# Monthly water situation report

## England

### Summary – October 2020

October rainfall totals were above the long term average across England. As a result, soils got wetter across the country and river flows increased at all of the indicator sites. River flows were classed as above normal or higher at more than three quarters of the sites reported on. Groundwater levels increased at half of the indicator sites during October, with more than two thirds of the sites reported on classed as normal for the time of year. Total reservoir stocks for England were at 82% of total capacity at the end of October.

### Rainfall

The October rainfall total for England was 141mm, which represents 182% of the 1961 to 1990 long term average (LTA) (154% of the 1981 to 2010 LTA). The highest monthly rainfall totals were recorded in parts of Cumbria, Lancashire, Hampshire, West Sussex and Gwynedd with more than 210mm total rainfall for the month (Figure 1.1).

Monthly rainfall totals were classed as above normal or higher for the time of year across the majority of England. Across the whole of south-east England, October rainfall totals were classed as notably high or exceptionally high while parts of south-west, east and north-west England also recorded exceptionally high rainfall totals for the month. The South Essex, Roding, Lower Lee and Chilterns East Colne hydrological areas received the highest rainfall totals as a percentage of the LTA, classed as exceptionally high and receiving more than 280% of the LTA rainfall for October. The Fal and St Austell and West Cornwall hydrological areas received the lowest October rainfall total as a proportion of the LTA (128%). The six-month and twelve-month cumulative rainfall totals are classed as normal or higher for all catchments across England (Figure 1.2).

At a regional scale, October rainfall totals were above the LTA in all regions, ranging from 150% of the LTA in north-west England to 244% of the LTA in south-east England (Figure 1.3). It has been the wettest October since 2000 for south-east England and the seventh wettest October since 1910 for England as a whole.

### Soil moisture deficit

Soil moisture deficits (SMDs) decreased (meaning soils got wetter) across the whole of England during October, reflecting the high rainfall totals across much of the country. In most parts of north-west, north-east, south-west and western areas of central England, SMDs were less than 10mm at the end of October. The largest month-end SMDs were in parts of Lincolnshire, north Norfolk and parts of Nottinghamshire, where SMDs were greater than 40mm (Figure 2.1).

At a regional scale, the end of month SMD values were less than the end of October LTA in all regions (Figure 2.2).

### River flows

River flows increased at all of the indicator sites reported on, compared to September. Monthly mean flows for October were classed as normal or higher for the time of year at all gauging stations. Half of all the sites reported on recorded above normal flows for the time of year, with a quarter of all sites classed as notably high. River flows were classed as exceptionally high at two sites, the Ver at Hansteads in south-east England, with a monthly mean flow of 233% of the LTA, and the Brue at Lovington in south-west England with 359% of the LTA (Figure 3.1).

Monthly mean river flows for the regional index sites were classed as above normal for the time of year at all gauging stations other than Horton on the Great Stour (Kent) which was classed as normal, and Offord (Bedford Ouse) and Kingston (Thames) which were classed as notably high (Figure 3.2).

## Groundwater levels

Groundwater levels continued to recede at nearly half of the indicator sites we report on during October, with the remaining half seeing an increase in groundwater levels through the month. At more than two-thirds of the sites, groundwater levels were classed as normal for the time of year. Only two sites (Redlands Hall in the Cam and Ely Ouse Chalk, and Chilgrove in the Chichester chalk) remain below normal or lower for the time of year. Levels at Weir Farm (Bridgnorth sandstone), Coxmoor (Idle and Torne sandstone) and Priors Hayes (West Cheshire sandstone) were classed as exceptionally high. These sites recorded the highest end of October levels on record (records go back to 1983, 1970 and 1973 respectively). Most of the indicator sites are likely to have increasing water levels during November as there are signs of widespread groundwater recharge starting across England.

End of month groundwater levels at the major aquifer index sites ranged from notably low at Chilgrove (Chichester chalk) to exceptionally high at Weir Farm (Bridgnorth sandstone) (Figures 4.1 and 4.2).

## Reservoir storage

Reservoir stocks increased at two-thirds of the reservoirs and reservoir groups we report on during October. The biggest increase, as a proportion of total capacity, was at Clatworthy reservoir in Somerset, where stocks increased from 60% at the end of September to 93% at the end of October. The majority of reservoirs and reservoir groups were classed as normal for the end of October. Three sites were classed as below normal or lower for the end of October (Ardingly in West Sussex, Colliford in Cornwall and the Dove Group in Leicestershire) (Figure 5.1).

Total reservoir stocks for England were at 82% of total capacity at the end of October (an increase from 78% at the end of September), just above the LTA for the time of year. At a regional scale, total reservoir stocks were close to or above the LTA for the time of year, with the exception of south-west England where total stocks were just below the average (Figure 5.2).

## Forward look

The weather in the first week of November will increasingly be dominated by high-pressure, with low cloud and mist in many areas interspersed by sunny spells and some rain, particularly in the south-west. Mild and settled conditions are likely to dominate the middle of the month, with any rain and strong winds expected to be largely confined to the western areas. These generally settled conditions are likely to continue through to the end of November, although occasional unsettled periods are possible, mainly affecting western and northern areas.

Below average precipitation is slightly more likely than above average precipitation across the UK for the three-month period November to January[1].

**Projections for river flows at key sites[2]**

More than nine tenths of the modelled sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year by the end of March 2021. By the end of September 2021, all sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year.

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

**Projections for groundwater levels in key aquifers[2]**

By the end of March 2021, four fifths of the modelled sites have a greater than expected chance of groundwater levels being below normal or higher for the time of year. By the end of September 2021, 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 March 2021 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in September 2021 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2021 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2021 see Figure 6.8

Authors: National Water Resources Hydrology Team

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1 Source: Met Office
2 Information produced by the Water Situation Forward Look group led by Environment Agency in partnership with the Centre for Ecology and Hydrology, British Geological Survey, Met Office (www.hydoutuk.net).

