Urban Climate News

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Inside the Winter issue...

From the IAUC President

Welcome to the 54th Edition of the *Urban Climate News*, our last issue for 2014.

IAUC members may be interested to read the recently posted "Strategic Research Agenda" from Future Earth, an alliance of International Science and Social Science Councils, several UN organizations (UNESCO, UNEP and UNU), the Belmont Forum of funding agencies and WMO as an observer.

One of the 8 key focal challenges identified by the report is to *"Build healthy, resilient and productive cities by identifying and shaping innovations that combine better urban environments and lives with declining resource footprints, and provide efficient services and infrastructures that are robust to disasters."*

The report identifies 62 research priorities that are categorized into three broad research themes: Dynamic Planet, Global Sustainable Development, and Transformations towards Sustainability. A graphical key is used to identify which of the 8 key focal challenges are associated with each of the research priorities, making it easy to see where cities fit within the priorities. By their organization, 22 of the research priorities are related to cities. Those listed under the Dynamic Planet theme are most easily related to the type of research that IAUC members undertake. Arguably at least a couple more from the list of priorities could be considered in an urban framework. For example, if we identify cities as comprising a distinct urban ecosystem then the challenge of identifying climate change effects on ecosystems might also be linked to cities.

The report is intended as guide for national funding councils that will support strategic and integrated Earth system research. It is expected that these funding councils will issue calls for research proposals. Some calls have already been issued by the Belmont Forum and there are urban environment related projects such as Urbanization and Global Environmental Change which have already occurred under Future Earth.

The Future Earth vision for research includes a desire for integration among scientific disciplines, international collaboration, engaging societal partners in the design and production of knowledge and producing results that can be used by decision makers. This vision aligns well with the nature of IAUC as an integrative, international organization that can facilitate collaborations among members. I would encourage members to be on the look-out for upcoming funding calls that may align with research expertise and to use both IAUC and the upcoming ICUC as a forum for organizing responses to these calls that can incorporate the interdisciplinary, multinational participation that is required.

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– James Voogt,
IAUC President

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Why Climate Change Affects Poor Neighborhoods The Most

October 2014 — Scientists frequently tout new evidence that climate change will drive some of the most populated cities in the United States underwater. New York, Boston and Miami are all at risk. But the impact of climate change varies even within cities, putting residents of poor neighborhoods at greatest risk of suffering from heat-related ailments, researchers say.

"Cities tend to be warmer, but it's spatially variable within cities," says Joyce Klein Rosenthal, a researcher at Harvard who published a recent study on the impact of climate change in cities (see Feature, page 7).

"Generally, higher poverty neighborhoods are warmer and wealthier neighborhoods are cooler."

This difference in neighborhood temperatures affects senior citizens and correlates with a disparity in their mortality rates due to heat-related causes, a study of New York City led by Rosenthal suggests. This higher rate in poor neighborhoods isn't just because lower-income families aren't always able to afford owning and operating an air conditioner, though that certainly contributes to the problem. Poor neighborhoods often have few trees and have buildings that tend to be constructed from materials that retain heat, Rosenthal said.

Cities tend to be warmer, but it's spatially variable: generally, higher poverty neighborhoods are warmer and wealthier neighborhoods are cooler. ***Source:*** **TIME.com**

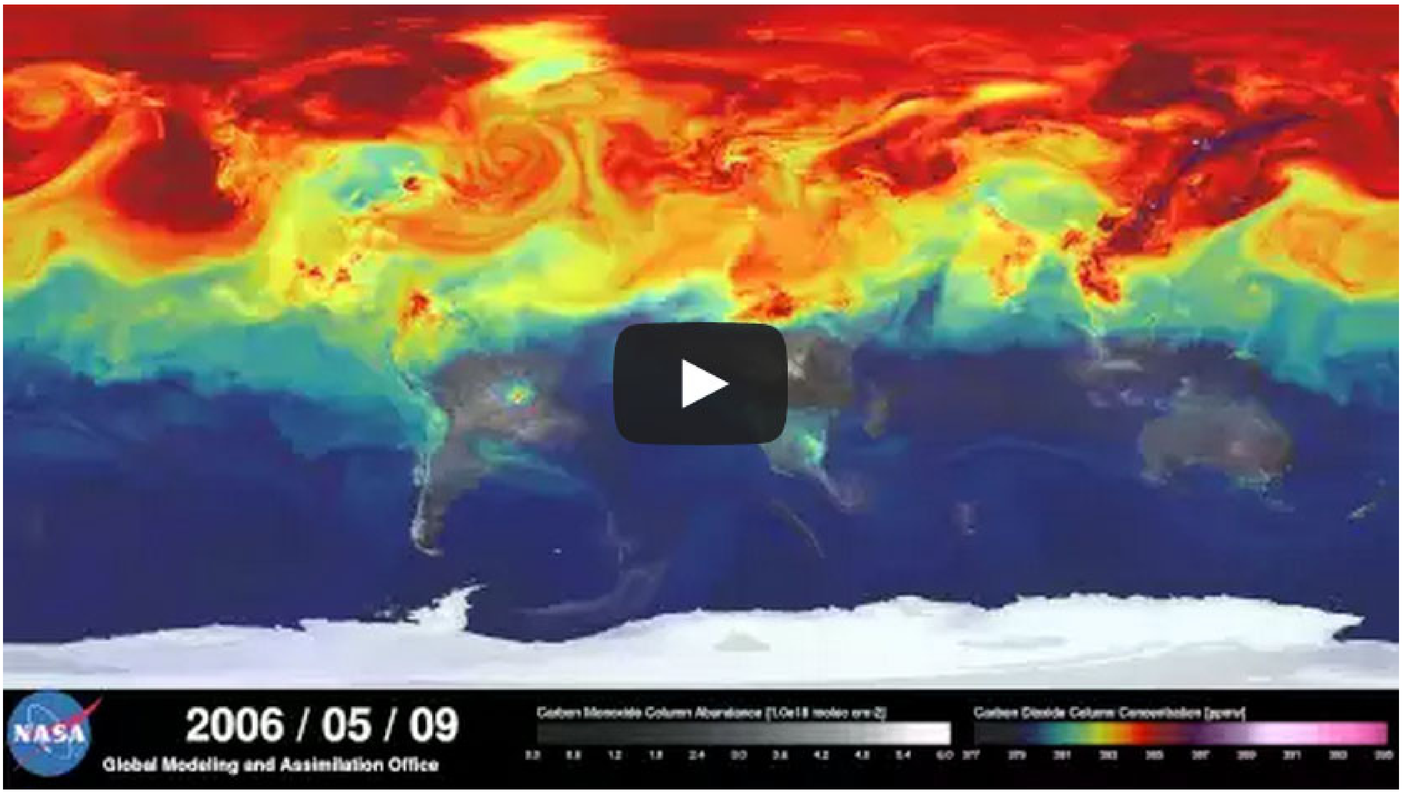
Poor neighborhoods often have few trees and have buildings that tend to be constructed from materials that retain heat. *Photo: D. Pearlmutter*

Climate change also affects these areas more because of the professions of some of the residents, according to Olga Wilhelmi, a researcher at the University Corporation for Atmospheric Research. Laborers who work outside all day in extreme temperatures and return home to a hot apartment are more likely to experience heat stroke or another heat-related ailment.

"It's not just your housing conditions but whether or not you have a choice to modify your daily behaviors and routine to better cope with extreme temperatures," says Wilhelmi.

As scientists grapple with long-term solutions to climate change, policymakers need to consider a entirely new set of solutions to address the health risks posed by extreme heat in cities. Ironically, many of the methods used to address climate change broadly are ineffective, if not problematic, for handling heat stroke at the neighborhood level. For one, while public awareness campaigns encourage people to use less electricity, residents of poor neighborhoods should probably turn up the air conditioning while their counterparts in wealthier, cooler neighborhoods may not.

Wilhelmi says that some cities including Chicago have begun to implement measures like heat warning systems to warn vulnerable populations about extreme heat conditions. Still, changing factors like building codes and urban design isn't always easy, making fundamental improvements potentially generations away. *Source*: http://time.com/3457668/climate-change-poor-neighborhoods/



NASA Computer Model Provides a New Portrait of Carbon Dioxide

November 2014 — An ultra-high-resolution NASA computer model has given scientists a stunning new look at how carbon dioxide in the atmosphere travels around the globe.

Plumes of carbon dioxide in the simulation swirl and shift as winds disperse the greenhouse gas away from its sources. The simulation also illustrates differences in carbon dioxide levels in the northern and southern hemispheres and distinct swings in global carbon dioxide concentrations as the growth cycle of plants and trees changes with the seasons.

Scientists have made ground-based measurements of carbon dioxide for decades and in July NASA launched the Orbiting Carbon Observatory-2 (OCO-2) satellite to make global, space-based carbon observations. But the simulation – the product of a new computer model that is among the highest-resolution ever created – is the first to show in such fine detail how carbon dioxide actually moves through the atmosphere.

“While the presence of carbon dioxide has dramatic global consequences, it’s fascinating to see how local emission sources and weather systems produce gradients of its concentration on a very regional scale,” said Bill Putman, lead scientist on the project from NASA’s Goddard Space Flight Center in Greenbelt, Maryland. “Simulations like this, combined with data from observations, will help improve our understanding of both human emissions of carbon dioxide and natural fluxes across the globe.”

The carbon dioxide visualization was produced by a computer model called GEOS-5, created by scientists at NASA Goddard’s Global Modeling and Assimilation Office. In particular, the visualization is part of a simulation called a “Nature Run.” The Nature Run ingests real data on atmospheric conditions and the emission of greenhouse gases and both natural and man-made particulates. The model is then is left to run on its own and simulate the natural behavior of the Earth’s atmosphere. This Nature Run simulates May 2005 to June 2007.

While Goddard scientists have been tweaking a “beta” version of the Nature Run internally for several years, they are now releasing this updated, improved version to the scientific community for the first time. Scientists are presenting a first look at the Nature Run and the carbon dioxide visualization at the SC14 supercomputing conference this week in New Orleans.

“We’re very excited to share this revolutionary dataset with the modeling and data assimilation community,” Putman said, “and we hope the comprehensiveness of this product and its ground-breaking resolution will provide a platform for research and discovery throughout the Earth science community.”

In the spring of 2014, for the first time in modern history, atmospheric carbon dioxide – the key driver of global warming – exceeded 400 parts per million across most of the northern hemisphere. Prior to the Industrial Revolution, carbon dioxide concentrations were about 270 parts per million. Concentrations of the greenhouse gas in the atmosphere continue to increase, driven primarily by the burning of fossil fuels.

Despite carbon dioxide's significance, much remains unknown about the pathways it takes from emission source to the atmosphere or carbon reservoirs such as oceans and forests. Combined with satellite observations such as those from NASA's recently launched OCO-2, computer models will help scientists better understand the processes that drive carbon dioxide concentrations.

The Nature Run also simulates winds, clouds, water vapor and airborne particles such as dust, black carbon, sea salt and emissions from industry and volcanoes.

The resolution of the model is approximately 64 times greater than that of typical global climate models. Most other models used for long-term, high-resolution climate simulations resolve climate variables such as temperatures, pressures, and winds on a horizontal grid consisting of boxes about 50 kilometers (31 miles) wide. The Nature Run resolves these features on a horizontal grid consisting of boxes only 7 kilometers (4.3 miles) wide.

The Nature Run simulation was run on the NASA Center for Climate Simulation's Discover supercomputer cluster at Goddard Space Flight Center. The simulation produced nearly four petabytes (million billion bytes) of data and required 75 days of dedicated computation to complete.

In addition to providing a striking visual description of the movements of an invisible gas like carbon dioxide, as it is blown by the winds, this kind of high-resolution simulation will help scientists better project future climate. Engineers can also use this model to test new satellite instrument concepts to gauge their usefulness. The model allows engineers to build and operate a "virtual" instrument inside a computer.

Using GEOS-5 in tests known as Observing System Simulation Experiments (OSSE) allows scientists to see how new satellite instruments might aid weather and climate forecasts.

