Urban Climate News

Quarterly Newsletter of the IAUC

ISSUE NO. 27 MARCH 2008 • www.urban-climate.org • INTERNATIONAL ASSOCIATION FOR URBAN CLIMATE

From the IAUC President

Welcome to the first issue of the IAUC Newsletter in 2008, which will now be published on a quarterly basis. Our new editor, David Pearlmutter has also designed a very attractive new graphic "look". The last change concerns the name of the newsletter: **Urban Climate News** will continue to be a source of IAUC community information but the name change also reflects the fact that the newsletter includes developments across the entire breadth of the field of urban climatology.

Feature: Short reports about urban perspectives on global climate change will hopefully become a regular element in future editions. We start with a feature article titled "Impact of urbanization and land surface changes on climate trends" by Eugenia Kalnay *et al*. (University of Maryland, USA). The Country Report series is continued in this newsletter with a review of urban climate research in Denmark by Alexander Baklanov (Danish Meteorological Institute, Denmark).

Conferences: Preparation for *ICUC-7* in Yokohama (Japan) (http://www.ide.titech.ac.jp/~icuc7/) is proceeding well and the 2nd Circular will be published soon. If you have not done so yet, please mark the conference dates (June 29 – July 3, 2009) in your calendar and make an effort to attend. The *31st International Geographical Congress* will take place in Tunis (Tunisia) from August 12 - 15, 2008 (http://www.igc-tunis2008.com/). Please consider attending the special session on "Urbanisation and Climate Change" which is co-sponsored by IAUC (see announcement on p. 23).

IAUC news: We will soon be holding an election for a new Board member (see the announcement on p. 28). Please consider nominating either a colleague and/or yourself. Julia Hidalgo (University of Vigo, Spain) is the new chair of the IAUC Bibliography Committee, and together with the other committee members is responsible for the compilation of the Bibliography section. The large number of references (over 70) listed in the current issue is a clear indication of the vibrancy and relevance of the urban climate field. I wish to thank Jennifer Salmond, past chair of the committee, for her dedicated effort over the last few years. I would also like to thank Marshall Shepherd for compiling the News section. Since he has taken on other responsibilities recently we need to find someone else to collect and edit relevant submissions. If you are interested in this opportunity to contribute directly to the newsletter, please contact David (davidp@bgu.ac.il) or myself. I generally urge all of our members to consider submitting an article, short research report, urban climate news item, conference report or similar contribution for publication either directly to David or to the respective sub-editors.

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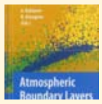
Inside the Spring issue...



2007 Was Tied as Earth's Second-Warmest Year in GISS Record

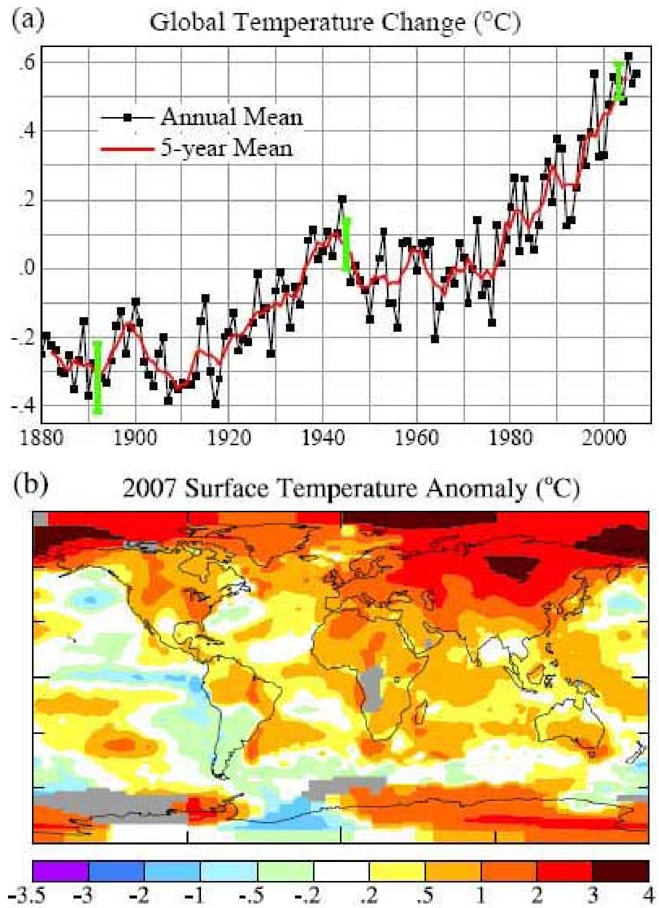
January, 2008

Climatologists at the NASA Goddard Institute for Space Studies (GISS) in New York City have found that 2007 tied with 1998 for Earth's second warmest year in a century.

The global mean temperature anomaly, 0.57°C warmer than the 1951-1980 mean, continues the strong warming trend of the past 30 years that has been "confidently attributed to the effect of increasing human-made greenhouse gases," said James Hansen, director of NASA GISS. The eight warmest years in the GISS record have all occurred since 1998, and the 14 warmest years in the record have all occurred since 1990.

The greatest warming in 2007 occurred in the Arctic, and neighboring high latitude regions. The large Arctic warm anomaly of 2007 is consistent with observations of record low geographic extent of Arctic sea ice in September 2007.

Temperatures in 2007 tied for second warmest in the period of instrumental data (since 1880), behind the record warmth of 2005, and together with 1998 - which had leapt a remarkable 0.2°C above the prior record with the help of the "El Niño of the century." The unusual warmth in 2007 is noteworthy because it occurs at a time when solar irradiance is at a minimum and the equatorial Pacific Ocean is in the cool phase of its natural El Niño-La Niña cycle.



(a) Annual surface temperature anomaly relative to 1951-1980 mean. (b) Global map of surface temperature anomalies for 2007. ***Source: NASA GISS*** **(http://data.giss.nasa.gov/gistemp/2007/)**

Treatment of Urban Station Data

Goddard Institute researchers use temperature data from weather stations on land, satellite measurements of sea ice temperature since 1982 and data from ships for earlier years.

The basic GISS temperature analysis scheme was defined in the late 1970s when a method of estimating global temperature change was needed for comparison with one-dimensional global climate models. Prior temperature analyses covered only 20-90°N latitudes, and the rationale was that the number of Southern Hemisphere stations was sufficient for a meaningful estimate of global temperature change, because temperature anomalies and trends are highly correlated over substantial geographical distances.

It was shown that the correlation of temperature change was reasonably strong for stations separated by up to 1200 km, especially at middle and high latitudes. Quantitative estimates were obtained of the error in annual and 5-year mean temperature change by sampling at station locations a spatially complete data set of a long run of a global climate model, which was shown to have realistic spatial and temporal variability.

This derived error bar only addressed the error due to incomplete spatial coverage of measurements. As there are other potential sources of error, such as urban warming near meteorological stations, other methods have been used to verify the approximate magnitude of inferred global warming. These include studies by several groups of the effect of urban and other local human influences on the global temperature record. All of these yield consistent estimates of the approximate magnitude of global warming, which has now increased to about twice the magnitude reported in 1981.

Improvements in the analysis include the use of satellite-observed night lights to determine which stations in the U.S. are located in urban and peri-urban areas, the long-term trends of those stations being adjusted to agree with long-term trends of nearby rural stations.

The current analysis uses surface air temperature measurements from the the GHCN/USHCN/SCAR data sets, which are modified in two steps: multiple records at a given location are combined into one record, and the urban and peri-urban stations are adjusted so that their long-term trend matches that of the mean of neighboring rural stations. Urban stations without nearby rural stations are dropped. (*Source:* http://www.giss.nasa.gov/research/news/20080116/)

Effects of Urbanization Extend to the Global Scale

February 7, 2008

What shape could future cities take, and how will their populations meet growing environmental challenges?

A paper authored by Arizona State University ecologist Nancy Grimm and colleagues concludes that global change and the ecology of cities are closely linked. Their article, "Global Change and the Ecology of Cities," was published in a February 2008 special issue of *Science* focusing on the theme of Cities.

"When we think of global change, images of melting ice caps and pasture replacing tropical rainforest come to mind," Grimm says. "What drives these changes? In fact, much of the current environmental impact originates in cities, and with demographic transition to city life the urban footprint is likely to continue to grow."

Cities as ecosystems

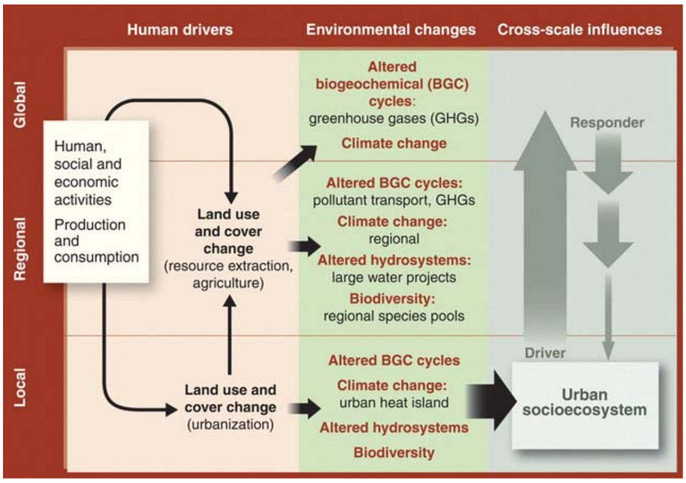
For a decade, Grimm and more than a dozen co-principal investigators have pioneered urban studies in one of the first long-term ecological research (LTER) projects designed about urban environments. One of two urban long-term projects funded by the National Science Foundation (NSF) – the other is the Baltimore Ecosystem Study in Maryland – CAP LTER researchers have examined the living and non-living components of a city with participation from city planners, engineers, sociologists and other scientists, revealing the dynamic nature of this "ascendant ecosystem."

"Urban areas are hot spots that drive environmental change," says John Briggs. "They are complex, adaptive socioecological systems, centers of production and consumption, in which the delivery of the ecosystems services link society and ecosystems at multiple levels."

Phoenix's rapid growth provides a platform for CAP LTER researchers, as an evolving "before" and "after" laboratory. Phoenix is the fifth largest city in the U.S., with a metro area population or more than 4 million. Phoenix's growth is emblematic of the U.S. West in general, which is expected to experience the largest percentages of population increases in the next 20 years.

"Phoenix, and cities in general, are microcosms for the kinds of changes that are happening globally," notes Grimm. "In biogeochemical cycles, for example, they show symptoms of the imbalances in nitrogen, carbon dioxide, ozone and other chemicals that they help to create globally."

How can so many environmental challenges and changes be considered in a unified way? One approach is to view urban systems as organic units: organisms that take up resources and produce wastes. Such an integrated perspective can be useful for interpreting such things as biogeochemical cycles in cities and to analyze their regional or global effects. For example, cities are point sources for carbon dioxide and other greenhouse gases, and anthropogenic nutrient deposition. Fallout from cities can come in the form of urban aerosols, including atmospheric nitrogen, such as that wafted from fast-food joints or manicured lawns.



Framework showing urban socioecosystem as a driver of and responder to environmental change. *Source*: From Grimm *et al.*, SCIENCE 319:756 (2008). Reprinted with permission from AAAS.

Grimm and fellow ASU ecologist Sharon Hall have found that fertilized and irrigated lawns release more nitrous oxide, a potent greenhouse gas, than the native desert soils that preceded them. Also, lawns support a more sustained, year-round production of nitrogen oxide than desert soils, which contributes to tropospheric ozone production and regional increases in photochemical smog.

"Global emissions of nitrous oxide (N_2O) and nitric oxide (NO) have increased dramatically during the last century, primarily due to human activity associated with agriculture and fossil fuel combustion," notes Hall. "We are just now discovering how urban centers figure into this equation, and how cities such as Phoenix impact surrounding landscapes, as well as contribute to larger regional or global climate."

Urban ecological study may be multi-faceted and complex, yet it offers pivotal insight in how to navigate a sustainable urban future. "The relatively young and highly interdisciplinary field of urban ecology has demonstrated how well-designed cities can actually have less overall impact on the environment than equivalent dispersed rural populations," says Jonathan Fink, director of ASU's Global Institute of Sustainability. "The kind of counter-intuitive research results described in Grimm's paper show how an ecological perspective can help urban planners and engineers find ways for society to live more harmoniously with nature." *Sources*: http://www.nsf.gov/news/news_summ.jsp?cntn_id=111079 • http://www.eurekalert.org/pub_releases/2008-02/asu-uet020508.php

CEC Report: Most Inexpensive CO_2 Emission Cuts from Green Buildings

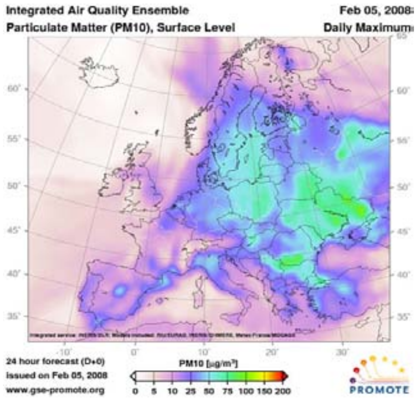
March, 2008 — Promoting the green design, construction, renovation and operation of buildings could cut North American greenhouse gas emissions that are fuelling climate change more deeply, quickly and cheaply than any other available measure, according to a new report issued by the trinational Commission for Environmental Cooperation (CEC).

