Urban Climate News

Quarterly Newsletter of the IAUC

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From the IAUC President

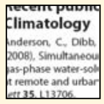
Welcome to the last issue in 2008 of Urban Climate News, the quarterly newsletter of the IAUC. It has been another exciting and busy year for urban climatology and I would like to take this opportunity to thank all members who have contributed to the continuing success of the IAUC.

The current newsletter includes a mix of articles, reports as well as lots of news and conference announcements. In particular I would like to draw you attention to the **Feature** article by Brian Stone, which analyzes urban and rural temperature trends in the proximity of large U.S. cities during the second half of last century. Further, two **Urban Project** reports look at urban climate spaces as a multi- and interdisciplinary research project and the influence weather information has on predicting the thermal performance of buildings.

I am very pleased to report that one of our esteemed IAUC members, **Sue Grimmond**, is the winner of the 2009 **Helmut E Landsberg Award** of the American Meteorological Society. This award recognizes an individual or team for exemplary contributions to the fields of urban meteorology, climatology, or hydrology. Quoting from the citation Sue has received the award "for numerous important contributions that have greatly advanced urban meteorology and urban climate sciences, and for sustained and effective leadership that has energized the urban climate research community". Sue was an inaugural Board member (2000-03) and President (2003-07) of IAUC and currently serves as Past-President on the Board.

As you will probably have seen by now, the **deadline for submitting abstracts for the 7th International Conference on Urban Climatology (ICUC-7) has been extended until 23 January, 2009** (see also p. 21). I urge all members to consider attending and advertising this important conference (the only one to focus exclusively on themes across the entire breadth of the field of urban climatology) as widely as possible. The International Scientific Committee

Inside the Winter issue...



is in the process of putting together an exciting program with a mix of local and international plenary speakers who will share their insight on applied and timely topics.

It gives me great pleasure to report that the voting members of the Board have elected **Gerald Mills** (School of Geography, Planning and Environmental Policy, University College Dublin, Ireland) as the next President and **Rohinton Emmanuel** (School of Built and Natural Environment, Glasgow Caledonian University, UK) as the next Secretary of the IAUC. Gerald and Rohinton will serve as President-Elect and Secretary-Elect, respectively until assuming their duties in 2010 when the terms of the current President and Secretary end. Finally, please look out for the announcement of the 2008 winner of the IAUC Luke Howard Award early next year.

With best wishes for a happy and healthy NEW Year in 2009!

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Olympic pollution controls in Beijing had big impact on local air quality

UPDATE: In the Fall issue of Urban Climate News, Winston Chow reported on urban air quality strategies being implemented in Beijing, China for the summer Olympic games. Now, satellite data from NASA indicate that these strategies — while they were in effect — did in fact lead to a noticeable reduction in air pollution levels.

December, 2008 — Chinese government regulators had clearer skies and easier breathing in mind in the summer of 2008 when they temporarily shut down some factories and banished many cars in a pre-Olympic sprint to clean up Beijing's air. And that's what they got.

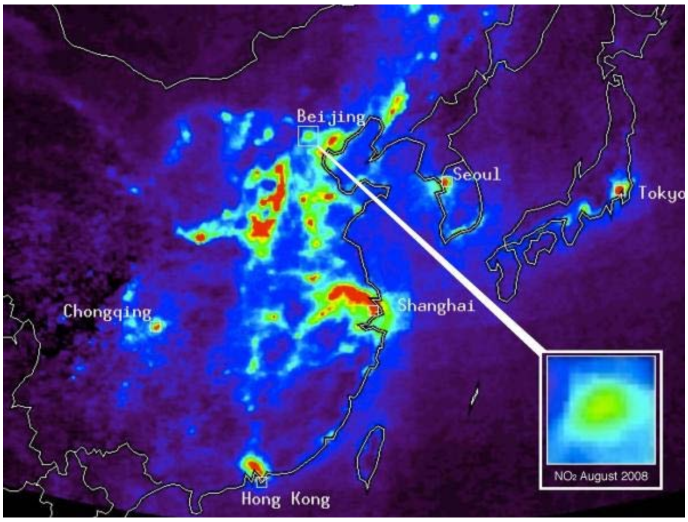
NASA researchers have analyzed data from NASA's Aura and Terra satellites showing how key pollutants responded to the Olympic restrictions — and according to atmospheric scientist Jacquelyn Witte and colleagues from NASA's Goddard Space Flight Center, the emission restrictions had an unmistakable impact. During the two months when restrictions were in place, the levels of nitrogen dioxide (NO_2) — a noxious gas resulting from fossil fuel combustion (primarily in cars, trucks, and power plants) — plunged nearly 50 percent. Likewise, levels of carbon monoxide (CO) fell about 20 percent. Witte presented the results on behalf of the team on December 16 at the fall meeting of the American Geophysical Union in San Francisco.

Some scientists have questioned whether Beijing's highly publicized air quality restrictions actually had an impact, and the new data indicate that they did. "After the authorities lifted the traffic restrictions, the levels of these pollutants shot right back up," Witte noted.

The steep decline in certain pollutants surprised the researchers. In a preliminary analysis of the data, the effect seemed to be minimal, explained Mark Schoeberl, project scientist for the Aura mission and a contributor to the study. The reductions only became noticeable when the investigators focused tightly on the Beijing area.

"If you take a wide view, you start to pick up long distance transport of pollutants," Schoeberl said. That seemed to be the case with sulfur dioxide (SO_2), which has a longer lifetime in the atmosphere. Although satellites detected reductions in levels of SO_2 — a major byproduct of coal-fired power plants and a key ingredient of acid rain — the decline was more widespread due to a larger effort to reduce SO_2 emissions across China, explained Kenneth Pickering, another Goddard scientist involved in the research.

Witte and colleagues presume that winds carried SO_2 in from the heavily industrialized provinces to the south of Beijing. However, she cautions that it is difficult to capture accurate readings of sulfur dioxide from the satellites due to difficulties detecting the gas low to the ground, where it is most abundant. It's best to consider the SO_2 measurements a work in progress, emphasized Pickering.



Levels of nitrogen dioxide (NO_2) plunged nearly 50 percent in and around Beijing in August 2008 after officials instituted strict traffic restrictions in preparation for the Olympic Games. *Source:* NASA

Ultimately, researchers aim to use satellite data to evaluate and refine local and regional models to predict how pollution levels respond to changes in emissions. Such models are important for understanding the integrated Earth system and aiding policymakers considering ways to reduce pollution.

Until recently, it's been difficult to improve atmospheric composition and chemistry models because scientists have had difficulty correlating "bottom up" estimates of total emissions — tallies of likely pollution sources, such as the number of cars on the road or the amount of coal burned — with "top down" observations from instruments on satellites. According to Pickering, data from the Netherlands-supplied Ozone Monitoring Instrument (OMI) on Aura and the Measurement of Pollution in the Troposphere (MOPITT) instrument on Terra help significantly.

Still, it will take a few years for the research team — which includes investigators from the University of Iowa and Argonne National Laboratory in Illinois — to perfect and finalize the models.

Pickering notes that the data from Aura and Terra are unique and will help scientists devise more accurate ways to quantify and evaluate ongoing efforts to reduce emissions.

Source: http://www.nasa.gov/topics/earth/features/olympic_pollution.html

Atmospheric brown clouds dramatically reducing sunlight in Asian cities

November, 2008 — A noxious cocktail of soot, smog and toxic chemicals is blotting out the sun, fouling the lungs of millions of people and altering weather patterns in large parts of Asia, according to a report released recently by the United Nations.

The byproduct of automobiles, slash-and-burn agriculture, wood-burning kitchen stoves and coal-fired power plants, these plumes of carbon dust rise over southern Africa, the Amazon basin and North America but are most pronounced in Asia, where so-called atmospheric brown clouds are dramatically reducing sunlight in many Chinese cities and leading to decreased crop yields in swaths of rural India, says a team of more than a dozen scientists who have been studying the problem since 2002.

Combined with evidence that greenhouse gases are leading to a rise in global temperatures, the report's authors called on governments rich and poor to address carbon emissions.

"The imperative to act has never been clearer," Achim Steiner, executive director of the United Nations Environment Program, said in Beijing, where the report, "Atmospheric Brown Clouds: Regional Assessment Report With Focus on Asia," was released.

The brownish haze, sometimes more than 1.6 kilometers thick and clearly visible from airplanes, stretches from the Arabian Peninsula to the Yellow Sea.

In the spring it sweeps past North and South Korea and Japan. Sometimes the cloud drifts as far west as California. The report identifies 13 cities as brown-cloud hotspots, among them Bangkok, Cairo, New Delhi, Seoul and Tehran. In some Chinese cities, the smog has reduced sunlight by as much as 20 percent since the 1970s, the report says.

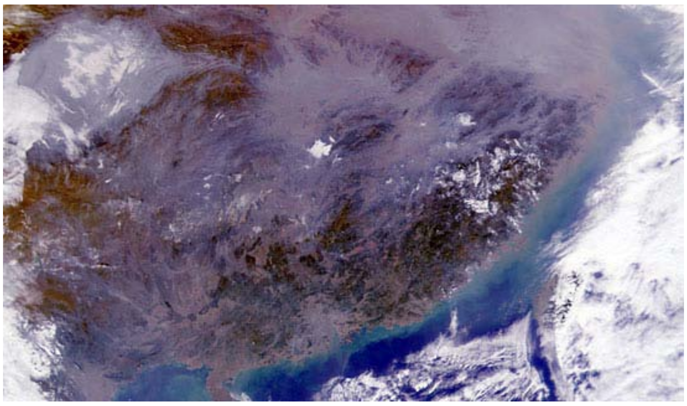
Rain can cleanse the skies, but some of the black grime that falls to earth ends up on the surface of the Himalayan glaciers that are the source of water for billions of people in China, India and Pakistan.

The result: The glaciers that feed into the Yangtze, Ganges, Indus and Yellow rivers are absorbing more sunlight and melting quicker, researchers say.

According to the Chinese Academy of Sciences, those glaciers have shrunk 5 percent since the 1950s and at the current rate of retreat could shrink by an additional 75 percent by 2050.

"We used to think of this brown cloud as a regional problem, but now we realize its impact is much greater," said Veerabhadran Ramanathan, who led the UN scientific panel. "When we see the smog one day and not the next, it just means it's blown somewhere else."

Although their overall impact is not entirely understood, Ramanathan, a professor of climate and ocean sciences at the University of California in San Diego, said the clouds might be affecting rainfall in parts of India and Southeast Asia, where monsoon rainfall has been decreasing in recent decades, and central China, where devastating floods have become more frequent.



A satellite image shows a dense blanket of polluted air over central eastern China covering the coastline around Shanghai. *Source:* NASA/Goddard Space Flight Center

He said some studies suggested the plumes of soot that block the sun have led to a 5 percent decline in the growth of Asian rice harvests since the 1960s.

For those who breathe the toxic mix, the impact can be deadly. Henning Rodhe, a professor of chemical meteorology at Stockholm University, estimates that 340,000 people in China and India die each year from cardiovascular and respiratory diseases that can be traced to the emissions from coal-burning factories, diesel trucks and kitchen stoves fueled by twigs.

"The impacts on health alone is a reason to reduce these brown clouds," he said, adding that in China about 3.6 percent of the nation's annual gross domestic product, or $82 billion, is lost to the health effects of pollution.

The scientists who worked on the report said the blanket of haze hovering over Asia and other parts of the world might be mitigating the worst effects of greenhouse gases by absorbing solar heat or reflecting it away from the earth. Greenhouse gases, by contrast, tend to trap the warmth of the sun and lead to a rise in ocean temperatures.

Steiner, the head of the UN environment program, said the findings complicated the global-warming narrative. The brown clouds mask the impact of the greenhouse gases, he said: Without the blocking effect of the smog, he said, climate change would be far worse.

"All of this points to an even greater and urgent need to take on emissions across the planet," he said.

Source: http://www.iht.com/articles/2008/11/13/healthscience/cloud.php

US conservation headquarters building gets new green roof

December, 2008 (ENS) — Secretary of the Interior Dirk Kempthorne recently cut the ribbon opening a new green roof that has been planted on the third wing of the Main Interior Building in Washington.

"What more suitable place for a green roof than the headquarters of America's conservation department in Washington, DC?" Secretary Kempthorne asked.

"With more than half of Washington, DC covered with paved or constructed surfaces that do not allow water to infiltrate the ground, 75 percent of rainfall becomes runoff," he said. The vegetation and soil on the green roof will absorb rainwater and curb runoff.

Washington, DC has an enormous problem from stormwater runoff and sewer overflows. Each year, at least a billion gallons of raw sewage are discharged into the Potomac River, Anacostia River and Rock Creek - all tributaries of the fragile Chesapeake Bay watershed.

The green roof on the Main Interior Building will help ease this problem by holding up to seven-tenths of an inch of rainfall to reduce stormwater runoff entering the sewage system. The green roof also will improve water quality by neutralizing the effects of acid rain and filtering pollution from rain and snow. And it provides habitat for songbirds and pollinators.

The plants will shield the roof from the sun's direct rays, which extends the roof's life span, insulates the building during the summer and saves energy as well as mitigating urban heat island effects. Inside the building, it will reduce noise transfer from the outdoors and provide a visually attractive sight for employees and visitors. Finally, the green roof is expected to improve the city's air quality a little by filtering the air that moves across the plants and, through photosynthesis, convert carbon dioxide into oxygen.

The green roof project started more than seven years ago when Mike Cyr, the National Business Center's chief of the Division of Facilities Management Services, read an article on the benefits of green roofs in Europe. Although green roofs were not commonplace at the time, Cyr decided to explore the possibility of installing a green roof on the Main Interior Building.

National Business Center personnel worked with in-house technical experts in the Office of Environmental Policy and Compliance. The group started by applying for and receiving free technical assistance from the Department of Energy's Federal Energy Management Program via the National Renewable Energy Laboratory. The feasibility study confirmed a green roof would work on the Main Interior Building within specified limitations.

They also partnered with the U.S. Environmental Protection Agency and the General Services Administration to work through the contracting process to find a green roofing company. The roof was installed by Roofscapes, Inc. of Phildelphia, the award-winning company that installed the famous green roof on Chicago City Hall.

Plants growing on the roof of the Montgomery Park Business Center, Baltimore, Maryland (Photo courtesy of the National Renewable Energy Lab)

Deputy Secretary of the Interior Lynn Scarlett, Office of Environmental Policy and Compliance Director Willie Taylor, National Business Center Director Douglas Bourgeois and Cyr joined the secretary at the ribbon cutting ceremony on the roof terrace outside the South Penthouse. At the ceremony, Kempthorne credited the deputy secretary for providing leadership on the green roof project.

"As the nation's premier conservation agency, Interior is pioneering use of green roofs at our historic headquarters in Washington. We want to apply a green thumb to our rooftops to reduce stormwater runoff," said Scarlett.

"Perhaps," she said, "we are entering what might be called the Age of Biology - the age of borrowing from nature's lessons as we manage lands, waters, and even our buildings."

The green roof is part of an ongoing modernization of the Main Interior Building will be conducted in six phases. Each phase will correspond to one of the six wings of the building, with a scheduled completion date of 2011 at an estimated cost of $175 million.

