Monthly water situation report

England

Summary – January 2021

January was the second consecutive month with significantly above average rainfall across England. Many parts of the country had exceptionally high rainfall with one catchment in North Yorkshire recording the highest January rainfall total on record. Soils were wet for the time of year. Many rivers had exceptionally high flows in January – particularly in east and central England; eight rivers recorded the highest flows on record for January. Groundwater levels continued to rise and a number of aquifers now have levels classed as exceptionally high; six sites recorded the highest levels on record for the end of January. Reservoir stocks generally increased or remained similar to last month; while total stocks for England remain slightly above average.

Rainfall

The January rainfall total for England was 124mm, which represents 154% of the 1961 to 1990 long term average (LTA) (150% of the 1981 to 2010 LTA). This is now the second consecutive month with significantly above average rainfall. Rainfall was widespread with the highest monthly rainfall totals recorded in north-west England (Figure 1.1).

Monthly rainfall totals were classed as normal or higher across all catchments. The lowest rainfall total, as a proportion of the LTA, was over the Ock catchment in Oxfordshire, where the rainfall total was 77mm representing 137% of the January LTA. Exceptionally high rainfall totals for the time of year were recorded across much of north-east and central England, as well as parts of Kent. The Dales North Sea tributaries catchment in North Yorkshire recorded the highest January rainfall total on record (records since 1891) with 204mm of rainfall representing 266% of the January LTA. This catchment also recorded the second wettest 3 month cumulative total on record to the end of January. January rainfall totals were classed as either notably high or exceptionally high in half the catchments across England.

The 3, 6 and 12 month cumulative rainfall totals ending in January were classed as normal or higher in every catchment across England. Despite November being a relatively dry month the 3 month cumulative rainfall totals were higher than normal for most of the catchments across England except for parts of southern England where they were normal (Figure 1.2). Over the past 12 months a total of 7 out of 138 catchments have recorded the largest rainfall totals on record (records since 1891), mainly in north-west England.

At a regional scale, January rainfall totals ranged from 116% of LTA in south-west England, to 182% of LTA in east and north-east England (Figure 1.3). North-west England has recorded the wettest 12 month period since 1955 and second wettest on record. For England as a whole, 6 of the previous 8 months have recorded higher than average rainfall.

Soil moisture deficit

Across almost the whole of England soils were wetter than the LTA and close to saturation at the end of January, with a soil moisture deficit (SMD) of less than 10mm. (Figure 2.1).

At a regional scale, the end of month SMD values were smaller (ie wetter) than the end of January LTA in all regions (Figure 2.2).

River flows

Monthly mean flows for January were classed as normal or higher for the time of year at all of the reported gauging stations; flows were classed as either exceptionally high or notably high at over half of these. In east and central England flows at all of the indicator sites were classed as exceptionally high or notably high. The highest January monthly mean flows on record were recorded on the Upper Witham (258% LTA) and (for a second consecutive month) the River Yare (272% LTA) and the River Gipping (346% LTA) in east England (records from 1959, 1970 and 1964 respectively). The highest January monthly mean flows on record were also recorded on

the rivers Dove (207%) and Trent (216%) in central England, the rivers Derwent (256%) and Don (229%) in north-east England and the River Mersey (233% LTA) in north-west England (records from 1965, 1969, 1973, 1959 and 1976 respectively).

River flows increased at over two-thirds of sites compared to December. For example, at St Michaels on the River Wyre (Lancashire) monthly mean flows had been classed as normal in December (105% LTA) but were nearly double that in January and classed as exceptionally high for the time of year (195% LTA), responding to the high rainfall totals in this part of the country (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 four-fifths of the indicator sites we report on during January. 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 over a quarter of 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 January 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.

End of month groundwater levels at the major aquifer index sites ranged from normal at both Chilgrove (chalk) and Jackaments Bottom (Jurassic limestone) to exceptionally high at both Weir Farm (Bridgnorth sandstone) and Dalton Home (chalk). At Dalton Home the end of December groundwater levels were classed as normal for the time of year but had risen to an exceptionally high level by the end of January (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks increased at three-fifths of the reservoirs and reservoir groups we report on during January. The biggest increase, as a proportion of total capacity, was in Abberton reservoir (Essex), where stocks increased from 61% of capacity at the end of December to 75% at the end of January. Stocks decreased at only 3 of the reservoirs and reservoir groups we report on.

While reservoir stocks in one-sixth of the reservoirs and reservoir groups we report on were classed as below normal the rest were classed as normal or above normal for the time of year (Figure 5.1).

Total reservoir stocks for England were at 93% of total capacity at the end of January (an increase from 91% at the end of December), just above the LTA for the time of year. At a regional scale, total reservoir stocks ranged from 86% in east England to 96% in central and north-east England (Figure 5.2).

Forward look

February will get off to a wet start in the north-east and north-west of England. It will turn very cold across much of the country from the weekend of 6 February with easterly winds bringing snow to some areas. During the following week snow showers are likely in some western areas with longer spells of snow in some eastern areas. Around Friday 12 February there is potential for some more disruptive snow in the west. Cold conditions are generally expected to persist through the rest of the month, across much of England, but a spell of milder and potentially more unsettled conditions over south-western and western areas is possible in the second half of the month.

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

Projections for river flows at key sites[1]
More than four-fifths 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 nine-tenths 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

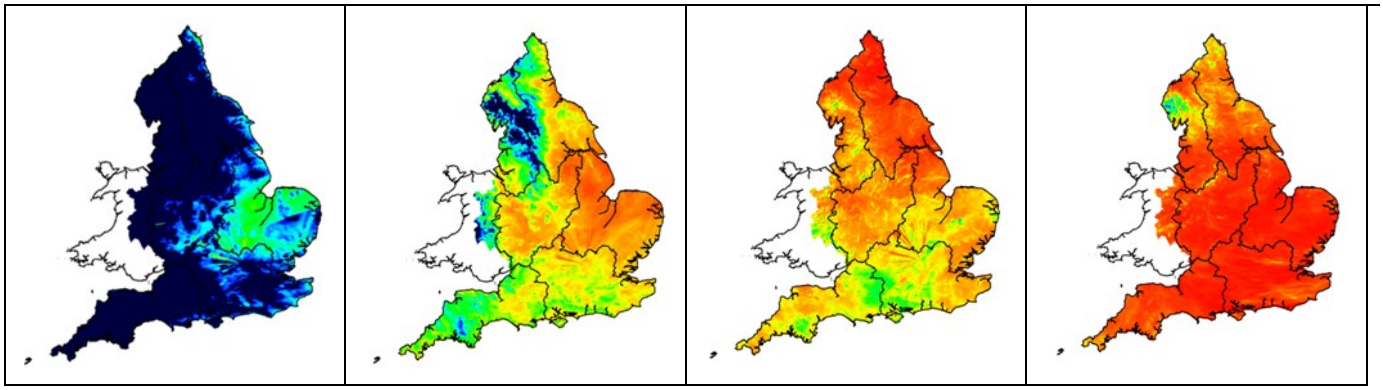
Projections for groundwater levels in key aquifers[2]
By the end of March 2021, over nine-tenths of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year. By the end of September 2021, half of the modelled sites have a greater than expected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

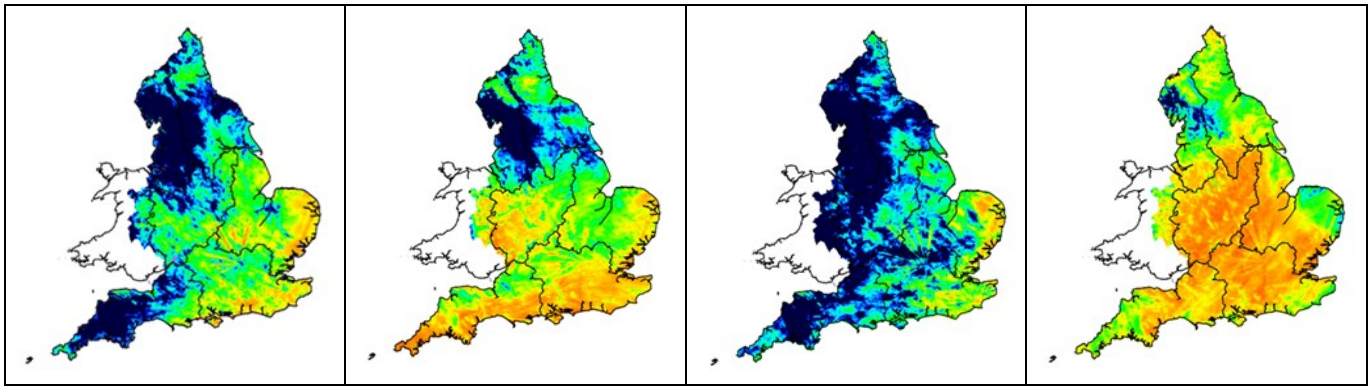
Authors: National Water Resources Hydrology Team

[1] 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).

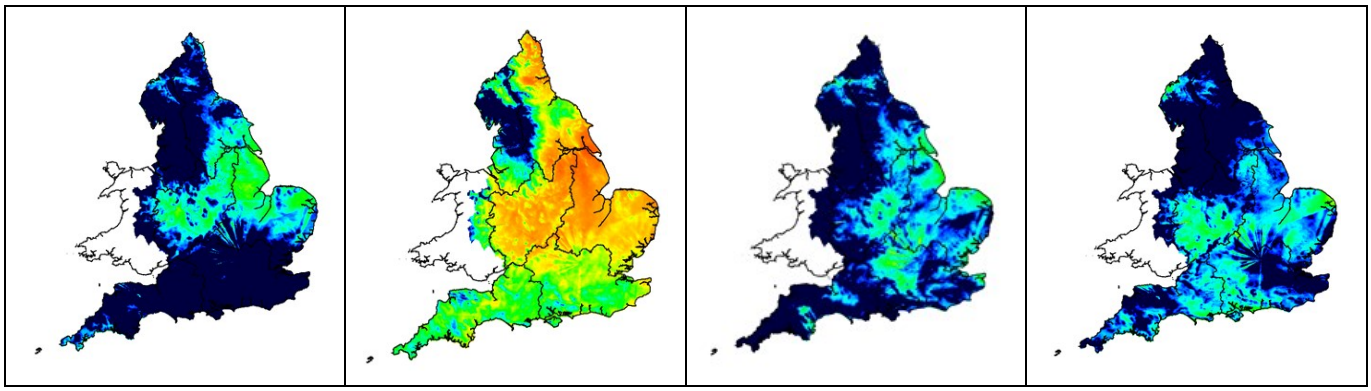
Rainfall



February 2020 | March 2020 | April 2020 | May 2020

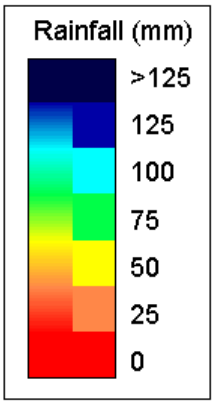


June 2020 | July 2020 | August 2020 | September 2020



October 2020 | November 2020 | December 2020 | January 2021

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.



