Monthly water situation report

England

Summary – February 2018

February's rainfall was below average across England at 77% of the monthly long-term average. Soil moisture deficits remained small across almost all of England. Mean monthly river flows were lower in February than in January at most indicator stations. River flows were in the normal range for the time of year in most reported catchments. Groundwater levels at the end of February were normal or higher for the time of year at the majority of indicator sites. However, eight groundwater indicator sites ended the month at below normal levels, two were at notably low levels and one was at an exceptionally low level for the time of year at the end of February. Overall reservoir storage in England was at 94% of total capacity at the end of February.

Rainfall

The average rainfall total for February across England was 77% of the 1961-90 monthly long-term average (74% of 1981-2010 LTA). Rainfall totals were generally highest in the North of England, and lowest in Central England. The Esk catchment in Cumbria received the highest rainfall total at 119 mm (122% of LTA). The Lower Severn catchment and River Ock catchment (Oxfordshire) received the lowest rainfall totals (both 25 mm) during February, representing 50% and 59% of the long-term average respectively. (Figure 1.1)

February rainfall totals were classed as normal for the time of year across the majority of hydrological areas. Rainfall totals were below normal in just over an eighth of hydrological areas. The 3, 6 and 12 month cumulative rainfall totals were normal across the majority of hydrological areas. However both the 6 and 12 month cumulative rainfall maps highlight parts of central, south-east and south-west England where rainfall totals were below normal or lower (Figure 1.2).

At a regional scale, February rainfall totals for central England represented 62% of LTA, with regional totals ranging up to 100% of LTA in east England (Figure 1.3).

Soil moisture deficit

The drier than average month led to a slight increase in soil moisture deficits (SMDs) in many areas during February. SMDs remained small however, and were at less than 10 mm across almost all of England at the end of February. Reductions in SMD were seen around the lower River Thames. Larger SMD values of 21-30 mm persisted in small areas of central and south-east England (Figure 2.1). At a regional scale average end of month SMDs ranged from 2 mm in north-east England to 10 mm in east England (Figure 2.2).

River flows

Monthly mean river flows at most indicator sites in England decreased for February in comparison to flows in January. River flows were normal or higher for the time of year at nine tenths of indicator sites. Five indicator sites recorded below normal monthly mean flows, including the groundwater-fed River Ver in Hertfordshire, where flows were notably low in January (Figure 3.1).

The regional index sites reflected the general national pattern in the change in river flows for February; monthly mean flows reduced in comparison to January, but were normal for the time of year (Figure 3.2).

Groundwater levels

Groundwater levels increased at just under three-quarters of indicator sites during February. Groundwater levels at the end of February were normal or higher for the time of year at the majority of indicator sites. However, eight indicator sites ended the month at below normal levels and two were at notably low levels for February; this included Woodleys No.1 (Otter Valley sandstone, Devon), which had been at an exceptionally low level for the time of year at the end of January. The groundwater at Crossley Hill (Permio-Triassic sandstone, Nottinghamshire) had fallen to an exceptionally low level for the time of year at the end of February (Figures 4.1 and 4.2).

Reservoir storage

Overall reservoir storage in England was at 94% of total capacity at the end of February. Reservoirs remained full or stocks increased in over three-fifths of reported reservoirs during the month. The most notable change in reservoir storage was at Bewl reservoir where storage increased from 64% of capacity at the end of January to 88% of capacity at the end of February. End of month stocks were classed as normal or higher for the time of year at all but 5 reported reservoirs and reservoir groups (Figure 5.1). Regional reservoir stocks were above 90% of capacity across all regions at the end of February, ranging from 92% in east England to 96% in south-west England (Figure 5.2).

Forward look

The weather for March is expected to be generally unsettled, with spells of heavy rain across much of England, combined with periods of sunny spells and blustery showers. For the 3-month period March-April-May, above average precipitation is slightly more likely than below average precipitation[1].

Projections for river flows at key sites[2]

More than three-quarters 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 March 2018. By the end of September 2018, two-thirds of the modelled sites have a greater than expected chance of cumulative flows being below normal or lower for the time of year.

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

Projections for groundwater levels in key aquifers[2]

Just over half of the modelled sites have a greater than expected chance of groundwater levels being below normal or lower for the time of year at the end of March 2018 and at the end of September 2018.

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

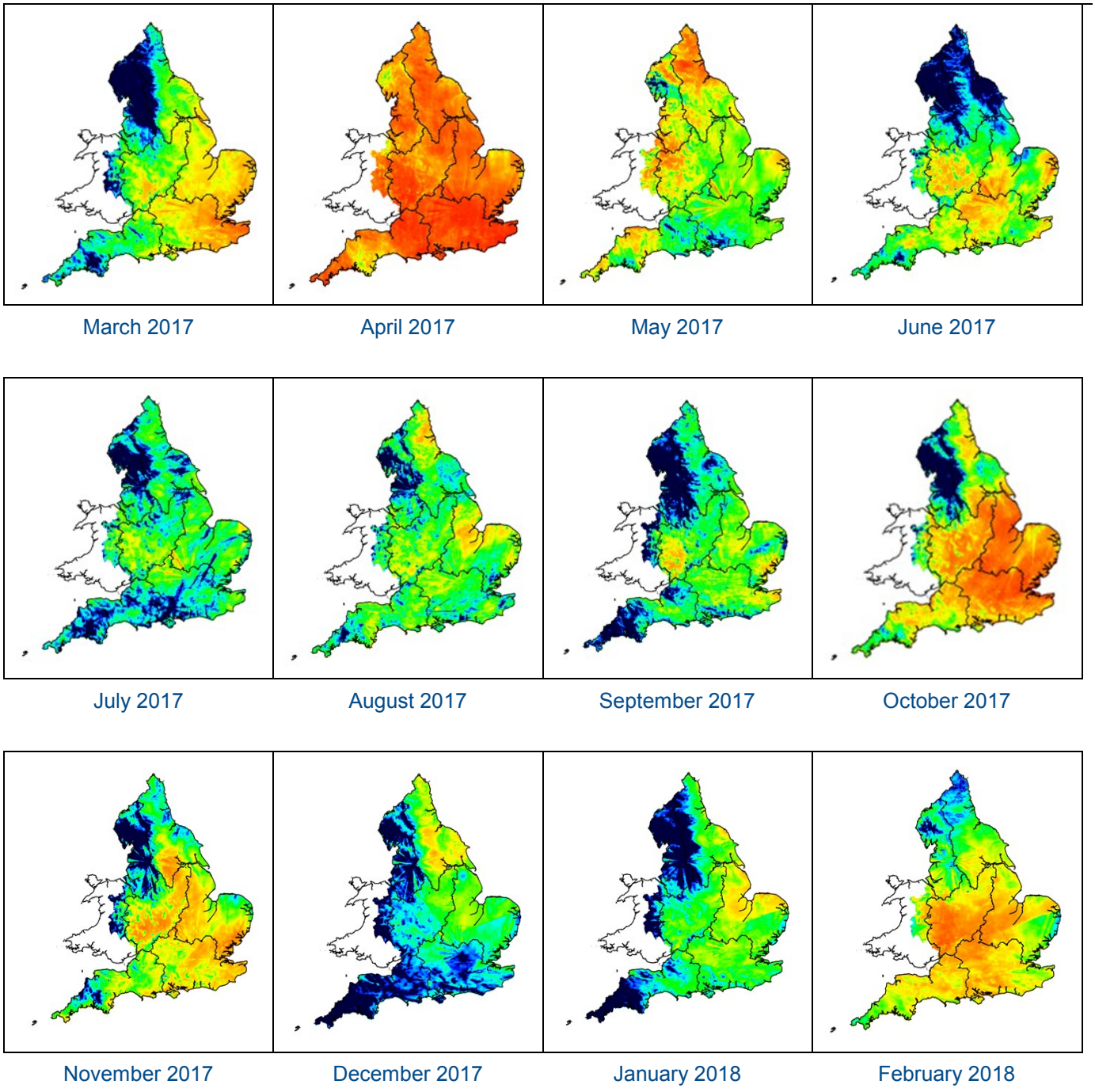


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2018). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.

