Monthly water situation report

England

Summary – June 2020

After the driest May on record in England, June was a wetter month. June rainfall totals were classed as normal or higher for the time of year across the country. Soils in south-east and east England generally got drier during June but in north-west and south-west England soils got wetter. Monthly mean river flows were classed as normal or higher at over two-thirds of indicator sites. End of month groundwater levels were classed as normal or higher at over four-fifths of indicator sites. Total reservoir stocks for England were at 77% of capacity at the end of June, below the long term average for the time of year. Reservoir stocks were classed as notably low or exceptionally low for the end of June at over a quarter of the reservoirs and reservoir groups we report on.

Rainfall

The June rainfall total for England was 88mm, which is 146% of the 1961 to 1990 long-term average (LTA) (143% of 1981 to 2010 LTA). This is over eight-times the May rainfall total of 10mm (16% of the 1961 to 1990 LTA) The highest rainfall totals for June were in north-west and south-west England (Figure 1.1).

The Fal and St Austell catchment (Cornwall) received the highest June rainfall total as a proportion of LTA, with 146mm, representing 229% of LTA. This is the second highest June total for the catchment on record (records from 1891). Across England rainfall totals were classed as normal or higher for the time of year. Notably high or exceptionally high totals were recorded in a third of catchments. Although cumulative rainfall totals for the last three months were below the LTA across much of England, the twelve month cumulative totals were above the LTA in almost all catchments. In over a fifth of catchments the twelve month cumulative rainfall total was classed as exceptionally high (Figure 1.2).

At a regional scale, the June rainfall total ranged from 54mm (100% of LTA) in south-east England to 142mm (175% of LTA) in north-west England. This followed three consecutive months of below-average rainfall in all regions (Figure 1.3).

Soil moisture deficit

Soils generally got drier in south-east and east England, but wetter in north-west and south-west England during June. End of month soil moisture deficits across England ranged from 1mm in parts of north-west England to 142mm in parts of east England (Figure 2.1). At a regional scale, average soil moisture deficits at the end of June were still drier than the LTA for the time of year in all regions (Figure 2.2).

River flows

River flows increased at two-fifths of indicator sites, compared to May; this included all sites in north-east and north-west England. At over two-thirds of indicator sites monthly mean river flows for June were classed as normal or higher for the time of year. This is in contrast to the situation in May, when flows were classed as normal or higher at only a third of indicator sites and were classed as notably low or exceptionally low at two-fifths of sites (23 in total). An exceptionally low monthly mean river flow for June was recorded at Dernford gauging station on the River Cam (Cambridgeshire), representing 41% of LTA (Figure 3.1).

River flows for the regional indicator sites ranged from being classed as below normal for the time of year on the River Dove at Marston-on-Dove (central England) to above normal on the River Lune at Caton (north-west England) (Figure 3.2).

Groundwater levels

As is typical for the time of year, groundwater levels fell at almost all of the indicator sites we report on during June. End of month groundwater levels were classed as normal or higher at over four-fifths of indicator sites. Groundwater levels were classed as exceptionally high at four sites and of these Coxmoor (Idle and Torne Sandstone), Weir Farm (Bridgnorth sandstone) and Prior Hayes (West Cheshire sandstone) recorded the highest

end of June levels on record (Figures 4.1 and 4.2). Levels at Priors Heyes remain high, compared to historic levels, because the aquifer is recovering from the effects of historic abstraction.

Groundwater levels at the major aquifer index sites ranged from notably low at Jackaments Bottom (Burford Jurassic Limestone in the Cotswolds) to exceptionally high in the sandstone aquifers recorded at Weir Farm (Bridgnorth sandstone) and Skirwith (Carlisle Basin and Eden Valley sandstone) (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks decreased at four-fifths of the reservoirs and reservoir groups that we report on during June. At Blithfield (central England), Ardingly (south-east England), Blagdon (south-west England) and the Haweswater and Thirlmere Group (north-west England) stocks reduced by more than 10% of total storage capacity. The biggest decrease in reservoir stocks, as a proportion of total storage capacity, was at Ardingly reservoir where stocks reduced by 20% during June. Stocks were classed as notably low or exceptionally low for the end of June at a quarter of the reservoirs and reservoir groups we report on (Figure 5.1).

Total reservoir stocks for England were at 77% of capacity at the end of June, below the LTA for the time of year. At a regional scale, total reservoir stocks were below the LTA in central, north-east and north-west and south-west England; stocks were above average in south-east England and very close to average in east England (Figure 5.2).

Forward look

The early part of July is expected to be unsettled across much of England, and particularly wet in north-east and north-west areas. The middle part of the month is likely to be largely dry and settled across many parts of England, especially in the south. North and north-west areas may see more unsettled conditions, with spells of rain, although widespread unsettled conditions are unlikely. Towards the end of July, there may be a period of fine, dry weather although there is a risk of spells of rain, particularly in the north and west of England.

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

Projections for river flows at key sites[2]

More than half 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 September 2020. By the end of March 2021, nearly two-thirds of sites have a greater than expected chance of cumulative river flows being below normal or lower for the time of year.

For scenario based projections of cumulative river flows at key sites by September 2020 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2021 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2020 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2021 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

More than 90% of all 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 2020. By the end of March 2021, half of the modelled sites have a greater than expected chance of groundwater levels being notably high or higher, and nearly half 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 September 2020 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2021 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2020 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 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

