FACTSHEET

German Bight Coast Pilot Study

Micro-scale coastal flood risk analysis

FLOODsite Task 27 has developed:

- A micro-scale (i.e. at the scale of individual buildings) risk analysis tool based on the community of St. Peter Ording on the German Bight Coast.

The outcomes of this pilot will benefit:

- Coastal defence authorities intending to establish an integrated coastal defence management scheme.
- Researchers, modellers and engineers undertaking micro-scale flood risk analysis.

Where to find further information:

- Report T35-09-02 “FLOODsite Final Report, Volume 2” is available in the publications section of the website www.floodsite.net.
- A book will be published beyond the end of the FLOODsite project describing the development and testing of FLOODsite methodologies in the pilot studies.

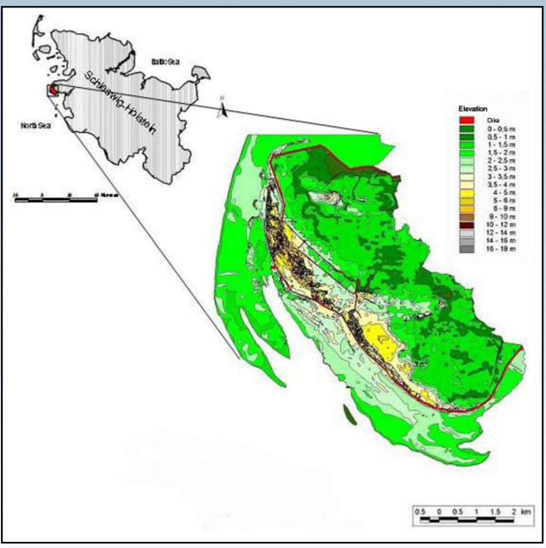

Fig. 1. Map of the St. Peter Ording pilot site

In Brief

The community of St. Peter Ording, on the German Bight Coast, is very exposed to the North Sea on the west coast of the Eiderstedt peninsula (Fig. 1). The size of the study area is approximately 6000 ha; of which 4000 ha are considered to be flood-prone due to their elevation. A flooding of the municipality could also potentially spread far into the hinterland of the Eiderstedt peninsula.

The flood defence system is complex, divided into a foreland, a major dike line (approximately 12 km in length), dune structures (more than 2.5 km long, and from 10 m to 18 m high) and a second dike line.

Detailed measurements were taken of the defence structures by laser scanning and analysis was undertaken to identify likely failure points, dimensions, and associated uncertainties and return periods. Probabilistic analysis was then performed and results were applied to a flood inundation model.

A micro-scale vulnerability analysis was undertaken following an integrated approach and combining economic, social and ecological criteria to estimate the overall damage for different flooding scenarios.

A spatial multi-criteria risk assessment was used to display overall results as risk maps.

SIXTH FRAMEWORK PROGRAMME

FACTSHEET

Principal Results

Hazard analysis

A source-pathway-receptor conceptual model was used, focussing on high sea levels and wave action (risk sources) and the area’s dikes (risk pathways).

A fully probabilistic analytical approach was taken requiring mostly stochastic input parameters. Various failure modes and different sections of the defence line were investigated in detail using uncertainties of input parameters as obtained from previous investigations or literature. Results provided the failure probability due to wave overtopping of the sea dikes and breaching of the flood defences in specific sections. The defence section with the highest probability of breach failure was assumed to be where the flood inundation would start.

Definition of flood scenarios

The hazard analysis of likely defence failure locations and characteristics was input to a two-dimensional numerical inundation model to simulate flood spreading.

Vulnerability analysis

An integrated approach was chosen to assess economic, social and ecological vulnerability. It was found that micro-scale estimates of economic vulnerability could be simplified by reducing the key damage categories to those that make up 90% of the total damage potential. A high resolution database was used to derive a standardised methodology to estimate the economic value of buildings, private inventories, gross value added and fixed assets. Results were compared to a previous study to show that similar potentials for economic damage had been achieved with the simplified methodology.

Simple transfer of depth-damage relationships from fluvial studies was found to be problematic due to the differing hydrological and hydraulic conditions of coastal flooding. Expert interviews were carried out to develop a more appropriate damage evaluation model.

Community statistics including seasonal variations in tourist numbers were used to estimate social vulnerability. Vulnerable groups (particularly the young and elderly) were identified, allowing designation of social hotspots that would suffer most in a flood event.

A simplified approach was chosen for assessing ecological vulnerability. This mapped size and extent of coastal biotopes and weighted them according to their ecological relevance, for inclusion in the overall risk estimation.

Finally a multi-criteria risk assessment was conducted to produce risk zones and maps (Fig. 2). Based on this, a micro-scale risk analysis tool was developed that includes:

- A combined hazard probability, flood scenarios and micro-scale vulnerability assessment;
- An integrated approach for assessing economic, social and ecological risk, which is transferable to other coastal sites; and
- A multi-layer GIS output that can be used for the spatial analysis of flood risk.

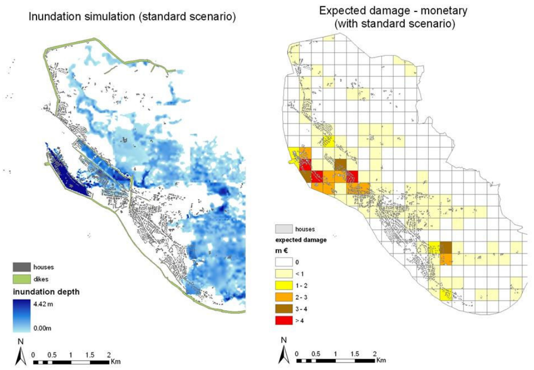

Fig.2. Flood simulation and damage estimation

Related Work

This pilot study enabled the integration of knowledge from the following FLOODsite Tasks: 2, 4, 6 and 7 for Hazard analysis methodology; Tasks 9 and 10 for Vulnerability analysis.

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.

Email: floodsite@hrwallingford.co.uk
Website www.floodsite.net

SIXTH FRAMEWORK PROGRAMME

The work described in this fact sheet was supported by the European Community’s Sixth Framework Programme through the grant to the budget of the Integrated Project **FLOODsite**, Contract GOCE-CT-2004-505420