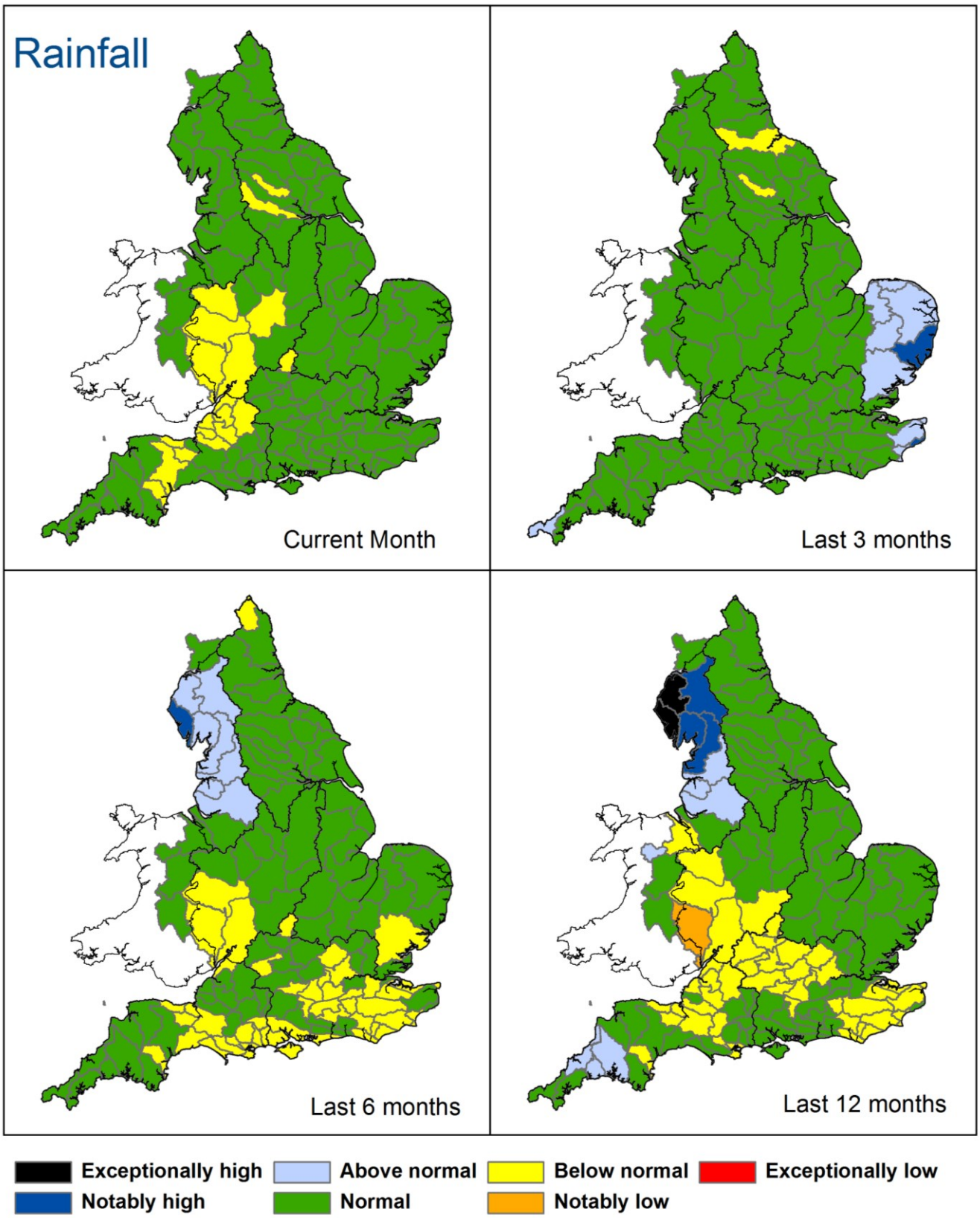


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 28 February), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met 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

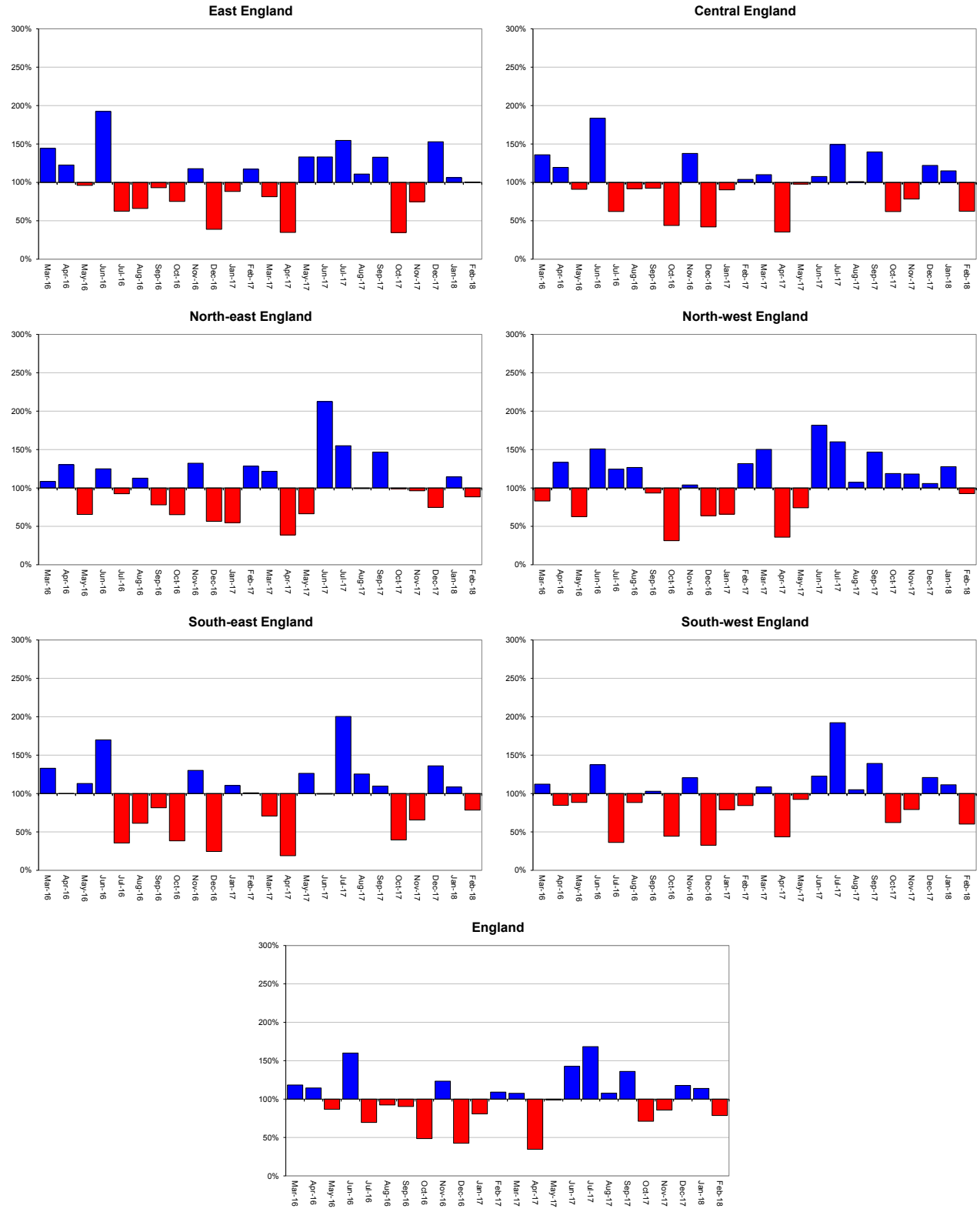


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2018).

Soil moisture deficit

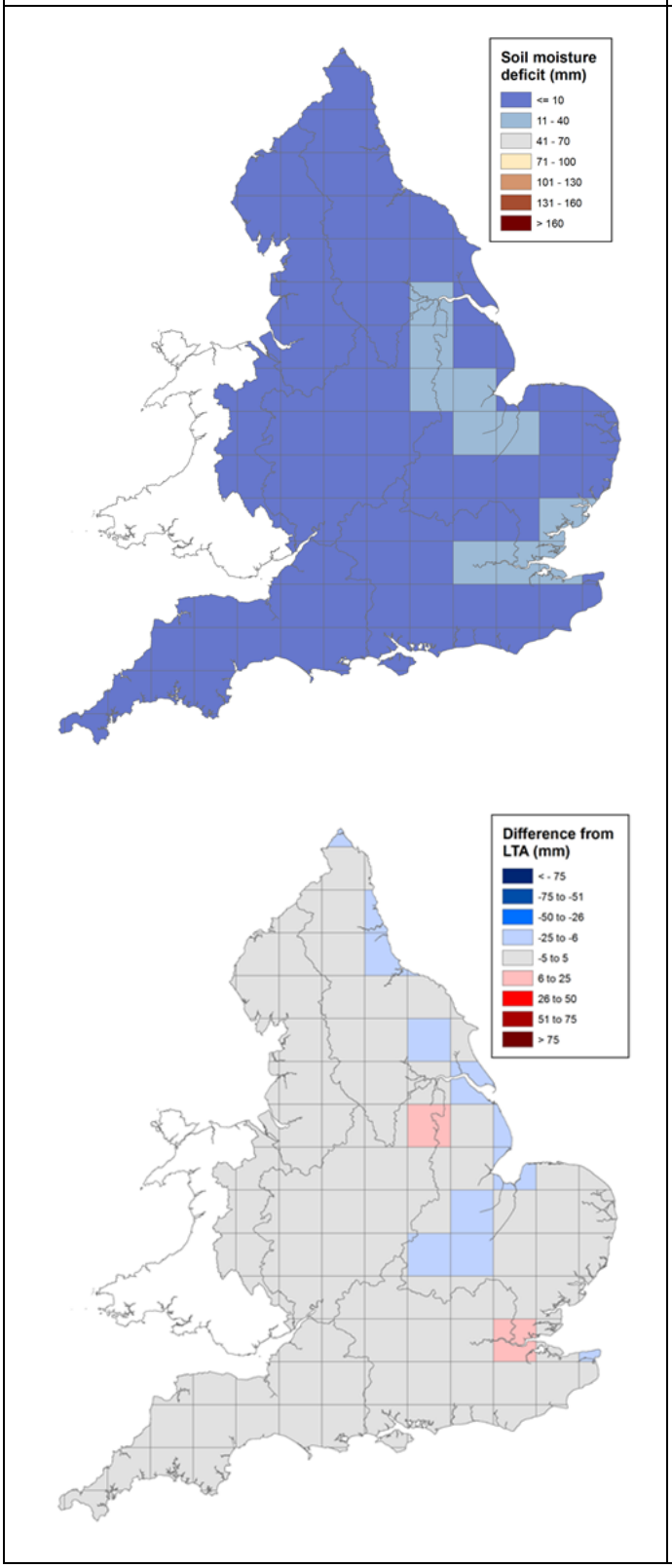
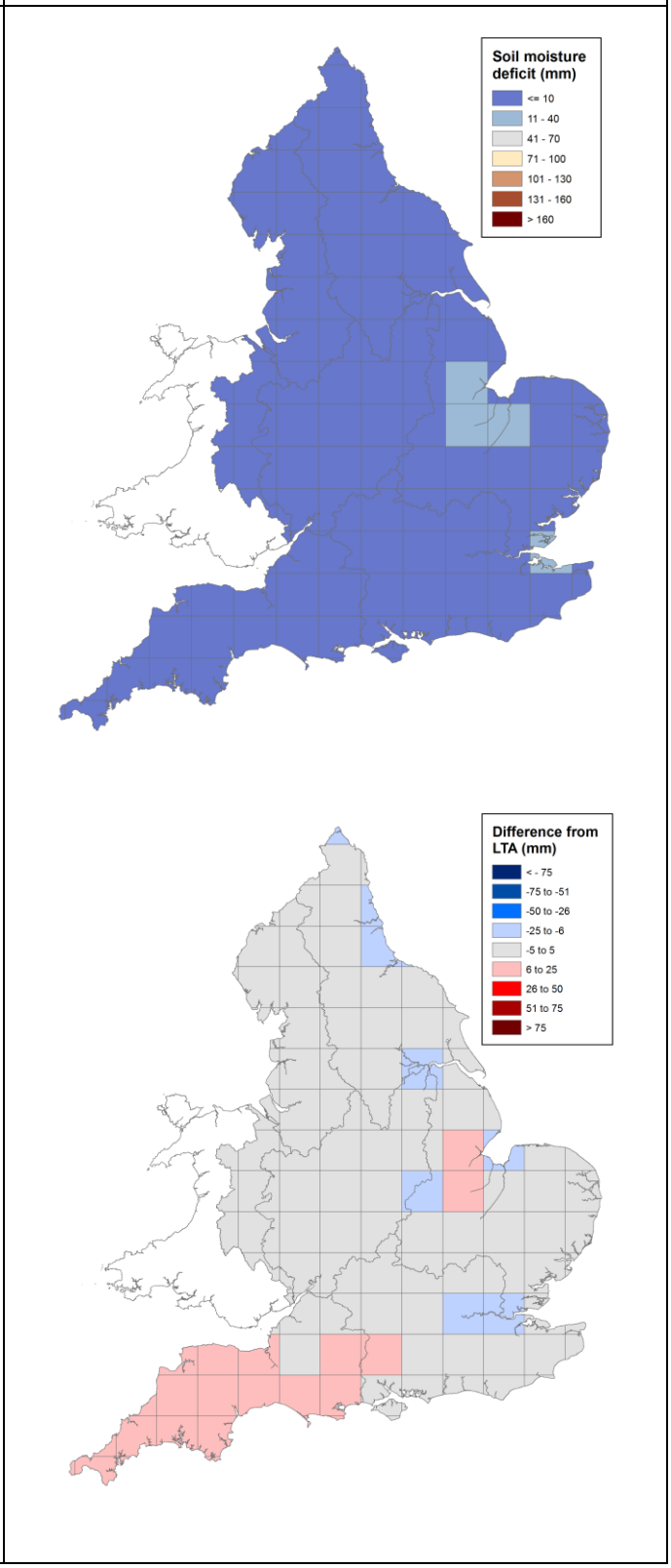
End of January 2018[1]	End of February 2018[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 30 January 2018[1] (left panel) and 27 February 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