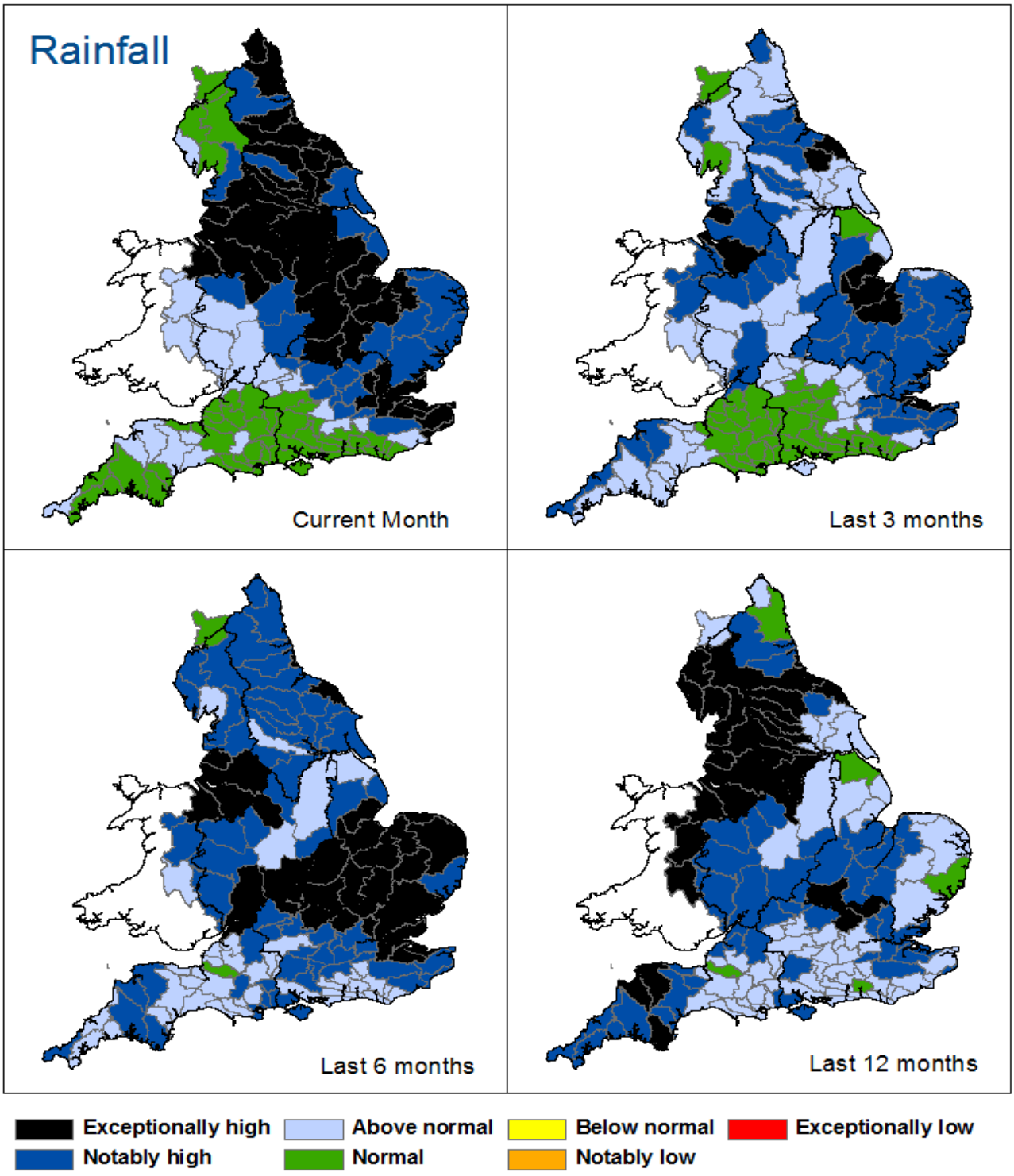


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 January), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived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

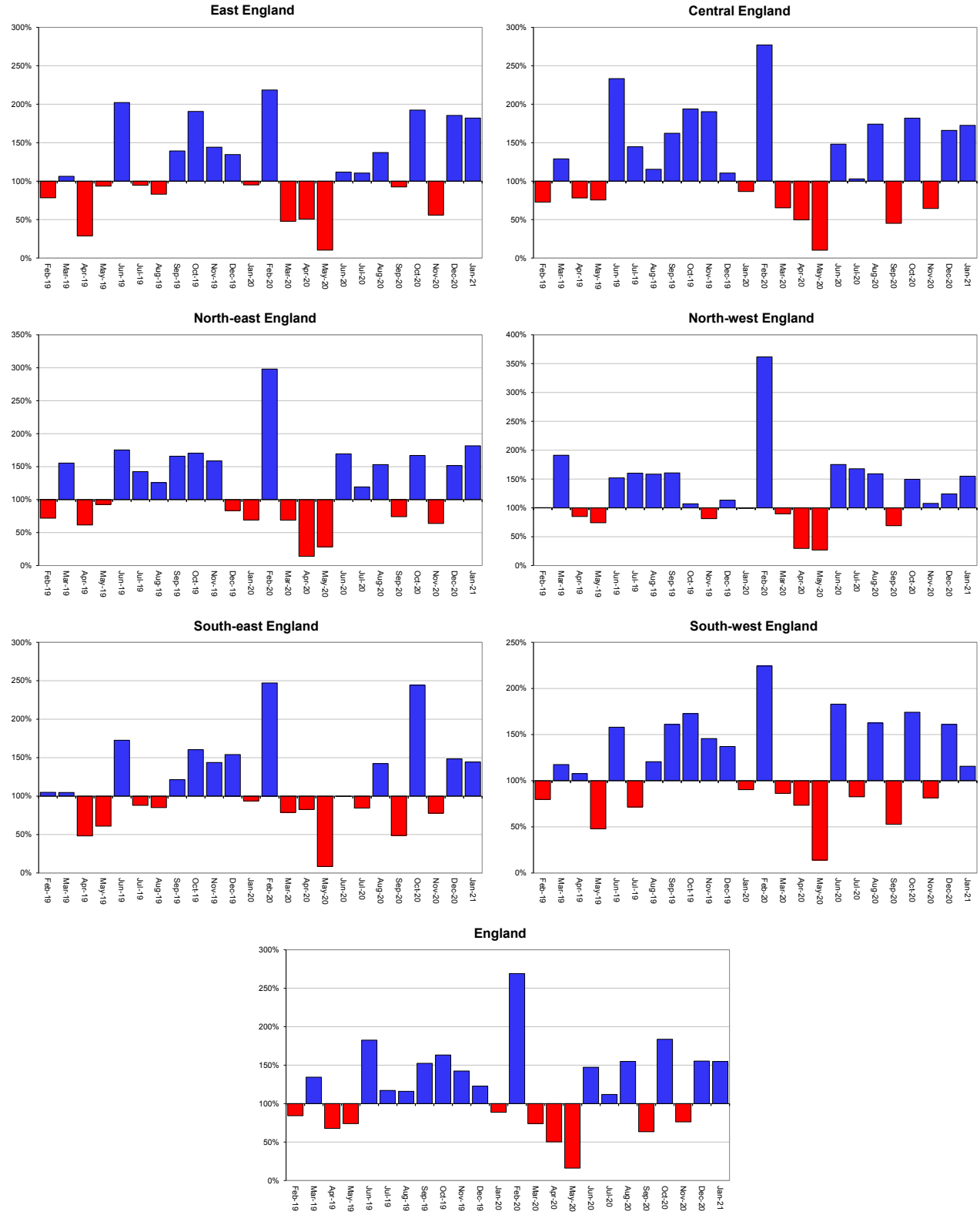


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2021).

