Monthly water situation report

England

Summary – January 2015

Rainfall in January was above average across England at 115% of the long term average. Soil moisture deficits continued to decrease during the month and were close to or smaller than average at the end of January. Monthly mean river flows increased at more than four-fifths of indicator sites and were **normal** or **above normal** for the time of year at the majority of sites. Groundwater levels increased at all but two indicator sites and were **normal** or higher for the time of year at all but one site. Reservoir stocks increased 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 were 94% of total capacity at the end of January.

Rainfall

The highest January rainfall totals of 180 mm or more fell across parts of Cumbria and south Devon, while parts of Lincolnshire, and Yorkshire were the driest at less than 35 mm. January rainfall totals were above the long term average (LTA) in the majority of hydrological areas, with the northern part of Cumbria and coastal areas in East Sussex and Kent receiving more than 150% of the LTA. In contrast, parts of Lincolnshire and Yorkshire received less than 70% of the LTA (Figure 1.1).

January rainfall totals were classed as **normal** for the time of year across the majority of hydrological areas, with those covering the far south-east and north-west corners of England being classed as **above normal** to **exceptionally high**. The hydrological areas covering parts of Lincolnshire, Nottinghamshire and East Riding of Yorkshire were classed as **below normal** or **notably low** for the time of year. Over the 3 and 6 month periods ending in December, cumulative rainfall totals were generally **normal** to **above normal** across most of England. Over the 12 month cumulative rainfall period, much of the southern half of England is classed as having received **above normal** to **notably high** rainfall totals (Figure 1.2).

January rainfall totals were **normal** for the time of year across all regions except north-west England which was **above normal** for the time of year. Totals ranged from 97% of the January LTA in east England to 137% in north-west England. Overall, England received 115% of the January LTA (Figure 1.3).

Soil moisture deficit

Soil moisture deficits (SMDs) continued to decrease during January across most of England. At the end of January SMDs were less than 20 mm across the whole of England and less than 10 mm in all but 3 MORECS grid squares. End of month SMDs were close to the LTA across much of England and up to 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 during January and by the end of the month ranged from less than 1 mm in north-west and south-west England to 5 mm in east England. (Figure 2.2).

River flows

Monthly mean river flows for January increased compared to December at more than four-fifths of indicator sites across England. Flows were **normal** or **above normal** for the time of year at the majority of indicator sites. Flows were **notably high** on the rivers Lune and Derwent in Cumbria and the Eastern Rother in East Sussex, whilst the River Derwent in Ryedale, North Yorkshire was classed as **notably low**; this broadly reflects the areas of highest and lowest rainfall totals during the month (Figure 3.1).

Monthly mean river flows were classed as **normal** or **above normal** at 6 of the 7 regional index sites; while the Lune in north-west England was **notably high** for the time of year (Figure 3.2).

Groundwater levels

Groundwater levels rose at all but two indicator sites across England during January. At the end of the month levels were classed as **normal** or **above normal** for the time of year at just over four-fifths 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 level at Wetwang (in the Hull and East Riding chalk aquifer) dropped to **below normal** for the time of year.

End of month groundwater levels at the major aquifer index sites were **normal** for the time of year at 4 sites (located in the Carlisle Basin and Eden Valley sandstone, the Burford Jurassic limestone and the Hull and East Riding and South West Chilterns chalk aquifers), **above normal** at 3 sites (located in the Shropshire Middle Severn sandstone, Cam and Ely Ouse chalk and Chichester chalk aquifers) and **notably high** at one site (located in the East Kent Stour chalk aquifer) (Figures 4.1 and 4.2).

Reservoir storage

During January reservoir stocks increased or remained static at almost all of the reported reservoirs and reservoir groups. Increases in stocks of between approximately 12 and 18% occurred at 6 reservoirs located in east, south-east and south-west England. More than four-fifths of reservoirs are within 10% of full capacity, with 8 being full. At the end of January, stocks were classed as **normal** or **above normal** for the time of year at all but two reported reservoirs (Figure 5.1).

At a regional scale, reservoir stocks increased during January by between 2 and 10% in all but one area. At the end of January regional stocks ranged from 89% of total capacity in east England to 96% in central and north-west England. Overall reservoir storage for England increased by 3% to 94% of total capacity (Figure 5.2).

Forward look

Cold, settled conditions with mainly dry weather are expected for most during February. Longer-term, predictability is low for the period from February to April, and above or below average rainfall are equally probable[1].

Projections for river flows at key sites [2]

More than two thirds of the sites have a greater than expected chance of **above normal** or higher cumulative river flows from February to March 2015. Three quarters of sites have a greater than expected chance of **normal** cumulative river flows between February 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 **above 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 **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.
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Rainfall

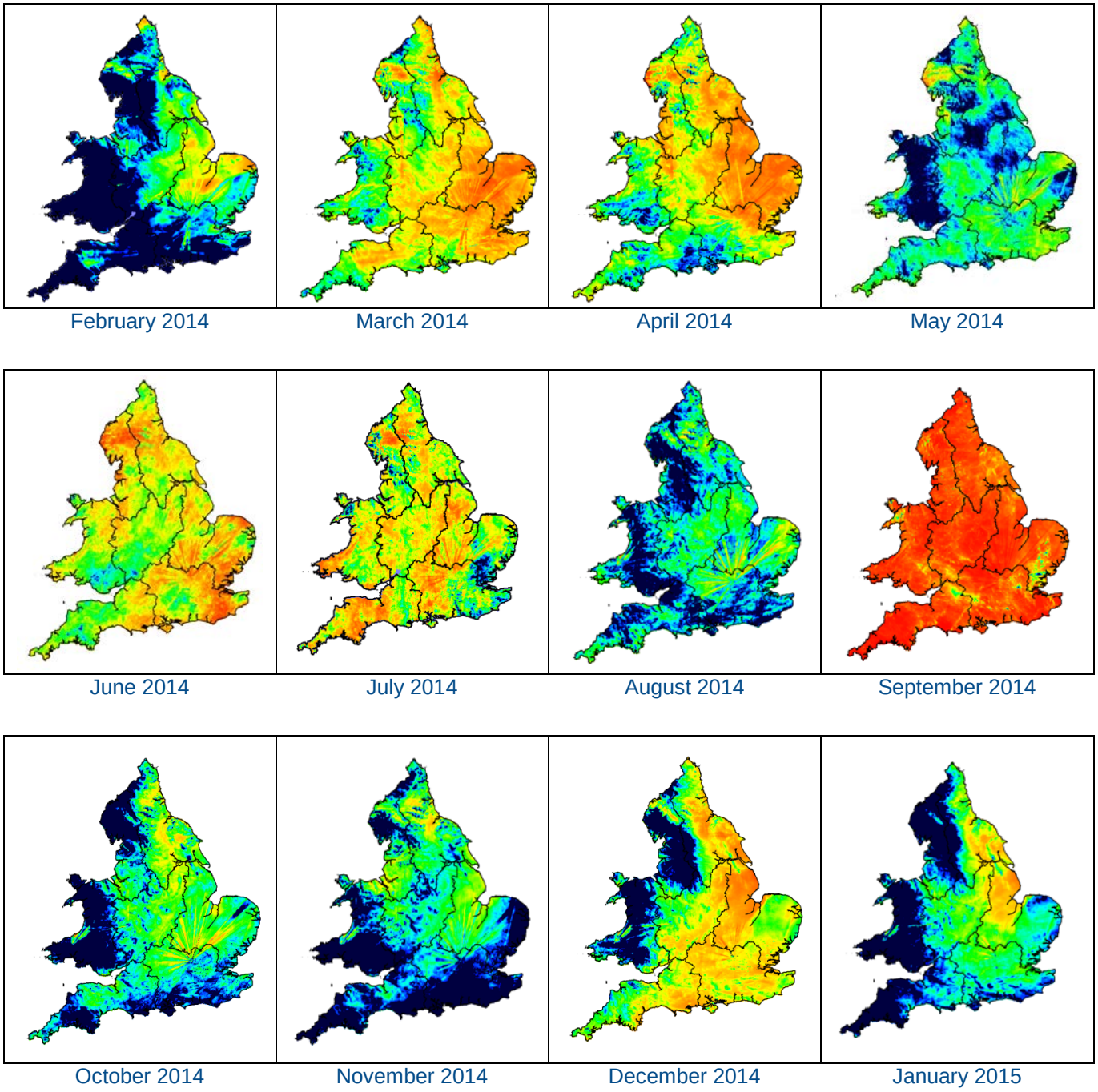


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2015). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2015.

