Operational groundwater level and river flow ensemble projections

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Environment Agency

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Operational groundwater level and river flow ensemble projections

- Presentation overview
  - Catchment modelling and ensemble projection methods
  - Applying the projections operationally - examples
  - Further work

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Ensemble projections – operational requirements

- Purpose:
  - Help decision makers **plan** for and **respond** to drought and flood incidents

- Aims:
  - Technically robust
  - Cheap and easy to deploy operationally (no complex IT platform required)
  - Quick to update and run at short notice
  - Easy to adapt to different situations
  - Build resilience within the hydrology community

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Modelling methods

- Catchmod
  - Lumped rainfall-runoff model
  - Excel-based – simple to calibrate and quick to run for individual sites, can also run up to 10 sites at once
  - Widely used amongst the EA hydrologists

- Historic climate ensemble approach
  - Ensemble Streamflow Prediction (ESP) technique: Day (1985); Franz et al. (2003)
  - 50+ years of daily rainfall and potential evaporation data
  - Excel VBA module developed as an extension to Catchmod to run ensemble forecasts

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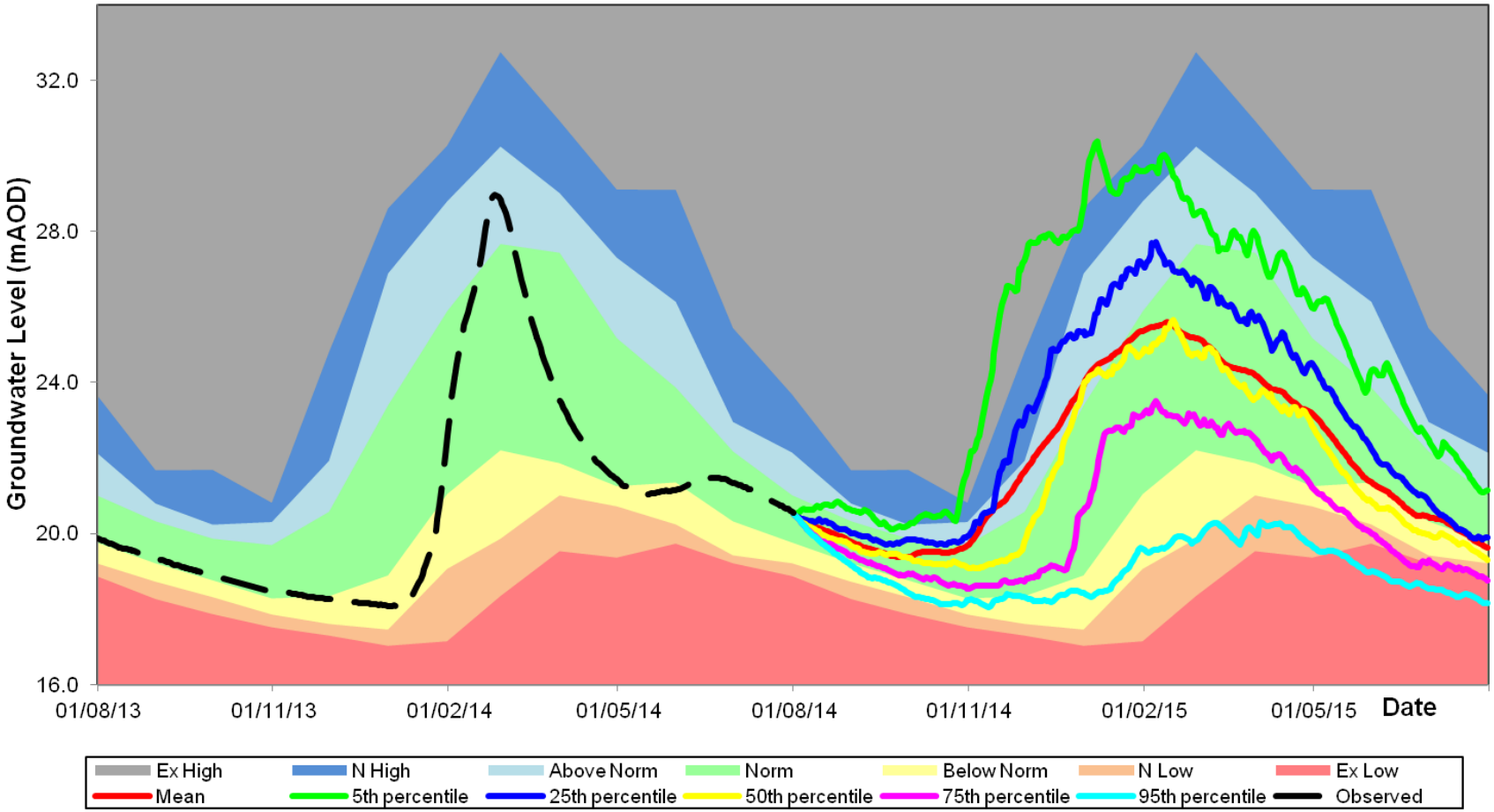

