Monthly water situation report

England

Summary – February 2021

February was the third consecutive month with above average rainfall across England and for many parts of the country these three months have been some of the wettest on record. Northern England recorded higher February rainfall totals than the rest of the country where rainfall was largely classed as normal for the time of year. After a very wet January soils had become slightly drier by the end of February. Most rivers recorded mean monthly flows that were slightly lower than in January, however seven rivers recorded the highest monthly mean flows on record for February and flows were classed as higher than normal for the month at most of the sites reported on. Groundwater levels continued to rise and a number of aquifers have levels classed as exceptionally high; six sites recorded the highest levels on record for the end of February. Reservoir stocks generally increased or remained similar to last month; total stocks for England remain above average.

Rainfall

The February rainfall total for England was 73mm, which represents 126% of the 1961 to 1990 long term average (LTA) (121% of the 1981 to 2010 LTA); early in the month, some of this fell as snow. For most of England this is now the third consecutive month with above average rainfall. The highest monthly catchment rainfall totals were recorded in north-west England (Figure 1.1).

Monthly rainfall totals were classed as normal across four fifths of all catchments in England. The lowest rainfall total as a proportion of the LTA was over the Pevensey Levels in East Sussex where the rainfall total was 44mm, representing 82% of the February LTA. Exceptionally high rainfall totals for the time of year were recorded over three catchments in north-east England: the Seaham Area in county Durham (95mm and 232% of the LTA), the Northumbria North Sea Tributaries (105mm and 204% of the LTA) and the Tweed catchment in Northumberland (109mm and 219% of the LTA).

The 3, 6 and 12 month cumulative rainfall totals ending in February were classed as normal or higher in every catchment across England. The 3 month cumulative rainfall totals were higher than normal for nearly all of the catchments across England except for parts of southern England where they were normal (Figure 1.2). Over the past 3 months a total of 9 out of 137 catchments have recorded the largest rainfall totals on record for the time of year (records since 1891), mainly in North Yorkshire, East Riding, South Lincolnshire, West Norfolk, Northamptonshire and Cambridgeshire. Two fifths of catchments across England have recorded rainfall totals that ranked in the top ten wettest December to February 3 month periods on record. One fifth of the catchments across England have recorded rainfall totals that ranked in the top ten wettest September to February 6 month periods on record

At a regional scale, February rainfall totals ranged from 98% of the LTA in south-east England, to 159% and 160% of the LTA in north-east and north-west England respectively (Figure 1.3). North-east England has recorded the wettest December to February 3 month period since 1915 and third wettest on record (records since 1891). East England has recorded the wettest December to February 3 month period since 1915 and second wettest on record. East England has also recorded the wettest September to February 6 month period since 1919 and ninth wettest on record. For England as a whole it has been the wettest September to February 6 month period since 1919 and tenth wettest on record.

Soil moisture deficit

Compared to the end of January, soils at the end of February were drier in all reported grid-squares across England. However soil moisture deficits (SMD) remain less than 20mm and the difference compared to the end of February LTA was small, in the range +/-10mm. (Figure 2.1).

At a regional scale, the end of month SMD values were close to the end of February LTA in all regions and slightly drier than at the end of January (Figure 2.2).

River flows

Monthly mean flows for February were classed as normal or higher for the time of year at all of the reported gauging stations; flows were classed as exceptionally high at 7 out of 47 indicator sites, these sites were on the eastern side of England. The highest February monthly mean flows on record were recorded on the River Burn (332% LTA), River Yare (244% LTA), the Ely Ouse (213% LTA) and River Lud (228% LTA) in east England (records from 1970, 1970, 1971 and 1968 respectively). For the River Yare this was the third consecutive month with the highest flows on record for the time of year. Record monthly mean flows for the month were also recorded on the River Till (333% LTA) and River Derwent (195% LTA) in north-east England (records from 2002 and 1973 respectively). For the River Derwent this was the second consecutive month with the highest monthly mean flows on record for the time of year.

Although most reported flow indicator sites remain higher than normal and widespread February rainfall totals were above average, river flows decreased at two-thirds of sites compared to January which had been an even wetter month. (Figure 3.1).

At the regional index sites monthly mean flows ranged from being classed as normal on the River Lune (north-west England) to being classed as exceptionally high on the Bedford Ouse (east England) and the River Dove (central England) (Figure 3.2).

Groundwater levels

Groundwater levels increased at over three-quarters of the indicator sites we report on during February. The end of month groundwater levels were classed as normal or higher for the time of year at all sites, with exceptionally high groundwater levels recorded at 10 out of 26 sites.

Hanthorpe (Whitam Jurassic limestone), Washpit Farm (north-west Norfolk chalk), Weir Farm (Bridgnorth sandstone), Coxmoor (Idle and Torne Permotriassic sandstone), Wetwang (Hull and East Riding chalk) and Priors Heyes (West Cheshire sandstone) recorded the highest end of February levels on record (records go back to 1972, 1950, 1983, 1969, 1971 and 1972 respectively). Levels at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction. For all these indicator sites this is the second consecutive month with the highest levels on record for the time of year.

End of month groundwater levels at the major aquifer index sites ranged from normal at Jackaments Bottom (Jurassic limestone) to exceptionally high at Weir Farm (Bridgnorth sandstone), Skirwith (Carlisle Basin and Eden Valley sandstone) and Dalton Home (chalk). At Chilgrove (Chicester chalk) the end of January groundwater levels were classed as normal for the time of year but had risen to a notably high level by the end of February (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks increased at half of the reservoirs and reservoir groups we report on during February. The biggest increase, as a proportion of total capacity, was in the lower Thames group of reservoirs (south-east England), where stocks increased from 87% of capacity at the end of January to 97% at the end of February. Stocks decreased slightly at a quarter of the reservoirs and reservoir groups we report on.

Reservoir stocks in only two of the reservoirs and reservoir groups we report on were classed as below normal the rest were classed as normal or higher for the time of year (Figure 5.1).

Total reservoir stocks for England were at 96% of total capacity at the end of February (an increase from 93% at the end of January), this is 4% above the LTA for the time of year. At a regional scale, total reservoir stocks ranged from 91% in east England to 98% in central and south-west England (Figure 5.2).

Forward look

A succession of Atlantic low pressure systems are expected to bring very unsettled weather conditions from around Tuesday 9 March, with heavy rain across much of England and gale force winds in some areas. Frequent heavy showers and some longer periods of rain are expected during the rest of the week. Western areas will be wettest with eastern areas seeing some drier spells. There is a chance of drier, more settled conditions in southern England during the following week and by the end of March unsettled conditions are expected to be confined to northern and western areas.

For the 3 month period March to May there is a slightly higher than normal chance of dry conditions across the UK, but near average or wet conditions remain possible[1].

[1] Source: Met Office

Projections for river flows at key sites[2]
Two-thirds of the modelled sites have a greater than expected chance of cumulative river flows being notably high or higher for the time of year by the end of March 2021. By the end of September 2021, more than three-quarters 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, over nine-tenths 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, 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

[2] Information produced by the Hydrological Outlooks partnership (Environment Agency, Centre for Ecology and Hydrology, British Geological Survey, Met Office) (www.hydoutuk.net).

Rainfall

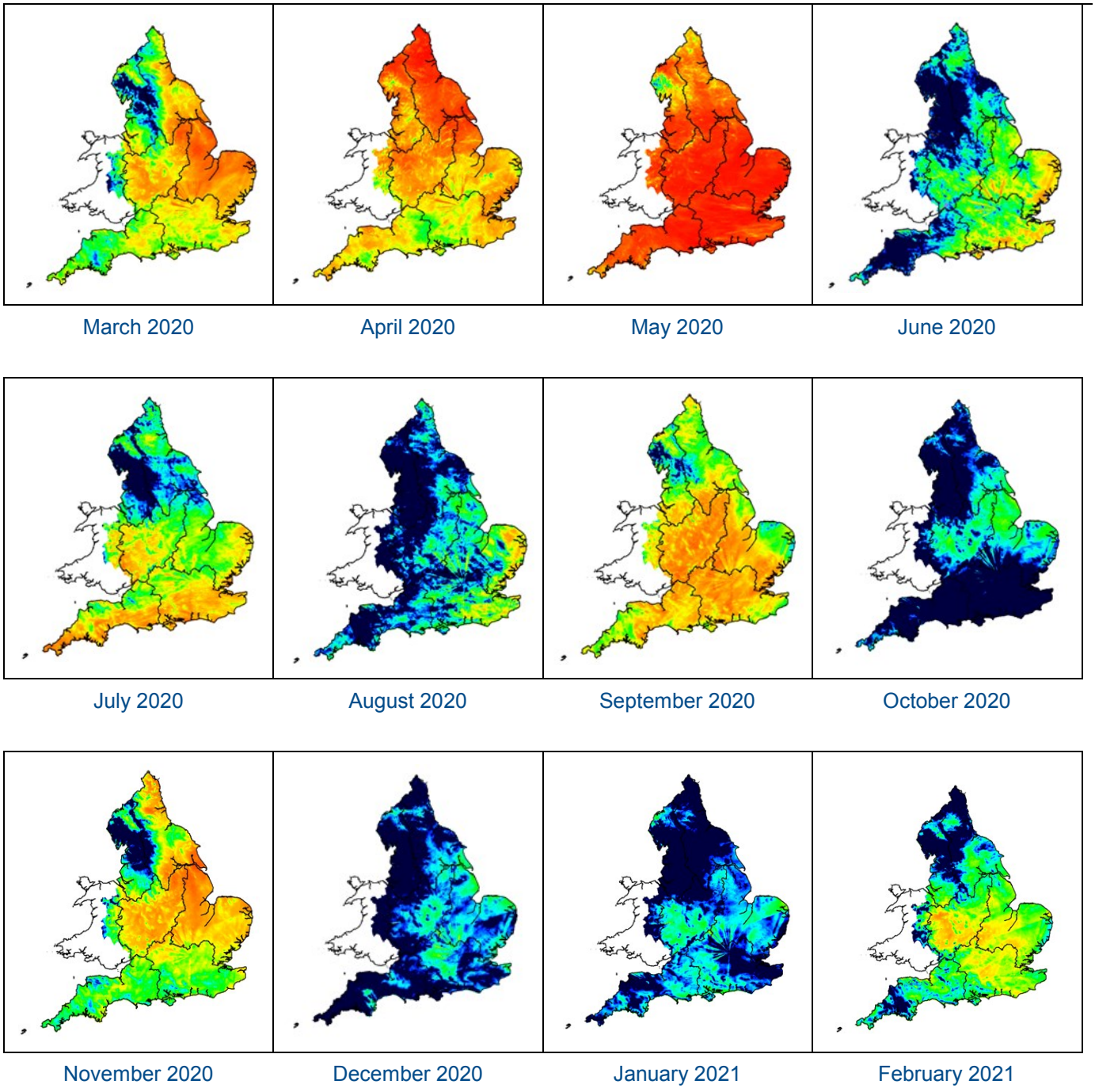


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2021). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

