Issue No. 20
December, 2006.

IAUC NEWSLETTER

INTERNATIONAL ASSOCIATION FOR URBAN CLIMATE

www.urban-climate.org

President's Column

As the year draws to an end, I would like to thank all of you who have contributed to the IAUC in 2006. It's been an excellent year for the IAUC, with the highlight being the ICUC6 conference in Sweden. Please vote for the ICUC7 location before January 15, 2007 http://www.urban-climate.org/

I am very pleased to announce that the IAUC Awards Committee have selected Professor Arieh Bitan, Professor Emeritus at Tel Aviv University Israel as this year's recipient of the IAUC's Luke Howard Award (see further details p2). This award honors an individual who has made outstanding contributions to the field of urban climatology in a combination of research, teaching, and/or service to the international community of urban climatologists. Clearly, Professor Bitan has made important contributions in each of these realms. Please join me in congratulating him on this highly deserved recognition. The award will be presented at the ICUC-7 meeting. I would like to thank the Awards committee for all of their work and particularly those who submitted and wrote in support of nominations.

I also want to take this opportunity to encourage you to participate in IAUC activities in the coming year. It would very useful if you could:

- Contribute items to the Newsletter: short items (1-3 paragraphs) ideally with an image to showcase how urban climate research is being used/reported/discussed/debated in your local community (see examples throughout this newsletter (send these to Marshall Shepherd or Gerald Mills)
- Country reports: provide an overview of the urban climate work being conducted in your country (these have been highlights of many of the newsletters in the last 2-3 years)
- Provide information on urban climate papers published in languages other than English (contact Jenny Salmond) .

I would make a special plea for graduate students to become involved in the IAUC by:

- Writing a short item about some of the work that you are doing (see examples in this newsletter)
- Encouraging your colleagues and (post-)graduate students to join IAUC .
- Joining the fund raising committee (Contact: Benedicte Dousset)
- Making constructive suggestions about other things that IAUC could be doing (contact the incoming President: Matthias Roth)

We look forward to hearing from you!

Best wishes for 2007

Sue Grimmond
sue.grimmond@kcl.ac.uk

Newsletter Contributions

The next edition will appear in early February. Items to be considered for the next edition should be received by **January 31, 2007.**

The following individuals compile submissions in various categories. Contributions should be sent to the relevant editor:

News:	Dr. J. Marshall Shepherd marshall.shepherd@nasa.gov
Conferences:	Jamie Voogt javoogt@uwo.ca
Websites:	Gerald Mills gerald.mills@ucd.ie
Bibliography:	Jennifer Salmond j.salmond@bham.ac.uk
Urban Projects:	Sue Grimmond sue.Grimmond@kcl.ac.uk

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.

ICUC-7

The Board of the IAUC is seeking member input prior to selecting the venue for ICUC-7 (7th International Conference on Urban Climate) to be held in 2009. Please follow the respective link on the IAUC webpage (http://www.urban-climate.org/) to register your preferences by 15 January 2007. To aid in your choice a pdf document containing a summary of the four proposals submitted can be downloaded at the same link.

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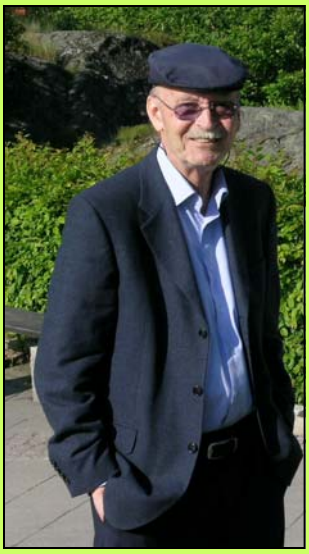
The Luke Howard Award



Prof. Arieh Bitan pictured earlier this year at ICUC-6 in Göteborg. Prof. Bitan joins Profs. Tim Oke and Ernesto Jauregui as winner of the IAUC's Luke Howard Award.

The IAUC is happy to announce that Prof. Arieh Bitan of the Department of Geography and the Human Environment of Tel Aviv University (TAU) has been selected by its Awards Committee for the third (2006) Luke Howard Award. His influence over the filed is significant, covering various aspects of regional climatology of Israel and its arid regions, topo-climatology and in particular urban climatology.

Prof. Bitan is one of the leaders of urban and settlement climatology in Israel and in its arid regions. His works has focused on settlements in arid regions and cities in Israel, and in the early 1990s has co-authored the Climatic Atlas of Israel for Physical and Environmental Planning and Design. This atlas, the only one of its kind in Israel, won the "Quality of Life" Knesset Speaker Award in 1992. His long-standing interest in climate-relevant planning and the use of planning principles to mitigate the adverse climatic effects of cities on human health and performance in the different climates of Israel including the arid regions is probably his most important legacy. He has published a great number of journal papers and edited a series of four books on urban climatology and planning. Prof. Bitan has been one of the first climatologists to recognize the important role of city and building design that can play in improving the local climate of cities not only in extreme climate conditions, and his papers attest to his keen interest in the applied aspects of urban climatology.

Due to the applied nature of his work, Prof. Bitan has been a consultant and advisor on various national-level urban climate projects. For example he was a consultant to the Settlement Department of the Jewish Agency, advisor to the Ministry of Housing and Construction, Ministry of National Infrastructure, the climatology advisor for the "Israel 2020" Planning Team and a member of numerous city planning teams.