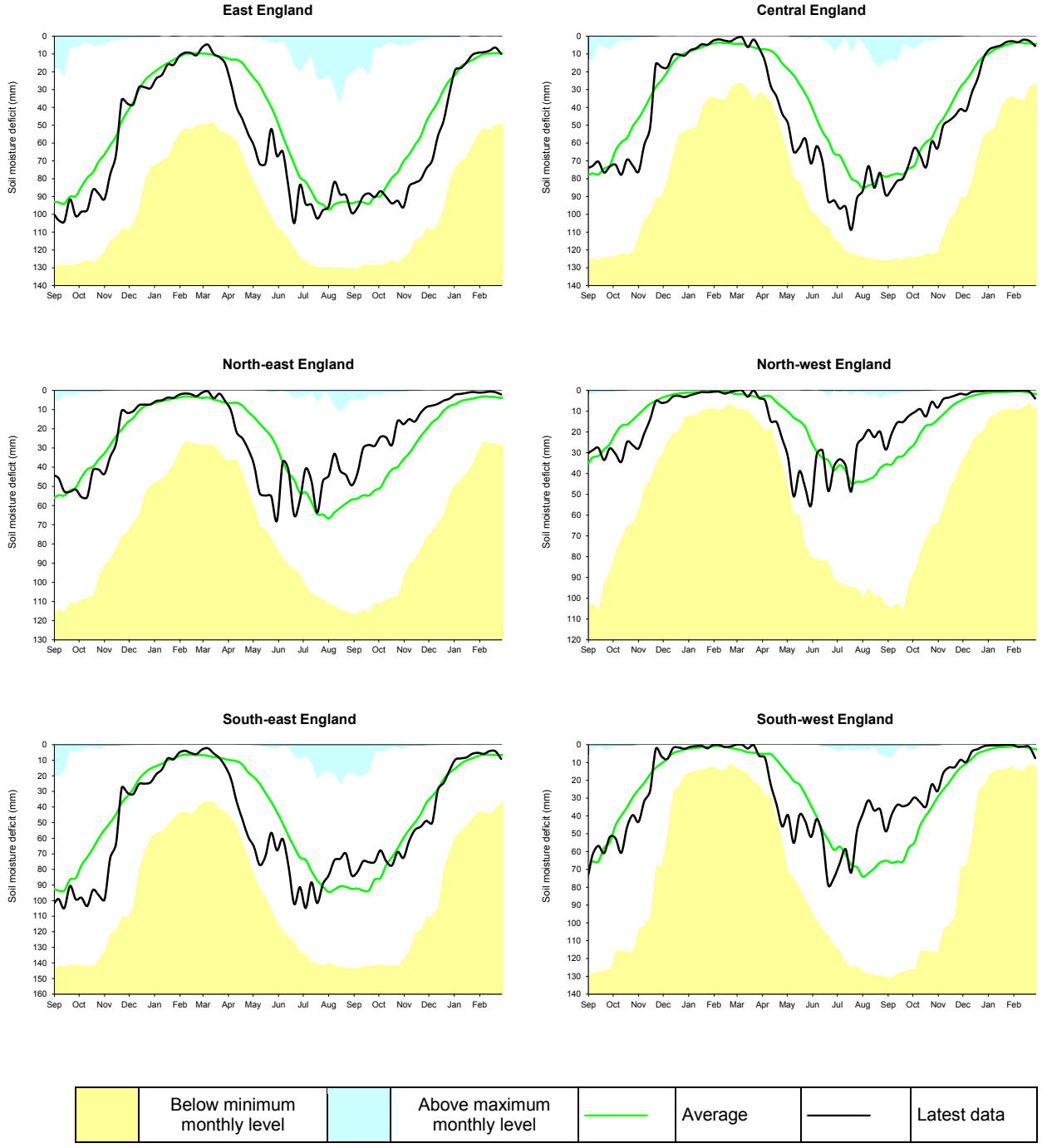
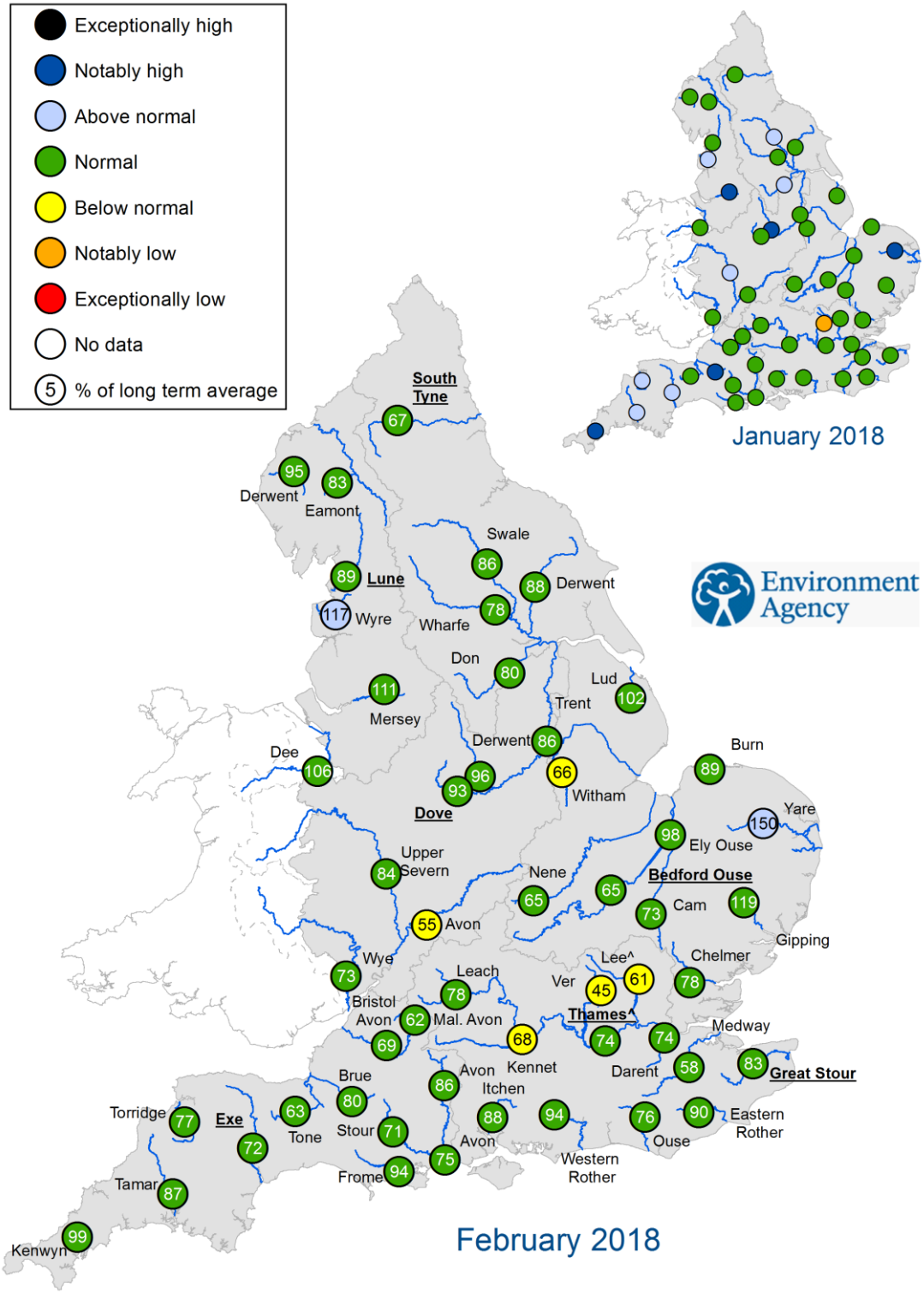


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2018).

River flows



^ "Naturalised" flows are provided for the River Thames at Kingston and the River Lee at Feildes Weir
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 2018 and February 2018, 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, 100026380, 2018.

