Monthly water situation report

England

Summary – February 2017

Across England as a whole, February rainfall totals were slightly above the 1961-90 long term average (LTA) for February at 107% (103% of the 1981-2010 LTA). Rainfall totals were classed as normal or higher for the time of year across all hydrological areas. Soils remained saturated across most of England with soil moisture deficits (SMD) at the end of February at or close to zero. Monthly mean river flows for February increased at all indicator sites across England compared with January, and the majority were classed as normal for the time of year. Groundwater levels increased at the majority of indicator sites during February. Given the late onset of recharge end of month levels were normal or lower for the time of year at the majority of sites. Reservoir stocks increased at all but one of the reported reservoirs or reservoir groups, with end of month stocks normal or higher for the time of year at half of the sites. Overall reservoir storage for England increased to 91% of total capacity.

Rainfall

Rainfall totals were close to, or above, the long term average (LTA) for February across two thirds of England. February rainfall totals have been typically lower in the south and east and higher in the north-west and far south west. Parts of central southern England, East Anglia and Kent received less than 40mm of rainfall, while parts of Cumbria, Cornwall and Devon received more than 100mm (Figure 1.1).

Across hydrological areas in central, south-east and south-west England, rainfall totals were between 70 and 90% of the LTA for February. Rainfall totals were classed as normal or higher for the time of year across all catchments, with hydrological areas in Northumberland and south of the Humber estuary receiving above normal rainfall for the time of year. The 3-month and 6-month accumulations to February show below normal or lower rainfall totals for the majority of hydrological areas across England. The 12-month accumulations were the second driest March to February totals on record since 1910 in two hydrological areas. For the Teign and Torbay, this period was the driest since 1975/6 and for the West Somerset Streams it was the driest March to February period since 1933/4 (Figure 1.2).

February rainfall totals were above average across all geographic regions of England, with the exception of south-west England. Monthly totals ranged from 84% of the LTA in south-west England to 132% in north-west England. Across England as a whole, monthly rainfall totals were slightly above the LTA for February at 107% (Figure 1.3).

Soil moisture deficit

Soils remained largely saturated across England in February. Soil moisture deficits (SMDs) for February decreased or remained the same across much of England compared to January. At the end of the month, SMDs were between 11 and 28mm in only a few parts of south-east and east England. Across much of the rest of England, month end values were at, or close to zero and close to the long term average (LTA) for the end of February (Figure 2.1).

At a regional scale, SMDs at the end of February were the same or smaller than at the end of January, with end of month values ranging from less than 1mm (north-west and south-west England) to 5mm (east England) (Figure 2.2).

River flows

Monthly mean flows for February increased at all indicator sites across England compared with January and were mainly classed as normal for the time of year. Monthly mean flows were above normal for the rivers Wyre and Mersey in north-west England and below normal for the time of year for the groundwater dominated rivers Lee, Kennet and Itchen in south-east England and the River Avon in south-west England (Figure 3.1). At the regional index sites, monthly mean river flows were normal for the time of year at all sites (Figure 3.2).

Groundwater levels

As a result of the combination of saturated soils and close to, or above average rainfall across most of England, groundwater levels increased at over four-fifths of indicator sites during February. End of month groundwater levels were normal or lower for the time of year at all but two indicator sites, largely as a result of the late onset of recharge this winter. Groundwater levels in the chalk of the Wessex, Hampshire, Marlborough and South Downs have all seen modest recoveries in February while in the Chilterns and North Downs, levels are rising more slowly (Figures 4.1).

End of month groundwater levels at the major aquifer index sites ranged from notably low at Stonor Park (Chalk) to normal for the time of year at Heathlanes (Shropshire Middle Severn sandstone aquifer) and Skirwith (Carlisle Basin and Eden Valley sandstone aquifer) (Figure 4.2).

Reservoir storage

During February, reservoir stocks increased at all but one of the reported reservoirs or reservoir groups. Storage in the Lower Lee Group of reservoirs decreased by 4% (in response to planned maintenance work which is now complete), but elsewhere reservoir stocks increased by between 2% (Lower Thames Group in south-east England) and 32% (Bough Beech reservoir in south-east England). Increases of greater than 20% were also seen in at Ardingly Reservoir (south-east England) and Clatworthy Reservoir (south-west England). At the end of the month, 5 reservoirs were full and a further 8 were above 95% of total capacity. End of month stocks were classed as normal or higher for the time of year at half of reservoirs and reservoir groups, with the remaining sites being below normal or lower (Figure 5.1).

Reservoir stocks increased in all geographic regions compared to the end of January. End of February stocks ranged from 71% of total capacity in south-west England to 95% in central and north-east England. Overall storage for England increased to 91% of total capacity (Figure 5.2).

Forward look

Weather conditions during March are likely to be unsettled, with a mix of drier spells and showers interspersed with periods of more prolonged rainfall. Drier, brighter conditions are more likely in south and east England, with more prolonged and heavy rainfall likely in the north and west. Over the 3 month period March to May, above average precipitation is slightly more probable than below average precipitation[1].

Projections for river flows at key sites[2]

There is a greater than expected chance of cumulative river flows being below normal or lower at around half of the modelled sites at the end of March and end of September 2017.

For scenario based projections of cumulative river flows at key sites by March 2017 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by September 2017 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by March 2017 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by September 2017 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

More than half of the modelled sites have a greater than expected chance of below normal or lower groundwater levels for the time of year at the end of March and end of September 2017.

For scenario based projections of groundwater levels in key aquifers in March 2017 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in September 2017 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2017 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2017 see Figure 6.8

Authors: E&B Hydrology Team

1 Source: Met Office
2 Information produced by the Hydrological Outlook (a partnership between the Environment Agency, Centre for Ecology and Hydrology, British Geological Survey and the Met Office) (www.hydoutuk.net).

Rainfall

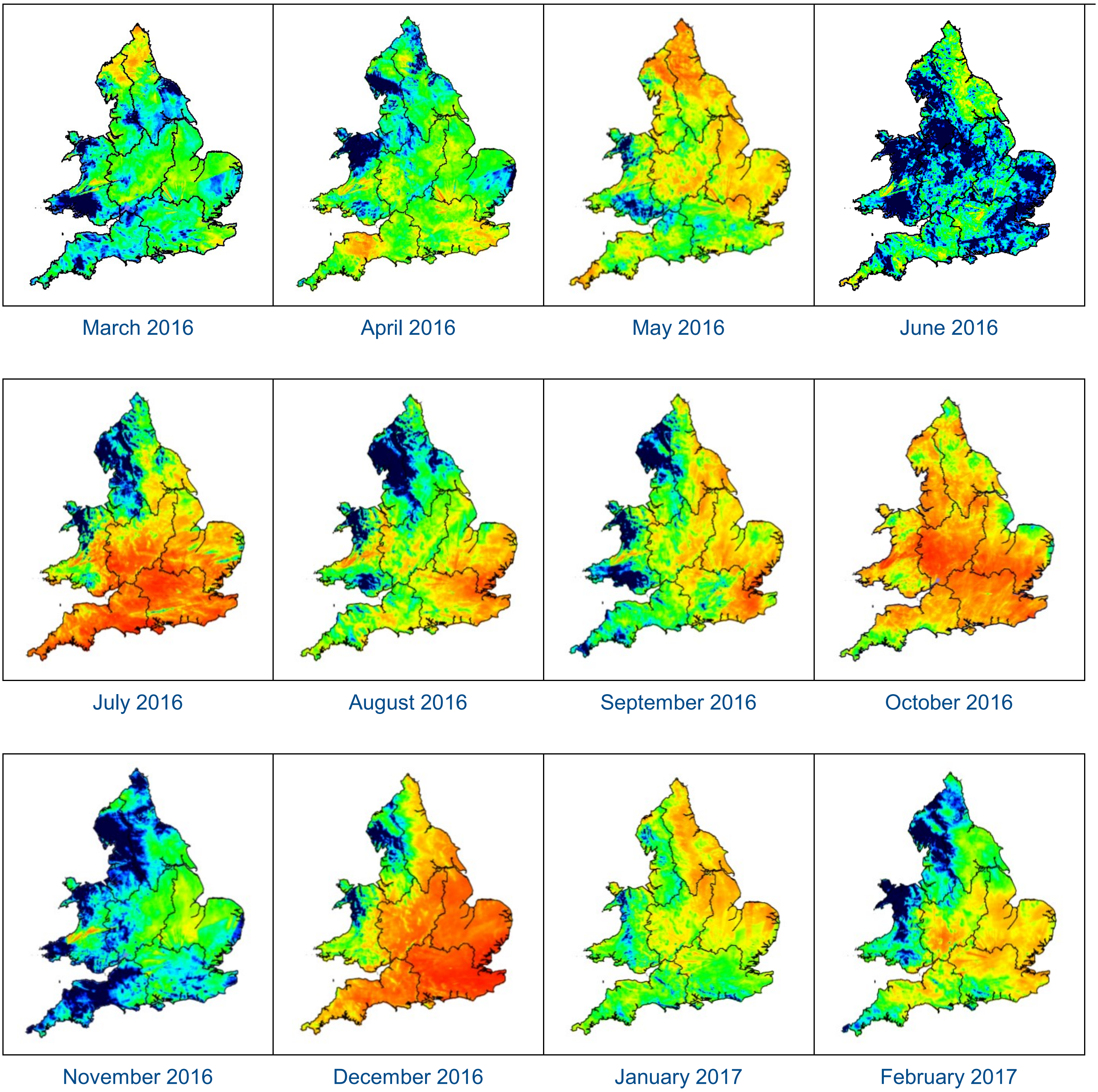
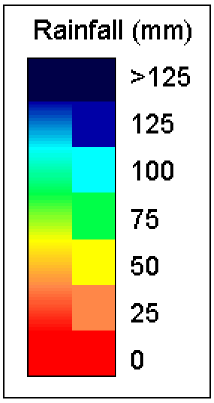


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2017). Note: Radar beam blockages in some regions may give anomalous totals in some areas.



