Monthly water situation report

England

Summary – February 2015

February's rainfall was just below average across England at 92% of the long term average. Soil moisture deficits generally decreased during the month and were close to zero by the end of February across the whole of England. Monthly mean river flows decreased compared to January at all but 3 indicator sites and were classed as **normal** or **above normal** for the time of year at all sites. Groundwater levels increased at nearly two-thirds of indicator sites and were classed as **normal** or higher for the time of year at all but 3 sites. Reservoir stocks increased or remained static at the majority of sites and stocks were classed as **normal** or higher for the time of year at all but two sites. Overall reservoir stocks for England remained unchanged at 94% of total capacity.

Rainfall

Parts of Cumbria and coastal areas of Devon and Cornwall received the highest rainfall totals during February of between 100 and 130 mm. The lowest rainfall totals of between 17 and 30 mm occurred across parts of Lincolnshire, Nottinghamshire, North Yorkshire and Northumberland. February rainfall totals were above the long term average (LTA) in half of the hydrological areas, with much of Kent, East and West Sussex and parts of Cumbria receiving between 125 and 160% of the LTA. In contrast, parts of Yorkshire and Northumberland received less than 60% of the LTA (Figure 1.1).

February rainfall totals were classed as **normal** for the time of year across the majority of hydrological areas, although those covering much of north-east England were classed as **below normal** or **notably low**. Over the 3 and 6 month periods ending in February, cumulative rainfall totals were **normal** across most of England; however much of north-east England, Lincolnshire and Nottinghamshire were **below normal** or **notably low** (Figure 1.2)

At a regional scale, February rainfall totals were **normal** for the time of year except in north-east England where they were classed as **below normal**. Totals ranged from 68% of the February LTA in north-east England to 117% in south-east England. Overall, England received 92% of the February LTA (Figure 1.3)

Soil moisture deficit

Soil moisture deficits (SMDs) decreased or remained at zero during February across two thirds of the MORECS grid squares covering England. At the end of February SMDs were less than 10 mm in all but one MORECS grid square. End of month SMDs were close to the LTA across much of England and up to approximately 30 mm smaller than the LTA in parts of east, south-east and north-east England (Figure 2.1).

At a regional scale, SMDs decreased by up to 2mm across England. End of month SMDs were 3 mm or less across all regions (Figure 2.2).

River flows

Monthly mean river flows for February decreased compared to January at all but 3 indicator sites across England. Flows were classed as **normal** for the time of year at all but 6 indicator sites; these 6 sites, all located in east and south-east England, were classed as **above normal**. Flows on the River Derwent in north-east England returned to **normal** for the time of year in February, having been classed as lower than **normal** since December 2014 (Figure 3.1).

Monthly mean river flows were classed as **normal** for the time of year at 6 of the 7 regional index sites; the Great Stour in south-east England was **above normal** for the time of year (Figure 3.2).

Groundwater levels

Groundwater levels rose at nearly two thirds of indicator sites across England during February. At the end of the month, levels were classed as **normal** or **above normal** for the time of year at just over three quarters of the indicator sites. Levels at Little Bucket (located in the East Kent Stour chalk aquifer) and Smeetham (in the North

Essex chalk aquifer) remained **notably high**, whilst the levels at Swan House (in the Wear magnesian limestone aquifer), Jackaments Bottom (in the Burford Jurassic limestone aquifer) and Tilshead (in the Upper Hampshire Avon chalk aquifer) dropped to **below normal** for the time of year.

End of month groundwater levels at the major aquifer index sites were **normal** or **above normal** for the time of year at 6 of the 8 sites. Little Bucket in the East Kent Stour chalk aquifer was **notably high** whilst Jackaments Bottom in the Burford Jurassic limestone aquifer was **below normal** (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks increased or remained static at nearly three-quarters of all reported reservoirs and reservoir groups. Increases in stocks of between 5 and 8% occurred at 5 reservoirs located in east, south-east and south-west England. The NCZ Regional and Pennines reservoir groups in north-west England decreased by 4%. All but 3 reservoirs are within 10% of full capacity, with 9 being full. At the end of February, stocks were classed as **normal** or higher for the time of year at all but two reported reservoirs (Figure 5.1).

Regional-scale reservoir stocks increased during February by up to 3%, except in south-east and north-west England where stocks decreased by 2% and 3% respectively. At the end of February, regional stocks ranged from 91% of total capacity in east England to 98% in central England. Overall reservoir storage for England remained unchanged at 94% of total capacity (Figure 5.2).

Forward look

Cold, settled conditions interspersed with periods of wet and windy weather are expected during March. Temperatures will become milder mid-way through the month as more settled conditions prevail, particularly in south-east England. For the period March to May, predictability is low although there is a slightly increased chance of near- to below-average precipitation[1].

Projections for river flows at key sites[2]

Three quarters of sites have a greater than expected chance of **normal** river flows by the end of March 2015. More than two thirds of sites have greater than expected chance of **normal** cumulative river flows between March and September 2015.

For scenario based projections of river flows at key sites in March 2015 see Figure 6.1
For scenario based projections of river flows at key sites in September 2015 see Figure 6.2
For probabilistic ensemble projections of river flows at key sites in March 2015 see Figure 6.3
For probabilistic ensemble projections of river flows at key sites in September 2015 see Figure 6.4

Projections for groundwater levels in key aquifers[3]

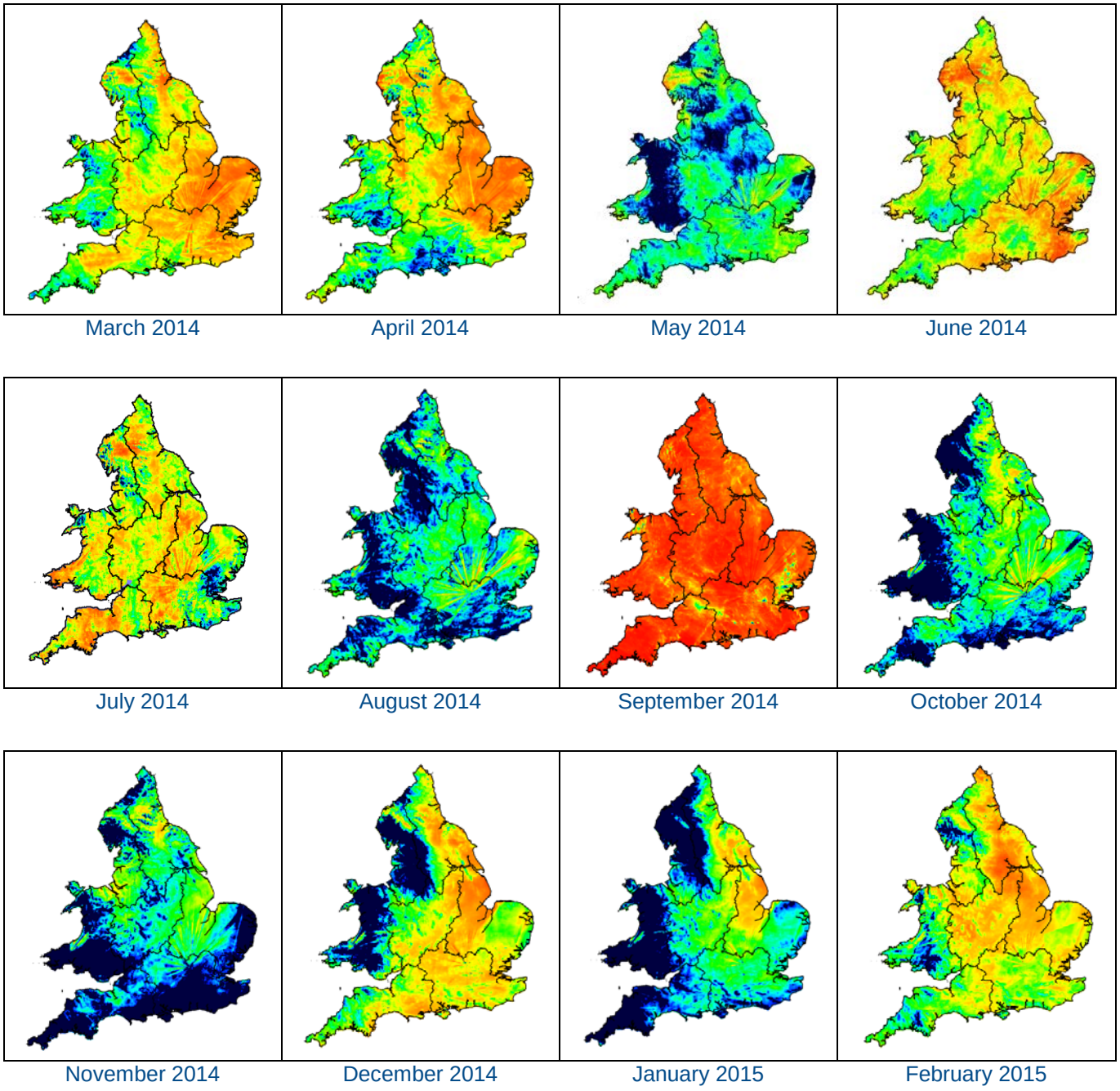
More than half of the sites have a greater than expected chance of **normal** or higher groundwater levels at the end of March 2015. At the end of September 2015 nearly two thirds of sites have a greater than expected chance of **normal** groundwater levels.

For scenario based projections of groundwater levels in key aquifers in March 2015 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in September 2015 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2015 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2015 see Figure 6.8

Authors: E & B 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.
3 Information produced by the Water Situation Forward Look group lead by Environment Agency in partnership with the Centre for Ecology and Hydrology, British Geological Survey, Met Office.

Rainfall



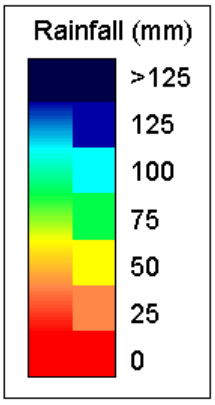


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2015). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2015.