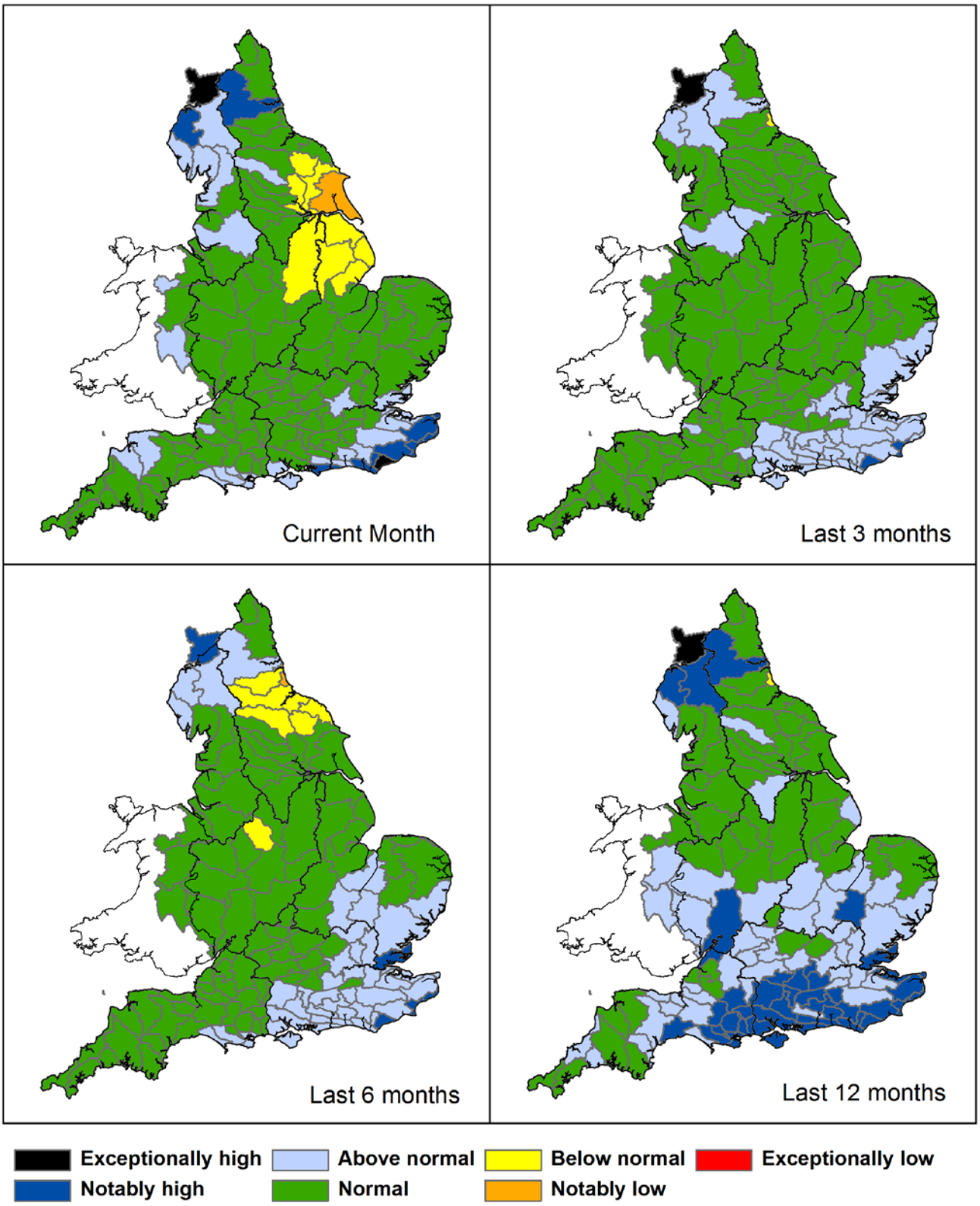


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 January), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final and provisional NCIC (National Climate Information Centre) data 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.

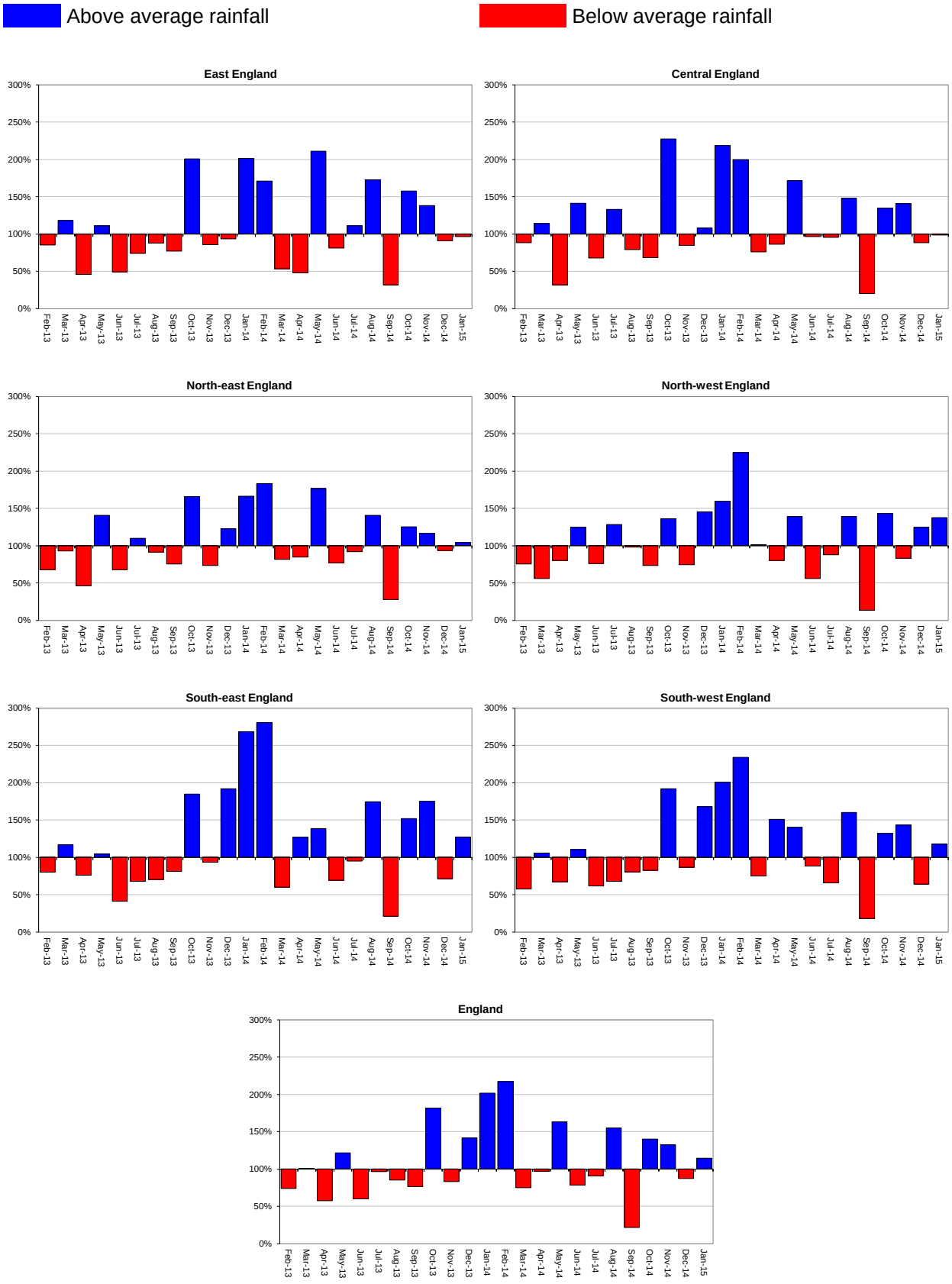


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2015).

Soil moisture deficit

End of December 2014 [1]	End of January 2015 [2]

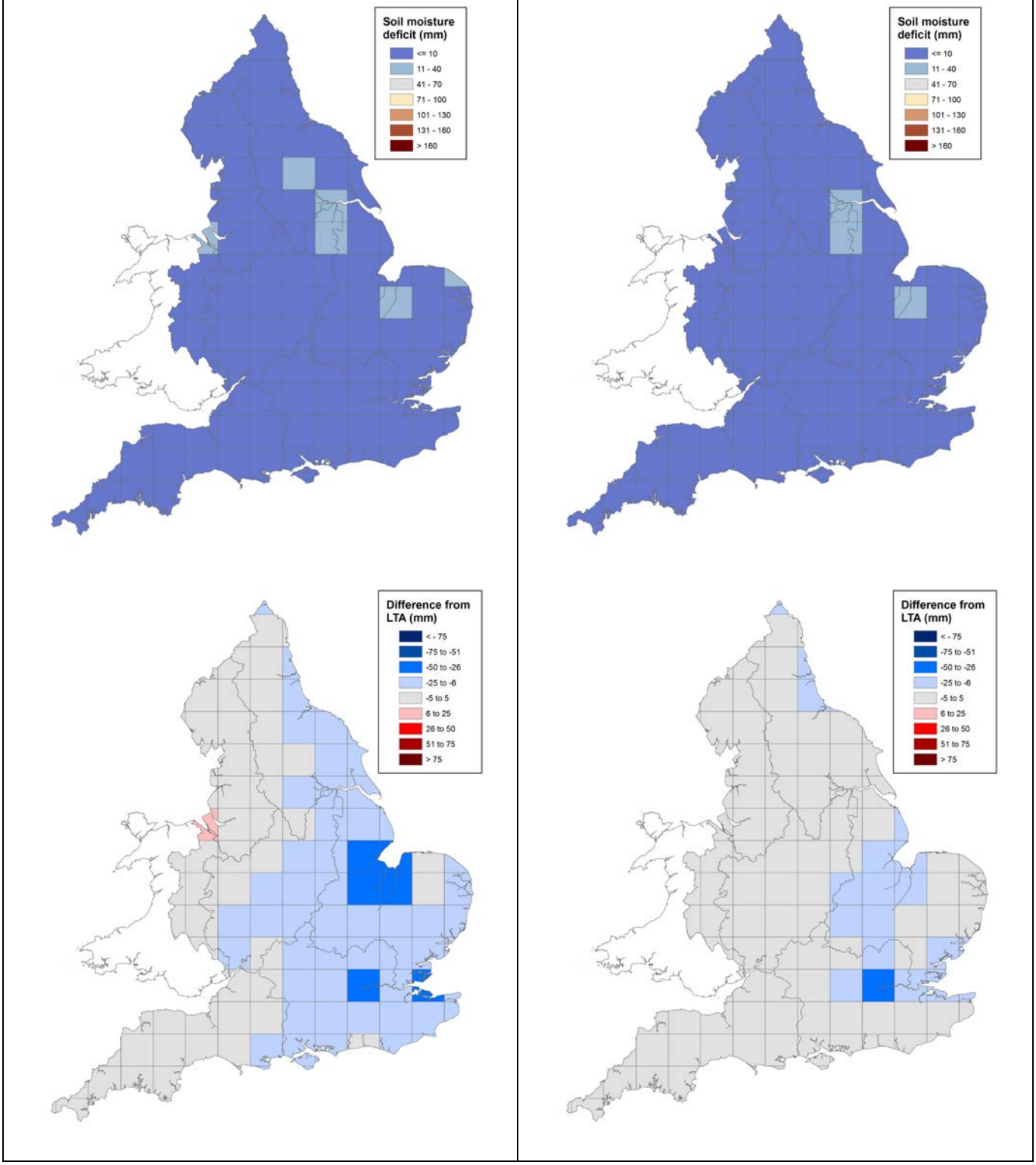


Figure 2.1: Soil moisture deficits for weeks ending 30 December 2014 [1] (left panel) and 27 January 2015 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2015). Crown copyright. All rights reserved. Environment Agency, 100026380, 2015

