Monthly water situation report

England

Summary – August 2018

The August rainfall total for England was close to normal for the time of year with 67 mm, representing 94% of the 1961-90 long-term average (97% of the 1981-2010 long-term average). The highest rainfall totals were in parts of north-west and south-east England. Soils got wetter in response to rainfall, but remain drier than average across almost all of England. Monthly mean river flows increased at almost two-thirds of indicator sites in August, compared to July, with normal flows recorded at over half of rivers. As is typical for the time of year, groundwater levels continued to decrease at all but two indicator sites and reservoir stocks reduced at the most of the reservoirs and reservoir groups across England. Reservoir storage for England fell at a lower rate than during July, stocks across England were 65% at the end of August.

Rainfall

August rainfall totals were generally higher than in June or July across England. The highest rainfall totals were in parts of north-west and south-east England. The River Esk catchment in Cumbria had the highest rainfall total with over 200 mm, representing 155% of the long-term average (LTA) for August. The lowest rainfall totals were in east Yorkshire, with the Hull and Humber area receiving 30 mm of rainfall (48% of LTA) (Figure 1.1 and Figure 1.2).

Across most of England, August rainfall totals were classed as normal for the time of year. In just under one-seventh of catchments rainfall totals were classed as below normal or lower. For England, the three month summer period (June, July and August) this year was the driest since 1995 and the fifth driest on record. This reflects the particularly dry conditions experienced across much of England during June and July (Figure 1.2). In the east Cotswolds and north Norfolk catchments and the upper Welland and Nene catchments, it was the second driest three month summer period on record.

At a regional scale the rainfall total for north-east England was classed as below normal for August (79% of LTA). In all other regions the rainfall totals were classed as normal for the time of year, representing between 86-115% of LTA. The August rainfall total for England was 67 mm, representing 94% of the 1961-90 LTA (97% of the 1981-2010 LTA) (Figure 1.3).

Soil moisture deficit

Soils were generally significantly drier than average at the end of July but soil moisture deficits decreased during August, as soils got wetter in response to rainfall. The lowest SMD values at the end of August were in the north-west of England, reflecting the higher rainfall totals in these catchments (Figure 2.1).

At a regional scale, soil moisture deficits reduced during August across England. Despite this, soils remained drier than average for the time of year at the end of the month. Soil moisture deficits were still above 100 mm in east, south-east and central England at the end of August (Figure 2.2).

River flows

Monthly mean river flows increased at almost two-thirds of indicator sites in August, compared to July. River flows were classed as normal or higher for the time of year at over half of indicator sites. Below normal monthly mean flows were recorded at two-fifths of indicator sites. Notably low monthly mean river flows were recorded on the River Don in Yorkshire and on the River Tone in Somerset (Figure 3.1).

The only regional index site where there was a reduction in the monthly mean flow, compared to July, was on the River Dove in central England. At all other regional index sites river flows increased during August. The biggest change was seen on the River Lune, in north-west England, where monthly mean flows were classed as exceptionally low in July, but responded to rainfall and were classed as normal in August (Figure 3.2). This pattern was reflected in most of the river flow indicator sites in north-west England, where notably low or exceptionally low flows were recorded in July, but where flows were classed as normal or above normal in August (Figure 3.1).

Groundwater levels

As is typical for the time of year, groundwater levels continued to decrease at all but two indicator sites during August. The two sites at which groundwater levels increased are in slower responding sandstone aquifers. Groundwater levels at the end of August were classed as normal or higher for the time of year at four-fifths of indicator sites. Below normal groundwater levels were recorded in the south-west Chilterns and East Chilterns chalk aquifers at Stonor Park and Ashley Green, the Burford Jurassic limestone aquifer at Jackaments Bottom and in the Fylde and Preston sandstone aquifer at Crow Lady Farm. The end of month groundwater level in the Idle and Torne sandstone aquifer at Crossley Hill was classed as notably low (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks reduced at the most of the reservoirs and reservoir groups across England during August but generally at a lower rate than during July. However, small increases in reservoir stocks were seen at just under a fifth of reservoirs and reservoir groups. Stocks in the Lower Lee Group (south-east England) increased 5% during the month to 76% of capacity at the end of August (Figure 5.1).

At just under half of the reservoirs and reservoir groups, stocks were classed as normal for the time of year at the end of August. Stocks in nine reservoirs or reservoir groups were classed as below normal, five were notably low and the Derwent Valley and Dove reservoir groups were classed as exceptionally low for the time of year. Reductions in reservoir stocks of more than 10% of capacity were seen at just under a third of reservoirs or reservoir groups. This included decreases of 13% of capacity in the Derwent Valley Group and 12% of capacity in the Dove reservoir group, during August.

Regional reservoir stocks decreased for all regions, ranging from a decrease of 1% of capacity in north-east and north-west England to a decrease of 12% of capacity in central England. Total reservoir storage for England was at 65% of capacity at the end of August, a reduction of 4.5% over then month (Figure 5.2).

Forward look

September's weather is expected to be mixed, with showers and rain affecting most areas at times, particularly in the north and west of the UK where it will also be cooler. Slightly more settled and warmer weather is likely at times in the south and south-east. For the 3-month period September-October-November, below average precipitation is slightly more likely than above average precipitation[1].

Projections for river flows at key sites[2]

Just over two-thirds of the modelled sites have a greater than expected chance of cumulative river flows being below normal or lower for the time of year by the end of September 2018. By the end of March 2019, all of the modelled sites have a greater than expected chance of being below normal or lower for the time of year.

For scenario based projections of cumulative river flows at key sites by September 2018 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2019 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2018 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2019 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

Just over 80% of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year at the end of September 2018. By the end of March 2019, nearly two-thirds of the modelled sites have a greater than expected chance of groundwater levels being below normal or lower for the time of year.

For scenario based projections of groundwater levels in key aquifers in September 2018 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2019 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2018 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2019 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

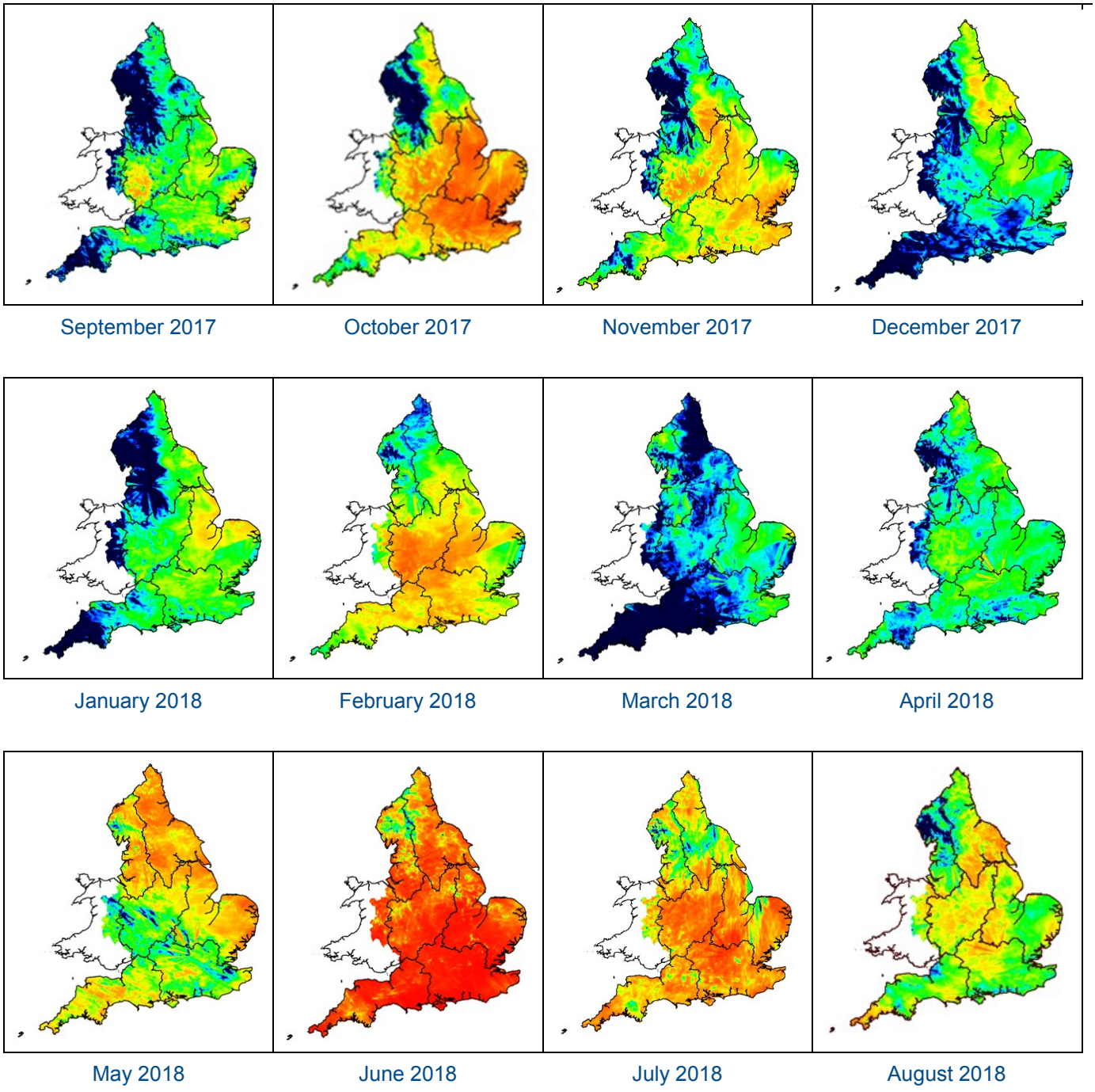


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2018). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.