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Monthly water situation report

England

Summary – July 2014

July rainfall was below average in England as a whole at 93% of the long term average. Rainfall totals were classed as **below normal** for the time of year in the southwest, but **normal** elsewhere. Soil moisture deficits increased across most of the country, and only decreased in areas where heavy, localised showers occurred. Monthly mean river flows for July were **normal** or higher for the time of year at four fifths of the indicator sites across England. Groundwater levels decreased at all but one of our indicator sites, but remain **normal** or higher for the time of year at all sites. Reservoir stocks decreased across the country during July, with overall storage in England as a whole at 83% of total capacity at the end of the month.

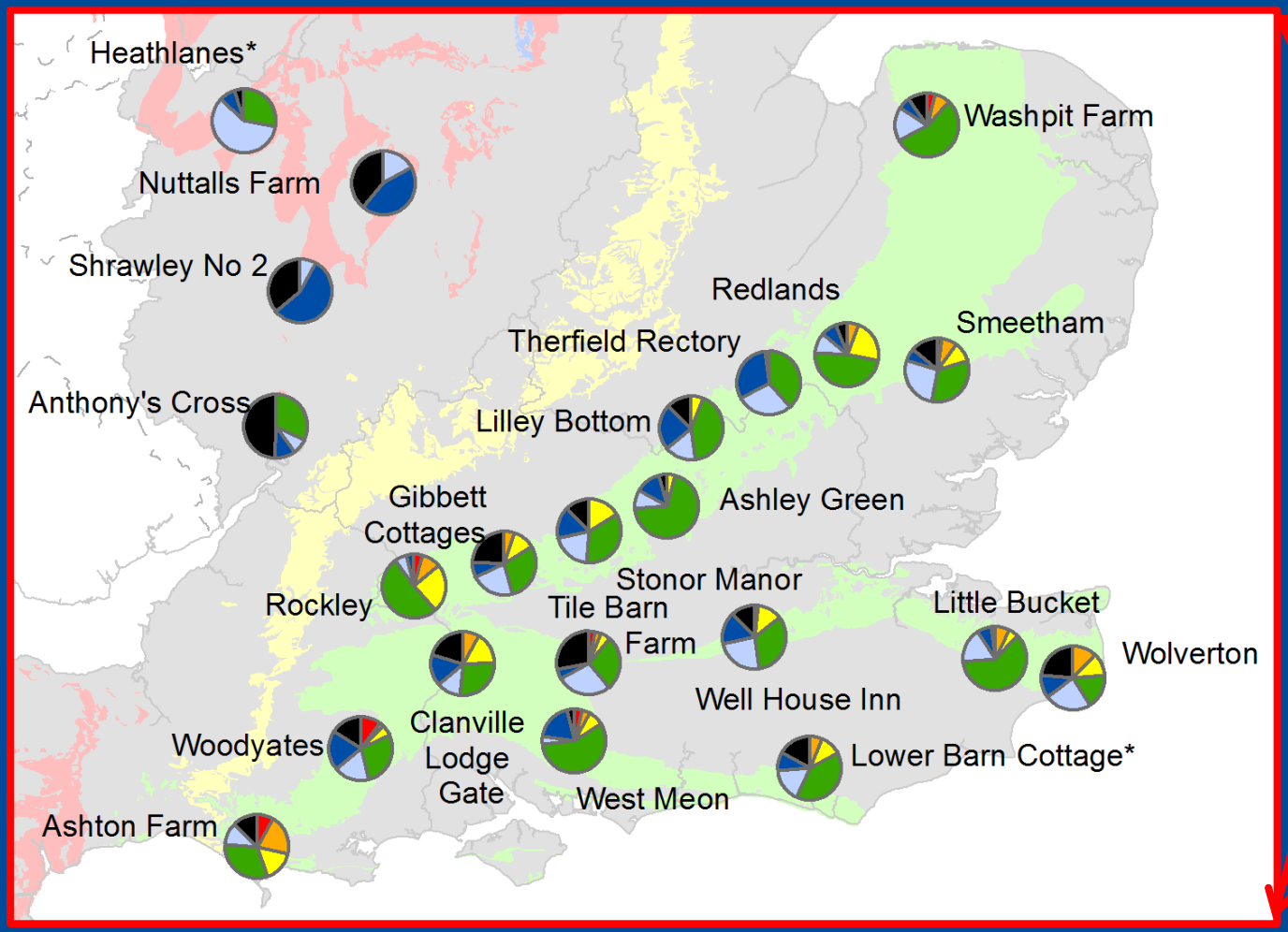
Rainfall

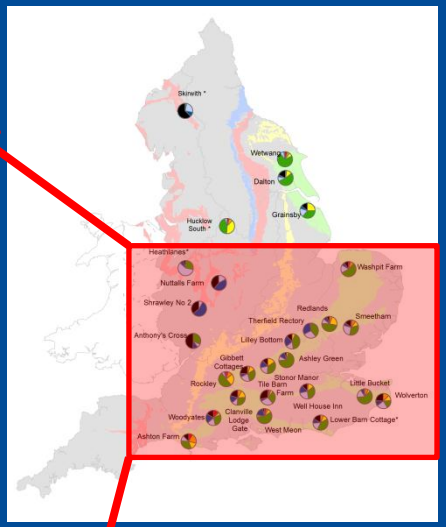
During July, the highest rainfall totals (more than 80 mm) fell across parts of Cumbria, Lancashire and in Essex, whilst the lowest rainfall totals (less than 25 mm) fell across parts of Oxfordshire, and on the Isle of Wight (Figure 1.1).

July rainfall totals were classed as **normal** for the time of year at nearly two thirds of hydrological areas across England; rainfall totals across Essex catchments were **notably high**, and totals were **above normal** in hydrological areas covering parts of Norfolk, Suffolk, Kent and East Sussex. In the remaining hydrological areas across parts of central, southern, southwest England and in the far north, rainfall totals were **below normal**. In some areas of Devon, Cornwall and Hampshire, rainfall totals were classed as **notably low** for the time of year. Cumulative rainfall totals for the three months ending in July were **normal** or higher for much of England, although parts of the northwest, the far southeast and far southwest of England were **below normal**. The exceptional rainfall in February is still influencing the cumulative six month rainfall totals, with much of England classed as **above normal** to **exceptionally high** (Figure 1.2).

Rainfall totals for July were below average in all but one region of England. Monthly totals as a percentage of the