Soil moisture deficit

End of December 2020[1]	End of January 2021[2]

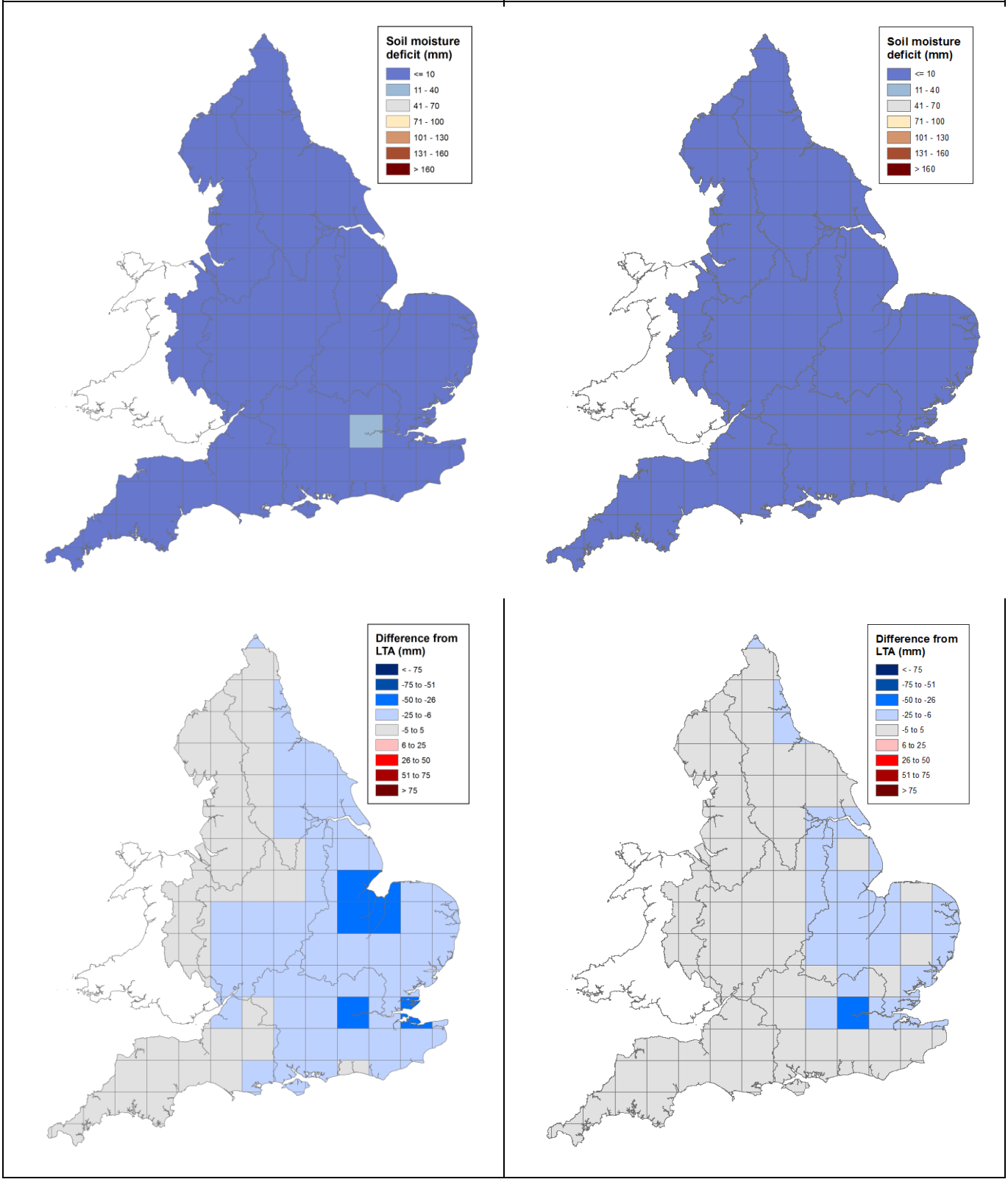


Figure 2.1: Soil moisture deficits for weeks ending 29 December 2020 [1] (left panel) and 02 February 2021 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2021). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021

Soil moisture deficit charts

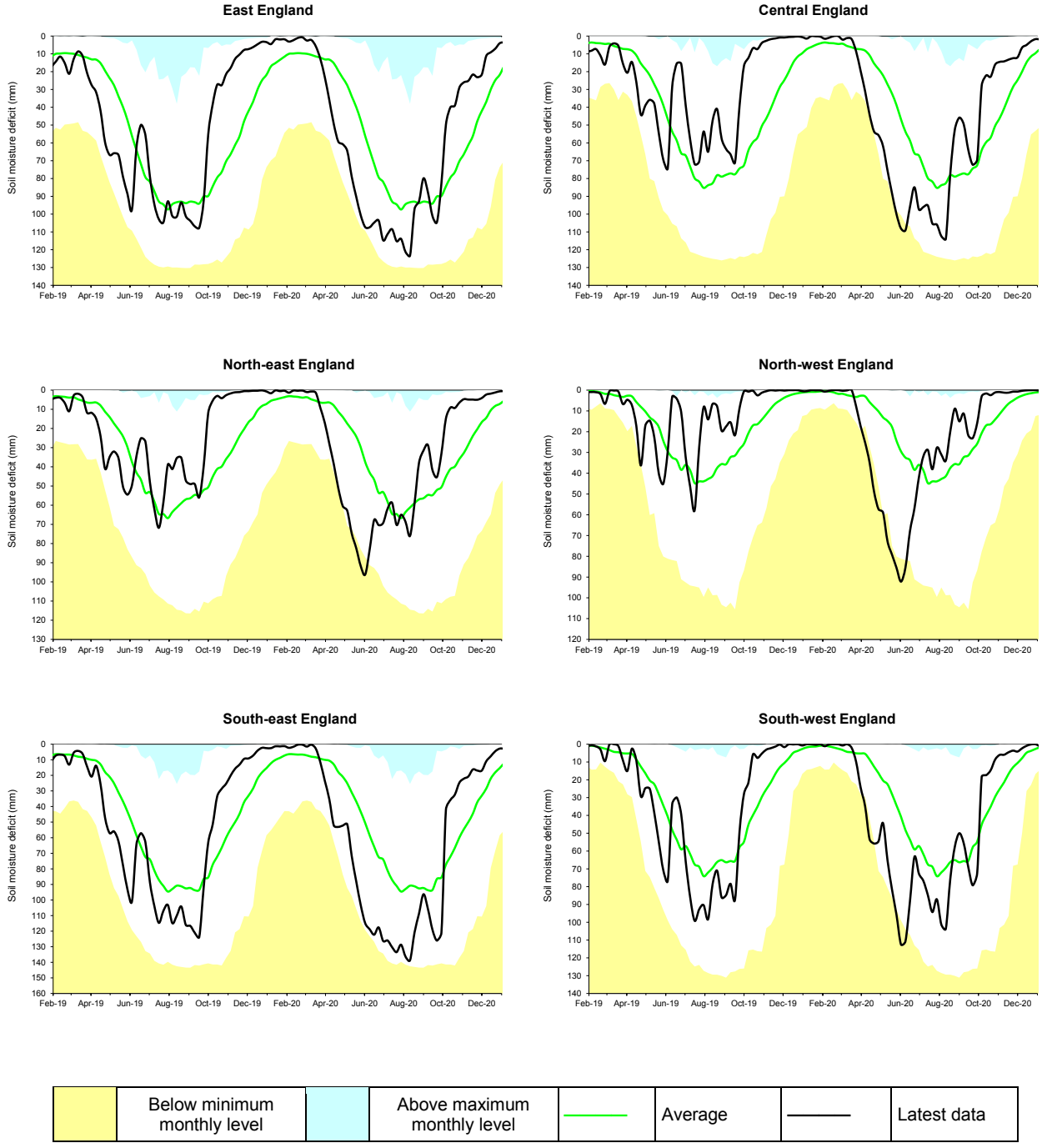
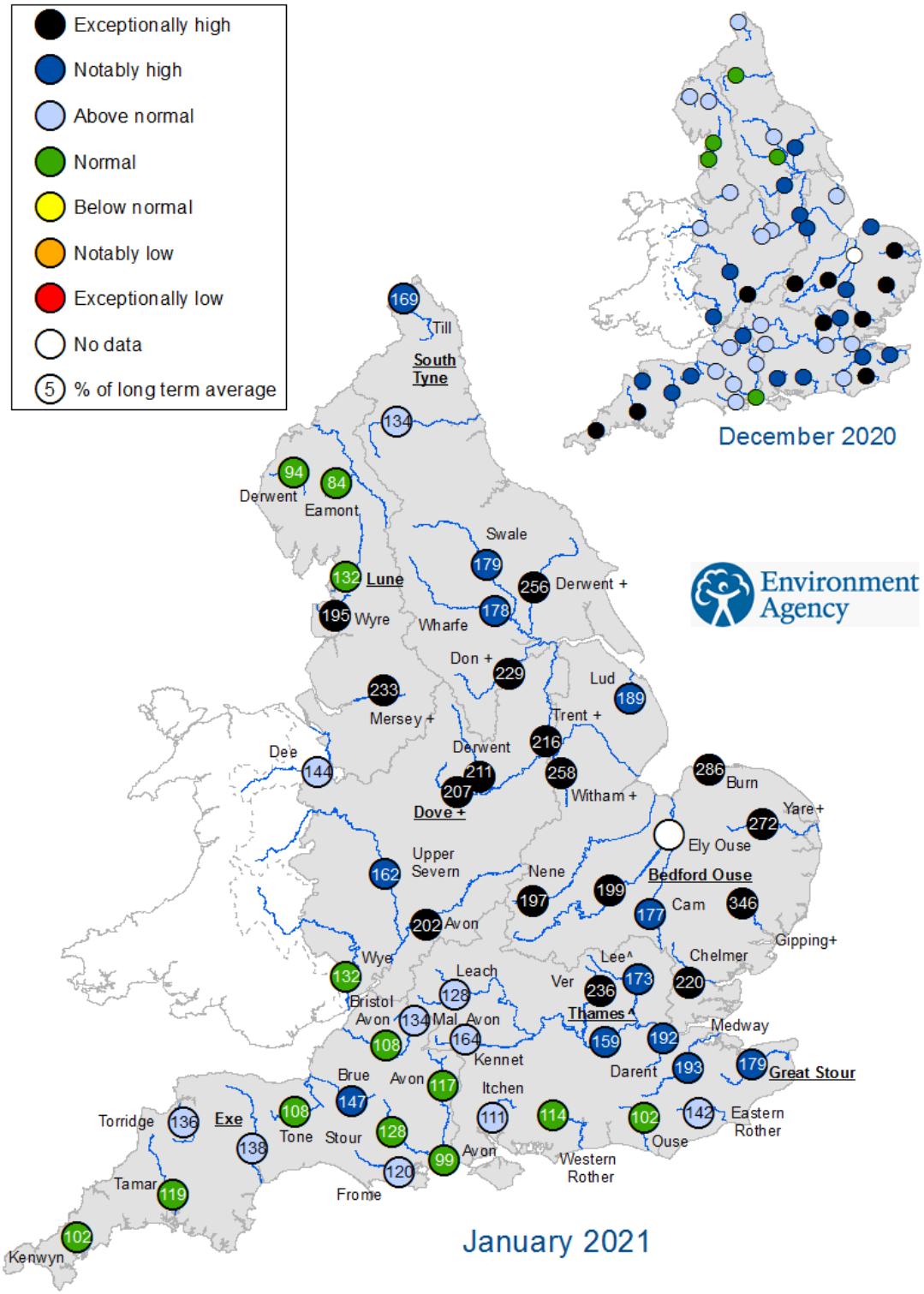


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2021).

