Monthly water situation report

England

Summary – November 2020

Most of the country received below average rainfall totals during November, most notably in parts of north-east, east and central England. Despite this, soils were close to, or wetter than average across most of the country at the end of the month. Monthly mean flows for November were classed as normal or higher for the time of year at almost all indicator sites. Groundwater levels increased at almost two-thirds of indicator sites during November. Reservoir stocks in most of the reservoirs and reservoir groups we report on were classed as normal or higher for the time of year.

Rainfall

The November rainfall total for England was 62mm, which represents 76% of the 1961 to 1990 long term average (LTA) (71% of the 1981 to 2010 LTA). The highest monthly rainfall totals were recorded in north-west England, with much lower totals recorded in much of eastern and central England (Figure 1.1).

Monthly rainfall totals were classed as below normal or lower in a third of catchments across England. The lowest rainfall total, as a proportion of the LTA, was over the catchments draining to the Northumbria coastline. Here, the rainfall total (26mm) represented only 33% of the LTA , and was classed as exceptionally low for the time of year, This was the sixth lowest November rainfall total on record (records since 1891). Exceptionally low rainfall totals were also recorded in parts of Lincolnshire and Nottinghamshire. The catchments around Louth, Grimsby and the River Ancholme, received only 37% of the LTA rainfall (22mm). Ten-times more rain fell in the River Esk catchment in Cumbria during November, with a total of 224mm (representing 134% of LTA). November rainfall totals in the Esk and Derwent catchments (Cumbria) were classed as above normal for the time of year. Despite the relatively dry conditions in some parts of England during November, the 3, 6 and 12 month cumulative rainfall totals, ending in November, are classed as normal or higher in almost every catchment across England (Figure 1.2).

At a regional scale, November rainfall totals were slightly above average (108% of LTA) in north-west England. In all other regions rainfall totals were below the LTA , with the east England total representing only 56% of the LTA for the time of year (Figure 1.3).

Soil moisture deficit

Across most of south-west, central, north-east and north-west England soils were close to saturation at the end of November, with a soil moisture deficit (SMD) of less than 10mm. Across England SMDs were close to average (<10mm difference from LTA), or lower than average (indicating that soils are wetter than typical) for the time of year (Figure 2.1).

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

River flows

Monthly mean flows for November were classed as normal or higher for the time of year at all but one of the reported gauging stations. The exception was at Heaton Mill on the River Till (Northumberland) where the monthly mean flow represented only 43% of the long-term average and was classed as below normal for the time of year. This reflected the low November rainfall total in this area. In comparison to the monthly mean flows in October, November flows decreased at a third of reported gauging stations (Figure 3.1).

Monthly mean flows on the Bedford Ouse (east England), River Lune (north-west England) and River Thames (south-east England) were classed as above normal for November. At all the other regional index sites, flows were classed as normal (Figure 3.2).

Groundwater levels

Groundwater levels increased at almost two-thirds of the indicator sites we report on, during November. At Redlands Hall, in the Cam and Ely Ouse Chalk aquifer, end of month groundwater levels were classed as below normal for the time of year but are now rising. Groundwater levels were classed as normal or higher for the time of year at all other indicator sites. Levels at Coxmoor (Idle and Torne sandstone) and Priors Hayes (West Cheshire sandstone) were classed as exceptionally high for the time of year. These sites recorded the highest end of November levels on record (records go back to 1970 and 1973 respectively). Levels at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction.

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

Reservoir storage

Reservoir stocks increased at over half of the reservoirs and reservoir groups we report on during November. The biggest increase, as a proportion of total capacity, was in the Haweswater and Thirlmere group in Cumbria, where stocks increased from 72% at the end of October to 100% at the end of November. Reservoir stocks in most of the reservoirs and reservoir groups we report on 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 November (an increase from 82% at the end of October), just above the LTA for the time of year. At a regional scale, total reservoir stocks ranged from 75% in south-west England to 93% in north-west England (Figure 5.2).

Forward look

A wet start to December for most parts of England, with snow and sleet on higher ground. Moving into the second week of the month, a brief spell of more settled weather, albeit cold with persistent fog in many places, will make way for showers in the north and south-west, before more persistent rain moves in from the west affecting many parts of England. Towards the middle of the month, there is likely to be a mix of drier conditions and more unsettled weather, with rain affecting eastern England at first, before rain is expected in the west. The possibility of snow and sleet on higher ground remains throughout much of the period. The end of December is likely to remain changeable, with the possibility of heavier rain in eastern and southern England.

For the 3 month period December to February, across the UK, above average precipitation is more likely than below average precipitation[1].

Projections for river flows at key sites[2]

More than two-thirds 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 2021. By the end of September 2021, two-thirds of 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 and end of September 2021, four-fifths 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 September 2021, less than one-fifth of the modelled sites have a greater than expected chance of groundwater levels being below normal or lower 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