## Rainfall

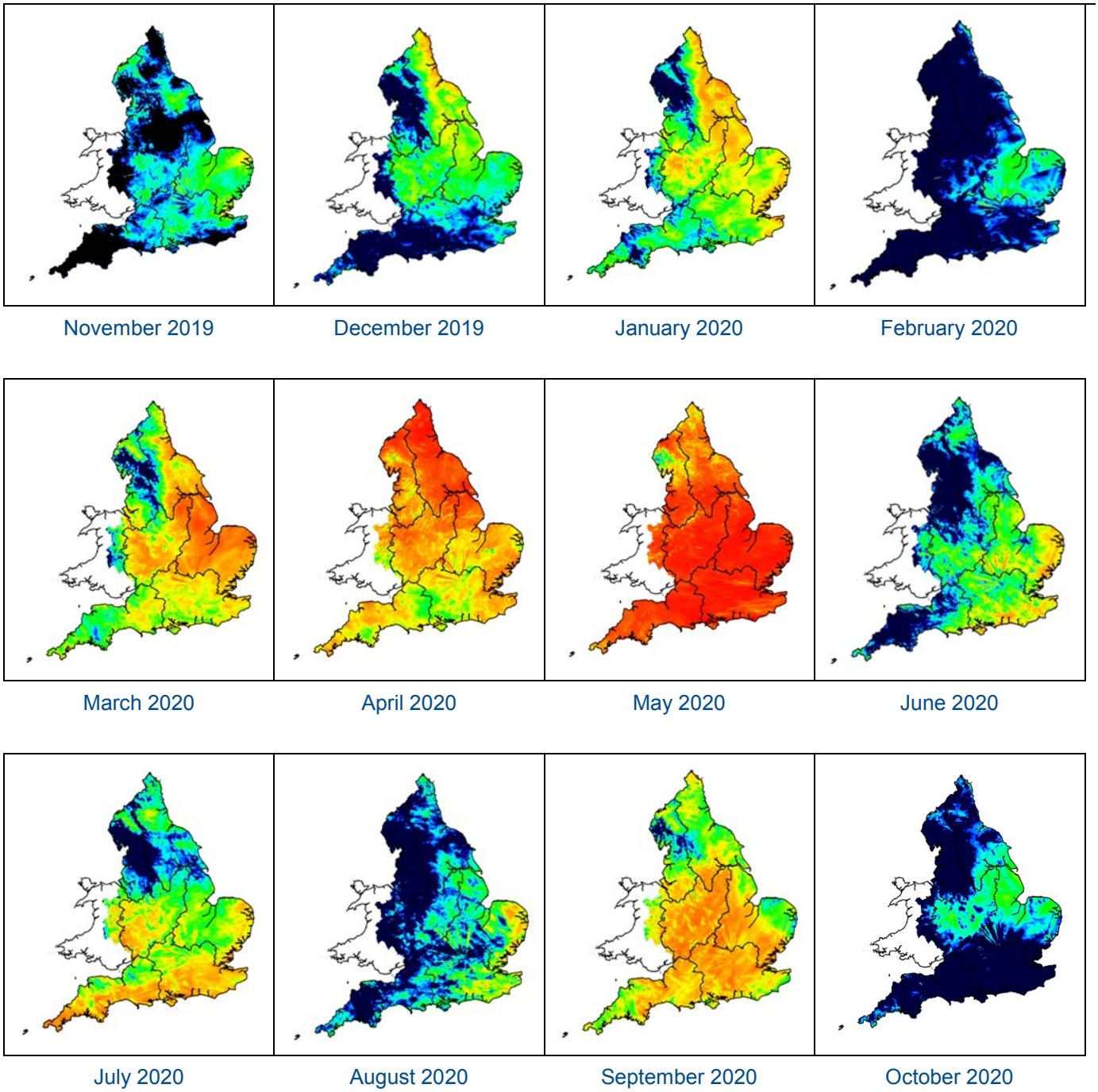



**Figure 1.1**: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

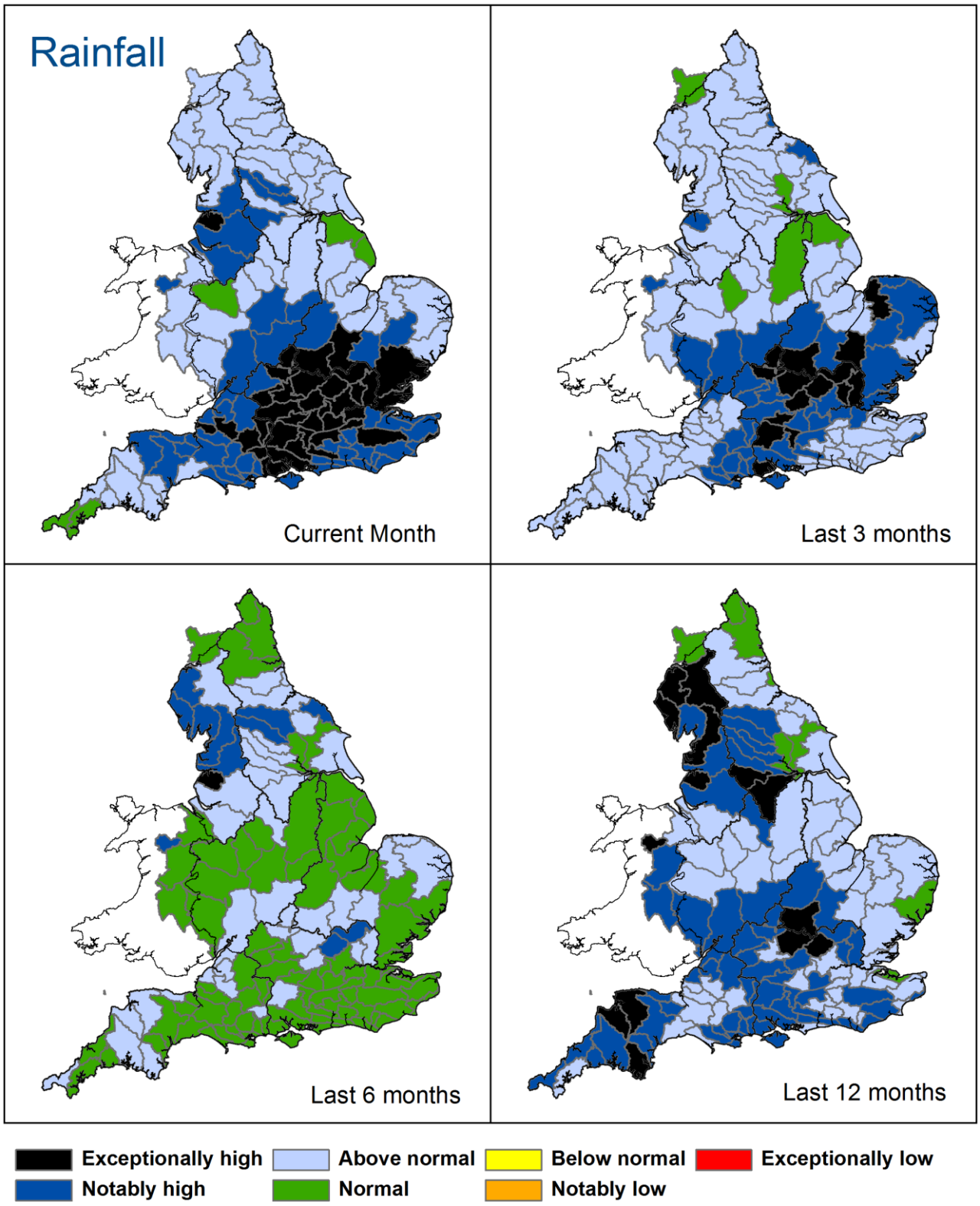



**Figure 1.2**: Total rainfall for hydrological areas across England for the current month (up to 31 October), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2020).* 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, 2020.

## Rainfall charts

Above average rainfall

Below average rainfall

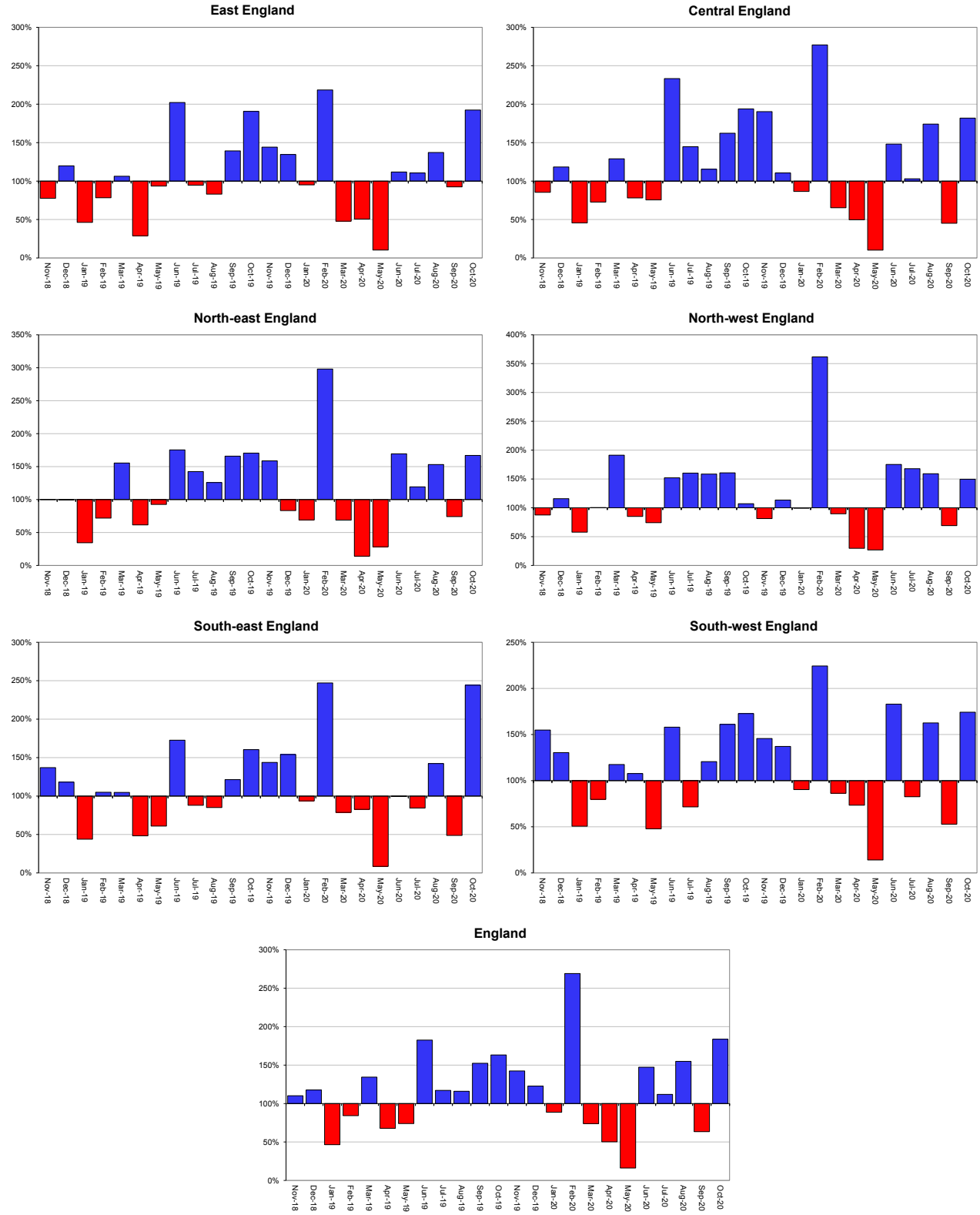



**Figure 1.3**: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

# Soil moisture deficit

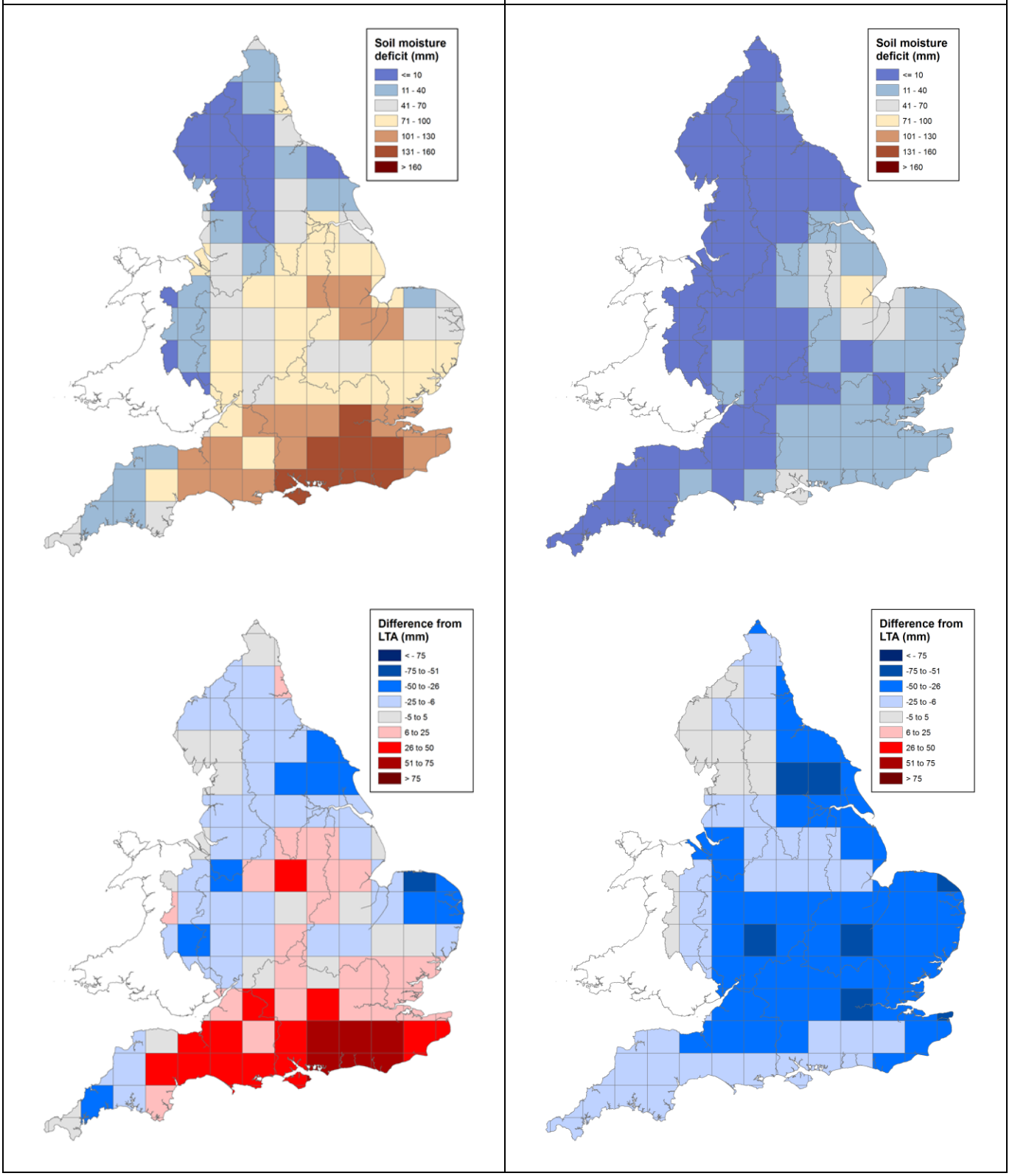
| End of September 2020[1] | End of October 2020[2] |
|---|---|
|  | |