Source: http://www.ens-newswire.com/ens/dec2008/2008-12-16-092.asp

Oklahoma City Micronet commissioned at National Weather Festival

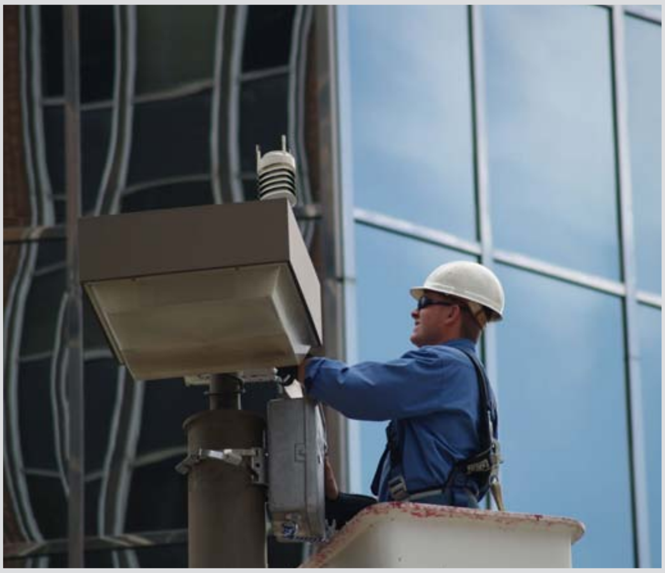
November, 2008 — On November 8, 2008, the Oklahoma City Micronet was commissioned as part of the festivities of the National Weather Festival in Norman, OK, USA. The Oklahoma City Micronet (OKCNET) is an operational network designed to improve atmospheric monitoring across the Oklahoma City metropolitan area and includes important partnerships between the Oklahoma Climatological Survey at the University of Oklahoma, the City of Oklahoma City, and the Oklahoma Mesonet (a joint project between the University of Oklahoma and Oklahoma State University). Some important facts about the Micronet include:

• The 40-station network consists of four Oklahoma Mesonet Stations (www.mesonet.org) and 36 stations mounted on traffic signals across Oklahoma City.

• All OKCNET stations collect real-time observations of air temperature, relative humidity, pressure, rainfall, wind speed, and wind direction.

• Observations from the OKCNET traffic signal stations are collected, quality assured, and displayed every minute while observations from the Oklahoma Mesonet sites installed in Oklahoma City are collected, quality assured, and displayed every five minutes.

• The multipurpose network was designed to provide critical weather information for the daily operations of the City of Oklahoma City, to spur new scientific research focused on urban meteorology, and to serve as a resource for the citizens of Oklahoma City.



One of the traffic light sites being deployed in Oklahoma City by Phillip Browder.

Unveiling a demo traffic light station at the National Weather Festival in Norman, OK (from left to right: Phillip Browder, Brad Illston and Jeff Basara)

• The Oklahoma City Micronet is a direct result of the Joint Urban 2003 (JU2003) experiment conducted during June and July of 2003 in Oklahoma City. The results of JU2003, the largest urban dispersion experiment ever conducted, demonstrated (a) the need for the rapid collection of atmospheric observations in urban areas and (b) the feasibility of deploying a dense network across the Oklahoma City metropolitan area.

It is also important to note that the Oklahoma City Micronet was designed to provide information to scientists as well as the public. As such, OKCNET is unique anywhere in the world in terms of rapid data collection, data quality assurance, and data provided to a variety of customers and end users. For more information about OKCNET or to view live data, please visit http://okc.mesonet.org/. For information regarding collaborations or datasets focused on scientific research, please contact Dr. Jeff Basara (jbasara@ou.edu).

Expert consortium preparing assessment report on cities and climate change

As cities around the world confront the urgent challenge of climate change, there is growing recognition that effective mitigation and adaptation policies must rely on sound scientific research and data. To facilitate and build the connections between science and policy, a consortium of experts from academic and research institutions around the world have formed the Urban Climate Change Research Network (http://www.uccrn.org/Site/Home.html).

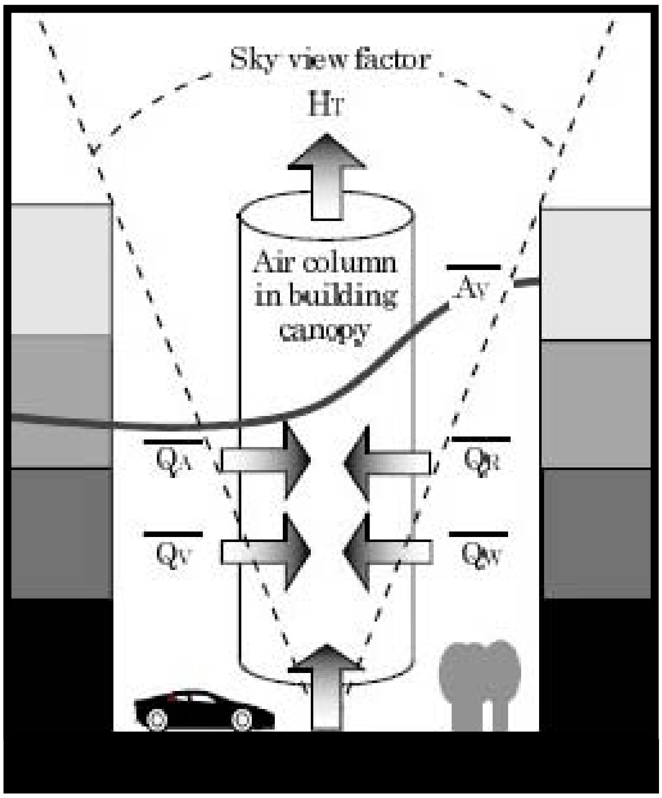
The UCCRN has recently announced plans to carry out an "International Panel for Cities and Climate Change (IPC3)" Assessment Report. This will be an effort similar to IPCC-style syntheses (involving about 50-60 experts) that includes mitigation, impact and adaptation for cities.

The assessment will be divided into separate chapters as well as cross-cutting chapters. This will be the first such assessment focusing on cities, and the outcome will be fed to processes such as the Copenhagen COP-15 and C-40 Summit in addition to the general scientific community.

The key leadership in this effort is being taken by colleagues from Columbia University, NASA's Goddard Institute for Space Studies and City University of New York, with support from a number of institutions including the World Bank, Earth Institute and others. For more information about the project, contact Toshiaki Ichinose (toshiaki@nies.go.jp).

Architectural Institute of Japan offering newsletter on Heat Island studies

The Architectural Institute of Japan (AIJ) has been giving special attention to the urban heat island phenomenon for many years. Since the 1990s, the AIJ has managed several subcommittees concerning this phenomenon and held many related workshops and symposiums. In 2007, a "Subcommittee on Heat Island" was established under the AIJ and initiated an english-language newsletter on heat island studies carried out in Japan. Volume 5 of the newsletter is now available on the subcommittee's website: http://news-sv.aij.or.jp/tkankyo/s3/



For more information contact: Takaaki Kono, Building Research Institute (t-kono@kenken.go.jp)

Urban and Rural Temperature Trends in Proximity to Large U.S. Cities: 1951-2000

by Brian Stone, Jr., Georgia Institute of Technology
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The annual reporting of mean global temperature estimates has become perhaps the most widely publicized and compelling evidence of global climate change in the eyes of the general public. Derived from a large network of meteorological stations distributed across the Earth's surface, these estimates are intended to provide the most reliable assessment of spatially averaged, "background" rates of climate change that are independent of local scale, human-induced effects on temperature (Quayle et al. 1999; Hansen et al. 2001). As data from urban meteorological stations are typically eliminated or adjusted for use in continental and global analyses of climate change, few studies have addressed how temperatures are changing in the areas most vulnerable to the public health impacts of warming: large cities. In this study, temperature data from urban and proximate rural stations for 50 large U.S. metropolitan areas are analyzed to establish the mean decadal rate of change in urban temperatures, rural temperatures, and heat island intensity over five decades.

1. Research Approach

Three principal methodological issues must be addressed in measuring urban and rural temperature trends over a multiyear time scale. These include a set of spatial and temporal inhomogeneities in the temperature record of in-situ meteorological stations, the classification of meteorological stations as urban or rural, and the selection of specific stations for inclusion in a study network.

This study makes use of meteorological stations drawn from the Global Historical Climatology Network (GHCN) that have been adjusted for standard inhomogeneities. Compiled by the Goddard Institute for Space Studies (GISS), the data are adjusted for urbanization through methods independent of those employed through the GHCN, and are available with or without the urban corrections (Hansen *et al*. 2001). Specifically, data for urban and rural meteorological stations located within or in proximity to each of 50 large metropolitan regions were obtained for this study. Specific criteria used in the process of station selection are discussed in the following section.

Urban and Rural Classification

Two principal methods have been used in temperature trend analyses to classify meteorological stations as urban or rural; these include the use of population information from the U.S. Census Bureau and the use of night light intensities recorded by satellite radiometers (Owen *et al*. 1998; Gallo *et al*. 1999; Hansen *et al*. 1999; Hansen *et al*. 2001).

In this present study, stations are classified as urban or rural based on both population data and satellite night light rankings provided by GISS. Urban stations are those found within metropolitan areas with populations greater than 700,000 and a night light ranking of C (bright). Rural stations are those found in non-metropolitan areas with populations less than 10,000 and a night light ranking of A (dark). As discussed in the following section, for some cities a minimum number of rural stations was not available in proximity to an urban station. In these instances, proximate stations with a population less than 10,000 and a night light ranking of B (dim) were used.[1] Overall, about one-fifth of the rural stations included in this study were ranked in the B category of night light.

Station Selection

A central objective of this study is to measure temperature trends in the most highly populated re-

[1] Imhoff *et al*. (1997) report that in many instances the level of night light intensity associated with the intermediate or dim ranking was a product of reflected light from urban areas and not necessarily indicative of urbanized land covers. A comparison of results from cities associated with A stations only and those associated with a mix of A and B stations found no significant difference in temperature trends.

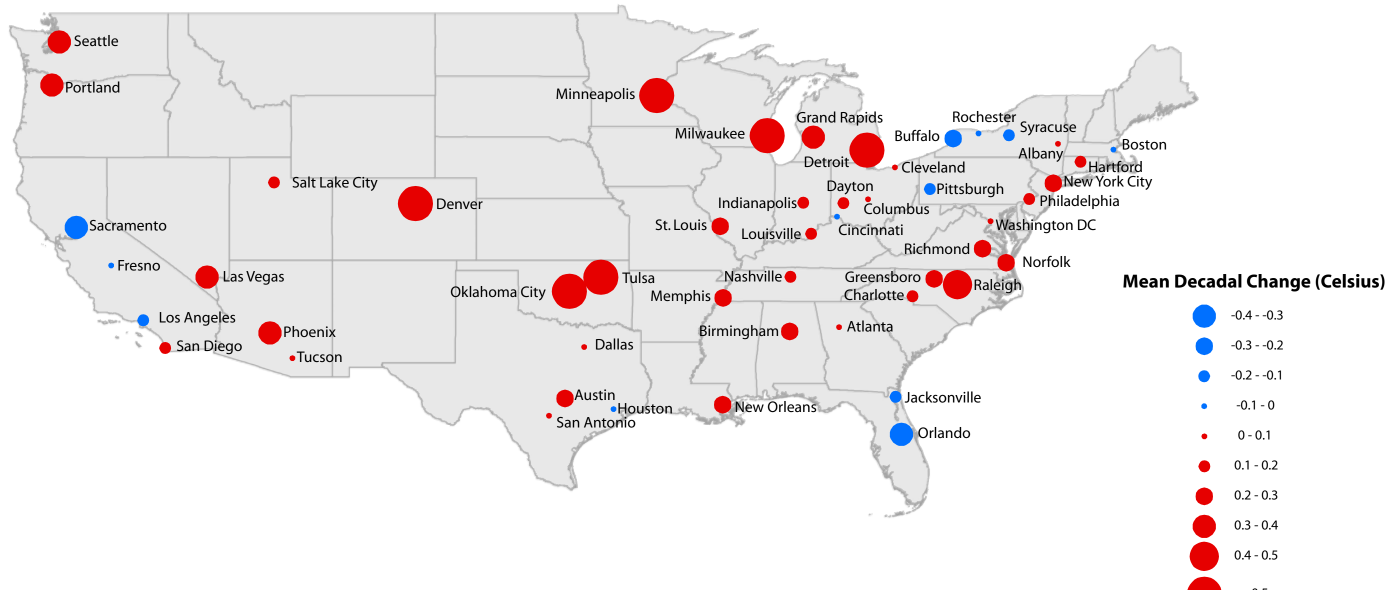

Figure 1. Temperature trends in URBAN stations.

gions of the United States, rather than evenly across a geographic extent. To this end, the 50 most populous U.S. metropolitan regions meeting a set of predetermined criteria were included in the study database. As only a single urban station is available for many large cities through the GHCN-based network compiled by GISS, all urban trends are represented by the primary airport meteorological station for each region.

To be included in the study database, an urban airport station must have a minimum of 550 of 600 complete months of mean monthly temperature observations between 1951 and 2000, a threshold for missing data that was found to be attainable for 48 of the 50 most populous cities. All urban stations were drawn from metropolitan statistical areas (MSA) with a 2000 U.S. Census population of at least 700,000 residents and a night light ranking of C.

For each study area, three rural meteorological stations were selected to represent regional background temperature trends based on three criteria. These included a minimum and maximum distance from the urban station (50 and 250 km, respectively), population and night light thresholds as discussed above, and a minimum of 550 of 600 months of monthly mean temperature observations between 1951 and 2000. In many regions, only three rural stations satisfying these criteria could be found; to be methodologically consistent, three rural stations were thus selected for each metropolitan area.

The outcome of this selection process resulted in the inclusion of 50 of the 60 most populous MSAs in the United States, representing more than 50% of the national population.

Analysis

Once constructed, the study database was analyzed to estimate the mean decadal rate of change in the temperature differential between urban and rural stations. To do so, monthly mean temperatures were averaged annually for each station. The mean annual temperatures for the three rural stations per city were averaged to derive a regional rural mean. This rural mean was then subtracted from the annual mean for the urban station to derive an estimate of the average urban heat island (UHI) intensity in each year between 1951 and 2000. As a final step, the mean annual heat island intensity was subtracted from the heat island intensity of the following year to estimate the annual rate of change in the regional UHI.