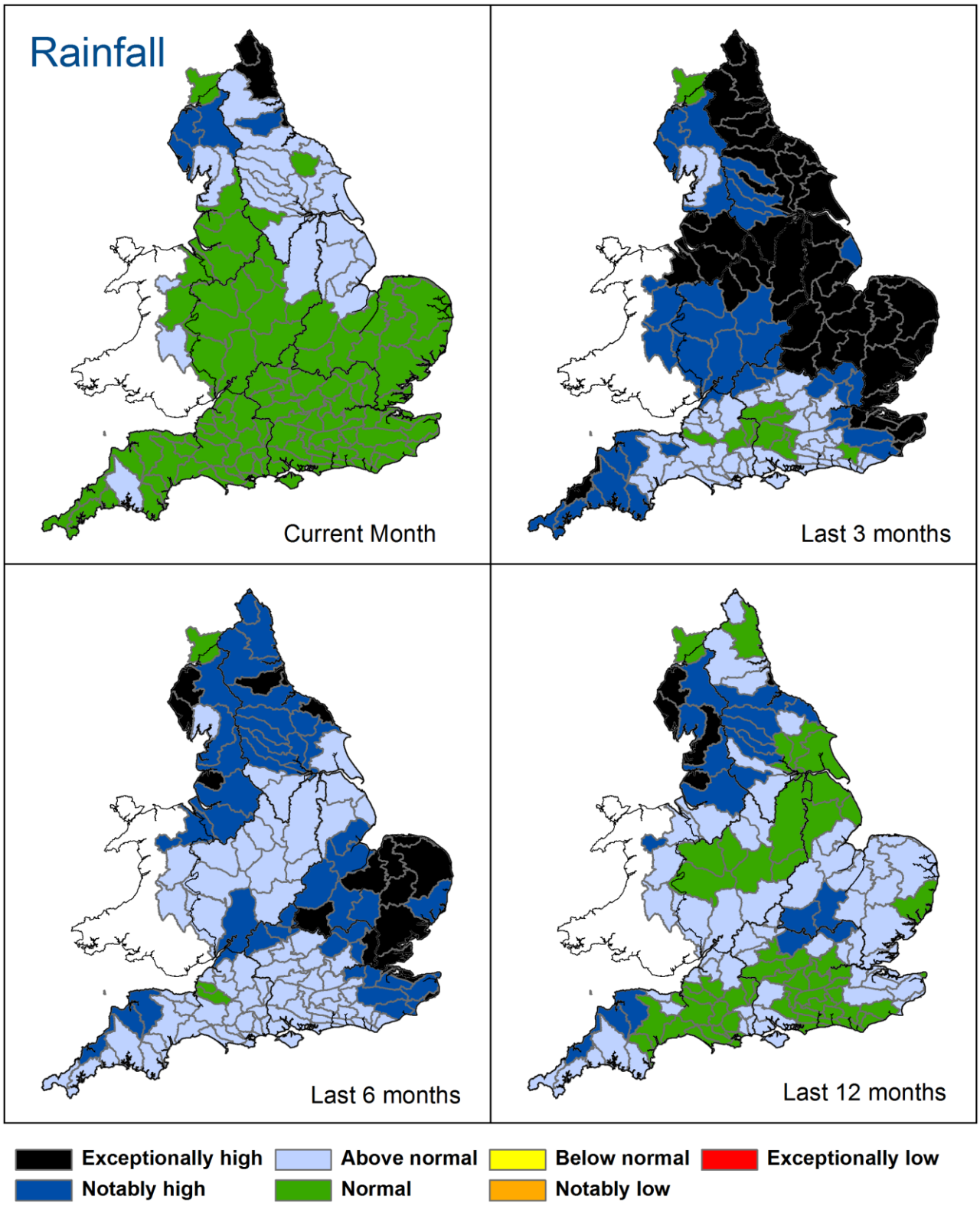


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 28 February), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived 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. Recent historical totals in some west Midlands Hydrological Areas may be underestimated due to recently identified outstation configuration. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

Rainfall charts

Above average rainfall

Below average rainfall

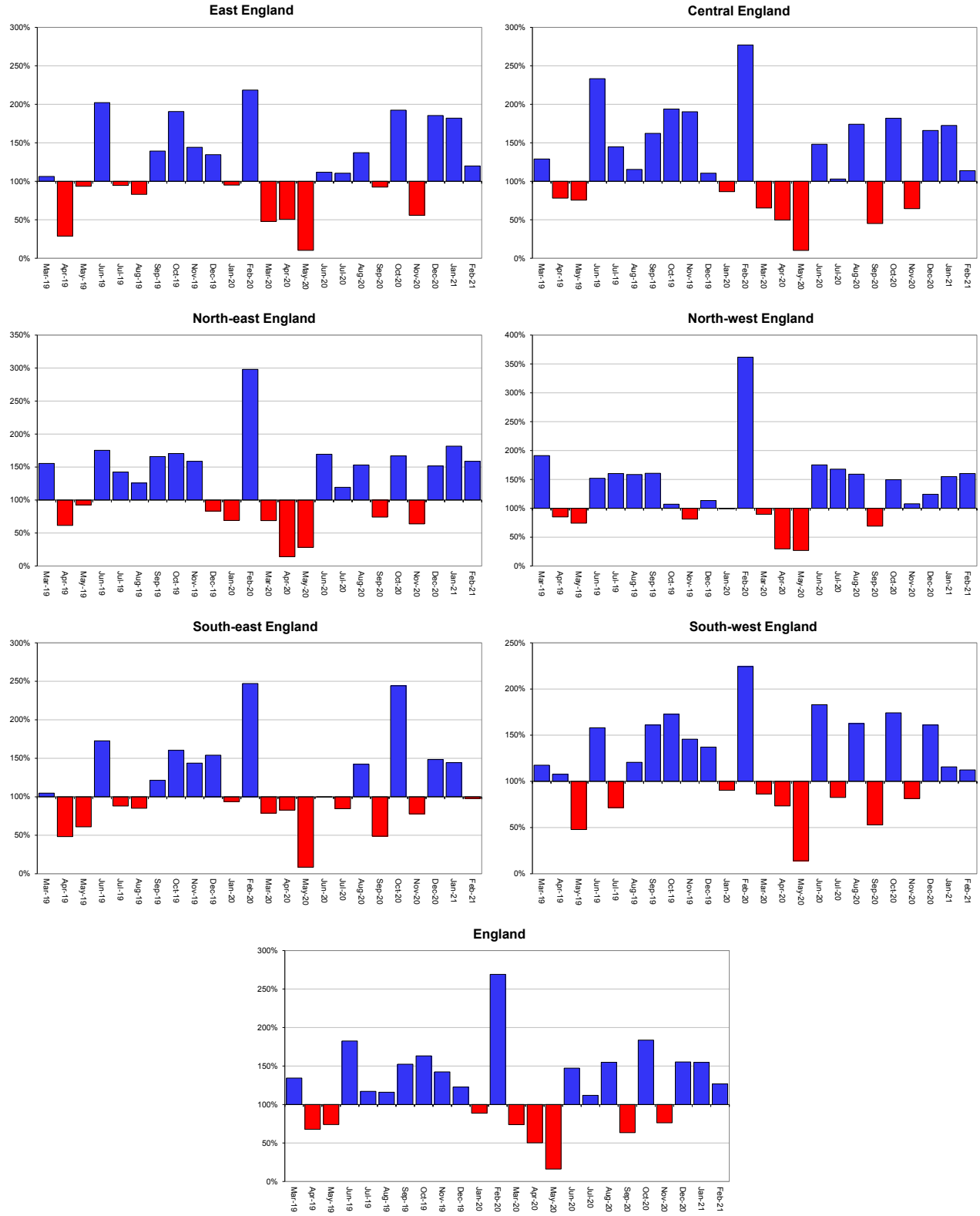


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2021).