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 December 2020 and January 2021, expressed as a percentage of the respective long term average and classed relative to an analysis of historic December and January monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

River flow charts

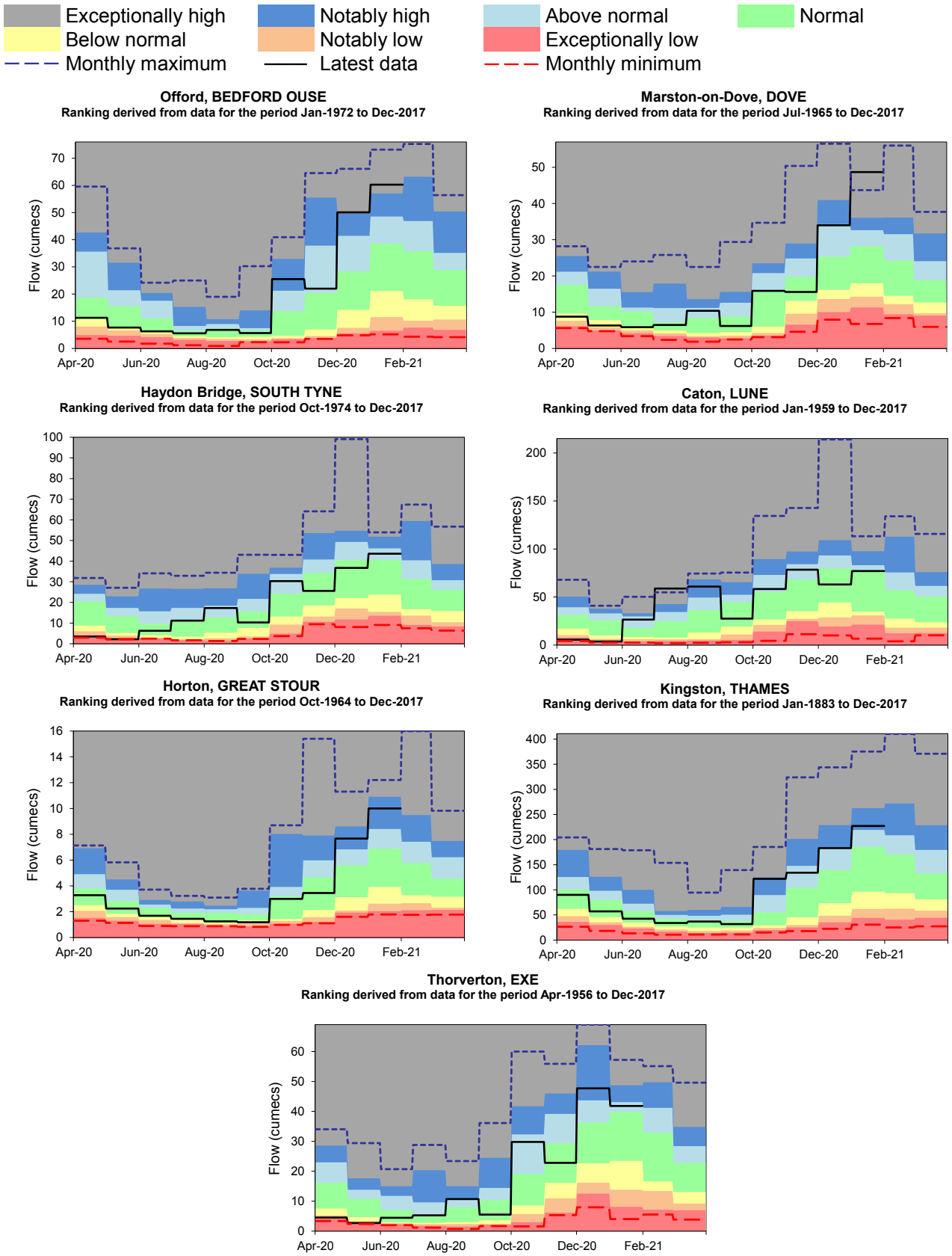
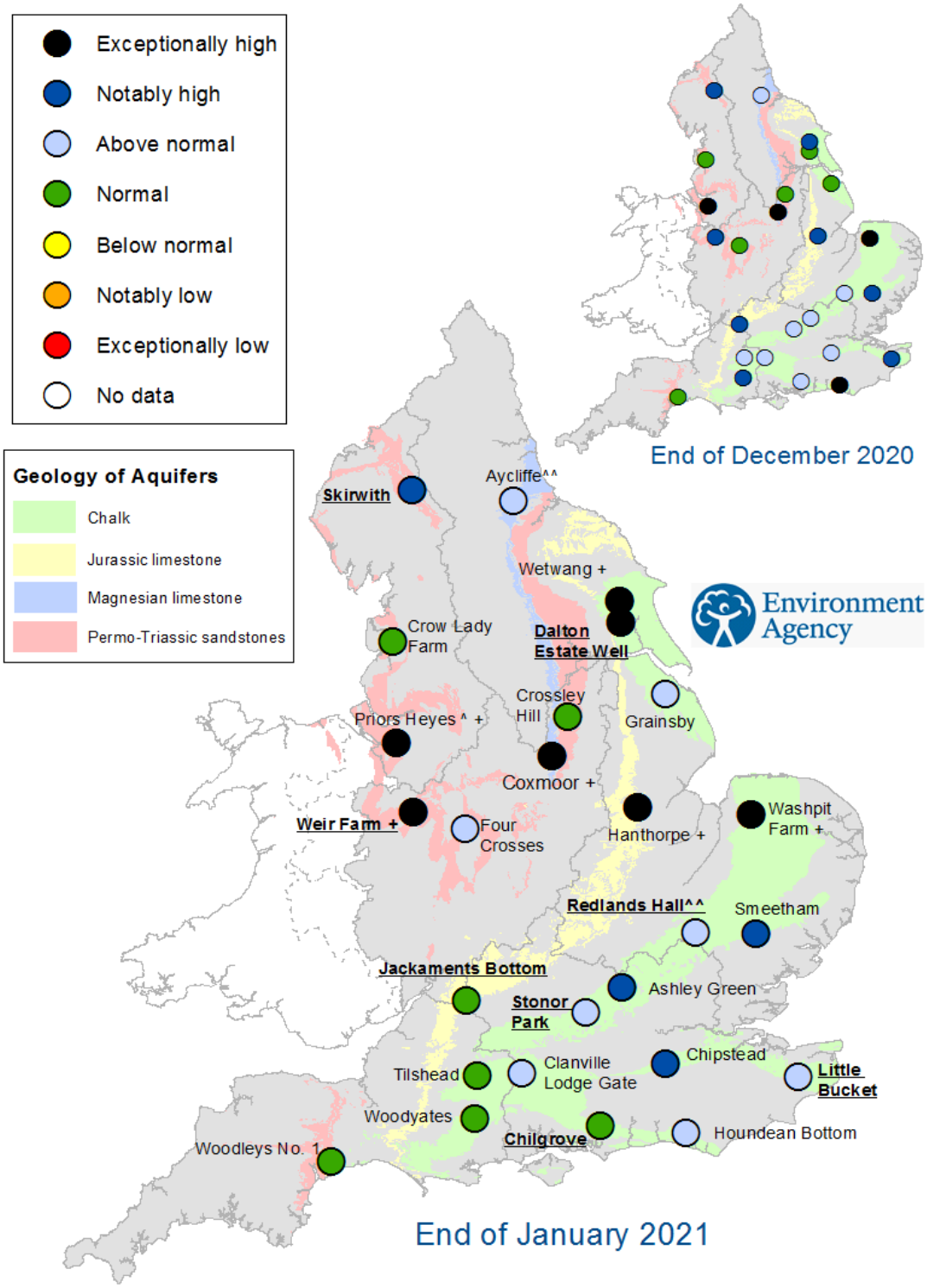


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 December 2020 and January 2021, classed relative to an analysis of respective historic December and January 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