Prof. Bitan is active in many international agencies that deal with urban climate, especially in the area of climate related urban planning. He was a founder of the International Association of Urban Climatology (IAUC), and has been on its Board since its inception. From 1982 until 1995 he was the head of the Expert Committee for Urban Climatology and Building Climatology of the International Federation for Housing and Planning (IFHP), and since 2003 has been a member of the Commission on Climatology of the International Geographical Union (IGU). In 2005 he was invited to join the international research group of the World Health Organization (WHO) for improving public health responses to extreme weather (EuroHEAT). In a 1991 paper, he introduced the term "Climatic Rehabilitation of the Urban Environment," now used worldwide to express methods of improving urban climate. In 1980 and 1983, he initiated international conferences in Israel on urban climatology and climatic related planning. These became the foundation for similar triennial congresses organized today by IAUC, held in different global venues; he has been on the Scientific Committee for all these conferences. He also organized two international summer schools in 1992 and 1993 at TAU on climatic related urban planning.

Based on his leading research into the climate of cities, the applied aspects of climate-sensitive urban and housing design, his service contributions to the Israel urban climate community and his involvement in a number of high-level international urban climate organizations and committees, Prof. Bitan was selected as the winner of the IAUC Luke Howard Award 2006.

Manabu Kanda
IAUC Awards Committee Chair

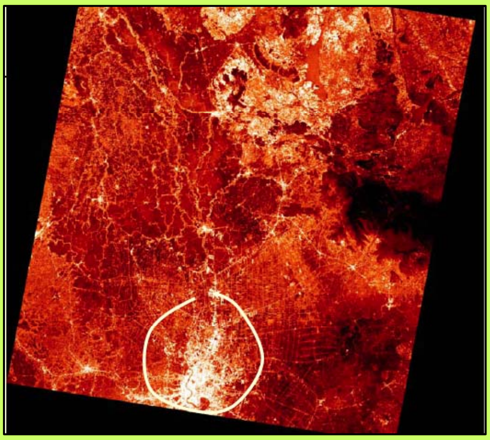
The Luke Howard Award

This is given annually to an individual who has made outstanding contributions to the field of urban climatology in a combination of research, teaching, and/or service to the international community of urban climatologists.

Urban Climate News

Bangkok's cool season declines due to UHI.

Derived from an article appearing in the bangkokpost.com (11/30/2006)



According to a environmentalists at the Southeast Asia START Regional Centre (an environmental research organisation), Bangkok's chances for a cool season will decline in the next four decades as the capital's temperature continues to rise due to an "urban heat island or UHI" and global warming. Other provinces would also experience shorter spells of cool weather over the long run.

Jariya Boonjawat, an environmentalist, noted that concrete and asphalt roads, as well as human and industrial activities in urban areas, were all factors contributing to high temperatures in cities, she told the conference on Thailand and the global climate. The UHI in Thailand's capital is 5°C higher than in rural areas.

The result is in line with big cities around the world, like Tokyo. Suppakorn Chinvanno, the project coordinator of the Bangkok-based START centre, also noted that the dry seasons could be extended and that north-eastern and eastern regions could receive more rainfall based on a study using the Conformal Cubic Atmospheric Model. This model assumes carbon emissions that result in an atmospheric CO_2 concentration of between 540-720 ppm. As a result, people living in Chiang Rai province would have shorter cool seasons, from 126 days now to only 90 days in the future, while those in Tak would have only 18 days of cold weather from 97 days now, and residents of Kanchanaburi would have 40 days in their cold season, from 73 days currently.

The image shows a high resolution thermal satellite view of Bangkok.

Smog-eating Church

The image on the right is of The Dives in Misericordia Church in Rome designed by Richard Meier. The church is constructed of new white cement, Bianco TX Millennium. According to the promotional website of Italcementi, the aesthetic quality that the architect wanted to achieve along with the durability requirements entailed by the nature of the project resulted in the development of a new white cement containing titanium dioxide, the Bianco TX Millennium.

According to the website, *Bianco TX Millennium is the result of extensive laboratory research aimed to optimize the aesthetic durability of top quality, cement-based elements. The photocatalytic particles contained in the white cement allow it, once it has hardened in the form of paste, mortar or concrete, to oxidize the organic and inorganic air pollutants in the presence of air and light. The photocatalytic action destroys the various organic air pollutants – e.g. exhaust fumes, emissions from residential heating systems, industrial emissions of aromatic chemical substances, and pesticides – that come in contact with the cement surface, oxidizing them to carbon dioxide. Therefore, the pollutants lack a sub-layer they can adhere to, and the building or element made with the new cement can maintain its original aesthetic appearance over time.*

The Church and its affect on pollution has been reported in many news outlets, including the International Herald Tribune (November 22, 2006). In that publication Elisabetta Povoledo reports that: *According to Italcementi, tests in urban settings determined that some pollutants could be reduced by 20 to 70 percent, depending on atmospheric and light conditions as well as the size of the area treated with the cement. The reduction of pollutants is greatest within 2.5 meters, or 8.2 feet, of a surface that has been treated, the company said. This means that a pedestrian walking down a street with traffic would inhale fewer pollutants while walking past buildings treated with the substance.*

Urban Climate News

Study suggests morning pollution pall for Manchester commuters

28 Nov 2006

Source: www.manchester.ac.uk/

Early findings from a new urban pollution study suggest that commuters in Manchester inhale their biggest daily dose of harmful traffic fumes during the morning rush hour. A team from the Centre for Atmospheric Studies at the University of Manchester took measurements in 2005 and 2006 along some of the city's busiest routes.

The work forms part of the wider CityFlux project, which has involved sophisticated air sampling in major cities in England and Europe over the last two years.

