

# Assessing The Urban Microclimate Erg Ucd

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 Meteorology Today for Scientists and Engineers  
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 Sustainable Water Management in Urban Environments  
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## PATRICK LAYLAH

*Handbook of Atmospheric Science* Springer Nature

Microclimate for Cultural Heritage: Measurement, Risk Assessment, Conservation, Restoration, and Maintenance of Indoor and Outdoor Monuments, Third Edition, presents the latest on microclimates, environmental issues and the conservation of cultural heritage. It is a useful treatise on microphysics, acting as a practical handbook for conservators and specialists in physics, chemistry, architecture, engineering, geology and biology who focus on environmental issues and the conservation of works of art. It fills a gap between the application of atmospheric sciences, like the thermodynamic processes of clouds and dynamics of planetary boundary layer, and their application to a monument surface or a room within a museum. Sections covers applied theory, environmental issues and conservation, practical utilization, along with suggestions, examples, common issues and errors. Incorporates research on the effects of climate change from Climate for Culture, the EU funded, five-year project focusing on climate change's impact on cultural heritage preservation. Covers green lighting technology, like LED and OLED, it's impacts on indoor microclimates, preservation and color rendering. Includes a case study on sea level issues and cultural heritage in Venice.

**Meteorology Today for Scientists and Engineers** Cambridge University Press

In recent years, bioeconomy strategies have been implemented and adapted internationally. In the bioeconomy, materials are to a certain extent circular by nature. However, biomaterials may also be used in a rather linear way. Lately, a transition towards a circular economy, a more restorative and regenerative economic model, is being promoted worldwide. A circular economy offers an alternative model aiming at "doing more and better with less". It is based on the idea that circulating matter and energy will diminish the need for new input. Its concept lies in maintaining the value of products, materials, and resources for as long as possible and at the same time minimizing or even eliminating the amount of waste produced. Focused on "closing the loops", a circular economy is a practical solution for promoting entrepreneurial sustainability, economic growth, environmental resilience, and a better quality of life for all. The most efficient way to close resource loops is to find value in the waste. Different modes of resource circulation may be applied, e.g., raw materials, by-products, human resources, logistics, services, waste, energy, or water. To that end, this Special Issue seeks to contribute to the circular bioeconomy agenda through enhanced scientific and multidisciplinary knowledge to boost the performance efficiency of circular business models and support decision-making within the specific field. The Special Issue includes innovative technical developments, reviews, and case studies, all of which are relevant to green, closed-loop, circular bioeconomy.

**A Microclimatic and Bioclimatic Modelling Assessment of the Compact City Morphology** Routledge

This volume focuses on practical aspects of sustainable water management in urban areas and presents a discussion of key concepts, methodologies, and case studies of innovative and evolving technologies. Topics include: (1) challenges in urban water resiliency; (2) water and energy nexus; (3) integrated urban water management; and (4) water reuse options (black water, gray water, rainwater). This volume serves as a useful reference for students and researchers involved in holistic approaches to water management, and as a valuable guide to experts in governmental agencies as well as planners and engineers concerned with sustainable water management systems in urban environments.

**Sustainable Water Management in Urban Environments** MDPI

The combination of global warming and urban sprawl is the origin of the most hazardous climate change effect detected at urban level: Urban Heat Island, representing the urban overheating

respect to the countryside surrounding the city. This book includes 18 papers representing the state of the art of detection, assessment mitigation and adaption to urban overheating. Advanced methods, strategies and technologies are here analyzed including relevant issues as: the role of urban materials and fabrics on urban climate and their potential mitigation, the impact of greenery and vegetation to reduce urban temperatures and improve the thermal comfort, the role the urban geometry in the air temperature rise, the use of satellite and ground data to assess and quantify the urban overheating and develop mitigation solutions, calculation methods and application to predict and assess mitigation scenarios. The outcomes of the book are thus relevant for a wide multidisciplinary audience, including: environmental scientists and engineers, architect and urban planners, policy makers and students.