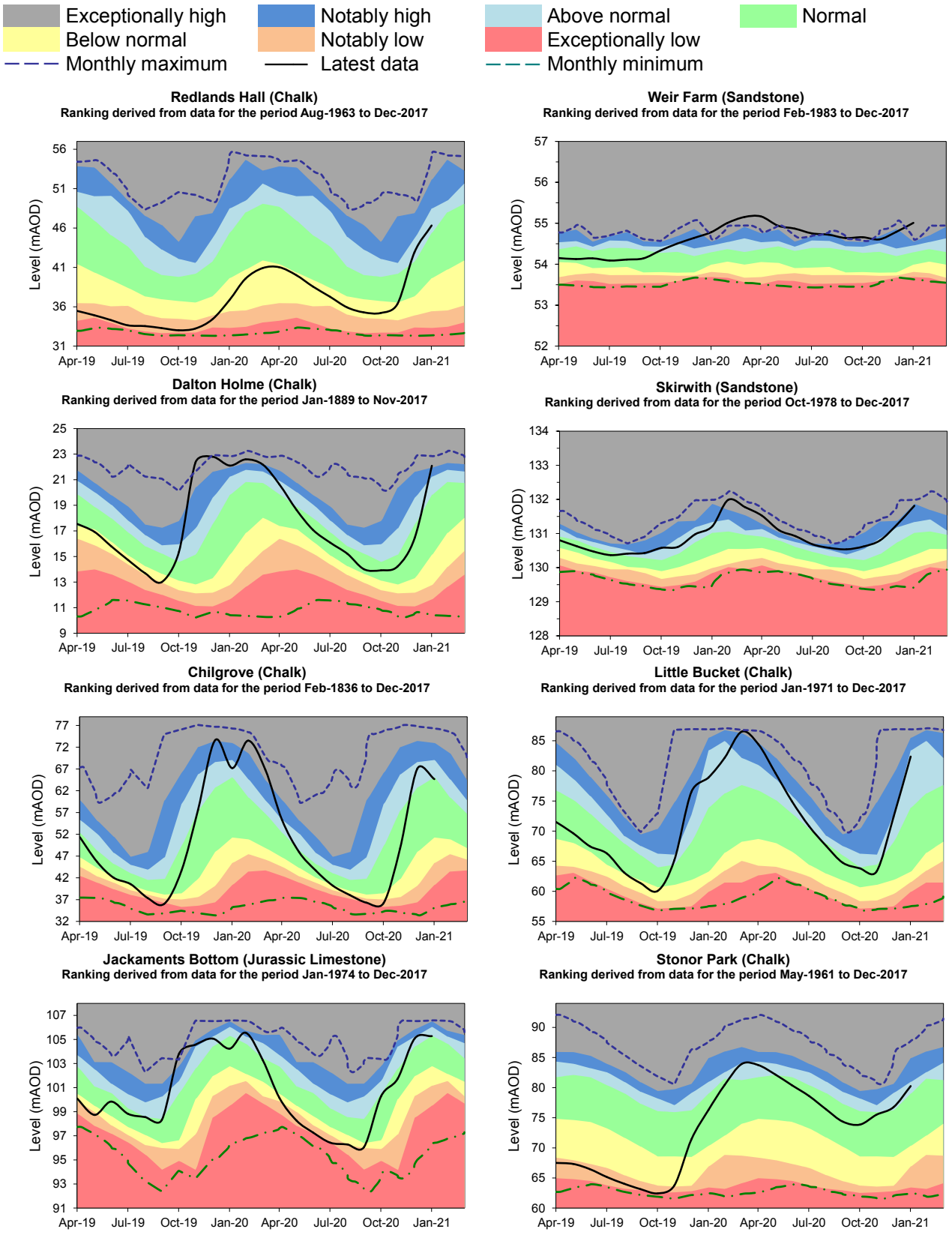
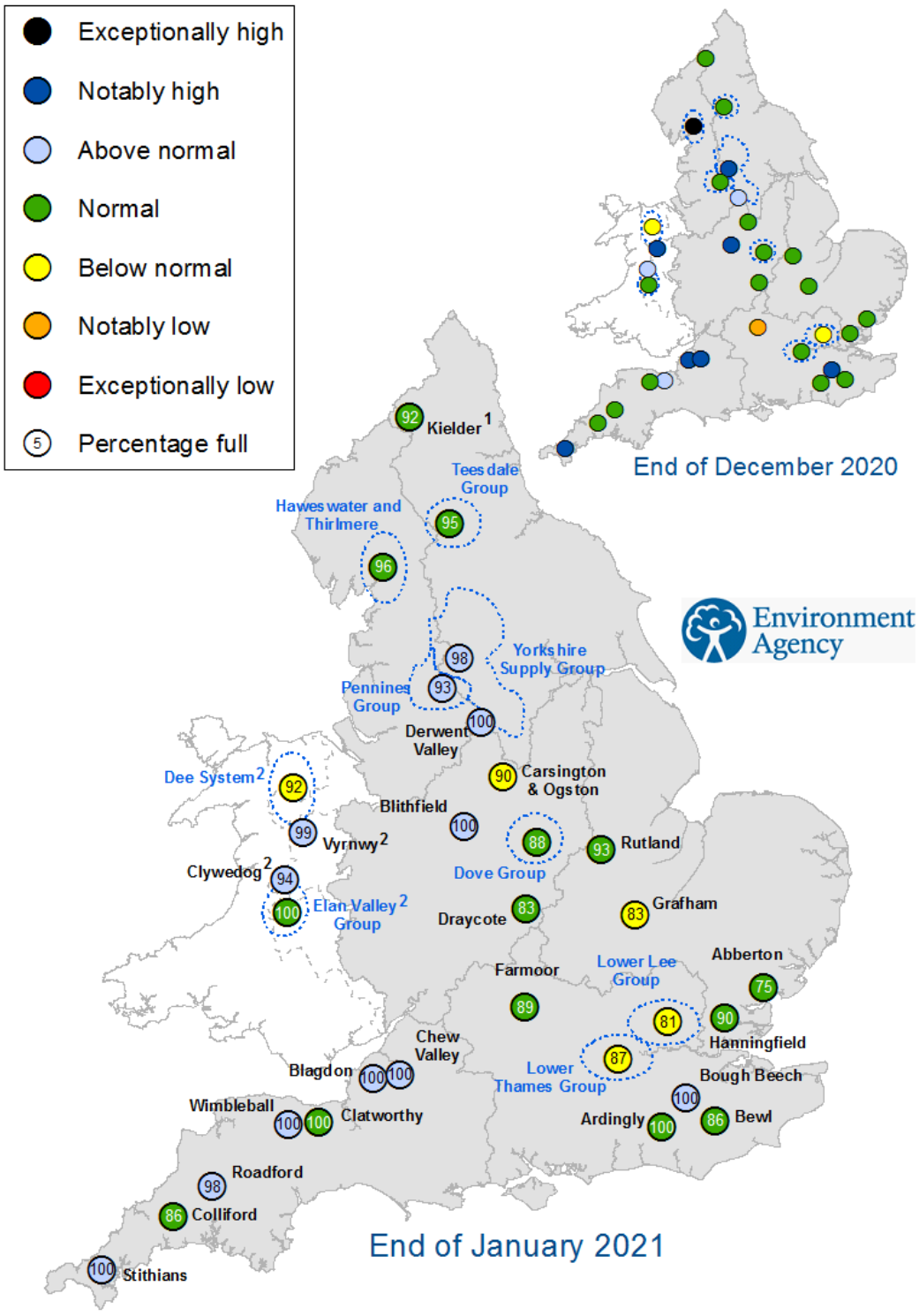


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

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 December 2020 and January 2021 as a percentage of total capacity and classed relative to an analysis of historic December and January 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