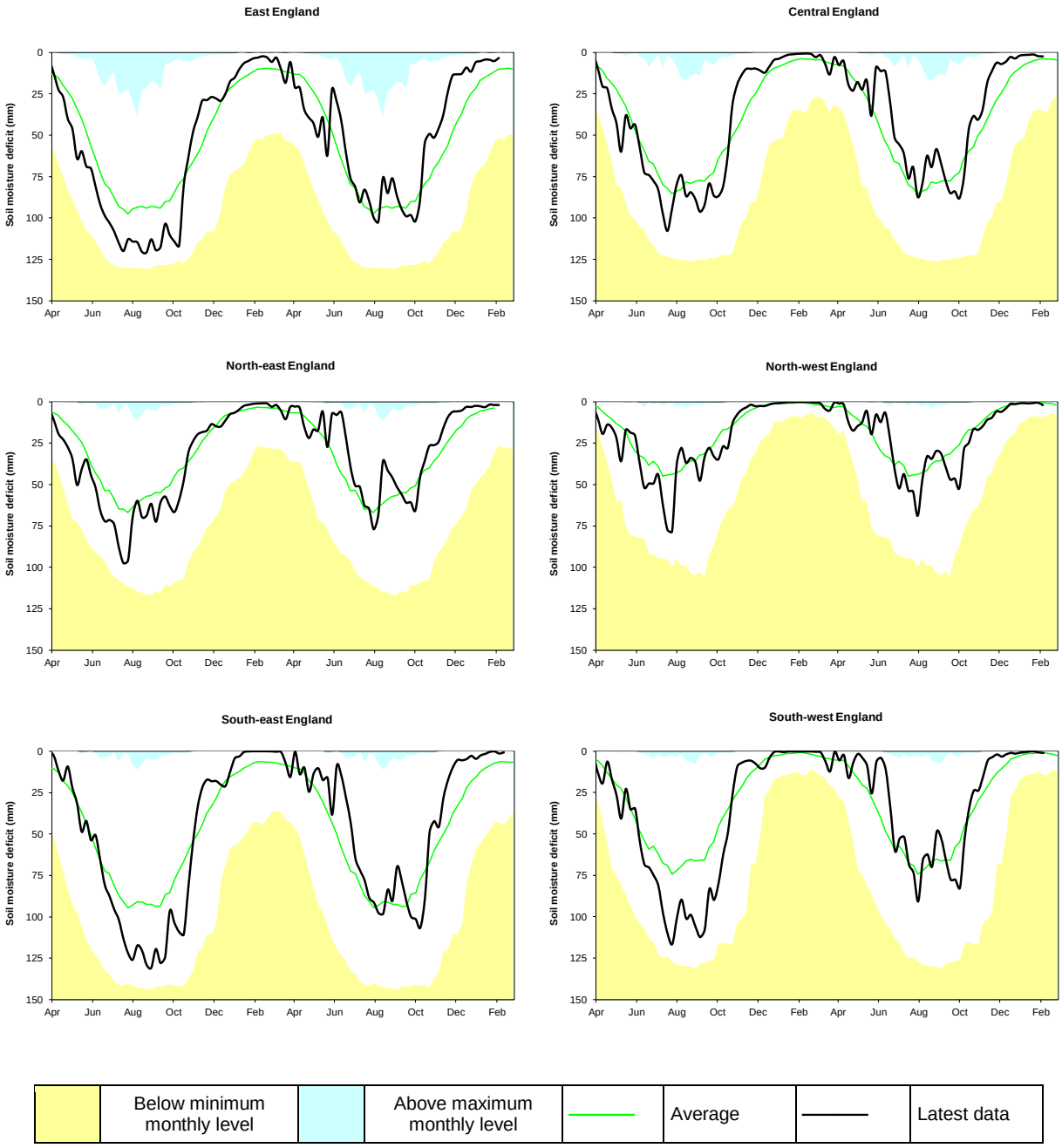
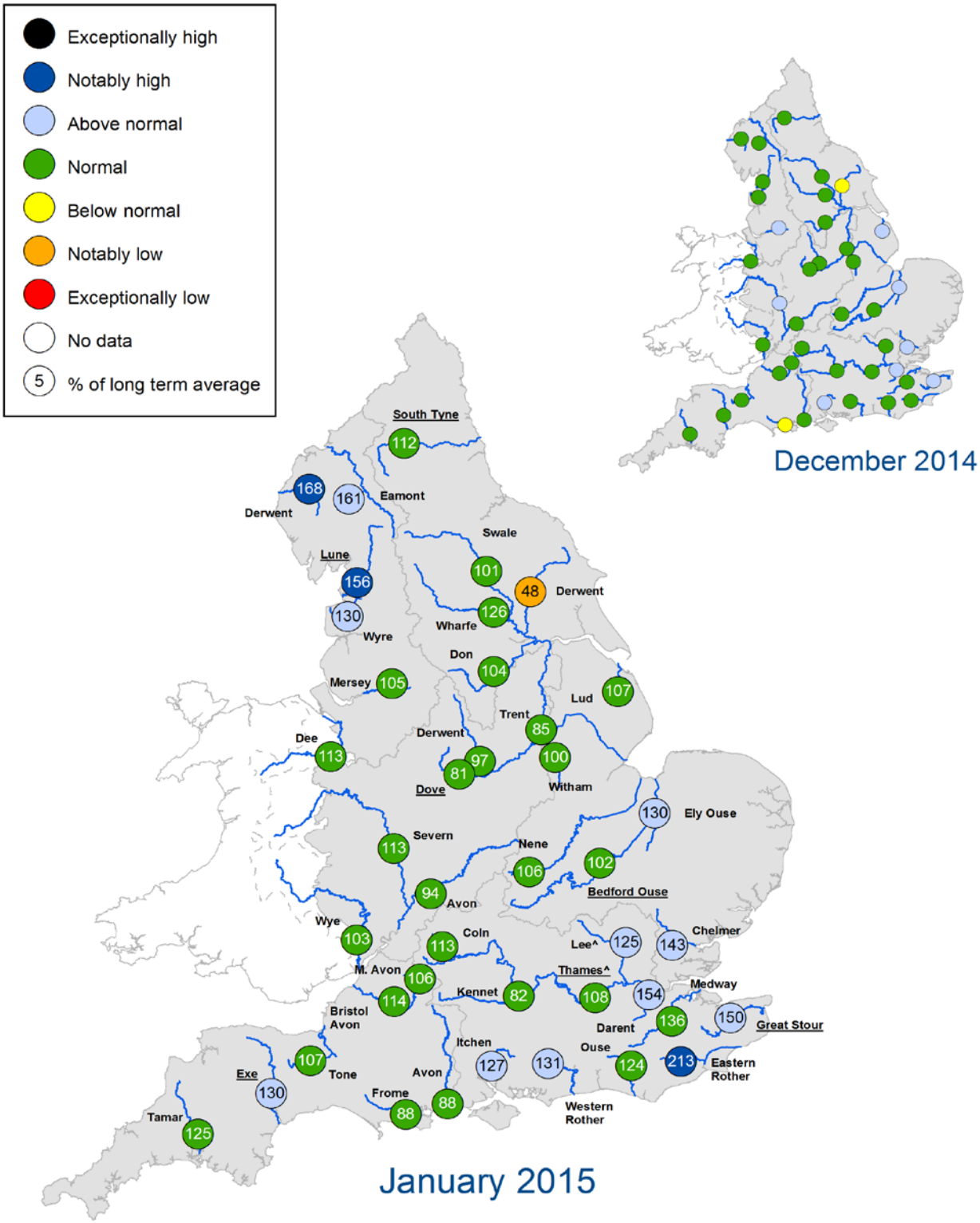


Figure 2.2: Latest soil moisture deficits for all regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2015).

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 December 2014 and January 2015, expressed as a percentage of the respective long term average and classed relative to an analysis of historic December and January monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2015.

