

Günter Groß

Numerical Simulation of Canopy Flows



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Numerical Simulation Of Canopy Flows

Minjie Lin



Numerical Simulation Of Canopy Flows:

Numerical Simulation of Canopy Flows Günter Groß,1993-07-29 Starting with the description of meteorological variables in forest canopies and its parameter variations a numerical three dimensional model is developed Its applicability is demonstrated first by wind sheltering effects of hedges and second by the effects of deforestation on local climate in complex terrain Scientists in ecology agricultural botany and meteorology but also urban and regional planners will profit from this study finding the most effective solution for their specific problems *Numerical Simulation of Canopy Flows* Günter

Groß,2012-12-06 Starting with the description of meteorological variables in forest canopies and its parameter variations a numerical three dimensional model is developed Its applicability is demonstrated first by wind sheltering effects of hedges and second by the effects of deforestation on local climate in complex terrain Scientists in ecology agricultural botany and meteorology but also urban and regional planners will profit from this study finding the most effective solution for their specific problems *Numerical Simulation of Canopy Flows* Günter Groß,2011-12-21 Starting with the description of

meteorological variables in forest canopies and its parameter variations a numerical three dimensional model is developed Its applicability is demonstrated first by wind sheltering effects of hedges and second by the effects of deforestation on local climate in complex terrain Scientists in ecology agricultural botany and meteorology but also urban and regional planners will profit from this study finding the most effective solution for their specific problems **Large Eddy Simulations of Canopy**

Flows Over Complex Terrain Yulong Ma,2019 Forest canopies cover about 30% of the land surfaces some of which are hilly or mountainous Both complex terrain and forest canopies influence mean flow and turbulence playing a critical role in affecting momentum and scalar transfer Although recent advances have been made in numerical simulations of canopy flows few have been conducted over steep slope terrain and considered full sets of physical and physiological processes in sub canopy layers which greatly limits our understanding of canopy flows and scalar transfer To address this limitation we upgrade the Weather Research and Forecasting model with the large eddy simulations module WRF LES by incorporating the immersed boundary method IBM to improve the simulations over steep slope terrain In addition an advanced multiple layer canopy module MCANOPY is developed based largely on the Community Land Model version 4.5 and coupled with WRF LES to simulate sources and or sinks of momentum heat water vapor and CO₂ across multiple canopy layers Both IBM and MCANOPY are evaluated against field measurements demonstrating good performances compared with observations The updated modeling system i.e WRF LES IBM MCANOPY is then applied over a forest edge to investigate the effects of foliage distributions and scalar distributions on canopy flows and scalar transfer The results show that foliage distributions have a significant impact on the flow dynamics and scalar transfer mainly due to the sub canopy jet The scalar distributions affect the scalar field with the ground source being the most important The modeling system also simulates flows over forested hills Flow dynamics over a three dimensional hill show a different feature to those over a two dimensional hill where much large

turbulence structures are simulated in the lee of a three dimensional hill Simulations over different slope hills demonstrate significant impacts of slopes The lee side turbulence is enhanced as the hill slope increases A new flow feature is the nearly unvarying flow field within the canopy in the lee of a steep slope hill subjected to the influence of foliage distributions Our upgraded WRF LES IBM MCANOPY system has demonstrated promising capacities in many applications such as wind turbine siting wildfire propagation prediction and interpretation of eddy covariance data over complex landscapes

Numerical Simulation of Turbulent Flow and Microclimate Within and Above Vegetation Canopy Hao-Chi Cynthia Poon, 2017-01-26 **Numerical Simulation of Turbulent Flow and Microclimate Within and Above Vegetation Canopy** Hao-chi Poon (Cynthia), University of Hong Kong, 2010 Computational Wind Engineering 1 S. Murakami, 2014-06-28 The aim of this volume is to explore the challenges posed by the rapid development of Computational Fluid Dynamics CFD within the field of engineering CFD is already essential to research concerned with fluid flow in civil engineering and its further potential for application in wind engineering is highly promising State of the art papers from all over the world are contained here illuminating the present parameters of the field as well as suggesting fruitful areas for further research Eleven papers have been contributed by invited speakers outstanding in the fields of CFD and wind engineering This volume will serve as a vehicle to promote further development in computational wind engineering *An Analysis of Drag Coefficient at Hurricane Windspeeds from a Numerical Simulation of Dynamical Water Level Changes in Lake Okeechobee, Florida* Robert E. Whitaker, Robert O. Reid, Andrew C. Vastano, 1975 **Coherent Flow Structures at Earth's Surface** Jeremy G. Venditti, James L. Best, Michael Church, Richard J. Hardy, 2013-08-28 An expert review of recent progress in the study of turbulent flows with a focus on recently identified organized structures This book reviews the recent progress in the study of the turbulent flows that sculpt the Earth's surface focusing in particular on the organized structures that have been identified in recent years within turbulent flows These coherent flow structures can include eddies or vortices at the scale of individual grains through structures that scale with the flow depth in rivers or estuaries to the large scale structure of flows at the morphological or landform scale These flow structures are of wide interest to the scientific community because they play an important role in fluid dynamics and influence the transport erosion and deposition of sediment and pollutants in a wide variety of fluid flow environments Scientific knowledge of these structures has improved greatly over the past 20 years as computational fluid dynamics has come to play an increasingly important part in building our understanding of coherent flow structures across a broad range of scales Chapters comprise a series of major invited papers and a selection of the most novel innovative papers presented at the second Coherent Flow Structures Conference held August 3-5 2011 at Simon Fraser University in Burnaby British Columbia Chapters focus on six major themes Dynamics of coherent flow structures CFS in geophysical flows Interaction of turbulent flows vegetation and ecological habitats Coherent structure of atmospheric flows Numerical modeling of coherent flow structures Turbulence in open channel flows Coherent