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

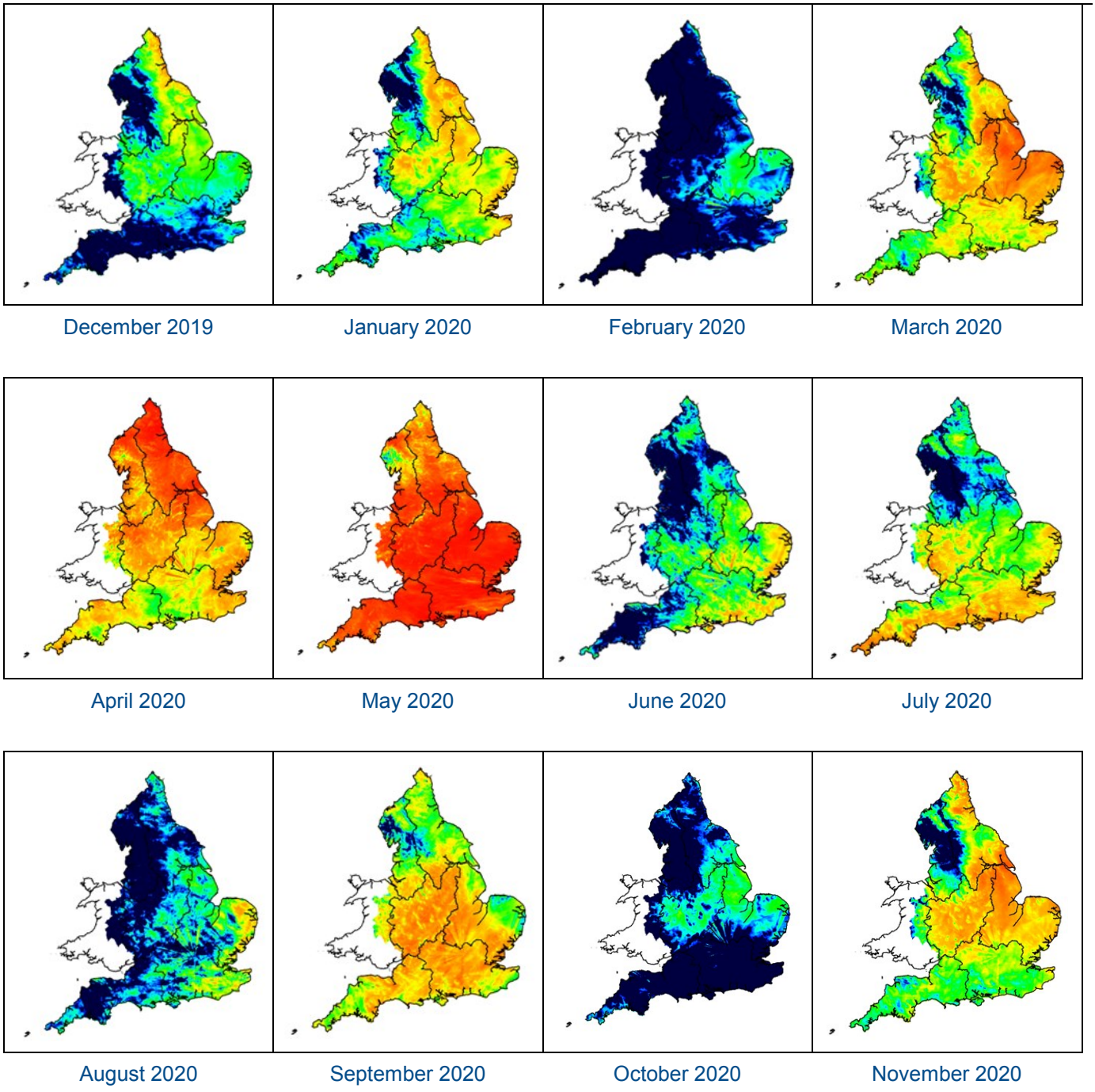


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

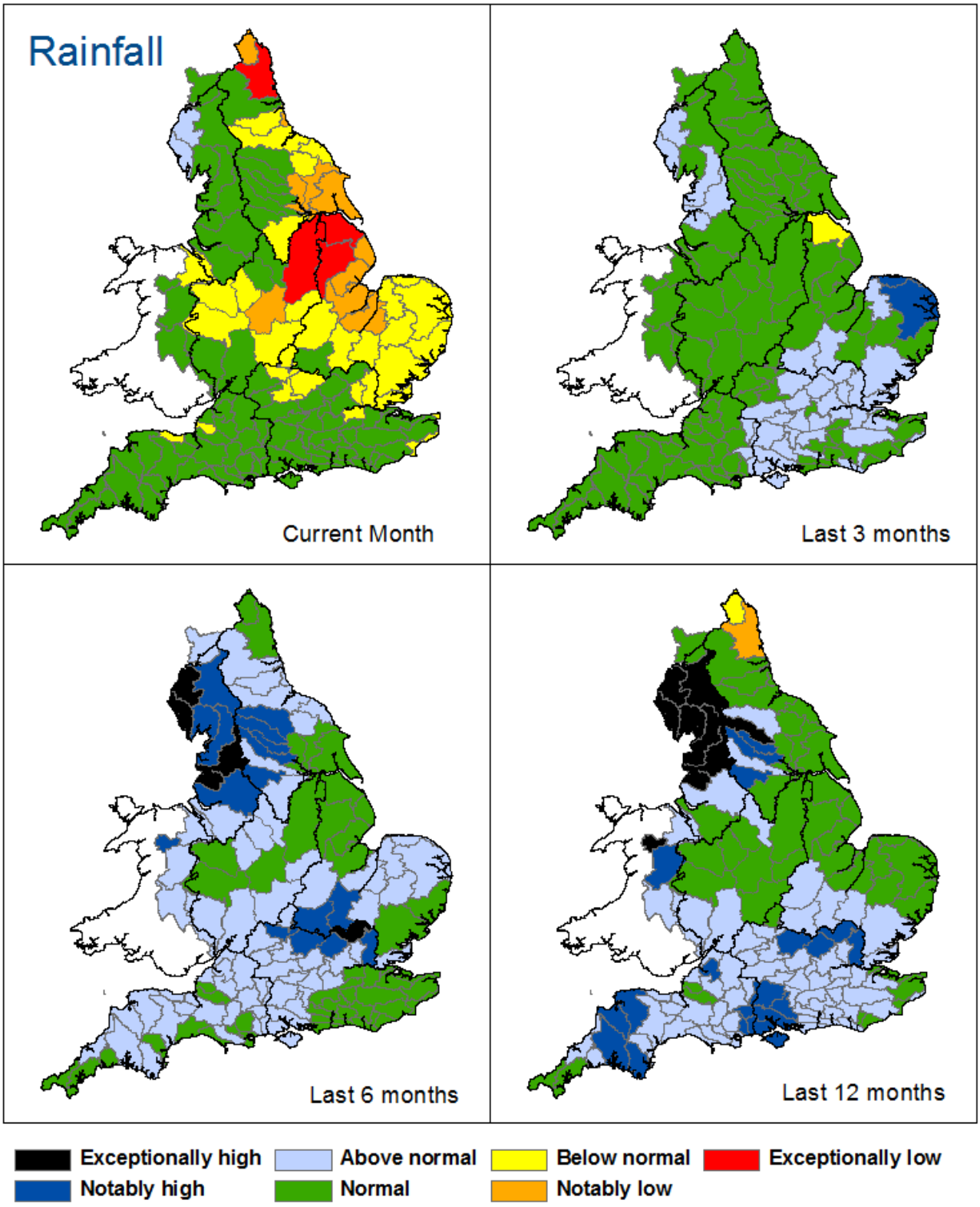


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 30 November), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived 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

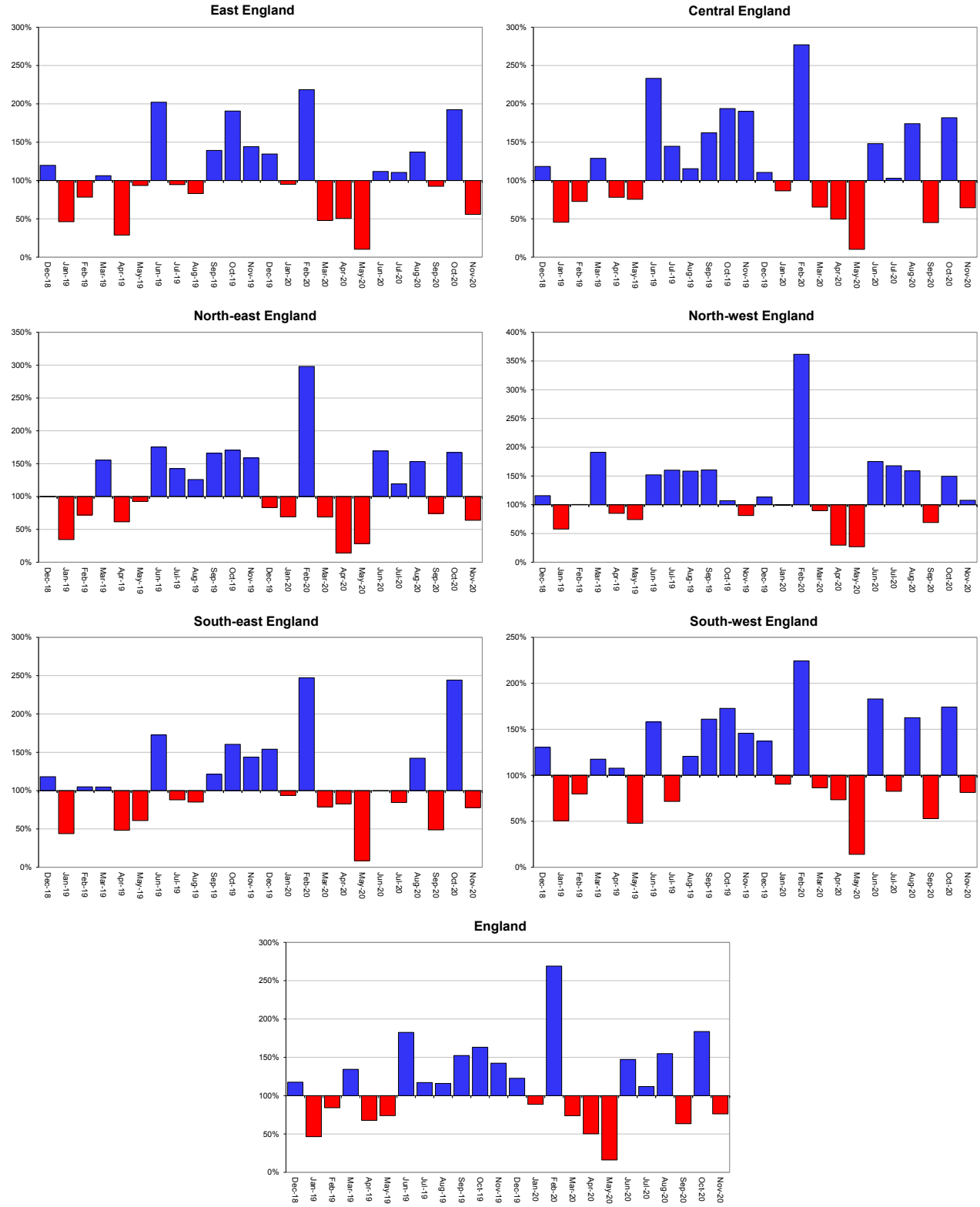


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

Soil moisture deficit

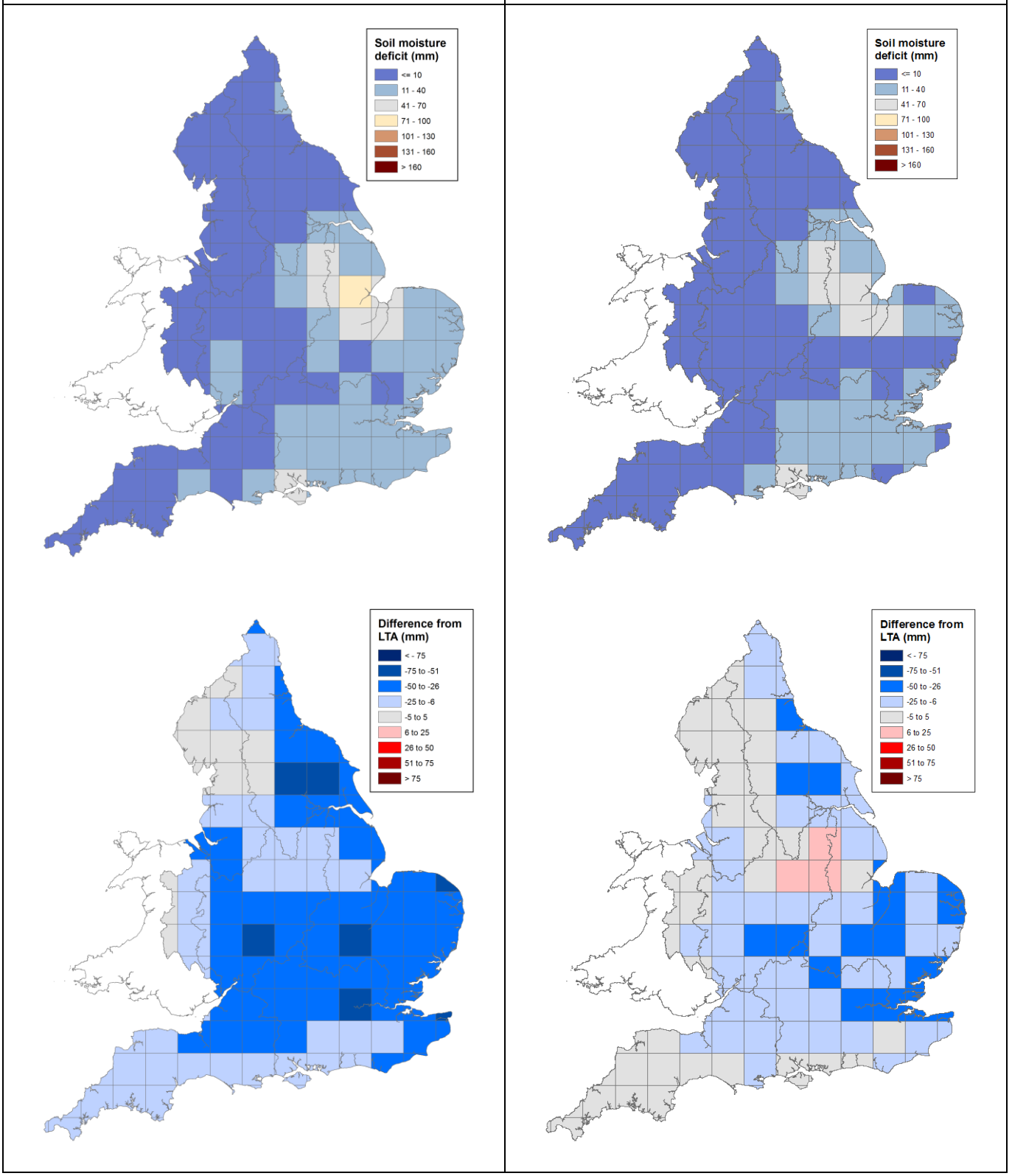
End of October 2020[1]	End of November 2020[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 03 November 2020[1] (left panel) and 02 December 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