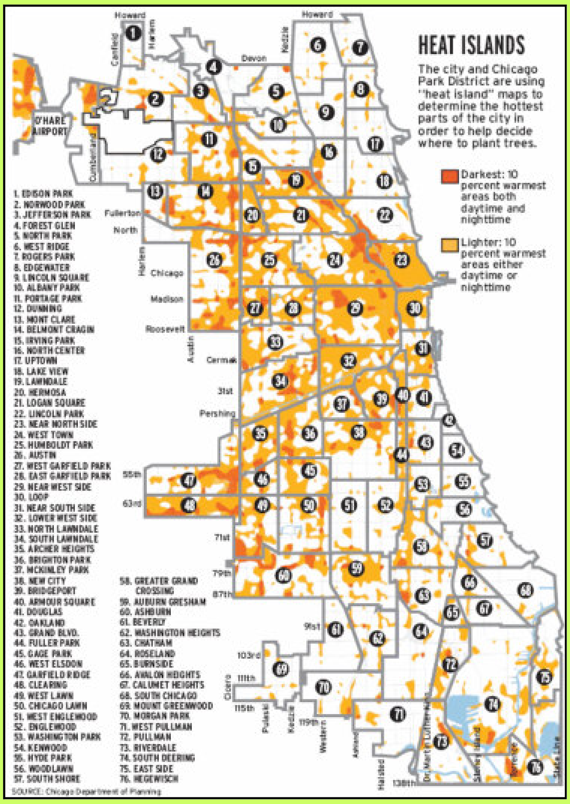
Analysis of all the data collected during the study is continuing, and the full results are not expected to be published until at least the end of 2007. But initial results appear to show that harmful particles produced by vehicles stay trapped near to ground level during the morning rush hour.

Researchers have observed that in the middle of the day, warm bubbles of air rise up from the city streets. This warm air lifts particles from vehicle exhausts away from the built environment. But earlier in the morning the air is too cold to rise and the particles remain trapped at street level.

The research team hopes the mass of data they have collected during their study will give them a better picture of the type and level of harmful particles city dwellers are being exposed to. They also hope to discover how and when particles are exported away from Manchester, what factors affect their distribution, and if chemical and physical reactions in the atmosphere affect the toxicity of the particles.

Weather conditions such as temperature and wind are known to have an effect on pollution levels, and so in addition to taking air samples at street level, the Manchester team set up equipment on rooftops to sample air as it rose and dispersed out of the city centre.

CityFlux 2006 was reported upon in IAUC Newsletter 16 in April of this year.



October 25, 2006

Chicago Uses Satellite Images to Determine City's True Hot Spots

According to a recent article in the Chicago Sun-Times, the Chicago Planning Department recently used satellite image data to determine the city's "hottest" areas. Not to be confused with popular neighborhoods or trendy locations, this type of "heat" is the real kind - based on both daytime and nighttime temperatures. The goal of the study was to determine the overall effect that "dark" structures, such as tar roofs and asphalt parking lots, are having on the temperatures in various parts of the city - and what can be done to lower those temperatures. The methodology used by the city was simple: two Landsat 7 satellite images were used -- one captured on a morning in September 2001 and another at night in May 2005. The satellites captured surface temps, not air temps, said Anne Jaluzot, a city urban planner. The map above is the image produced by merging the data from the daytime and nighttime temperature images.

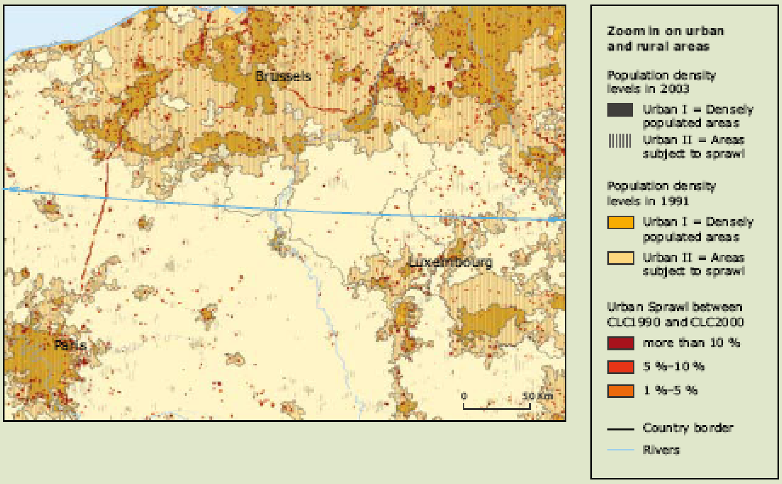
Source: news.satimagingcorp.com/2006/10/chicago_uses_satellite_images.html

Urban Climate News

Urban Sprawl in Europe

The report, 'Urban sprawl in Europe - the ignored challenge', shows that many environmental problems in Europe are caused by rapidly expanding urban areas. The global economy, cross border transport networks, large scale societal, economic and demographic changes and differences in national planning laws are some of the major drivers of change to the urban environment. EU policy to co-ordinate and control planning is required, the report says.

The map of northeast France, Belgium, Luxembourg and northwest Germany illustrates the definition of urban sprawl, and shows the urban areas overlaid with population density. It is clear that low density populated areas extend far beyond the centres of cities, with new urban areas spreading along the Paris-Brussels axis adjacent to the TGV high-speed railway (an effect of the 'beetroot' train stations).



Note: Due to changes in the Eurostat methodology the two datasets (1991 and 2003) differ.

Source: EEA (based on EEA and Eurostat data).

Urban sprawl occurs when the rate of land-use conversion exceeds the rate of population growth. More than a quarter of the EU territory has now been directly affected by urban land use, according to the report. Europeans are living longer and more of us live alone putting greater demands on living space. We travel further and consume more. Between 1990 and 2000, more than 800 000 hectares of Europe's land was built on. That is an area three times the size of Luxembourg. If this trend continues, our urban area will double in just over a century. Sprawling cities demand more energy supply, require more transport infrastructure and consume larger amounts of land. This damages the natural environment and increases greenhouse gas emissions. Among the consequences are climate change, increased air and noise pollution. As a result, urban sprawl impacts directly on the quality of life of people living in and around cities.