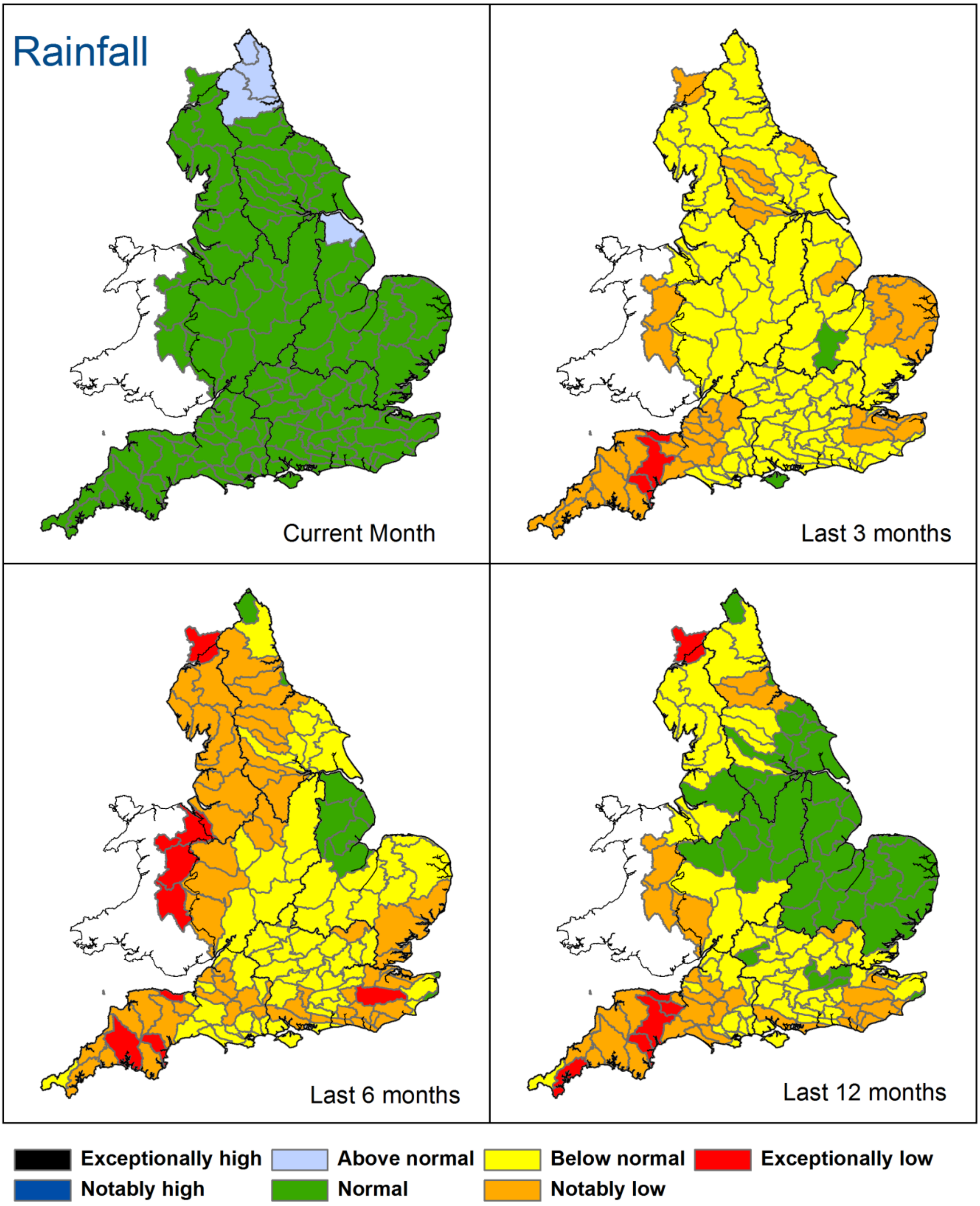


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to February 2017), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2017).* 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, 2017.

Rainfall charts

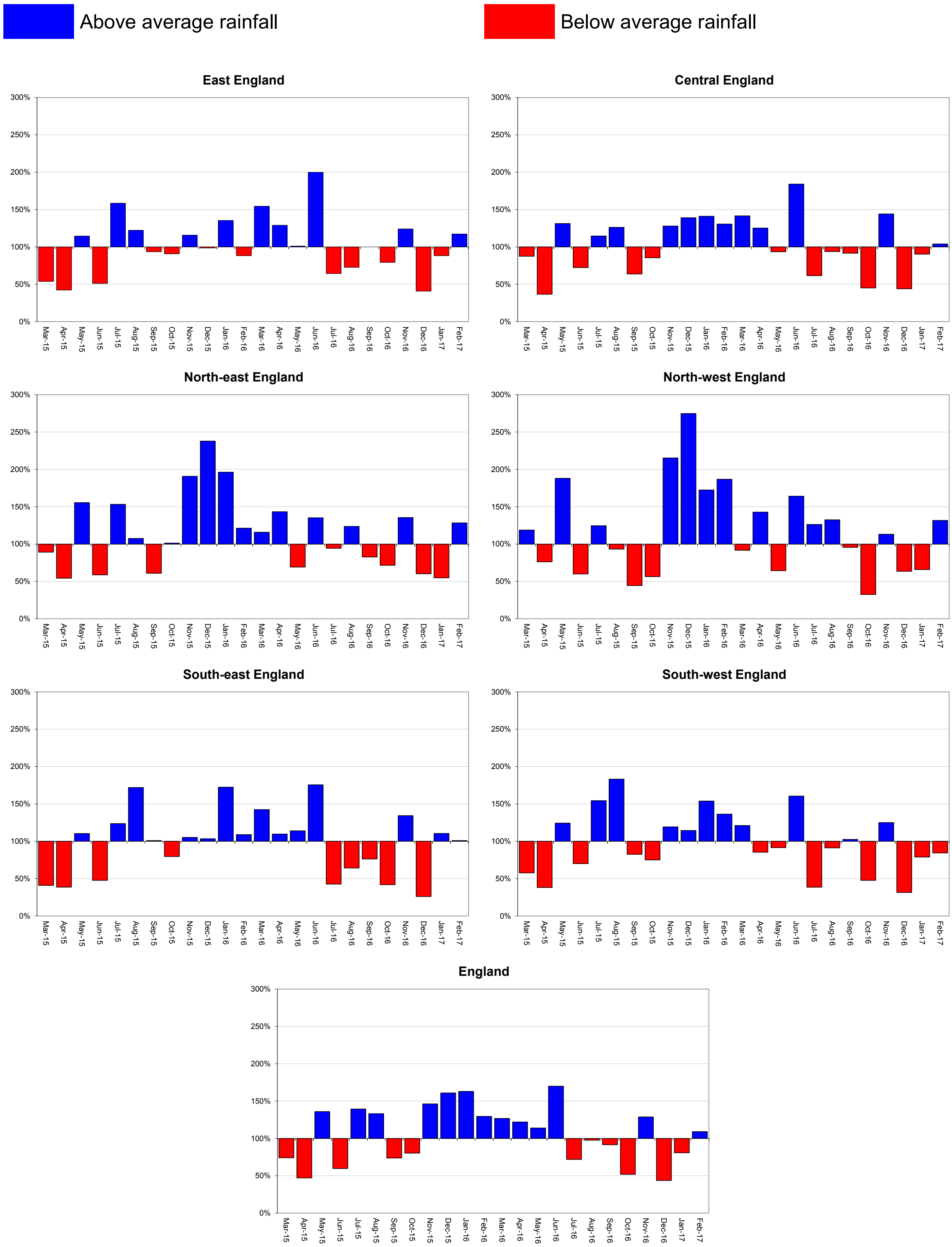


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2017).

Soil moisture deficit

End of January 2017[1]	End of February 2017[2]