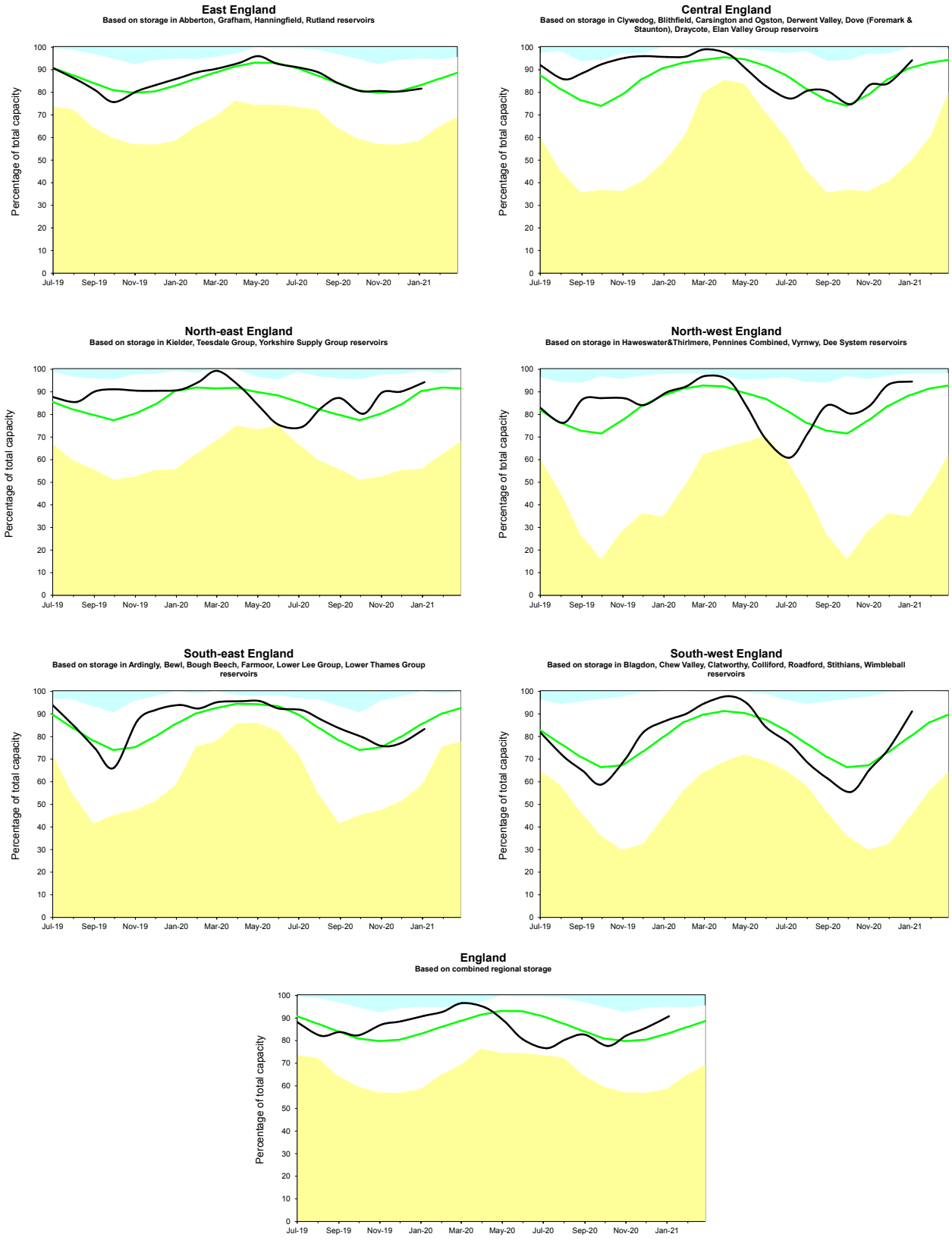


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

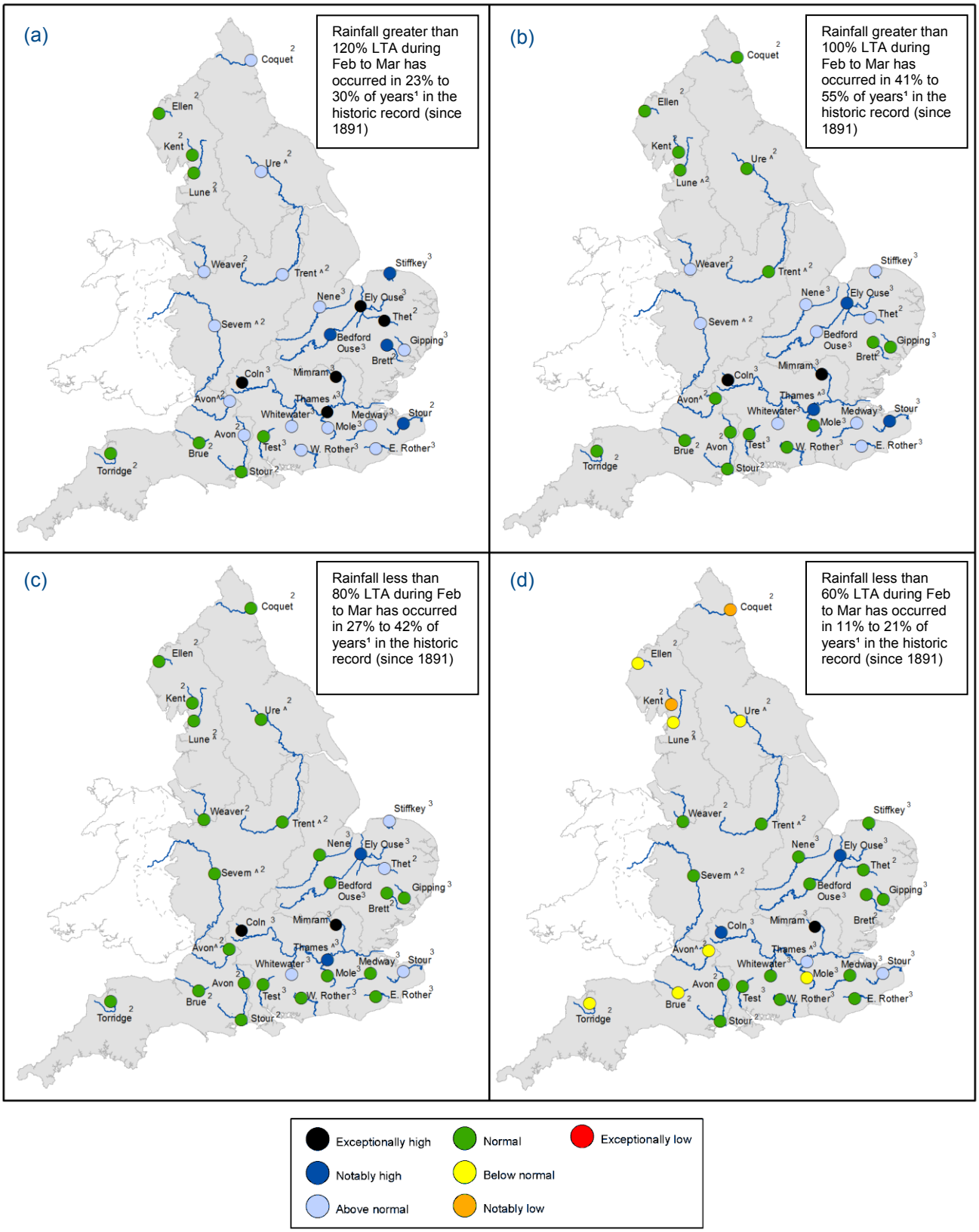


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2021 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*

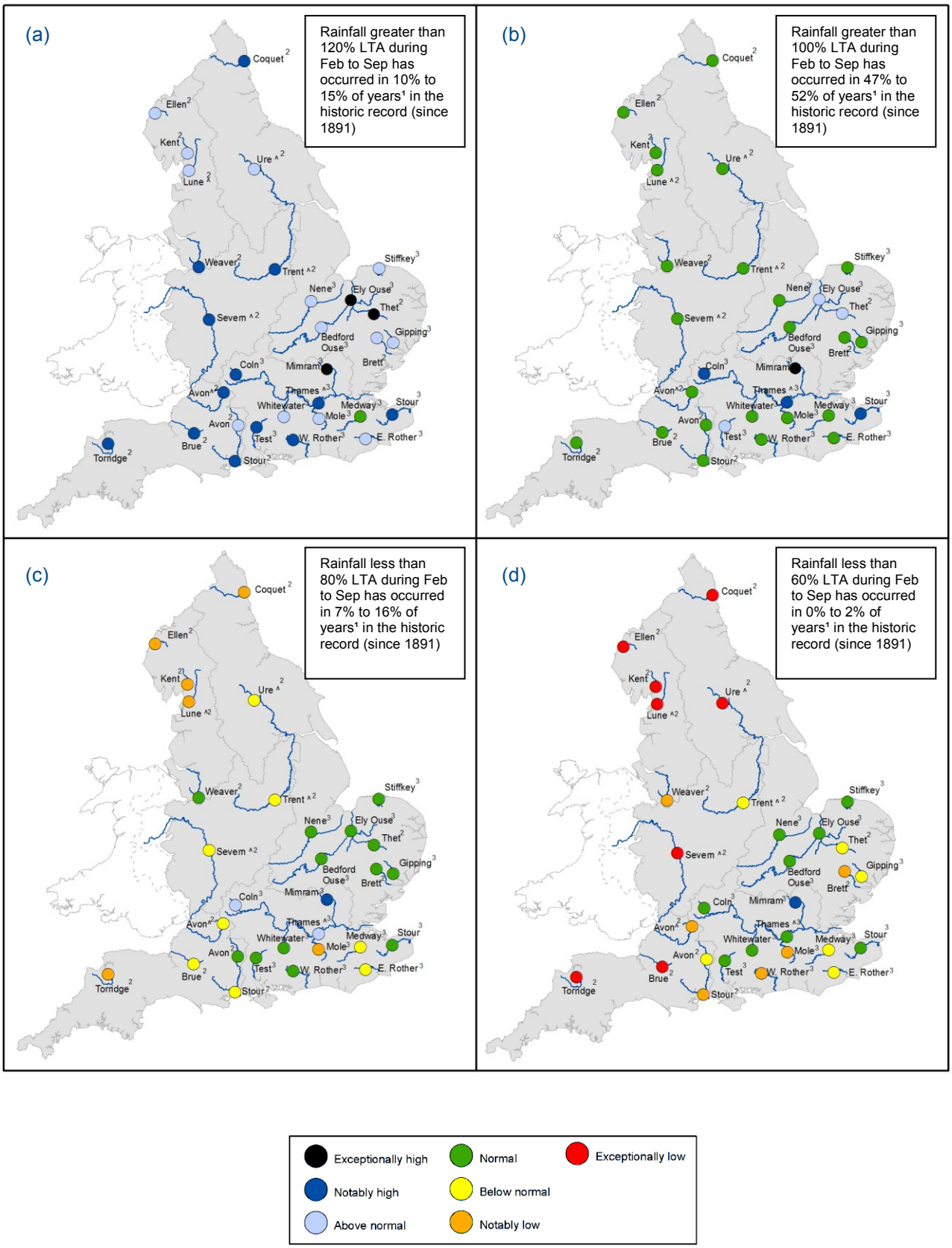
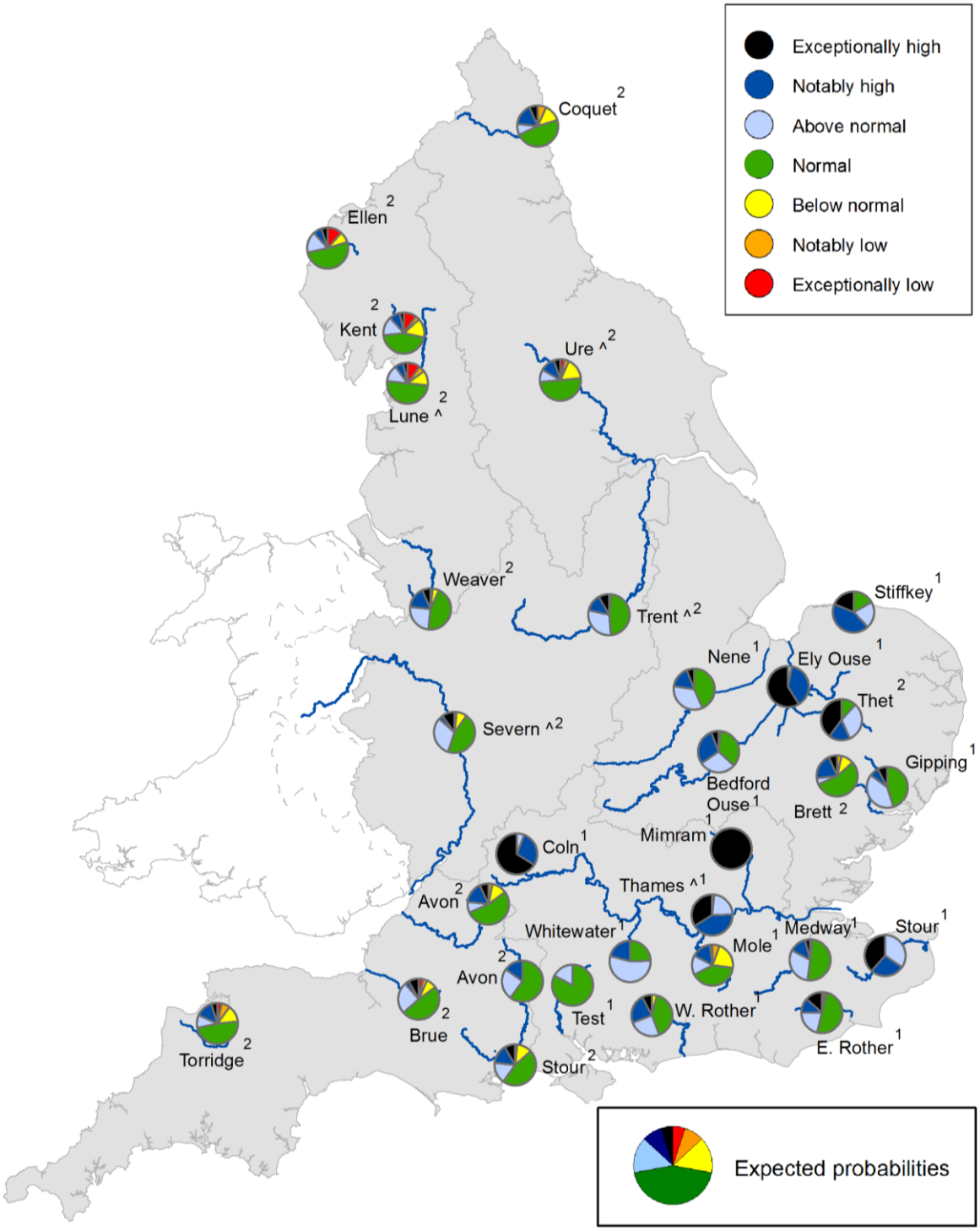