Soil moisture deficit

End of January 2021[1]	End of February 2021[2]

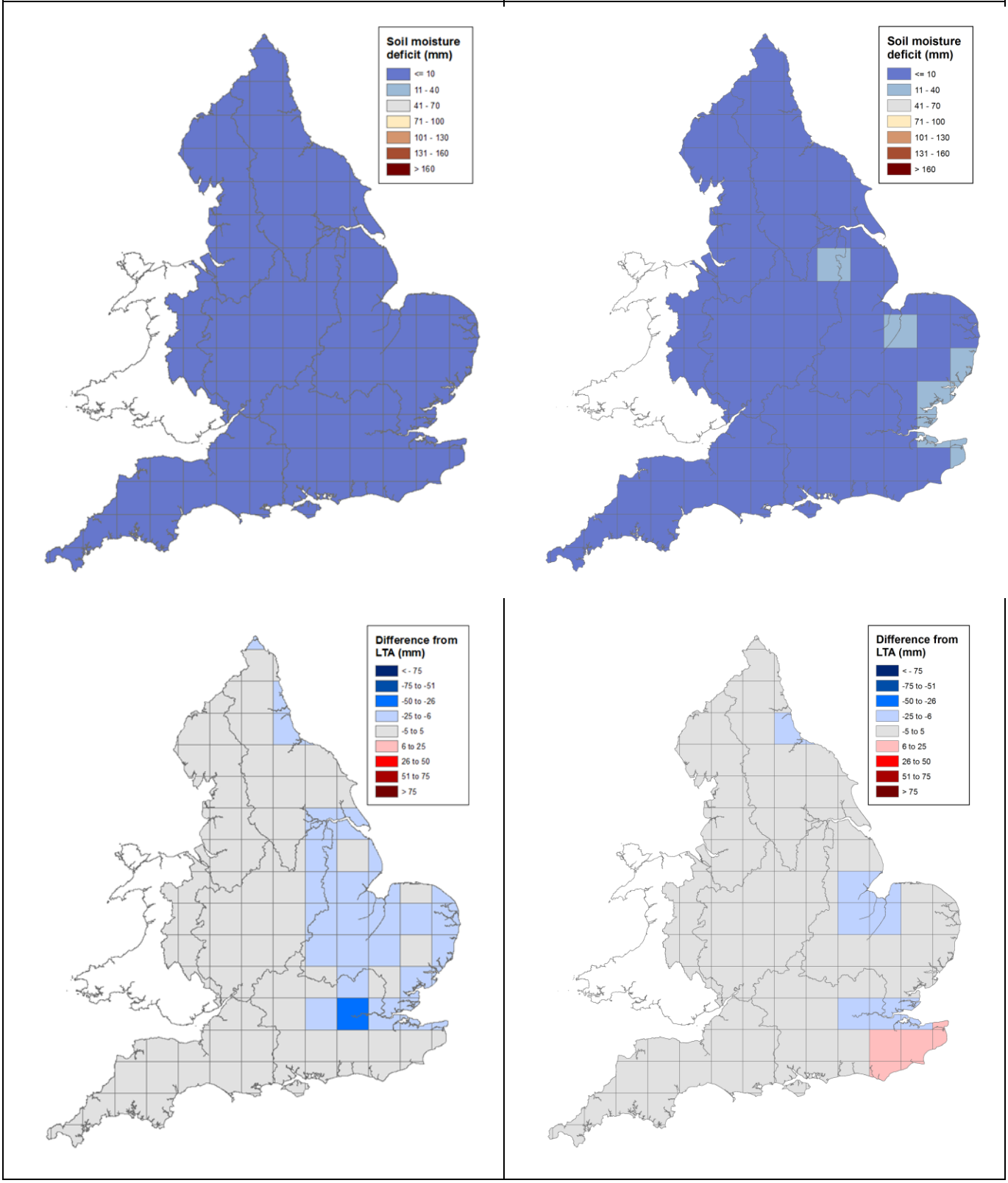


Figure 2.1: Soil moisture deficits for weeks ending 02 February 2021 [1] (left panel) and 02 March 2021 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data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

Soil moisture deficit charts

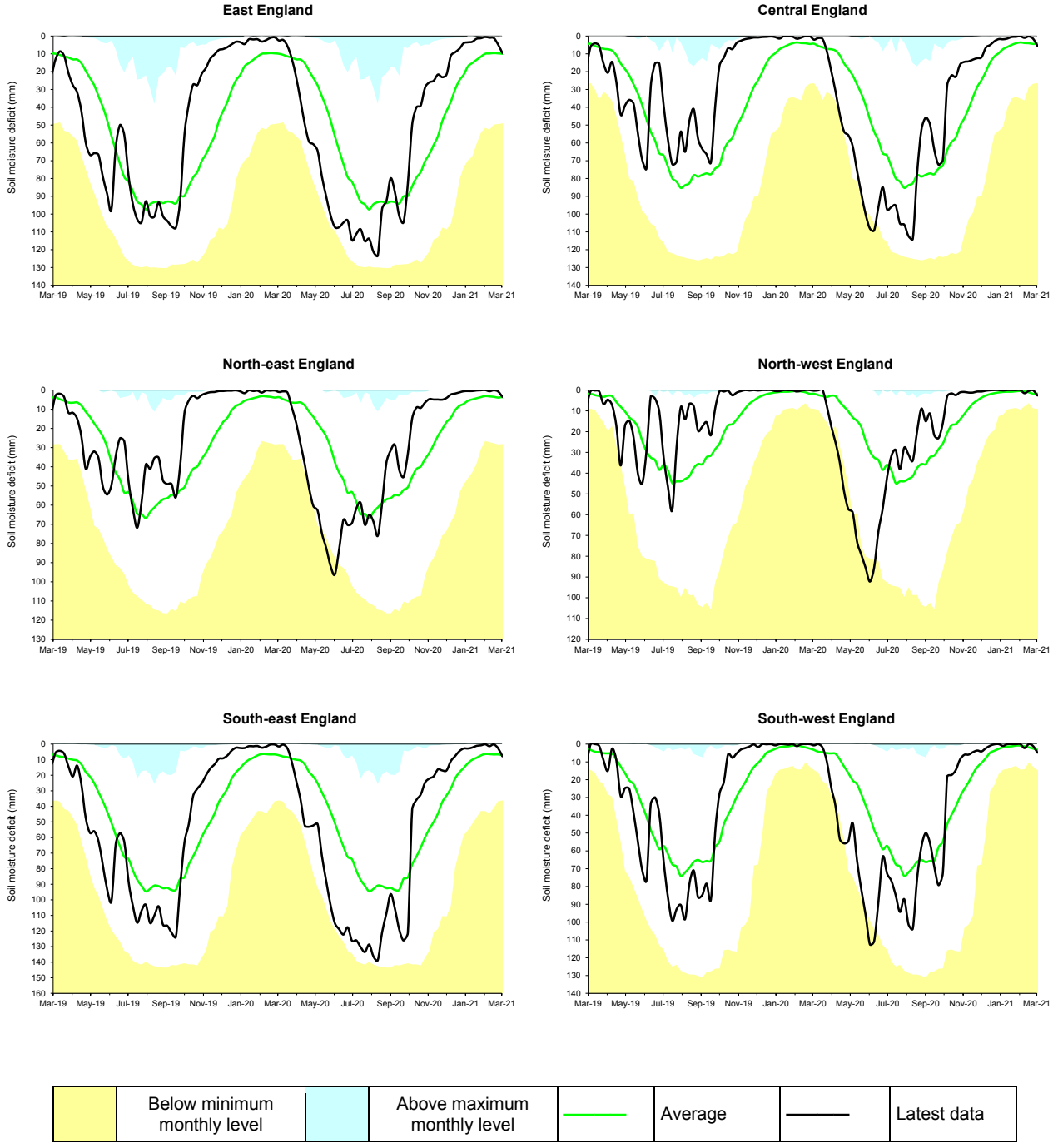
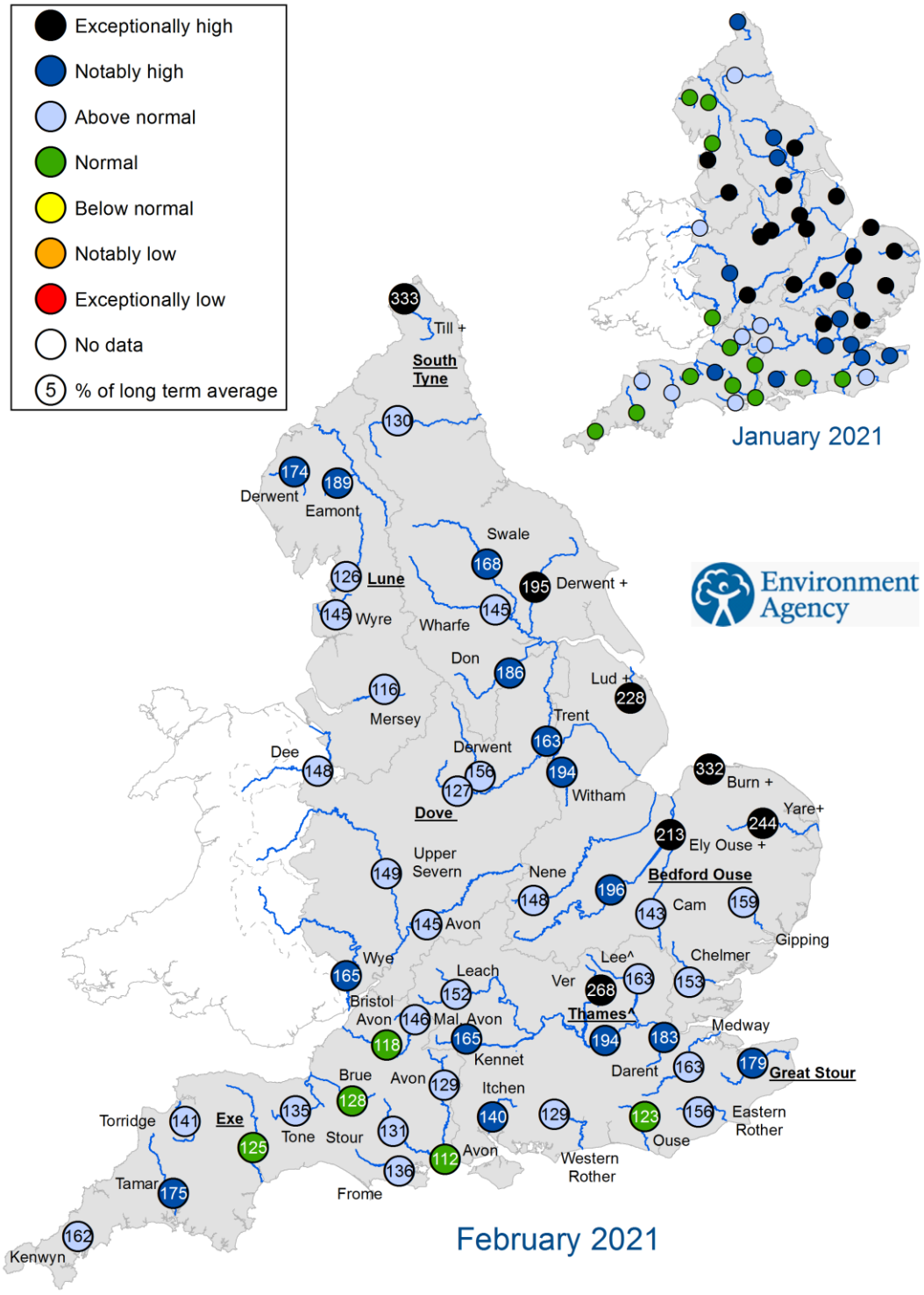


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2021).