flow structures sediment transport and morphological feedbacks

Small Scale Processes in Geophysical Fluid Flows

Lakshmi H. Kantha, Carol Anne Clayson, 2000-08-07 While ocean waves are the most visible example of oceanic mixing processes this macroscale mixing process represents but one end of the spectrum of mixing processes operating in the ocean. At the scale of a typical phytoplanktonic diatom or larval fish inhabiting these seas the most important mixing processes occur on the molecular scale at the scale of turbulence. Physical biological interactions at this scale are of paramount importance to the productivity of the seas fisheries and the heat balance that controls large scale ocean climate phenomena such as El Niño and tornadoes. This book grew out of the need for a comprehensive treatment of the diverse elements of geophysical fluid flow at the microscale. Kantha and Clayson have arranged a logical exposition of the various mixing processes operating within and between the oceans and its boundaries with the atmosphere and ocean floor. The authors' intent is to develop a volume that would provide a comprehensive treatment of the fundamental elements of ocean mixing so that students academics and professional fluid dynamicists and oceanographers can access this essential information from one source. This volume will serve as both a valuable reference tool for mathematically inclined limnologists oceanographers and fluid modelers. Simple models of oceanic and atmospheric boundary layers are discussed. Comprehensive and up to date review. Useful for graduate level course. Essential for modeling the oceans and the atmosphere. Color Plates.

Flow and Transport Processes with Complex Obstructions

Yevgeny A. Gayev, Julian C.R. Hunt, 2007-02-06 The NATO Advanced Study Institute Flow and Transport Processes in Complex structured Geometries from cities and vegetative canopies to engineering problems was held in Kyiv Ukraine in the period of May 4-15 2004. This book based on the papers presented there provides an overview of this new area in fluid mechanics and its applications that have developed over the past three decades. The subject whose origins lie both in theory and in practice is now rapidly developing in many directions. The focus of applied fluid mechanics research has steadily been shifting from engineering to environmental applications. In both fields there has been great interest in the study of flows around obstacles initially single isolated obstacles and then groups together with the effects of nearby resistive surfaces such as the walls of a pipe the ground or a free surface in hydraulics. Simplified theoretical analysis began with studies of axisymmetric and cylindrical free mounted bodies. However other methods had to be used for quantifying the complete flows past arbitrary bluff bodies either by using experiments or when powerful computers became available by direct calculation and solution of the full equations of fluid dynamics. In most practical cases the Reynolds numbers are too large to compute all the small scale eddy motions which therefore have to be described statistically.

Handbook of Environmental Fluid Dynamics, Volume Two Harindra Joseph Fernando, 2012-12-12 With major implications for applied physics engineering and the natural and social sciences the rapidly growing area of environmental fluid dynamics focuses on the interactions of human activities environment and fluid motion. A landmark for the field the two volume Handbook of Environmental Fluid Dynamics presents the basic principles fundamental flow processes modeling techniques and measurement methods used in

the study of environmental motions It also offers critical discussions of environmental sustainability related to engineering The handbook features 81 chapters written by 135 renowned researchers from around the world Covering environmental policy biological and chemical aspects it tackles important cross disciplinary topics such as sustainability ecology pollution micrometeorology and limnology Volume Two Systems Pollution Modeling and Measurements explores the interactions between engineered structures and anthropogenic activities that affect natural flows with particular emphasis on environmental pollution The book covers the numerical methodologies that underpin research predictive modeling and cyber infrastructure developments It also addresses practical aspects of laboratory experiments and field observations that validate quantitative predictions and help identify new phenomena and processes As communities face existential challenges posed by climate change rapid urbanization and scarcity of water and energy the study of environmental fluid dynamics becomes increasingly relevant This volume is a valuable resource for students researchers and policymakers working to better understand environmental motions and how they affect and are influenced by anthropogenic activities See also Handbook of Environmental Fluid Dynamics Two Volume Set and Volume One Overview and Fundamentals Scientific and Technical Aerospace Reports ,1992 28th AIAA Fluid Dynamics Conference, 4th AIAA Shear Flow Control Conference ,1997

