Monthly water situation report

England

Summary – May 2013

Above average rainfall across England in May has brought to an end to four consecutive months of below average rainfall across northern England. Despite the rain, soil moisture deficits (SMDs) increased during May particularly in parts of eastern England where they exceeded 70mm. Monthly mean river flows for May were *normal* or higher across most of England but *below normal* in parts of southwest England. Groundwater levels decreased at the majority of our indicator sites but were *normal* or higher in all the principal aquifers of England, with the exception of levels in the Cotswolds Jurassic Limestone aquifer in our South East Region. Overall reservoir stocks remained stable during May with storage in England as a whole at 93% of total capacity.

Rainfall

May rainfall totals were highest in our Yorkshire and North East, and North West Regions at 86mm. In our remaining regions totals ranged from 79mm (Midlands Region) to 51mm (Anglian Region) (see Figure 1.1). Locally, the highest rainfall totals (more than 130mm) fell in the Upper Dee catchment (Gwynedd) which flows into England and in coastal parts of the North York Moors, while the lowest rainfall totals (less than 40mm) fell in parts of Kent, Suffolk and across Essex.

Rainfall totals for the whole of May were classed as *normal* or higher for the time of year for all reported hydrological areas. In large parts of northeast England and the Midlands, rainfall totals were classed as *above normal* or higher. Cumulative rainfall totals over the past twelve months to May 2013 were *exceptionally high* in most areas of central and western England and *notably high* or *above normal* in eastern England (see Figure 1.2). The twelve month period ending May 2013 was the wettest since records began in 1910 in our South West Region and the second wettest in our Midlands and North East Regions and for England as a whole.

Monthly rainfall totals as a percentage of the May long term average (LTA) were above average in all of our regions, ranging from 105% in our Anglian, South West and South East Regions to 144% in our Yorkshire and North East Region (see Figure 1.3). The average monthly rainfall across England as a whole was 120% of the LTA rainfall (see Figure1.3).

Soil moisture deficit

During May soil moisture deficits (SMDs) increased in all but our North West Region as increased evapotranspiration offset the impact of the above average rainfall. At the end of May, SMDs ranged from less than 10mm in parts of the Welsh borders, southwest and northwest England, to between 70-90mm in parts of East Anglia and northeast England. Month end SMDs were approximately between 5-40mm greater than the LTA in two fifths of MORECS grid squares covering large parts of eastern England and between 5-33mm less than the LTA in two fifths of MORECS grid squares covering large parts of western England (see Figure 2.1).

At the beginning of May, SMDs ranged from 22mm in our North West Region to 46mm in our Anglian Region. SMDs decreased in mid-May by approximately 5mm in western and central regions, but increased in all but our North West Region by the end of the month. At the end of May, SMDs were approximately between 5-10mm less than the LTA in our Midlands, North West and South West Regions and approximately 5-15mm greater than the LTA in our Anglian and North East regions. SMD remained close to the LTA in our South East Region (see Figure 2.2).

River flows

Compared with April, monthly mean river flows for May decreased at four fifths of our reported indicator sites across England. Flows decreased at all indicator sites in our Anglian and South East Regions, but showed a mixed response in all other regions (see Figure 3.1).

Monthly mean river flows for May were classed as *normal* or higher for the time of year at almost all of our indicator sites across England, with the exception of two sites in our South West Region which were *below normal.* Flows on the South Tyne River at Haydon Bridge in our Yorkshire and North East Region, and on the

River Itchen at Allbrook and Highbridge in our South East Region, were classed as *notably high* for the time of year (see Figure 3.1).

River flows at all the regional index sites remained *normal* or higher for the time of year. Regional index sites in our Anglian and our Yorkshire and North East Regions were classed at *above normal* and *notably high* for the time of year respectively (see Figure 3.2).

Groundwater levels

Groundwater levels decreased at the majority of indicator sites in England during May. At the end of May, groundwater levels at all but one of our indicator sites were *normal* or higher for the time of year. Three sites were classed as *exceptionally high* for the time of year (see Figure 4.1) in the West Cheshire sandstone (Prior Heyes - which remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction), the Carlisle Basin and Eden Valley sandstone (Skirwith) and the Wear Magnesian Limestone (Swan House).

Groundwater levels in the Shropshire Middle Severn sandstone at Heathlanes, in our Midlands Region, was the only regional index site to show a rise as levels continue to recover from their minima of 2012. Levels in the Burford Jurassic Limestone in the Cotswolds (Jackaments Bottom) remain *below normal* for the time of year (see Figure 4.2).

Reservoir storage

During May reservoir stocks decreased or remained static in three quarters of the reported reservoirs, including all those supplying our South West Region which decreased by between 1% and 8%. Increases in reservoir storage, where they occurred, were very modest (1-3%).

Despite the decreases, reservoir storage remained classed as *normal* or higher in the majority of reported reservoirs and reservoir groups supplying England. Stock in three reservoirs across our Midlands, North West and Anglian Regions were *below normal* or lower for the time of year.

At a regional scale reservoir stocks remained relatively stable, decreasing by 1% and 3% in our Anglian, North West and South West Regions, and increasing by 1% in all other regions. At the end of May, regional reservoir stocks were lowest in our North West Region at 87%, and highest in our South East Region at 98% of capacity. Overall reservoir storage for England remained stable during May at 93% of total capacity (see Figure 5.2).

Forward look

The outlook for June is for the weather to remain changeable with outbreaks of rain interspersed with drier and warmer spells. Further ahead temperatures are likely to be lower than average for the period June to August 2013. Above average rainfall is most probable in the period June to August 2013[1].

Probabilistic ensemble projections for river flows at key sites[2,3]

September 2013: Nearly three quarters of modelled sites have a greater than expected chance of *normal flows* from June to September. Nearly half of sites have a greater than expected chance of *exceptionally high* flows, whilst only two sites, the River Thames at Kingston (naturalised flows) and the River Weaver at Ashbrook, have a slightly greater than expected chance of *exceptionally low* flows (see Figure 6.1).

March 2014: Over two thirds of modelled sites have a greater than expected chance of *notably high* flows from June 2013 to March 2014. Only one site, the River Thames at Kingston (naturalised flows), has a slightly greater than expected chance of *exceptionally low* flows (see Figure 6.2).

Scenario based projections for groundwater levels in key aquifers[3]

September 2013: With average rainfall (100% of the LTA) from June to September, groundwater levels are likely to be *normal* or higher for the time of year at all except one modelled site, and *above normal* or higher at a third of modelled sites. With above average rainfall (120% of the LTA) all sites will be *normal* or higher. With 60% of the LTA rainfall, all except three modelled sites are likely to have *normal* or higher groundwater levels for the time of year (see Figure 6.3).

[1] Source: Met Office

[2] Projections have been produced for a revised set of locations this month, additional locations and scenario based projections will be phased in over the coming months

[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 and Met Office.

March 2014: With average rainfall (100% of the LTA) from June 2013 to March 2014, groundwater levels are likely to be *normal* or higher for the time of year at all except one modelled site, and *above normal* or higher at nearly half of the modelled sites. With below average rainfall (80% of the LTA), groundwater levels are likely to be *normal* or higher at just over half of our modelled sites. With above average rainfall (120% of the LTA), levels are likely to be *exceptionally high* for the time of year at a third of the modelled sites (see Figure 6.4).

Probabilistic ensemble projections for groundwater levels in key aquifers [3]
September 2013: Nearly two thirds of modelled sites have a greater than expected chance of *normal* groundwater levels for the time of year. More than half of the sites have a greater than expected chance of *above normal* levels, with 10% having a greater than expected chance of *exceptionally high* levels for the time of year (see Figure 6.5).

March 2014: A third of modelled sites have a greater than expected chance of levels being *normal* for the time of year. Three quarters of the modelled sites have a greater than expected chance of *notably high* groundwater levels for the time of year and two thirds of all modelled sites have a greater than expected chance of *exceptionally high* groundwater levels by the end of March 2014 (see Figure 6.6).

