Monthly water situation report

England

Summary – February 2022

February was dominated by the arrival of storms Dudley, Eunice and Franklin in the middle of the month. Across much of England rainfall totals for February were significantly higher than average. Soil moisture deficits were average for the time of year, with some areas having slightly wetter than expected soils at the end of the month. River flows increased at almost all the indicator sites we report on, with the majority of sites classed as normal or above for the time of year. End of February groundwater levels were classed as normal or higher for the time of year at most of the indicator sites we report on, although the south still has many below normal. Reservoir stocks increased during February at almost all the reservoirs and reservoir groups we report on.

Rainfall

After three named storms dominated the middle of the month, the February rainfall total for England was 97mm which represents 168% of the 1961-1990 long term average (LTA) (146% of the 1991-2020 LTA). Storms Dudley, Eunice and Franklin arrived between February 16 and 21 bringing strong winds and heavy rainfall across much of the country. (Figure 1.1)

Monthly rainfall totals were classed as normal for the time of year in half of all catchment across England, with the majority of these in the south of the country. In contrast the rest of the country received above normal, notably high and exceptionally high rainfall. The highest rainfall totals were in the west, north-west and north-east, with 24 catchments receiving more than double the expected rainfall for the time of year. The wettest catchment was the Calder in West Yorkshire with 282% of the LTA rainfall. (Figure 1.2)

The 3 and 6 month cumulative rainfall totals remained below normal in parts of southern England as the drier than averages conditions during January continue to be felt. The 12 month cumulative rainfall totals were classed as normal for most of England, although some areas in the north-east were below normal or lower. (Figure 1.3)

At a regional scale, February totals ranged from normal in the south-east and south-west, to exceptionally high in the north-west. The central, east and north-east regions were all notably high for the time of year.

Soil moisture deficit

Despite dry conditions in January leaving many soils slightly drier than average going into to February, soil moisture deficits (SMD) diminished everywhere during February in response to the wet conditions. (Figure 2.1). At the end of the month SMD were around the LTA for the time of year (Figure 2.2), with little to no deficit anywhere (soils fully wet).

River flows

February monthly mean river flows increased at 80% of the indicator sites we report on compared to January. Just over half of sites across England were classed as normal for the time of year. Fifteen indicator sites were above normal or higher, all of which were found in the west and north where rainfall totals were highest. River flow indicator sites on the rivers Wyre, Don, Mersey and Derwent (central England) recorded exceptionally high monthly mean flows. In the south river flow indicator sites were normal or below normal as around average rainfall helped river flow begin to increase following very dry conditions during January. (Figure 3.1)

In groundwater dominated catchments in the south, such as the River Kennet at Marlborough, drier than average conditions across the winter have reduced expected seasonal recharge of groundwater resources in the Chalk aquifer. This meant the groundwater contribution to these rivers is lower than expected, and they were below normal for the time of year despite wet conditions in February. (Figure 3.1)

At the regional index sites monthly mean flows were classed as normal for the time of year at three sites, below normal for one site, and notably high at three sites. Horton on the Great Stour in the south-east was below normal for the second consecutive month. (Figure 3.2)

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Groundwater levels

Groundwater levels rose at over half of the reported indicator sites during February. End of month levels were classed as normal for the time of year at 15 of the indicator sites reported on. Four sites were above normal or higher, including Priors Heyes in the north-west that ended February with exceptionally high groundwater levels – although this site is recovering from the effects of historic abstraction which makes recent levels appear high compared to the historic record. Three sites in the south were below normal at the end of February, a change from normal in January. (Figure 4.1)

Groundwater levels declined or plateaued at three sites in chalk aquifers, as the impact of an exceptionally dry January for much of the country continues to impact on the expected seasonal recharge of groundwater resources. Chilgrove (west Sussex) and Little Bucket (east Kent) remained normal for the time of year, while Stonor Park in the Chilterns was below normal. (Figure 4.2)

At the major aquifer index sites February groundwater levels were very varied, from notably low in the Jurassic Limestone at Jackaments Bottom, to notably high at Weir Farm in the Sandstone. The chalk index sites at Little Bucket, Redlands Hall, Dalton Holme and Chilgrove were all normal for the time of year. (Figure 4.1)

Reservoir storage

Following a wet month, end of February reservoir stocks increased at more than three quarters of the reservoirs and reservoir groups we report on. Seven reservoirs or groups saw an increase of more than 10% of total capacity, with Haweswater and Thirlmere increasing by 21%. Small decreases were seen at four reservoirs and reservoir groups, with the largest being a 7% decrease at Farmoor in the south-east. (Figure 5.1)

End of month reservoir stocks were classed as normal or higher for the time of year for more than three quarters of reported reservoir sites, including three that were exceptionally high. Six reservoirs or reservoir groups were classed as below normal for the time of year.

At a regional scale, total reservoir stocks ranged from 89% in east England to 98% in north-east England. Total reservoir stocks for England were at 95% of total capacity at the end of February. (Figure 5.2)

Forward look

Unsettled conditions are expected throughout March, with a mix of showers and dry, cloudy spells. The heaviest rain and windiest conditions are likely to be in the north-west, while the south-east will see more settled conditions with sunshine. Later in the month bright, showery conditions are likely to be broken by wet and windy weather with temperatures remaining mild for most.

From March to May the 3 month period is more likely than normal to be warm, with a slightly reduced chance of it being wetter than normal. There is an increased chance of windy conditions at the beginning of the period.

Projections for river flows at key sites[1]

By the end of March and September 2022 the majority of modelled 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 2022 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by September 2022 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by March 2022 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by September 2022 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

By the end of March and September 2022 the majority of modelled sites have a greater than expected chance of normal or lower groundwater levels for the time of year. By the end of September there is a slightly higher chance of above normal groundwater levels at some sites.

For scenario based projections of groundwater levels in key aquifers in March 2022 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in September 2022 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2022 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2022 see Figure 6.8

Authors: National Water Resources Hydrology Team

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1 Information produced by the Hydrological Outlook, a partnership between UK Centre for Ecology and Hydrology, British Geological Survey, Met Office, Environment Agency and other devolved agencies.

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Rainfall

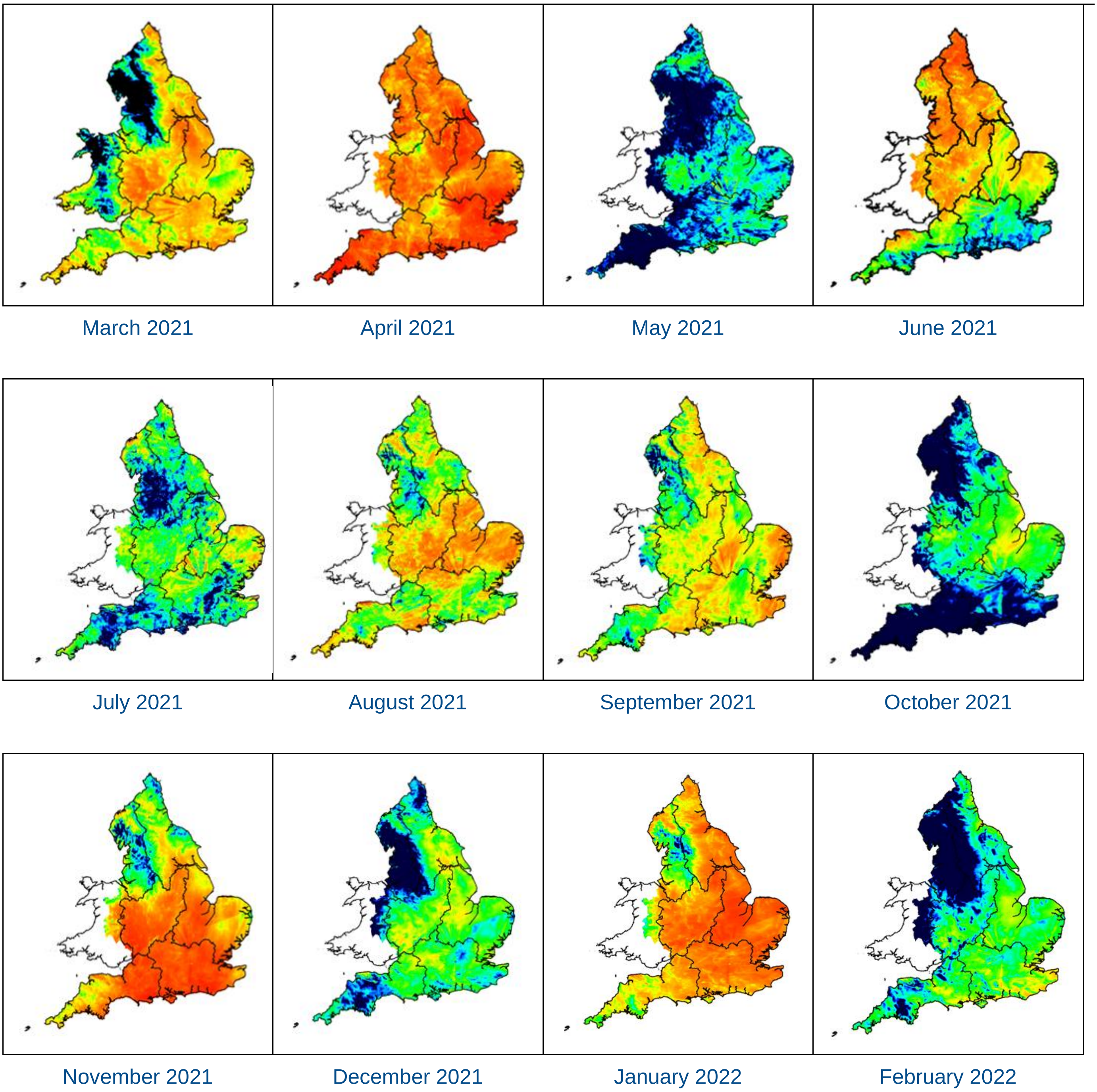
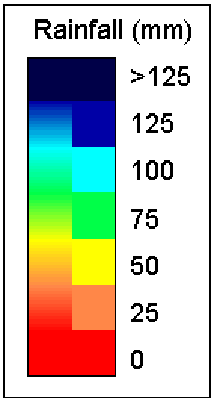


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2022). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.



