Urban Climate News

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From the IAUC President

Colleagues,

In my column this issue, I would like to highlight two upcoming conferences. The first is our own **ICUC-10** for which the abstract submission process is now open. Abstracts may be submitted (and special sessions suggested) at the Conference Web page. The submission deadline is **15 December 2017**. If this seems far off, then put in another time context, this is the last issue of the *Urban Climate News* before the abstract submission deadline!

The second conference is that of the **Cities and Climate Change Conference**, also referred to as Cities IPCC https://www.citiesipcc.org/. This is a first conference of its type and is supported by a number of partners, including IPCC, UN, ICLE, C40 and Future Earth, among others. The conference aims to "improve scientific knowledge and to stimulate research underpinning effective and efficient urban responses to climate change, as well as to provide inputs to the products of the Intergovernmental Panel on Climate Change (IPCC)".

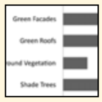
From among the four conference themes, I see particular relevance to IAUC members in Theme 2 – Urban emissions, impacts and vulnerabilities (Science and practice of cities). This theme includes assessments of greenhouse gas and "short-lived climate pollutant" emissions from cities, how urban form, design and typology may help guide the emissions reductions and climate vulnerability, and also incorporates how the science of cities can help to better understand and reduce urban climate impacts, risks and vulnerabilities in cities. The experience of past extreme climate events, urban climate detection, attribution and climate information are also included in this theme.

The other three conference themes include: Cities & climate change (Imperatives for action); Solutions for the transition to low carbon and climate resilient cities (Science and practice for cities); and Enabling transformative climate action in cities (advancing science and advancing cities). Full details on the theme content are available from their website.

The conference, to be held in Edmonton, Canada March 5-7, is less a traditional science conference and more of a multi-stakeholder gathering (along the lines of Habitat III for those familiar with that type of event). The organizers ask that "all sessions must incorporate a clear and visible element of knowledge exchange or co-generation among the scientific community and the practitioner and/or policy-making communities" and provide a number of suggestions of how these may be organized. There is also an opportunity for individuals to submit individual abstracts.

It would be great to see some IAUC representation in sessions or presentations at Cities IPCC with a view to exposing

Inside the Fall issue...



our member's work to the IPCC, which is increasing the attention it pays to climate at the urban scale, and to attracting a larger audience to ICUC-10. I am currently working with Alexander Baklanov on a session proposal related to the WMO-IAUC submission to Habitat III on the Urban Integrated Weather, Environment and Climate Services (UI-WECS). I see opportunities for sessions that could feature many other types of work that IAUC members do related to climate change. The deadline is very soon – Oct 6 – but the requirements for proposing a session are not onerous – a title, an indication of the theme(s) to which the session contributes, the session aim (50 words), format and working methods (50 words) and a description (200-400 words). Session participants are also asked to be identified. Can I ask if members propose a session that they let me know so I have a general idea of the total number of IAUC-related sessions.

Enjoy this issue of the *Urban Climate News*, and thanks again to Editor David Pearlmutter, the production team and all our contributors.

– James Voogt,
IAUC President

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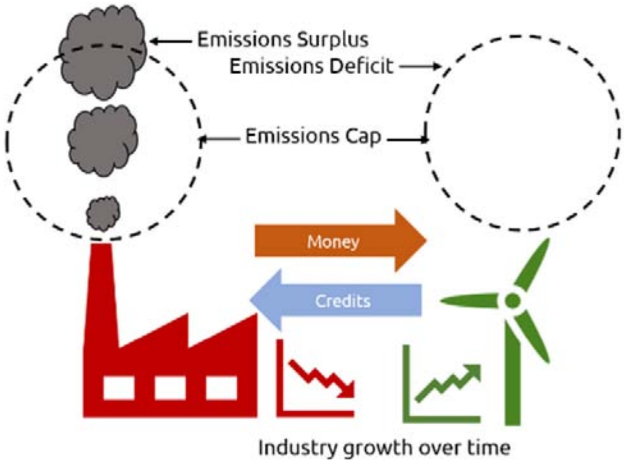
Cities are tackling climate change: let's continue