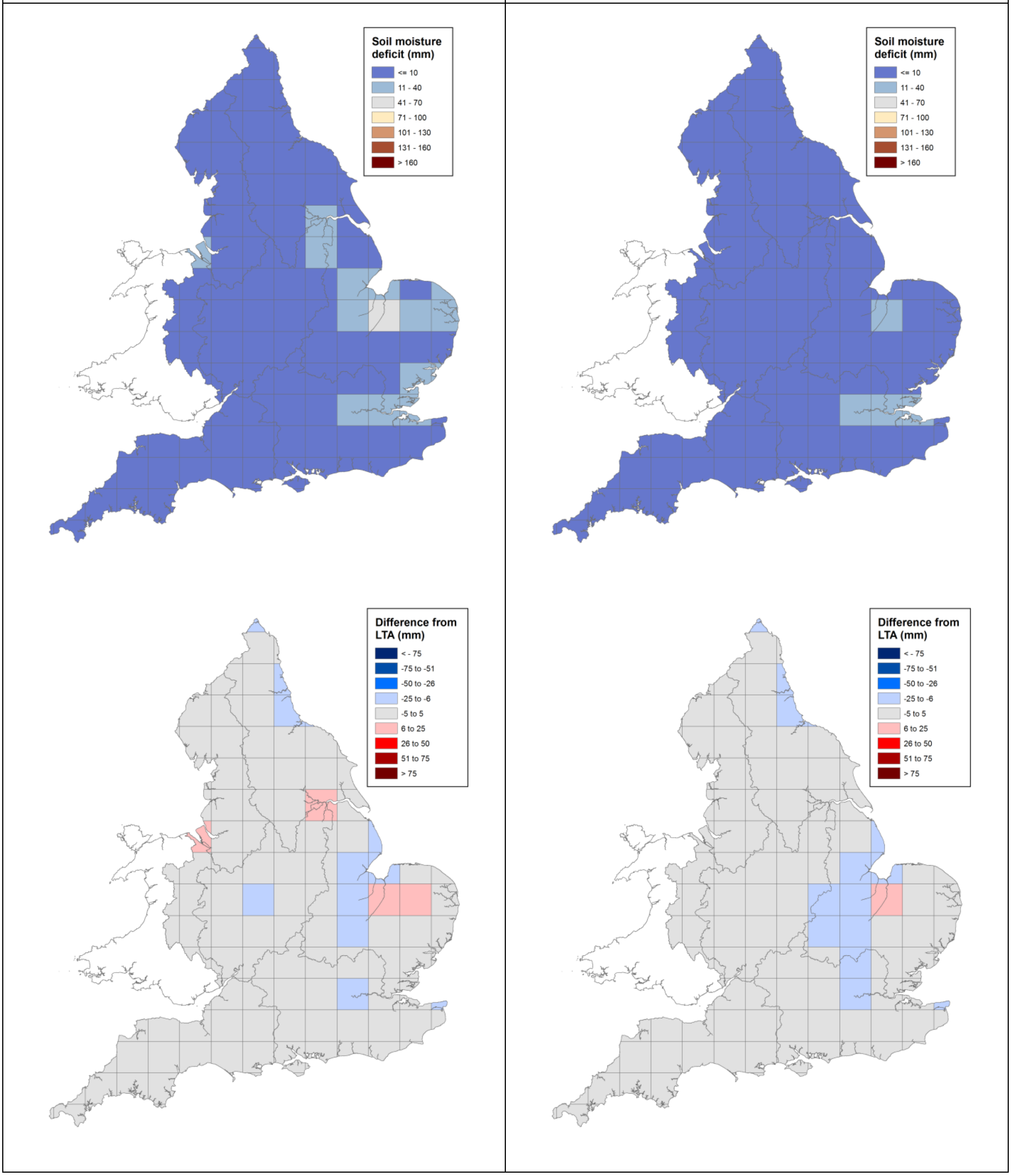


Figure 2.1: Soil moisture deficits for weeks ending 31 January 2017 [1] (left panel) and 28 February 2017 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2017). Crown copyright. All rights reserved. Environment Agency, 100026380, 2017

Soil moisture deficit charts

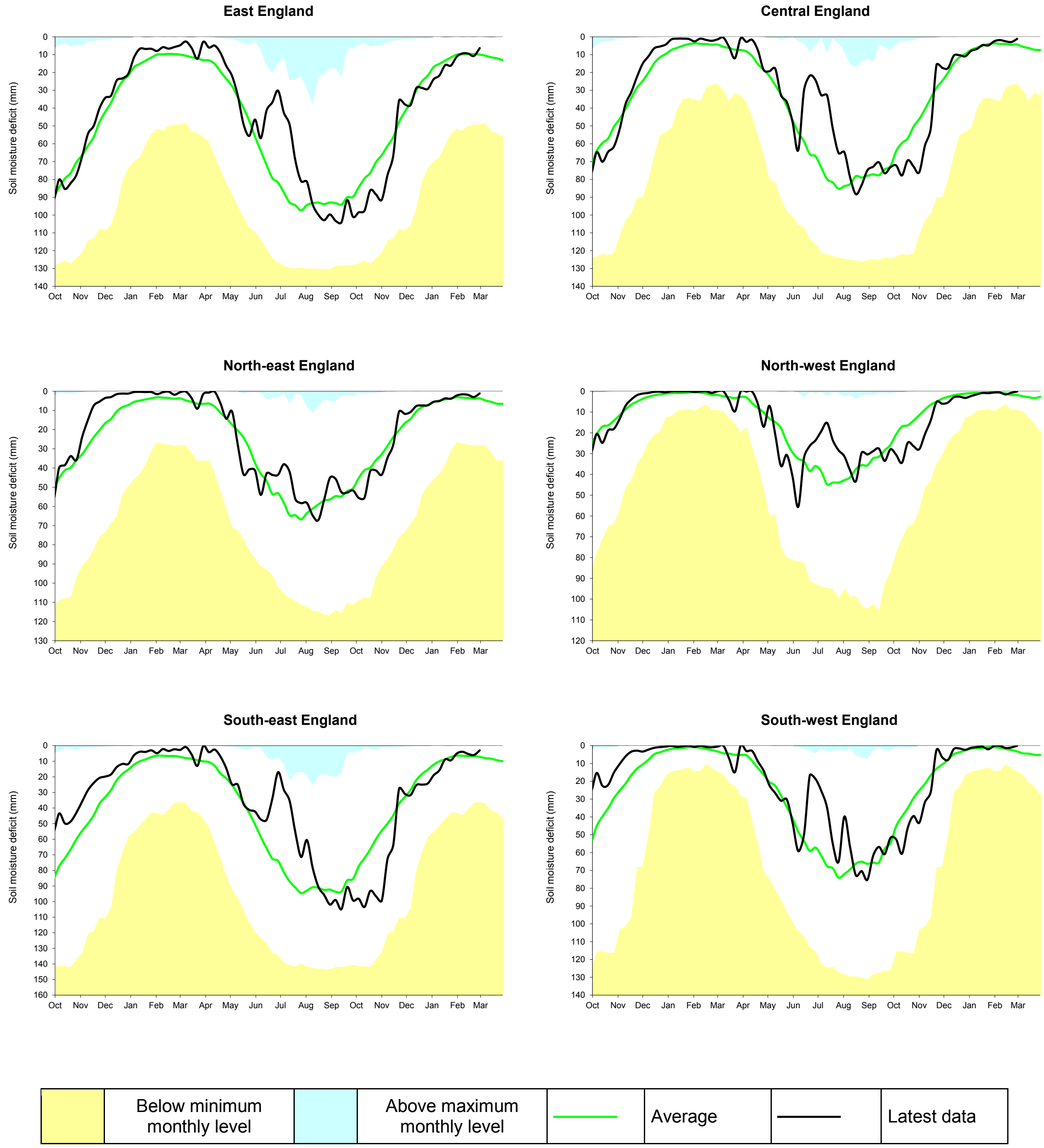
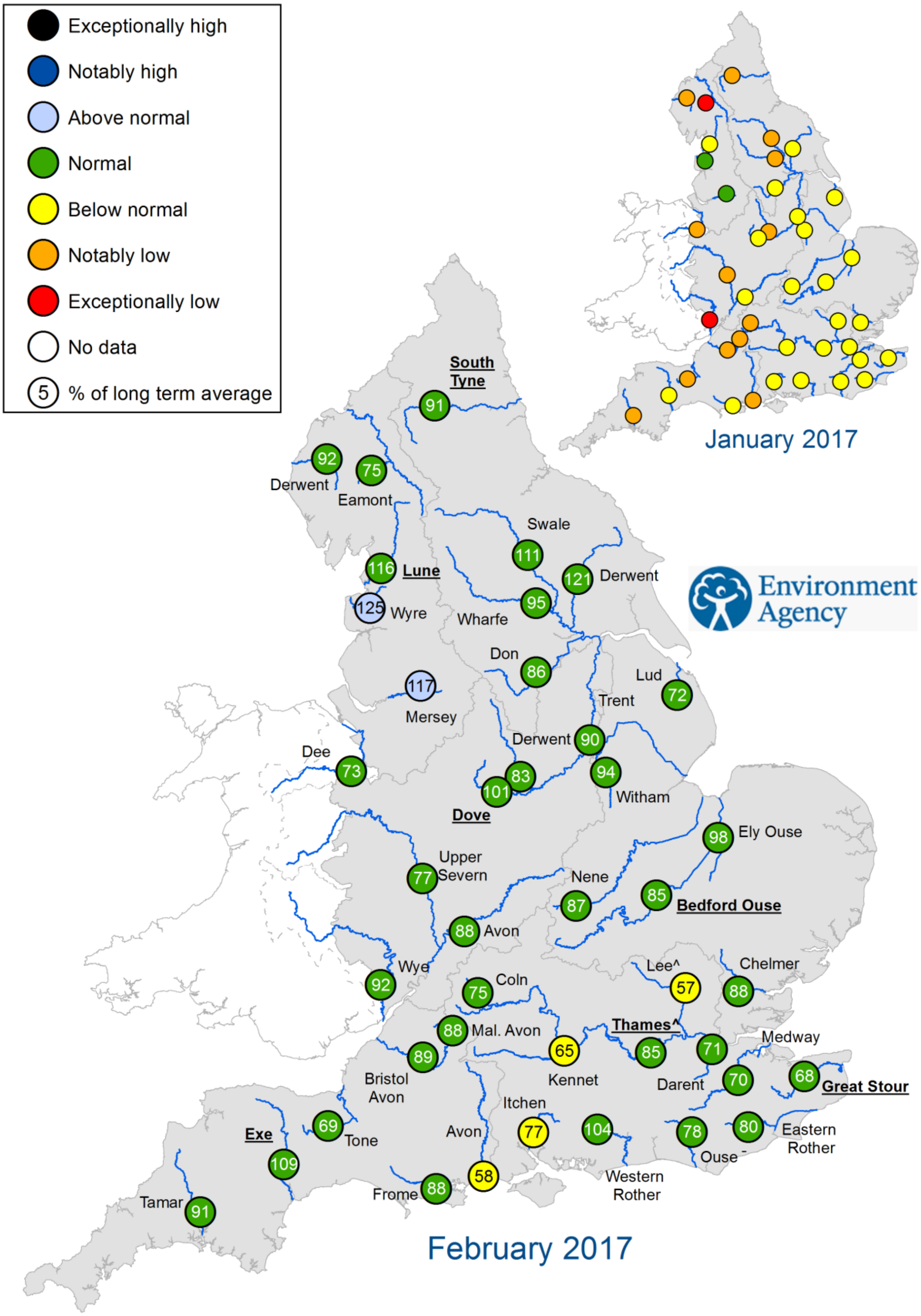


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2017).

