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

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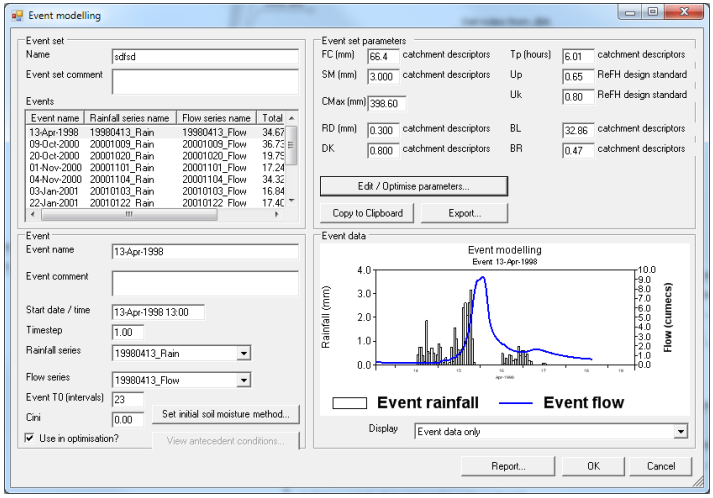
Outline of presentation

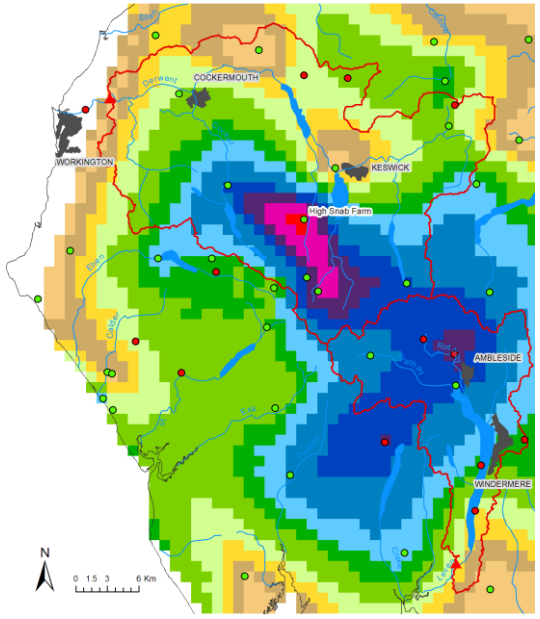
- Rainfall depth-duration-frequency (DDF) models
- Why revise the FEH rainfall DDF model?
- Development of FEH13 model and results
- FEH web service
- Conclusions and next steps

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)





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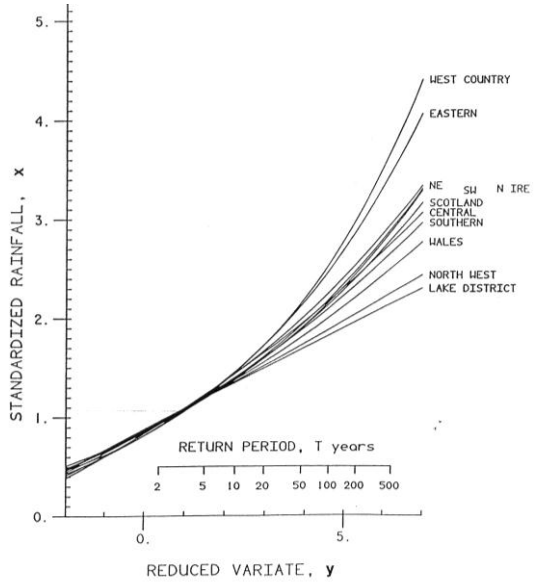
The Flood Studies Report (FSR) model

FSR was published in 1975

- Based on paper maps and tables
- Over-generalised – masks important local and regional variations
- Includes PMP estimates



Typical growth curves for 1-day rainfall (from Dales & Reed, 1989)

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The FSR was superseded by the FEH in 1999 incorporating: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?