River flows



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

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

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 January 2021 and February 2021, expressed as a percentage of the respective long term average and classed relative to an analysis of historic January and February monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

River flow charts

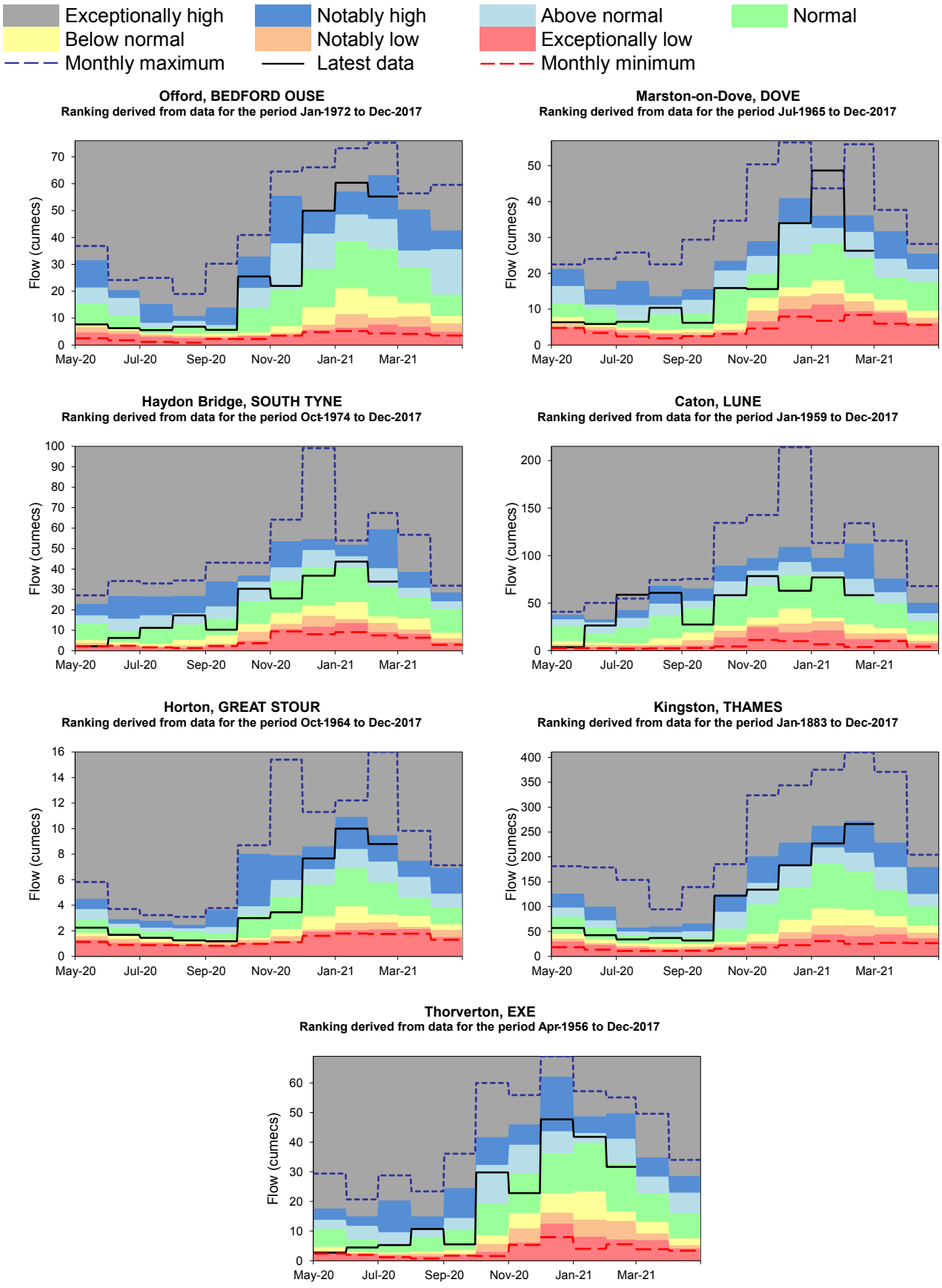
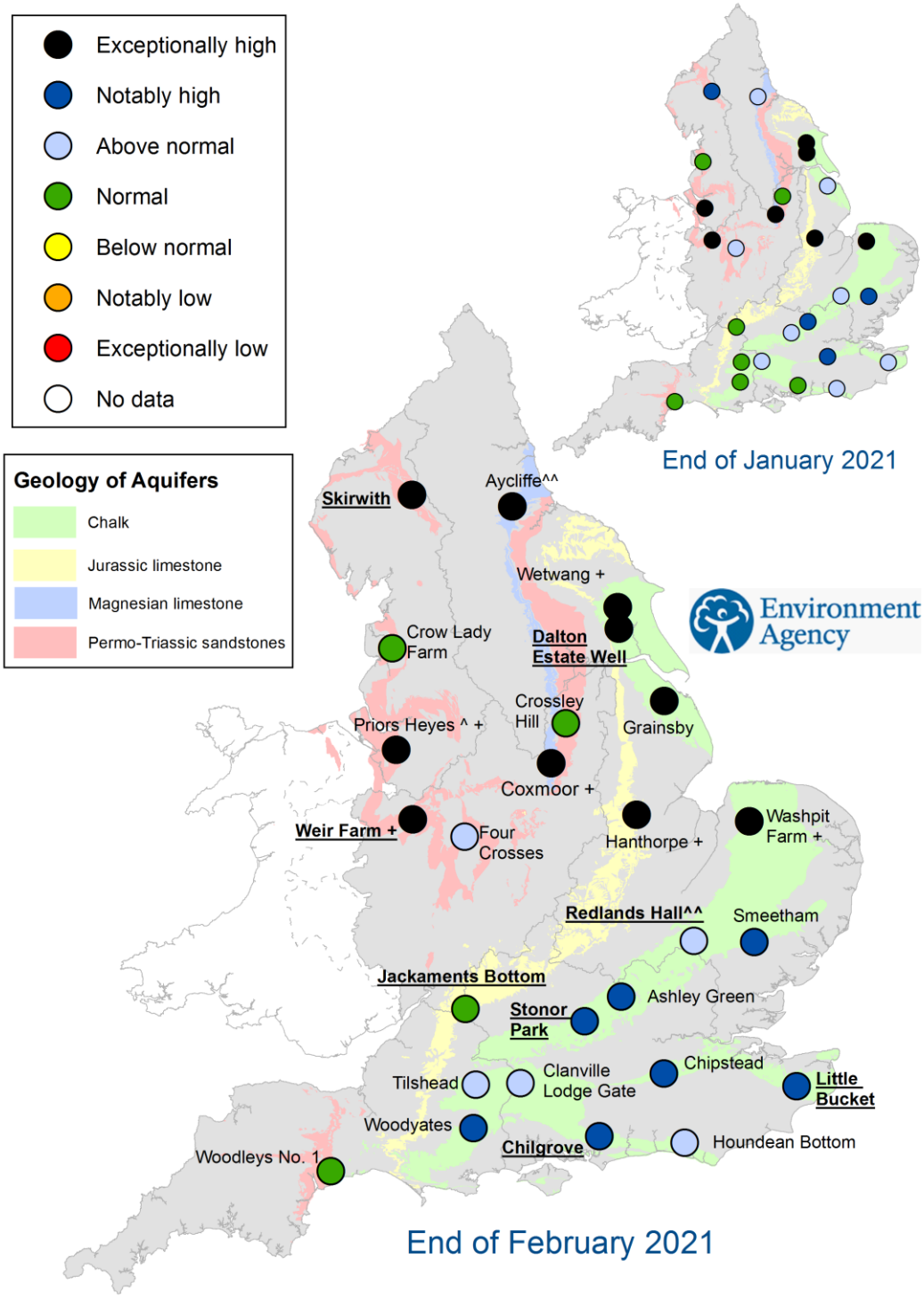


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency, 2021).

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 January 2021 and February 2021, classed relative to an analysis of respective historic January and February 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