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Rainfall

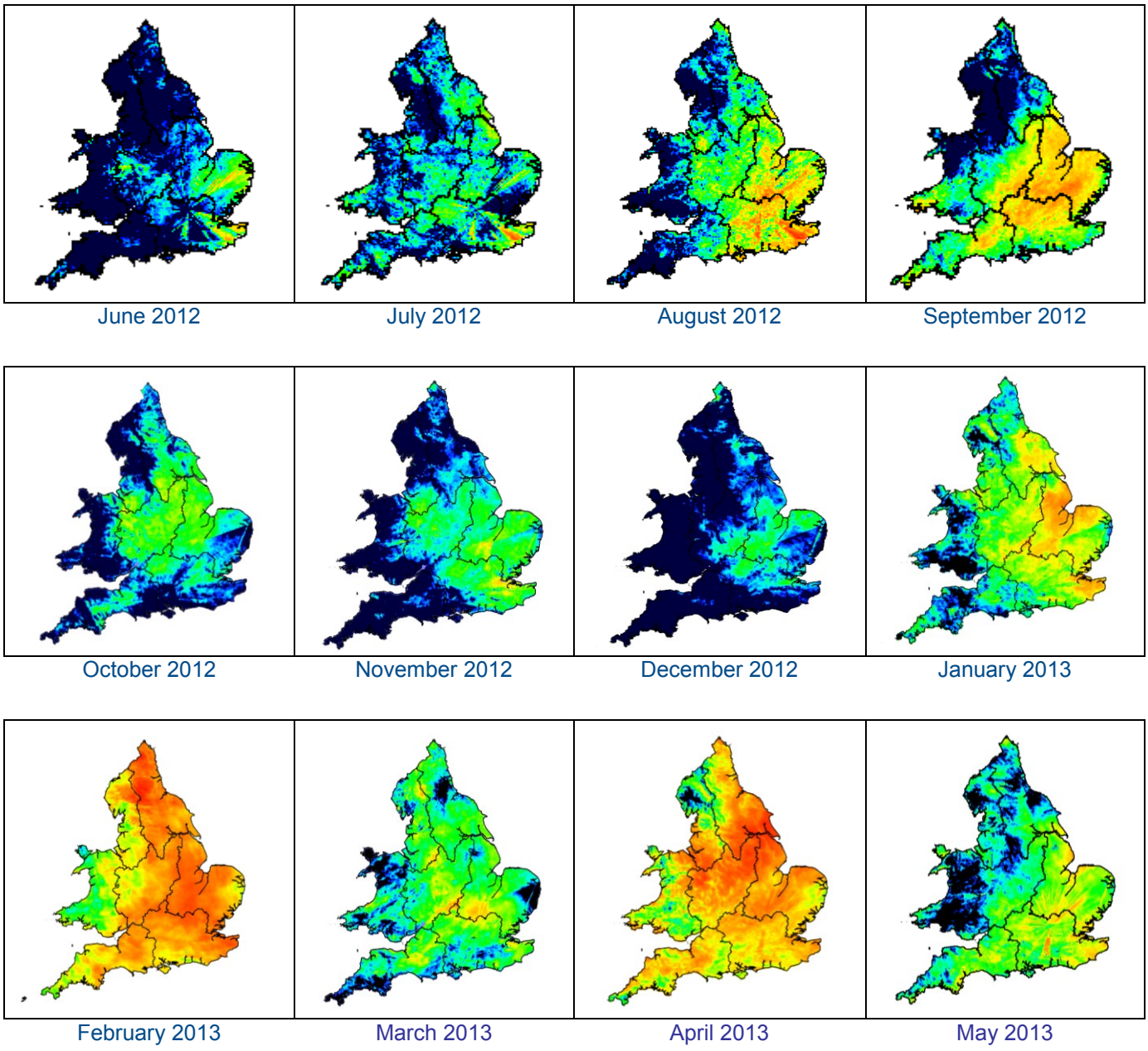


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2013). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2013.

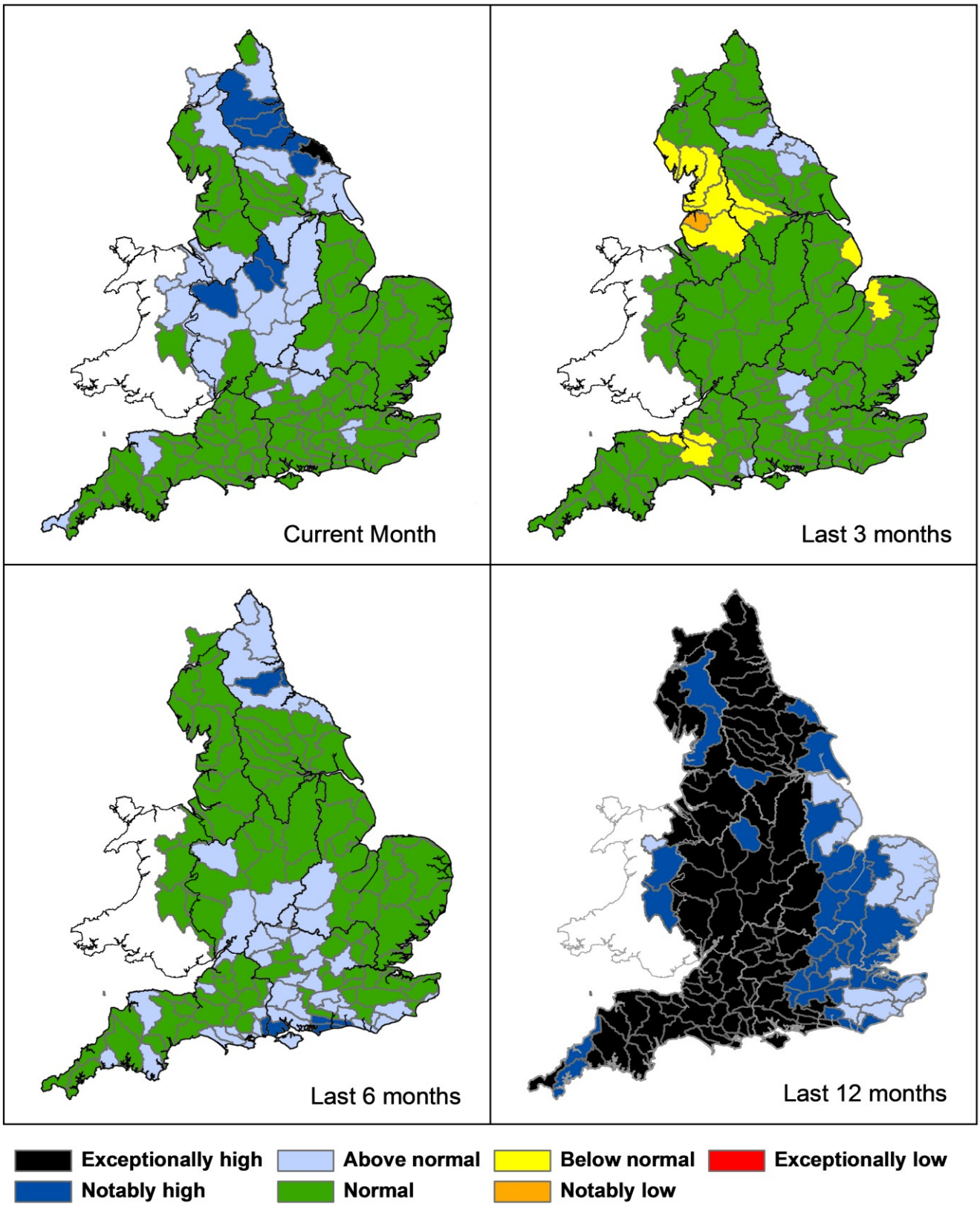


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31st May), the last three months, the last six months, and the last 12 months, classed relative to an analysis of respective historic totals. Final and provisional NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2013).* Crown copyright. All rights reserved. Environment Agency, 100026380, 2013.

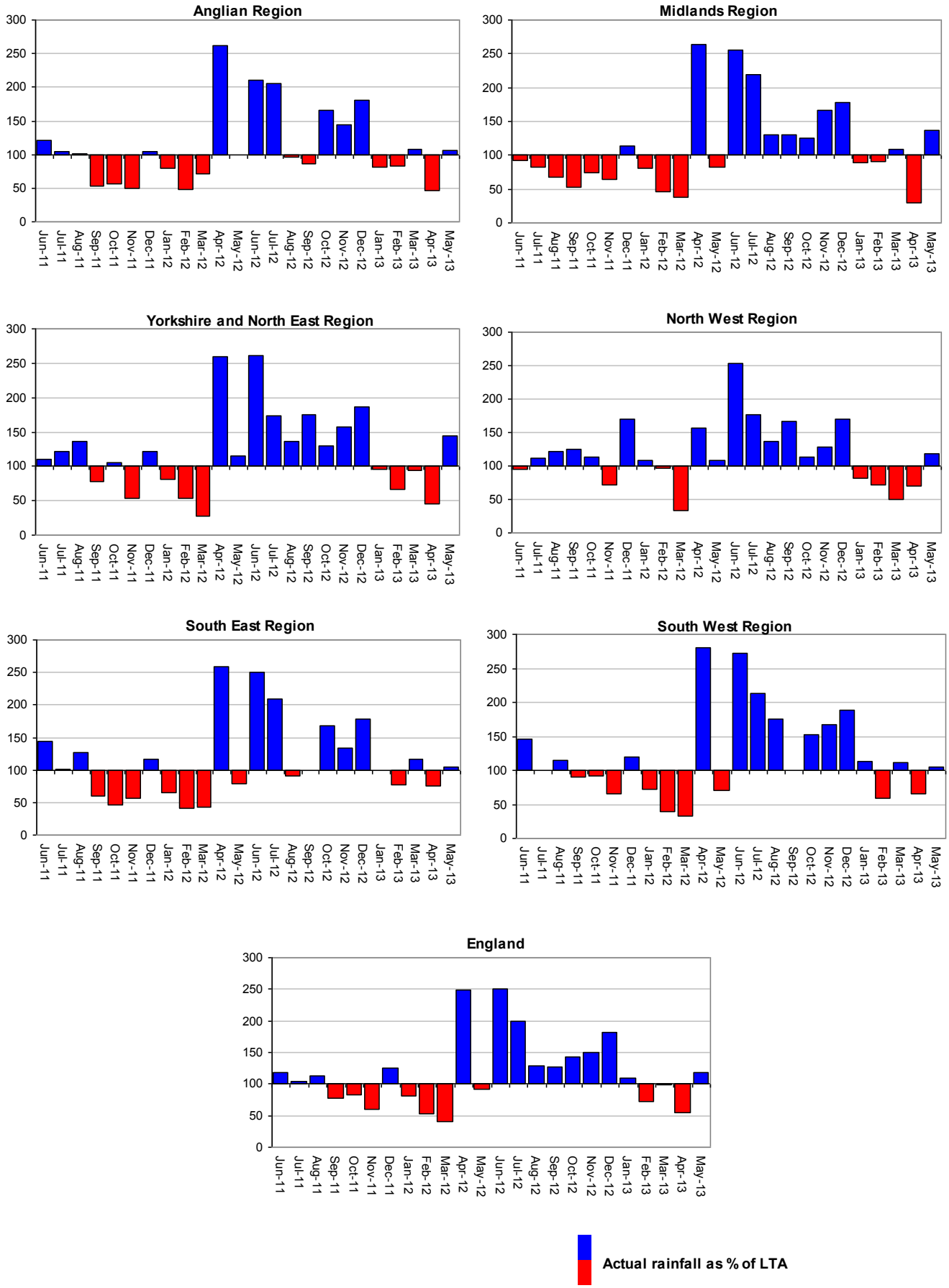


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each Environment Agency Region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2013).