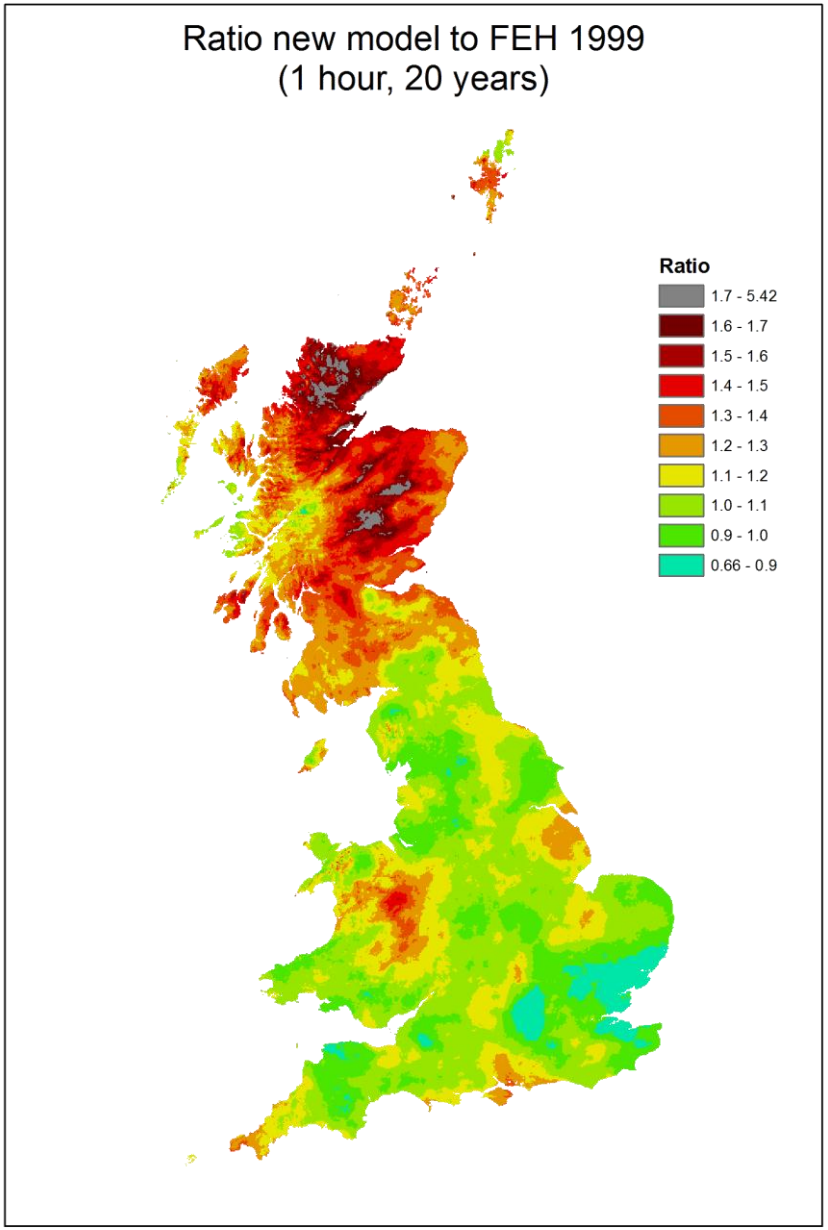
FEH/FSR comparisons for reservoir safety:

- 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)
- Babtie 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