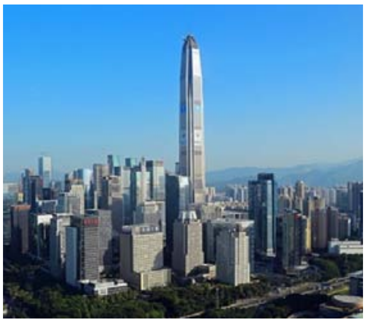
*News Editor Paul Alexander continues a special series profiling the eleven winners of the **C40 Cities Award** for addressing climate change in 2016*

Category:	**Finance & Economic Development**
Entrants (2016):	• Canberra (Australia) • Toronto (Canada) • Shenzhen (China)
Winning City:	**Shenzhen** *Shenzhen Emissions Trading Scheme* http://www.sz.gov.cn/cn/xxgk/xwfyr/wqhg/20120919/ (Chinese)



The urban climate community now has an agreed standard for referencing scales, though this took some time to establish. Indeed, it is increasingly common to now see UHI studies in the literature making explicit references to the canopy layer UHI, the boundary layer UHI, micro, local and meso scales. This was an important development (as reference by Tim Oke almost ten years ago) since it increases our ability to communicate as a community and fosters deeper theoretical understanding by observing, describing and modelling processes at the appropriate scale.

In discussing *Finance and Economic Development*, mentioning scales in urban climate may appear rather unrelated, but in fact, scale is at the heart of the winning city's project. Those of us with even the remotest of connections to financing of climate change will have heard of "emission trading schemes" and "carbon credits" at some point. It is a quasi-market-driven financial mechanism (as opposed to a full-fledged government driven administrative mechanism) and formed the basis of the Kyoto Protocol. The basic premise of emissions trading is actually quite simple: high-polluting developed countries who have invested heavily in infrastructure reliant on fossil fuels (and hence argue divesting from this path abruptly would be too costly) can purchase carbon credits (1 credit = 1 ton CO_2) from low-polluting developing countries; thus they are obliged to pay the cost of being polluters and simultaneously reward developing countries for investing in low-carbon technologies. In theory, this means development in these countries will have low-carbon infrastructure as its basis, since finance to establish this technology is provided by developed countries. Where scales come into the picture is that emissions trading arrangements operate at a national scale, so it begs the question: can this work on a city-scale?



The winning city for the 2016 C40 award in Finance & Economic Development is solid proof of the concept that emissions trading can indeed operate on the city scale. Shenzhen remains one of the fastest growing cities in the world, with a population of 15 million. The problem facing the city is one the project team identified as transcending scales: increasing GDP (or urban growth) is coupled with increasing GHG emissions. The Shenzhen Emissions Trading Scheme (SETS) project was developed to decouple growth potential from emissions, by rewarding developments and industries that adopt low-carbon technologies and practices and obliging heavy polluters to pay for their emissions.

Traditionally, China has been better at using administrative mechanism (rather than market-based) to meet its GHG emissions reduction goals. For example, China reduced its energy intensity by 19% during the period (2006-2010), mainly through top-down, national policies, such as closing small plants. However, the SETS project represents an attempt to disaggregate emission reduction across the city itself and at the same time promote urban development that is low in carbon intensity. As with most national level ETS, the urban project started with agreeing on a cap, a maximum value of annual GHG emissions permitted across the entire city, a mammoth task in itself. Additionally, the reduction target over the next number of years required reaching a consensus with the 636 compliant enterprises. Since the introduction of SETS in 2011, the heaviest polluting industries (primarily power generation) are obliged to purchase credits where they exceed their emissions, driving investment in low carbon development.

One interesting example for the urban climate community is the benefit of this financing arrangement to urban air quality. Shenzhen's only coal-fired power plant (which has had to purchase credits under SETS since 2011) has begun gradually reducing its power generation, with significant developments in 2013 and 2014. In the years that have followed, city officials and urban dwellers have noted a marked improvement in air quality in the vicinity.