**Figure 2.1**: Soil moisture deficits for weeks ending 29 September 2020 [1] (left panel) and 03 November 2020 [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, 2020). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

# Soil moisture deficit charts

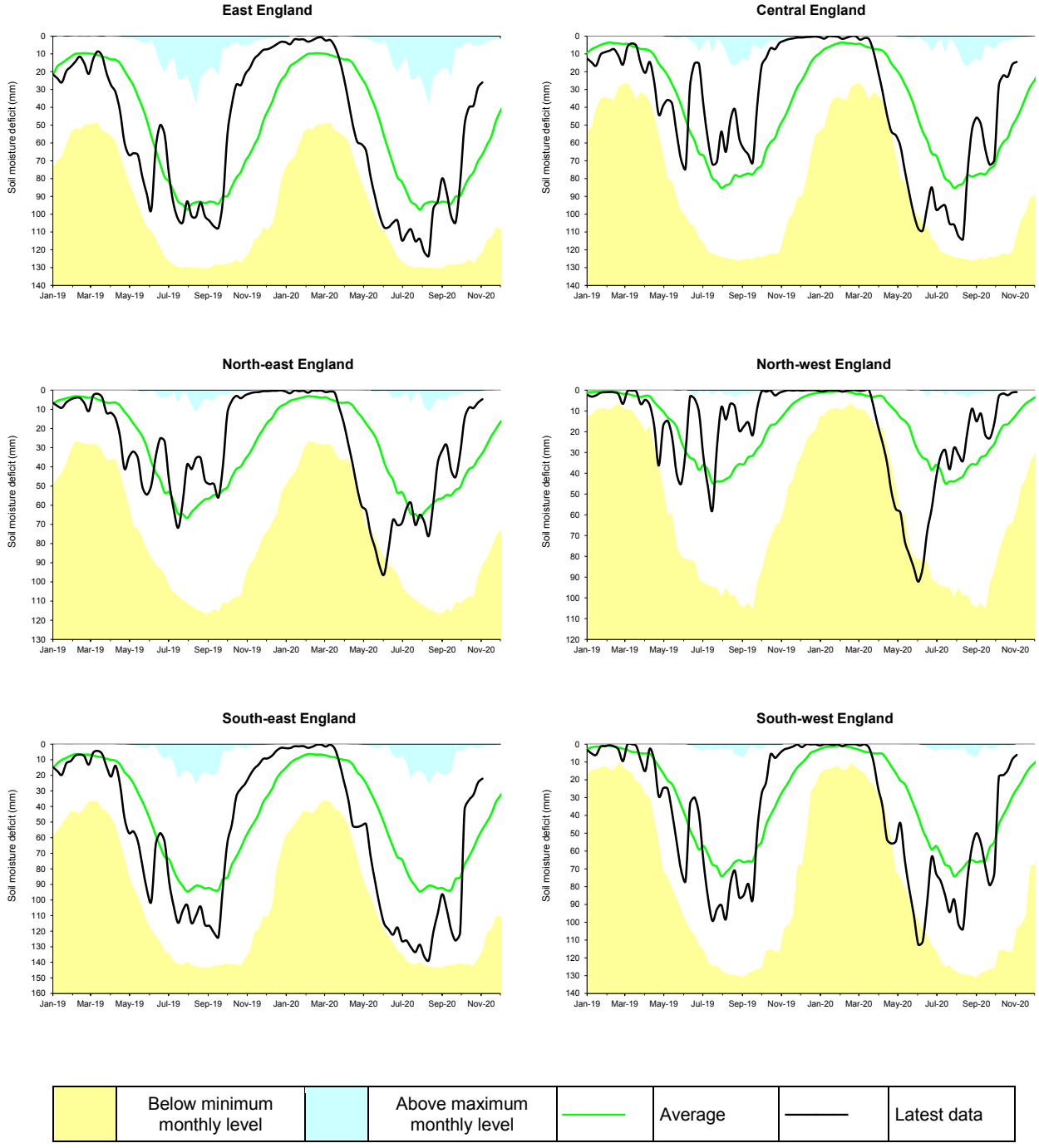
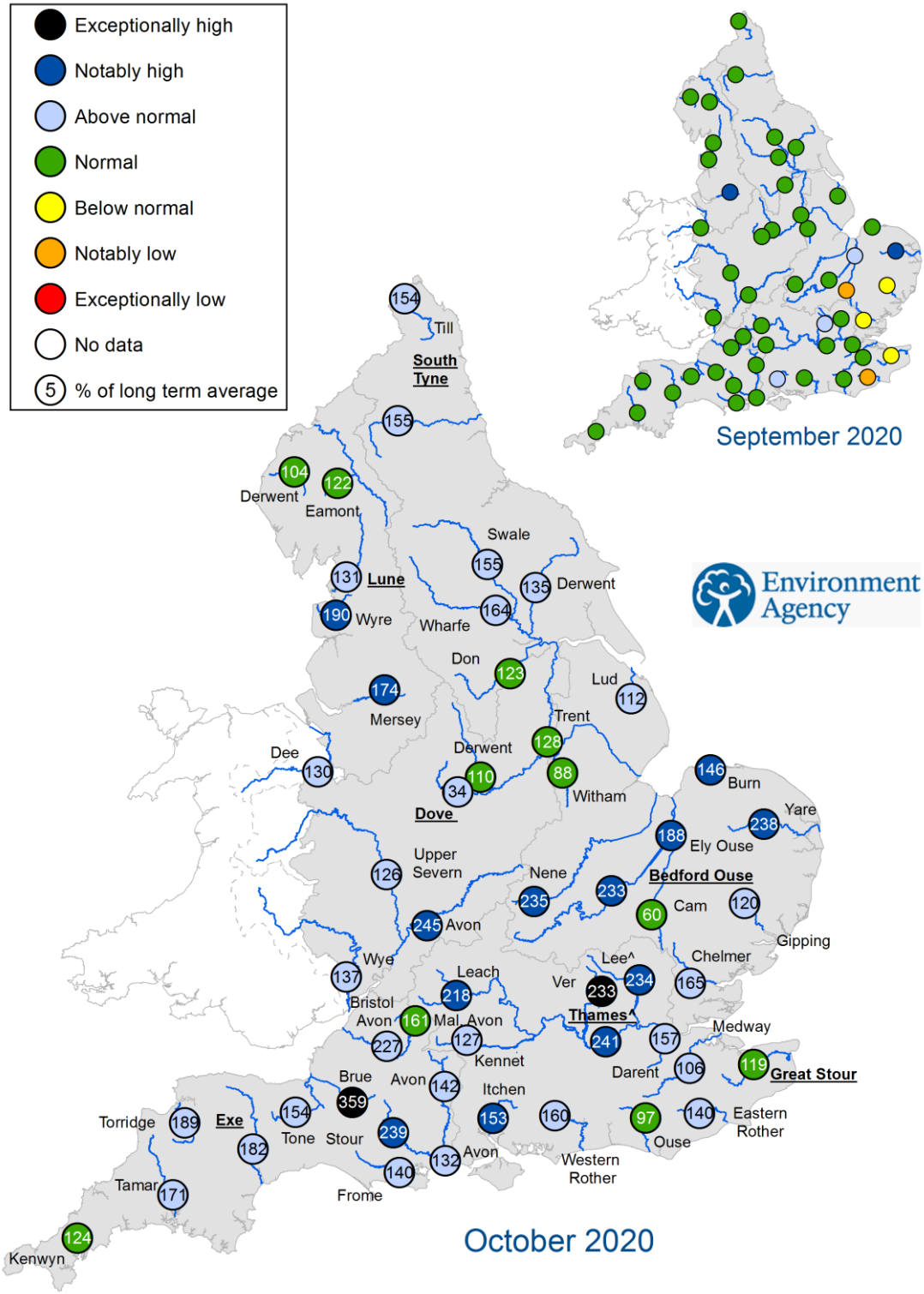



**Figure 2.2**: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2020).

# River flows




^ "Naturalised" flows are provided for the River Thames at Kingston and the River Lee at Feildes Weir
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 September 2020 and October 2020, expressed as a percentage of the respective long term average and classed relative to an analysis of historic September and October monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