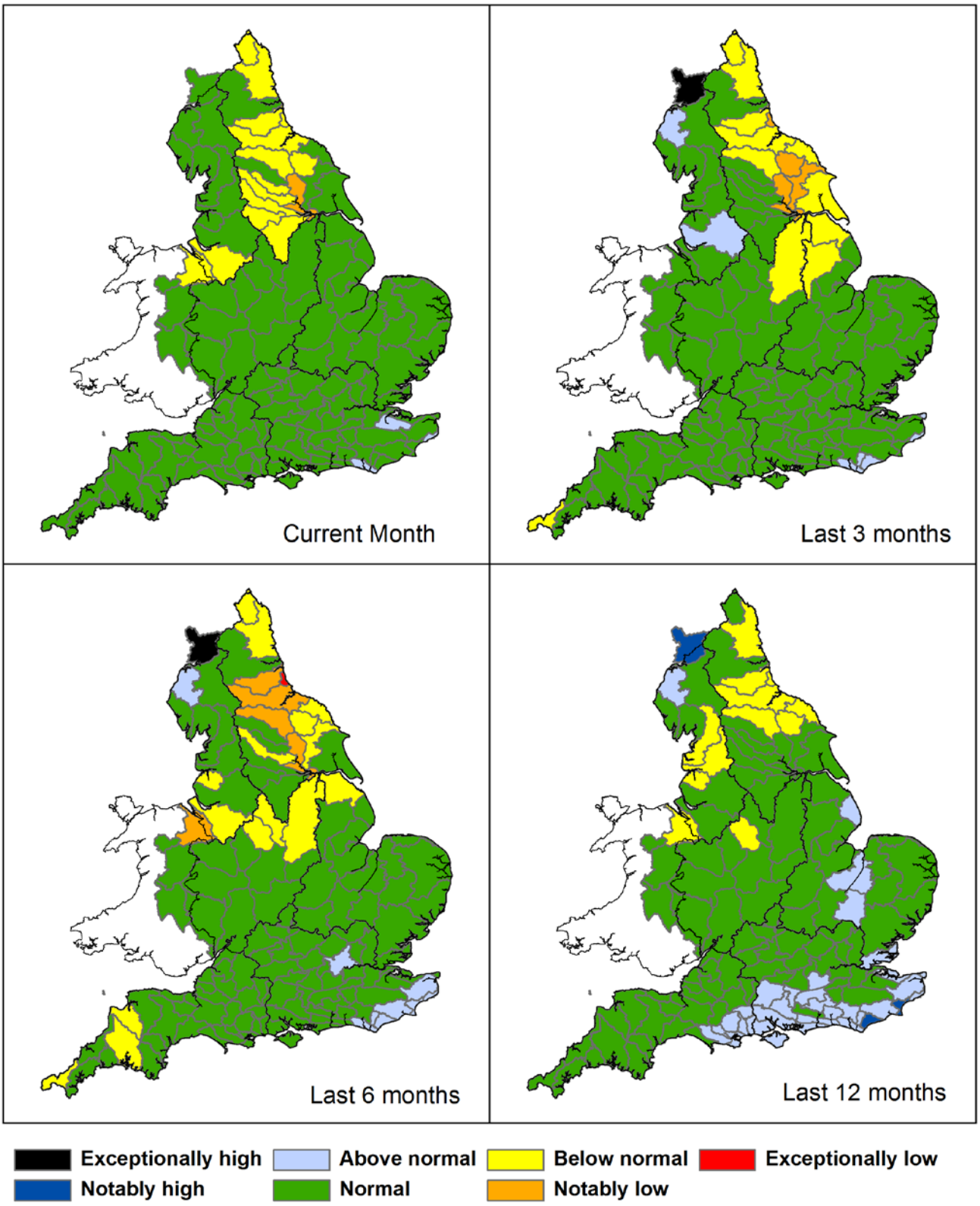


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 28 February), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final and provisional NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2015).* Crown copyright. All rights reserved. Environment Agency, 100026380, 2015.

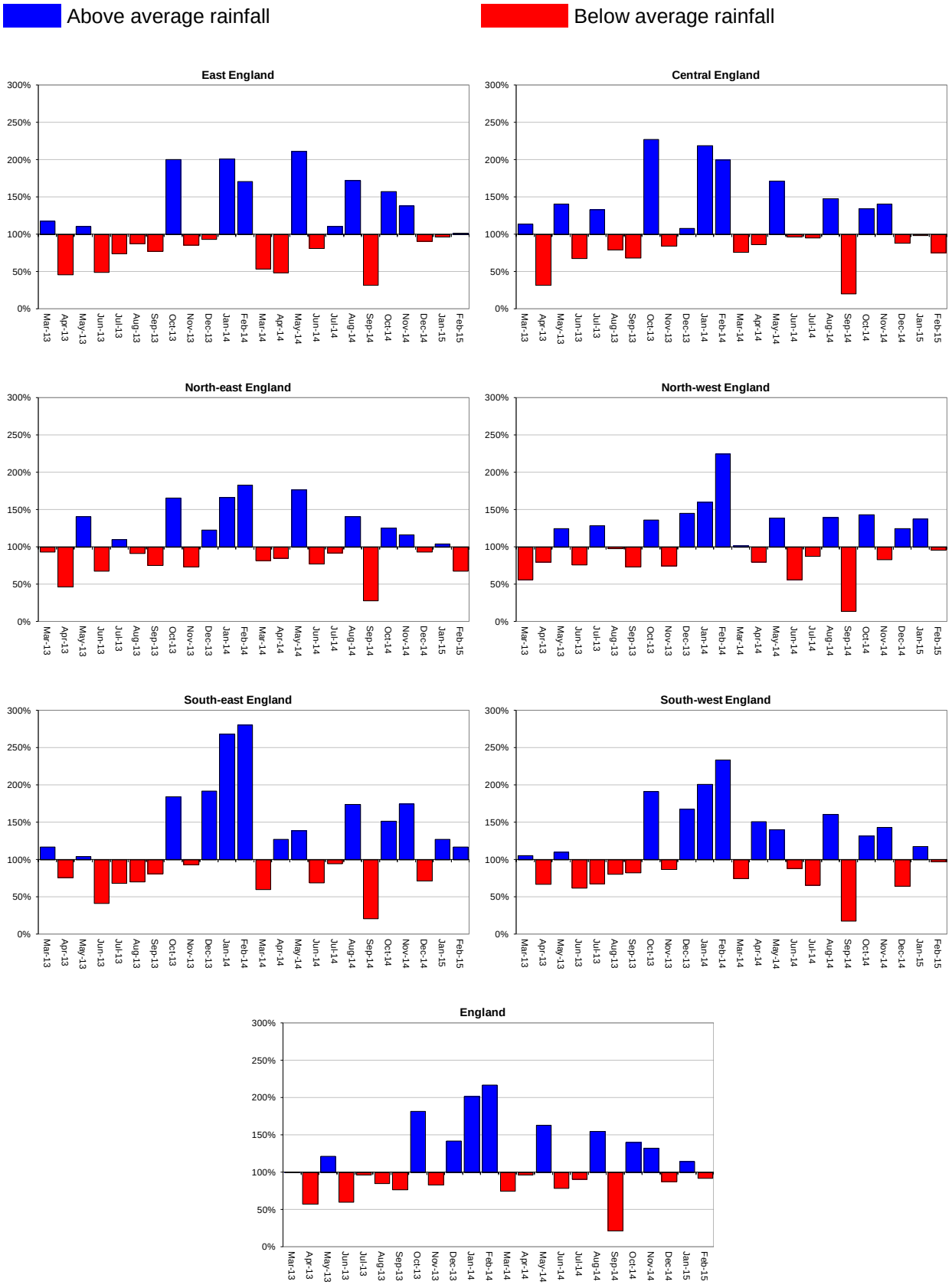


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2015).