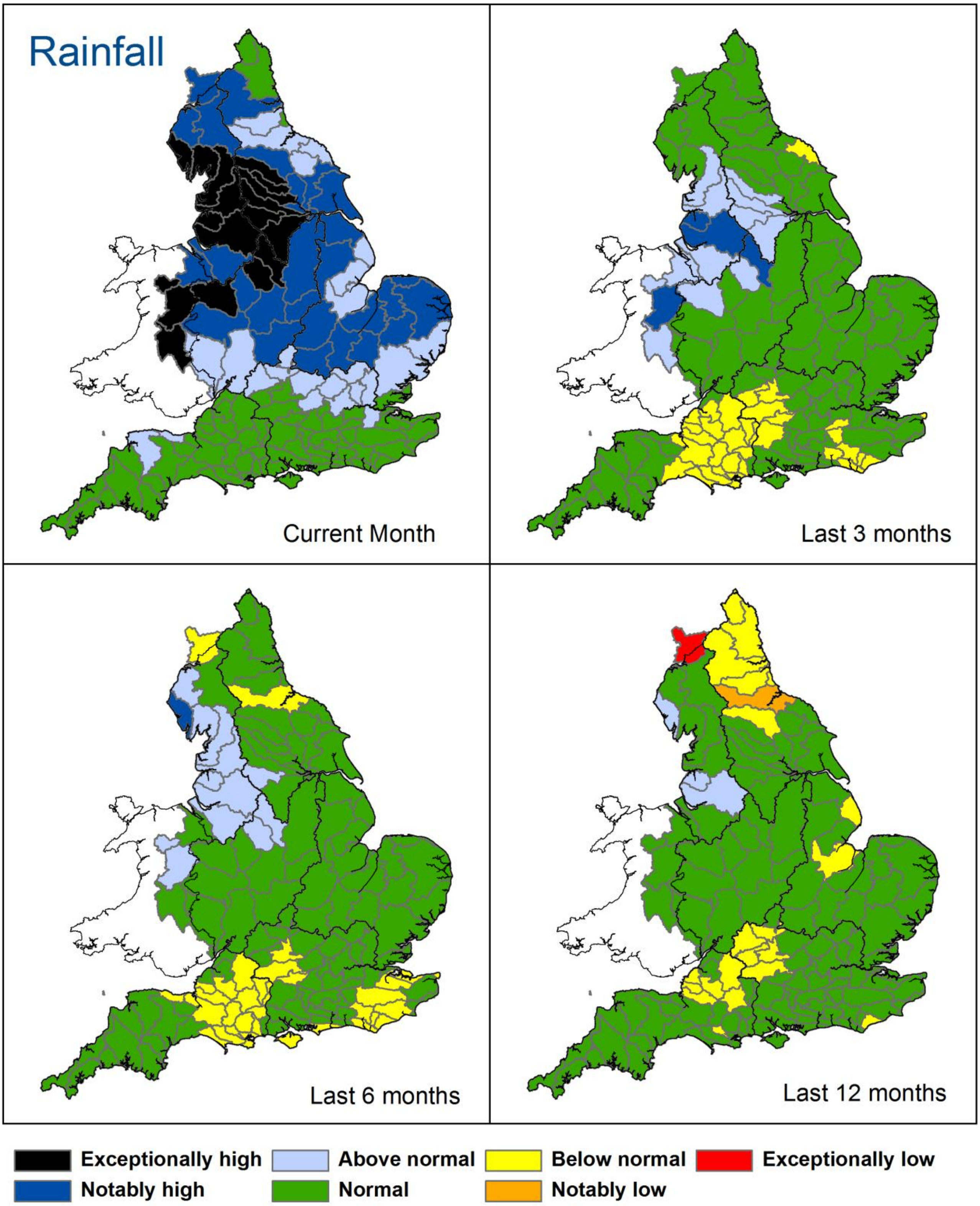


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 28 February), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2022).* 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, 2022.

Rainfall charts

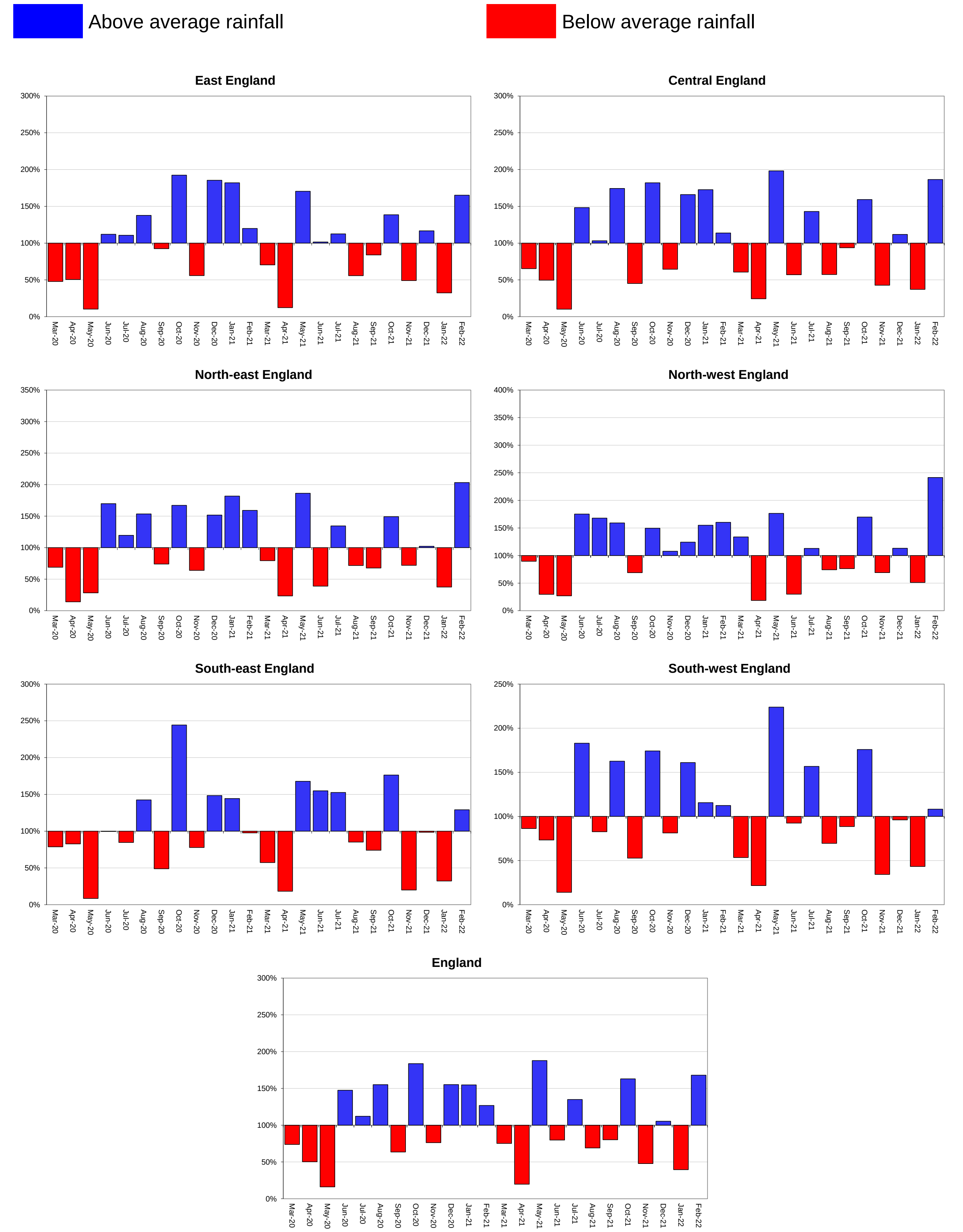
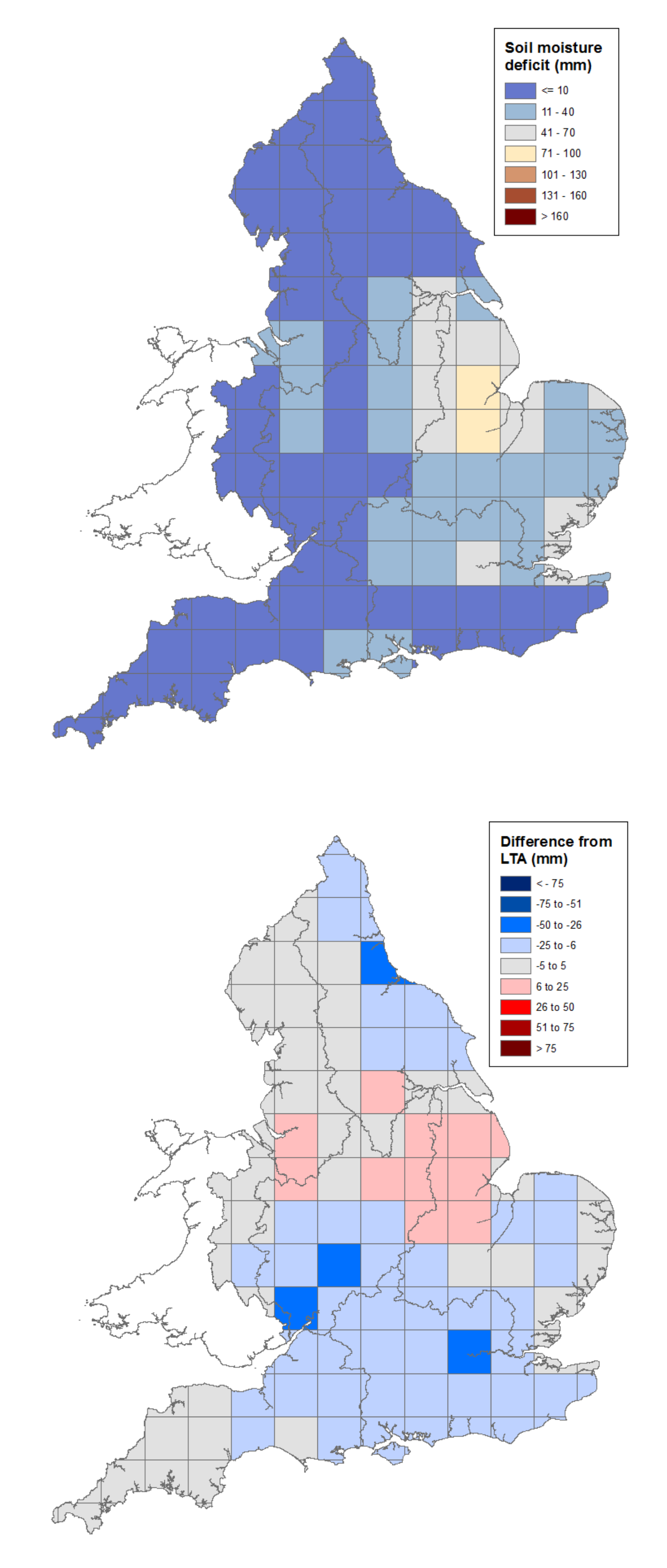


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2022).