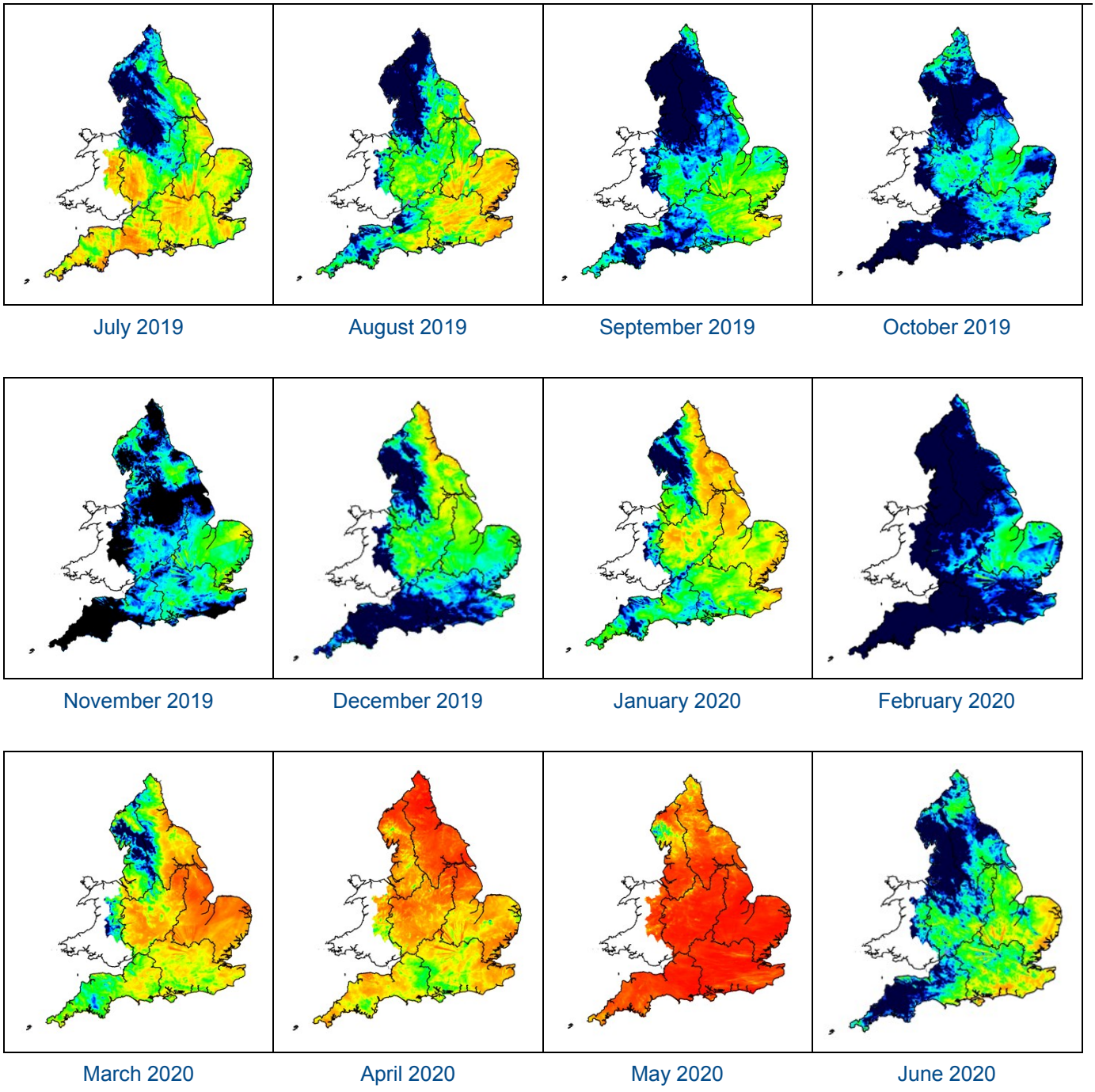


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

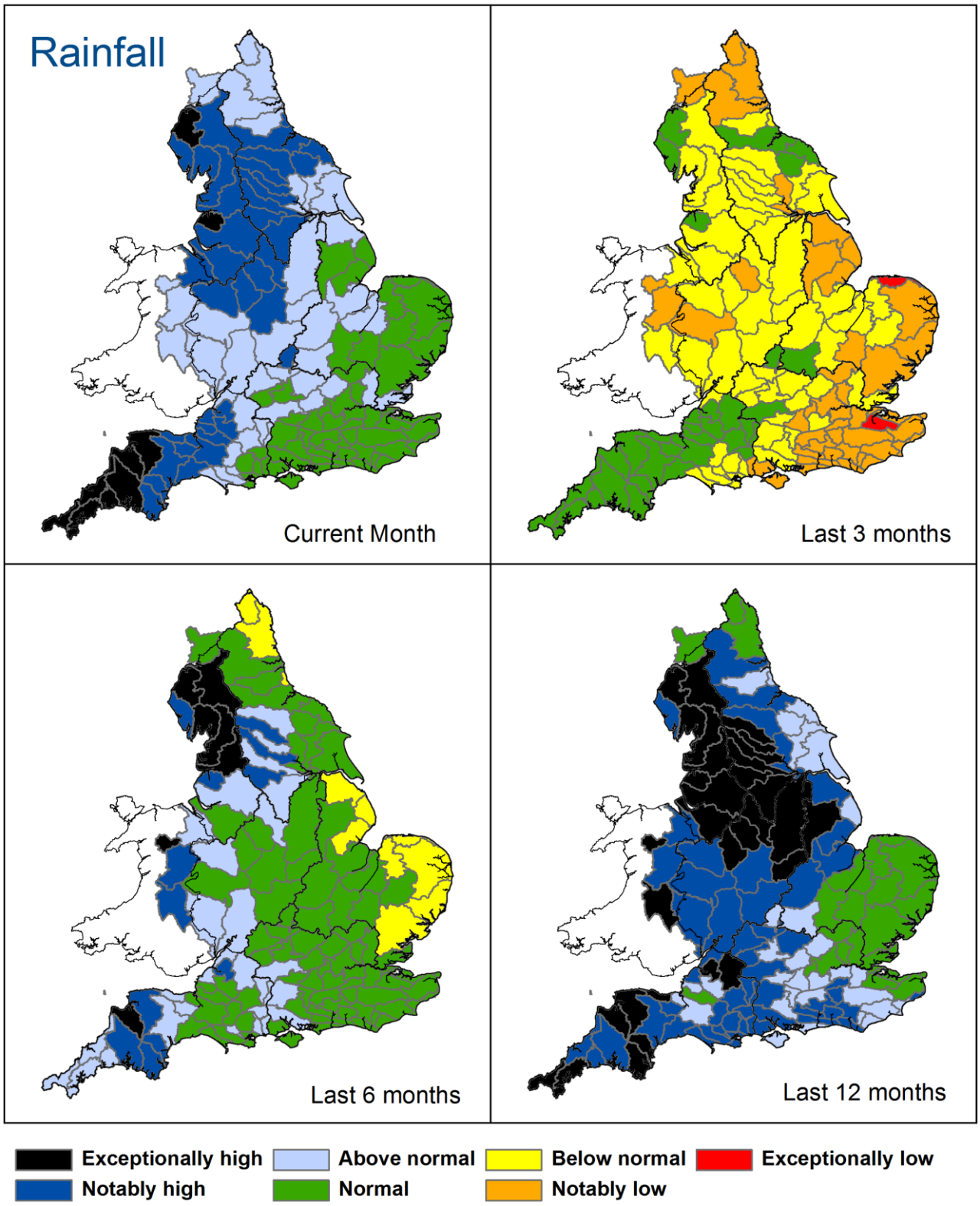


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 30 June), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived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

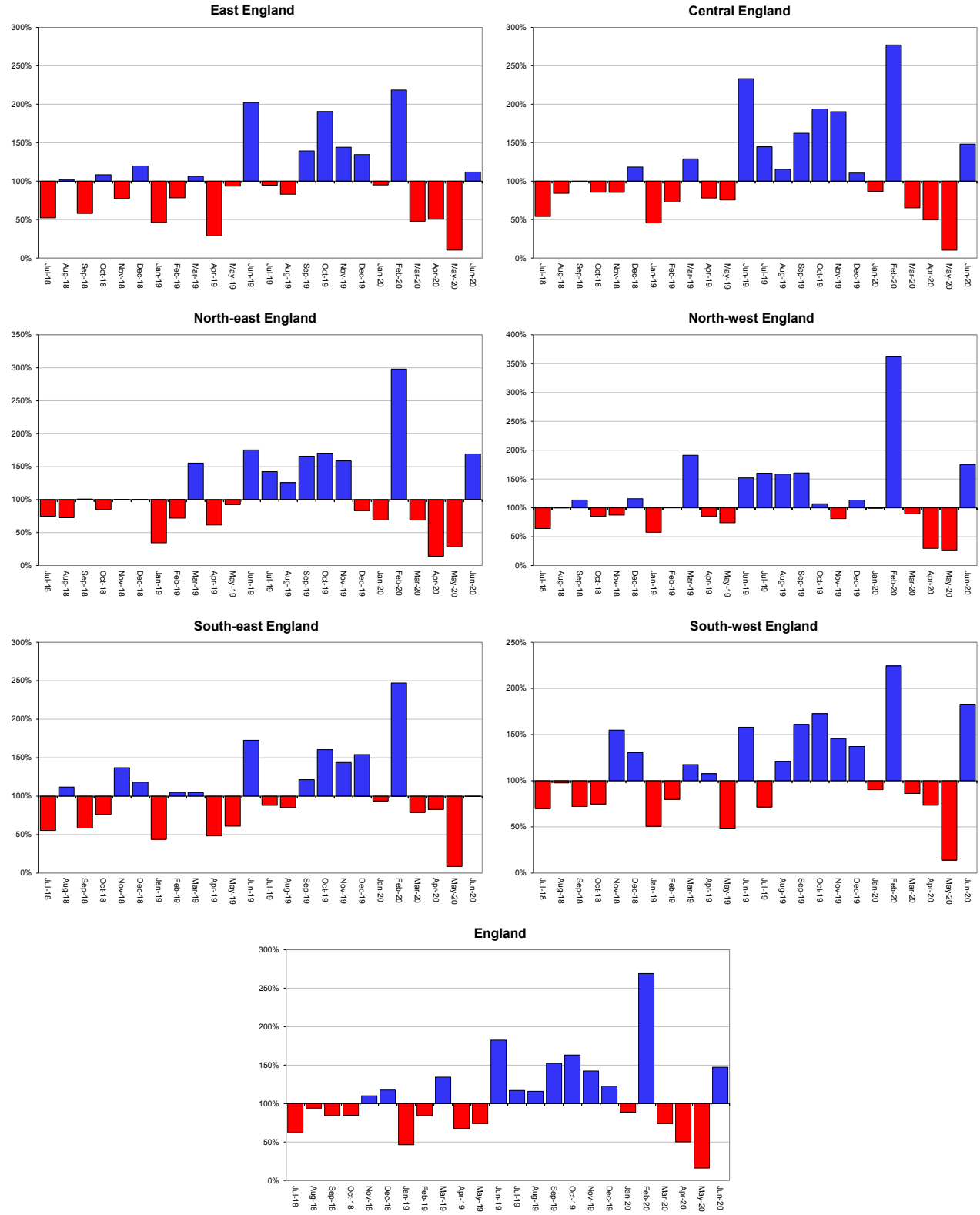


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

Soil moisture deficit

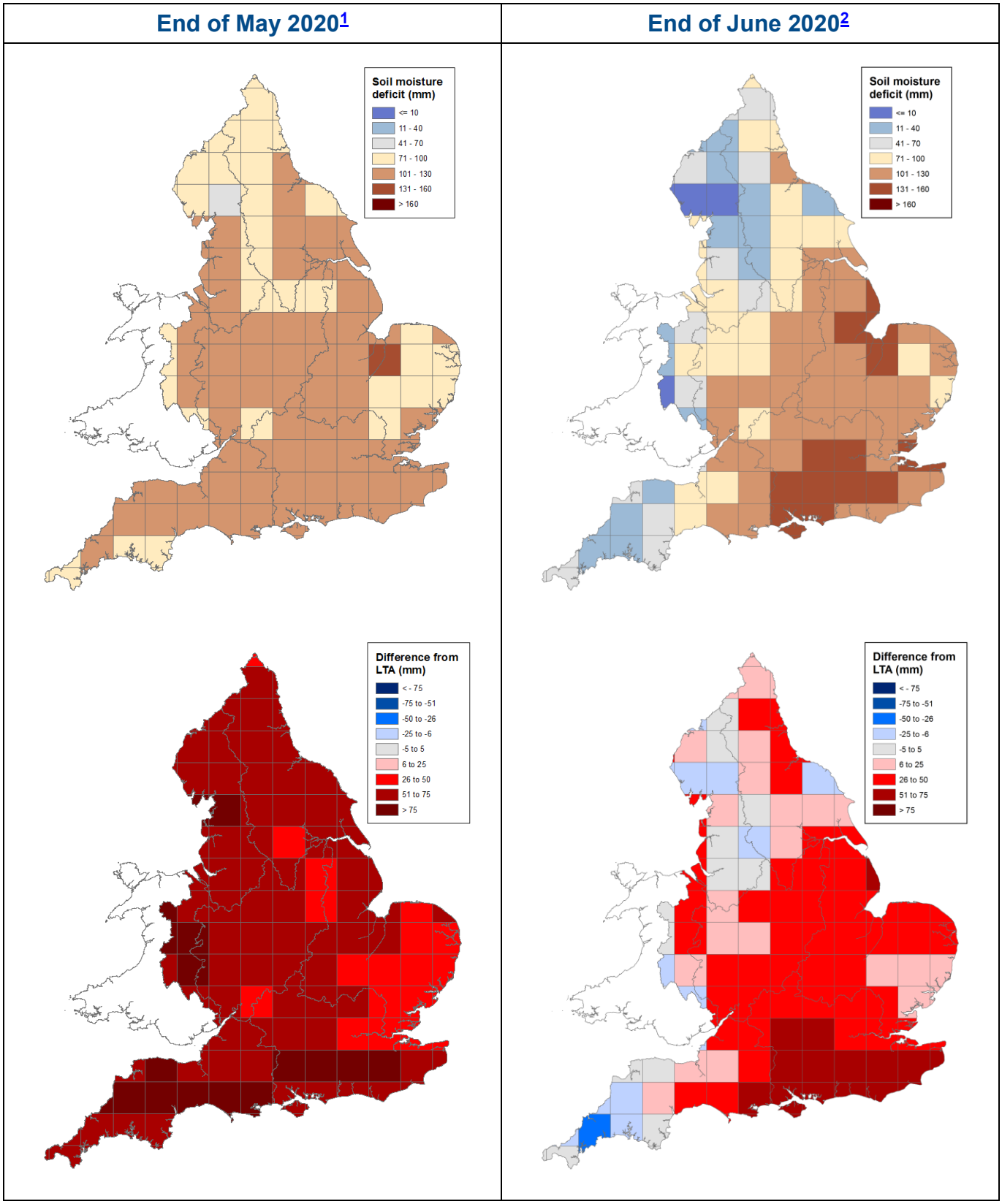


Figure 2.1: Soil moisture deficits for weeks ending 02 June 2020 [1] (left panel) and 30 June 2020[2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2020). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