2. Results

The mean decadal changes in urban temperatures, rural temperatures, and UHI intensity by city are presented in Figures 1-3. As illustrated in Fig. 1, the majority of urban stations experienced a warming trend between 1951 and 2000. Thirty-eight of the 50 cities registered a warming trend averaging 0.30°C ($t=6.19$; $p<.01$) per decade, while 12 cities registered a cooling trend averaging -0.14°C ($t=4.33$; $p<.01$) per decade. Regionally, clusters of cooling can be seen in the northeast, Florida, and in three of

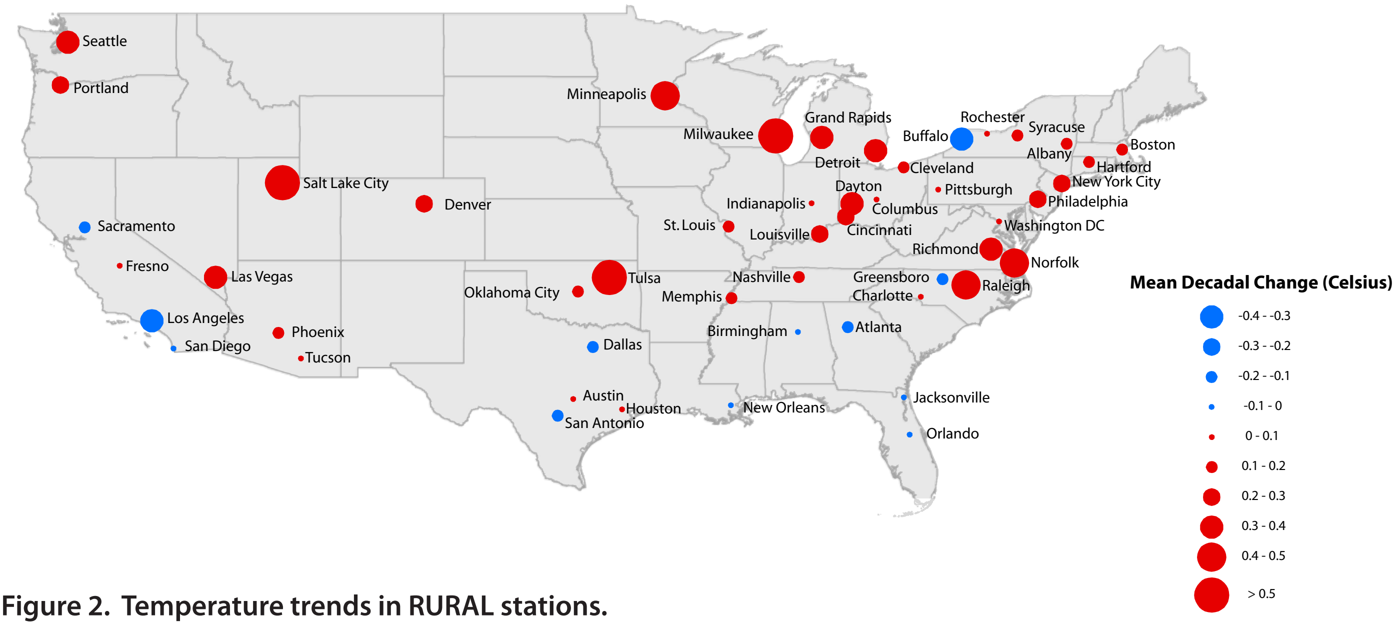

Figure 2. Temperature trends in RURAL stations.

four cities in California. The most rapidly warming cities tend to be found in the southern and upper Midwestern sections of the country.

Figure 2 indicates that an equal number of cities registered a cooling trend in their rural reference stations but with variance in the regional distribution of these trends. For 38 of 50 cities, rural reference stations experienced an average warming trend of 0.24°C (t = 6.48; p<.01) per decade, while 12 of 50 stations experienced a cooling trend of -0.13°C (t=-3.94; p<.01) per decade. Fig. 2 also indicates that many cities found to have warmed during this 50 year period are paired with rural stations that have experienced an average cooling trend, serving to further enhance an increase in heat island intensity during this period.

Figure 3 illustrates the mean decadal change in the urban and rural temperature differential during the study period. Across all 50 cities, the mean decadal change in urban temperatures between 1951 and 2000 was found to be 0.20°C (t=4.26; p<.01), while the mean decadal change in rural temperatures was found to be 0.15°C (t=4.04; p<.01). The mean decadal growth in UHI intensity between 1951 and 2000 was thus found to be 0.05°C (t=1.71; p<.05).

Twenty-nine of 50 cities experienced a mean decadal increase in heat island intensity of 0.19°C (t=7.31; p<.01), while 21 of 50 cities experienced a mean decadal reduction in heat island intensity of -0.14°C (t=-6.26; p<.01). Interestingly, a regional clustering of diminishing heat islands was found in the northeastern U.S. and in parts of the Ohio River Valley, while heat island intensity was found to be generally increasing throughout the southern U.S., with the exception of two cities in Florida.

3. Discussion and Conclusions

The results of this study compare favorably with other long-term, time-series analyses of urban and rural temperature trends. While the finding of a mean decadal differential between urban and rural temperatures of 0.05°C is higher than that found in previous, comparable analyses, this present study is the first to focus exclusively on large cities, which have been shown to exhibit more intense heat islands than less populous cities (Oke 1976; Karl *et al.* 1988). In their analysis of urban and rural temperature trends employing a similar but larger dataset, Hansen *et al.* (2001) report a mean decadal differential in urban and rural temperatures of 0.015°C. Gallo *et al.* (1999) find a differential in the mean rate of warming between urban and non-urban stations of 0.026°C per decade. In each case, a magnitude difference between the observed trends and those reported herein may be reasonably explained by the inclusion of less populous cities than this present study.

The results of this analysis suggest a wide variance in the temperature trends of large U.S. cities that is not well captured by any single measure of change. While the most populous U.S. cities were found to have warmed more rapidly than proximate rural stations on average, a significant number of ur-

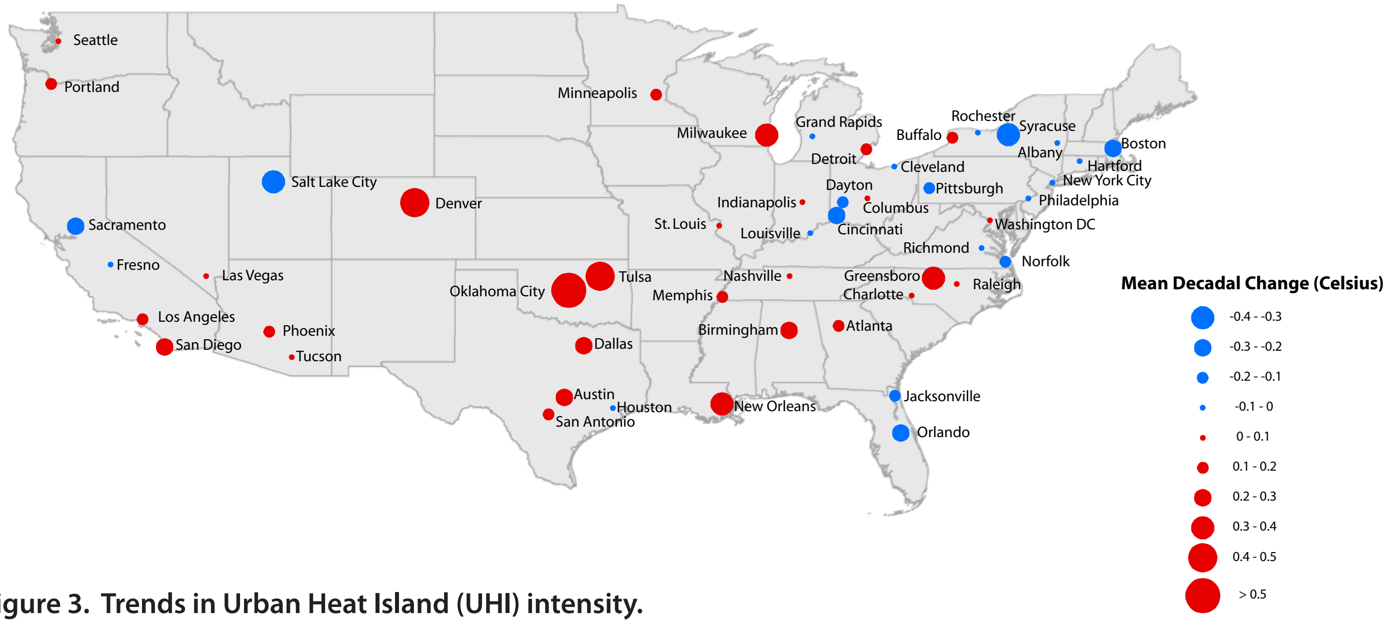

Figure 3. Trends in Urban Heat Island (UHI) intensity.

ban stations was found to have warmed less rapidly or cooled more rapidly than paired rural stations between 1951 and 2000. For those cities experiencing growth in heat island intensity over time, the mean rate of growth was found to be about four times greater (almost 2°C per century) than the mean for all cities, suggesting a substantial enhancement of background warming rates over time. In addition, the composition of heat island formation, both negative and positive, was found to be highly variable.

Significant to the field of planning and public health is the degree to which large urbanized areas may be amplifying background rates of warming attributed to global scale climate change. If the rural warming trends observed through this analysis are assumed to represent background warming rates in these regions (0.15°C per decade), then the finding of a mean decadal increase in heat island intensity of 0.05°C suggests background rates of warming are being amplified by a factor of one-third across all cities in the study. For the 29 cities experiencing an increasing trend in urban warming between 1951 and 2000, the rural rate of warming is 0.12°C per decade and the urban rate is 0.31°C per decade, yielding a mean decadal rate of increase in heat island intensity of 0.19°C. For these regions, the amplification of background warming rates through heat island formation is about 150%. These findings suggest planners and public health officials in large cities should be prepared to manage changes in temperature potentially in excess of those forecast by the Intergovernmental Panel on Climate Change (IPCC).

4. References

Gallo, K., T. Owen, D. Easterling, P. Jamason, 1999. Temperature trends of the U.S. Historical Climatology Network based on satellite-designated land use / land cover. *Journal of Climate* **12**: 1344-1348.

Hansen, J., R. Ruedy, J. Glascoe, and M. Sato, 1999. GISS analysis of surface temperature change. *Journal of Geophysical Research* **104**: 30,997-31,022.

Hansen, J., R. Ruedy, M. Sato, M. Imhoff, W. Lawrence, D. Easterling, T. Peterson, and T. Karl. 2001. A closer look at United States and global surface temperature change. *Journal of Geophysical Research* **106**: 23 947–23 963.

Imhoff, M.L., W.T. Lawrence, D.C. Stutzer, and C.D. Elvidge, 1997. A technique for using composite DMSP/OLS "city lights" satellite data to map urban area. *Remote Sensing of Environment* **61**: 361-370.

Karl et al., 1988. Urbanization: Its detection and effect in the United States climate record. *Journal of Climate* **1**: 1099–1123.

Oke, T. R., 1976. City size and the urban heat island. *Atmospheric Environment* **14**, 268–277.

Owen, T. W., K. P. Gallo, C. D. Elvidge, and K. E. Baugh. 1998. Using DMSP-OLS light frequency data to categorize urban environments associated with U.S. climate observing stations. *International Journal of Remote Sensing* **19**: 3451–3456.

Quayle, R.G., T.C. Peterson, A.N. Basist, C.S. Godfrey. 1999. An operational near-real-time global temperature index. *Geophysical Research Letters* **26**: 333-335.

Urban Climates Spaces – a multi- and interdisciplinary research project

Introduction

Architects, climatologists, engineers and psychologists have for a long time been interested in how weather and climate affects people in the outdoor environment in order to design better cities. The climate-human-behaviour link crosses the border of many different disciplines and thus an integrated research approach is necessary. However, most research has been carried out within the individual disciplines. This report presents the multi- and interdisciplinary research project "Urban Climate Spaces". The aim is to integrate and enlarge the knowledge of the complex climate-human-behaviour link and its implications for sustainable urban design. The project, which started in 2003, comprises scientists from the fields of climatology, psychology and architecture. In this respect the project is unique.

Methods

In the UCS project the focus is on the Nordic city, but an international perspective has been gained through a parallel study in Japan. Three cities located in different climate and cultural zones were selected for case studies – Göteborg, (57°42'N, 11°58'E), Luleå (65°35'N, 22°9'E) and Matsudo, a satellite city to Tokyo (35° 78' N, 139° 90' E). In total nine different urban places, representing typical outdoor public places such as parks, squares, courtyards and waterfronts plazas, were selected for case studies as shown in Fig. 1.

Outdoor activity, subjective weather assessments and place-related perceptions and emotions were investigated through structured interviews, observations and micrometeorological measurements. In total 6000 on-site interviews, 620 observations and 60 days of meteorological measurements were conducted.

The structured interviews comprised questions about demographic variables, general and specific questions about current weather and place, and behaviours and attitudes related to place and person (Thorsson *et al*. 2007). The interviews included three main questions and the participants were asked to answer the questions by responding to 5-point scales.

1. How do you perceive the weather today? (perception – perceived weather): (1) calm-windy; (2)

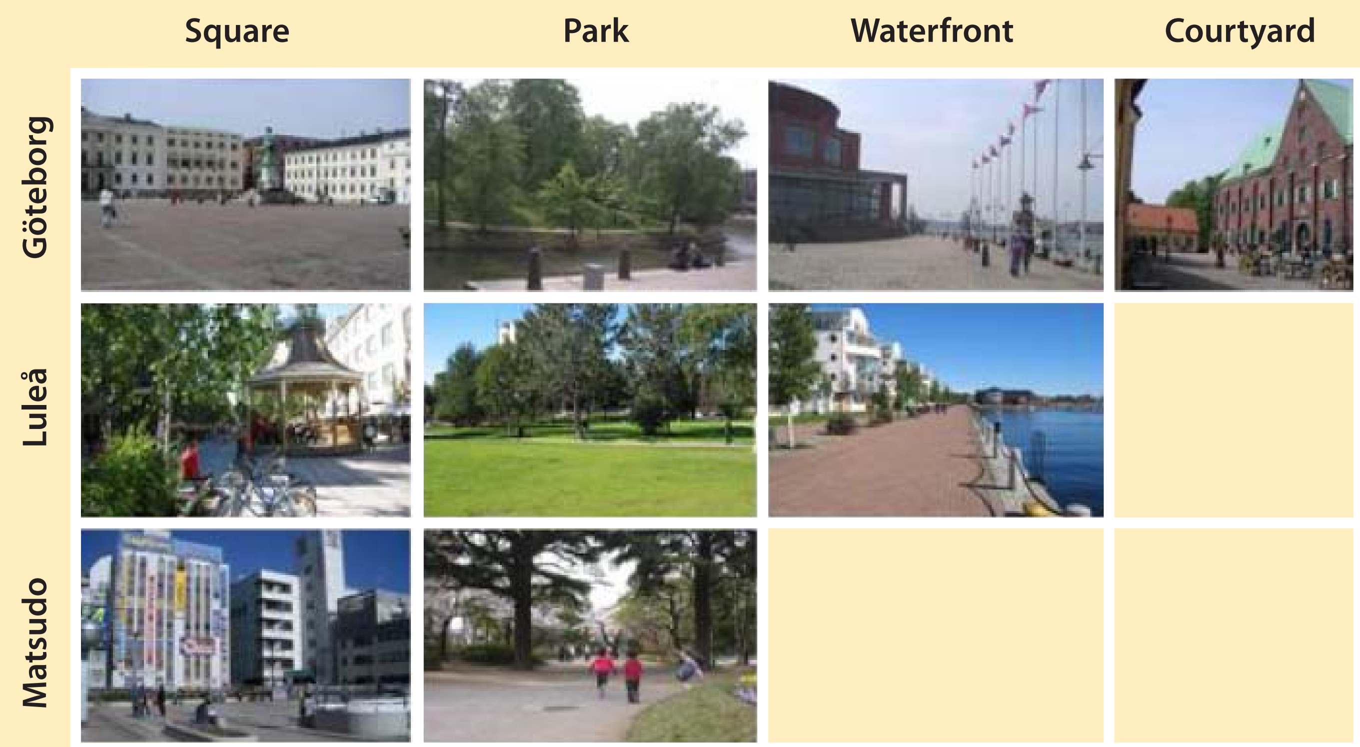

Figure 1. The nine urban places included in the UCS project.

cold-warm; and (3) good-bad for outdoor activity

2. How do you perceive the place right now? (perception – perceived place): (1) ugly-beautiful; (2) unpleasant-pleasant; (3) windy-calm; and (4) cold-warm

3. How do you feel right now in this place? (emotional and thermal perception): (1) elated-bored; (2) glad-gloomy; (3) calm-nervous and (4) active-passive

Weather and activity

Results show that Swedish people spend in general 5 percent of the day outdoors, i.e. about 45 minutes on weekdays and about 1 hour on weekends. Weather has a significant influence on the use of outdoor places, explaining up to 47 % of the variance in attendance (Eliasson *et al*. 2007). In general, the use of a place increases with air temperature and clear skies, but decreases with wind speed as shown in Fig. 2. Most places, with some exceptions are hardly ever used at low temperatures (i.e. below 0°C), but the use increases rapidly above certain site-specific temperature thresholds (8-15°C). Above these temperature thresholds, other meteorological factors such as clearness index and wind speed are more important. These results confirm those of previous studies (e.g. Nikolopoulou *et al*. 2001; Thorsson *et al*. 2004).