"Urban sprawl is a reflection of changing lifestyles and consumption patterns rather than an expanding population. Increasing demands from housing, food, transport and tourism all demand land. Agricultural land surrounding cities is often under priced and this is an issue facilitating sprawl in the face of the above pressures", said Professor Jacqueline McGlade, Executive Director of the EEA. Source: http://urbact.eu/news-events/single-news/article/

Tokyo Schoolyards go Green

Daily Yomiuri Online Nov 18, 2006.

The Tokyo metropolitan government has decided to turf the schoolyards of all the capital's primary and middle schools over the next 10 years, it was learned Friday. When the project--involving about 2,000 public primary and middle schools--is completed, the turfed area will be equivalent to twice the size of the Imperial Palace's grounds. The metropolitan government hopes the move will moderate the so-called heat island phenomenon and provide children with an improved environment for outdoor activities.

Tokyo's school playgrounds were mostly soil-based until the 1960s, when the trend of covering them with asphalt began--initially in urban areas. Recently, due to its drainage properties, crushed limestone has been used to surface playgrounds. Rubber chips, which are often used in all-weather tennis courts, are also popular. Currently, only 44 primary and middle schools have playgrounds that are totally covered with grass. The project will be financed with funds for countering the heat island phenomenon. During the past century, the temperature in central Tokyo has increased by 3 C, which means the heat island phenomenon is progressing five times faster than the average global temperature rise.

On a hot midsummer's day, the surface temperature of an asphalt or soil-based playground is about 50 C, but a turfed surface will remain at about 30 C. "If the temperature remains low, we won't use air-conditioning as much as we do now, which will help reduce carbon dioxide," said an official from the metropolitan government's Environment Bureau. In addition, the metropolitan government expects that grass surfaces will tempt children to play outside more. As children are said to be increasingly less athletic, the metropolitan government hopes that grass playgrounds will lead to improvements in children's physical health. The Central Education Council, an advisory panel to the education, science and technology minister, suggested in 2002 that school yards should be turfed. However, of the nation's public primary, middle and high schools, only 1,291, or 3.5 percent, had surfaced their playgrounds with grass as of May 2005. Source: http://www.yomiuri.co.jp/dy/index.htm

Urban Climate News

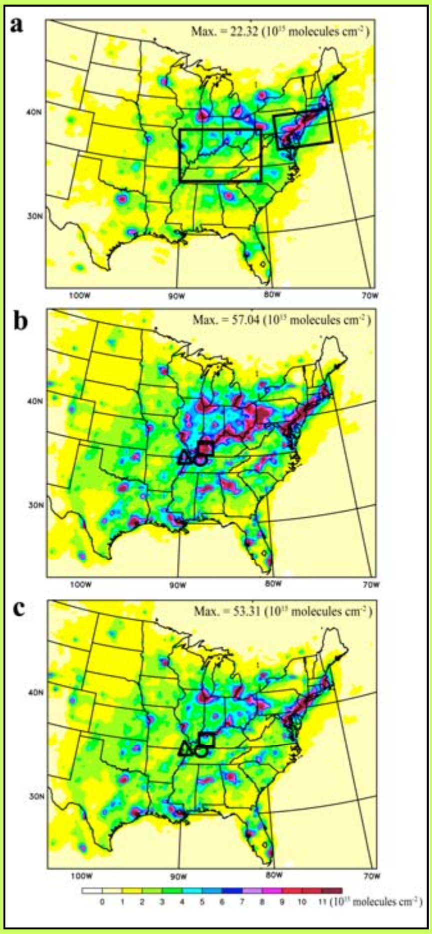
SATELLITES FIND CLEANER AIR ACROSS EASTERN U.S.

Dec. 8, 2006 — A major smog-forming pollutant is declining over the eastern United States, according to a new study by scientists at NOAA and the University of Bremen, Germany. New satellite observations mark the first time space-based instruments have detected the regional impact of pollution controls implemented by coal-burning electric power plants in the 1990s.

The findings were published this month in Geophysical Research Letters, a publication of the American Geophysical Union.

High-precision instruments aboard European satellites have detected a 38 percent decline in nitrogen dioxide in the Ohio River Valley and nearby states between 1999 and 2005 (Figs c to a above), according to the study. Nitrogen dioxide (NO2) and nitric oxide (NO) are two gases that form a group of pollutants known as nitrogen oxides (NOx), which are created primarily through fossil fuel burning. When combined with other gases and sunlight, they form ozone, the major urban air pollutant in smog. Ground-level ozone harms human health and vegetation and is a key pollutant targeted by the U.S. Environmental Protection Agency.

Source: NOAA (www.noaanews.noaa.gov/)

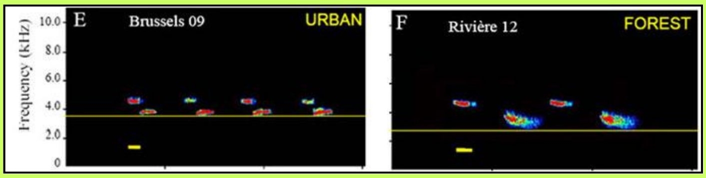


Urban songbirds raise their voices to be heard

Cathering Brahic (NewScientist.com) reports on research published on urban songbirds in the December issue of Current Biology (vol 16, p2326):

Entire populations of birds across Europe are adapting their song to be better heard above the din of the city. It is well-established that some birds are able to modulate their songs to adapt to different environments. In 2004, for instance, researchers showed that individual nightingales made their songs very much louder so they could be heard over urban noise. Now, researchers have shown this adaptation is happening on a population level, as well in cities around Europe. Hans Slabbekoorn and Ardie den Boer-Visser, at Leiden University in the Netherlands, recorded and compared great tits (Parus major) singing in 10 European cities and in nearby forests.