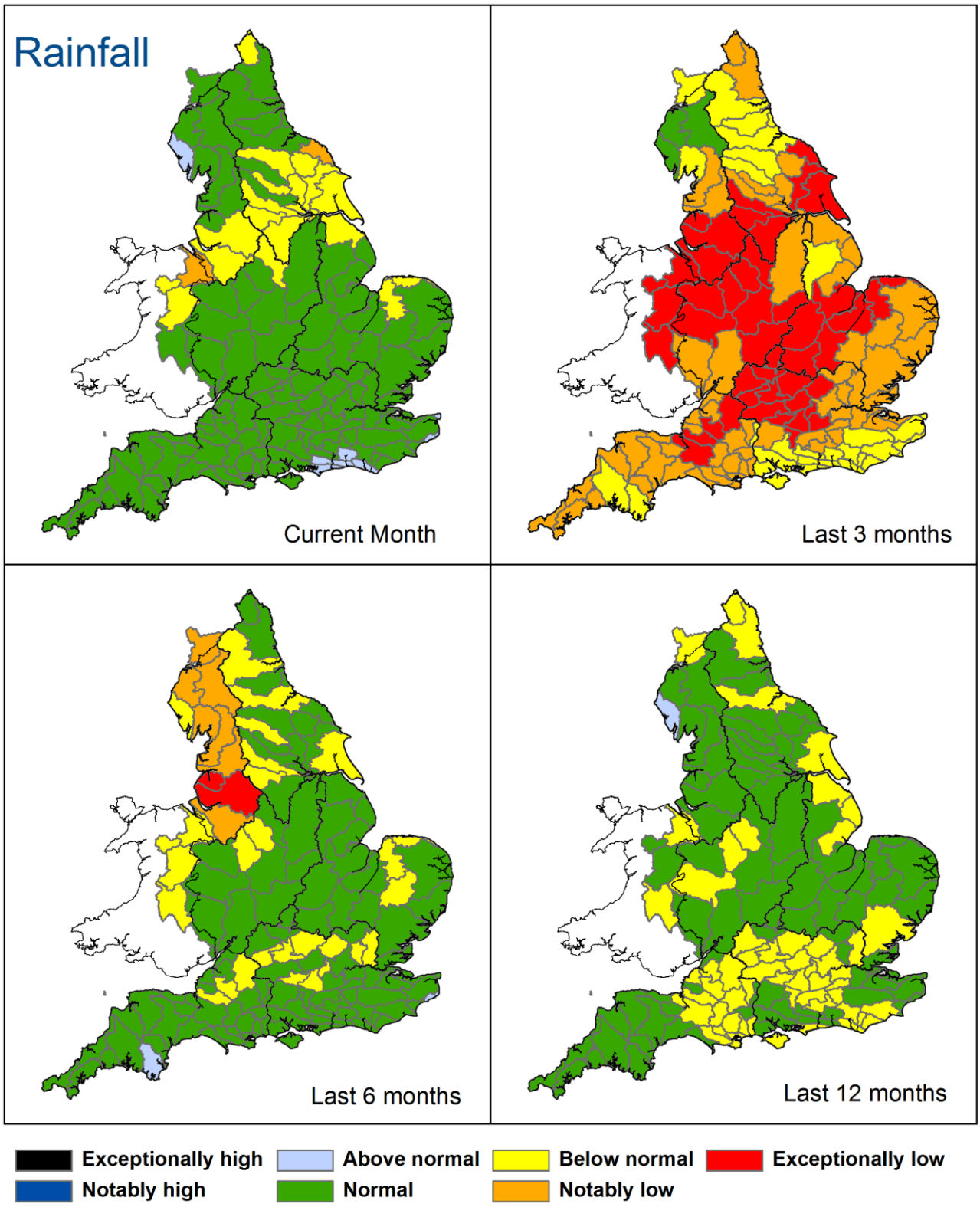


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 August), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2018)*. Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.

Rainfall charts

Above average rainfall

Below average rainfall

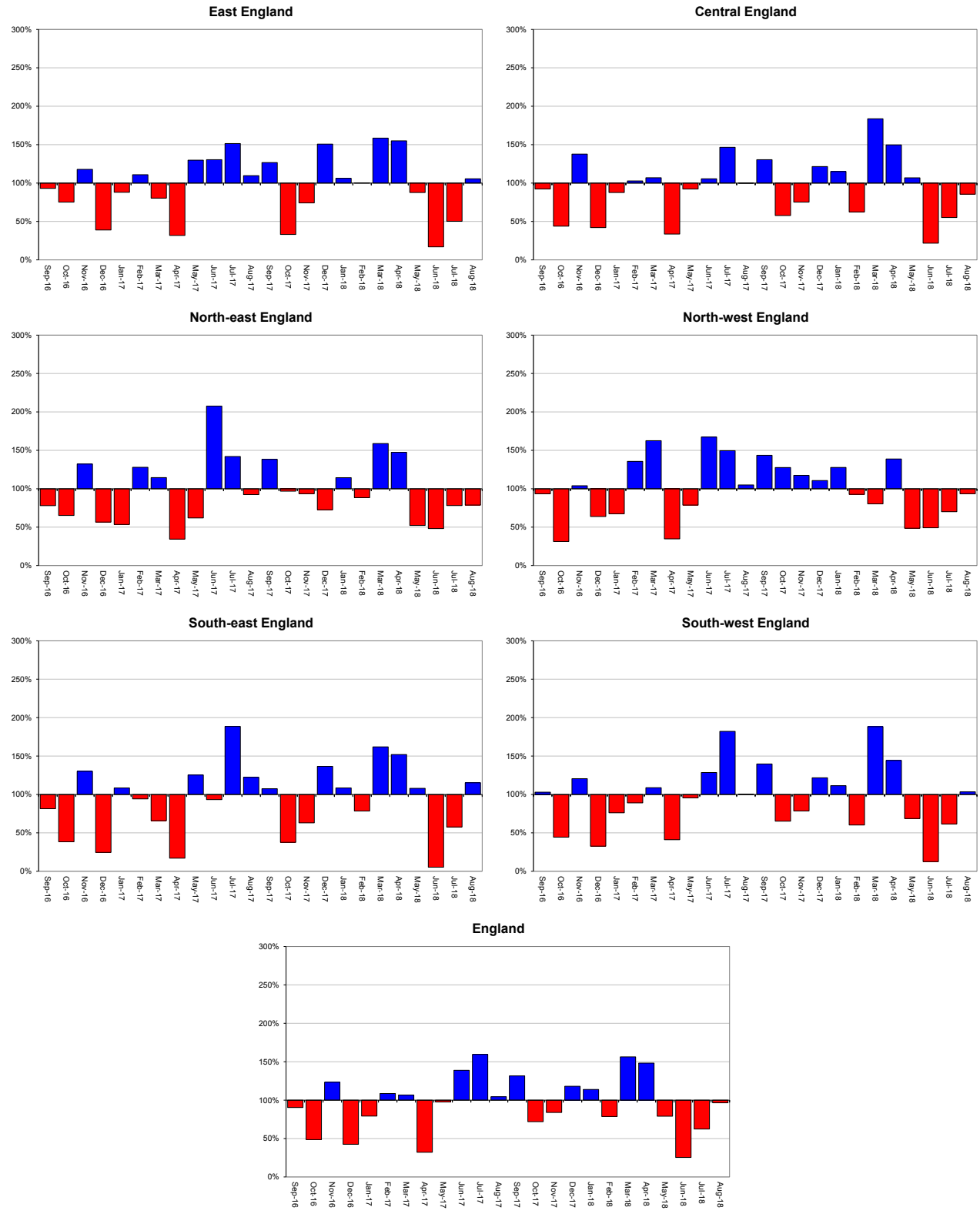


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2018).

Soil moisture deficit

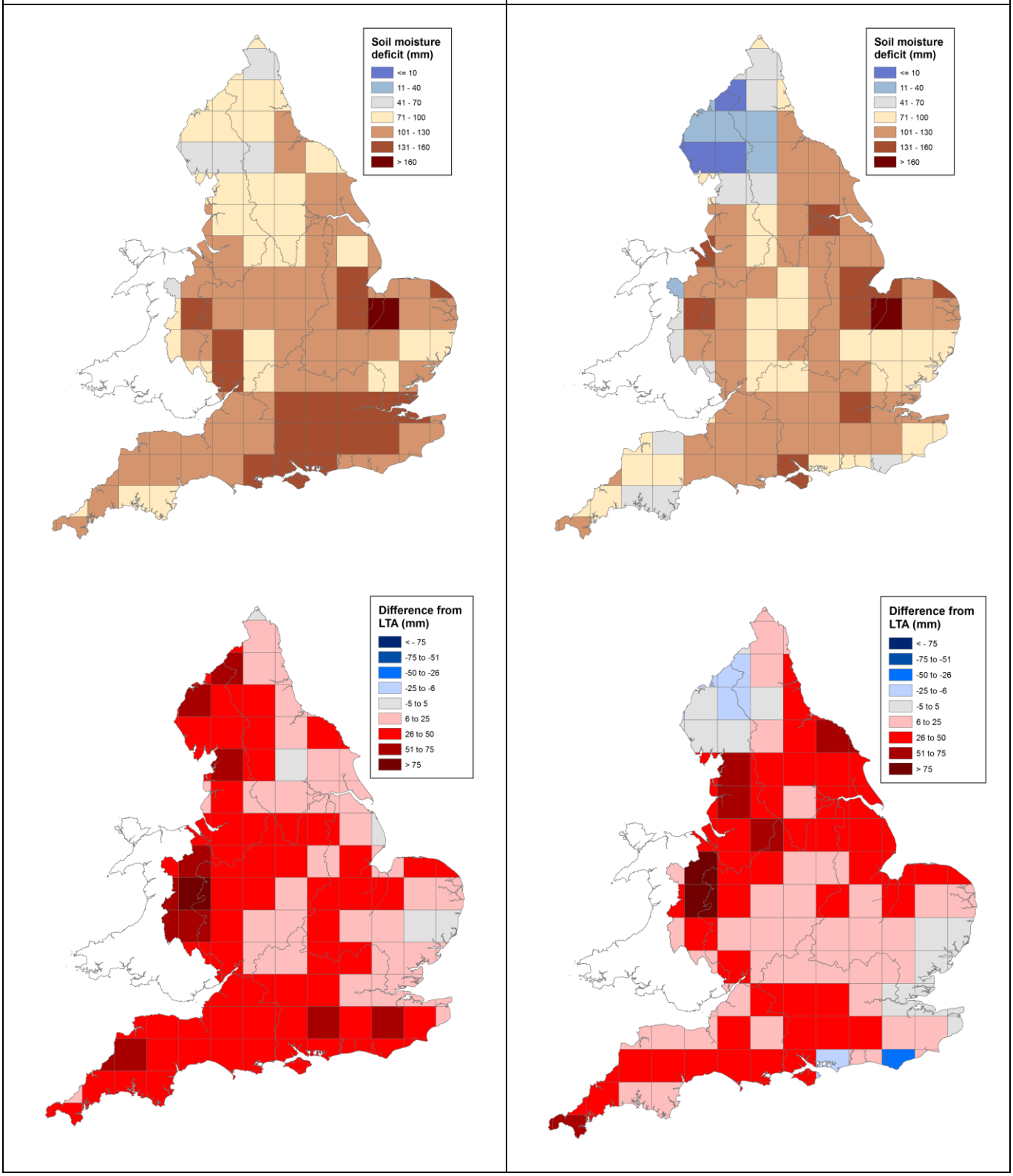
End of July 2018[1]	End of August 2018[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 31 July 2018 [1] (left panel) and 28 August 2018 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2018). Crown copyright. All rights reserved. Environment Agency, 100026380, 2018