Category:	**Adaptation in Action**
Entrants (2016):	• Copenhagen (Denmark) • Hong Kong (China) • San Francisco (USA)
Winning City:	**Copenhagen** *Cloudburst Management Plan (CMP)* http://www.deltacities.com/documents/WEB_UK_2013_skybrudsplan.pdf

For many years, we have argued that in dealing with urban climate effects (such as the UHI) administrators can create urban spaces that are cooler, better ventilated and able to manage water more effectively. But we must be clear: no city can truly be climate-immune, particularly so in light of inevitable climate changes. *Climate Adaptation Actions* in urban areas are actions that help urban dwellers cope in the face of climate adversity. They strive to protect people, business and vital national critical infrastructure assets, all of which are found in abundance in cities. But more than this, they are designed to specifications and implemented – this is what differentiates *goals* from *actions*.

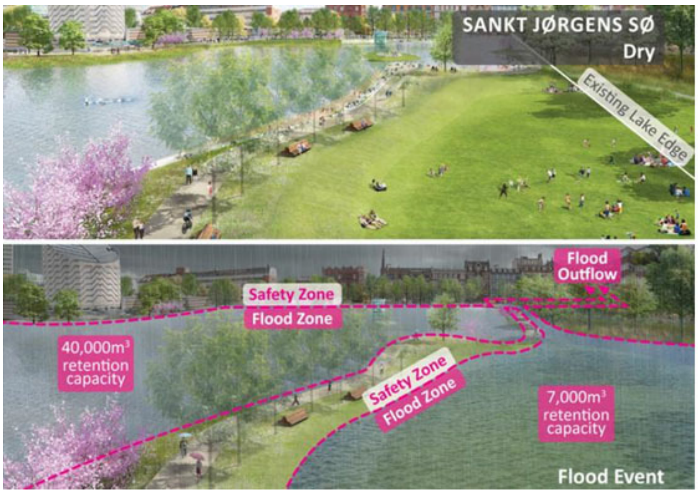
A simple example of a climate adaptation action is a whistle used by farmers on the outskirts of Karwar, India. With no early warning system in place for monsoonal flooding, each year the farmers lose livestock. Their adaptation action was to build elevated platforms alongside their farms and purchase whistles. During flooding, nominated farmers would ride around on bicycles and blow their whistle: this would alert their neighbours flood waters were rising and they should move their livestock onto the platforms. If they rode by again blowing the whistle, it meant the flood water was now rising above the level of the platform and they should move the herd to high ground. The winning city for the C40 award in *Climate Adaptation Action* for 2016 was just as pragmatic as the farmers of Karwar, though arguably more complex.

In July 2011, in less than two hours, Copenhagen was hit by an extreme 1000-year storm event – or Cloudburst – where 150mm of rain left large areas of the city under up to one meter of water. The 2011 event had been preceded by a 100-year storm in August 2010 and was hit again in 2014. Copenhagen realized that Cloudbursts were not a one-off occurrence; the threat compounds as harbor sea levels are predicted to rise one meter by 2110. In a city where many buildings and services are located below street level and where stormwater and sewage are in a combined pipe system, contaminated floodwater penetrated buildings and city infrastructure. In response, city officials established the "Cloudburst Management Plan" (CMP).

The CMP targets 8 central city catchments encompassing a total area of 34 km^2. It includes 300 separate projects that are expected to run over the course of the next 20 years.

Instead of choosing "grey" infrastructure (walls, barriers and underground tunnels) as the main adaptation strategy, the CMP will establish a city-wide layer of blue-green climate adaptation solutions. If torrential rain hits the city, the integrated system of green streets and pocket parks will function as retention areas and water basins. Thanks to a new system, the squares will be able to collect water locally and direct it to the harbour. The infrastructure will also increase the city's resilience to the UHI. This involves a large-scale project of lowering the profile of certain areas while raising up others, so as to redirect runoff to where city planners want the water to flow.

