OPERATIONAL SEASONAL HYDROLOGICAL FORECASTING IN THE UK

Christel Prudhomme
with contributions from Vicky Bell, Cecilia Svensson, Chris Jackson, Jon Mackay, Jamie Hannaford, Helen Davies, Ali Rudd, Richard Davis

HEPEX – Seasonal Hydrological Forecasting Workshop
21-23 Sep 2015, Norrköping, Sweden

Two complementary operational systems

- ## Hydrological Outlook UK
    - UK wide projections
    - Outlooks: focus 1 to 3 months
    - Based on three methods
    - Summary maps for range of users

- ## Water Situation Report for England
    - England only
    - Outlooks: March and October
    - Single method: ensemble Streamflow Projection
   - Report on near past and outlook for decision-makers in the Environment Agency for England

Methods

Methods	Forecast horizon
Persistence and analogy (river flow only)	1 and 3 months
Modelled from forecast rainfall	1 and 3 months
Ensemble Streamflow Prediction (WSR)	Up to 12 months

Methods: 1) Statistical methods
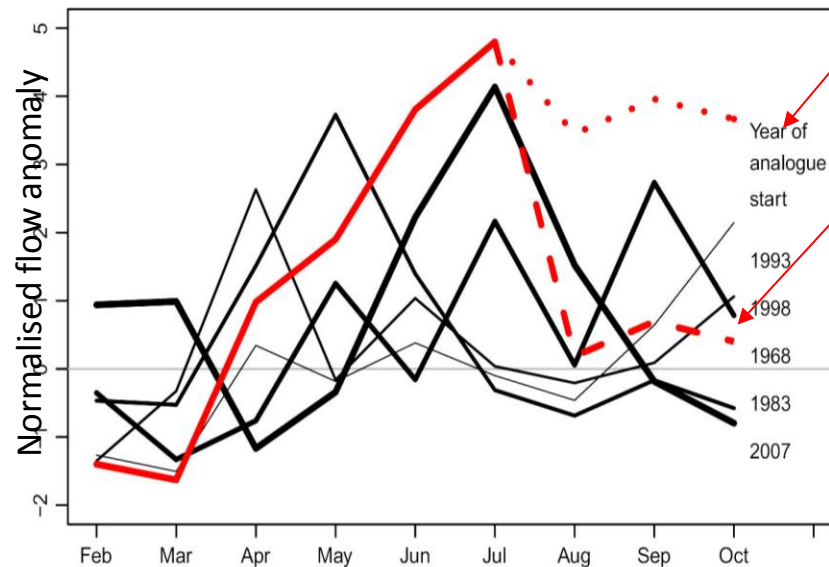
Persistence and historical analogues

Persistence forecasts

- Simplest of the forecasts

- Flow anomaly now = flow anomaly next month

- Standardised anomalies = seasonal cycle accounted for

Ness at Ness-side — 2012
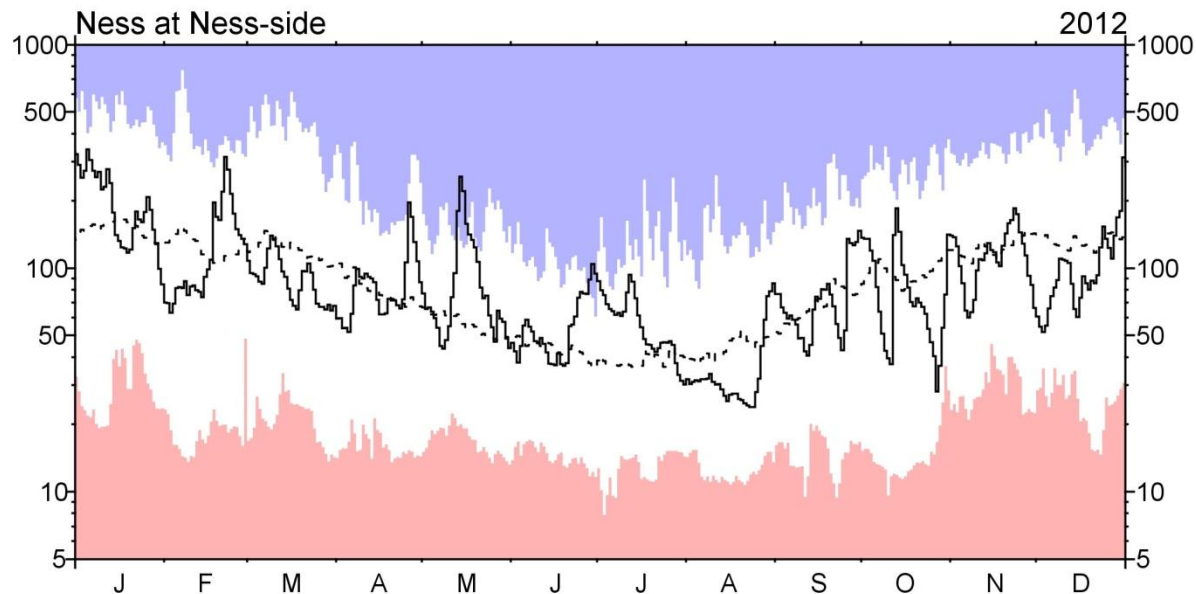
Historical analogues

