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Preface for special section on flood modeling and resilience

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Climate change has led to increased frequency, intensity, and duration of extreme weather events, e.g., intense rainfall, heat waves, droughts, and storm surges, worsened by rapid population growth and urbanization at the global scale. Evidence can be found in the exceptional number of unprecedented weather extremes and the resulting natural hazards, especially flooding, as seen in the last few decades. For example, the UK has experienced numerous storms and severe floods in the last decade, particularly in 2007, 2012, and 2015, with 2012 being recorded as the second wettest year in the UK and the wettest ever in England. These events have resulted in lives lost and tremendous economic damage. The UK is not alone. Similarly unusual weather events have been reported across the globe. In China, different types of flooding threaten 1/10 of the country's total area, millions of hectares of farmland, and over 100 large cities, making it one of the most vulnerable countries to flooding.

With increasing pressure from climate change and rapid urbanization, mitigating flood impacts and boosting resilience against flooding have become challenges, and important goals, for the governments, stakeholders, and wider communities at different levels in the UK, China, and the rest of the world. Resilience and long-term sustainability of traditional *hard* engineering solutions to flooding are becoming increasingly questionable when reconciling future increases in risk against the costs of maintaining current levels of protection, among many other shortcomings. There is an urgent need to incorporate more flexible and adaptable measures (e.g., by implementing natural flood management schemes in catchments and developing *sponge cities*) to improve resilience and reduce the vulnerability of our communities to flooding and other natural hazards. Modeling has become a useful tool for facilitating the management of flood risk and the development of flood resilience strategies.

In view of the challenges and research needs, the Workshop on Catchment Systems Management and Flood Resilience (CSMFR 2015) was held from May 31 to June 5, 2015 at Hohai University, in Nanjing, China. Researchers from the UK, China, and other countries attended this workshop to discuss the key research challenges in flood modeling and resilience in both countries and promote research collaboration. Following the workshop, a call for a special section in *Water Science and Engineering* was issued to welcome submission of papers broadly related to flood modeling and resilience. All of the submissions have gone through the full peer review process as required by the journal. Seven papers are presented in this special section. The main content of the papers is summarized below.

Hou et al. (2017) present a new dynamic Cartesian grid system for inundation modeling using a Godunov-type finite volume shallow water equation solver. The grid system allows automatic refinement to capture the advancing wet-dry fronts, leading to improved computational efficiency without compromising solution accuracy. Adopting a different approach to achieve efficient flood modeling, especially in complex urban environments, Özgen et al. (2017) consider porous shallow water equations (PSWEs), which take into account the influence of sub-grid features, e.g., buildings, on numerical solutions. They analyze the differences in wave propagation speeds of two different formulations of PSWEs, one formulated with a single porosity term (SP model) and the other featuring two porosity terms, known as the integral or anisotropic porosity model (AP model). In the paper by Zhao et al. (2017), two different mathematical models are compared for the simulation of dam break flow over movable beds. The presented models respectively solve the fully coupled formulation of shallow water equations with erosion and deposition terms (an averaged concentration flux model), as well as shallow water equations coupled with the Exner equation

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(bed-load-flux model) using a second-order cell-centered finite-volume Godunov-type scheme. Moving to coastal hydrodynamics, Wang et al. (2017) introduce an edge-wave model based on the numerical solution to the extended Boussinesq equations, and use it to investigate the nonlinear properties of standing edge waves. In terms of model application, Lai and Wang (2017) use a hydrodynamic model to predict flood processes and investigate the effects of the fully operating Three Gorges Dam on the flood risk in the middle and lower reaches of the Yangtze River. Yang et al. (2017) investigate the sediment distribution and morphology of the Yellow River Estuary (YRE) following the implementation of the Water-Sediment Regulation (WSR) scheme. This special section is further complemented by Li et al. (2017), who investigate the effect of urban vegetation cover on rainfall-runoff process in the arid areas of China through physical experiments.

Finally, we would like to acknowledge the support provided by Hohai University for holding CSMFR 2015 and sincerely thank all the authors and reviewers for their contributions to this special section. We hope the readers enjoy these papers and find them useful in their research.

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