North America's buildings cause the annual release of more than 2,200 megatons of CO_2 into the atmosphere, about 35 percent of the continent's total. The report says rapid market uptake of currently available and emerging advanced energy-saving technologies could result in over 1,700 fewer megatons of CO_2 emissions in 2030, compared to projected emissions that year following a business-as-usual approach. A cut of that size would nearly equal the CO_2 emitted by the entire US transportation sector in 2000. *Source*: http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=2242

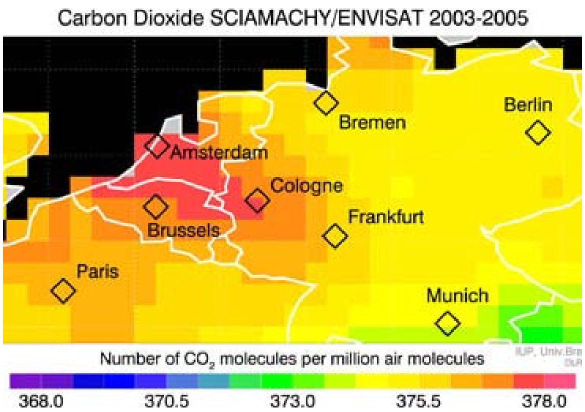
Satellite Data to Deliver 'State-of-the-art' Air Quality Information in Europe

February, 2008 — The European Environment Agency (EEA) has finalised an agreement with a consortium led by the European Space Agency (ESA) to provide unparalleled information on air pollution, which contributes to the premature deaths of hundreds of thousands of Europeans annually.

Under the agreement, the EEA will use a service which combines and processes satellite data with surface measurements from 29 European countries to deliver accurate information on air quality daily, to support the implementation of European air-quality policies. "Sophisticated processing and satellite data from ESA will combine to deliver state-of-the-art information on air quality. This will allow EEA to get the most from ground-based measurements collected through its networks," EEA Project Manager Tim Haigh said. *Source*: http://www.esa.int/esaCP/SEMDC5PR4CF_index_0.html



First-ever Observation of Regionally Elevated CO_2 from Manmade Emissions



March, 2008 — Using data from the SCIAMACHY instrument aboard ESA's Envisat environmental satellite, scientists have for the first time detected regionally elevated atmospheric carbon dioxide originating from manmade emissions. Dr Michael Buchwitz from the Institute of Environmental Physics (IUP) at the University of Bremen in Germany and his colleagues detected the relatively weak atmospheric CO_2 signal arising from regional anthropogenic CO_2 emissions over Europe by processing and analysing SCIAMACHY data from 2003 to 2005. The findings show an extended plume over Europe's most populated area, the region from Amsterdam in the Netherlands to Frankfurt, Germany. *Source*: http://www.esa.int/esaCP/SEMZHVM5NDF_index_0.html#subhead1

Alarming Emissions Growth in China

March, 2008 — The growth in China's CO_2 emissions is far outpacing previous estimates, making the goal of stabilizing atmospheric greenhouse gases even more difficult, according to a new analysis by economists at the University of California. Previous estimates, including those used by the IPCC, say the region that includes China will see a 2.5 to 5 percent annual increase in CO_2 emissions between 2004 and 2010. The new UC analysis puts that annual growth rate for China to at least 11 percent for the same time period. *Source*: http://www.sciencedaily.com/releases/2008/03/080310155857.htm

LiDAR Being Applied for Wind Energy

March, 2008 — The optimal operation of large new-generation wind turbines requires reliable measurements of wind inflow characteristics, which may not be feasible using met masts due to cost and technical considerations. A team including researchers from the Universities of Stuttgart and Oldenburg is testing an alternative remote sensing technique, using LiDAR technology (Light Detection and Ranging), a laser-based measurement technique which performs wind field measurements in a more flexible and economical way. *Source*: http://www.sciencedaily.com/releases/2008/03/080306221723.htm

Impacts of urbanization and land surface changes on climate trends

by Eugenia Kalnay, University of Maryland (ekalnay@atmos.umd.edu)

(with Ming Cai, Florida State University; Mario Nuñez, University of Buenos Aires and Young-Kwon Lim, Florida State University)

By now there is little doubt that the increase in greenhouse gases (GHG) is producing global warming. The question we addressed in this project is whether the regional response to the GHG effect is uniform or depends on the land characteristics and use. In this report we summarize results we obtained showing that the response is very much dependent on the type of land cover and use, and that desertic and urban areas get more than their "fair share" of GHG warming, whereas broadleaf forested areas have locally reduced warming.

1. The Observation Minus Reanalysis (OMR) method

We use the Observation Minus Reanalysis (OMR) surface temperature trends method suggested by Kalnay and Cai (*Nature*, 2003) to provide an estimate of the impact of surface effects on regional warming (or cooling). It takes advantage of the insensitivity of the NCEP-NCAR Reanalysis (NNR) to land surface type, and eliminates the natural variability due to changes in circulation (since they are also included in the reanalysis), thus separating surface effects from greenhouse warming. Kalnay *et al.* (*JGR*, 2006) showed that over the US the OMR *average* is small, but it has different regional signs, in good agreement with the regions of "urban heating and cooling" obtained by Hansen *et al* (JGR, 2001) when using nightlights to discriminate between urban and rural regions (Fig. 1). Kalnay *et al*. (2006) also showed that the results obtained with OMR were not qualitatively affected by the NCDC corrections of non-climatic effects (e.g., change of observation time and station location), which increase the overall warming trend in the US (compare Fig. 2c with Fig. 2d, obtained using the USHCN observations corrected for nonclimatic effects).

2. Relationship between OMR and land vegetation type

Lim *et al*. (*GRL*, 2005) compared two global observation-based data sets (CRU and GHCN) and two different global reanalyses (NCEP-NCAR and ERA40) and MODIS-derived land classes. The results (Figure

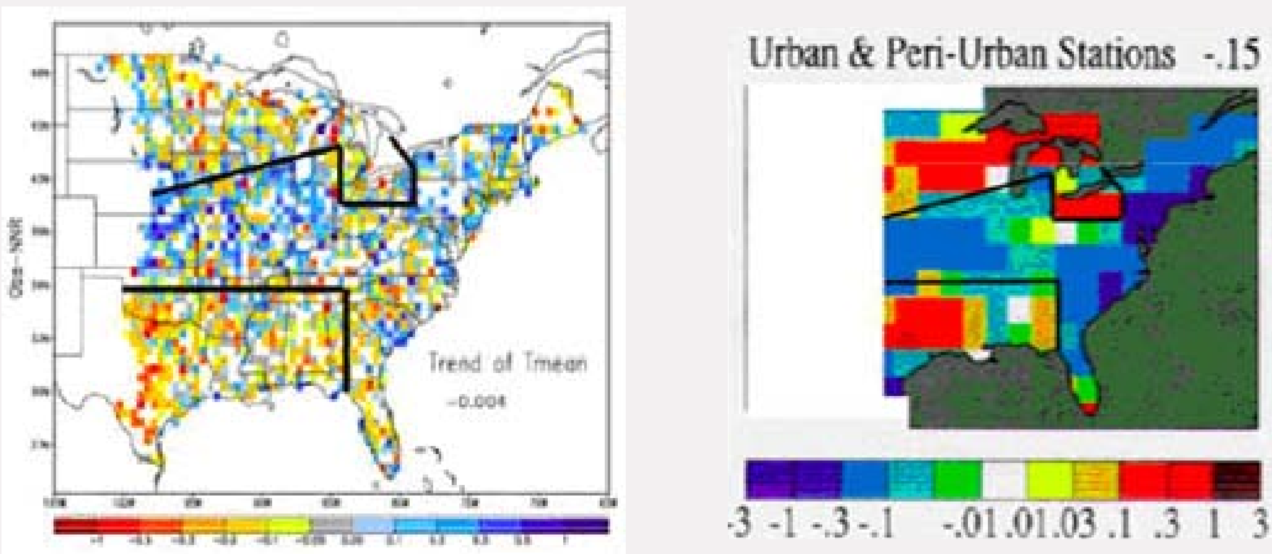
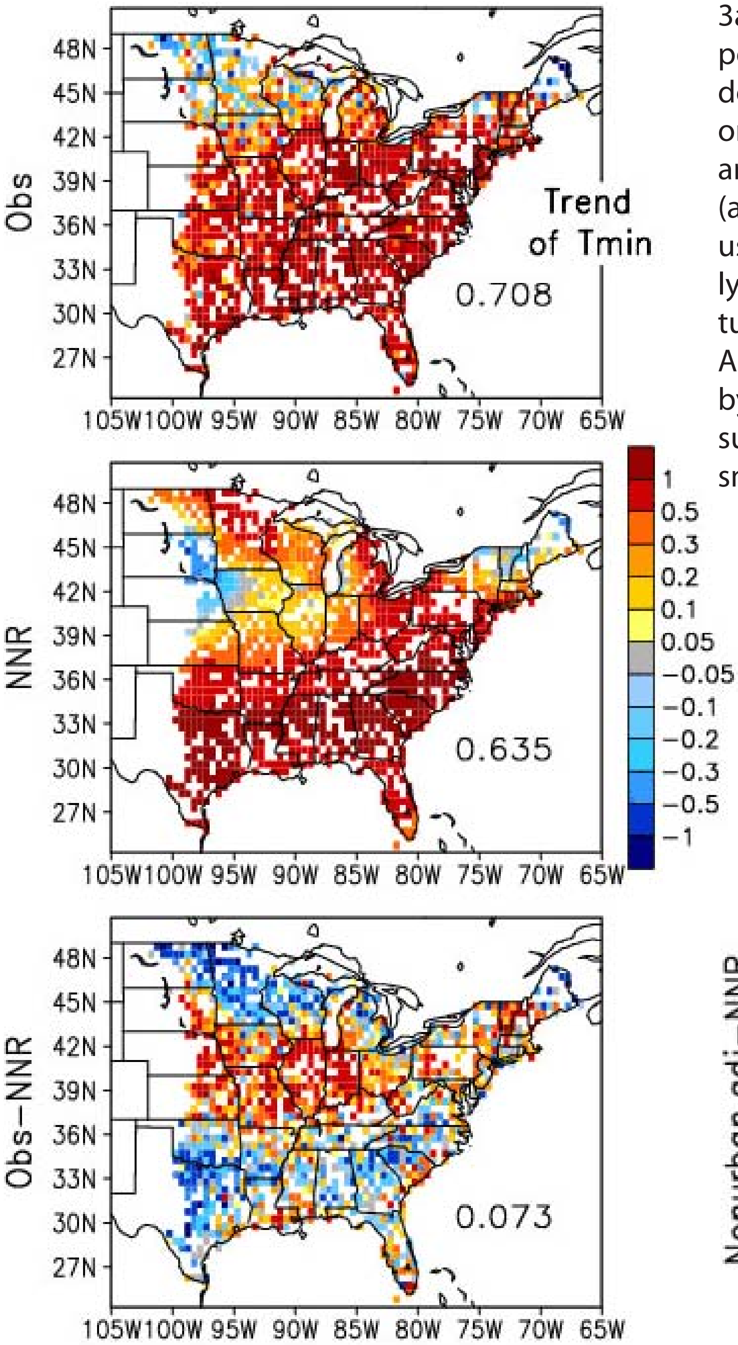


Figure 1. Left: OMR trend difference for the mean temperature with the scale of colors having been reversed so that warming appears as blue, in units of °C/decade. Right: Urban *correction* (opposite of the trend) obtained by Hansen *et al*. (2001) in units of °C/century.

3a) showed that the OMR trends have a strong dependence on the type of land-surface, and that this dependence is similar using either the NCEP-NCAR or the ERA-40 Reanalyses. The ERA40 OMR trends are smaller than those of the NCEP reanalysis OMR (about half), as could be expected since the ERA40 uses air surface temperature observations indirectly, from an off-line OI analysis of surface temperature, to initialize the soil temperature and moisture. As a result the ERA40 analysis is partially influenced by surface observations, which are affected by land surface properties, and the OMR is correspondingly smaller (Figure 3b).



