FACTSHEET

Thames Estuary Pilot Study

Long-term flood risk management planning

FLOODsite Task 24 has produced:

- A model enabling the quantification of flood risk that can be used to investigate different flood risk management strategies for the Thames Estuary, UK.
- A method for uncertainty analysis.

The pilot study outcomes will benefit:

- Practitioners involved in long-term flood risk management planning and maximising the benefits of limited capital expenditure.

Where to find the main outputs:

The following are available in the publications section of the FLOODsite website www.floodsite.net:

- Floodsite report T24-08-01 "Uncertainty and sensitivity analysis method for flood risk analysis" by Ben Gouldby;
- Journal paper T24-08-05 by Ben Gouldby et al. published by the Institution of Civil Engineers (abstract only); and
- Conference paper T24-09-01 by Ben Gouldby et al. published by Wit Press (abstract only).

Fig. 1. Thames Barrier - part of the flood defence system in the Thames estuary

In Brief

Effective flood risk management requires the quantification of flood risk. FLOODsite Task 24 has produced a new flood risk analysis model that enables a rational quantification of flood risk. The model facilitates the production of maps of both probability of flooding and flood risk, expressed as Expected Annual Damage (EAD). The model has been applied to the Thames Estuary in the UK.

The modelling method utilises the *Source, Pathway, Receptor, Consequence* conceptual representation of the flood system. The primary scientific advances of the model are:

- Development of a new computationally efficient flood spreading model;
- Development of an efficient Monte-Carlo sampling procedure for simulating multiple flood defence failure scenarios; and
- Development of a method for attributing residual risk to flood defences.

The model quantifies flood risk at a specific point in time so the input databases can be modified to reflect future changes to the system associated with, for example, different:

- Climate change scenarios;
- Asset maintenance strategies;
- Strategic management strategies, associated with both flood defence assets and flood warning or resilience measures (so-called receptor responses); and
- Floodplain development scenarios.

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Uncertainty and Sensitivity Method

It is important for decision-makers to be aware of the limitations associated with models. Risk modelling is an inexact science and uncertainties are present from numerous different sources. A staged method (see FLOODsite Report T24-08-01) was developed that quantifies the uncertainty associated with the flood risk model. The scientific advances within this piece of work were the efficiencies achieved by selecting appropriate staging points within the overall model structure, to make the propagation of uncertainties through the model without drastically increasing computation time.

Sensitivity analysis seeks to identify those input variables that contribute most to uncertainty on the output variable. An existing method for sensitivity analysis was adapted for use with the staged uncertainty method. The output of this analysis can be used to identify priorities in development of the model, for example, to target data gathering activities to the most important input variables.

Thames Estuary Case Study

The Thames Estuary flood system is complex; it is subject to flooding from different sources, comprises a range of fixed and active structures, including the Thames Barrier (Fig. 1), variable floodplain topography and assets with a wide range of value within the floodplain area. The primary source of flooding is from high sea levels propagating up the Thames Estuary, although extreme fluvial flows can overtop defences, particularly in west London.

A 1D hydrodynamic model was used to simulate the flows in the estuary. Different tidal and fluvial events were simulated using a sophisticated joint probability approach to determine the distribution of extreme water levels at each node within the estuary. Sets of extreme water levels occurring at different future points in time under different assumed climate change scenarios were then generated by modifying the tidal and fluvial events for each future point-in-time and climate change scenario.

The primary outputs for each model run were:

- Floodplain economic risk and annual probability of inundation within each impact cell,
- Defence contribution to residual risk, and
- Annual probability of defence failure.

The model can be used to determine the risk reduction (benefit) afforded by different intervention strategies over their life-cycle, which can then be compared with associated costs within a relative cost-benefit framework. Outputs of the system model related to specific defence sections can be used for asset management purposes, identifying where it is most cost effective to invest in defence maintenance and refurbishment.

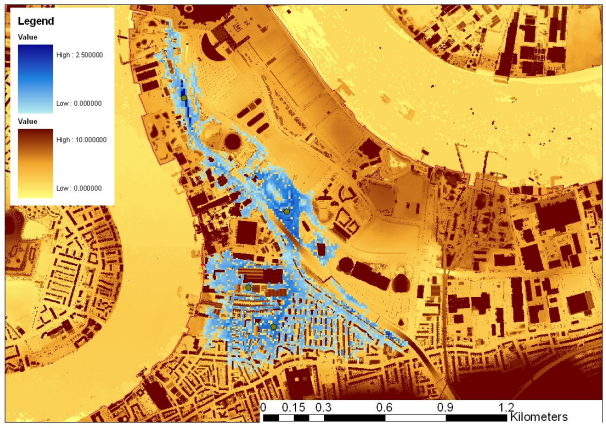

Fig. 2. Breach simulation at Thamesmead using the Rapid Flood Spreading Model

Related Work

The Environment Agency (for England and Wales) is applying this model methodology to their NaFRA, PAMS and Thames Estuary 2100 projects.

Task 24 also worked in collaboration with Tasks 14, 18 and 20. Further information regarding these tasks can be found on the FLOODsite website.

The FLOODsite project

FLOODsite is an interdisciplinary project integrating expertise from physical, environmental and social sciences, as well as spatial planning and management. The project has over 30 research tasks across seven themes, including pilot applications in Belgium, the Czech Republic, France, Germany, Hungary, Italy, the Netherlands, Spain and the UK. The EC has identified FLOODsite as one of its contributions to the European Flood Action Programme.

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