Editorial

Steve B. Mitchell PhD, CEng, MICE, MCIWEM
School of Civil Engineering and Surveying, University of Portsmouth, UK

With autumn well and truly underway in the UK, we can all have sympathy for those affected by hurricanes, flooding and coastal problems. The challenges for water infrastructure and its planning, operation and maintenance is clearly an ongoing part of the daily to-do lists of civil engineers, and whatever the policy directions with regard to infrastructure and investment, the demand for knowledge and understanding is still as strong as ever. The work undertaken by researchers and practitioners to share this knowledge in the Institution of Civil Engineers (ICE) journals is vital to such efforts and ensures that the benefits are passed on to students and other researchers, as well as designers, contractors and local authorities. The present issue contains a further set of peer-reviewed articles that draw on a range of current theories and cover a range of topics, though the focus on detailed open-channel hydraulic models of one sort or another in this issue is striking, and points to the importance of revisiting our understanding of essential elements of flows in drainage and river management, and also shows the considerable advantages of modern instrumentation and software compared with even just a decade ago.

However, the issue opens with the only article unrelated to open channels. In their paper, Margeta and Đurin (2017) focus on a multi-criteria approach to the use of photovoltaics for water-pumping systems in urban areas. The notion of the ‘critical period’, representing the length of time for which pumping is required, is shown to be of particular importance in assessing the sustainability of a solar-powered option. Arguments of this kind can be used to estimate the size and cost of the infrastructure required for any such scheme and can be of use in efforts to promote their political and social acceptability. The novelty of this article lies in the extent to which it accounts for the complexity of the problem related to uncertainties in both solar radiation and water consumption. The authors’ focus on economic constraints reflects the importance of the multi-criteria approach in which a range of complex factors are taken into account. A similar set of constraints is reflected elsewhere (e.g., Sullivan and McCombie, 2013) and reinforces the view that for any renewable scheme the challenge is to find the most sustainable option; that is, just because the emissions are low it does not necessarily follow that all sustainability criteria have been addressed. The authors also admit that work is always needed to address local factors; their own case study in the Mediterranean region does not necessarily translate to colder and wetter climates with less tourism. This is nevertheless a useful study that will doubtlessly be built on as we get to grips with the need to adjust to ever more stringent emissions targets.

The first of the three articles on open-channel flows relates to the issue of flow control over sharp-crested weirs, and here Vatankhah and Khalili (2017) address the problem of such a device for measuring flows in a circular channel. This is a good example of a paper dealing with accurate experimental data and how to analyse them, and gives a good description of experimental outcomes in flow measurement. The point is well made that the discharge coefficient C_d for a circular channel depends on the value of h/P , where h is the water level over the crest and P is the height of the crest relative to the channel invert, and that a numerical method can be used to show there is a minimum value of C_d for an h/P of approximately 0.35. Such an approach is useful where accurate measurements of flow rate are required for irrigation and water treatment schemes.

We then move on to the case of flow modelling in the Yangtze, China, in which Huang *et al.* (2017) highlight progress in their one-dimensional model of this complex and highly industrialised section. Building on a long history of the successful application of models of this type, a one-dimensional approach seems entirely appropriate where the channel is long and contains a large number of branches. More sophisticated approaches using two- and three-dimensional modelling are appropriate, but are computationally intensive and require more data to calibrate them. Furthermore, interventions such as the Three Gorges Dam have in recent years altered the flow regime considerably. The approach is also suitable for cases such as this where the influence of flood storage reservoirs is under investigation. The importance of this system of large river channels means that a large data set is available to validate the model, and shows that at this large scale an approach of this type is both reasonable and highly useful. By way of an illustration, the authors show how the model is used to simulate a large and long-lasting flood event, allowing the effects of different flood risk management strategies to be assessed. It is possible to reflect on the use of such approaches to simulate any large fluvial flooding event and the engineering infrastructure intended to counter its effects.

Finally, and also in China, Wang *et al.* (2017) discuss back-water effects associated with the presence of bridges under various flow conditions. This is an interesting and useful study of the effects of multiple flow-confining structures on the nature of the flow regime in a large river, and builds on some work originally carried out by Yarnell (1934) while he was working for the US Department of Agriculture. One of the main findings is to do with the minimum desirable distance

between bridges that is required to ensure that any compound effects of bridge piers is minimised. Their use of a large physical model has yielded some valuable data that form the basis of this study. There is a clear need for studies of this type where increasing demands for infrastructure (bridges in this case) cause fresh challenges when coupled with the effects of global climate change (more and worse fluvial flooding). The implied need for resilience in urban civil engineering and its planning is a theme that has received increasing attention lately (e.g., Dijkstra *et al.*, 2014)

In all of these studies, there is a clear emphasis on detailed investigation and interpretation, often involving the synthesis of large amounts of data into graphical output, and building on peer-reviewed work carried out by others in the field, often carried out decades previously. The levels of precision in measuring and recording coupled with the ability to store large amounts of data for subsequent analysis mean that it is now possible to achieve significant advances in old problems, ultimately yielding better designs. Reading this issue will, I hope, provide encouragement and stimulate discussion among your networks and co-workers. I and other members of the Editorial Advisory Panel would like to encourage you to contribute data and interpretation from your own experiences of working or researching in the water sector. Please do consider submitting an outline to one of the Panel members; full details of how to do this are available on the journal's home page. Each article also contains a note about how you can

contribute a discussion on that article, perhaps building on it using previously unpublished data, and these are also welcome.

REFERENCES

- Dijkstra T, Dixon N, Crosby C *et al.* (2014) Forecasting infrastructure resilience to climate change. *Proceedings of the Institution of Civil Engineers – Transport* **167**(5): 269–280, <http://dx.doi.org/10.1680/tran.13.00089>.
- Huang G, Zhou J, Lin B, Xu X and Zhang S (2017) Modelling flow in the middle and lower Yangtze River, China. *Proceedings of the Institution of Civil Engineers – Water Management* **170**(6): 298–309, <http://dx.doi.org/10.1680/jwama.15.00123>.
- Margeta J and Đurin B (2017) Multi-criteria approach in solar urban water supply systems. *Proceedings of the Institution of Civil Engineers – Water Management* **170**(6): 273–286, <http://dx.doi.org/10.1680/jwama.16.00010>.
- Sullivan P and McCombie P (2013) Optimisation of tidal power arrays using genetic algorithm. *Proceedings of the Institution of Civil Engineers – Energy* **166**(1): 19–28, <http://dx.doi.org/10.1680/ener.12.00011>.
- Vatankhah AR and Khalili S (2017) Sharp-crested weir located at the end of a circular channel. *Proceedings of the Institution of Civil Engineers – Water Management* **170**(6): 287–297, <http://dx.doi.org/10.1680/jwama.16.00032>.
- Wang H, Tang H, Xu X, Xiao J and Liang D (2017) Backwater effect of multiple bridges along Huaihe River, China. *Proceedings of the Institution of Civil Engineers – Water Management* **170**(6): 310–321, <http://dx.doi.org/10.1680/jwama.16.00003>.
- Yarnell D (1934) *Bridge Piers as Channel Obstructions*. US Department of Agriculture, Washington, DC, USA.