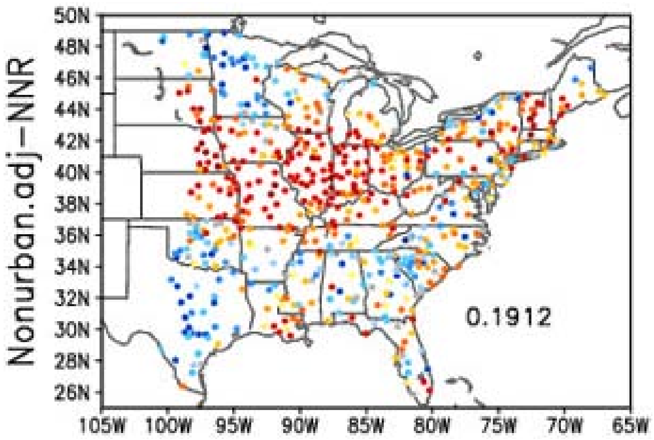


Figure 2: Surface temperature trend for the minimum temperature in winter. Top left: Unadjusted observations; Center left: NCEP-NCAR Reanalysis; Bottom left: Their difference (OMR). Bottom right: The OMR computed from the USHCN observations corrected for nonclimatic effects. (From Kalnay *et al.* 2006)

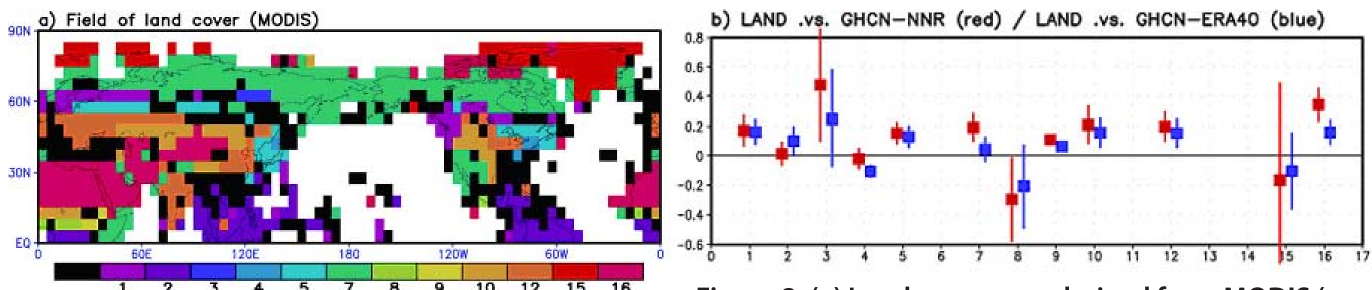


Figure 3. (a) Land cover map derived from MODIS (see Table 1). Grid boxes in which the dominant land cover type covers less than 40% are colored black and not used in the analysis presented in Figure 2b. (b) The mean OMR trend of "GHCN-minus-NNR" (red), and "GHCN-minus-ERA40" (blue) per decade (°C/decade) over the NH as a function of land types. Filled squares represent the mean OMR trends and vertical lines the error bars at 95% significance level. The OMR trend per decade is obtained by taking the average of two decadal mean difference (90s-80s and 70s-60s). (From Lim *et al.* 2005)

Table 1. 16 Land-Cover Categories From MODIS and the Number of 5°x5° Grid Boxes Used for the Calculation of OMR Trends Per Decade

Land Cover Category		Number of Grid Boxes
1	Evergreen needle-leaf forest	29
2	Evergreen broadleaf forest	42
3	Deciduous needle-leaf forest	4
4	Deciduous broadleaf forest	3
5	Mixed forest	31
6	Closed shrubland	0
7	Open shrubland	81
8	Woody savannah	6
9	Savannah	6
10	Grassland	36
11	Wetland	0
12	Cropland	51
13	Urban	0
14	Natural vegetation mosaic	0
15	Snow and ice	3
16	Barren or sparsely vegetated	56

The results show that OMR warming over barren areas is larger than most other land types, and that urban areas show a large warming second only to barren areas. Croplands with agricultural activity show a larger warming than natural broadleaf forests. The overall assessment indicates surface warming is larger for areas that are barren, anthropogenically developed, or covered with needle-leaf forests (see also Figs. 4 and 5).

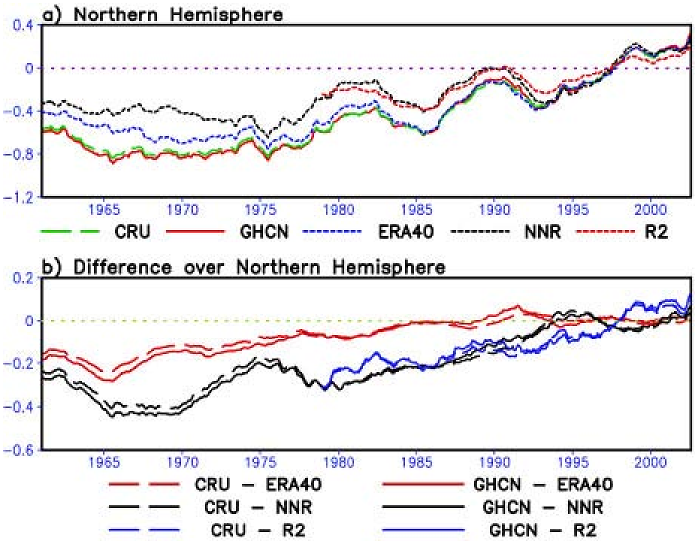


Figure 4. Time series (three-year running mean) of (a) land surface temperature anomalies (°C) derived from CRU, GHCN, ERA40, NNR, and R2 and (b) the OMRs. Anomaly values are obtained by removing the 30-yr mean from 1961 to 1990 and they are further adjusted to have zero mean over the last 10 years (1993–2002). (From Lim *et al*. 2005)

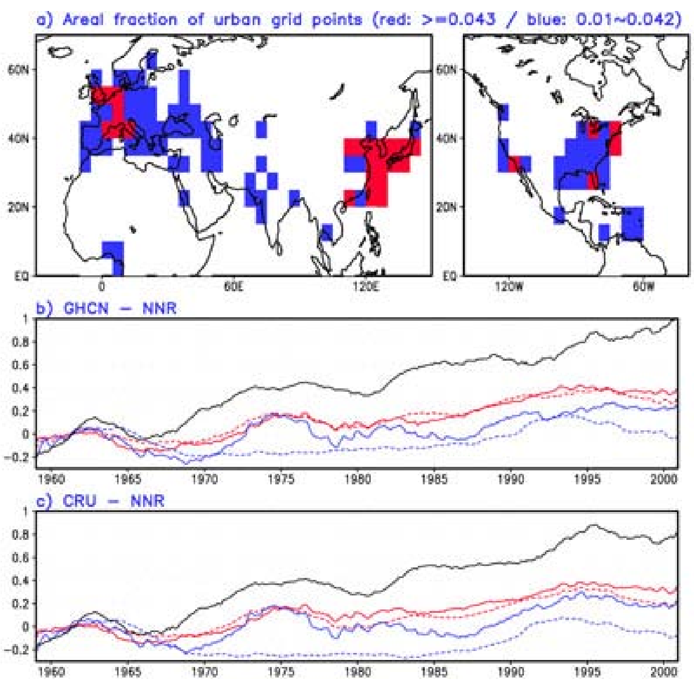


Figure 5. (a) Geographical distribution of urban grids (5°x5°). Grid boxes where the fractional area of 1 km x 1 km urban pixels is greater than 0.043 (in red), and between 0.01 and 0.042 (in blue) are categorized respectively as big and small urban areas. Time series (°C) of (b) GHCN-NNR, and (c) CRU-NNR, for the areas of big urban areas (red solid), small urban areas (red dashed), agriculture (blue solid), natural broadleaf (blue dashed), and barren areas (black solid), respectively. (From Lim *et al*. 2005)

3. Relationship between OMR and NDVI

Lim *et al*. (*JAMC*, 2008) extended this study to establish the dependence of OMR on the Normalized Difference Vegetation Index (NDVI), and hence on the Leaf Area Index, LAI (Figure 6).

The trend of the observations (Global Historic Climate Network, GHCN) does not show a dependence on the vegetation index (Fig. 6a). Both the ERA-40 and the NCEP-NCAR Reanalysis show a positive correlation in the temperature trends and the vegetation index. For both reanalyses, the OMR decreases with NDVI (Figs. 6c and e).

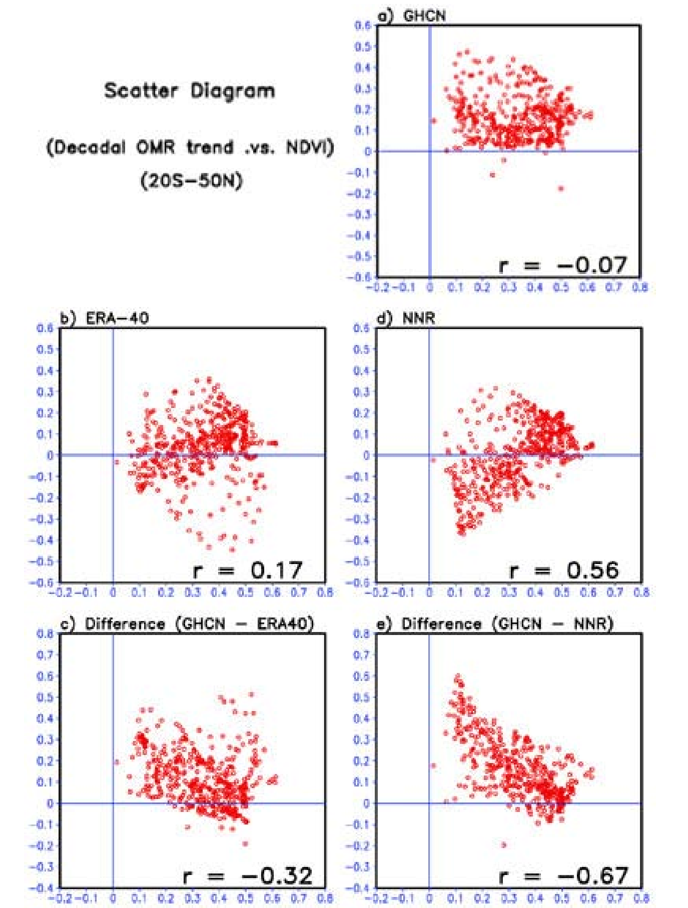


Figure 6. Scatter diagram between the NDVI and the decadal surface temperature trend of a) GHCN, b) ERA40, c) GHCN – ERA40, d) NNR, and e) GHCN – NNR over (0º-360ºE)x(20ºS-50ºN) region. Data have been spatially smoothed to remove the extreme outliers. Abscissa denotes the NDVI whereas the ordinate the decadal trend. Here r is the correlation coefficient of all the data points. (From Lim *et al*. 2006)

4. Impact of land-use and precipitation changes on surface temperature trends in Argentina

In this paper (Nunez *et al*., JGR, 2008) we applied the OMR method to surface stations in Argentina for the period 1961-2000. In contrast to most other land areas, over most of Argentina there has been net cooling, not warming (about -0.04ºC/decade) (Figs. 7 and 8, left). Observations also show a very strong decrease in the diurnal temperature range north of 40ºS latitude. This is associated with an observed strong reduction in the maximum temperature (-0.12ºC/decade) together with a weak warming trend in the minimum temperature (0.05ºC/decade).

The OMR trends show a warming contribution to the mean temperature (+0.07ºC/decade) and a decrease in the diurnal temperature range (-0.08ºC/decade) (Figs 7 and 8, right). This decrease is especially strong in the areas where the observed precipitation has increased the most (Figure 9). The increase in precipitation is apparently associated with an increase in the moisture transport from the Amazons to northern Argentina by the low level jet (Figure 10).

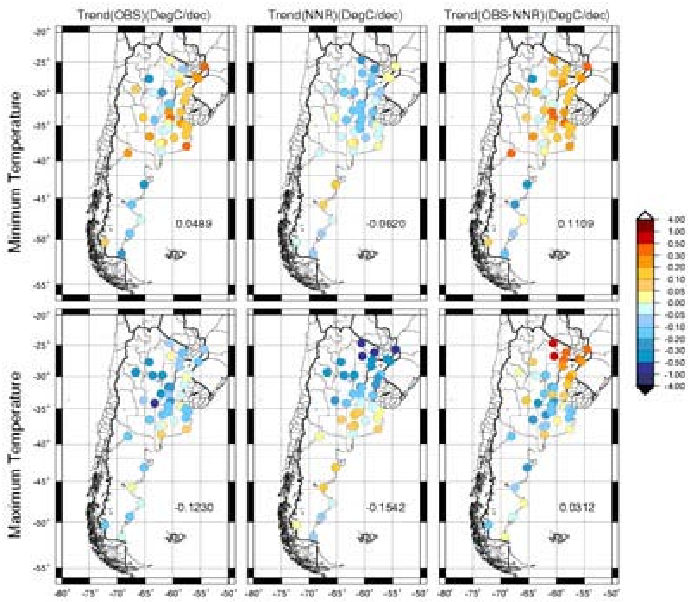


Figure 7: 40-year minimum temperature (top) and maximum temperature (bottom) trends for Argentina (in ºC/decade) over stations located below 500m. Left: trends from stations, Center: from the NNR, Right: observations minus NNR trend. The number represents the average trend of all stations in the study.