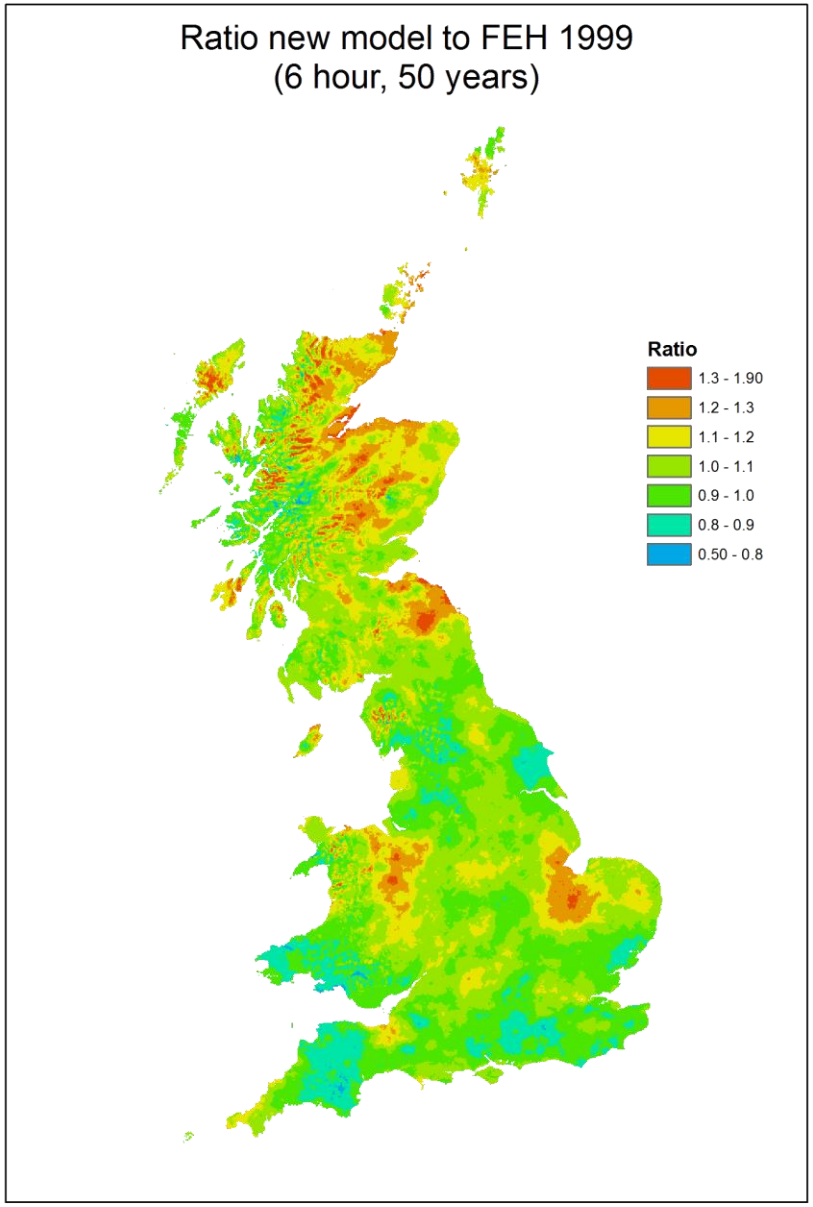
Development of FEH13 model

- *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

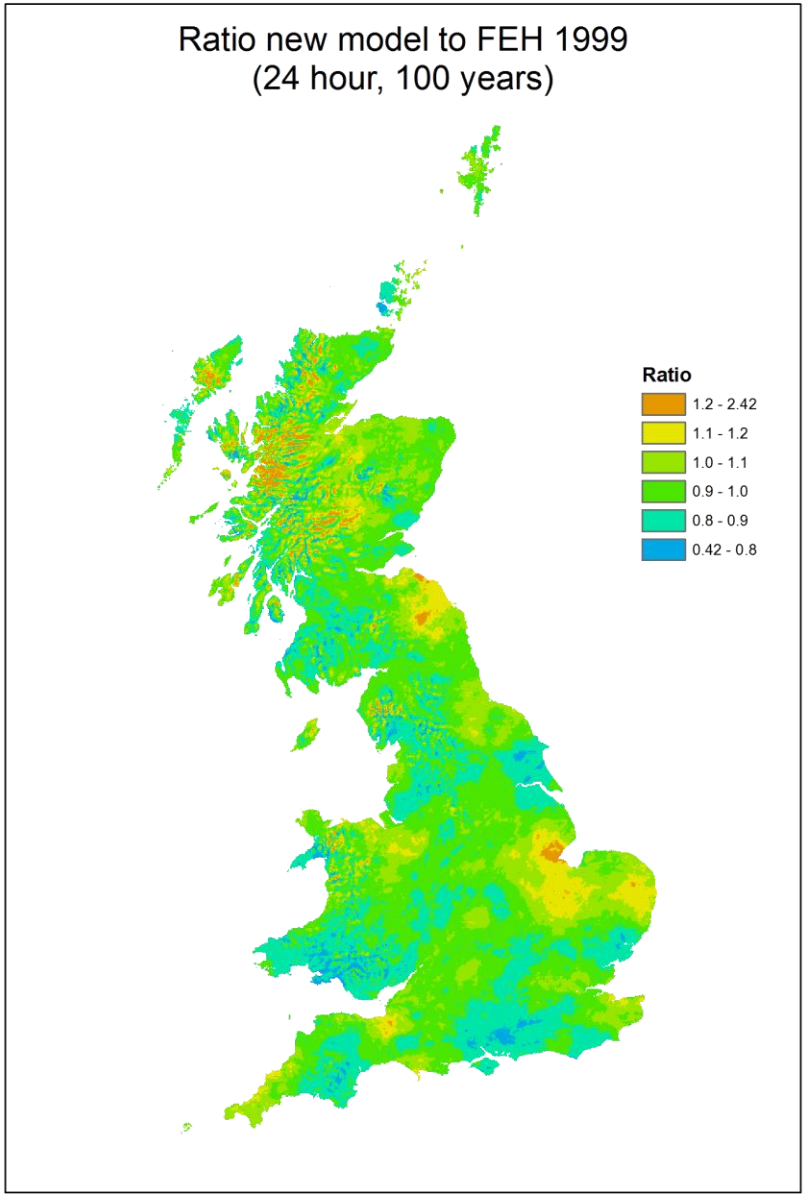