Soil moisture deficit

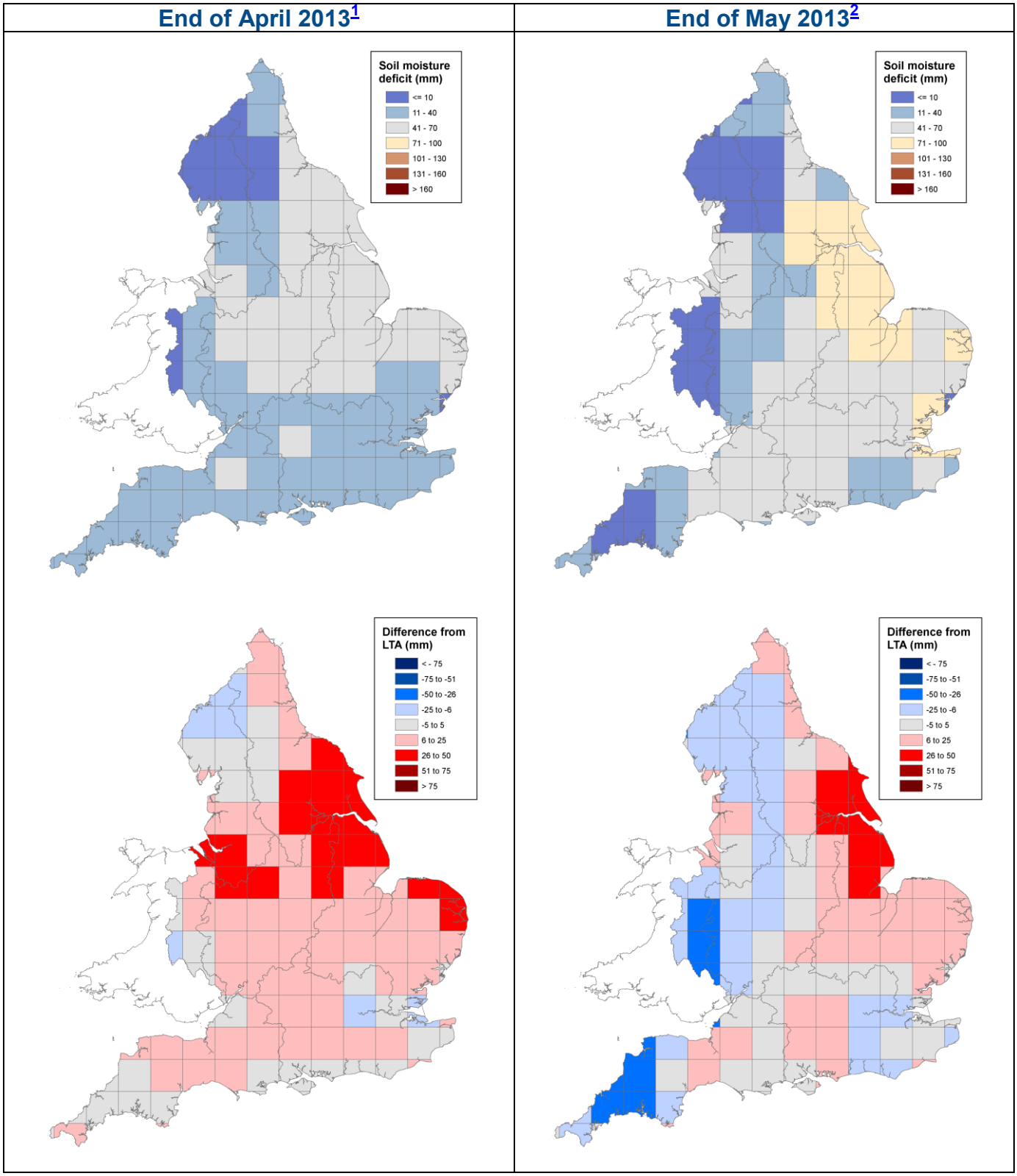


Figure 2.1: Soil moisture deficits for weeks ending 30 April 2013 [1] (left panel) and 28 May 2013 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2013). Crown copyright. All rights reserved. Environment Agency, 100026380, 2013

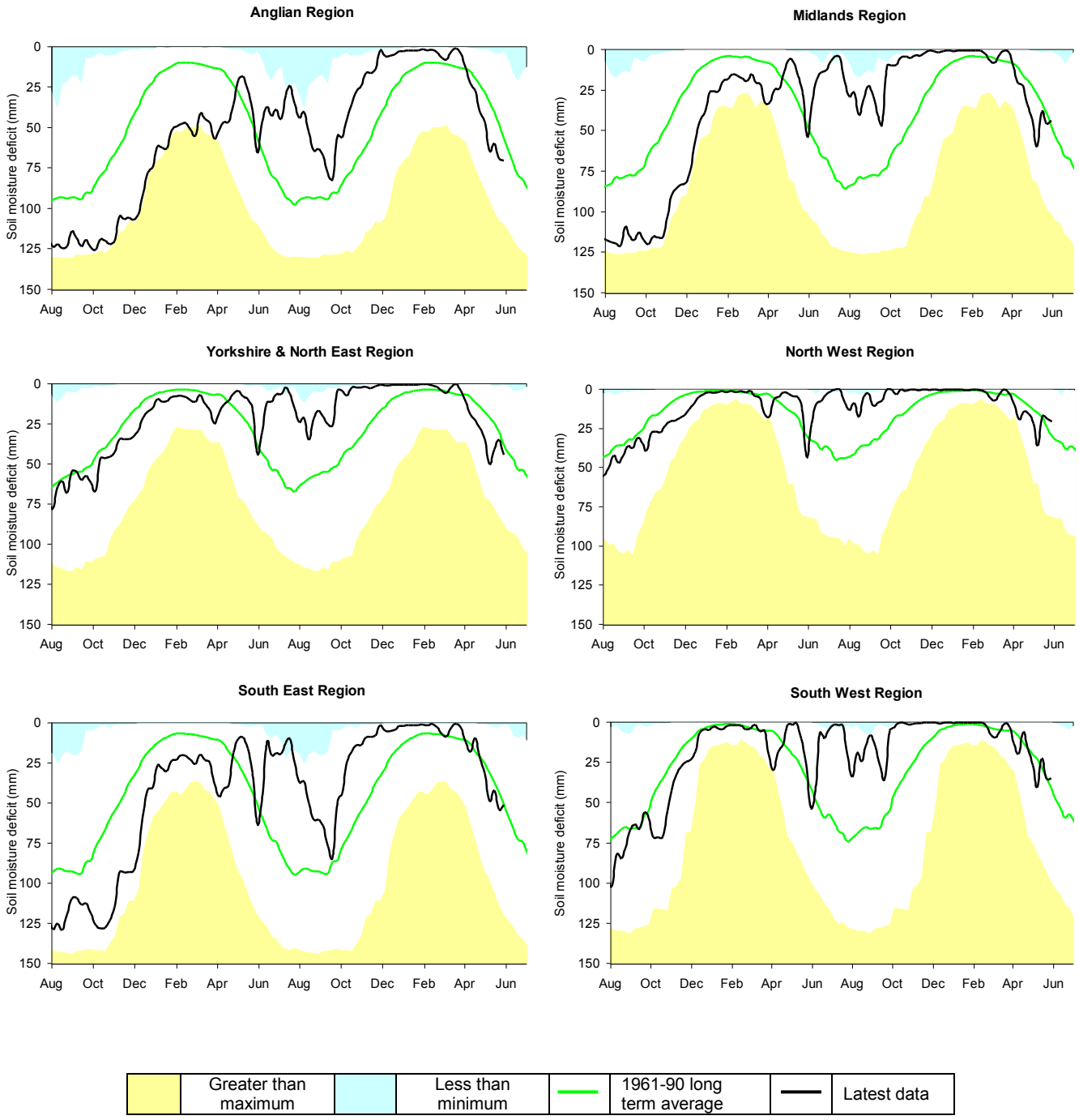
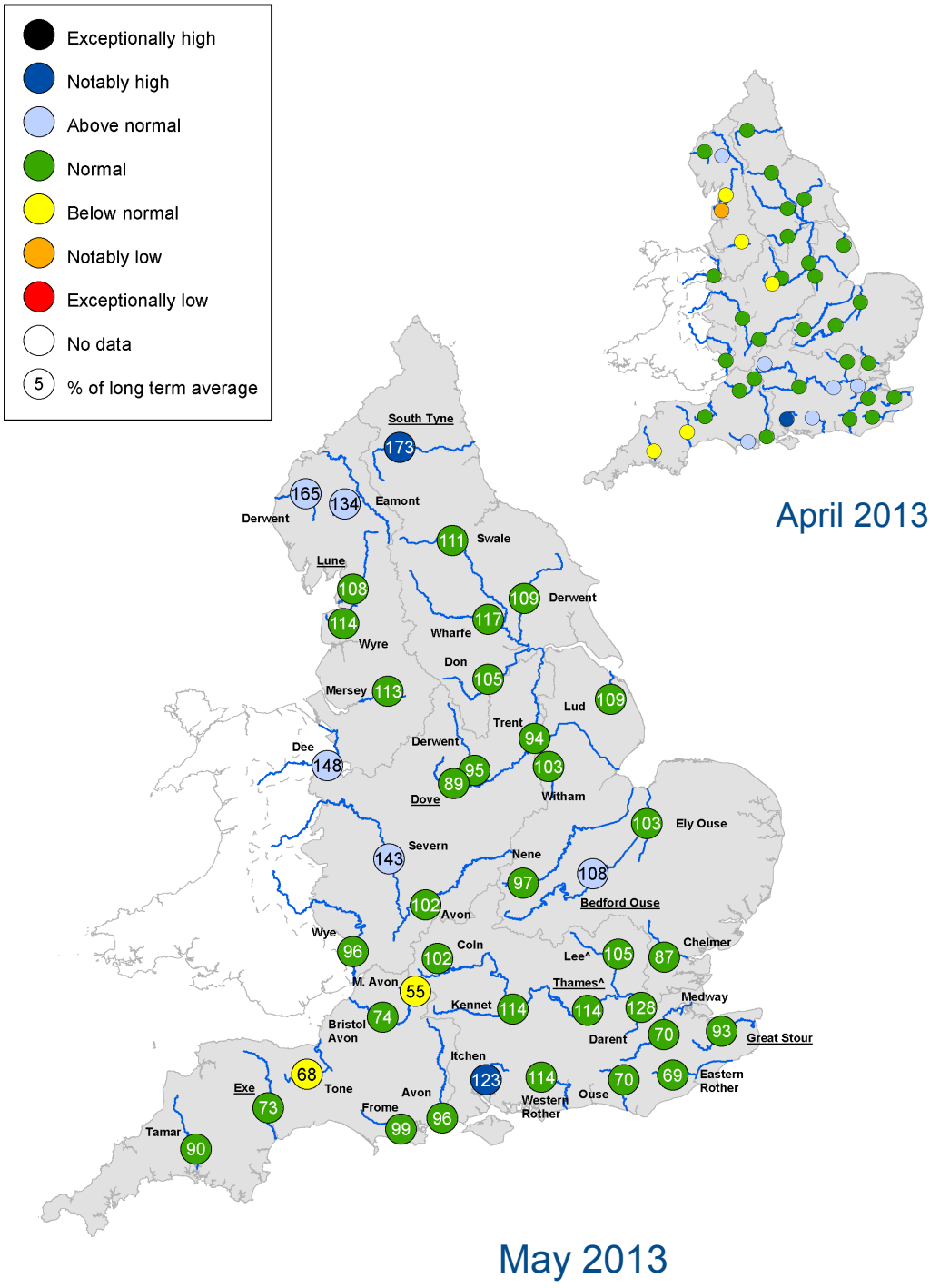