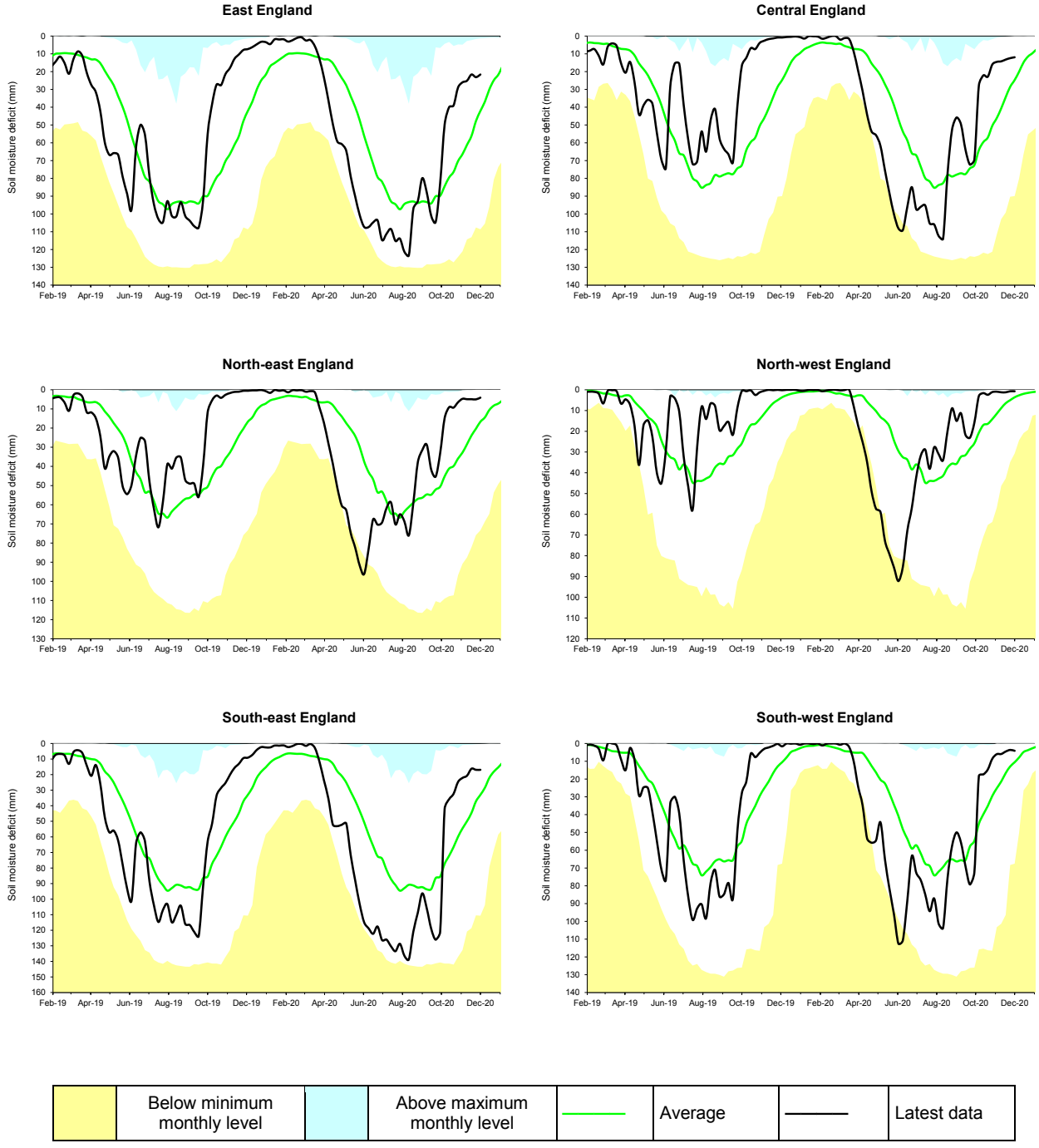
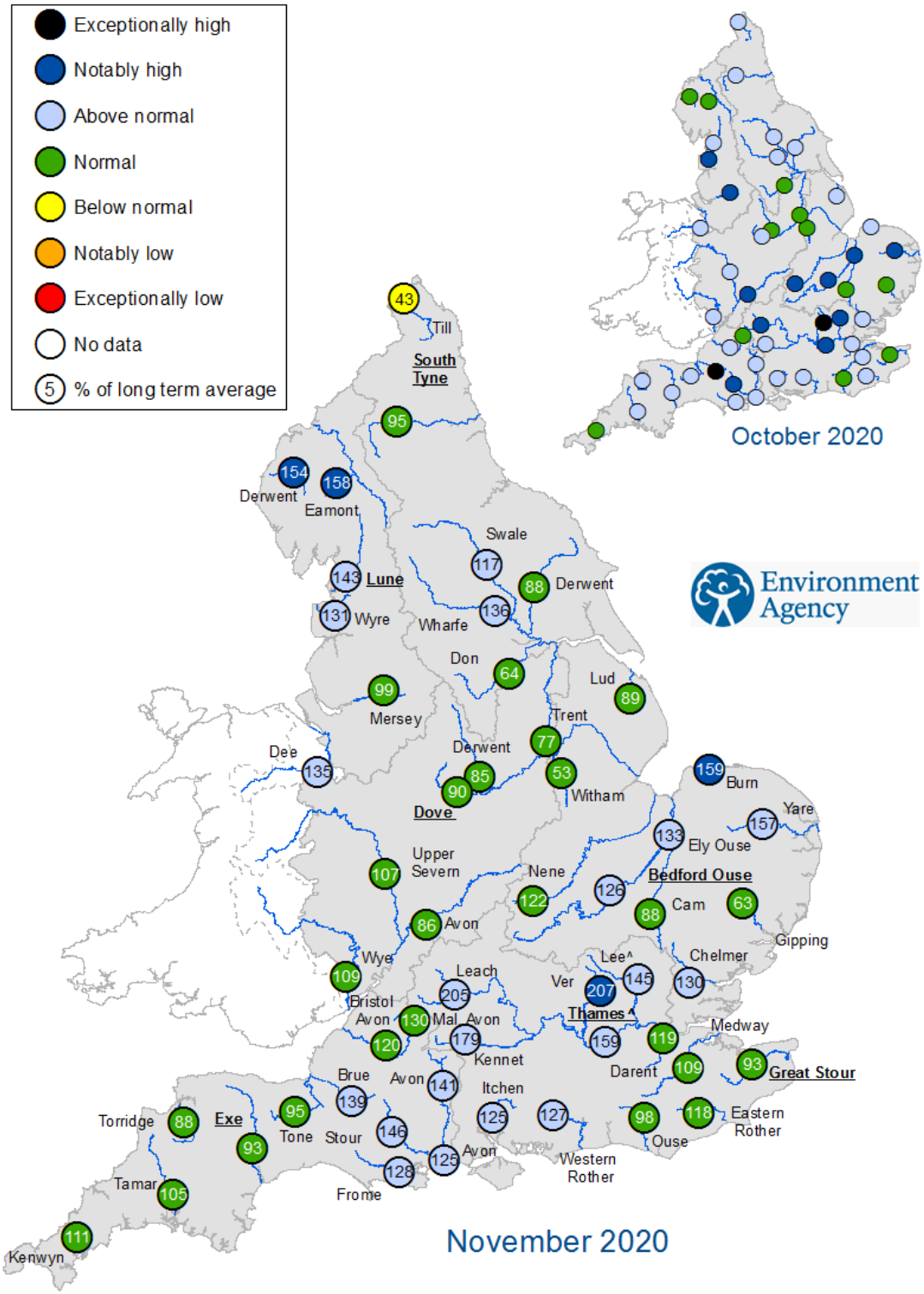


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2020).