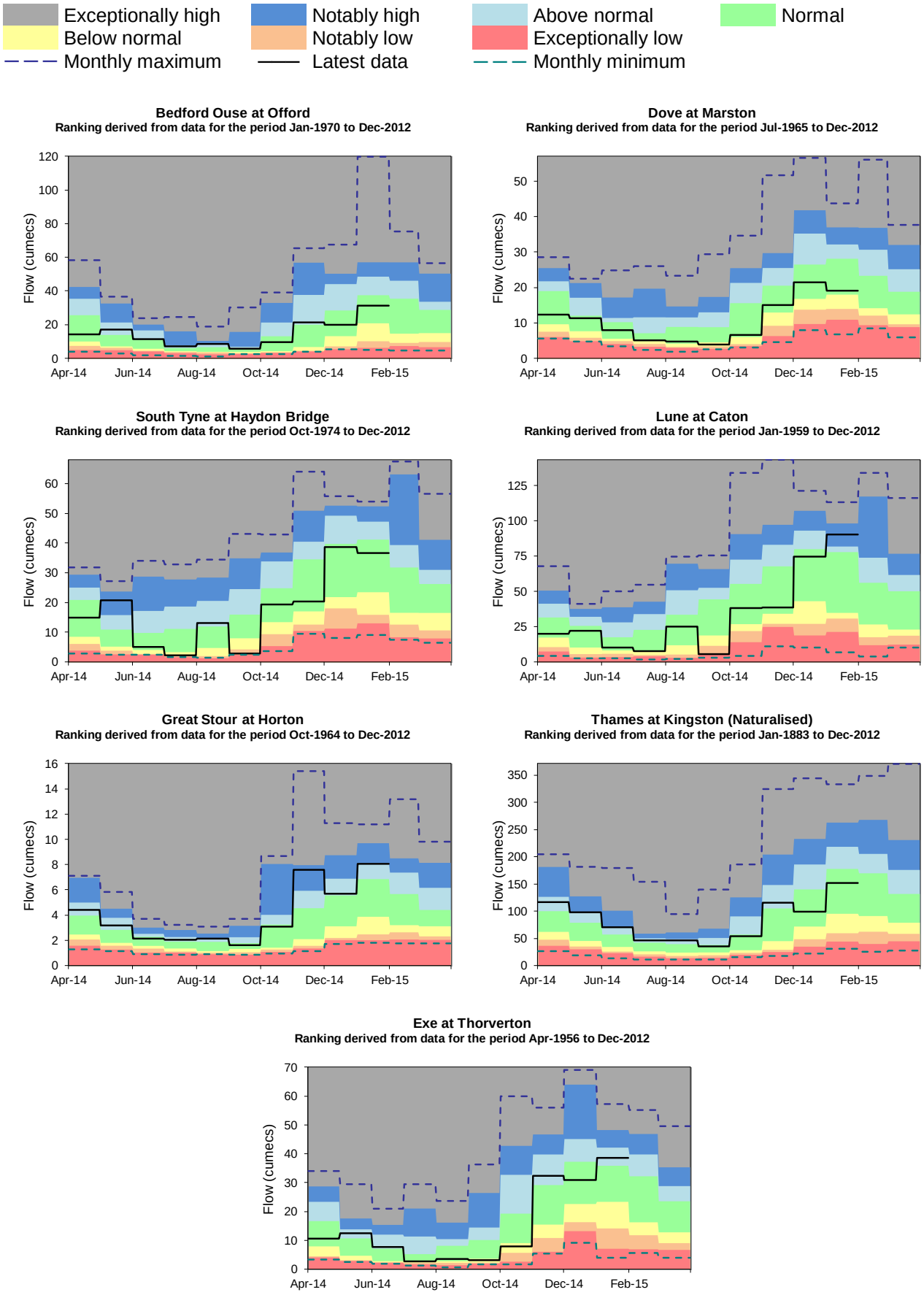
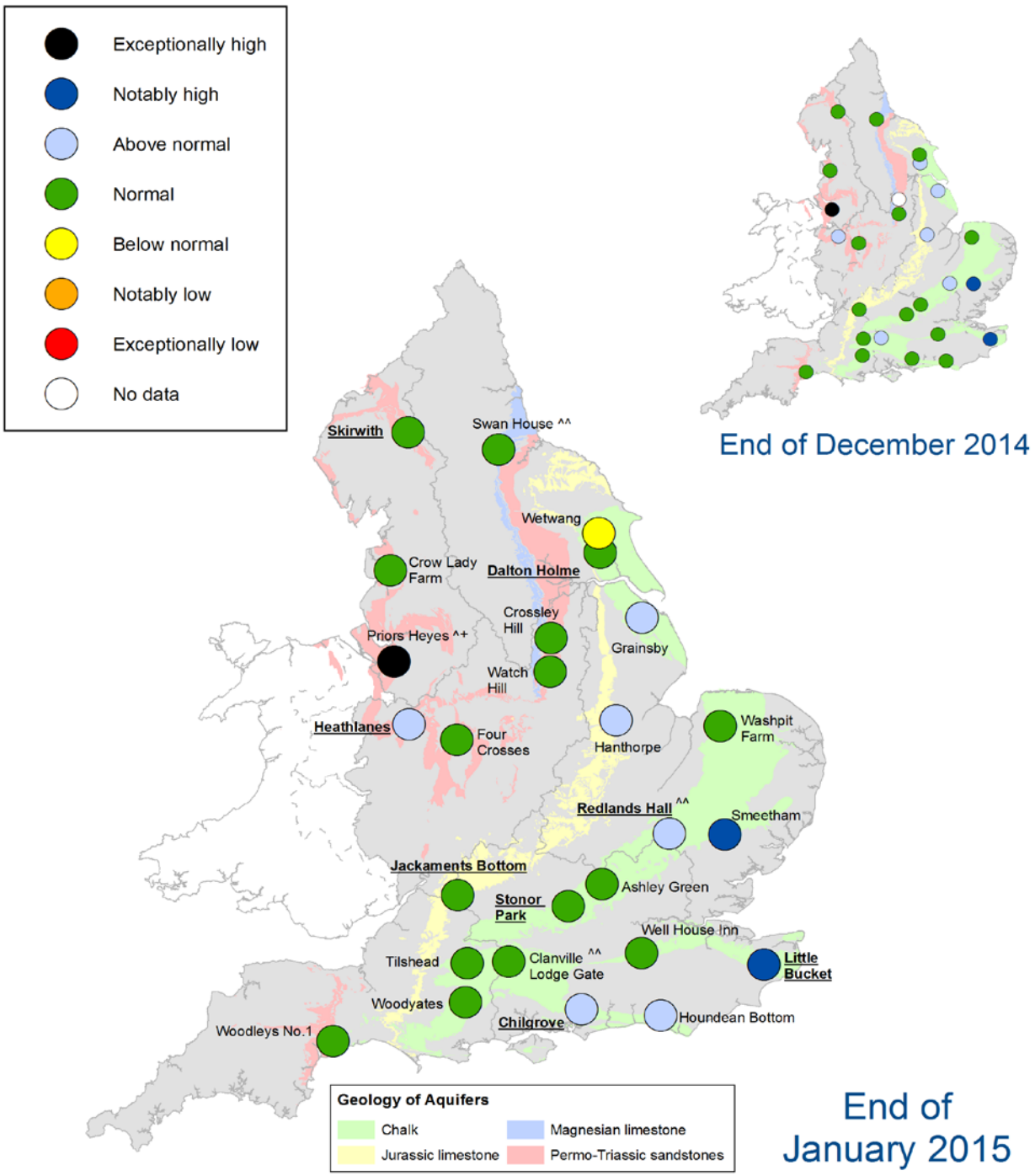


Figure 3.2: Index river flow sites for each region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 December 2014 and January 2015, classed relative to an analysis of respective historic December and January 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.