Example results 1



Example results 2



Example results 3



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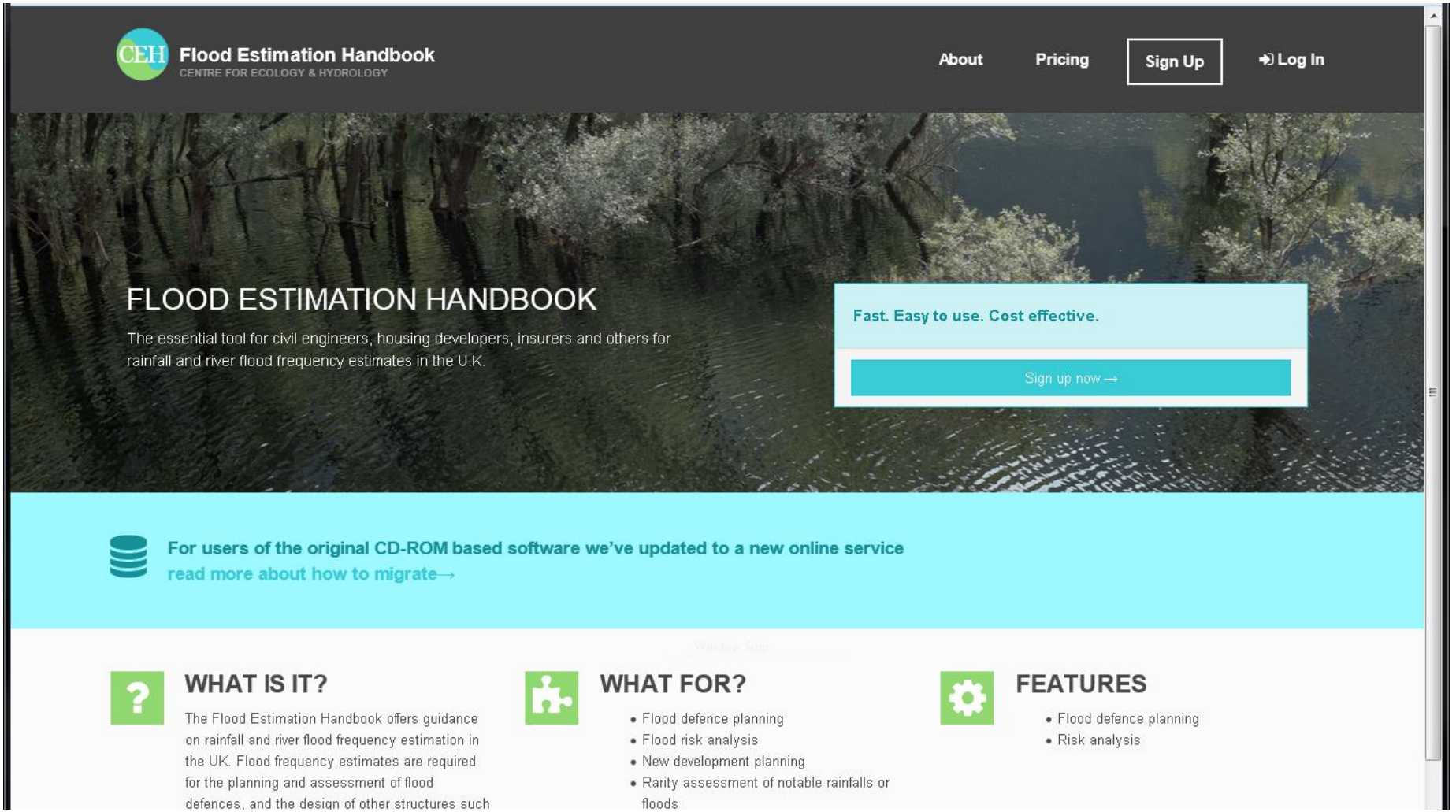
FEH web service