River flow charts

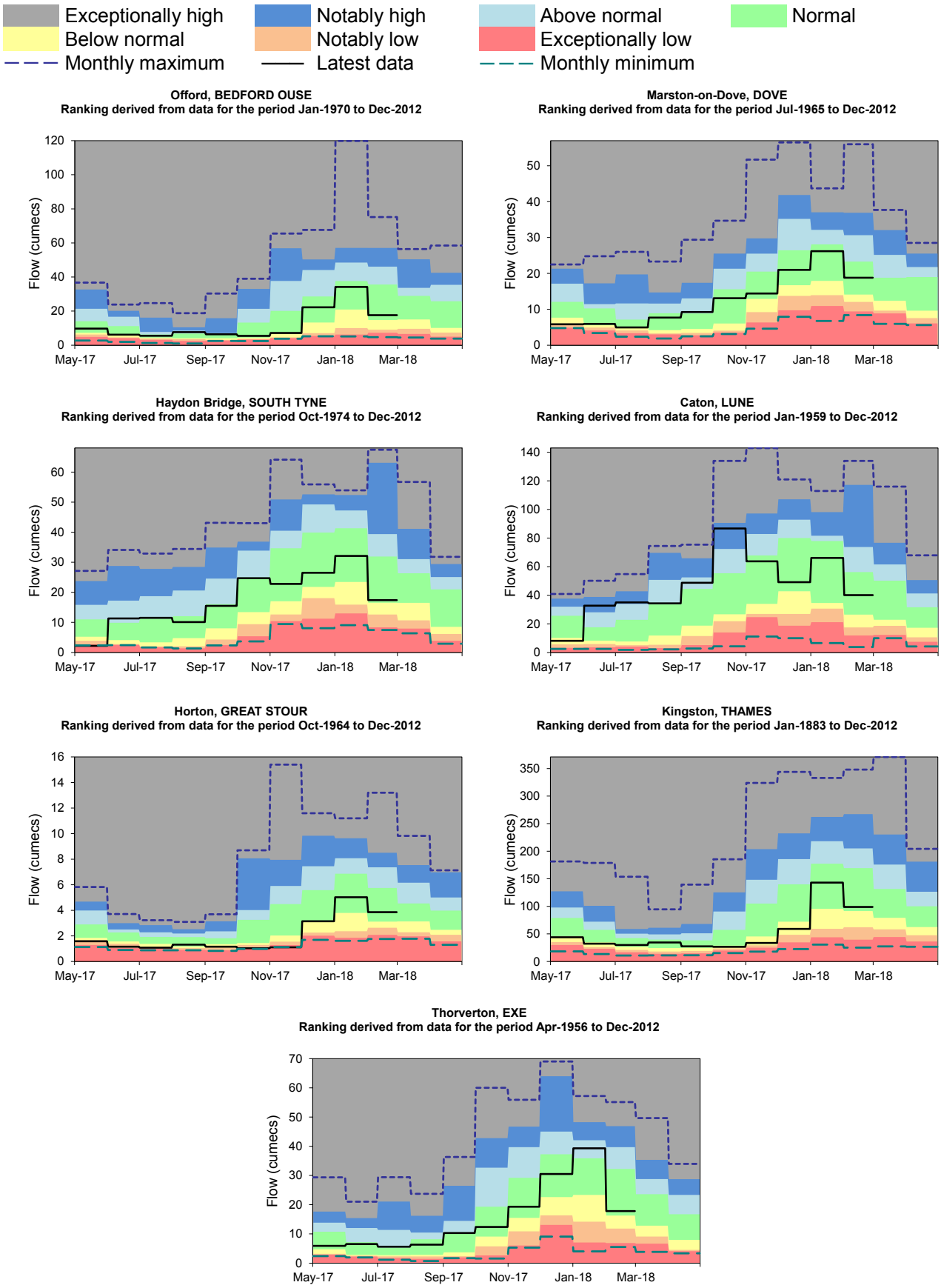
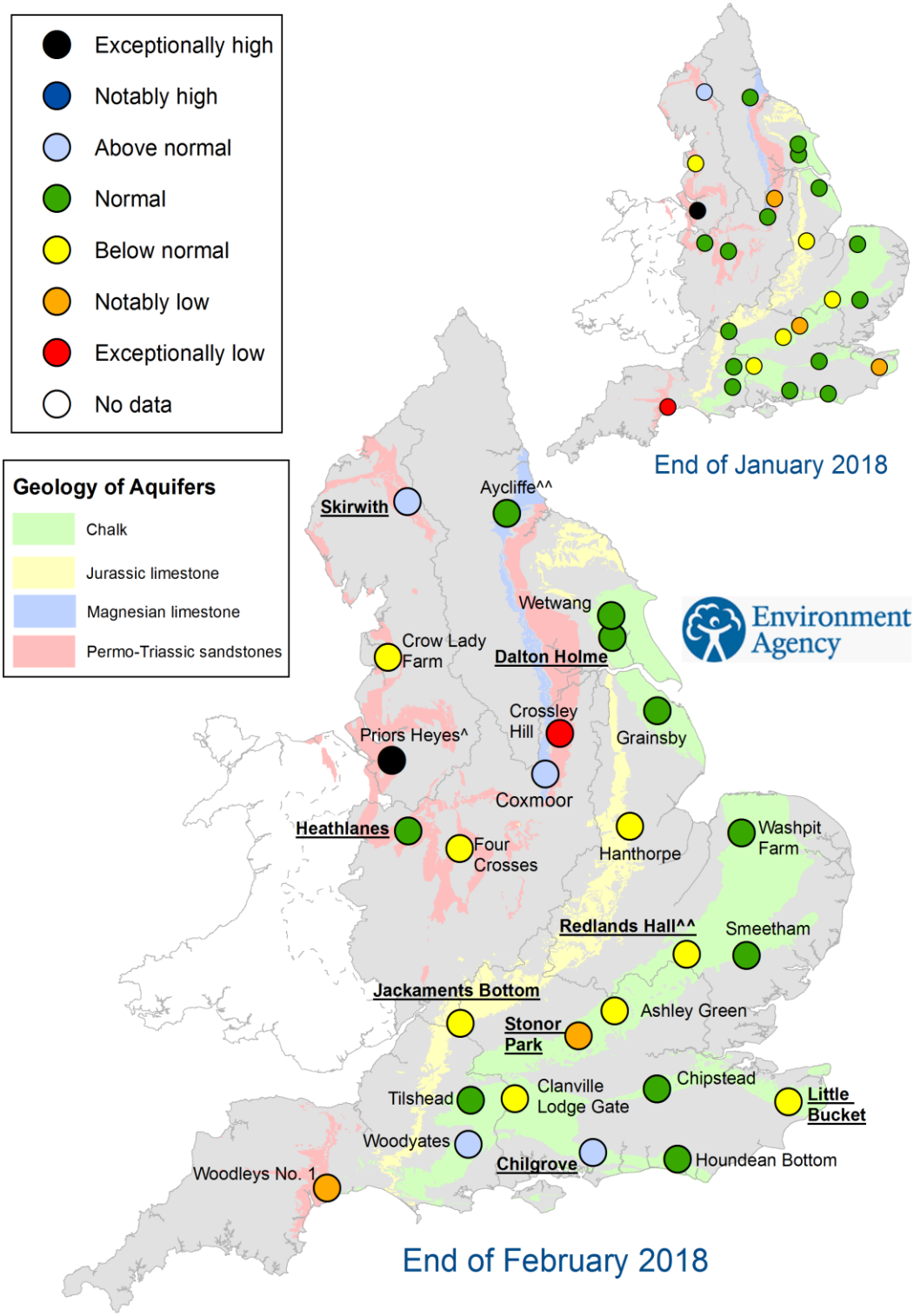


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

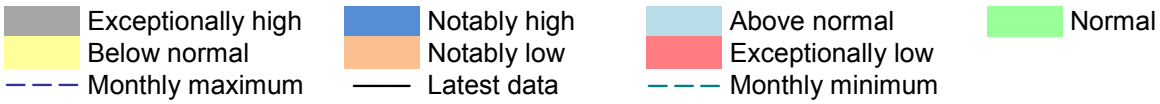
Groundwater levels



^ 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 January and February 2018, 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, 100026380, 2018.

