science summary

Environment Agency

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SCHO0507BMTJ-E-P

Exploring the sensitivity of RASP HLM+ to variations in input data and model parameters

Science Summary SC050064/SS

Background

HR Wallingford and Halcrow have been commissioned by the Environment Agency to undertake a sensitivity analysis of the RASP HLM+ Risk Assessment of Flood and Coastal Defence for Strategic Planning (RASP) High Level Method Plus (HLM+) approach as applied within National Flood Risk Assessment (NaFRA) 2005. The project aim is to establish the relative contribution of different input data sets to the variability in the RASP HLM+ outputs. The sensitivity testing is undertaken through a perturbation approach, whereby input data are varied within realistic ranges (based on knowledge of the associated field measurement techniques). The sensitivity of outputs such as the flood probability and average economic damage are measured.

The sensitivity tests are undertaken for three pilot sites, selected to include a fluvial, estuary and coastal location, including:
the Stour fluvial site in south-east England;
the Thamesmead site on the Thames Estuary; and
the Skegness coastal site in Lincshore, Lincolnshire.

These sites are well- known by the project team and the Environment Agency, and in most instances results are available from more detailed RASP-type analyses.

The perturbed input and model parameters include, for example:
source terms, e.g. fluvial loading;
pathway terms, e.g. Crest Levels, Valley shape;
receptor terms, e.g. depth-damage curves; and
model parameters, e.g. breach width.

Results

The essential project findings and recommendations are as follows:

Appropriate resources and technology should be devoted to evaluating the fluvial loading and understanding the uncertainty bounds associated with these levels; .
The calculated risk is very sensitive to the accuracy of the Crest Levels;.
The calculated risk is sensitive to property floor space and hence the source of this data should be selected with care.

The calculated risk is very sensitive to the number of events used to define the loading curve and a minimum of 40 return periods is recommended.
The calculated risk is sensitive to the defence failure order, and it is recommended that the

defence failure order is set equal to the number of defences within the defence system associated with a given Impact Zone.
Although the coastal site results do provide some very useful conclusions regarding the importance of Toe Level data, more generic conclusions about the sensitivity of coastal sites cannot be derived from the existing pilot results and further exploration of sensitivity for a coastal site with measured Toe Level information is recommended.
The coastal element of this study emphasises the importance of good quality data on toe levels as well as crest levels - – this is clearly necessary in order to move to more probabilistic analysis of flood risk.
If further work on sensitivity and uncertainty analysis is carried out, the choice of pilot sites should be based on an audit of data availability and quality at the pilot sites under consideration.
The project has pointed the way to a rational approach to the value of data quality and model accuracy. Where the risks are high (e.g. large expected annual damage

values), data needs to be of high quality so that the band of uncertainty is reduced, as far as possible, to model uncertainty only. For lower- risk areas, data quality may be less critical for risk-based decision-making.

Who are the users?
The information is intended for Environment Agency staff and consultants engaged with the RASP risk-based methods through the various R&D and other related projects. The readership extends to all those involved in the NaFRA projects (e.g. the Environment Agency, consultants, Local Authorities, Internal Drainage Boards via Performance Based Asset Management Systems the PAMS project, other) as it provides useful information on the methods and the sensitivity of the HLM+ to the various input data sets and model parameters.

The information may be used for:
improving the NaFRA calculation approach; improving the methods for estimating uncertainty (e.g. streamlining these to focus on the more sensitive input data and model parameters); prioritising data collection activities within the Environment Agency to focus on those parameters which significantly change the risk.

This summary relates to information from Science Project SC050064, reported in detail in the following output(s):

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