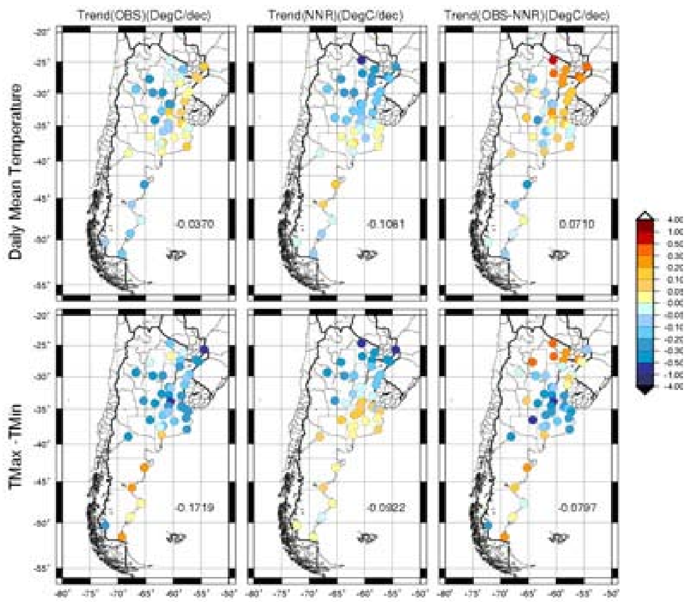


Figure 8: As figure 7 but for the daily mean temperature and the diurnal temperature range.

The maximum precipitation increase also corresponds with the area where there has been an exponential increase of soy production in the last decade.

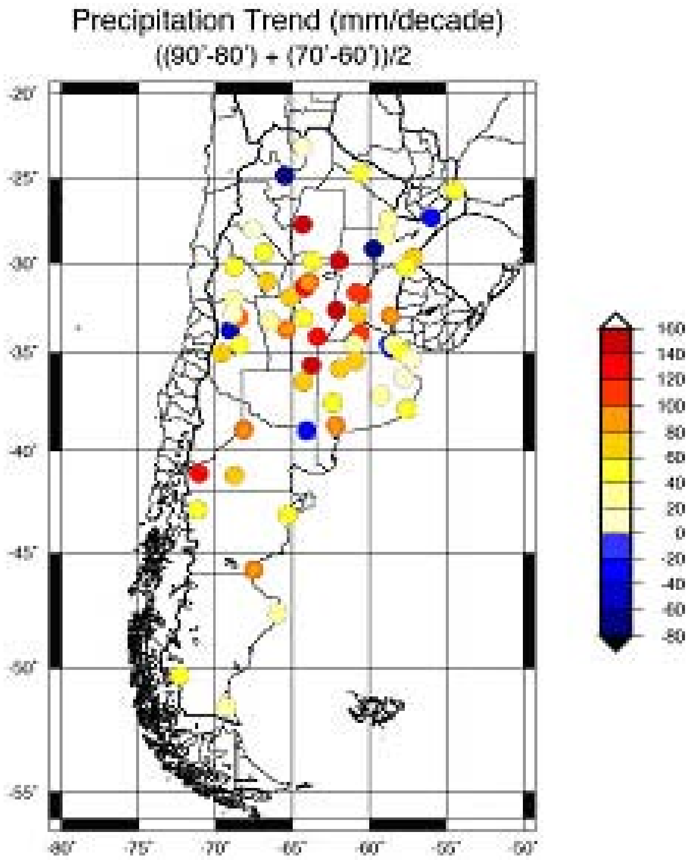


Figure 9: Decadal precipitation trend (mm/decade) computed as the temperature trends.

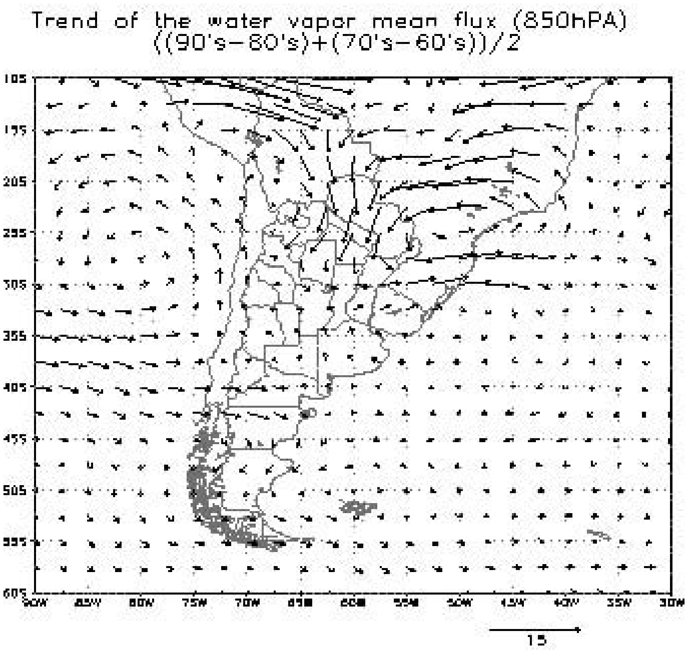


Figure 10: Trend of the mean flux of water vapor from the NNR, estimated as the trend in precipitation in Figure 9. Units are in $ms^{-1}gkg^{-1}$/decade.

5. Summary

The Observation Minus Reanalysis (OMR) trend method has been proposed to estimate the impact of surface and near surface effects on the temperature trends, to the extent that these effects are not included in the Reanalysis and do affect the observations. The results suggest that these effects are regional and depend on the type of land cover. Areas with little vegetation suffer from warming higher than their "fair greenhouse gases warming share", as estimated from reanalysis, whereas for highly vegetated zones, the OMR is small or negative indicating that high vegetation cover can help ameliorate the impact of global warming. In central-northern Argentina, where there has been an exponential growth in the planting of soy beans in an area of increased precipitation, possibly due to an increase in water vapor transport from the Amazons, there is a strong negative OMR trend of diurnal temperature range.

We gratefully acknowledge support from NOAA grant NA04OAR4310103 and NSF grant ATM403518.

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The Oklahoma City Micronet Project

1. Introduction

The need for improved atmospheric observations has been well established, as the global percentage of humans living in urban zones continues to increase. Oklahoma City is a growing metropolitan area with a population of approximately 530,000 citizens (United States Census Bureau, 2003) and a spatial extent of approximately 1610 km^2; the latter places Oklahoma City within the top ten largest cities by land area in the United States, and the largest city that is not a consolidated city-county. However, the urbanized area of Oklahoma City is considerably smaller and spans approximately 630 km^2. Embedded within the urbanized area of Oklahoma City is a well-defined central business district (CBD) approximately 20 km^2 in extent with buildings up to 120 m in height.

During a six-week period in June and July 2003, the Joint Urban 2003 field experiment (JU2003) was conducted in Oklahoma City. It was during and immediately following JU2003 that a vision was drafted to design and deploy an automated atmospheric observing network across Oklahoma City. During 2004 and 2005, funding was secured and the Oklahoma City Micronet (OKCNET) project began. OKCNET includes two main phases of implementation including (1) the deployment of three new Oklahoma Mesonet sites within Oklahoma City and (2) the installation of a dense network of sites mounted on traffic lights. When finalized in early 2008, 40 stations will collect continuous observations of atmospheric conditions at 1-minute intervals.

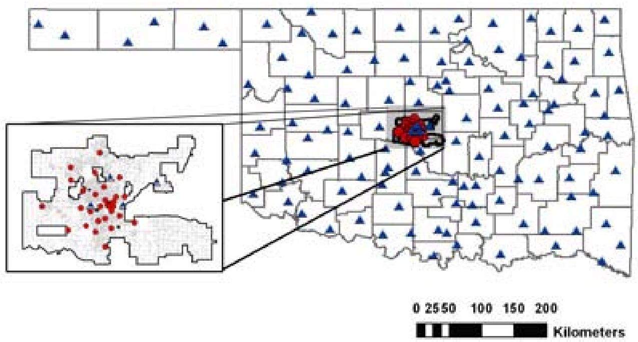

Figure 1a. A graphical representation of Oklahoma Mesonet Station locations (blue triangles), the boundaries of Oklahoma City, and the location of Oklahoma City Micronet stations (red dots).

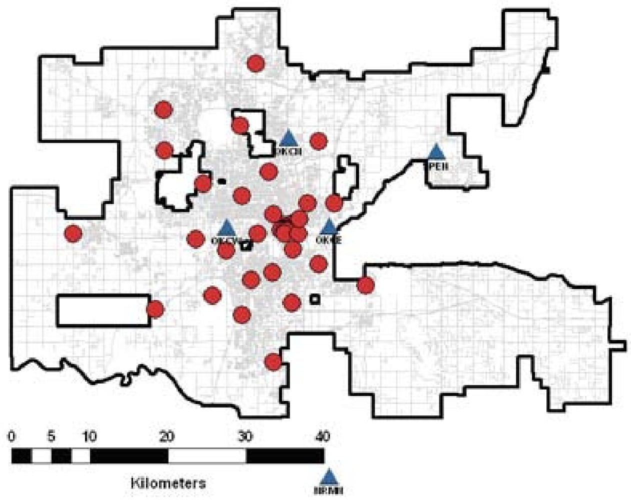

Figure 1b. The location of Oklahoma City Micronet stations including traffic light sites (red dots) and Oklahoma Mesonet sites (blue triangles).

2. Oklahoma City Mesonet Stations

The Oklahoma Mesonet is an automated network of over 110 meteorological stations across Oklahoma (McPherson et al. 2007). Each station measures core parameters that include: air temperature and relative humidity at 1.5 m, wind speed and direction at 10 m, atmospheric pressure, incoming solar radiation, rainfall, and bare and vegetated soil temperatures at 10 cm below ground level. In addition, over 100 sites measure soil moisture at 4 depths: 5, 25, 60, and 75 cm. Oklahoma Mesonet data are collected and transmitted to a central point every 5 minutes where they are quality controlled, distributed and archived (Shafer et al. 2000). Additional information concerning the Oklahoma Mesonet, including site photographs and metadata, is located at http://www.mesonet.org.

As part of a joint effort between the OKCNET project and the Oklahoma Mesonet, three new Mesonet sites were installed within Oklahoma City in early 2007 (Figs. 1a-b). The first site (OKCN) was installed in February 2007 approximately 7 miles north of the central business district. In April 2007, two additional sites were deployed including one approximately 4 miles west of the central business district (OKCW) and one approximately 4 miles east of the central business district (OKCE). More information regarding the specifics of the new Mesonet sites deployed in Oklahoma City can be found at:

OKCW:
http://www.mesonet.org/sites/sitedescription.php?site=OKCW&dir=pr

OKCN:
http://www.mesonet.org/sites/sitedescription.php?site=OKCN&dir=pr

OKCE:
http://www.mesonet.org/sites/sitedescription.php?site=OKCE&dir=pr

A fourth Oklahoma Mesonet site (SPEN) is currently installed within the Oklahoma City boundaries and is considered an Oklahoma City Micronet station.

3. Traffic Light Stations

A key component of the OKCNET project includes stations deployed on traffic lights across Oklahoma City. Each traffic light station consists of a Vaisala WXT510 sensor and associated hardware mounted at a height approximately 10 meters above the surface (Figs. 2-3). The variables recorded by each site include air temperature, relative humidity, pressure, wind speed, wind direction, and rainfall. All observations are recorded at 1-minute intervals.

With assistance provided by Oklahoma City officials and personnel, extensive design and testing was focused on the deployment of stations mounted on traffic lights. The City of Oklahoma City recently deployed a network of broadband wireless nodes on traffic lights across Oklahoma City for support of public safety and public works activities and the traffic light stations were designed to leverage the capabilities of the wireless nodes. As such, the efforts led to significant innovations associated with the design of the traffic light sites. For example, each traffic light station utilizes power over ethernet (PoE) technologies to provide power needed to operate each traffic light station. Thus, a single Ethernet cable, designed for exterior use, is connected between the traffic light station and the wireless node and, as such, (a) power is provided to the site and (b) a network link is established for data transmission from the site to the central data processing and archival center at the Oklahoma Climatological Survey.