Soil moisture deficit

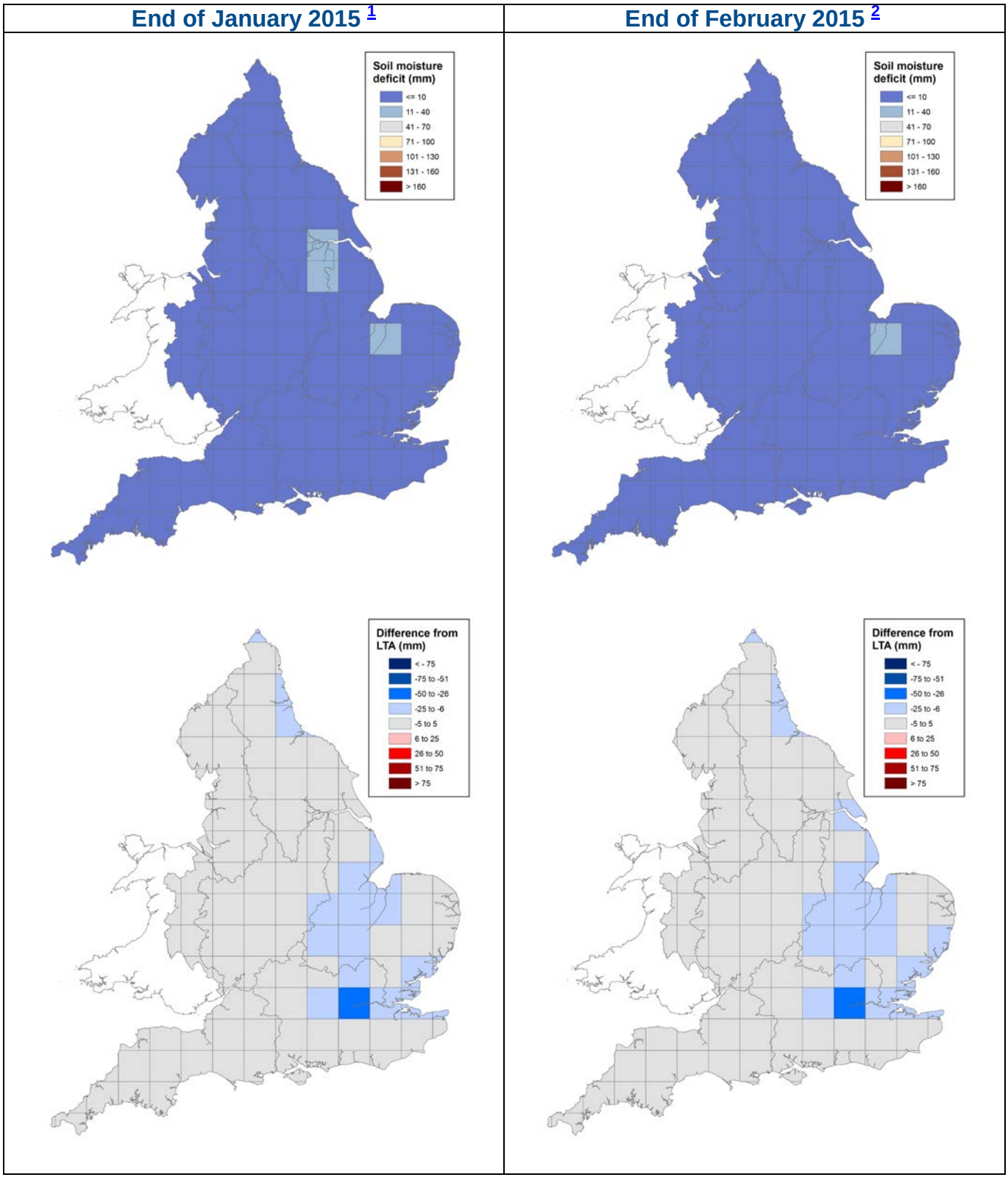


Figure 2.1: Soil moisture deficits for weeks ending 27 January 2015 [1] (left panel) and 24 February 2015 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2015). Crown copyright. All rights reserved. Environment Agency, 100026380, 2015

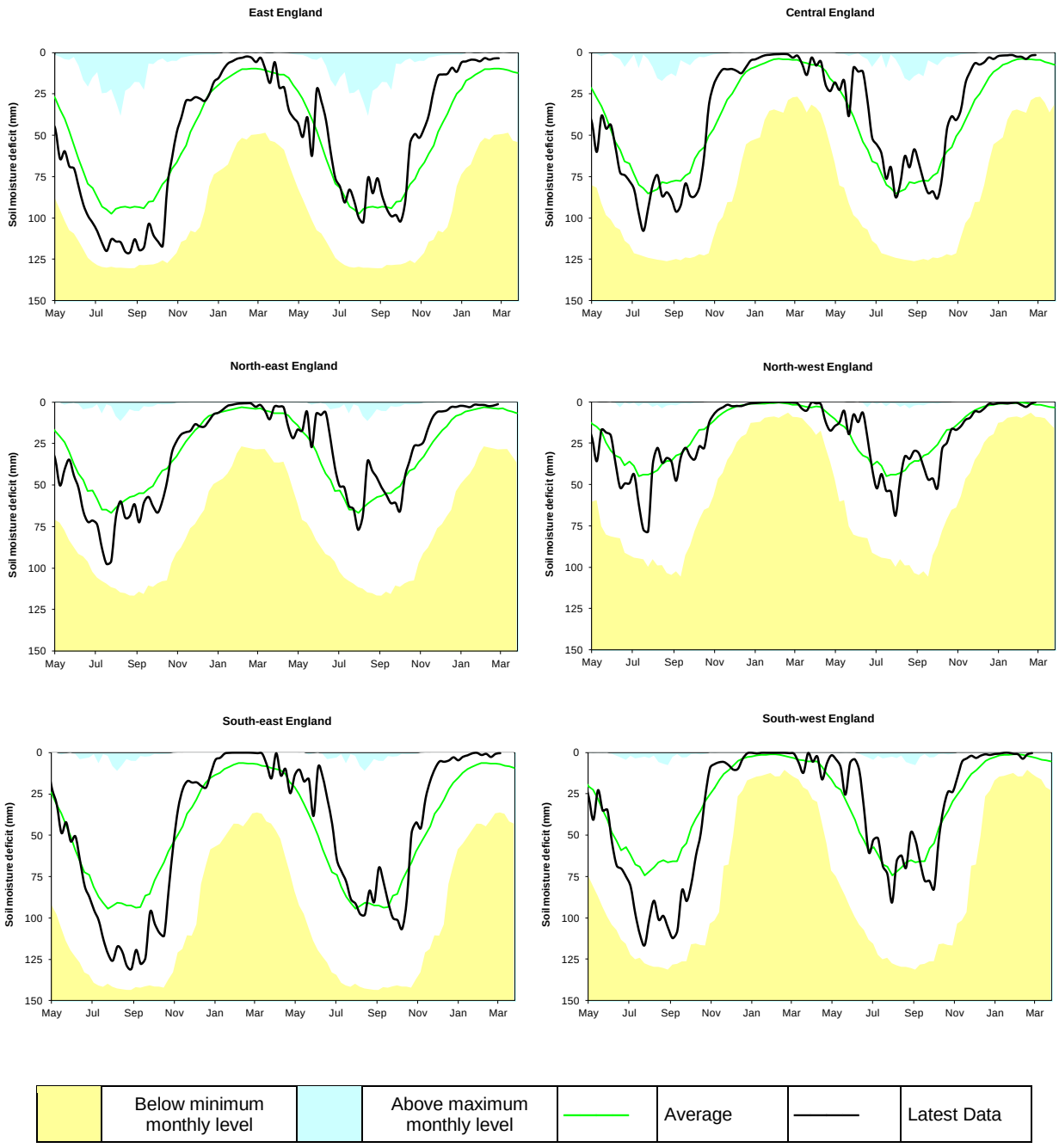
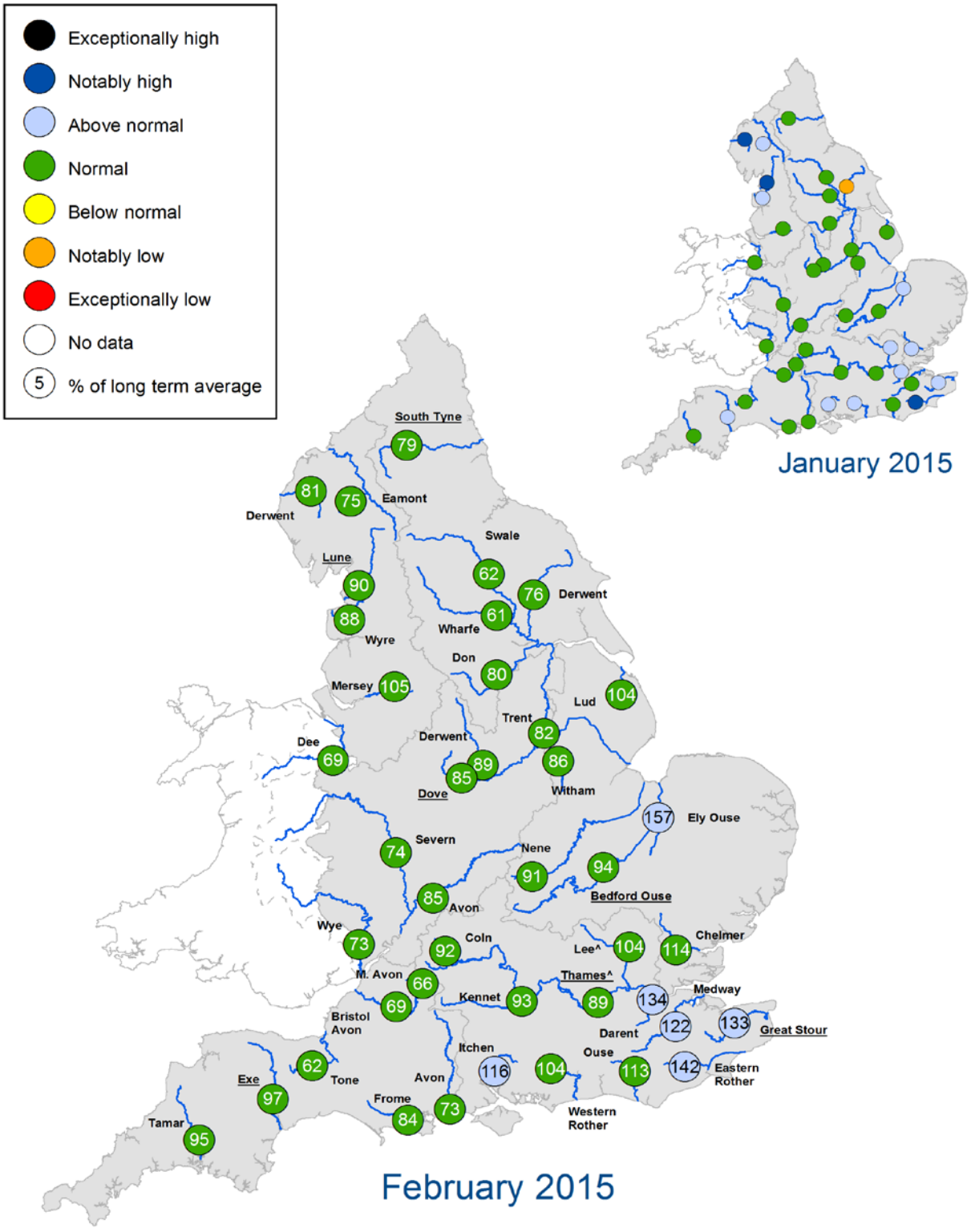


Figure 2.2: Latest soil moisture deficits for all regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2015).

River flows



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

+/- Monthly mean flow is the highest/lowest on record for the current month (note that record length varies between sites)

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 2015 and February 2015, 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, 2015.

