



# The new FEH rainfall DDF model: results, comparisons and implications

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# Outline of presentation

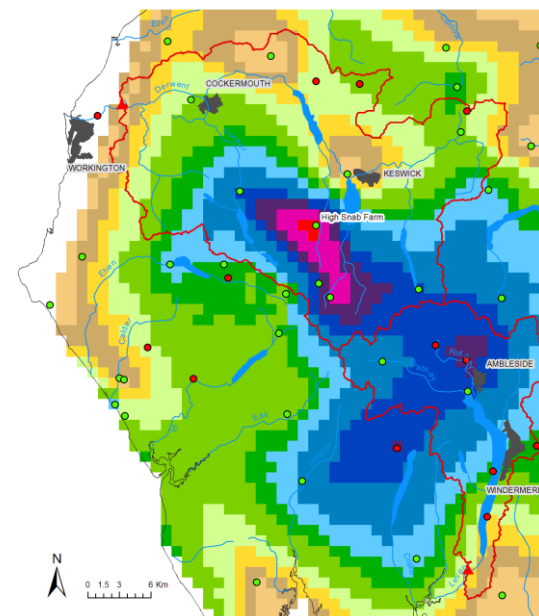
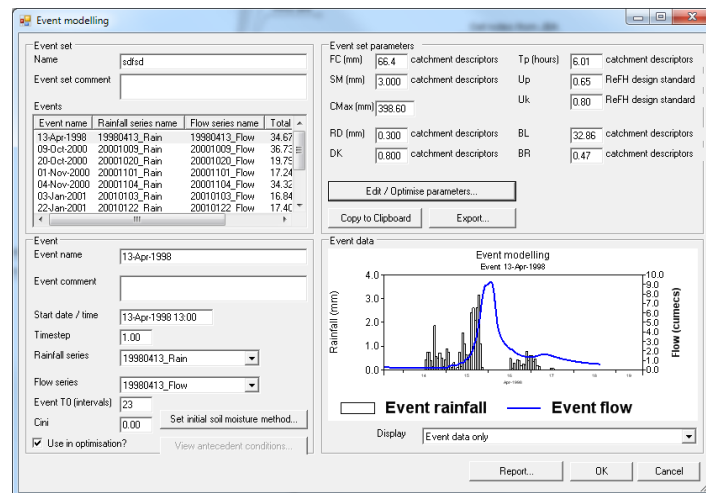
- Rainfall depth-duration-frequency (DDF) models
- Why revise the FEH rainfall DDF model?
- Development of FEH13 model and results
- FEH web service
- Conclusions and next steps



# Rainfall DDF models in the UK

Used to estimate **total event rainfall** of a particular **duration** (a few minutes to several days) that corresponds to a particular **return period** (probability):

- Design storm inputs to rainfall-runoff model e.g. ReFH
- Post event analysis e.g. Boscastle (2004), Cumbria (2009)





# The Flood Estimation Handbook (FEH)

The FSR was superseded by the FEH in 1999 incorporating:

- Digital datasets
- Longer records of rainfall and river flows
- Flexible regionalisation
- Rainfall model presented in Vol.2 based on FORGEX methodology
- Rainfall model implemented on FEH CD-ROM





# Why revise the FEH rainfall DDF model?

## FEH/FSR comparisons for reservoir safety:

- Rainfall model results diverge significantly at 10,000-year return periods ( $FEH > FSR$ )
- In some cases  $FEH > PMP$  from FSR
- MacDonald & Scott (2000, 2001):
  - Conclude that problems stem from extrapolation of line of best fit (DDF model rather than statistical analysis)
- Babbie Group (2000):
  - FEH estimates found to be  $> 50\%$  greater in many upland areas in west and in much of Eastern England
  - Ratios greatest for  $T=10,000$  years