- 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



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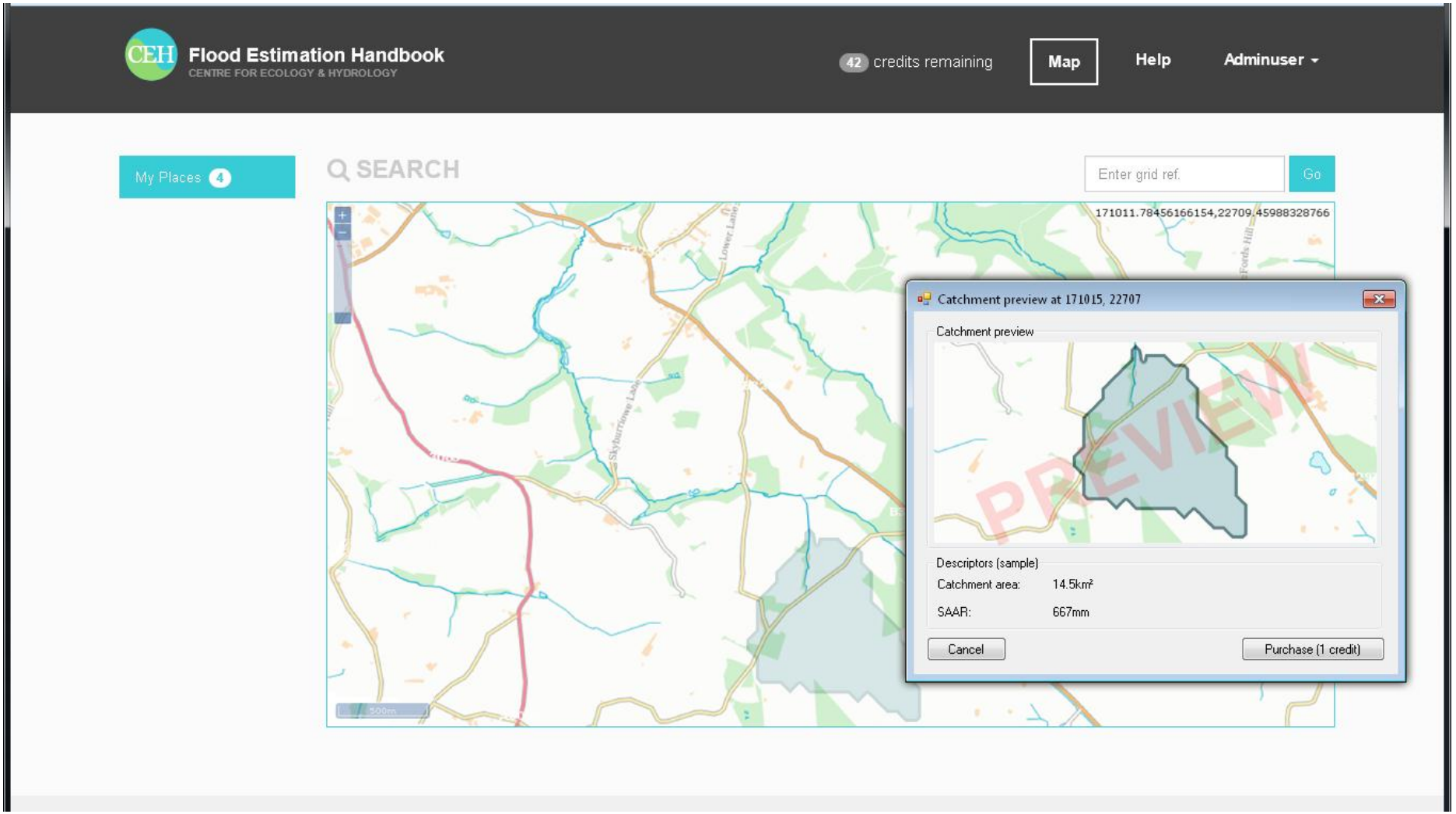
Map view



