Human Thermal Environments The Effects Of Hot Moderate And Cold Environments On Human Health Comfort And Performance Author Ken Parsons Feb 2003

The purpose of this study is to evaluate the effects of moisture vapor transport properties of four different groups of overgarments (OGs)

on physiological, sensory, and comfort responses. These OGs were made from materials containing an impermeable film and three semi-permeable (or moisture vapor permeable) membranes with varying moisture vapor transmission rates (MVTR). The impermeable film had an MVTR of 5 g/m2/24 h, and the three moisture vapor membranes had MVTRs of 360, 670, and 864. These four OGs were evaluated under two environmental and work/rest conditions. The environmental conditions consisted of a warm environment, Ta = 29.2°C, 51 % relative humidity, V = 1.1 m/s and a cool environment,

Ta = 18.4°C, 50 % relative humidity, V = 1.1 m/s. Eight men wore the OGs while performing 4 h of intermittent exercise. Rectal temperature, an 8-point mean weighted skin temperature and heart rate were continuously recorded. Skin wettedness was calculated from dew point sensors under the OG. Mean body weight loss and moisture absorption by the OG, underwear, and foot-wear were measured from pre- and post-experiment weights. A sensory and comfort rating questionnaire was presented to the volunteers every 30 min. During prolonged intermittent exercise in

moderate environmental conditions, volunteers wearing OGs with MVTR of 670 and greater produced less thermo-physiological stress, independent of changes in perceived comfort. Perceived comfort of the MVTR 5 OG was significantly lower than all other garments at 18.4°C. At 29.2°C, both the MVTR 5 and 360 OG produced lower comfort, but not significantly. At 29.2°C, volunteers were significantly warmer, sweatier, and experienced significantly greater moisture on their skin, undergarments, and inside their OGs than at 18.4°C, and these sensations

increased over time. However, at 29.2°C, perceived comfort differences among MVTR levels were either not significant or not associated with MVTR level. Ergonomics, Thermal analysis, Thermal comfort, People, Physiological effects (human body) Adaptation Measures for Urban Heat Islands helps the reader understand the relative performance of these adaptation measures, methods and analysis relating to their creation and maintenance, evaluation methods, and the role of policy and governance in implementing them. A suite

of case studies is included on these urban or metropolitan areas that are significantly warmer than their surrounding rural areas due to human activities. In recent years, a suite of adaptation measures have been developed to mitigate the urban heat island phenomena. Provides a range of concrete implementation methods Assesses relative performance of adaptation measures and countermeasure technologies Establishes methods for human thermal environmental interventions Reviews adaptation cities selected for excellent energy performance and

thermal comfort indicators
Thermal Analysis--human Comfort--indoor Environments
Proceedings of the AHFE 2020 Virtual Conferences on Neuroergonomics and Cognitive Engineering, and Industrial Cognitive Ergonomics and Engineering Psychology, July 16-20, 2020, USA
Proceedings of a Symposium Held at the National Bureau of Standards, Gaithersburg, Maryland, February 11, 1977
Nutritional Needs in Cold and High-Altitude Environments
Thermal Comfort Under Transient Metabolic and Dynamic Localized Airflow Conditions Combined with

Neutral and Warm Ambient Temperatures
Human Heat Stress
Ergonomics, Occupational safety, Cold rooms, Cold tolerance, Tolerances (human body), Thermal testing, Cold storage, Physiological effects (human body), Environment (working), Temperature, Humidity, Clothing, Clothing accessories, Injuries, Thermal insulation, Thermal comfort, Protective clothing, Working conditions (physical), Work study, Metabolism Ergonomics, Surfaces, Temperature, Skin (body), Human body, Hazards, Risk assessment, Physiological

effects (human body), Cold tests, Environment (working), Working conditions (physical), Occupational safety, Data processing, Thermal properties of materials