Soil moisture deficit charts

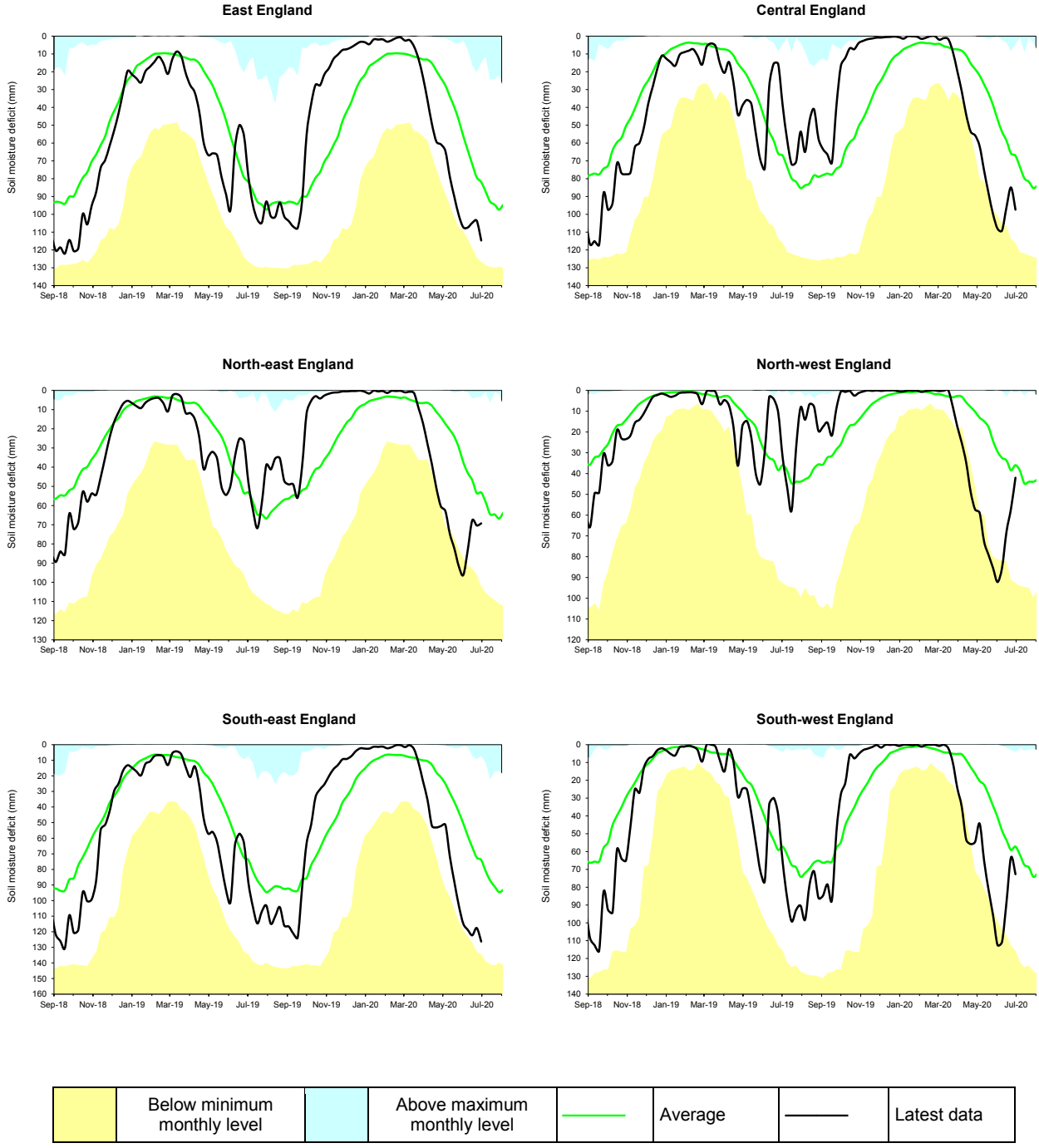
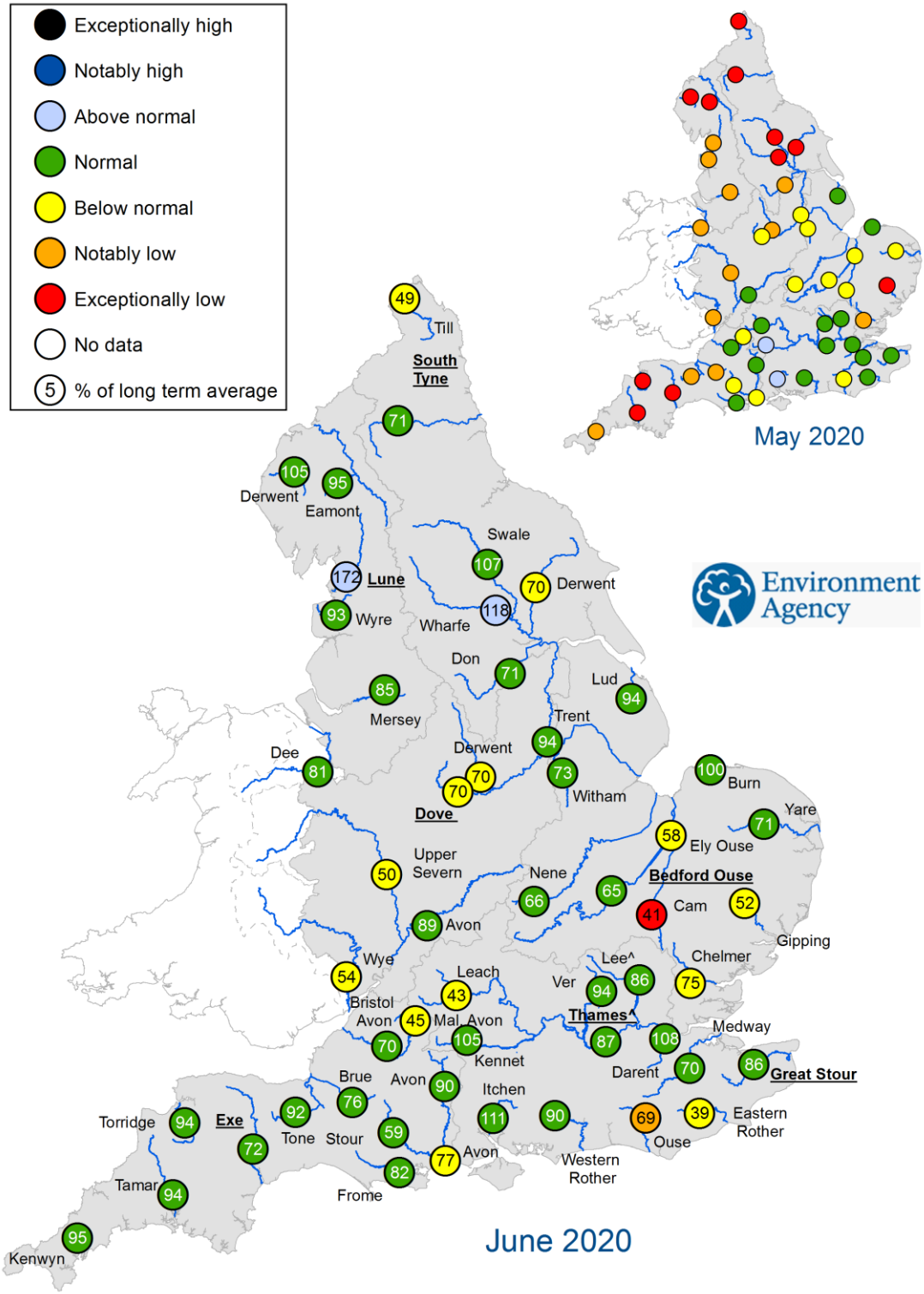


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2020).