# Development of FEH13 model

- *Reservoir Safety – Long Return Period Rainfall* (Defra/EA Project FD2613)
- Duration: 1-192 hours
- Return period: 2 - 10,000+ years
- Complex statistical analysis of extensive dataset of annual and seasonal maxima
- Revised standardisation of annual maxima prior to pooling
- Improved model of spatial dependence
- Changes to the pooling methodology
- Subsequent work has refined the model and smoothed the results across the UK on a 1-km grid



delivering benefits  
through evidence



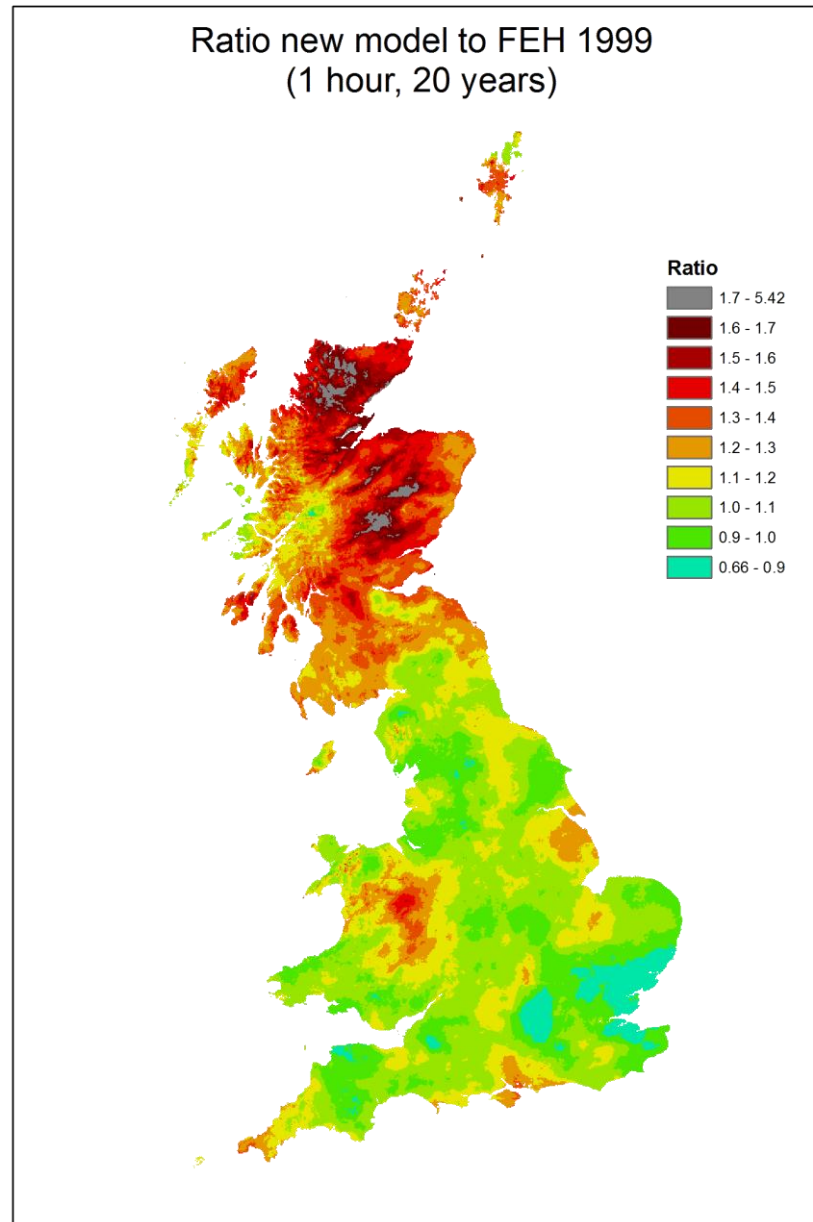
Reservoir Safety – Long Return Period  
Rainfall

Volume 1 Technical Report (Part 2)