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 October 2020 and November 2020, expressed as a percentage of the respective long term average and classed relative to an analysis of historic October and November monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

River flow charts

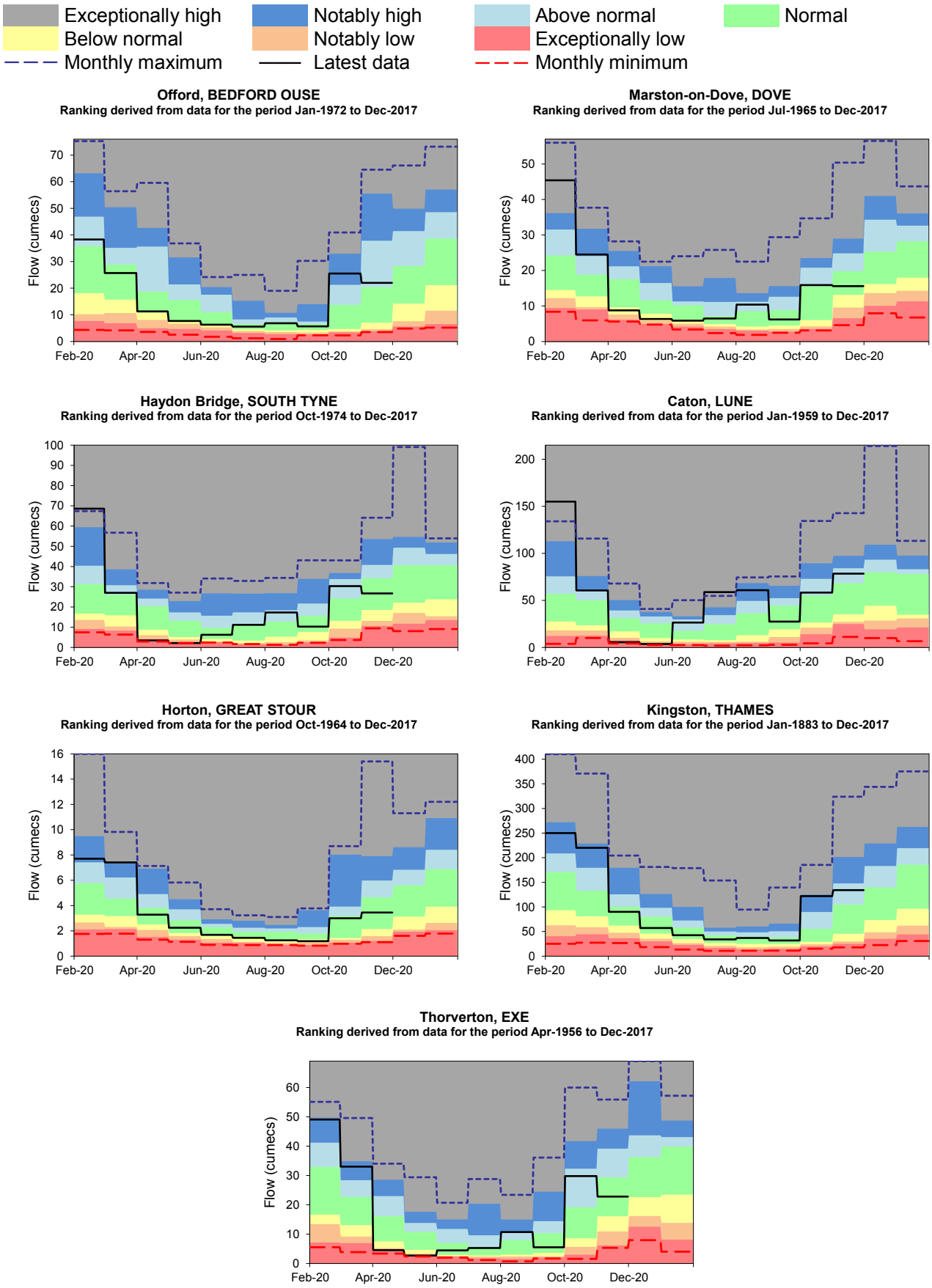
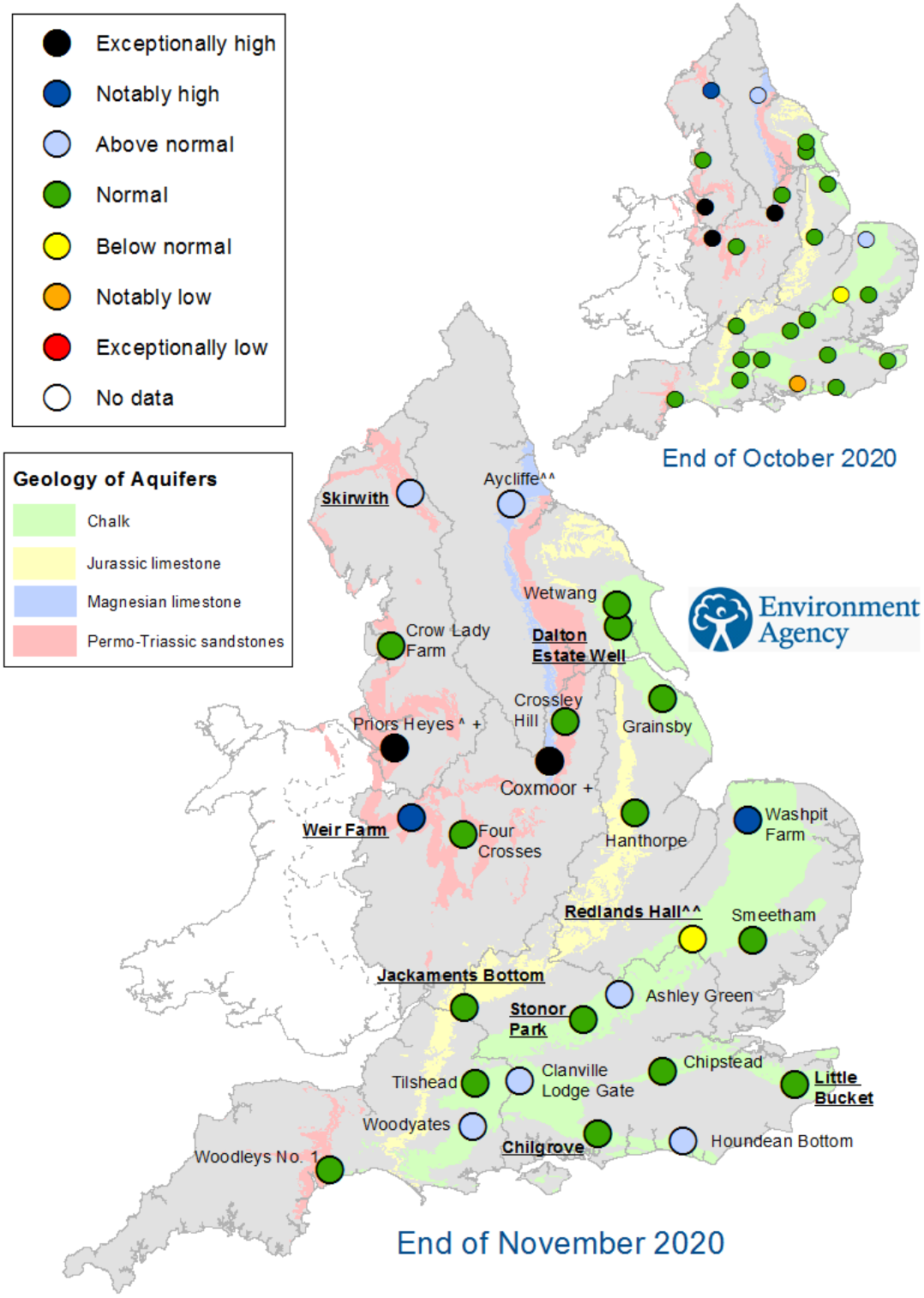


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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/lowest 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 October 2020 and November 2020, classed relative to an analysis of respective historic October and November 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