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

River flow charts

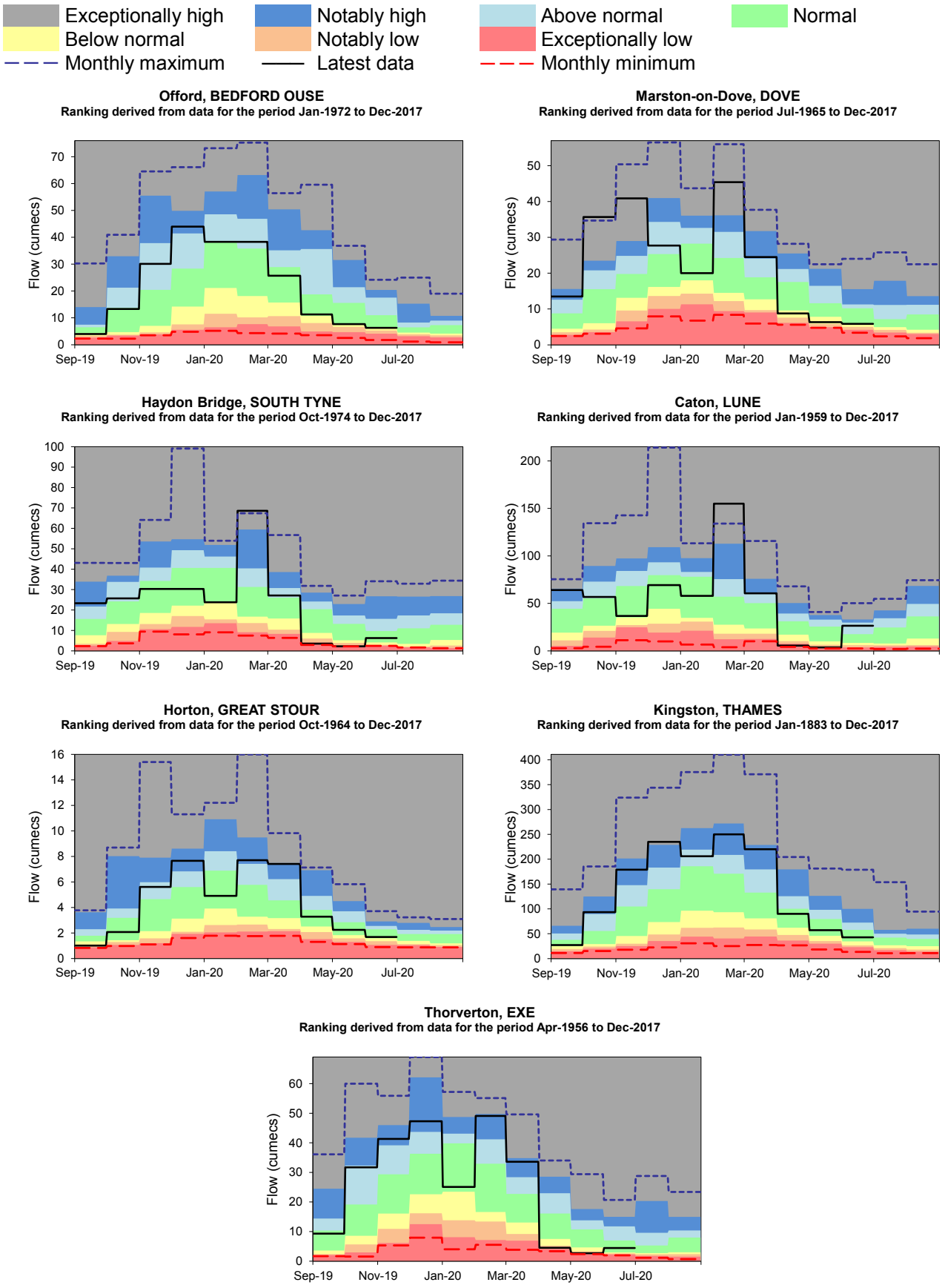
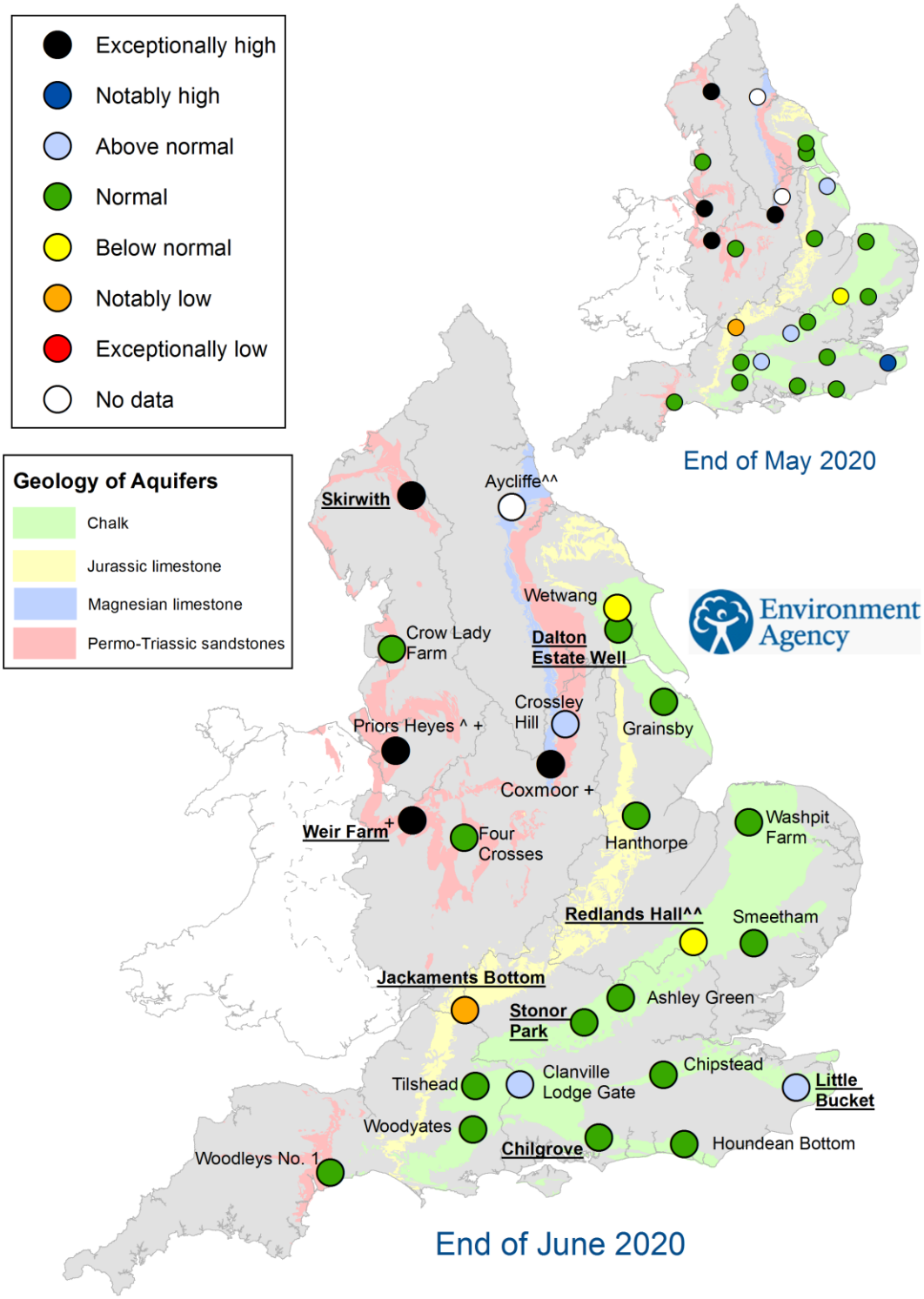


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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