**Cooling the Cities** Routledge

Climate Change and Cities bridges science-to-action for climate change adaptation and mitigation efforts in cities around the world.

**Green, Closed Loop, Circular Bio-Economy** Routledge

Urban form plays a critical role when planning city transitions toward decarbonization. However, in urban climate conditions the complex relationship between urban form and cooling demand remains understudied. This thesis develops integrated approaches and knowledge in the transdisciplinary domain of urban morphology, urban climatology and energy-related fields while addressing the question: 'How does urban form influence building cooling demand in urban microclimate conditions, and how can the magnitude of the relationship be assessed?'. By answering this main research question, the thesis delivers a threefold contribution. First, it contributes to the conceptualization and understanding of both the intrinsic and the extrinsic role of urban form, by identifying urban form characteristics that directly influence building cooling demand, and indirectly contribute to shaping urban microclimate conditions in buildings' surroundings. Second, the thesis contributes to increasing the assessment accuracy of urban form-related climate and energy performance. It does so by developing a quantitative morphological method to identify Local Climate Types (LCTs) and by developing a modelling method that enhances the use of microclimate data as boundary conditions for energy demand assessments. Finally, for the city of Rotterdam, the testing of these novel methods provides an understanding of how and to what extent the form of buildings and contexts influence building cooling demand.

**Numerical Simulations to Assess the Effect of Urban Heat Island Mitigation Strategies on Regional Air Quality** Routledge

The value of applied climatology - the study of the impact of climate - lies in the analysis of measurements and estimates within the context of change. This study provides a review of the theory and practice underlying current climatic research.

**Building Adaptation** Spons Architecture Price Book

Nature Based Strategies for Urban and Building Sustainability reviews the current state-of-the-art on the topic. In the introduction, the editors review the fundamental concepts of nature elements in the built environment, along with the strategies that are necessary for their inclusion in buildings and cities. Part One describes strategies for the urban environment, discussing urban ecosystems and ecosystem services, while Part Two covers strategies and technologies, including vertical greening systems, green roofs and green streets. Part Three covers the quantitative benefits, results, and issues and challenges, including energy performances and outdoor comfort, air quality improvement, acoustic performance, water management and biodiversity. Provides an overview of the different strategies available to integrate nature in the built environment. Presents the current state of technology concerning systems and methodologies on how to incorporate nature in buildings and cities. Features the latest research results on operation and ecosystem services. Covers both established and new designs, including those still in the experimental stage.



#### Urban Overheating - Progress on Mitigation Science and Engineering Applications Elsevier

The Urban Heat Island (UHI) is an area of growing interest for many people studying the urban environment and local/global climate change. The UHI has been scientifically studied for 200 years and, although it is an apparently simple phenomenon, there is considerable confusion around the different types of UHI and their assessment. The Urban Heat Island—A Guidebook provides simple instructions for measuring and analysing the phenomenon, as well as greater context for defining the UHI and the impacts it can have. Readers will be empowered to work within a set of guidelines that enable direct comparison of UHI effects across diverse settings, while informing a wide range of climate mitigation and adaptation programs to modify human behaviour and the built form. This opens the door to true global assessments of local climate change in cities. Urban planning and design strategies can then be evaluated for their effectiveness at mitigating these changes. Covers both on-surface and near-surface, or canopy, measurements and impacts of Urban Heat Islands (UHI) Provides a set of best practices and guidelines for UHI observation and analysis Includes both conceptual overviews and practical instructions for a wide range of uses