Weather and perception

Results show that the participants in the three cities perceive air temperature differently (Knez and Thorsson, 2006; 2008; Thorsson, 2008). For example, people living in northern Sweden (Luleå) perceive air temperatures below 10°C as warmer than people living in southern Sweden (Göteborg). The fact that the thermal environment is perceived differently in different climate regions must be taken into account when interpretating the output of thermal indices.

Weather and place-related perceptions

Results show that people's place-related perception is also influenced by the weather. For example, it is shown that a place is perceived more beautiful at high air temperatures than at low temperatures (Eliasson *et al*. 2007). Furthermore, it is shown that people assess some places, such as the waterfront plaza in Göteborg, as being more beautiful at high wind speeds, whereas other places such as the square in Göteborg are assessed as uglier as a result of high wind speeds (Eliasson *et al*. 2007). A tentative explanation is that high temperatures have a positive influence on peoples' place perceptions and that high wind speeds at the waterfront renders a positive aesthetic and symbolic value. The results are in line with previous studies that showed that the experience of nature in the city is a source of positive feelings (Chiesura, 2004) and that a high amount of natural characteristics such as trees increases the tolerance to widespread changes in the physical environment, provided they are produced naturally (Nikolopoulou and Steemers, 2003).

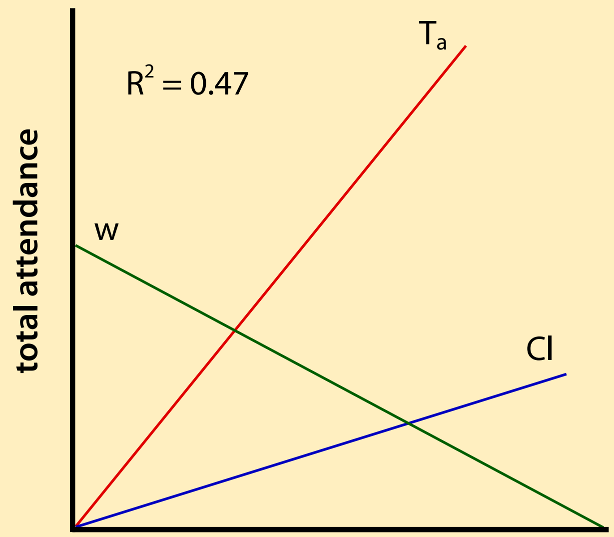

Figure 2. Total attendance as a function of air temperature (T_a), clearness index (CI) and wind speed (w), in the courtyard in Göteborg.

Weather and place-related emotions

Concerning place-related emotions, the participants feel most glad when the air temperature is high and the sky is clear (Eliasson *et al*. 2007; Knez *et al*. 2008), indicating a relation between weather and emotions, which generally is in line with Cunningham (1979) showing that sunlight might lead to a positive mood.

Climate and place-related attachment and identity

In Knez (2005) place-related identity and emotional bonds (attachment) evolved towards urban places, and the kind of autobiographical (self-related) memories people have for urban places are examined. The results indicate a significant role of climate in subjects' conceptions of urban places, especially for those considered to be highly attached to their residential area. The results show that prolonging one's stay at a place intensifies one's emotional bond to that place which in turn leads to that place becoming more a part of one's place-related identity.

Significance of research

In sum, the UCS project shows that weather is an important factor for the use of outdoor places, as well as for peoples' place perception and emotions. The project also illuminates the psychological mechanisms involved in outdoor place and weather assessment.

High usage and activity are often used as measures of successful urban places (Carmona *et al*. 2003). The UCS project thus shows that in order to create successful public places weather can not be neglected, since it accounts for up to 50% of the variance in attendance. By designing with climate in mind and taking advantage of the positive effects of weather and climate it is possible to create a more comfortable outdoor living environment. This will lead to more people in the streets, which in turn will have positive social, health, safety, economical and environmental effects.

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References

Carmona, M., Heat, T., Oc, T., Tiedsell, S., 2003: *Public Places—Urban Spaces: The dimensions of urban design.* Archtectural Press, Elsevier.

Chiesura, A., 2004: The role of urban parks for the sustainable city. *Landscape and Urban Planning* **68**, 129–138.

Cunningham, M.R. 1979: Weather, mood, and helping behaviour: Quasy experiments with the sunshine Samaritan. *Journal of Personal Social Psychology* **37**, 1947-1956.

Eliasson, I., Knez, I., Thorsson, S., Westerberg U., Lindberg, F., 2007: Climate and behavior in a Nordic city. *Landscape and Urban Planning* **82**, 72-84.

Knez, I., 2005: Attachment and identity as related to a place and its perceived climate. *Journal of Environmental Psychology* **25**, 207-218.

Knez, I., Thorsson, S., 2006: Influences of culture and environmental attitude on thermal, emotional and perceptual evaluations of a square. *International Journal of Biometeorology* **50**, 258-268.

Knez, I., Thorsson, S., 2008: Thermal, emotional and perceptual evaluations of a park: Cross -cultural and environmental attitude comparisons. *Building and Environment* **43**, 1483–1490.

Knez, I., Thorsson, S., Eliasson, I., Lindberg, F. 2008: Psychological Mechanisms in Outdoor Place and Weather Assessment: Towards a Conceptual Model. Submitted to *International Journal of Biometeorology.*

Nikolopoulou, M., Baker, N., Steemers, K., 2001: Thermal comfort in outdoor urban spacers; understanding the human parameter. *Solar Energy* **70**, 227-235.

Nikolopoulou, M., Steemers, K., 2003: Thermal comfort and psychological adaptation as a guide for designing urban spaces. *Energy and Buildings* **35**, 95-101.

Thorsson, S., Lindqvist, M., Lindqvist, S., 2004: Thermal bioclimatic conditions and patterns of behaviour in an urban park in Göteborg, Sweden. *International Journal of Biometeorology* **48**, 149-156.

Thorsson, S., Honjo, T., Lindberg, F., Eliasson, I., Lim, E.M., 2007: Thermal comfort and outdoor activity in Japanese urban public spaces. *Environment and Behaviour* **39**, 660-684.

Thorsson, S., 2008: Urban Climate Spaces – a multi- and interdisciplinary research project. 18th International Congress of Biometeorology (ICB2008), Tokyo, Japan, 22-26 September.

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The effects of the variance in weather information on predictions of buildings' thermal performance

This study explores the implications of different input assumptions pertaining to local weather conditions (as represented in weather files) for computational predictions of buildings' thermal performance. As a case in point, we used twenty two distinctive weather files (based on meteorological data from different weather stations, different years) for the city of Vienna to compute heating and cooling energy demands of three different buildings. The results demonstrate the significant fluctuations in the buildings' predicted heating and cooling energy demand due to differences in micro-climatic assumptions. We explored the possibility to assess the impact of projected changes in standard micro-climatic indicators such as heating degree days and cooling degree hours on the buildings' heating and cooling loads.

1. Introduction

Computational building performance simulation provides a potentially effective means to support the design of buildings that provide desirable indoor environmental conditions while operating in an energy-efficient manner [1]. The reliability of performance simulation is, however, dependent on the quality of simulation input assumptions. Simulation-based prediction of the primary indicators of a building's thermal performance (energy requirements, thermal comfort conditions) requires, amongst other things, the specification of the micro-climatic context of the building [2]. Toward this end, dynamic thermal simulation applications typically rely on standard weather files. Such files are based on long-term monitored data from weather stations. There are two main reasons why this process involves uncertainties:

- Firstly, monitored data on weather conditions is available, in the strict sense of the word, only for a limited number of locations. Conditions in the specific location of a building may deviate from those of the designated (e.g. closest) weather station's location [3]. Algorithms are available, of course, that generate weather file data for locations for which measured data is not available. But the generated results contain various levels of error depending on the circumstances (e.g. the distance of the building location from the weather station location, differences in topographic conditions).
- Secondly, weather files are typically based on past observations. The actual weather conditions in any specific year can be very different from the pattern indicated by such long-term data. This is of course to be expected and is, as such, not problematic: the main objective of performance simulation is usually design benchmarking and optimization and not derivation of absolutely accurate predictions for a specific point in time in future. A problem occurs, however, if – as highlighted by recent discussions – a change in climate is to be expected [4]. For example, according to recent studies, the winter temperatures in eastern Austria in the next thirty years will be about 1.3 K higher than in the last eighty years. The summer temperatures in the dense urban areas could be up to 2.5 K higher and the frequency of heat waves will significantly increase. This would imply that historic weather information, if uncritically used for the prediction of the future performance of a long-life product such as a building, may lead to systematic errors. Thus, the scope of uncertainties caused by variations in the assumptions regarding micro-climatic conditions must be studied and the respective results must be provided to the professionals (architects and building performance specialists) toward realistic appraisal and specification of thermal performance characteristics of designs.

In this context, the present contribution explores the implications of different assumptions regarding micro-climatic boundary conditions (in a specific location) for

Table 1. General information concerning the three building models for simulation of heating and cooling demand

Building	B1	B2	B3
Type	Single family house	Unit in Apartment house	Office building
Gross floor area [m^2]	287	222	2887
Net floor area [m^2]	233	191	2656
Volume V [m^3]	976	687	10025
Envelope area A [m^2]	737	143	1594
Window area [m^2]	51	19.4	1409
Mean envelope U-Value [$W\,m^{-2}\,K^{-1}$]	0.72	0.63	1.37
V/A [m]	1.32	4.33	6.29

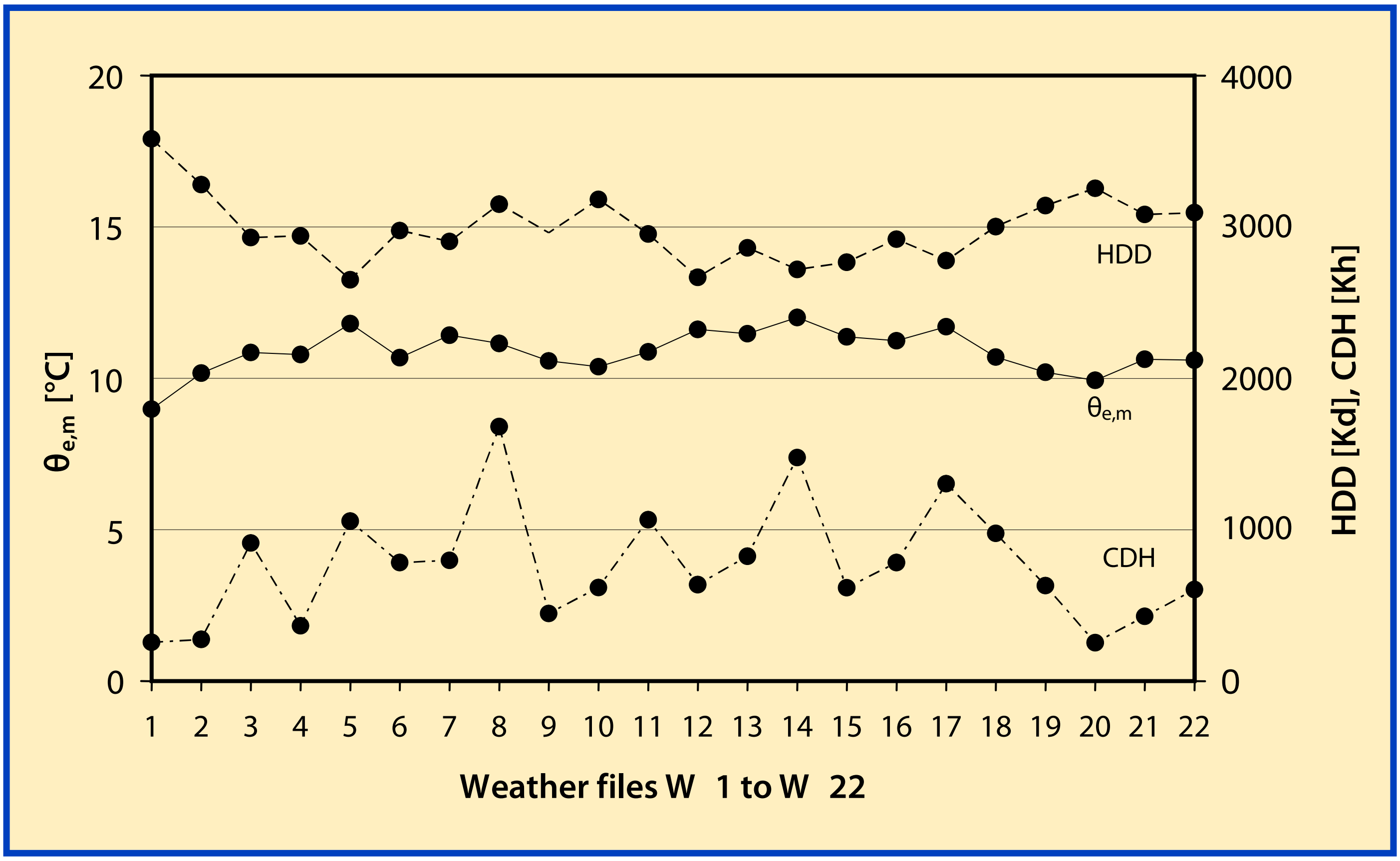

Figure 1. Mean outdoor temperature $\theta_{e,m}$ [°C], HDD [Kd], and cooling degree hours CDH [Kh] corresponding to weather files W_1 to W_22 (see Table 1).

computational predictions of energy performance of buildings. Specifically, the effects of variance in micro-climatic input data due to spatial (position of the monitoring station) and temporal (date of weather file) origins of weather information on the outcome of thermal performance simulation studies are analyzed.