They found that in all the cities, songs were sung faster and in higher pitches than in nearby forests. The researchers say this is explained by the fact that urban noise pollution, most of which comes from traffic, tends to be at a lower pitch. This drowns out low-pitched birdsong notes. In contrast, noise in natural environments is not biased towards one end of the frequency spectrum. Another factor contributing to the high-pitched and faster urban songs is the relative openness of city landscapes compared to forests. Earlier work showed that songs in forested habitats were sung lower and more slowly than those in open countryside, because these songs are less likely to be lost in reflections in the dense foliage.



This sonogram shows a song's variation in pitch (frequency) with time for great tits singing in the city of Brussels (left) and in the nearby Rivière forest (Image: Current Biology/ Slabberkoorn)

Urban Project

The Urban Heat Island Phenomenon, Urban Morphology and Building Energy: The Case of Chicago, USA

Introduction

This brief report is on a study designed to link urban climate, urban design and building energy. The role of urban fabric in forming distinctive microclimatic zones within an urban area is well known (Figure 2). As a consequence, the energy consumption in similar building types should differ between these zones. This might be the case especially in the growing urban areas, where urban boundaries are expanding to meet existing suburban areas. It follows that the passive strategies best suited to minimizing building energy use should be adapted to these climatic zones.

One element of urban design that has great potential for passive management of building solar access is street geometry (width, height, length and orientation). This might be especially true in the case of where new urban developments occur or older urban areas are redeveloped. If street design can be shown to moderate the energy use of single buildings, then such a strategy may be applied to enhance the energy saving potential at the neighborhood scale.

In the USA, more than 40 percent of the energy is consumed by buildings and equivalent contribution of the green house gases is made. With the increasing use of air conditioners in buildings, energy planning at neighborhood or at larger scale would provide favorable conditions for the building scale energy saving strategies.

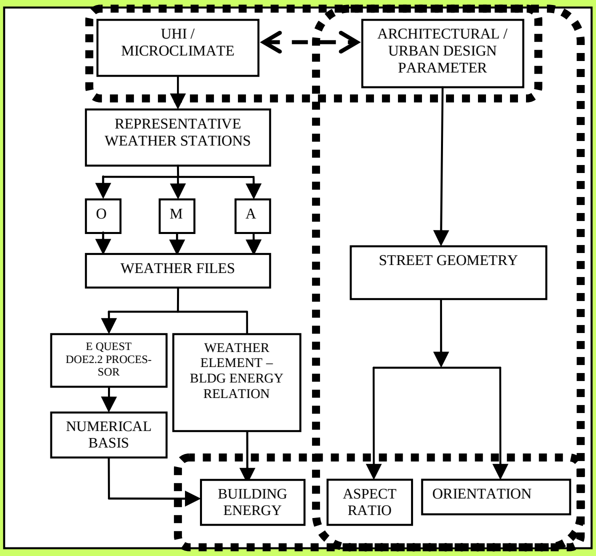


Figure 1. Schematic diagram showing the links between urban climate, urban design and building energy as captured in the current model (O-O'Hare, M-Midway, A-Auroa).

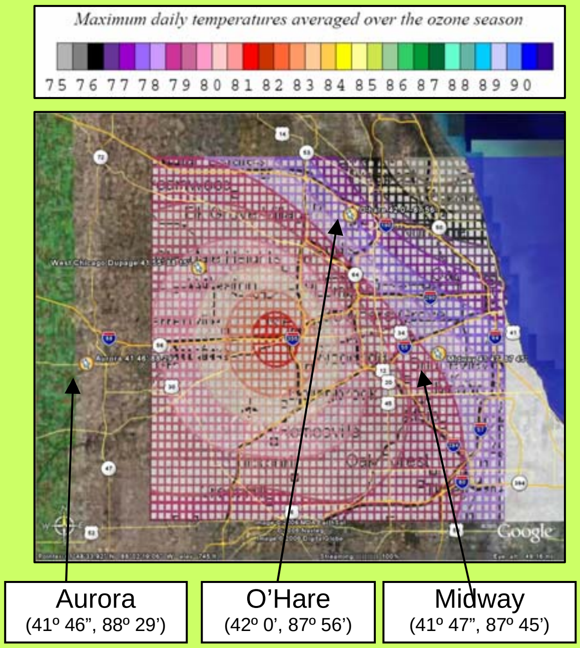


Figure 2. Chicago Urban Heat Island Profile and Selected Weather Stations *(Source: Gray and Finster, 2000).*

In this study, an attempt was made to examine the role of street geometry on building energy use in different urban microclimatic conditions (see Figure 1). Using Chicago as a case-study, winter-time heating and summer-time cooling energy needs were investigated.

Microclimate

Three National Climatic Data Center weather stations were identified for the study on the basis of Chicago's available heat island profile (Figure 2). Two weather stations (O'Hare and Midway) located within the urban boundaries, more than nine miles away from the lake front, were selected. To represent the suburban area, a station located in Aurora, on the western side of the city was also selected. Hourly weather data was used to represent the urban microclimatic environment in the simulation of building energy needs.

The maximum average monthly dry bulb temperature difference between Aurora and Midway weather stations was observed as 2.9ºF for the month of July. The difference between Aurora-O'Hare and Midway-O'Hare weather stations for the same month was 0.3ºF and 2.6ºF respectively.