Soil moisture deficit

End of January 2022[1]



End of February 2022[2]

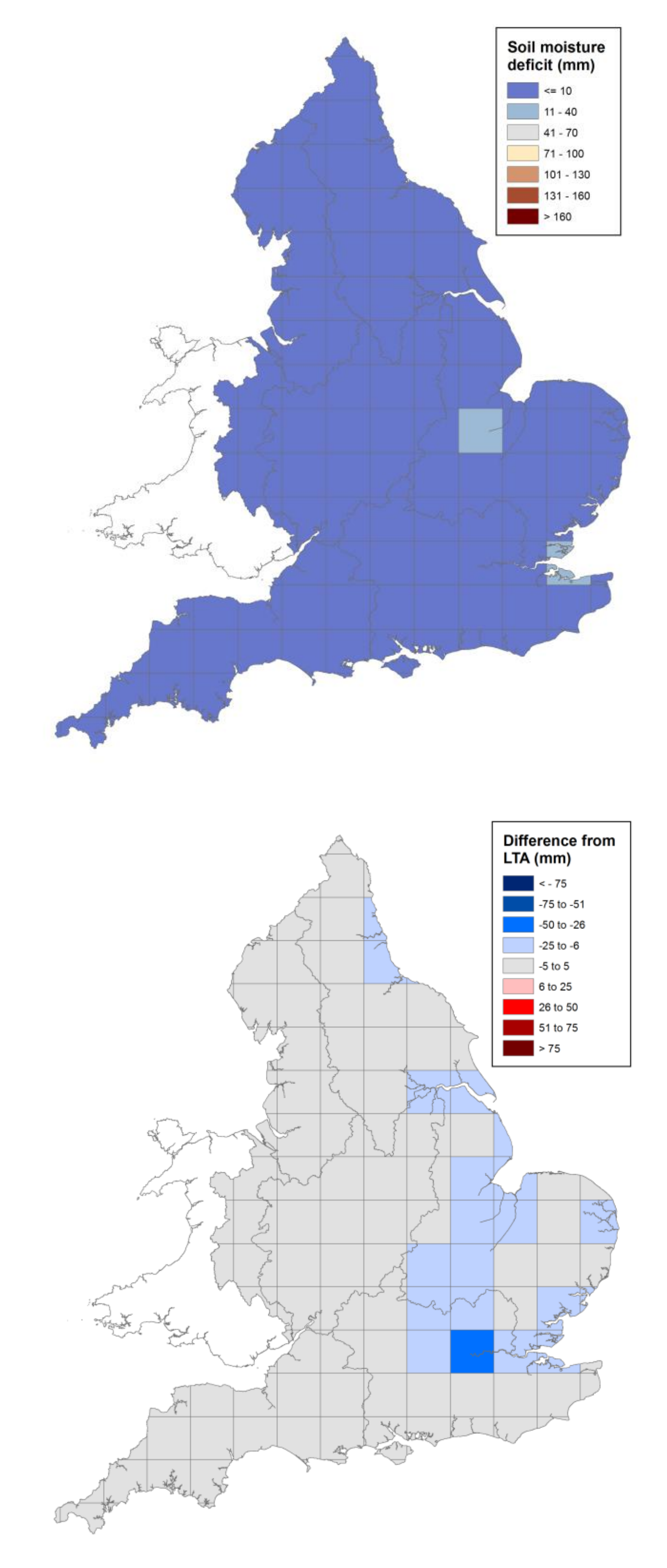


Figure 2.1: Soil moisture deficits for weeks ending 1 February 2022 [1] (left panel) and 1 March 2022[2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2022). Crown copyright. All rights reserved. Environment Agency, 100024198, 2022

Soil moisture deficit charts

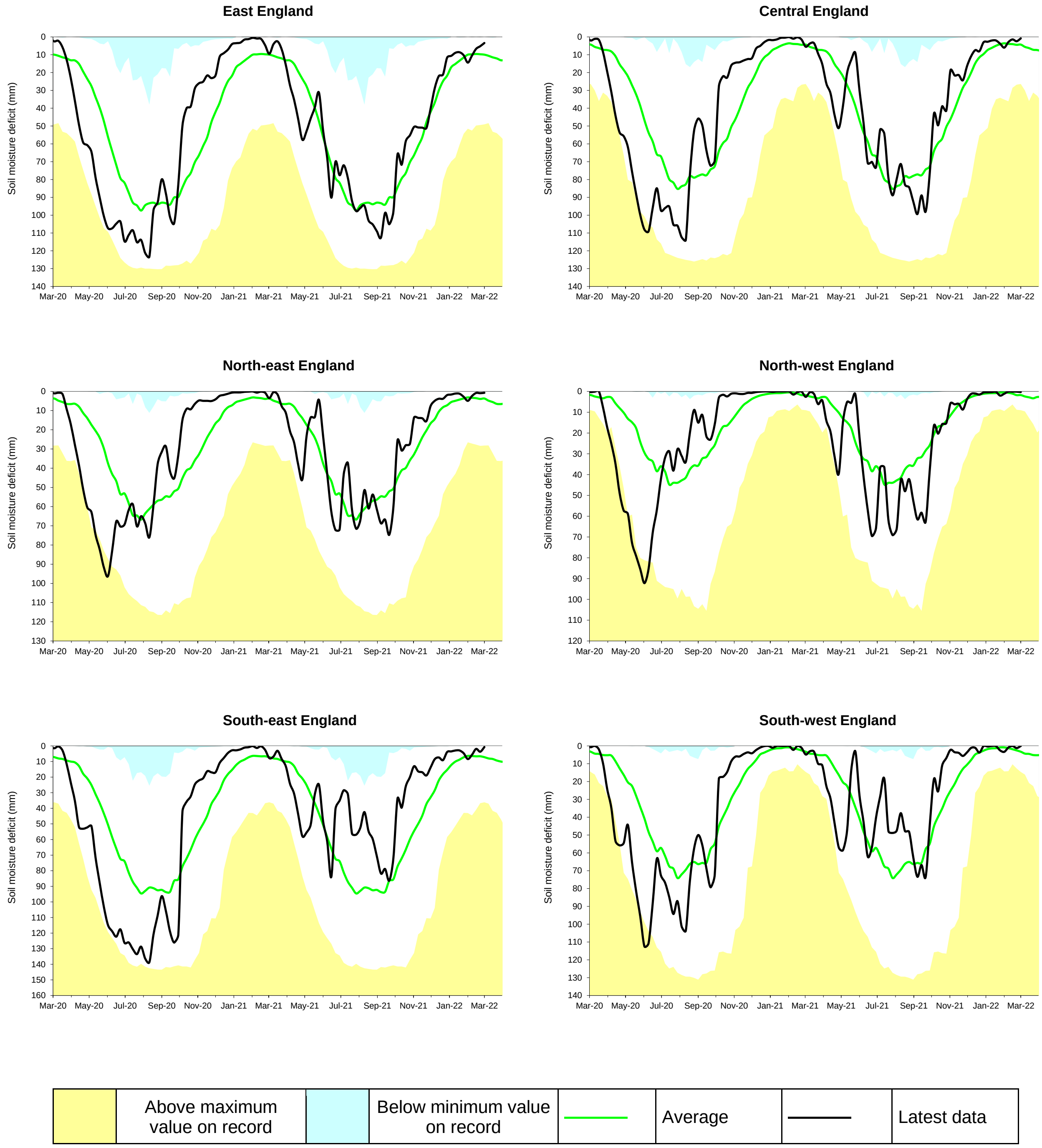
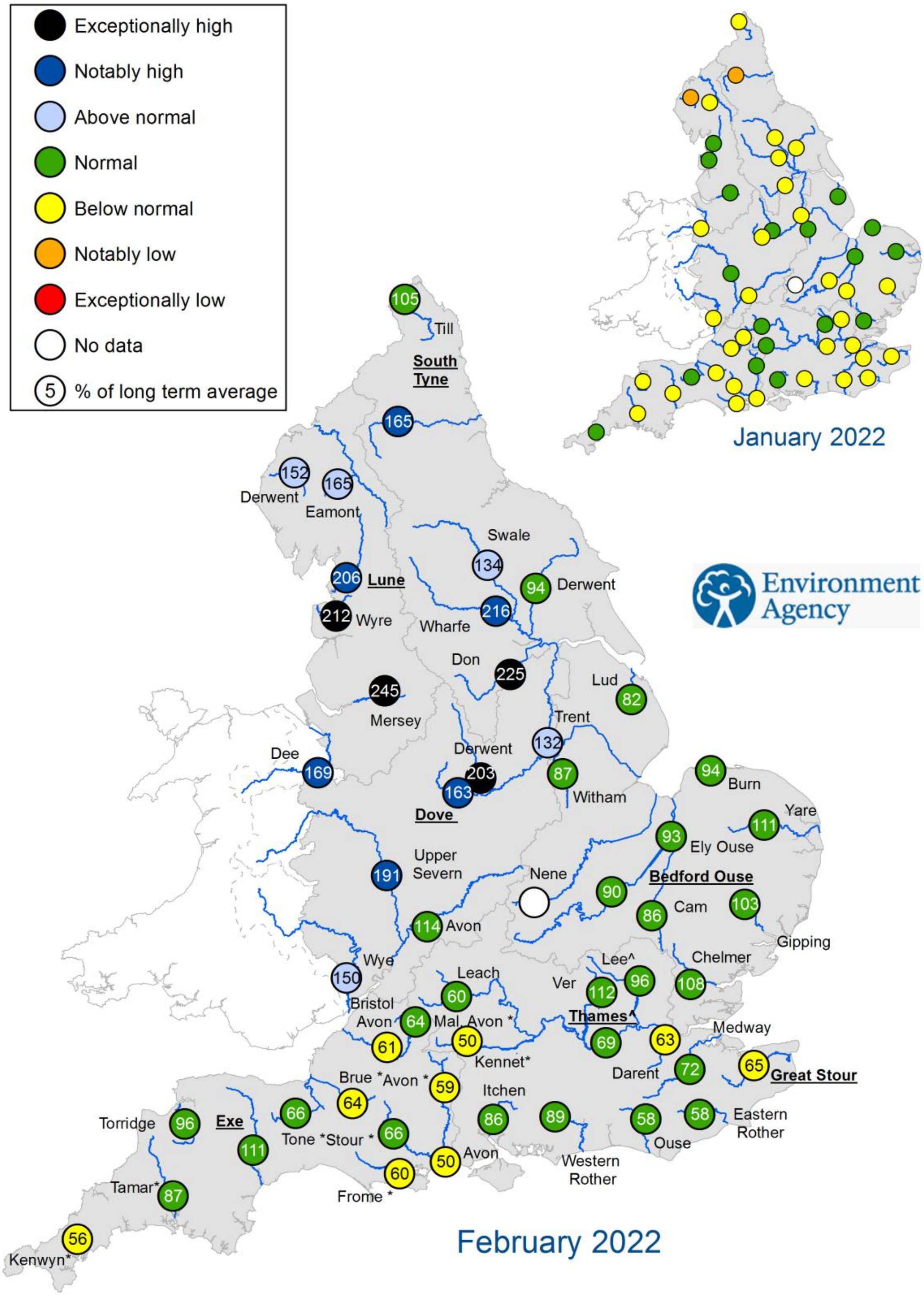