Environmental Ergonomics addresses the problems of maintaining human comfort, activity and health in stressful environments. Its subject areas include thermal environments, illumination, noise and hypo- and hyperbaric environments. The book concentrates fundamentally on the way the thermal environment has affected human comfort, health and performance from

the age of cave-dwellings to our age of skyscrapers. This book contains only papers selected from the 10th ICEE held in Japan 23-27 September 2002. The ICEE has been held biannually since 1982, and has firmly established itself as the world's most distinguished conference in its field, offering the ideal forum for research scientists, medical doctors, engineers, administrators, technicians, healthcare professionals and students to share their work and ideas. Selected papers from the 10th International Conference on Environmental Ergonomics held in Japan, 23-27

September 2002. They have been revised and peer-reviewed. Papers included in this text have been widely recognised as the catalyst for the recent advances witnessed in Environmental Ergonomics in Asia. They strike a balance between academia and industries' views on environmental ergonomics. Add this volume to your copy of the Elsevier Ergonomics Book Series.

Guide to Design and Evaluation of Working Practices for Cold Indoor Environments

Ergonomics of the Thermal Environment. Methods for the

Assessment of Human Responses to Contact with Surfaces. Human Contact with Surfaces at Moderate Temperature

A Theoretical Study Using a 25-node Model of Thermoregulation

ILO-CIS Bulletin

Routledge Handbook of Resilient Thermal Comfort

Adaptive Thermal Comfort: Principles and Practice

This dissertation research examines the effects of different cool pavement design and management strategies on improving the thermal environment and

mitigating near-surface heat island effects through field measurements, modeling and simulation. In this research, nine experimental test sections were designed, constructed and instrumented and the thermal performance of different types of pavements and management strategies (including high reflectance, high thermal resistance pavement, and permeable pavement with evaporative cooling)

were empirically investigated. Different cooling effects were identified for each strategy along with their advantages and associated disadvantages. Relevant properties of pavement materials (e.g. albedo, permeability, thermal conductivity, heat capacity and evaporation rate) were measured in many cases using newly developed methods. With these fundamental materials properties, a local microclimate model

was developed, validated and applied to conduct sensitivity analysis on some key parameters to evaluate the thermal impacts of different cool pavement strategies in different climate regions. In addition, the impacts of different strategies on outdoor human thermal comfort were evaluated for different climate regions (Sacramento and Los Angeles in California and Phoenix in Arizona). One type of thermal load associated

with building energy use was evaluated for Davis, California. Findings indicate that using high reflectance pavement will reduce pavement surface temperature and consequently might help improve the air quality through reduction of the formation of ground-level ozone. However, increasing the pavement reflectance would affect human thermal comfort during hot periods due to an increase in the Mean Radiant Temperature contributed by the

increased reflected radiation striking human bodies. Enhancing the evaporation from the pavement through use of permeable pavement and creating shading on pavement with trees or other devices (e.g. solar panels) are likely to be effective strategies to reduce pavement surface temperature and improve human thermal comfort in hot periods. However, to be effective in arid and semiarid climates such as California, the water

level must be kept near the surface of the permeable pavement through infusions of waste water such as waste landscape irrigation. Some cool pavement strategies used to improve the summer thermal environments might make the cold winter slightly colder. Therefore strategies such as evaporation and shading only in summer that can help reduce the summer hot temperatures but will not heavily reduce the winter cold

temperature is desirable for some regions. Based on the findings from this study, some preliminary recommendations on the application of cool pavement strategies for mitigating near-surface heat island are: (1) Pave less and plant more. For some areas such as parking lots and alleys, the sites could be partly paved, and more grass and/or trees could be planted on the sites to reduce negative impacts of pavement. (2)