Groundwater level charts



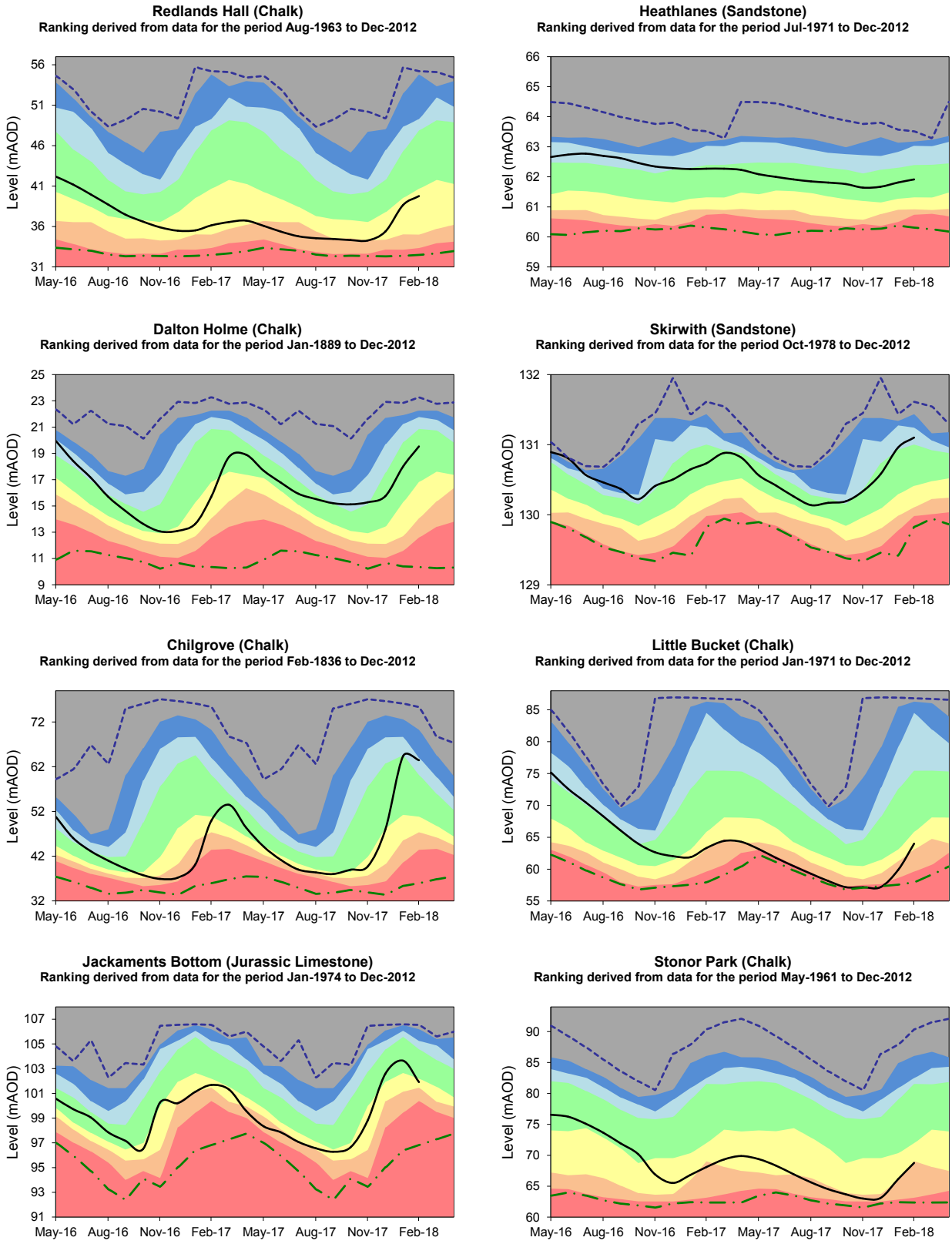
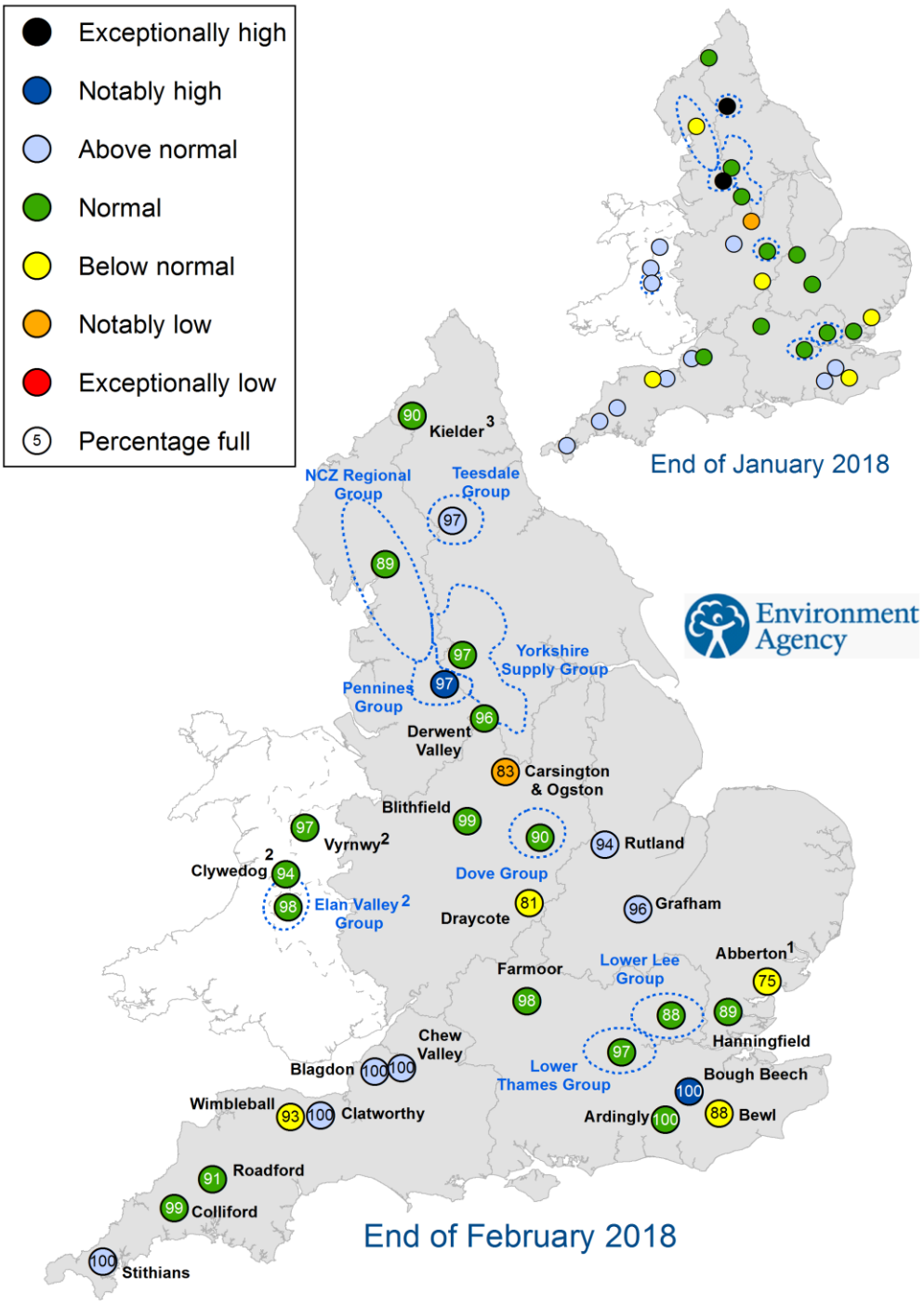


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2018).

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 January 2018 and February 2018 as a percentage of total capacity and classed relative to an analysis of historic January and February values respectively (Source: Water Companies). Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones.

