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Third international symposium on shallow Flows

THIRD INTERNATIONAL SYMPOSIUM ON SHALLOW FLOWS IOWA CITY, USA, JUNE 4-6 2012

BY GEORGE CONSTANTINESCU

The International Symposium on Shallow Flows (ISSF) series of symposia was established by the (then) International Association of Hydraulic Research (IAHR). ISSF is the key international meeting in the area of shallow flows. The meeting is held every 5-6 years and attracts scientists and engineers interested in understanding fundamental physics of shallow flows as well as in applications of shallow flows in diverse areas including geosciences, coastal and river engineering, eco-hydrology and atmospheric dynamics.

The 3rd ISSF symposium was organized for the first time in the U.S. by the University of Iowa and the University of Notre Dame. The Symposium is co-organized by IIHR-Hydroscience and Engineering of the University of Iowa (Convener: George Constantinescu) and by the Department of Civil Engineering and Geosciences at the University of Notre Dame (Co-Convenor: H.J.S. Fernando). The meeting was co-sponsored by the US National Science Foundation (NSF), the American Society of Civil Engineers (ASCE-EWRI) and the American Geophysical Union (AGU). The 3rd ISSF symposium was the first in the series to introduce ecological aspects and large scale geophysical flows as main topics. A special session honoring the contributions of the late Prof. G. Jirka was organized as part of the symposium.

Shallow flows are important in many applications in water and air environments. Major advances are underway in gaining insights into the dynamics of shallow flows using state-of-the-art experimental (e.g., particle image velocimetry) and numerical (e.g., highly resolved direct numerical simulation, large eddy simulation, large-scale predictive models) techniques. In particular, these advances should allow for better understanding of the role played by the quasi-2D large-scale coherent structures and the interactions between these large scales and three-dimensional turbulence; the degree of non-uniformity of shallow flows in the vertical direction and the role of vertical motions; and the effect of the large-scale turbulence on bottom friction and morphodynamic processes. Shallow water models are routinely used for coastal construction activities as well as to aid risk assessment.

Three of the most important and imminent challenges in shallow flow research are understanding to what extent the physics of these flows is dependent on scale effects; how the physics changes between the simpler geometries studied in the laboratory in controlled environments or using eddy resolving simulations; and how understanding of shallow water flows and their interaction with natural elements can culminate to better predictive models. Another challenge is the use of this detailed information on processes and mechanisms to develop accurate simpler analytical models that can help understand global quantities characterizing the spatial and temporal development of these flows. As in nature, shallow flows occur most often over alluvial beds, the investigation of morphodynamics processes in shallow flows was another major focus area of the symposium. In many shallow aquatic environments, the interactions among flow, turbulence, vegetation, macroinvertebrates and other organisms, as well as the transport and retention of particulate matter, have important consequences on the ecological health of rivers and coastal areas. Large scale atmospheric flows are also often analyzed using shallow water theory, and hence will be of particular interest in the symposium. The main themes of the symposium reflected these areas of active research in shallow flows:

1 Laboratory and eddy resolving (DNS, LES) numerical investigations of fundamental physical processes and transport mechanisms in shallow mixing layers, wakes, jets and open channels
2 Experimental and numerical investigations of transport of heat, solutes and pollutants in canonical shallow flows or simplified geometries
3 Field studies and numerical investigations of shallow flows at field conditions and/or in realistic geometries.
4 Experimental and numerical aspects of sediment transport and morphodynamics in shallow flows
5 Shallow flows and stratification
6 Ecological aspects of shallow flows
7 Engineering applications of shallow flows (more applied experimental and numerical–RANS modeling- studies)
8 Shallow flow models for prediction of flood related phenomena
9 Analytical modeling of shallow flows
10 Innovative field and laboratory instrumentation for the study of shallow flows

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About 200 abstracts were originally submitted and after preliminary selection about 170 full papers were submitted and presented in four parallel sessions. Six recognized international experts in shallow flows presented plenary talks, focusing on broader applications of shallow flows for environmental problems. Additionally, six invited keynote lectures were presented by leading world scientists in different areas of shallow flow research. An important public education objective was to take advantage of the meeting to increase awareness of the importance of shallow flows for the society.

The 3-day program was attended by close to 140 participants from 23 countries. Among them close to 50 were graduate students. The 3rd ISSF Proceedings were published on a CD-ROM. The CD-ROM will be available free of charge of IIHR members via the IIHR website starting in 2014. A special issue of the Environmental Fluid Mechanics journal will contain several review papers on important aspects of shallow flows as well as extended versions of papers presented during the ISSF symposium. We think the special issue has the potential to become a main reference for scientists interested in shallow flows and their application in the environment.