The CMP was successfully tested through a pilot project in 2012 in the Sankt Kjelds district. By transforming 20% of the neighbourhood formerly characterised as impervious surfaces into green space, 30% of stormwater is now managed locally. At Tåsinge Square in the Sankt Kjelds neighbourhood, a plain grass area and parking spaces were transformed into a green oasis. Cloudburst measures include collecting rainwater from the nearby roofs in an underground reservoir and sloping the area such that rainwater collects at the bottom of the slopes, where it seeps into the ground instead of being directed to the drains. This modifies the runoff profile of the area to resemble far more natural environments, easing pressure on waste water management systems and at the same time providing a natural amenity for the urban population residing there.



Harvey Wasn't Just Bad Weather. It Was Bad City Planning

Houston exulted in sprawling, hands-off growth – that's no way to prepare for natural catastrophes

August 2017 — Houston has been wet since birth. In the 1840s, the German explorer Ferdinand von Roemer described the Brazos River prairie just outside the young town as an "endless swamp" that mired the wheels of his wagons. He reported that some people who'd intended to settle in Texas turned around and left after seeing the "sad picture." But Houston never let itself be hampered by its hydrology. It spent billions patching together a mess of dams and drainage projects as it grew and grew. It's the fourth-biggest city in the U.S., boasting one of the world's largest medical centers, oil refineries, a stupendous livestock show and rodeo, highbrow culture, vibrant economic growth, and speakers of 145 languages. The consolidated metropolitan statistical area surrounding Houston and extending to Galveston is larger than the state of New Jersey.

Harvey is a devastating reminder to Houston that nature will have its due. The Category 4 hurricane that hung around as a stationary tropical storm punished greater Houston with rainfall measured in feet, not inches. No city could have withstood Harvey without serious harm, but Houston made itself more vulnerable than necessary. Paving over the saw-grass prairie reduced the ground's capacity to absorb rainfall. Flood-control reservoirs were too small. Building codes were inadequate. Roads became rivers, so while hospitals were open, it was almost impossible to reach them by car.

"Sprawling Houston is a can-do city whose attitude is grow first, ask questions later. It's the only major U.S. city without a zoning code saying what types of buildings can go where..."

Harvey's damage was selective. It's a minor event for the $19 trillion U.S. economy, since most of the economic activity that was interrupted will be made up later. It was a light hit for insurers, because few underwrite flood insurance and the wind damage they do cover was minimal; insurers' stock prices barely fell. The refining and petrochemical industries lining the busy Houston Ship Channel also got off fairly lightly (this time), because they've invested heavily in storm defenses.

The impact on taxpayers is more serious, because Harvey is likely to generate tens of billions of dollars in emergency federal aid and claims on the money-losing National Flood Insurance Program. In the short run, the precautionary shutdown of refineries drove wholesale gasoline prices traded in New York to a two-year high.

A family in Katy, just west of Houston, floats on an inflatable mattress. *Source:* https://www.bloomberg.com

Above all, Harvey is a humanitarian disaster. Ordinary Texans were defenseless against rising waters contaminated by sewage and dotted with floating colonies of fire ants. The confirmed death toll, 20 as of Aug. 30, was expected to rise as rescuers discover more bodies. Residents would return to damaged homes vulnerable to the spread of mold. Much of the damage, which could run to $100 billion or more by one estimate, is uninsured. "This will be the worst natural disaster in American history" in financial terms, Joel Myers, founder and president of AccuWeather, predicted in an Aug. 29 statement.

Sprawling Houston is a can-do city whose attitude is grow first, ask questions later. It's the only major U.S. city without a zoning code saying what types of buildings can go where, so skyscrapers sometimes sprout next to split-levels. Voters have repeatedly opposed enacting a zoning law.

Most of the time, the light hand works: Harris County, which encompasses Houston, added more people than any other U.S. county for eight straight years until 2016, when it fell to second. But Houston is suffering now from the lack of an effective plan to deal with chronic flooding.