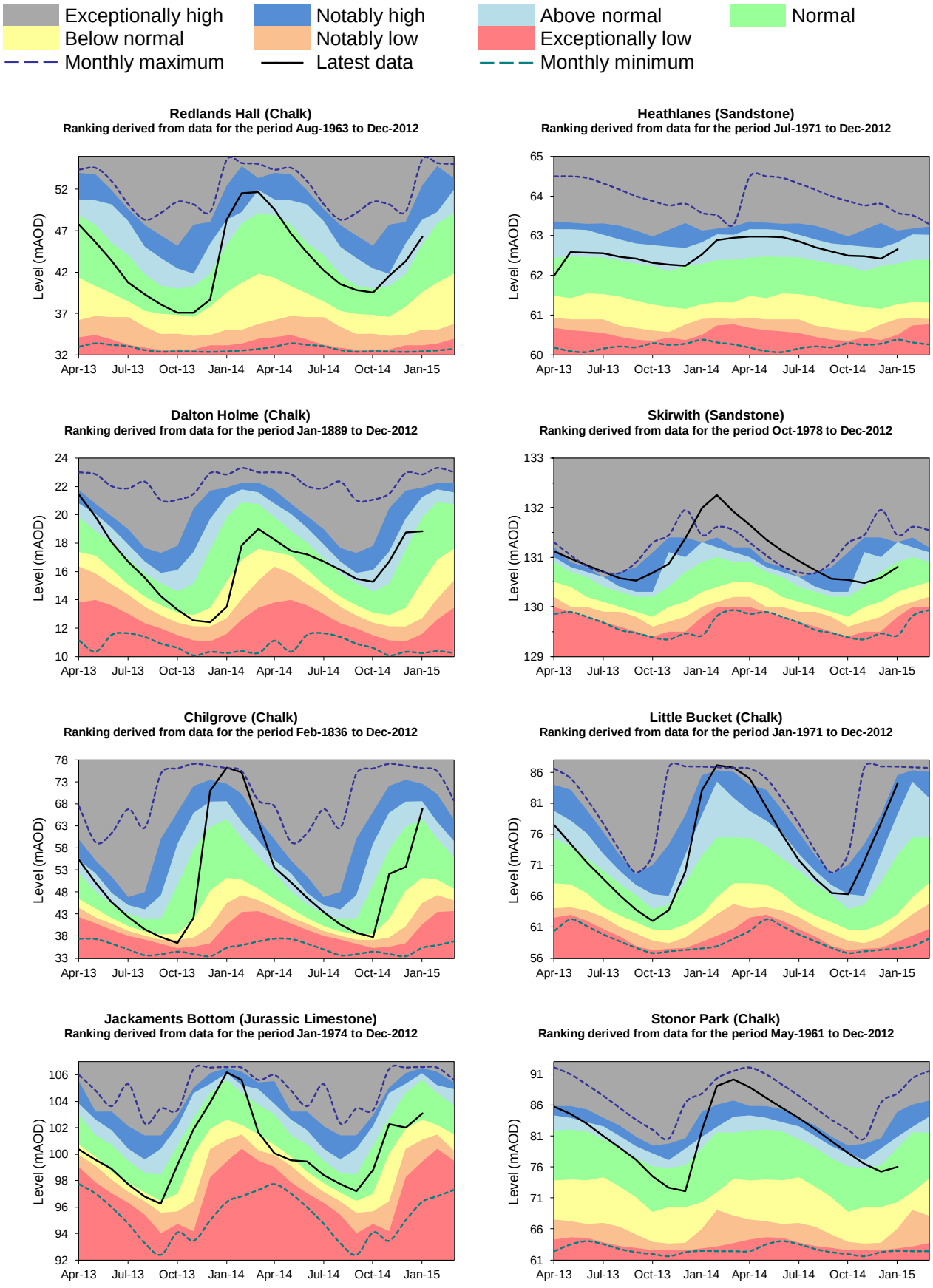
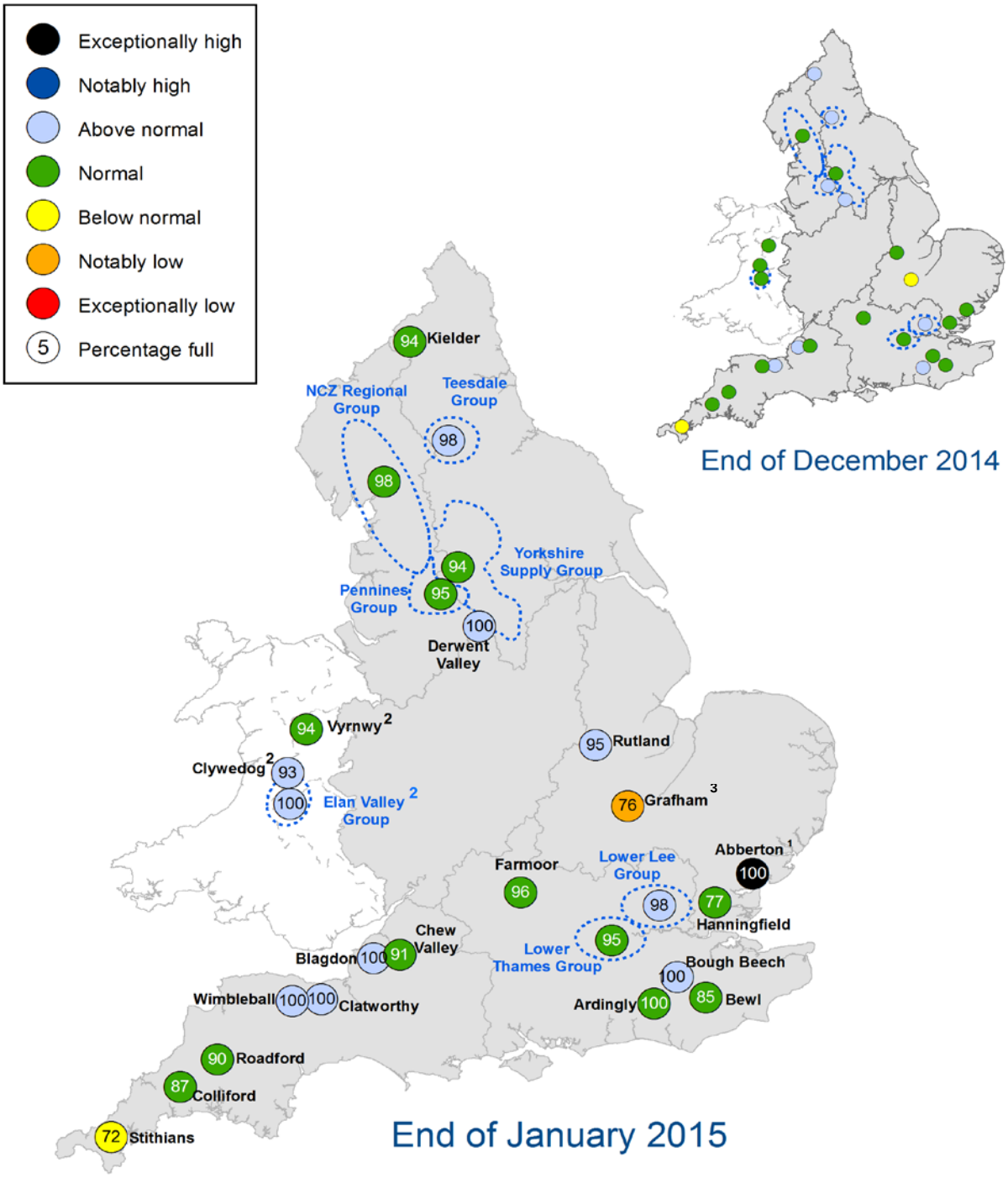


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2015).

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
3. Water quality issues have affected the ability to refill Grafham following the completion of recent engineering work

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of December 2014 and January 2015 as a percentage of total capacity and classed relative to an analysis of historic December and January 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.