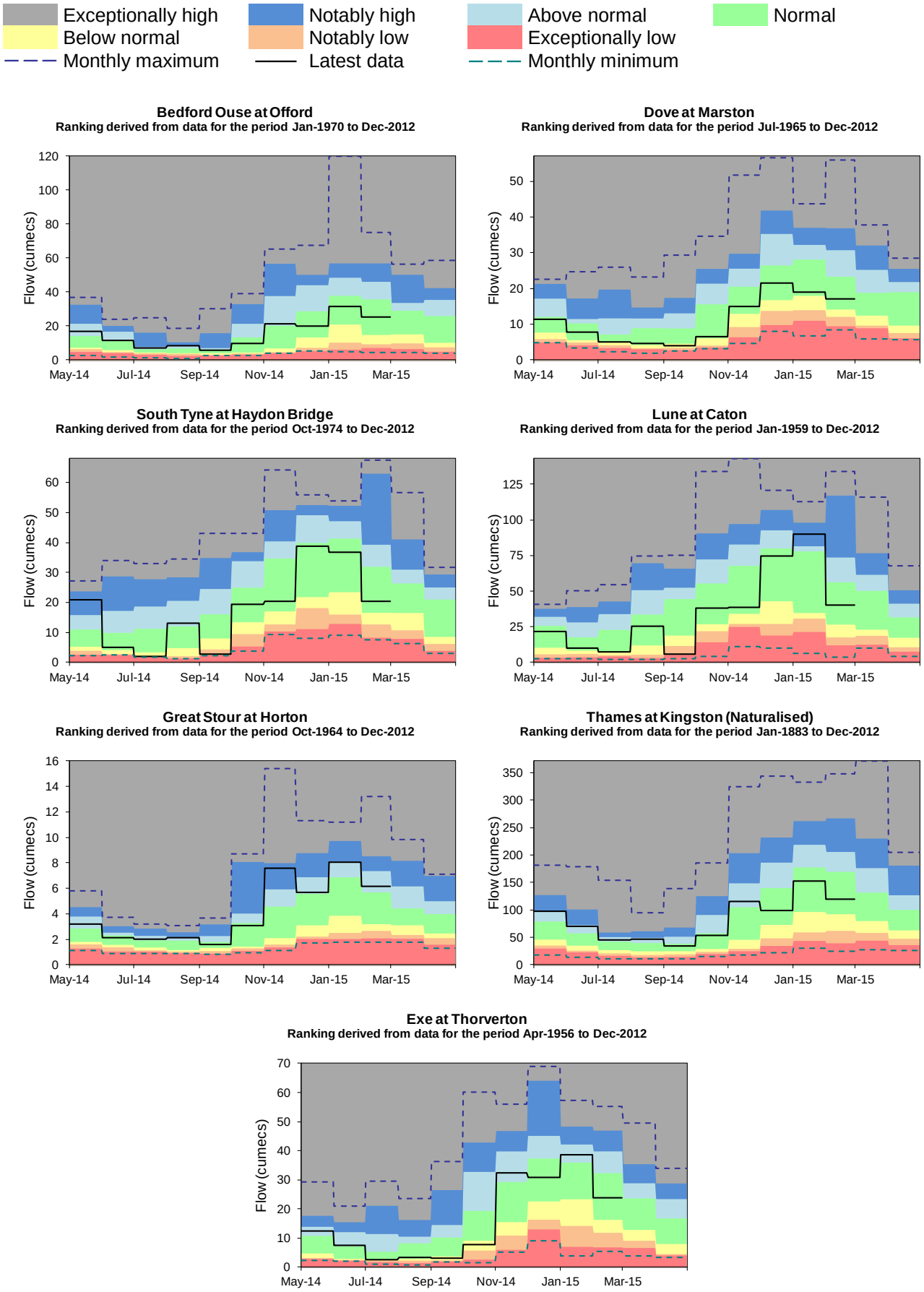
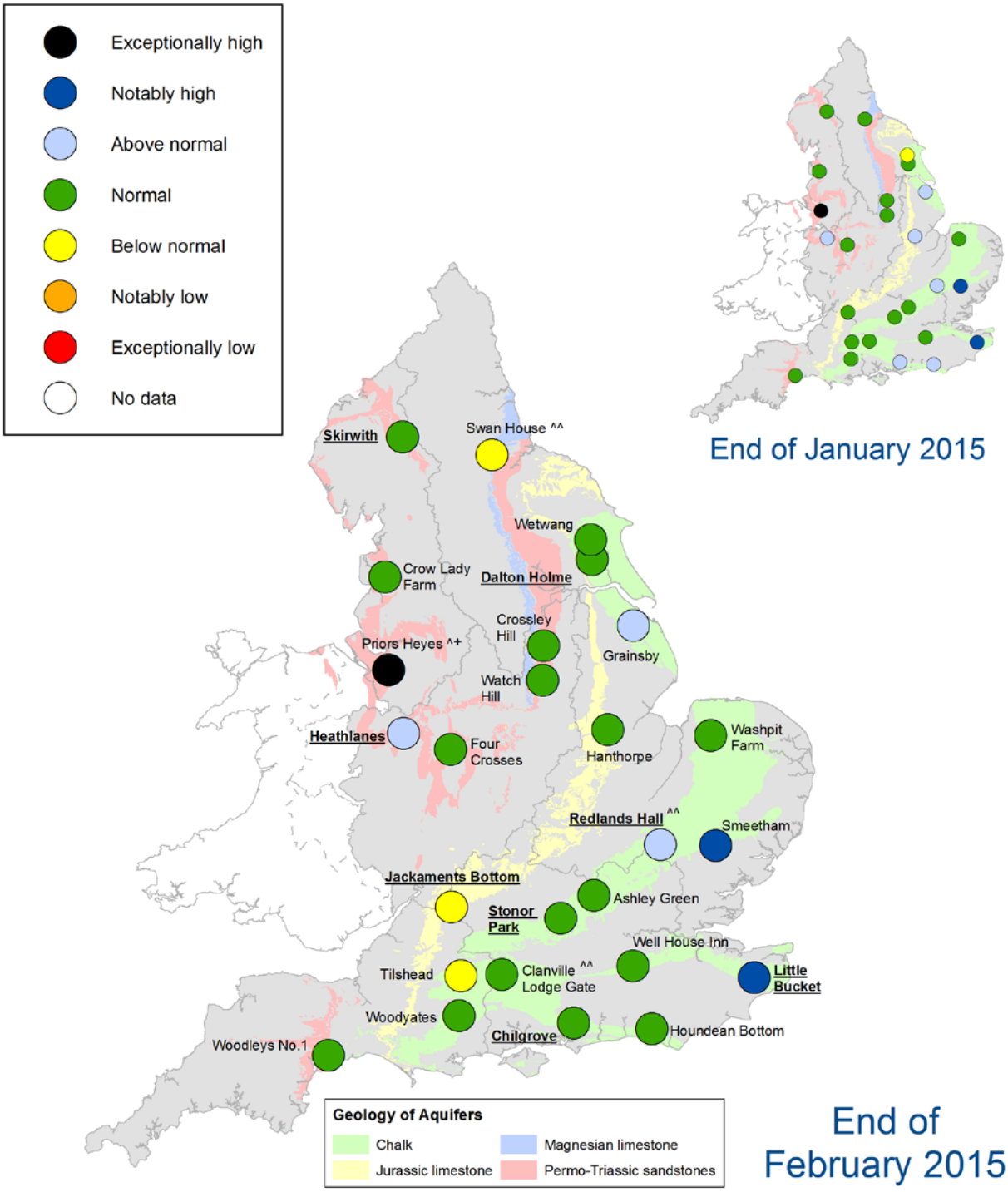


Figure 3.2: Index river flow sites for each region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

Groundwater levels



^ The level at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction.
^^ Sites are manually dipped at different times during the month. They may not be fully representative of levels at the month end
+/- End of month groundwater level is the highest/lowest on record for the current month (note that record length varies between sites).
Highlighted 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 2015 and February 2015, 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, 2015.