## River flow charts

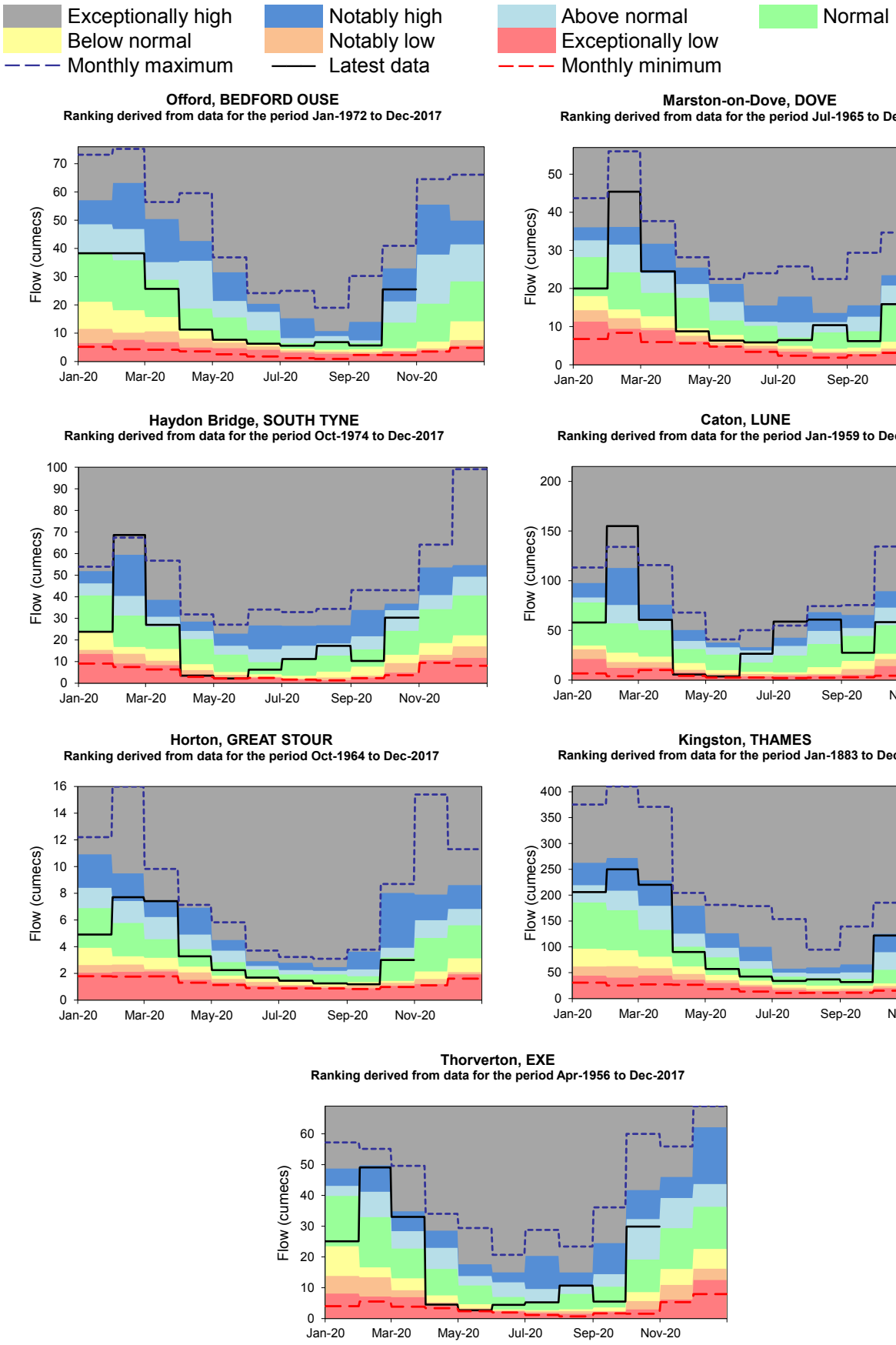
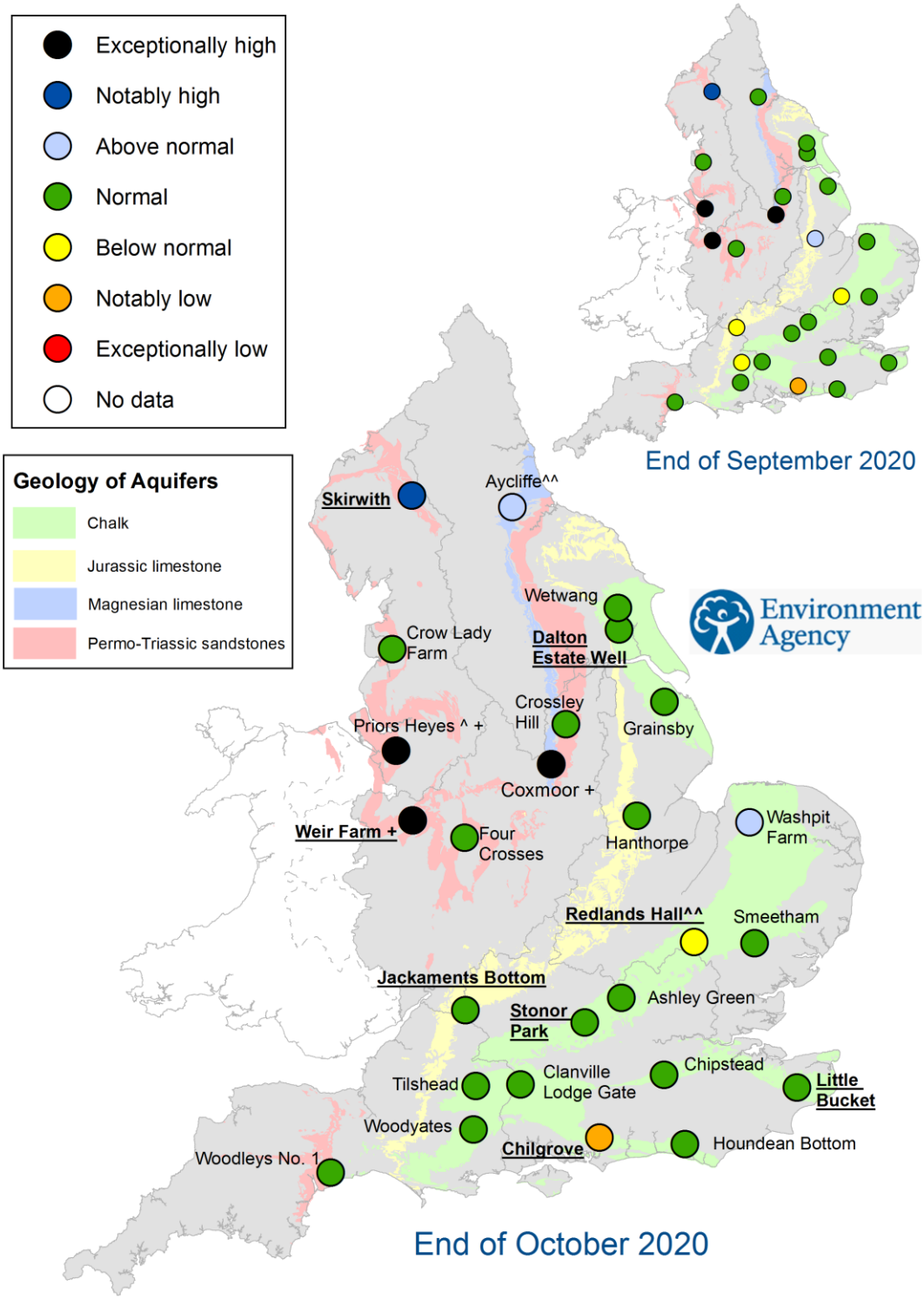



**Figure 3.2**: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

# 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 September 2020 and October 2020, classed relative to an analysis of respective historic September and October levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