Figure 6.2: Projected river flows at key indicator sites up until the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2021 and September 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

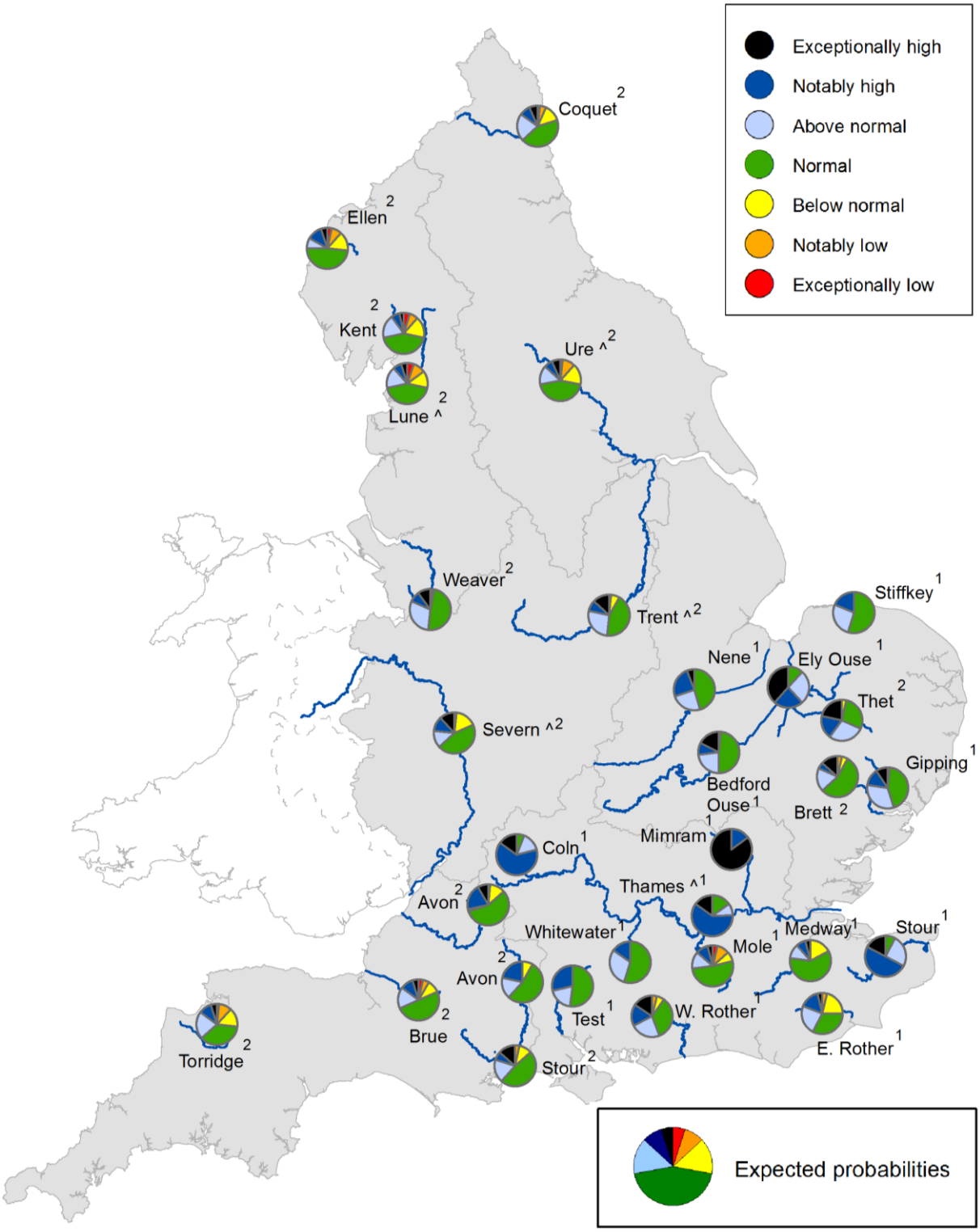
[1] This range of probabilities is a regional analysis
[2] Projections for these sites are produced by CEH
[3] Projections for these sites are produced by the Environment Agency
^ *"Naturalised" flows are projected for these sites*



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).

[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



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 6.4: 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

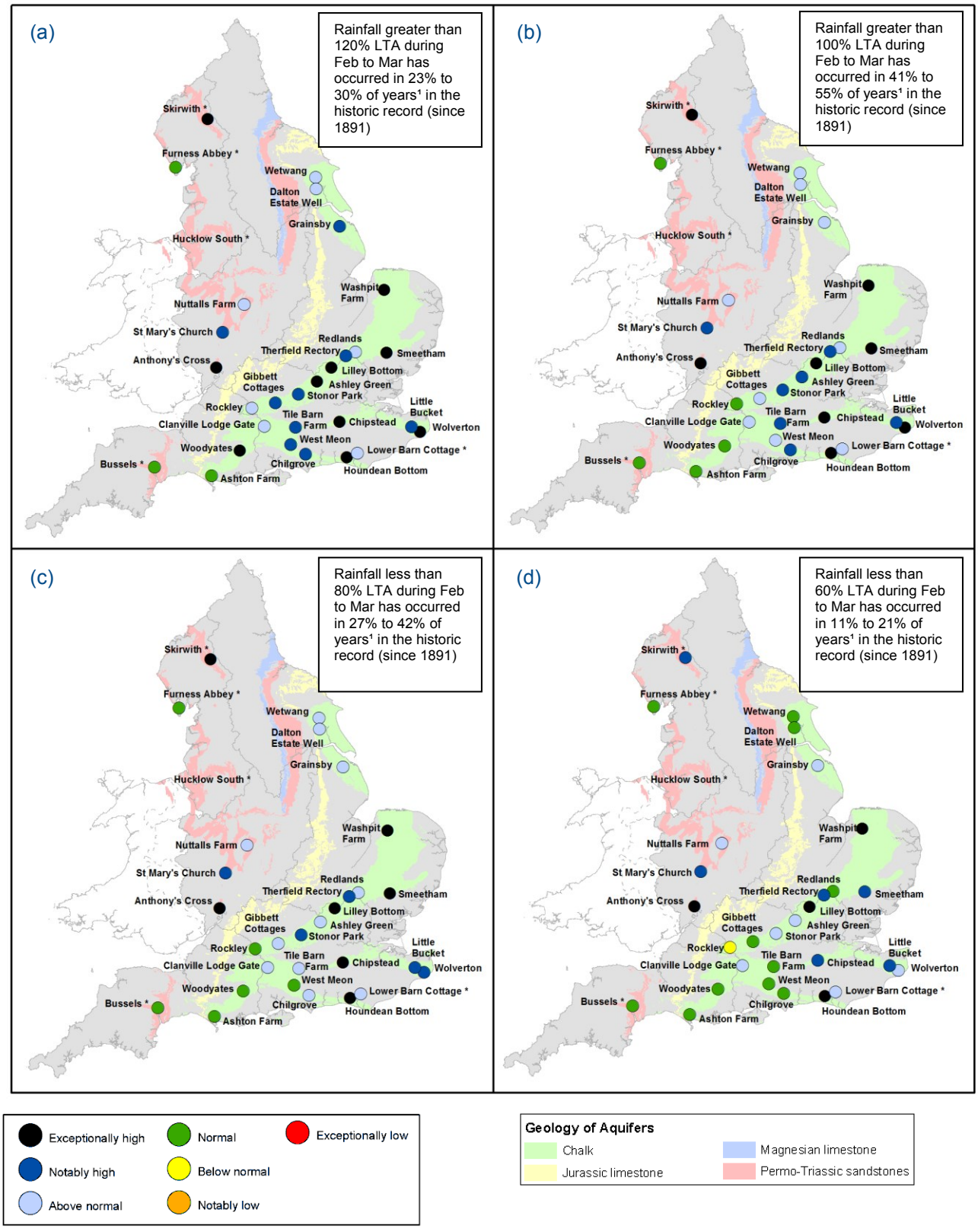


Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2021 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission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

* Projections for these sites are produced by BGS. No projections for Hucklow South available this month.
[1] This range of probabilities is a regional analysis