Attitude is partly to blame. Michael Talbott spent 35 years with the Harris County Flood Control District trying to protect Houston, mainly by seeking funds for widening drainage channels and bayous. But he resisted the notion that more drastic measures such as preserving green space and managing growth were required. Shortly before retiring as executive director in 2016, Talbott gave an interview to ProPublica and the *Texas Tribune* in which he disputed the effect of global warming and said conservationists were antidevelopment. "They have an agenda . . . their agenda to protect the environment overrides common sense," he said. Talbott, now retired, couldn't be reached for comment.

It's not only Houston that's hands-off. Texas, despite being among the states most vulnerable to storms, has one of the nation's most relaxed approaches to building codes, inspections, and other protections. It's one of only four states along the Gulf and Atlantic coasts with no mandatory statewide building codes, and it has no statewide program to license building inspectors. Corpus Christi uses codes that reflect national standards, minus the requirement that homes be built 1 foot above expected 100-year-flood levels. But Nueces County, which encompasses Corpus Christi, has no residential building code.

Nationally, insurers favor tighter building codes and fewer homes in vulnerable locations. Homebuilders and developers want to keep houses as inexpensive as possible. As the costs of extreme weather increase, that fight has spilled over into politics: The federal government wants local governments to adopt policies that will reduce the cost of disasters, while many state and local officials worry about the lost tax revenue that might accompany restrictions on development.

The consequence of loose or nonexistent codes is that storm damage is often worse than need be. "Disasters don't have to be devastating," says Eleanor Kitzman, who was Texas' state insurance commissioner from 2011 to 2013. She now runs a company called MyStrongHome that helps homeowners upgrade their homes to qualify for lower homeowners' insurance premiums. "We can't prevent the event, but we can mitigate the damage."

"The consequence of loose or nonexistent codes is that storm damage is often worse than need be... 'We can't prevent the event, but we can mitigate the damage.'"

Any measure introduced in Texas that increases costs draws opposition from homebuilders, a powerful group in state and local politics. At the end of this year's state legislative session, the Texas Association of Builders posted a document highlighting its success in killing legislation it didn't like. That included a bill that would have let cities require residential fire sprinklers. Another would have given counties with 100,000 people or more authority over zoning, land use, and oversight of building standards—something the builders' group called "onerous."

Ned Muñoz, vice president of regulatory affairs for the Texas builders' organization, says cities already do a good job choosing which parts of the building code are right for them. And he argues that people who live outside of cities don't want the higher prices that come with land use regulations.

A flooded neighborhood just west of Houston, in Katy, Tex., south of Interstate 10, on Aug. 29, 2017. *Source:* https://www.bloomberg.com

The fight in Texas is a microcosm of a national battle. The International Code Council, a Washington nonprofit made up of government officials and industry representatives, updates its model codes every three years, inviting state and local governments to adopt them. Last year the National Association of Home Builders boasted of its prowess at stopping codes for 2018 that it didn't like. "Only 6 percent of the proposals that NAHB opposed made it through the committee hearings intact," the association wrote on its blog. The homebuilders demonstrated their power again this year, when President Donald Trump reversed an Obama initiative restricting federally funded building projects in flood plains. "This is a huge victory for NAHB and its members," the association blogged.

Not all homebuilders are OK with the organization's antiregulatory bent. Ron Jones, a member of the NAHB board who builds houses in Colorado, says that while the first priority now is helping the victims, he hopes the storm will force new thinking. "There's no sort of national leadership involved," he says. "For them it's just, 'Hell, we'll rebuild these houses as many times as you'll pay us to do it.'"

There's a glimmer of a possibility that Harvey could lead to a détente between environmentalists and Trump administration officials in charge of disaster response. Some of the codes the homebuilders blocked had been proposed by the Federal Emergency Management Agency, which is on the hook when homes collapse, flood, or wash away. In an interview before Harvey hit, FEMA Administrator William "Brock" Long expressed support for an Obama administration proposal to spur more local action on resilience, such as better building codes, if states want to keep getting first-dollar disaster relief from Washington. States that didn't reduce their risks would have to cover a deductible before qualifying for federal aid. "I don't think the taxpayer should reward risk," Long told Bloomberg.