Pave smart if it has to be paved. Permeable pavements (integrated with irrigation systems during hot dry seasons), including pervious concrete pavement, porous asphalt pavement, and permeable interlocking concrete pavers and reinforced grass pavers, could be good alternatives for paving if applicable, to both manage the stormwater runoff and potentially help mitigate near-surface heat island effect and

improve thermal environments. (3) Care should be taken with the application of high-reflectance pavements. High-reflectance pavements can be used in open areas to help mitigate the heat island effects. However, special attention should be given when applied in high-density areas or areas with frequent walking or cycling human occupancy. (4) Consider evaporation and shading. Evaporation and shading could be very effective

strategies to help improve the thermal environments in hot climates. (5) The models developed in this study for local microclimate, thermal comfort and building energy use can be used, if needed, and improved for evaluating seasonal impacts of different pavement strategies in different contexts. (6) Life cycle cost analysis (LCCA) and/or benefit-cost analysis (BCA), as well environmental life cycle assessment (LCA) should

be performed to quantitatively evaluate the life cycle economic and environmental impacts for different cool pavement strategies in different climates. Thermal comfort is a desirable state familiar to all people. Providing inspirational indoor and outdoor environments that provide thermal comfort, in the context of energy use and climate change, is a challenge for the 21st century. This book provides an up-to-date,

comprehensive coverage of thermal comfort from principles and theory to practical application. The book begins with current knowledge and understanding of thermal comfort and its application to providing thermal conditions for indoor and outdoor environments. It integrates and presents new ideas to provide a comprehensive model of thermal comfort so that we can move on from the 20th and early 21st century and provide a

focus for developments for future decades. This book will be of interest to practitioners and students and anyone involved with fields such as environmental design, physiology, ergonomics, human factors, industrial hygiene, architecture, health and safety and air conditioning. • Provides current thermal comfort standards and regulations • Describes the PMV, PPD, ET* and SET thermal comfort indices • Discusses

adaptive thermal comfort, adaptive opportunity and explains why we have not moved towards a more dynamic and interactive approach to providing thermal comfort • Presents a new model relating thermal discomfort to performance • Shows how to construct a computer model of thermal comfort • Offers how to conduct a thermal comfort survey Human Thermal Comfort provides new ideas for achieving thermal comfort for offices,

vehicles, atriums, and plazas of the future.

Human Thermal EnvironmentsThe Effects of Hot, Moderate, and Cold Environments on Human Health, Comfort, and Performance, Third EditionCRC Press

Ergonomics of the Thermal Environment. Principles and Application of Relevant International Standards

Advances in Neuroergonomics and Cognitive Engineering

Human Thermal

Environments

Safety and Health at Work

Assessments and Applications in Urban Planning and Design

In the ten years since the publication of the second edition of Human Thermal Environments: The Effects of Hot, Moderate, and Cold Environments on Human Health, Comfort, and Performance, Third Edition, the world has embraced electronic communications, making international

collaboration almost instantaneous and global. However, there is still a need for a compilation of up-to-date information and best practices. Reflecting current changes in theory and applications, this third edition of a bestseller continues to be the standard text for the design of environments for humans to live and work safely, comfortably, and effectively, and for the design of materials that

help people cope with their environments. See What's New in the Third Edition: All existing chapters significantly updated Five new chapters Testing and development of clothing Adaptive models Thermal comfort for special populations Thermal comfort for special environments Extreme environments Weather Outdoor environments and climate change Fun runs, cold snaps, and heat waves The book covers hot, moderate, and cold

environments, and defines them in terms of six basic parameters: air temperature, radiant temperature, humidity, air velocity, clothing worn, and the person's activity. It focuses on the principles and practice of human response, which incorporates psychology, physiology, and environmental physics with applied ergonomics. The text then discusses water requirements, computer modeling, computer-aided design,

and current standards. A systematic treatment of thermal environments and how they affect humans in real-world applications, the book links the health and engineering aspects of the built environment. It provides you with updated tools, techniques, and methods for the design of products and environments that achieve thermal comfort. Environments are assessed and environmental limits

defined often only in terms of air temperature, which is insufficient; in most situations the interaction of air temperature with five other factors - radiant temperature; humidity; air movement; activity-generated metabolic heat; and clothing is central to that environment's evaluation.; In this book, Ken Parsons focuses on the principles and practice of human response to

thermal environments. He incorporates psychology, physiology and environmental physics with an applied ergonomic approach. The book details important new developments in determining the thermal properties of clothing, computer modelling and computer-aided environmental design, and offers practical applications and case studies.

