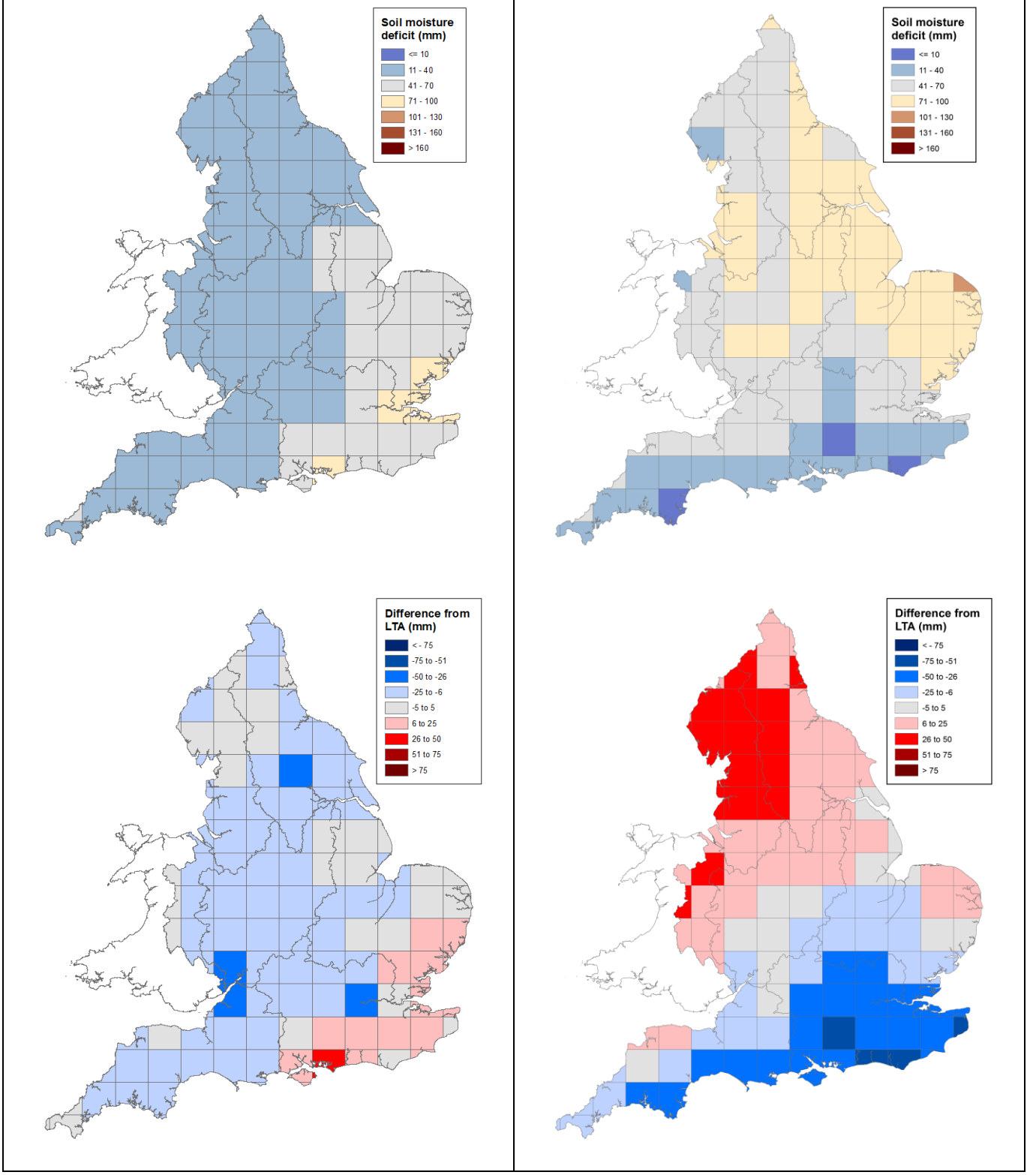
End of May 2021[1]	End of June 2021[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 02 June 2021[1] (left panel) and 29 June 2021[2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2021). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021

Soil moisture deficit charts

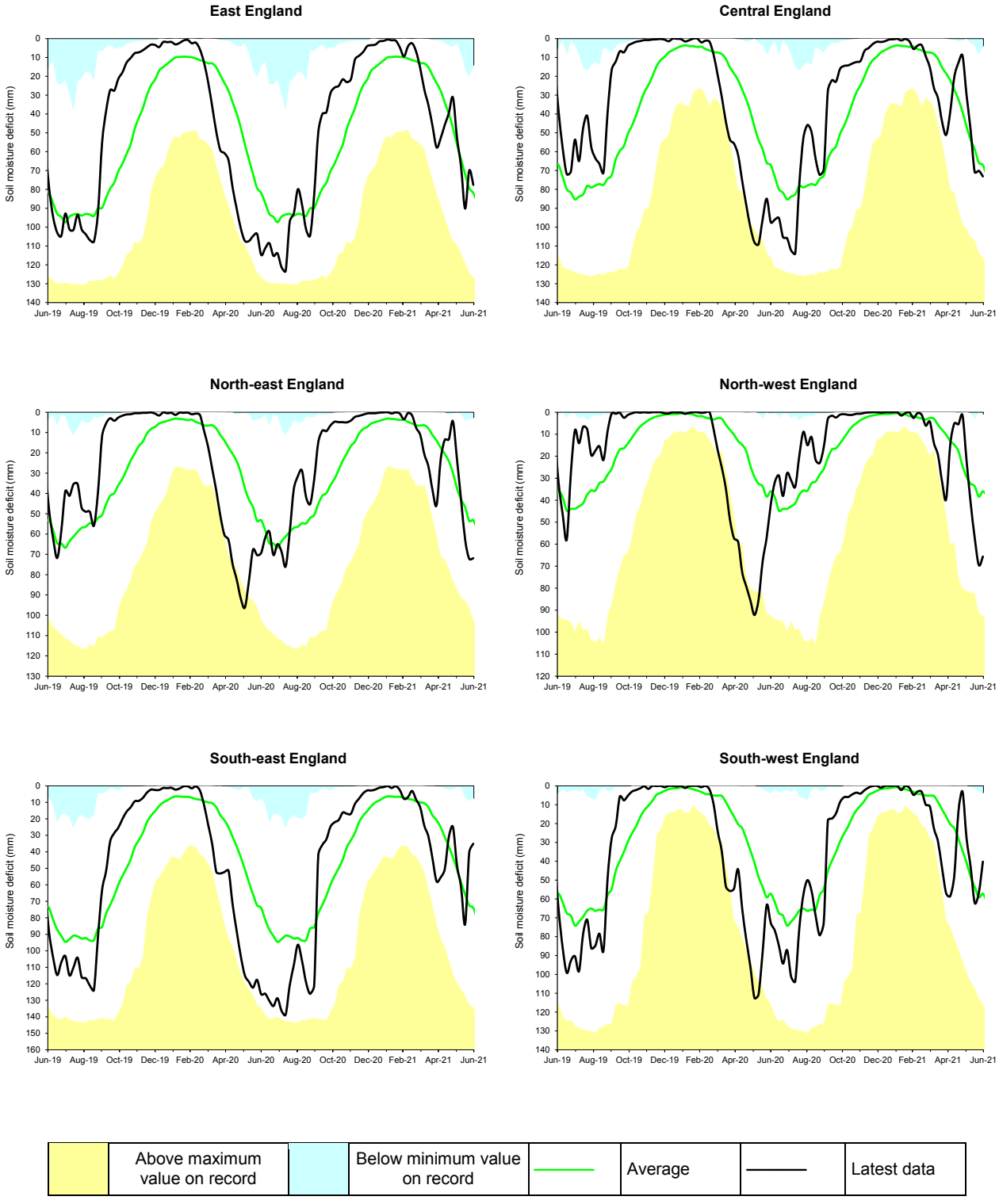
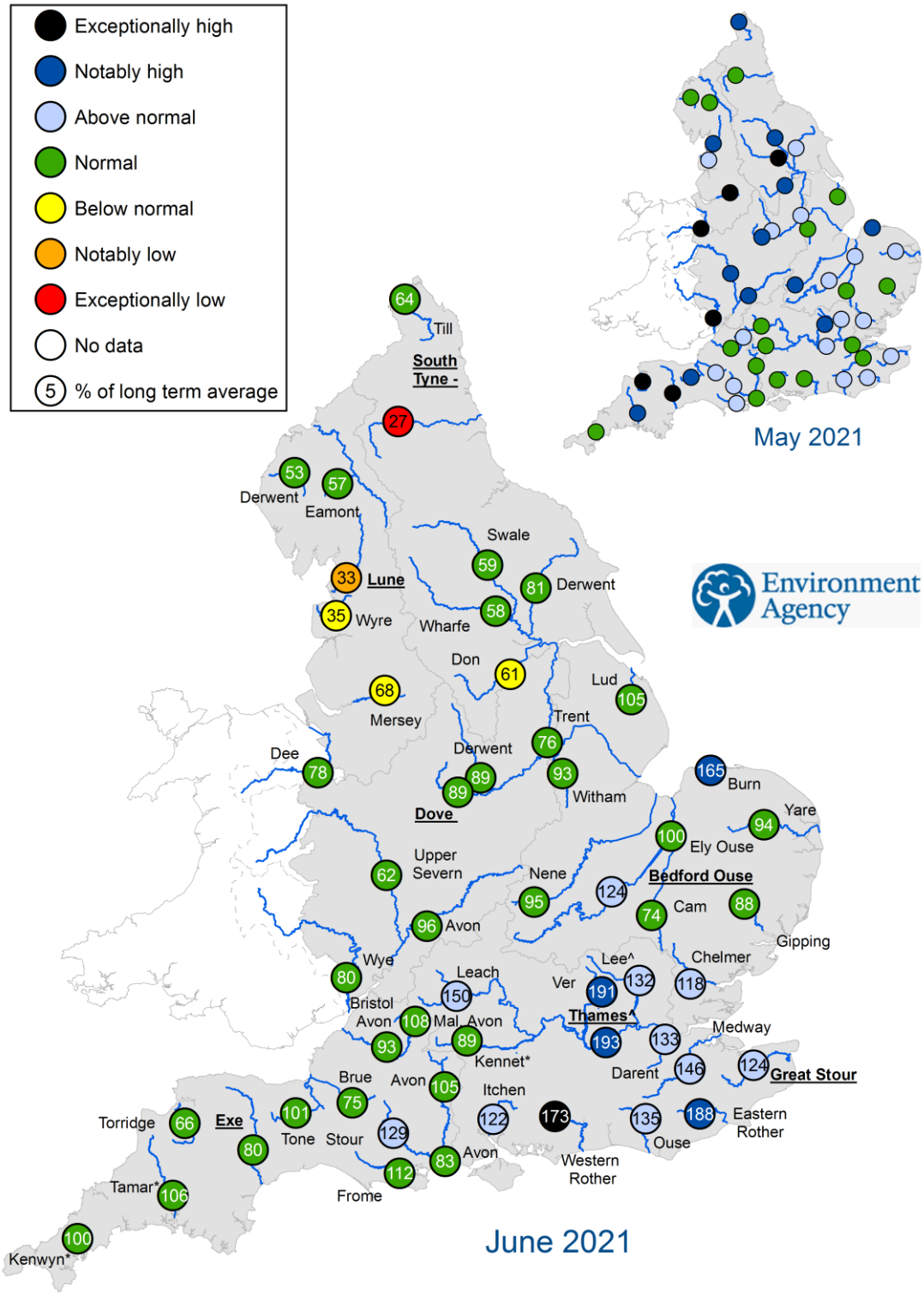