Soil moisture deficit charts

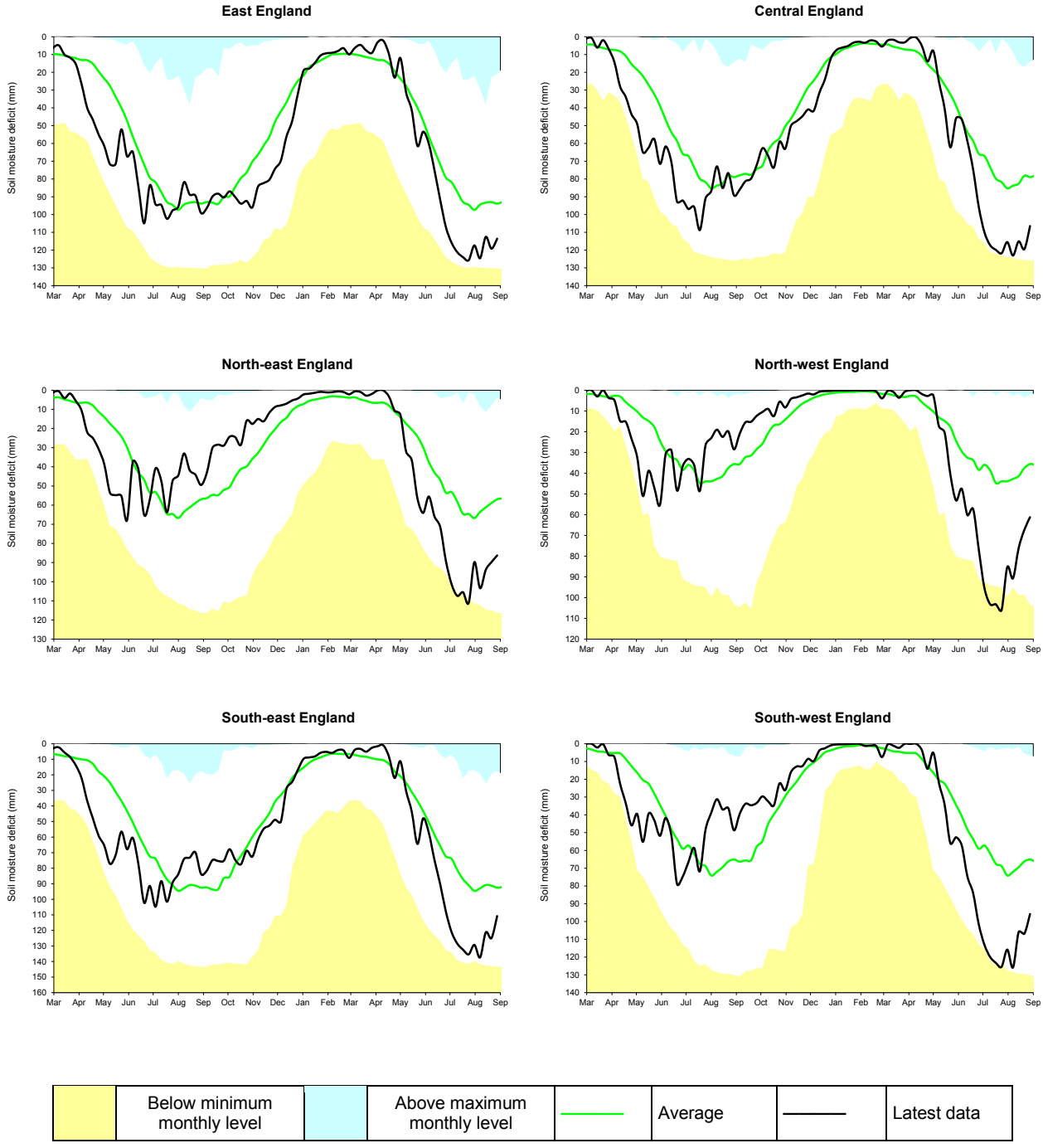
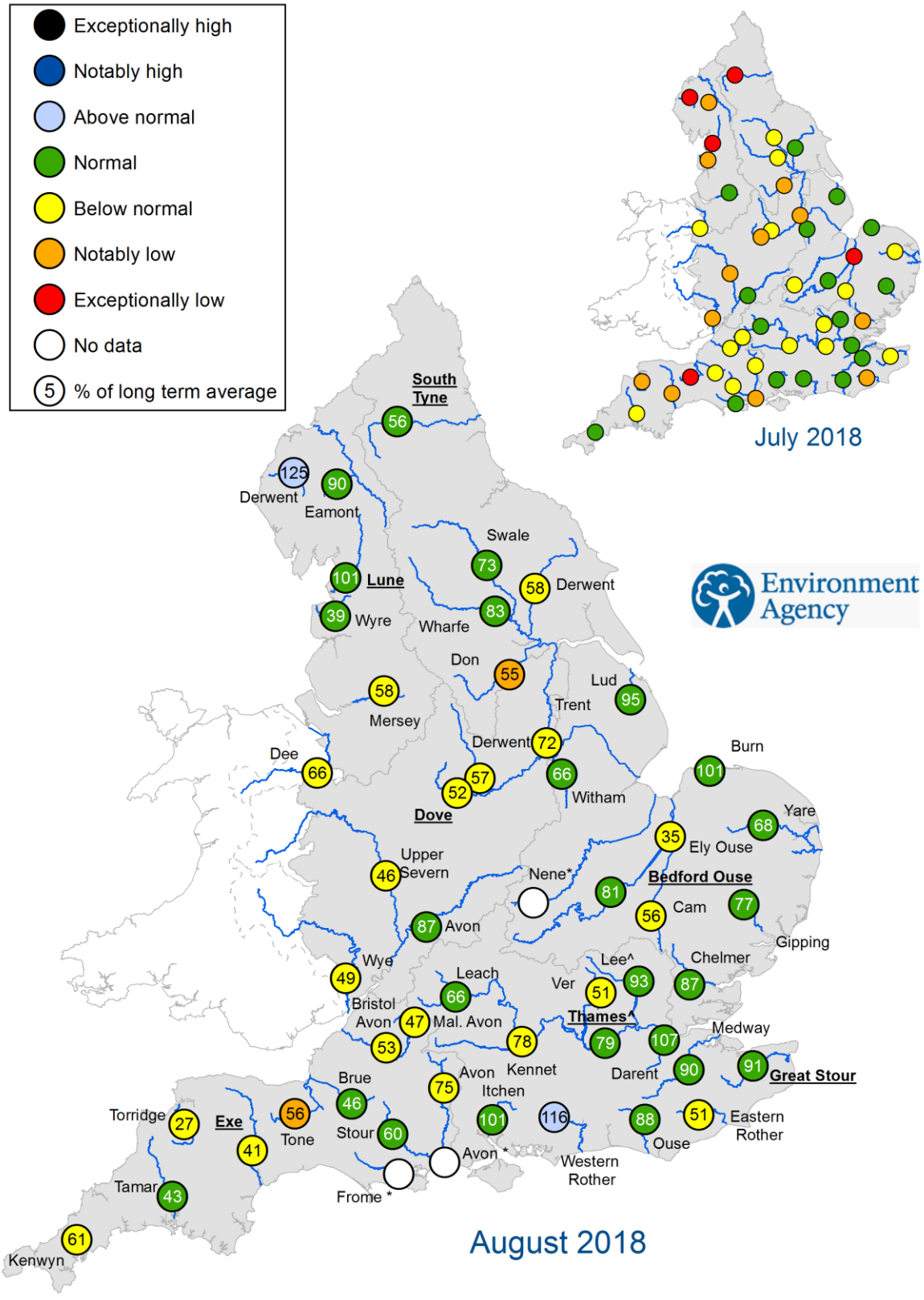


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2018).

River flows



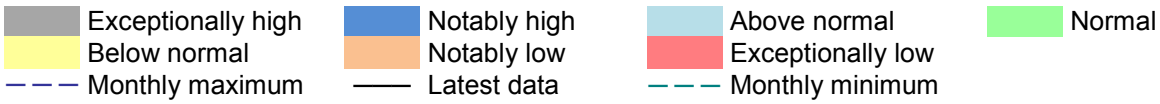
^ "Naturalised" flows are provided for the River Thames at Kingston and the River Lee at Feildes Weir

* River flow data not available or not of sufficient quality

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 July and August 2018, expressed as a percentage of the respective long term average and classed relative to an analysis of historic July and August monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.