2. Approach

The research method involved the following steps:

i) Three reference objects were selected, representing buildings of different size, function, and construction. Table 1 provides some basic information on these objects.

ii) Local weather information was collected for a reference city (Vienna, Austria). Thereby, 22 annual climatic data documents were considered (seven files from three different weather stations, data from one weather station for eleven successive years, a file from a simulation application, and three files from a climate database). Table 2 provides a summary of the selected weather files. Figure 1 shows the considerable differences in mean outdoor temperature, heating degree days (HDD), and cooling degree hours (CDH) associated with these files. HDD is a single-number descriptor (in Kd) of the climatic conditions in a specific location in view of building heating requirements. It is computed as the sum of the differences between the design indoor temperature (in this case 20 °C) and the mean daily outdoor temperature over all days for which the average outdoor temperature is below a certain threshold value (in this case 12°C). CDH is a single-number descriptor (in Kh) of the climatic conditions in a specific location in view of building cooling requirements. It is computed as the sum of the differences between the threshold indoor temperature (in this case 26°C) and the hourly outdoor temperature over all hours for which the outdoor temperature is above the threshold value [5].

iii) Numeric simulation of heating and energy demand was conducted for the selected reference objects using the above mentioned 22 alternative micro-climatic input data assumptions (cp. Table 2). Table 3 summarizes the user profile assumptions used for the simulations, which were conducted using a numeric transient thermal simulation application [6].

iv) Simulation results were used to explore the uncertainty involved in the computational prediction of criteria pertaining to the thermal performance of buildings. Moreover, the results were discussed in the context of climate change projections and their implications for the simulation-based predictions of buildings' energy performance.

3. Results

Figures 2 and 3 show the simulated heating and cooling energy demands of buildings B1 to B3 for weather files W_1 to W_22. As these figures demonstrate, computed heating and cooling energy requirements under the assumption of a standard reference year (such as W_19) can significantly deviate from those computed for the weather station of any specific year. To further illustrate this point, Table 4 summarizes the deviation of simulated heating and cooling energy demand of buildings B1 to B3 for standard weather file W_19 from the corresponding mean values simulated for more recent weather station files W_1 to W_11.

Furthermore, Table 5 shows the relative deviations (in %) of the maximum heating and cooling energy demand of buildings B1 to B3 from corresponding minimum values as applied to simulation results from year W_1 to year W_11.

These results suggest that assumptions pertaining to past data on micro-climatic conditions lead – given an ongoing gradual increase in global temperatures – to overestimation of future heating energy demand and underestimation of future cooling energy demand of buildings.

Our data allow us also to further explore the influence of the location of the weather station on fluctuations of simulated heating and cooling demand: As mentioned before, Vienna weather files were available for three different weather station locations ("Hohe Warte", "Innere Stadt", and "TU-Vienna") for three consecutive years (2004 to 2006). Table 6 summarizes the relative deviations of maximum from minimum simulated heating and cooling demand (in %) based on weather data from the three above-mentioned weather stations and for the years 2004 to 2006. These results suggest that discrepancies in simulated heating and cooling energy demand due to the application of weather data from different locations can be significant. In our study, such deviations were especially high in the case of heating energy demand calculations for office buildings and cooling energy demand for single houses.

Table 2. Selected weather files (city of Vienna, Austria)

Weather file	Source	Year
W_1	WS "Hohe Warte"	1996
W_2	WS "Hohe Warte"	1997
W_3	WS "Hohe Warte"	1998
W_4	WS "Hohe Warte"	1999
W_5	WS "Hohe Warte"	2000
W_6	WS "Hohe Warte"	2001
W_7	WS "Hohe Warte"	2002
W_8	WS "Hohe Warte"	2003
W_9	WS "Hohe Warte"	2004
W_10	WS "Hohe Warte"	2005
W_11	WS "Hohe Warte"	2006
W_12	WS "Innere Stadt"	2004
W_13	WS "Innere Stadt"	2005
W_14	WS "Innere Stadt"	2006
W_15	WS "TU-Vienna"	2004
W_16	WS "TU-Vienna"	2005
W_17	WS "TU-Vienna"	2006
W_18	WS "Unterlaa"	2006
W_19	Standard weather file in TAS [6]	1993
W_20	Standard weather Meteonorm [7]	1961-1990
W_21	Standard weather Meteonorm	1996-2005
W_22	Standard weather Meteonorm (extreme)	1996-2005

4. Conclusion

Computational building performance simulation is an important instrument to support the design of habitable and sustainable buildings. It provides a means to perform virtual experiments on building designs and to evaluate and optimize their expected performance before the actual construction and operation of buildings. However, building performance simulation is prone to errors and uncertainties beyond those associated with the reliability and robustness of the underlying algorithmic methods and procedures: one such source of uncertainty was addressed in the present paper, i.e., implications of micro-climatic assumptions for the simulation of the thermal performance of buildings.

Using the instance of alternative weather files for the city of Vienna, Austria, the significant range of fluctuations in the simulated values of buildings' heating and cooling energy demands were demonstrated. Specifically, simulation-based thermal performance predictions based on long-term past weather data are likely to considerably deviate from those that take climate change projections into account.

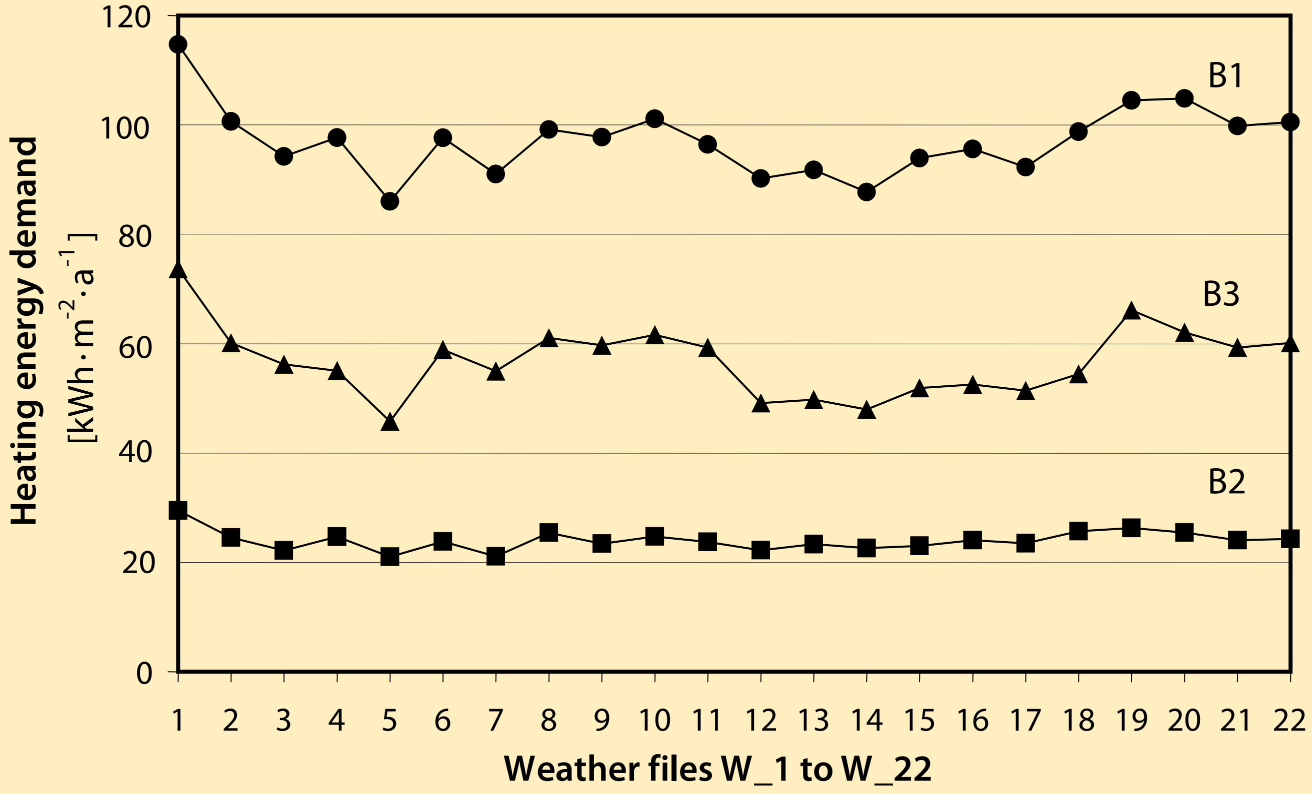

Figure 2. Simulated heating energy demands of buildings B1 to B3 for weather files W_1 to W_22

Table 3. User profile assumption for simulations

Building type	Residential	Commercial
Heating set-point temperature [°C]	20	20
Cooling set-point temperature [°C]	27	26
Heating system operation (hours)	24	14
Cooling system operation (hours)	24	12
Air change rate [h^{-1}]	0.4	1.2
Internal gains (people, lights, equipment) [W m^{-2}]	3.75	3.75
Operation days	365	269

Table 4. Relative deviations (in %) of heating and cooling energy demand of buildings B1 to B3 simulated for standard weather file W_19 from the corresponding mean values simulated for weather station files W_1 to W_11

Building	B1	B2	B3
Heating energy demand deviation	+7	+10	+12
Cooling energy demand deviation	-111	-14	-8

Table 5: Relative deviations (in %) of the maximum heating and cooling energy demand of buildings B1 to B3 from corresponding minimum values as applied to simulation results from year W_1 to year W_11

Building	Energy demand for	Relative deviation [%] of maximum from minimum
B1	Heating	33
	Cooling	566
B2	Heating	40
	Cooling	66
B3	Heating	61
	Cooling	143

References

1. Mahdavi, A. (2004). Reflections on computational building models. *Building and Environment*. Volume **39**, Issue 8, August 2004. ISSN 0360-1323. pp. 913 – 925.

2. Degelman, L. (2003). Simulation and uncertainty:

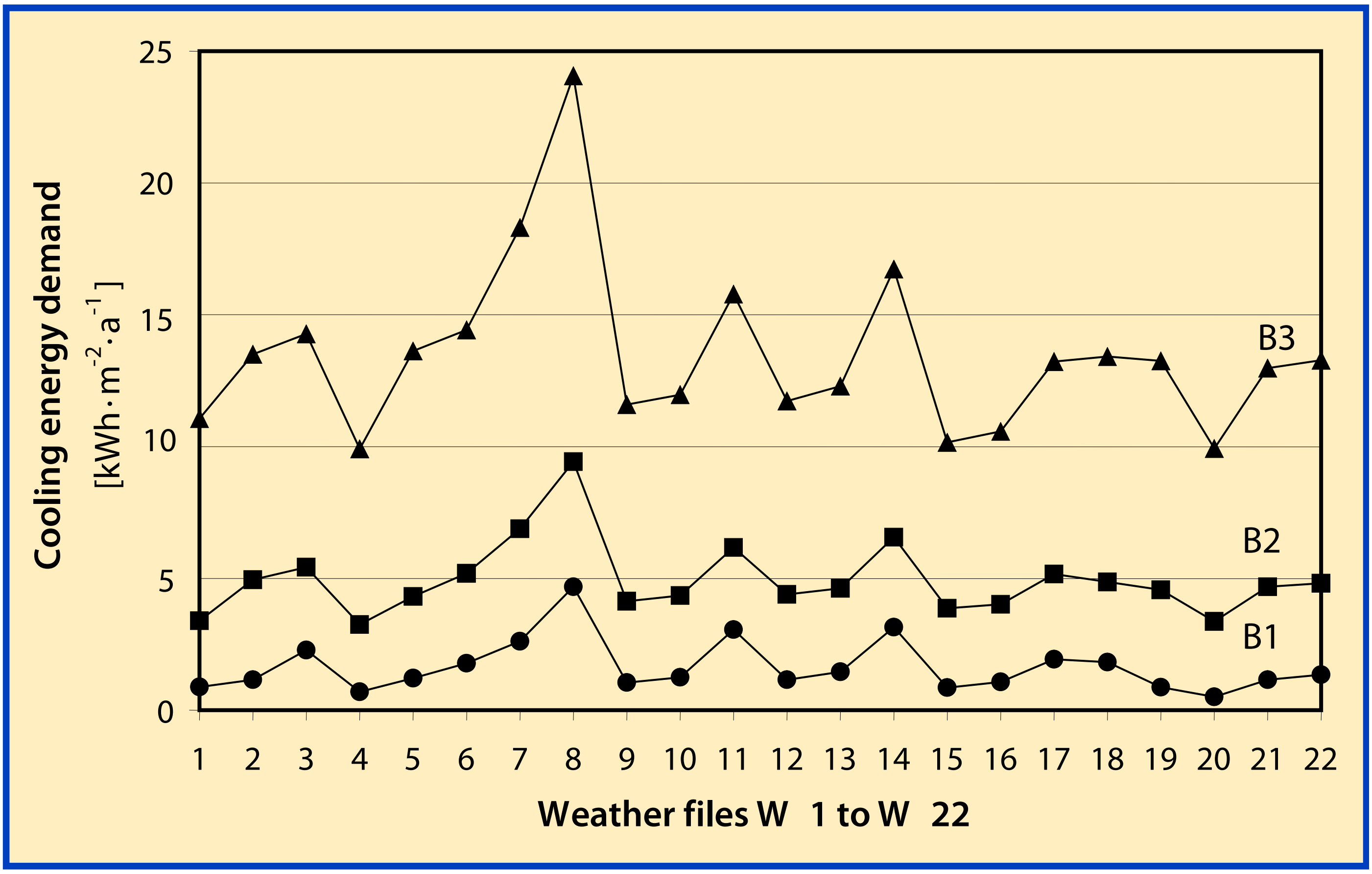

Figure 3. Simulated cooling energy demands of buildings B1 to B3 for weather files W_1 to W_22

weather predictions. In: Malkawi and Augenbroe (Eds). *Advanced building simulation*. Spon Press. ISBN 0-415-32122-0.

3. S Johansson D. (2008). Comparison between synthetic outdoor climate data and readings – Applicability of Meteonorm in Sweden for building simulations. In *Indoor Air 2008: Proceedings of the 11th International Conference on Indoor Air Quality and Climate*. Eds.: Strøm-Tejsen P, Olesen BW, Wargocki P, Zukowska D, Toftum J, Indoor Air 2008, Copenhagen, Denmark, 2008, paper ID: 74. ISBN 9788778772701.

4. Girman J, Axelrad B, Duncan A, and Kolb L. (2008). Impacts of climate change on indoor environments. In *Indoor Air 2008: Proceedings of the 11th International Conference on Indoor Air Quality and Climate*. Eds.: Strøm-Tejsen P, Olesen BW, Wargocki P, Zukowska D, Toftum J, Indoor Air 2008, Copenhagen, Denmark, 2008, paper ID: Mo9K2. ISBN 9788778772701.