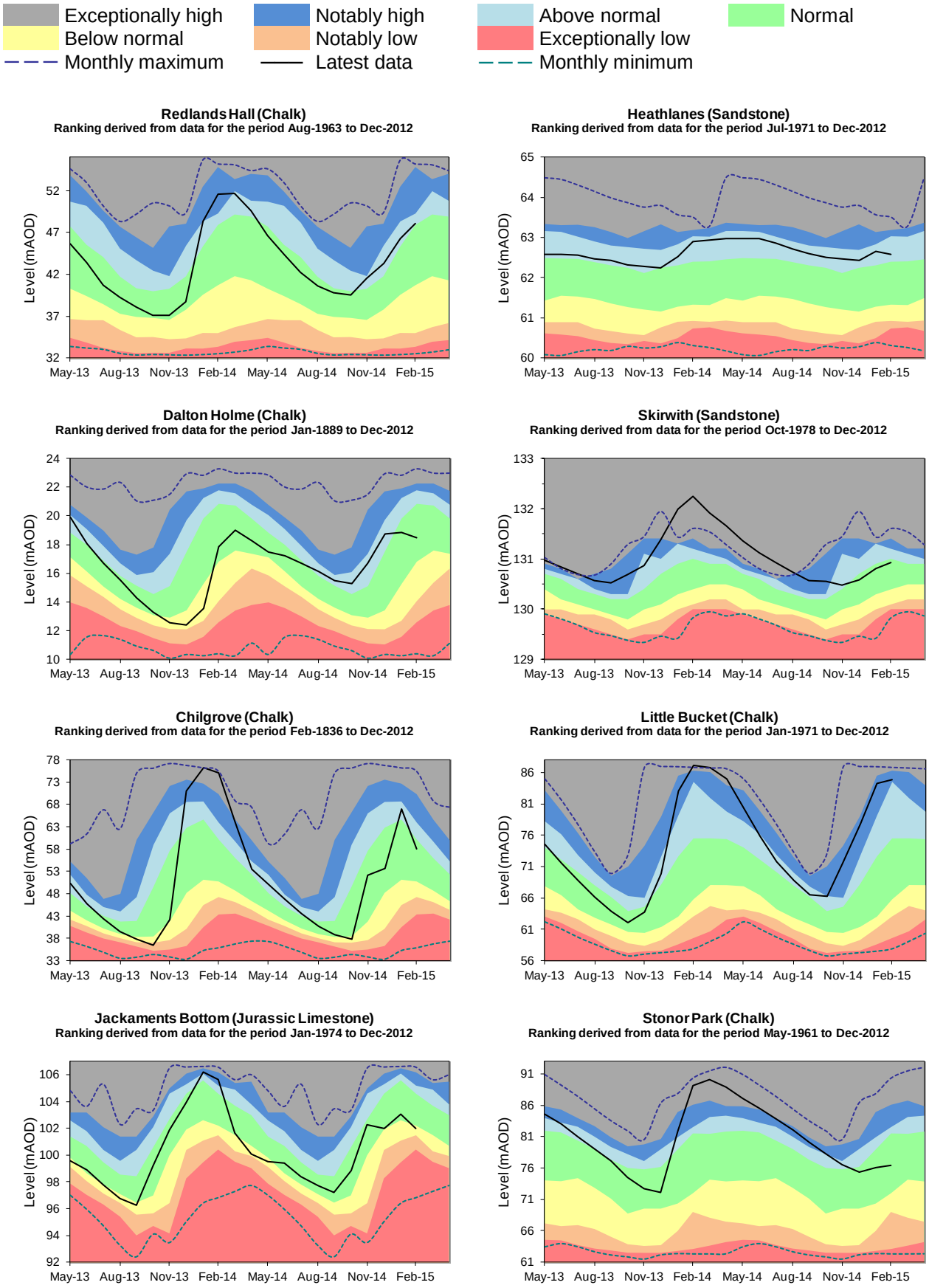
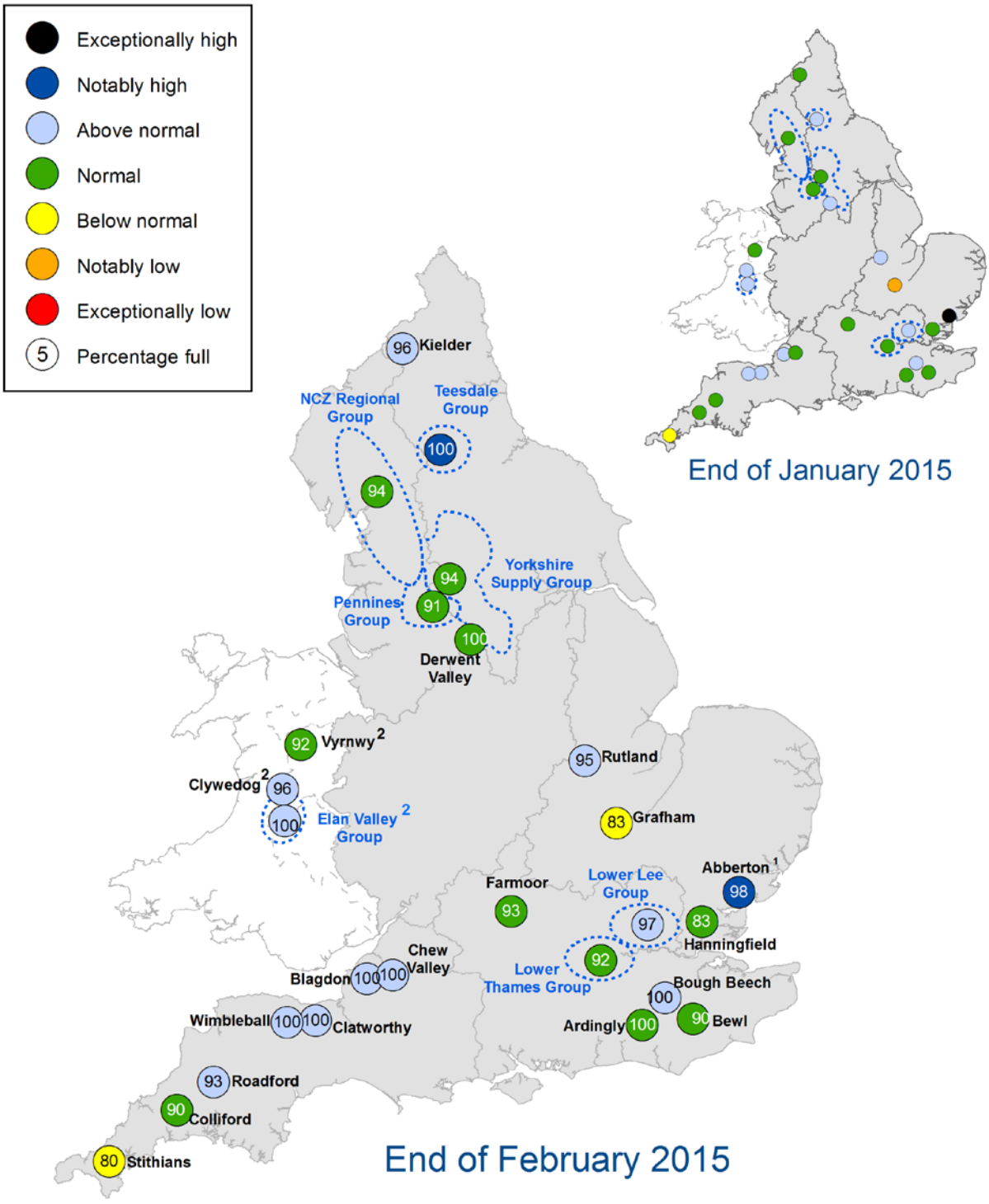


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2015).

Reservoir storage



1. Water levels have been affected by engineering work at Abberton Reservoir in Essex to increase capacity
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to central and northwest England

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end January 2015 and February 2015 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.