River flow charts



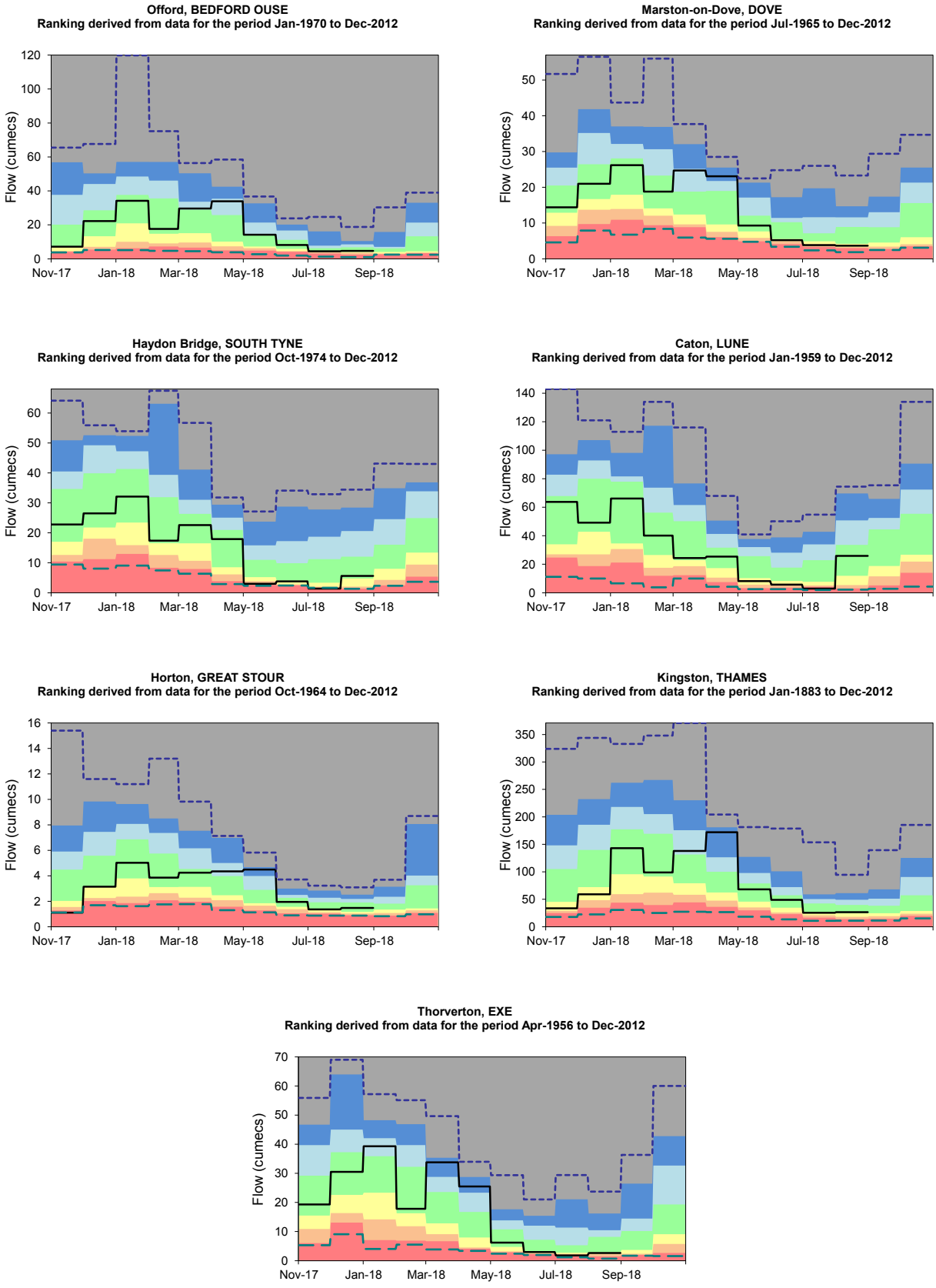
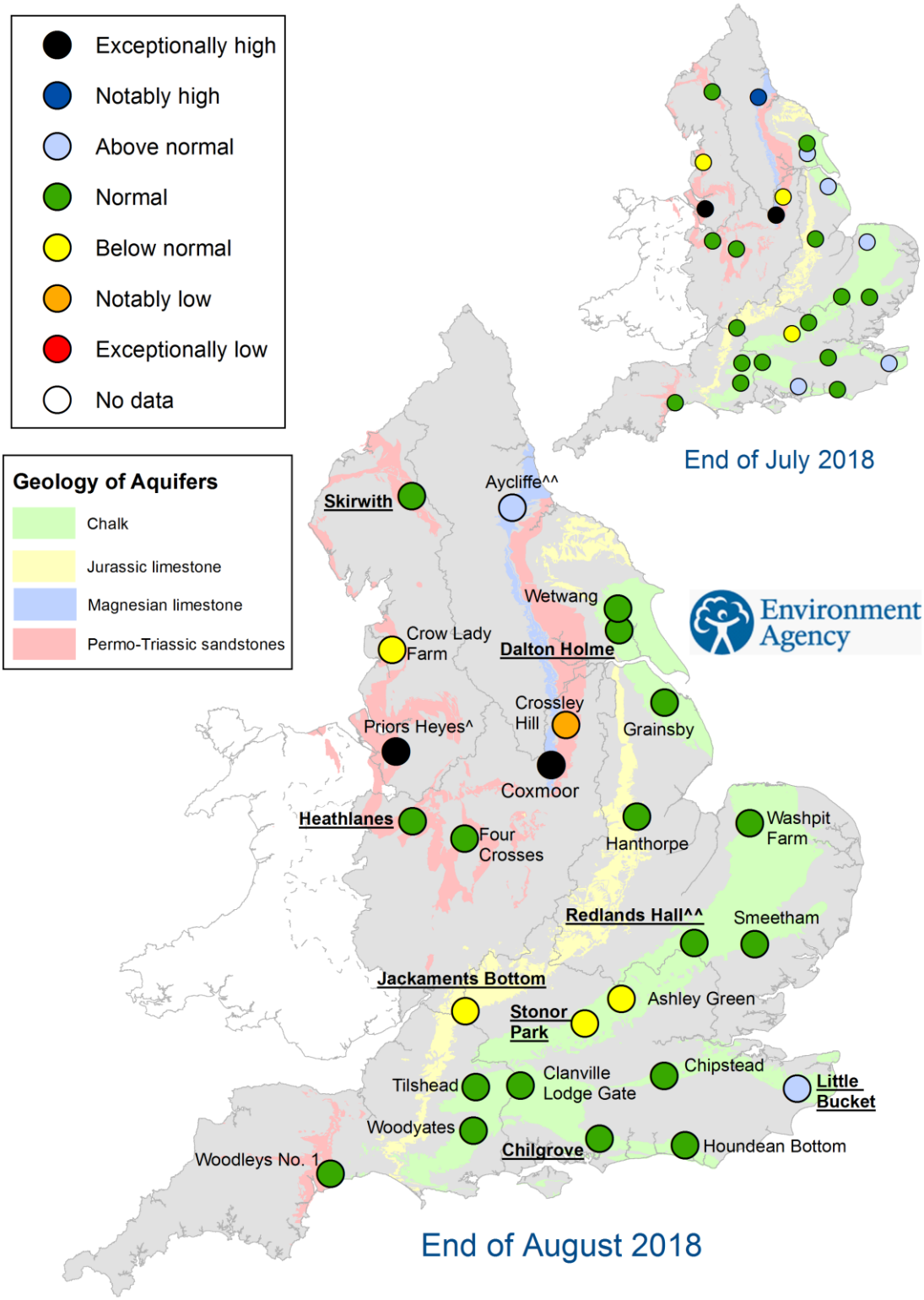


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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
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 July and August 2018, classed relative to an analysis of respective historic July and August levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.