5. Szokolay, S. V. (2004). *Introduction to Architectural Science*. Architectural Press. Elsevier. ISBN 0 7506 58495.

6. EDSL (2008). A-TAS Version 8.5. Environmental Design Solutions Limited. http://www.edsl.net

7. Meteotest (2008). Meteonorm V. 6.0. http://www.meteotest.ch

Table 6. Relative deviations of maximum from minimum simulated heating and cooling demand (in %) based on weather data from three different weather stations in the city of Vienna for the years 2004-2006

	Heating energy demand			Cooling energy demand		
Year	**B1**	**B2**	**B3**	**B1**	**B2**	**B3**
2004	8	5	22	22	13	15
2005	10	6	23	36	15	16
2006	10	5	24	68	27	27



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The 25th PLEA International Conference in Dublin, Ireland

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According to its website, PLEA stands for *"Passive and Low Energy Architecture", a commitment to the development, documentation and diffusion of the principles of bioclimatic design and the application of natural and innovative techniques for sustainable architecture and urban design.*

- *It serves as an open, international, interdisciplinary forum to promote high quality research, practice and education in environmentally sustainable design.*
- *It is an autonomous, non-profit association of individuals sharing the art, science, planning and design of the built environment.*
- *It pursues its objectives through international conferences and workshops; expert group meetings and consultancies; scientific and technical publications; and architectural competitions and exhibitions.*

http://www.plea-arch.net/

PLEA was formed in 1981 and has adopted an informal structure whereby membership is essentially related to interest in the subject matter and attendance at its annual conferences. In many respects, then, its structure and conferences provide an interesting comparison with those of the IAUC. It has a membership of over 2000 drawn from more than 50 countries. It is distinguished however from IAUC membership by the strong representation from applied professions (architects, town planners, engineers, etc.). Abstracts are submitted and accepted subject to approval by the organizers. Once accepted authors are requested to submit papers that are refereed. As a consequence organizing the event takes a considerable amount to time, particularly as a conference is held annually. This year's event was held in Dublin and was focused on the theme **Towards Zero Energy Buildings**.

The event lasted three days (Wednesday to Friday) and was comprised of plenary sessions on over-arching themes followed by paper and poster sessions. The scientific programme which consisted of 150 presentations and 100 posters was broken into three parallel sessions (see Table). All the sessions were held in a single building with three different sized rooms and an atrium. Sessions were switched from allocated rooms to adjust to the varying levels of interest. The atrium was used for the poster sessions and for coffee and lunch breaks. The conference integrated the poster sessions into discussions by setting aside time where interested parties would move systematically from poster to poster, each introduced by the poster author.

The papers reflected the level of interest in PLEA matters, particularly in the energy performance of buildings. Unlike ICUC conferences, there was a strong emphasis on engineering design and case-studies. However, from our perspective it was interesting to note the degree of interest in urban climates. Much of this stems from broader concerns about climate change. Nevertheless, there were sufficient papers to form a coherent session on the urban heat island (UHI), for example. On the worrying note however, it is apparent that much of the literature on the UHI in the urban climate field is largely unknown outside academic research circles. As a consequence, common observational and interpretation errors are being repeated anew as urban planners/architects consider the effects of the UHI and climate change. If nothing else this would suggest a need for greater interaction of the urban climate community with the PLEA community. At the same time, unlike ICUC, PLEA's focus on practical sustainable design, tools and case-studies showed how environmental performance could be linked to built form.

There were a couple of papers that that I found especially interesting because of their approach to topics often considered by urban climatologists. Almodovar Melendo

	Keynote presentations		
Wednesday	Sustainable Urban Design: The City 1	Design Tools and Technique for the Building and its Fabric	The User and Post-Occupancy Evaluation
Wednesday	Sustainable Urban Design: The City 2	Design Tools and Technique in Urban Design	Comfort
Wednesday	Sustainable Urban Design: Community	Design Support & Tools	Climate Sensitive Architecture
	Keynote presentations		
Thursday	Innovative Materials, Components and Systems 1	Integrated Design Practice	Showcase of Irish Architecture
Thursday	Innovative Materials, Components and Systems 2	Low Energy Design Strategy 1	Passive Design and Policy
Thursday	Daylight and Architecture 1	Low Energy Design Strategy 2	Bio-climatic low energy design
Thursday	Daylight and Architecture 2	Low Energy Design Strategy 3	Zero Energy Building, Design Process and Evaluation Innovative Systems, Components and Energy Systems Building Assessments and the Occupant
	Keynote presentations		
Friday	Zero Energy Building	Sustainable Urban Design: Urban Climate 1	The Role of Education
Friday	Low Carbon Design	Sustainable Urban Design: Urban Climate 2	Environmental Theory and Architecture
Friday	Zero Energy Building Regulation & Policy	Sustainable Urban Design: The Urban Heat Island	Renewable Energy Systems
	Closing event		

Table: Scientific Programme of PLEA 2008 in Dublin, Ireland

(University of Seville) presented on "Spanish-American Urbanism based on the Laws of the Indies: A comparative solar access study of eight cities." A great number of cities were constructed by the Spanish in many different climates over a 300 year period. Many of the cities have common components that were set down by the Laws of the Indies. This paper explored the effects of this form on solar access using eight cities located in different climates.

This paper illustrated the historical (and environmental) legacy that is embedded in existing cities.

Darren Robinson (École Polytechnique Fédérale de Lausanne) presented on "Comprehensive simulation and optimisation for more sustainable urban design." The paper presented an urban simulation model that assessed the performance of buildings while accounting for their urban context, including the presence of other buildings and their climatic effect. As described, the model could generate new buildings (to allow for urban growth), assess their 'fitness' and effectively generate an optimal solution. This paper demonstrated a comprehensive approach to the assessment of new urban growth and clearly has links with tools being developed in urban climatology.

PLEA 2009 will be held in Québec City, Canada on 22-24 June 2009 and will be held on the theme of **Architecture, Energy and the Occupant's Perspective**. Find all information on the website: http://www.plea2009.arc.ulaval.ca

The 7th International Conference on Urban Climate (ICUC-7)

June 29 – July 3, 2009 • Yokohama, Japan

Deadline for abstract submission has been extended: New deadline is **January 23, 2009**

Invitation

The International Association for Urban Climate (IAUC) warmly invites you to the *Seventh International Conference on Urban Climate (ICUC-7)* to be held in Yokohama, Japan from June 29 to July 3, 2009. *ICUC-7* is the continuation of a series of conferences starting in Kyoto, Japan in 1989, followed by those in Dakha, Bangladesh in 1993, Essen, Germany in 1996, Sydney, Australia in 1999, Lodz, Poland in 2003, and Göteborg, Sweden in 2006. The success of this series has helped to create a cohesive international community of urban climatologists.

The aims of the conference remain to provide an international forum where the world's urban climatologists can meet, to showcase and discuss modern developments in research and the application of climatic knowledge to the design of better cities. *ICUC-7* wishes to cater to the interests of a diverse community of meteorologists, climatologists, hydrologists, ecologists, engineers, architects and planners and others interested in these topics. On behalf of the organisers we are honoured to invite you to attend.

Dr. Manabu Kanda, *ICUC-7* Local Organizer
Dr. Matthias Roth, President of IAUC

Scientific Programme

The focus can be original research into the physical, biological and chemical atmospheric processes operating in built areas, the weather, climates and surface hydrology experienced in built areas, the design and testing of scale, statistical and numerical models of urban climates or reports on the application of climatic understanding in architectural design or urban planning. Papers may relate to new concepts, methods, instruments, observations, applications, forecasting operations, scenario testing, projections of future climates, etc. Sessions that focus on major field or other projects may be proposed. Appropriate topics include (but are not limited to):

- *Airflow over cities including turbulence, urban roughness and drag, changes of wind speed and direction, urban circulation systems, wind engineering*
- *Urban impacts on surface moisture, dew, evaporation, humidity, fog, cloud and precipitation*
- *Exchanges of heat, mass and momentum between the urban surface and its boundary layer*
- *Short- and long-wave radiation in polluted air, urban visibility*
- *Urban heat islands, their nature, genesis and mitigation*
- *Remote sensing of cities and urban climate*
- *Emission, dispersion, transformation and removal of air pollutants and their impact on the urban climate*

Venue: Pacifico Yokohama-Pacific Convention Plaza

- *Models of the urban atmosphere at all scales*
- *Forecasting urban weather, comfort, hazards, air quality*
- *Topoclimatology of cities including the effects of coasts, valleys and other landforms*
- *Climates of impervious surfaces such as streets, highways, runways and parking lots*
- *Climatic performance of urban trees, lawns, gardens, parks, irrigation, rivers, lakes and reservoirs*
- *Climate sensitive urban design and planning*
- *Building climates (interior and exterior) and the climatic performance of built features*
- *Urban bioclimates relevant to the functioning of plants, wildlife and humans*
- *Cities and global climate change (urban climate adaptation and mitigation)*

Abstract Submission

- Abstract submission deadline: **January 23, 2009** (new) Short abstract (maximum 200 words) can be submitted online at http://www.ide.titech.ac.jp/~icuc7
- Notification of acceptance: February 28, 2009
- Submission of extended abstract: May 15, 2009

Registration

- Early online registration: February 1 – March 31, 2009
- Late online registration: April 1 – May 31, 2009
- Onsite registration: June 28 – July 3, 2009

Registration fees

	Early (online)	*Late (online)*	*Onsite*
Full registration	60,000 JPY	65,000 JPY	70,000 JPY
Student/Retired	35,000 JPY	40,000 JPY	45,000 JPY
Accompanying person	10,000 JPY	12,000 JPY	15,000 JPY

Fees for delegates from less developed countries or non-OECD countries will be available upon request. Fees include access to all sessions, CD-ROM proceedings/program, on-site internet access, ice-breaker, all coffee breaks and an evening Tokyo Bay cruise (300 persons maximum). The International Scientific Committee will be composed of the board members of the IAUC (http://www.urban-climate.org/)

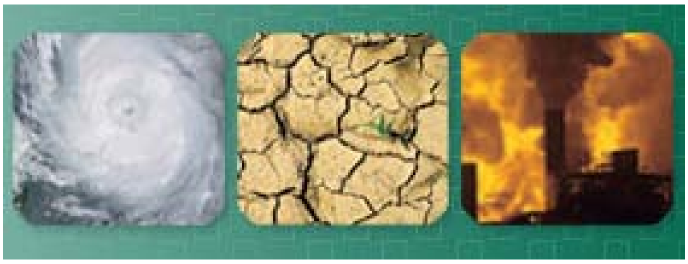
Contact Information:
Manabu Kanda, Chairman
Secretariat of ICUC-7
Tokyo Institute of Technology
E-mail: icuc7secretariat.mk@ide.titech.ac.jp
Web site: http://www.ide.titech.ac.jp/~icuc7/

NCAS Workshop on Urban Meteorology

We would like to invite you to participate in a 2-day Urban Meteorology workshop organized by the National Centre for Atmospheric Science (NCAS), UK.

Please register at: http://www.ncas.ac.uk/urban-met

Deadline for registration is **30 January 2009**.



Title: "Urban roughness sublayers - from measurements and CFD to predictive models"

Date: Mon 30 & Tue 31 March 2009

Venue: University of Reading, Department of Meteorology

Aims: There is a scarcity of reliable models of urban roughness sublayers, despite the wealth of experimental and CFD data gathered over recent years. This workshop will bring together leading scientists working in the subject and in related fields, with the aim of reviewing recent experimental and numerical results, discussing about the nature of turbulence in urban roughness sublayers, and generating ideas of how the urban roughness sublayer may be better modelled on the basis of the available results. Since modelling needs and methods depend on the application, scientists with expertise in urban dispersion and NWP are also invited.

Format of meeting: Review talks by invited speakers, shorter contributed research talks, discussions.

Broad themes:

• Linking recent work at street scale to modelling at larger scales.

• Understanding the relationship between urban morphology, flow structure/dynamics and flow statistics.

• What are the similarities and how do urban roughness sublayers differ from flows over other rough surfaces, e.g. over vegetation?

• Original experimental and numerical studies that may contribute to better understanding & modelling of urban roughness sublayers

Invited speakers will include:

• Prof John Finnigan (CSIRO, Australia)

• Prof Ian Castro (University of Southampton)

• Prof Alan Robins (University of Surrey)

• Prof Stephen Belcher (University of Reading)

• Dr. Andreas Christen (University of British Columbia)

• Mr Pete Clark (UK Met Office)

• Dr Janet Barlow (University of Reading)

• Dr Alberto Martilli (CIEMAT, Spain)

Organizing committee: Dr. Omduth Coceal , Dr, Janet Barlow, Dr. Zheng-Tong Xie, Prof. Stephen Belcher

Contact: Dr. Omduth Coceal (o.coceal@reading.ac.uk) or Dr. Zheng-Tong Xie (z.xie@soton.ac.uk).

Web: www.met.rdg.ac.uk/~sws97oc

Upcoming Conferences…

SPECIAL SESSION ON URBAN MICROCLIMATES: MAPPING, MEASUREMENTS, MODELS
Association of American Geographers Annual Meeting
Las Vegas, Nevada USA · March 22-27, 2009 · http://aag.org/annualmeetings/2009/
Session organizers: Jimmy Adegoke (adegokej@umkc.edu) & Joe McFadden (mcfadden@geog.ucsb.edu)

URBAN WEATHER & CLIMATE: NOW AND THE FUTURE
AMS 89th Annual Meeting
Phoenix, Arizona, USA • 11–15 January 2009
http://www.ametsoc.org/meet/annual/index.html

INTERNATIONAL CONFERENCE ON MEGACITIES:
Risk, Vulnerability and Sustainable Development
Leipzig, Germany • September 7-10, 2009
http://www.megacity-conference2009.ufz.de/

European Geosciences Union General Assembly 2009

Vienna, Austria • 19 – 24 April 2009

Special Session on "Megacities: Air Quality and Climate Impacts from Local to Global Scales"

http://meetingorganizer.copernicus.org/EGU2009/session/247

Convener: L. Molina
Co-Conveners: A. Baklanov , M. Gauss

The world's population is projected to increase 33% during the next three decades, to 8.1 billion. Nearly all of the projected growth is expected to be concentrated in urban centers. These rapidly expanding urban regions and surrounding suburban areas are leading to the phenomenon of megacities.

Megacities are defined as metropolitan areas with populations exceeding 10 million inhabitants. These mega-centers of human population are tied directly to increasing demands for energy and associated industrial activities that lead to accelerated stress and impacts on the environment. These impacts are significant and act on urban, regional and global scales. Air pollution has become one of the most important problems of megacities and has serious impacts on public health, visibility, and can cause heat island effects on the urban scale. On the regional scales, releases of aerosols and precursor gases can lead to regional haze and acidic deposition, as well as regional oxidant impacts. Release of longer lived greenhouse gases, aerosols, and other radiatively important species from megacity sources will be significant contributors to climate change.

Participants in this session will present atmospheric science studies conducted in large urban centers around the world, highlighting the following areas:

1. Emissions;
2. Photochemistry;
3. Aerosol and trace gas measurements;
4. Meteorological measurements;
5. Dynamics and radiative effects;
6. Regional climate;
7. Air quality modeling;
8. Satellite remote sensing of air quality in cities;
9. Implications of policy to reduce air pollution (air quality, health, climate change).