This book reviews the research pertaining to nutrient requirements

for working in cold or in high-altitude environments and states recommendations regarding the application of this information to military operational rations. It addresses whether, aside from increased energy demands, cold or high-altitude environments elicit an increased demand or requirement for specific nutrients, and whether performance in cold or high-altitude environments can be enhanced by the

provision of increased amounts of specific nutrients.

Ergonomics of the Thermal Environment

Ergonomics of the Thermal Environment.

Application of International Standards to People with Special Requirements

Effects of Ventilation on Human Thermal Comfort in Rooms

Effects of Overgarment Moisture Vapor Transmission Rate on Human Thermal Comfort

Environmental Ergonomics

- The Ergonomics of Human Comfort, Health, and Performance in the Thermal Environment
Human Responses to Outdoor Thermal Environments

This book provides an up-to-date, accessible, and comprehensive coverage of human cold stress from principles and theory to practical application. It defines cold stress and how people respond to it. It describes how to assess a cold environment to predict when discomfort, wind-chill, hypothermia, shivering, frostbite, and other consequences will occur. It also advises on what

to do to prevent unacceptable outcomes, including determination and selection of clothing to preserve comfort and health. The book will be of interest to practitioners and students and anyone involved with fields such as textiles, clothing, and industrial hygiene.

Human thermal environments constitute complex combinations of various interacting thermal factors. The transient and non-uniform nature of those thermal factors further increases the complexity of the thermal comfort problem. The conventional approach to the thermal comfort problem has been simplifying the

problem and providing steady thermal environments which would satisfy the majority of the people in a given space. However, several problems emerged with this approach. People became finely tuned to the narrow range of conditions and developed expectations for the same conditions which made them uncomfortable when there were slight deviations from those conditions. Also, the steady approach didn't solve the comfort problem because, in practice, people move between spaces, and thermal conditions such as metabolic rate, surface temperatures, airflow speed and

direction vary in a typical day. A human subject test was designed to determine the transient relationship between the people and their environments. In the first part, thermal perceptions of people were taken during various metabolic rate conditions. In the second and the third parts, transient conditions of different thermal factors were created. Various combinations of airflow frequencies, airflow location around the body, metabolic rate, and room temperatures were tested for their individual and interaction effects of providing thermal comfort. The concept of Localized Dynamic Airflow was

proposed in which room airflow was simply redirected to different parts of the body with a varying airflow speed. Results showed that males and females respond differently to the thermal conditions. The room temperatures they found neutral were significantly different. People's thermal comfort during transient metabolic conditions was similar to high metabolic conditions. This heightened response extended into the next ten minutes after the high metabolic conditions ended. Test results suggested that people tolerate higher temperatures during transient environmental

conditions. The average response was for comfortable even during the high temperature (83°F) and high metabolic rate (4 met) conditions. Low energy use of the localized dynamic airflow and the increased room temperatures has significant potential for monetary savings.

This book offers broad overview of the field of cognitive engineering and neuroergonomics, covering emerging practices and future trends toward the harmonious integration of human operators and computer systems. It presents novel theoretical findings on mental workload and stress,

activity theory, human reliability, error and risk, and a wealth of cutting-edge applications, such as strategies to make assistive technologies more user-oriented. Further, the book describes key advances in our understanding of cognitive processes, including mechanisms of perception, memory, reasoning, and motor response, with a particular focus on their role in interactions between humans and other elements of computer-based systems. Gathering the proceedings of the AHFE 2020 Virtual Conferences on Neuroergonomics and Cognitive Engineering, and Industrial

Cognitive Ergonomics and Engineering Psychology, held on 16–20 July 2020, this book provides extensive and timely information for human–computer interaction researchers, human factors engineers and interaction designers, as well as decision-makers.