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2021).

River flows



^ "Naturalised" flows are provided for the River Thames at Kingston and the River Lee at Feildes Weir

\- Monthly mean flow is the lowest on record for the current month (note that record length varies between sites)

* Flows may be overestimated at these sites the data should be treated with caution

Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

Figure 3.1: Monthly mean river flow for indicator sites for May 2021 and June 2021, expressed as a percentage of the respective long term average and classed relative to an analysis of historic May and June monthly means (Source: Environment Agency).

River flow charts

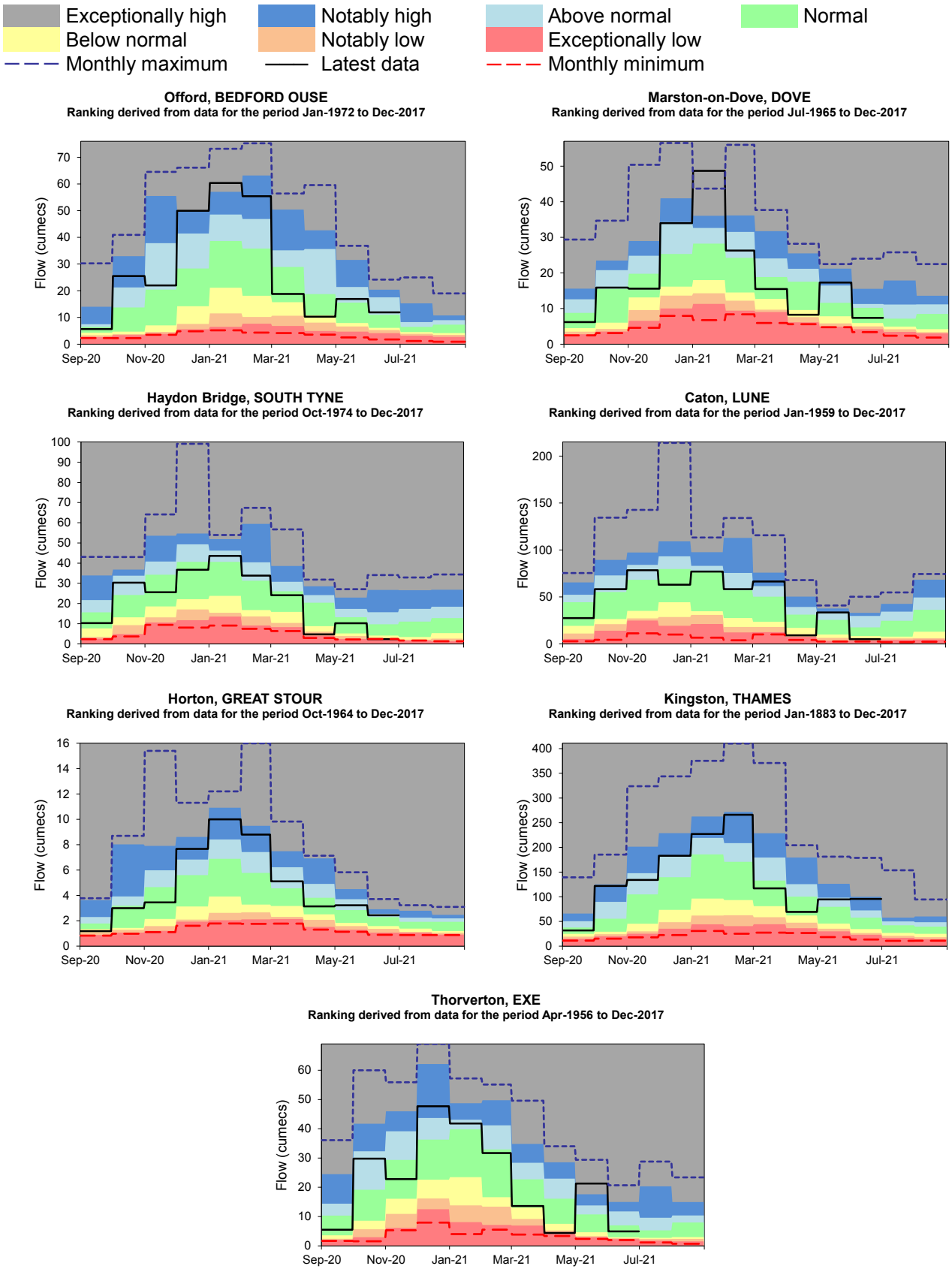
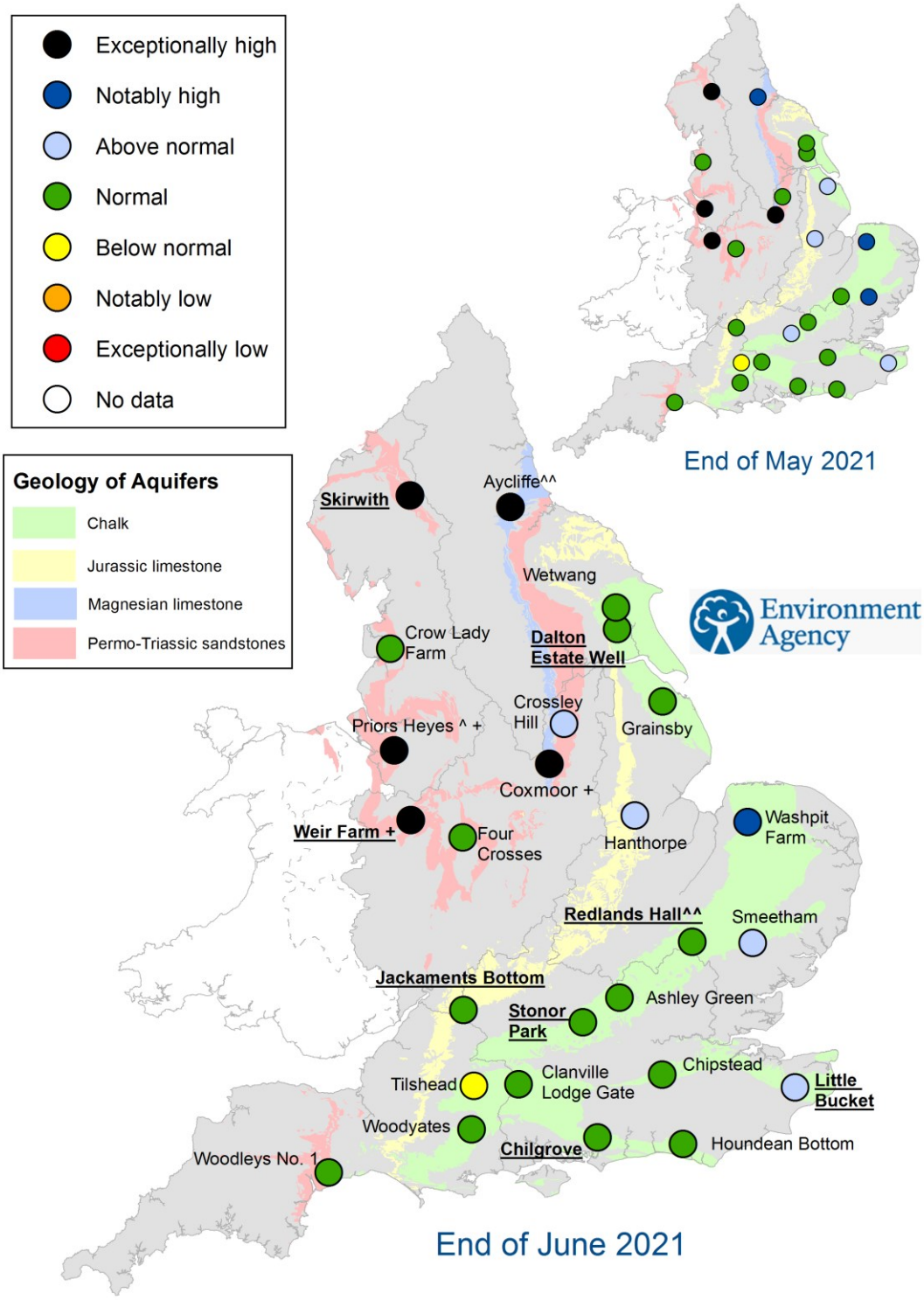