Using the locations of the broadband wireless nodes across the Oklahoma City metropolitan area,

Figure 2. An Oklahoma City Micronet traffic light station.

the OKCNET team developed a list of station locations based on a number of critical attributes including:

- The OKCNET project represents a partnership involving the City of Oklahoma City, and to provide benefits to all citizens, a spatial distribution was designed to incorporate the populated regions of Oklahoma City and beyond.
- Sites could only be located where the wireless nodes were installed.
- To ensure the safety of OKCNET personnel, sites were avoided where overhead power lines were within 3 meters of a traffic light.

Figure 3. View of the WXT510 sensor associated with the traffic light station installed at the intersection of Main St. and Walker Ave. in Oklahoma City (looking south at the elevation of the sensor; sensor height is approximately 10 meters).

Once all options regarding available sites were considered, a total of 36 sites were chosen including 10 within the CBD. The locations include an increased density of stations within the central business district of Oklahoma City and a decreased density of stations toward the periphery of the metropolitan area (Fig. 1b).

4. Summary

The Oklahoma City Micronet will be completed in 2008 and will provide enhanced monitoring of atmospheric conditions across the Oklahoma City metropolitan area. It is anticipated that the continuous, quality-assured observations will provide new research opportunities focused on the urban heat island, atmospheric dispersion, and the impact of severe weather on Oklahoma City. In addition, OKCNET will also provide enhanced atmospheric observations that will be used by public safety, public works, emergency management personnel, and K-12 educational outreach programs across the Oklahoma City Metropolitan area. As such, OKCNET will be a multifaceted tool used by various groups including scientists, educators, first responders, and school children.

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Analysis of PM_{10} along a Pedestrian Precinct

Important sources of particle concentration within urban environments include traffic, industrial facilities, and domestic fuel combustion. Because of EU-limits for urban PM_{10} coming into effect in January 2005, there is an increasing body of literature concerning the urban particle concentration within the urban environment. PM_{10} measurements have been taken from urban stations at several locations within urban areas (e.g. Holst *et al*., 2006; Weber *et al*., 2006; Wolf *et al*., 2006; Dietze *et al*., 2007).

With regard to the reduction of the particle concentration within urban street canyons, stationary air quality measurements have been taken to determine how a traffic diversion or a closure of the street by introducing a pedestrian precinct leads to decreasing concentrations (Henninger, 2007).

Air quality indicators (CO_2, CO, NO_X, O_3) and particulate matter (PM_{10}, $PM_{2.5}$, PM_1) were analyzed within the urban area of Bad Ems, Germany (50°25´N, 7°45´E; Rhineland-Palatinate), based on measurment periods in the months June/July and November/December in 2005, 2006 and 2007. The investigation indicated an obvious differentiation of the concentration of the air quality indicators (CO, NO_X, O_3) before and after the introduction of a pedestrian precinct along the former main road. Individually, CO_2 and PM_{10} rose (CO_2 > 410 ppm; PM_{10}

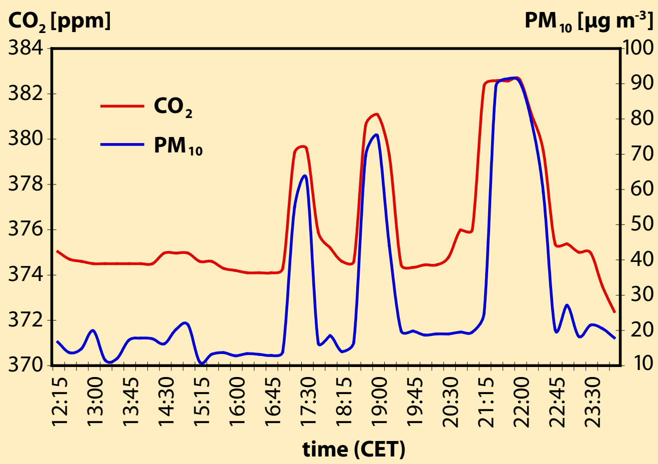

Fig. 1 CO_2 and PM_{10} courses for the urban measuring station within the pedestrian precinct in Bad Ems, Germany; June 15th 2006.

> 130 µg m^{-3}) proportionately to the number of pedestrians ($R^2 = 0.85$), independently from other local emissions and the season.

First of all, the relationship with the presence of pedestrian visitors could be shown for specific events which occurred along the pedestrian precinct. For example, Fig. 1 indicates an obvious correlation ($R^2 = 0.93$) between CO_2 and PM_{10} when the number of people slowly increased with the beginning of the event at 5 p.m. (CO_{2max} = 383 ppm; PM_{10max} = 90 µg m^{-3}; 9:30 p.m.) and a strict decrease at 10:30 p.m. (CO_2 = 373 ppm; PM_{10} = 19 µg m^{-3}; 11 p.m.) when the event was brought to an end and the visitors dispersed.

However, this dependence of CO_2 and PM_{10} on the number of the people is not a snapshot. This pattern could also be detected for weekends when people go for a walk if the weather is fine. The clearest example is illustrated in Fig. 2. The course of PM_{10} and CO_2, calculated for all clear and calm weather situations in the months June/July 2005, 2006 and 2007, obviously describes the behaviour of people within this area by a correlation of $R^2 = 0.92$ (Fig. 2): fewer pedestrians before 12 p.m. walking around (CO_2 = 381 ppm; PM_{10} = 80 µg m^{-3}), disappearing for lunch (CO_2 = 374 ppm; PM_{10} = 20 µg m^{-3}) and starting a walk after finishing their meals, which offers the situation of CO_2 = 383 ppm and PM_{10} = 92 µg m^{-3} and a fast decrease of concentration with the absence of pedestrians in the late afternoon hours (CO_2 = 372 ppm; PM_{10} = 15 µg m^{-3}). This phenomenon could also be determined from respective calculations of the mean diurnal course of CO_2 and PM_{10} for November/December 2005, 2006 and 2007.

Primarily, the measurements of air quality in Bad Ems, Germany have shown that traffic diversion of course results in lower concentration, but with increasing numbers of pedestrians a rise in CO_2 and PM_{10} could be detected. Thus, CO_2 was a kind of "tracer" for the concentration of PM_{10} and revealed a difficulty which might be of interest for many city councils. Only diverting or banning the traffic from the streets cannot eliminate particle concentrations. Even in roads with speed bumps and speed limits, or in exclusively pedestrian precincts, concentrations can rise above the prescribed limits. The measurements have revealed that away from the main roads the PM_{10} problem also still exists. However, for the council of Bad Ems this knowledge resulted in the sanction that not only major streets, but also pedestrian precincts should be kept clean regularly.

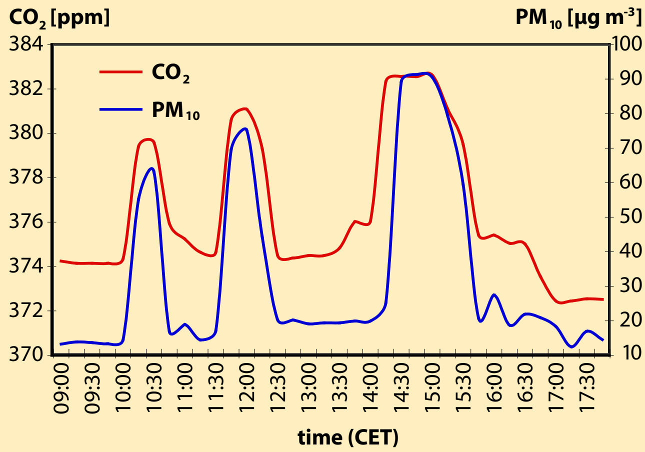

Fig. 2 Diurnal mean CO_2 and PM_{10} courses for the urban measuring station within the pedestrian precinct in Bad Ems, Germany during clear and calm weather situations; June/July 2005, 2006, 2007.

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The Environmental Prediction in Canadian Cities (EPiCC) Network

Project

The Environmental Prediction in Canadian Cities (EPiCC) network is a multi-year (2006-2010) urban atmosphere research project. The overall objective is to provide Canadian urban residents (80% of the population) with better weather and air quality forecasts through development of an urban-atmosphere modeling system evaluated for Canadian urban climates. Our participants[1] include academic and government scientists from several Canadian and international institutions. The project is funded through the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) and also receives significant in-kind support from Environment Canada and through the university partners.

History

The impetus for EPiCC arose from established collaborations among our participants, which have been in existence for over a decade. Our members have participated in a range of important international urban meteorological field projects familiar to IAUC members, including ESCOMPTE-CLU, BUBBLE, CAPITOUL, and Joint Urban 2003 directed towards understanding urban-atmosphere interactions through observation and modeling. In Canada, interest by Canadian government scientists to investigate urban-scale processes and modeling led to the two Montréal Urban Snow Experiments, MUSE-2005 (Lemonsu *et al*. 2008) and MUSE-2006. The idea for EPiCC arose from MUSE planning meetings and was intended to build upon and broaden both the modeling and fieldwork basis of the limited-scope MUSE project. The re-emergence of Montréal as a study site, along with Vancouver, builds upon urban climate field work in the two most studied Canadian cities, which began in Montréal in the 1960s with the work of T.R. Oke. EPiCC received formal funding approval in July 2006, and began to acquire site permissions, make personnel appointments and accept graduate students in 2007. The majority of our measurement sites became operational in late 2007 and further measurements will come on-line as sites become ready.

EPiCC Themes and Objectives

The EPiCC network is organized around observation, modeling and remote sensing themes.

Observations

Direct continuous measurements of radiation and energy balances from urban and rural sites in and around Montréal and Vancouver are underway, with sites chosen to represent the urban and suburban land use typical of the majority of Canadian urban areas. Montréal measurements (Figure 1) focus on winter-time conditions with additional measurements to detail the urban snow cover. Vancouver measurements focus on summer-time evaporation and urban hydrology. Ground-based remote sensing of urban boundary layer characteristics through celiometers (Figure 2) and McGill university radar facilities will also be used to help determine the ur-

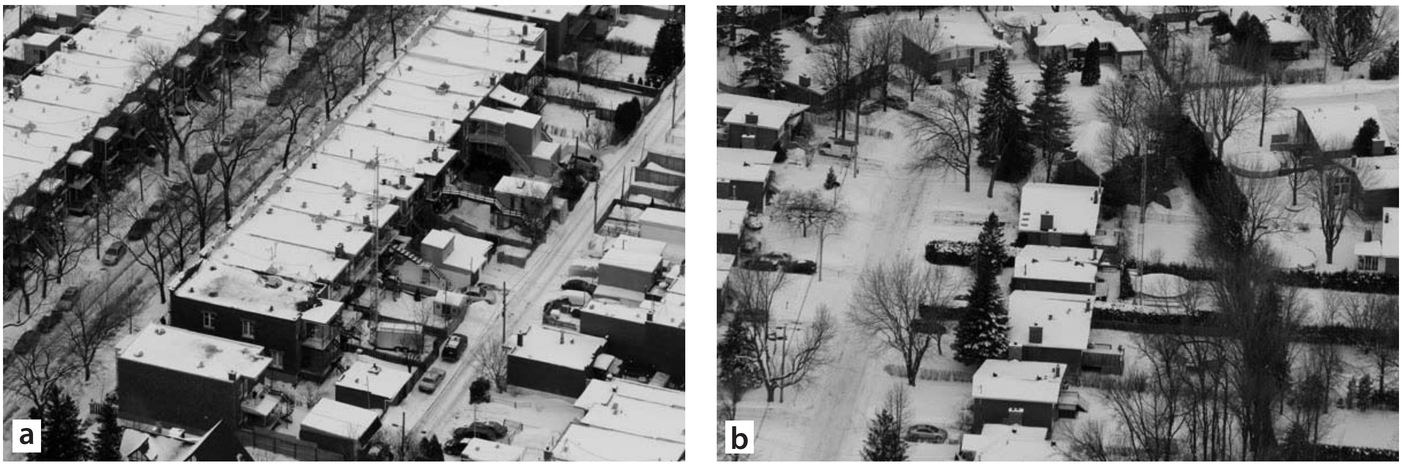

Figure 1. Montréal tower sites: (a) urban residential, and (b) suburban.

[1] *A full list of project participants is available from the EPiCC web page:* www.epicc.uwo.ca

ban boundary layer structure and evaluate model performance at the mesoscale. A summary of the network observations is provided in Table 1.

Modelling

EPiCC is developing the TEB-ISBA (TEB - Town Energy Balance; ISBA - Interactions Soil-Biosphere-Atmosphere) model (Masson 2000, Noilhan and Planton 1989) for use in Canadian urban environments and conditions, with particular attention to the incorporation of urban vegetation and urban hydrology into the modeling system, the model performance in cold winter conditions, and the impacts of anthropogenic heat and water forcing. The refined model will be used to investigate the influences of urban environments on mesoscale atmospheric circulation and other meteorological phenomena and processes.