Human Thermal Comfort

Analysis and Applications in Environmental Engineering

Applications for Military Personnel in Field Operations

Effect of an Airplane Cabin Water Spray System on Human Thermal Behavior

Indoor Thermal Comfort Perception

Ergonomics of the Thermal Environment. Methods for the Assessment of Human Responses to Contact with Surfaces. Hot Surfaces

The fundamental function of buildings is to provide safe and healthy shelter. For the fortunate they also provide comfort and delight. In the twentieth century comfort became a 'product' produced by machines and run on cheap energy. In a world where fossil fuels are becoming ever scarcer and more expensive, and the climate more extreme, the challenge of designing comfortable buildings today requires a new approach. This timely book is the first in a trilogy from leaders in the field which will provide just that. It explains, in a clear and comprehensible

manner, how we stay comfortable by using our bodies, minds, buildings and their systems to adapt to indoor and outdoor conditions which change with the weather and the climate. The book is in two sections. The first introduces the principles on which the theory of adaptive thermal comfort is based. The second explains how to use field studies to measure thermal comfort in practice and to analyze the data gathered. Architects have gradually passed responsibility for building performance to service engineers who are largely trained to see comfort as the "product", designed using simplistic comfort models. The result has contributed to a shift to buildings that use ever more energy. A growing international consensus now calls for

low-energy buildings. This means designers must first produce robust, passive structures that provide occupants with many opportunities to make changes to suit their environmental needs. Ventilation using free, natural energy should be preferred and mechanical conditioning only used when the climate demands it. This book outlines the theory of adaptive thermal comfort that is essential to understand and inform such building designs. This book should be required reading for all students, teachers and practitioners of architecture, building engineering and management – for all who have a role in producing, and occupying, twenty-first century adaptive, low-carbon, comfortable buildings.

Thousands of people continue to die from heat. Heat illnesses and advice for preventing heat casualties at work, during heatwaves, sport and the effects of global warming are described. A new perspective on thermoregulation integrates physiological and psychophysical regulated variables. Heat stress indices, the WBGT and the SWreq are presented. It is time to understand and routinely use computer simulations of people in hot conditions. How to understand how a model can be constructed is also described. This book provides an accessible, concise and comprehensive coverage into how people respond to heat and how to predict and avoid heat causalities. A practical productivity model, and Burn thresholds, complete the book which

begins with up to date knowledge on measurement of heat stress, heat strain, metabolic rate and the thermal properties and influences of clothing. Features Provides methods and regulations through international standards Illustrates the WBGT and analytical heat stress indices and how to construct a thermal model Discusses the role of clothing on heat stress and thermal strain Presents a new model for predicting productivity in the heat Offers a new method of human thermoregulation Considers heat illness and prevention during heatwaves and in global warming

This book brings together some of the finest academics in the field to address important questions around the way in which people experience their physical

environments, including temperature, light, air-quality, acoustics and so forth. It is of importance not only to the comfort people feel indoors, but also the success of any building as an environment for its stated purpose. The way in which comfort is produced and perceived has a profound effect on the energy use of a building and its resilience to the increasing dangers posed by extreme weather events, and power outages caused by climate change. Research on thermal comfort is particularly important not only for the health and well-being of occupants but because energy used for temperature control is responsible for a large part of the total energy budget of the built environment. In recent years there has been an increasing focus on the

vulnerabilities of the thermal comfort system; how and why are buildings failing to provide safe and agreeable thermal environments at an affordable price? Achieving comfort in buildings is a complex subject that involves physics, behaviour, physiology, energy conservation, climate change, and of course architecture and urban design. Bringing together the related disciplines in one volume lays strong, multi-disciplinary foundations for new research and design directions for resilient 21st century architecture. This book heralds workable solutions and emerging directions for key fields in building the resilience of households, organisations and populations in a heating world.