River flows



^ “Naturalised” flows are provided for the ‘Thames at Kingston’ and the ‘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 2017 and February 2017, 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, 2017.

River flow charts

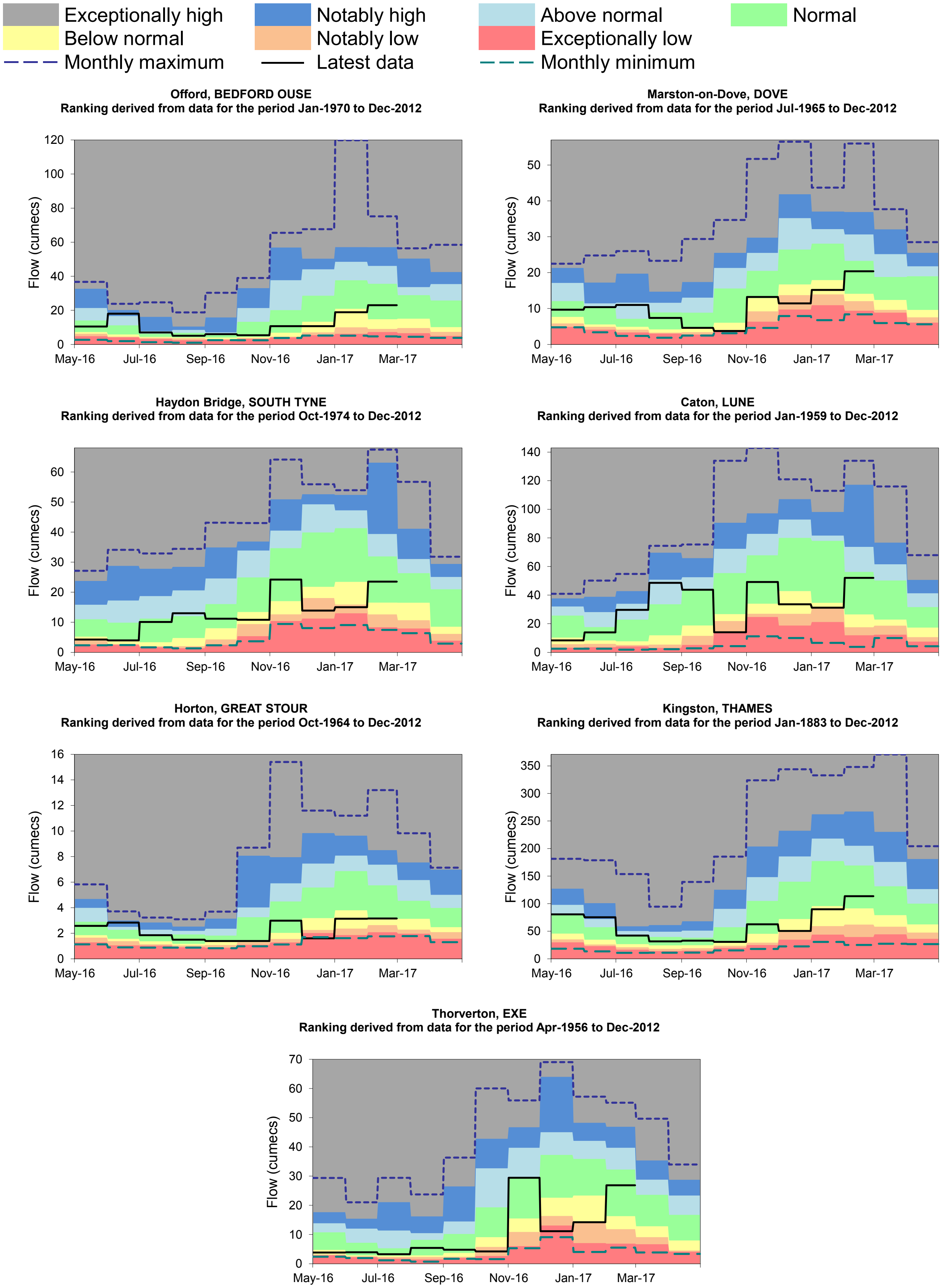
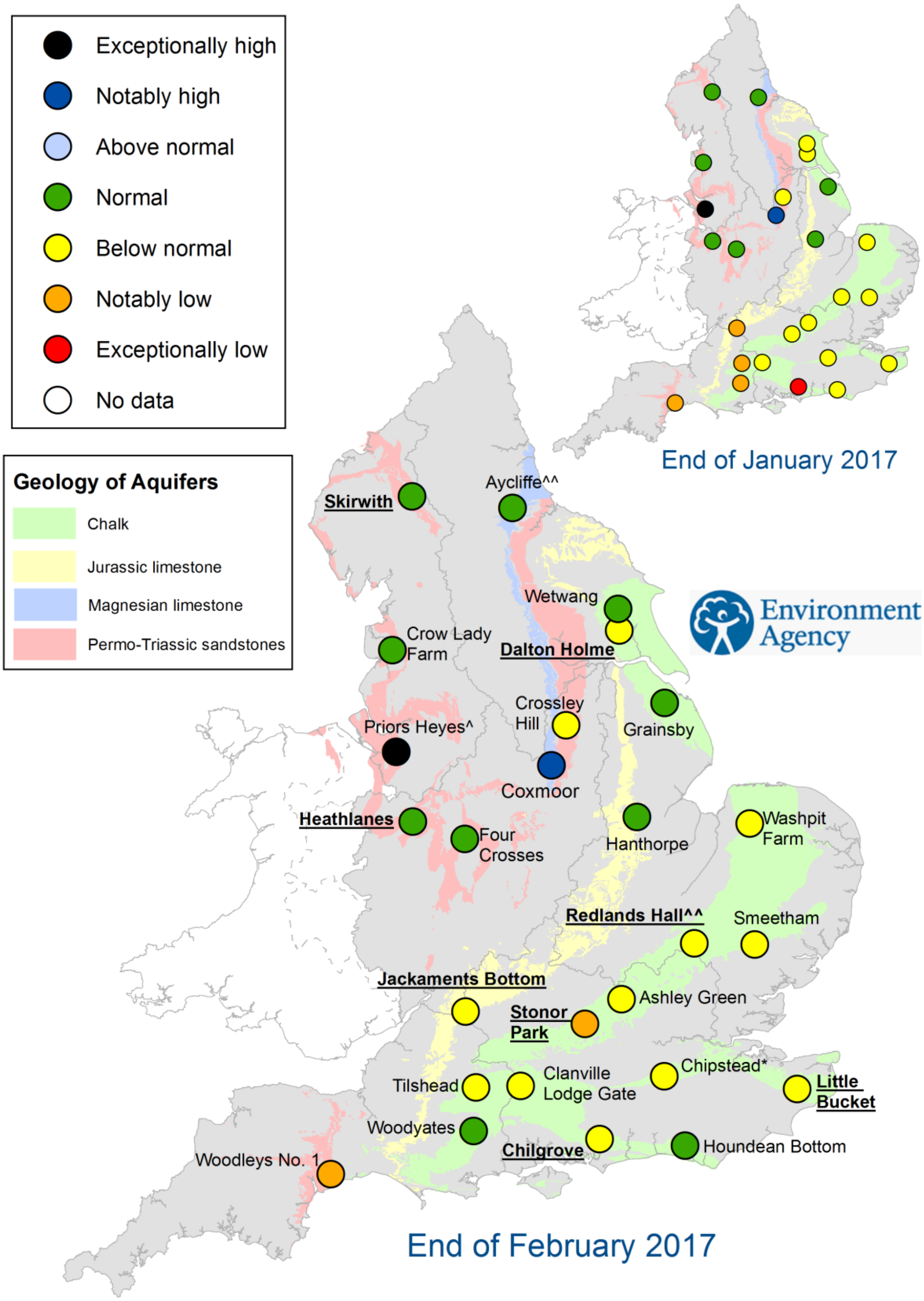


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 2017 and February 2017, 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, 2017.