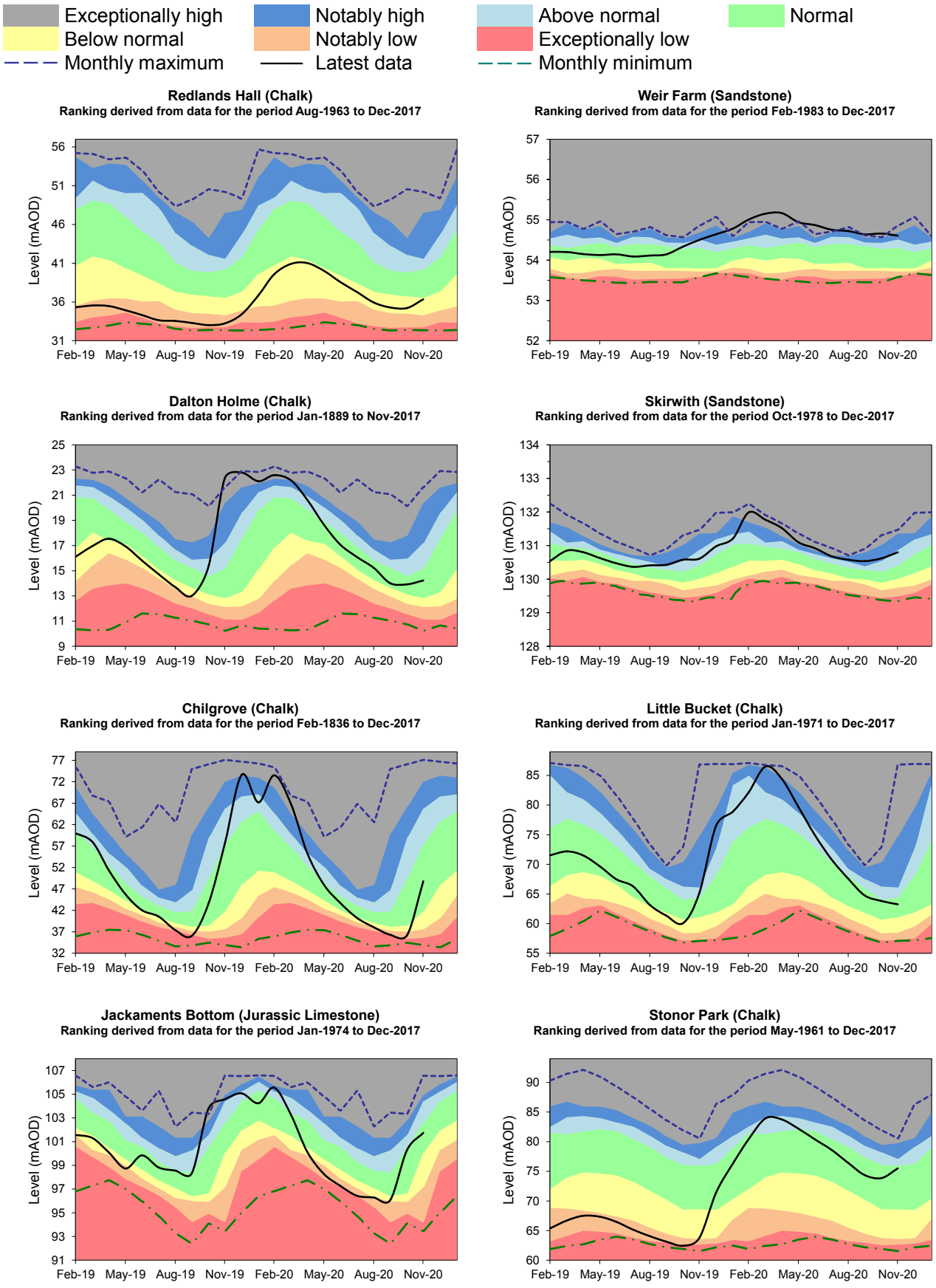
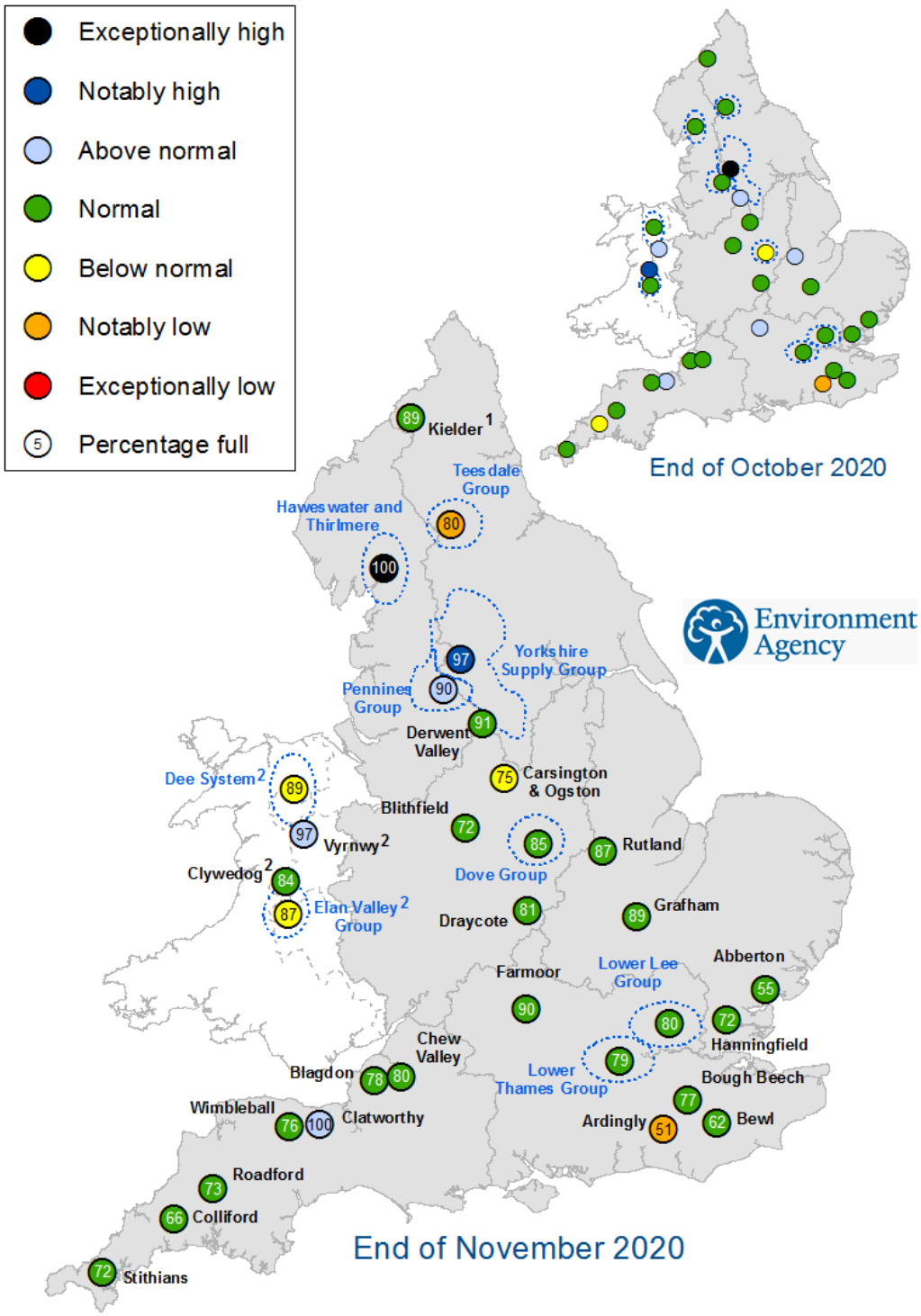


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

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 October 2020 and November 2020 as a percentage of total capacity and classed relative to an analysis of historic October and November 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