Monthly water situation reporting:
Groundwater level projections





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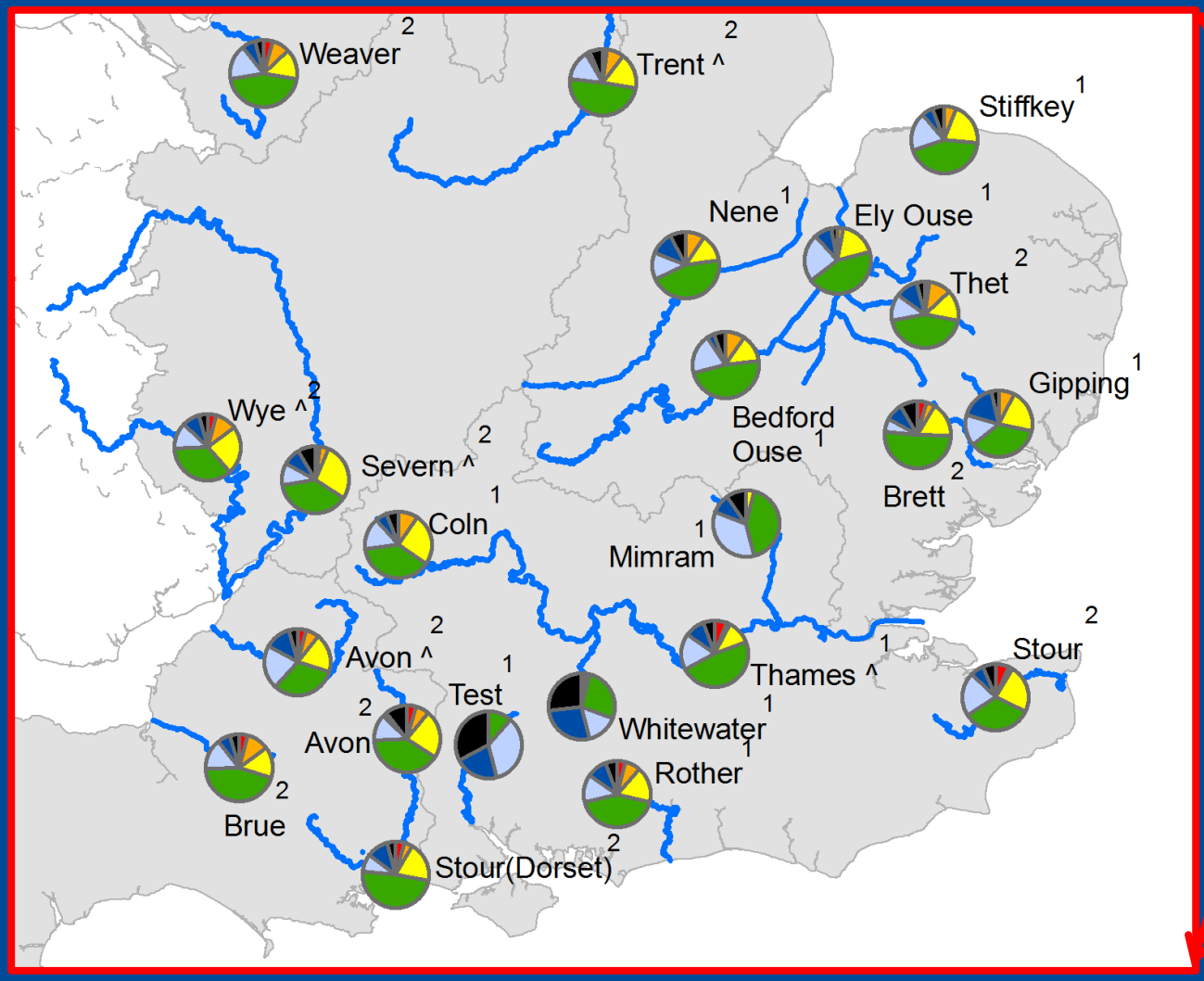
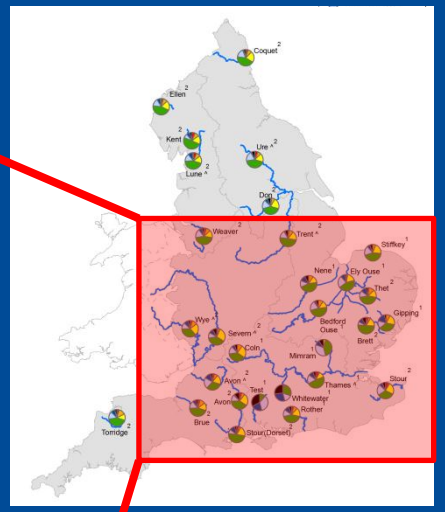
Monthly water situation reporting:
River flow projections