- Five analogues from the past flow record

- Similarity in the past will persist into the near future

- Weighted mean flow forecast

- Shifted weighted mean forecast

Shifted weighted mean forecast

Weighted mean forecast

Persistence and historical analogues

- Observed flow from various river authorities

- For each location and calendar month, use method with best reforecasting skills

- Categorical forecast

- Size of dots = skill indicator

- Poor skill in the north and west, particularly in winter/spring

River flow outlook for Sep 2015

Forecast flow magn. (colour)		Percentile range
●	Low	<0.28
●	Medium	0.28-0.72
●	High	>0.72

Confidence in forecast (size)		Hindcast correlation
○	High	0.8
○	Moderate	0.5
○	Low	0.23
·	No forecast	<0.23

Type of forecast

○	Persistence
○	Historical analogue

Aquifer
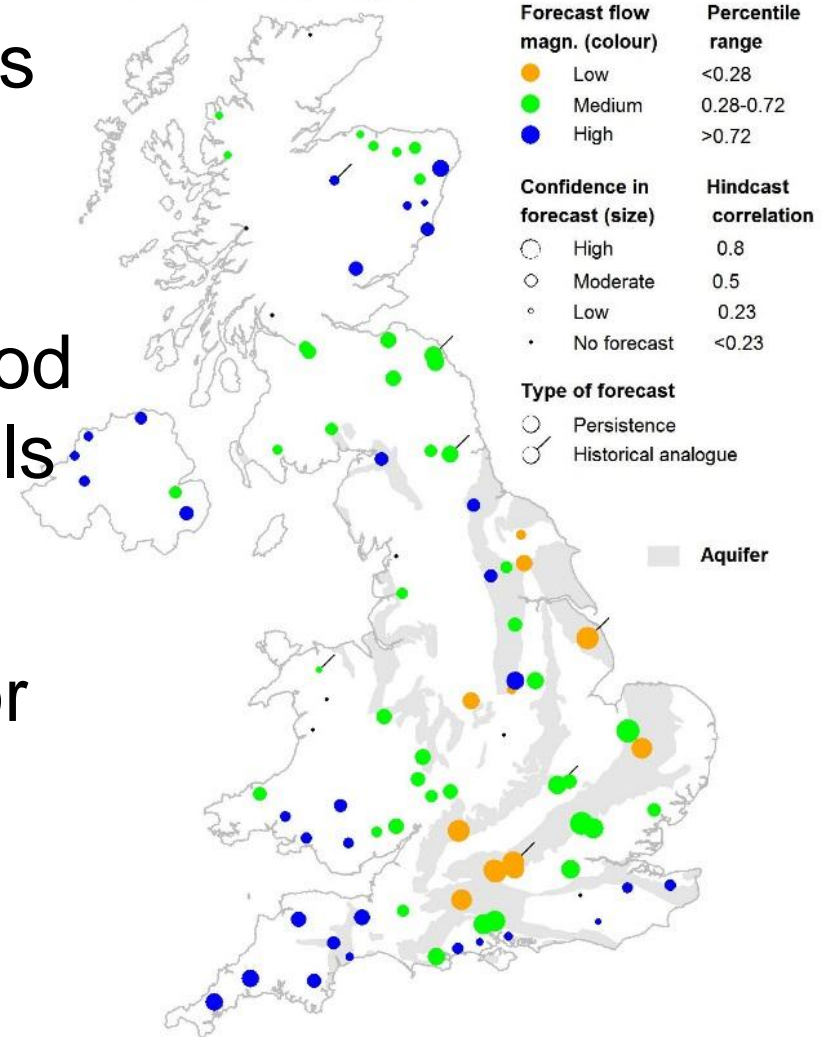
Method 2

Modelling river flows from rainfall forecasts

From Met Office by email
5 years of 5-km near-past daily rainfall

At CEH
1-km gridded hydrological model (G2G)
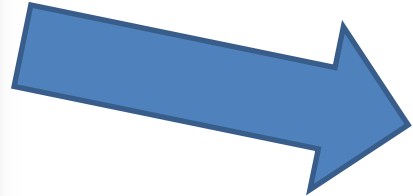
40-km near past PET
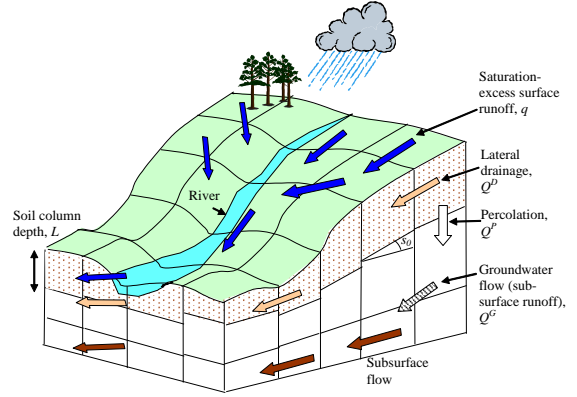
Initial store/ river flow state at last day of previous month
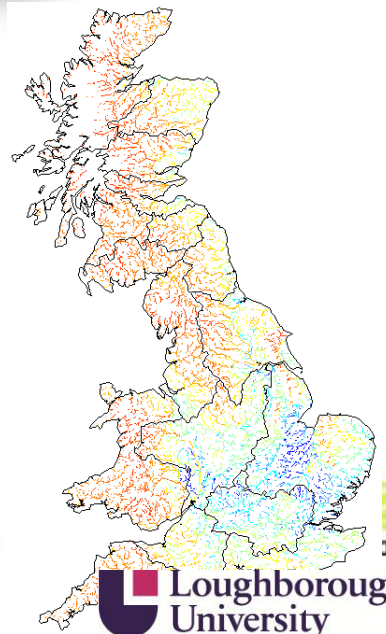
Hydrological ensemble forecast: initialisation
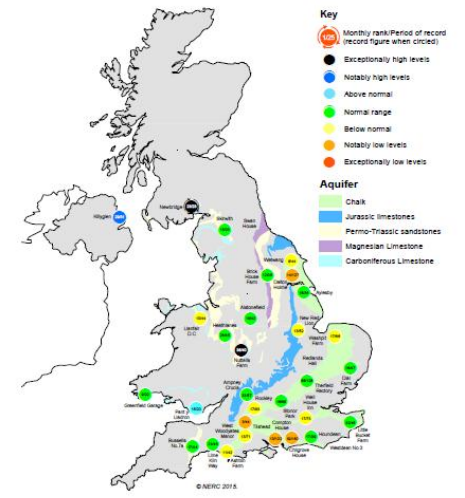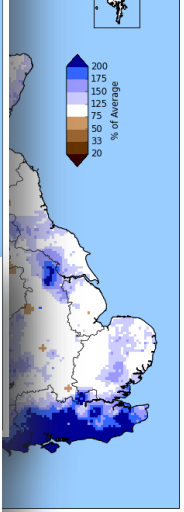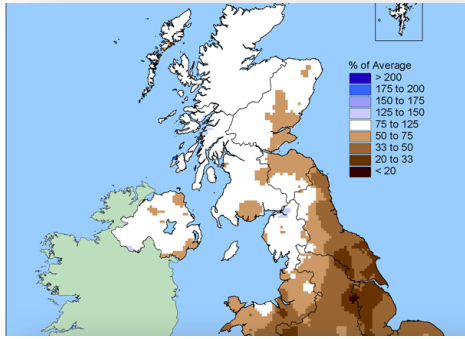
From Met Office by email
5 years of 5-km near-past daily rainfall

