

## **Keynote Paper**

# **Harnessing hydrological systems knowledge for improved water resource management in water stressed cities such as Singapore**

**VLADAN BABOVIC & RAGHURAJ RAO**

*SDWA, Department of Civil Engineering, National University of Singapore, EW1(Annex)-02, Engineering Drive 2, 117576 Singapore*

[cvebv@nus.edu.sg](mailto:cvebv@nus.edu.sg); [cverr@nus.edu.sg](mailto:cverr@nus.edu.sg)

**Abstract** Many water-stressed countries, such as Singapore, need to efficiently manage their resources. The reservoir system often needs to operate optimally, catering to multiple demands within many operational constraints. Suitable solutions are usually quite complex and call for holistic approaches combining the systems knowledge of the various hydrological and hydrodynamic processes involved. The governing mechanisms and their interactions are often complex and are not easily described by simple numerical models. With the increasing availability of stored data on each of these processes, data-driven techniques provide additional support in understanding these processes. A unified multi-reservoir management framework is suggested and various possible uses of different hydroinformatics techniques are outlined. Specific applications of model emulation and data assimilation using genetic programming techniques are illustrated with representative examples. The advantages of using these computationally efficient techniques are highlighted.

**Key words** hydroinformatics; data mining; genetic programming; data assimilation