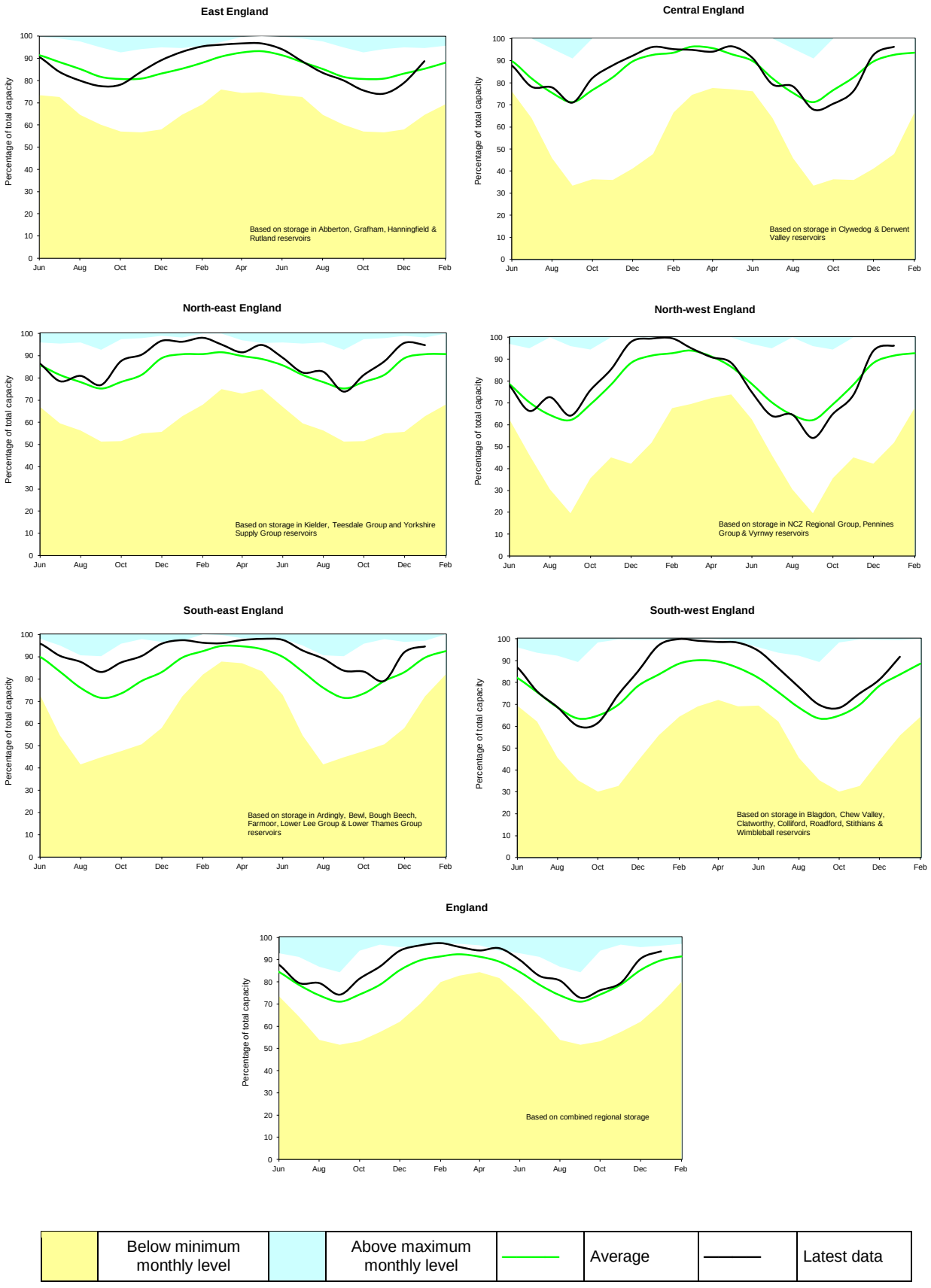


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

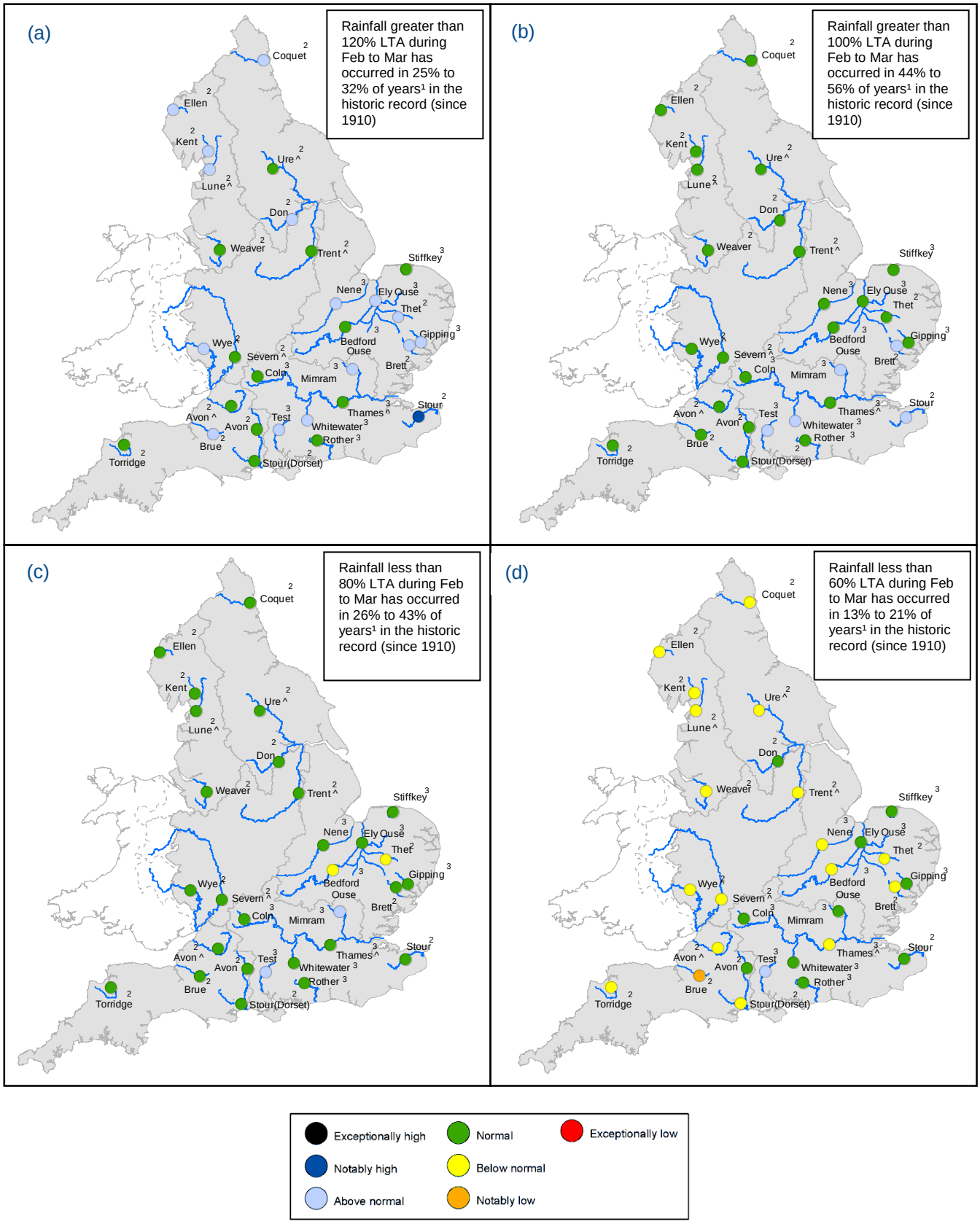
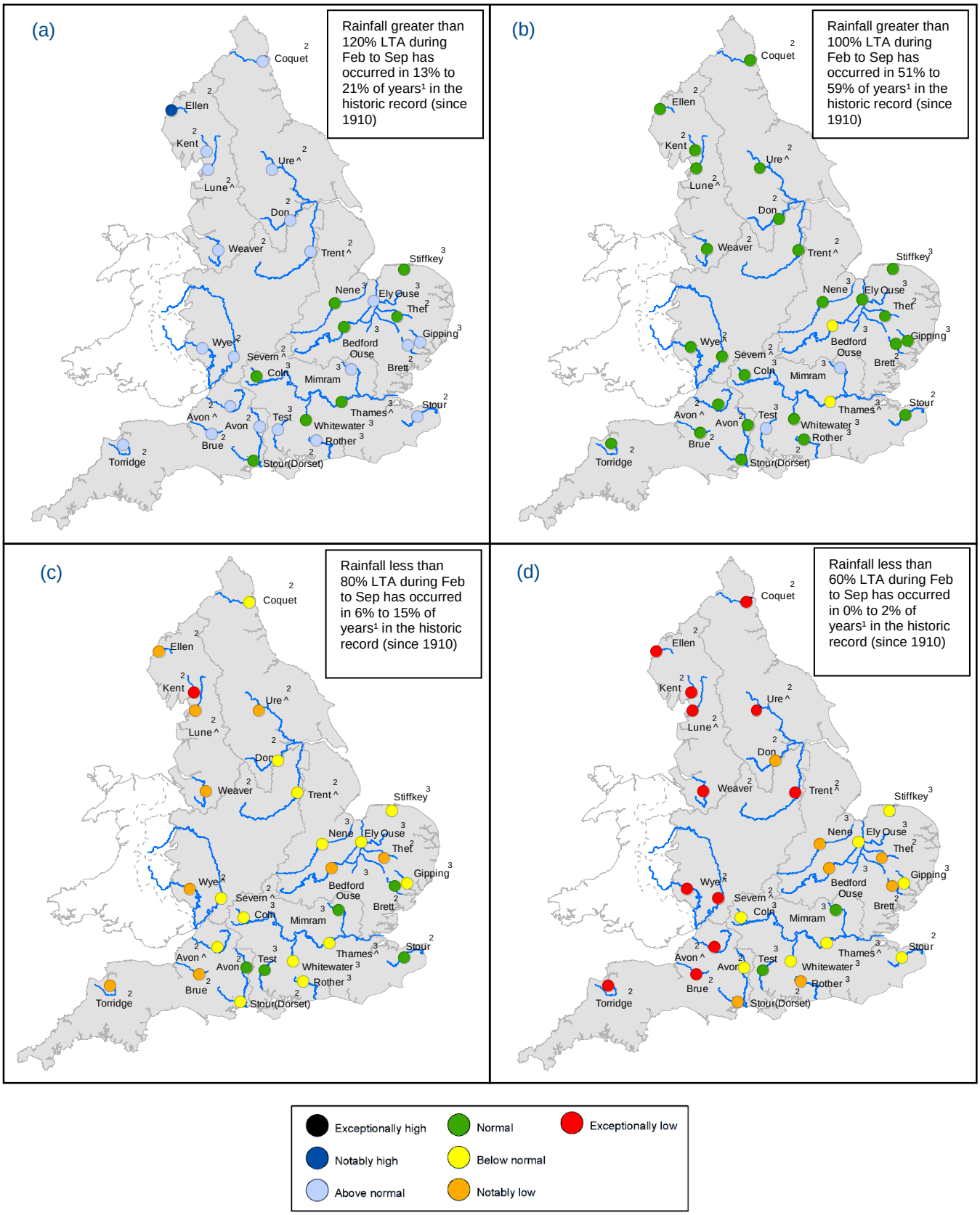


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2015. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and March 2015 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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



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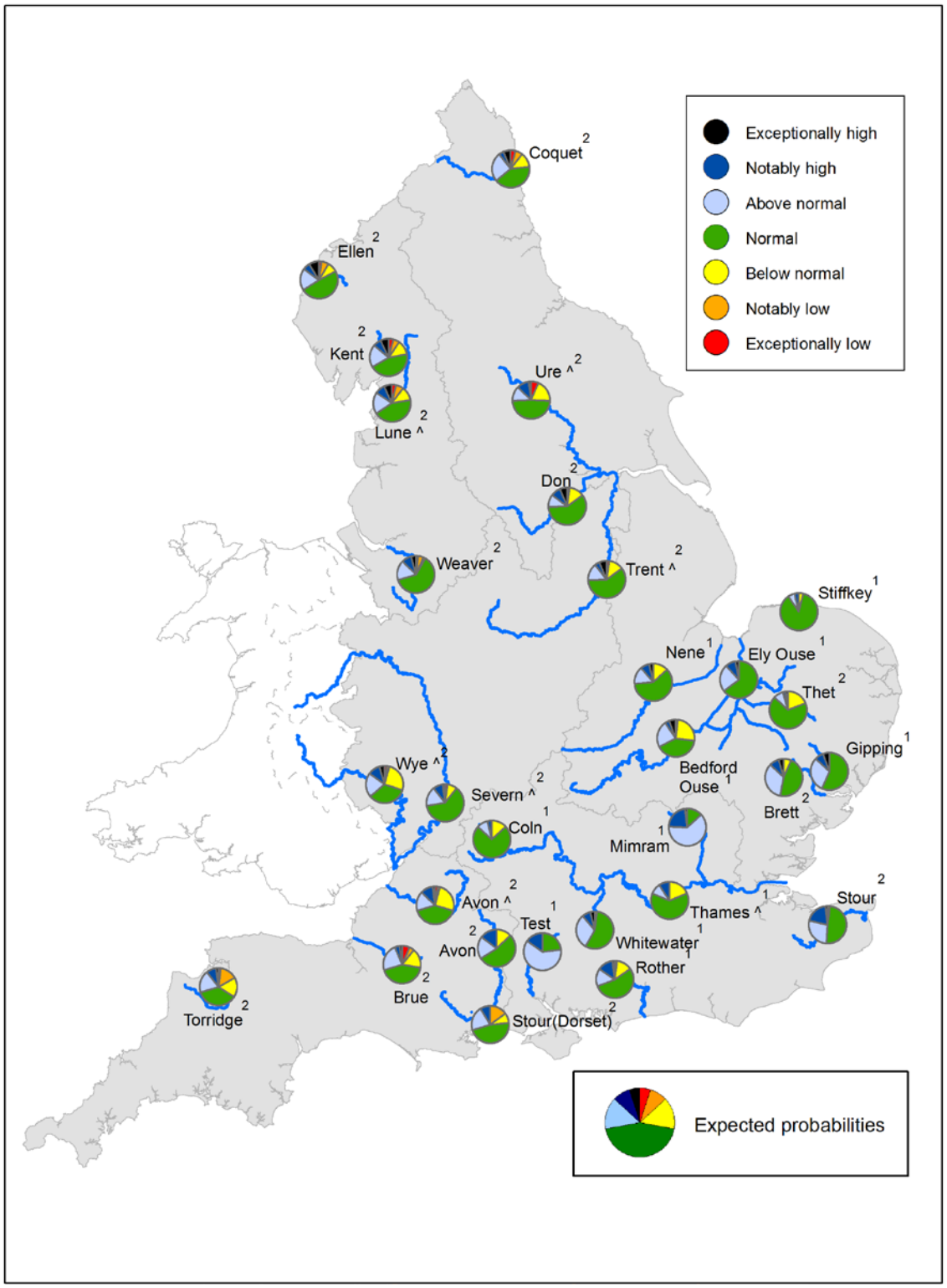