Groundwater level charts

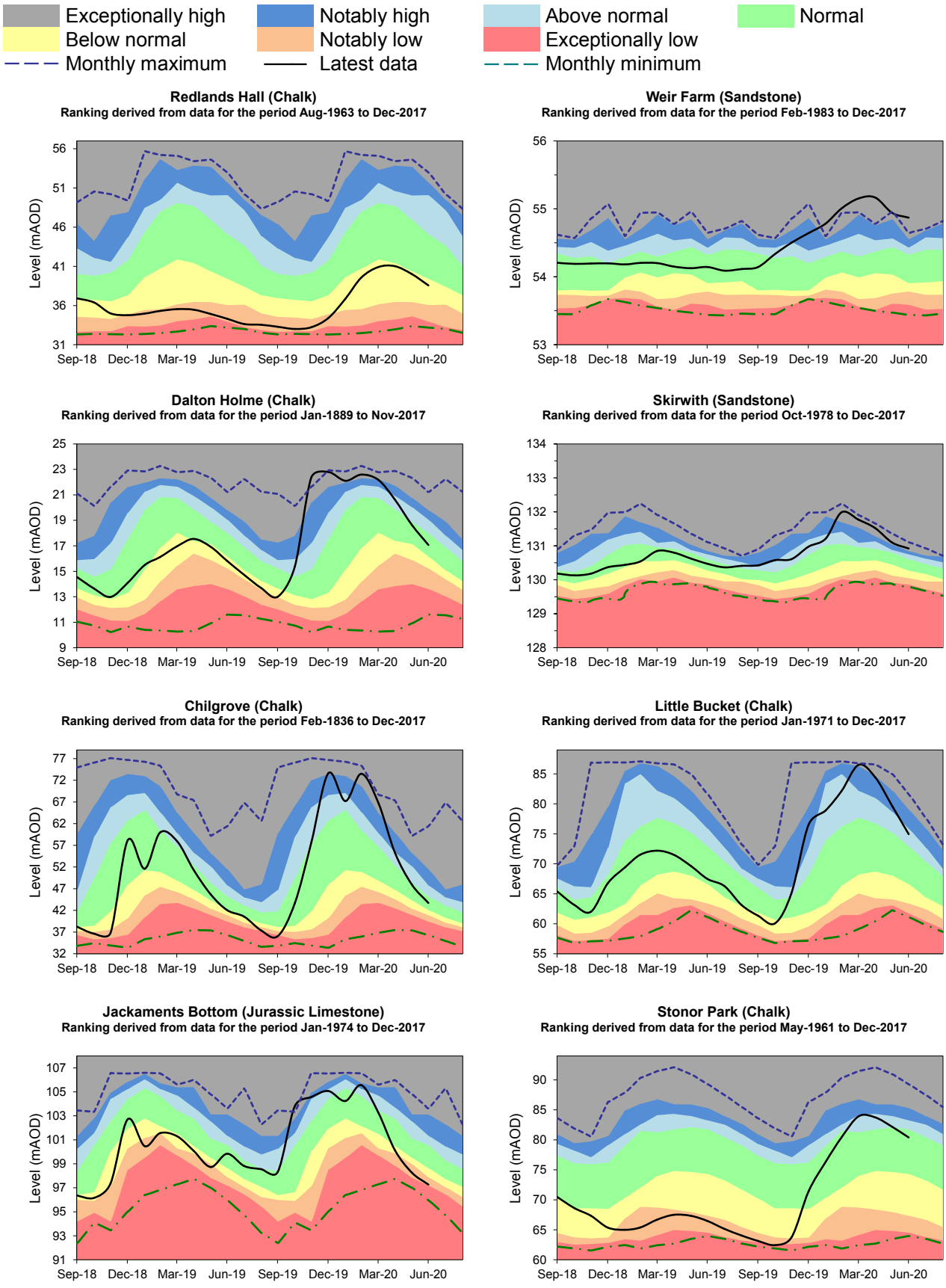
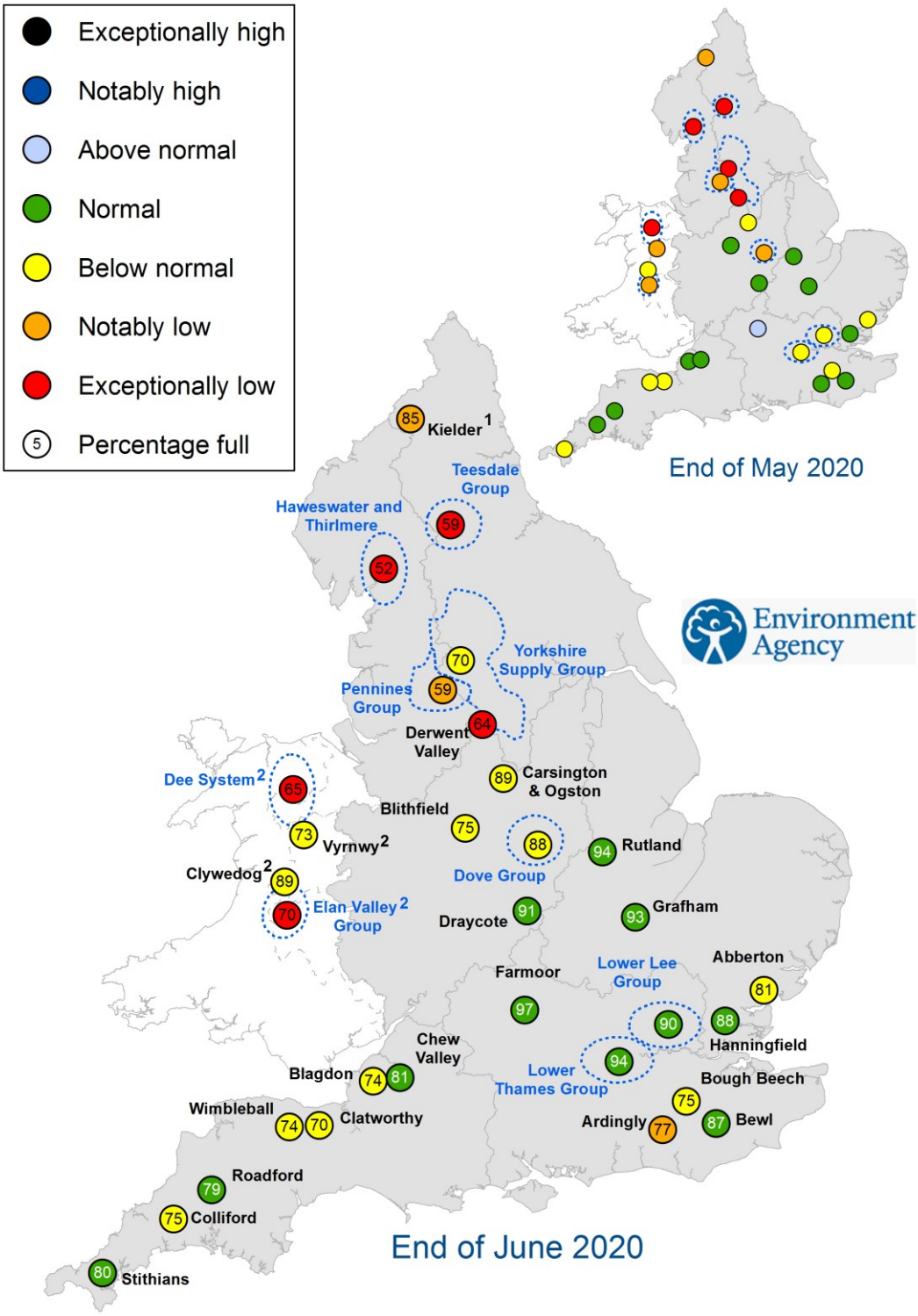


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

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 May 2020 and June 2020 as a percentage of total capacity and classed relative to an analysis of historic May and June values respectively (Source: Water Companies). Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones.