Sun, Wind & Light Routledge

The compact city morphology; Melbourne @ 5 million was released by the Victorian Government in 2002, as a planning framework to contain urban population growth and development within the Melbourne metropolitan region. Although Melbourne @ 5 million is guided by broad sustainability principles and goals, it has no recognition for the importance of the urban microclimate. This is particularly important because Melbourne @ 5 million promotes the widespread development of higher density urban morphologies that have the potential to modify the urban microclimate and induce physiological heat stress. This study aims to investigate the microclimatic and associated outdoor human thermal environment implications resulting from proposed changes in urban morphologies as highlighted in Melbourne @ 5 million. A three-dimensional microclimatic modelling tool ENVI-met, was used to evaluate the urban microclimate and outdoor human thermal environment across a range of urban configurations. An initial validation assessment of ENVI-met was completed for two residential density developments to discern the ability of ENVI-met to simulate spatial and temporal patterns of microclimatic parameters (air temperature, relative humidity, wind speed and mean radiant temperature). This analysis identified that ENVI-met was able to adequately differentiate the relative spatial and temporal differences in microclimatic parameters across land uses, based on canyon geometry and surface and vegetative properties. A statistical analysis identified that model error and bias predominated. Limitations in the model were identified including; over/underestimation in the diurnal radiative energy budget, generic leaf area density profiles, simplified hydraulic and heat storage within the soil model and user specified boundary forcing conditions. ENVI-met model simulations demonstrated that consolidating urban morphologies into higher density developments generated large spatial and temporal microclimatic variations dependent upon the urban canyon geometric form, vegetative cover and surface properties. Greater building mass and impervious surface cover associated with higher density developments, combined with insufficient vegetative cover and low soil moisture conditions, increased the radiative energy exchange between the urban dweller and canyon surfaces and increased mean radiant temperatures. Subsequently, throughout various periods of the day the Physiological Equivalent Temperature exceeded 50.0 oC. During nocturnal conditions, the morphological form of higher density developments and lack of evaporative cooling simulated average magnitudes of mean radiant temperatures 4.0 oC greater than low density developments that are characteristic of dispersed and shallower urban canyon geometries. The need to alleviate unfavourable microclimatic conditions and moderate physiological heat stress is of major importance to support the continuous implementation of higher density developments. An assessment of urban heat island mitigation strategies (urban greening, irrigation and modifying canyon albedo) within an idealized urban canyon representative of various higher density developments revealed that urban greening coupled with irrigation was the most beneficial strategies to regulate the Physiological Equivalent Temperature by an average daytime magnitude between 2.0 to 12.4 oC. However, the cooling effect of urban greening, irrigation and modifying canyon albedo within each urban canyon differed considerably. This emphasises that urban heat island mitigation strategies should be developed and implemented locally to cater for the heterogeneity of microclimatic conditions across urban canyons within higher density developments. Overall, the outcomes of this study contributed to our understanding of how consolidating urban morphologies will modify the interaction between individual elements within the built environment, microclimatic processes and the human energy balance across higher density developments within the Melbourne metropolitan region. The recommendations outlined should be adopted in the implementation of Melbourne @ 5 million and could also assist in developing policies to include urban climate considerations in future planning frameworks. These recommendations could also improve Melbourne's climate and offset the likely temperature and health impacts arising from consolidating urban morphologies and projected climate change impacts and extremes.

#### Urban Overheating - Progress on Mitigation Science and Engineering Applications Birkhäuser

The combination of global warming and urban sprawl is the origin of the most hazardous climate change effect detected at urban level: Urban Heat Island, representing the urban overheating respect to the countryside surrounding the city. This book includes 18 papers representing the state of the art of detection, assessment mitigation and adaption to urban overheating. Advanced methods, strategies and technologies are here analyzed including relevant issues as: the role of urban materials and fabrics on urban climate and their potential mitigation, the impact of greenery and vegetation to reduce urban temperatures and improve the thermal comfort, the role the urban geometry in the air temperature rise, the use of satellite and ground data to assess and quantify the urban overheating and develop mitigation solutions, calculation methods and application to predict and assess mitigation scenarios. The outcomes of the book are thus relevant for a wide multidisciplinary audience, including: environmental scientists and engineers, architect and urban planners, policy makers and students.