Reservoir storage charts

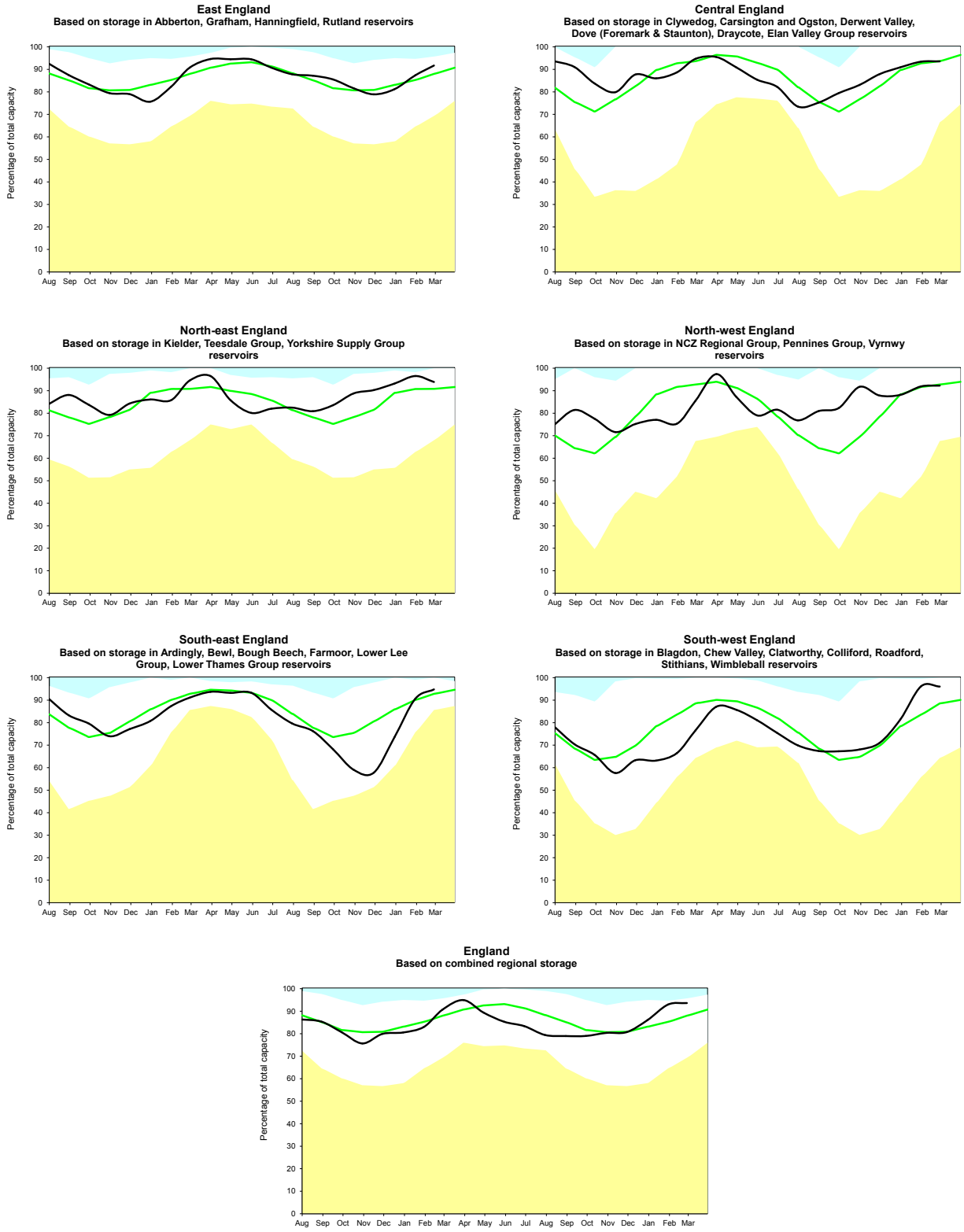


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

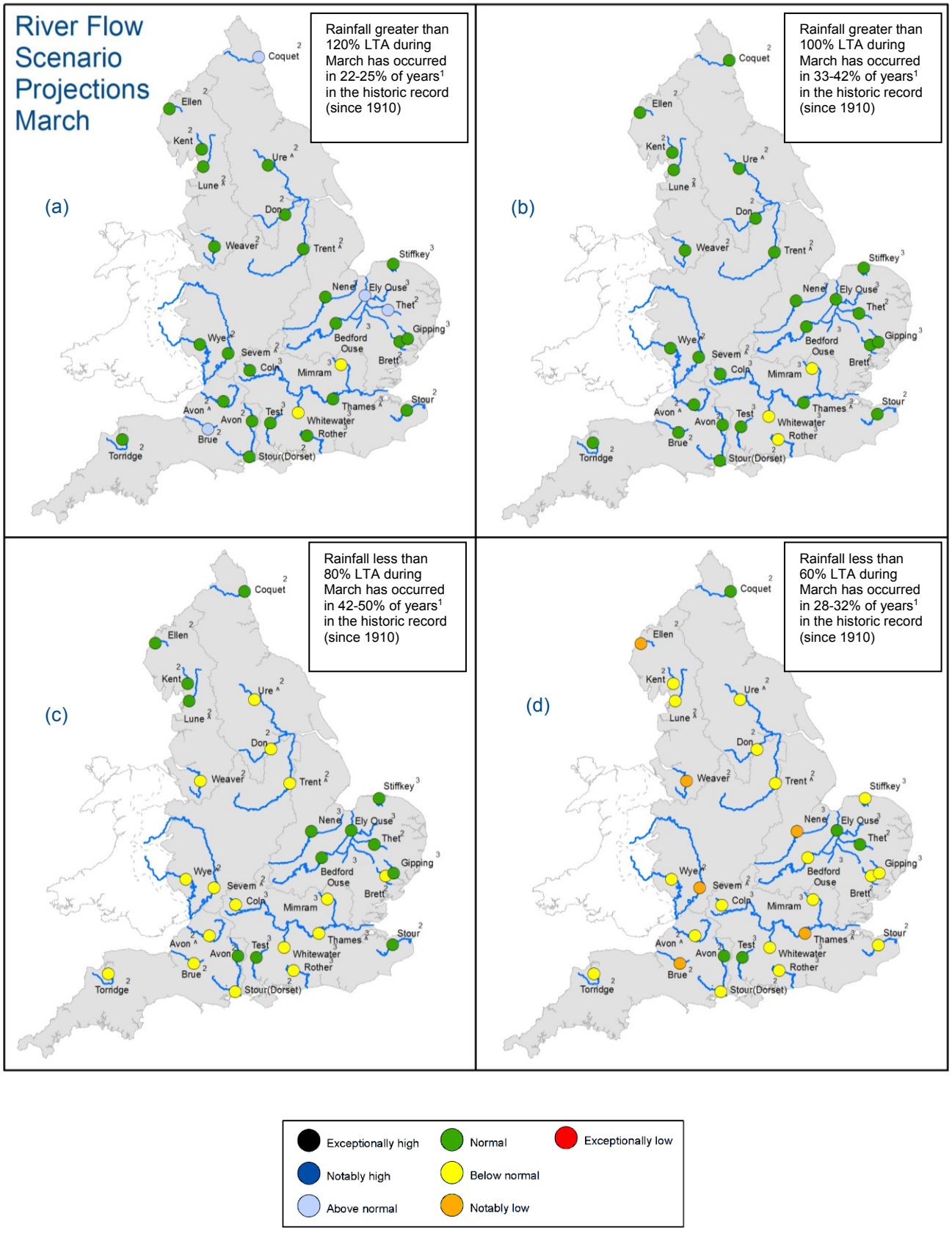


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall in March 2018 (Source: Centre for Ecology and Hydrology, Environment Agency)

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

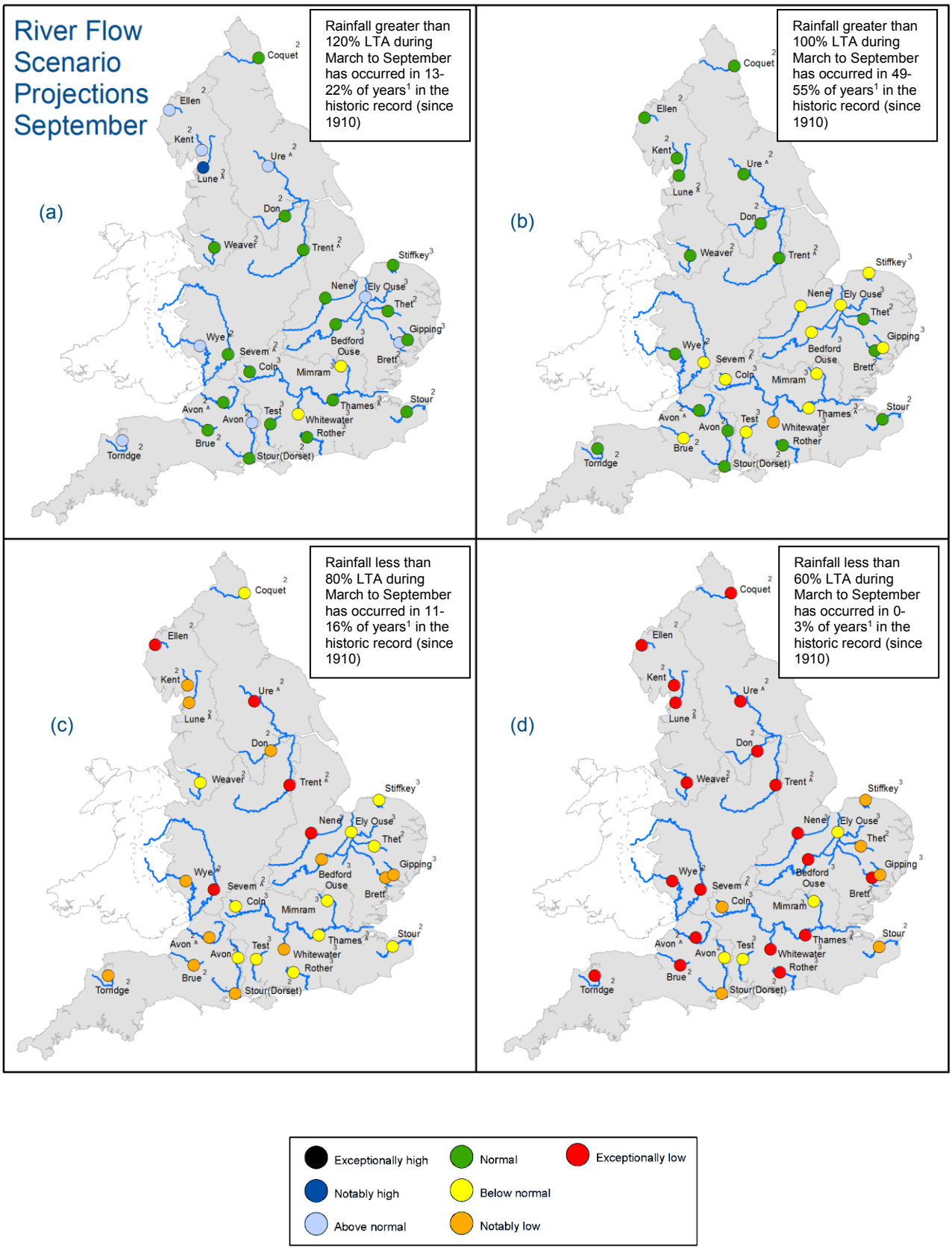


Figure 6.2: Projected river flows at key indicator sites up until the end of September 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March 2018 and September 2018 (Source: Centre for Ecology and Hydrology, Environment Agency)

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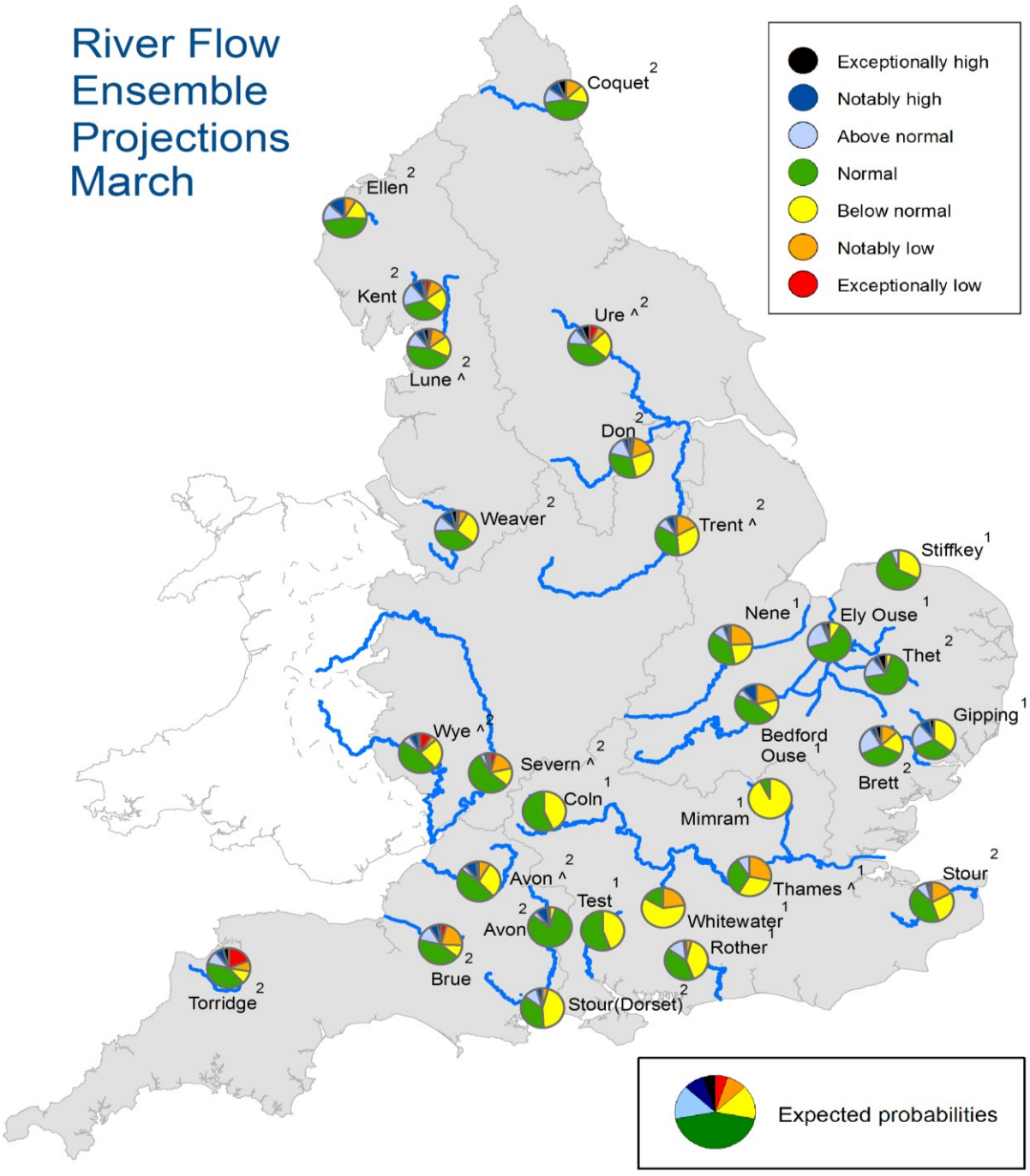