Reservoir storage charts

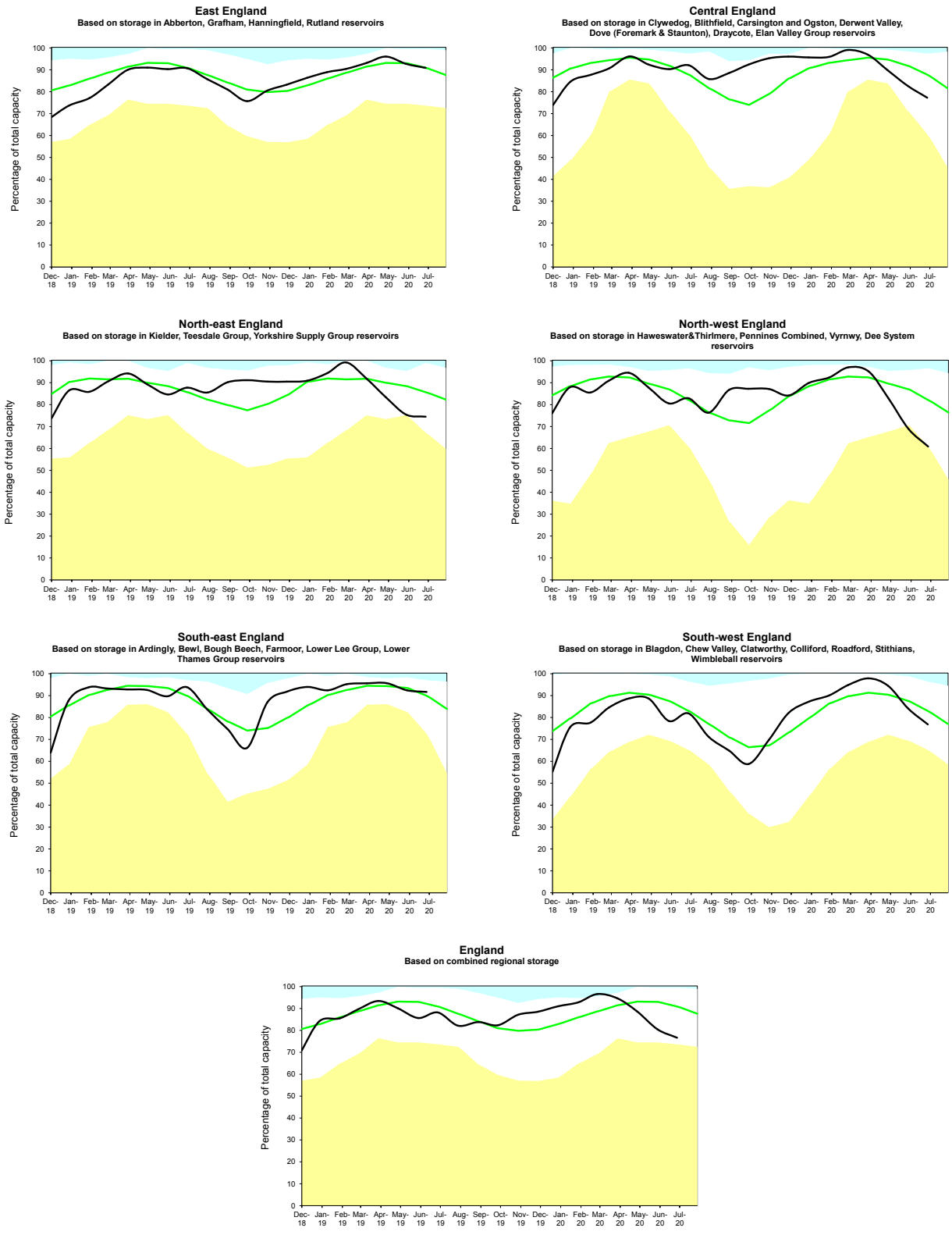


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

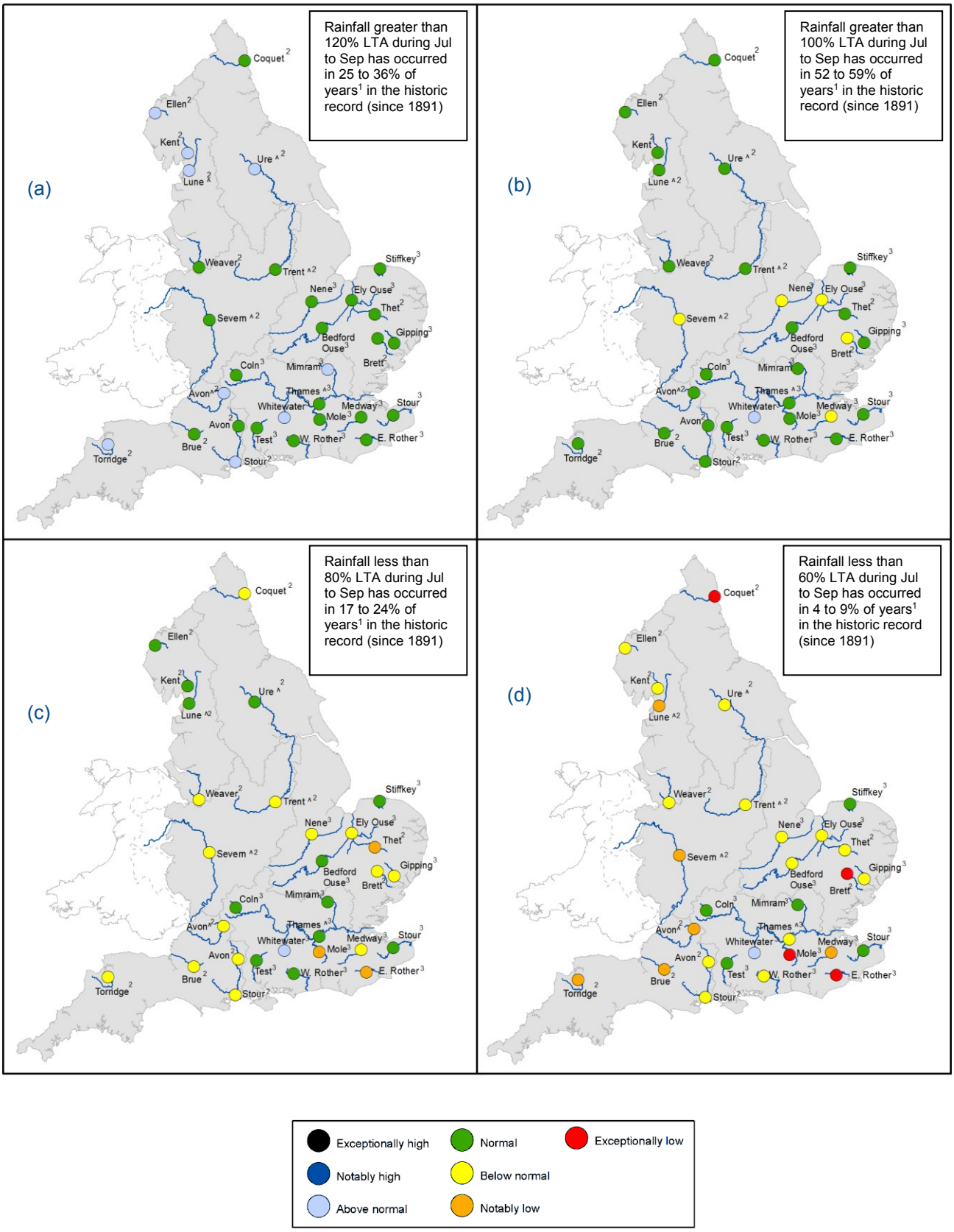


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2020.Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2020 and September 2020 (Source: Centre for Ecology and Hydrology, Environment Agency)

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

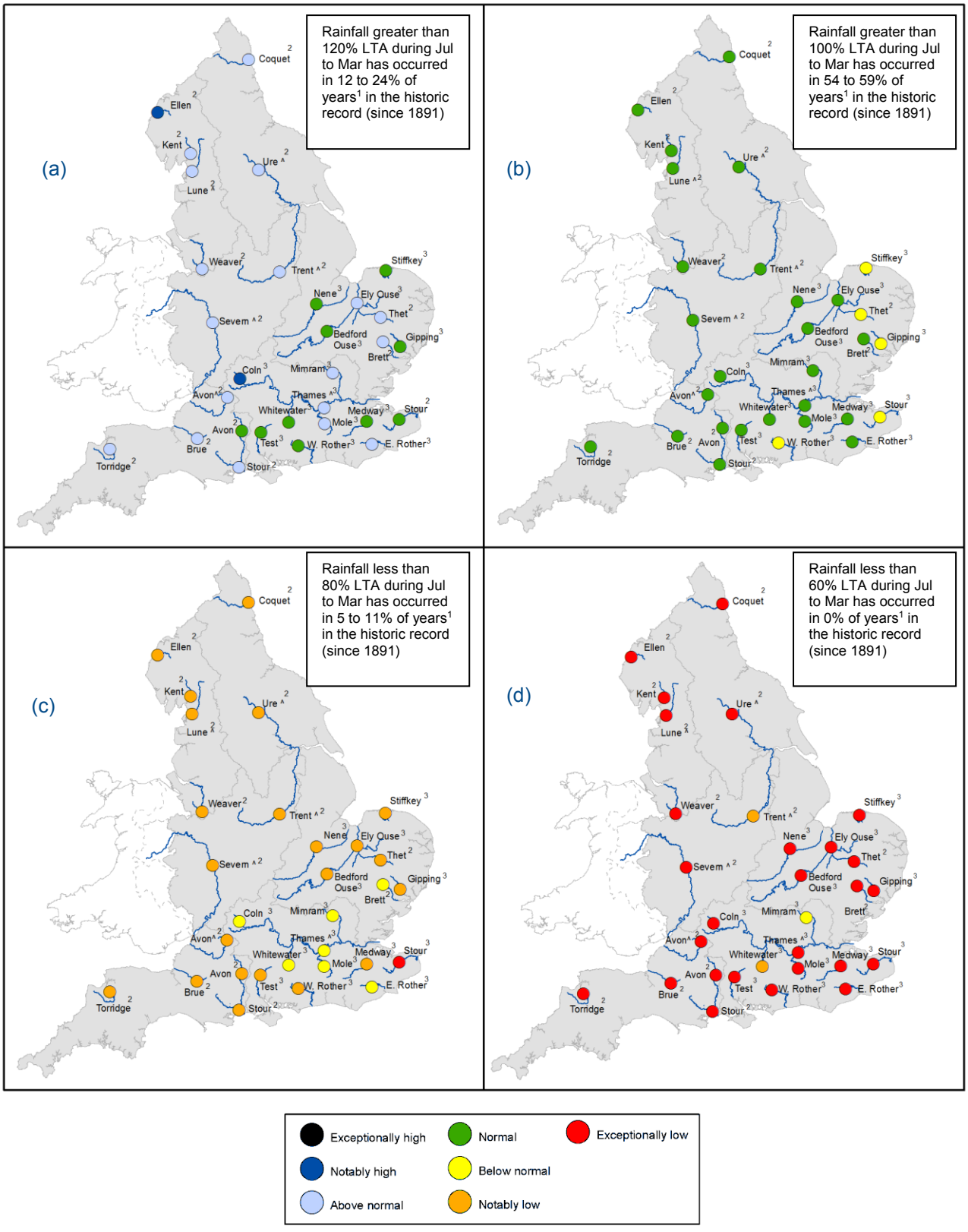


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2021.Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

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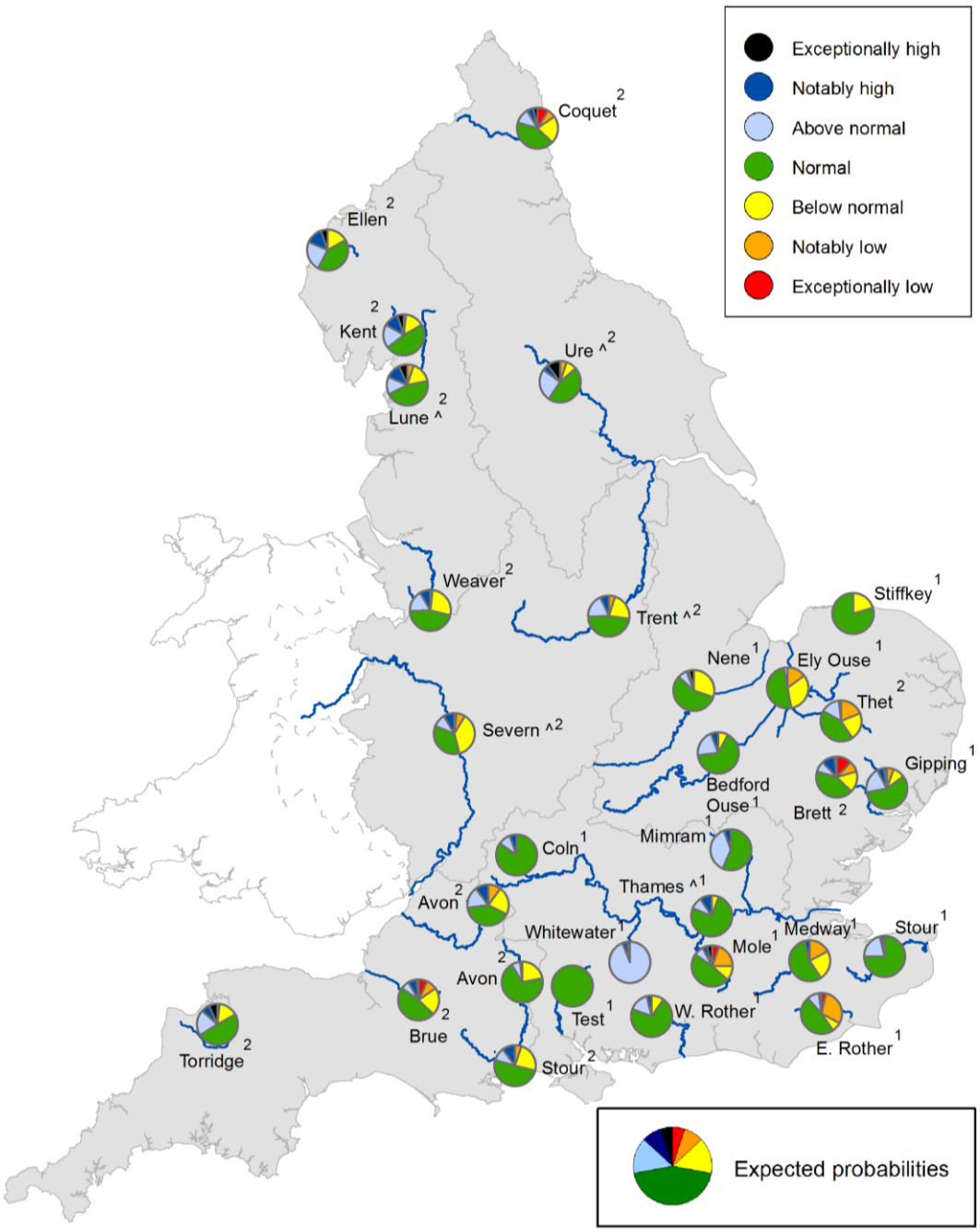

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 September 2020. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency).