"While researchers working on OSSEs have had to rely on regional models to provide such high-resolution Nature Run simulations in the past, this global simulation now provides a new source of experimentation in a comprehensive global context," Putman said. "This will provide critical value for the design of Earth-orbiting satellite instruments." *Source:* http://www.nasa.gov/press/goddard/2014/november/nasa-computer-model-provides-a-new-portrait-of-carbon-dioxide

The heat is on: Causes of hospitalization due to heat waves identified

December 2014 — In the largest and most comprehensive study of heat-related illness to date, Harvard School of Public Health (HSPH) researchers have identified a handful of potentially serious disorders – including fluid and electrolyte disorders, renal failure, urinary tract infections, sepsis, and heat stroke – that put older Americans at significantly increased risk of winding up in the hospital during periods of extreme heat.

The study also showed that risks were larger when the heat wave periods were longer and more extreme and were largest on the heat wave day, but remained elevated for up to five subsequent days.

"An innovative aspect of this work is that, rather than preselect a few individual diseases to examine, we considered all possible causes of hospital admission during heat waves in order to characterize the effects of heat on multiple organ systems," said Francesca Dominici, professor of biostatistics at HSPH and senior author of the study. The study appears online December 23, 2014 in the *Journal of the American Medical Association* (JAMA).

Although it's well-known that heat waves pose a health risk to older people, previous studies had investigated only a small number of potential heat-related health outcomes, such as cardiovascular and respiratory diseases.

For this study, the researchers analyzed 127 billion daily hospitalization rates from 214 diseases in a population of 23.7 million Medicare beneficiaries between 1999 and 2010, in 1,943 counties across the U.S., and paired that information with data from more than 4,000 temperature monitors around the country.

Heat stroke posed the greatest risk; older Americans were two-and-a-half times more likely to be hospitalized from heat stroke during heat waves than on non-heat-wave days. Extreme heat also put the elderly at 18% greater risk of being hospitalized for fluid and electrolyte disorders; 14% greater risk for renal failure; 10% greater risk for urinary tract infections; and 6% greater risk for sepsis (severe blood infection).

The findings are significant because extreme heat is the most common cause of weather-related mortality in the U.S., and because, as climate change progresses, the health impacts are expected to be profound. For example, the National Resources Defense Council recently reported that, under climate change, extreme heat events could lead to more than 150,000 deaths in the 40 largest U.S. cities by the end of the century.

"Knowledge of which diseases are most likely to occur during heat waves could help health systems to be better prepared to prevent and treat excess heat-related hospitalizations now and as climate change progresses," said Jennifer Bobb, research associate in the Department of Biostatistics at HSPH and lead author of the study. *Source:* http://www.sciencedaily.com/releases/2014/12/141223191712.htm

Holiday Lights From Space: Satellite Sees Cities Brighten

December 2014 — Cities around the world brighten considerably during the holiday season, surprising new images from space reveal.

City lights across the United States blaze 20 to 50 percent more brightly in December than they do the rest of the year, and some cities in the Middle East brighten by more than 50 percent during the Muslim holy month of Ramadan, researchers said.

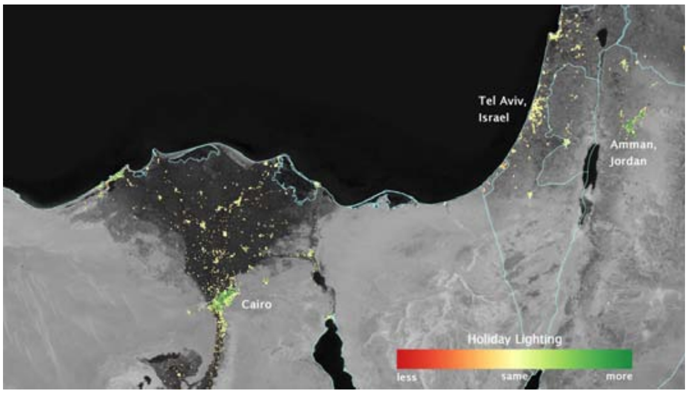
"What's happening during the holidays is that our patterns are changing," study co-leader Miguel Roman, of NASA's Goddard Space Flight Center in Greenbelt, Maryland, said during a press conference Dec. 16 in San Francisco at the annual fall meeting of the American Geophysical Union.

"People are leaving work for the holiday, and they're turning on the lights," he said, adding that scientists had previously thought that nighttime lights were relatively stable throughout the year. "People are demanding more energy services, and we see that embedded in this data."

Roman and his colleagues analyzed data collected in 2012 and 2013 by the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument aboard the Suomi NPP (National Polar-orbiting Partnership) satellite, a joint mission involving NASA and the U.S. National Oceanic and Atmospheric Administration.

The researchers developed a new algorithm that filtered out clouds and moonlight in the VIIRS data, allowing them to isolate city lights and track how they changed over time. Snow was too reflective for the algorithm to handle, however, so the team looked at 70 warm American cities, all south of St. Louis.

Every one of the 70 (as well as cities and towns throughout Puerto Rico, an unincorporated territory of the United States) lit up just after Thanksgiving and blazed brightly through Jan. 1, Roman said.



City lights brighten in several cities in North Africa and the MIddle East during the Muslim holy month of Ramadan, as shown by an analysis using data from the NASA-NOAA Suomi NPP satellite. Dark green pixels are areas where the lights are at least 50 percent brighter during Ramadan. *Source:* Space.com

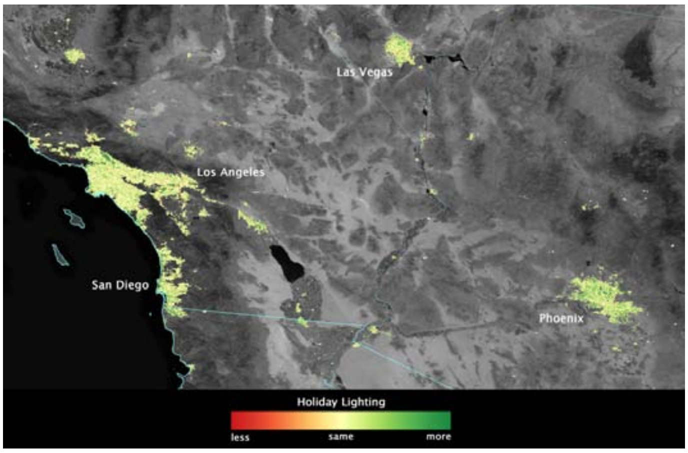


Image showing how Los Angeles, Las Vegas, San Diego and Phoenix shine more brightly during December. Scientists used data from the NASA-NOAA Suomi NPP satellite to create this view. *Source:* Space.com

"This is telling us something that we all as Americans know, which is that Christmas is not just a religious holiday; it is also a civic holiday," he said. "This space-based retrieval is tracking this national tradition. It's amazing."

The same pattern was also observed throughout the Middle East – but the holiday of note in this region is Ramadan, the ninth month in the Islamic calendar. Many Muslims fast during the daylight hours throughout Ramadan, delaying meals and a number of other activities until nightfall.

Cities in Muslim countries such as Jordan and Egypt exhibited the brightness spike during Ramadan while the lights in neighboring Israel remained stable throughout the year, showing that the VIIRS data can track cultural differences, researchers said.

The effects of geopolitical conflicts can also be observed. For example, the satellite data revealed a 94 percent drop in the nighttime brightness of the Syrian city of Aleppo just after a major battle began there on July 19, 2012, during the country's ongoing civil war.

"These nighttime lights really are in some ways the EKG of a city," said study co-leader Eleanor Stokes, a Ph.D. candidate at Yale University. The new results – and the approach developed by the research team – could help scientists better understand energy demand, which in turn may lead to better climate change mitigation strategies down the road, Stokes added.

"What we found here is that energy service demand is the aggregate of human activity, and human activity is driven not just by individual factors like price – like energy and electricity prices – but also, activity is driven by social and cultural context," she said. "When you look at the energy signatures, you can see those imprints, those cultural and social imprints." *Source:* http://www.space.com/28036-holiday-lights-from-space-satellite-photos.html

A hazy road to Mecca

UC Irvine and other researchers are testing air pollution in the Middle East, including in Mecca during the annual hajj, at burning landfills and elsewhere. Dangerously high levels of smog forming contaminants are being released, the scientists have found. ***Source:*** **http://www.sciencedaily.com**

December 2014 — Dangerously high levels of air pollutants are being released in Mecca during the hajj, the annual holy pilgrimage in which millions of Muslims on foot and in vehicles converge on the Saudi Arabian city, according to findings reported at a recent American Geophysical Union meeting in San Francisco.

"Hajj is like nothing else on the planet. You have 3 to 4 million people – a whole good-sized city – coming into an already existing city," said Isobel Simpson, a UC Irvine research chemist in the Nobel Prize-winning Rowland-Blake atmospheric chemistry laboratory. "The problem is that this intensifies the pollution that already exists. We measured among the highest concentrations our group has ever measured in urban areas – and we've studied 75 cities around the world in the past two decades."

Scientists from UCI, King Abdulaziz University in Saudi Arabia, the University of Karachi in Pakistan, the New York State Department of Health's Wadsworth Center, and the University at Albany in New York captured and analyzed air samples during the 2012 and 2013 hajjes on roadsides; near massive, air-conditioned tents; and in narrow tunnels that funnel people to the Grand Mosque, the world's largest, in the heart of Mecca.

The worst spot was inside the Al-Masjid Al-Haram tunnel, where pilgrims on foot, hotel workers and security personnel are exposed to fumes from idling vehicles, often for hours. The highest carbon monoxide level – 57,000 parts per billion – was recorded in this tunnel during October 2012. That's more than 300 times regional background levels.

Heart attacks are a major concern linked to such exposure: The risk of heart failure hospitalization or death rises sharply as the amount of carbon monoxide in the air escalates, the researchers note in a paper published in the journal *Environmental Science & Technology*. Headaches, dizziness and nausea have also been associated with inhaling carbon monoxide.

"There's carbon monoxide that increases the risk of heart failure. There's benzene that causes narcosis and leukemia,"Simpson said. "But the other way to look at it is that people are not just breathing in benzene or CO, they're breathing in hundreds of components of smog and soot." The scientists detected a stew of unhealthy chemicals, many connected to serious illnesses by the World Health Organization and others.

"Air pollution is the cause of one in eight deaths and has now become the single biggest environmental health risk globally," said Haider Khwaja of the University at Albany. "There were 4.3 million deaths in 2012 due to indoor air pollution and 3.7 million deaths because of outdoor air pollution, according to WHO. And more than 90 percent of those deaths and lost life years occur in developing countries."

Khwaja experienced sooty air pollution firsthand as a child in Karachi, Pakistan, and saw his elderly father return from the hajj with a wracking cough that took weeks to clear. He and fellow researchers braved the tunnels and roads to take air samples and install continuous monitors in Mecca.

"Suffocating," he said of the air quality.

In addition to the high smog-forming measurements, the team in follow-up work found alarming levels of black carbon and fine particulates that sink deep into lungs. Once the hajj was over, concentrations of all contaminants fell but were still comparable to those in other large cities with poor air quality. Just as unhealthy «bad air» days once plagued Greater Los Angeles, research is now showing degraded air in the oil-rich, sunny Arabian Peninsula and elsewhere in the Middle East. Because the number of pilgrims and permanent residents is increasing, the scientists recommend reducing emissions by targeting fossil fuel sources.

Besides vehicle exhaust, other likely culprits include gasoline high in benzene, a lack of vapor locks around gas station fuel nozzles, and older cars with disintegrating brake liners and other parts. Coolants used for air-conditioned tents sleeping up to 40 people also contribute to greenhouse gas buildup. And the dearth of regulations exacerbates these problems.

The researchers said that Saudi officials are aware of the issues and taking steps to address them, such as working to reduce benzene in area gasoline supplies. Directing Mecca pedestrians and vehicles to separate tunnels would be optimal. In addition, clearing the region's air with time-tested technologies used elsewhere in the world could sharply reduce pollution and save lives.