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

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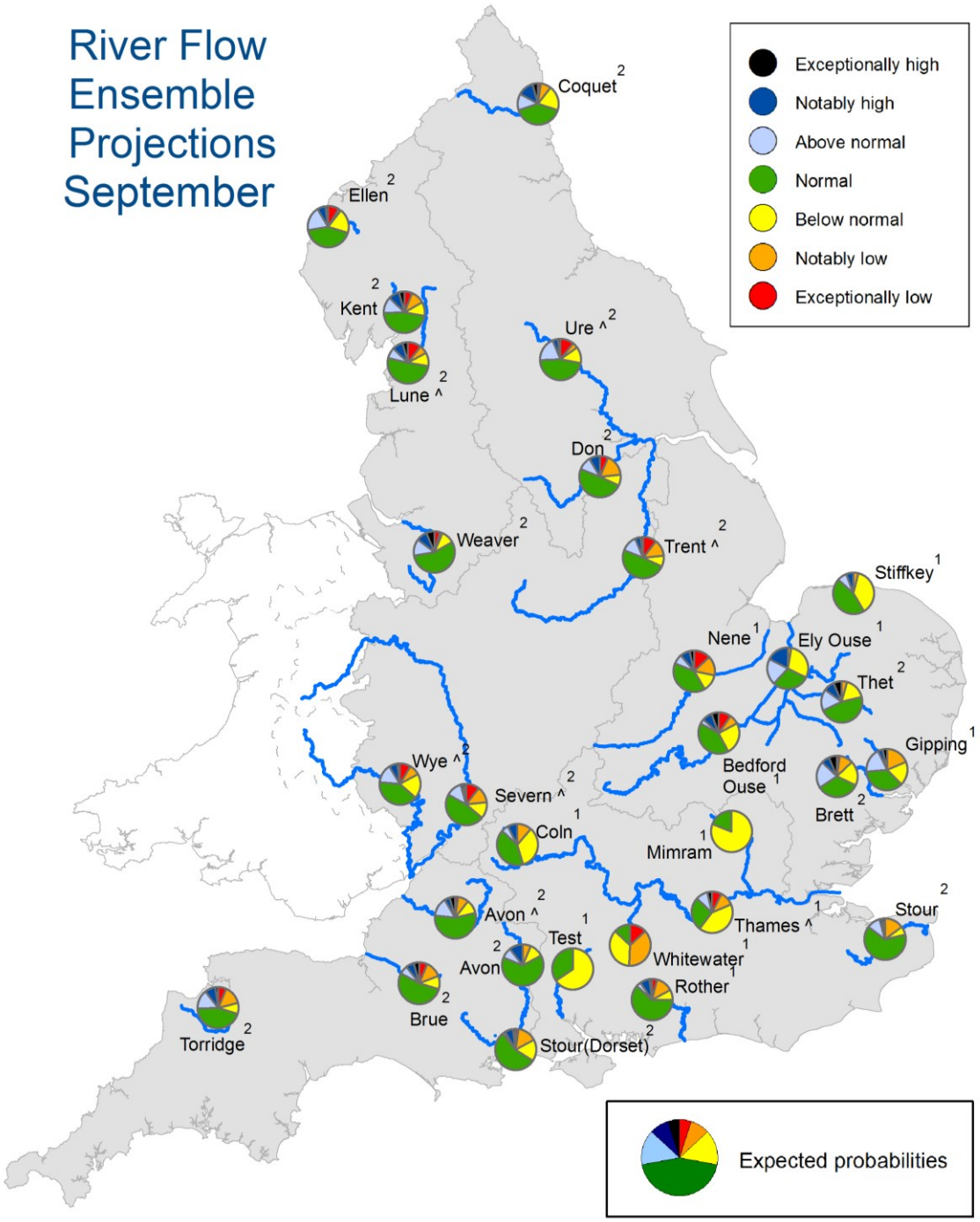

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2018. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for 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

Forward look - groundwater

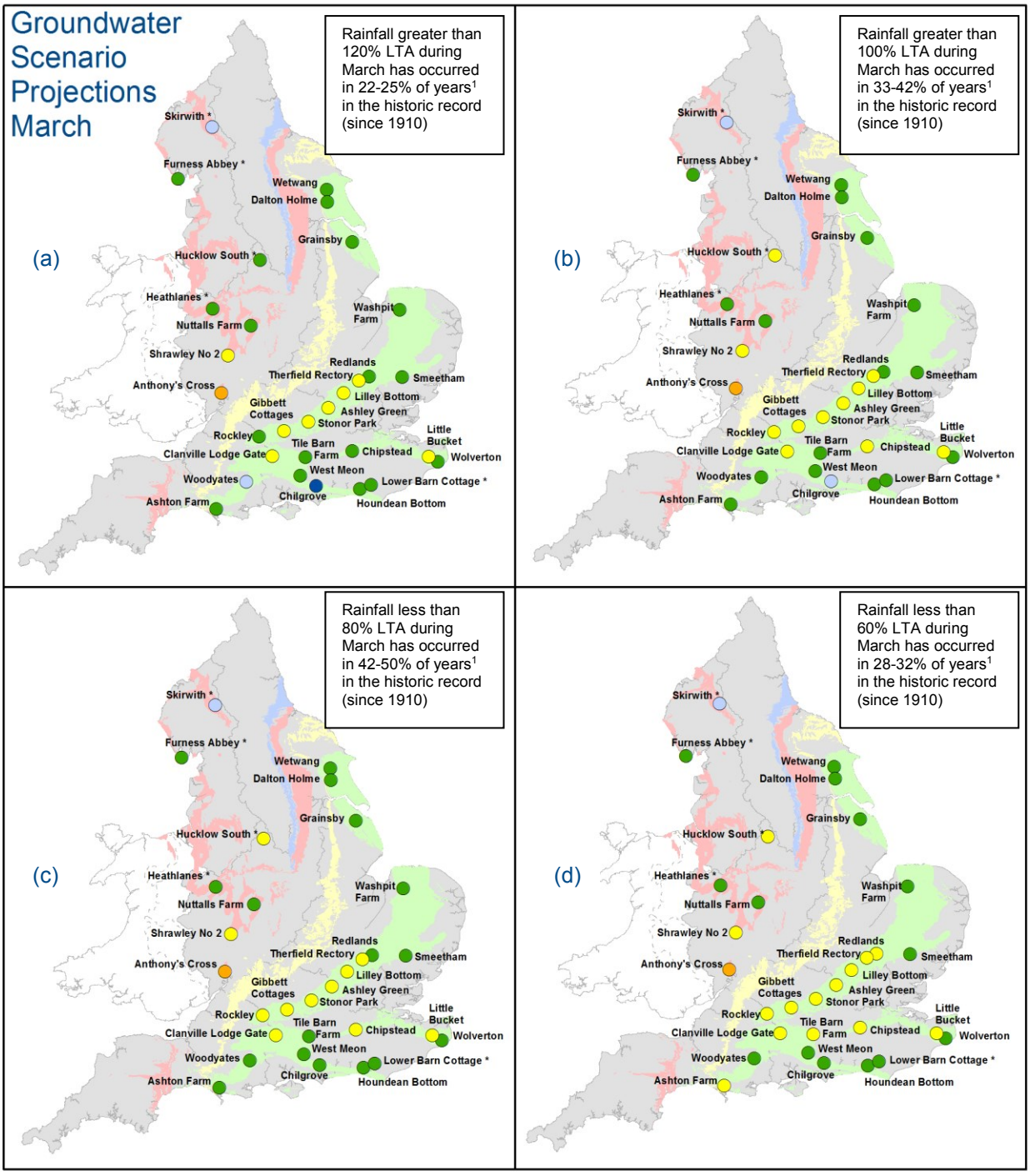


Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall in March 2018 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater 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