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2022).

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)

* Flows may be overestimated at these sites – data should be treated with caution

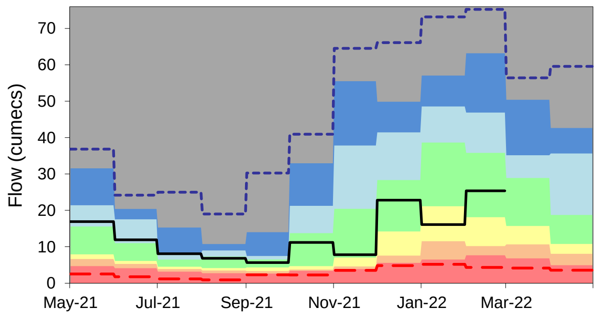
Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

Figure 3.1: Monthly mean river flow for indicator sites for January 2022 and February 2022, 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, 2022.

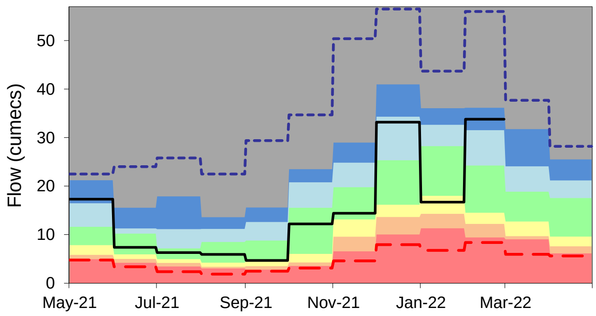
River flow charts

Exceptionally high · Notably high · Above normal · Normal
Below normal · Notably low · Exceptionally low
Monthly maximum · Latest data · Monthly minimum

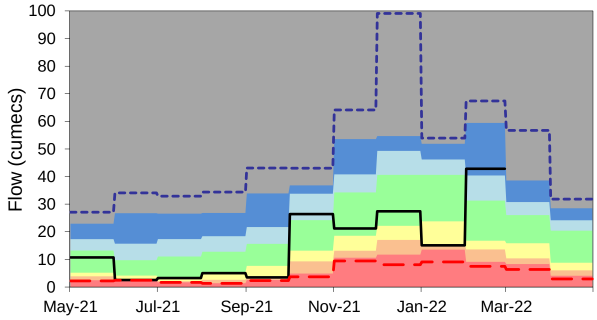
Offord, BEDFORD OUSE
Ranking derived from data for the period Jan-1972 to Dec-2017



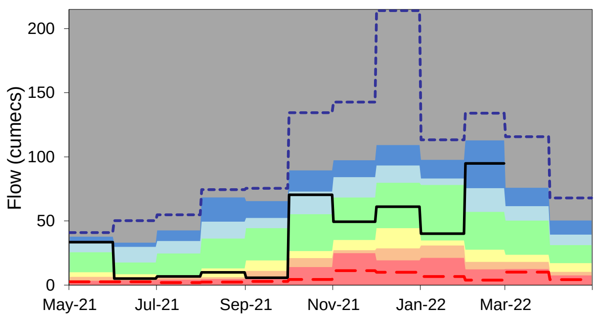
Marston-on-Dove, DOVE
Ranking derived from data for the period Jul-1965 to Dec-2017



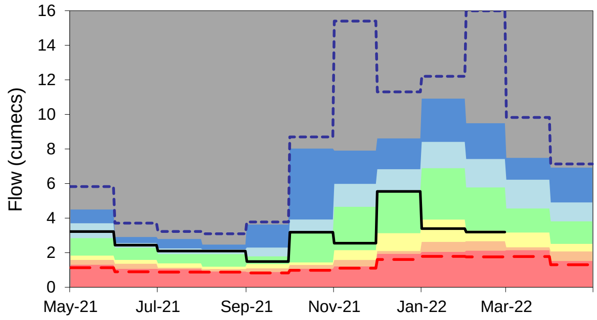
Haydon Bridge, SOUTH TYNE
Ranking derived from data for the period Oct-1974 to Dec-2017



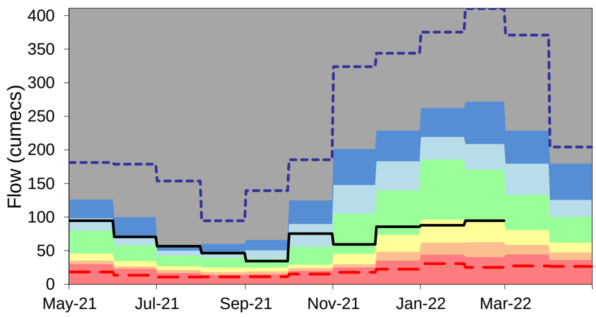
Caton, LUNE
Ranking derived from data for the period Jan-1959 to Dec-2017



Horton, GREAT STOUR
Ranking derived from data for the period Oct-1964 to Dec-2017



Kingston, THAMES
Ranking derived from data for the period Jan-1883 to Dec-2017



Thorverton, EXE
Ranking derived from data for the period Apr-1956 to Dec-2017

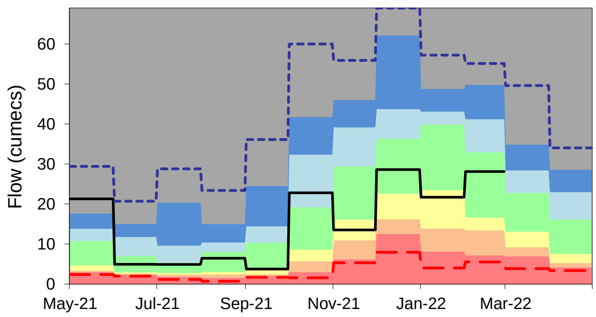


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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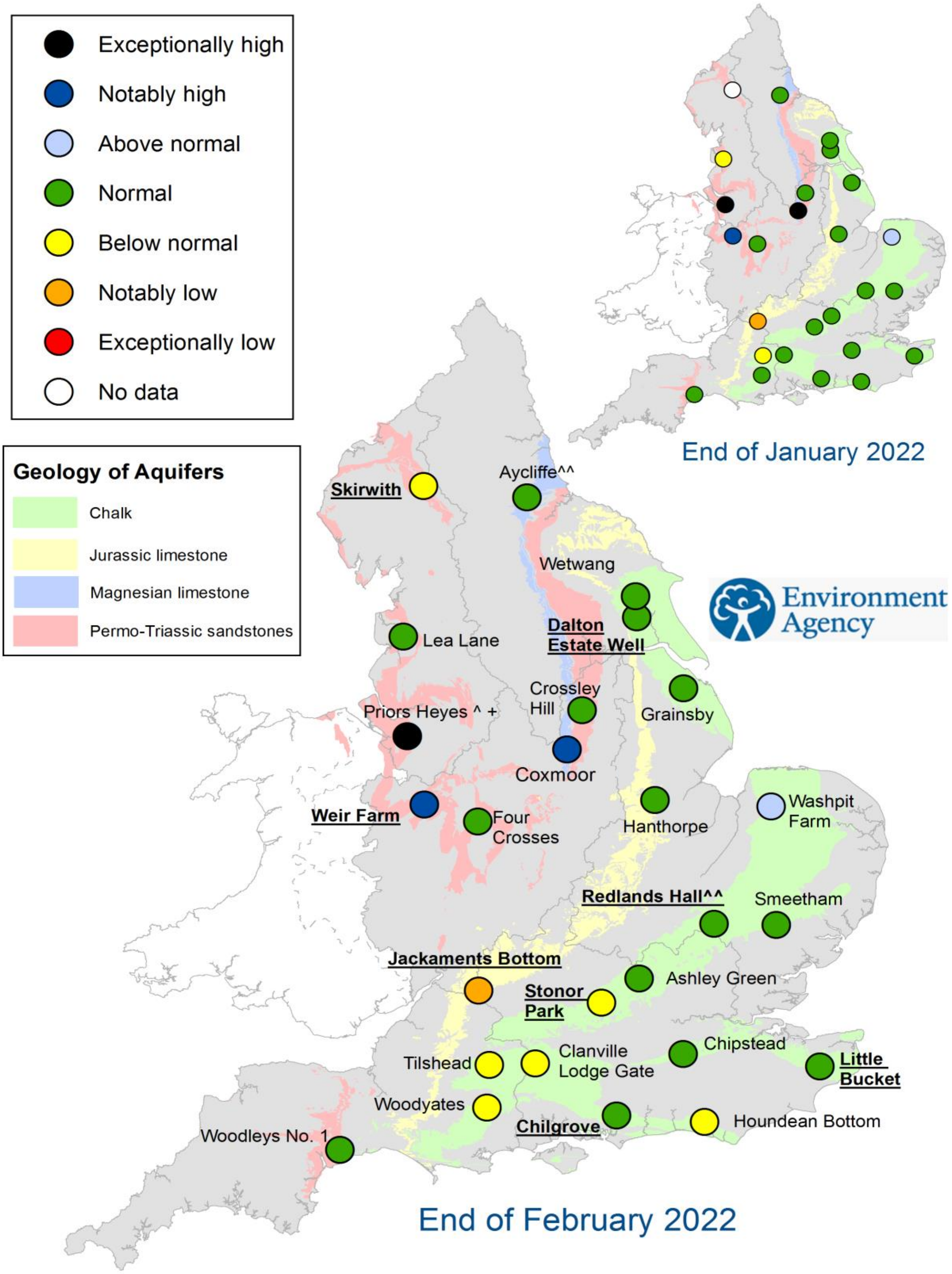
Groundwater levels



^ 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 2022 and February 2022, 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, 2022.