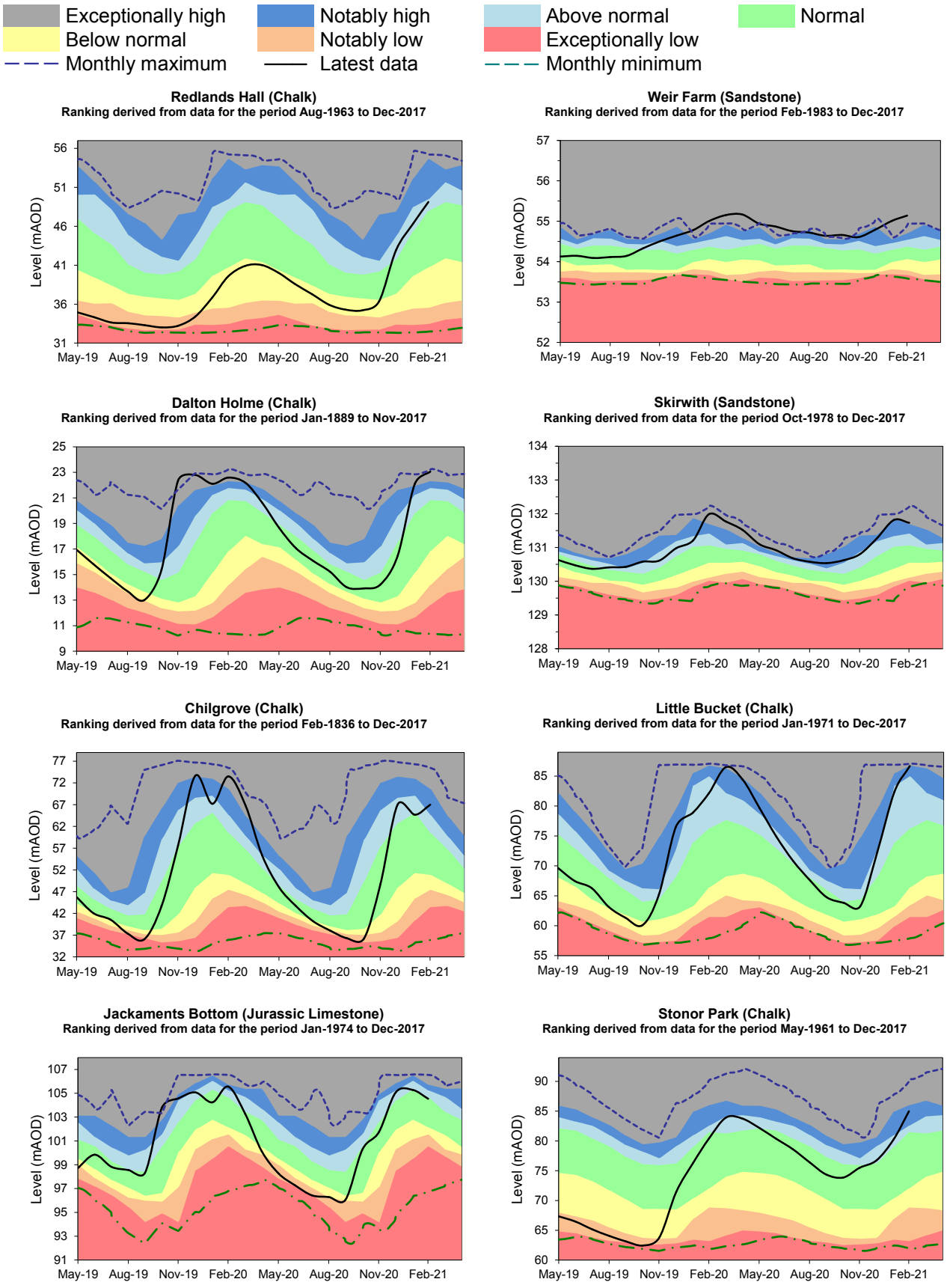
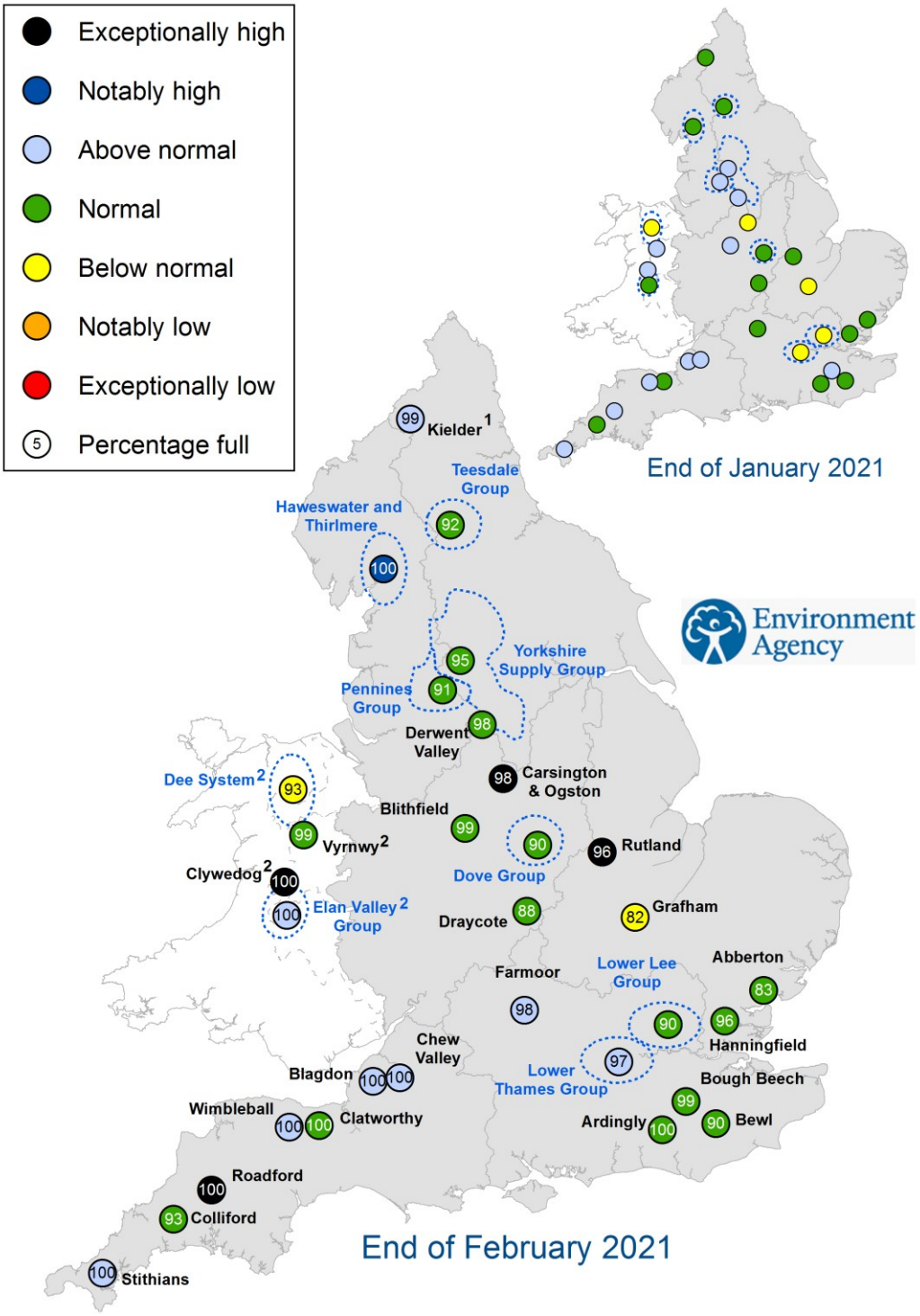


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2021).

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

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of January 2021 and February 2021 as a percentage of total capacity and classed relative to an analysis of historic January and February 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