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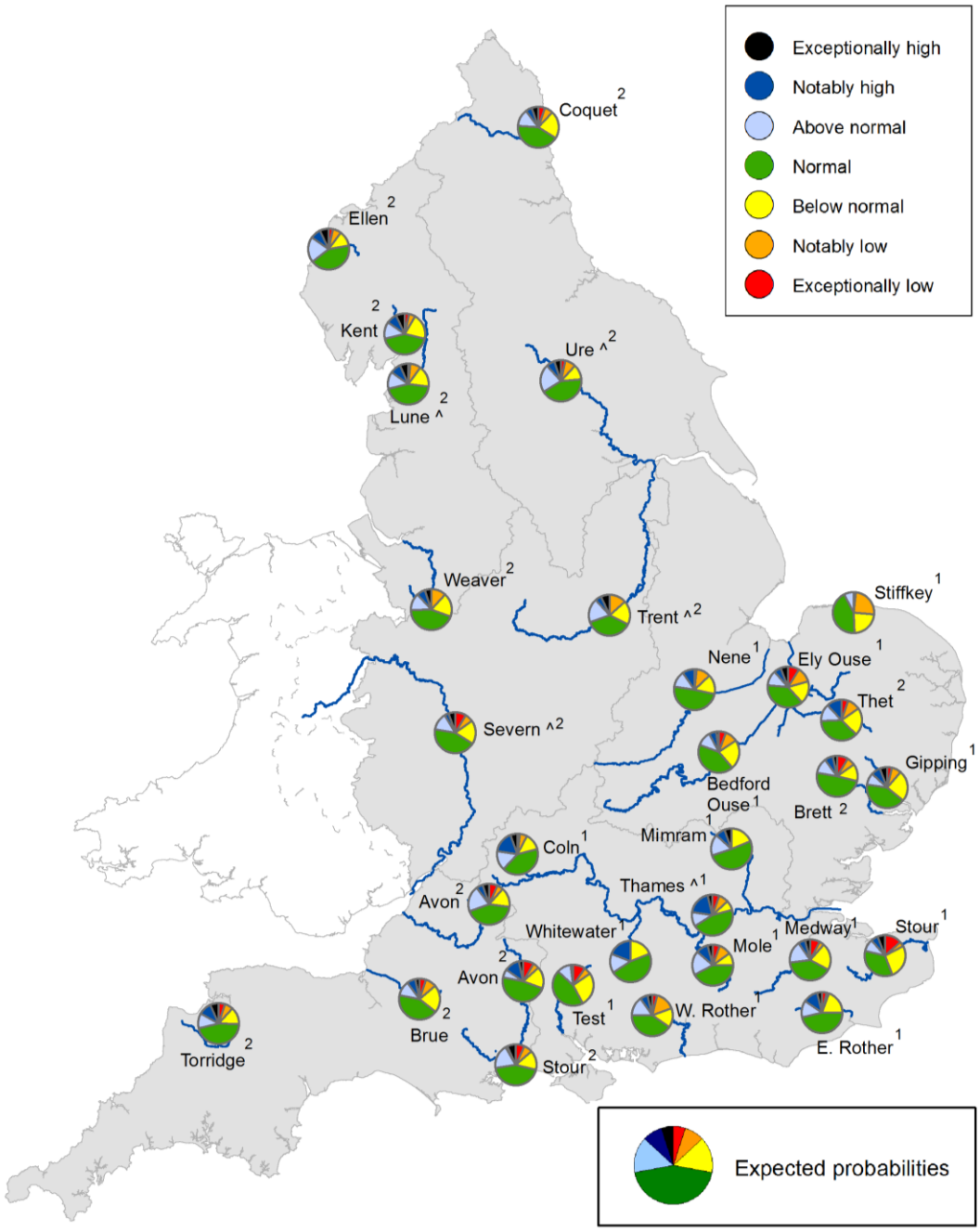

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2021. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the 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
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Forward look: groundwater

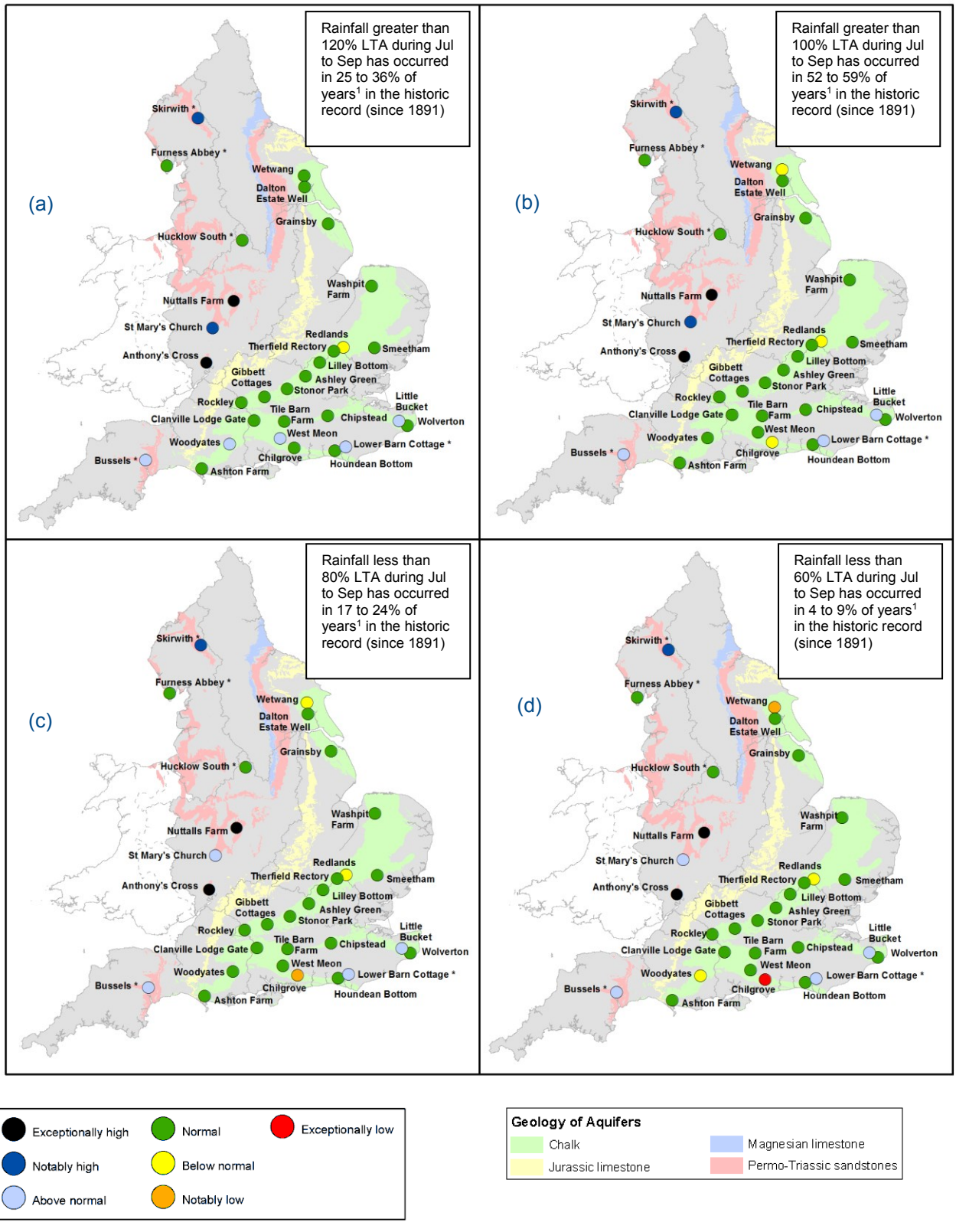

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2020 and September 2020 (Source: Environment Agency) Geological map reproduced with kind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