Remote Sensing

The remote sensing component includes evaluation and continued development of an urban land use characterization scheme that provides the surface information necessary for the TEB-ISBA modeling system, use of airborne LiDAR data to help parameterize the vertical and horizontal structure of urban environments for the modeling system (including both the built and vegetated environment) and use of other ground or space-based remote sensing to assess surface characteristics, especially temperature and snow cover.

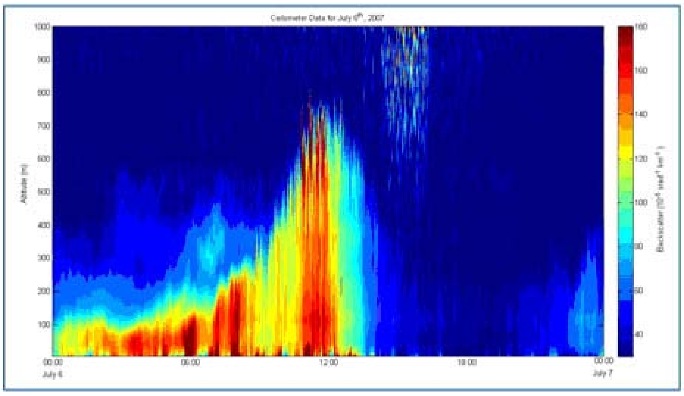

Figure 2. Vancouver urban residential site ceilometer backscatter development on a clear summer day. A 2-D running average has been applied to the data: 4 point averaging temporally and 10-point average along the vertical. Image resolution: 15 s × 5 m (Image provided by D. van der Kamp).

Table 1. Summary of EPiCC observations

	Montréal	*Vancouver*
Flux Observations	• urban residential • suburban • scintillometer * • rural	• urban residential • mobile tower * • rural
Related Tower Site Measurements	• thermal imaging • digital camera (snow cover) • canyon wall and lot area *Tsfc* and snow measurements	• microscale hydrology (soil moisture, *Tsfc* and *Tsoil*) • water monitoring
Boundary Layer Observations	McGill Radar Facilities: • X band, S band doppler • ceilometer • RASS • UHF wind profiler	• ceilometer • LiDAR * • tethered balloon *
Mesonet Observations	Mésonet Montréal	GVRD / Lower Fraser Valley Monitoring Network
	** select deployment periods*	

EPiCC Intensive Observation Periods (IOPs)

EPiCC is proposing to hold IOPs for select periods in Montréal and Vancouver. These IOPs will provide an opportunity for the scientific community to make use of the EPiCC network infrastructure and undertake detailed studies of the urban atmosphere that will contribute to network objectives. The anticipated dates for these IOPs include summer-time IOPs for Vancouver in 2008 and 2009 and winter IOPs for Montréal (likely Jan.-Feb. 2009). Interested members of the scientific community should identify their interest with EPiCC (see how to contact us below) and should watch our website for information about proposed IOPs.

Requests for EPiCC Network data should be made to the Scientific Steering Committee; public access to data will be available once the project data base is finalized (likely September 2010). Full information on EPiCC data policy is available from the project website.

How to Contact Us

On the Web: www.epicc.uwo.ca

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Collaborators: S. Bélair, M. Benjamin, A. Christen, N. Coops, C.S.B. Grimmond, A. Lemonsu, J. Mailhot, V. Masson, I. McKendry, I. Strachan and J. Wang

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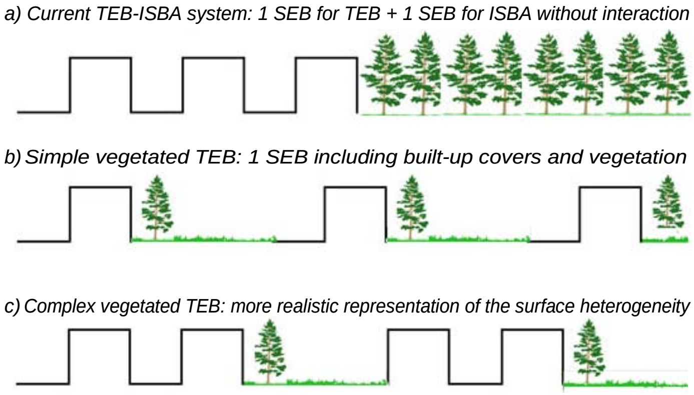

Figure 3. TEB-ISBA modelling system showing current and proposed modifications to the incorporation of vegetation and surface structure within the model.

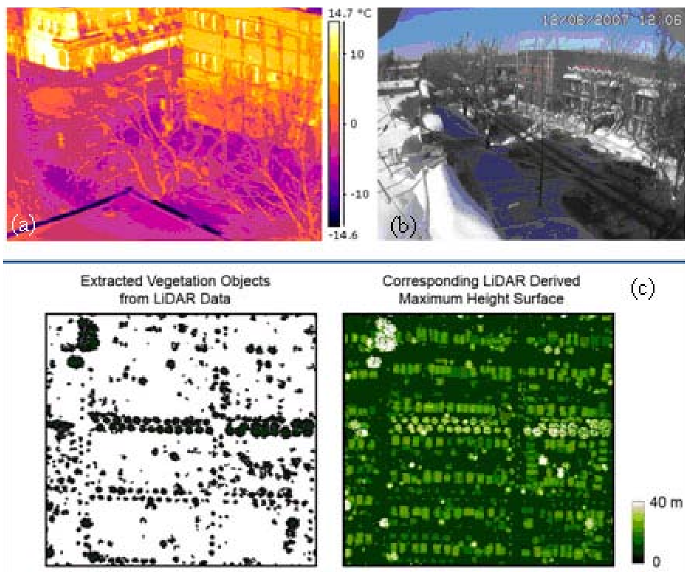

Figure 4. Remotely-sensed surface characteristics: (a) tower-mounted thermal image and (b) web-camera image of snow cover from the Montréal urban site (Images provided by O. Bergeron of McGill University and F. Chagnon of Environment Canada); (c) LiDAR extraction of vegetation and derived maximum surface from the urban residential study site (Area=300x300m) in Vancouver (Image provided by N. Goodwin, UBC).

Acknowledgements

EPiCC thanks the following individuals and institutions for their support:
F. Chagnon (Environment Canada), O. Bergeron (McGill), J. Thibodeau (McGill), N. Goodwin (UBC), R. Ketler (UBC), D. van der Kamp (UBC), C. Siemens (UBC), J. Bau (UBC), R. Tooke (UBC), D. Aldred (UWO)
BC Hydro, City of Vancouver, Hydro Quebec, GVRD, Ville de Montréal, Vancouver and Montréal area landowners who have permitted access to their properties.
CCRS, CMHC, FCM, ICSC, MSC Pacific Region, NRC

Urban Surface Energy Balance Scheme Comparison

It will not come as a surprise to readers that there has, in recent years, been a significant increase in the number of models to parameterise energy exchanges within the urban environment. Given the range of models, a large number of assumptions are implicitly required as to how fluxes are modelled. Many of these models have yet to be evaluated, while others have been evaluated to a limited extent but not in a controlled, impartial manner to allow for a robust and comprehensive comparison.

Thanks to funding from the UK Met Office, this project (a GEWEX deliverable) has now commenced and will follow the methodology used in PILPS[1]. Initially, participants will be given forcing data only to use with their models but no information concerning the location from which the data were collected. The second stage will consist of providing modellers with information about the urban morphology; at the third stage, modellers will be provided with data concerning the urban fabric and in the fourth and final stage, the evaluation dataset will be provided allowing for full parameter optimisation of each model. The model outputs from each stage will be assessed and compared, as will the parameters used by each group. This will consist of a statistical analysis of the models relative to each other and of course, relative to the actual observed data.

Although this work has already commenced with a trial data set, it is not too late to become involved. If any readers wish to add a model, either new, modified or one they are using, to this comparison then please get in touch with us at: urbanmet@kcl.ac.uk. Prospective participants will be sent details of how to participate. Please contact us as soon as possible as we aim to commence with stage one in April (2008) and a number of steps are required for participants even before this date.

We aim to present the initial results of this work at the *AMS* Annual Meeting (2009) which has an urban theme. A more thorough and detailed analysis will be presented at the *ICUC-7* Conference in July 2009.

[1] Henderson-Sellers A, Yang ZL, Dickinson RE (1993) The project for intercomparison of land-surface parameterization schemes, *Bull. AMS*, **74**, 1335-1349.

The objectives of the project include:

- The determination of the main physical processes which need to be considered for a realistic and accurate estimation of energy balance exchanges within the urban environment.
- An assessment of the complexity required to realistically simulate urban fluxes.
- An analysis of the parameters which need to be considered to provide the necessary compromise in terms of the parameter inputs and the robustness of model outputs.
- Formulation of future field observations and model development needs.

For regular updates as to progress, please see the project website at (http://www.kcl.ac.uk/ip/suegrimmond/model_comparison.htm) and/or contact us with any queries regarding the work.

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Funding for the project has been provided by the UK Met Office and we have received support from GEWEX, GLASS and the WMO.

Urban Climate Research in Denmark

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Introduction

Denmark, with a population of 5 million, does not have megacities (the metropolitan area of Copenhagen includes no more that 1.5 million inhabitants). However, urban research for different aspects of urban environment and climate is a focus in many Danish national and international projects. Urban climate studies have a long-term tradition in Denmark, e.g., the Copenhagen tracer experiment, realised in 1979, is still used in many urban model validation studies. Several experimental studies on the ABL structure and dispersion in the Copenhagen area and surroundings have been performed, including the Copenhagen experiment (Gryning and Lyck, 1980), the Øresund experiment (Gryning, 1985), the Jagtvej study (Palmgren *et al*., 1997; Ketzel *et al*., 2003), the Jægersborg study (Baklanov and Kuchin, 2004), and a study of the spatial CO_2 budget of the Copenhagen metropolitan region (Soegaard and Moller-Jensen, 2003).

Danish scientists have leading positions in many international urban research projects, e.g. TRAPOS: Optimisation of Modelling Methods for Traffic Pollution in Streets, COST-715: Urban Meteorology, FUMAPEX: Integrated Systems for Forecasting Urban Meteorology, Air Pollution and Population Exposure, COST-728: Meso-scale Meteorology and COST-732: Micro-scale Meteorology, MEGAPOLI, etc.

Meteorological and climate monitoring and modelling in Denmark, including most of the Danish cities, has been conducted for many years by the Danish Meteorological Institute (DMI). The environmental meteorology group of the research department of DMI is focusing on urban climate and environment modelling. Many universities and research organisations are also involved in urban studies, including Risø National Laboratory (RisøNL), National Environmental Research Institute (NERI), State Building Research Institute (SBI), University of Copenhagen (UC), Danish Technical University (DTU), Aalborg University (AaU), Danish Emergency Management Agency (DEMA), Danish National Centre for Biological Defence (NCBD), and Prolog A/S.

Urban climate research activities in Denmark deal mainly with urban meteorology modelling, urban climatology studies, urban air quality assessments and forecasting, emergency preparedness modelling, urban greenhouse gas fluxes, regional models of urbanisation effects, indoor pollution and building energy saving (heating and comfort), wind energy, and traffic regulations. Let us introduce some of the above-mentioned directions in urban climate modelling research in Denmark.

Urban meteorology and climate modelling

Due to increasing supercomputer power at DMI, modern nested numerical weather prediction (NWP) and meso-meteorological (MM) models utilise land-use databases down to a hundred meters of resolution or finer, and approach the necessary horizontal and vertical resolutions to provide weather forecasts for the urban scale (Baklanov *et al*., 2005). In combination with recent scientific developments in the urban sub-layer atmospheric physics and the enhanced availability of high-resolution urban surface characteristics, the NWP models can provide high quality urban meteorological and climate data. Several models were developed or applied for simulation of urban climate, meteorology and chemical composition, from LES (SUBMESO) to city- and regional-scale forecasting (HIRLAM/HARMONIE). According to the FUMAPEX urbanisation strategy (Baklanov *et al*., 2005) the following improvements were realised:

(i) Model down-scaling, including increasing vertical and horizontal resolution and nesting techniques;

(ii) Modified high-resolution urban land-use classifications, parameterizations and algorithms for roughness parameters in urban areas based on the morphologic method;

(iii) Specific parameterization of urban fluxes in a meso-scale model;

(iv) Parameterization of meteorological fields in the urban sublayer;

(v) Calculation of the urban mixing height based on prognostic approaches.

Several urban parameterizations (Baklanov *et al*., 2005) have been considered in the HIRLAM (HIgh Resolution Limited Area Model) NWP model: (i) DMI module with urban fluxes and analytical profiles in the urban canopy is the cheapest and easy way to urbanise operational NWP models as well as Regional Climate Models; (ii) Building Effect Parameterization (BEP) module is relatively more expensive (up to 5-10% computational time increase), but it gives the possibility to consider the energy budget components and fluxes inside the urban canopy; (iii) Soil Model for SubMeso Urbanized (SM2-U) module is considerably more expensive computationally, but provides the possibility to accurately study the urban soil and canopy energy exchange, including the water budget. Therefore, the second and third modules are recommended for use in advanced urban-scale NWP and meso-meteorological research models.