Urban Project

Street Geometry

A hypothetical street pattern, similar to the existing gridiron pattern, was chosen for the study. Two geometric descriptors, those of street width (W) and the abutting building heights (H), were used to describe the attributes of the modelled city (Figure 3). Each building in the grid has a footprint of 160 ft by 160 ft (approx. 50 m^2) and a height of 100 ft (approx. 30 m). The model is run for one building in the centre of the grid pattern.

For the purposes of simulations, street width was varied to produce street aspect (or H/W) ratios of 8, 4, 2 and 1 corresponding to decreased density. In addition, five grid orientations were chosen (N, NNW, NW, WNE and W), see Figure 4. The geometric configurations were represented by the street aspect ratio and street orientation, for example, AR1N represents the aspect ratio of one, oriented towards north.

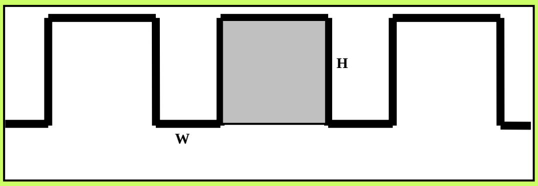


Figure 3. The physical model. The energy consumption of the building in the center is examined, while the neighbouring buildings cast shadows.

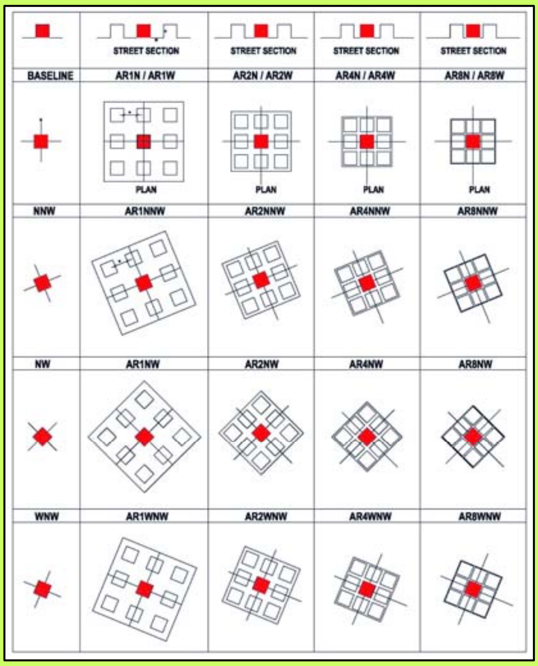


Figure 4. Street geometry variation, showing baseline condition as a standalone building used for the comparison of a building energy in an urban configuration with varying aspect ratio (horizontally) and orientation (vertically). The building under investigation is in the center of the configuration.

Building Energy

The hourly building energy simulations were performed using the building energy simulation program E-Quest (DOE2.2 processor). The sensitivity analysis for the street aspect ratio and street orientation was performed for the building energy. The building energy for the street geometries with AR=1, 2, 4 and 8 oriented towards the same direction were compared with the baseline condition for all three weather stations. Similarly, the building energy for the geometric configuration with fixed aspect ratio and oriented towards N, NNW, NW, WNE and W were compared. The thermal and radiative properties of the buildings and streets were kept constant throughout the experiment.

The building energy simulations were performed for all the configurations using three weather files representing each microclimatic zone. The weather elements, dry bulb temperature and cloud cover were studied for its relationship with the building cooling energy.

Results and Discussion

Figures 5 & 6 illustrate typical model results. Both show building cooling energy needs (in millions of BTUs) over the course of a year. Figure 5 shows the effects of aspect ratio and Figure 6 shows the effects of street orientation.

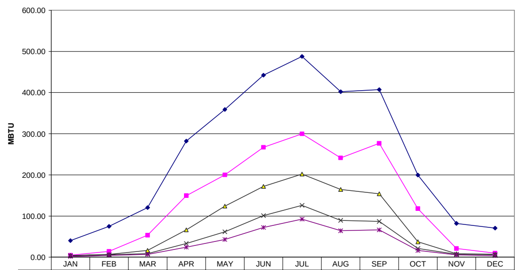
For the climatic conditions of Chicago (typically cold winter and hot-humid summer months) compact street geometry reduces the cooling energy during summer months, however an increase in heating energy is observed during winter months. Aspect ratio is found out to be a more dominant urban design parameter on building energy.

In the larger study from which this report is draw, these results were used to examine the appropriate geometry, street geometry, surface albedo, and vegetation. Moreover, the effects of green roof strategies for high rise buildings and future development on the west side (in the high intensity heat island zone, Figure 2) were examined.

Pravin Bhiwapurkar
PhD Candidate
College of Architecture
Illinois Institute of Technology
Chicago, USA

Email: pbhiwapurkar@yahoo.com

Urban Project



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
B	40.18	74.70	120.28	282.15	358.78	442.20	487.79	402.21	407.20	199.46	82.08	70.49
1N	4.40	13.98	53.22	149.49	200.01	266.90	299.70	241.17	276.49	117.80	20.78	9.82
2N	3.86	6.70	16.19	66.25	123.79	171.67	201.90	164.30	153.91	37.09	8.36	6.94
4N	3.38	5.80	8.51	33.16	61.62	100.90	125.69	89.46	86.62	20.87	6.85	6.26
8N	1.65	4.35	6.43	23.91	42.86	71.79	92.30	64.00	66.38	16.16	5.68	3.68

MONTHS

Figure 5. Comparative building cooling energy for the street aspect ratio of 1, 2, 4 and 8 with reference to the baseline facing north, (Midway-2004).