Groundwater level charts

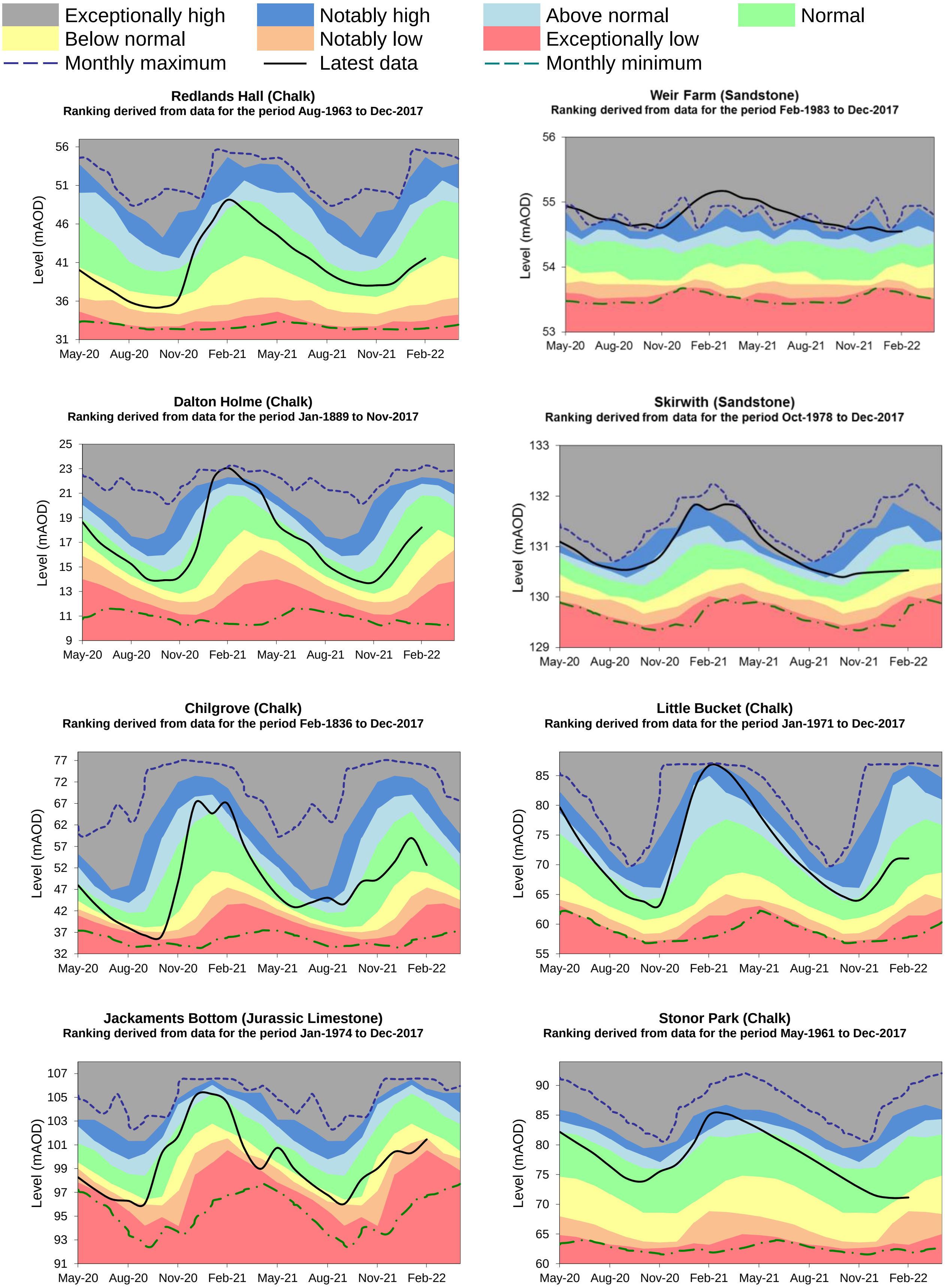
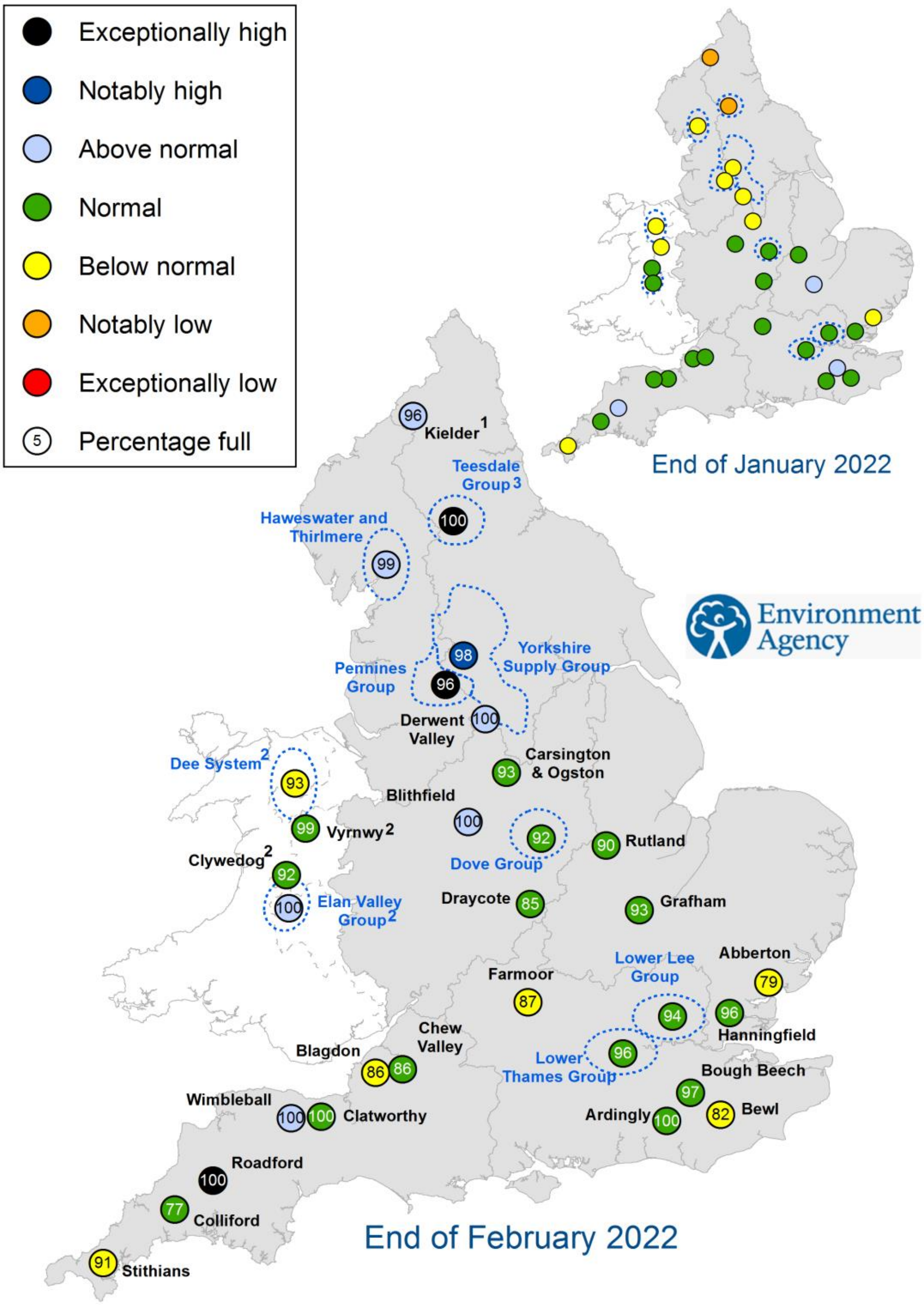


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2022).