Handbook of Environmental Fluid Dynamics, Two-Volume Set Harindra Joseph Fernando,2012-12-11 With major implications for applied physics engineering and the natural and social sciences the rapidly growing area of environmental fluid dynamics focuses on the interactions of human activities environment and fluid motion A landmark for the field this two volume handbook presents the basic principles fundamental flow processes modeling techniques and measurement methods used in the field along with critical discussions of environmental sustainability related to engineering aspects The first volume provides a comprehensive overview of the fundamentals and the second volume explores the interactions between engineered structures and natural flows **Footprints in Micrometeorology and Ecology** Monique Y. Leclerc,Thomas Foken,2014-06-17 How to interpret meteorological measurements made at a given level over a surface with regard to characteristic properties such as roughness albedo heat moisture carbon dioxide and other gases is an old question which goes back to the very beginnings of modern micrometeorology It is made even more challenging when it is unclear whether these measurements are only valid for this point region and precisely describe the conditions there or if they are also influenced by surrounding areas After 50 years of field experiments it has become both apparent and problematic that meteorological measurements are influenced from surfaces on the windward side As such extending these measurements for inhomogeneous experimental sites requires a quantitative understanding of these influences When combined with atmospheric transport models similar to air pollution models the footprint concept a fundamental approach introduced roughly 20 years ago provides us with information on whether or not the condition of upwind site homogeneity is fulfilled Since these first models the development of more scientifically based versions validation experiments and applications has

advanced rapidly The aim of this book is to provide an overview of these developments to analyze present deficits to describe applications and to advance this topic at the forefront of micrometeorological research Informatics, Networking and Intelligent Computing Jiaxing Zhang,2015-05-06 This proceedings volume contains selected papers presented at the 2014 International Conference on Informatics Networking and Intelligent Computing held in Shenzhen China Contributions cover the latest developments and advances in the field of Informatics Networking and Intelligent Computing **Quantifying and Managing Soil Functions in Earth's Critical Zone**,2017-02-18 Quantifying and Managing Soil Functions in Earth's Critical Zone Combining Experimentation and Mathematical Modelling Volume 142 the latest in the Advances in Agronomy series continues its reputation as a leading reference and first rate source for the latest research in agronomy Each volume contains an eclectic group of reviews by leading scientists throughout the world Five volumes are published yearly ensuring that the authors contributions are disseminated to the readership in a timely manner As always the subjects covered are varied and exemplary of the myriad of subject matter dealt with by this long running serial Includes numerous timely state of the art reviews on the latest advancements in agronomy Features distinguished well recognized authors from around the world Builds upon this venerable and iconic review series Covers the extensive variety and breadth of subject matter in the crop and soil sciences **Saturated Flow and Soil Structure** Heiko Diestel,2012-12-06 Soil and water pollution have a serious impact on the environment and soil scientists and hydrologists need fundamental help for the estimation of the consequences The experiments described in this volume deal with the quantification of the morphology of interaggregate voids and of the flow through such voids as well as around impermeable inclusions The diagrams given in the appendix can be used as references for such measurements This work is put into the context of the international literature on the subject An index and a glossary complete the volume The subject of this work is of great interest to hydrologists and soil scientists working on the estimation of the consequences of soil and water pollution **River Flow 2024** Iacopo Carnacina,Mawada Abdellatif,Manolia Andredaki,James Cooper,Darren Lumbroso, Virginia Ruiz-Villanueva,2025-04-28 River Flow 2024 features keynote lectures and contributed papers presented at the 12th International Conference on Fluvial Hydraulics held from September 2nd to 6th 2024 in Liverpool River Flow 2024 provides an overview of the latest experimental theoretical and computational findings on fundamental river flow and transport processes river morphology and morphodynamics It also addresses the impacts of hydraulic structures on flow regimes river morphology and ecology sustainable river engineering practices including stream restoration and re naturalization and the effects of climate change including extreme flood events Additionally the conference covers topics such as sediment pollutant and microplastic dynamics in rivers fluid mechanics numerical modelling and two phase flow monitoring techniques and artificial intelligence and natural flood management vegetation wood and river restoration River Flow 2024 aims to present ongoing and the state of the art in river research and engineering targeting academics and practitioners in hydraulics hydrology and environmental engineering Organized under

the auspices of the Committee on Fluvial Hydraulics of the International Association for Hydro Environment Engineering and Research IAHR the River Flow conference series has gained international recognition as one of the most reputable events in the fluvial hydraulics community attracting a large and loyal audience of river researchers and engineers Thanks to the Stephen E Coleman Award for the best research paper from a young academic and for its mission focused towards promoting knowledge transfer and idea exchange it has also become a point of reference for the early career researcher and younger academics with the master classes at the centre of it The 12th edition also featured the Networking and Mentoring Event Embracing Gender Equity and Diversity to enable all the member of the community to maximise their opportunity withing the sector

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