Since 2003 an experimental urbanised version of DMI-HIRLAM with a high resolution of 1.4 km has been run for the Danish territory, including the Copenhagen metropolitan area. The large eddy simulations employing the SUBMESO model with SM2-U were performed for the Copenhagen metropolitan area (Mahura *et al.*, 2005). Monthly and diurnal cycle variability was studied for net radiation, sensible and storage heat fluxes, surface temperatures, etc. for non-urban surfaces vs. urban districts such as the city center, high buildings, industrial, and residential. The results show strong effects of urban features on the temporal and spatial variability.

On-line integrated urban climate and pollution modelling system EnviroHIRLAM

In addition to traditional urban air pollution modelling systems in Denmark (see e.g. Berkowicz, 2000; Brandt *et al.*, 2003; Baklanov *et al.*, 2005), a new generation on-line integrated urban MM and Atmospheric Chemical Transport Model (ACTM) system EnviroHIRLAM (Chenevez *et al.*, 2004; Baklanov and Korsholm, 2007; Baklanov *et al.*, 2008) for predicting atmospheric composition, meteorology and climate change due to urbanisation has been recently developed at DMI in collaboration with the UC, HIRLAM consortium and others. The new strategy considers urban air quality as a combination, interaction and integration of at least the following factors: meteorological/climatic conditions, air pollution/chemical composition, and population exposure. These are reasonable to consider together due to: (i) the fact that meteorology is a main source of uncertainty in urban air pollution and emergency preparedness modelling, (ii) the complex and combined effects of meteorology and pollution on human health (e.g., hot spots in July of 2003 in Paris), (iii) the effects of pollutants, especially urban aerosols, on climate forcing and meteorological phenomena (radiation, clouds, precipitation, thunderstorms, etc.).

EnviroHIRLAM is developed as a fully on-line integrated system based on the DMI-HIRLAM NWP model with ACTM implemented inside the model (Fig. 1). The system realisation included: (i) nesting of models for higher resolutions (from regional to street-canyon scale), (ii) improved resolving of boundary and surface layer characteristics and structures, (iii) different levels of urbanisation (statistical presentation of urban features or obstacle resolved), (iv) improvement and harmonisation of advection schemes, (v) implementation of chemical mechanisms and aerosol dynamics, (vi) realisation of aerosol and gas feedback mechanisms (direct and indirect forcing), (vii) assimilation of monitoring data. The current version includes on-line coupled tracers, a versatile aerosol-cloud module, and heterogeneous chem-

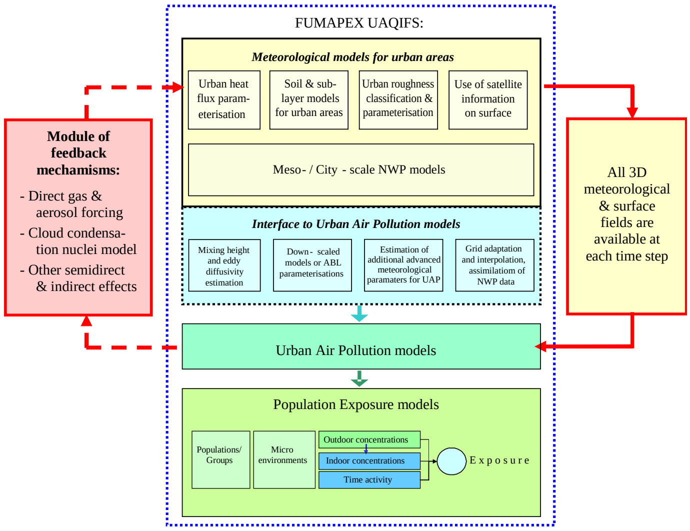

Figure 1. On-line integrated EnviroHIRLAM system structure: extended FUMAPEX scheme of the urban meteorlogy and air quality information forecasting and information systems (UAQIFS).

istry and aerosol feedbacks (Baklanov *et al.*, 2008; Korsholm *et al.*, 2008).

It was demonstrated (Korsholm *et al.*, 2008) that urban aerosol indirect effects modulate dispersion by affecting atmospheric stability (the difference in deposition fields are up to 7%), and its effects on the urban boundary layer height could be comparable with the effects of the the urban heat island ($\Delta h \approx 100$-200 m for the nocturnal boundary layer, see Figure 2). Tests of the off-line vs. on-line integrations of EnviroHIRLAM show that the on-line integration of urbanised MMs and ACTMs with consideration of the feedbacks of air pollution (e.g. urban aerosols) on meteorological processes and urban climate is a more promising way for future development.

Scale interaction for urban climate & air pollution

In most urban simulations for real conditions only a small part of the urban area is considered in a micro-meteorological model but urban heterogeneities outside the simulation domain affect the micro-scale processes. Therefore, a chain of models of different scales with nesting of high resolution models into larger-scale lower resolution models is under development at DMI. This includes downscaling from regional (or global) meteorological models to the urban-scale meso-meteorological models with statistically parameterised building effects (e.g. EnviroHIRLAM, see above) and further downscaling to micro-scale obstacle-resolved CFD-type models. The down-scaled CFD-type Micro-Meteorological model for Urban Environment (M2UE, see Nuterman *et al.*, 2007) is obstacle-resolved and considers detailed geometry of buildings and the urban canopy.

The scale interaction can play an important role in both directions: i.e. not only from a larger scale to the smaller micro-scale, but also vice versa (e.g. atmospheric transport of harmful pollutants, initially released and dispersed in a street canyon; effects of megacities on air chemical composition and climate, etc.). Therefore, it is important to consider two-way nesting, when the scale effects in both directions (from the meso-scale on the micro-scale and the opposite) are considered.

The next proposed step to improve indoor climate systems (energy saving for building heating and ventilation or filtering) is the realisation of integrated indoor-outdoor environment models and better local weather and air pollution forecasts for indoor climate systems, developed by SBI and AaU.

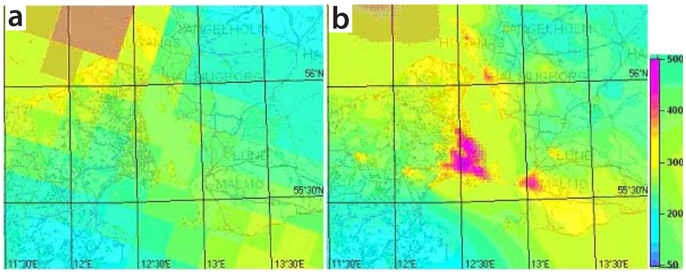

Figure 2. Nocturnal mixing height (in meters) mapped in ARGOS over the Copenhagen region for DMI-HIRLAM forecasts: a) operational non-urbanised version (15 km horizontal resolution), b) experimental urbanised 1.4 km resolution version.

Urban emergency preparedness using the decision support system ARGOS

ARGOS is a decision support system (DSS) for enhancing crisis management for incidents with chemical, biological, radiological and nuclear (CBRN) releases (http://www.pdc.dk/argos/). The target is accidents as well as terror acts related to CBRN industries, transports of hazardous materials etc. ARGOS is a prognostic modelling tool as well as a database system for collection and presentation of emergency-relevant data. ARGOS was initiated by the Danish team from DEMA, Prolog, RisøNL and DMI (ARGOS, 2007), but now has expanded to Australia, Brazil, Canada, Denmark, Estonia, Ireland, Lithuania, Norway, Poland, and Sweden.

The incorporation of urban effects into ARGOS city-scale dispersion models (e.g., RIMPUFF: Mikkelsen *et al*., 1997) was done first of all via urbanisation of meso-meteorological and NWP models, used as drivers, and special urban meteo-preprocessors to improve non-urbanised NWP input data (Baklanov *et al*., 2005). For city-scale dispersion modelling, the statistical description of building structure is suitable only for distances longer than 3-4 buildings from the release; for the epicentre a more precise obstacle-resolved approach is used (e.g. the simple wind-flow model, being developed by FOI for the urban ARGOS). For detailed case studies more comprehensive CFD-type obstacle-resolved urban wind-flow and dispersion models, e.g. M2UE, can be used (Figure 3).

Future plans and perspectives

Anticipating the crucially important UN climate change talks in Copenhagen in late 2009, Denmark is paying increasing attention to climate issues (Rasmussen, 2008) — including urban climate research for Danish cities as well as for world-wide problems of urbanised agglomerations (especially in developing countries).

DMI is coordinating a big new FP7-ENV-2007.1.1.2.1: 'Megacities and regional hot-spots air quality and climate' Collaborative Project MEGAPOLI: "Megacities: Emissions, urban, regional and Global Atmospheric POLlution and climate effects, and Integrated tools for assessment and mitigation" starting in the middle of 2008 and involving 28 teams from 12 European countries.

The Association of Development Researchers in Denmark is organising an international multidisciplinary **Conference on "Cities, Climate Change and Development: Is Urban Change for Sustainability Possible?"** in Copenhagen during the 14th and 15th of May 2008 (see more info at: http://www.fau.dk). The conference includes workshops on: (i) Megacities: Development Scenarios and Impact on Environment and Climate, (ii) Climate change and sustainable development, (iii) Sustainable energy: Planning, distribution and consumption, (iv) Urban Ecosystems and Environmental Change, (v) Global growth of cities: Water related problems, and (vi) Industrial hotspots, health and poverty reduction.

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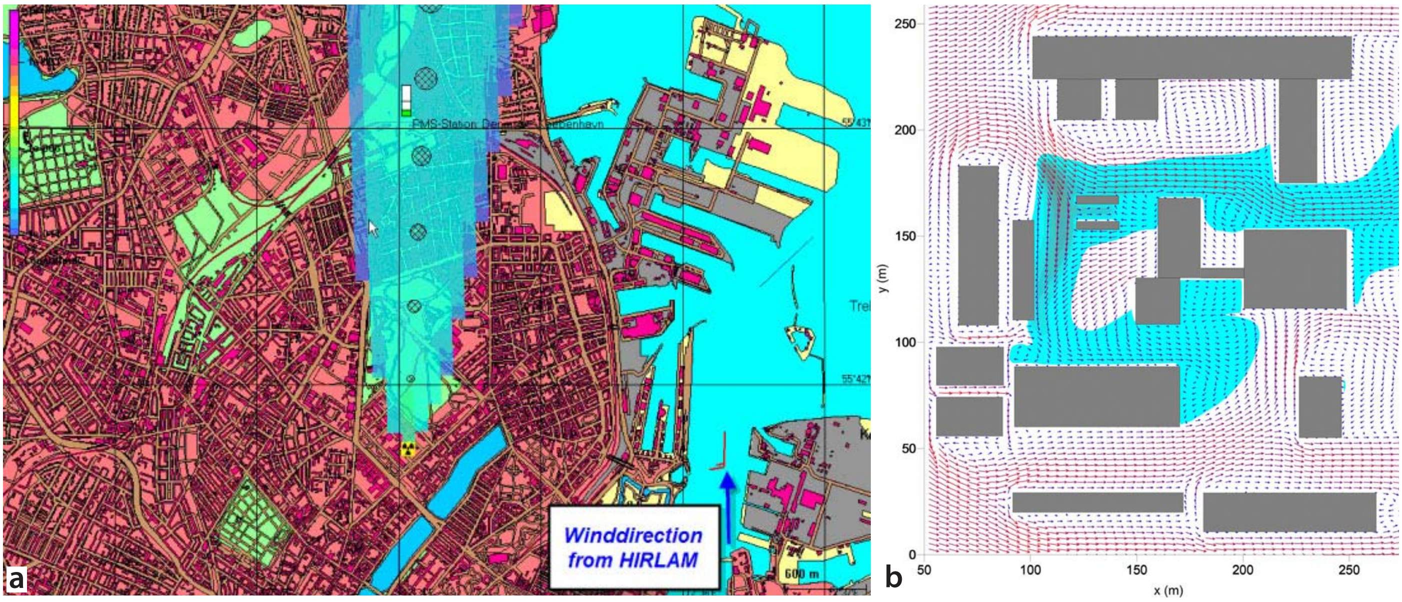

Figure 3. a) ARGOS emergency response simulation for Copenhagen: a hospital release detected by PMS stations; b) Results of downscaled M2UE computations for a release in Copenhagen: near surface velocity field and concentration at z = 3.5 m.