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 2022 and February 2022 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. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

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

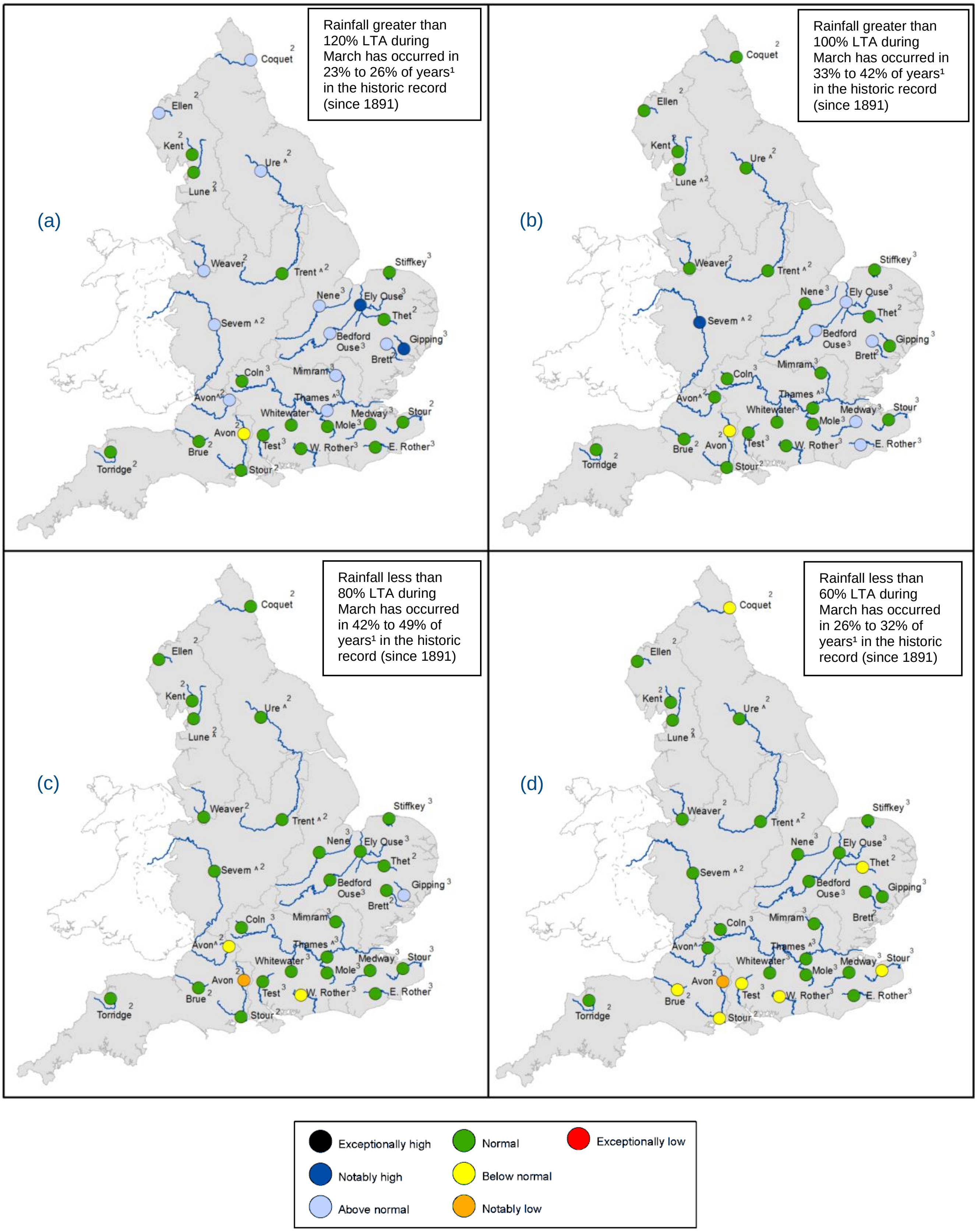


Figure 6.1: Projected river flows at key indicator sites up until the end of Macrh 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during March 2022. (Source: UK Centre for Ecology and Hydrology, Environment Agency)

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

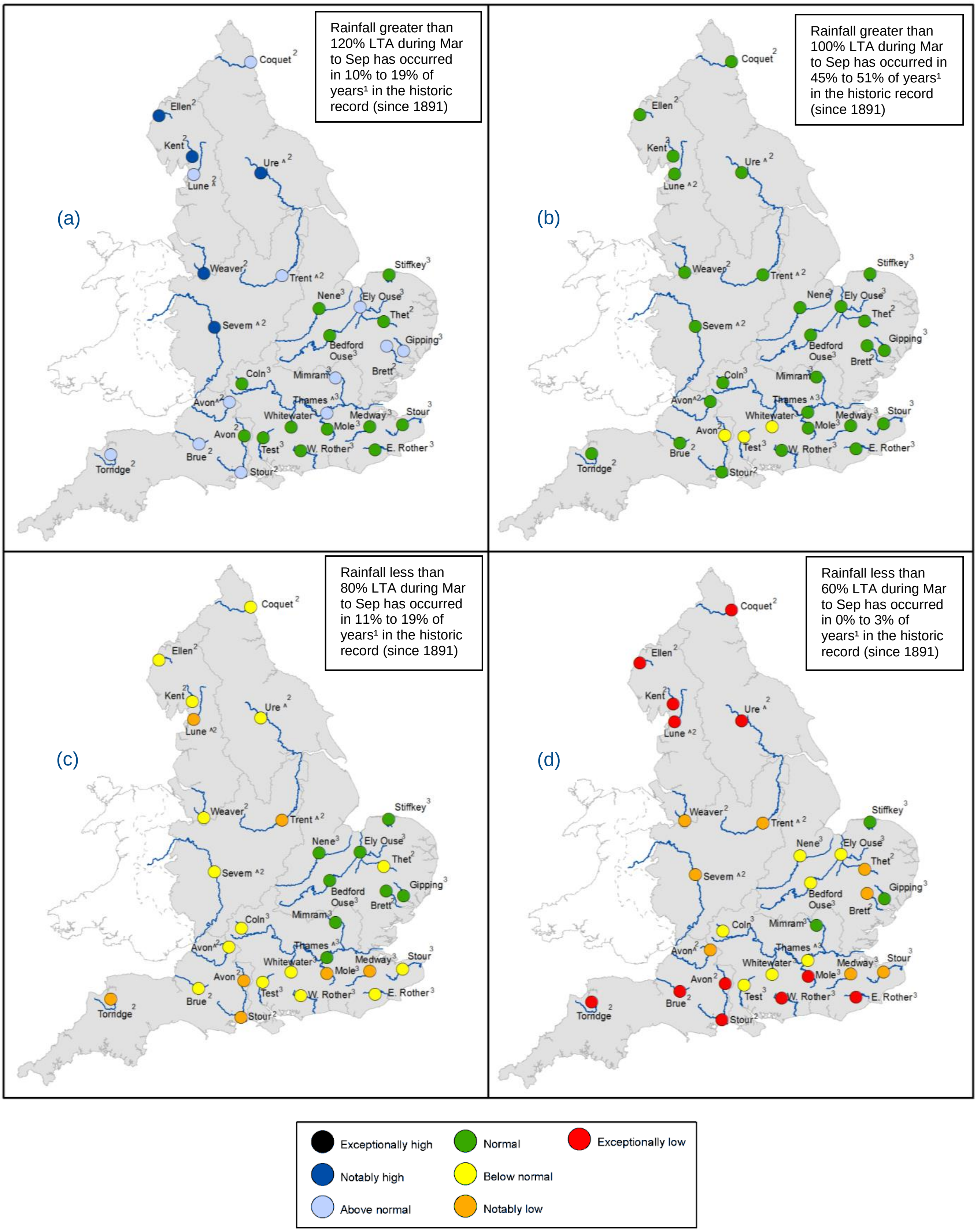


Figure 6.2: Projected river flows at key indicator sites up until the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March 2022 and September 2022 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

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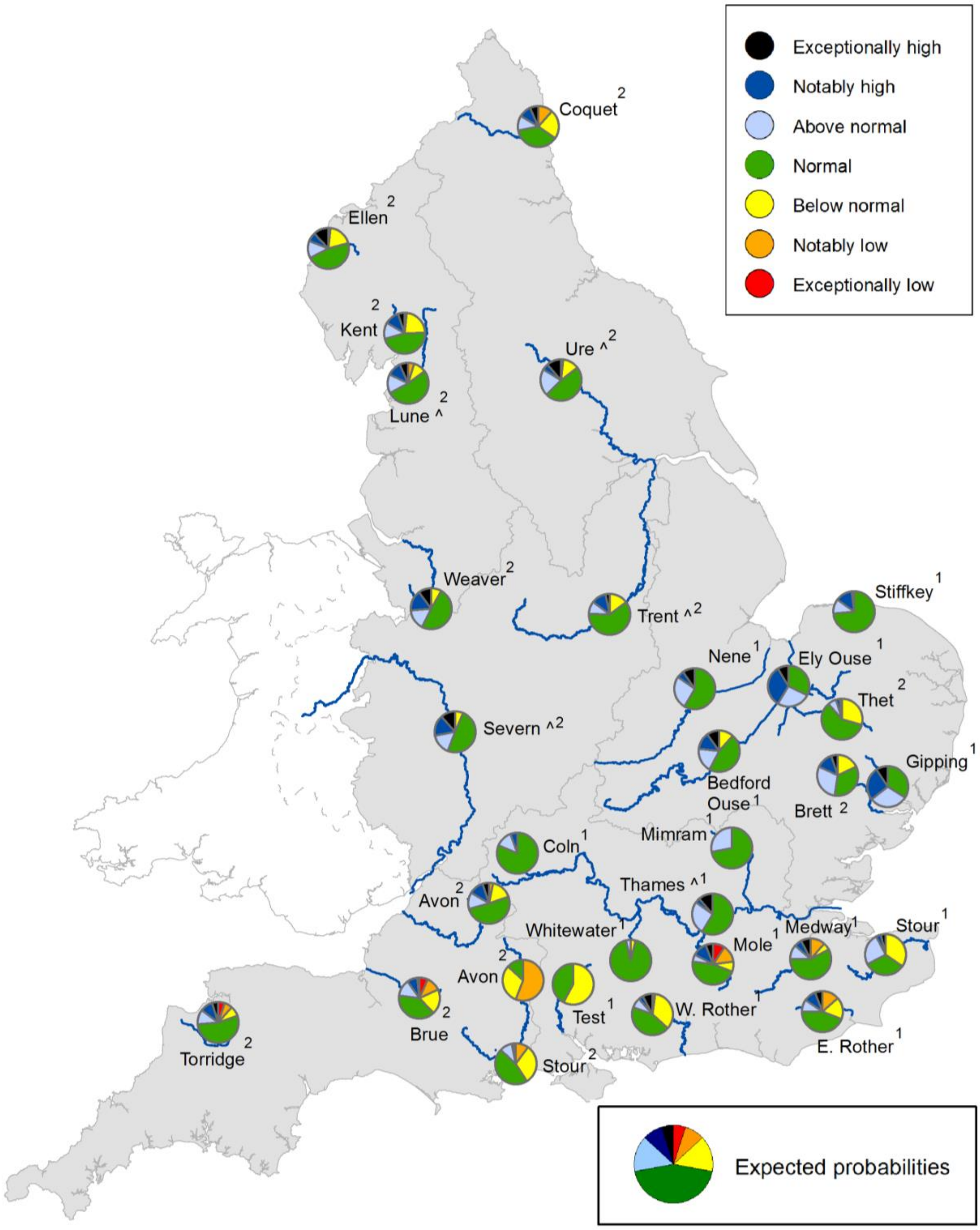

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

Figure 6.3: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2022. 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: UK Centre for Ecology and Hydrology, Environment Agency).