At BGS
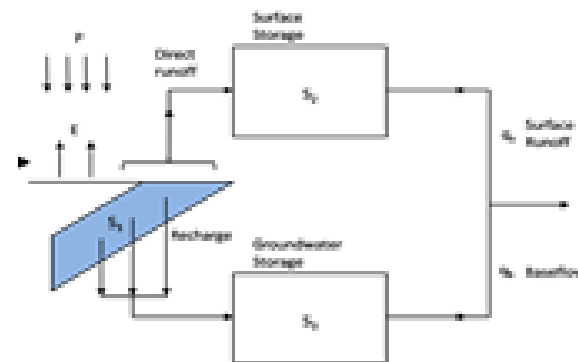Lumped conceptual groundwater model (AQUIMOD)

40-km near past PET

From river authorities by email
Observed groundwater levels ~ last day previous month
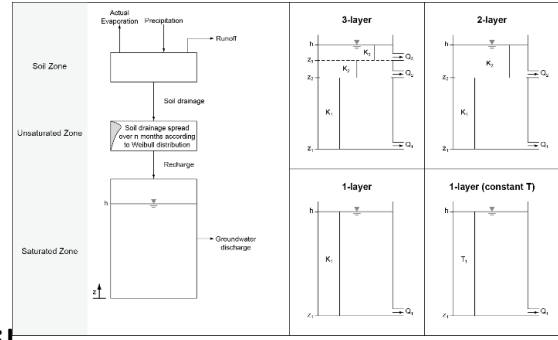
Initial groundwater level at last day of previous month
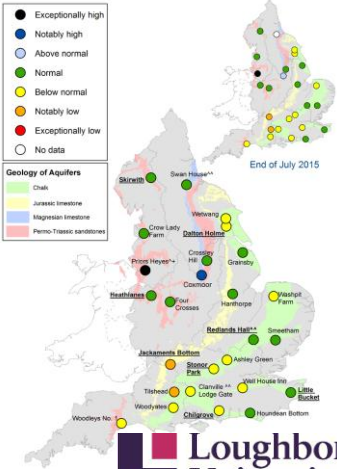
Hydrological ensemble forecast

From Met Office – by email
42-member ensemble
national rainfall forecasts
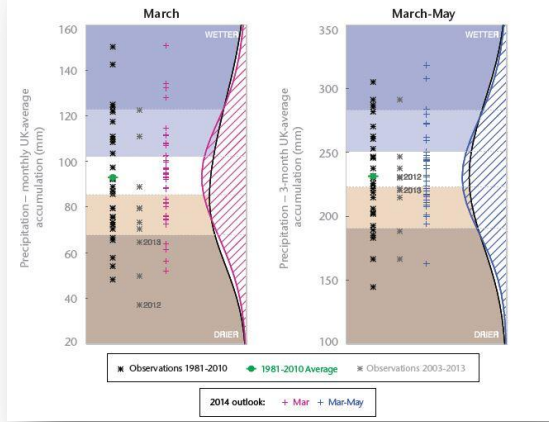
At CEH and BGS
Simple spatial
distribution based
on %LTA
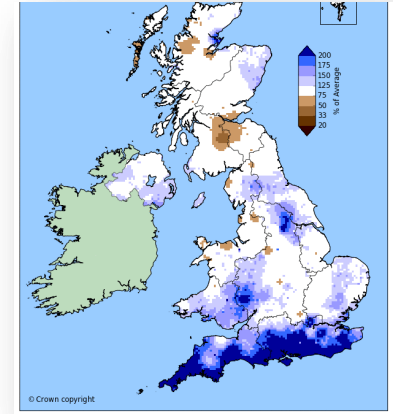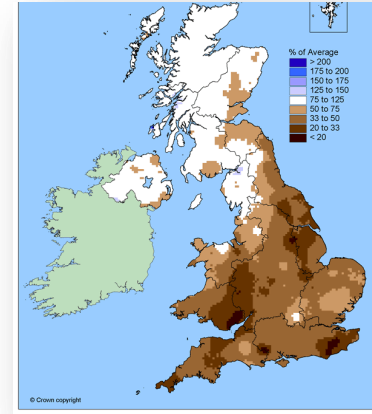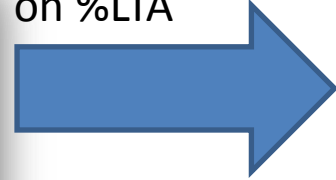
CEH
1-km gridded Water
Balance Model
(single time step)

