Storm Scale Numerical Modelling

Technical Summary: FD2207

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

Background to R&D project

Short-range prediction of precipitation amount is a critical input to flood prediction and hence the accuracy of flood warnings. The most accurate current methods are based on extrapolation of radar analyses. At best, these provide sufficiently accurate predictions of rainfall for flood warnings up to about three hours ahead and inherent limitations will reduce the scope of long-term improvements in quantitative precipitation forecasts by this method.

The next major advance in quantitative precipitation forecasting methods is expected to come from the application of storm scale Numerical Weather Prediction Models. This project, jointly funded by DEFRA and the Met Office, was to investigate the ability of a storm scale configuration of the Met Office NWP model to predict flood-producing rainfall up to 12 hours ahead and to develop appropriate tools for interpreting and presenting the predictions so that they enhance operational flood prediction capabilities.

Results of R&D project

The key findings and conclusions of the project are:

1. The storm-scale model (grid spacing – 1km) is capable of producing significantly more realistic and spatially accurate forecasts of convective rainfall events than is possible with current operational systems.
2. There is now a prospect of producing useful forecasts of convective storms on scales applicable for flood prediction.
3. Innovative diagnostic products have been developed to improve the interpretation of rainfall forecasts from a storm-scale model. The use of such products is essential if a storm-resolving model is to be used for flood prediction.
4. Data assimilation in a storm scale model (the process of adjusting the start of forecast to be in better agreement with new observations) improves the first few hours of forecasts, but requires further development to give consistent benefit.

The project has provided evidence that a storm-scale model does indeed have the potential to deliver a significant improvement in our ability to predict high-impact convective rainfall events.

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The main recommendation is that the development of a storm-scale model should continue and move towards operational implementation in conjunction with a post-processing system for the delivery of precipitation products for use in flood prediction. The potential exists for a substantial improvement in flood-warning capability. Considerable research is still needed to fully realize this potential, particularly in the area of data assimilation.

Three new avenues of research have been identified as necessary:

- Assessing and optimising the ability of the next generation NWP model to predict extreme rainfall events.
- Blending convective scale numerical weather prediction with ensemble nowcasting.
- Incorporating rainfall predictions from NWP models into hydrological models.

R&D Outputs and their Use

Seven technical reports present technical information and research findings from the project. The results are to be used to determine whether a storm scale NWP suite should be implemented in support of flood prediction and, if so, what its configuration and outputs should be.

This R&D Technical Summary relates to R&D Project FD2207 and the following R&D outputs:

- ***Results from High Resolution Simulations of Convective Events*** Published February 2003, Met Office Forecasting Research Technical Report 402 (JCMM Internal report 140)
- ***Report on Sensitivity of Case Studies to Model Parameters and Options*** Published March 2003, Met Office Forecasting Research Technical Report 407 (JCMM Internal report 142)
- ***Precipitation Diagnostics for a High Resolution Forecasting System*** Published September 2003, Met Office Forecasting Research Technical report 423 (JCMM Internal Report 143)
- ***Measuring the Fit of Rainfall Analyses and Forecasts to Radar*** Published January 2004, Met Office Forecasting Research Technical report 432 (JCMM Internal Report 146)
- ***Verification of the Fit of Rainfall Analyses and Forecasts to Radar*** Published April 2004, Met Office Forecasting Research Technical Report 442 (JCMM Internal Report 148)
- ***An Investigation of the Ability of a Storm Scale Configuration of the Met Office NWP Model to Predict Flood-producing Rainfall*** Published December 2004, Met Office Forecasting Research Technical Report 455 (JCMM Internal Report 150)
- ***Review of the Storm Scale Modelling Project and Proposals for Future ResearchFD2207TR*** Published March 2006

The above Met Office reports (1 -6) are available from the website:
http://www.metoffice.gov.uk/research/nwp/publications/papers/technical_reports/fr.html

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The FD2207TR 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.

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