Editorial

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The models used to describe most water systems are complex and the development of water management as a discipline is a history of the development of modelling techniques. The papers in this issue illustrate some of the range of modelling problems that currently arise in water management.

The first paper in this issue by Wang *et al.* (2011) on modelling of urban flooding due to a dike break adds to the literature on flood risk assessment. The importance of urban flood risk to society has been highlighted by recent floods in urban areas. It is difficult to overestimate the economic and social impact of such floods. In the UK, floods such as that in Carlisle in 2005 are still being studied (Horritt *et al.*, 2010) because of their impact and as a means to develop and refine modelling techniques. As urban areas develop and with the expected future climate change it is likely that the risk of urban flooding will increase. A framework for such flood risk assessment was described by Sayers *et al.* (2008). One of the key problems of implementation, however, is to develop fast models of flood spreading or inundation over an irregular topography (Lamb *et al.*, 2009 and Wang *et al.*, 2010). Modelling flood spreading in urban areas presents many challenges due to the nature of the topography. In this issue, the paper by Wang *et al.* (2011) demonstrates the importance of mesh resolution and the estimation of hydraulic roughness on the model predictions for such problems.

The authors of the first paper illustrate the importance of accurate predictions of hydraulic roughness for flow modelling. Our ability to predict channel roughness has improved significantly recently; see for example, McGahey *et al.* (2009). Their approach relies, however, on having descriptions of the contributions to hydraulic roughness from different physical processes. The second paper in this issue (Kumar, 2011) adds to this information by providing a description of hydraulic roughness in mobile bed channels. The paper demonstrates the benefits that can be derived from collecting and using data that already exists in the literature. The paper represents an application of neural networks to a topic in water management. Although initially very suspicious of the use of neural networks over more traditional approaches, I was convinced after seeing a demonstration that neural networks can provide a better approximation to data than methods based on assuming some functional form for the relationship between the variables involved. Therefore although the use of neural networks may not seem to add to our understanding of the fundamental physics of a problem, they can provide improved tools for prediction.

The next paper by Kangrang *et al.* (2011) represents an interest-

ing application of the optimisation technique simulated annealing to a longstanding problem of the optimum use of reservoirs. The method of simulated annealing may be particularly suited to global optimisation problems in water management where noisy data makes the application of other optimisation techniques difficult. The paper can be regarded, in part, as a response to the challenge provided by Dooge (2002) for new methods to provide integrated water management.

In much modelling in the past the objective was to simulate the movement of water. Increasingly, models are being extended to more complex systems in which the movement of the water is just one aspect of the system. The paper in this issue by Nash *et al.* (2011) describes a generic methodology for modelling water quality within estuarine systems involving the modelling of nutrient dynamics and phytoplankton growth. Estuaries are increasingly subject to development pressures and it is important that methods are developed to model such systems so that the impact of future development can be simulated. While offering solutions to some problems, the paper also contains future challenges. The work relied on site-specific data to characterise light attenuation and in the development of initial numerical grids. As collection of such data is both expensive and time consuming, the challenge now is to develop generic methods that can be used.

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