"This is a major public health problem, and the positive news is that some of the answers are very much within reach, like putting rubber seals on nozzles at gas stations to reduce leaks," Simpson said. "It's a simple, doable solution." *Source:* http://www.sciencedaily.com/releases/2014/12/141215123049.htm

Intra-urban vulnerability to heat-related mortality in New York City

By Joyce Klein Rosenthal (jkrosenthal@gsd.harvard.edu)

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Increased rates of mortality and morbidity due to summertime heat are a significant problem in New York City (NYC) and for many cities around the world, and are expected to increase with a warming climate. This article is a synopsis of our study, recently published in Health & Place (2014), that investigated whether vulnerability to heat-related mortality in NYC is influenced by a range of characteristics measured at relatively fine spatial scales within the city. The characteristics that we examined through spatial and statistical analysis included demographic, social, built environment, public health and biophysical characteristics, aggregated to the neighborhood level.

Most previous epidemiological studies examined risk factors for heat-related mortality at the municipal or regional scale and may have missed place-based variation of vulnerability within NYC's diverse neighborhoods and populations. Understanding the associations between places that have experienced increased rates of heat-mortality during heat events and their built environment characteristics, such as percent vegetative cover, might help to identify vulnerable populations and inform effective preventative interventions.

Methods and data

An ecologic design was used to evaluate the association between the neighborhood scale characteristics (socioeconomic/demographic, the built and biophysical environment, health status and risk behaviors) and senior citizen's mortality rates during heat events in New York City. As a measure of relative vulnerability to heat, we used neighborhood-based mortality rate ratios (MRR65+) among those aged 65 and over, comparing the rates of natural cause (non-external) mortality on extremely hot days (maximum heat index 100°F and above) to all warm season days (May-September), across 1997–2006 for NYC's 59 Community Districts (CDs) and 42 United Hospital Fund (UHF) neighborhoods.

The range of neighborhood-level characteristics that might influence the risk of heat-related mortality were categorized into three main groups: (1) demographic and area-level socioeconomic status and (2) health risk characteristics describing neighborhood-level prevalence of health conditions (e.g., diabetes, obesity, hypertension) and risk characteristics (e.g., living alone, being at risk for social isolation) and (3) characteristics describing the neighborhood's biophysical environment. Sources for data included the 2000 US Census, the New York City Department of Health and Mental Hygiene (NYCDOHMH), the New York City Department of City Planning (DCP), the New York City Department of Housing Preservation & Development (HPD), the New York City Department of Finance, the United States Forest Service (USFS), and the National Aeronautics and Space Administration (NASA).

We used NASA's Landsat 7 thermal infrared data to derive estimates of surface temperatures averaged to the neighborhood scale to examine the relationship between intra-urban microclimates and rates of heat-related mortality. The ecological scale of our study required converting the Landsat thermal data to estimated land surface temperatures, and then aggregating these data through averaging the finer-scale (60 m) raster data to the CD and UHF-level. High-resolution data (3-foot pixels) from the analysis of NYC's land cover by the USFS, also averaged

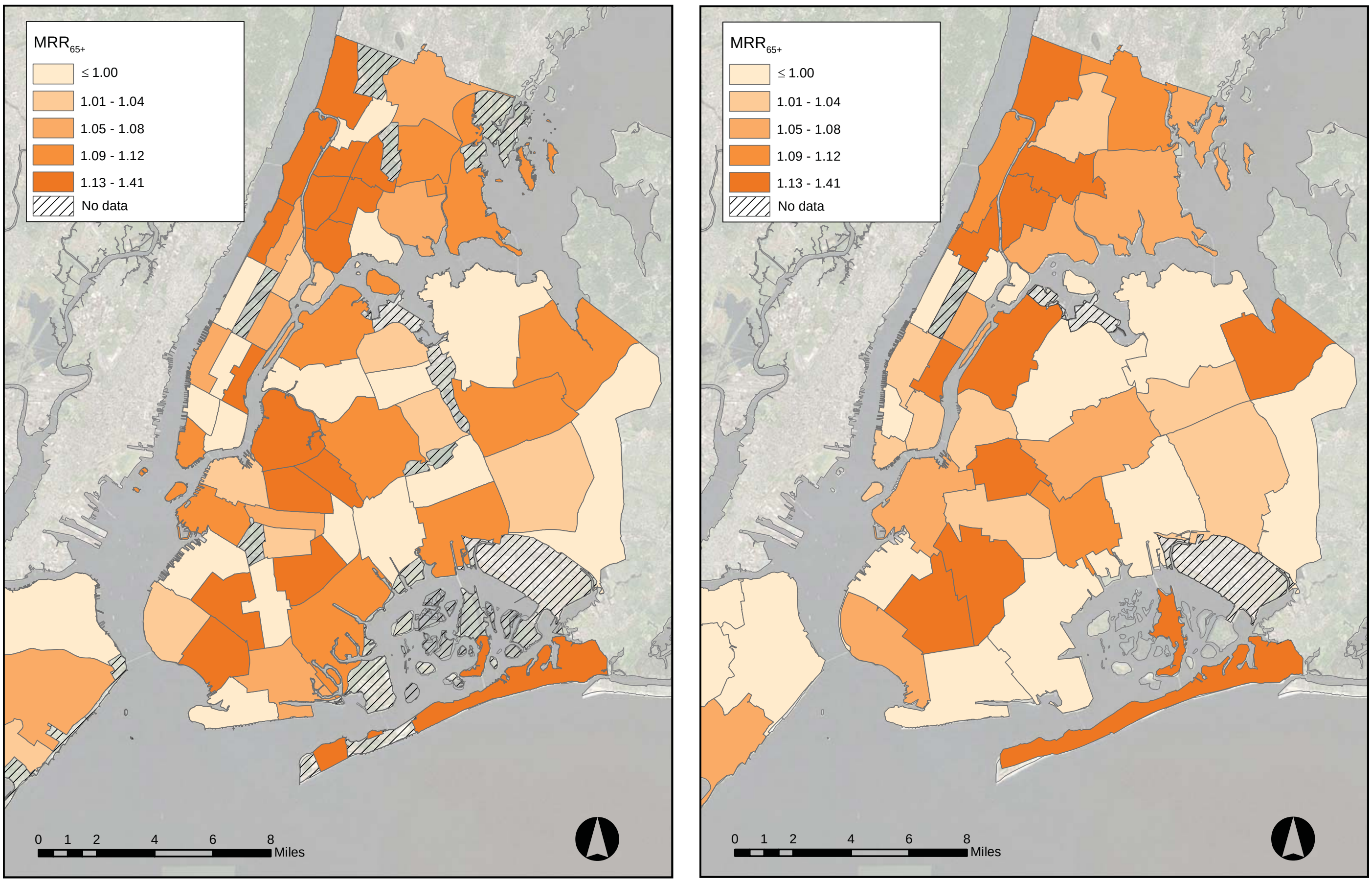

Figure 1. Mortality Rate Ratios for seniors age 65 and older (MRR$_{65+}$) by New York City Community District (CD, n=59), left; and United Hospital Fund (UHF) neighborhood (n=42), right. The MRR$_{65+}$ shows excess mortality during very hot days (maximum heat index ≥ 100 °F) compared to all May-September days, 1997–2006.

to the Community District and UHF-neighborhood scale, enabled us to test relationships between vegetative (tree and grass cover) and impervious surface cover with the mortality rate ratios.

First, bivariate relationships between the mortality rate ratios and each of the candidate variables were analyzed through OLS linear regression. Correlations between explanatory variables were also assessed using Pearson's correlation coefficient to identify groups of variables tending to capture the same phenomena. For example, the percent of population in poverty and measures of educational attainment (e.g., percent adults without a high school diploma) are so strongly correlated (r=0.89) at the neighborhood scale in NYC that it does not make sense to include both variables in multivariate modeling. The Pearson's r correlations between independent variables and the bivariate regression models (R-squared values) were used to select among the correlated metrics of similar factors for use in multivariate linear OLS regression.

To assess the interaction and effect modification of income and neighborhood poverty rates, fundamental characteristics used to describe population vulnerability to climate variability hazards, we also stratified bivariate analyses by rates of neighborhood poverty and income measures (Cutter et al., 2009; Fothergill and Peek, 2004). Community Districts (CDs) were stratified into two groups, above and below the average of the median household income for 59 CDs, and UHF-areas were stratified into two groups, above and below the average proportion of population poverty in UHF-areas, for use in OLS linear regression analysis with the mortality rate ratio as the dependent variable.

The results of this analysis are summarized in the Tables in the full paper in *Health & Place* (Klein Rosenthal et al. 2014).

Findings

Natural-cause mortality of seniors aged 65 and over increased significantly in New York City during extremely hot days (HI ≥ 100 °F) from 1997 to 2006 (p = 0.001). For 59 Community Districts (CDs), the mortality rate ratio (MRR_{65+}) had a mean weighted by senior population of 1.0479 (95% confidence interval, 1.021, 1.090). For 42 UHF areas, the MRR_{65+} had a mean weighted by senior population of 1.0464 (95% confidence interval, 1.016, 1.085). City-wide there were over 4% more deaths on days with a Heat Index equal to or above 100 °F compared to all other warm season days from 1997 to 2006.

Excess mortality rates during heat event days were unevenly distributed in New York City's Community Districts (CDs) and United Hospital Fund (UHF) areas during 1997-2006, with higher rates of excess deaths in parts of southwestern Bronx, northern Manhattan, central Brooklyn and the eastern side of midtown Manhattan (Figure 1).

Significant positive associations ($p < 0.05$) were found between heat-mortality rates and neighborhood-level measures of poor housing conditions, poverty, impervious land cover, seniors' hypertension and the surface temperatures aggregated to the UHF-area level during the warm season (see Klein Rosenthal et al. 2014, Tables 1, 2 and 4). The rates of owner-occupied housing units and the percent of homes near structures rated good or excellent had the strongest negative associations with the mortality rate ratios, followed by the prevalence of residential air conditioning access and percent Asian population. The negative association between UHF area-based home-ownership rates and the mortality rate ratio was the strongest identified in the study ($\beta = -0.413$; $p = 0.007$). Several measures of housing quality were significantly correlated with the mortality rate ratios (MRR_{65+}), including rates of serious housing violations, property tax delinquencies, and deteriorating and dilapidated buildings, suggesting that the quality of seniors' housing is a population-level risk factor for heat-associated mortality.

Percent Black/African American and percent poverty by UHF-area were strong negative predictors of senior's air conditioning access in multivariate regression. In multivariate models, heat-mortality rates were positively associated with impervious cover and neighborhood prevalence of hypertension. NYC surface temperatures (aggregated to the CD and UHF-neighborhoods) were strongly associated with impervious cover and poverty rates in multivariate spatial regression.

The lowest-income Community Districts and UHF-areas had a trend towards higher heat-associated mortality rates (Table 1 below). Low-income

Table 1. Average mortality rate ratios (MRR_{65+}) by poverty ranking for NYC Community Districts (CDs).

Group by poverty	Mean population	Age 65+ (mean)	Below 1999 poverty level (mean)	Median household income	MRR_{65+} (mean)	SD (mean MRR_{65+})
20 least impoverished CDs	140,133	13.13%	10.57%	$55,683	**1.026**	0.111
20 median CDs	142,445	11.97%	20.39%	$37,010	1.0319	0.092
19 most impoverished CDs	123,876	9.18%	36.89%	$22,645	**1.1104**	0.172
All CD average	135,681	11%	22.38%	$38,714	1.0552	0.134

areas also had a general trend towards hotter surface temperatures and a lower degree of air conditioning access for senior citizens. The hottest Districts and UHF-areas generally had higher mortality rate ratios (e.g., see Figure 2).

However, stratification by poverty rates and income levels showed this trend existed for the low-income/high poverty neighborhoods, but not for high-income/low poverty areas. In other words, the ecological risk created by certain placed-based conditions, such as hotter microclimates or air-conditioning access, was mediated by poverty for rates of heat-associated in New York City neighborhoods during our study period.

Discussion

Areas with higher rates of poor quality housing (e.g., increased violations or property tax delinquencies) had significant positive associations with higher mortality rates; neighborhoods with indicators of better quality housing (e.g., buildings rated good or excellent, rates of homeowners) had significant negative associations with higher mortality rates. These data suggest that housing quality is one of the salient characteristics through which poverty fosters risk of heat-related mortality. In this interpretation, the characteristics of housing and the built environment may amplify or buffer the risk of heat-related health impacts, whether through exposure to hotter environments, lack of access to cooling, or other risk pathways. For example, as suggested by Olga Wilhelmi, a researcher at the University Corporation for Atmospheric Research, adults with greater outdoor exposure to heat during the day may disproportionately live in poor quality housing, providing a combination of behaviors and conditions that amplifies exposure and risk (Worland, 2014).