Project: FD2613 WS 194/2/39

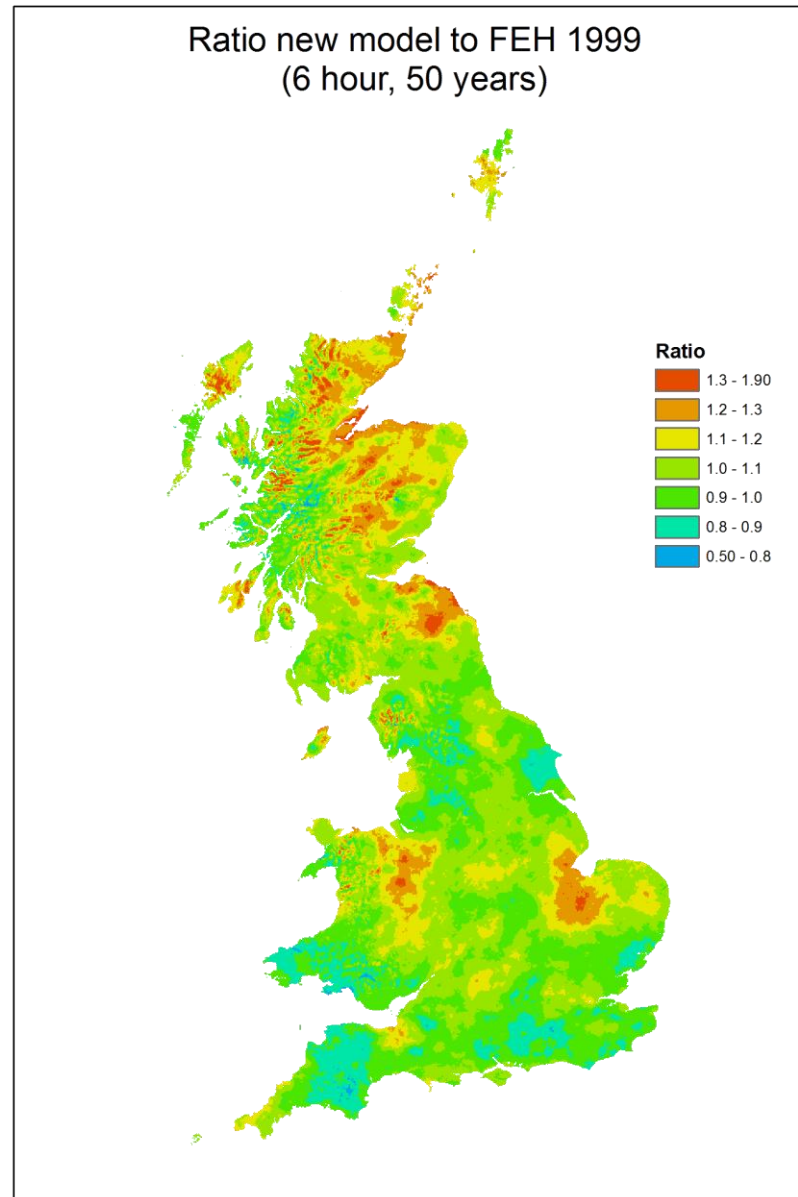
Flood and Coastal Erosion Risk Management Research and Development Programme

