

Editorial

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This issue of *Water Management* includes four papers that cover a broad range of topics, from the analysis of weather extremes to three-dimensional hydrodynamic modelling. Such a variety of topics reveals the undeniable complexity that characterises the management of water on Earth. In this respect, identifying the correct scenarios for extreme rainfall events (Darch *et al.*, 2016) and the deterministic or chaotic behaviour of hydrological processes (Kędra, 2016) is tightly related to the optimal design of reservoirs (Celeste, 2016) and, at a more detailed scale, to the interaction between hydrodynamics and sedimentation that can strongly affect the management of shallow reservoirs (Esmaeili *et al.*, 2016).

The first paper (Darch *et al.*, 2016) analyses the use of UK climate projections (UKCP09) weather generation (WG) to infer changes in the magnitude of short-duration extreme rainfall events. The problem is undoubtedly relevant as the UK experienced a two-fold increase in the magnitude of extreme rainfall events in the last 50 years, and UKCP09 projections show a further increase in rainfall and extreme events in winter. With the goal of defining meaningful weather series and to analyse their possible variations, WG can be used as a form of statistical downscaling. Two methodologies are proposed for this kind of analysis: (1) the definition of design storms for events of varying duration and frequency; and (2) the time series method to select a manageable number of WG series to be used as an input for data- and time-intensive models, for instance for flood risk modelling. The proposed methodology contributes to define reliable scenarios with important practical applications, and can be particularly useful for the design of urban drainage and sewer systems.

In the second paper (Kędra, 2016), the non-linearity in the response of hydrological systems is discussed considering the daily discharge of the Krzyworzeka Stream (Poland) as a case study. The author shows how it is possible to assess the nature (deterministic versus stochastic) of the process by means of a combination of different methods. Two standard linear (autocorrelation function, ACF, and Fourier analysis) and two non-linear ('averaged false neighbours', AFN, and '0–1 test') methods were applied to the data relative to the Krzyworzeka Stream, and to three other synthetic test cases (periodic signal with noise, white noise and red noise). The analysis of the results of the four methods allows for clearly identifying the nature of the four time series, and in particular to show that the measured discharge of the Krzyworzeka Stream was deterministic, but with chaotic dynamics. Such a conceptual framework may be used to quantitatively measure the relative degree

of deterministic behaviour and of random features in hydrological and other geophysical processes, thus supporting the choice of the most adequate predictive model.

The third paper (Celeste, 2016) analyses some methods for reservoir design optimisation (RDO), which are used to avoid iterations in the sizing problem. The methods traditionally used for the optimal design of reservoirs cannot explicitly handle the overflows and may cause overflows to occur when the storage is not at capacity. In this paper, the author proposes two RDO formulations that are able to prevent unnecessary spills, discussing also some technical details of the implementation, and highlighting strengths and weaknesses of the different solutions.

The fourth paper (Esmaeili *et al.*, 2016) represents a shift towards a more hydrodynamic problem and is concerned with the analysis of the flow field in shallow reservoirs. Thus, it investigates a different aspect of reservoir management; while the previous contribution by Celeste aimed at optimising the volume of a reservoir, Esmaeili and co-workers look at the details of the three-dimensional (3D) processes that occur in shallow water bodies. In their paper, they propose a numerical approach to interpret experimental tests previously performed in the EPFL laboratory (Lausanne, Switzerland). They exploited the Sediment Simulation In Intakes with Multiblock (SSIIM) code, developed at the Norwegian University of Science and Technology (Trondheim, Norway) to solve the 3D flow field and characterise the main hydrodynamic properties, and especially those that could be important for flood risk management and affect sediment transport and deposition. They found that, depending on the bed configuration, both symmetrical and asymmetrical flow patterns can originate, giving rise to different jet trajectories and recirculation zones. Although the work is mainly theoretical, important applications can be obtained following the approach proposed by the authors, concerning both management issues and increased flushing efficiency. Indeed, numerical models are becoming powerful tools to study real cases, but the reader should keep in mind that the uncertainty in the results of coupled hydrodynamic–morphological evolution can be relatively large. In this regard, coupling numerical exercises and laboratory experiments, as in this paper, still represents a valuable approach to validate model results.

All four papers in this issue present interesting aspects that will surely attract the readership of *Water Management*. They also open the possibility of a debate on these topics, and further

comments or original contributions are welcome in this journal.

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