BGS
Lumped conceptual
groundwater model
(AQUIMOD)

CEH
1- and 3- month
mean river flow

BGS
1- and 3-month
instantaneous
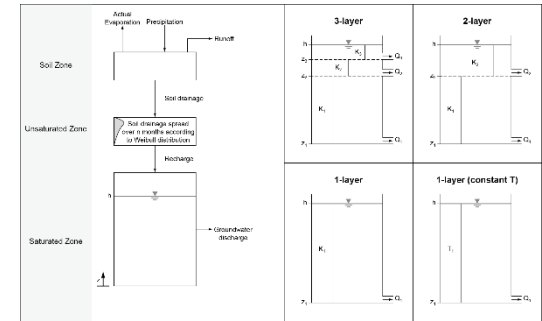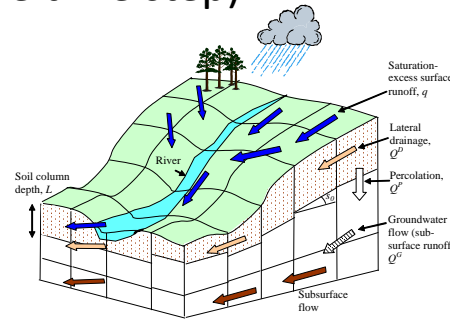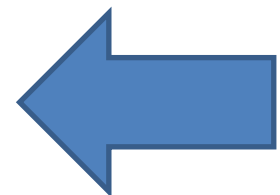
Ensemble Mean Flow forecasts

Lowest rainfall forecast | 1st quartile | Median | 3rd quartile | Highest rainfall forecast
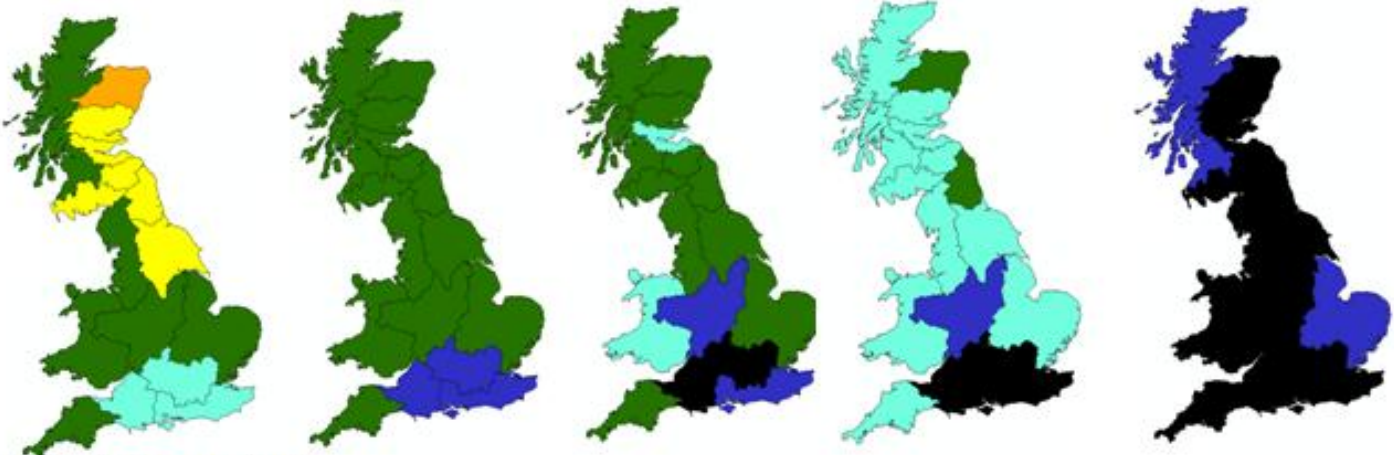
1-month flow outlook

Lowest rainfall forecast | 1st quartile | Median | 3rd quartile | Highest rainfall forecast

Exceptionally high flow
Notably high flow
Above normal
Normal range
Below normal
Notably low flow
Exceptionally low flow