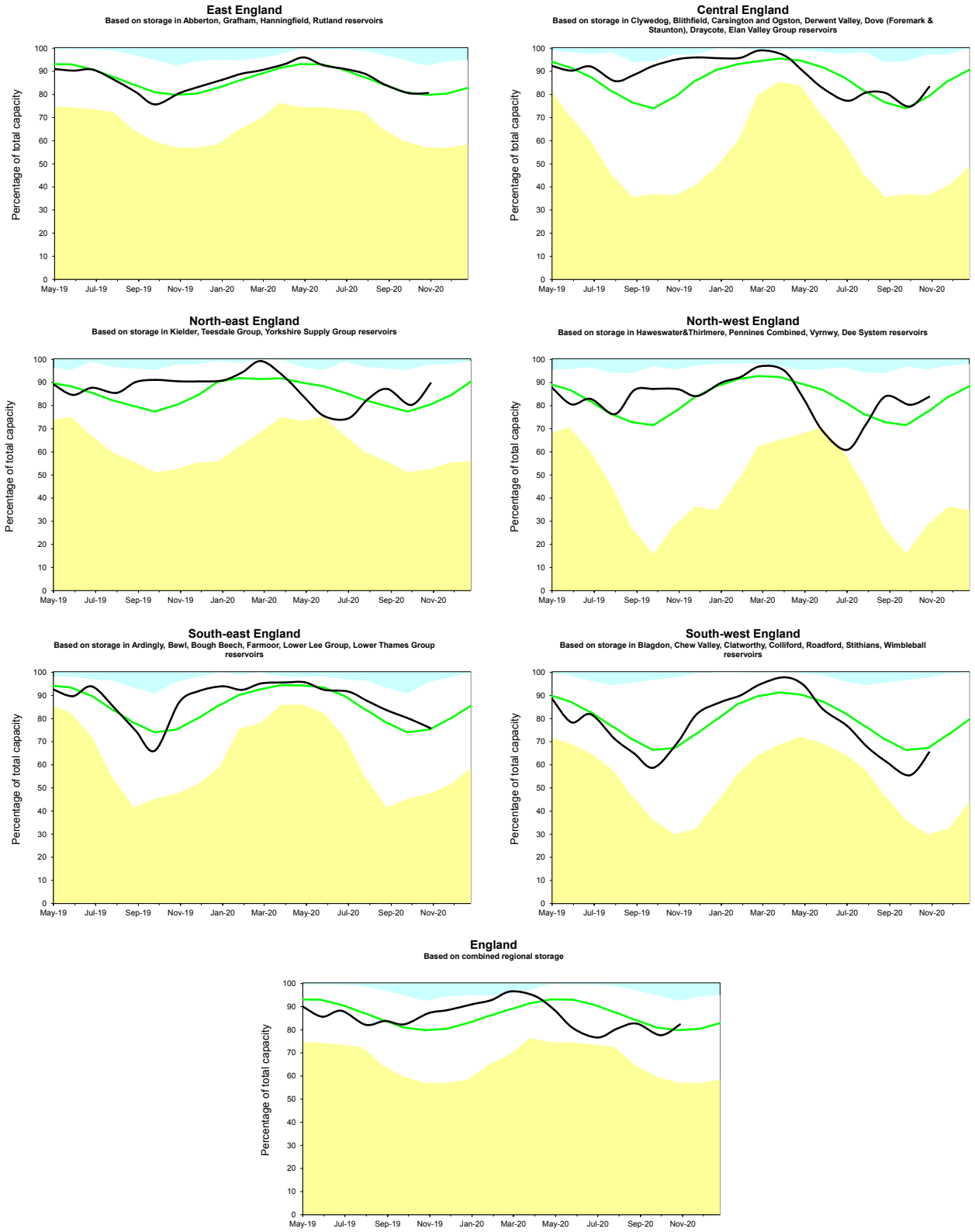


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

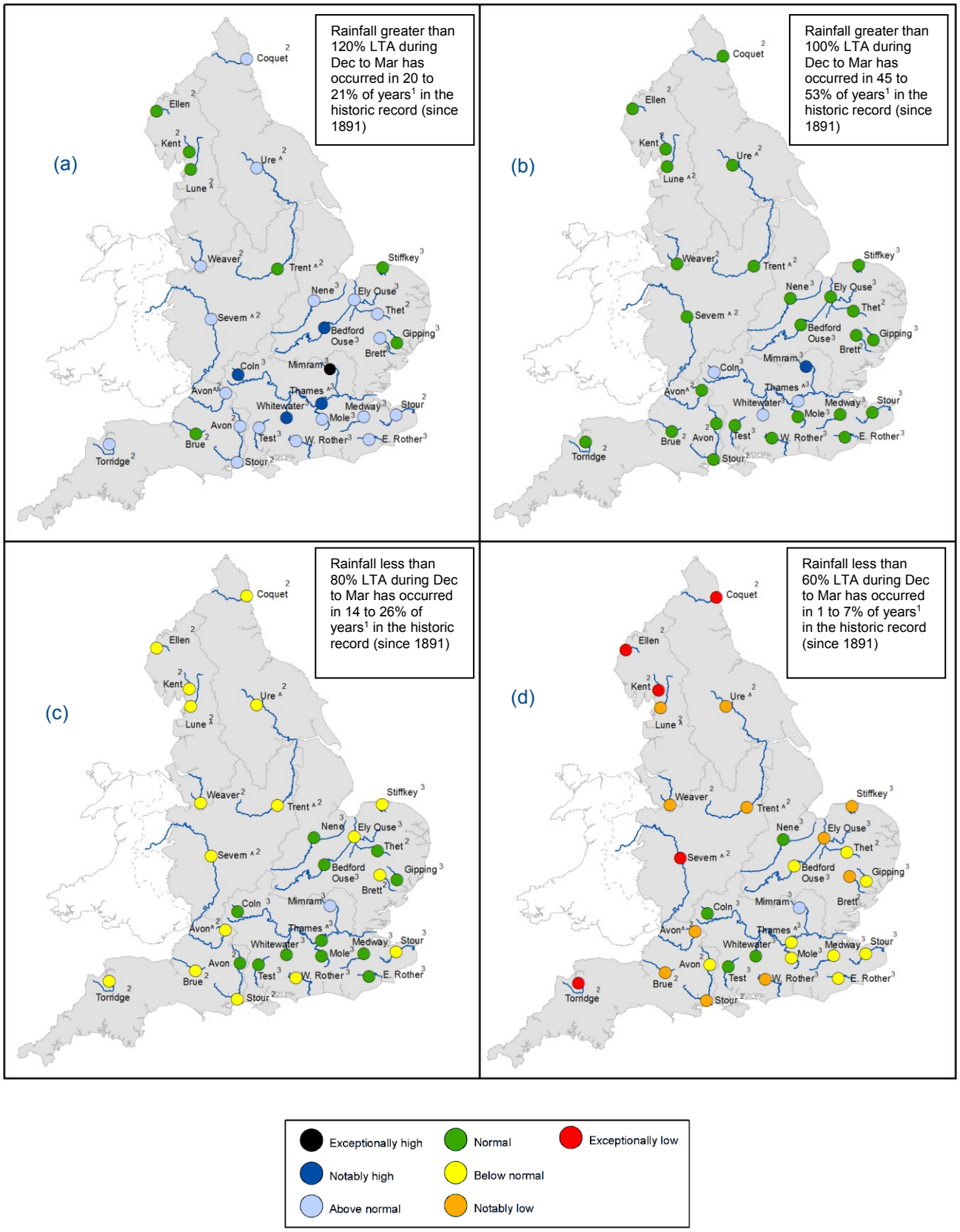
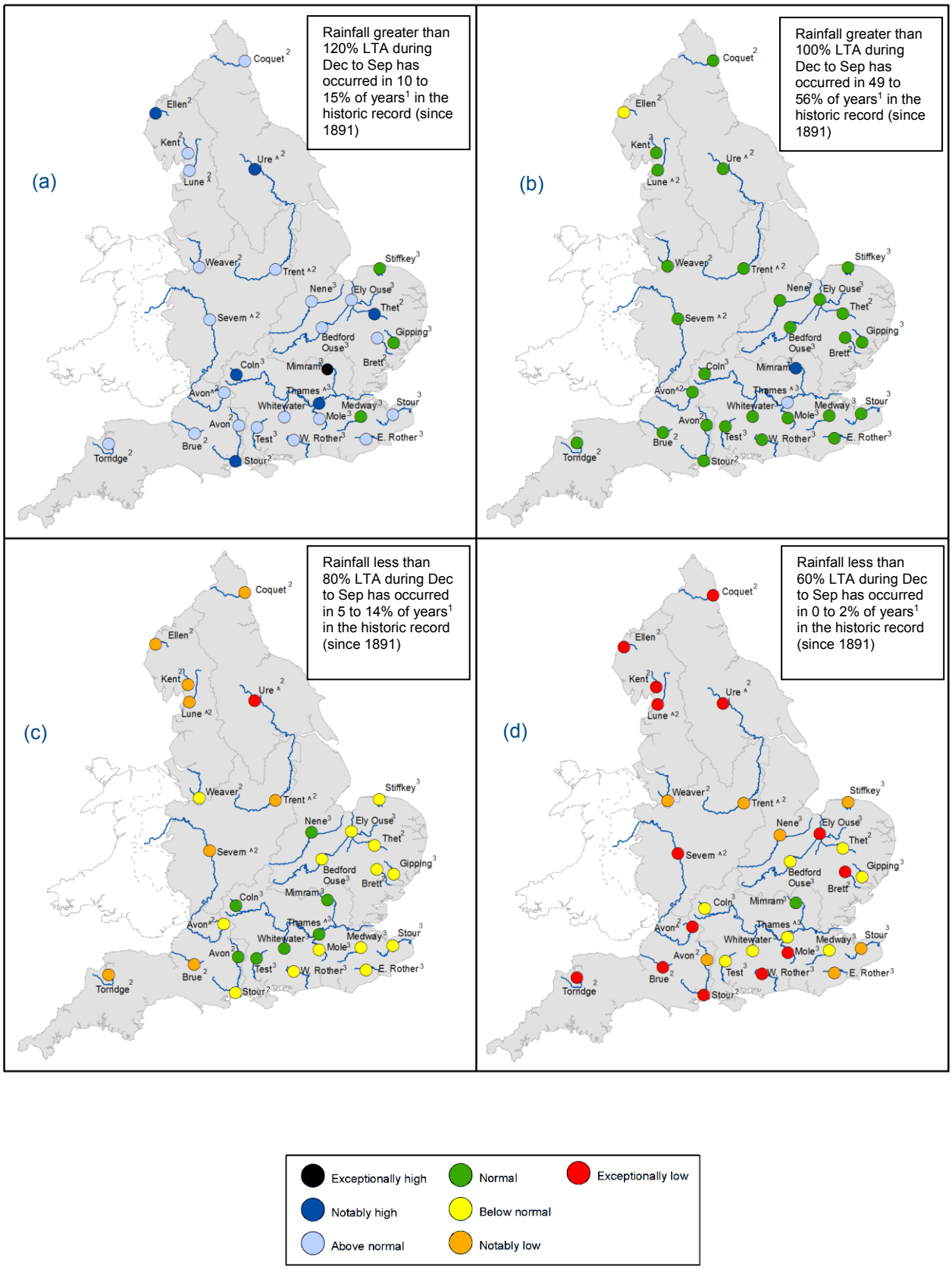


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between December 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*



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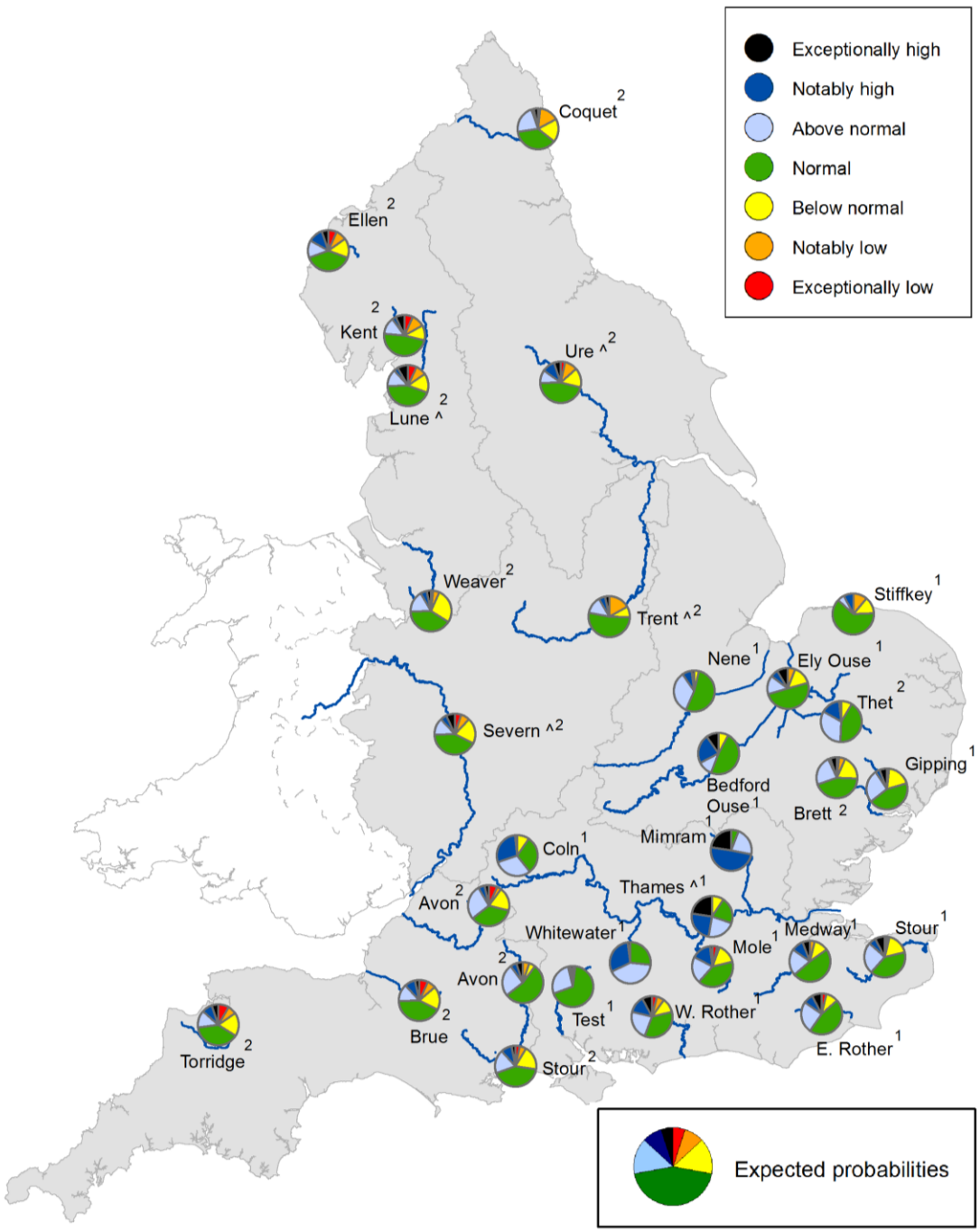