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

Groundwater levels



^ The level at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction
^^ Sites are manually dipped at different times during the month. They may not be fully representative of levels at the month end
\+ End of month groundwater level is the highest on record for the current month (note that record length varies between sites).
Underlined sites are major aquifer index sites and are shown in the groundwater level charts in Figure 4.2

Figure 4.1: Groundwater levels for indicator sites at the end of May 2021 and June 2021, classed relative to an analysis of respective historic May and June levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

Groundwater level charts

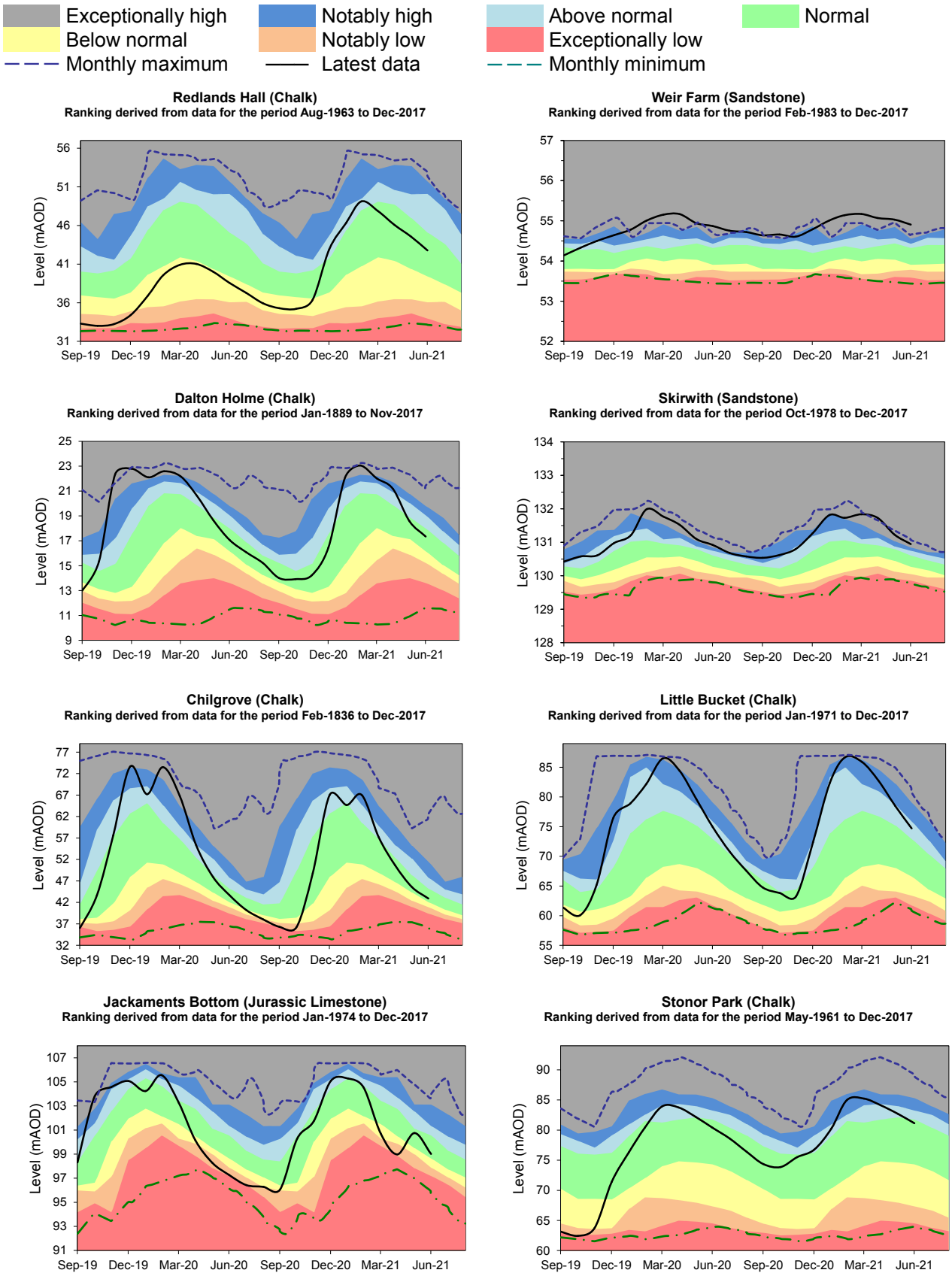
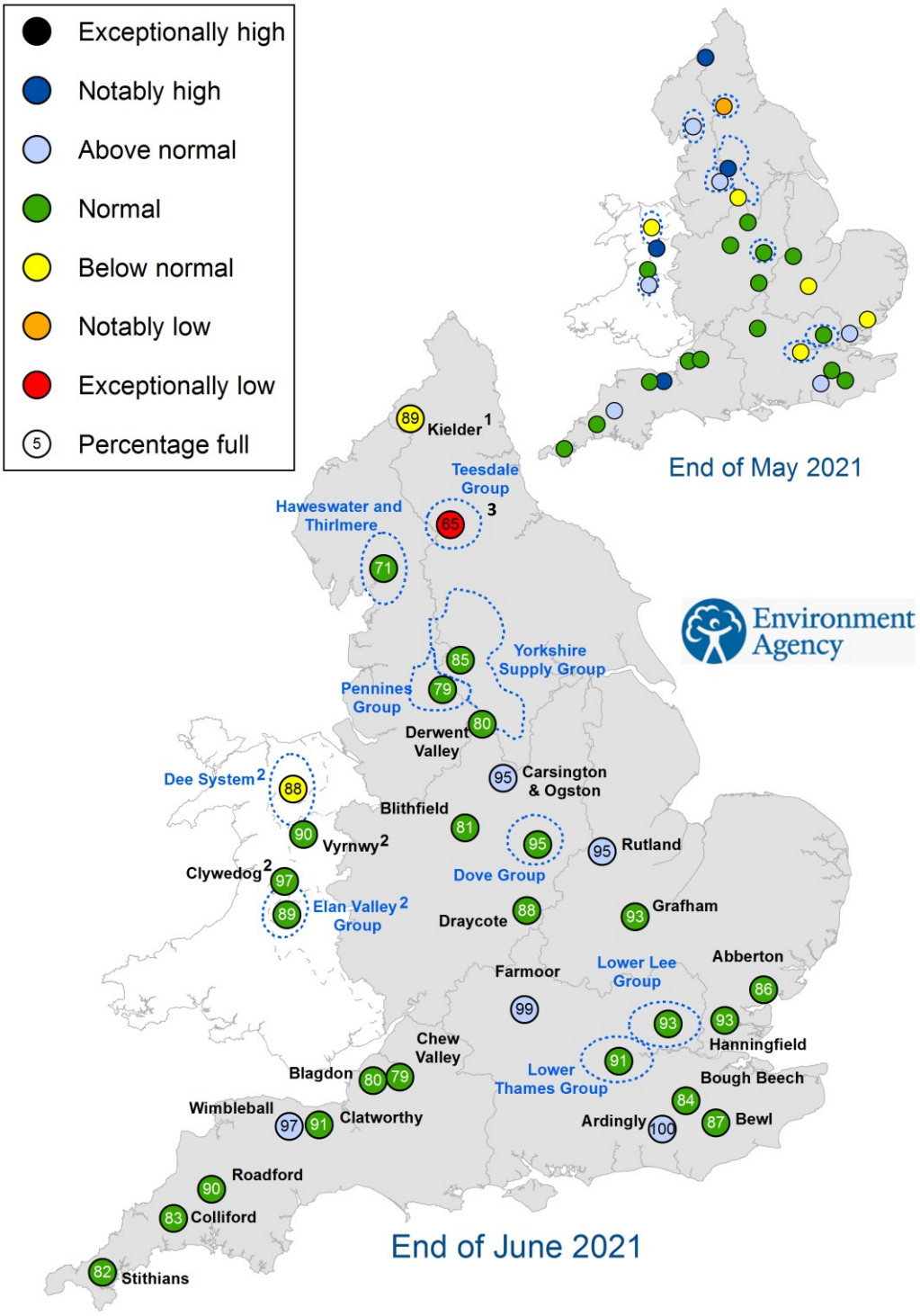