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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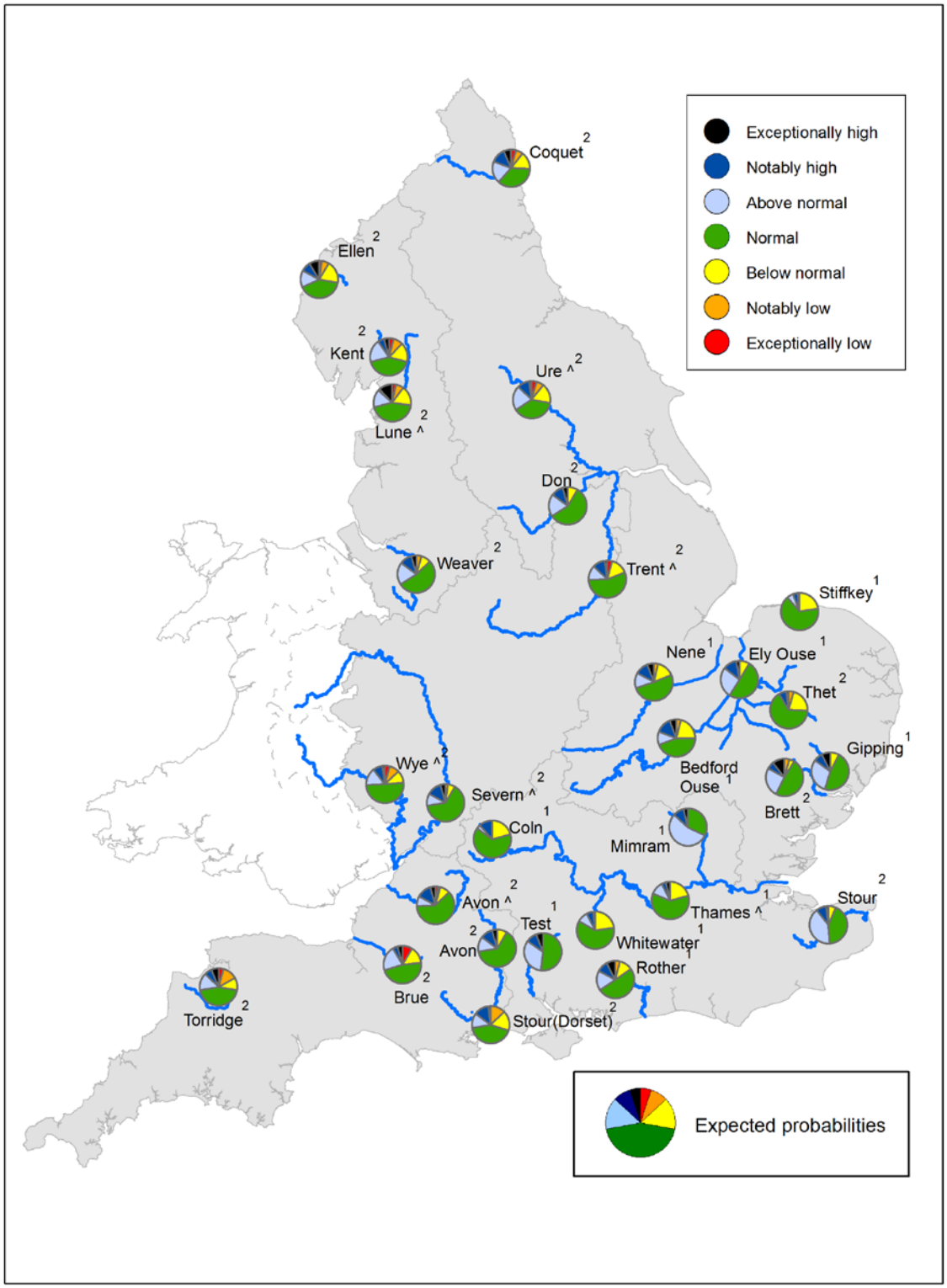

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2015. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for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

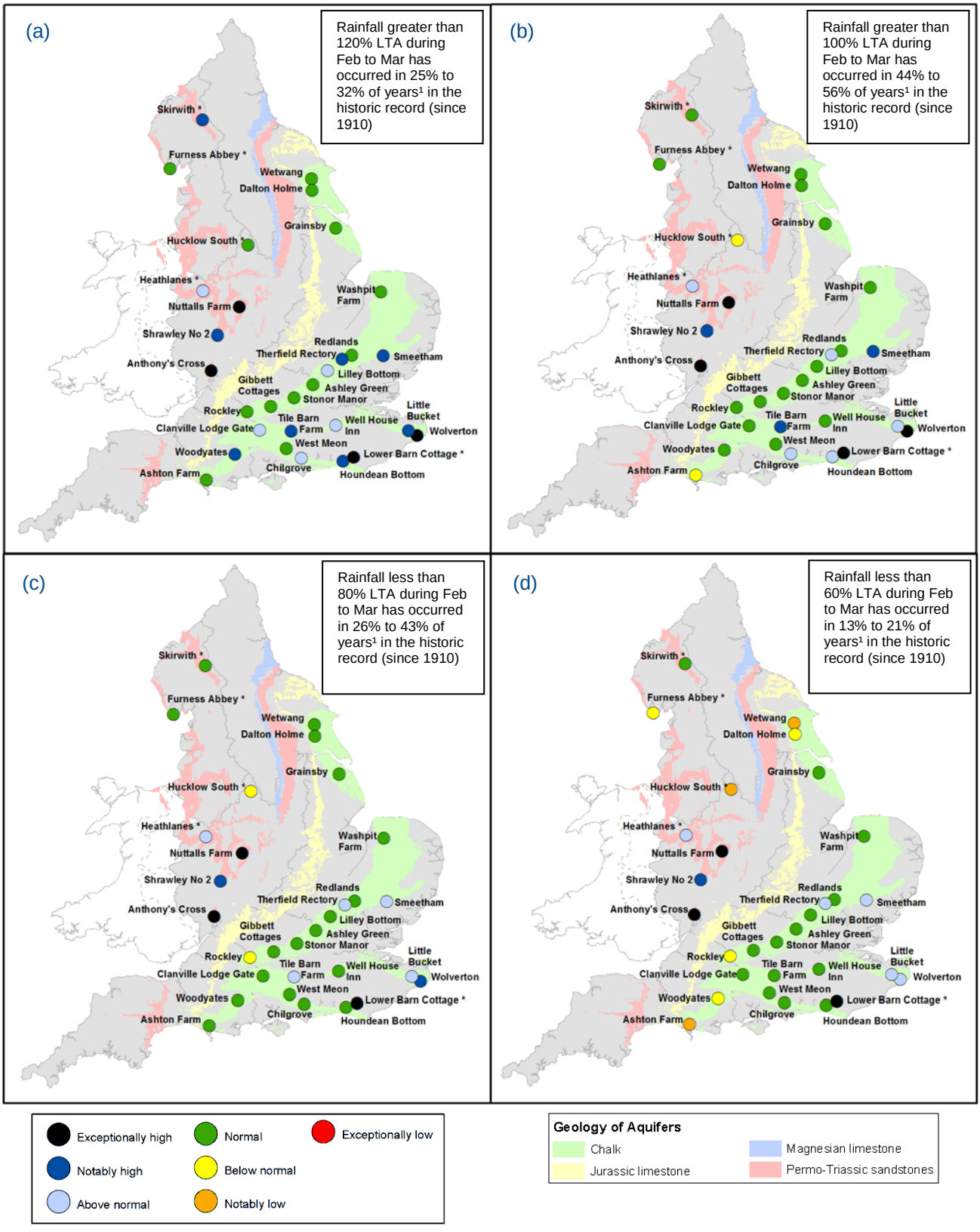


Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2015. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and March 2015 (Source: Environment Agency) Geological map reproduced with kind permission 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