Figure 2.2: Latest soil moisture deficits for all Environment Agency Regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2013).

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 April 2013 and May 2013, expressed as a percentage of the respective long term average and classed relative to an analysis of historic April and May monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2013.

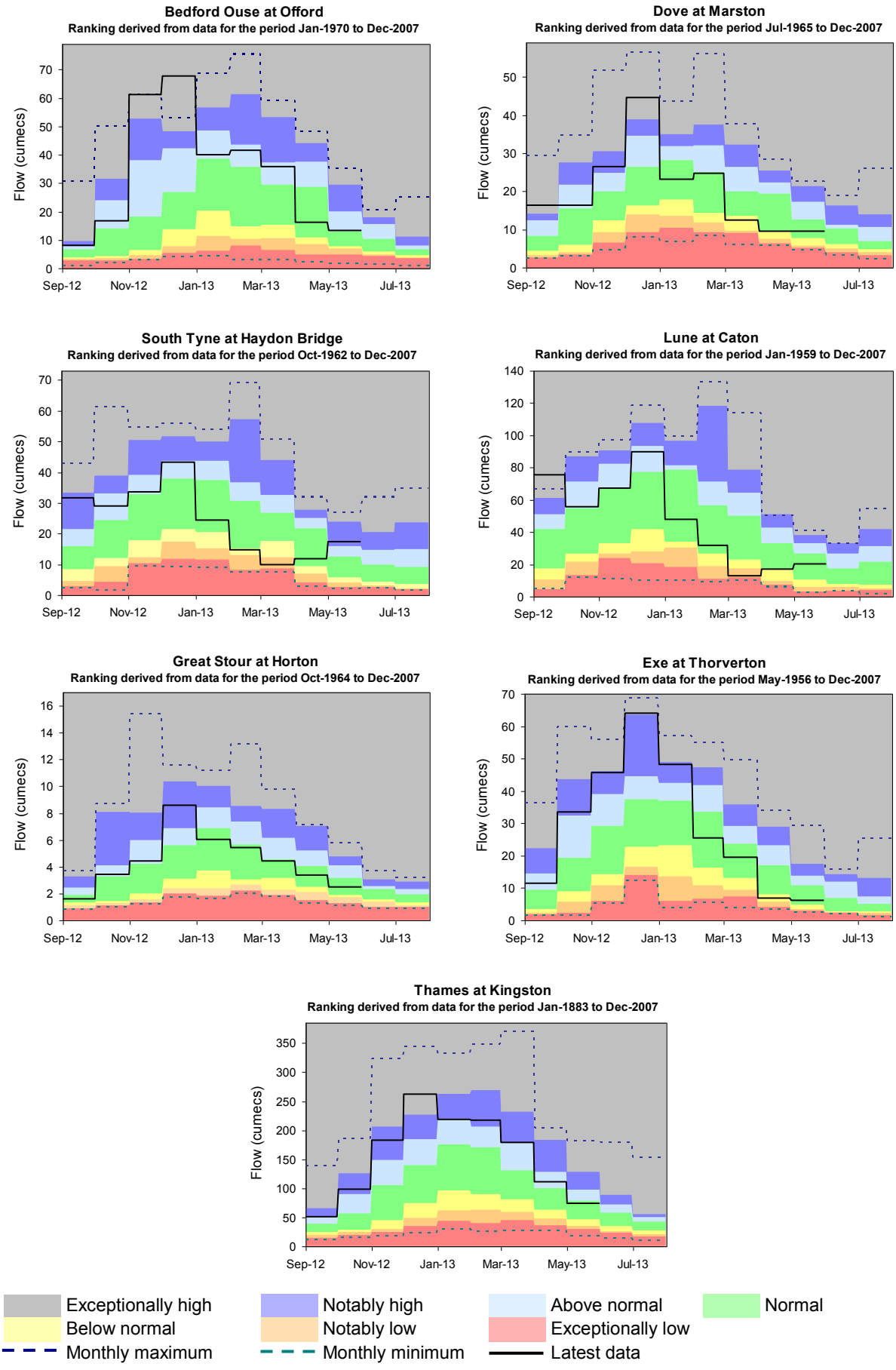
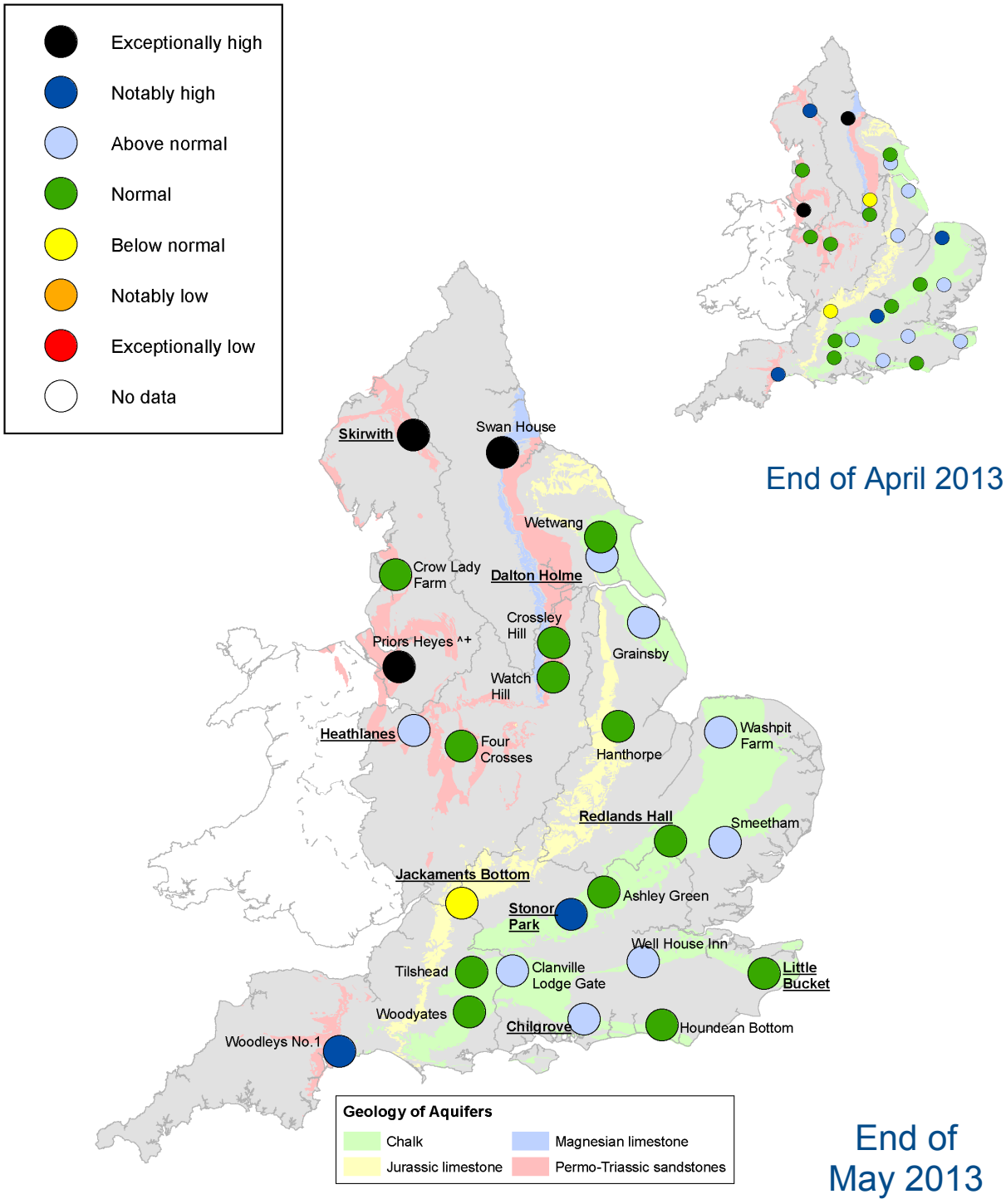