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2021).

Reservoir storage



1. Current levels at Kielder are lower than historical levels due to the implementation of a new flood alleviation control curve
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to Central and north-west England
3. Current levels in the Teesdale Group have been drawn down for maintenance and safety inspections

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of May 2021 and June 2021 as a percentage of total capacity and classed relative to an analysis of historic May and June values respectively (Source: Water Companies). Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones.

Reservoir storage charts

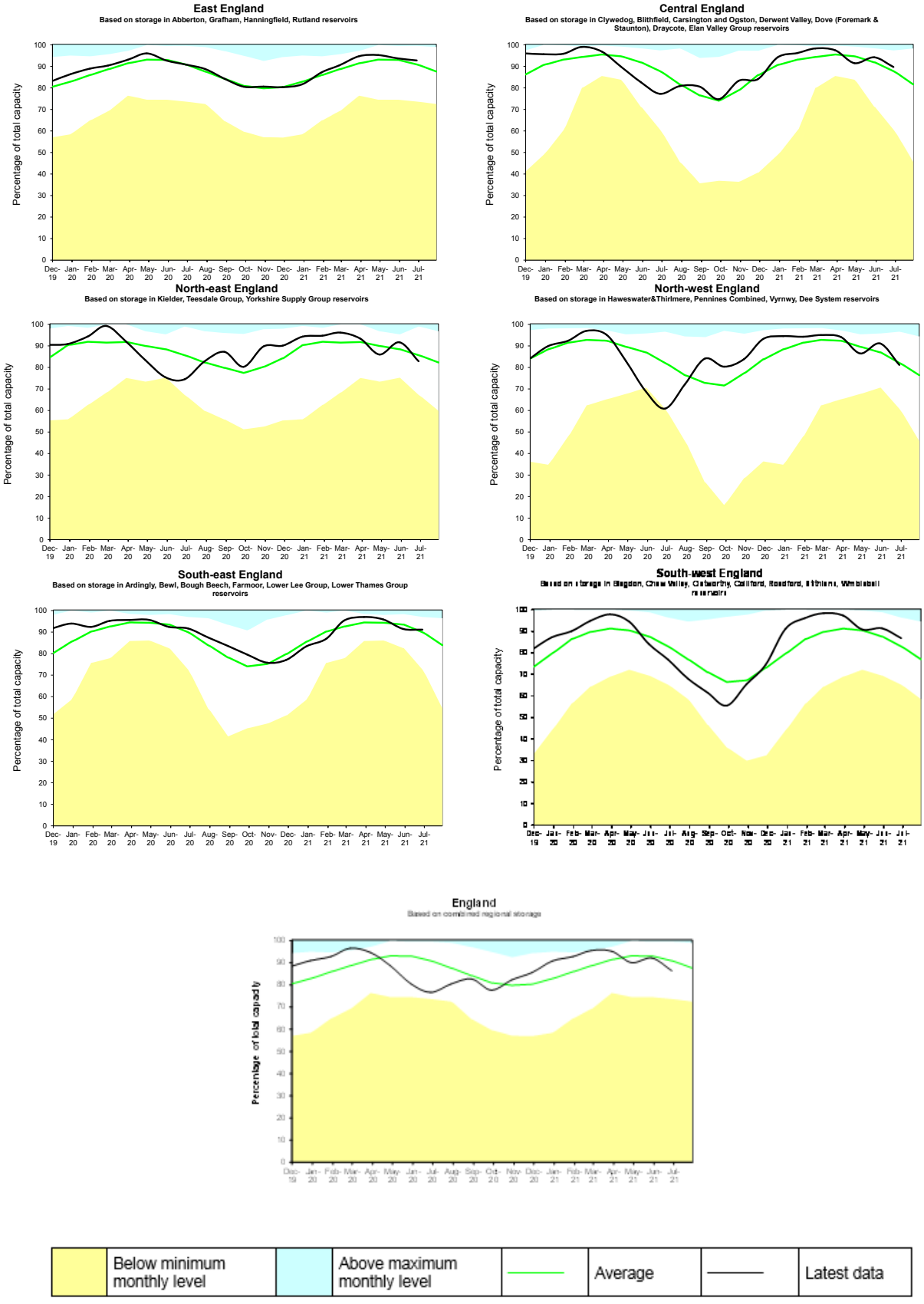


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

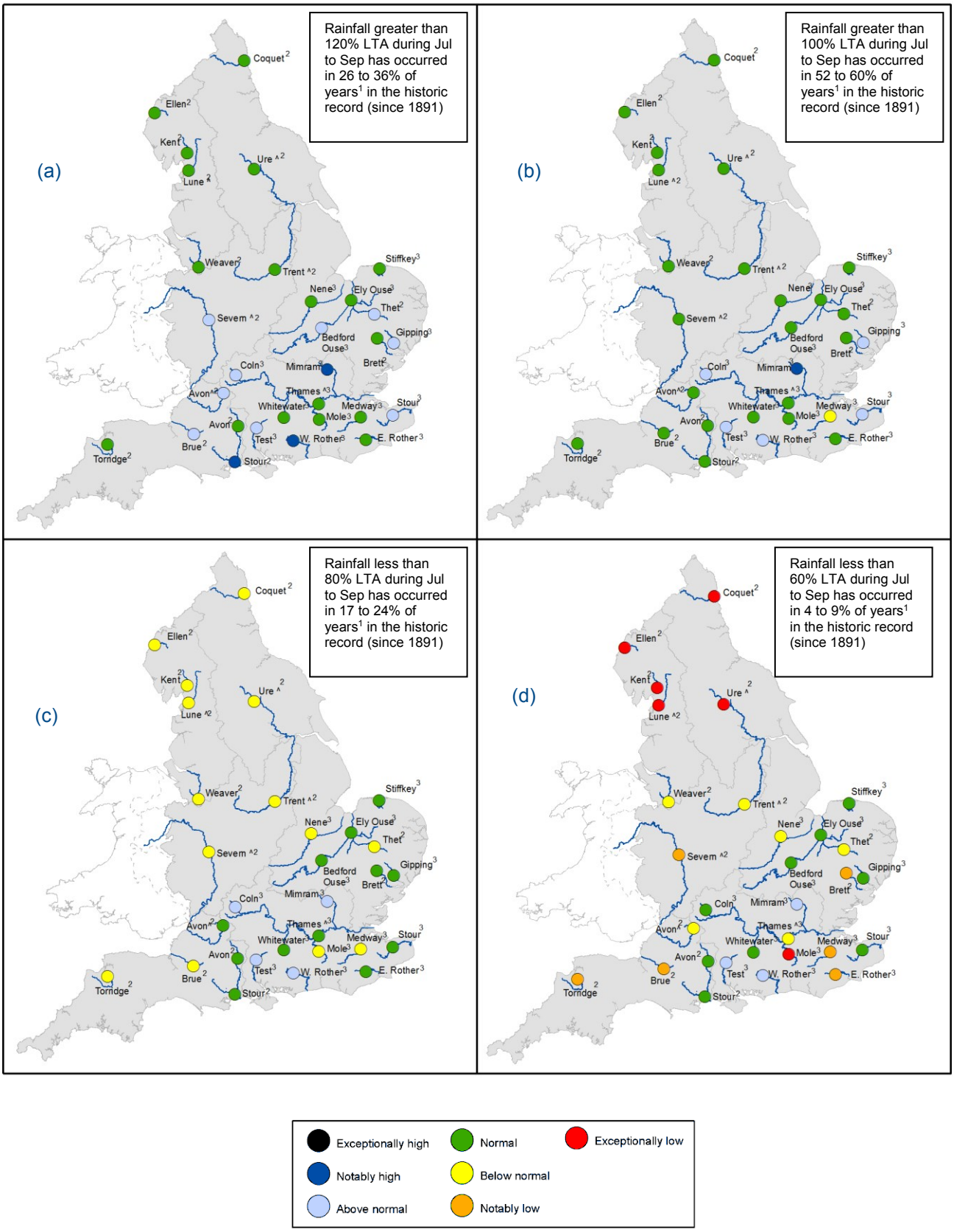


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2021 and September 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

[1] This range of probabilities is a regional analysis
[2] Projections for these sites are produced by CEH
[3] Projections for these sites are produced by the Environment Agency
^ *"Naturalised" flows are projected for these sites*

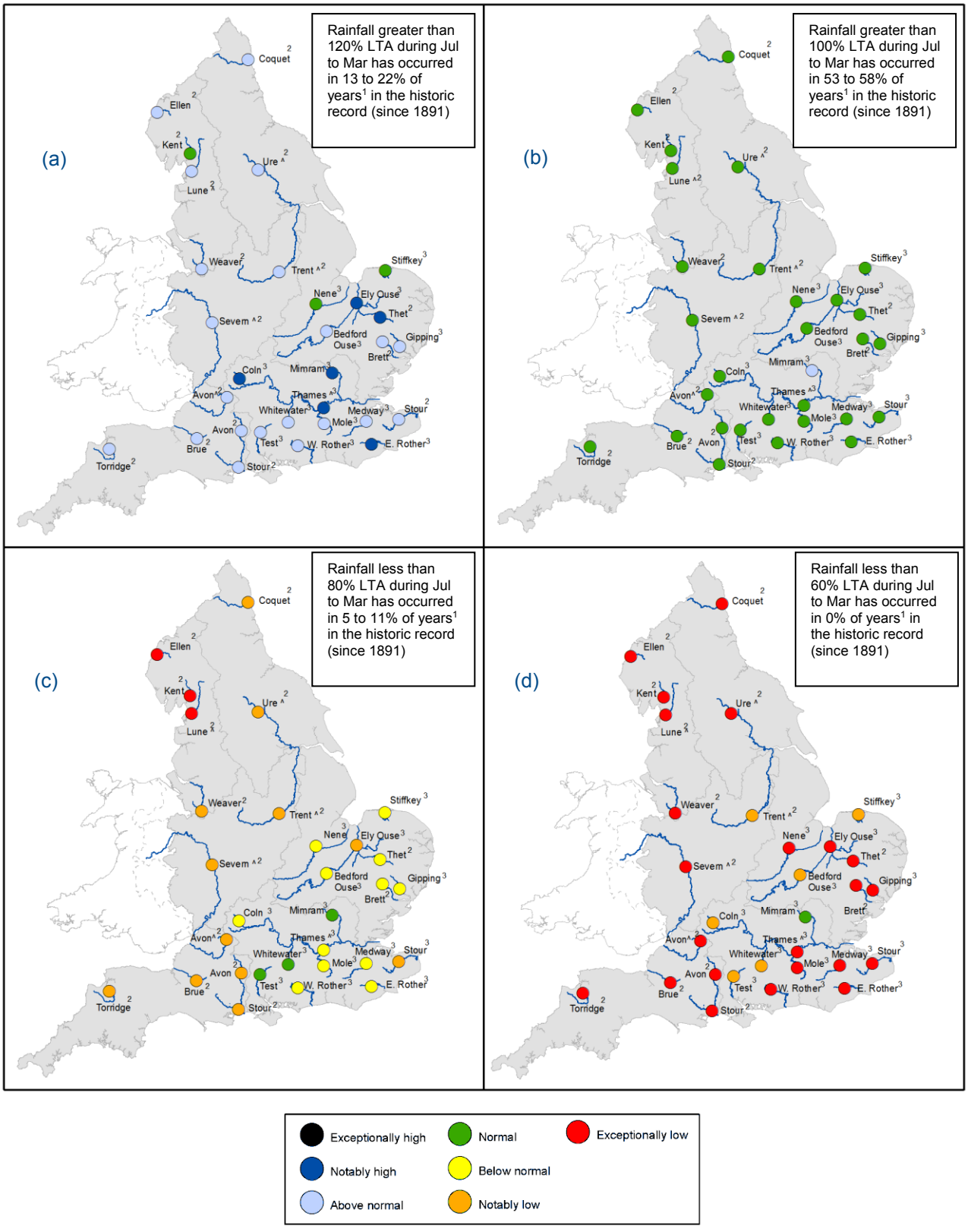


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2021 and March 2022 (Source: Centre for Ecology and Hydrology, Environment Agency)

