Defra / Environment Agency
Flood and Coastal Defence R&D Programme

R&D Technical Summary FD2206

Best Practice in Coastal Flood Forecasting

Background to R&D project

The Environment 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 fluvial project is also complete, the Rainfall Measurement and Forecasting (RMF) component being reported on in R&D Technical Summary W5C-013/4/TS/1 and the Real Time Modelling (RTM) component being reported on in R&D Technical Summary W5C-13/5/TS/1.

This project is the final one in the series and the purpose was to investigate ways of improving coastal flood forecasting (CFF) and provide best practice guidelines for the future development of CFF systems. The objectives were to:

- identify present and future flood forecast needs and aspirations
- categorise available CFF methods and identify advantages, disadvantages and inconsistencies
- short-list a range of suitable CFF options and appraise their performance with regard to meeting present and future needs
- outline the way forward for future CFF including R&D required to fill any identified deficiencies in present practice
- review existing initiatives and develop a common understanding of requirements and an associated best practice framework for coastal flood forecasting.

The project team acknowledges the major contribution made to the success of this project by Jenny McArthur of Posford Haskoning who sadly passed away on 24 October 2003.

Results of R&D project

CFF is discussed within the wider conceptual context of risk assessment (*Source, Pathway, Receptor, Consequence*) and emergency response (*Detection, Forecasting, Warning, Dissemination, Response*), but the particular interest of the report is in *Source / Pathway* and *Detection / Forecasting*. The physical extent of CFF is divided into four zones, *Offshore* and *Nearshore* comprising the *Sources*, and *Shoreline* and *Flood* comprising the *Pathways*. The *Source* model types are categorised as *Offshore* wave forecasts, *Offshore* tide/surge forecasts, *Nearshore* wave transformation and *Nearshore* tide/surge transformation. The *Pathway* model types are categorised as *Shoreline* overtopping, *Shoreline* breaching and *Flood* inundation.

The range of models within each physical category is further categorised by model complexity, as *Judgement*, *Empirical*, *1st Generation*, *2nd Generation* or *3rd Generation*. Broadly speaking, higher complexity implies greater accuracy and lower uncertainty, but possibly at the expense of increased cost and reduced timeliness. The phrase 'model type' is then used to indicate a particular physical type (e.g. *Offshore* waves, *Nearshore* tide/surge or overtopping) coupled with a particular complexity level (e.g. *Empirical* or *2nd Generation*). The characteristics of each model type are described in terms of the physical processes simulated, modelling methodologies used, inputs / outputs, and relative performance. A list of particular models is given for each type, with a series of tick boxes for the particular characteristics of each model. The model types are compared, and those found suitable for use in CFF are short-listed.

It is recommended that different levels of CFF are used in different areas, depending on the assets at risk

in a particular area, and the reduction in loss that might be achieved by mitigation measures prompted by CFF. The main difference between the four recommended levels of CFF, i.e. none, low, medium or high, lies in the extent of the physical system to be modelled, i.e. none, *Source* only, *Source / Pathway* or *Source / Pathway / Receptor / Consequence*. It is also recommended that CFF not be looked at in isolation, but in the wider context of an overall CFF service, including the subsequent *Warning*, *Dissemination* and *Response* stages. Only in this way can the timeliness, potential value and overall performance of the service be assessed.

This report includes a section on future research requirements, concluding that basic science developments are not a priority. Instead it recommends continuing developments within existing forecasting models, continuing development and uptake of open architecture software systems and performance measures, and improvements in communication and sharing of existing data resources.

The accompanying guide to best practice in CFF is intended for use in design, implementation and evaluation of CFF services. It focusses on the monitoring and forecasting elements of the flood forecasting and warning process and is deliberately brief but includes many links back to details in the technical report. The guide is maintained by and available from the Technical Manager Flood Warning at the Environment Agency.

R&D Outputs and their Use

The technical report presents technical information and research findings from the project. It presents a review of current practice and aspirations for CFF and identifies current forecasting problems in the Agency. This provides a background against which to categorise and prioritise practices, model data sources etc, and to recommend improvements. The improvement plans recommended by this project are in the form of outline R&D proposals. It will be of interest to all involved in operational real time flood forecasting modelling. The technical report supports the Guide to Best Practice in Coastal Flood Forecasting that is intended assist Environment Agency staff in developing CFF services, the Agency own and maintain this document. The intention is that the guide should be followed for the design of any new CFF service.

This R&D Technical Summary relates to the Guide to Best Practice in Coastal Flood Forecasting and R&D Project FD2206 output:

- **R&D Technical Report FD2206/TR1 - Best Practice in Coastal Flood Forecasting .** Published January 2004

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