Figure 3.2: Index river flow sites for each Environment Agency Region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

Groundwater levels



^ The level at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction.
End of month groundwater level is the highest (+) and lowest (-) on record (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 April 2013 and May 2013, classed relative to an analysis of respective historic April and May levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Note: groundwater levels are reported at different times during the month and therefore may not be fully representative of levels at the month end. Crown copyright. All rights reserved. Environment Agency, 100026380, 2013.

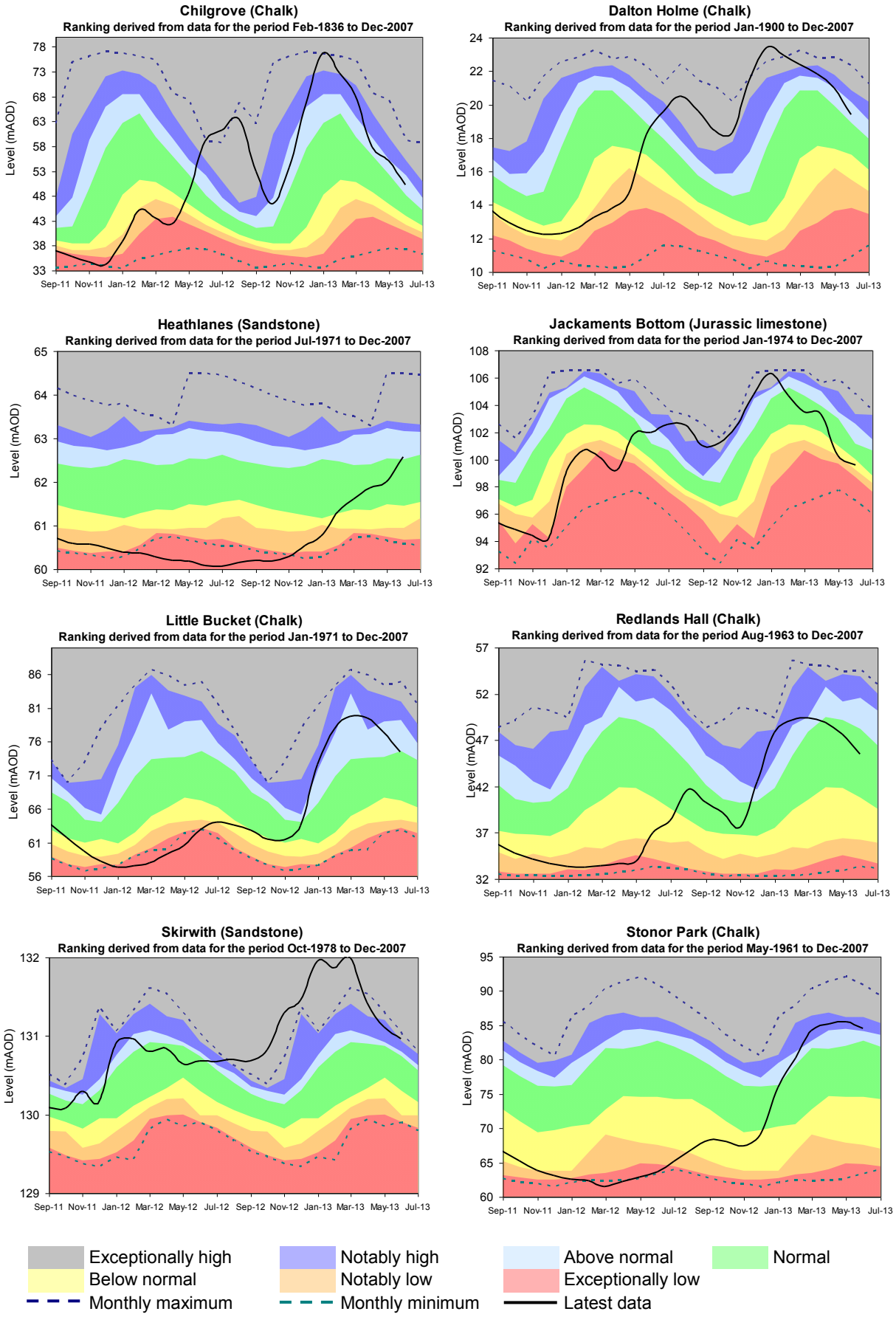
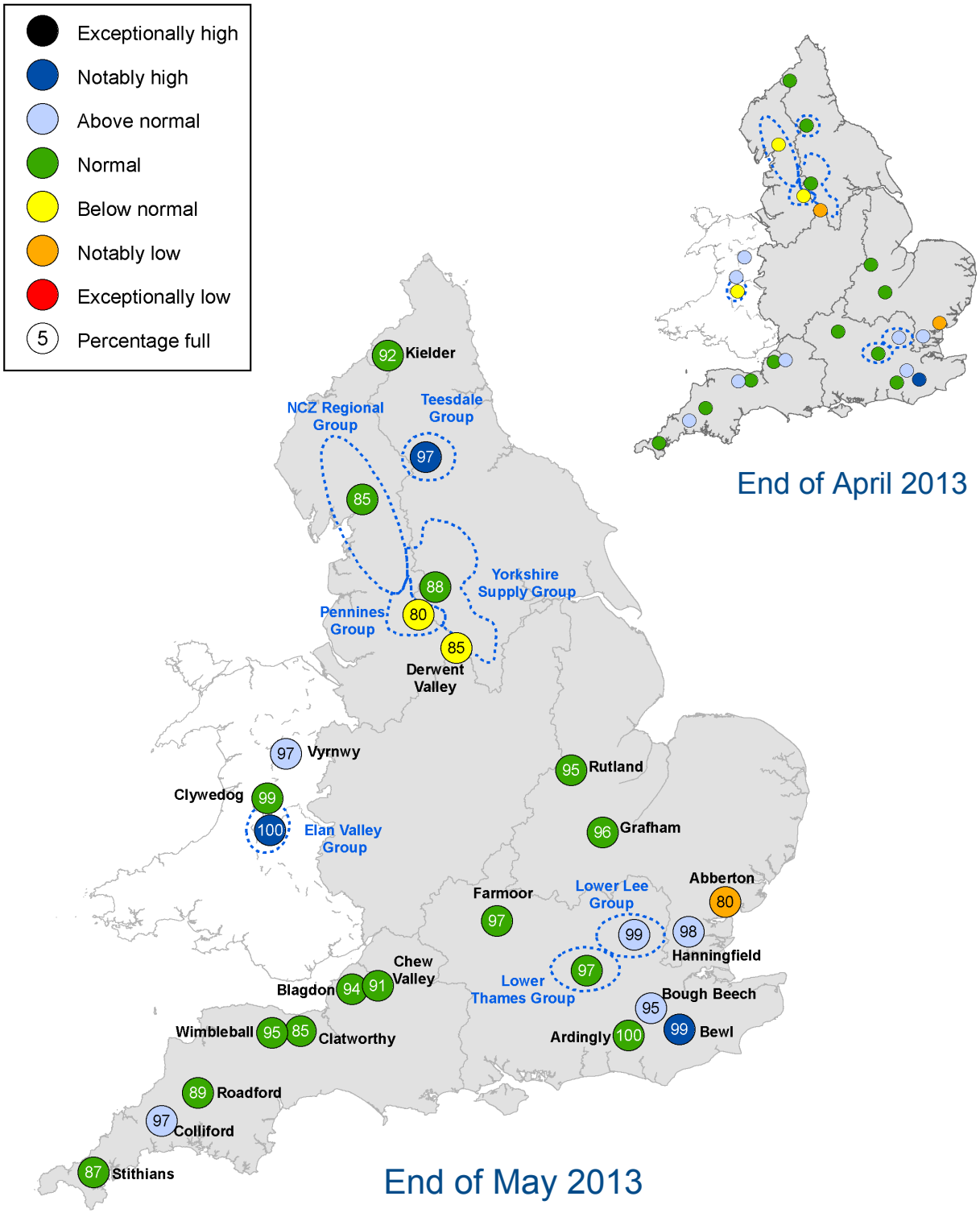


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2013).