Groundwater level charts

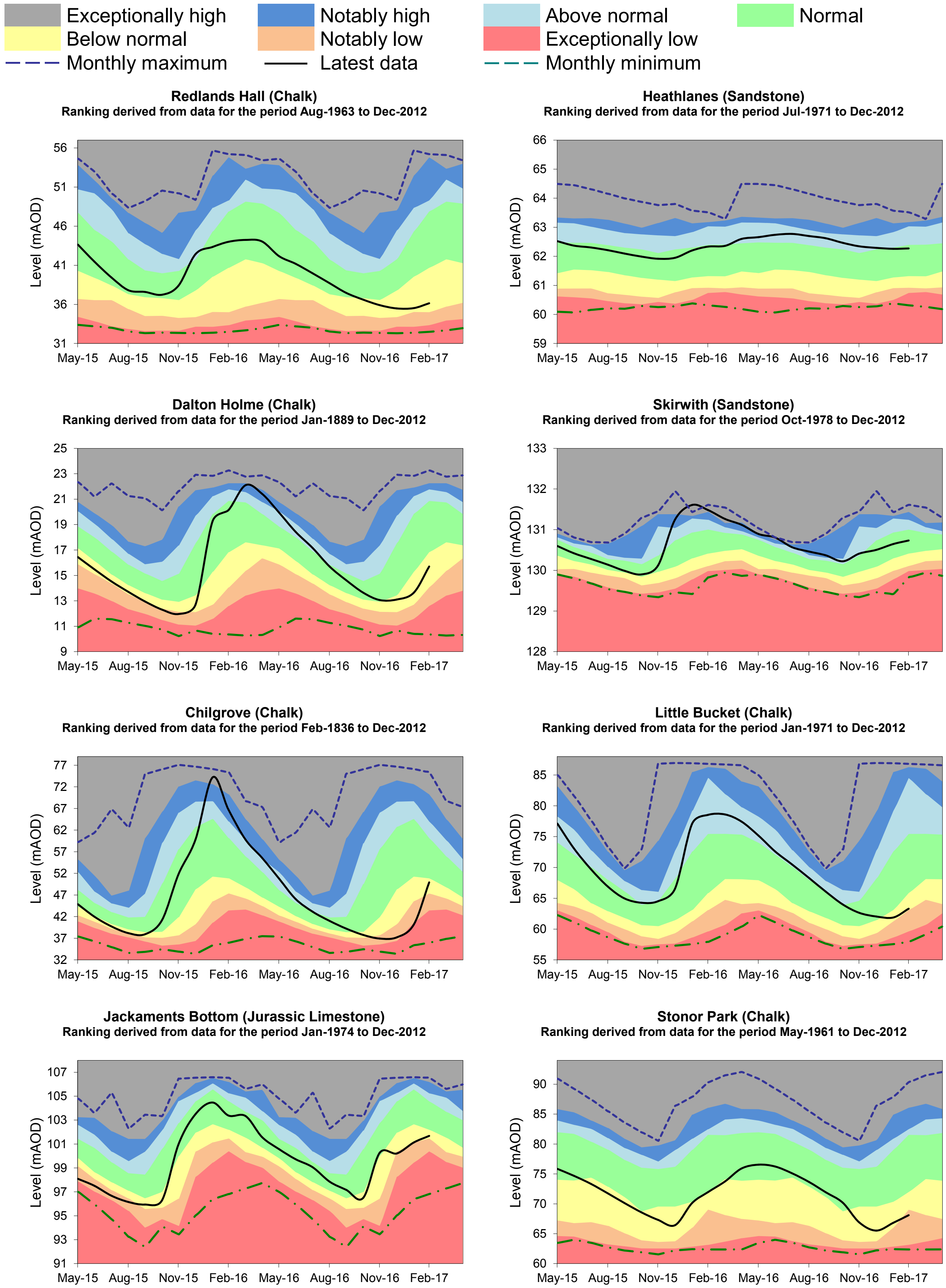
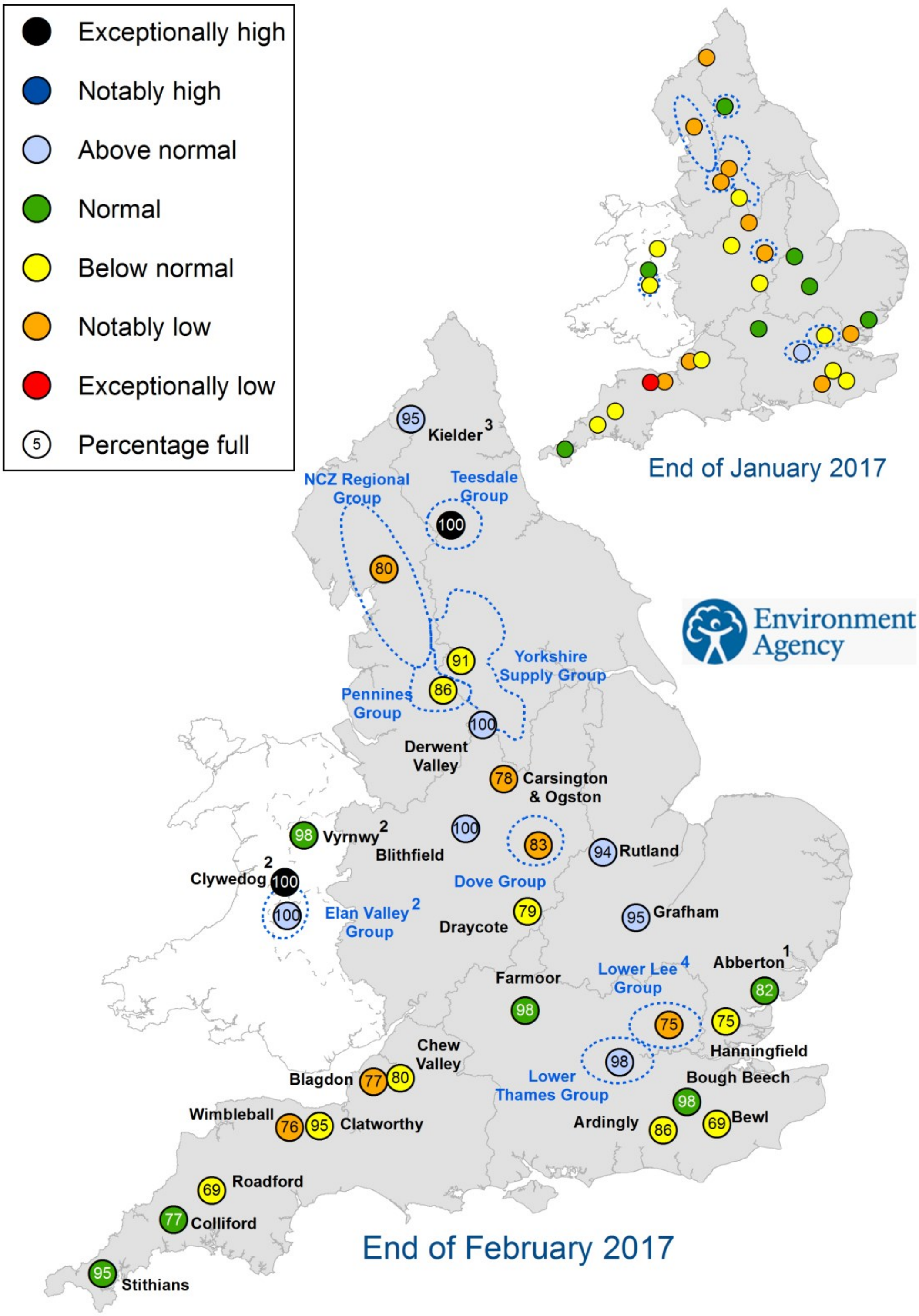


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2017).

Reservoir storage



1. Engineering work at Abberton Reservoir in east England to increase capacity has been completed
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 will be deliberately lower than historical levels during a trial of a new flood alleviation control curve
4. Stocks affected by planned maintenance work

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of January 2017 and February 2017 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

