IMPROVING INTEGRATION OF SCIENCE AND PRACTICE FOR FORECASTING FLOODING FROM INTENSE RAINFALL

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A REVIEW OF THE NERC FFIR PROGRAMME
FFIR VIDEO
FRANC:
Forecasting Rainfall exploiting new data Assimilation techniques and Novel observations of Convection

SINATRA:
Susceptibility of catchments to INTense RAinfall and flooding

TENDERLY:
Towards END-to End flood forecasting and a tool for Real-time catchment susceptibility
The team

Institutions and partners delivering research

FRANC SINATRA TENDERLY

International agencies on advisory board

UK End user beneficiaries on advisory board

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT
What should an improved end-to-end framework look like?

• What information do end users need to make decisions?
• How do we effectively link meteorology – hydrology – inundation – impacts?
• How do we know where in the chain we can have the biggest improvements?
AN INTEGRATED END-TO-END FRAMEWORK FOR FORECASTING FLOODING FROM INTENSE RAINFALL

Science developments
- Components and linkages investigated by the FFIR programme

Interdisciplinary working practices
- Lessons learned through the FFIR programme

Interdisciplinary working practices
- Establishing common end goals
- Managing expectations
- Sharing data

Components and linkages investigated by the FFIR programme
- Knowledge of catchment susceptibility
- River and geomorphic observations
- Meteorological observations
  - Radar
  - Satellite
  - Rainfall product
  - In-situ
- Data assimilation
- National scale flood model
  - Land surface modelling
- Numerical weather prediction model
- Catchment and urban models
- Weather forecast
- Inundation maps
- Flood warnings
- Weather warnings
Meeting end user challenges

=> Short lead times & location and timing uncertainty = communication challenge

- Establish confidence in the forecasts, models and data that are available
- Effectively represent uncertainty for a given forecast, be explicit about potential implications
- Developing post processing tools for probabilistic forecasts that alert decision makers to take action when needed
- Improving skills and understanding of probabilistic modelling among decision makers and the public including the realisation that things can happen that aren’t in the forecast
- Consider the staff resources required to provide operational surface water flood forecasting and communicate clear messages

=> Radar and data assimilation work
=> Convective ensembles work
=> Convective ensembles work
=> Hydraulic modelling
=> Catchment susceptibility work
=> Engagement activities

=> Simple, interpretable tools
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Outputs
- Other components
- Outputs

Managing expectations
- Establishing common end goals
- Sharing data
- Developing a joint language

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Other components

Establishing common end goals

Managing expectations

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Other components
INTERDISCIPLINARY WORKING

• Joint language
• Establishing a common end goal
• Sharing data
• Managing expectations
Case study 1: Met Office partnership

• The match funding from the Met Office has meant that there has been more effort in improving convective forecasting than there would have been without the programme

• The Met Office work has benefitted from the overall FFIR programme umbrella

• Joint proposal was designed as integrated project:
  • the underlying aims of both parties were the same
  • good access to data
  • equal partnership (not data provider and researcher)

• Helped by
  • Met Office@Reading co-location
  • Long-term post doc funding
Case study 2: Flash Flood!

FlashFlood! has been an important part of the FFIR programme.

• It has started conversations about geomorphology within the programme team.
• It has played a valuable role in building relationships between members of the programme from different universities who have joined together to demonstrate FlashFlood! at science fairs.
• It has been the principle public engagement tool for the FFIR programme.

The success of FlashFlood! helped lead to the establishment of the Serious GeoGames Lab and Earth Arcade led by Dr Chris Skinner at the University of Hull.
Case Study 3: Flood Action Team (FLoAT)

- Provided opportunity for nation wide engagement with FFIR from Scotland to SW England
- Developed good links between academia and EA hydrometry teams
- Fostered community engagement
- Visualisation of the link between hydrology and geomorphology / sediment

- Environment Agency have provided legacy funding for more sites for a longer period demonstrating direct impact from the FFIR programme
Improving integration

- Operational communication is good but before FFIR research links were poor / isolated
- FFIR has laid foundations for improving integration

“We valued the opportunity through the FFIR programme to test ideas with different people and organisations, with whom we might not otherwise have had so much contact”

Rob Lamb JBA Consulting

“Where meteorologists and hydrologists have worked together on the FFIR programme they have started to close the gaps in understanding between disciplines”

Rob Thompson, University of Reading

- Need individuals with skills to cross boundaries
  - ECRs have been able to develop these skills
  - More experienced members have been able to put their skills to good use
  - Long term questions about development of future hydrologists/meteorologists
- Needs funding / time / resources
  - Funding for consultancies / secondments
  - Message from high level leadership that it is a valuable use of time to engage with others
  - Balancing day-to-day responsibilities
Overview of FFIR achievements

- Improved flood forecasts and warnings
- Reduced uncertainty / increased understanding
- Consistent messaging
- Improved relationships
- Common focus / shared end goal
- Consistent data and modelling framework
- Improved knowledge of vulnerability
- Improved observations
- Improved forecasting of convection
- Potential for real time inundation modelling
TOWARDS END-TO-END FLOOD FORECASTING

What should an improved end-to-end framework look like?

- What information do end users need to make decisions?
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Integrated end to end forecasting has a number of benefits. It helps:

“Put weather forecasts in the context of decision makers”
Ken Mylne Met Office

“Promote better understating and accessibility by exploring explicit links between parts of the chain”
Rob Lamb JBA Consulting

“Reduce wasted research effort as you only make improvements to things that are beneficial to those further down the chain”
Nigel Roberts Met Office
References and further information

- The FFIR programme website [http://blogs.reading.ac.uk/flooding](http://blogs.reading.ac.uk/flooding) contains lots of information including a link to the programme [video](#) and a [summary](#) of the science developments and outputs.

- An overview of the programme output and its impact on forecasting flooding from intense rainfall is described in:
  - Dance et al (2019) Improvements in Forecasting Intense Rainfall: Results from the FRANC (Forecasting Rainfall Exploiting New Data Assimilation Techniques and Novel Observations of Convection) Project, Atmosphere, 10(3), 125; [https://doi.org/10.3390/atmos10030125](https://doi.org/10.3390/atmos10030125)