#### Fundamentals of Geomorphology MDPI

This book discusses the concepts and technologies associated with the mitigation of urban heat islands (UHIs) that are applicable in hot and humid regions. It presents several city case studies on how UHIs can be reduced in various areas to provide readers, researchers, and policymakers with insights into the concepts and technologies that should be considered when planning and constructing urban centres and buildings. The rapid development of urban areas in hot and humid regions has led to an increase in urban temperatures, a decrease in ventilation in buildings, and a transformation of the once green outdoor environment into areas full of solar-energy-absorbing concrete and asphalt. This situation has increased the discomfort of people living in these areas regardless of whether they occupy concrete structures. This is because indoor and outdoor air quality have both suffered from urbanisation. The development of urban areas has also increased energy consumption so that the occupants of buildings can enjoy indoor thermal comfort and air quality that they need via air conditioning systems. This book offers solutions to the recent increase in the number of heat islands in hot and humid regions.

#### Vegetation-Climate Interaction Presses des MINES

As existing buildings age, nearly half of all construction activity in Britain is related to maintenance,

refurbishment and conversions. Building adaptation is an activity that continues to make a significant contribution to the workload of the construction industry. Given its importance to sustainable construction, the proportion of adaptation works in relation to new build is likely to remain substantial for the foreseeable future, especially in the developed parts of the world. Building Adaptation, Second Edition is intended as a primer on the physical changes that can affect older properties. It demonstrates the general principles, techniques, and processes needed when existing buildings must undergo alteration, conversion, extension, improvement, or refurbishment. The publication of the first edition of Building Adaptation reflected the upsurge in refurbishment work. The book quickly established itself as one of the core texts for building surveying students and others on undergraduate and postgraduate built environment courses. This new edition continues to provide a comprehensive introduction to all the key issues relating to the adaptation of buildings. It deals with any work to a building over and above maintenance to change its capacity, function or performance.

#### Climate Data and Resources Springer

The urban heat island (UHI) effect is the phenomenon that the temperature in an urban area is higher than its surrounding rural area. UHI can exacerbate extreme weather in summer, influence human thermal comfort, and harm human health and local ecology. The magnitude of UHI is related to mesoscale meteorological conditions and biophysical structures within a city. Stewart and Oke's (2012) local climate zone (LCZ) framework provides rich information connecting urban biophysical properties with spatial variability of UHI. In this research, we used high-resolution 2D/3D data and object-based image analysis (OBIA) to generate an LCZ map with 81% overall accuracy. It shows a 17% improvement compared with the LCZ map with 64% overall accuracy by using a common process provided by the Database and Access Portal Tools (WUDAPT) process. At this zonal scale, the LCZ scheme effectively connects urban structures and air temperature by identifying significant temperature differences among LCZ categories (p

#### Urban Heat Island (UHI) Mitigation Springer

Global Urban Heat Island Mitigation provides a comprehensive picture of global UHI micro-thermal interaction in different built environments. The book explains physical principles and how to moderate undesirable consequences of swift and haphazard urban development to create more sustainable and resilient cities. Sections provide extensive discussion on numerous UHI mitigation technologies and their effectiveness in cities around the globe. In addition, the book proposes novel UHI mitigation technologies and strategies while also assessing the effectiveness and suitability of UHI mitigation interventions in various climates and urban forms. Adopts a multidisciplinary approach, bridging theoretical and applied urban climatology with urban heat mitigation Compiles disparate urban climate research concepts and technologies into a coherent framework Includes contributions from leaders in fields from around the globe

#### Climate Change and Cities Springer Science & Business Media

Climate change is one of the most significant global challenges facing the world today. It is also a critical issue for the world's cities. Now home to over half the world's population, urban areas are significant sources of greenhouse gas emissions and are vulnerable to the impacts of climate change. Responding to climate change is a profound challenge. A variety of actors are involved in urban climate governance, with municipal governments, international organisations, and funding bodies pointing to cities as key arenas for response. This book provides the first critical introduction to these challenges, giving an overview of the science and policy of climate change at the global level and the emergence of climate change as an urban policy issue. It considers the challenges of governing climate change in the city in the context of the changing nature of urban politics, economics, society and infrastructures. It looks at how responses for mitigation and adaptation have emerged within the city, and the implications of climate change for social and environmental justice. Drawing on examples from cities in the north and south, and richly illustrated with detailed case-studies, this book will enable students to understand the potential and limits of addressing climate change at the urban level and to explore the consequences for our future cities. It will be essential reading for undergraduate students across the disciplines of geography, politics, sociology, urban studies, planning and science and technology studies.