British Geological Survey — NATURAL ENVIRONMENT RESEARCH COUNCIL

Centre for Ecology & Hydrology — NATURAL ENVIRONMENT RESEARCH COUNCIL

Environment Agency

Met Office

NERC SCIENCE OF THE ENVIRONMENT

Cyfoeth Naturiol Cymru / Natural Resources Wales

RIVERS Agency

SEPA Scottish Environment Protection Agency

Loughborough University

Ensemble Groundwater Level forecasts

Legend:
- Exceptionally high flow
- Notably high flow
- Above normal
- Normal range
- Below normal
- Notably low flow
- Exceptionally low flow

Method 3

Ensemble Streamflow Prediction (ESP)
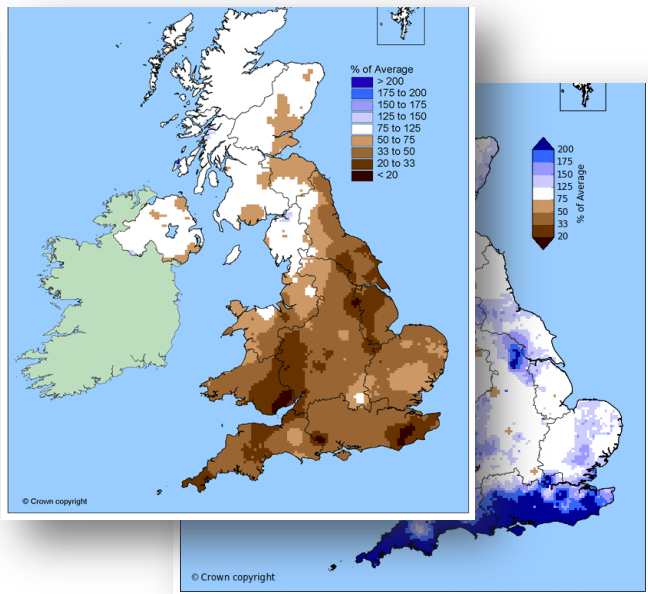
From Met Office by email
5 years of 5-km near-past daily rainfall

At CEH and EA
Lumped conceptual hydrological model
(PDM; CATCHMOD)

40-km near past PET

Initial river flow state at last day of previous month
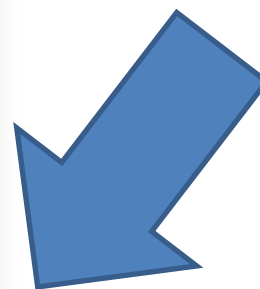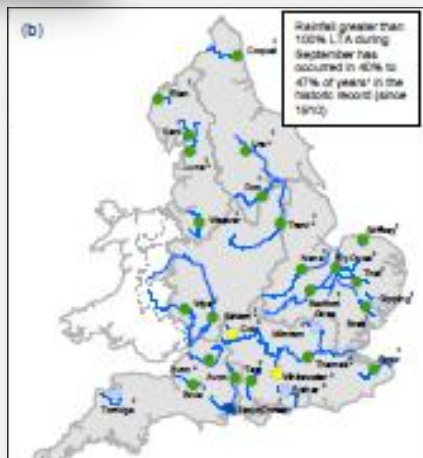
From Met Office by email
5 years of 5-km near-past daily rainfall

At BGS
Lumped conceptual groundwater model (AQUIMOD)

40-km near past PET

From river authorities by email
Observed groundwater levels ~ last day previous month