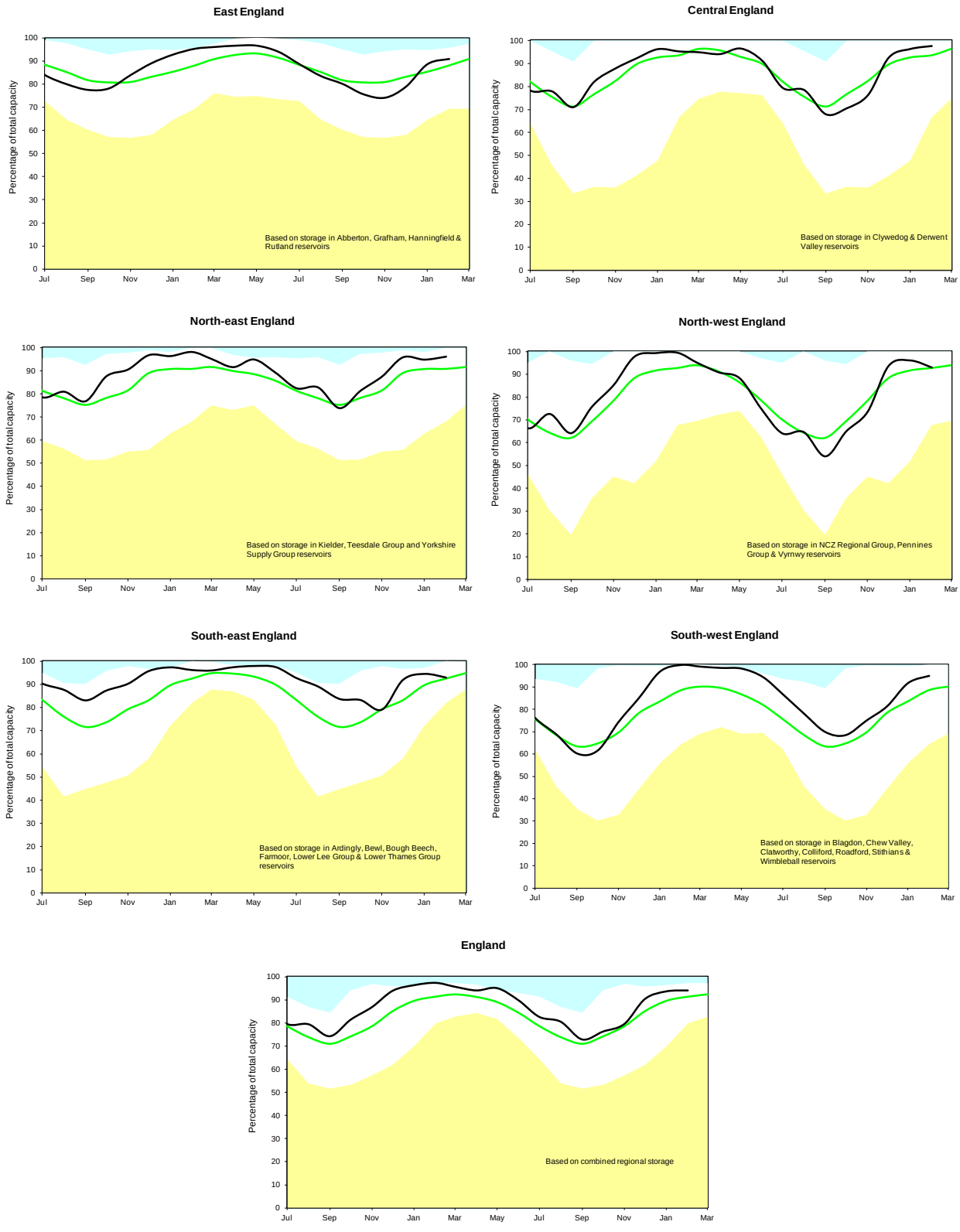


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

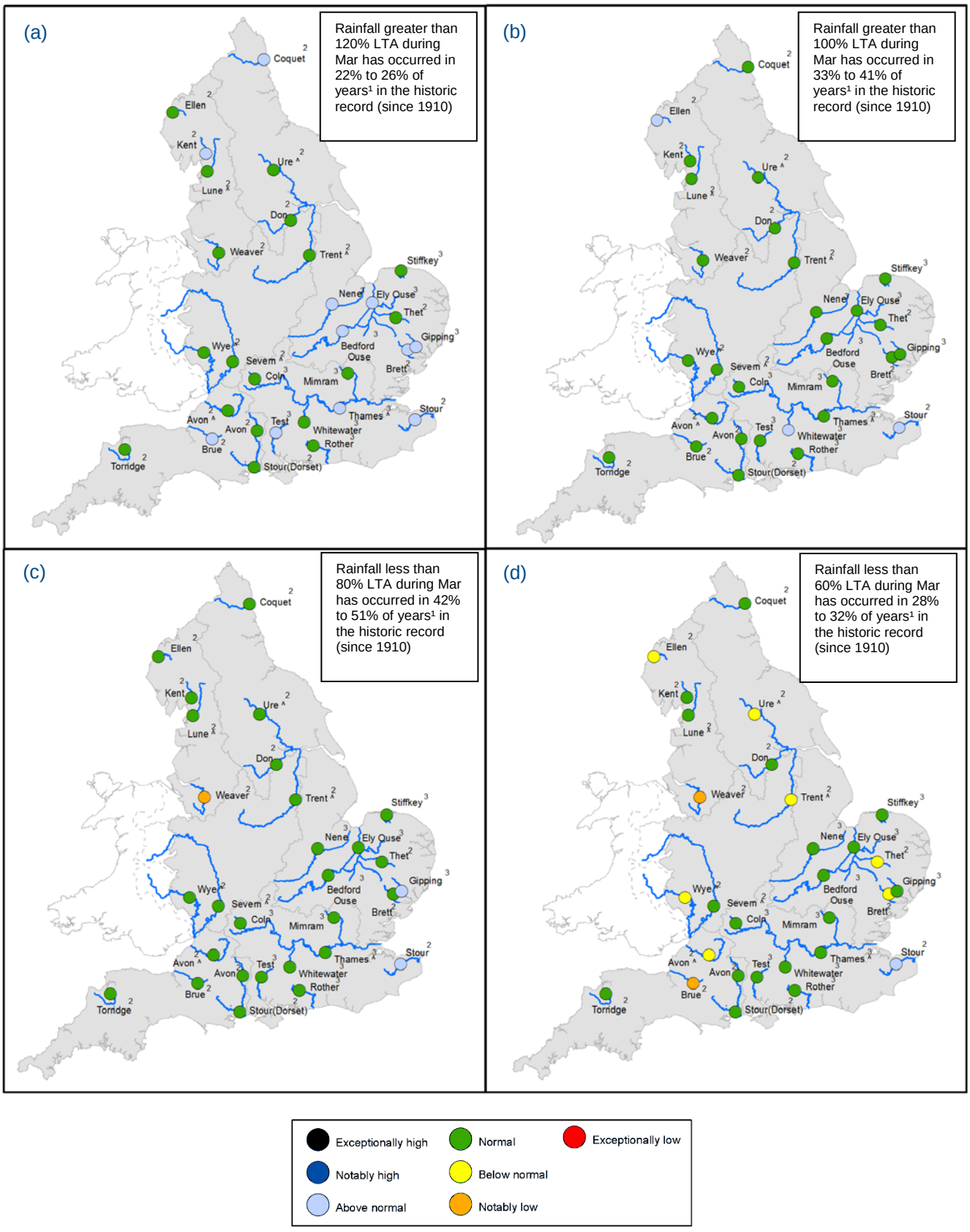


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2015. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during March 2015 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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

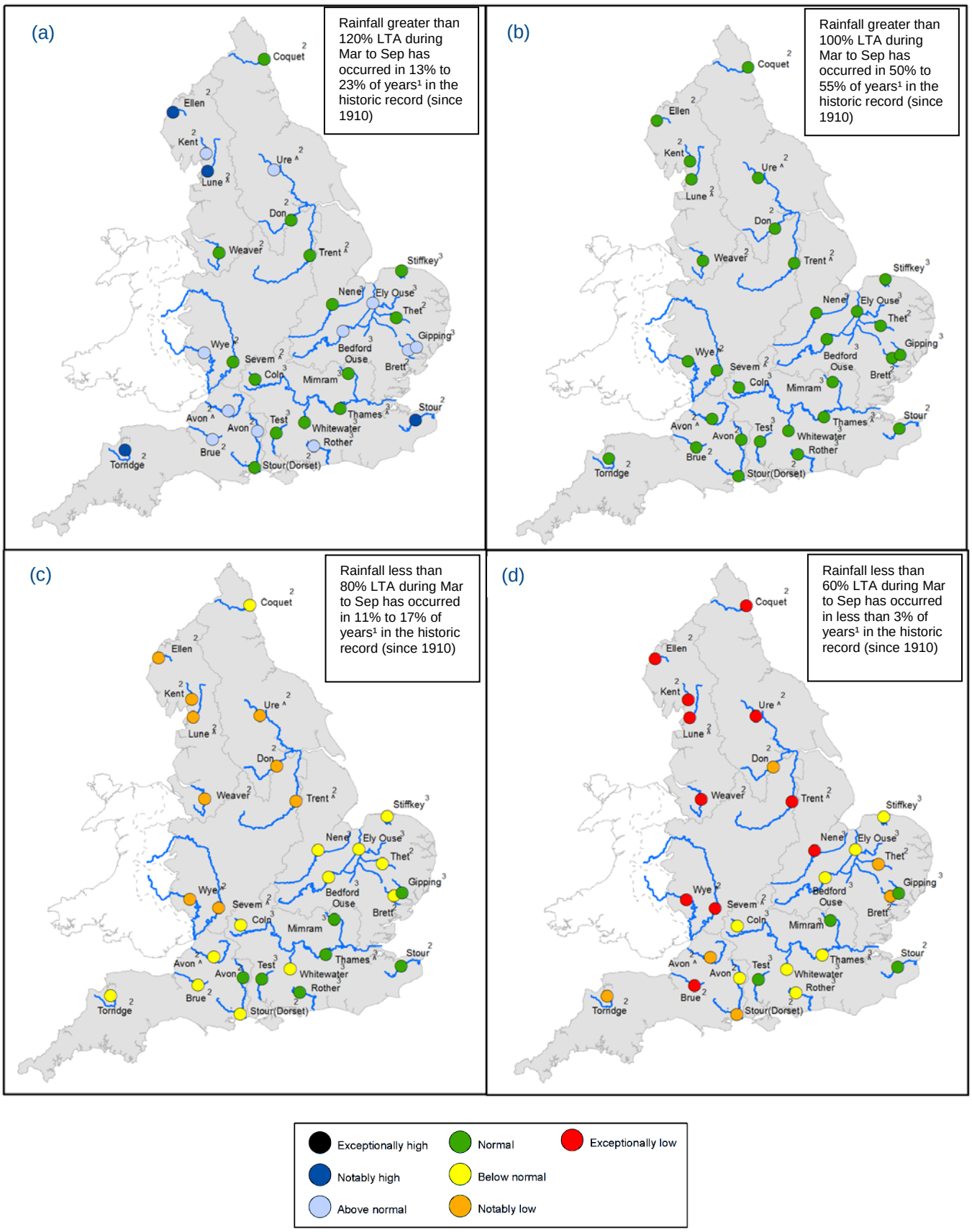


Figure 6.2: Projected river flows at key indicator sites up until the end of September 2015. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March and September 2015 (Source: Centre for Ecology and Hydrology, Environment Agency).

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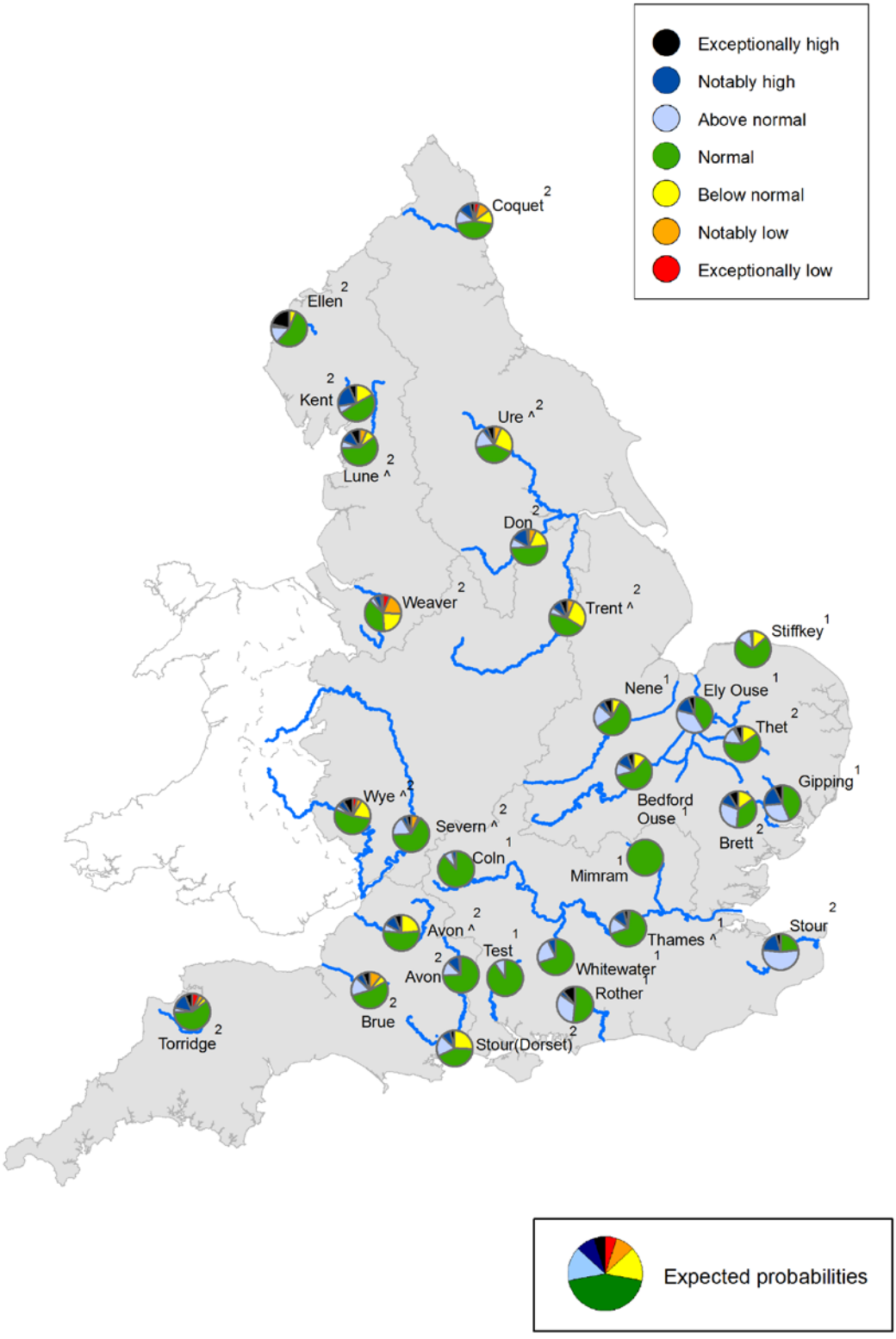

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2015. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency).