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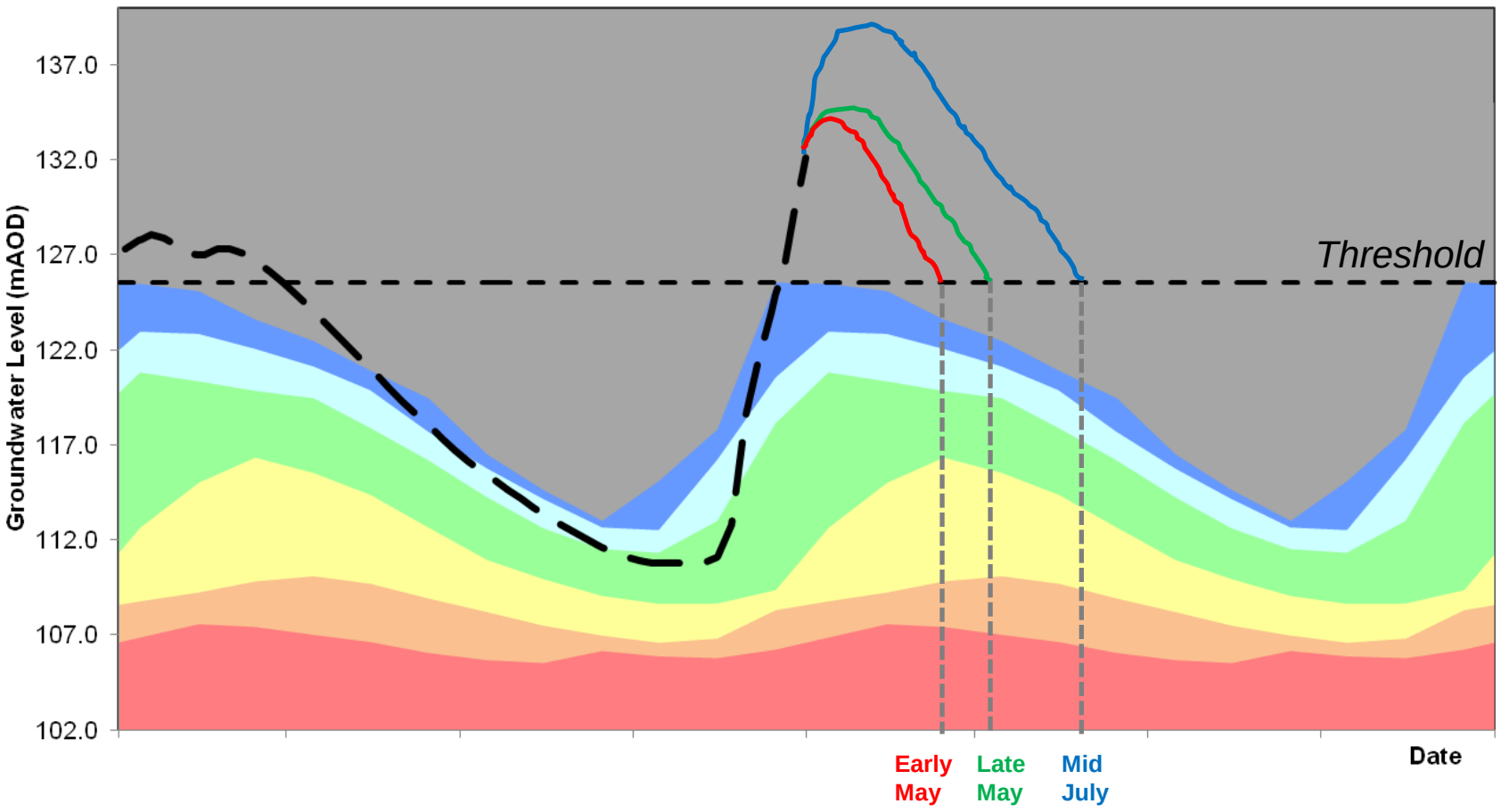
Long range projections:
Persistence of high GW levels above a threshold