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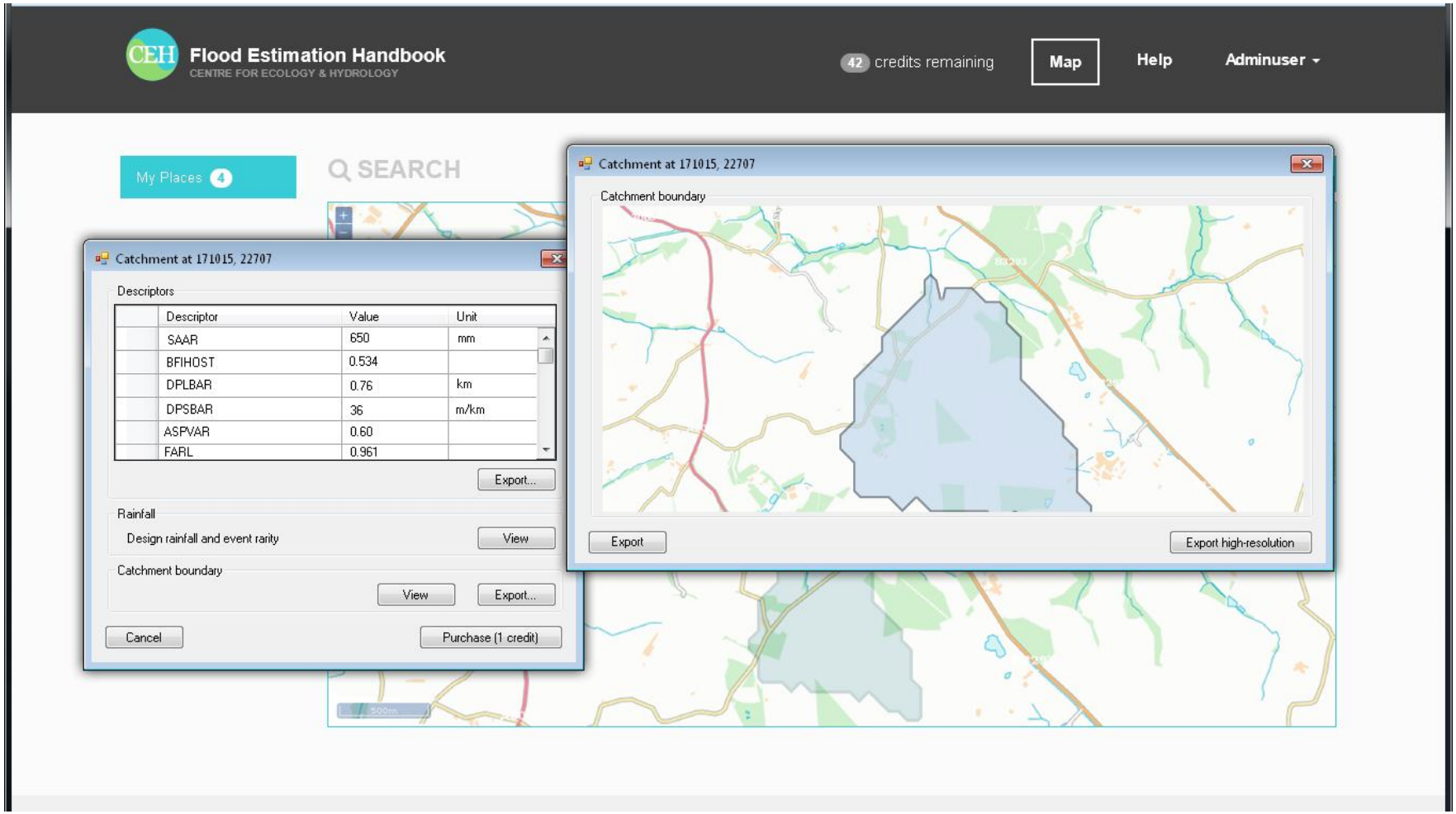
Map with full catchment descriptors