Groundwater level charts

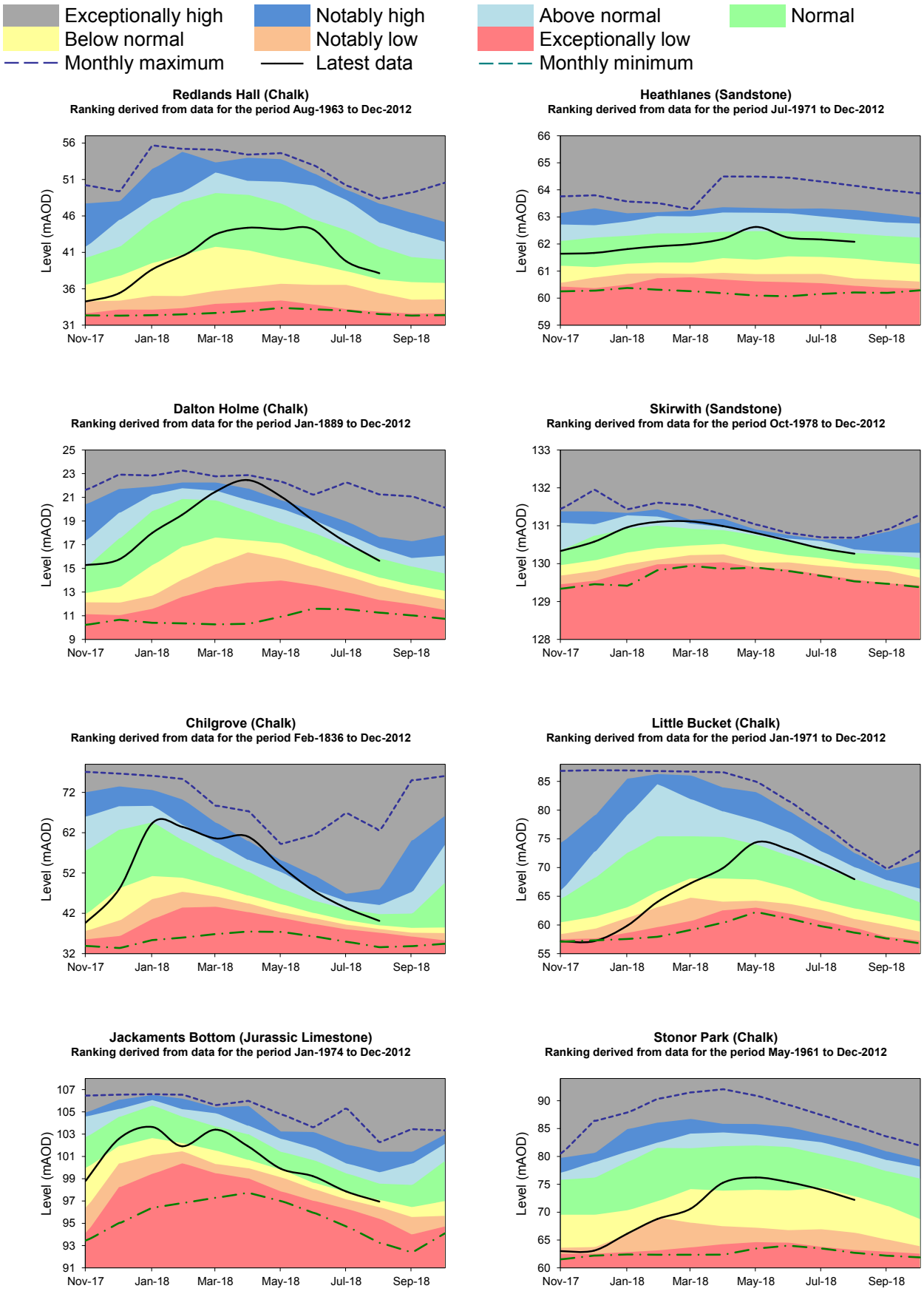
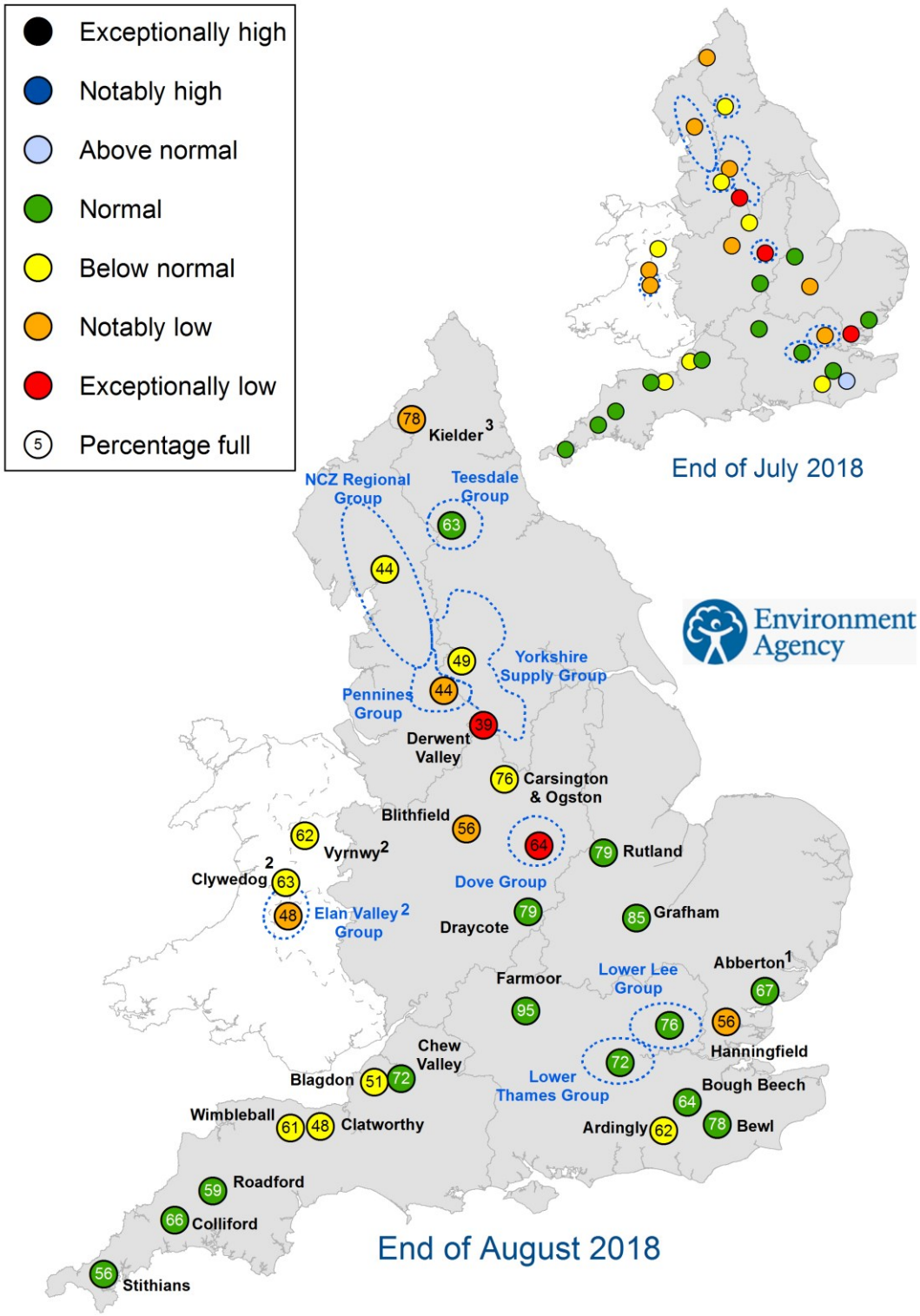


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2018).

Reservoir storage



1. Current levels at Abberton Reservoir in east England are relative to increased capacity
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to Central and north-west England
3. Current levels at Kielder are lower than historical levels due to the implementation of a new flood alleviation control curve

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of July and August 2018 as a percentage of total capacity and classed relative to an analysis of historic July and August 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