The associations between socioeconomic status, race/ethnicity and demographics with the intra-urban variation of surface temperature reflect an emergent form of spatial inequality in regards to climate risks—the environmental exposures and adverse impacts of extreme weather events and climate change. Excess heat was conceptualized as an unevenly distributed urban pollutant that may be relatively higher in minority and low-income neighborhoods due to the design and maintenance of the built environment (including the distribution of vegetative cover) and housing conditions. This is consistent with earlier literature on heat-health impacts that found greater exposures and impacts for residents of low-income neighborhoods and communities of color in other cities (e.g., Harlan et al., 2006 and 2013).

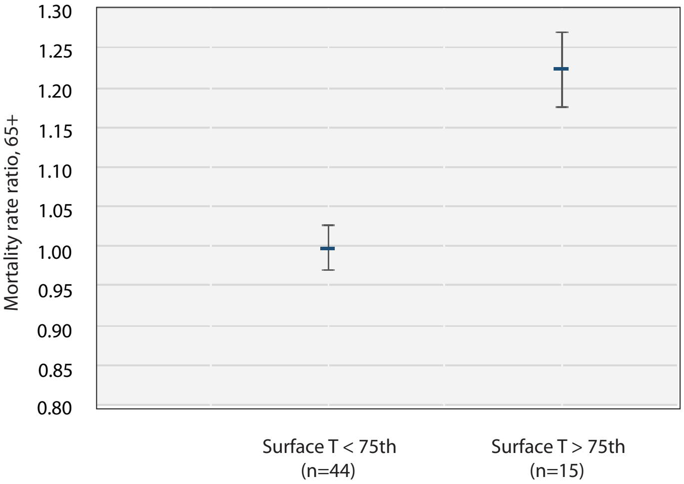

Figure 2. Mean Community District (CD, n=59) mortality rate ratios (MRR_{65+}), stratified by the 75th percentile daytime surface temperature (August 14, 2002), with 95% Confidence Intervals. Landsat-derived surface temperatures were averaged to the CD-level. The mean MRR_{65+} for the hottest quartile of CDs (Surface Temperature >75th)=1.223; the mean MRR_{65+} for the relatively cooler 44 CDs (Surface Temperature <75th)=0.998.

These findings are limited by an ecologic design, coarse spatial scale, the lack of near surface ambient air temperature measurements of the urban heat island, the dichotomous heat index measure used to estimate excess mortality, and the need for greater control for correlated neighborhood characteristics. The multivariate models that achieved statistical significance for heat-mortality rates were limited due to the multicollinearity of independent variables. Despite limitations, these findings affirm the importance of neighborhood characteristics and social determinants in targeting heat emergency response activities. Future research may use additional modeling methods to evaluate community characteristics using a lag time with same day and previous 1-and 2- day temperature as a predictor, and examine excess mortality using different heat exposure periods (e.g., during heat waves rather than HI ≥ 100°F) and more complex spatially-stratified time series models.

Given the importance of access to cooling during periods of extreme heat, further research on the spatial distribution and use of cool spaces within neighborhoods – including parks, air conditioned stores, public buildings and pools – may help identify and characterize resources for seniors able to leave their homes. Although air conditioning prevalence is relatively high in New York City as a whole, we found disparities in the prevalence of air conditioning ownership and use in United Hospital Fund (UHF) areas among seniors aged 65 years and older, with nine UHF-areas in which over 25% of the senior citizens were not protected by air conditioning during the warm season in 2007 (Fig. 3). Our results suggest that research on the effects of residential building design on indoor temperatures and building thermal performance is important to inform adaptive planning, even while outreach and prevention measures such as home air conditioner distribution for low-income seniors will continue to be needed for an increasing elderly NYC population.

Policies to improve the housing conditions of older adults could play a role in reducing heat-related mortality in New York City, although these policies are not yet explicitly considered as part of climate adaptive planning. Climate adaptation and heat island mitigation programs that seek to identify neighborhood hot spots within cities and address economic disparities may help to reduce the health impacts of climate extremes and variability. Towards that end, a community-based adaptation planning process may help address the social justice dimension of the impacts of extreme events and climate change in New York City while increasing the effectiveness of adaptive programs and policies.

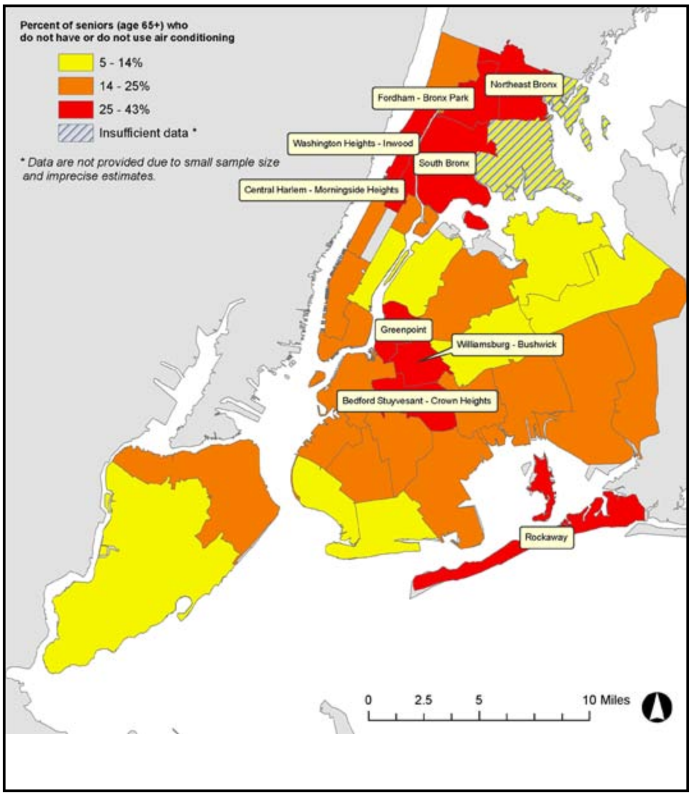

Figure 3. Air-conditioning ownership and use by United Hospital Fund neighborhoods, data from the 2007 NYCDOHMH Community Health Survey (n=42).

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Evaluation and public display of urban patterns of human thermal conditions (URBAN-PATH project)

Introduction

Intra-urban heterogeneity of the physical attributes of surfaces can provide different thermal modifying effects. The interactions between the urban parameters and thermal comfort are not yet known sufficiently. These interactions can only be analyzed properly using detailed and long-term measurements (over several years) and with the help of an urban climate monitoring network system installed representatively and in appropriate density (Unger et al. 2015). Up to now, there are a few examples of automatic monitoring networks set up in the urban canopy layer for the detection of patterns of human comfort conditions, but these are completely lacking in the region of Central Europe (Watkins et al. 2002, Mikami et al. 2003, Dabberdt et al. 2005, Chang et al. 2010, Basara et al. 2011, Davis et al. 2011, Houet and Pigeon 2011, Hung and Wo 2012, Petralli et al. 2013, Hi-Temp Project 2014, Castell et al. 2014).

During the years 2013 and 2014, urban monitoring and online information systems on the spatial distribution of temperature, humidity and human thermal comfort conditions were developed in the mid-sized cities of Szeged (Hungary) and Novi Sad (Serbia). Within the framework of the EU-funded "Hungary-Serbia Cross-border Co-operation Programme" (URBAN-PATH Project, 2014), climatologists from the University of Szeged and University of Novi Sad installed two urban climate monitoring networks (24 stations in Szeged and 27 stations in Novi Sad) in order to get long-term and effective measurement data. The networks aim to provide data on the differences in thermal characteristics between neighborhoods and cities (intra-urban and inter-urban comparisons). The temporal resolution allows for the exploration of both the diurnal and seasonal peculiarities. Knowledge based on the developed systems should contribute to the effectiveness of sustainable development and climate-conscious urban planning strategies, mitigation of the impacts of global climate change, and maintaining the health of the urban population (Savić et al. 2013, 2014, Unger et al. 2014).

Study area

Szeged is located in the south-eastern part of Hungary (46°N, 20°E) at 79 m a.s.l. on flat terrain. It has population of 160,000 and an urbanized area of about 40 km^2. Novi Sad is located in the northern part of the Republic of Serbia (45°N, 19°E) at 86 m a.s.l. with gentle relief in its surrounding area. It has a population of 320,000 and an urbanized area of about 55 km^2 (Fig. 1). Both cities are in Köppen-Geiger climate region Cfb, characterized by a temperate warm climate with a rather uniform annual distribution of precipitation (Kottek et al. 2006).

Figure 1. Locations of Szeged in Hungary and Novi Sad in Serbia and their positions in Europe.

Defining and mapping Local Climate Zones

For defining and delineating the Local Climate Zone (LCZ) types (Stewart and Oke 2012) in Szeged and Novi Sad, an automated Geographic Information System (GIS) method developed by Lelovics et al. (2014) was utilized (Fig. 2). The urban areas are divided into lot area polygons (Gál and Unger, 2009) consisting of a building and

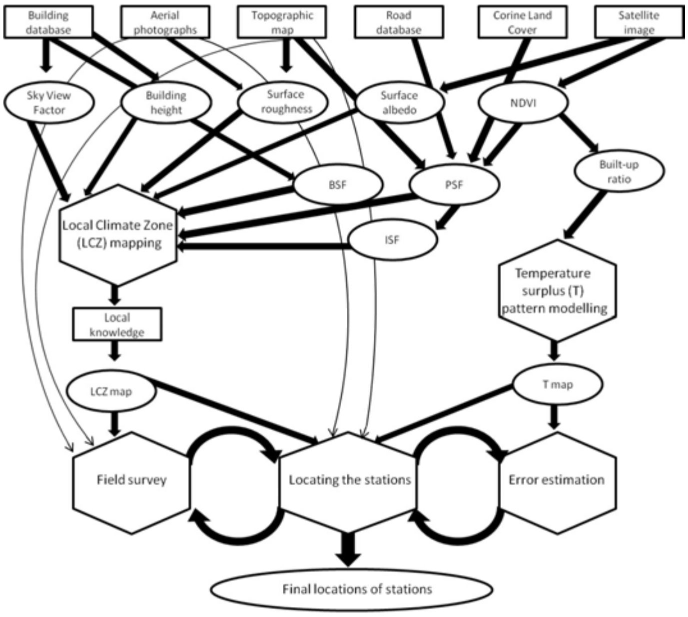

Figure 2. Pattern of indentifying and delineating LCZs and selecting the representative station sites for urban monitoring networks. NDVI = normalized difference vegetation index; BSF = building surface fraction; PSF – pervious surface fraction; ISF = impervious surface fraction.