The Effects Of Hot, Moderate And

Cold Environments On Human Health, Comfort and performance

Effect of Environment on Nutrient Requirements of Domestic Animals

The Effects of Hot, Moderate, and Cold Environments on Human Health, Comfort and Performance, Second Edition

A Questionnaire Approach Focusing on Children

Biometeorology for Adaptation to Climate Variability and Change

Bio-Climatology for Built Environment

Providing a methodology for evaluating indoor thermal comfort with a focus on children, this book presents an in-depth examination of children's perceptions of comfort. Divided into two sections, it first presents a history of thermal

comfort, the human body and environmental parameters, common thermal comfort indexes, and guidelines for creating questionnaires to assess children's perceptions of indoor thermal comfort. It then describes their understanding of the concepts of comfort and energy, and the factors that influence that perception. In this context, it takes into account the psychological and pedagogical aspects of thermal comfort judgment, as well as architectural and environmental characteristics and equips readers with the knowledge needed to effectively investigate children's perspectives on environmental ergonomics. The research field of indoor thermal

comfort adopts, on the one hand, physical parameter measurements and comfort indexes (e.g. Predicted Mean Vote (PMV) or adaptive comfort), and on the other, an ergonomic assessment in the form of questionnaires. However the latter can offer only limited insights into the issue of comfort, as children often use different terms than adults to convey their experience of thermal comfort. The books aims to address this lack of understanding with regard to children's perceptions of indoor thermal comfort. The book is intended for HVAC engineers and researchers, architects and researchers interested in thermal comfort and the built environment.

It also provides a useful resource for environmental psychologists, medical and cognitive researchers. This book focuses on human adaptive thermal comfort in the building environment and the balance between reducing building air conditioning energy and improving occupants thermal comfort. It examines the mechanism of human thermal adaptation using a newly developed adaptive heat balance model, and presents pioneering findings based on an on online survey, real building investigation, climate chamber experiments, and theoretical models. The book investigates three critical issues related to human thermal

adaptation: (i) the dynamics of human thermal adaptation in the building environment; (ii) the basic rules and effects of human physiological acclimatization and psychological adaptation; and (iii) a new, adaptive, heat balance model describing behavioral adjustment, physiological acclimatization, psychological adaptation, and physical improvement effects. Providing the basis for establishing a more reasonable adaptive thermal comfort model, the book is a valuable reference resource for anyone interested in future building thermal environment evaluation criteria.

This book highlights the importance of outdoor thermal comfort for

improving urban living quality in the context of urban planning and urban geometry design. It introduces readers to a range of assessment methods and applications of outdoor thermal comfort and addresses urban geometry and thermal environment at the neighbourhood scale using real-world examples and parametric studies. In addition, the subjective evaluations by urban dwellers and numerical modelling tools introduced in this book provide not only a comprehensive assessment of outdoor thermal comfort but also an integrated approach to using thermal comfort indicators as a standard in high-density cities. Given its scope, the book offers a

valuable guide for urban climate researchers, urban planners, and designers, and policymakers pursuing more liveable urban environments.

Evaluation of Cool Pavement Strategies for Heat Island Mitigation

A Review of Evidence

The Thermal Environment

Ergonomics of the Thermal Environment. Methods for the Assessment of Human Responses to Contact with Surfaces. Cold Surfaces

Adaptation Measures for Urban Heat Islands

The Dynamics and Mechanism of Human Thermal Adaptation in Building Environment

Our responses to our thermal

environment have a considerable effect on our performance and behavior, not least in the realm of work. There has been considerable scientific investigation of these responses and formal methods have been developed for environmental evaluation and design. In recent years these have been developed to the extent that detailed national and international standards of practice have now become feasible. This new edition of Ken Parson's definitive text brings us back up to date. He covers hot, moderate and cold environments, and defines these in terms of six basic parameters: air temperature, radiate temperature, humidity, air velocity, clothing worn, and the person's activity. There is a focus on the principles

and practice of human response, which incorporates psychology, physiology and environmental physics with applied ergonomics. Water requirements, computer modeling and computer-aided design are brought in, as are current standards. Special populations, such as the aged or disabled and specialist environments such as those found in vehicles are also considered. This book continues to be the standard text for the design of environments for humans to live and work safely, comfortably and effectively, and for the design of materials which help the same people cope with their environments.