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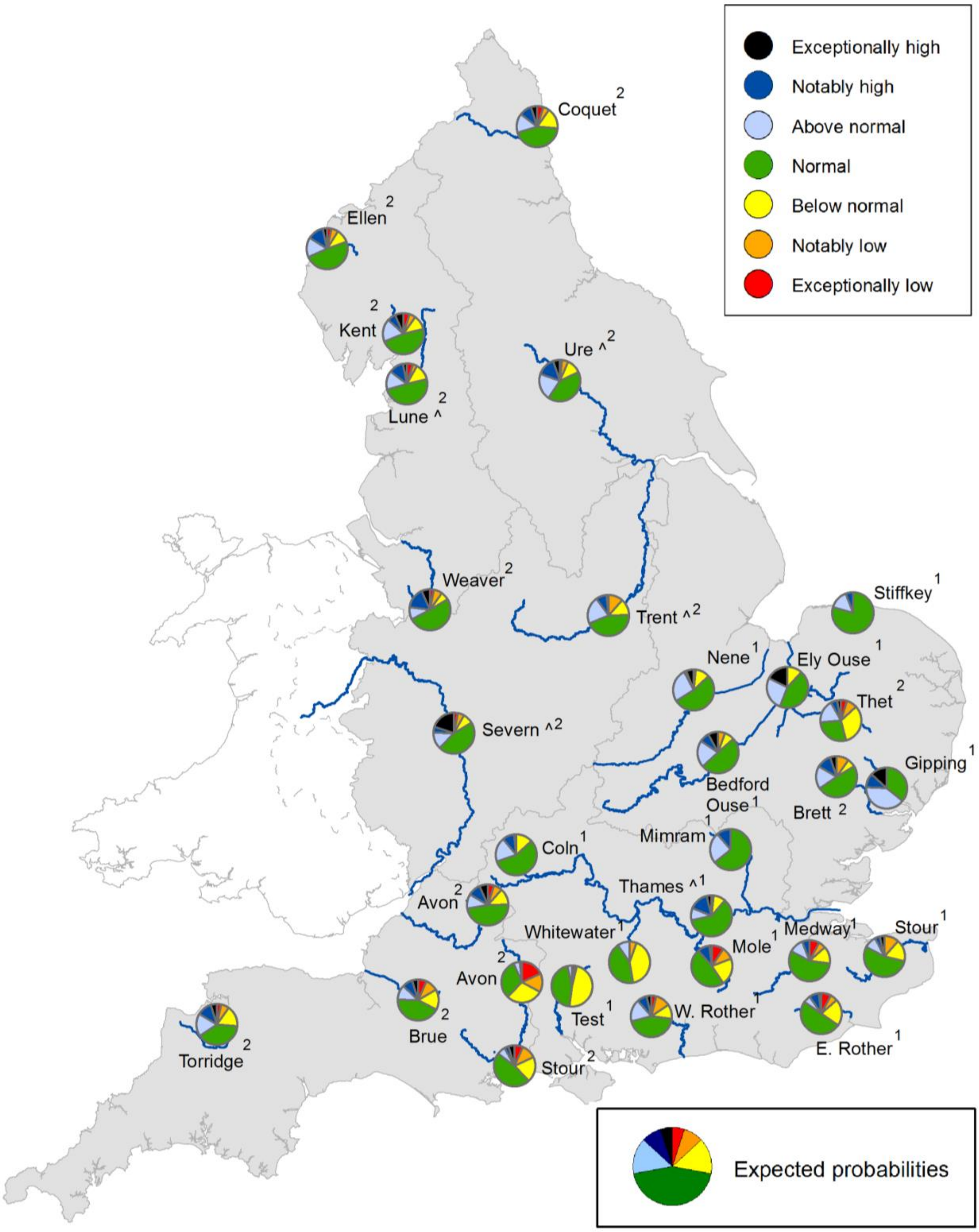

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2022. 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: UK 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 UK CEH
^"Naturalised" flows are projected for these sites

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Forward look: groundwater

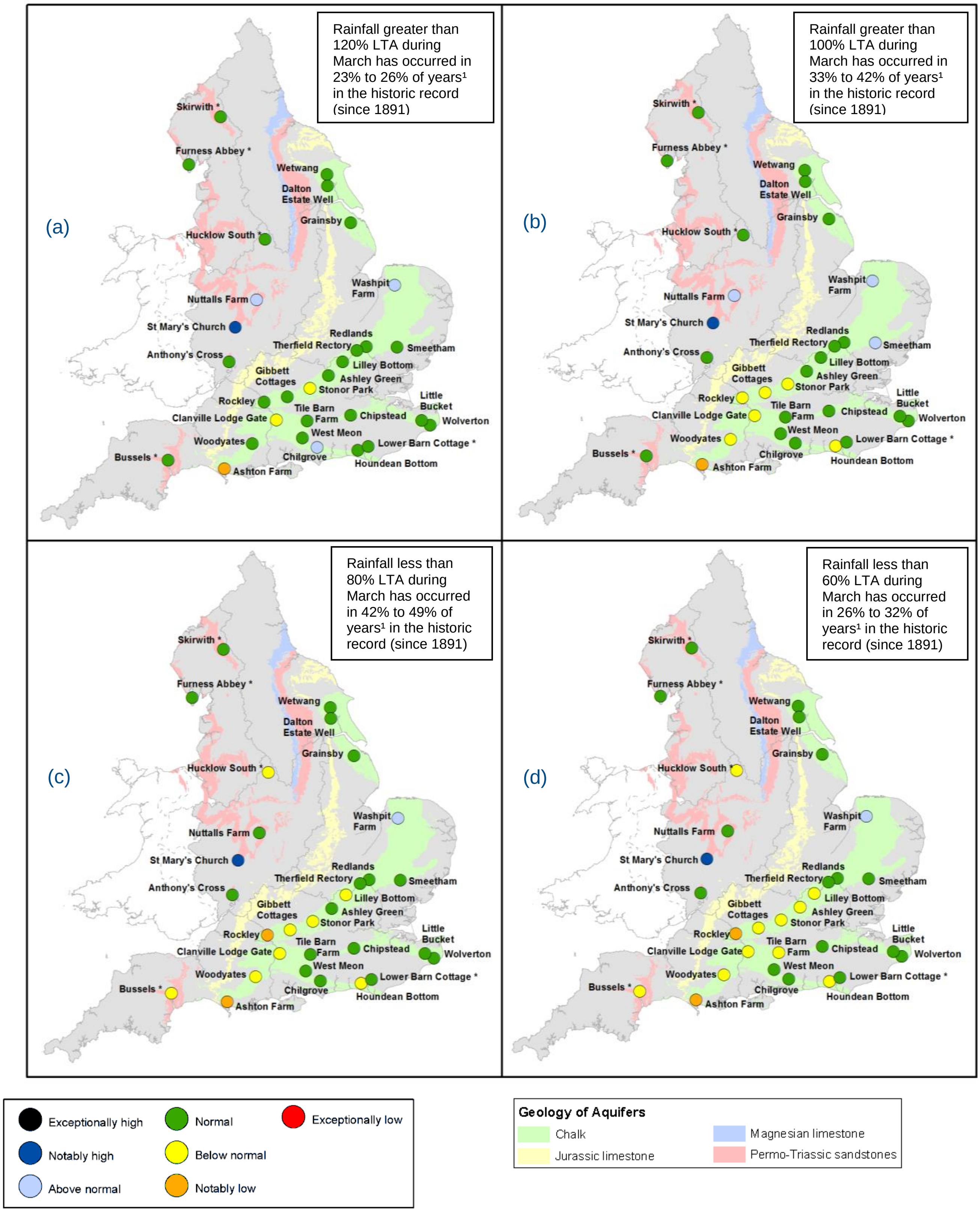


Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall in March 2022 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2022.