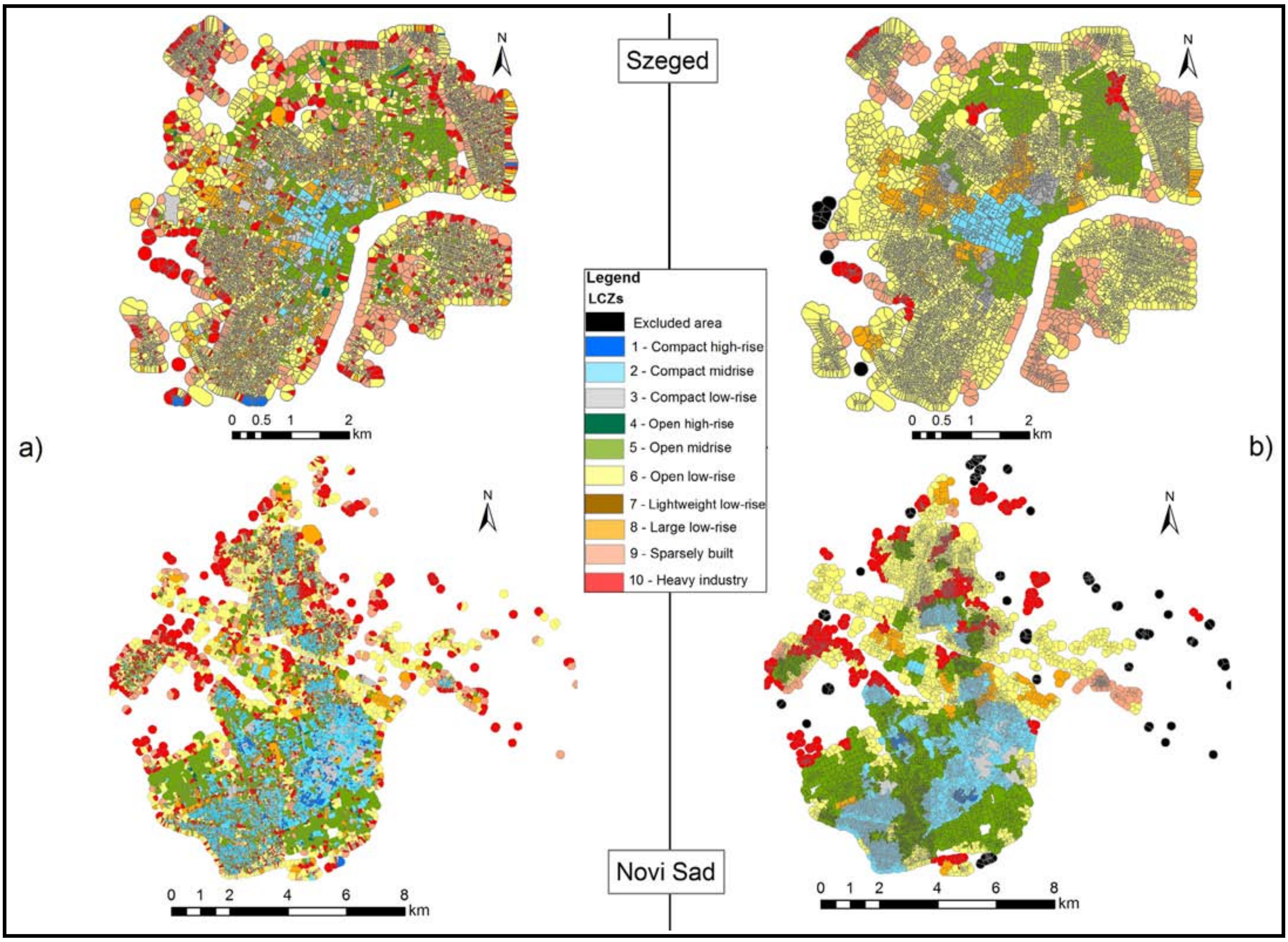

Figure 3. a) LCZ classification of lot area polygons; b) LCZ areas after aggregation of lot area polygons for Szeged and Novi Sad.

the area around it as basic areas in the calculation of surface parameters necessary to characterize the LCZ types. In determining the lot area polygons, building databases in ESRI shapefile format were utilized. From ten physical properties identified and designated for LCZ classification by Stewart and Oke (2012), we used seven. The aspect ratio, surface admittance and anthropogenic heat output were omitted because of the lack of data or inappropriate type of urbanization. The calculation processes of the physical properties and the utilized database are detailed in Lelovics et al. (2014).

The first step in the analysis was the LCZ classification of each lot area polygon (Fig. 3a). In order to obtain LCZ areas with appropriate size, these are aggregated and merged according to their LCZ category and their location relative to each other (Fig. 3b). The aggregation procedure was done according to the recommendations of Stewart and Oke (2012) and Lelovics et al. (2014).

Defining the locations for urban monitoring networks

In order to have a representative urban monitoring network, the siting of all stations was based on the following criteria (Fig. 2): 1) the sites had to be surrounded by at least 250 m wide homogeneous LCZ areas, and the number of stations per each LCZ had to be approximately proportional to the areas of different LCZs; 2) the site had to be representative of its microenvironment, i.e. typical of the LCZ where the station was located; 3) the sites had to be located near areas where high and low temperature surpluses occurred, as well as near local maxima and around spatial temperature stretches, as indicated by the modeled temperature pattern (Unger et al. 2011); 4) the site had to be suitable for instrument installation (e.g. in terms of safety, constant electricity consumption, stability of lamppost).

Results of the project activities

LCZ classes in Szeged and Novi Sad

Due to the urbanization characteristics of the cities, we did not expect to identify all ten built LCZ classes. According to the analyses of utilized surface parameters, aggregation of similar areas and complementation by the authors' local knowledge of the study area, seven built LCZ classes are detected and delineated.

Fig. 4 shows the spatial pattern of these seven LCZ classes within Szeged and Novi Sad, named as: LCZ 2 – Compact mid-rise, LCZ 3 – Compact low-rise, LCZ 5 – Open mid-rise, LCZ 6 – Open low-rise, LCZ 8 – Large low-rise, LCZ 9 – Sparsely built and LCZ 10 – Heavy industry. Furthermore, in non-urban areas around both cities, two land cover types were detected, named as: D – low plants and A – dense trees.

Urban climate monitoring networks in Szeged and Novi Sad

The monitoring networks in urban areas of Szeged and Novi Sad contain 22 and 25 station sites, respectively. Additionally, two stations are installed in LCZ land cover types D and A, respectively, in order to represent the general climate conditions in non-urbanized environments (Fig. 4, Table 1).

In both monitoring networks the mounted stations are equipped with air temperature (T) and humidity (RH) sensors in radiation-protection screens. The accuracies of the sensors are ±0.3-0.4ºC and ±2-3%, respectively. The sensors and all equipment were installed at 4 m above the ground on arms fixed to selected lampposts (Fig. 5). All stations contain a central processor, data storage card, GPRS/EDGE/3G modem, battery and charger. The system time of the stations (and the whole monitoring systems) is in UTC and this time is regularly synchronized by the main servers. The parameters are measured every minute and the readings related with T, RH, battery voltage, status values and other technical information are sent every 10 minutes to the main servers. If there is no mobile internet connection or the main server does not receive the data, the station tries to send them repeatedly until it succeeds. If the station's battery level is low, the station increases the time between two data transfers to decrease the power consumption. In the case of a shortage of continuous electric power supply, the stations can operate up to 10-15 days using battery power only.

Table 1. Detected LCZ built types and distribution of stations by LCZs

LCZ types	Szeged	Novi Sad
LCZ 2	1	3
LCZ 3	1	2
LCZ 5	4	6
LCZ 6	10	9
LCZ 8	2	1
LCZ 9	4	3
LCZ 10	0	1
LCZ A	0	1
LCZ D	2	1
Total	**24**	**27**

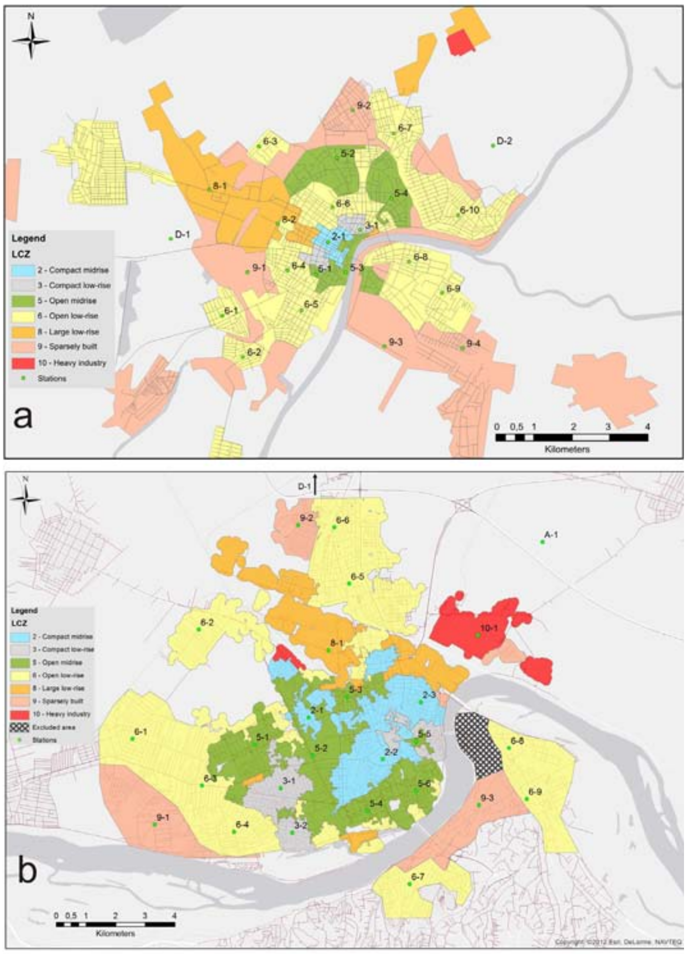

Figure 4. Obtained LCZ classes and station locations of the urban monitoring networks in a) Szeged and b) Novi Sad. Note (Station labels): first character – LCZ type; second character – station number in the given LCZ type.

In Szeged the lower box is utilized in the case of 20 stations, where the local electricity provider has made it possible to use the power for the station, and it contains only a separate power switch. At the remaining four stations there is direct access to the power so they do not need any additional box. Most of the stations (17) have continuous power supply, but seven stations have power supply only when the city lights are on. One station (D-1) is located in the garden of the Hungarian Meteorological Service (HMS) station in order to provide calibration information for the network.

In Novi Sad one station (A-1) has continuous power supply and all other stations have power supply when the city lights are on. During the day, the stations work on battery supply.

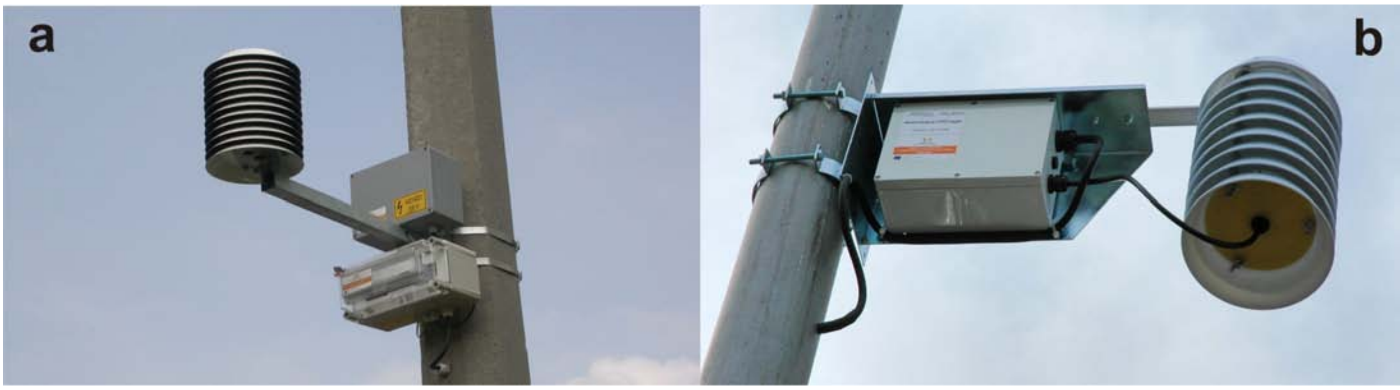

Figure 5. Examples of monitoring network stations in Szeged (a) and Novi Sad (b), mounted on lampposts.

Operational data processing and public display

After the transmission of the station data into the main servers the automatic data procession system creates the final two (site and spatial) databases (Fig. 6) in order to present these data as charts and maps on the public homepage of the project (http://en.urban-path.hu/monitoring-system.html). All of the measured and calculated parameters can be accessed in a way that the time of the maps and charts can be freely modified by the visitors. Additionally, public displays (monitors) are installed at frequently visited places of both universities (Fig. 7).

The received data from the monitoring networks are stored in one text file per day on the server, and also stored in a MySQL database. Every 10 minutes Java software calculates the Physiologically Equivalent Temperature (PET) value (Mayer and Höppe 1987) describing the human comfort conditions for each station using the temperature and relative humidity values measured there, as well as global radiation and wind speed data measured at the HMS station (for Szeged) and using WRF model predictions (for Novi Sad) (Fig. 8). The results of these calculations are also stored in the MySQL database (Fig. 6).