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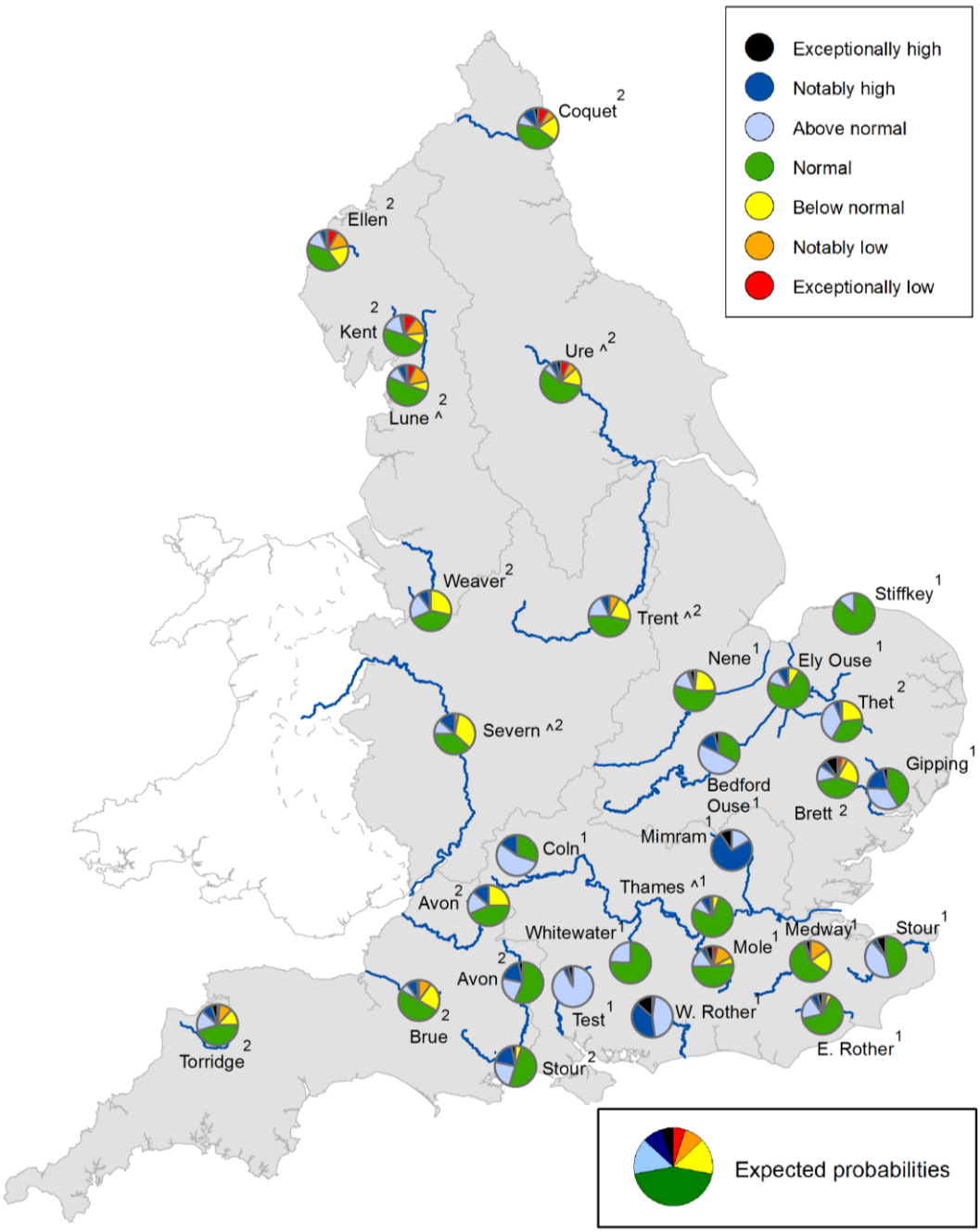

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.

Figure 6.3: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2021. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency).

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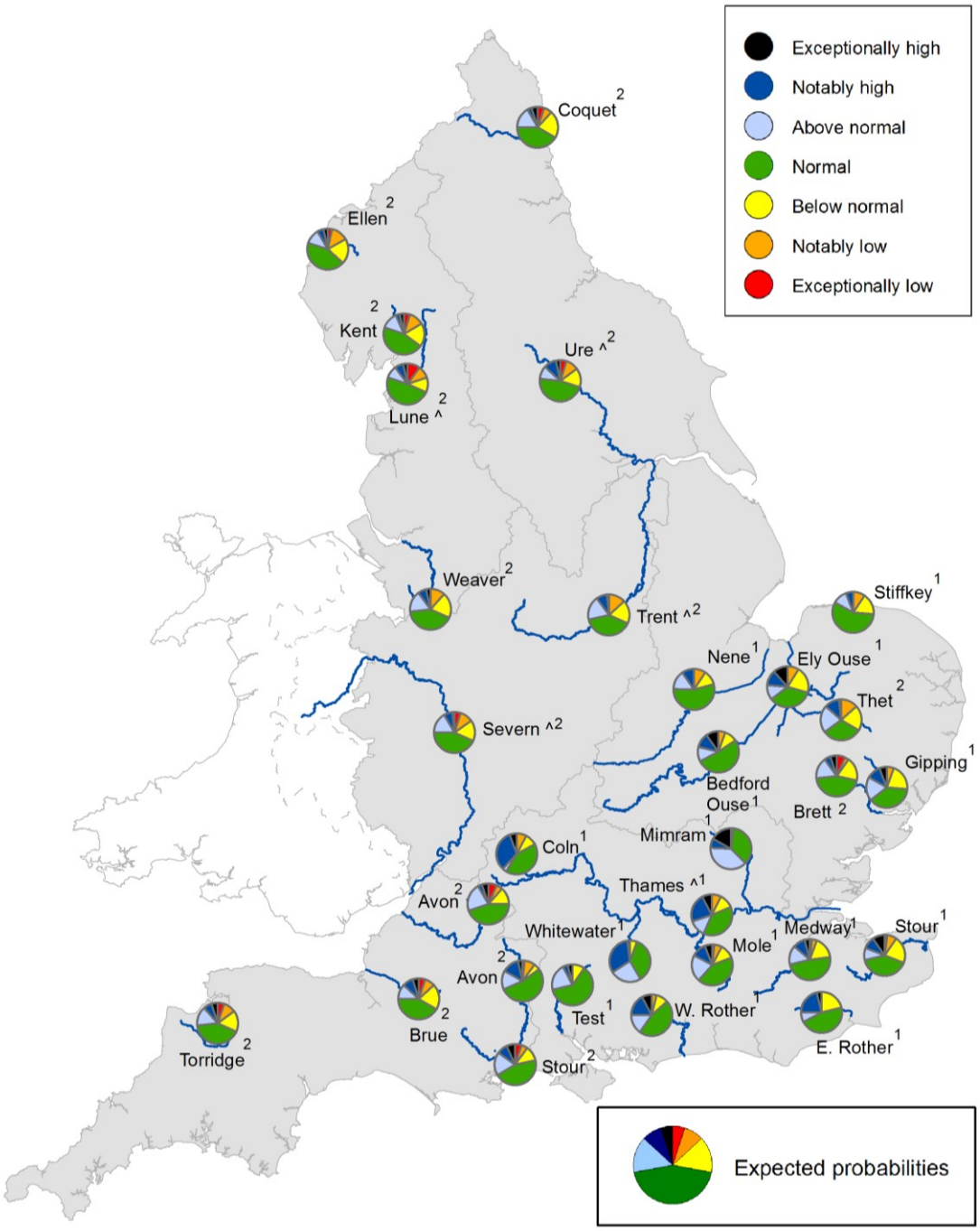

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2022. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency).

[1] Projections for these sites are produced by the Environment Agency
[2] Projections for these sites are produced by CEH
^"Naturalised" flows are projected for these sites