Reservoir storage



1. The level at Abberton Reservoir in Anglian Region is affected by ongoing engineering works to increase capacity by 60% - works are expected to be complete by the end of 2013.
2. Clywedog and Vyrnwy and reservoirs are located in Wales but provide a water resource to our Midlands and North West regions.

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of April 2013 and May 2013 as a percentage of total capacity and classed relative to an analysis of historic April and May 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.

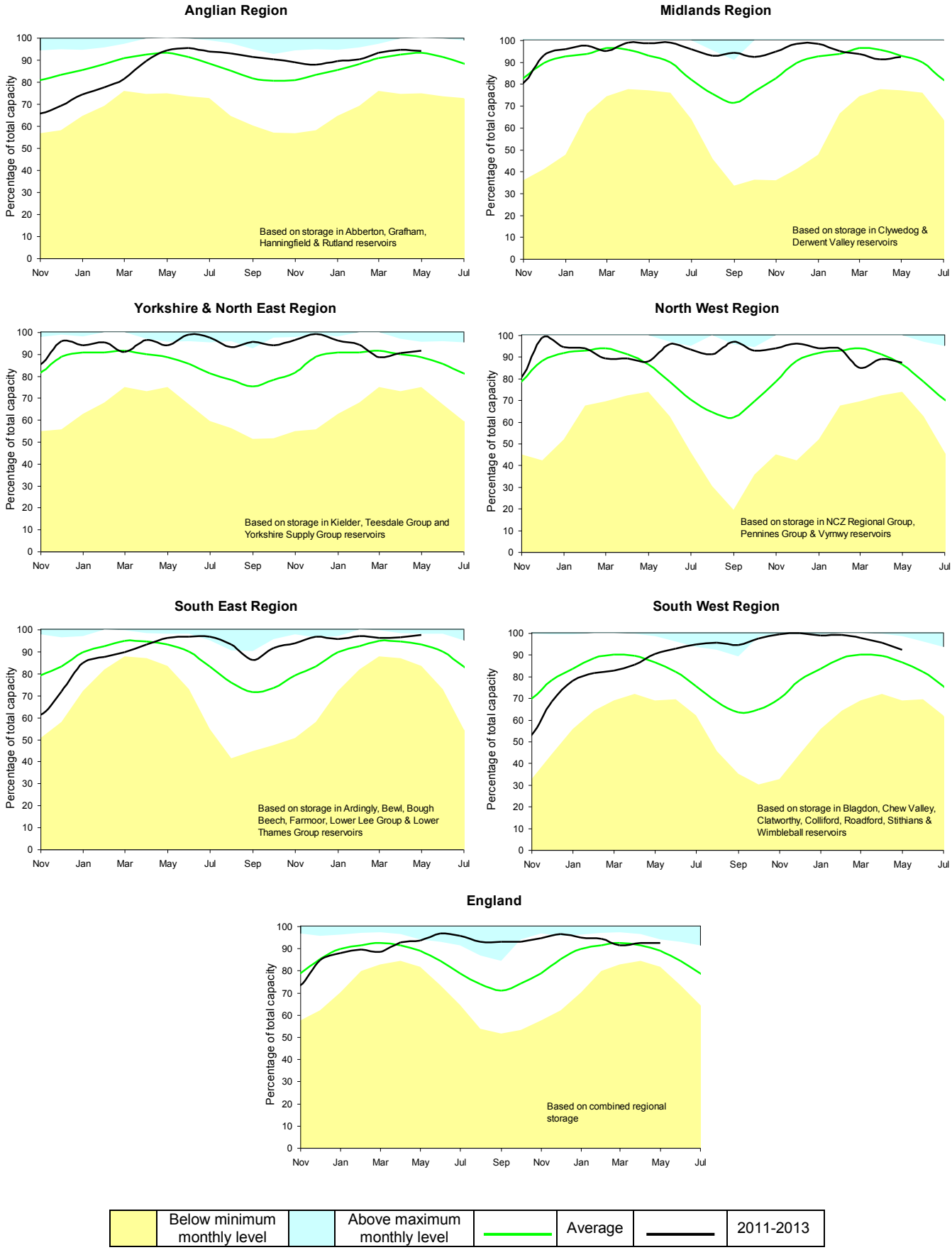
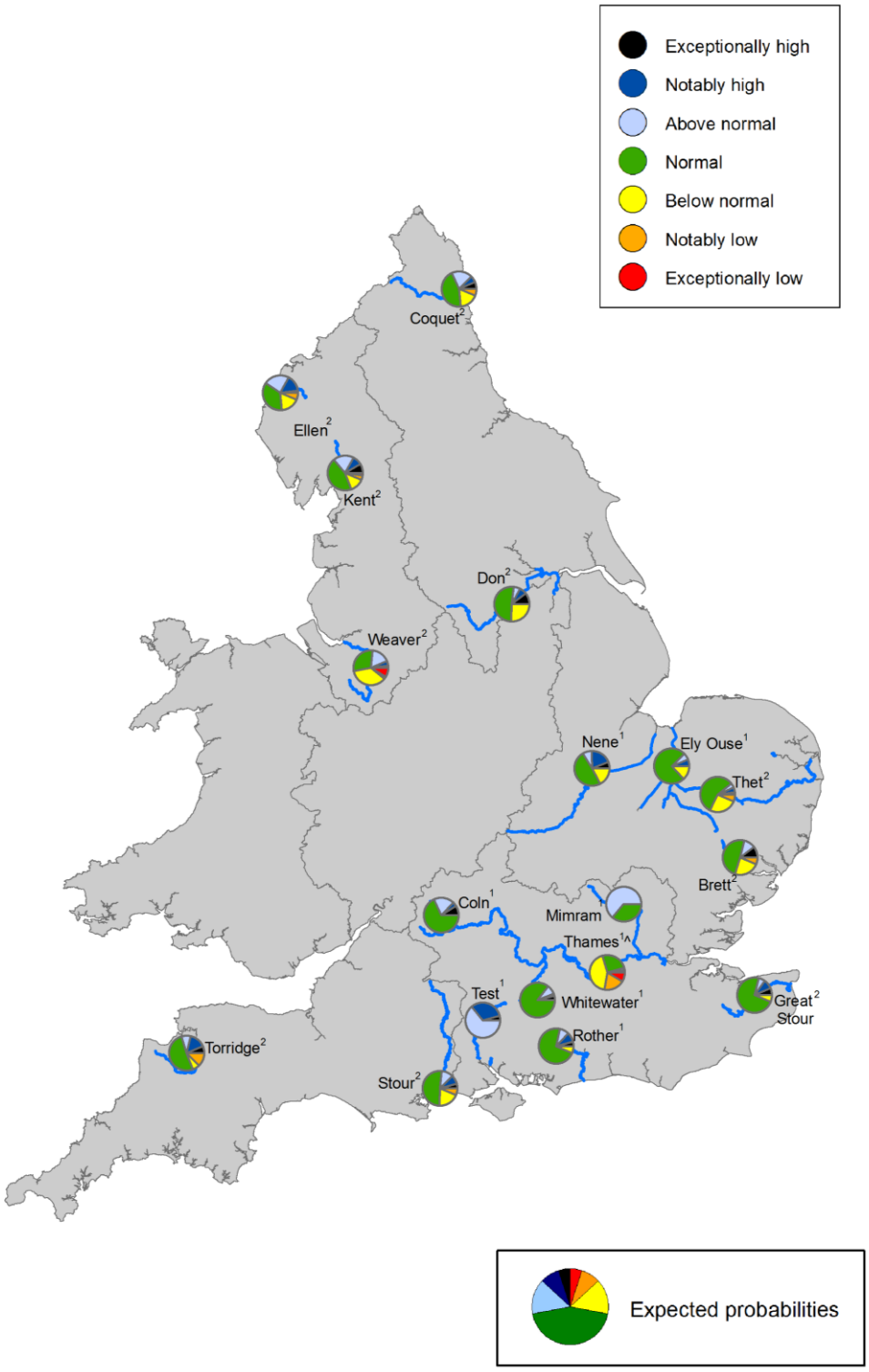