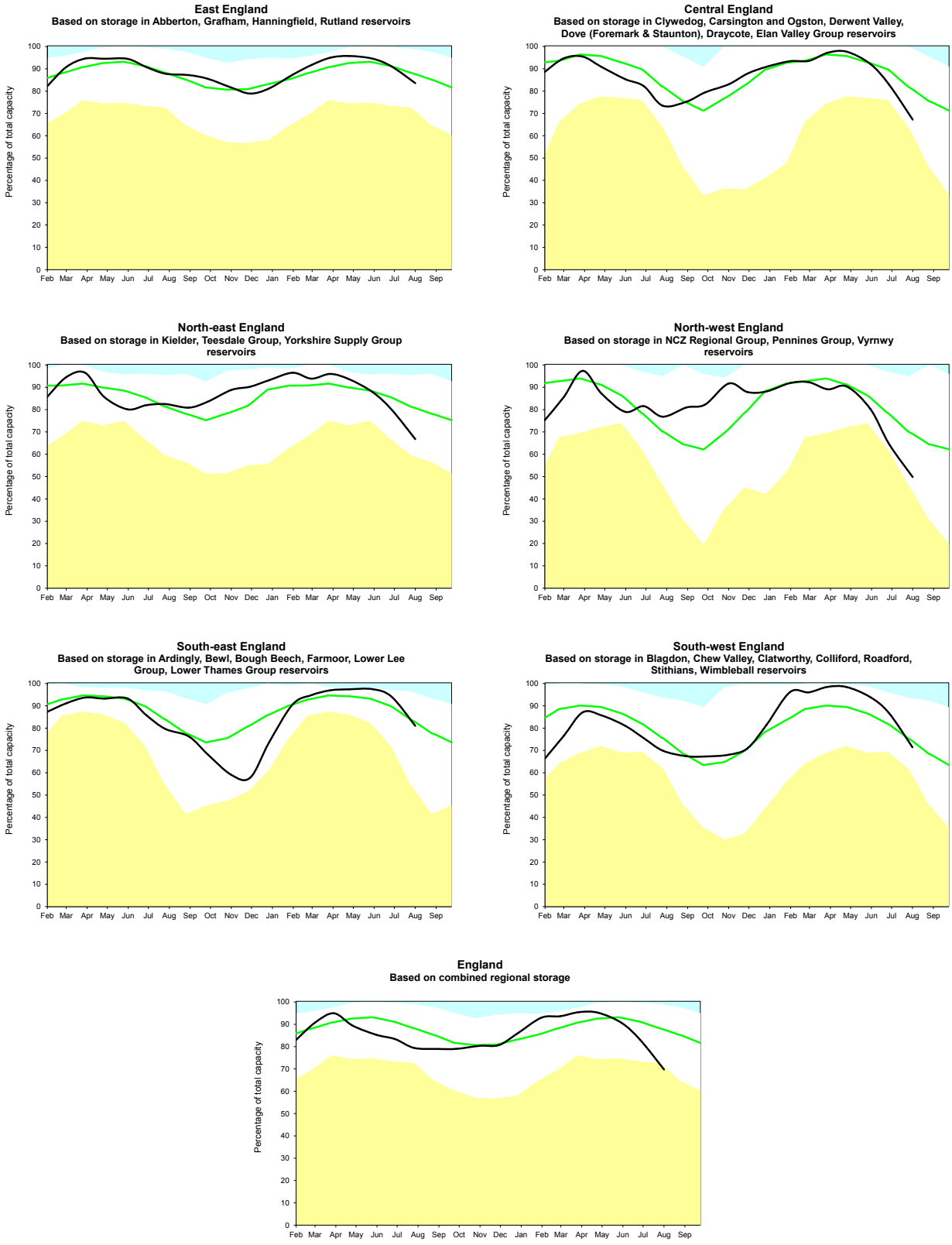


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

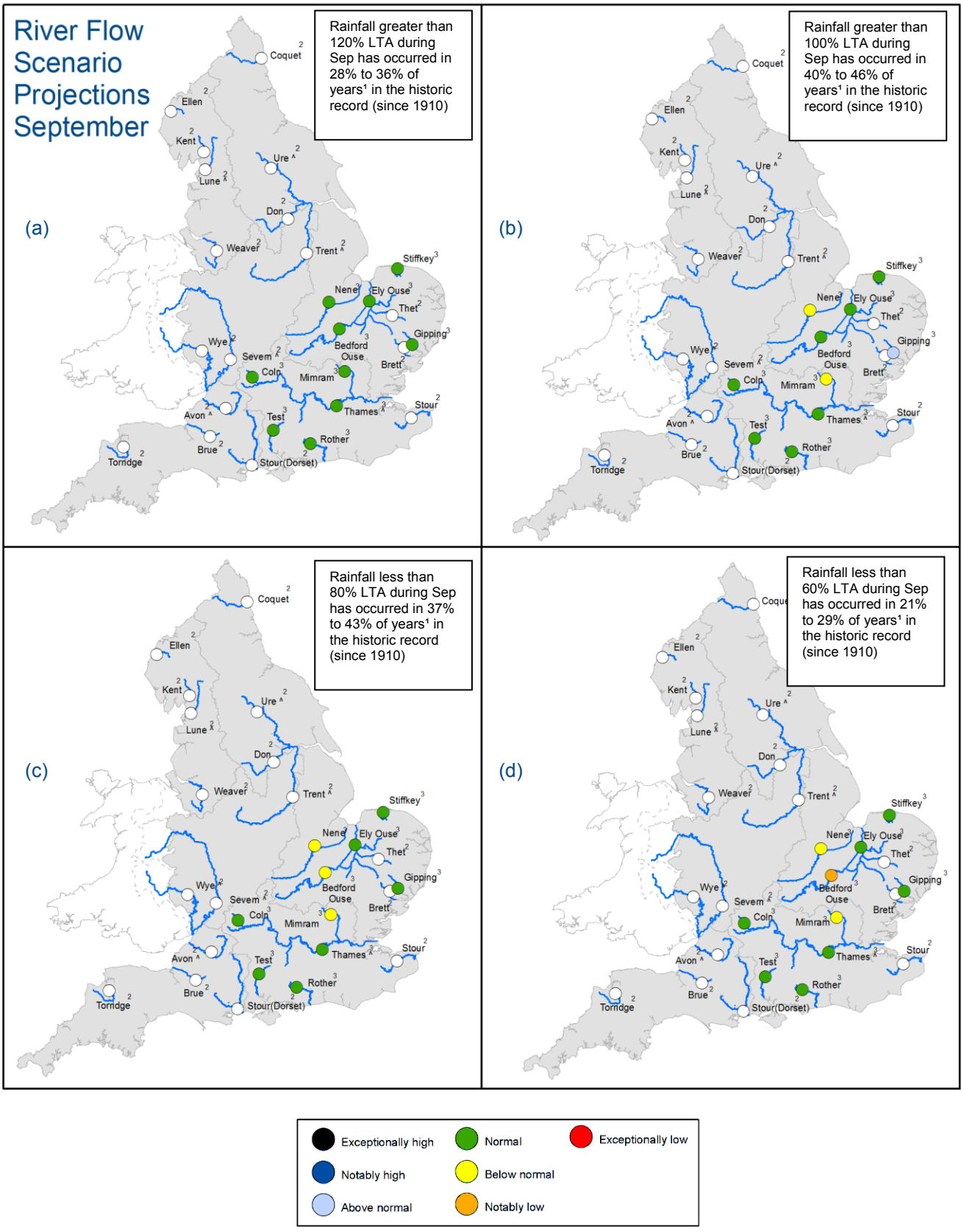


Figure 6.1: Projected river flows at key indicator sites up until the end September 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during September 2018 (Source: Centre for Ecology and Hydrology, Environment Agency).

[1] This range of probabilities is a regional analysis
[2] Projections for these sites are produced by CEH (note: data for these sites unavailable this month)
[3] Projections for these sites are produced by the Environment Agency
^ *"Naturalised" flows are projected for these sites*

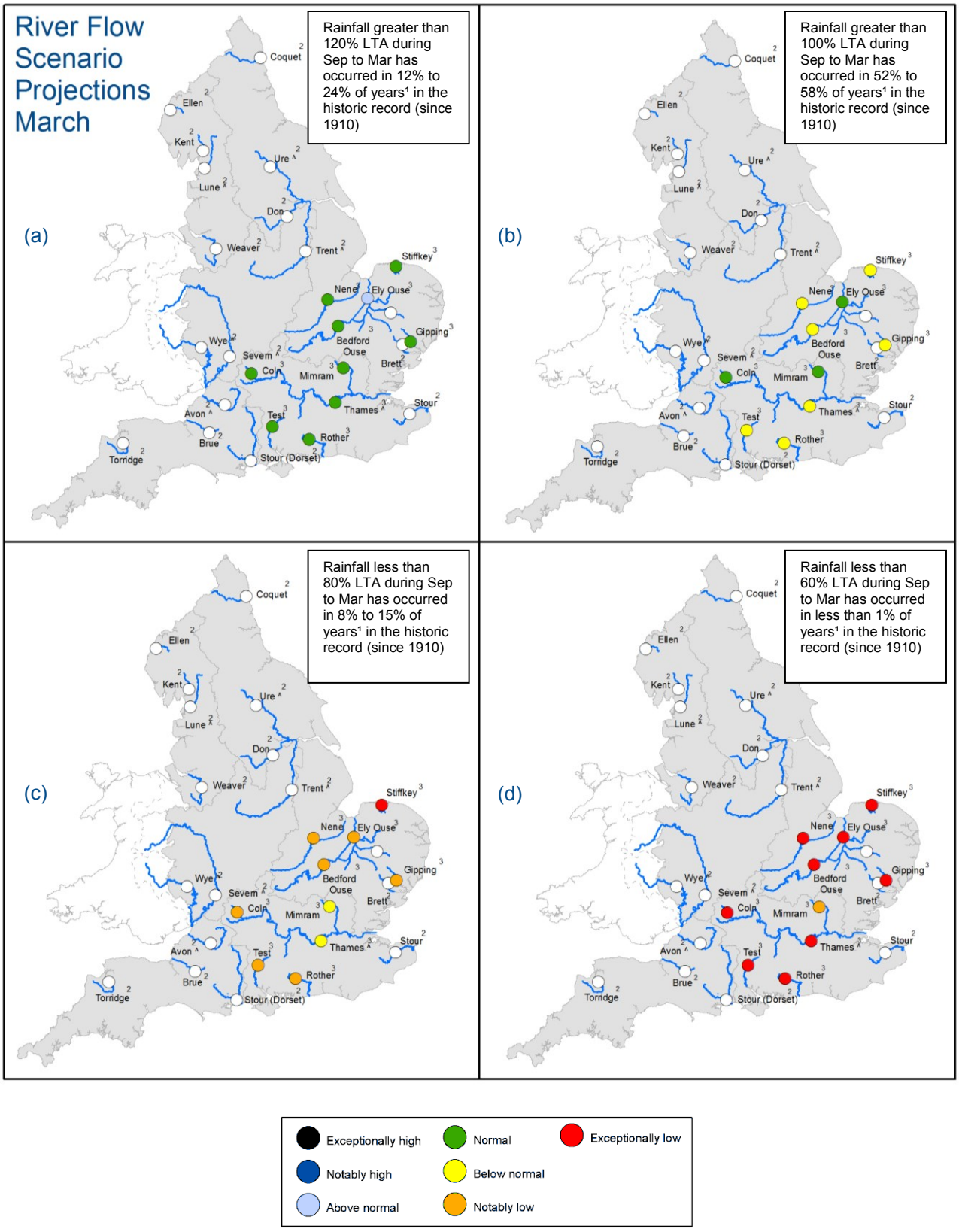


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between September 2018 and March 2019 (Source: Centre for Ecology and Hydrology, Environment Agency).

[1] This range of probabilities is a regional analysis
[2] Projections for these sites are produced by CEH (note: data for these sites unavailable this month)
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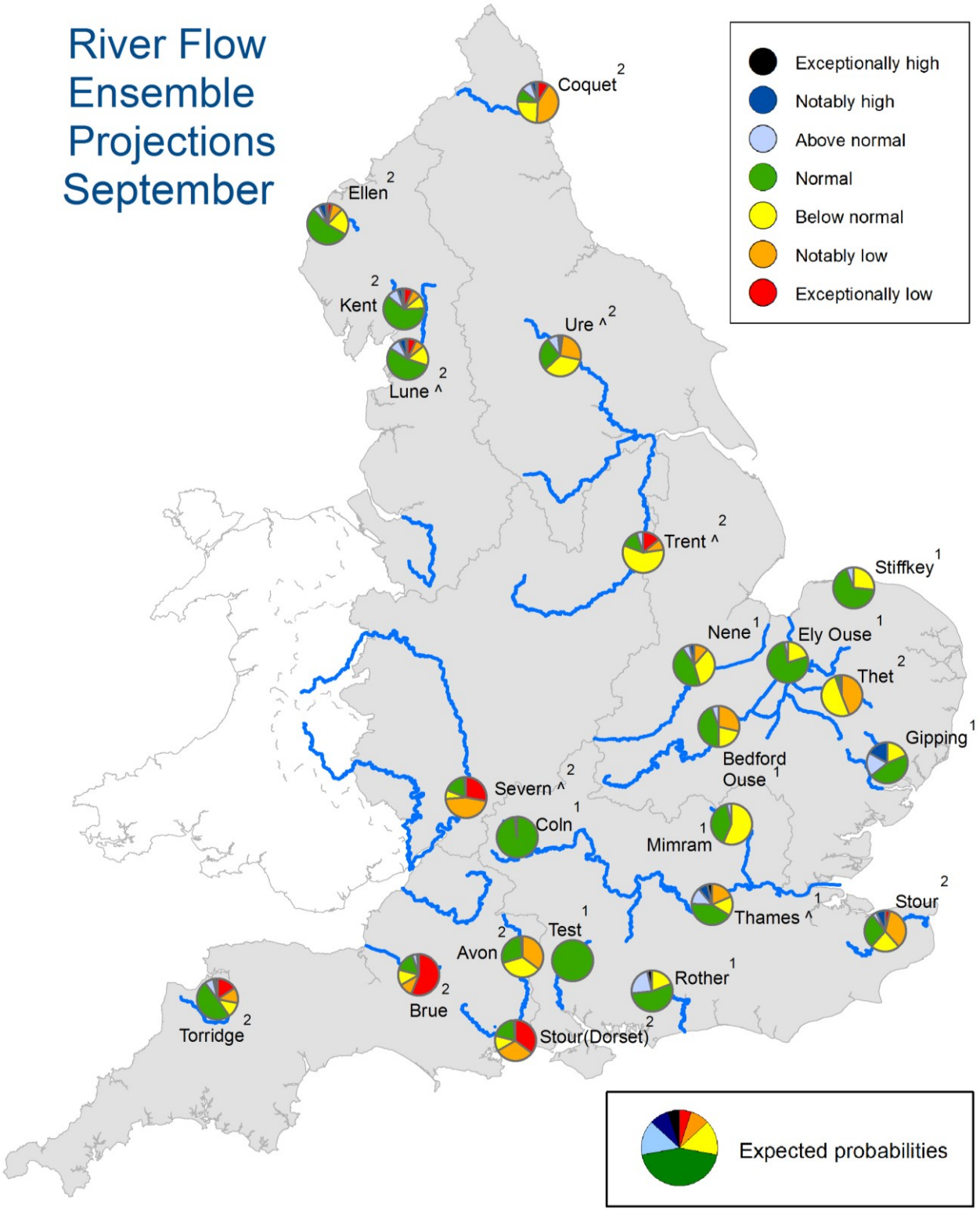

