Knowledge Transfer from the Chinese Flood Foresight Project

Project Summary SC090034/S

Changing climate, land use and housing expansion means that flood risk will increase in many parts of the UK. A new report by the Environment Agency suggests that broad-scale computer modelling of possible flooding scenarios can help to manage flood risk, by guiding the planning and investment in flood defences and emergency and mitigation measures.

Today, around 5.5 million properties in England and Wales face a risk of flooding. Within England about 490,000 properties face a strong likelihood of flooding.

This report covers the lessons learnt from the Taihu Basin project, a cooperative project between the governments of UK and China to develop and adapt the UK's Flood Foresight methods in China. The study area selected, the Taihu Basin, is one of the most important regions of China, containing Shanghai and a number of other major cities.

The Taihu Basin is located in the delta region of the Yangtze River with a total area of 36,895 km^2 (for comparison, England covers 130,795 km^2). Although its area is only 0.4 per cent of China's national territory, the population of 36.8 million and gross domestic product (GDP) of 1,890 billion Yuan (£10 billion) in 2003, represent about 3 and 13 per cent of the nation's totals respectively. The basin is rapidly developing socially and economically.

During a 1991 flood, the water level of the Tai Lake in the basin reached a historical record. Heavy damages were caused to life and property. Following this flood eleven projects for flood control were set up, to retard and store floodwater in the Tai Lake, and drain it northward to the Yangtze, southward to Hangzhou Bay and eastward to the East China Sea.

The new flood control system in the Taihu Basin was severely tested in a 1999 flood. Though the control system played an important role in mitigating flood damage and saving life, the 1999 flood brought a loss of 13 billion Yuan to the basin economy. It was timely and important, therefore, to re-examine the regulation of the water system, as well as the relationship between flood storage and discharge, flood control in the overall basin and flood discharge in each district.

The Taihu project involved a complete flood risk analysis, from the generation of climate and socio-economic scenarios, through hydrological, hydraulic and damage modelling to a final GIS system, the Taihu Basin Risk Assessment System (TBRAS).

The results show an increase to flood risk for the period 2005-2050 of around five times for climate and socio-economic factors if considered separately. When these two factors are combined and sea level rise and land subsidence are added, the multiplication factors rise to 25 to 35 times, (higher than predicted for the UK) owing to socio-economic drivers like rapid housing expansion. Thus, flood risk may rise sharply for the Taihu Basin.

One of the features highlighted by computer modelling is the transfer of risk from the Tai Lake to areas outside polders (reclaimed low-lying land protected by dykes) that now circle many of the larger urban areas in the region. Thus, a presumably unintended consequence of the success of diversion canals built in the last decade to take water from the lake to the estuaries and sea is to increase the risks of flooding to areas that were once relatively flood-free.

The key lessons from the Taihu project are as follows:

Project planning can be improved by carrying out preliminary screening using qualitative analysis – that is, consulting those with an interest or expertise in local risk on their knowledge, opinions and judgement – to help shape the project at an early stage. In the US, this is known as 'expert elicitation'.

Spatial and temporal flood modelling can be used to obtain insights into the patterns and impacts of real, complex floods to guide emergency planning and other non-structural flood responses.

The socio-economic dimension of scenarios has been given little attention compared with climate change, yet we know from both the Taihu and UK that such drivers are of the same order of magnitude. That is, socio-economic factors such as rapid housing development can have a similar effect on flood risk as climate change.

End-to-end modelling systems that encompass the full range of scenarios, drivers, pathways and responses within a linked system of computational models are valuable for long-term large-scale flood risk planning. This has not been carried into practice in the UK. Associated issues include the long run-times of computer models used in the UK compared to TBRAS.

The report recommends a series of actions and projects to build on the knowledge gained in China, ranging from producing good practice manuals to improve current UK practice, to applied research and development into end-to-end computer modelling.

This report will be of interest to those involved in flood risk management, particularly the modelling and mapping of flood risk, or planning and implementing of emergency response and mitigation measures. It will also be of interest to Environment Agency partners such as developers and policymakers, as well as Environment Agency staff working to help the UK manage its future flood risk.

This summary relates to information from project SC090034, reported in detail in the following output(s):

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Project manager: Jacqui Cotton, Evidence Directorate

Research Contractor: Professor Edward Evans
School of Geography, University of Nottingham, Nottingham NG7 2RD

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