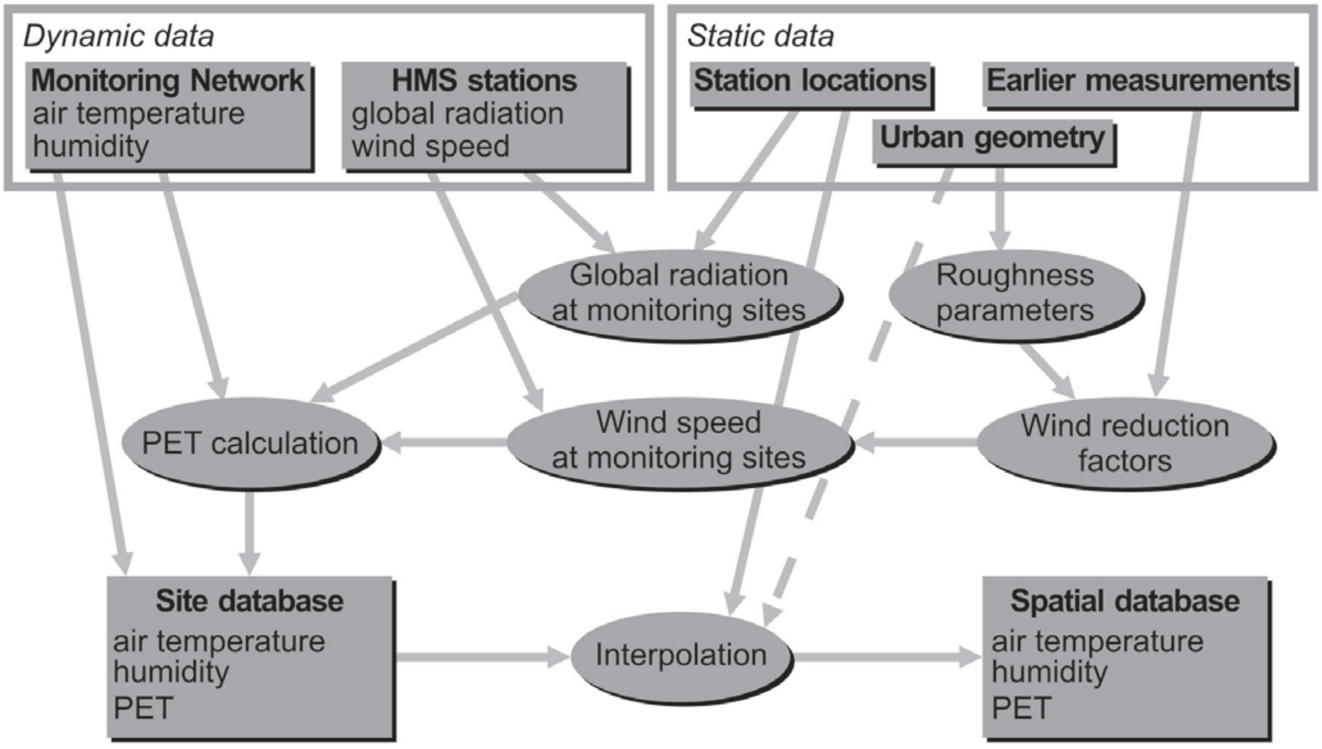

Figure 6. Flow chart of the automatic data processing of the monitoring systems.

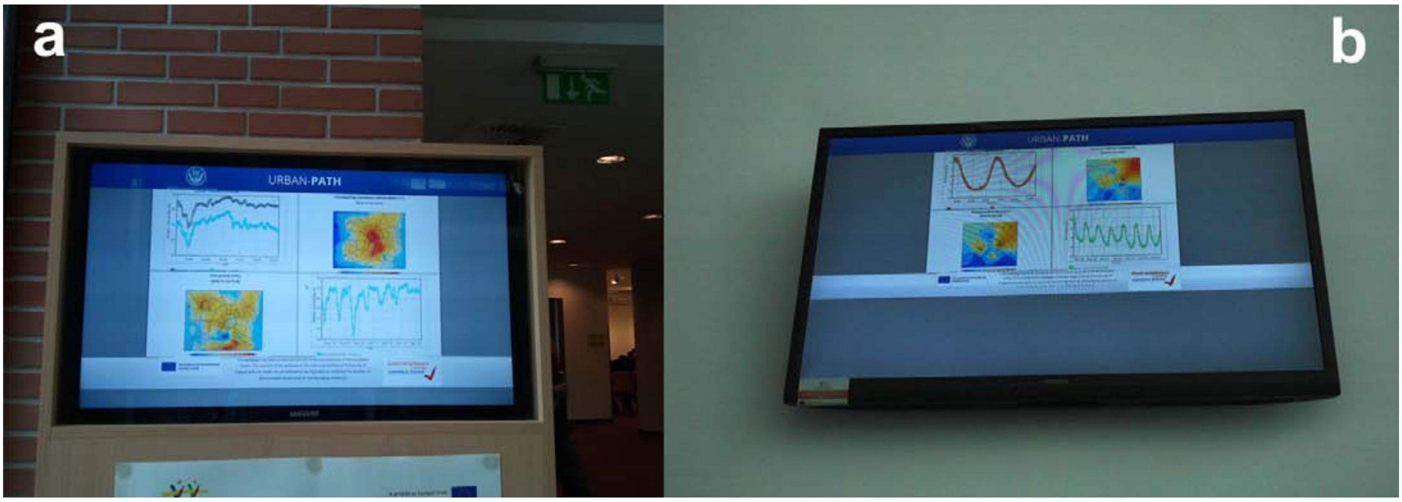

Figure 7. Installed public display systems in Szeged (a) and Novi Sad (b).

For the automatic interpolation of the spatial patterns of the measured and calculated data, Java software was developed. This program applies simple linear interpolation for a 500 m resolution grid of the study area using the data from the three nearest stations to each grid point. In order to avoid incorrect interpolation at the edge of the study area, the two rural stations are considered as the background stations, thus at the bordering (non-urban) grid points we used the data of the nearest rural station, and all of these points were added to the original measurement points for the interpolation (Fig. 6). The coordinates of the grid points and the stations are in the Unified Hungarian Projection, but at the end of the interpolation they were converted to WGS84 latitude and longitude coordinates because it is more appropriate for the further processing (drawing maps with GrADS, comparing the measurements with weather prediction models). At first we applied a weighting constant (currently it is 1) in the interpolation, and after further investigations we will alter this constant using the statistical connection between the surface parameters (e.g. built up ratio, SVF, green area, water surface) and the measured temperature, relative humidity or the PET in order to increase the precision of the interpolation (Fig. 6). The final patterns are stored in another location, the spatial database, which is technically a NetCDF file. The public project homepage presents these patterns as maps created by GrADS and PHP scripts.

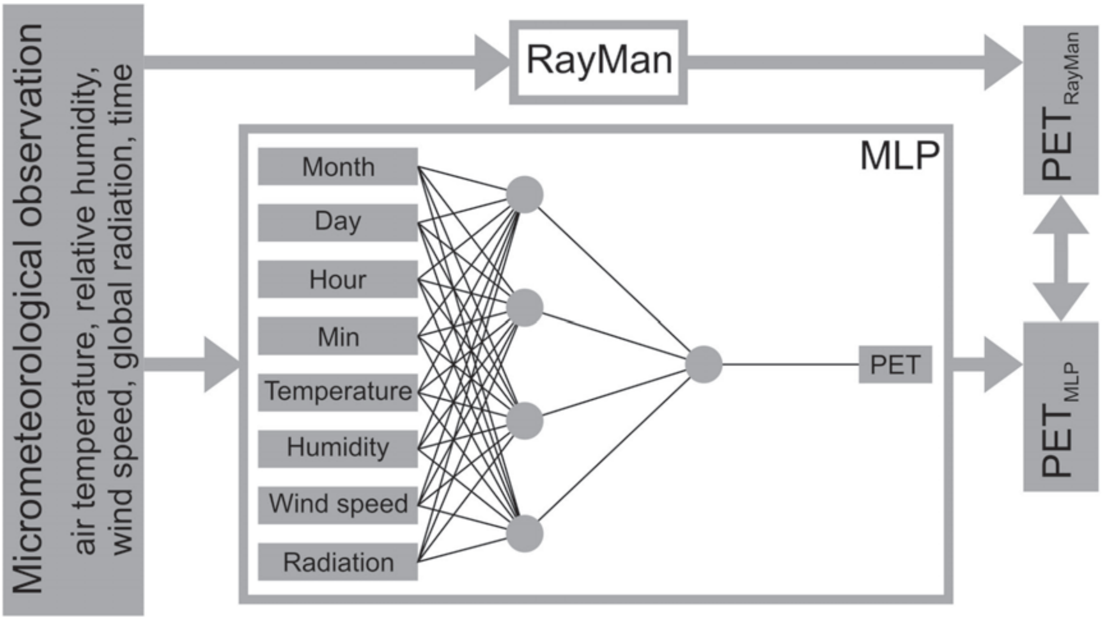

Figure 8. Flow chart of the development of the Multilayer Perception (MLP) network structure.

Conclusions

As a result of the infrastructure development and related research in the frame of the URBAN-PATH project, urban climate monitoring networks and public information systems were established in Szeged (Hungary) and Novi Sad (Serbia).

The data from the station sites of urban monitoring networks, based on the Stewart and Oke (2012) classification system and detection and delineation using Lelovics et al. (2014) automated GIS method, should provide adequate datasets in order to research short-term and long-term urban climate processes. Additionally, these networks can provide an opportunity for intra-urban and inter-urban comparisons.

As public display information, the maps and graphs about the thermal, humidity and human comfort conditions appear in 10-minute time steps as a real-time visualisation on the project homepage.

The utilization possibilities of the results in the future are related to the high-resolution weather prediction models, which can be applied in the urban environments – these are real alternatives to urban climate measurement networks – but their results are not yet adequate enough (e.g. Chen et al. 2011, Salamanca et al. 2011). The real-time predictions are not only based on the attributes of static urban parameters (built-up ratio, sky view factor, building heights etc.) because these data are basically constant in the prognostic time-scales. On the other hand, the actual weather of a given urban region strongly depends on physical processes working at macro- and meso-scales. These processes can be taken into account only using a well-defined, telescopic downscaling method with the help of a high resolution numerical weather prediction model (such as WRF). Today these high resolution models are directly able to predict the urban meteorological effects and give adequate data for a complex urban weather prediction system. Nevertheless, the basic urban surface data sets and their attributes which are needed to make a successful forecast will have to be specified. Based on these challenges, it is important to implement a high-resolution urban static database into the WRF system as well, as the global and local (urban) meteorological data assimilation are also required. A WRF-based urban meteorological prediction system may be able to give fundamental data for some new research aspects such as urban planning and public health applications.

As a final remark, it should be mentioned that our LCZ mapping is a first step in the development of urban climate maps (Ren et al. 2011). These maps also distinguish urban areas based on the degree of local climate modification, and carry information on the spatial distribution of heat loads and the dynamic potentials of urban areas.

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Developing a Global Urban Climate Database: WUDAPT

Earlier this year (July 7th-9th) a first workshop on developing a global database on cities (WUDAPT) for urban climate science was held in Dublin, Ireland. Its objectives were: to bring together a number of individuals that have experience and interest in acquiring such data, to test tools for the acquisition of urban data in select cities, and to design a methodology for gathering and storing urban data in an accessible form.

Although significant advances have been made in the development of urban climate science in the last two decades, there remain some obstacles to the application of this knowledge. Among these is the absence of useful data on cities that captures climate-relevant information that can be used in a number of areas such as: parametrising urban models; designing urban observations; providing metadata on instrument exposure; evaluating exposure to hazardous weather events; and so on. The World Urban Database and Access Portal Tools (WUDAPT) describes a project to gather this information on cities worldwide and will create a geographical database that is accessible to climate scientists (Ching, 2012). The goal of WUDAPT is to create an urban database that has data on the form and function of cities at a spatially detailed scale (<1km^2).

There are other global urban databases but most of these are based on satellite imagery and/or municipal databases that mainly measure the urban extent although satellite-derived 'nightlight' data can also be used to evaluate the intensity of energy use. However, none of these databases provide detail on the three-dimensional character of cities, which is needed for urban climate science. On the other hand, official (municipal) information provides information on land-cover/ land-use but it is often inconsistent in its coverage and content and difficult to obtain. There are exceptions; for example the CORINE database provides information on urban land-cover on cities throughout Europe.

