Editorial

Role of hydrology in managing consequences of a changing global environment

This issue of *Hydrology Research* brings together 14 research papers arising from presentations made at the 2010 international symposium of the British Hydrological Society. The theme of the symposium was 'Role of Hydrology in Managing Consequences of a Changing Global Environment', and the papers can be seen to illustrate the diversity of issues captured by that theme. Six main groups can be identified as encompassing all of the 14 papers presented here, and have been used to organise the papers within this issue, although inevitably there is some cross-over with some papers relating to more than one theme.

The first group of papers is concerned predominantly with **environmental change**, both natural and anthropogenic. By far the longest timescale studied within the papers is that by Whitehead & Edmunds (2012) who, using archaeological knowledge of a site in southern England, infer past levels of water demand and present a novel comparison of groundwater and low flow hydrology between 4,200 years ago and today. They illustrate the further potential of climate model data extending back into the quaternary period to allow palaeohydrological reconstruction of other sites. By contrast, Dunn *et al.* (2012) focus on rather shorter timescales of decades, in investigating changes in nitrate concentrations in surface and groundwaters, and the role of groundwater processes in determining catchment response to management changes. They illustrate the value of catchment and groundwater modelling in providing improved predictions for the achievement of water quality targets. Finally in this group, Lázár *et al.* (2012) present an original study of the phytoplankton dynamics of the Thames system, the largest river catchment in the United Kingdom, explaining observed behaviour by reference to river flow and a range of other environmental controls. This work contributes to the process of river basin management planning implemented in response to the European Water Framework Directive and which requires the use of the best available science.

Catchment modelling of a range of types emerges in many of the papers, but four can be identified where modelling techniques are a primary focus. Alvisi *et al.* (2012) explore uncertainties in flood forecasts by comparing artificial neural network (ANN) and evolutionary polynomial regression (EPR) models using grey numbers, finding in their trial on the Tiber River in Italy that ANN performance exceeds that of the EPR model with increasing lead times. Adeloye & Rustum (2012) similarly find favour in an ANN approach, in a water resources study in Nigeria where exceptionally large uncertainties arising from a very sparse river flow gauging network can be compensated for, to some extent, by the use of longer rainfall records, and assist in enhancing the planning of water resources investments. A range of statistical models are reviewed by Harvey *et al.* (2012) to develop a new strategy for selecting appropriate methods for the routine infilling of gaps in national river flow data sets, offering a means of enhancing the utility of national archives. By contrast, Ewen & O'Donnell (2012) present a novel method for determining the prediction intervals in flood models, guided by raw error containment thresholds. These authors suggest their work is at a pre-operational stage, but is ultimately intended to offer a means of generating more robust modelling in future.

A set of three papers is primarily concerned with **flood risk assessment and management**. Stewart *et al.* (2012) explore the meteorological and hydrological rarity of the exceptional Cumbria flooding of 2009 using a new rainfall depth-duration-frequency model for the UK. The event established a new 24-hour rainfall record for the UK and provides an excellent opportunity for application of the new method. Faulkner *et al.* (2012) outline a method for overcoming the problem of hydrological and flood routing models providing differing flood flows in a single scenario.

doi: 10.2166/nh.2012.101

The opportunities worldwide for applying such an approach are numerous and the authors present their proposals as an iterative advance in addressing a long-established problem. The case study by McEwen & Jones (2012) addresses a very different dimension to flood science, by exploring the contrasts in understanding of flood risk in a given location between experts and local residents. Greater recognition of the complementarity of different perspectives can only help in future flood risk management.

The paper by Parry *et al.* (2012) stands alone to some extent in focusing primarily on **drought and water resources**, though the theme of climate change does link it with some of the other papers. Their work emphasises the importance of spatial and temporal variability in catchment characteristics and meteorological conditions in explaining the differences between three contrasting major European 20th century droughts. An appreciation of these differences is essential when reviewing model calibration and forecasting the hydrological effects of future droughts.

The paper by Ireson *et al.* (2012) shares a **groundwater** focus with several of the other papers, but focuses primarily on the distinction between non-preferential and preferential fracture flow in the chalk of the Thames basin. Using borehole data, the authors suggest there is a limit to the depth to which preferential flow may extend, presenting ramifications for the assumptions made in groundwater modelling.

Finally, two papers focus on **earth observation** techniques for supporting hydrological studies. Sandells *et al.* (2012) use snowpack and soil moisture models to develop an assessment of the remote sensing requirements of future satellite missions needed to provide estimates of real-time catchment storage. Model choice, parameterisation and coupling are shown to affect the results of the assessments, and are evaluated with reference to high quality field data from Reynolds Mountain, Idaho. Also in the pre-operational stage, Zhu & Cluckie (2012) investigate the effects of dual polarisation radar on operational flood estimation. Again, system performance was assessed using a variety of model structures in order to arrive at a recommendation for future applications, with the study having been conducted using a radar on the margins of the UK's largest centre of population.

While the papers address a considerable diversity of objectives, there are significant commonalities also. The majority of papers are built around the development or evaluation of one or more types of hydrological models, but also take advantage of contemporary understanding of hydrological processes and the latest advances in monitoring surface water, ground water and (using remote sensing) near-surface water in soils and snowpacks. Applications to water management are explicit or implicit in all of the papers. The drivers underpinning the work extend from flood risk to water resource management, and from European Directives to the needs to better manage hydrological archives.

The papers collectively reflect many of the themes and priorities of the British Hydrological Society (BHS). Like many other national hydrological associations, BHS seeks to promote hydrological knowledge exchange not only among researchers but also among practitioners and water resource managers, and between members of these groups. Accordingly, while the majority of the authors are from universities and research institutes, some are also from the consultancy sector and from government bodies and add to the breadth of perspectives presented. The authors are well spread internationally too, given the UK focus of the meeting, with Syria, Italy, Ireland and the USA all represented, adding to the richness of the papers. All the papers are multi-authored, reflecting the dominance of collaborative or team approaches to research.

The Guest Editors would like to acknowledge the invaluable contributions of all the reviewers involved in the preparation of these papers, and the consistently helpful guidance and support of the Editor (BHS), Dr Ian Littlewood.

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