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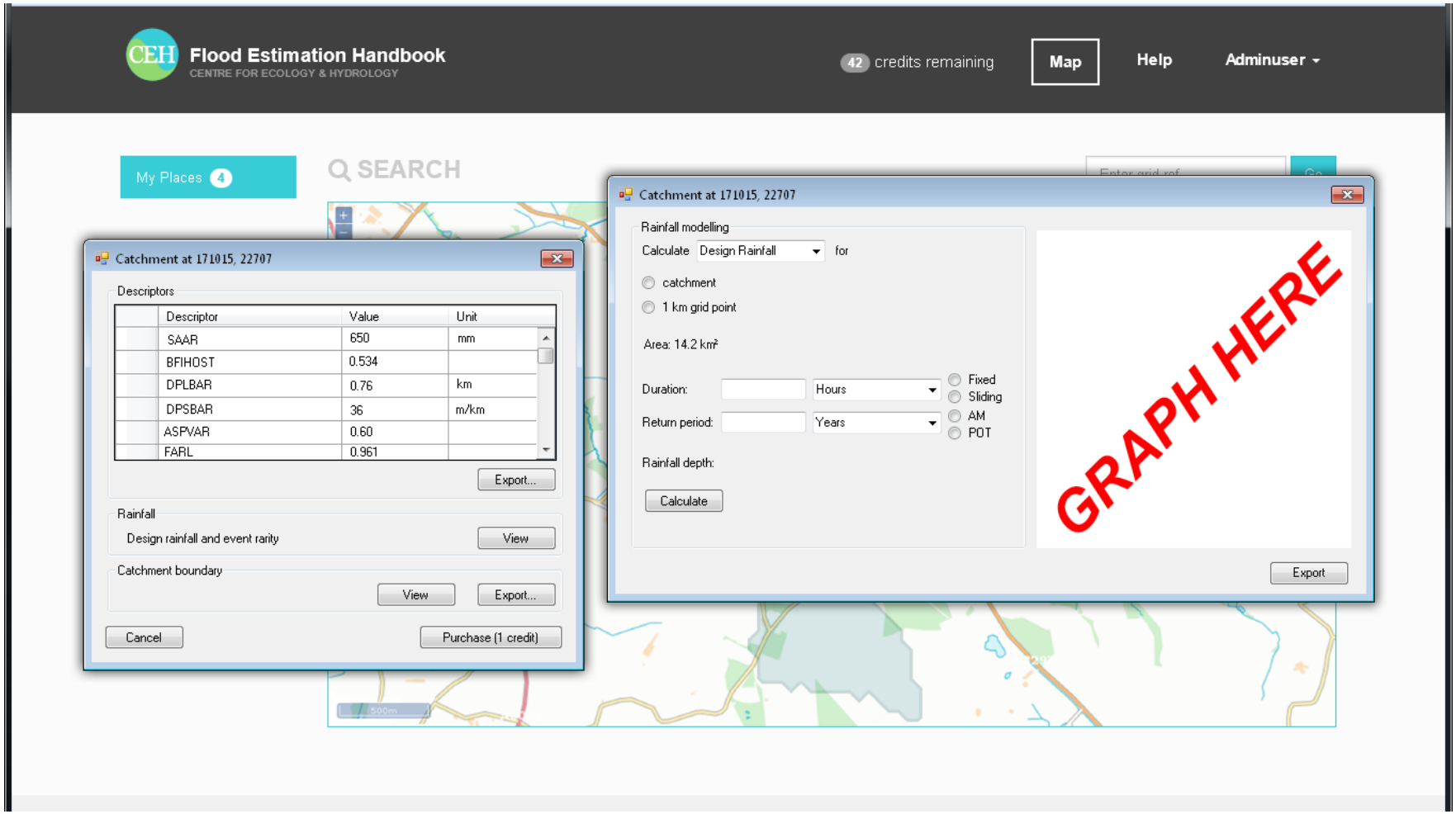
Rainfall model outputs



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

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