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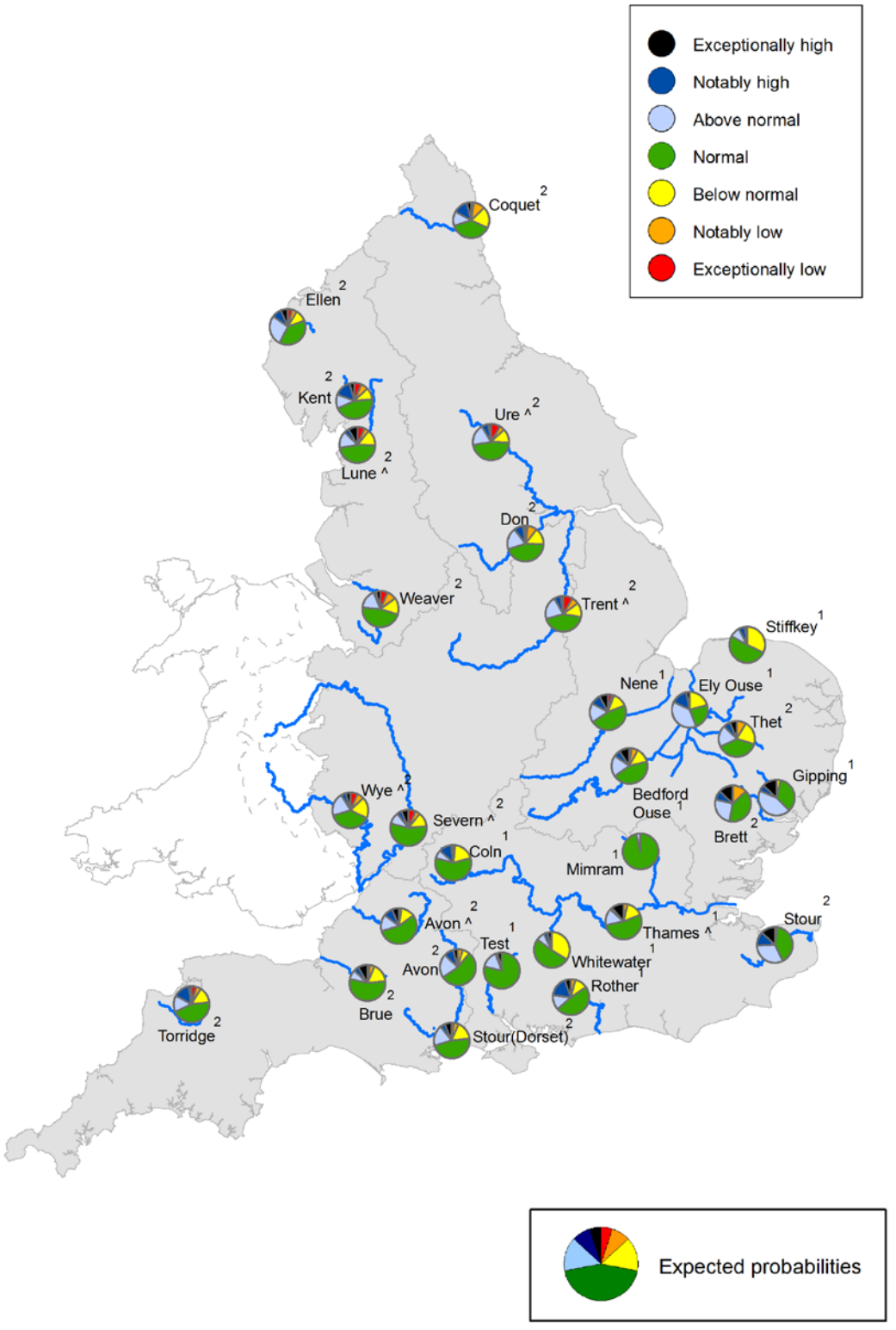

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2015. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the 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

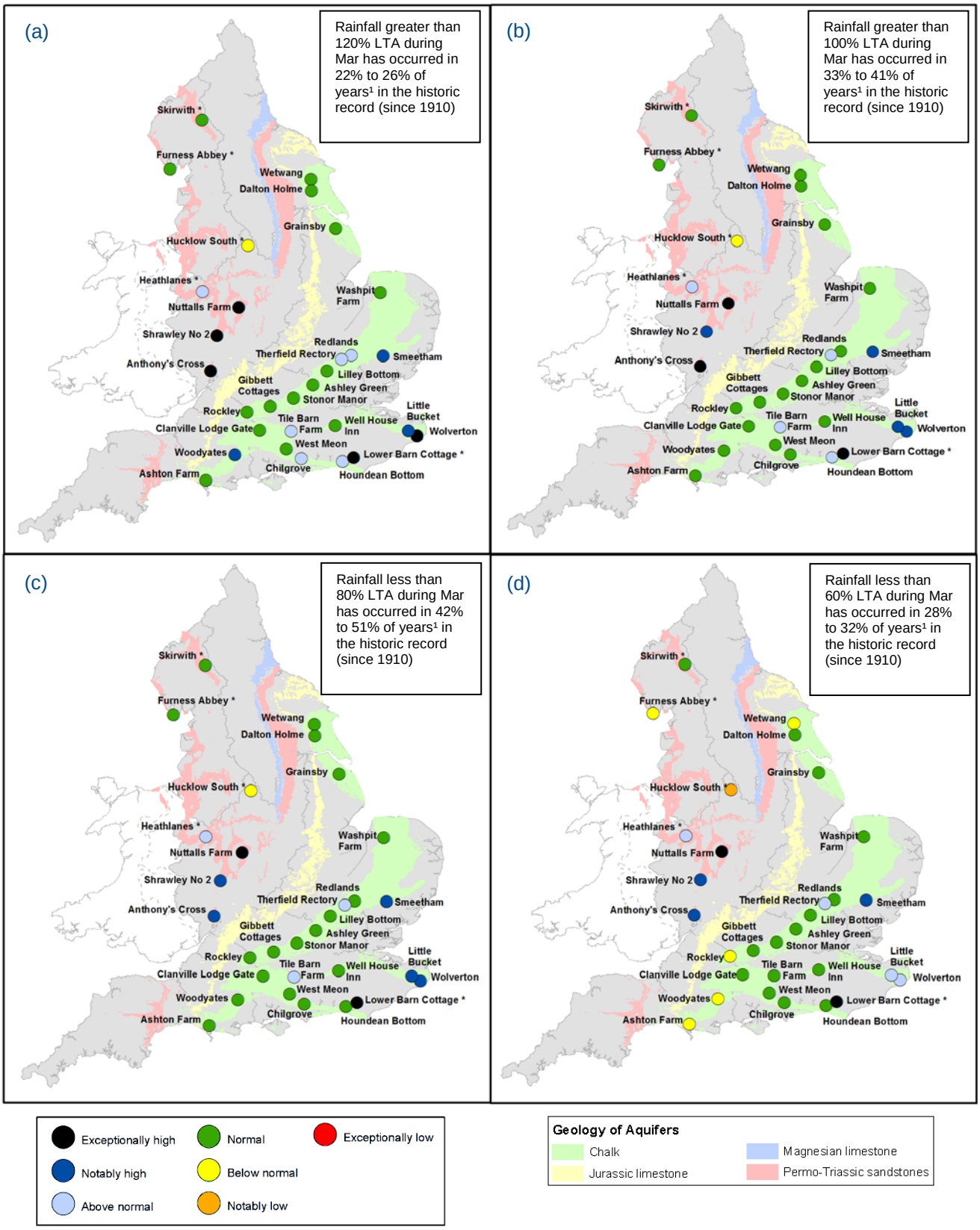


Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2015. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during March 2015 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2015.