#### Urban Form Influence on Microclimate and Building Cooling Demand Routledge

There is pressing evidence of phenomena, linked to meteorology and climate, which are modifying their temporal occurrence and which have a very evident impact on the safety and health of populations residing in cities. The urban problem at the beginning of the second set of twenty years of the new century requires a complete rethinking of the way of aggregation of man who, today, represents a large part of the world population due to increasingly accelerated urbanization processes over time. The human being has become a citizen, and within the city limits, he tries to develop his life expectancy by seizing opportunities from this. This search for well-being, understood as a complete state of man, at once physiological and psychological and social, can be thwarted by an urban structure that is not functionally capable of providing answers. The climate problem exacerbates this problem by strongly stressing the contradictions of living. Science, technology, and politics are today able to give answers if applied wisely in a joint effort, in a unit of language. This book proposes several solutions that can be implemented today, ranging from a full understanding of phenomena to adaptation policies for solving problems. The most pressing invitation is addressed precisely to politics to make cities more resilient and safe.

#### Energy and Climate in the Urban Built Environment Routledge

Architecture/Environment How to design buildings that heat with the sun, cool with the wind, light with the sky, and move into the future using on-site renewable resources Developed for rapid use during schematic design, this book clarifies relationships between form and energy and gives designers tools for designing sustainably. It also: \* Applies the latest passive energy and lighting design research \* Organizes information by architectural elements at three scales: \* building groups, individual buildings, and building parts \* Brings design strategies to life with examples and practical design tools \* Features: \* 109 analysis techniques and design strategies \* More than 750 illustrations, sizing graphs, and tables \* Both inch-pound and metric units

#### Urban Climates Springer Science & Business Media

The quality of life of millions of people living in cities could be improved if the form of the city were to evolve in a manner appropriate to its climatic context. Climatically responsive urban design is vital to any notion of sustainability: it enables individual buildings to make use of renewable energy sources for passive heating and cooling, it enhances pedestrian comfort and activity in outdoor spaces, and it may even encourage city dwellers to moderate their dependence on private vehicles. Urban Microclimate bridges the gap between climatology research and applied urban design. It provides architects and urban design professionals with an understanding of how the structure of the built environment at all scales affects microclimatic conditions in the space between buildings, and analyzes the interaction between microclimate and each of the elements of the urban landscape. In the first two sections of the book, the extensive body of work on this subject by climatologists and geographers is presented in the language of architecture and planning professionals. The third section follows each step in the design process, and in part four a critical analysis of selected case study projects provides a demonstration of the complexity of applied urban design. Practitioners will find in this book a useful guide to consult, as they address these key

environmental issues in their own work.

[EPA 630/R](#) Wiley

This book discusses urban microclimate and heat-related risks in urban areas, brought on by the combination of global climate change effects and local modification of climate determined by extensive urbanization such as the 'Urban heat island' phenomenon. This matter is relevant to almost all urbanized areas in the world, where the increase of urban population and air temperature

is expected to endanger both the overall health of the population and the energy supply for the functioning of urban systems. The book details the inter-relationship between urban morphology, microclimate and building energy performance and presents a multidisciplinary approach that brings together Urban Climatology, Engineering and Architectural knowledge to support the development of reliable models and tools for research and practice. This book is a useful tool for architects and building energy modelers, urban planners and geographers who need a practical guide to realize basic urban microclimate simulation for use in both academic research and planning practice.

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