## Groundwater level charts

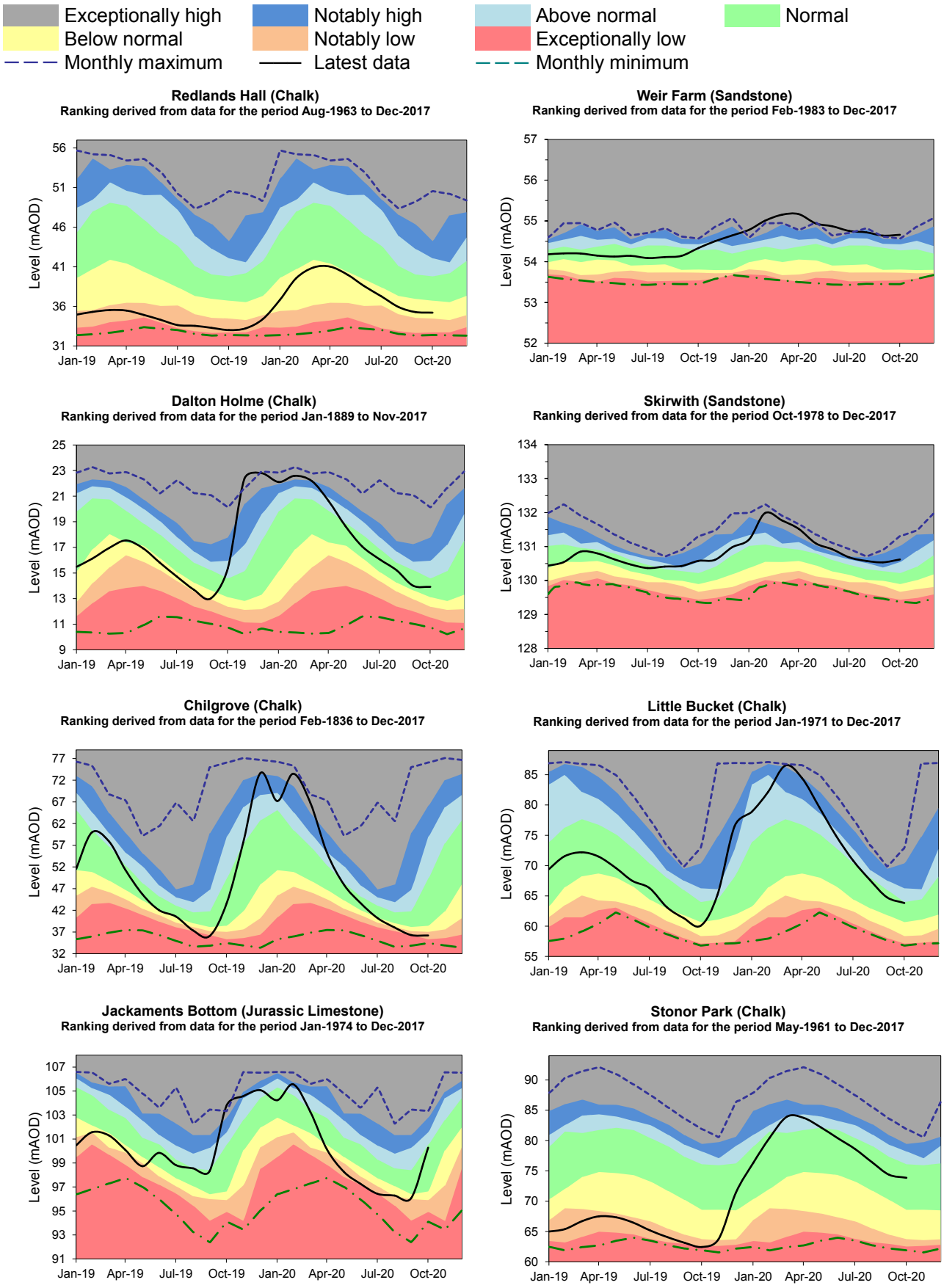
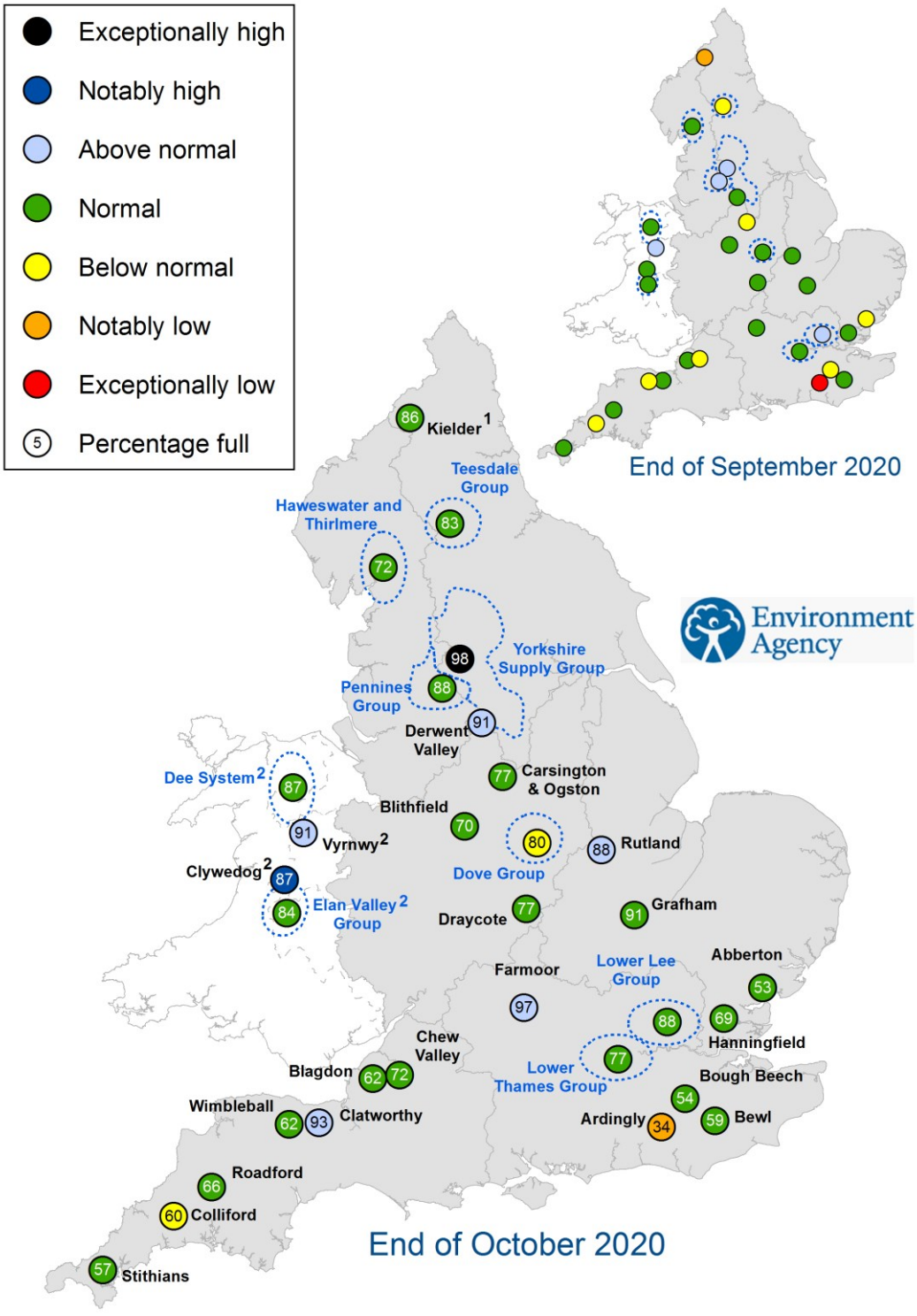



**Figure 4.2**: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

# 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

**Figure 5.1**: Reservoir stocks at key individual and groups of reservoirs at the end of September 2020 and October 2020 as a percentage of total capacity and classed relative to an analysis of historic September and October 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