	Below minimum monthly level		Above maximum monthly level		Average		Latest data

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

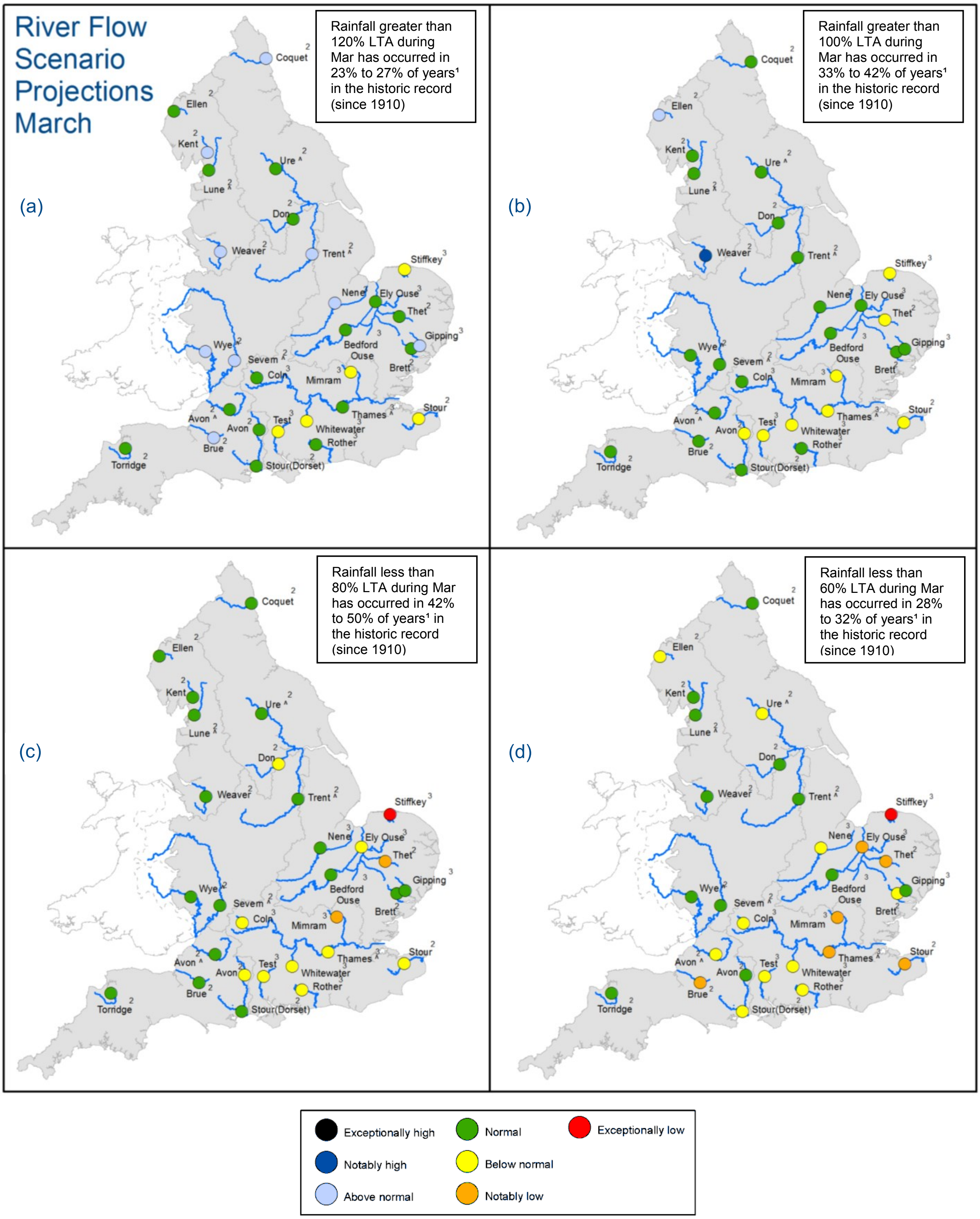


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during March 2017 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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*

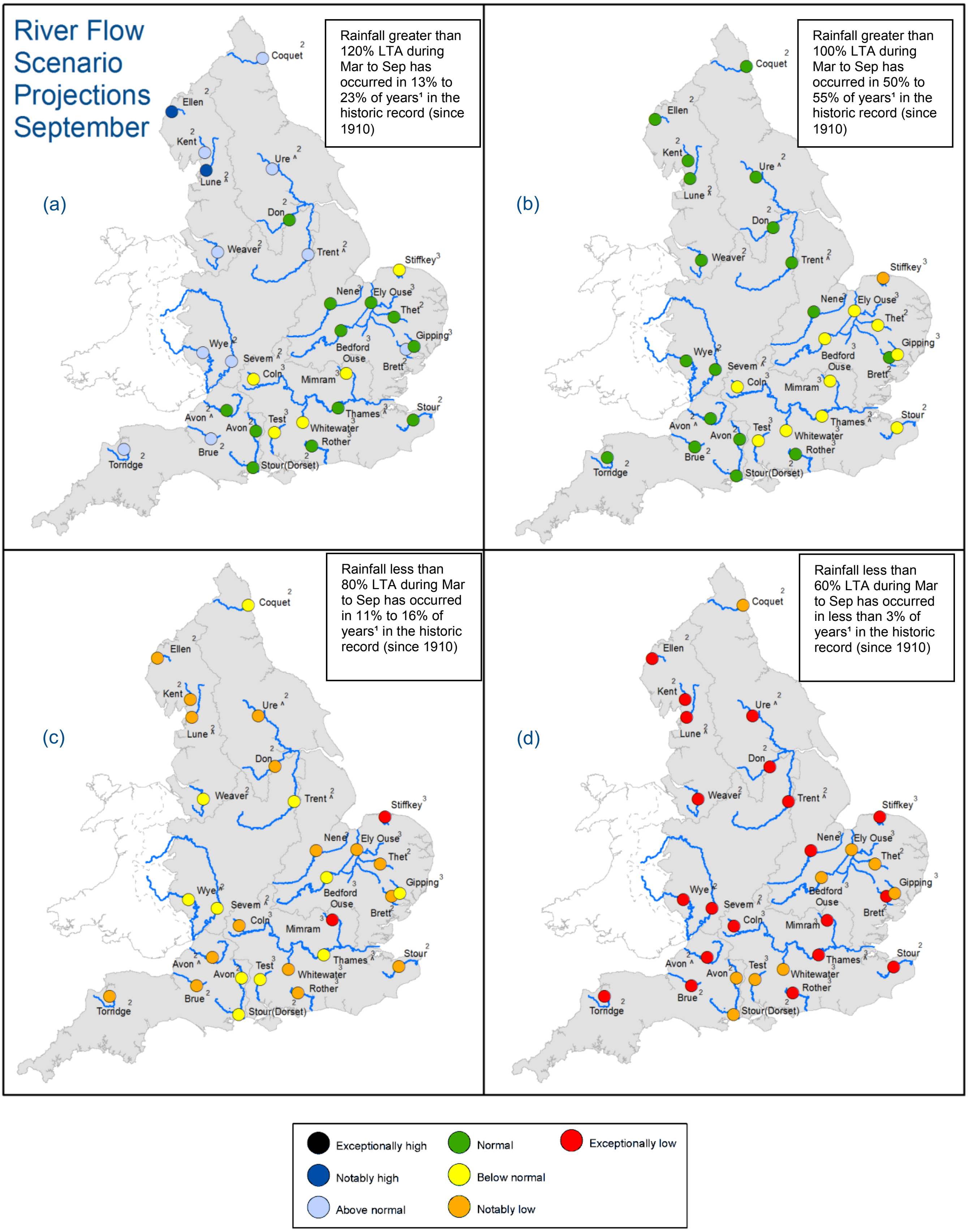


Figure 6.2: Projected river flows at key indicator sites up until the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March and September 2017 (Source: Centre for Ecology and Hydrology, Environment Agency).

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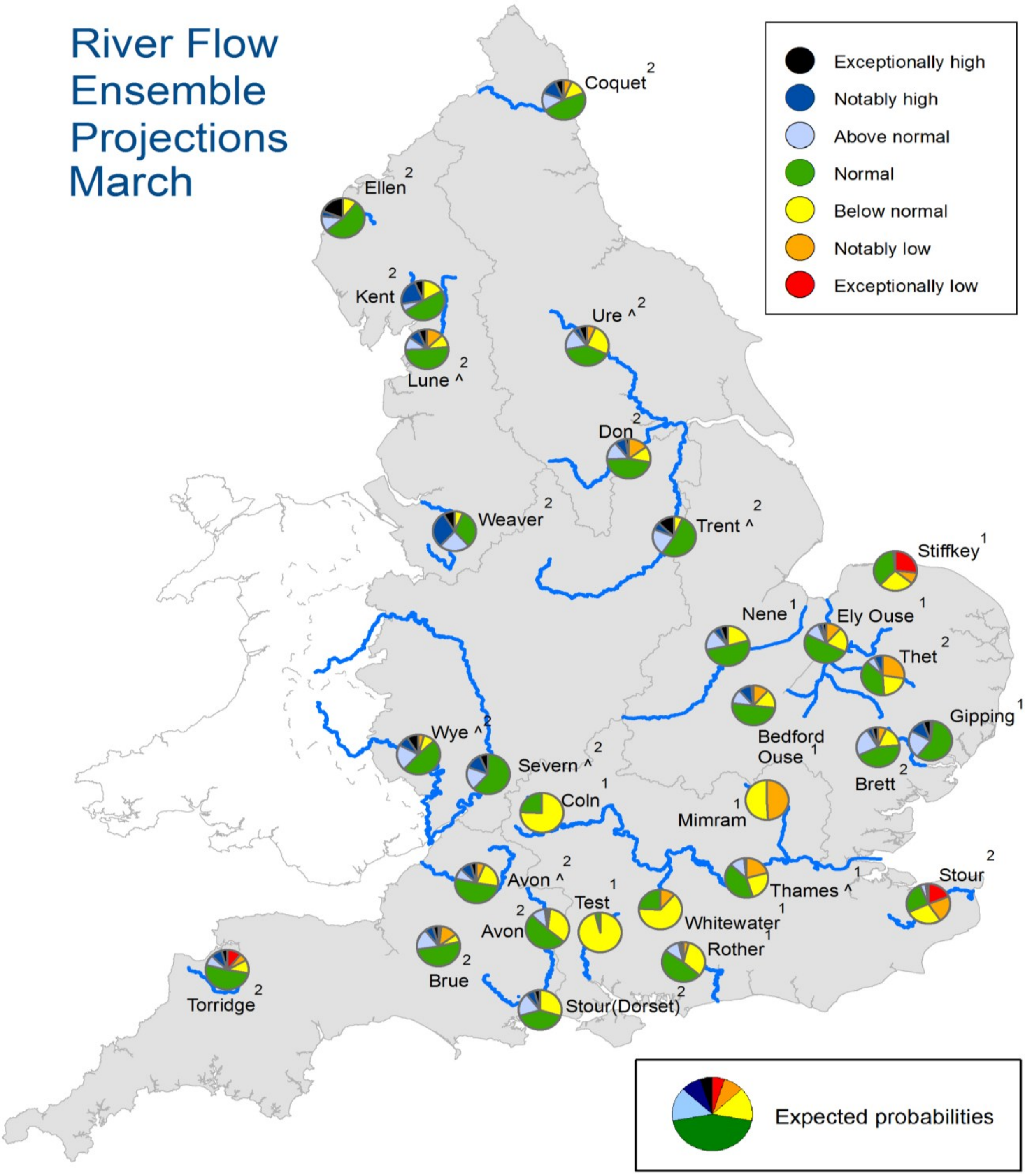