Solicited speakers:

Dr. Adrian Fernandez, President, National Institute of Ecology, Ministry of the Environment, Mexico, DF, Mexico: "Policy Implications of Air Quality Research and Co-benefit to Climate Change"

Dr. Mark G. Lawrence, Max Planck Institute for Chemistry, Department of Atmospheric Chemistry, Mainz, Germany: "An Overview of the MEGAPOLI Project"

Dr. Laurence Rouil, INERIS - Institut national de l'environnement industriel et des risques, France: "An Overview of the CityZen Project"

The deadline for submission of Extended Abstracts has been extended to December 1, 2008

The SICCUHI will be devoted to the science, engineering and public policies to help relieve the excess heat and air pollution of summers in hot cities. It has long been recognized that the excessive heat and smog in many cities in the summer, the "Urban Heat Island", is partly due to the choices of building materials, vegetation and urban design.

Scientists, engineers, builders, architects, and government officials concerned with improving the urban environment are urged to participate.

Recent publications in Urban Climatology

Anderson, C., Dibb, J. E., Griffin, R. J. & Bergin, M. H. (2008), Simultaneous measurements of particulate and gas-phase water-soluble organic carbon concentrations at remote and urban-influenced locations, *Geophys. Res. Lett* **35**, L13706.

Anderson, M., Holcombe, L., Flory, R. & Renaud, J. (2008), Implementing low-cost landslide risk reduction: a pilot study in unplanned housing areas of the Caribbean, *Natural Hazards* **47**(3), 297-315.

Azri, C., Tlijani, A., Abida, H., Maalej, A. & Medhioub, K. (2008), Seasonal evolutions of ozone (O_3) and its nitrogen precursors (NO, NO_2) in urban Sfax (Tunisia), *International Journal of Environment and Pollution* **35**(1), 71-89.

Barlow, J. F., Rooney, G. G., von Hünerbein, S. & Bradley, S. G. (2008), Relating Urban Surface-layer Structure to Upwind Terrain for the Salford Experiment (Salfex), *Boundary layer meteorology* **127**(2), 173-191.

Basara, J. B., Hall, P. K., Schroeder, A. J., Illston, B. & Nemunaitis, K. L. (2008), Diurnal cycle of the Oklahoma City urban heat island, *Journal of Geophys. Res.* **113**, D20109, doi:10.1029/2008JD010311,.

Brown, S. & Walker, G. (2008), Understanding heat wave vulnerability in nursing and residential homes, *Building Research & Information* **36**(4), 363 - 372.

Cai, X., Barlow, J. & Belcher, S. (2008), Dispersion and transfer of passive scalars in and above street canyons – Large-eddy simulations., *Atmospheric Environment* **42**(23), 5885-5895.

Carrara, M. & Colliera, C. (2007), Modelling the impact of high-rise buildings in urban areas on precipitation initiation, *Meteorological Applications* **14**(2), 149-161.

Cheng, W., Liu, C. & Leung, D. (2008), Computational formulation for the evaluation of street canyon ventilation and pollutant removal performance., *Atmospheric Environment* **42**(40), 9041-9051.

Chu, P., Chen, Y. & Lu, S. (2008), Atmospheric effects on winter SO2 pollution in Lanzhou, China, *Atmospheric Research* **89**(4), 365-373.

Codato, G., Oliveira, A. P., Soares, J., Escobedo, J. F., Gomes, E. N. & Pai, A. D. (2008), Global and diffuse solar irradiances in urban and rural areas in southeast Brazil, *Theoretical and Applied Climatology* **93**(1-2), 57-73.

Colle, B. A., Buonaiuto, F., Bowman, M. J., Wilson, R. E., Flood, R., Hunter, R., Mintzand, A. & Hill, D. (2008), New York Citys vulnerability to coastal flooding storm surge modeling of past cyclones, *Bulletin of American Meteorological Society* **89**(6), 829-841.

Thanks to everyone for their contribution in this edition. A large number of papers published until November 2008 are presented here.

All readers are invited to send any peer-reviewed references published since November 1, 2008 for inclusion in the next newsletter. Please send your references to jhidalgo@labein.es with a header "IAUC publications" and the following format:

Author:

Title:

Journal:

Volume:

Pages:

Dates:

Keywords:

Language:

Abstract:

Happy reading,

Julia Hidalgo

jhidalgo@labein.es

Davis, J., Collier, C., Davies, F. & Bozier, K. (2008), Spatial variations of sensible heat flux over an urban area measured using Doppler lidar, *Meteorological Applications* **15**(3), 367-380.

Di Sabatino, S., Solazzo, E., Paradisi, P. & Britter, R. (2008), A Simple Model for Spatially-averaged Wind Profiles Within and Above an Urban Canopy, *Boundary layer meteorology* **127**(1), 131-151.

Dijkema, M., van der Zee, S., Brunekreef, B. & van Strien, R. (2008), Air quality effects of an urban highway speed limit reduction, *Atmospheric Environment* **42**(40), 9098-9105.

El-Metwally, M., Alfaro, S. C., Wahab, M. A. & Chatenet, B. (2008), Aerosol characteristics over urban Cairo: Seasonal variations as retrieved from Sun photometer measurements, *J. Geophys. Res.* **113**, D14219.

Erell, E. (2008), The Application of Urban Climate Research in the Design of Cities, *Advances in Building Energy Research* **2**, 95-121.

Fang, C. (2008), Evaluating the thermal reduction effect of plant layers on rooftops, *Energy and Buildings* **40**(6), 1048-1052.

Favez, O., Sciare, J., Cachier, H., Alfaro, S. C. & Abdelwahab, M. M. (2008), Significant formation of water-insoluble secondary organic aerosols in semi-arid urban environment, *Geophys. Res. Lett.* **35**, L15801.

Finn, D., Kirk, L., Roger, G., Jason, D. & Jerry, K. (2008), Plume Dispersion Anomalies in a Nocturnal Urban Boundary Layer in Complex Terrain, *Journal of Applied Meteorology and Climatology* **47**(11), 2857--2878.

Furumai, H. (2008), Rainwater and reclaimed wastewater for sustainable urban water use, *Physics and Chemistry of the Earth* **33**(5), 340-346.

Georgakis, C. & Santamouris, M. (2008), On the estimation of wind speed in urban canyons for ventilation purposes- Part 1: Coupling between the undisturbed wind speed and the canyon wind, *Building and Environment* **43**(8), 1404-1410.

Georgescu, M., Miguez-Macho, G., Steyaert, L. T. & Weaver, C. P. (2008), Sensitivity of summer climate to anthropogenic land-cover change over the Greater Phoenix, AZ, region, *Journal of Arid Environments* **72**(7), 1358-1373.

Gibert, F., Xuéref-Rémy, I., Joly, L., Schmidt, M., Cuesta, J., Davis, K. J., Ramonet, M., Flamant, P. H., Parvitte, B. & Zéninari, V. (2008), A Case Study of CO2, CO and Particles Content Evolution in the Suburban Atmospheric Boundary Layer Using a 2-m Doppler DIAL, a 1-m Backscatter Lidar and an Array of In-situ Sensors, *Boundary layer meteorology* **128**(3), 381-401.

Golden, J., Hartz, D., Brazel, A., Luber, G. & Phelan, P. (2008), A biometeorology study of climate and heat-related morbidity in Phoenix from 2001 to 2006, *International Journal of Biometeorology* **52**(6), 471-480.

Gratani, L., Crescente, M. & Varone, L. (2008), Long-term monitoring of metal pollution by urban trees, *Atmospheric Environment* **42**(35), 8273-8277.

Gromke, C., Buccolieri, R., Di Sabatino, S. & Ruck, B. (2008), Dispersion study in a street canyon with tree planting by means of wind tunnel and numerical investigations – Evaluation of CFD data with experimental data, *Atmospheric Environment* **42**(37), 8640-8650.

Guler, B., Ugursal, V. I., Fung, A. S. & Aydinalp-Koksal, M. (2008), Impact of energy efficiency upgrade retrofits on the residential energy consumption and Greenhouse Gas emissions in Canada, *International Journal of Environmental Technology and Management* **9**(4), 434-444.

Halwatura, R. & Jayasinghe, M. (2008), Thermal performance of insulated roof slabs in tropical climates, *Energy and Buildings* **40**(7), 1153-1160.

Hamdi, R. & Masson, V. (2008), Inclusion of a Drag Approach in the Town Energy Balance (TEB) Scheme: Offline 1D Evaluation in a Street Canyon, *Journal of Applied Meteorology and Climatology* **47**(10), 2627--2644.

Hamdi, R. & Schayes, G. (2008), Sensitivity study of the urban heat island intensity to urban characteristics, *International Journal of Climatology* **28**(7), 973-982.

Han, J. & Baik, J. (2008), A Theoretical and Numerical Study of Urban Heat Island–Induced Circulation and Convection, *Journal of Atmospheric Sciences* **6**, 1859-1877.

He, J. & Hoyano, A. (2008), A numerical simulation method for analyzing the thermal improvement effect of super-hydrophilic photocatalyst-coated building surfaces with water film on the urban/built environment, *Energy and Buildings* **40**(6), 968-978.

He, Q., Li, C., Mao, J., Lau, A. K. & Chu, D. A. (2008), Analysis of aerosol vertical distribution and variability in Hong Kong, *J. Geophys. Res* **113**, D14211.

Herndon, S. C., Onasch, T. B., Wood, E. C., Kroll, J. H., Canagaratna, M. R., Jayne, J. T., Zavala, M. A., Knighton, W. B., Mazzoleni, C., Dubey, M. K., Ulbrich, I. M., Jimenez, J. L., Seila, R., de Gouw, J. A., de Foy, B., Fast, J., Molina, L. T., Kolb, C. E. & Worsnop, D. R. (2008), Correlation of secondary organic aerosol with odd oxygen in Mexico City, *Geophys. Res. Lett.* **35**, L15804.

Holland, D. E., Berglund, J. A., Spruce, J. P. & McKellip, R. D. (2008), Derivation of Effective Aerodynamic Surface Roughness in Urban Areas from Airborne Lidar Terrain Data, *Journal of Applied Meteorology and Climatology* **47**(10), 2614--2626.

Holst, J., Mayer, H. & Holst, T. (2008), Effect of meteorological exchange conditions on PM_{10} concentration, *Meteorologische Zeitschrift* **17**(3), 273-282.

Hong, S., Kim, D., Ryu, S., Kim, Y. & Lee, J. (2008), Chemical characteristics of PM2.5 ions measured by a semicontinuous measurement system during the fall season at a suburban site, Gwangju, Korea, *Atmospheric Research* **89**(1-2), 62-75.

Hua, L. J., Ma, Z. G. & Guo, W. D. (2008), The impact of urbanization on air temperature across China, *Theoretical and Applied Climatology* **93**(3-4), 179-194.

Huang, K., Zhuang, G., Xu, C., Wang, Y. & Tang, A. (2008), The chemistry of the severe acidic precipitation in Shanghai, China, *Atmospheric Research* **89**(1-2), 149-160.

Huh, J. & Brandemuehl, M. J. (2008), Optimization of air-conditioning system operating strategies for hot and humid climates, *Energy and Buildings* **40**(7), 1202-1213.

Kang, Y., Baik, J. & Kim, J. (2008), Further studies of flow and reactive pollutant dispersion in a street canyon with bottom heating, *Atmospheric Environment* **42**(20), 4964-4975.

Kavgic, M., Mumovic, D., Stevanovic, Z. & Young, A. (2008), Analysis of thermal comfort and indoor air quality in a mechanically ventilated theatre, *Energy and Buildings* **40**(7), 1334-1343.

Kirshen, P., Knee, K. & Ruth, M. (2008), Climate change and coastal flooding in Metro Boston: impacts and adaptation strategies, *Climatic Change* **90**(4), 453-473.

Kliucininkas, L., Balkeviciene, S., Mockuviene, J. & Filho, W. L. (2008), Experiences in the modelling of traffic policy measures for ambient air quality management in Lithuania, *International Journal of Environment and Pollution* **35**(1), 13-24.

Kramer, L. J., Leigh, R. J., Remedios, J. J. & Monks, P. S. (2008), Comparison of OMI and ground-based in situ and MAX-DOAS measurements of tropospheric nitrogen dioxide in an urban area, *J. Geophys. Res.* **113**, D16S39.

Kristl, Z. & Krainer, A. (2008), Influence of movable reflector on thermal response of an atrium building, *International Journal of Sustainable Energy* **27**(3), 121--130.

Kumar, P., Fennell, P. & Britter, R. (2008), Effect of wind direction and speed on the dispersion of nucleation and accumulation mode particles in an urban street canyon, *Science of The Total Environment* **402**(1), 82-94.

Kumar, P., Fennell, P., Langley, D. & Britter, R. (2008), Pseudo-simultaneous measurements for the vertical variation of coarse, fine and ultrafine particles in an urban street canyon, *Atmospheric Environment* **42**(17), 4304-4319.

Lee, H., Choi, H., Lee, S., Kim, Y. & Jung, W. (2008), The impact of topography and urban building parameterization on the photochemical ozone concentration of Seoul, Korea., *Atmospheric Environment* **42**(17), 4232-4246.

Letzel, M. O., Krane, M. & Raasch, S. (2008), High resolution urban large-eddy simulation studies from street canyon to neighbourhood scale,, *Atmospheric Environment* **42**, 8770-8784. doi:10.1016/j.atmosenv.2008.08.001.

Leung, Y., Yip, K. & Yeung, K. (2008), Relationship between thermal index and mortality in Hong Kong, *Meteorological Applications* **15**(3), 399-409.

Lin, C., Chen, F., Huang, J., Chen, W., Liou, Y., Chen, W. & Liu, S. (2008), Urban heat island effect and its impact on boundary layer development and land–sea circulation over northern Taiwan, *Atmospheric Environment* **42**(20), 5635-5649.

Lindberg, F., Holmer, B. & Thorsson, S. (2008), SOLWEIG 1.0 – Modelling spatial variations of 3D radiant fluxes and mean radiant temperature in complex urban settings, *International Journal of Biometeorology* **52**(7), 697-713.

Litschke, T., Kuttler, W. (2008), On the reduction of urban particle concentration by vegetation - a review, *Meteorologische Zeitschrift* **17**(3), 229-240.

Liu, Y. & Harris, D. J. (2008), Effects of shelterbelt trees on reducing heating-energy consumption of office buildings in Scotland, *Applied Energy* **85**(2-3), 115-127.

Mahmoud, K., Alfaro, S., Favez, O., Wahab, A., M.M. & Sciare, J. (2008), Origin of black carbon concentration peaks in Cairo (Egypt), *Atmospheric Research* **89**(1-2), 161-169.

Maniolu, G. & Yilmaz, Z. (2008), Energy efficient design strategies in the hot dry area of Turkey, *Building and Environment* **43**(7), 1301-1309.

Mapani, B. S. & Schreiber, U. (2008), Management of city aquifers from anthropogenic activities: Example of the Windhoek aquifer, Namibia, *Physics and Chemistry of the Earth* **33**(8-13), 674-686.

