Joint Defra / EA Flood and Coastal Erosion Risk Management R&D programme

Background to R&D project

The aim of Government strategy for flood & coastal erosion risk management is to reduce the threat to people and their property and to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles. To support this, it requires flood probabilities to be estimated. Flood probabilities are rarely a function of just one source variable therefore understanding the risk posed by the combined effect of two or more extreme environmental variables such as waves, tide, surge, river flow, rainfall, swell and wind are important.

Defra has been funding research into joint probability methods for use in flood risk studies for many years. Up-take of joint probability methods has been patchy due to two main reasons: lack of information on dependence between the source variables, and perceived difficulty in usage and interpretation of the methods. This project analysed dependence between key pairs of variables around England, Wales and Scotland, producing results in a form suitable for use in simplified joint exceedence analysis methods.

Results of R&D project

The main strands of the work were to:

- involve and consult the wider industry on their joint probability requirements, intended to increase the chance of appropriate take-up of methods and results, and to identify any gaps in the research programme;
- bring together recent joint probability work at HR Wallingford, CEH Wallingford and the Proudman Oceanographic Laboratory;
- extend it where necessary to the whole of the UK, analysing and mapping dependence for several variable-pairs relevant to flood and coastal defence, addressing the perceived problem of lack of appropriate data for use in joint probability work;
- produce and disseminate best practice guidance, including advice on the use of analysis methods, use of dependence data, special considerations in complex areas and allowance for future climate change.

The best practice guide (FD2308/TR2) is aimed at non-specialist users of joint probability methods, to encourage them to adopt and use the methods without the need for specialist advice. It includes a high level Introductory Users' Guide and enough information for routine use of the methods, with a summary of the desk study and analytical approaches to joint probability analysis, and a software tool for application of the desk study approach. It includes advice on data preparation, parameter selection, application of the methods and interpretation of the results.

The variable-pairs presented in the guide are:

- wave height & sea level, relevant to most coastal flood defence studies
- river flow & surge, relevant to most river flood defence studies
- hourly rainfall & sea level, of potential use in drainage studies in coastal towns
- wind-sea & swell, of potential use in coastal engineering studies.

These include techniques for use in complex areas and for incorporation of climate change allowances and case studies for each of the variable-pairs listed above, for each of the two main analysis methods. A detailed technical report (FD2308/TR1) contains more information and descriptions for experienced users. It includes the project glossary, descriptions of the source data sets, derivation and comparison of the dependence measures used, and descriptions of the desk study and analytical approaches to joint probability analysis. It also includes a full set of dependence results, with confidence limits, including some additional variable-pairs not reproduced in the guide, namely: wave height & surge; tide & surge; daily precipitation & surge. A third report (FD2308/TR3) contains more detailed results from the river flow, surge and daily precipitation analysis, including some time-lagged and spatially separated dependence analyses, with interpretation relevant to hydrologists.

R&D Outputs and their Use

The results of this project are relevant to most flood risk and defence design calculations. They would be used primarily by practitioners such as flood defence designers, but would also be of interest to policy makers, regulators and researchers.