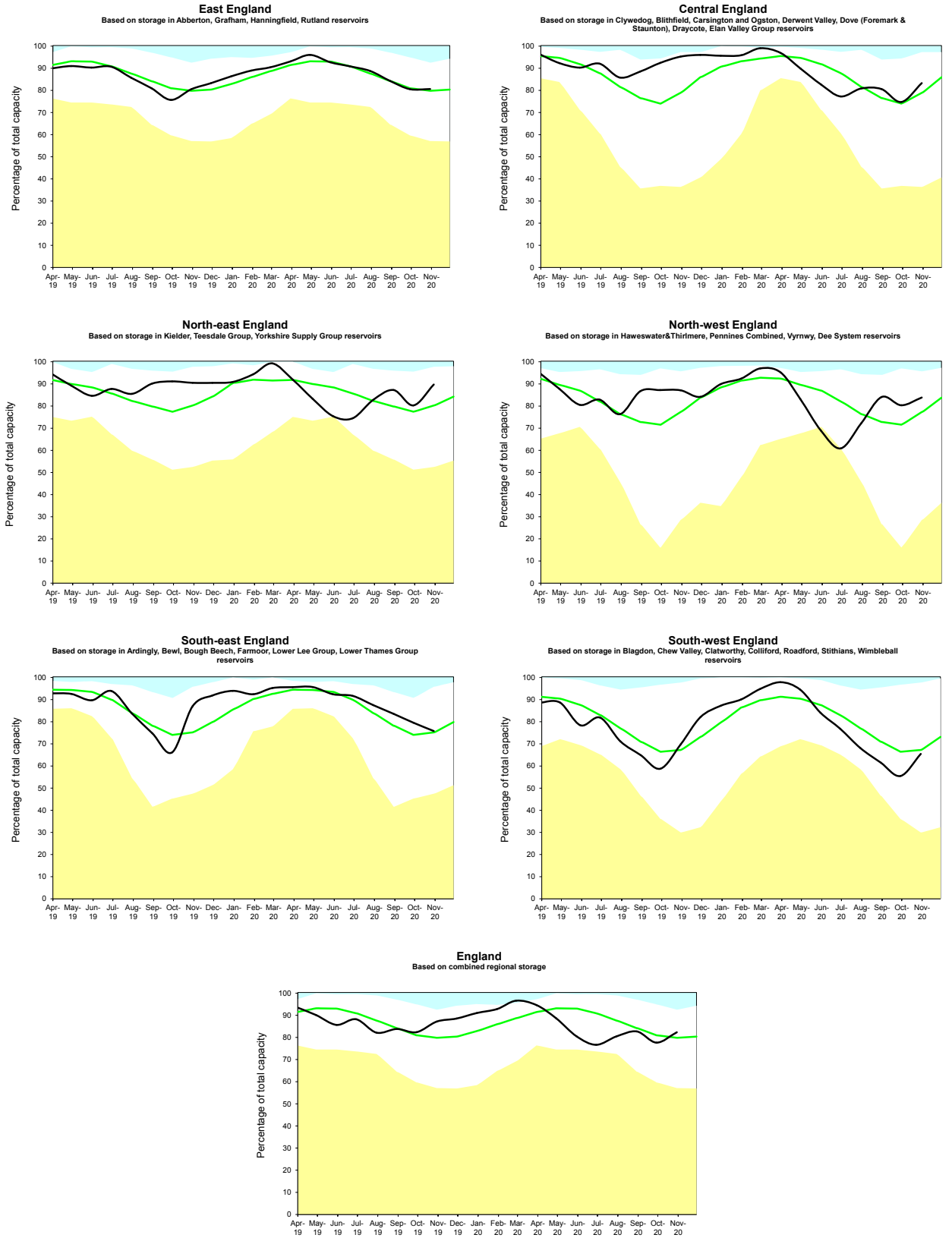



**Figure 5.2**: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

# Forward look: river flow

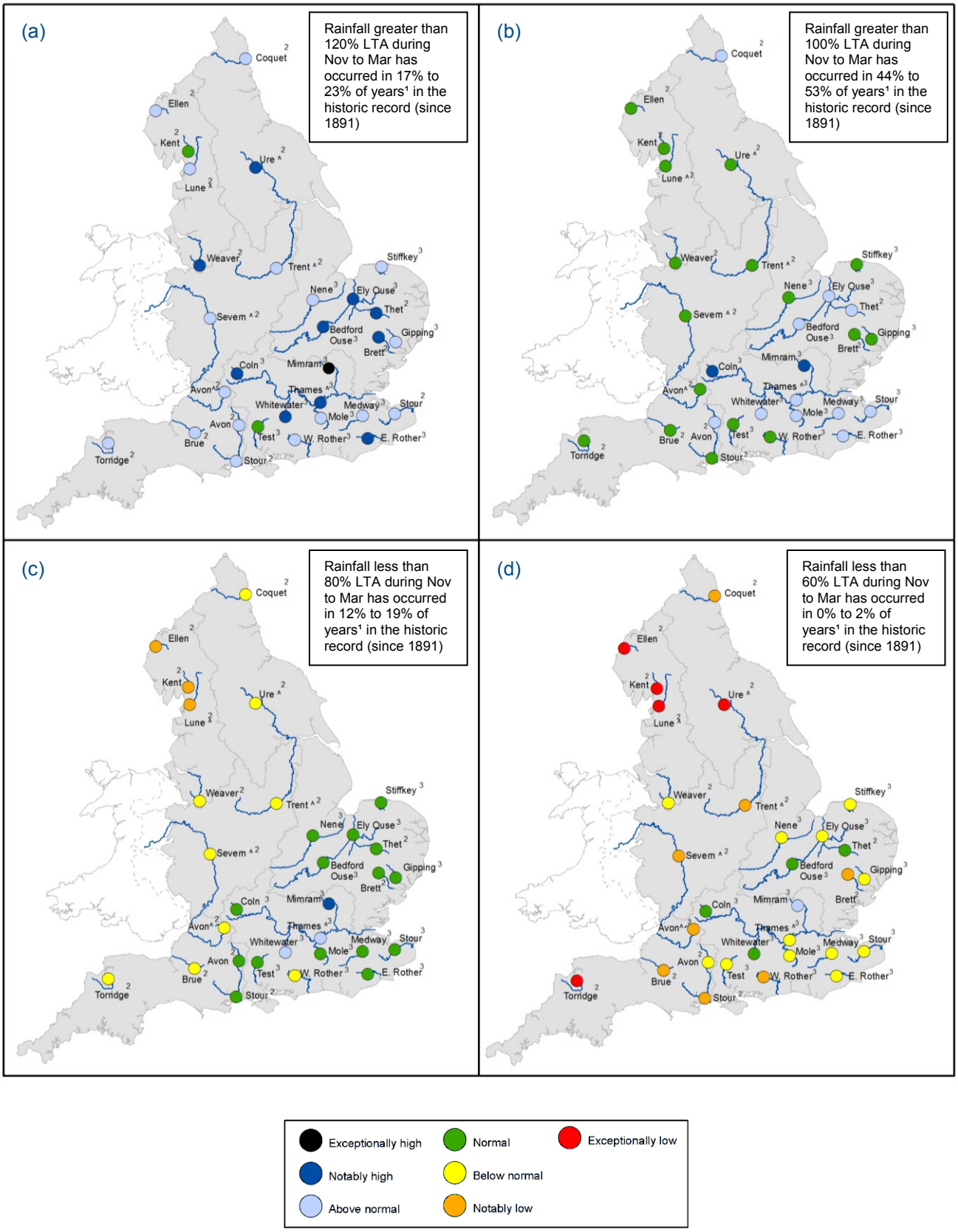



**Figure 6.1**: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between November 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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*

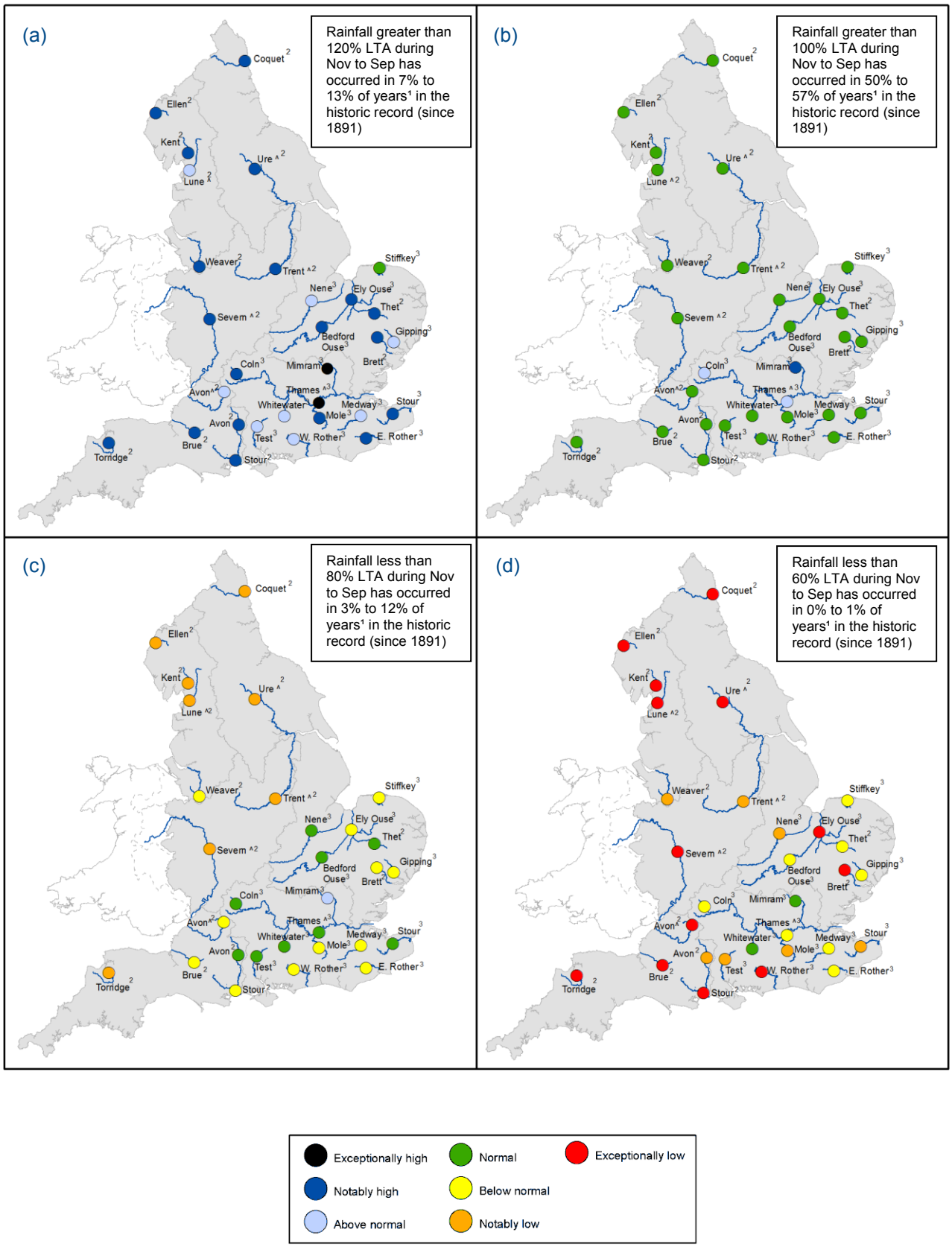



**Figure 6.2**: Projected river flows at key indicator sites up until the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between November 2020 and September 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

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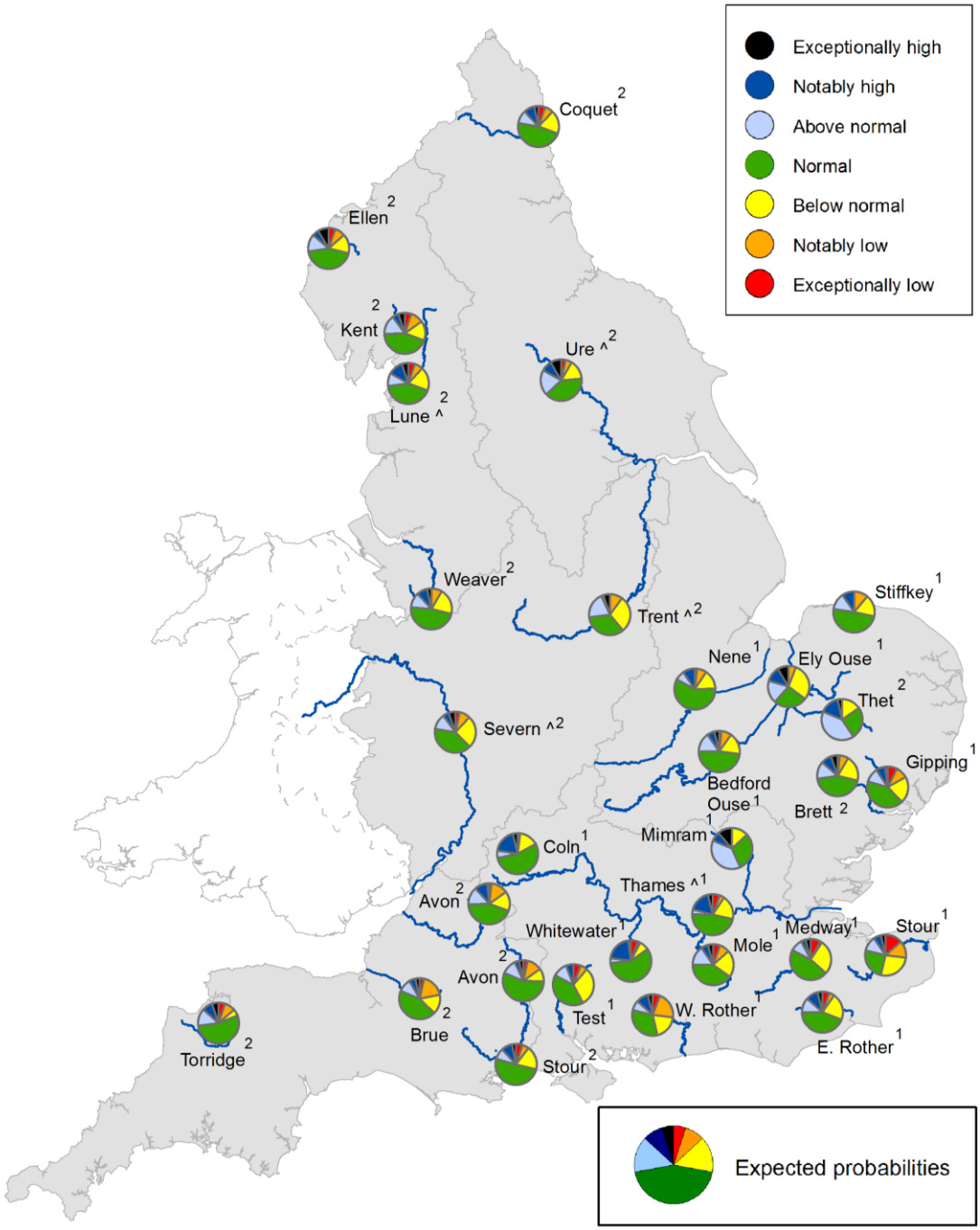


*Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels 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 March 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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^"Naturalised" flows are projected for these sites

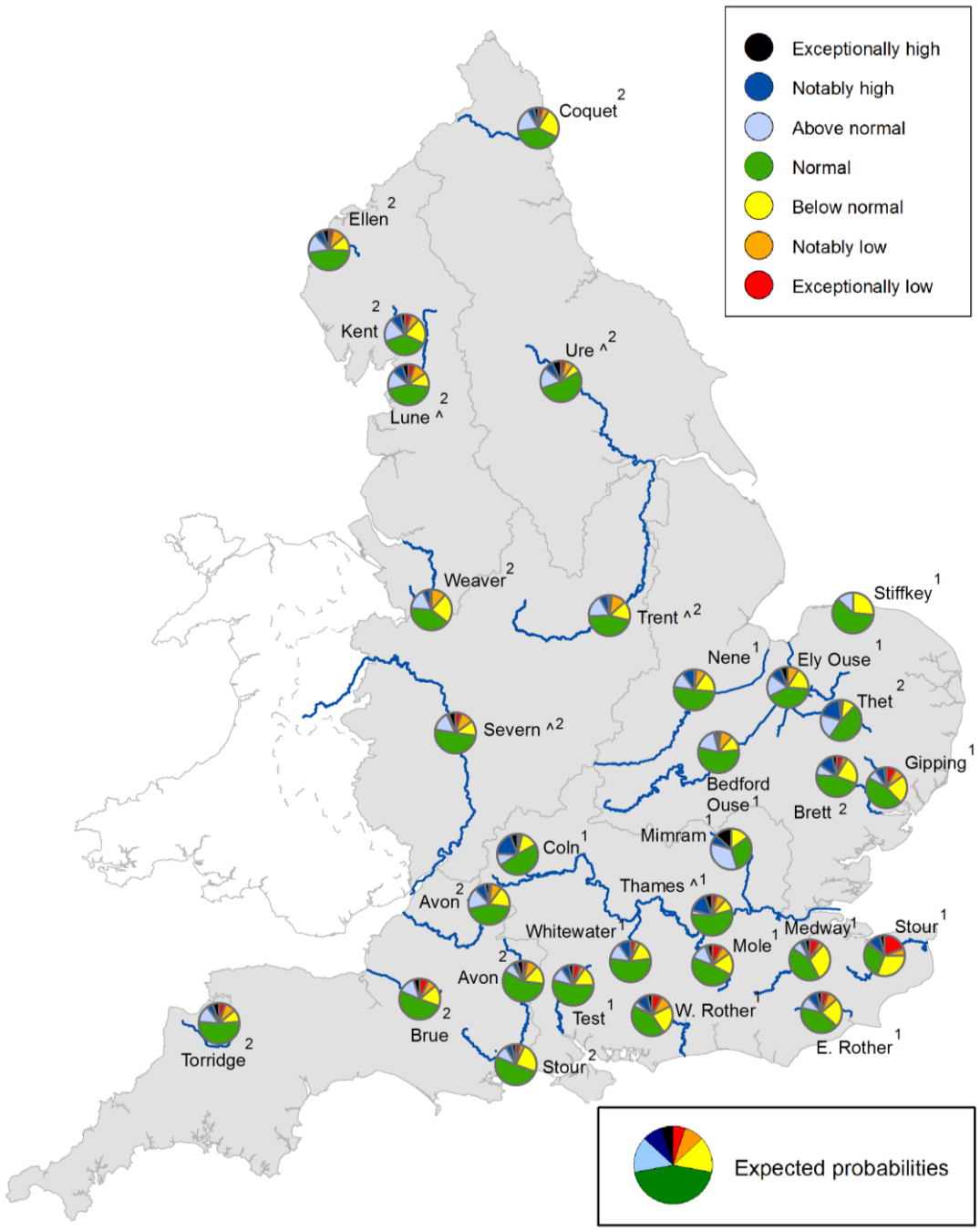


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**Figure 6.4**: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2021. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency).

[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

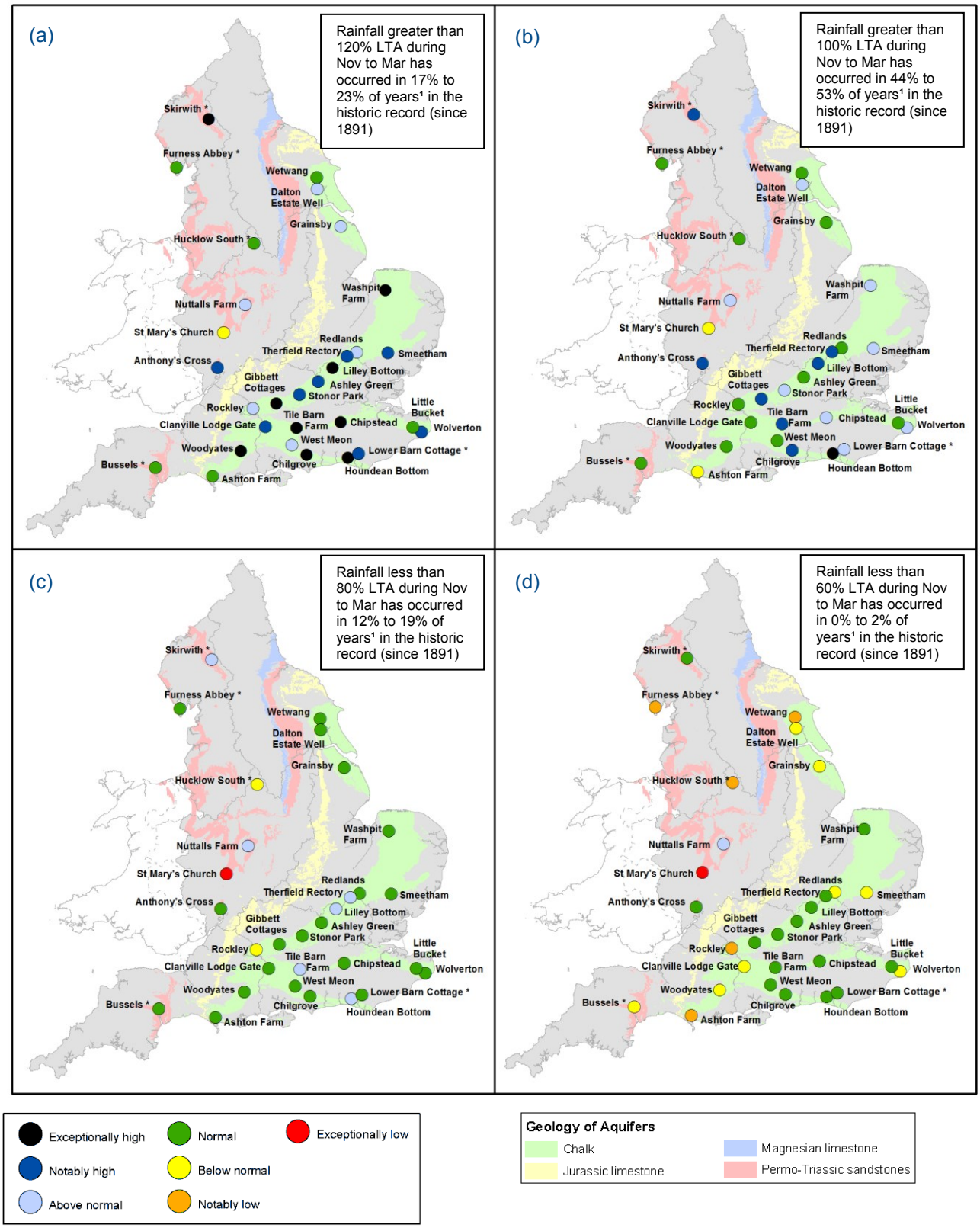


**Figure 6.5**: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between November 2020 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2020.