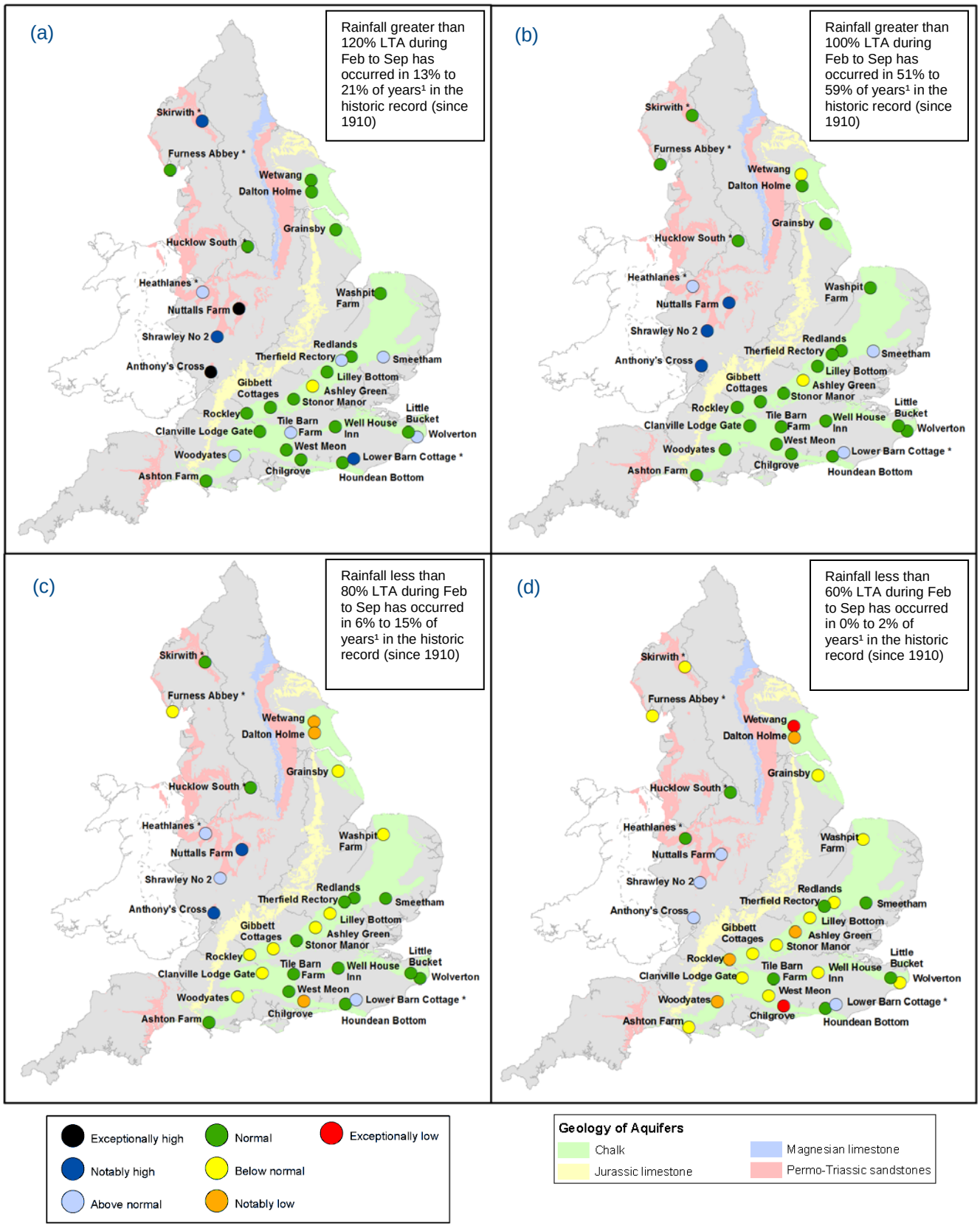
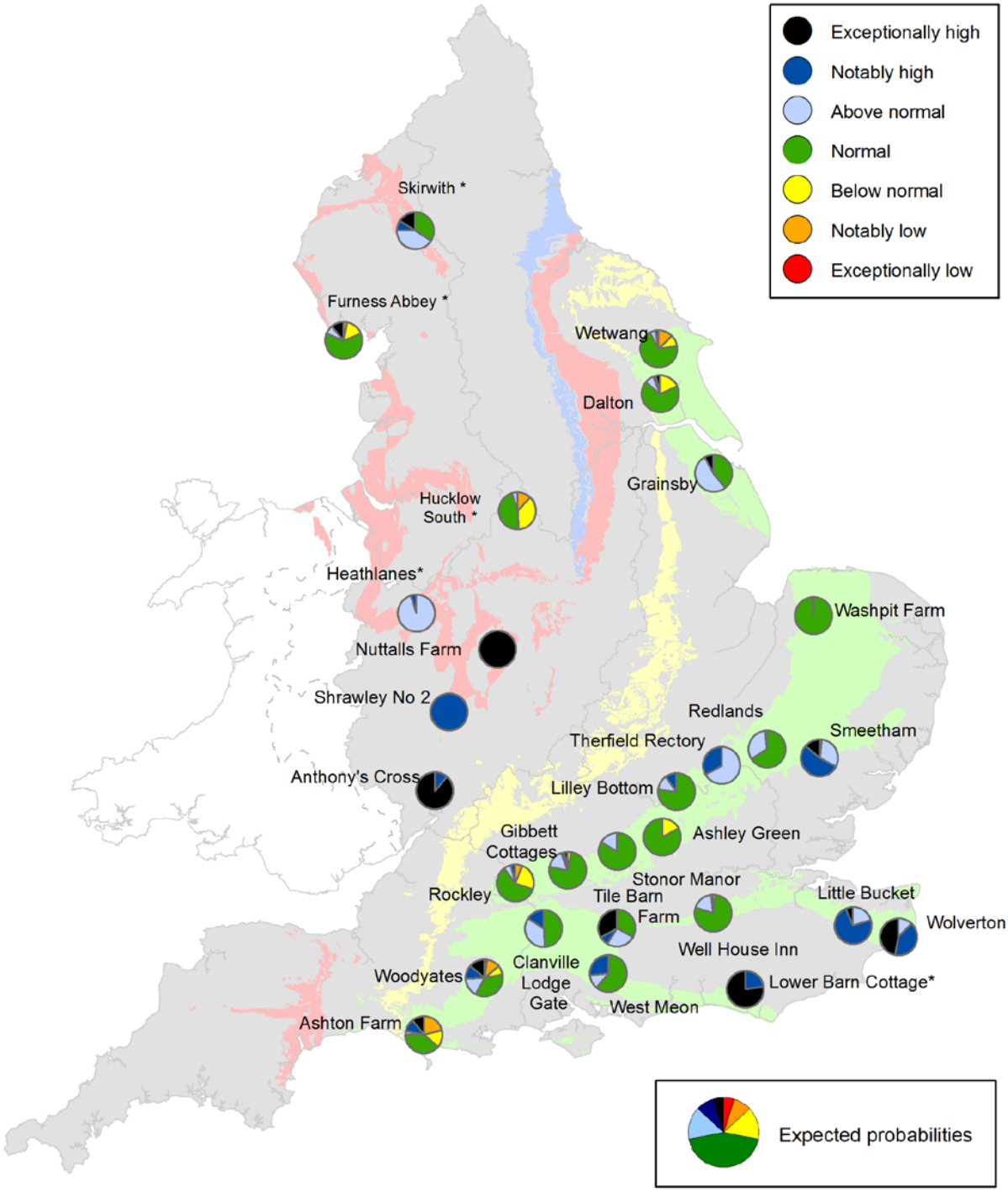


Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2015. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and September 2015. (Source: Environment Agency) Geological map reproduced with kind 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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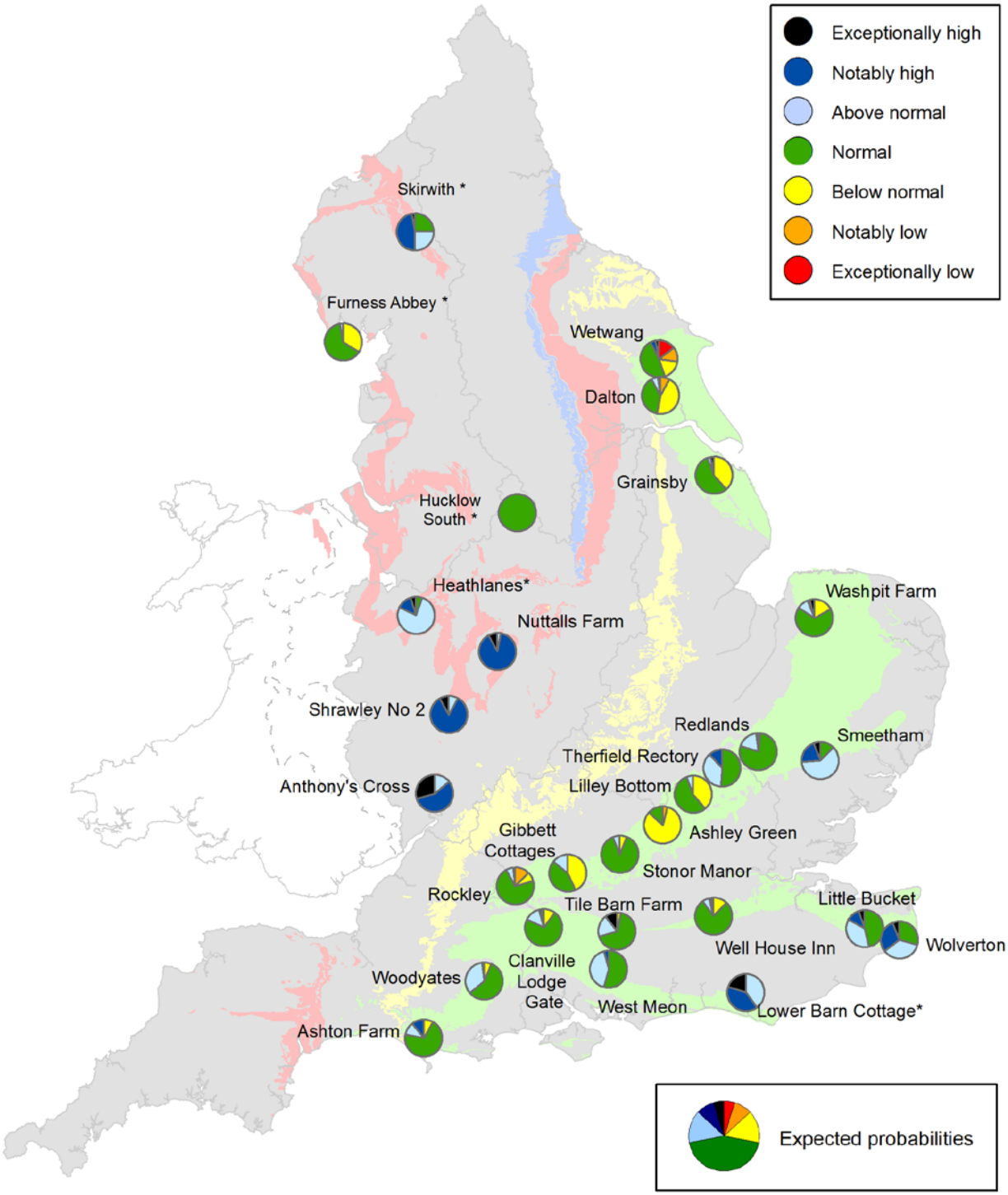

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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