The Trump administration's interest in strong building codes is less ideological than practical. Over the past decade, the federal government spent more than $350 billion on disaster recovery. Much of the money has gone to homes that keep getting damaged; 1.3 million households have applied for federal disaster assistance money at least twice since 1998—many of them in the same areas hit hardest by Harvey. Repeat claims are also common in the National Flood Insurance Program, which Congress must reauthorize by the end of September. Some lawmakers, and Long himself, have said homes that repeatedly flood should be excluded from coverage. "We need to take a look at where structures are being built," says Todd Hunter, who represents Corpus Christi in the state legislature.

The pressure on government to back off from tough rules is strong, and how hard Long will work to make good on his pledge remains to be seen. When a reporter asked who was responsible for planning the rebuilding effort after Harvey, a FEMA spokeswoman suggested contacting the Texas Department of Public Safety. The department suggested asking FEMA.

However important it was in the past to come to grips with flood control and construction codes, it's essential in this era of climate change. For Houston, the cruel irony is that the greenhouse gases that contribute to superstorms are intimately connected to the oil and petrochemical economy on which the city built its fortune.

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The contribution from global warming is the result of what meteorologists call the Clausius-Clapeyron relation, which says the water-holding capacity of the atmosphere increases about 7 percent for each 1 degree Celsius increase in the temperature. So: warmer air, more water, bigger storms. The temperature of the oceans is rising, too. Heat from the Gulf of Mexico is what fueled Harvey.

Jeff Masters, a meteorologist who flew with the National Oceanic and Atmospheric Administration's hurricane hunters in the 1980s and later co-founded the mischievously named Weather Underground Inc. website, argues that storms are worsening even more than one would expect from Clausius-Clapeyron. "The extra energy that you use to make the vapor stays with the vapor. It's latent heat. When the vapor condenses into rain, it releases the heat that helps power the storm," Masters says. "The more water vapor that you bring into a hurricane, the more energy, the stronger updrafts. You have to suck in even more air to replace the air that's leaving. It's a vicious cycle."

A swing hangs just above the water in the front yard of an Energy Corridor residence. ***Source:*** https://www.bloomberg.com

Climate change could also explain why Harvey hovered over Houston, dropping rain on it for days instead of moving on. Global warming tends to cause subtropical high-pressure systems to expand, pushing the jet stream northward, Masters says. When that happened in August, the winds that might have pushed Harvey somewhere else were largely absent, he says. Michael Mann, an atmospheric scientist at Pennsylvania State University, together with five co-authors, explored the jet stream theory in a recent paper in the journal *Scientific Reports*.

Skeptics point out that the United Nations-affiliated Intergovernmental Panel on Climate Change says it doesn't have the evidence to conclude that global warming is making storms and flooding worse. But not knowing if a phenomenon exists is different from saying it doesn't exist. The IPCC, appropriately cautious, said its uncertainty is partly because of a dearth of reliable data from gauge stations and partly because extreme events are hard to analyze statistically. "The more rare the event the more difficult it is to identify long-term changes," the panel wrote in 2012.

It's also true, as skeptics note, that no particular storm can be attributed to a long-term phenomenon such as global warming. Then again, neither could any particular home run by Barry Bonds be attributed to steroids. "But steroids sure helped him hit more and hit them farther," Eric Pooley, senior vice president of the Environmental Defense Fund and a former *Bloomberg Businessweek* deputy editor, said after Superstorm Sandy in 2012. "Now we have weather on steroids."

If climate change is a hoax, as President Trump has said, then Houstonians just got 50 inches of hoax dumped on their soaking wet heads. They don't want to live through this again. Unfortunately, should things keep going the way they're going, another 100-year or 500-year flood will hit within the decade, and we'll be back to chewing this over all over again.