Heat transfer calculations in different aspects of engineering

applications are essential to aid engineering design of heat exchanging equipment. Minimizing of computational time is a challenging task faced by researchers and users. Methodology of calculations in some application areas are incorporated in this book, such as differential analysis of heat recoveries with CFD in a tube bank, heating and ventilation of equipment and methods for analytical solution of nonlinear problems. Numerical analysis is the prerequisite of design and for the manufacture of heat exchanging equipment. Some numerical and experimental information are presented with utmost skill. Similarly, the analytical solution of heat transfer

is touched in this book. Study of heat transfer phenomena and applications are equally emphasized in this issue.

Ergonomics, Surfaces, Temperature, Skin (body), Human body, Hazards, Equipment safety, Occupational safety, Domestic safety, Risk assessment, Physiological effects (human body), Heat, Combustion, Thermal properties of materials, Safety measures, Tolerances (human body)

A Glimpse to Adaptive Thermal Comfort in Buildings

The Effects of Hot, Moderate, and Cold Environments on Human Health, Comfort and Performance

Thermal Comfort

Heat Transfer Phenomena and Applications

Environmental Factors Affecting Office Worker Performance

Human Cold Stress

Ergonomics, Working conditions (physical), Thermal comfort, Temperature, Climate, Environment (working), Physiological effects (human body), Thermal stress, Occupational safety, International standards

This thesis presents a series of studies into the responses of people to outdoor thermal conditions experienced over all seasons in the United Kingdom. The aim was to investigate practical methods for predicting human responses to outside weather conditions, which would be useful in predicting effects on human comfort and health. The studies involved both

laboratory experiments and field trials. One particular aspect of outside conditions, not usually investigated in laboratory studies, is the contribution of solar radiation. Single subject and thermal manikin studies were used to determine the contribution of solar radiation to human response. In addition to this, a total of 168 subjects responses were recorded during trials at the Loughborough University weather station compound. (latitude 52.47N and longitude 01.11W). The trials were distributed between July 2007 and October 2008. This provided a comprehensive data-base for the evaluation of thermal indices. The thesis is divided into four parts. Part one provides an introduction to the subject and a comprehensive literature

review. It also describes equipment, calibration procedures and methods used. Part two quantified the contribution of solar radiation to the heat load on a person. A human subject and a heated thermal manikin were exposed to outdoor thermal conditions, while in light clothing and (for the person) conducting a step test. They were then exposed to identical conditions in a thermal chamber, but without the contribution of the sun. The conditions outside were 23?C air temperature, 42?C mean radiant temperature and 54% relative humidity with an average air velocity of 0.75 ms-1. The difference in sweat rate (person) and heat required (manikin) between outdoor and indoor conditions were used to estimate the contribution

of the sun. Using three different analyses estimates were 14 Wm-2, 35 Wm-2 and 50 Wm-2 depending upon the assumptions made. Part three describes current thermal indices that can be used to assess the effects of weather conditions on people. It also presents the results of weather station measurements over the time period considered. In chapters 8 and 9 field trials are described which capture both the thermal conditions and human physiological and subjective responses to those conditions. Chapter 10 uses the data collected to provide an evaluation of current thermal indices for predicting human responses. The range of air temperature and relative humidity (at 2 pm) over a year was -2?C to 29?C and 34% to 95%

respectively. Wind speed varied and was greater in winter and spring than in summer and autumn. Solar radiation was influenced by the altitude of the sun which depended upon season. Mean solar radiation increased from December to June and decreased from June to December. The subjective and physiological responses for 130 people (65 males and 65 females) over a range of outdoor weather conditions are presented. Physiological responses for females generally showed a stronger relationship with environmental variables and subjective responses than those for males. The subjective and physiological responses of four groups (one in each season of the year - involving a total of 38 people), are presented. It was found that there were

significant individual differences in response. Part four provides a suggestion for an improved thermal index. The PMV (Predicted Mean Vote) out of four thermal indices (WBGT, PMV, WCI/tch and Twc) had the strongest relationship with environmental variables and physiological responses but had a weak relationship with subjective responses. A PMVoutdoors index was developed to improve the prediction of subjective responses for the outdoor conditions investigated. Conclusions and recommendations for future research are provided.