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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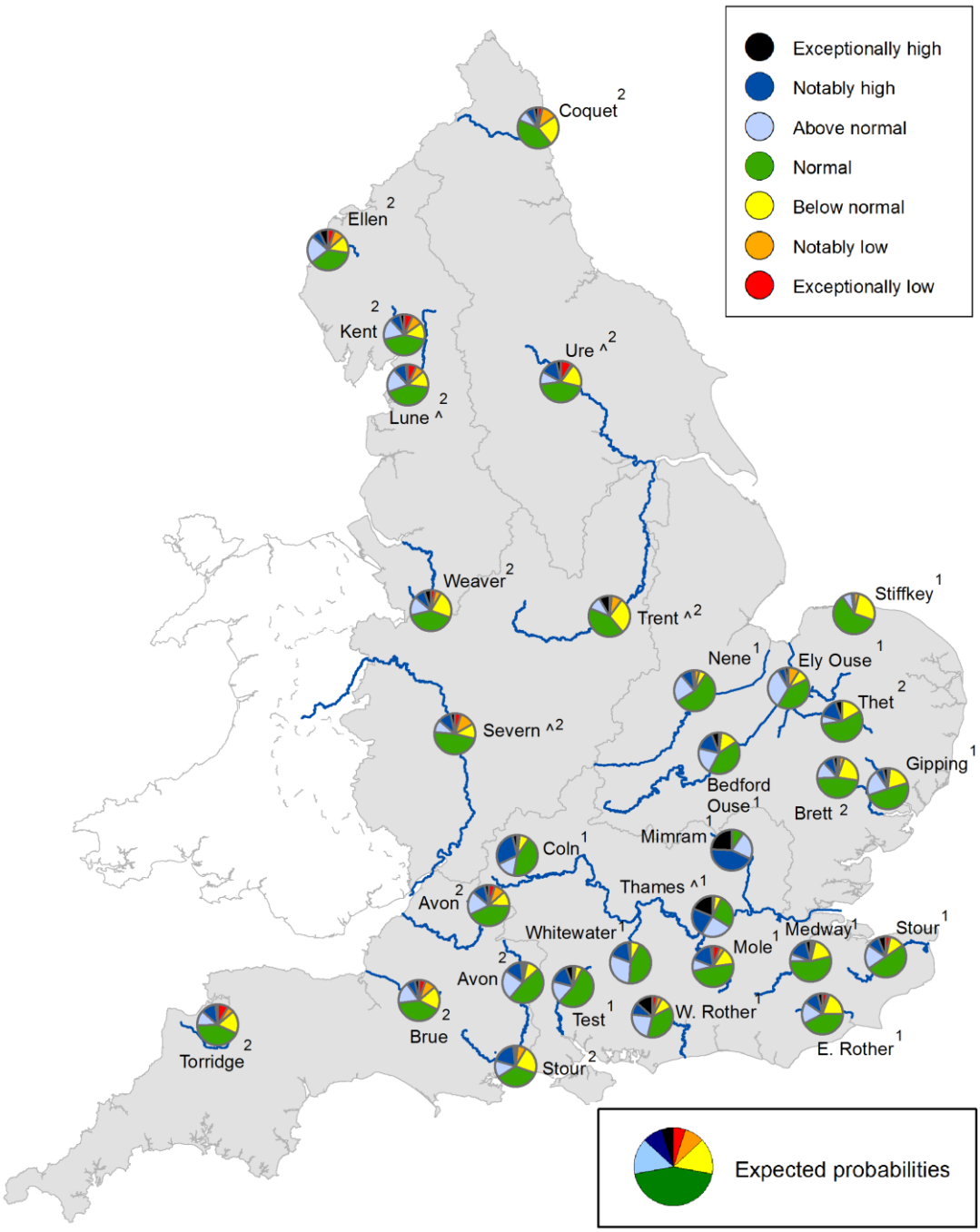

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2021. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for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

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^"Naturalised" flows are projected for these sites

Forward look: groundwater

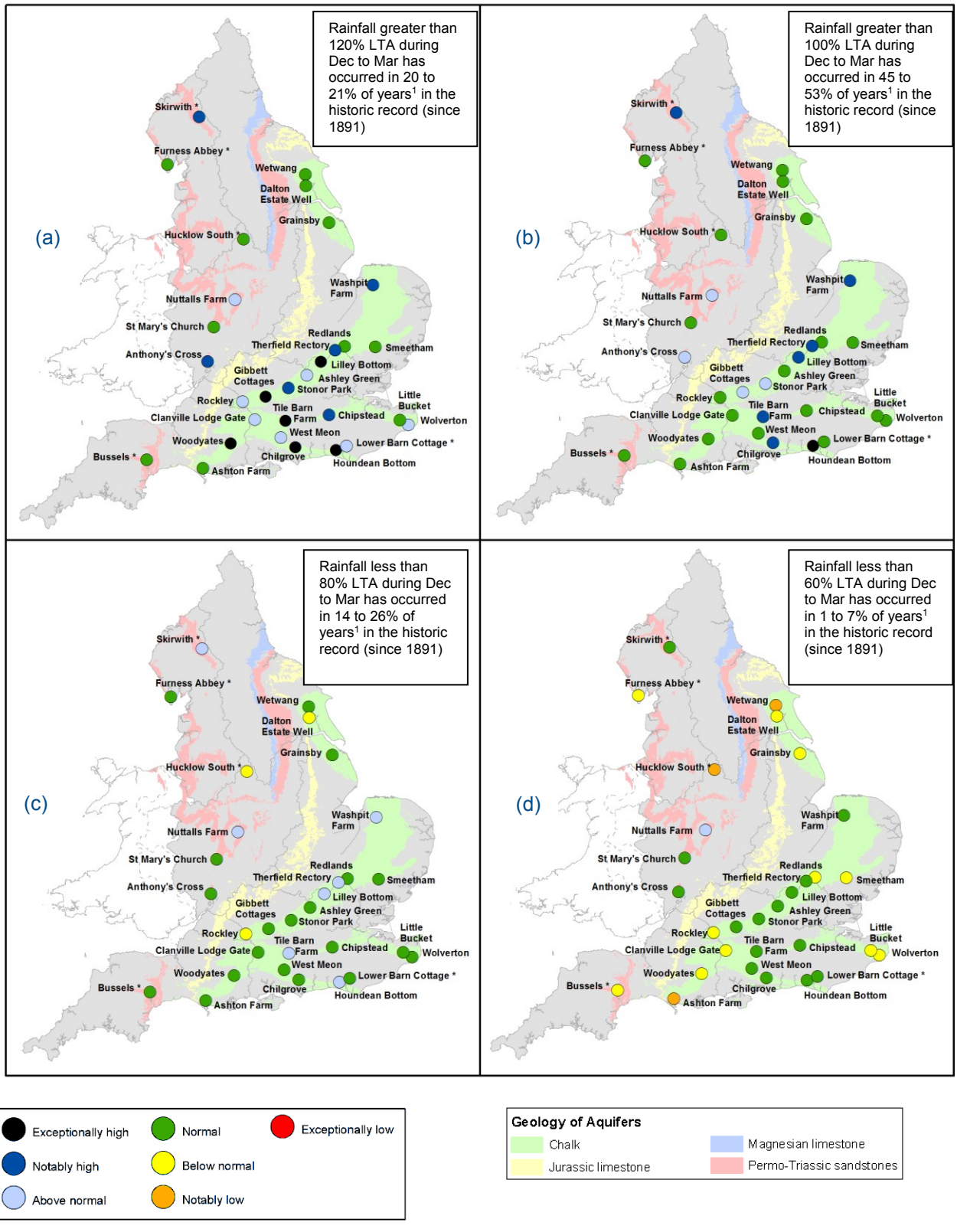

Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between December 2020 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission 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