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1N	2.40	9.44	48.24	137.63	183.38	266.15	312.04	245.26	279.18	106.16	16.26	7.98
1NNW	2.57	10.58	40.85	133.08	181.59	269.02	314.08	247.40	272.77	90.25	18.77	9.14
1NW	2.73	10.53	36.77	123.14	182.44	279.75	323.44	251.64	257.40	78.49	18.05	13.15
1WNW	2.58	10.66	41.84	127.86	183.07	271.25	317.11	250.21	268.81	91.12	17.89	10.48
1W	2.40	9.44	48.24	137.63	183.38	266.15	312.04	245.26	279.18	106.16	16.26	7.98

MONTHS

Figure 6. Comparative building cooling energy of AR1 for the street orientation of N with NNW, NW, WNW and W orientation (Midway-2004).

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Urban Climate News

Tokyo joins cities group to tackle climate change

Monday, 04 Dec: Tokyo has joined other major cities around the world in pledging to reduce carbon emissions linked to climate change. The Japanese capital is the latest member to join the Large Cities Climate Leadership Group (LCCLG), a body chaired by London mayor Ken Livingstone.

Members of the group contribute over three quarters of all greenhouse gas emissions in the world. After Tokyo governor Shintaro Ishihara and Mr Livingstone penned a partnership deal earlier this year on tackling common challenges facing both cities, the latter joined former US president Bill Clinton in August to launch a partnership of the LCCLG and the Clinton Foundation Climate Change Initiative (CCI).

Mr Livingstone said: "As one of the world's most important cities, Tokyo is a significant addition to the Large Cities Climate Change Group. There is much that they will contribute to other members' climate change work. Japan is at the forefront of developing renewable energy technology and Tokyo is leading the world in mapping and reducing its urban heat island and in developing innovative methods to manage flood risk. The world's largest cities have a major role to play in averting catastrophic climate change. Already they are at the centre of developing the technologies and innovative new practices that provide hope that we can radically reduce carbon emissions and prepare for the inevitable impacts."

Other members of the group include Berlin, Madrid, Moscow and New York. There are now 23 members of the group in total.

Next year, the Tokyo metropolitan government intends to launch a new ten-year project to cut CO2 emissions in all sectors of the city.

Source: www.inthenews.co.uk/

Urban Project
URBAN CLIMATE AND AIR POLLUTION IN OUAGADOUGOU, BURKINA FASO

Figure 1. Burkina Faso and its capital Ougadougou. Source: http://geography.about.com/library/cia/blcburkinafaso.htm.

Introduction

Ouagadougou, the capital of Burkina Faso in West Africa, is a rapidly growing city where air quality is a severe problem. Wind blown dust from the Sahara desert is a major source of dust during the dry period (usually October to Mars), but also resuspension of dust from unpaved roads and emissions from traffic are growing problems. Emissions from traffic is often a problem in the developing world due to the predominance of old, poorly maintained vehicles, the abundance of two-stroke vehicles, poor fuel quality, low fuel efficiency due to slow speeds caused by poor roadway conditions and a low level of traffic management and traffic enforcement (Duci et al., 2003). A case study of the moped-use in Ouagadougou, Burkina Faso shows an exceptionally high usage-rate of highly polluting mopeds as family vehicles, and states that Burkina Faso in particular deserves attention in this matter to improve the outdoor air quality in the city (Diallo 2000). Also the indoor air quality needs attention as the high usage of simple stoves with very incomplete combustion for burning coal and biomass for domestic energy in developing countries, causes extremely high levels of indoor air pollution, up to 200 times the recommended values (World Health Organisation, WHO 2000).

Study

The aim of the PhD project (2005 - 2010) is to study air quality in African cities in relation to meteorological conditions, in terms of dispersion mechanisms and its effect on human exposure. One important issue is to map the temporal and spatial variations of air pollutions within urban areas. Another important issue is to study how air pollution conditions influence human health in a gender perspective. The background is that women and children are exposed to air pollution mainly from incomplete combustion for burning coal and biomass for domestic energy, while men spend relatively more time outdoors, exposed to air pollutions mainly from traffic.

Described here are results from a pilot study of the urban air quality that was carried out in Ouagadougou in 2005. Carbon Monoxide (CO), and Suspended Particulate Matter (SPM), Air Temperature (T_A), and Relative Humidity (H_R), were collected during car traverses through the city. A total of 19 traverses were carried out. Each traverse consisted of a set route with nine chosen stopping points. At these points, CO and SPM were measured during four minutes about 1-3 meters away from main traffic stream. CO was also measured continuously during driving. The traverses started in a traditional residential neighbourhood, going through both areas with dense traffic and areas with slow traffic ending up in the city centre (Figure 2). In addition to mobile measurements, passive samplers measuring the total weight of SPM were placed at a total of nine points throughout the city to get a comparison of the levels SPM for a one week average in different areas (Figure 3). To obtain information of the CO exposure in a wood-fuelled kitchen, CO was measured continuously inside such a kitchen (Figure 3) for the duration of one week.

Figure 2. Photos illustrating typical urban environments at which measurements were made during car traverses.. In clockwise direction, a residential neighbourhood, a street with dense traffic, a street with slow traffic and the city centre.

Figure 3. Passive samplers were placed at a number of locations throughout Ouagadougou to get a comparison of the levels of SPM in different areas.

Figure 4. Instruments (encircled) mounted in a wood fuelled kitchen. The simple stove on the floor to the right in the picture, Apart from the entrance doorway, the only ventilation is via the holes in the wall seen in the picture.