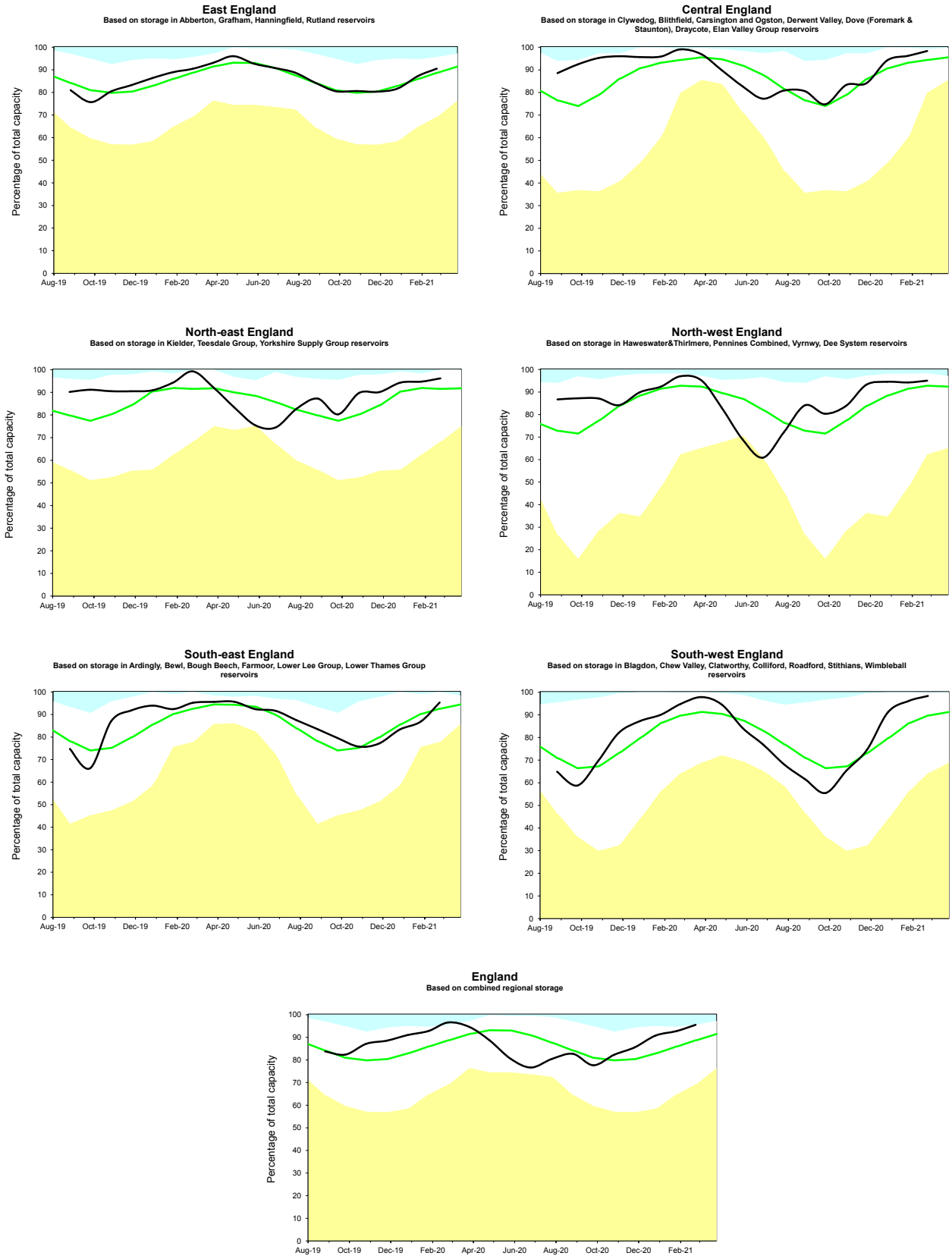


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

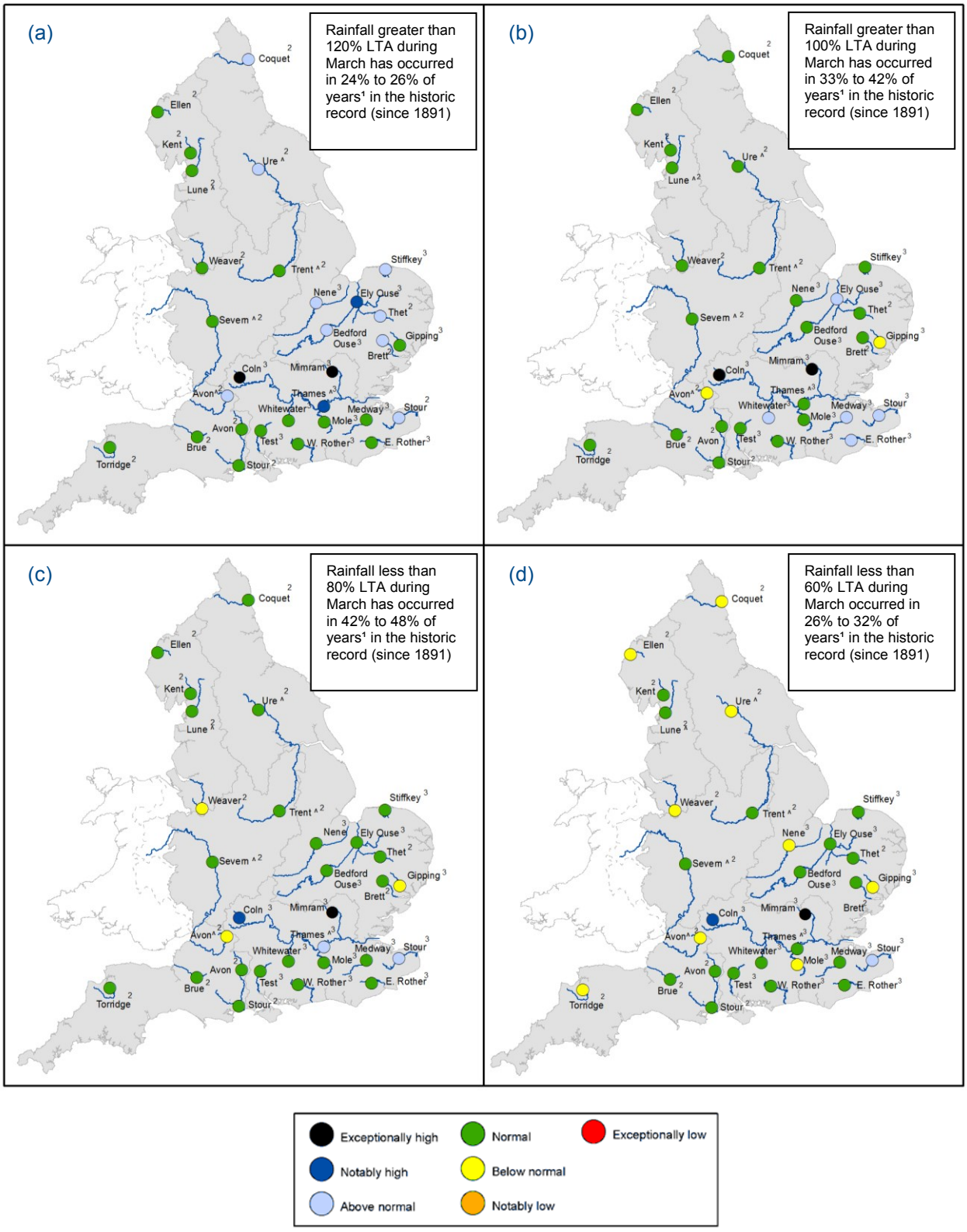
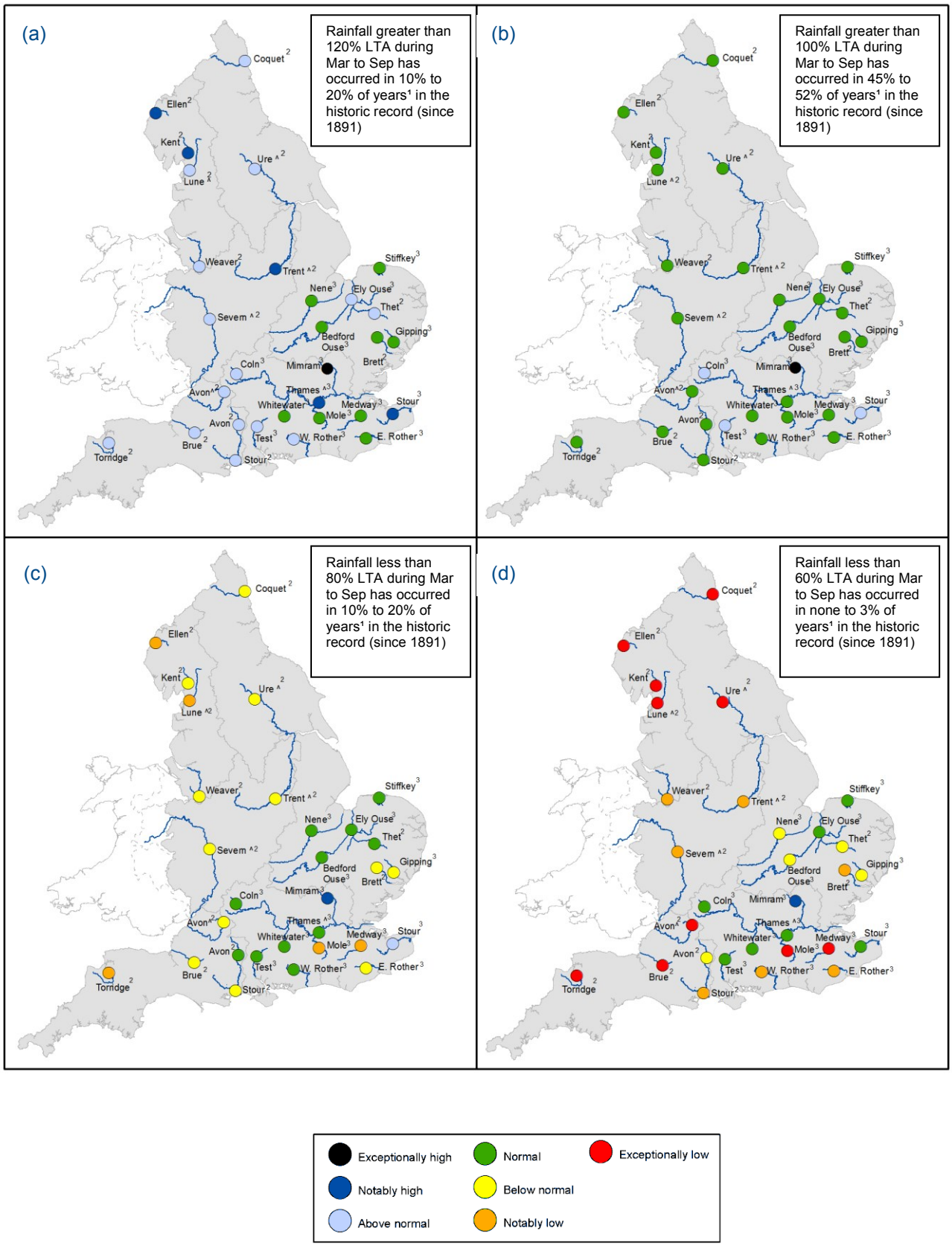


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2021 and September 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*



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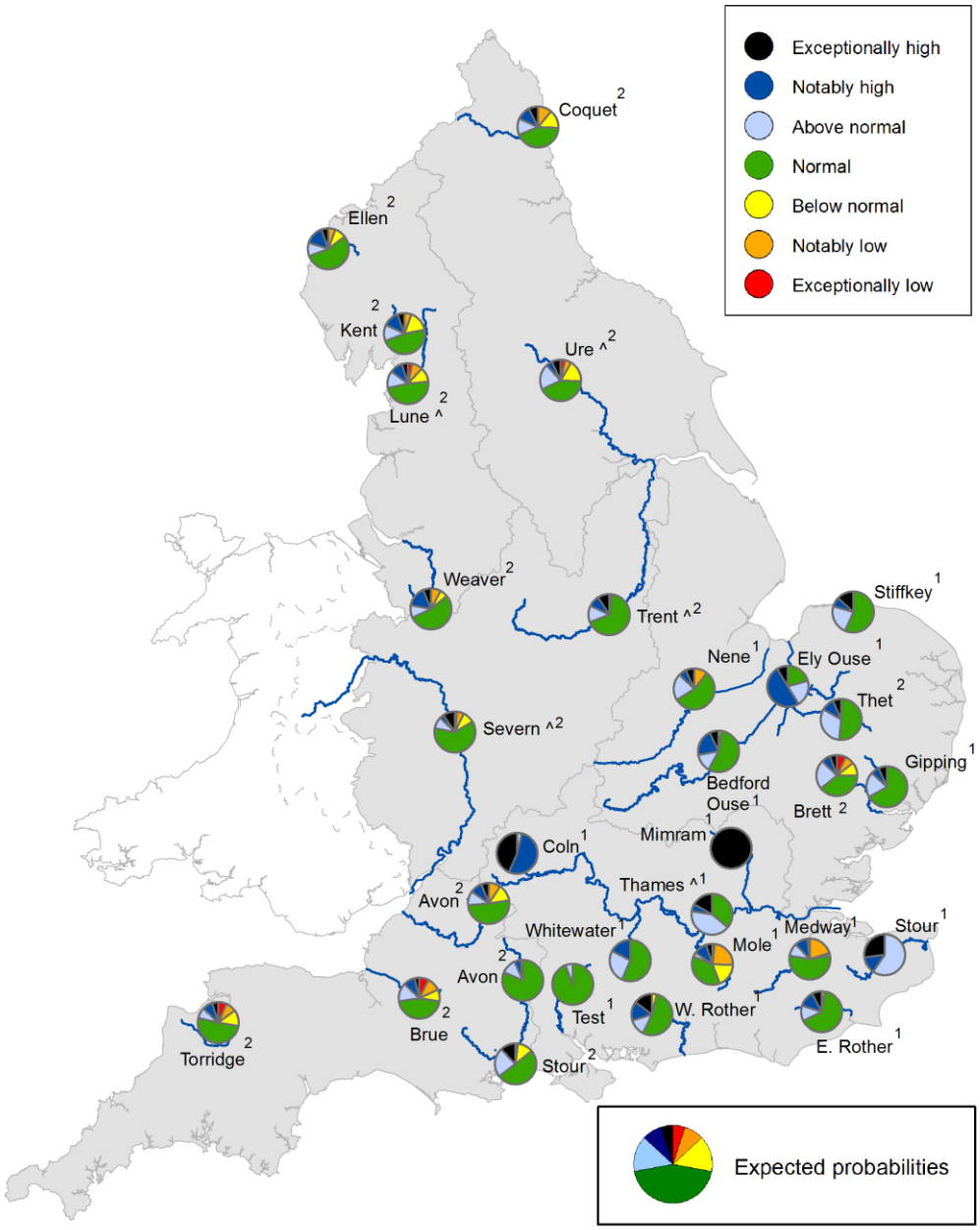