Biometeorology continues to grow as a discipline. It is increasingly recognised for its importance in providing science of relevance to society and well being

of the environment. This book is the first in a new book series on Biometeorology. The purpose of the new series is to communicate the interdisciplinary philosophy and science of biometeorology to as wide an audience as possible, introduce scientists and policy makers to the societal relevance of and recent developments in its s- fields and demonstrate how a biometeorological approach can provide insights to the understanding and possible solution of cross-cutting environmental issues. One such cross-cutting environmental issue is climate change. While the literature on the science of climate change, climate change mitigation and the impacts of climate change is voluminous, that on adaptation to

climate change is meagre in comparison. The purpose of this book is to partly redress this imbalance by providing insights from a biometeorological perspective. The book acknowledges that society has a long history of adapting to the impacts associated with climatic variability and change but makes the point that climate change poses a real threat to already strained coping systems. Therefore there is a need to realign human use systems with changing climate conditions.

Climate Change, the Indoor Environment, and Health

Outdoor Thermal Comfort in Urban Environment

The Effects of Hot, Moderate, and Cold Environments on Human Health,

Comfort, and Performance, Third Edition

The indoor environment affects occupants' health and comfort. Poor environmental conditions and indoor contaminants are estimated to cost the U.S. economy tens of billions of dollars a year in exacerbation of illnesses like asthma, allergic symptoms, and subsequent lost productivity. Climate change has the potential to affect the indoor environment because conditions inside buildings are influenced by conditions outside them. Climate Change, the Indoor Environment, and Health addresses the impacts that climate change may have on the indoor environment and the

resulting health effects. It finds that steps taken to mitigate climate change may cause or exacerbate harmful indoor environmental conditions. The book discusses the role the Environmental Protection Agency (EPA) should take in informing the public, health professionals, and those in the building industry about potential risks and what can be done to address them. The study also recommends that building codes account for climate change projections; that federal agencies join to develop or refine protocols and testing standards for evaluating emissions from materials, furnishings, and appliances used in buildings; and

that building weatherization efforts include consideration of health effects. Climate Change, the Indoor Environment, and Health is written primarily for the EPA and other federal agencies, organizations, and researchers with interests in public health; the environment; building design, construction, and operation; and climate issues.

This book focuses on human adaptive thermal comfort in the building environment and the balance between reducing building air conditioning energy and improving occupants' thermal comfort. It examines the mechanism of human thermal adaptation using a newly

developed adaptive heat balance model, and presents pioneering findings based on an on online survey, real building investigation, climate chamber experiments, and theoretical models. The book investigates three critical issues related to human thermal adaptation: (i) the dynamics of human thermal adaptation in the building environment; (ii) the basic rules and effects of human physiological acclimatization and psychological adaptation; and (iii) a new, adaptive, heat balance model describing behavioral adjustment, physiological acclimatization, psychological adaptation, and physical improvement effects. Providing

the basis for establishing a more reasonable adaptive thermal comfort model, the book is a valuable reference resource for anyone interested in future building thermal environment evaluation criteria.

Indoor climate is determined by rational lighting, heating, cooling and ventilating systems. For occupants' well-being it should be consistent with how regional outdoor climate works in the flow of radiation via four paths of heat transfer: radiation; convection; conduction; and evaporation. This book starts with the relationship between the human body and its immediate environmental space followed by a brief introduction of

passive and active systems for indoor climate conditioning. The nature of light and heat is discussed with a focus on building envelope systems such as walls and windows, and then examined from the viewpoint of thermodynamics and human-biology. Some examples are given to enable a better understanding of luminous and thermal characteristics of our most immediate environment particularly for those professionally involved in environmental planning, designing, and engineering to know about bio-climatic design principle.