Forward look: groundwater

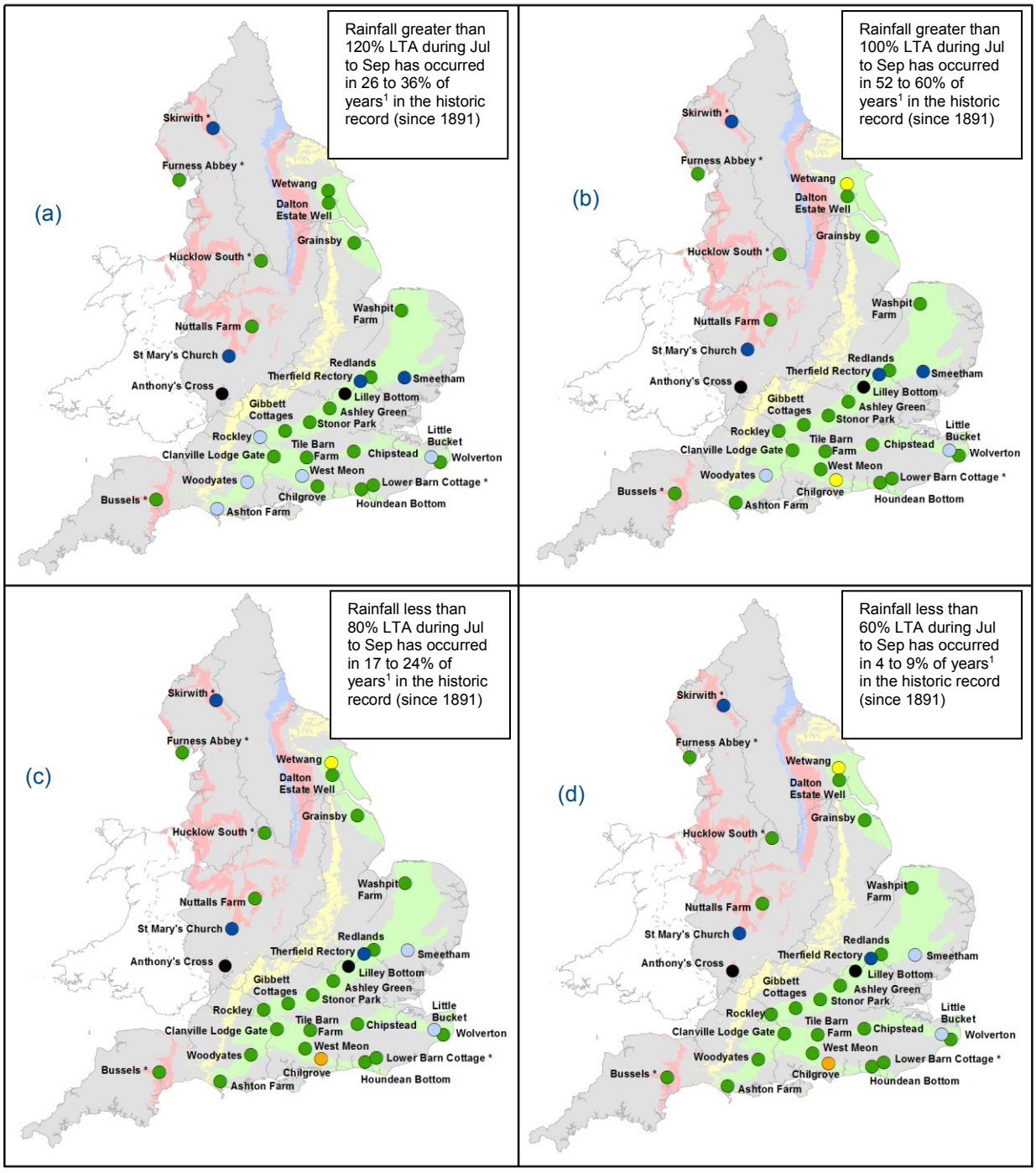

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2021 and September 2021 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2021.

* Projections for these sites are produced by BGS
[1] This range of probabilities is a regional analysis

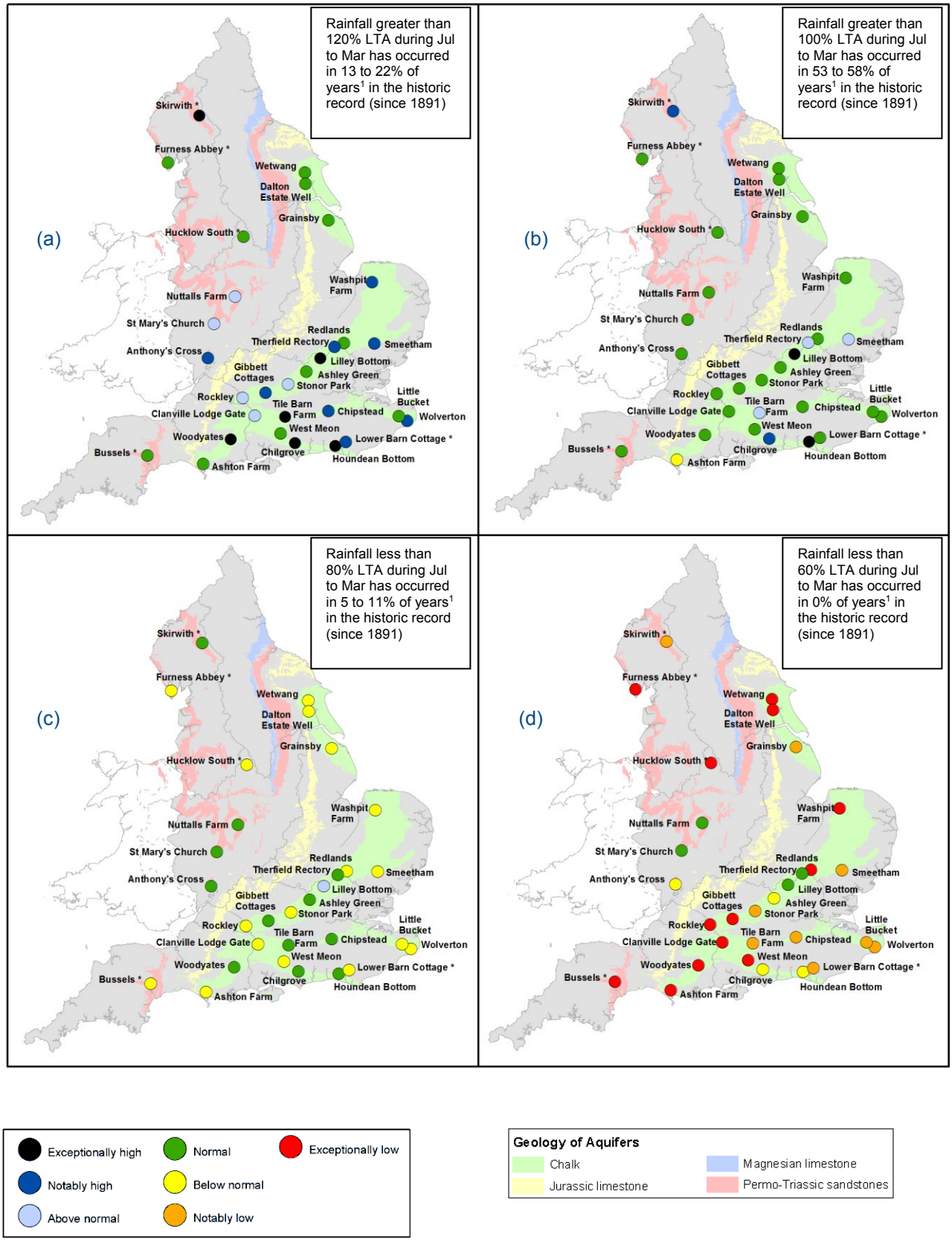

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2021 and March 2022 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2021.