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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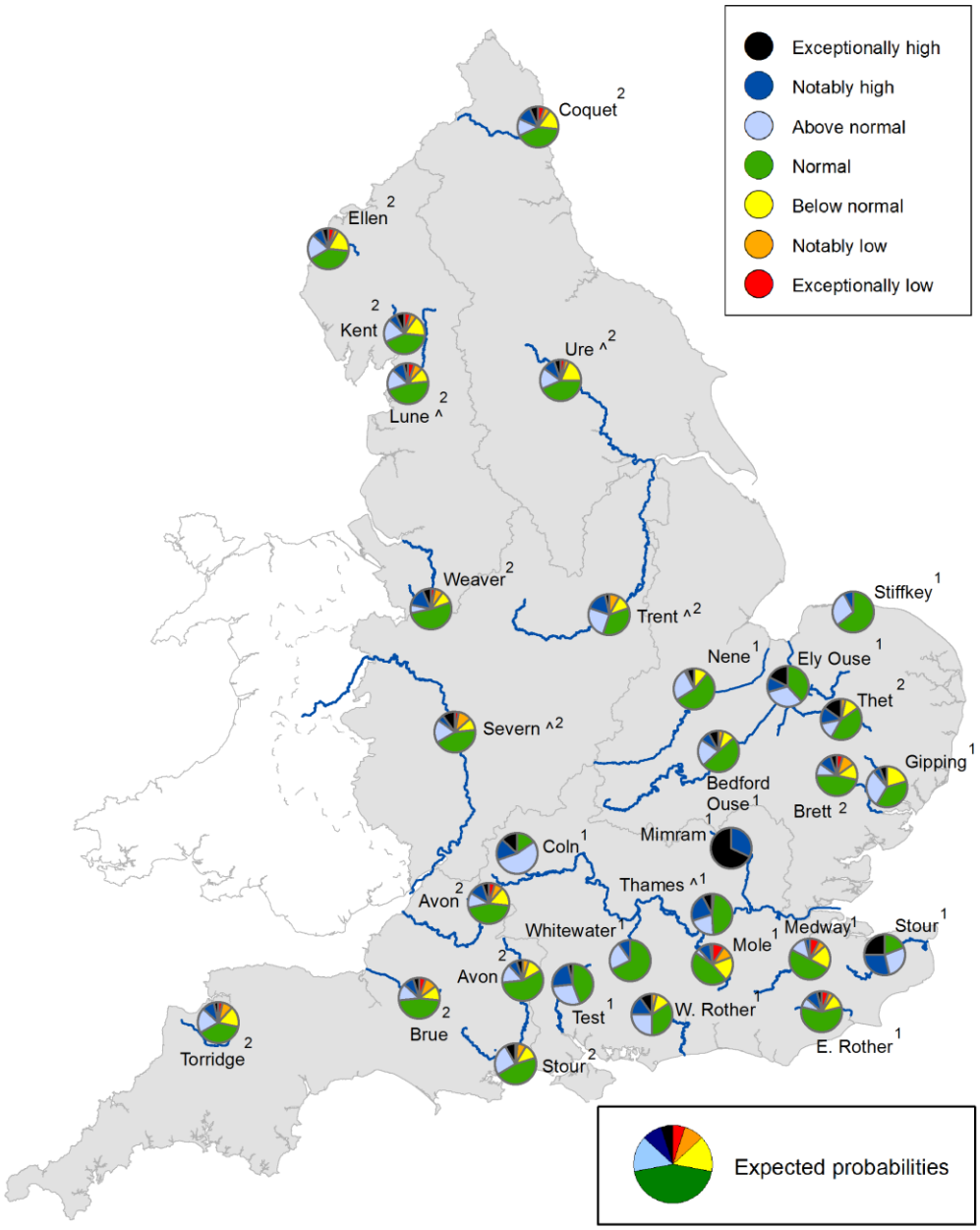

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2021. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for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

[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

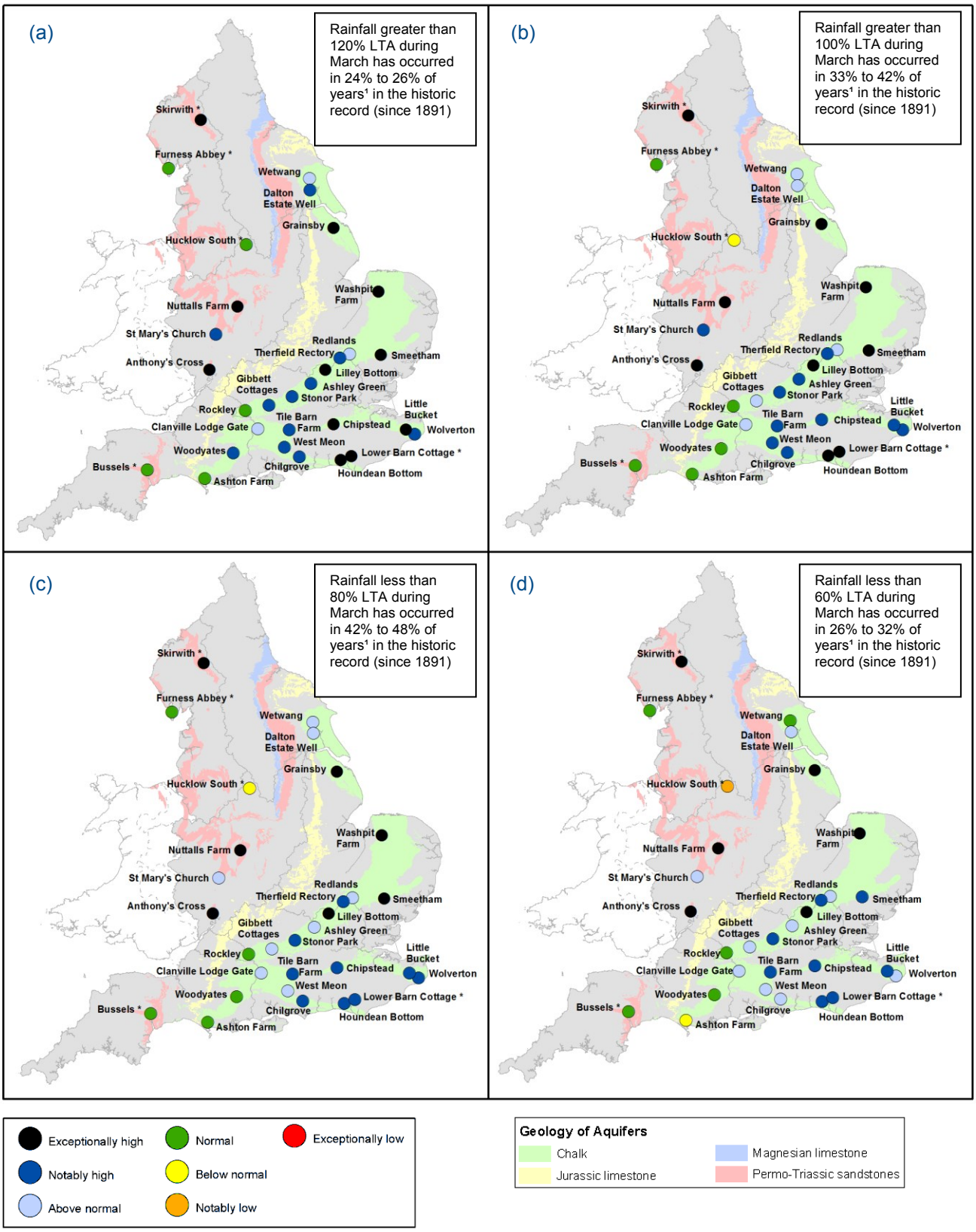

Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2021 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission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