Initial groundwater level at last day of previous month

Ensemble Streamflow Prediction: outlooks
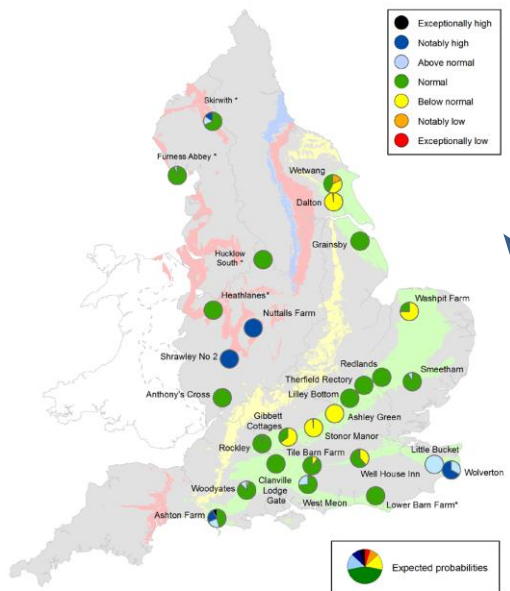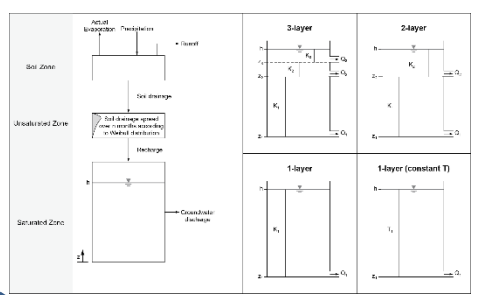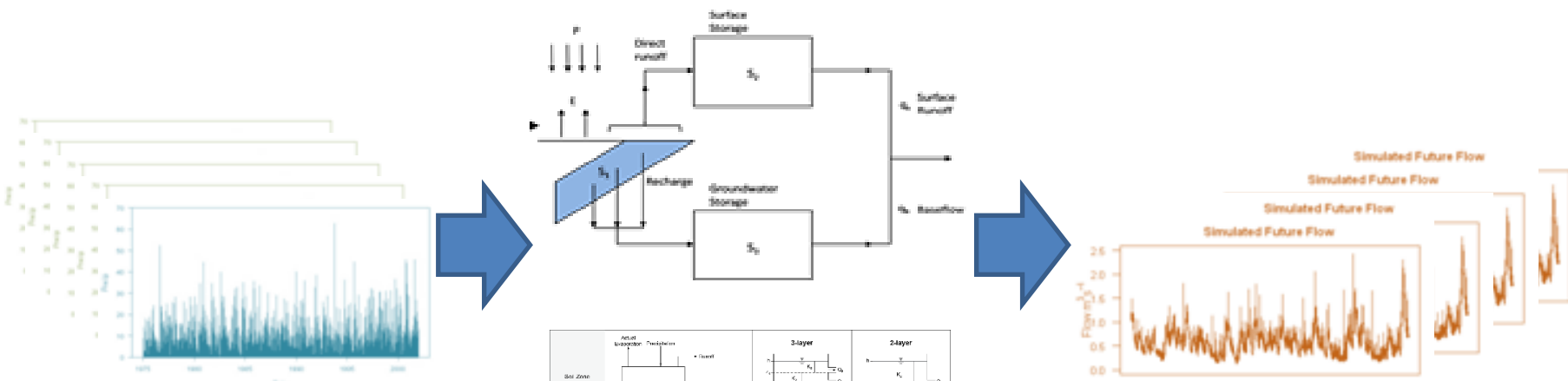
Groundwater level probabilistic ensemble From BGS
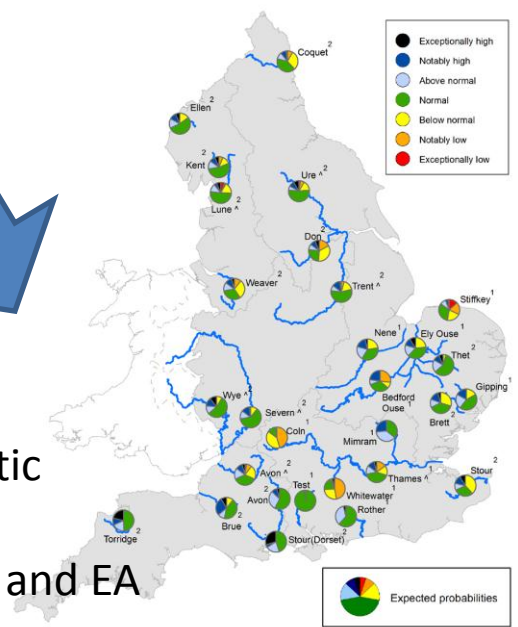
River flow probabilistic ensemble From CEH and EA