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2018. 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

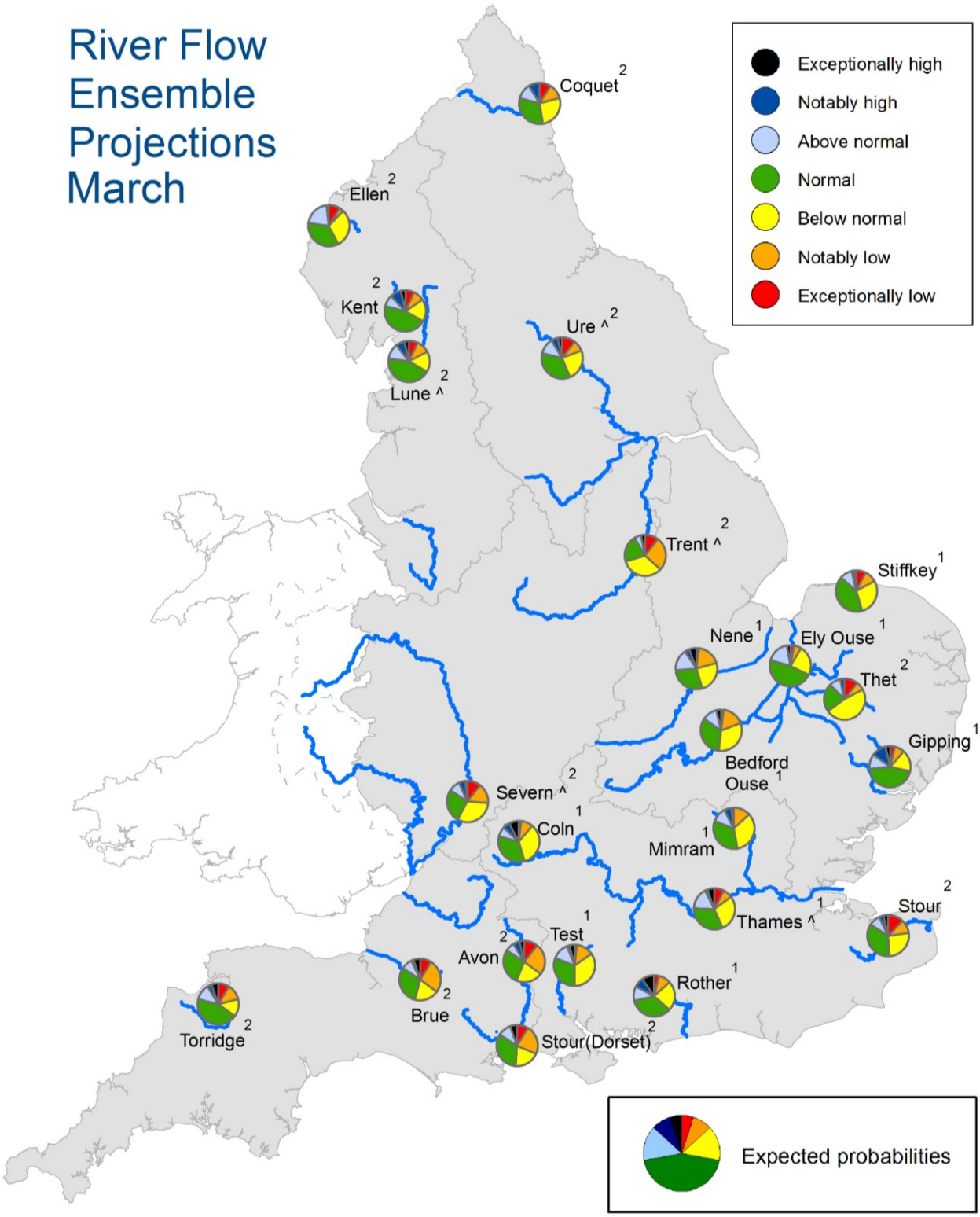

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2019. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the 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

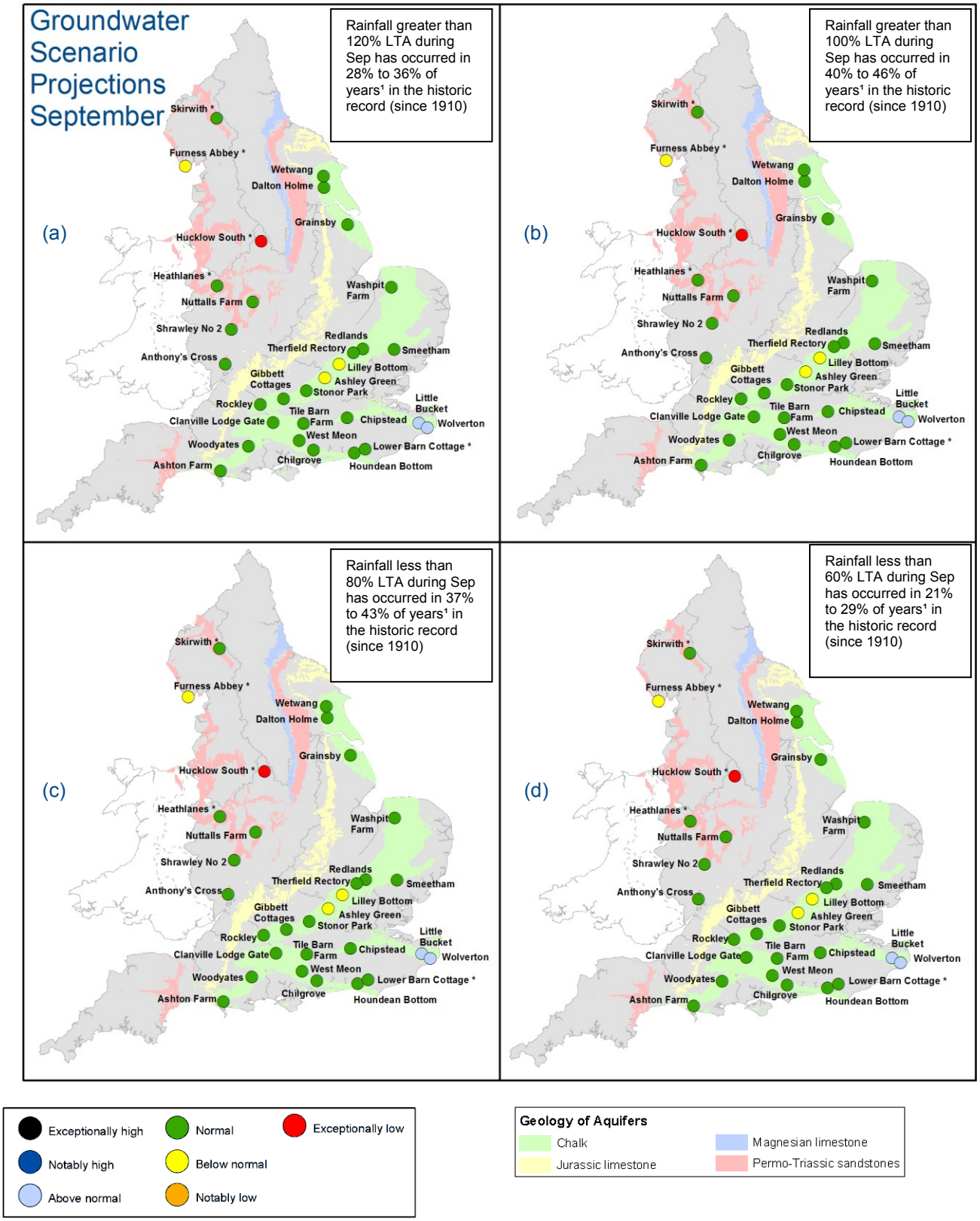

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during September 2018 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2018.