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

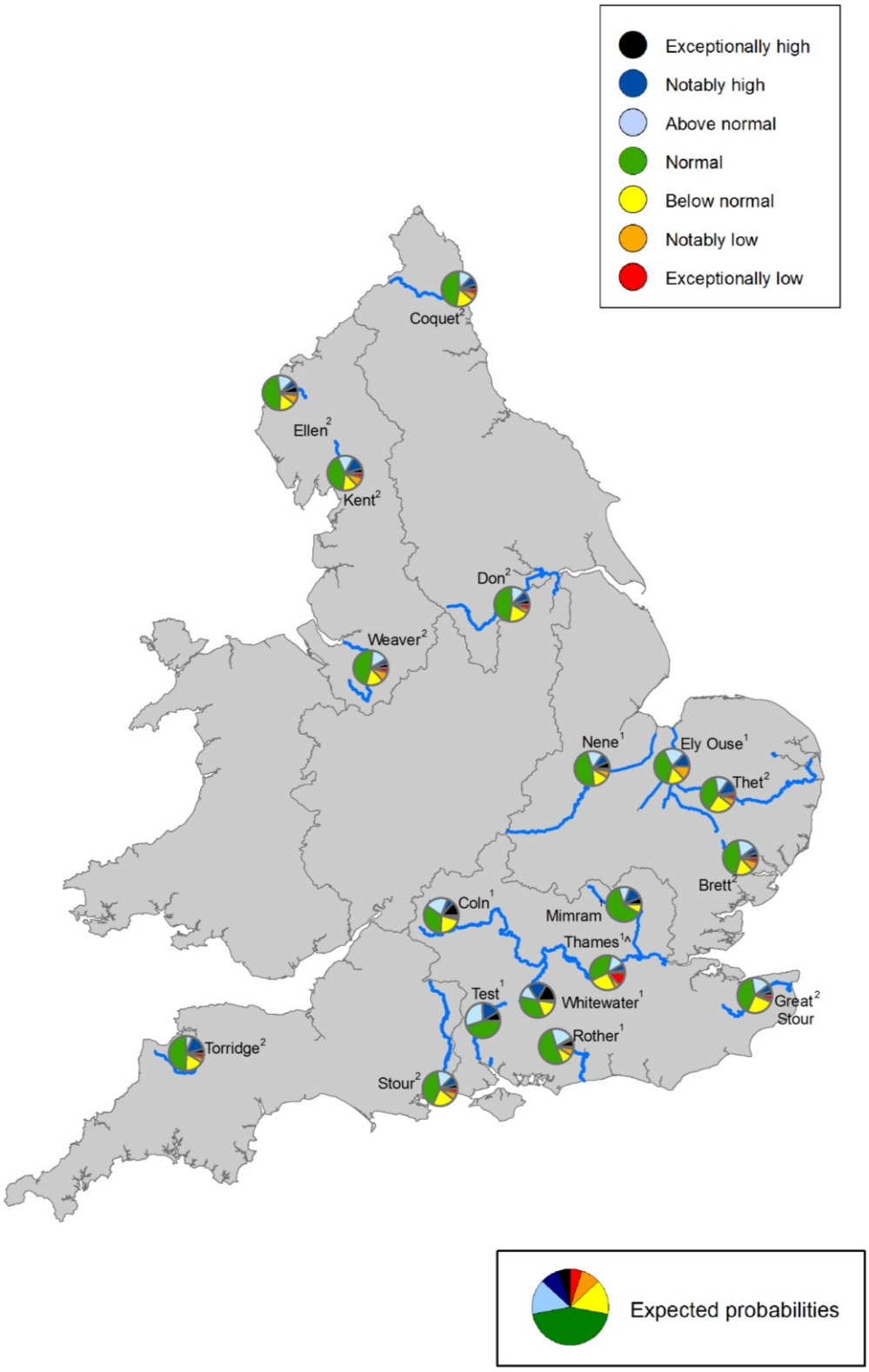


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

^ "Naturalised" flows are projected for the 'Thames at Kingston'

[1]Projections for these sites are produced by the Environment Agency,[2] Projections for these sites are produced by CEH

Figure 6.1: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2013. 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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Forward look - groundwater

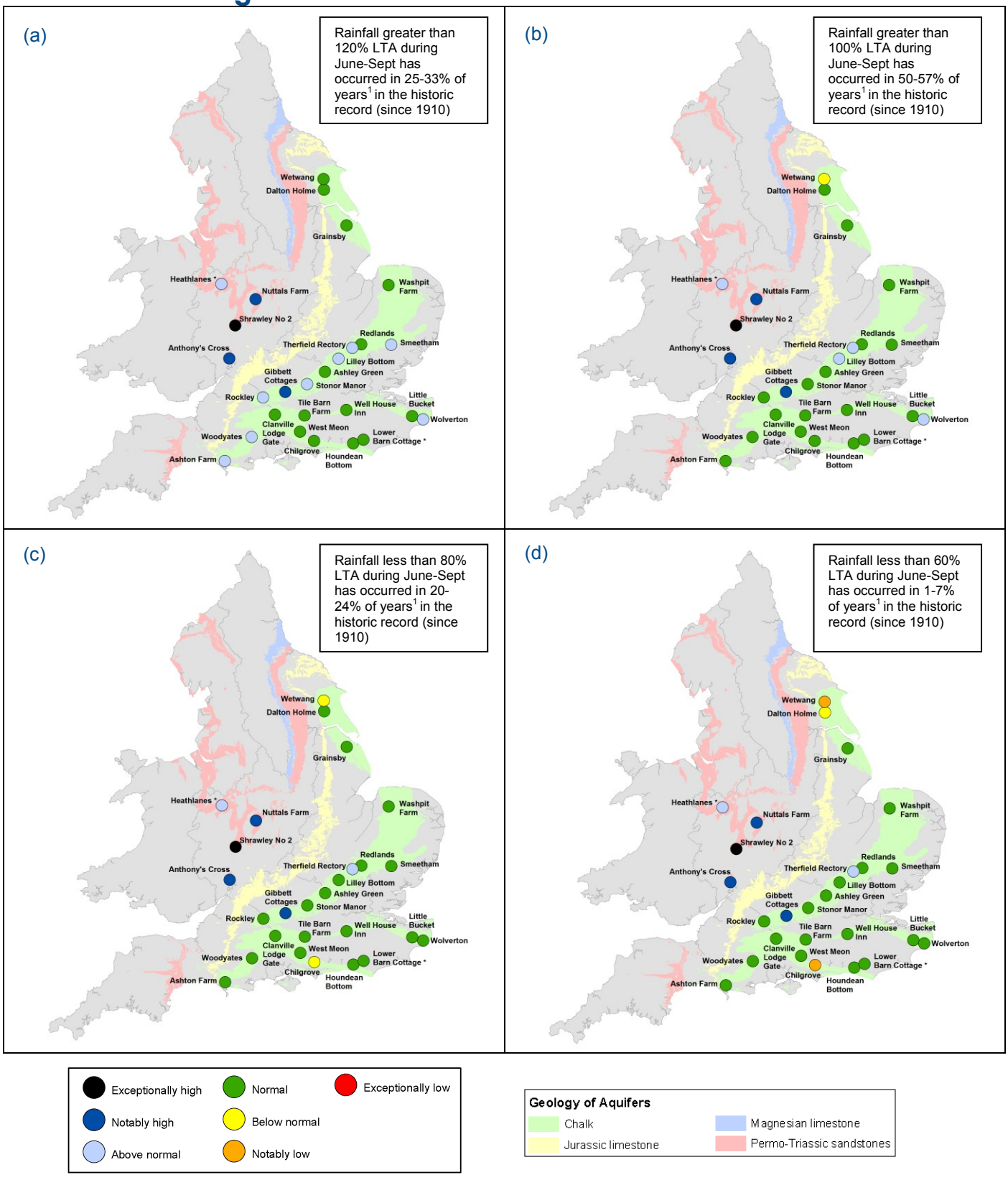

Figure 6.3: Projected groundwater levels at key indicator sites up until the end of September 2013. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2013 and September 2013 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2013.