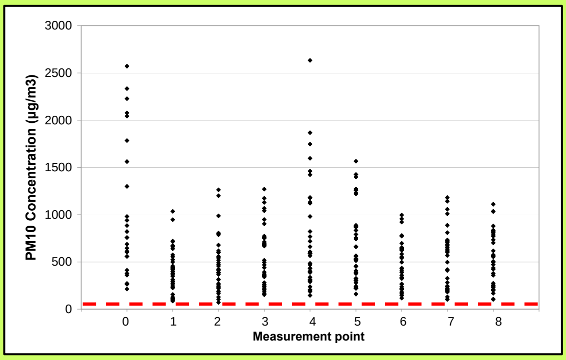

Figure 5. Measured levels of PM 10 during car traverses. Dotted red line shows WHO recommendations for maximum exposure.

Preliminary results and discussion

Results from the first field study show levels of both CO and SPM that greatly exceed levels recommended by WHO (WHO 2004, WHO 2005a). Levels of SPM especially were found to occur at alarmingly high concentrations. For example, concentrations of particulate matter under 10 microns in diameter (PM10) averaged 600 µg/m^3 during car traverses while the WHO recommends 50 µg/m^3 as a maximum 24 h mean (Figure 5). Though levels are generally very high, extreme values occur in the area with unpaved roads and areas with dense traffic, indicating that re-suspension of dust is an important factor for the high concentrations. This suggests that residents are exposed to hazardous levels of PM10 during most of their time outdoors. A smaller comparison with values of SPM measured by the same road before and after asphalting (Figure 6), show a 75% reduction in levels of PM10 when the road was paved. Values measured with the passive samplers show the same patterns as the mobile measurements.

Measurements of CO while driving show considerably higher values compared to values measured at stopping points. In general, the average concentration at the measurement points was 5ppm, and during driving the average was 10ppm. While these results fall well below the WHO guidelines for maximum 1h exposure of 26ppm (WHO 2004), levels in dense traffic frequently exceed this guideline with peaks up to 120ppm. Given the large spatial variations in CO, the placement of single street level point measurement becomes crucial. Care must be taken to ensure that the measurements are representative when using these measurements to estimate urban concentrations and exposure levels (for example for commuters or occupations like taxi drivers, traffic police etc.).

CO levels measured in a wood fuelled kitchen indicates that there are generally two cooking sessions per day that lasts on average 4h. Average concentration during cooking sessions is 33ppm with peaks of up to 151ppm, thus greatly exceeding WHO recommendations for maximum 15 min exposure of 87ppm. This creates a potentially very unhealthy situation for the person in charge of preparing meals in this kitchen. Though it is probably not realistic to assume that the household cook stays in the kitchen the whole duration of the cooking session, it is still reasonable to assume that she (the household cook is traditionally a woman) is exposed to levels greatly exceeding WHO-recommendations for significant time periods at least once a day.

The importance of assessing human exposure to air pollution is clear. Respiratory disease, the chief health main health is the second most common cause of death in Africa. when one considers that

Figure 5. The same road before (Dec 06 2004, top) and after (Nov 14 2005t) asphalting. The change in SPM from re-suspension of road dust is apparent.

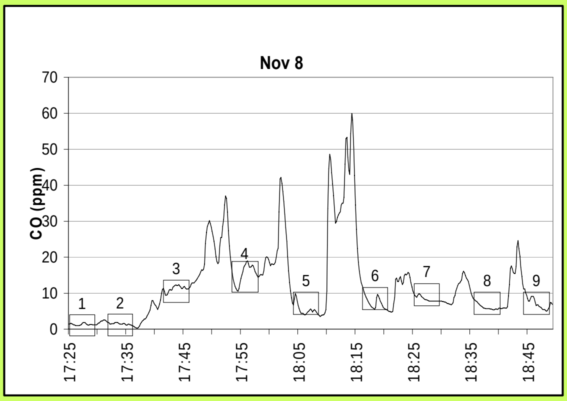

Figure 6. Continuous measurements of CO during evening car traverse on November 8, with measurement stops marked (numbered squares). Levels of CO increase when pulling out into traffic (between marked stops) and decrease again when stopping at next measurement stop.

respiratory diseases are the main health effect from exposure to air pollution. This is the second most common cause for death in Africa. The mortality rate due to lung diseases in Burkina Faso was in 2002 for example 407 persons per 100 000 (WHO 2005b) (in Sweden these Figures are about 70 per 100 000). The meteorological conditions in Ouagadougou further contributes to the poor air quality due to a generally high stability in the air over the city that prevents transportation and dispersion of the polluted air created in the city, hence causing accumulation of the airborne pollutions. Furthermore, a review by Han et al (2006) shows that studies of air pollution, especially suspended particulate matter, are generally very scarce in Africa This constraints the possibilities of creating regulations and policies for decreasing risks for health and environment.

Summary and future research

Preliminary results from this study show that the air quality situation in Ouagadougou is a serious health risk for the inhabitants of the city.

Future research includes comprehensive field studies of outdoor and indoor exposure to air pollutants and its relation to meteorological conditions in cities south of Sahara. The project will be conducted in cooperation with chemists at Göteborg University and local actors in Africa. Further case studies are planned for Ouagadougou and possibly other African cities.

Jenny Lindén, PhD candidate
Earth Science Centre,
Göteborg University, Sweden
Email: Jenny@gvc.gu.se

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Thanks to everyone for their contributions this month. Please send any further references to papers published since January 1 2005 for inclusion in the next newsletter to j.salmond@bham.ac.uk. As before, please mark the header of your email with 'IAUC Publications 2006'. In order to facilitate entering the information into the data base please use the following format:

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We look forward to hearing from you soon! Jennifer Salmond and Evyatar Erell

Recent publications in Urban Climatology

(Languages are specified where the publication is known to be in a language other than in English.)

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