* Projections for these sites are produced by BGS

[1] This range of probabilities is a regional analysis

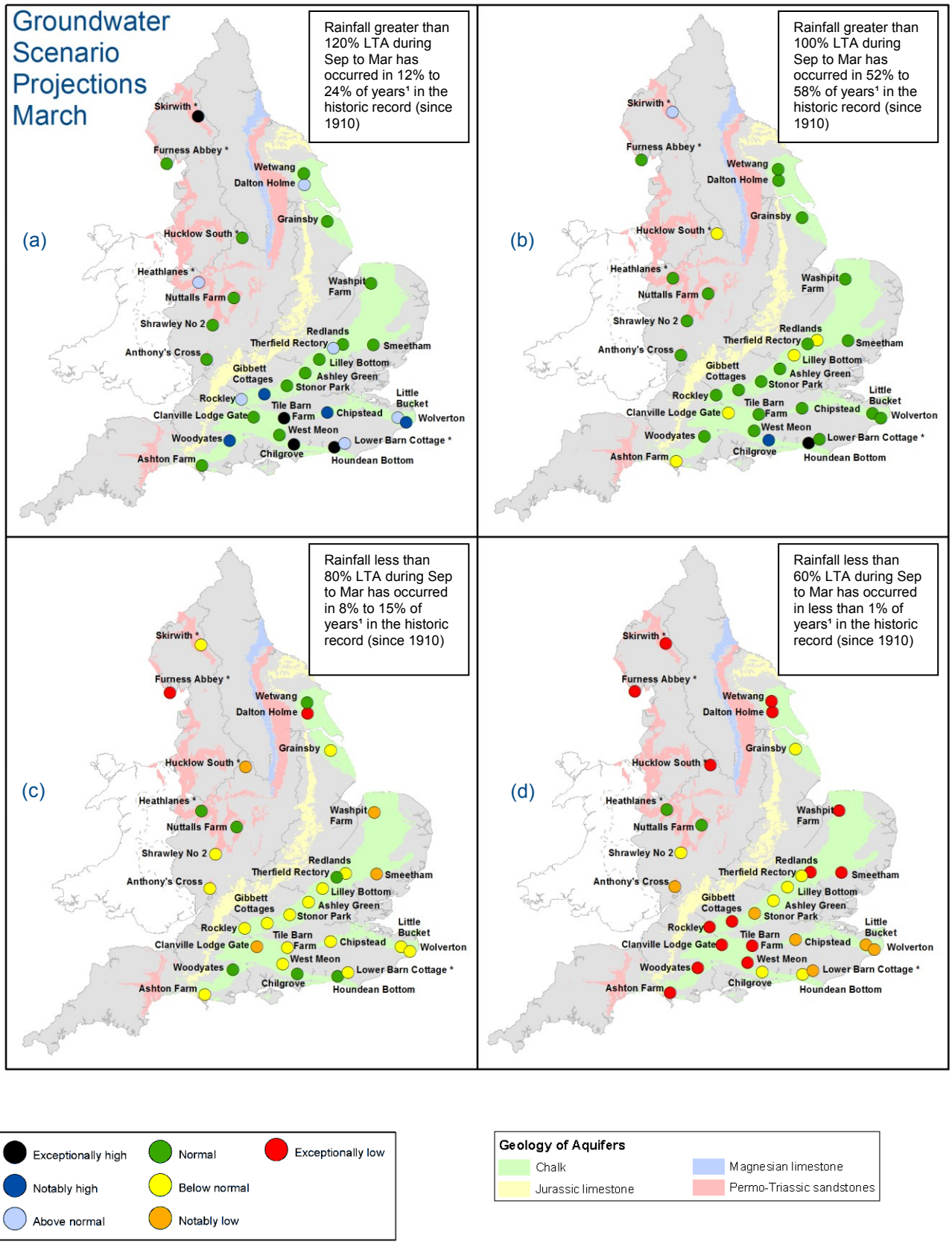

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between September 2018 and March 2019 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2018.

* Projections for these sites are produced by BGS

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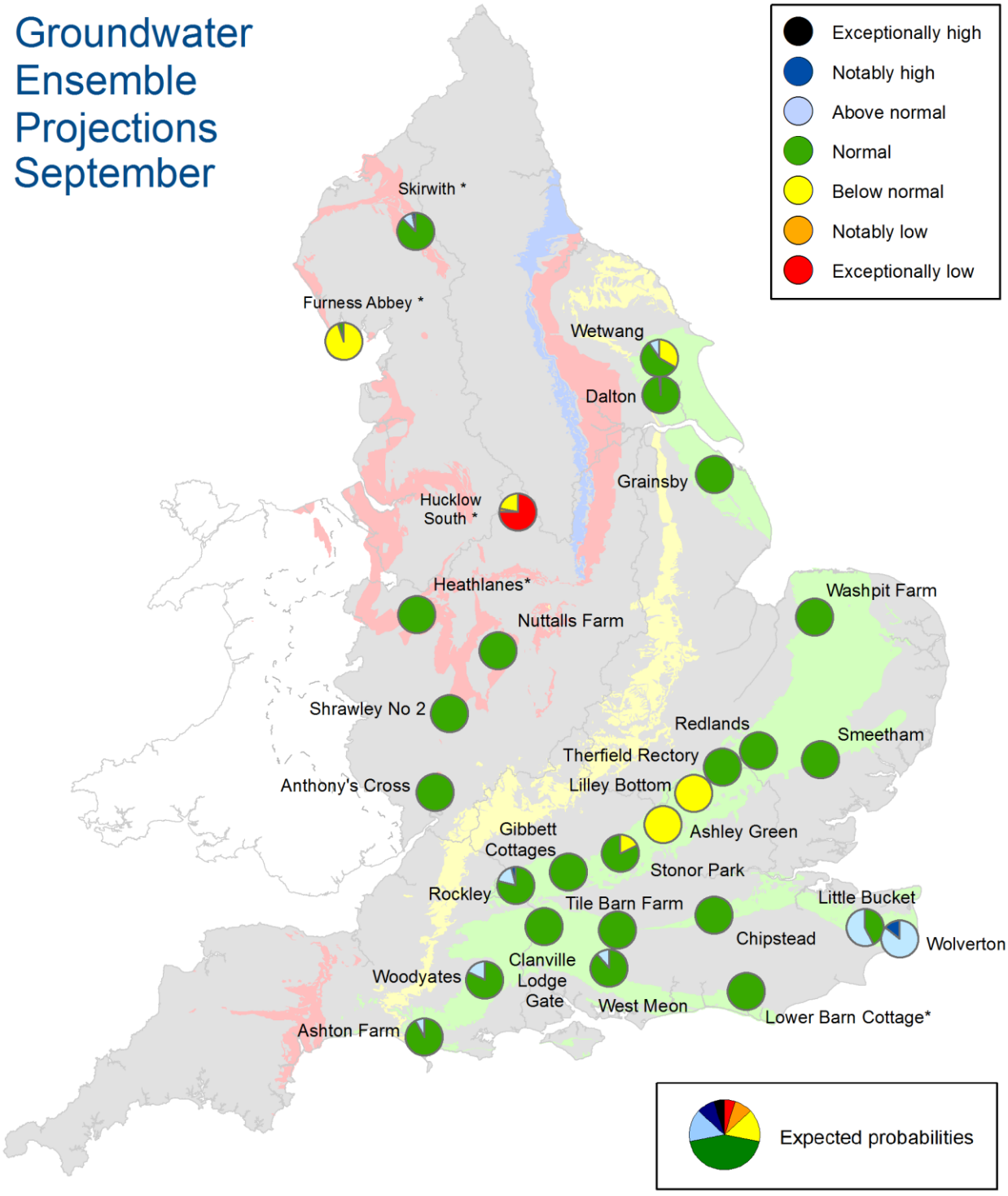
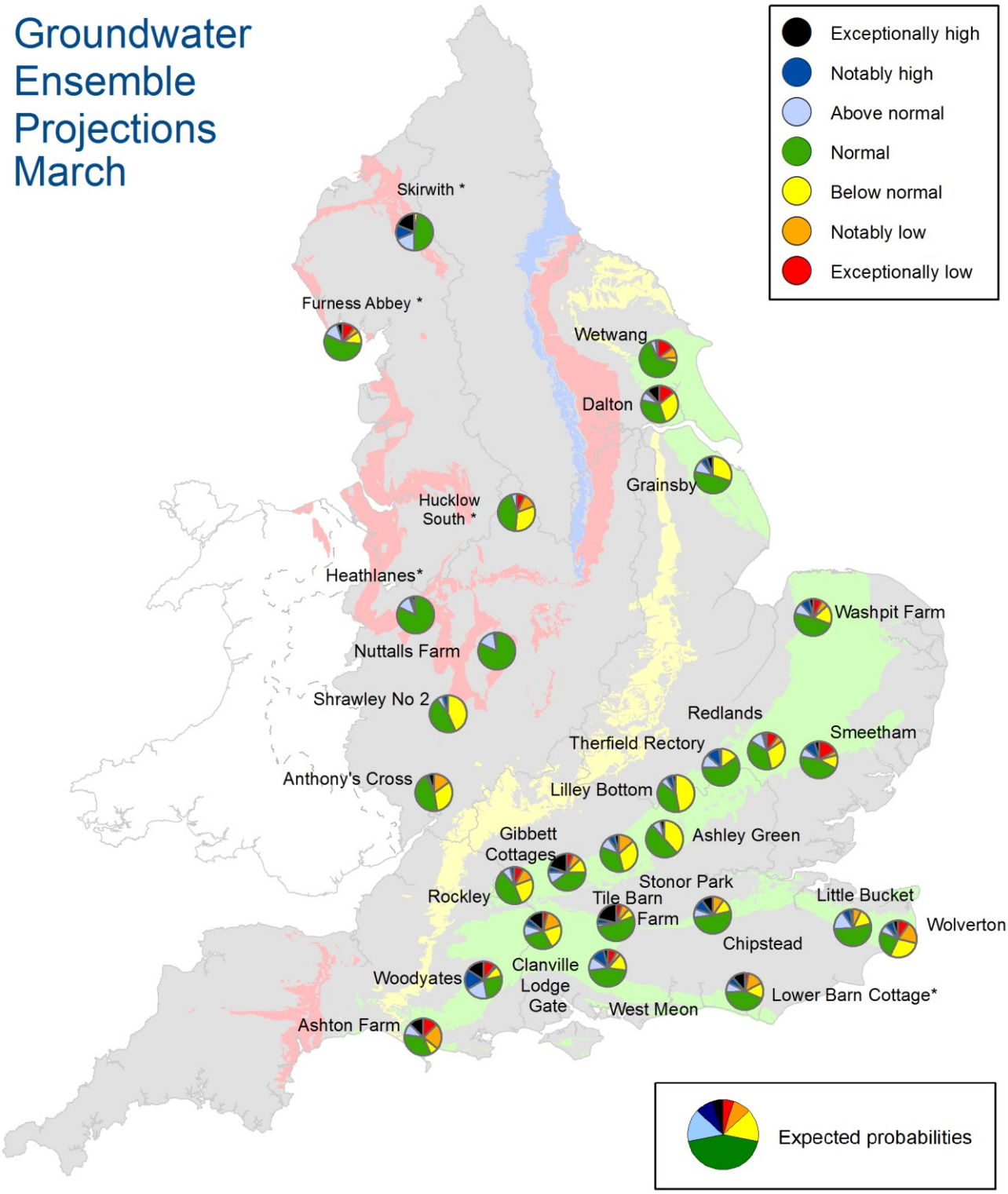


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2018. 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, 100026380, 2018.

** 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 March 2019. 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, 100026380, 2018.

* 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 1961-1990, 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