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2017. 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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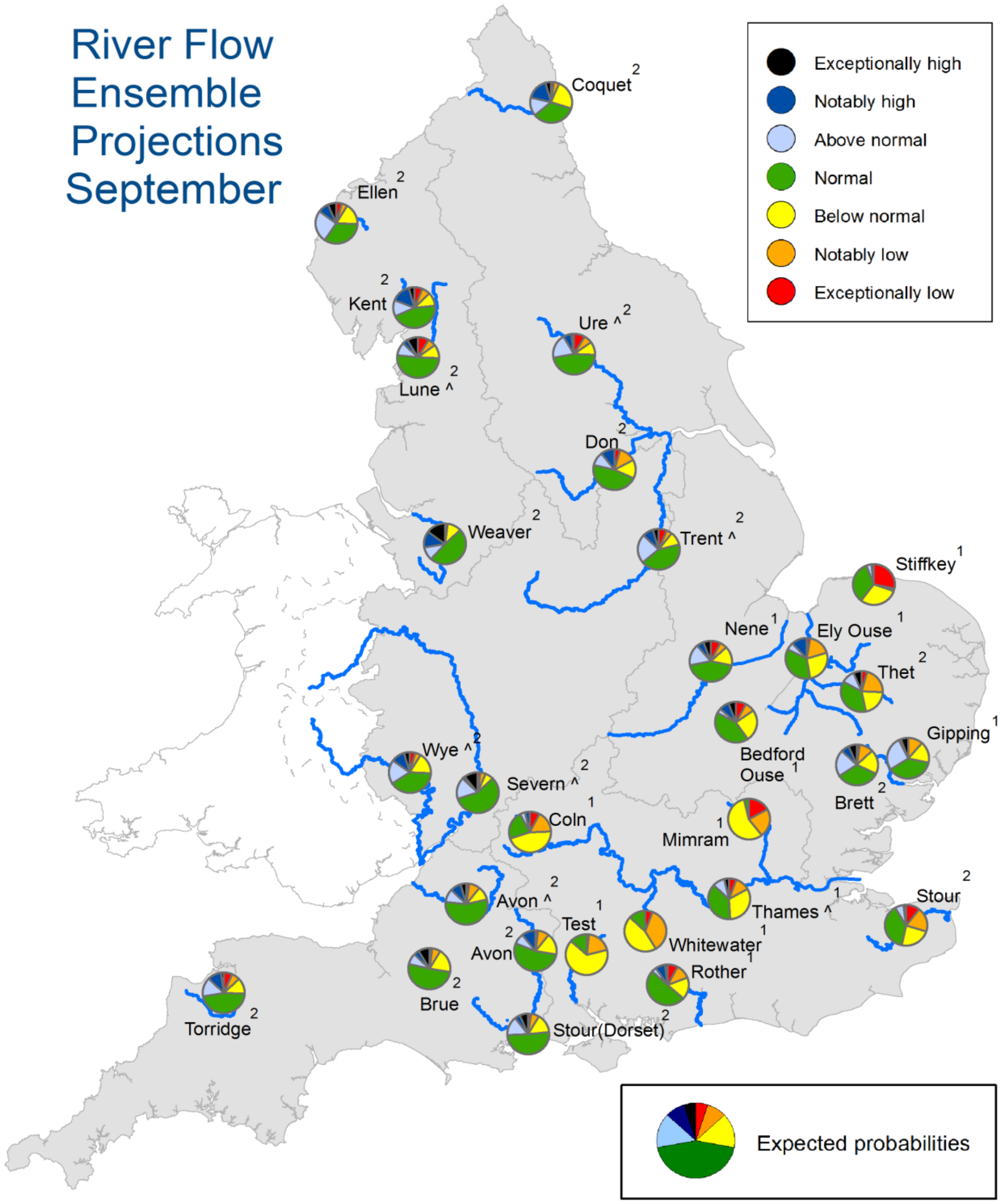


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2017. 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

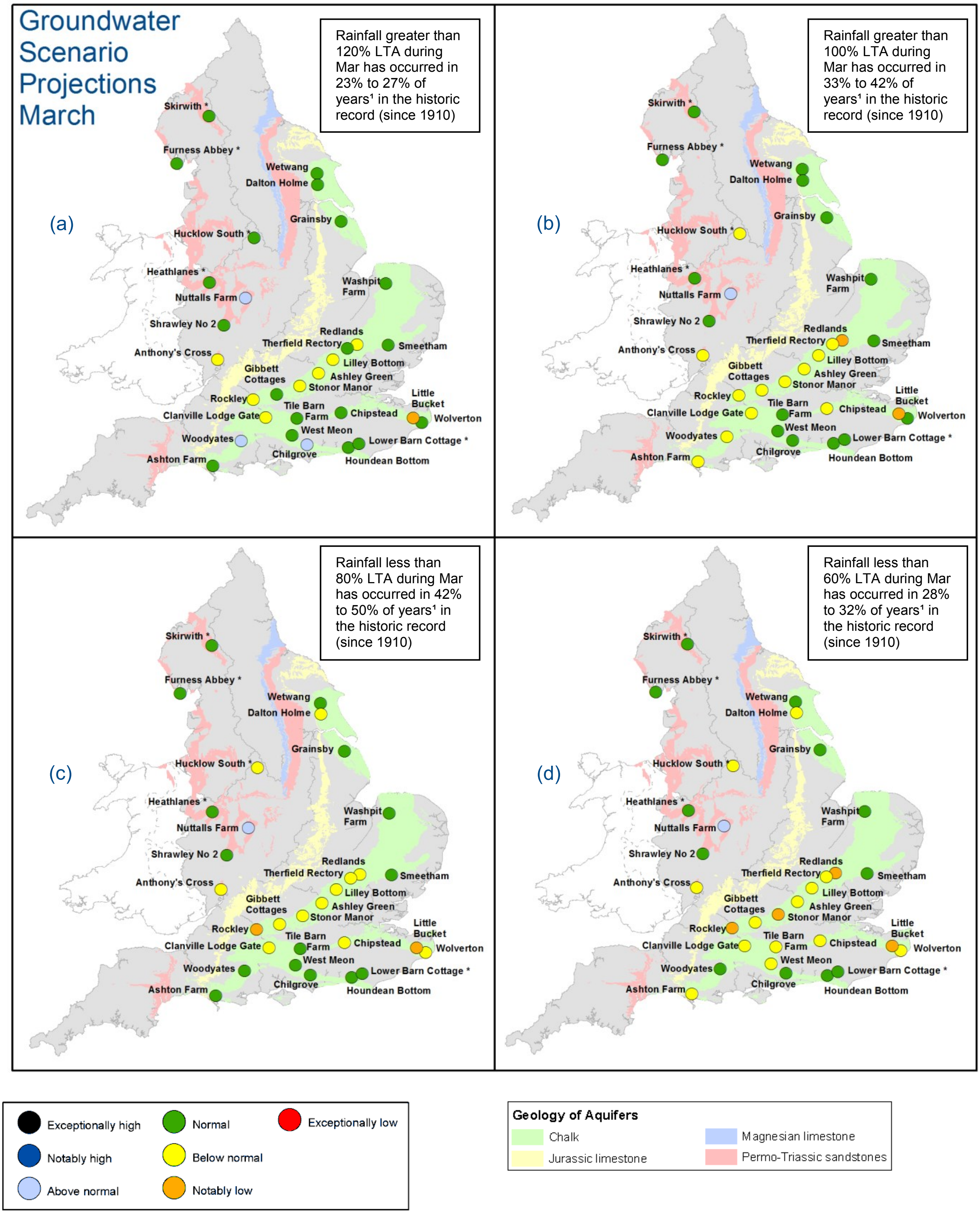


Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during March 2017 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2017.