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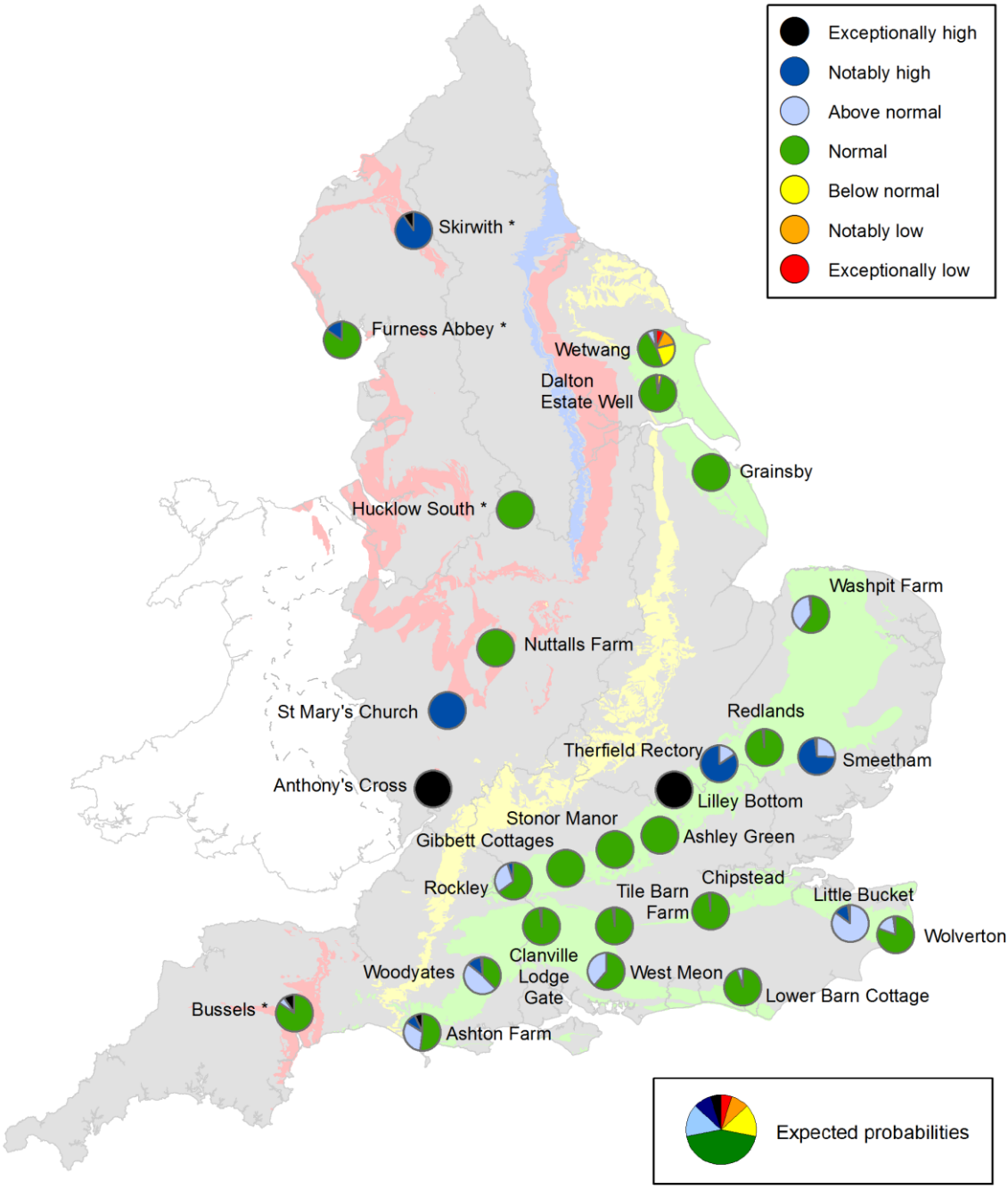
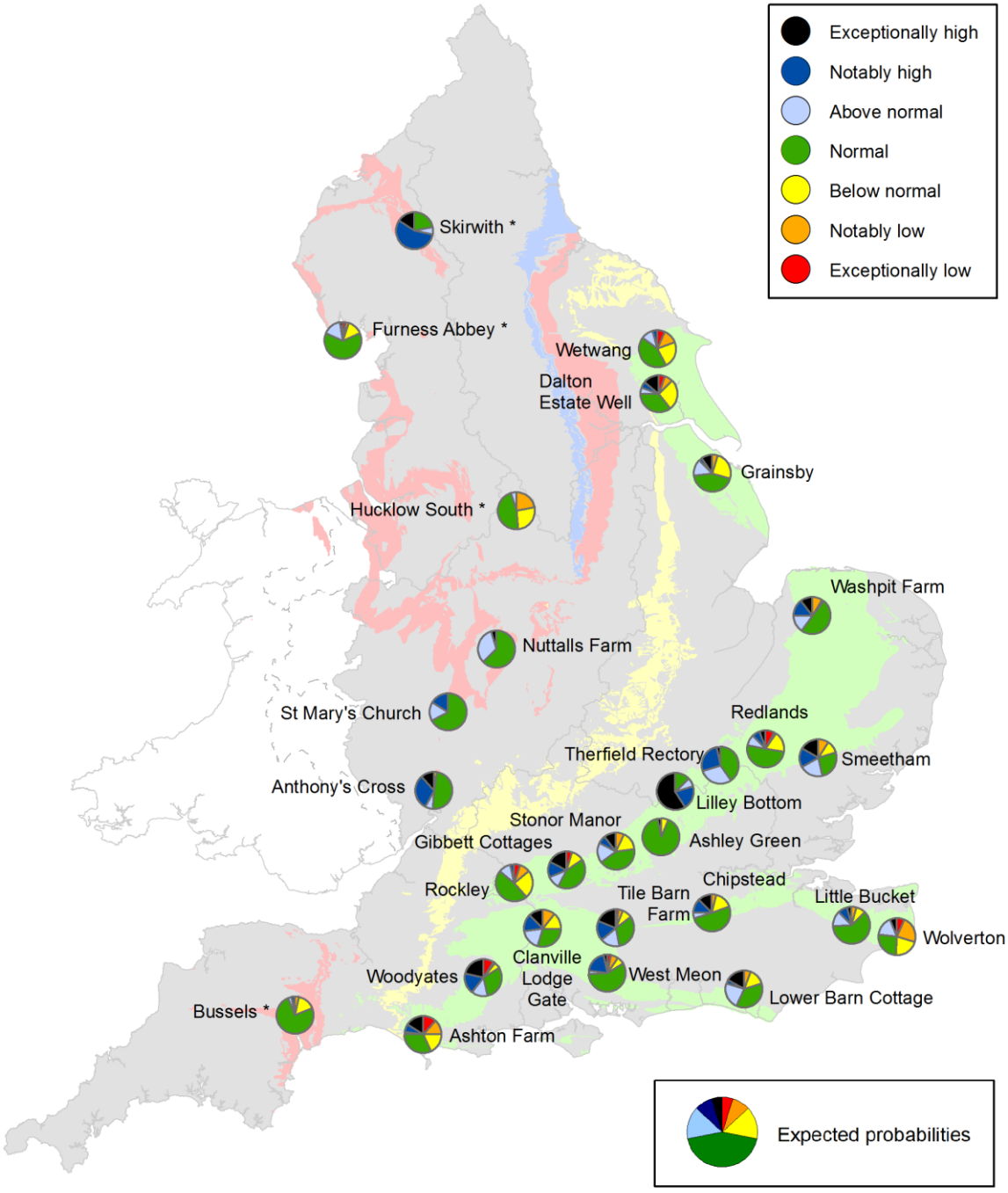


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.

Figure 6.7: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2021. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

** Projections for these sites are produced by BGS*



Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.

Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2022. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

* Projections for these sites are produced by BGS

Figure 7.1: Geographic regions

Glossary

Term	Definition
Aquifer	A geological formation able to store and transmit water.
Areal average rainfall	The estimated average depth of rainfall over a defined area. Expressed in depth of water (mm).
Artesian	The condition where the groundwater level is above ground surface but is prevented from rising to this level by an overlying continuous low permeability layer, such as clay.
Artesian borehole	Borehole where the level of groundwater is above the top of the borehole and groundwater flows out of the borehole when unsealed.
Cumecs	Cubic metres per second (m^3s^{-1})
Effective rainfall	The rainfall available to percolate into the soil or produce river flow. Expressed in depth of water (mm).
Flood Alert/Flood Warning	Three levels of warnings may be issued by the Environment Agency. Flood Alerts indicate flooding is possible. Flood Warnings indicate flooding is expected. Severe Flood Warnings indicate severe flooding.
Groundwater	The water found in an aquifer.
Long term average (LTA)	The arithmetic mean, calculated from the historic record. For rainfall and soil moisture deficit, the period refers to 1961 to 1990, unless otherwise stated. For other parameters, the period may vary according to data availability
mAOD	Metres Above Ordnance Datum (mean sea level at Newlyn Cornwall).
MORECS	Met Office Rainfall and Evaporation Calculation System. Met Office service providing real time calculation of evapotranspiration, soil moisture deficit and effective rainfall on a 40 x 40 km grid.
Naturalised flow	River flow with the impacts of artificial influences removed. Artificial influences may include abstractions, discharges, transfers, augmentation and impoundments.
NCIC	National Climate Information Centre. NCIC area monthly rainfall totals are derived using the Met Office 5 km gridded dataset, which uses rain gauge observations.
Recharge	The process of increasing the water stored in the saturated zone of an aquifer. Expressed in depth of water (mm).
Reservoir gross capacity	The total capacity of a reservoir.
Reservoir live capacity	The capacity of the reservoir that is normally usable for storage to meet established reservoir operating requirements. This excludes any capacity not available for use (e.g. storage held back for emergency services, operating agreements or physical restrictions). May also be referred to as ‘net’ or ‘deployable’ capacity.
Soil moisture deficit (SMD)	The difference between the amount of water actually in the soil and the amount of water the soil can hold. Expressed in depth of water (mm).

Categories

Exceptionally high	Value likely to fall within this band 5% of the time
Notably high	Value likely to fall within this band 8% of the time
Above normal	Value likely to fall within this band 15% of the time
Normal	Value likely to fall within this band 44% of the time
Below normal	Value likely to fall within this band 15% of the time
Notably low	Value likely to fall within this band 8% of the time
Exceptionally low	Value likely to fall within this band 5% of the time