# Example results 1

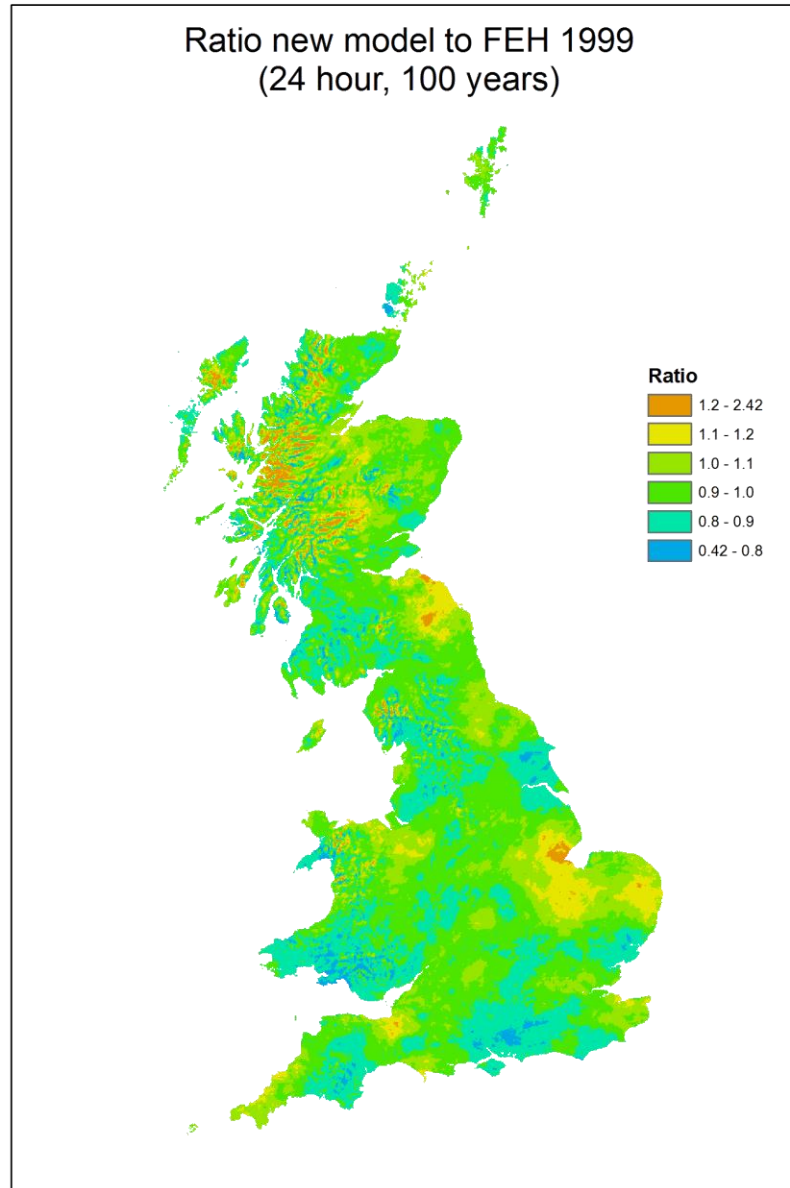




# Example results 2




# Example results 3



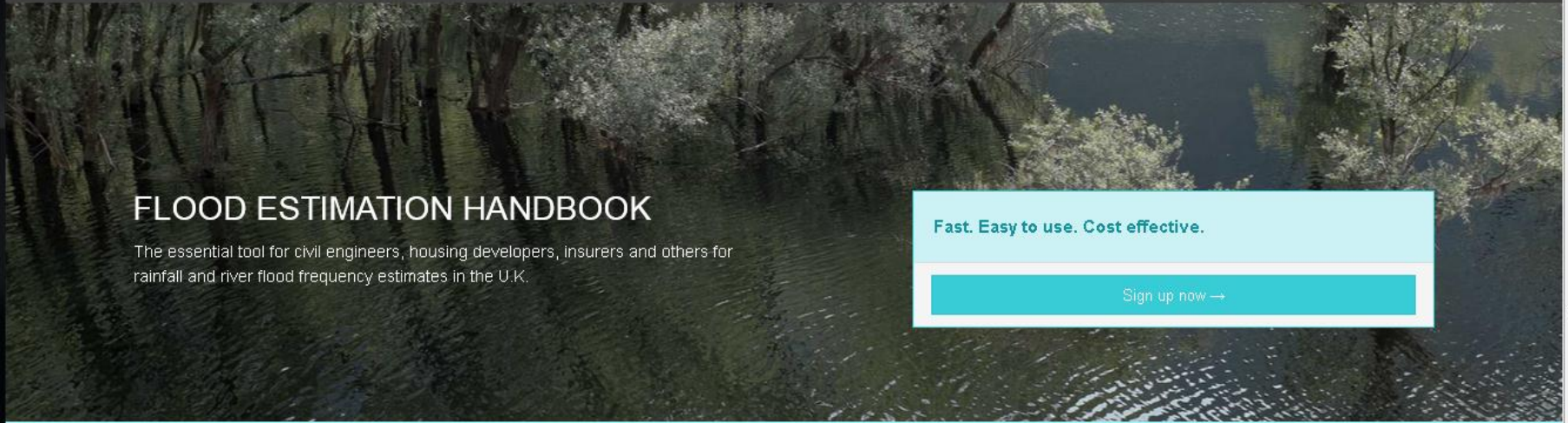
# FEH web service

- Currently under development to deliver FEH catchment descriptors and DDF rainfall model outputs
- Will replace FEH CD-ROM 3
- Planned to include FEH13, FEH1999 and FSR rainfall models as well as FSR PMP values
- Pay-per-view system
- Currently at proof of concept stage
- Beta test version February 2015

# FEH web service

**Flood Estimation Handbook**  
CENTRE FOR ECOLOGY & HYDROLOGY

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## FLOOD ESTIMATION HANDBOOK


The essential tool for civil engineers, housing developers, insurers and others for rainfall and river flood frequency estimates in the U.K.

Fast. Easy to use. Cost effective.

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For users of the original CD-ROM based software we've updated to a new online service  
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### WHAT IS IT?

The Flood Estimation Handbook offers guidance on rainfall and river flood frequency estimation in the UK. Flood frequency estimates are required for the planning and assessment of flood defences, and the design of other structures such



### WHAT FOR?

- Flood defence planning
- Flood risk analysis
- New development planning
- Rarity assessment of notable rainfalls or floods