* Projections for these sites are produced by BGS

[1] This range of probabilities is a regional analysis

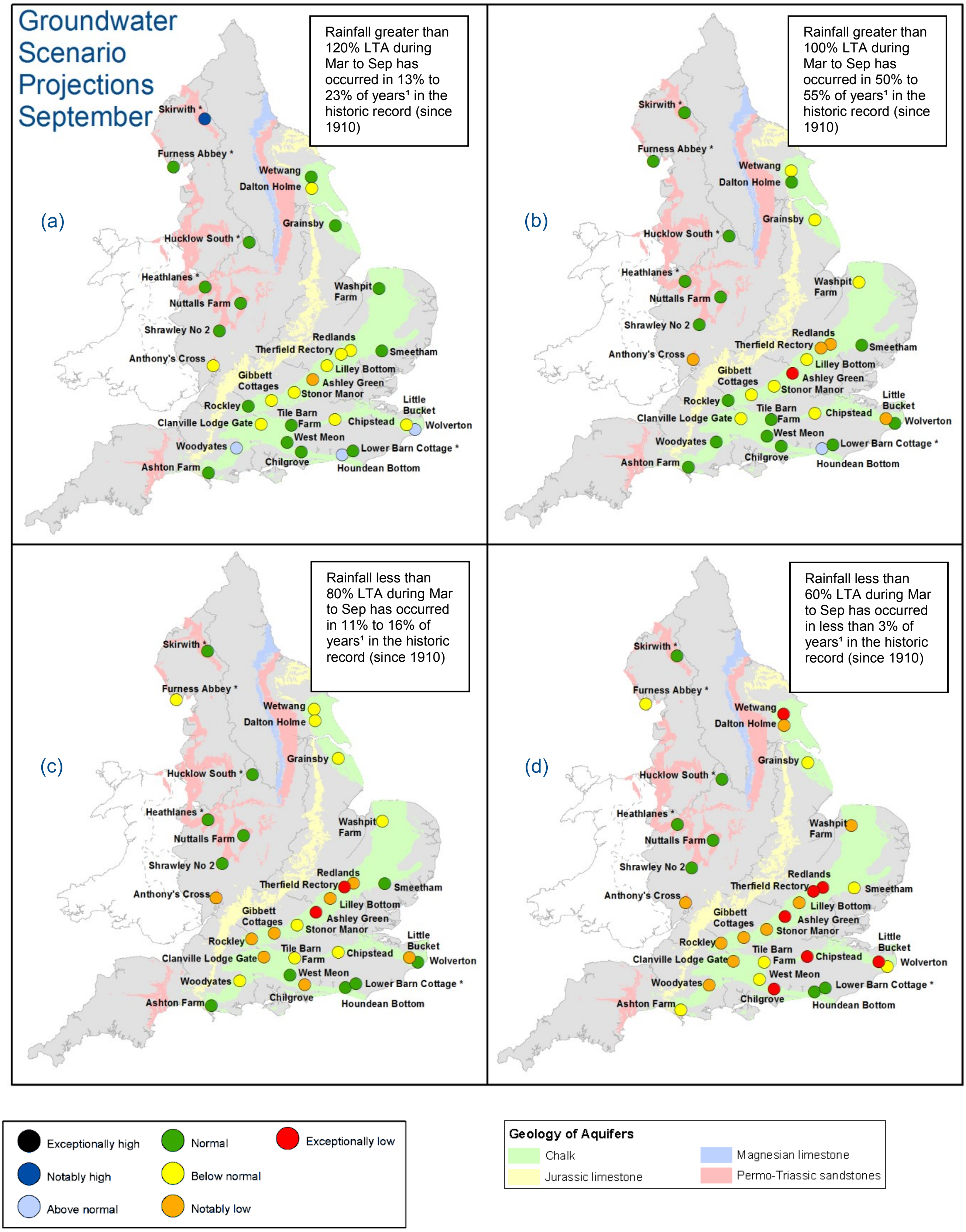
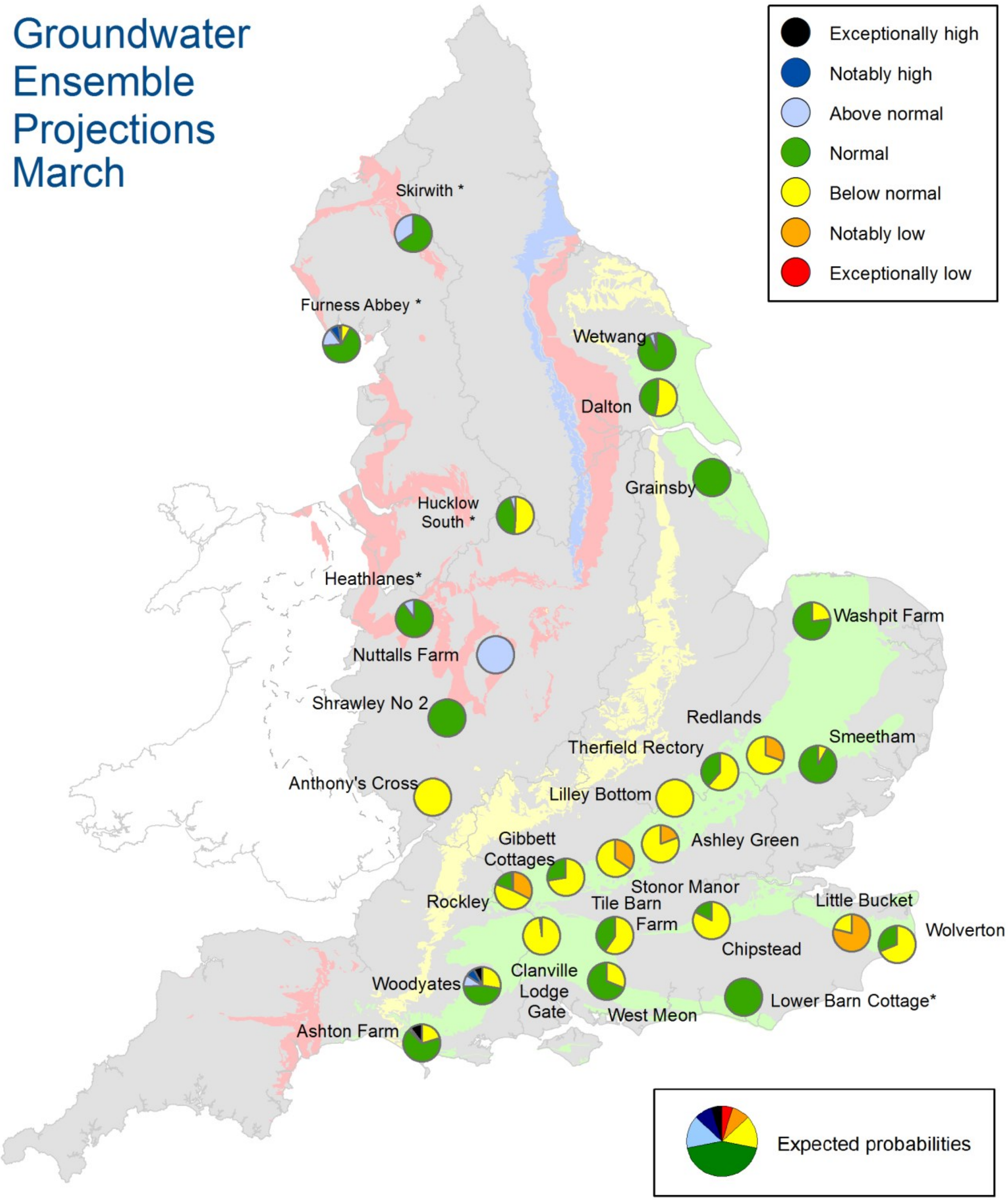


Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March and September 2017 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2016.

* 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 2017. 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, 2017.

** Projections for these sites are produced by BGS*

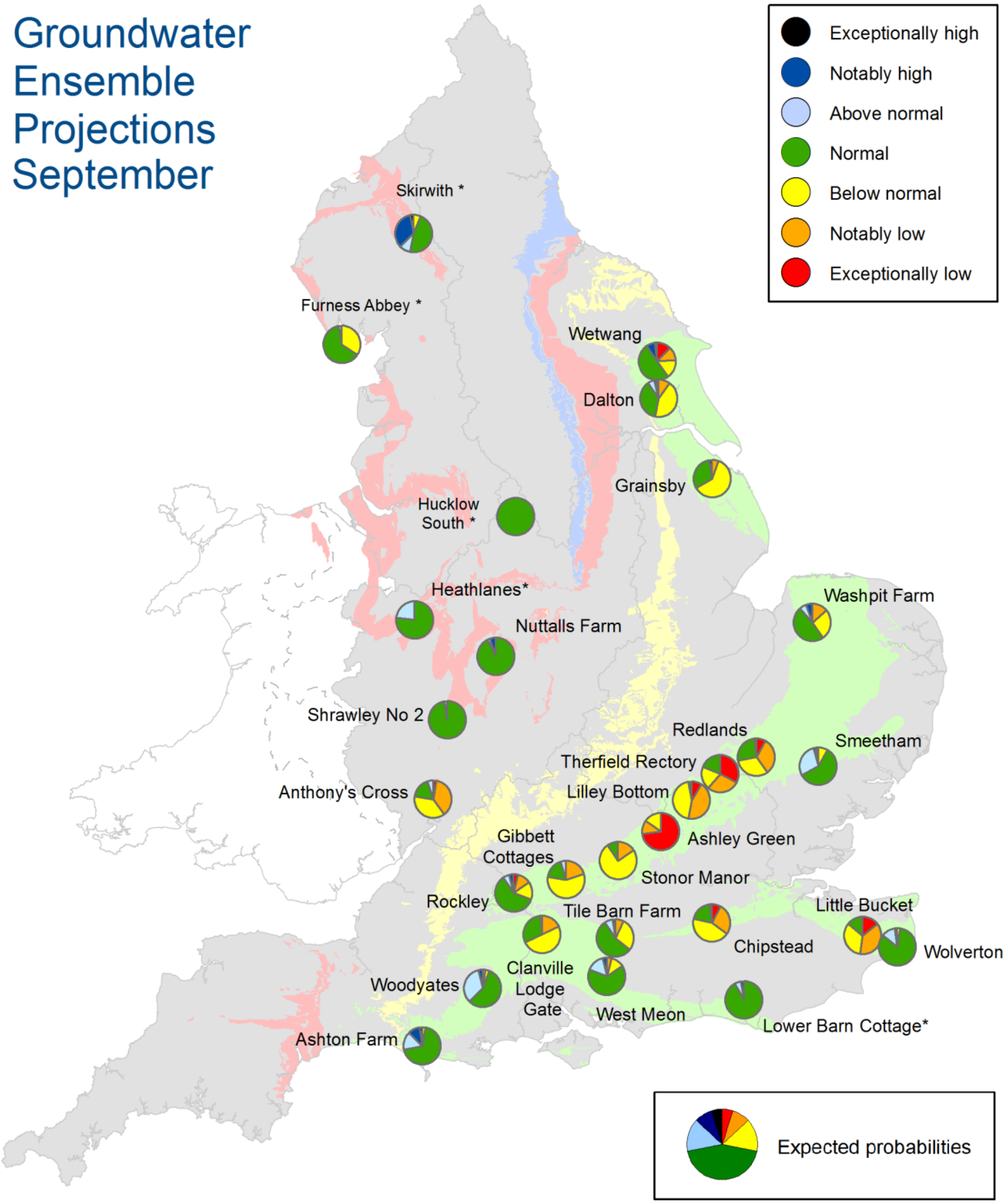


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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2017. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for 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, 2017.

* 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