* Projections for these sites are produced by BGS

[1] This range of probabilities is a regional analysis

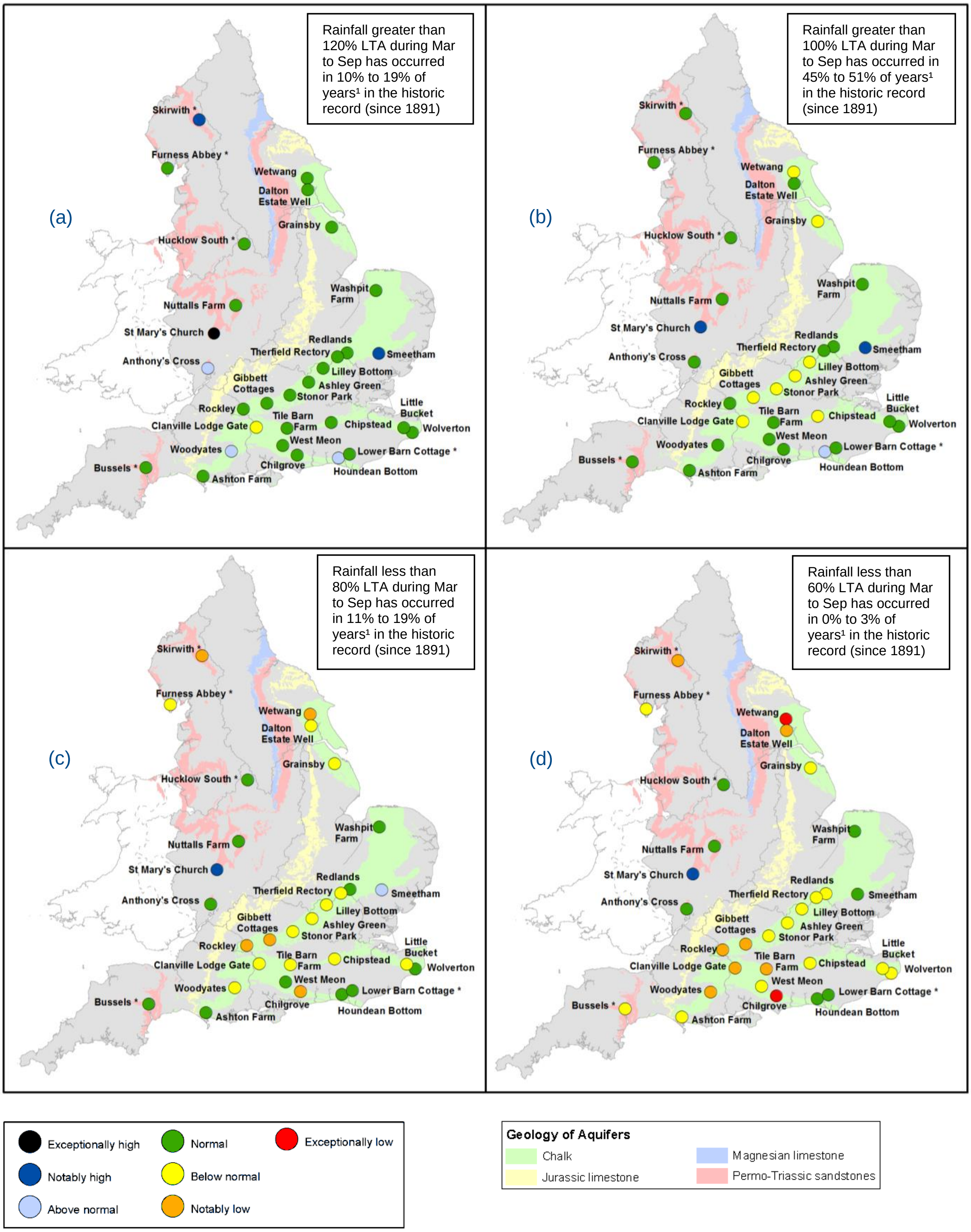
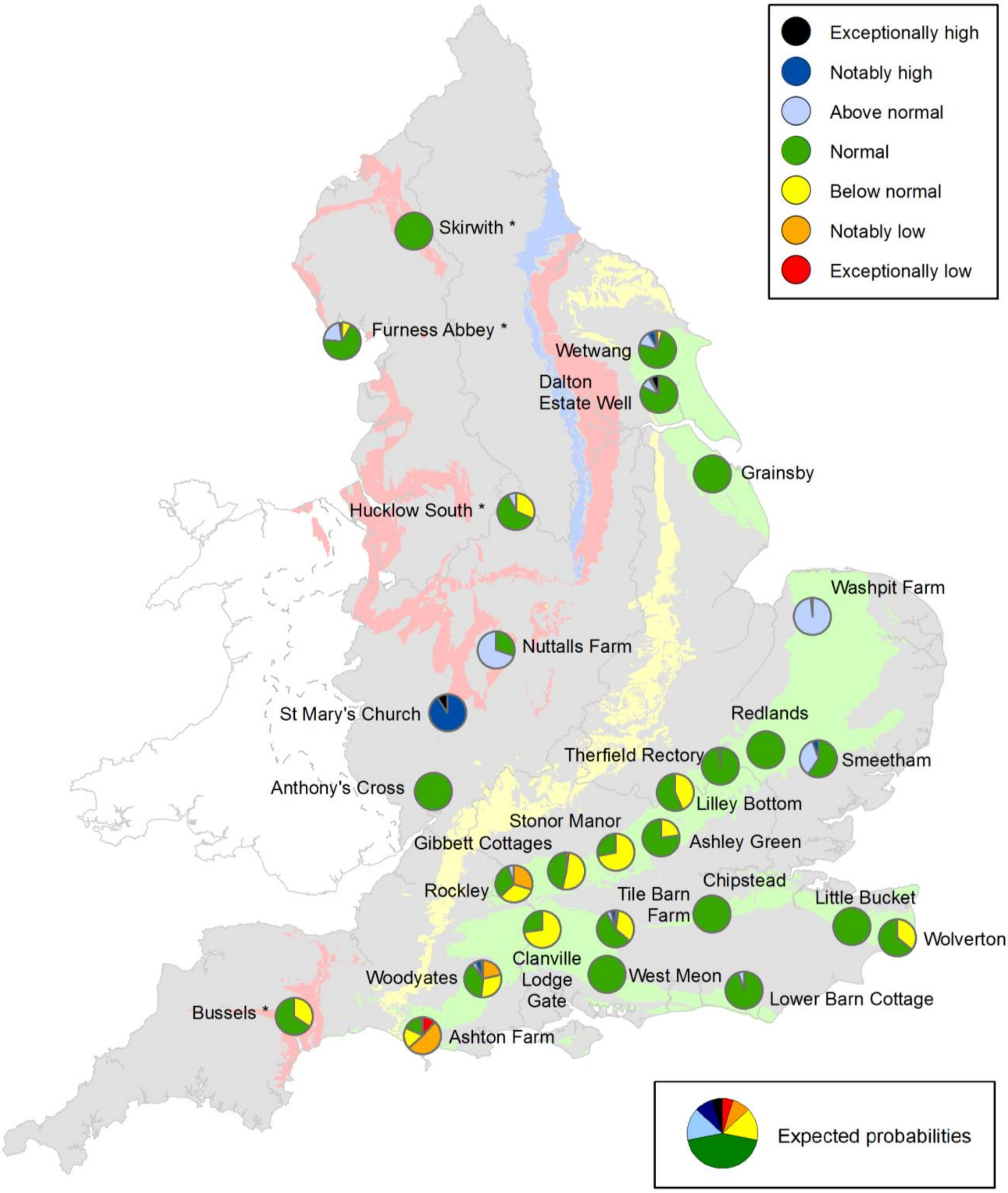


Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March 2022 and September 2022 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2022.

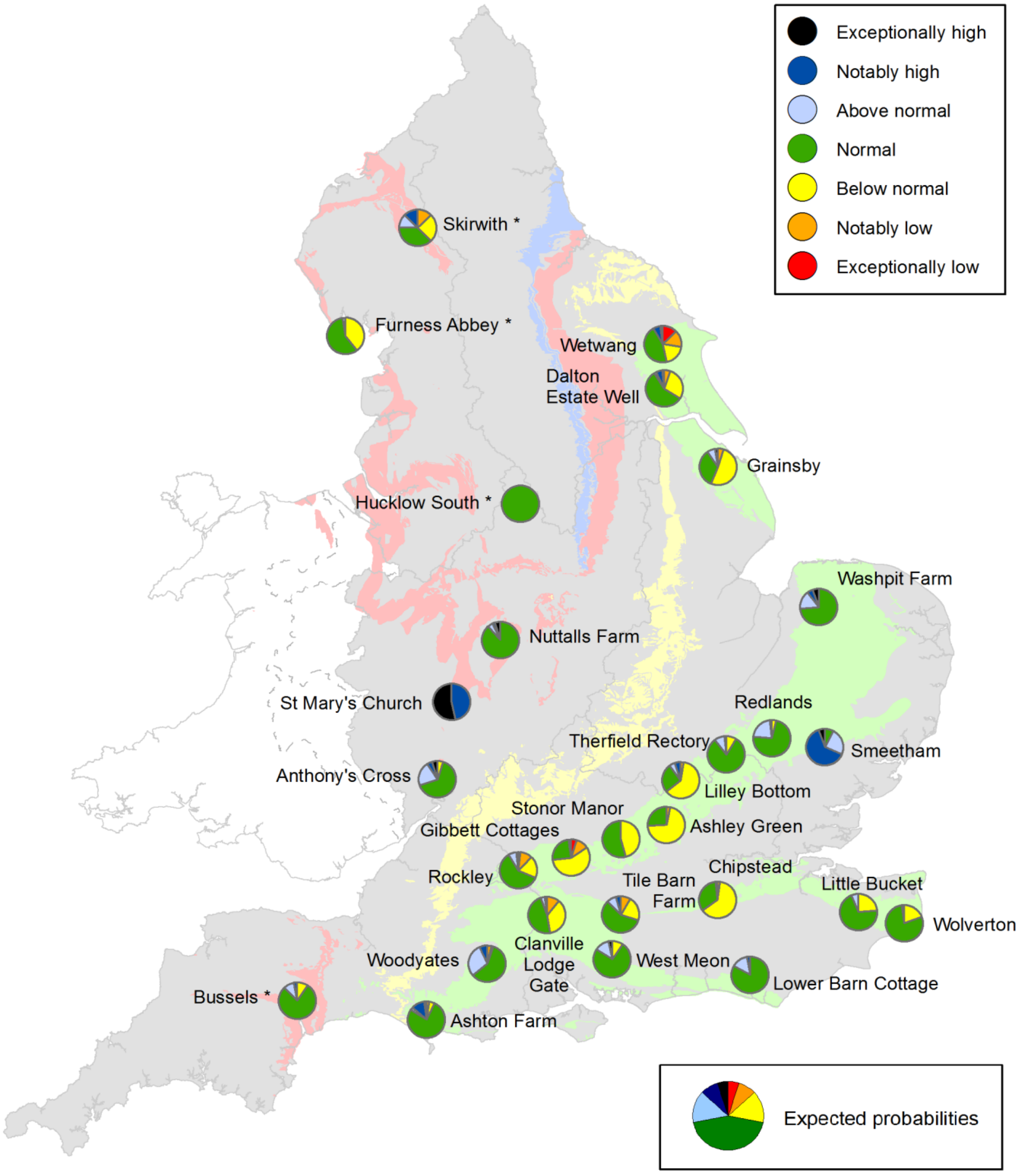
* Projections for these sites are produced by BGS
[1] This range of probabilities is a regional analysis



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 2022. 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, 2022.

** 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 2022. 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, 2022.

* Projections for these sites are produced by BGS

Figure 7.1: Geographic regions

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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