### FEATURES

- Flood defence planning
- Risk analysis

# Map view



**Flood Estimation Handbook**  
CENTRE FOR ECOLOGY & HYDROLOGY

42 credits remaining

Map

Help

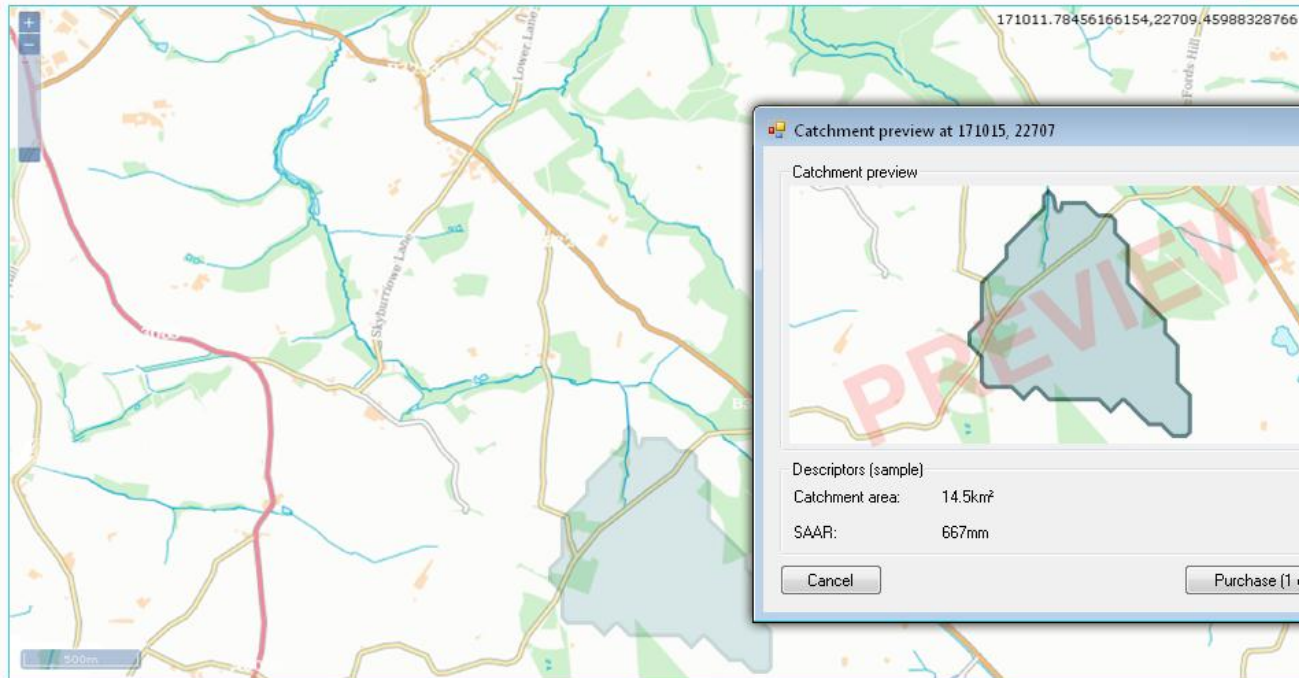
Adminuser ▾

My Places 4

Q SEARCH

Enter grid ref.

Go



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Ecology & Hydrology**

NATURAL ENVIRONMENT RESEARCH COUNCIL

**NERC** SCIENCE OF THE  
ENVIRONMENT



# Map with full catchment descriptors

The screenshot displays the CEH Flood Estimation Handbook web application interface. The top navigation bar includes the CEH logo, the text "Flood Estimation Handbook" and "CENTRE FOR ECOLOGY & HYDROLOGY", a credit balance of "42 credits remaining", and links for "Map", "Help", and "Adminuser".

The main interface features a "My Places" button with a count of 4, a search bar labeled "Q SEARCH", and a map. Two windows are open over the map:

- Catchment at 171015, 22707**: This window displays a table of descriptors for a specific catchment area.
- Catchment boundary**: This window provides a detailed view of the catchment boundary on the map, with options to "Export" or "Export high-resolution".

**Table of Descriptors:**

Descriptor	Value	Unit
SAAR	650	mm
BFIHOST	0.534	
DPLBAR	0.76	km
DPSBAR	36	m/km
ASPVAR	0.60	
FARL	0.961	

Below the table, there are sections for "Rainfall" (with a "Design rainfall and event rarity" option and a "View" button) and "Catchment boundary" (with "View" and "Export..." buttons). A "Cancel" button is at the bottom left, and a "Purchase (1 credit)" button is at the bottom right.



# Rainfall model outputs

CEH Flood Estimation Handbook  
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42 credits remaining

Map Help Adminuser ▾

My Places 4 Q SEARCH

Catchment at 171015, 22707

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Export...

Rainfall  
Design rainfall and event rarity View

Catchment boundary View Export...

Cancel Purchase (1 credit)

Catchment at 171015, 22707

Rainfall modelling  
Calculate Design Rainfall ▾ for

☐ catchment  
☐ 1 km grid point

Area: 14.2 km<sup>2</sup>

Duration:  Hours ☐ Fixed  
☐ Sliding  
Return period:  Years ☐ AM  
☐ POT

Rainfall depth:  
Calculate

GRAPH HERE

Export

# Summary

- FEH13 DDF model will replace existing FEH rainfall model for complete range of durations and return periods
- Complex statistical analysis that underlies the new model was peer reviewed by eminent scientists on Project Advisory Group
- More recent developments will be published shortly as report(s) and journal papers
- ReFH rainfall-runoff method will require recalibration/re-evaluation
- FEH web service to be available during 2015

Further information: [ejs@ceh.ac.uk](mailto:ejs@ceh.ac.uk)

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*Software development – Wallingford HydroSolutions*

*Current and former colleagues at CEH*

