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EDITORIAL

Preface

Recent advancements in urban flow research

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This special issue is a collection of original papers on urban flows, a topic that has received a great deal of attention in the latest 20 years or so, given its relevance to the management of urban environments that directly impacts urban quality of life.

The relationship between core disciplines of environmental fluid mechanics and urban flows has become more and more evident in connection with emerging themes linked to rapid urbanization of the world. In 2001, Fernando et al. [1] initiated a new focus area namely: urban fluid mechanics (UFM) aimed at researching issues relevant to urban flows (e.g., transport phenomena and air and water quality and health issues). Since then large progress has been made in the field especially through the realization of "urban experiments" in the US, in Europe and in Asia [2–5]. These experiments showed that multi-scale flows occurring in the urban boundary layer (from street canyon to city scale and beyond through the neighbourhood scale; from the roughness sub-layer through the canopy layer, the mixed layer to the free atmosphere) are intimately connected to the heterogeneity of the urban texture that arises due to shapes and distribution of building, material usage and land cover. The developments have shown that full-scale experimental investigations need to be combined with carefully designed laboratory experiments, theoretical analysis as well as numerical modelling [6]. Connecting results from these analyses translates into our ability to model and forecast. The current challenge is to find bridges between our understanding of basic flow phenomena at different scales and their integrative modelling. Since weather forecast models still grapple with full representation of urban environments and that the success of operational dispersion models depend upon detailed knowledge of fine-scale flow, the scientific community is called upon to respond to a host of challenging questions.

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This volume was motivated by the willingness of the UFM community to encapsulate their salient work in one volume, and the editors have selected a number of papers representing UFM research groups across several geographic regions worldwide. Although far from being exhaustive, papers in this collection form a snapshot of current understanding of the fluid mechanics of urban flows.

Specifically, this issue is composed of 11 high-quality scientific papers authored and reviewed by preeminent scientists. Ten are original research papers and the latest article is a summary of findings presented at the first symposium on UFM hosted by an ASME Conference, held in Chicago (IL) in early August 2014.

Six of the papers presents novel interpretations of results from experimental investigations of flow and turbulence characteristics in either full scale (Klein and Galvez; Barlow et al., Leo et al.), including simplified geometries (Zaijc et al., and Roth et al.) or in the laboratory (Pardyjak et al.). Emphasised are new scaling laws that can be used in operational flow and dispersion models or in cases where a careful representation of urban boundary layer deemed necessary.

Four papers show recent advancements using numerical simulations. Large eddy simulations have been used to investigate transport processes in street canyons (Li and Britter) and to analyse complex flow structures due to spatial inhomogeneities in real urban morphologies (Park et al.). Conversely, Monti et al. and Martilli et al. used numerical investigations to study the effect of heterogeneities of urban *features* (thermal properties and building morphology) within mesoscale models.

It is our hope that this special issue will stimulate new research and provide further emphasis for phasing challenges in this fascinating field.

In closing, as guest-editors of this special issue on *Recent Advancements in Urban Flow Research*, we wish to express our sincere gratitude to all the authors and reviewers for their invaluable contributions. We also wish to thank the editor-in-chief of *Environmental Fluid Mechanics*, Dr. H. J. S. Fernando, for suggesting the idea of this special issue and for his support during the editorial process.

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