Editorial: Current water challenges require holistic and global solutions

The world population is exploding and is estimated to reach 9.8 billion within the next 10 years (Gerland *et al.* 2014). Desire for more convenient lifestyles is not likely to be satisfied (United Nations 2009). Such lifestyles entail the unsustainable exploitation of water resources and the environment (Vitousek *et al.* 1997). Advanced technology and transportation systems have enabled the transfer of goods across the world and, eventually, also the water that is used to produce them. This means that luxurious lifestyles on one side of the planet can cause water and food scarcity on the other side (Hoekstra & Mekonnen 2012). We are also witnessing drastic global climate change: sea levels are rising, and droughts and floods have become more intense. These have exacerbated the global water and food crises (Vörösmarty *et al.* 2000; Hanjra & Qureshi 2010). Our generation's water challenge is no longer a local or isolated issue. It must be recognized, understood, and analyzed from a holistic and global perspective (Wagener *et al.* 2010). As such, the growing complexity of global water challenges requires better collection and analysis of ever increasing data with equipping smart techniques that can handle and interpret those vast information.

Given this context, the 12th International Conference on Hydroinformatics 2016 (HIC 2016) held in Incheon, Korea, was a fantastic platform to discuss comprehensive solutions to the water problems of this era. A total of 566 water experts from 45 countries presented 362 studies under a variety of themes, encompassing smart water issues, application of big data and IoT for water solution, sustainable water management, advanced research for surface water modeling, climate change studies with hydroinformatics, urban development and total risk assessment, advances in physically-based modeling, data-driven modeling, and soft computing and optimization, and other specialized topics.

This special issue contains the extended version of the articles that were presented at HIC 2016. To maintain a balance between the nine themes of the conference, we invited an equal number of articles from each of the themes to be submitted for this special issue, with a total of 45 invitations. For this, five anonymous water experts of Korea reviewed all articles submitted for the conference. We received 15 submissions among the invitations. Nine of those articles are published here. Following are brief remarks on each of them.

Two of the articles focus on the optimal management of water distribution networks. Berardi *et al.* (2018) demonstrated that their novel remote real-time control system of the water distribution network can significantly reduce background leakages compared to traditional approaches. De Marchis *et al.* (2018) reported that connecting private tanks to the water distribution network causes a significant initial supply load to the system. To precisely predict the system's behavior with private tanks in the network, a model for the pressure-discharge relationship of private tanks is necessary. The authors established this relationship through experimental analysis.

Further, two other studies applied cutting edge hydrodynamics models to enhance our understanding of flow in river channels. Park & Song (2018) employed a two-dimensional numerical flow model and identified that the pollutant trap existing in the lower reaches of the Han River in Korea is caused by reverse flow, which is induced by tidal mixing. Hou *et al.* (2018) developed a GPU-based two-dimensional hydrodynamic model that can simultaneously simulate river flow and river bed evolution. They found that the risk of floods in their study area (the Bayangaole Reach of the Yellow River, China) may be reduced in the future because high flow is lowering the river bed elevation through scour.

Methods for improving the simulation of urban drainage systems were proposed in two of the articles. Rubinato *et al.* (2018) estimated floodplain-to-sewer interactions and flow conditions with ten different settings of circular inlets during urban flood events, through their two-dimensional finite difference model. Yoon *et al.* (2018) found that considering evapotranspiration significantly enhances the accuracy of simulated rainfall runoff partitioning, by using the low impact development (LID) component of the SWMM-5, a widely applied storm water simulation software tool.

Two of the studies are related to the field of watershed hydrology. One study assesses the influence of climate change, while the other study investigates the influence of spatial variability of rainfall. Lee & Bae (2018) showed that, in some test watersheds in Korea, projected dam inflow can vary significantly based on different methods of downscaling climate change scenarios and hydrologic models. Therefore, an appropriate multi-model ensemble approach should be employed to develop reliable water resource plans. Zhang

et al. (2018) analyzed the influence of spatial variability of rainfall in rainfall-runoff modeling. They found that the coefficient of variation and Moran's I can be good indicators to describe the spatial variability of rainfall, and that the performance of hydrologic models decreases as spatial variability increases. They assert that the use of distributed models is essential to reduce the errors caused by the spatial variability of rainfall.

Lastly, one study is in the field of ecohydrology. Choi *et al.* (2018) investigated the relationship between reach-scale channel configurations and aquatic habitat diversity, based on nine sets of aerial photos taken between 1948 and 2012. They suggest that braided-sinuous and bifurcated-sinuous patterns of river channels were the most diverse and rich aquatic habitats among all the considered reach-scale channel configurations.

As reflected by the diversity and depth of the articles published here, the society of hydroinformatics is an important gathering of water specialists, capable of resolving a vast range of water challenges. Significantly more can be achieved through cooperation and synergy among diverse disciplines. Let's communicate more, get together more, and solve more water problems to save humans and the environment from water crisis!

Dongkyun Kim

Department of Civil Engineering, Hongik University, Seoul, Korea

E-mail: *kim.dongkyun@hongik.ac.kr*

Hyunhan Kwon

Department of Civil Engineering, Chonbuk National University, Jeonju, South Korea

Orazio Giustolisi

Department of Civil Engineering and Architecture, Technical University of Bari, via Orabona n.4, 70125 Bari, Italy. Editor in Chief, *Journal of Hydroinformatics*

Dragan Savic

University of Exeter, Centre for Water Systems, Harrison Building, North Park Road, Exeter EX4 4QF, UK. Editor in Chief Emeritus, *Journal of Hydroinformatics*

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