Mayer, H., Holst, J., Dostal, P., Imbery, F. & Schindler, D. (2008), Human thermal comfort in summer within an urban street canyon in Central Europe, *Meteorologische Zeitschrift* **17**(3), 241-250.

Mazzei, F., DAlessandro, A., Lucarelli, F., Nava, S., Prati, P., Valli, G. & Vecchi, R. (2008), Characterization of particulate matter sources in an urban environment, *Science of The Total Environment* **401**(1-3), 81-89.

Meinardi, S., Nissenson, P., Barletta, B., Dabdub, D., Rowland, F. & Blake, D. (2008), Influence of the public transportation system on the air quality of a major urban center. A case study: Milan, Italy, *Atmospheric Environment* **42**(34), 7915-7923.

Memon, R. A., Chirarattananon, S. & Vangtook, P. (2008), Thermal comfort assessment and application of radiant cooling: A case study, *Building and Environment* **43**(7), 1185-1196.

Miao, S. & Chen, F. (2008), Formation of horizontal convective rolls in urban areas, *Atmospheric Research* **89**, 298-304.

Milliez, M. & Carissimo, B. (2008), Computational Fluid Dynamical Modelling of Concentration Fluctuations in an Idealized Urban Area, *Boundary layer meteorology* **127**(2), 241-259.

Miyakawa, T., Takegawa, N. & Kondo, Y. (2008), Photochemical evolution of submicron aerosol chemical composition in the Tokyo megacity region in summer, *J. Geophys. Res*. **113**, D14304.

Mlecnik, E. & Marrecau, C. (2008), Passive house projects in Belgium, *International Journal of Environmental Technology and Management* **9**(4), 390-401.

Mohelnikova, Jitka, Vajkay & Frantisek (2008), Daylight simulations and tubular light guides, *International Journal of Sustainable Energy* **27**(3), 155--163.

Mok, K., Miranda, A., Leong, K. & Borrego, C. (2008), A Gaussian puff model with optimal interpolation for air pollution modelling assessment, *International Journal of Environment and Pollution* **35**(1), 111-137.

Mpamba, N., Hussen, A., Kangomba, S., Nkhuwa, D., Nyambe, I., Mdala, C., Wohnlich, S. & Shibasaki, N. (2008), Evidence and implications of groundwater mining in the Lusaka urban aquifers, *Physics and Chemistry of the Earth* **33**(8-13), 648-654.

Murena, F., Garofalo, N. & Favale, G. (2008), Monitoring CO concentration at leeward and windward sides in a deep street canyon, *Atmospheric Environment* **42**(35), 8204-8210.

Newsom, R., Calhoun, R., Ligon, D. & Allwine, J. (2008), Linearly Organized Turbulence Structures Observed Over a Suburban Area by Dual-Doppler Lidar, *Boundary layer meteorology* **127**(1), 111-130.

Niachou, K., Hassid, S., Santamouris, M. & Livada, I. (2008), Experimental performance investigation of natural, mechanical and hybrid ventilation in urban environment, *Building and Environment* **43**(8), 1373-1382.

Niachou, K., Livada, I. & Santamouris, M. (2008), Experimental study of temperature and airflow distribution inside an urban street canyon during hot summer weather conditions—Part I: Air and surface temperatures, *Building and Environment* **43**(8), 1383-1392.

Niachou, K., Livada, I. & Santamouris, M. (2008), Experimental study of temperature and airflow distribution inside an urban street canyon during hot summer weather conditions. Part II: Airflow analysis, *Building and Environment* **43**(8), 1393-1403.

Oxizidis, S., Dudek, A. V. & Aquilina, N. (2007), Typical Weather Years and the Effect of Urban Microclimate on the Energy Behaviour of Buildings and HVAC Systems, *Advances in Building Energy Research* **1**, 89–103.

Pandithurai, G., Dipu, S., Dani, K. K., Tiwari, S., Bisht, D. S., Devara, P. C. S. & Pinker, R. T. (2008), Aerosol radiative forcing during dust events over New Delhi, India, J. Geophys. Res. 113, D13209.

Park, S., Lee, K., Kim, Y., Kim, T., Cho, S. & Kim, S. (2008), High time-resolution measurements of carbonaceous species in PM2.5 at an urban site of Korea, *Atmospheric Research* **89**(1-2), 48-61.

Park, Y. & Baik, J. (2008), Analytical solution of the advection-diffusion equation for a ground-level finite area source, *Atmospheric Environment* **42**(40), 9063-9069.

Pena, M. A. (2008), Relationships between remotely sensed surface parameters associated with the urban heat sink formation in Santiago, Chile, *International Journal of Remote Sensing* **29**(15), 4385-4404.

Poirazis, H., Åke Blomsterberg & Wall, M. (2008), Energy simulations for glazed office buildings in Sweden, *Energy and Buildings* **40**(7), 1161-1170.

Priyadarsini, R., Hien, W. N. & Wai David, C. K. (2008), Microclimatic modeling of the urban thermal environment of Singapore to mitigate urban heat island, *Solar Energy* **82**(8), 727-745..

Radhi, H. (2008), A systematic methodology for optimising the energy performance of buildings in Bahrain, *Energy and Buildings* **40**(7), 1297-1303.

Rigby, M. & Toumi, R. (2008), London air pollution climatology: Indirect evidence for urban boundary layer height and wind speed enhancement, *Atmospheric Environment* **42**(20), 4932-4947.

Rodriguez, S., Cuevas, E., Gonzalez, Y., Ramos, R., Romero, P., Pérez, N., Querol, X. & Alastuey, A. (2008), Influence of sea breeze circulation and road traffic emissions on the relationship between particle number, black carbon, PM_1, $PM_{2.5}$ and $PM_{2.5-10}$ concentrations in a coastal city, *Atmospheric Environment* **42**(26), 6523-6534.

Saarnio, K., Sillanpää, M., Hillamo, R., Sandell, E., Pennanen, A. & Salonen, R. (2008), Polycyclic aromatic hydrocarbons in size-segregated particulate matter from six urban sites in Europe, *Atmospheric Environment* **42**(40), 9087-9097.

Sailor, D. (2008), A green roof model for building energy simulation programs, *Energy and Buildings* **40**(8), 1466-1478.

Salizzoni, P., Soulhac, L., Mejean, P. & Perkins, R. (2008), Influence of a Two-scale Surface Roughness on a Neutral Turbulent Boundary Layer, *Boundary layer meteorology* **127**(1), 97-110.

Santamouris, M. (2007), Heat Island Research in Europe:

The State of the Art, *Advances in Building Energy Research* **1**, 123–150.

Santamouris, M., Georgakis, C. & Niachou, A. (2008), On the estimation of wind speed in urban canyons for ventilation purposes - Part 2: Using of data driven techniques to calculate the more probable wind speed in urban canyons for low ambient wind speeds, *Building and Environment* **43**(8), 1411-1418.

Santiago, J. L., Coceal, O., Martilli, A. & Belcher, S. E. (2008), Variation of the Sectional Drag Coefficient of a Group of Buildings with Packing Density, *Boundary layer meteorology* **128**(3), 445-457.

Schwarz, J. P., Gao, R. S., Spackman, J. R., Watts, L. A., Thomson, D. S., Fahey, D. W., Ryerson, T. B., Peischl, J., Holloway, J. S., Trainer, M., Frost, G. J., Baynard, T., Lack, D. A., de Gouw, J. A., Warneke, C. & Negro, L. A. D. (2008), Measurement of the mixing state, mass, and optical size of individual black carbon particles in urban and biomass burning emissions, *Geophys. Res. Lett.* **35**, Geophys. Res. Lett..

Silva, D. G. D., Kruse, J. B. & Wang, Y. (2008), Spatial dependencies in wind-related housing damage, *Natural Hazards* **47**(3), 317-330.

Smalley, R., Tomlin, A., Dixon, N. & Boddy, J. (2008), The influence of background wind direction on the roadside turbulent velocity field within a complex urban street., *Q. J. Royal Meteorological Society* **134**(635), 1371-1384.

Solazzo, E., Cai, X. & Vardoulakis, S. (2008), Modelling wind flow and vehicle-induced turbulence in urban streets, *Atmospheric Environment* **42**(20), 4918-4931.

Sorbjan, Z. (2008), Local Scales of Turbulence in the Stable Boundary Layer, *Boundary layer meteorology* **127**(2), 261-271.

Stathopoulou, M. & Cartalis, C. (2007), Use of Satellite Remote Sensing in Support of Urban Heat Island Studies, *Advances in Building Energy Research* **1**, 203–212.

Su, J., Brauer, M. & Buzzelli, M. (2008), Estimating urban morphometry at the neighborhood scale for improvement in modeling long-term average air pollution concentrations, *Atmospheric Environment* **42**(34), 7884-7893.

Synnefa, A., Dandou, A., Santamouris, M., Tombrou, M. & Soulakellis, N. (2008), On the Use of Cool Materials as a Heat Island Mitigation Strategy, *Journal of Applied Meteorology and Climatology* **47**(11), 2846--2856.

Taha, H. (2008), Episodic Performance and Sensitivity of the Urbanized MM5 (uMM5) to Perturbations in Surface Properties in Houston Texas, *Boundary layer meteorology* **127**(2), 193-218.

Taha, H. (2008), Urban Surface Modification as a Potential Ozone Air-quality Improvement Strategy in California: A Mesoscale Modelling Study, *Boundary layer meteorology* **127**(2), 219-239.

Taha, H. (2008), Meso-urban meteorological and photochemical modeling of heat island mitigation, *Atmospheric Environment* doi:10.1016/j.atmosenv.2008.06.036. Online: http://dx.doi.org/10.1016/j.atmosenv.2008.06.036

Thompson, W., Holt, T. & Pullen, J. (2007), Investigation of a sea breeze front in an urban environment, *Quarterly Journal of Royal Meteorological Society* **133**(624), 579-594.

Tiangco, M., Lagmay, A. M. F. & Argete, J. (2008), ASTER-based study of the night-time urban heat island effect in Metro Manila, *International Journal of Remote Sensing* **29**(10), 2799-2818.

Tirabassi, T., Buske, D., Moreira, D. & Vilhena, M. (2008), A two-dimensional solution of the advection-diffusion equation with dry deposition to the ground, *Journal of Applied Meteorology and Climatology* **47**, 2096-2104.

Uboldi, F., Lussana, C. & Marta, S. (2008), Three-dimensional spatial interpolation of surface meteorological observations from high-resolution local networks, *Meteorological applications* **15**, 331-345.

Vaneckova, P., Beggs, P., de Dear, R. & McCracken, K. (2008), Effect of temperature on mortality during the six warmer months in Sydney, Australia, between 1993 and 2004, *Environmental Research* **108**(3), 361-369.

Velasco, E., Marquez, C., Bueno, E., Bernabe, R., Sanchez, A., Fentanes, O., Wohrnschimmel, H., Cardenas, B., Kamilla, A., Wakamatsu, S. & Molina, L. (2008), Vertical distribution of ozone and VOCs in the low boundary layer of Mexico City, *Atmos. Chem. Phys* **8**, 3061-3079.

Vesala, T., Järvi, L., Launiainen, S., Sogachev, A., Rannik, U., Mammarella, I., Siivola, E., Keronen, P., Rinne, J., Riikonen, A. & Nikinmaa, E. (2007), Surface-atmosphere interactions over complex urban terrain in Helsinki, Finland, *Tellus B* **60**, 188-199.

Vilhena, M., Costa, C., Moreira, D. & Tirabassi, T. (2008), A semi-analytical solution for the three-dimensional advection-diffusion equation considering non-local turbulence closure, *Atmospheric Research* **90**, 63-69.

Vivanco, M. G. & de Fatima Andrade, M. (2008), Relation between ozone levels and NOx and VOC emissions in the Sao Paulo Metropolitan Area for an episode of August, 1998, *International Journal of Environment and Pollution* **35**(1), 90-98.

Wang, P. & W. Zhao, W. (2008), Assessment of ambient volatile organic compounds (VOCs) near major roads in urban Nanjing, China, *Atmospheric Research* **89**(3), 289-297.

Bibliography (cont.)

Wangpattarapong, K., Maneewan, S., Ketjoy, N. & Rakwichian, W. (2008), The impacts of climatic and economic factors on residential electricity consumption of Bangkok Metropolis, *Energy and Buildings* **40**(8), 1419-1425.

Weber, S, Weber, K. (2008), Coupling of urban street canyon and backyard particle concentrations, *Meteorologische Zeitschrift* 17(3), 251-261.

Williamson, T. & Erell, E. (2008), The Implications for Building Ventilation of the Spatial and Temporal Variability of Air Temperature in the Urban Canopy Layer, *International Journal of Ventilation* **7**(1), 23-35.

Wu, Z., Hu, M., Lin, P., Liu, S., Wehner, B. & Wiedensohler, A. (2008), Particle number size distribution in the urban atmosphere of Beijing, China, *Atmospheric Environment* **42**(34), 7967-7980.

Xie, Z., Coceal, O. & Castro, I. P. (2008), Large-Eddy Simulation of Flows over Random Urban-like Obstacles, *Boundary layer meteorology* **129**(1), 1-23.

Xu, W., Wooster, M. & Grimmond, C. (2008), Modelling of urban sensible heat flux at multiple spatial scales: A demonstration using airborne hyperspectral imagery of Shanghai and a temperature–emissivity separation approach, *Remote Sensing of Environment* **112**(9), 3493-3510.

Yang, J., Yu, Q. & Gong, P. (2008), Quantifying air pollution removal by green roofs in Chicago, *Atmospheric Environment* **42**(31), 7266-7273.

Yang, L., Zmeureanu, R. & Rivard, H. (2008), Comparison of environmental impacts of two residential heating systems, *Building and Environment* **43**(6), 1072-1081.

Yassin, M., Kellnerová, R. & Jaňour, Z. (2008), Impact of street intersections on air quality in an urban environment, *Atmospheric Environment* **42**(20), 4948-4963.

Yu, J., Yang, C. & Tian, L. (2008), Low-energy envelope design of residential building in hot summer and cold winter zone in China, *Energy and Buildings* **40**(8), 1536-1546.

Zhang, S., Zhang, W., Shen, Y., Wang, K., Hu, L. & Wang, X. (2008), Dry deposition of atmospheric polycyclic aromatic hydrocarbons (PAHs) in the southeast suburb of Beijing, China, *Atmospheric Research* **89**(1-2), 138-148.

Zivkovic, I. (2008), Energy-efficient and low carbon emission residential building near Torino, Italy, *International Journal of Environmental Technology and Management* **9**(4), 369-377.

Zvyagintsev, A. (2008), Statistical forecast of surface ozone concentration in Moscow, *Russian Meteorology and Hydrology* **33**(8), 499--506.

Newsletter Contributions

The next edition will appear in early April. Items to be considered for the next edition should be received by **February 28, 2008**. The following individuals compile submissions in various categories. Contributions should be sent to the relevant editor:

News: Winston Chow (wtchow@asu.edu)
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General submissions should be relatively short (1-2 A4 pages of text), written in a manner that is accessible to a wide audience and incorporate figures and photographs where appropriate. In addition we like to receive any images that you think may be of interest to the IAUC community.