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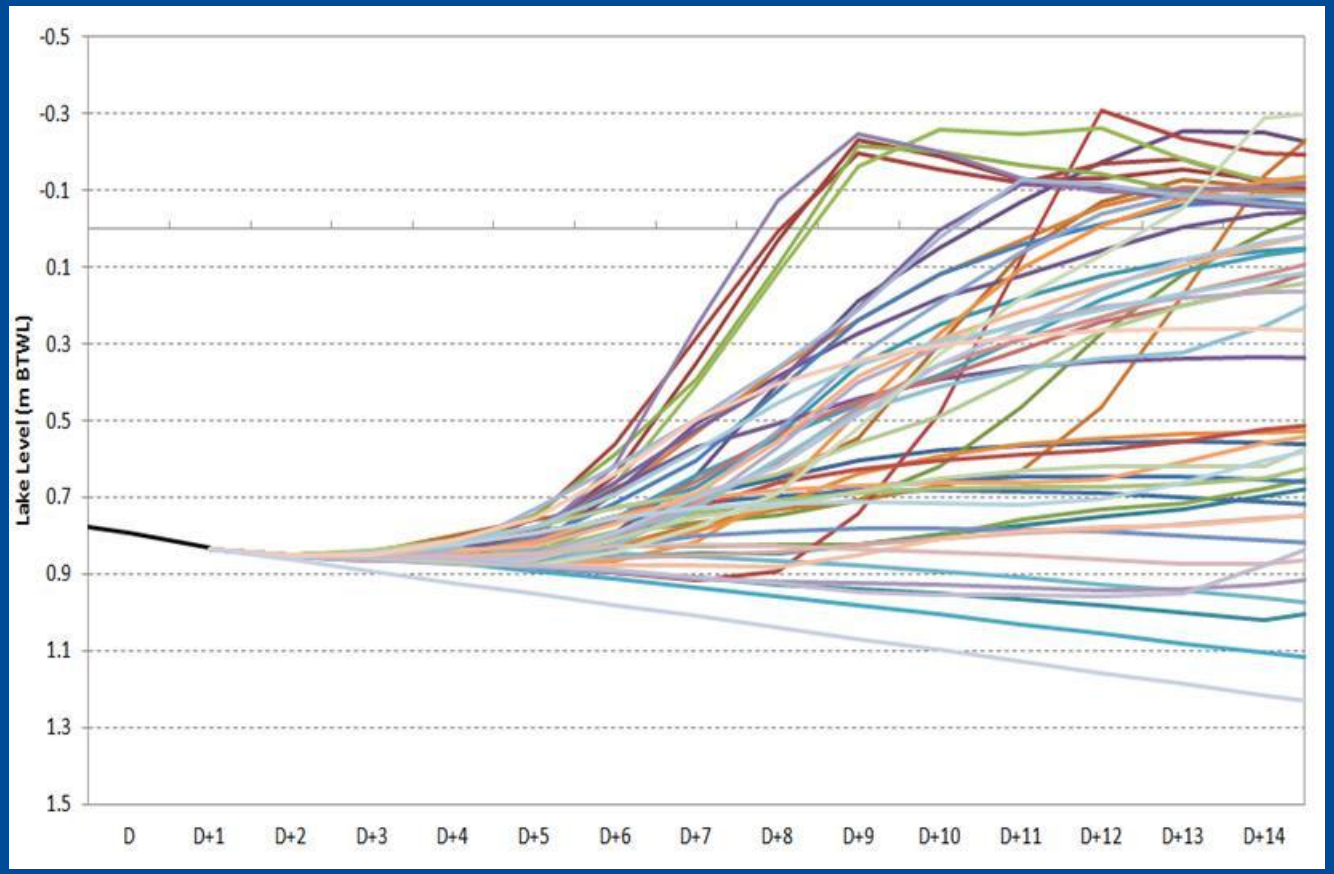
Shorter range projections:
Reservoir level response

15 day ahead ECMWF ensembles

Ensemble inflow sequences

Predicted lake levels



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Further work

- Verify projections using Ensemble Verification System (EVS) tool
- Explore conditioning ensembles based on forecasts for North Atlantic Oscillation
- Greater use of ECMWF 15 day ensembles provided by the Met Office
- Automate model runs
- Define thresholds based on ensemble projections for triggering management actions

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Acknowledgements

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- Monthly water situation reports:

  https://www.gov.uk/government/collections/water-situation-reports-for-england

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Examples of other applications

- Assessment of:
  - drought permit applications for the filling of major public water supply reservoirs
  - likelihood of spray irrigation restrictions being imposed
  - optimised pumping in the Ely Ouse to Essex Transfer Scheme
  - risk of groundwater flood alert thresholds being breached along with the likely severity and length of the incident at specific sites

- See poster 2-3P for further information

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