



Probabilistic Coastal Flood Forecasting: Forecast Demonstration and Evaluation

Science Summary SC050069/SS2

A new report published by the Environment Agency explores the use of probabilistic coastal flood forecasting to improve predictions of coastal flooding in the UK.

The Environment Agency is responsible for forecasting river and coastal flooding in England and Wales, while the Met Office is responsible for offshore forecasting for the UK. Use of offshore forecasts to estimate the likelihood of coastal flooding is not trivial, potentially involving nearshore transformation of wave and surge forecasts, transformation of waves in the surf zone, the effect of wind, waves and still water level in causing beach movement, overtopping and breaching, to a probability of damage to people and property. All this must be carried out with sufficient accuracy and lead time for actions to be taken to reduce potential losses due to flooding.

This report outlines the results and recommendations from the project *Probabilistic coastal flood forecasting* funded by the Environment Agency and carried out by HR Wallingford, the Met Office and the Proudman Oceanographic Laboratory. The report will be of most interest to Environment Agency flood forecasters, but its findings are also relevant to Scottish flood forecasters and Met Office forecasters, and to others involved in flood incident management.

The project set out to develop and evaluate probabilistic methods for surge, nearshore wave and coastal flood forecasting in England and Wales. The main features that distinguish these methods from existing ones are in the use of hydraulic models extending from offshore, through the nearshore and surf zones, to action at coastal defences, using ensemble and other probabilistic approaches throughout.

This project included several modelling elements in coastal flood forecasting. These are grouped under four headings, any or all of which could be developed further:

- surge ensemble modelling for all of the UK, run in near operational manner;
- temporary wave ensemble modelling specific to the South East Irish Sea, for demonstration use;

- wave transformation and overtopping models specific to the South East Irish Sea, for demonstration use;
- generic handling of a large number of uncertainties associated with nearshore waves and overtopping.

A real-time demonstration of the probabilistic coastal flood forecasting system provided distributions of surge, sea level, offshore waves, nearshore waves and overtopping rate, at each prediction point, at 15-minute time steps, updated 12-hourly. The feasibility of surge ensemble forecasting and probabilistic coastal flood forecasting was thus demonstrated. Evaluation of the overall system showed sufficient accuracy, timeliness, reliability, intelligibility and usefulness for future operational use.

Some elements were found to offer greater potential to flood forecasters. The main recommendations from this project are, in order of priority:

- implementation of the surge ensemble forecasting developed in this project;
- improved astronomical tidal prediction and flood thresholds at coastal flood forecasting locations;
- training to standardise flood forecasters' use of probabilistic forecasts;
- pilot study of near-operational wave ensemble forecasting;
- pilot study of near-operational probabilistic coastal forecasting.

These recommendations are described in more detail in the report, and are broken down into action points, with approximate costs and timings.

This report, the second of two, describes the forecast demonstration and forecast evaluation stages of the project, with brief reference to the earlier model development and model evaluation stages. The report outlines the overall conclusions and recommendations of the project.

Anyone involved in implementing the recommendations, or interested in the detail of the modelling approaches, will find more information in the first project report **Coastal flood forecasting: model development and evaluation**, published November 2007, describing the model development and evaluation.

This summary relates to information from Science Project, SC050069 reported in detail in the following output(s):

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