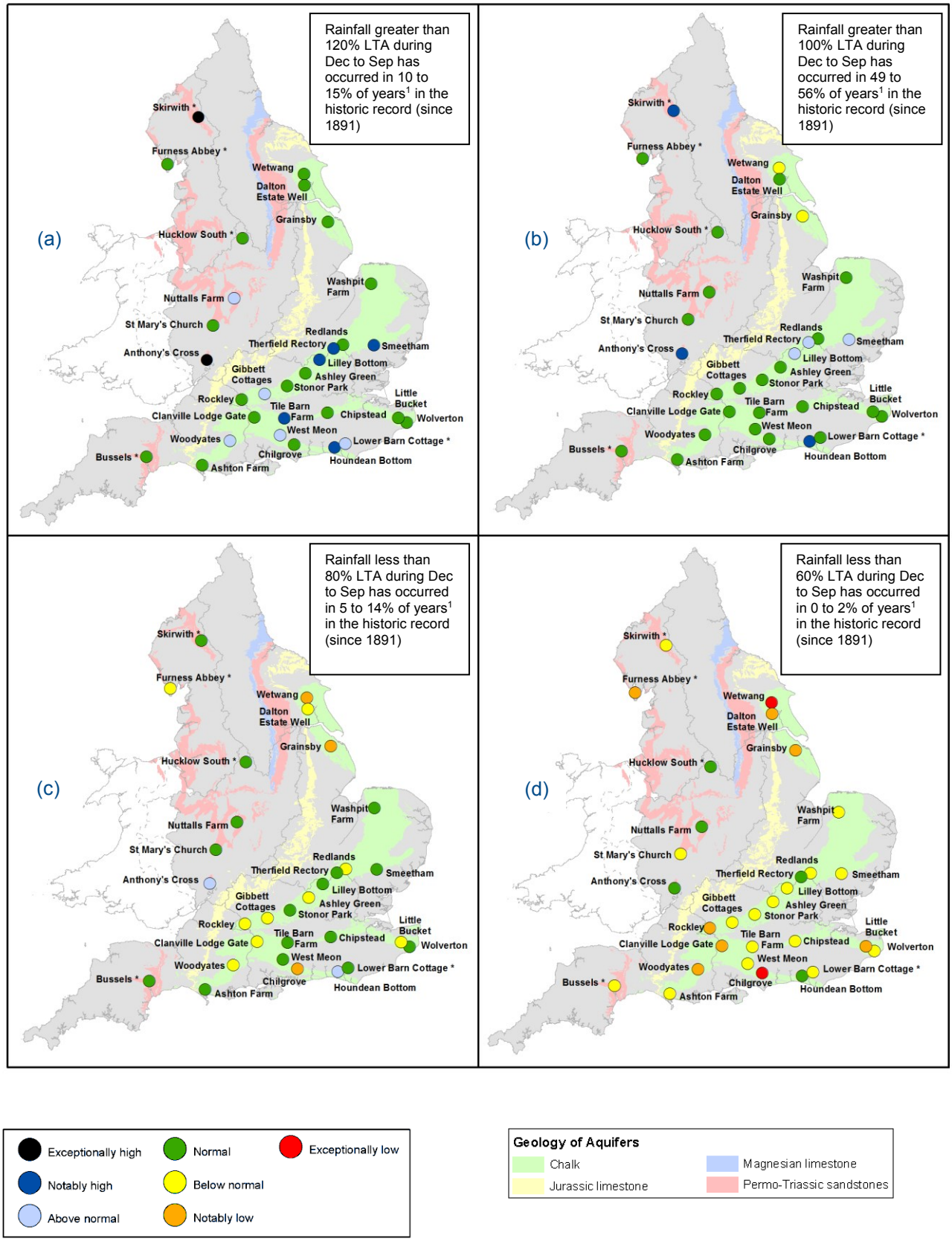

Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between December 2020 and September 2021 (Source: Environment Agency) Geological map reproduced with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

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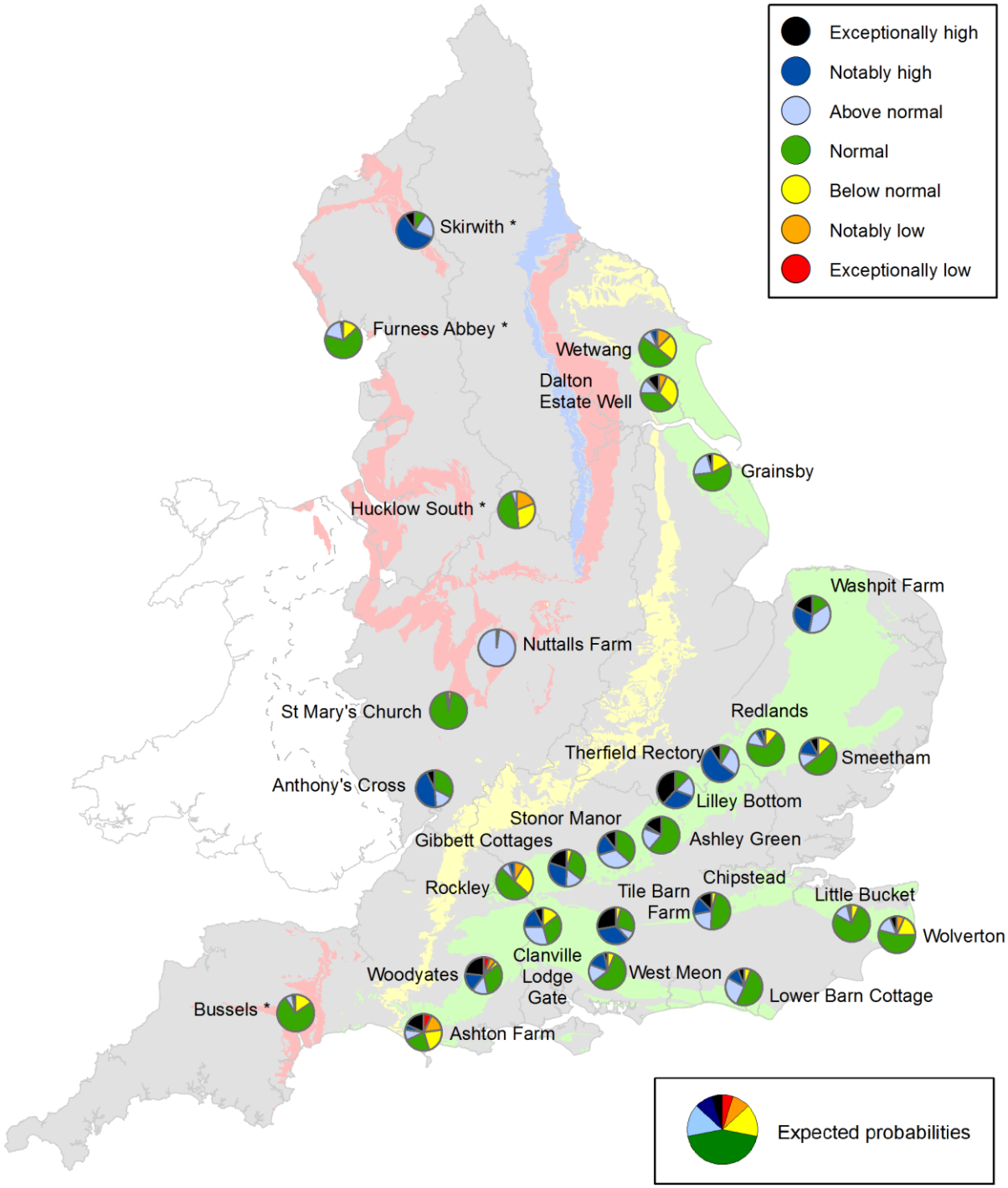

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Figure 6.7: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2021. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the 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*

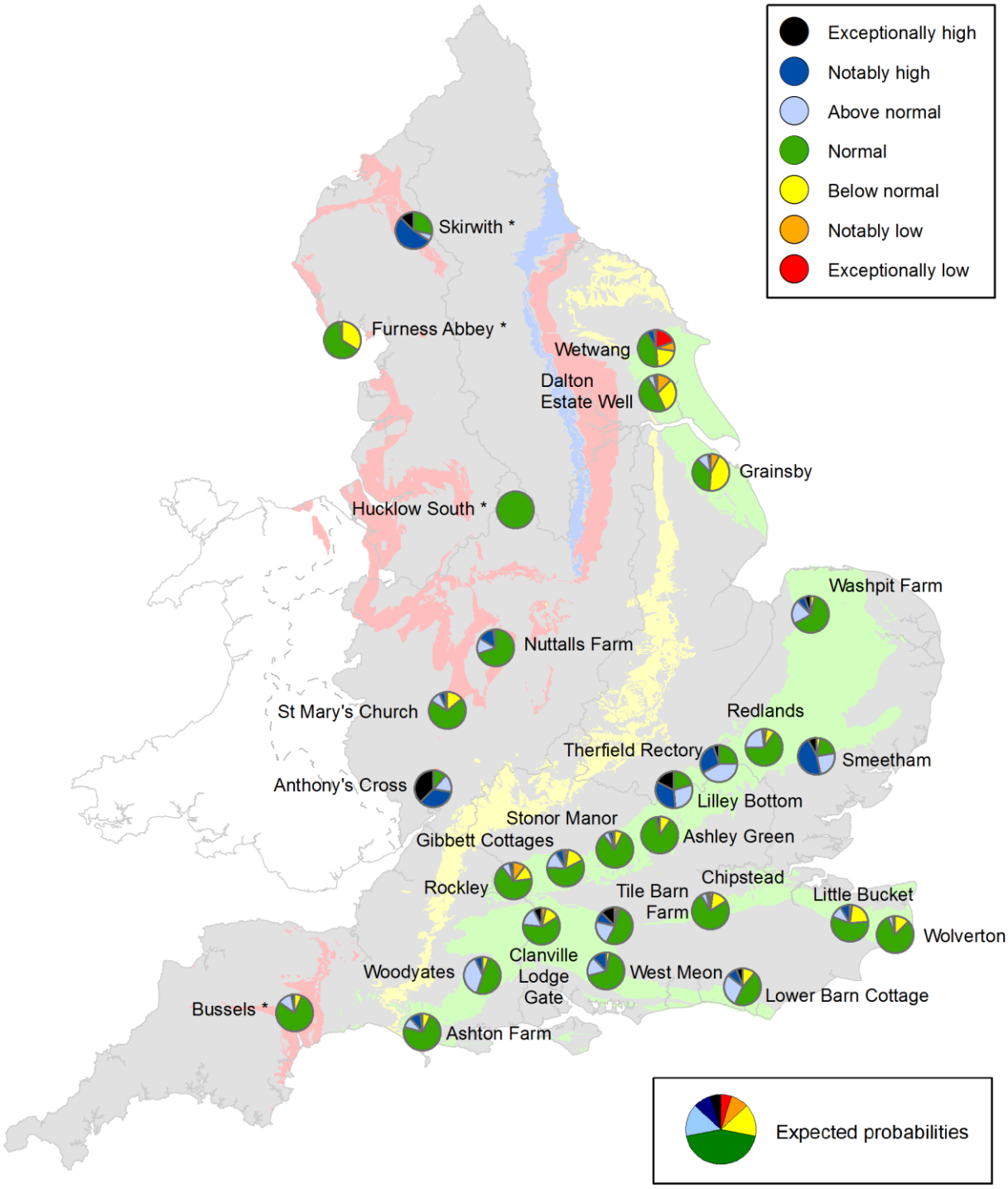

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2021. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for 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