Ensemble Streamflow Prediction: outlooks

River flow : 27 sites
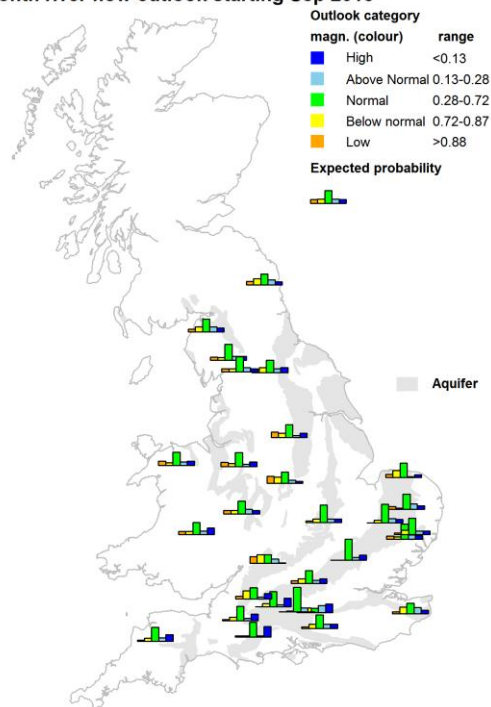
Monthly operation

For the next three months, groundwater levels in parts of north-east England are likely to be below-normal.

September river flows are likely to be in the normal range, except in the far south where above normal flows are likely
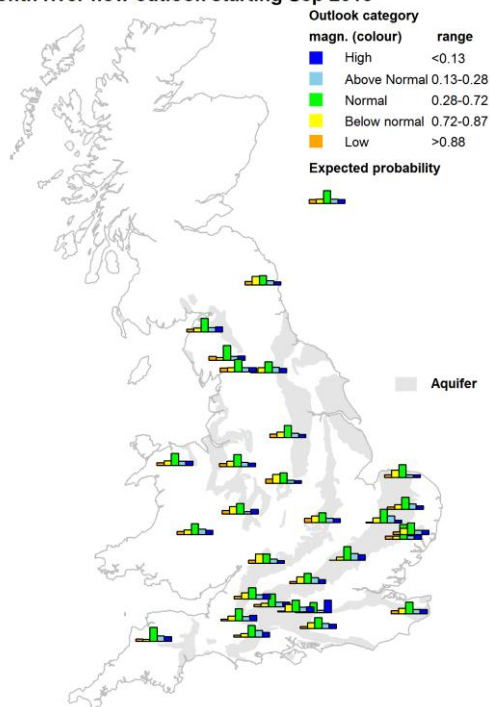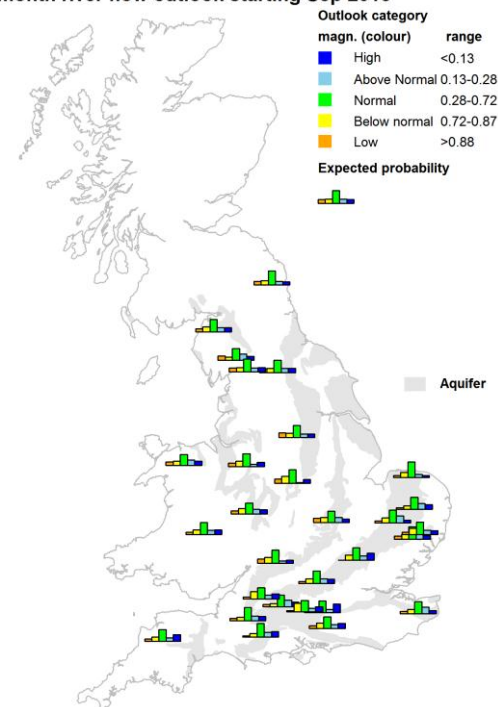
Shaded areas show principal aquifers

Monthly water situation report
England

Summary – August 2015

Rainfall

Soil moisture deficit

River flows

2nd wking day   1st week   ~7th wking day   2nd week   11 to 15th

Outputs

Published on open web sites

http://www.hydoutuk.net
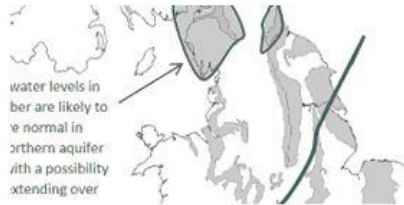
- Published monthly since November 2013
- Accessible to the public, aimed at a wide range of audiences
-

GOV.UK

Statistics

Water situation report for England: August 2015

From:	Environment Agency
First published:	11 September 2015
Part of:	Water situation reports for England

A monthly review of the water situation in England.

Document

Monthly water situation report: August 2015

PDF, 6.98MB, 23 pages

This file may not be suitable for users of assistive technology.

Centre for
Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Loughborough
University

NERC   SCIENCE OF THE ENVIRONMENT

Thank you!