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

June 29 – July 3, 2009 • Yokohama, Japan

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):

- *Building climates and climatic performance of built features*
- *Urban bioclimates relevant to the functioning of plants, wildlife and humans*
- *Climates of paved surfaces such as roads, streets, highways, runways and parking lots*
- *Climatic performance of urban trees, lawns, gardens, parks, irrigation, rivers, lakes and reservoirs*
- *Topoclimatology of cities including the effects of coasts, valleys and other landforms*
- *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*

Venue: Pacifico Yokohama-Pacific Convention Plaza
(www.pacifico.co.jp/english/index.html)

- *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*
- *Interactions between urban climate and the emission, dispersion, transport, transformation and removal of air pollutants*
- *Models of the urban atmosphere at all scales*
- *Climate-sensitive urban design and planning*
- *Forecasting urban weather, comfort, hazards, air quality*
- *Cities and global change*

Schedule:

* Pre-registration: October, 2008
* Abstract submission: October, 2008
* Notification of Acceptance: December, 2008
* Submission of extended abstract: March, 2009

Details for pre-registaration and abstract submission will be provided in the 2nd announcement.

The International Scientific Committee will be composed of the board members of the IAUC (http://www.urban-climate.org/).

Contact Information:

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Web site: http://www.ide.titech.ac.jp/~icuc7/
(site will be updated regularly)

Upcoming Conferences…

CLIMATE CHANGE AND URBAN DESIGN
The Third International C.E.U. Congress
Oslo, Norway • 14-16 September 2008
http://www.ceunet.org

PASSIVE & LOW-ENERGY ARCHITECTURE
25th PLEA International Conference
Dublin, Ireland • 22-24 October 2008
http://www.plea2008.org

AMS 89th Annual Meeting

11–15 January 2009 • Phoenix, Arizona, USA

Phoenix Civic Plaza Convention Center

The theme for the 2009 AMS Annual Meeting is "Urban Weather and Climate: Now and the Future." The relevance and timeliness of the urban theme cannot be overemphasized. Recent events – Hurricane Katrina; urban floods in Europe and China; heat waves in London, Paris and Chicago; homeland security concerns and industrial chemical accidents; to name a few – point out the vulnerability of urban populations to high-impact weather of all types. In the U.S. today, approximately two-thirds of the population live in cities that occupy less than two percent of the U.S. land mass. This past year, the global population may have reached a tipping point with the world's urban population equaling its rural population; by 2030, the urban population fraction is predicted to surpass 60% globally and exceed 82% in the more developed countries. Most of the urban population growth results from migration from the rural areas as birth rates tend to decline in the urban areas. The nexus of urbanization and population growth, coupled with anthropogenic urban weather influences and global climate changes, portend an impending 'perfect storm' for the urban environment.

The 2009 Annual Meeting aims to highlight advances and challenges in urban-related science, applications, observations, modeling and operations. The specialty conferences, symposia and special sessions that comprise the annual meeting will focus attention on six cross-cutting urban themes: (a) measurement systems and networks; (b) modeling and forecasting; (c) observations and studies of high-impact weather; (d) geographic influences on urban weather and climate; (e) human and environmental impacts; and (f) implications of climate change and population growth. "High-impact" weather is considered in its broadest sense, and includes severe weather, high wind events, precipitation, floods, icing, lightning, poor visibility, adverse air quality, and temperature extremes.

The meeting will also feature workshops and short courses, numerous town hall meetings, the Sunday WeatherFest, a Monday Presidential Policy Forum on the role of weather and climate in urban affairs, and two special named symposia honoring Prof. Timothy Oke and the late Dr. Tony Hollingsworth. Calls for Papers follow for the various specialty conferences, symposia and special sessions. For additional information on the organization of the 89th AMS Annual Meeting, please contact meeting co-chairpersons Sue Grimmond, King's College London (Sue.Grimmond@kcl.ac.uk) or Rita Roberts, National Center for Atmospheric Research (rroberts@ucar.edu). Also see the conference web site at: http://www.ametsoc.org/meet/annual/index.html

31st International Geographical Congress

12-15 August 2008 • Tunis

(http://www.igc-tunis2008.com/)

Call for papers for a special session theme on "Urbanisation and Climate Change"

The "Urbanisation and Climate Change" theme will be held as part of the special session on "Climate change from the geological eras to the 21st century: characteristics, impacts and governance" within TSS.2. 2008 on the United Nations International Year of Planet Earth. The theme aims to bring together findings from original research in areas of physical and human geography and inter-disciplinary research activities to help further understanding of urban climate and the relationships between climate, the urban environment and urban society. Papers within this theme are welcome on aspects of the physical environments of cities and related human-environment interactions, particularly those covering:

(i) physical climate and climate-related processes operating in urban environments, including projections of future urban climates;

(ii) human-environment interactions associated with expressions of climate-related risk and vulnerability in the urban environment; and

(iii) applications of climatic knowledge in urban design and other climate adaptation options, including the cultural, social and political dimensions of adapting to climate change.

This session is sponsored by the IGU Commission on Climatology, CCRG (Climate Change Research Group of the Royal Geographical Society with the Institute of British Geographers) and IAUC (International Association for Urban Climate). Deadline for abstract submission is 31 May 2008. Interested parties should clearly state that they would like their submission considered under the "Urbanisation and Climate Change" theme within the climate IYPE special session.

Recent publications in Urban Climatology

Ashley, R., Blanksby, J., Cashman, A., Jack, L., Wright, G., Packman, J., Fewtrell, L., Poole, T. & Maksimovic, C. (2007), Adaptable Urban Drainage: Addressing Change in Intensity, Occurrence and Uncertainty of Stormwater (AUDACIOUS), *Built Environment* **33(1)**, 70-84.

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I have taken over the coordination of the Bibliography Committee and the Bibliographic section in the Newsletter from Jennifer Salmond. Thanks to the work done by Jennifer and the Committee members during the last four years, we have inherited a complete Urban Climate Bibliography Section where more than 40 journals have systematically been covered to obtain a compilation of recent papers dealing with the field of urban climatology. As announced in the last Newsletter the members of the Committee are Lilly-Rose Amirtham (India), Evyatar Erell (Israel), Rohinton Emmanuel (Sri Lanka), Corinne Frey (Switzerland), Gregoire Pigeon (France), Abel Tablada (Belgium/Cuba), Janos Unger (Hungary), and a new recent member, Martina Petralli from Italy.

Soon we will be putting together the complete 'Urban Climate' bibliography for the period 2005-2007 for publication on the IAUC website. All readers are invited to send any peer-reviewed references to be included in this database. Papers published since January 1 2008 are welcome for inclusion in the next newsletter. Please send your references to julia.hidalgo@uvigo.es with a header "IAUC publications" and the following format:

Author:
Title:
Journal:
Volume:
Pages:
Dates:
Keywords:
Language:
Abstract:

In this edition a list of relevant publications that have come out in 2007 and so far in 2008, and have not already appeared in earlier issues of the newsletter are presented.

Happy reading,

Julia Hidalgo
julia.hidalgo@uvigo.es

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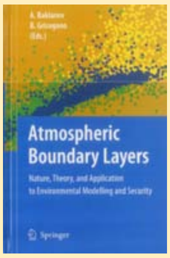
Recently Published…

Atmospheric Boundary Layers:
Nature, Theory and Applications to Environmental Modelling & Security

Alexander Baklanov and Branko Grisogono, Editors

http://www.springer.com/geosciences/meteorology/book/978-0-387-74318-9



This book presents a set of peer-reviewed papers following the NATO Advanced Research Workshop (ARW) "Atmospheric Boundary Layers: Modelling and Applications to Environmental Security". It was held in Dubrovnik, Croatia on April 18-22, 2006 and 57 researchers from 21 countries and 4 continents participated (see the ARW website: http://pbl-nato-arw.dmi.dk). The principal goals of the ARW were:

- to summarise and assess current knowledge on planetary boundary layer (PBL) physics and parameterization,
- to promote the exchange of ideas and knowledge between physicists, meteorologists, and environmental modellers,
- to set a course for improving PBL parameterisations in climate, numerical weather prediction, air-quality, and emergency preparedness models.

A pleasant reason to arrange this event in April 2006 was the 70th birthday of Professor Sergej Zilitinkevich (born on 13 April 1936 in St. Petersburg, Russia). A most appropriate tribute to him is the fact that a major part of the presentations at this ARW were based on or linked with his fundamental works.

Along with presentations and three general discussions, there were seven specialized discussions in the form of working groups, including 'Air flows within and above urban and vegetation canopies' (chaired by R. Bornstein) - which emphasised the key role of *urban* PBLs in air quality problems.

Call for Nominations 2008

We will shortly be announcing via urbclim a call for nominations for a new member of the Board of the International Association for Urban Climate. This is to replace Willhelm Kuttler whose term on the board will be ending shortly. Accordingly, the Board is seeking nominations for a new candidate. The procedures for Board elections are available at the IAUC website (www.urban-climate.org) - follow "Procedures and Administration" on the main navigation menu and then the link to "IAUC Board Procedures and Terms". To see the present composition of the IAUC board, follow the "Board Members" link from the same website. The nomination process will be conducted as described below.

(1) If you are nominating another person, proceed as follows:
a. E-mail the IAUC Secretary indicating your nominee.
b. Also name **TWO** other persons who support the nomination. They must also email the Secretary indicating their support of the nominee within the nomination period.
c. The nominee should also email the Secretary indicating her/his willingness to stand. The nominee should also provide his/her affiliation and country. Optionally, the nominee may supply a short statement that will be shared with the membership at the election (if there is one). That statement must not exceed 250 words, a limit that will be rigorously applied (longer statements will be truncated after the 250th word).
(2) If you are nominating yourself, proceed as follows:
a. E-mail the IAUC Secretary indicating that you are nominating yourself.
b. Also name **THREE** other persons who support your nomination. They must also email the Secretary indicating their support for your nomination within the nomination period.
c. You should also provide your affiliation and country. Optionally, you may supply a short statement that will be shared with the membership at the election. That statement must not exceed 250 words, a limit that will be rigorously applied (longer statements will be truncated after the 250th word).
Also please note the following:
(i) All nominees, nominators and persons supporting a nomination must be members of the IAUC as of this moment. New members will not be eligible to vote or be nominated in this round of elections.
(ii) All required information, as outlined in (1) or (2) above, must be received by the Secretary within one month, i.e. by **Wednesday, April 30th 2008, 11:59 pm** (UTC).
(iii) E-mails should be sent to the Secretary at e-mail address j.salmond@auckland.ac.nz. **DO NOT** use the 'reply' function of your mailer to contact the Secretary. Receipt of nomination e-mails will be confirmed. No other method of communication will be accepted.
(iv) It is the responsibility of the nominator and/or nominee to ensure that all necessary e-mails are sent to the Secretary within the nomination period. No reminders will be sent in the case of incomplete nominations.
(v) The statement supplied by the nominee should contain a reference to their link to IAUC and urban climate.
(vi) If more than one nomination is received, an election will be conducted via e-mail or the web, with the candidate receiving the highest vote count being deemed to have been elected. If an election is necessary, the exact procedure will be described in an e-mail to the current membership.

Please note that the Board is seeking members eager to play an active role in the development of the society, and who reflect the diversity of the membership in terms of their perspectives and fields of study.

Jennifer Salmond, IAUC Secretary

Board Members & Terms

- Toshiaki Ichinose (National Institute for Environmental Studies, Japan): 2007-2011
- Benedicte Dousset (Hawai`i Institute of Geophysics and Planetology, USA): 2006-2010
- Rohinton Emmanuel (University of Moratuwa, Sri Lanka): 2006-2010
- Kevin Gallo (National Oceanic and Atmospheric Administration (NOAA), USA): 2006-2010
- Dr. Petra Klein (University of Oklahoma, USA): 2007-2011
- Sue Grimmond (King's College London, UK): 2000-2003; President, 2003-2007; Past President, 2007-2009*
- Manabu Kanda (Tokyo Institute of Technology, Japan): 2005-2009, ICUC-7 Local Organizer, 2007-2009.
- Wilhem Kuttler (University of Essen, Germany): 2004-2008
- Sven Lindqvist (Göteborg University, Sweden): ICUC-6 Local Organizer, 2004-2006*
- Gerald Mills (UCD, Dublin, Ireland): 2007-2011
- Tim Oke (University of British Columbia, Canada): President, 2000-2003; Past President, 2003-2006; Emeritus President 2007-2009*
- Matthias Roth (National University of Singapore, Singapore): 2000-2003; Secretary, 2003-2007; Acting-Treasurer 2006; President 2007-2009
- Jennifer Salmond (University of Birmingham, UK): 2005-2009; Secretary, 2007-2009
- James Voogt (University of Western Ontario, Canada), 2000-2006; Webmaster 2007-*

* appointed members

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Newsletter Contributions

The next edition will appear in early July. Items to be considered for the next edition should be received by **May 30, 2008**. The following individuals compile submissions in various categories. Contributions should be sent to the relevant editor:

News: David Pearlmutter (davidp@bgu.ac.il)
Conferences: Jamie Voogt (javoogt@uwo.ca)
Bibliography: Julia Hidalgo (julia.hidalgo@uvigo.es)
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.