The design of WUDAPT is based on the model of NUDAPT (Ching et al., 2009), which provides very detailed building level data (obtained by Lidar survey) for parts of 40 cities in North America that can be used for urban modelling. WUDAPT, by contrast, will create a less detailed database but has global coverage (Ching, 2012 and Ching et al., 2014). The initial phase of WUDAPT, which has been tested on select cities, is focussed on creating a general description of cities using freely available Landsat8 and GoogleEarth images and the Local Climate Zone (LCZ) classification system (e.g. Betchel, 2011). The LCZ system was developed as a means of describing the urban features that give rise to distinct near-surface air temperature responses and was created to provide a common lexicon for studies of the urban heat island. It decomposes landscapes into 17 categories, 10 of which represent urban types; each category has a table of representative values that describe aspects of urban form (e.g. percent of impervious land-cover) and function (Stewart and Oke, 2012). The completed LCZ maps form a framework for gathering or collating more detailed urban data.

Figure 1. Delegates at the WUDAPT workshop analysing Landsat data for their city to complete an LCZ classification.

At the July workshop a simple workflow to generate LCZ maps was tested. While remote sensing can be used to distinguish between types of urban landscape based on their spectral signatures, translating these into LCZ types requires some expertise. WUDAPT's methodology relies on locally-based urban experts to 'train' the remote sensing software by identifying areas within selected cities that represent LCZ types (Figure 1); this information is then used to generate an LCZ map for the entire urban area (Figure 2). This process is iterative – once a map is generated it is examined by the expert and the training is refined. The expert is someone who has a basic geographic knowledge of their city (there is no requirement to be an urban climate scientist). Over the three-day workshop, 18 cities were processed by 16 different experts; a more complete description of the datasets will be presented at ICUC9 in Toulouse later this year.

In addition to the LCZ process, much of the time at the workshop was spent discussing how best to acquire the more detailed data needed for urban canopy models. As part of this, a 'geo-wiki', essentially a web-based geographic data collection system, was tested to examine what additional urban parameters can be obtained (see www.geo-wiki.org). Since the workshop, further development of the geo-wiki has been undertaken and the results will be presented at ICUC9.

WUDAPT is a community-based project and we encourage others to be involved; the key to its success will be the participation of those that reside in (or know well) cities from around the world. We have an open invitation to become involved in a project that is just beginning but has enormous potential. Please go to http://www.wudapt.org/ where you can indicate your interest in joining. This is also where we will provide updates on progress and links to training materials.

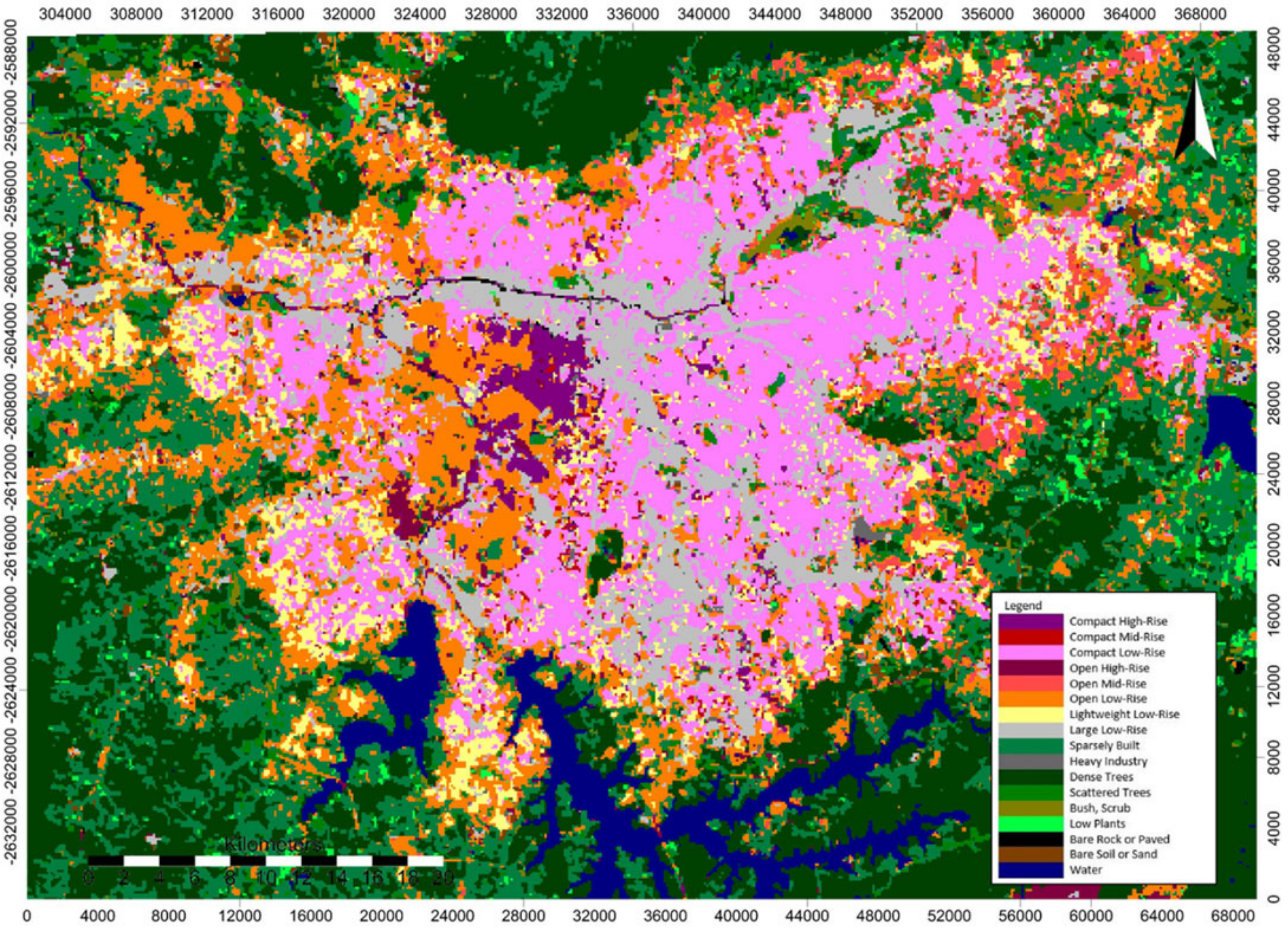

Figure 2: Local Climate Zone classification for Beijing, completed by Weibo Liu (Kansas University) at the Dublin workshop.

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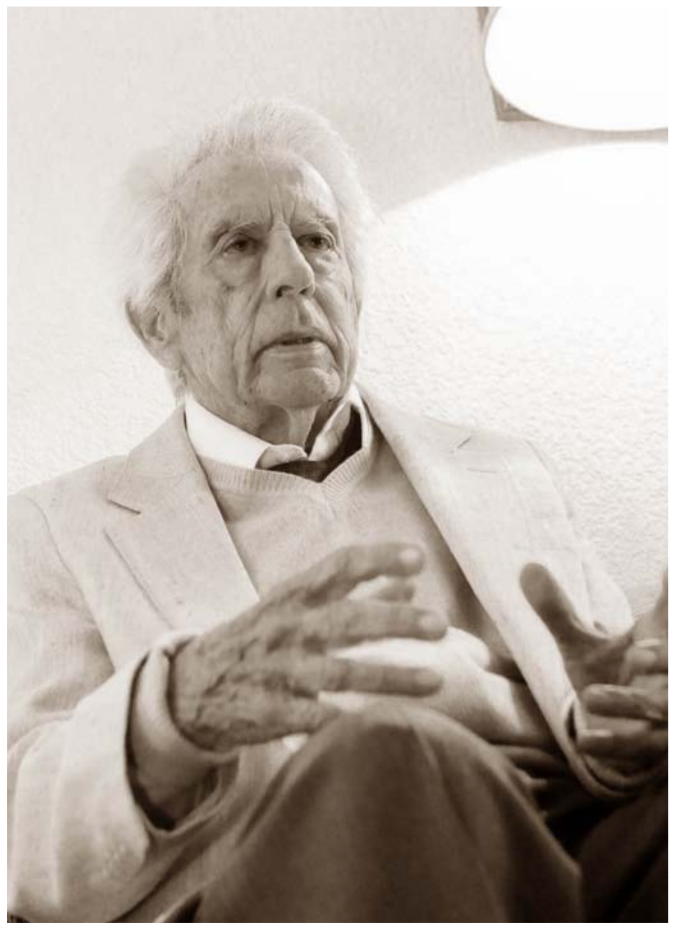
Professor Ernesto Jáuregui Ostos – A Tribute

Professor Ernesto Jáuregui passed away in Mexico City on September 18th, 2014; he was 91 years of age. Urban Climate will never see his like again. Undoubtedly a most remarkable scientific pioneer, he was the doyen of tropical urban climate. He will be sadly missed at IAUC and other urban climate meetings, where his knowledge, generosity and friendship have been so highly valued. He was always ready to give of himself to scholars and students alike.



Professor Ernesto Jáuregui Ostos, 1923-2014

One is astounded by the breadth and longevity of his scientific life. He was born in Pueblo Viejo (Villa Cuauhtémoc), Veracruz in 1923. He graduated with a B.Sc. in Meteorology from UCLA in 1946, then returned to Mexico where he was employed as a hydrometeorologist working on water resource issues in the Mexico City basin. This impressed on him the critical importance of the spatial and temporal variability of precipitation in the basin and the effects of the city itself. Ernesto qualified as a civil engineer at Universidad Nacional Autónoma de México (UNAM). He became a Research Climatologist in the Institute of Geography, UNAM, starting in 1965. His work attracted the attention of a UNESCO scientist who encouraged him to learn French, win a scholarship and study in France. He returned from that experience invigorated and conducted several studies in urban climate. He took his field data to the University of Bonn where he wrote his doctoral thesis in Natural Sciences (in German) on the Urban Climate of Mexico City, graduating in 1973. Based on that work he published several seminal papers on the heat island and urban effects on humidity and precipitation. He continued as a Climatologist in the Institute of Geography and from 1985 in the Centre for Geophysics and Atmospheric Science at UNAM, until his retirement in 2010, at the age of 87!

His scientific interests covered several subfields of climatology, most notably urban climate, human bioclimate, the regional climates of Mexico and climatic change. In each subfield he considered a wide range of variables – including radiation, visibility, heat fluxes, evaporation, rainfall and cloud, temperature, humidity, dust storms, and air pollution. He published prolifically on these topics: a total of more than 200 communications in no less than four languages. His curiosity and enthusiasm for understanding the climates of Mexico was inspirational. He was a Lead Author on the 3rd Assessment Report of the Intergovernmental Panel on Climate Change concerning Potential Impacts of Climate Change (WgG-II), 1999, and listed as a contributor to the work of the IPCC leading to the award of the Nobel Peace Prize, in 2007. He also won prizes for his teaching and mentorship of students (he supervised 21 graduate students).

Surely his greatest contribution was his relentless unraveling of the climates of Mexico City, in their many dimensions. He gave an excellent review of this work in a paper for the *WMO Technical Conference on Urban Climatology and its Applications with Special Regard to Tropical Areas* in 1984. This led to him being appointed as a Rapporteur to WMO for which he compiled several reports documenting emerging work on tropical urban climates. He was invited to join WMO initiatives leading to establishment of the *Tropical Urban Climate Experiment (TRUCE)*.

Surely his greatest contribution was his relentless unraveling of the climates of Mexico City, in their many dimensions.

> *"Ernesto had no peer in the climates of tropical cities. He stood as a model of what can be achieved by sheer dint of intellectual curiosity, intuition and scientific insight."*

Ernesto had no peer in the climates of tropical cities. He stood as a model of what can be achieved by sheer dint of intellectual curiosity, intuition and scientific insight. It should give us all pause to know that through much of his career this great natural scientist had little or no funding, he simply teased out his findings using standard network data and subjecting them to novel and revealing analyses. Even obtaining that standard climate information was not easy, given the relatively poorly resourced and bureaucratic National Meteorological Service, until recently. Much was only possible because of the respect for his work, the infectious warmth of his personality and the network created as a result of him having taught many of the Service's meteorologists. He relied on personal observation, intuition and scientific acumen, rather than technological wizardry, to achieve his undoubted insights and make his scholarly contributions. More recently, national and international recognition enabled him to obtain greater resources, to travel and collaborate with others.