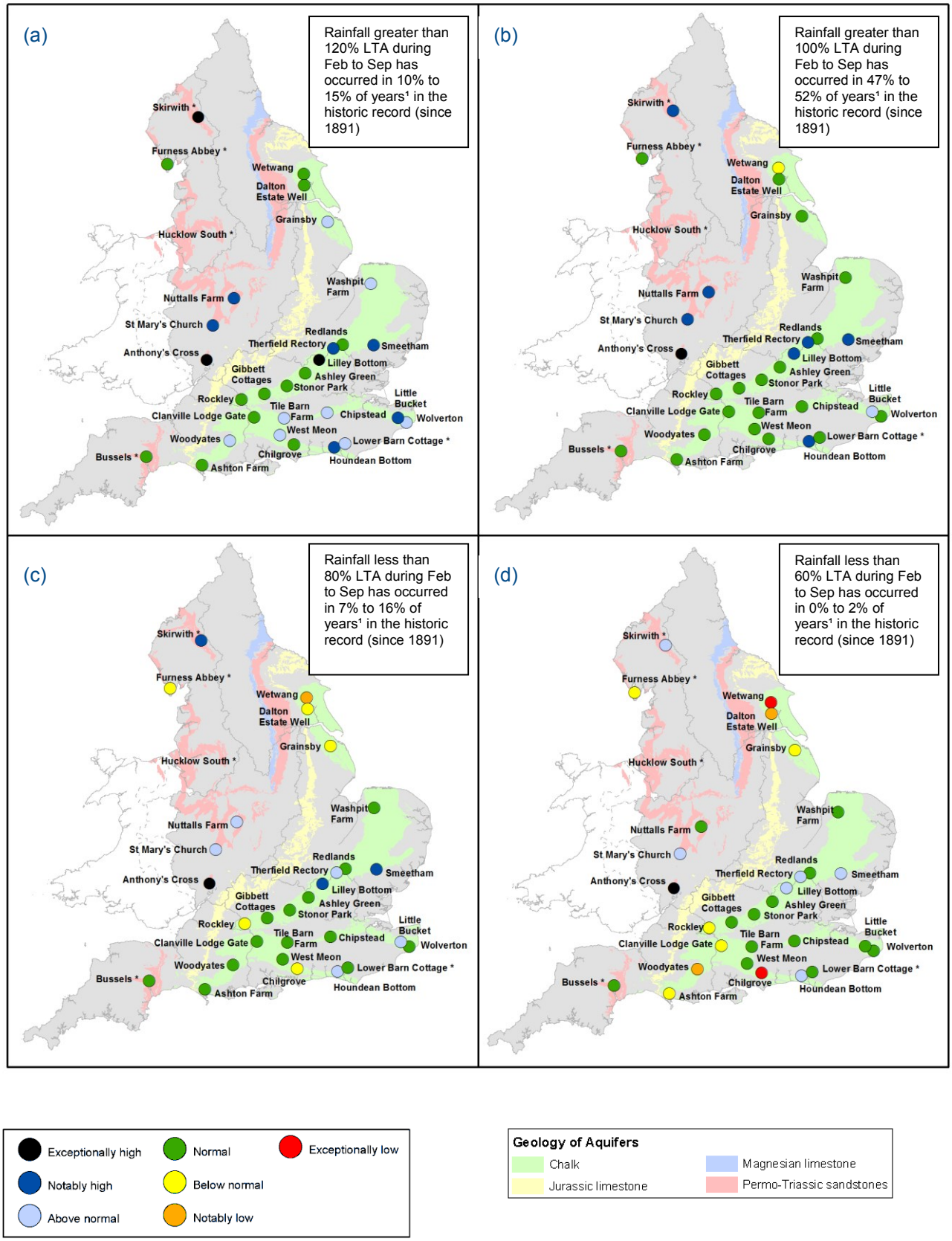
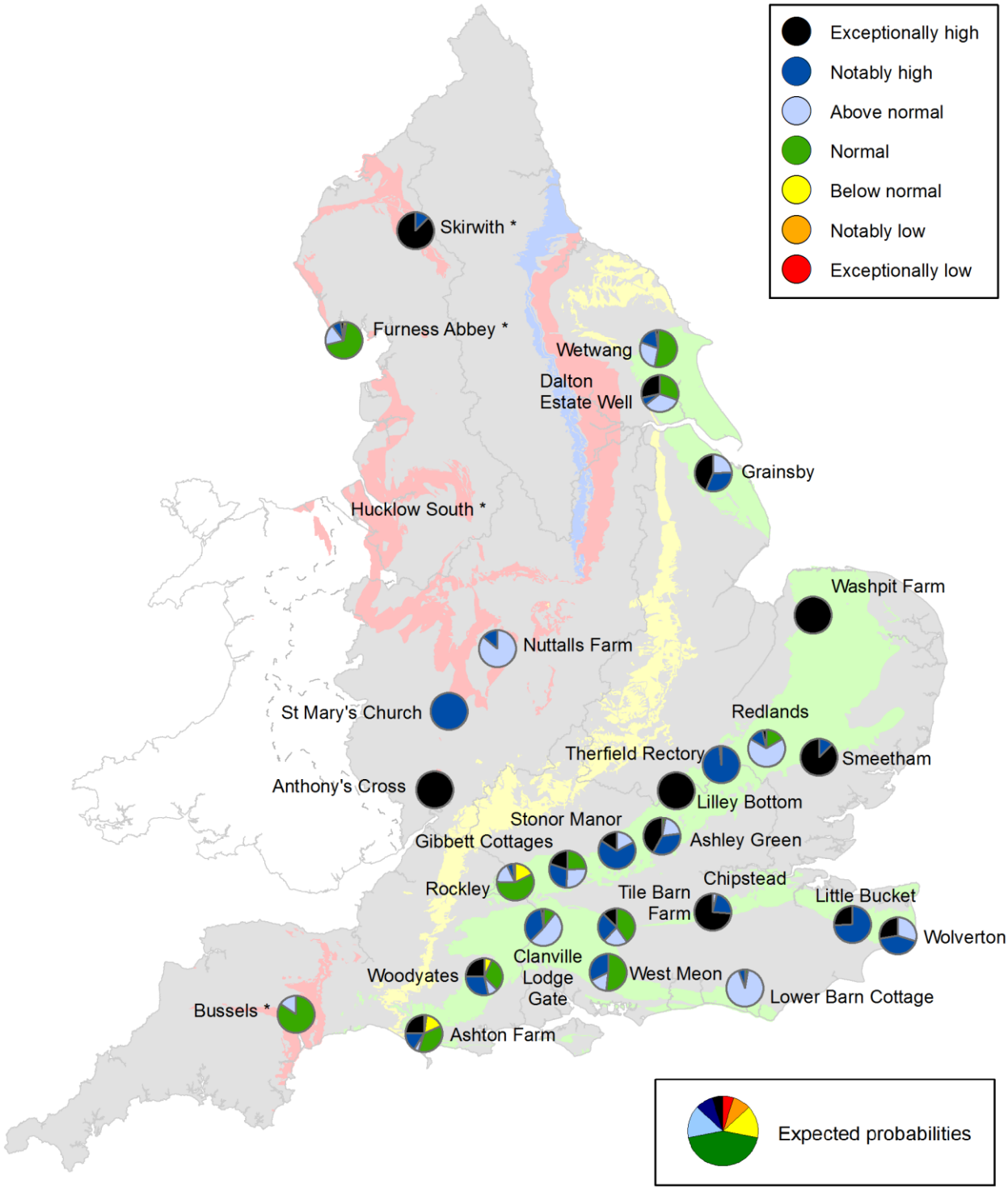


Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2021 and September 2021 (Source: Environment Agency) Geological map reproduced with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

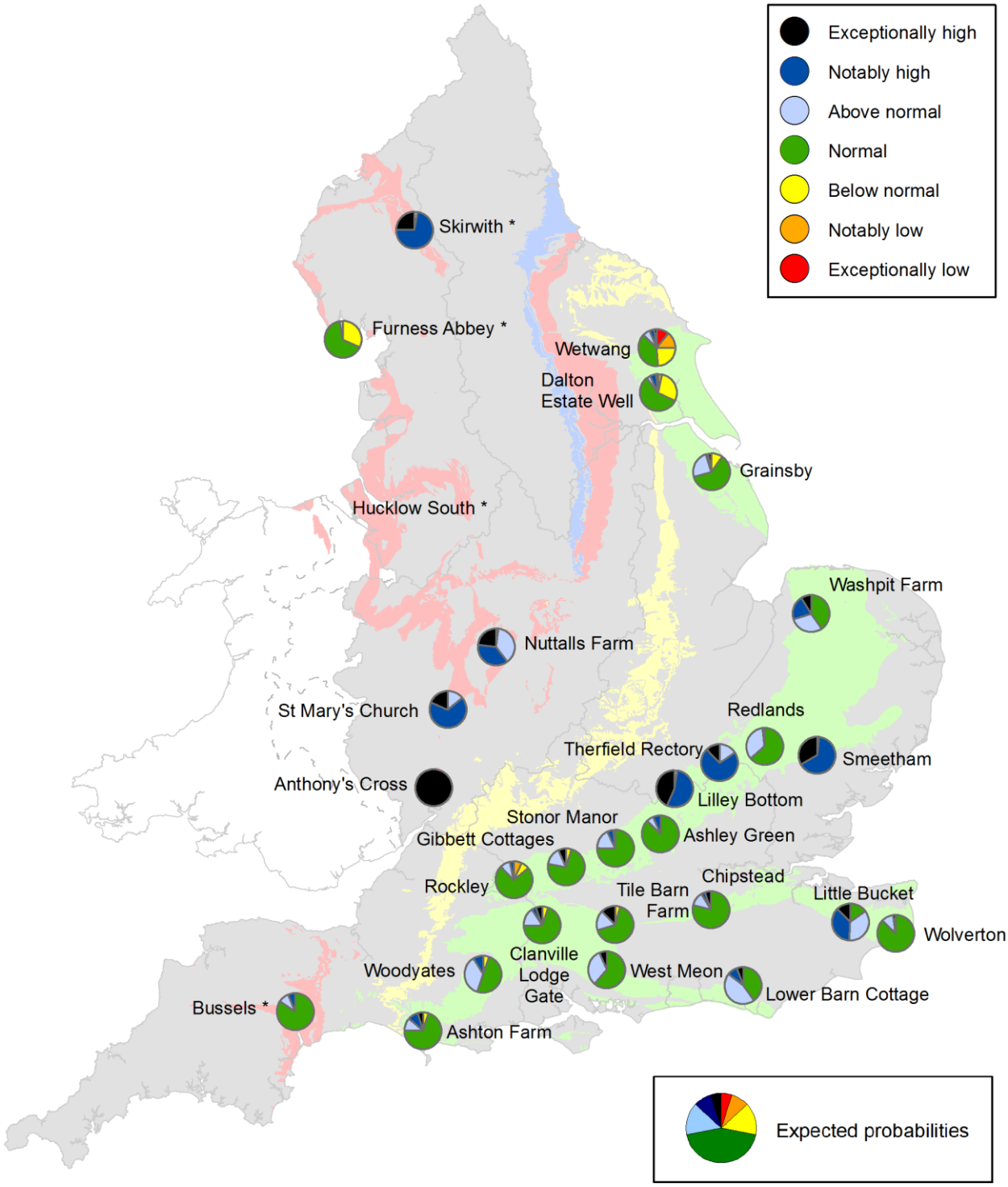
* Projections for these sites are produced by BGS. No projections for Hucklow South available this month.
[1] This range of probabilities is a regional analysis



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.* No projections for Hucklow South available this month.



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. No projections for Hucklow South available this month.

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