

R&D Technical Summary W5C-013/5/TS/1

Fluvial Flood Forecasting for Flood Warning Real Time Modelling

Background to R&D project

The Agency aims to deliver accurate, reliable and timely forecasts of flooding at locations in England and Wales where the benefits justify the costs and where the provision of this service is technically possible. There are several R&D projects helping to further this aim covering different sources of flooding - estuarial, fluvial and coastal. The estuarial project is complete and was reported on in R&D Technical Summary W5-010/TS/3. The project covering coastal flood forecasting is due to report later in 2003. The fluvial flood forecasting project comprises two components - Rainfall Measurement and Forecasting (RMF) and Real Time Modelling (RTM). This Technical Summary covers the RTM component; the RMF component is reported on separately in R&D Technical Summary W5C-013/4/TS/1. In addition, Guidelines have been produced covering both RMF and RTM. These are published separately but referred to in the Technical Summaries for completeness.

Results of R&D project

The project carried out a review of current forecasting methods and problems and produced guidelines for the selection of real time models for the use of flood forecasting staff.

Technical Report W5C-013/5

This report provides supporting material used in preparation of the Guidelines for RTM together with a summary of priorities for future R&D in RTM. The report also describes modelling studies performed during this project into the impacts of uncertainties in rainfall and other input data on the accuracy of flood forecasts.

The main topics considered in this report are:

- A description of existing flood forecasting approaches currently used ranging from simple relationships such as level correlations and time of travel relationships, through to rainfall runoff models, hydrological routing and hydrodynamic routing models. The assumptions and ease of use of each approach are also identified.
- An overview of forecast uncertainty and a description of the practical approaches that can be adopted to minimise uncertainty in flood forecasts (e.g. model updating), together with a summary of exploratory modelling studies into the magnitudes of some of these effects.
- The main forecasting problems identified by Agency staff.
- The technical background to the Guidelines for RTM.

The report considers a number of issues which are relevant to RTM including the indicative accuracy of models, methods for evaluating model and overall forecasting system performance, approaches to dealing with uncertainty, how errors in data, forecasts etc propagate through to flow forecasts and current active research areas in RTM.

The report summarises the main conclusions for the categories of model defined currently in operational use within the Agency and includes findings on a range of other issues such as post event analysis and error propagation.

Guidelines for Real Time Modelling

The Guidelines provide a structured decision making framework for selecting real time models for a given Flood Warning Area accounting for:

- Agency targets for flood warning systems
- Different physical types of catchment and river, including floodplains and control structures
- The varying levels of data availability and quality
- The levels of risk and the consequences of error
- The cost and time of developing or improving a system

Guidance is also provided on real time updating methods, post event evaluation criteria, and on the need for model recalibration after significant flood events. The Guidelines include a methodology (similar to that developed for the estuarial project covered by R&D Technical Summary W5-010/TS/3) to allow estimates to be made of the potential benefits of improved forecasts through damage avoidance. The Guidelines are maintained by and available from the Technical Manager for Flood Warning, Head Office, Environment Agency.

R&D Outputs and their use

The Guidelines are aimed primarily at Agency staff having some hydrological expertise that are responsible for designing, commissioning, managing, operating and maintaining real time modelling systems. The Guidelines are supplemented by the Technical Report and it may also be necessary to refer to the Guidelines for RMF for information on topics such as best practice use of weather radar or raingauges. The Technical Report will be of interest to all involved in operational real time flood forecasting modelling. Based on the modelling studies the Technical Report offers a possible way of thinking about the relative magnitude of the various errors and uncertainties and how they propagate through to errors or uncertainties in forecasts of levels. Although the final results are only indicative they may be useful in focusing attention on the aspects of a model which generate the largest uncertainty.

This R&D Technical Summary W5C-013/5/TS/1 relates to the Guidelines for Real Time Modelling and Forecasting and **R&D Technical Report W5C-013/5 – Fluvial Flood Forecasting for Flood Warning: Real Time Modelling**. Published February 2003.

Publication Status: Unrestricted

Report Product Code: SCHO0405BJAQ-E-P

The Environment Agency's Project Manager for Project WSC13/4 was Andrew Grime of Weetwood Services, Tarporley, Cheshire CW6 0NQ Tel/Fax: (+44) 1829 752500 Email: postbox@weetwoodservices.demon.co.uk Website: www.weetwoodservices.demon.co.uk

This document was produced under R&D Project W5C-013/5 by WS Atkins Consultants Ltd., Woodcote Grove, Ashley Road, Epsom, Surrey, KT18 5BW Tel: (+44) 1372 726140 Fax: (+44) 1372 740055 Website: www.atkinsglobal.com

Copies of these documents can be obtained from the Environment Agency's National Customer Contact Centre Email: enquiry@environment-agency.gov.uk Tel: 08708 506 506 or through the Environment Agency's Science publication catalogue <http://publications.environment-agency.gov.uk/epages/eapublications.storefront>. Alternatively they may be downloaded from the Defra FCERM Programme website www.defra.gov.uk/environ/fcd/research.

© Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, BS32 4UD Tel: (+44) 1454 624400 Fax: (+44) 1454 624409