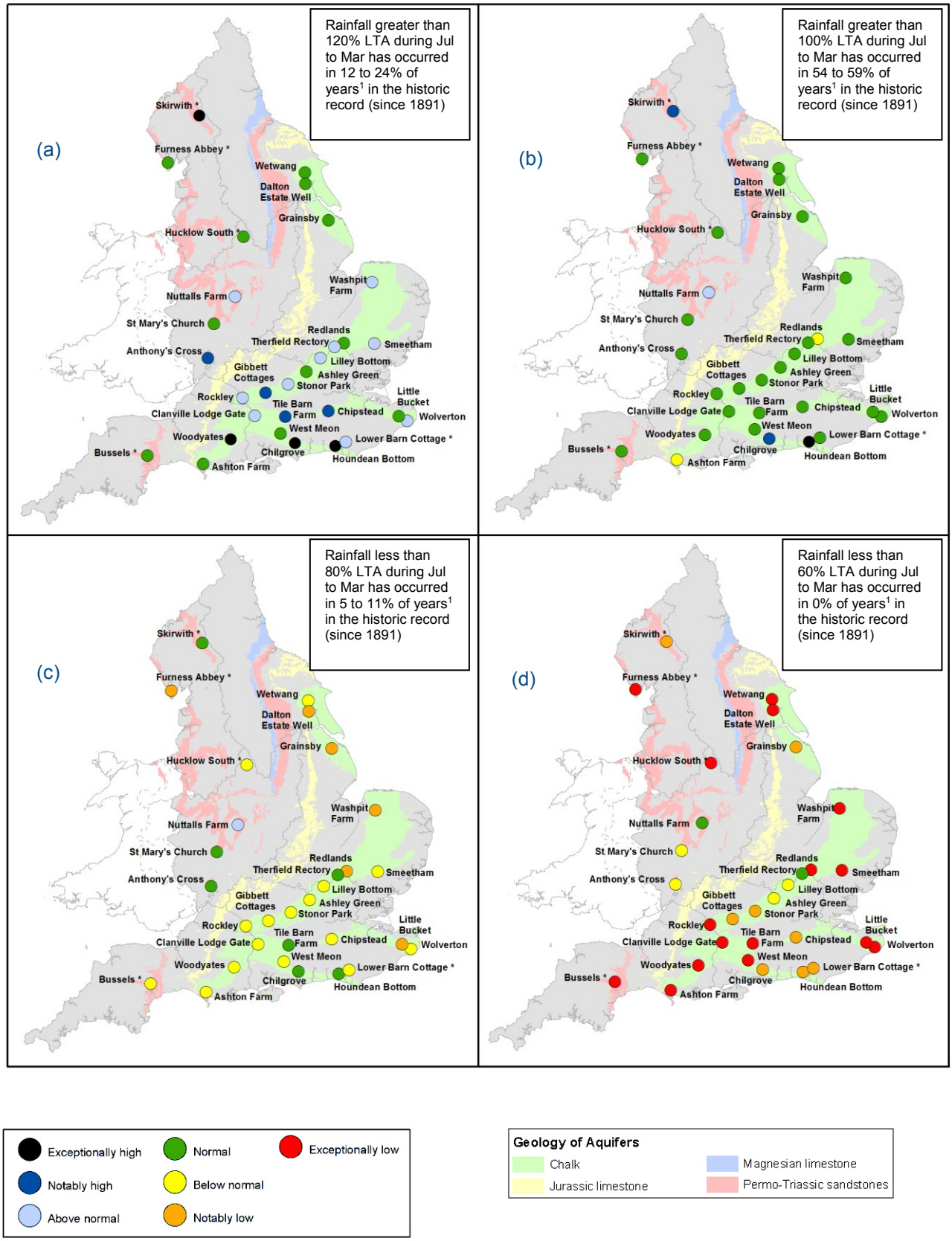

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2020 and March 2021(Source: Environment Agency) Geological map reproduced with kind permission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

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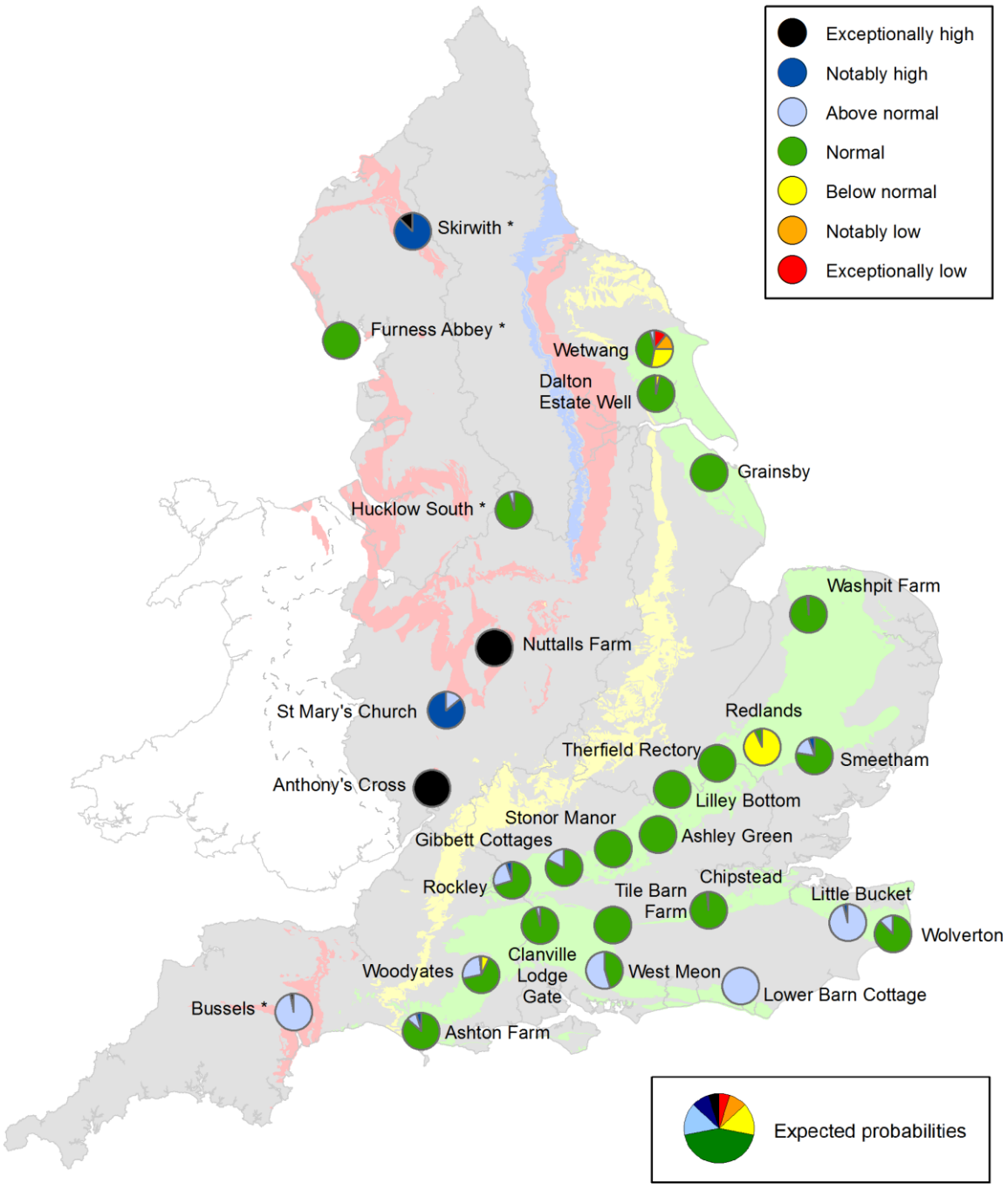

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

Figure 6.7: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2020. 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*

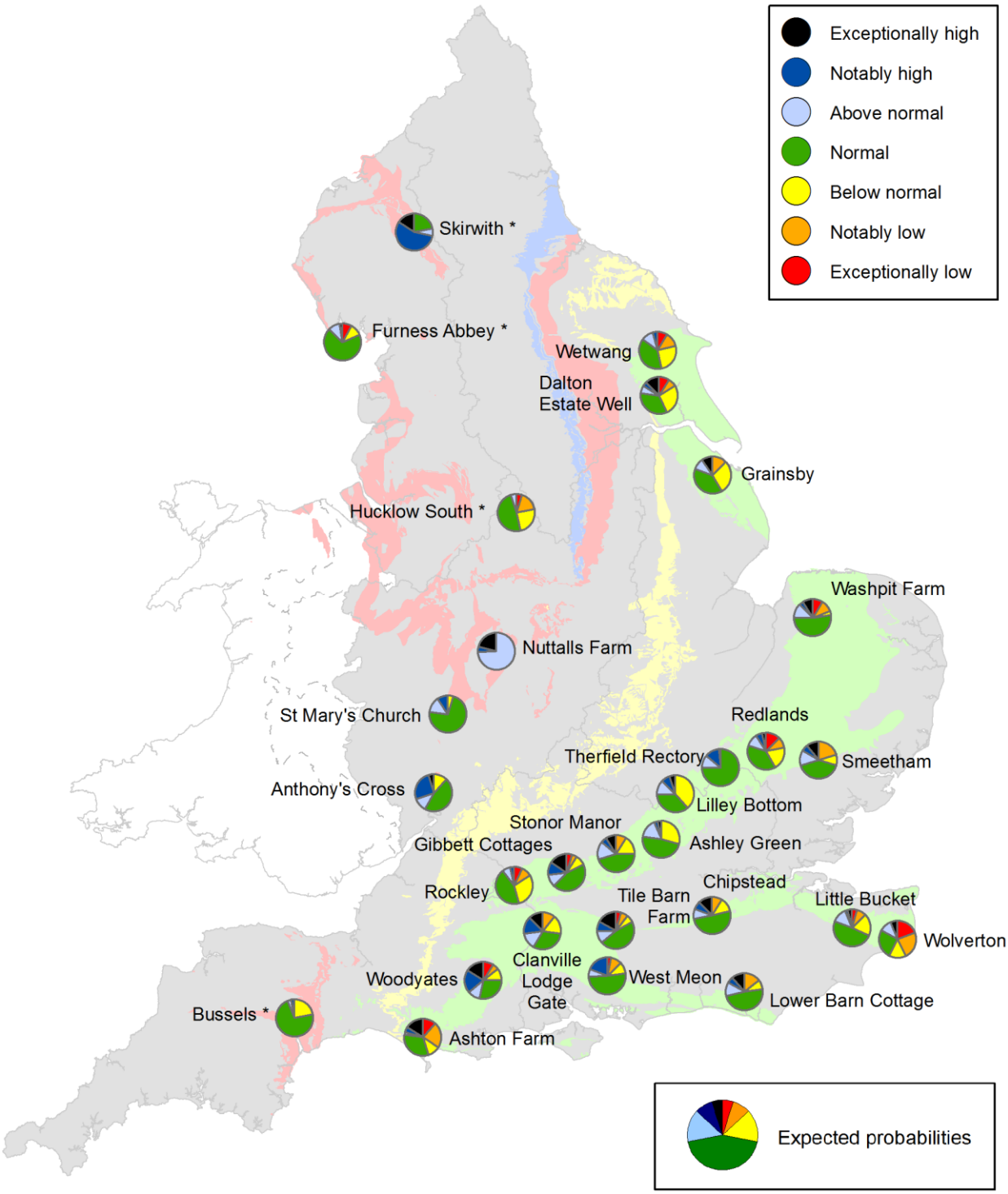

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2021. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the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

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