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

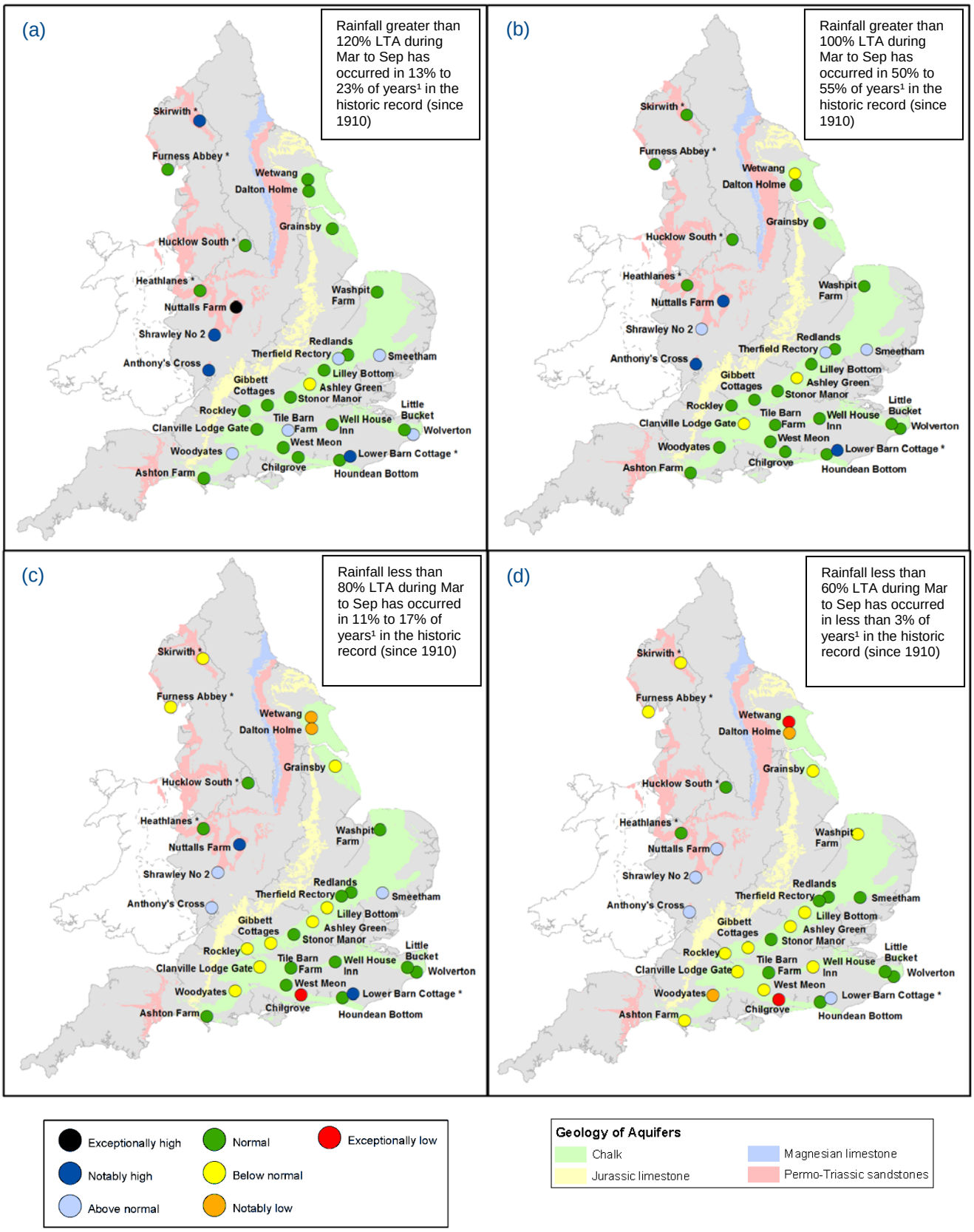
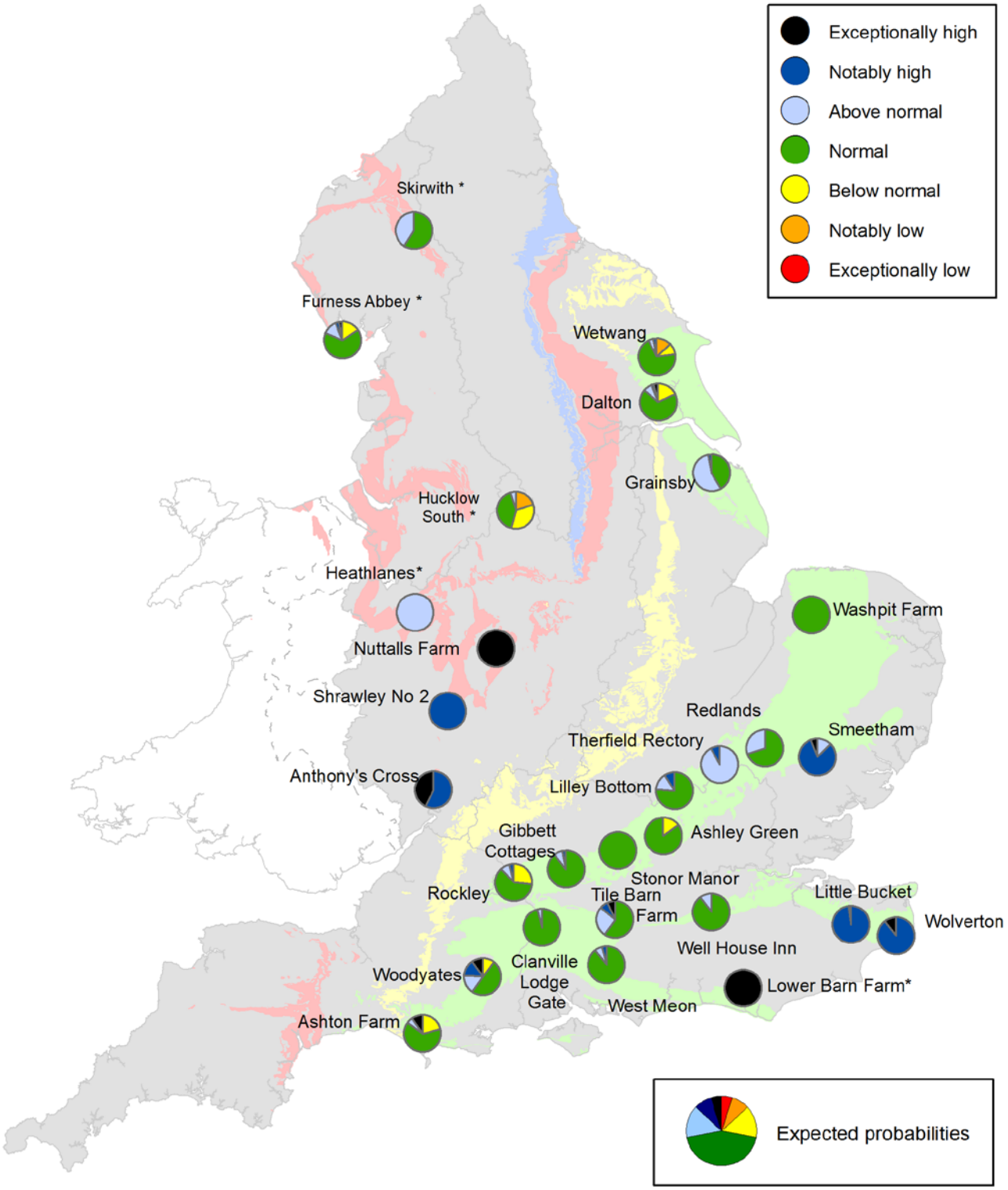


Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2015. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between March and September 2015 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2015.

* 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 2015. 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, 2015.

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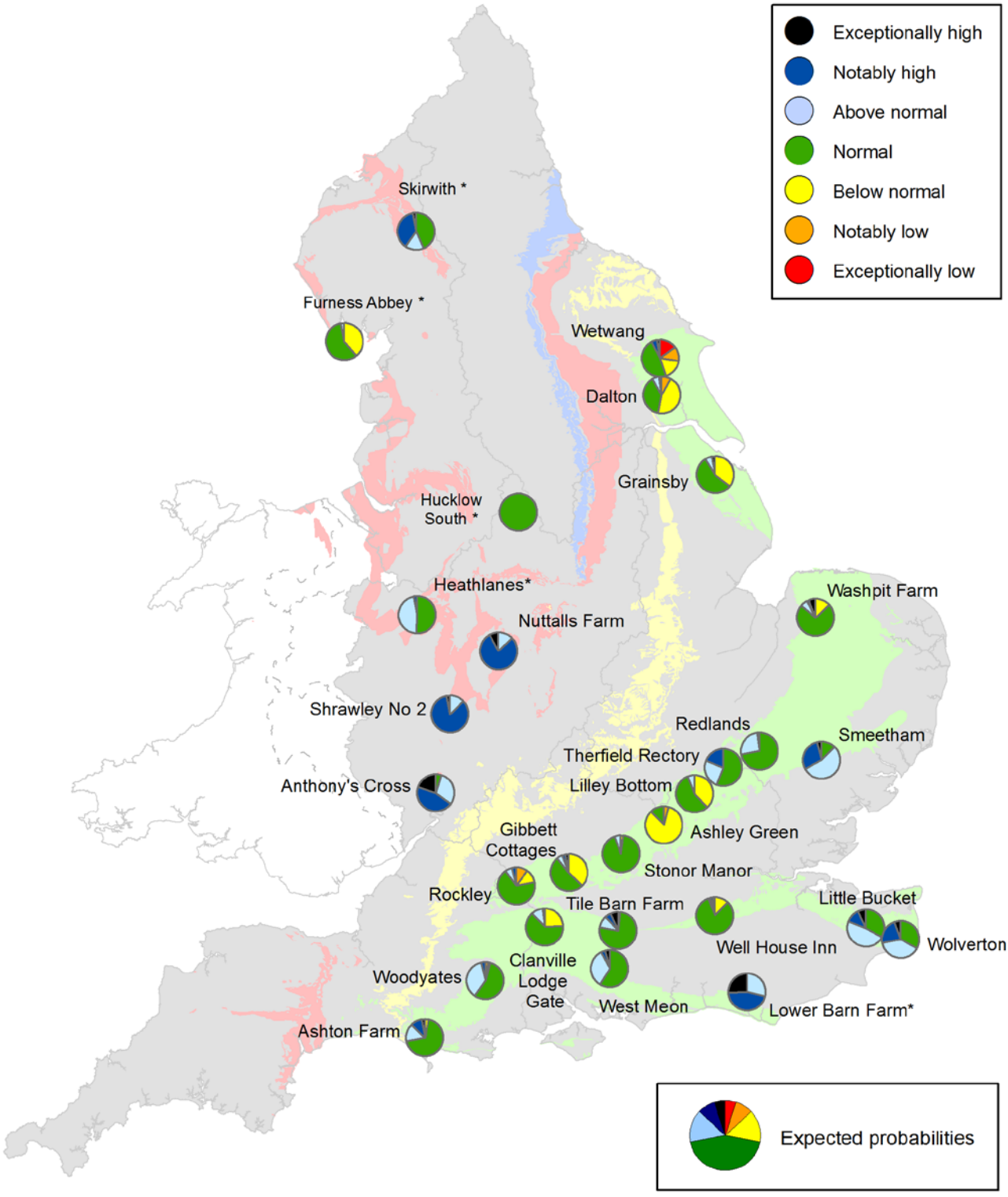

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2015. 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, 2015.

* 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, usually based on the period 1961-1990. However, the period used may vary by parameter being reported on (see figure captions for details).
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