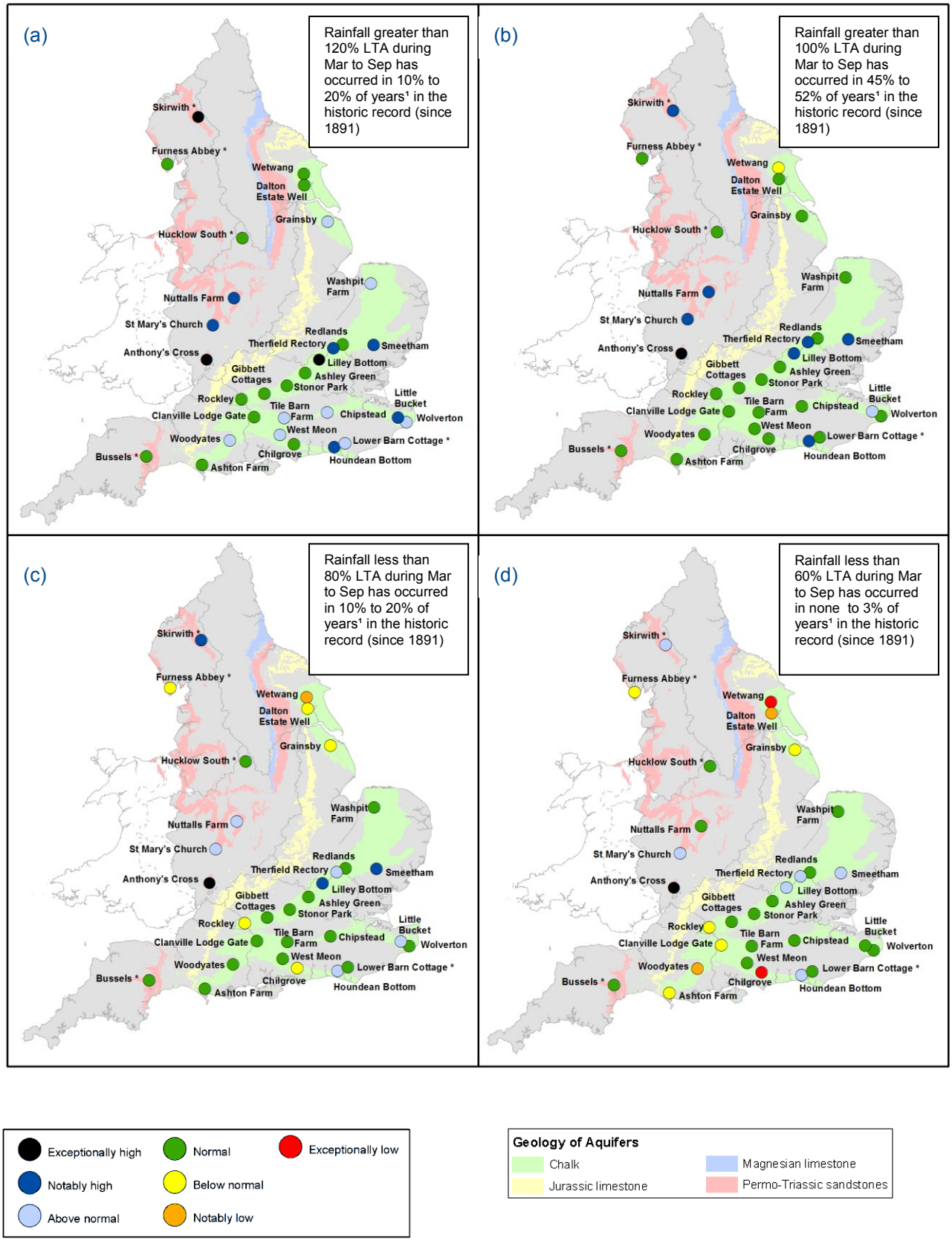

Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2021 and September 2021 (Source: Environment Agency) Geological map reproduced with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

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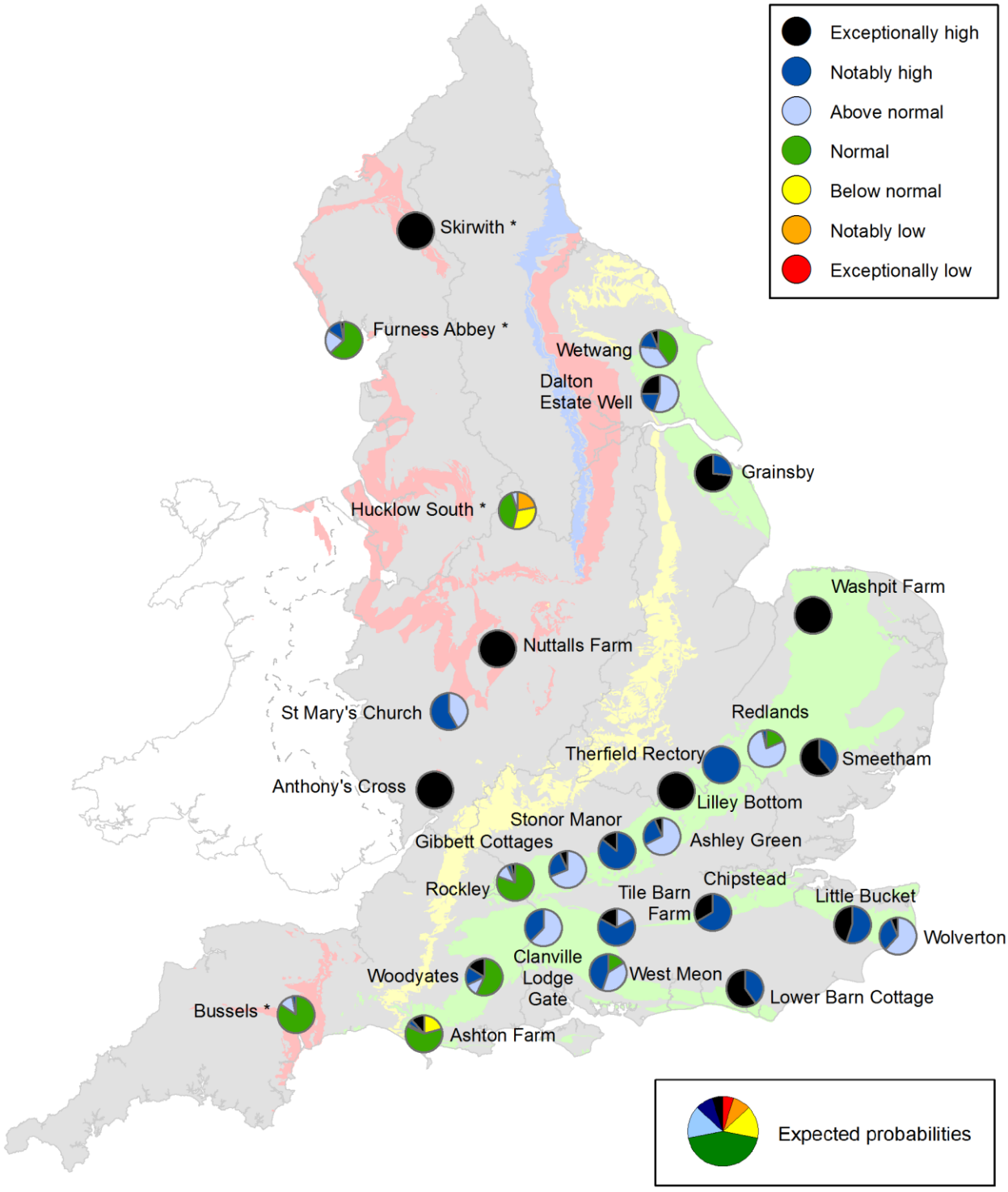
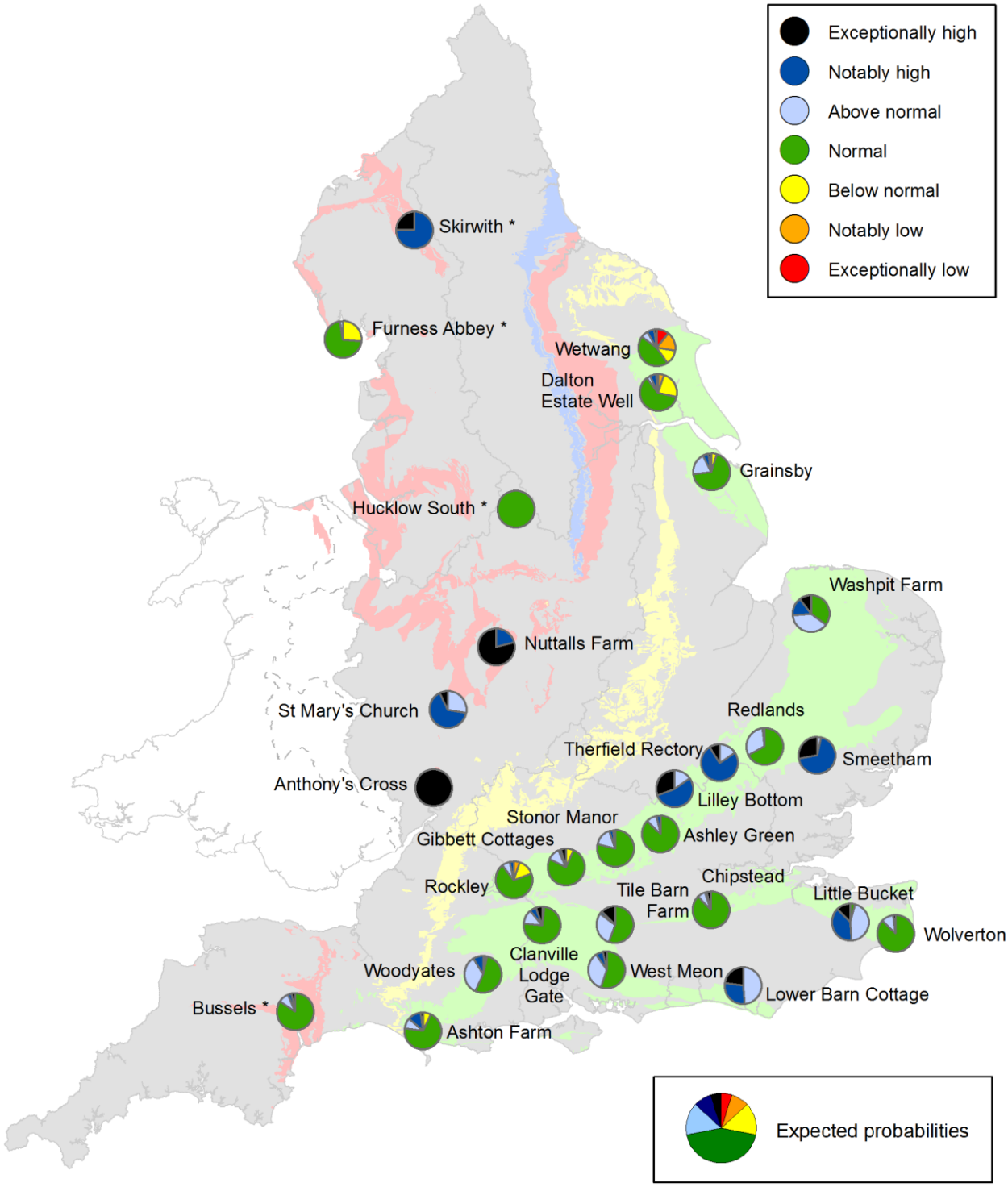


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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