Extreme Event Recognition Phase 2

Technical Summary: FD2208

Joint Defra / EA Flood and Coastal Erosion Risk Management R&D programme

Background to R&D project

This project was the second phase of work investigating ways of improving Extreme (rainfall) Event Recognition lead by the Met Office and working with Salford University and the Centre for Ecology and Hydrology (CEH). The principal findings from Phase 1 (Aug 2002) were that extreme rainfall events can be characterised into a number of different types e.g. frontal, convective, and orographic depending on the amount and duration of the rainfall. Phase 1 also identified an archetypal frontal situation that might be used as an indicator of potential extreme events. This project has focused on achieving a better understanding of Extreme events and their characteristics in order to enable a better forecasting service for these types of events which can develop very quickly, can have severe consequences and are currently problematic to predict.

This project addressed a key flood defence objective: to improve flood warning lead times and thereby facilitate more effective mitigation of flood impacts. The work was carried out in 5 work packages looking at different aspects of extreme events including:

- Extending the historical analysis of extreme events in Phase 1 to more recent and less extreme events to determine if these had the same or different characteristics.
- Developing and evaluating an extreme event prediction system as a service to forecasters.
- Evaluating an indicator for extreme convective (thunderstorm) events based on vorticity.
- Develop rainfall datasets from historical heavy rainfall events, enhanced to represent extreme events, and use them to evaluate the extreme event performance of flood forecasting models.

Results of R&D project

This project investigated a number of viable but untested hypotheses so as to move forward the body of understanding and science relating to Extreme Events. The detailed analysis of rainfall records undertaken in this work was some of the first undertaken for many years and it has demonstrated a potential gap in research areas. Although not all the approaches looked at in this work resulted in a significant advance in the forecasting of extreme events, the findings have given direction to those areas where further research is most likely to succeed and those that will not.

Environment Agency

defra
Department for Environment Food and Rural Affairs

The principal conclusions resulting from the Phase 2 work are:

1. Due to their complexity, there are no short cuts to reliable early prediction of extreme rainfall events using simple predictors. The work indicates that improvements to Numerical Weather Prediction models and observing systems over the next five years should result in better resolution and forecasting of the type of situations that result in extreme events (e.g. including using model grids finer then the current 4km^2)
2. Extreme events are not in a distinct distribution from less extreme ones.
    - Orographic events have the clearest association with the source conditions being critical for an extreme event and determined by the wind direction, fetch and source air mass temperature.
    - Frontal events are more likely to be extreme at locations close to and to the North of a low pressure system.
    - Extreme convective events are distinguished from less extreme ones primarily by the length of the rainfall event rather than its intensity.
3. Environment Agency flood forecasting and warning systems can now be tested to see how they perform under extreme rainfall event conditions and flood forecasters trained using the datasets produced from this work. Both of these elements should result in improvements in recognition of extreme events and mitigating their effects by provision of better warnings.

R&D Outputs and their Use

The project Report Technical Report FD2208 "Extreme Event Recognition Phase 2" summarises the objectives and findings of the work. Five separate reports are also available which provide more detail on the findings of the individual work packages. **Researchers will be particularly interested to read how this project has progressed the body of scientific knowledge on Extreme rainfall events**. Recommendations for further work are included within the technical report.

The Extreme Rainfall datasets used within this project have been passed to the Environment Agency in a form compatible with their flood forecasting systems, this was accompanied by the training of Users.

This R&D Technical Summary relates to R&D Project FD2208 and the following R&D output:
R&D Technical Report FD2208/TR – Extreme Event Recognition Phase 2. Published September 2007.

Publication Internal Status: Released Internally External Status: Released to Public Domain

Project Manager: Linda Aucott **– Defra Flood Management Division** Email: linda.aucott@defra.gsi.gov.uk
Research Contractor: Consortium leader: Brian Golding Email: brian.golding@metoffice.gov.uk
CEH Wallingford, Project Manager: Bob Moore Email: rm@ceh.ac.uk
University of Salford, Project Manager: Chris Collier Email: c.g.collier@salford.ac.uk
The above outputs may be downloaded from the Defra/EA Joint R&D FCERM Programme website (www.defra.gov.uk/environ/fcd/research). Copies are also available via the Environment Agency's science publications catalogue (http://publications.environment-agency.gov.uk/epages/eapublications.storefront) on a print-on-demand basis.

PB 12169 TS

Further copies are available from:
Defra Flood Management, Ergon House,
Horseferry Road, London SW1P 2AL

Tel: 020 7238 6000

Info-fm:defra.gsi.gov.uk
www.defra.gov.uk/environ/fcd/research