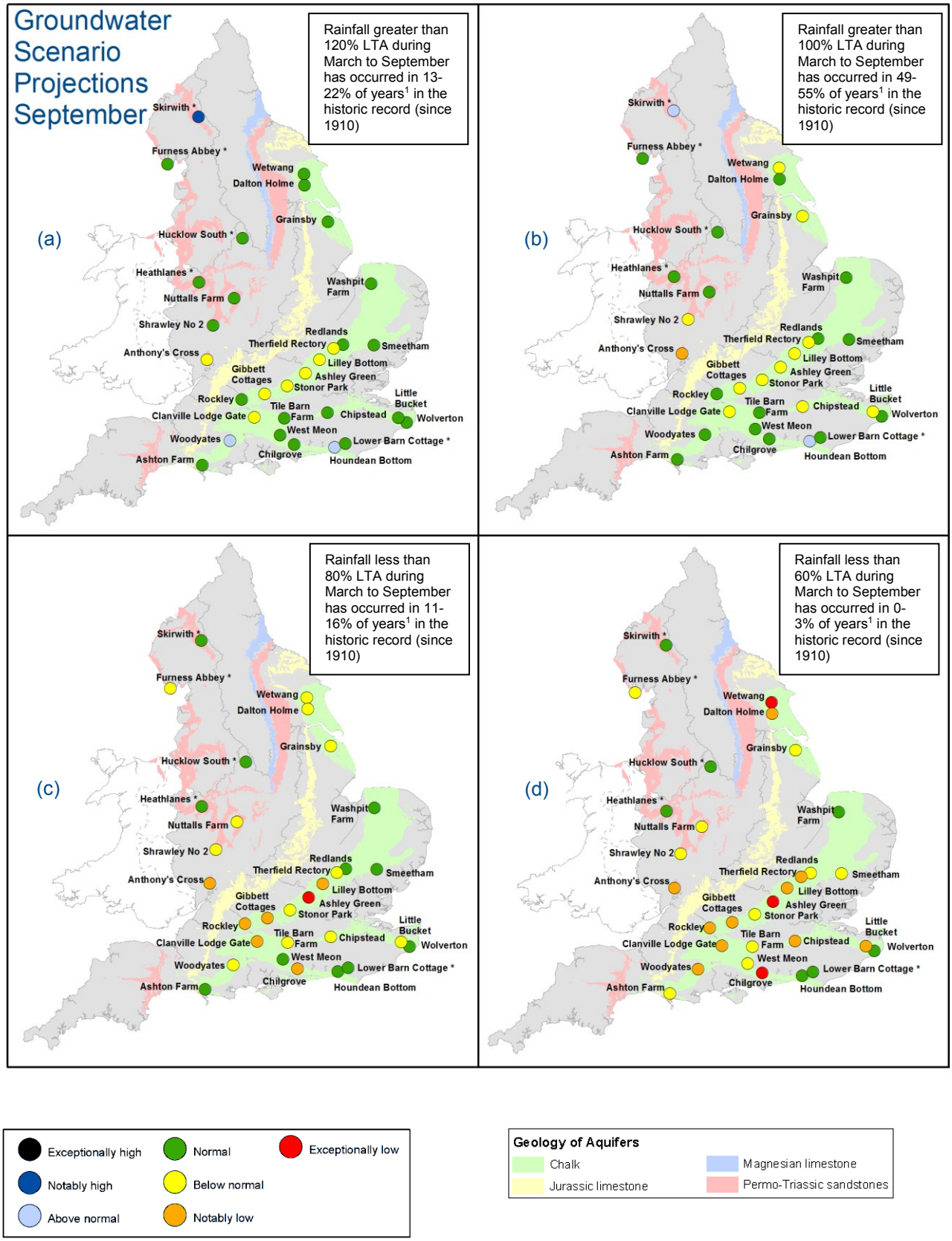
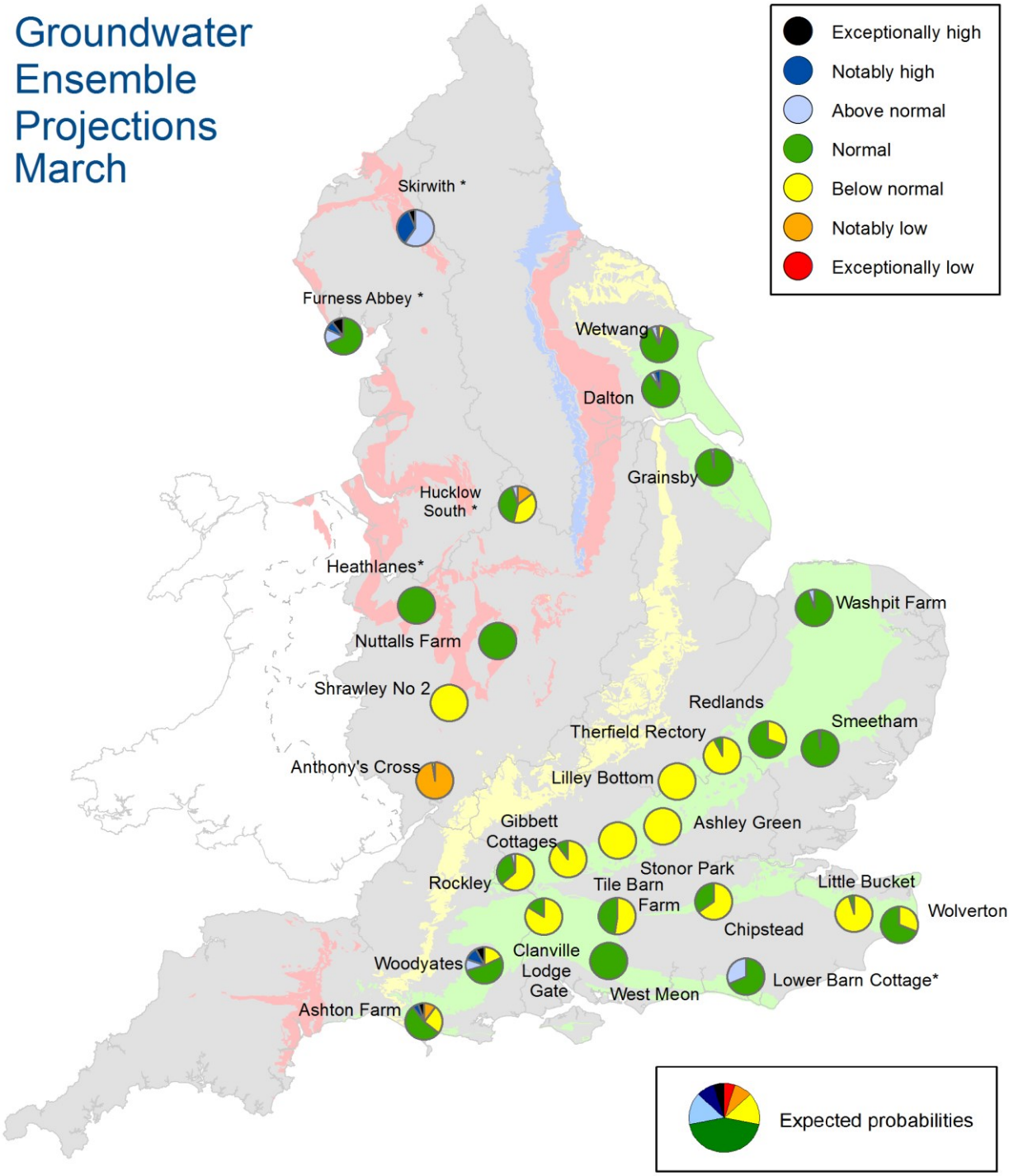


Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March 2018 and September 2018 (Source: Environment Agency) Geological map reproduced with kind 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



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 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*

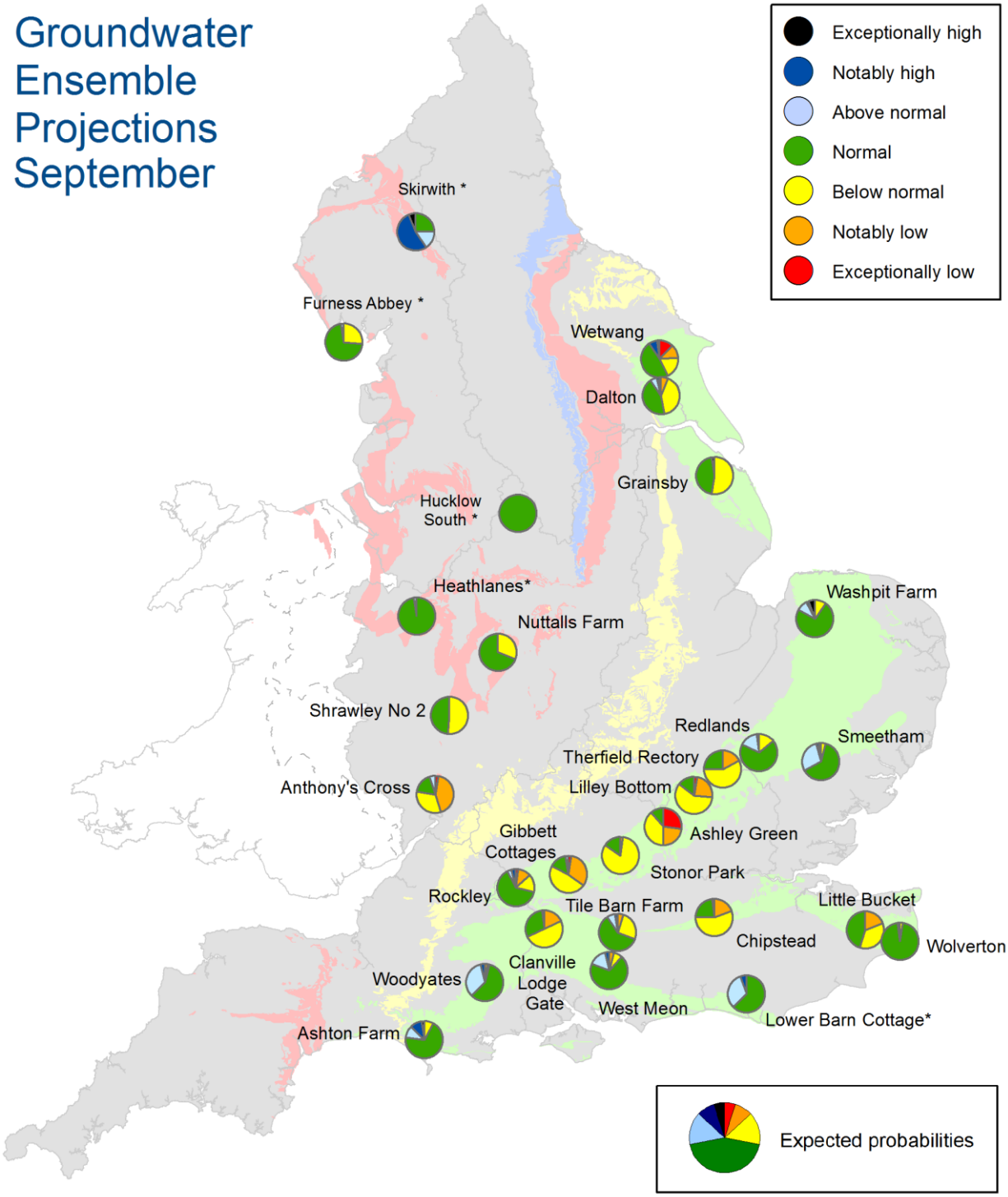


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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2018. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for 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

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