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

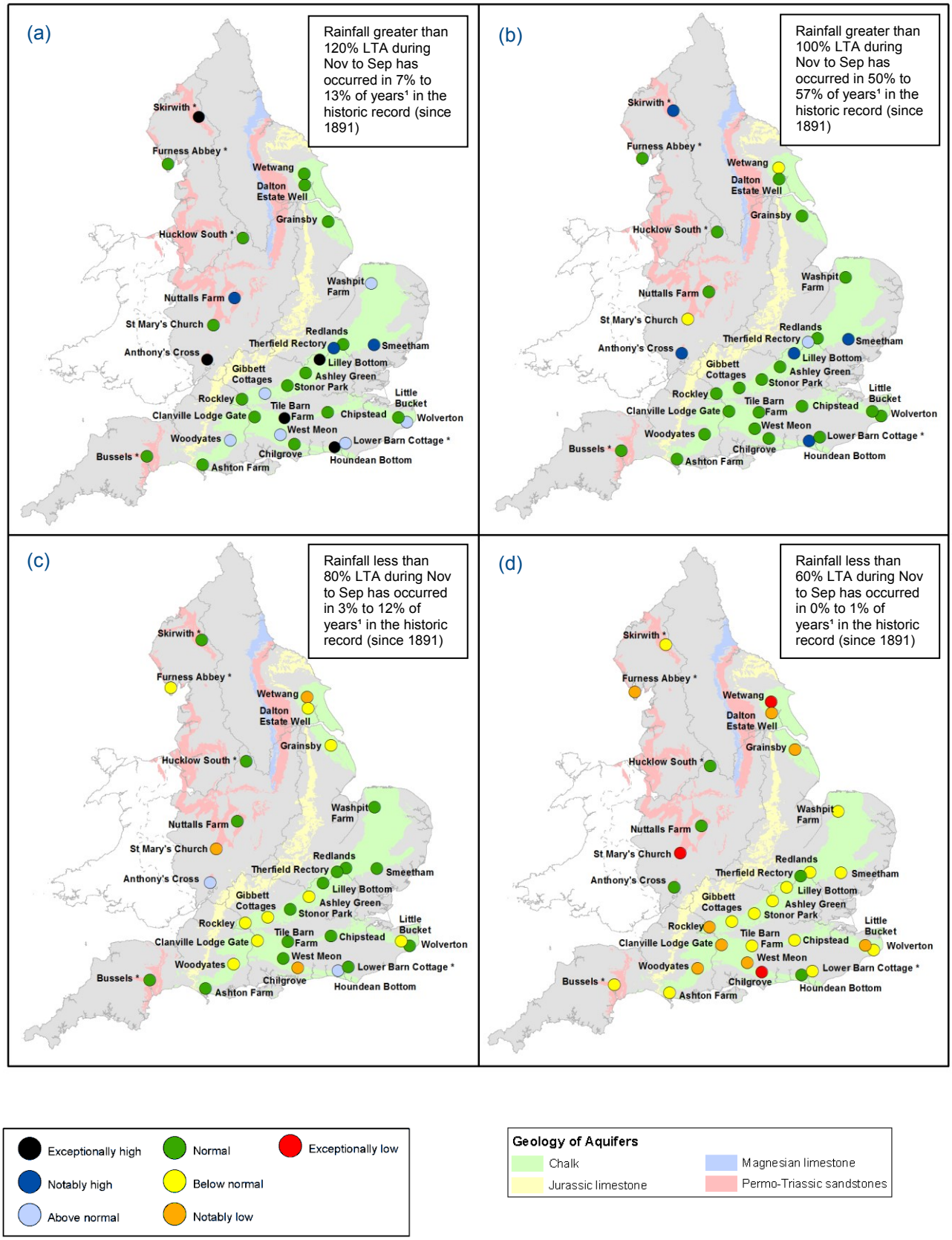


**Figure 6.6**: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between November 2020 and September 2021 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2020.

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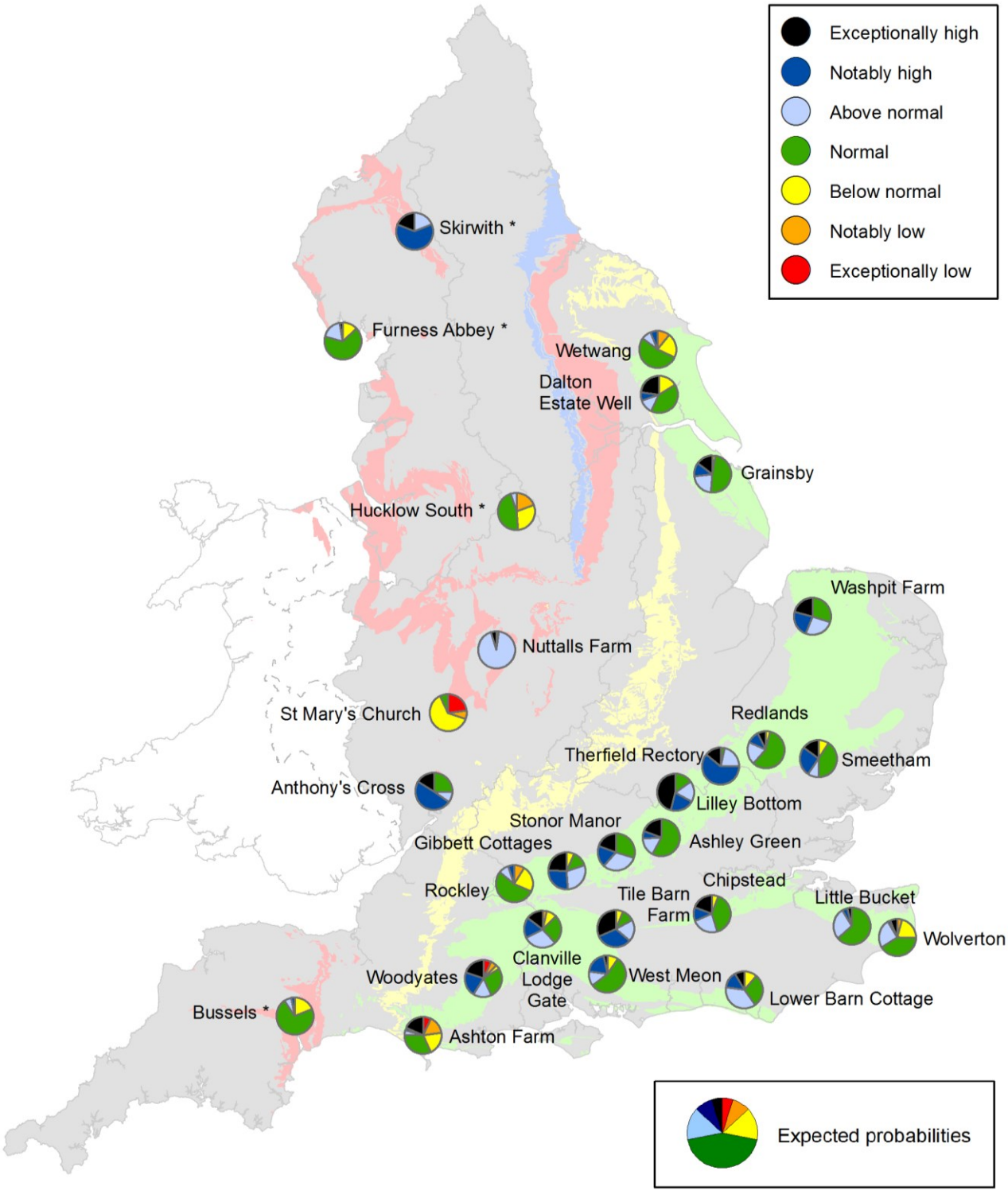
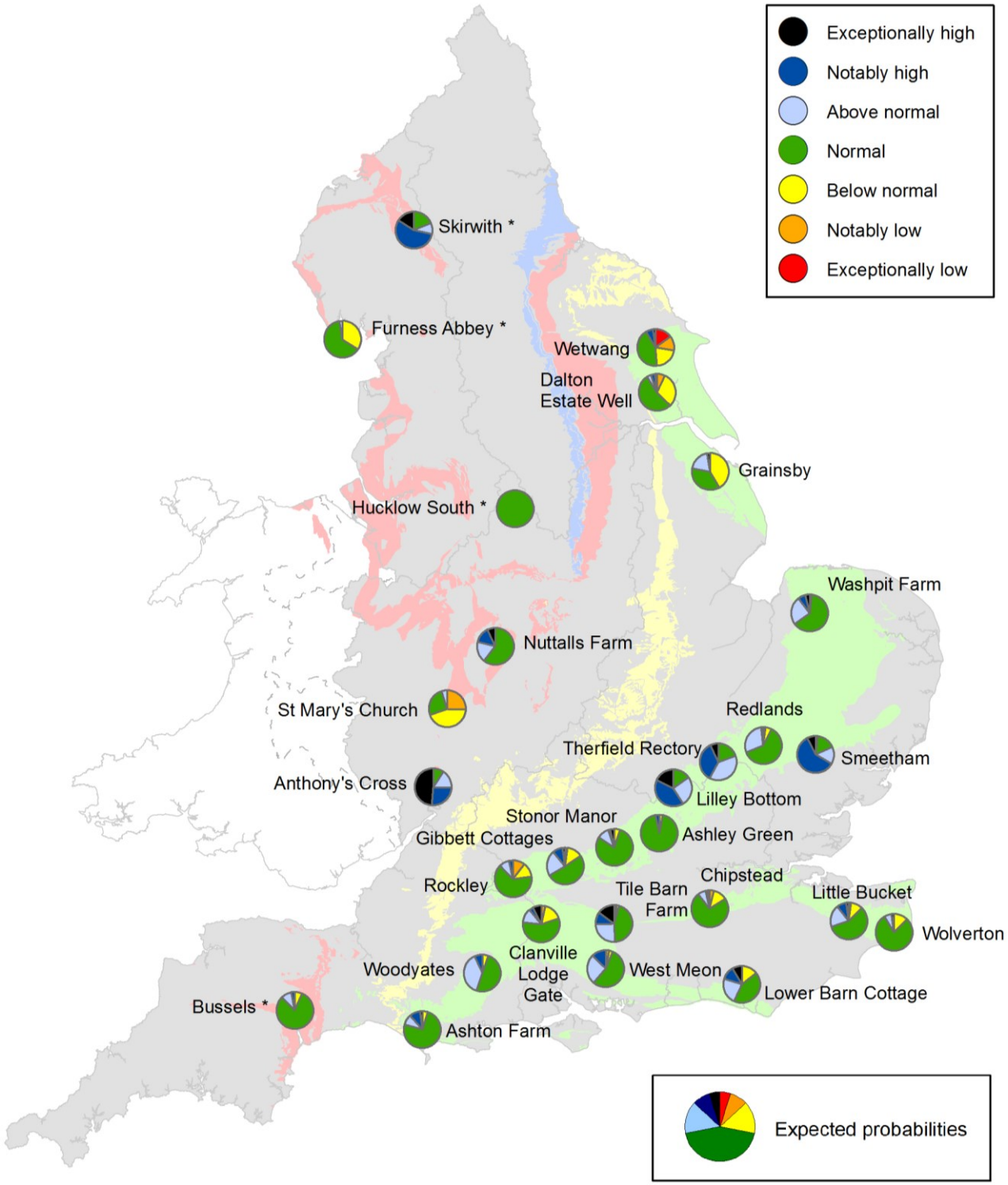



*Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels 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 March 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, 2020.

** 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 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, 2020.

* 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 |