He was undoubtedly the most notable figure on the climates of tropical cities. This was recognized in 2006 when he won the Luke Howard Award of the International Association for Urban Climate (IAUC); our highest accolade. He was a recipient of the Helmut E. Landsberg Award of the American Meteorological Society, which is similarly dedicated to urban climate. He was awarded the Mariano Bárcena Medal of the Unión Geofísica Mexicana, in 1997; the Medal of Geographical Merit from UNAM, in 2004; and the Medal of Merit from the University of Veracruz, in 2008.

Above all, Ernesto Jáuregui was a good man: gentle of spirit, with great humility who inspired affection and respect in all who knew him. He was a humanitarian with a deep sense of service to society, who sought to improve the welfare of city dwellers – none more than his beloved and challenged compatriots in Mexico City.

We offer our sincere sympathies to his family, colleagues, students and all who knew and loved him.

– Tim Oke

Recent publications in Urban Climatology

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In this edition a list of publications are presented that have come out between **September and November 2014**. As usual, papers published since this date are welcome for inclusion in the next newsletter and IAUC online database. Please send your references to the email address below with a header "IAUC publications" and the following format: Author, Title, Journal, Volume, Pages, Dates, Keywords, Language, URL, and Abstract. In order to make the lives of the Bibliography Committee members slightly more easy, please send the references in a .bib format.

Since a number of bibliography committee members have resigned, we are supporting (young) researchers to join this effort and contribute to the Committee. If you are interested to join or you want more information, please let me know via the email address below.

Regards,

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The joint 9th **International Conference on Urban Climate** (ICUC) and 12th **Symposium on the Urban Environment** (SUE), sponsored by the International Association for Urban Climate and the American Meteorological Society, will be held in Toulouse, France, 20-24 July 2015.

In the year of the 21st session of the Conference of the Parties on Climate Change Policy & Practice, the focus of ICUC9 will be put on the recent scientific activities on climate change mitigation & adaptation in urban environments, as well as on the transfer to institutional stakeholders and urban planners to include urban climate considerations in their practices.

Traditional topics covered by ICUC and SUE and related to advances in observations, modeling, and applications will also be presented. The submission of abstracts has been concluded, and those who submitted will be notified in early February. For additional scientific information, please contact the local scientific commitee (Valéry Masson and Aude Lemonsu) at : icuc9@meteo.fr

Upcoming Conferences...

GLOBAL FORUM ON SCIENCE, POLICY AND THE ENVIRONMENT: ENERGY AND CLIMATE CHANGE
Washington DC, USA • January 27-29, 2015
http://www.energyandclimatechange.org/

MEDITERRANEAN URBAN FORESTS: IMPROVING THE ENVIRONMENT & QUALITY OF LIFE IN CITIES
Barcelona, Spain • March 17-18, 2015
http://med.forestweek.org/

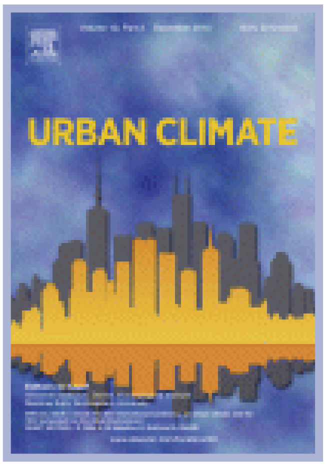
INTERNATIONAL CONFERENCE ON SUSTAINABLE DESIGN, ENGINEERING & CONSTRUCTION
Chicago, USA • May 10-13, 2015
http://www.icsdec.com/

INTERNATIONAL CONFERENCE ON URBAN CLIMATE (ICUC9)
Toulouse, France • July 20-24, 2015
http://www.meteo.fr/icuc9/

IUFRO LANDSCAPE ECOLOGY CONFERENCE: SUSTAINING ECOSYSTEM SERVICES
Tartu, Estonia • 23-30 August 2015
http://iufrole2015.to.ee/

PASSIVE AND LOW-ENERGY ARCHITECTURE: 31ST INTERNATIONAL PLEA CONFERENCE
Bologna, Italy • September 9-11, 2015
http://www.plea2015.it/

Announcing the ICUC8 Special Issue of *Urban Climate*



Colleagues, it has taken longer than expected but the special issue of the journal *Urban Climate* dedicated to ICUC8 (The 8th International Conference on Urban Climate and the 10th Symposium on the Urban Environment) has now been completed. Until recently these papers were available online but had not been assigned to an issue; the 13 papers that comprise *Urban Climate* Volume 10 (Part 2) were chosen by the ICUC8 organising committee with the intention of giving a glance of the multi-faceted nature of current urban climate research as well as its interdisciplinary flavour.

The tradition of ICUC events has been to use plenary talks to elucidate on past progress, current status and research prospective in urban climate research. Three of the papers in this issue are based on plenary talks given at ICUC8. These include: a historical perspective on climate-based urban planning (Hebbert), an overview on the techniques to estimate of urban-based greenhouse gas emissions (Christen), and an evaluation of progress on our understanding of the urban boundary layer (Barlow). The topic of another plenary session on meso-scale urban modelling challenges (Ching) has previously been published by this journal. Together, these papers help to identify current gaps in knowledge on urban climate effects and the potential of this knowledge in the application to urban design and planning.

The other papers in this issue capture the breadth and diversity of the field both in terms of topics covered and methods employed. These include: a concern for the quality of observations in the complex urban setting, the need to meld observational and modelling approaches for a more complete understanding, the importance of scale when examining urban processes and climate effects, a concern for standardisation of approaches to ensure clarity in scientific dissemination and research, and increased sophistication in modelling urban processes across time and space scales.

By agreement with the journal, each of these papers is free to download at http://www.sciencedirect.com/science/journal/22120955/10/part/P2

– *Gerald Mills, Silvana Di Sabatino, Evyatar Erell and Alberto Martilli, Editors*

Special issue papers

Barlow, J. (2014). Progress in observing and modelling the urban boundary layer. *Urban Clim.* 10 (P2), 216–240.

Best, M. & Grimmond, S. (2014). Importance of initial state and atmospheric conditions for urban land surface models' performance. *Urban Clim.* 10 (P2), 387–406.

Christen, A. (2014). Atmospheric measurement techniques to quantify greenhouse gas emissions from cities. Urban Clim.10 (P2), 241–260.

Erell, E., Pearlmutter, D., Boneh, D. & Bar Kutiel, P. (2014). Effect of high-Albedo materials on pedestrian thermal stress in urban street canyons. *Urban Clim.* 10 (P2), 367–386.

Fenner, D., Meier, F., Scherer, D. & Polze, A. (2014). Spatial and temporal air temperature variability in Berlin, Germany, during the years 2001–2010. *Urban Clim.* 10 (P2), 308–331.

Hebbert, M. (2014). Climatology for city planning in historical perspective. *Urban Clim.* 10 (P2), 204–215.

Johansson, E., Thorsson, S., Emmanuel, R. & Krüger, E. (2014). Instruments and methods in outdoor thermal comfort studies – the need for standardization. *Urban Clim.* 10 (P2), 346–366.

Kotthaus, S. & Grimmond, S. (2014a). Energy exchange in a dense urban environment – Part I: temporal variability of longterm observations in central London. *Urban Clim.* 10 (P2), 261–280.

Kotthaus, S. & Grimmond, S. (2014b). Energy exchange in a dense urban environment – Part II: impact of spatial heterogeneity of the surface. *Urban Clim.* 10 (P2), 281–307.

Martilli, A. (2014). An idealized study of city structure, urban climate, energy consumption, and air quality. *Urban Clim.* 10 (P2), 430–446.

Masson, V., Marchadier, C., Adolphe, L., Aguejdad, R., Avner, P., Bonhomme, M., Bretagne, G., Briottet, X., Bueno, B., de Munck, C., Doukari, O., Hallegatte, S., Hidalgo, J., Houet, T., Le Bras, J., Lemonsu, A., Long, N., Moine, M.-P., Morel, T., Nolorgues, L., Pigeon G. et al. (2014) Adapting cities to climate change: a systemic modelling approach. *Urban Clim.* 10 (P2), 407–429.

Mouzourides, P., Kyprianou, A., Brown, M.J., Carissimo, B., Choudhary, R. & Neophytou, M.K.-A. (2014). Searching for the distinctive signature of a city in atmospheric modelling: could Multi-Resolution-Analysis (MRA) provide the DNA of a city? *Urban Clim.* 10 (P2), 447–475.

Thorsson, S., Rocklöv, J., Konarska, J., Lindberg, F., Holmer, B., Dousset, B. & Rayner, D. (2014). Mean radiant temperature – a predictor of heat related mortality. *Urban Clim.* 10 (P2), 332–345.

(continued from page 1)

A second related initiative led by the International Council for Science that may be of interest to some IAUC members is that of "Urban Health and Wellbeing". This new programme is intended to inform city planning, policies and design with science-based strategies and tactics to improve the health of populations living in fast-growing urban areas. It will also identify and help manage the unintended health consequences of urban policy and the connections between cities and planetary change. The international program office was recently opened at the Institute for the Urban Environment in Xiamen, China. Thanks to my colleague at Western University, Dr. Gordon McBean, who is the current president of ICSU, for bringing this to my attention.

In IAUC-related business I have two items to bring to members' attention. First, the annual call for nominations for the IAUC **Luke Howard Award** has now been circulated and is posted on our website, http://www.urban-climate.org/. The Luke Howard Award recognizes outstanding contributions to the field of urban climatology in a combination of research, teaching and/or service to the international community of urban climatologists. A nomination package includes a CV of the nominee and three letters of recommendation. Full details are provided on the posting on our website and in the email circulated from IAUC Secretary David Sailor. We are asking that members who intend to lead a nomination contact the Awards Committee Chair by **January 15, 2015** indicating the name of the nominee; this step will allow us to avoid duplicate nominations. Thank you to Jason Ching for agreeing to Chair the Awards Committee.

Second, the abstract submission phase of ICUC9 is now complete and more than 760 abstracts have been received for review. This is an excellent response, with an increase of almost 100 abstracts compared to ICUC8/UE10 in Dublin and bodes well for a very successful conference in Toulouse. Abstract reviews are underway and should be completed early in the New Year. Thank you to all who have contributed abstracts and to those who are performing the reviews. I look forward to an exciting conference in Toulouse.

Finally, I would like to take this opportunity to thank all those who have contributed to the IAUC this year through their contributions to the Board, to the ICUC, to the *Urban Climate News*, and to the operation of IAUC through various committees, the website, and meturbclimlist. As always I welcome contributions of members to the activities of IAUC and if this is your New Year's resolution please let me know and I can assist you in contributing to the IAUC.

Happy New Year to all and best wishes for 2015.

– James Voogt

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- Tim Oke (Univ. of British Columbia, Canada): President, 2000-2003; Past President, 2003-2006; Emeritus President 2007-2009*
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- Jennifer Salmond (University of Auckland, NZ): 2005-2009; Secretary, 2007-2009
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- Rohinton Emmanuel (Glasgow Caledonian University, UK): 2006-2010; Secretary, 2009-2013
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- Aude Lemonsu (CNRS, France): 2010-2014; ICUC-9 Local Organizer, 2014-2015*
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- Alexander Baklanov (University of Copenhagen): 2013-2017
- Curtis Wood (Finnish Meteorological Inst., Finland): 2013-2017
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- Edward Ng (Chinese University of Hong Kong, Hong Kong): 2014-2018
- Nigel Tapper (Monash University, Australia): 2014-2018

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Newsletter Contributions

The next edition of ***Urban Climate News*** will appear in late March. Items to be considered for the upcoming issue should be received by **February 28, 2015** and may be sent to Editor David Pearlmutter (davidp@bgu.ac.il) or to the relevant section editor:

News: Winston Chow (winstonchow@nus.edu.sg)

Conferences: Jamie Voogt (javoogt@uwo.ca)

Bibliography: Matthias Demuzere (matthias.demuzere@ees.kuleuven.be)

Projects: Sue Grimmond (Sue.Grimmond@kcl.ac.uk)

Submissions should be concise and accessible to a wide audience. The articles in this Newsletter are unrefereed, and their appearance does not constitute formal publication; they should not be used or cited otherwise.