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

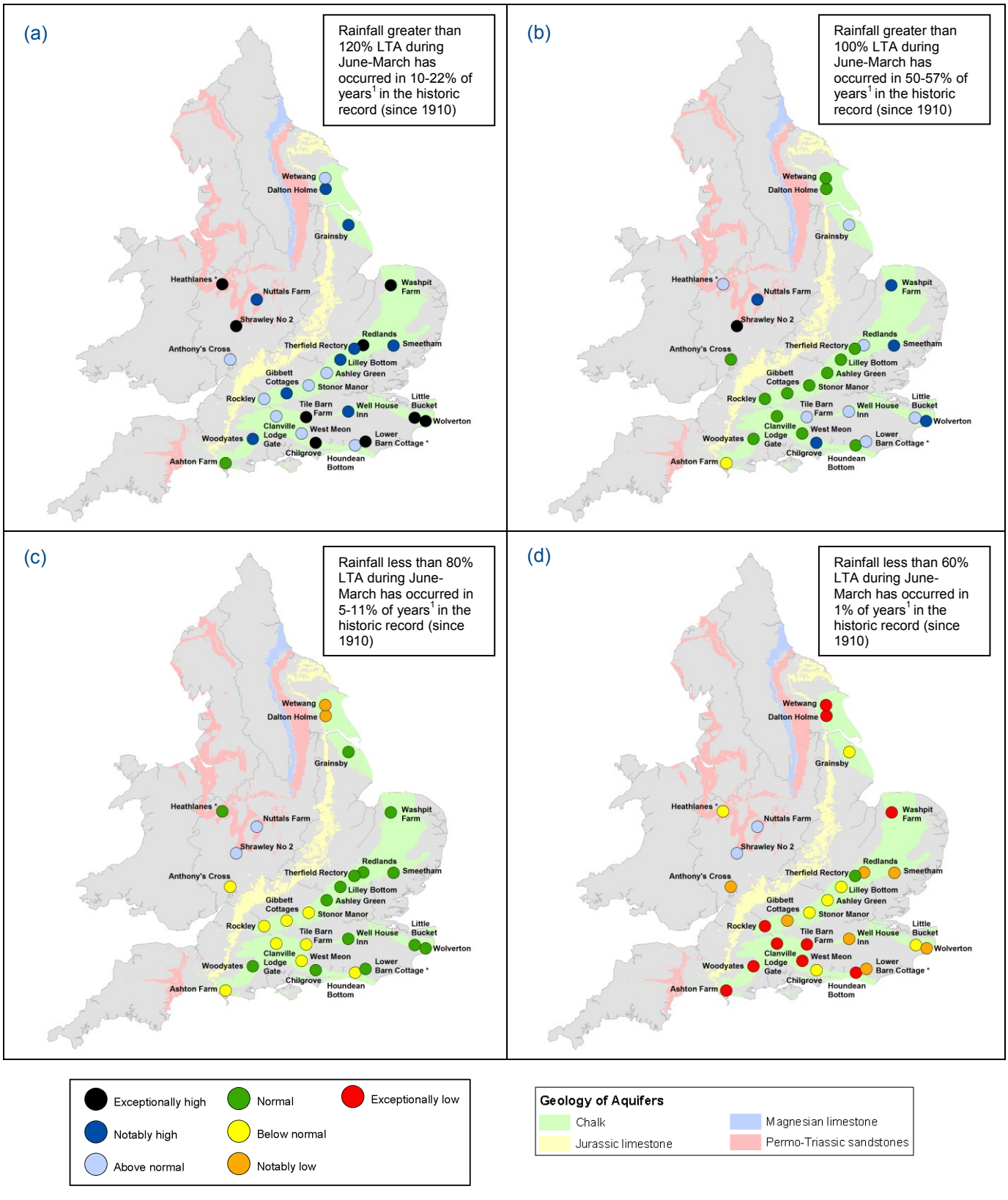

Figure 6.4: Projected groundwater levels at key indicator sites up until the end of March 2014. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2013 and May 2014 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2013.

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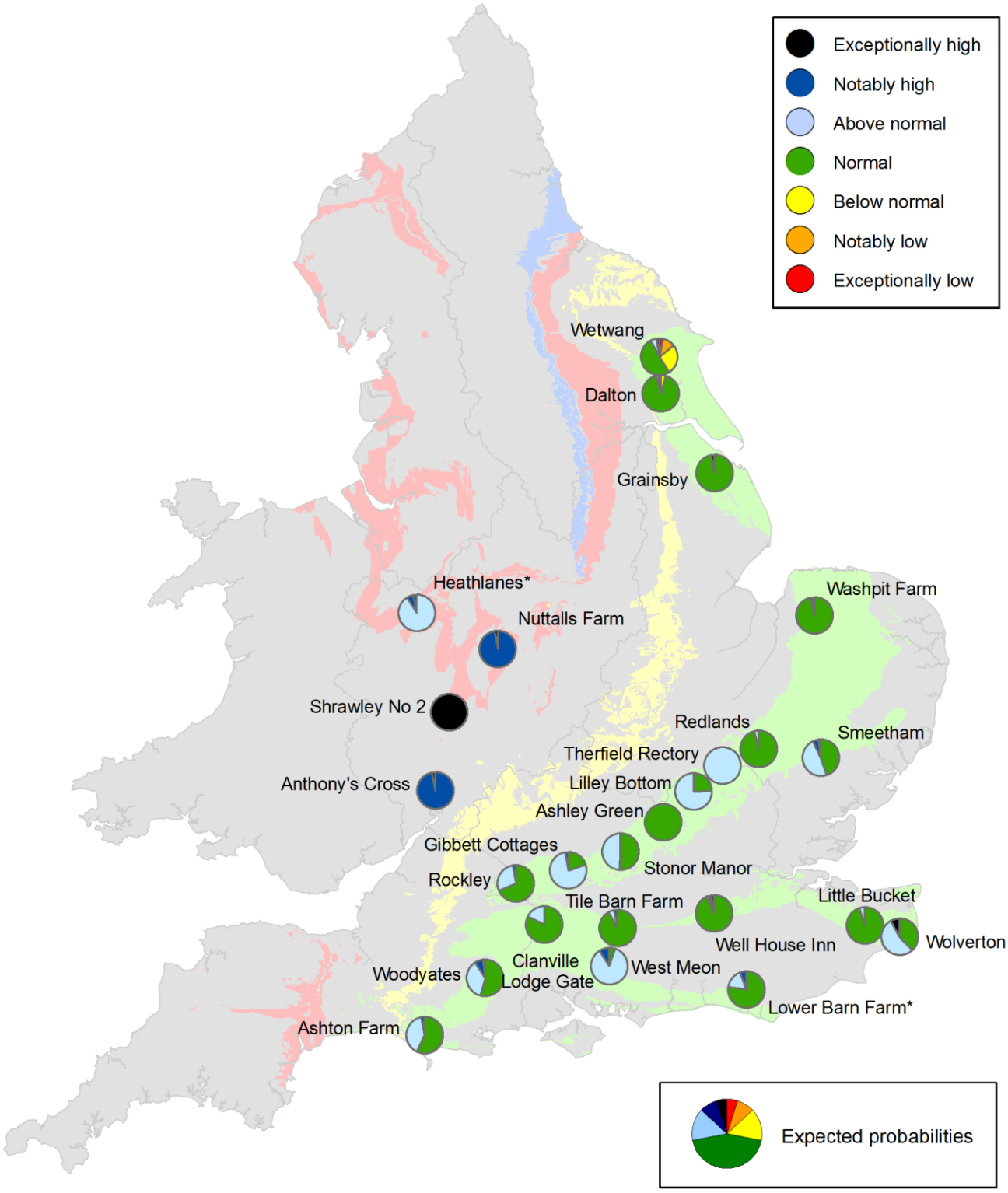

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

Figure 6.5: Probabilistic ensemble projections of groundwater levels at key indicator sites up until the end of September 2013. 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, 2013.

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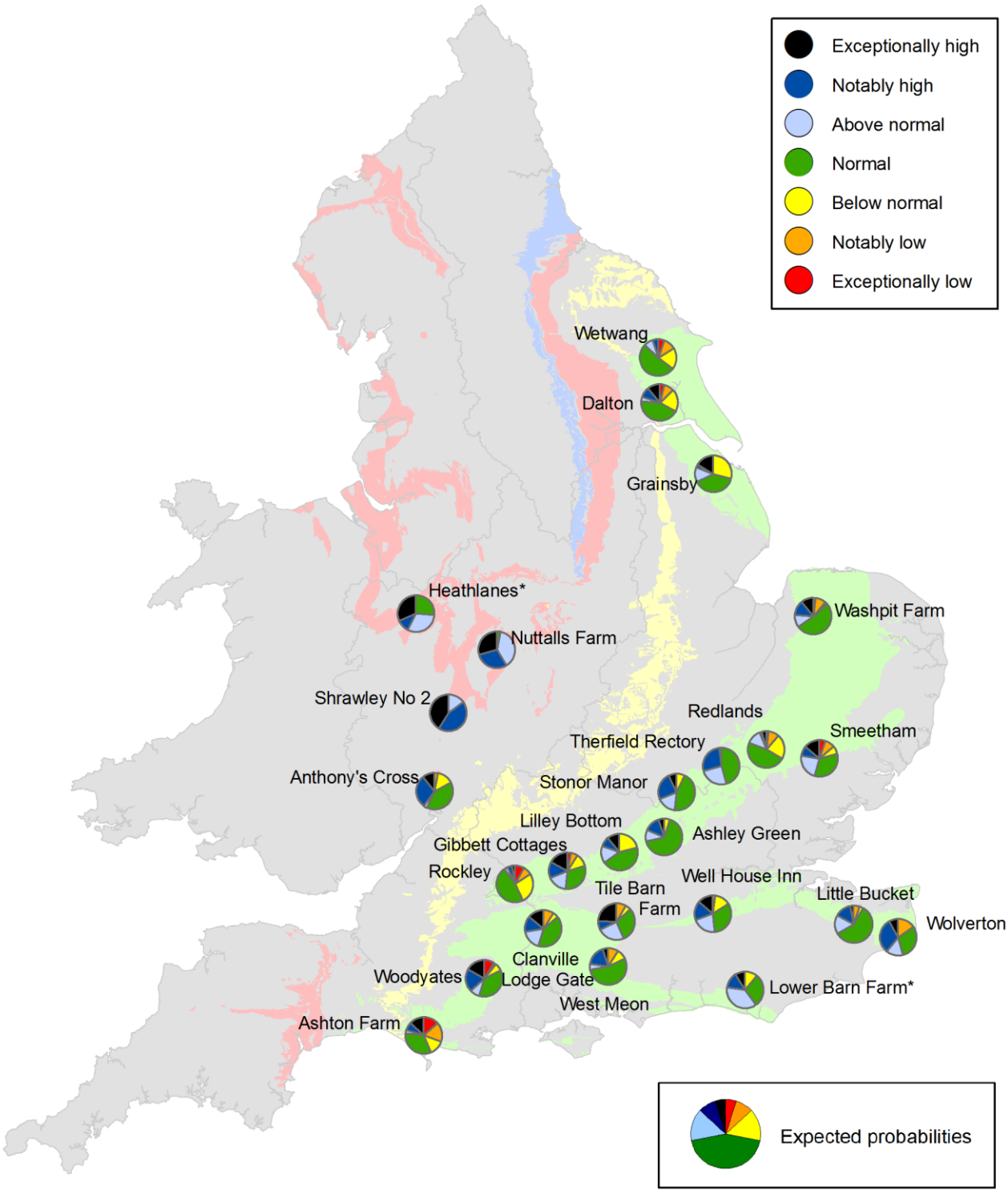

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Figure 6.6: Probabilistic ensemble projections of groundwater levels at key indicator sites up until the end of March 2014. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for 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, 2013.

* Projections for these sites are produced by BGS

Figure 7.1: Environment Agency Region Location Map