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EDITORIAL

Preface

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This special issue focuses on the latest advances in the study and prediction of shallow flows using state-of-the-art experimental, field and numerical investigation methods. Shallow flows have a multitude of oceanic, atmospheric, limnologic and engineering applications. In particular, understanding and predicting shallow flows and related transport and dispersion of heat, sediment and contaminants as well as fluid-driven ecological processes are very important in a wide range of environmental problems at various scales. Shallow flow approximations are also common in studying stratified flows, in particular, stratified wakes, katabatic flows and gravity currents, since the aspect ratio of such flows become large due to inhibition of vertical scales by stable stratification. In many shallow aquatic environments, the interactions among flow, turbulence, vegetation, macroinvertebrates and other organism as well as the transport and retention of particulate matter, have important consequences on the ecological health of rivers, marshes and coastal areas. Given the vast applications of shallow flows, I hope that this special issue will become a main reference for scientists interested in shallow flows and their applications.

The literature on shallow flows has grown into an active research field over the last two decades. This was one of the main reasons for the International Association of Hydraulic Research to initiate a symposia series focusing on shallow flows under the leadership of late Prof. G. Jirka. All but two of the 14 contributions in this special issue are based on papers presented at the 3rd International Symposium of Shallow Flows (ISSF) held in Iowa City during June 2012. In putting together this special issue, we invited contributions focusing on fundamental physics and development of better analytical models with special applications to natural flows.

The topics in this special issue span a wide range of shallow flow issues, including propagation of vortices, mixing layers, wakes and jets, stratified environments, ecological aspects (e.g., algal blooms) and transport of contaminants and sediments in estuaries and shallow lakes. The contributions emphasize the use of state-of-the art experimental and eddy resolving

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numerical techniques as main tools to investigate large-scale quasi two-dimensional coherent structures and their role in the transport of mass, heat and contaminants in the environment. Perhaps the most exciting progress over the past decade was the development of experimental techniques that can be used to study unsteady dynamics and structure of shallow flows in the field. As such, several of the contributions report on innovative field and laboratory instrumentation. In parallel, the development of large-eddy-simulation based techniques that can be applied at field conditions provide a powerful tool to investigate the physics of both canonical shallow flows as well as complex shallow flows in natural environments, to understand interaction between the quasi two-dimensional turbulent eddies and bottom friction and to quantify scale effects between laboratory and field conditions.

I would like to thank the editor of Environmental Fluid Mechanics, Prof. H.J. Fernando, with whom I had the pleasure to co-organize the 3rd ISSF symposium, for his continuous support for publishing this special issue. Many of the papers in this special issue relate to areas of shallow flows research in which Prof. Jirka made significant contributions. I hope he would have been pleased with the scientific level of the 3rd ISSF symposium and of this special issue. Finally, we would like to extend our gratitude to all the authors and reviewers for their contributions as well as to the Springer staff for their assistance throughout various stages of the publication process.