Houston's clay soil doesn't absorb water quickly, so when a hard rain comes, much of it runs off to pool elsewhere. Authorities have made matters worse by allowing developers to pave over much of Harris County and beyond; it's spent its flood-control budget on culverts, canals, drains, levees, berms, pumps, and other "gray" (as in concrete) infrastructure to flush the water away—but that hasn't been enough. It builds new roads with curbs and gutters designed to channel water away from buildings. Roads make good sluices in an ordinary storm, but in Harvey they couldn't shed their water fast enough and became rivers.

"...no particular storm can be attributed to a long-term phenomenon such as global warming. Then again, neither could any particular home run by Barry Bonds be attributed to steroids. "Now we have weather on steroids."

Samuel Brody, a resident of the west side of Houston who says the flood waters crept up "into the freak-out zone" of his house, argues that Houston and the region should make better use of green solutions, such as preserving wetlands and digging more detention ponds, which are normally dry but fill up in storms. New buildings—and even old ones—should be elevated on piles so water flows under them, not into them, says Brody, who has a doctorate in city and regional planning and teaches at Texas A&M University's Galveston campus. And, he says, builders should be prohibited from raising the heights of building lots with fill, which merely diverts more water onto their neighbors' property.

The acreage of metro Houston that can't soak up rainfall increased by 32 percent from 2001 to 2011, according to U.S. Geological Survey data. The political difficulty of green solutions is that they require buying up and ripping out stuff that's already been built, which is expensive, or protecting existing green spaces from development, which means forgoing property tax revenue, which is also a costly response. (That's especially so in Texas, which relies heavily on property taxes, since there's no state income tax.) "What we've done hasn't worked," Brody says. "The question is, what else can be done? Keep developing and putting people in harm's way, or do we need a shift in thinking?"

A flooded office building in the Energy Corridor. *Source:* https://www.bloomberg.com

Making a city more resilient isn't easy. Lots of U.S. cities—Miami comes to mind—were built in places that don't make a lot of sense anymore. It's worse abroad, where the world's poorest cities are among the most vulnerable. More than 1,200 people in Bangladesh, India, and Nepal have died this summer from the worst monsoon flooding in years. One obvious solution is to curb the emission of the gases heating up the planet. But even if countries get a lot more serious about slowing climate change, we're still going to have catastrophes. Mitigation of the consequences will have to be part of the answer.

Singapore could be a role model, says Michael Berkowitz, president of 100 Resilient Cities, a nonprofit founded by the Rockefeller Foundation. While its population has more than doubled since the 1980s, the city-state, which is in the path of monsoons, has increased to 46 percent from 35 percent the area of land with green cover, according to the government's Centre for Liveable Cities.

"The acreage of metro Houston that can't soak up rainfall increased by 32 percent from 2001 to 2011... The political difficulty of green solutions is that they require ripping out stuff that's already been built, which is expensive, or protecting existing green spaces from development, which means forgoing property tax revenue..."

A strategy such as Singapore's takes time, though. Rattled by Harvey, Houstonians may understandably want a quicker fix. "There will be such a focus to reduce a single hazard, to get the water away as quickly as possible" through sluices, berms, and the like, Berkowitz says. "Houston will miss an opportunity. If you're really going to make those improvements, that's the work of a generation." *Source:* https://www.bloomberg.com/news/features/2017-08-31/a-hard-rain-and-a-hard-lesson-for-houston

Friday, Aug. 25 at 5:23 p.m. Saturday, Aug. 26 at 8:25 a.m. Sunday, Aug. 27 at 7:13 a.m.

More than 9 trillion gallons of rain fell across the greater Houston area and Southeast Texas in the aftermath of Hurricane Harvey. These photos, taken mostly from high-rise buildings or drones, begin to show the enormous scale of the flooding throughout the Houston area. *Source:* https://www.washingtonpost.com

Trump Rolls Back Obama-Era Flood Standards For Infrastructure Projects

August 2017 — President Trump's astonishing press conference on August 15 was, ostensibly, an announcement about infrastructure. But his brief remarks on the permitting process were entirely overshadowed by his defense of attendees at a white supremacist rally, among other remarks.

But the president was, in fact, announcing a new executive order with serious repercussions. Among other things, he is rolling back an Obama-era order that infrastructure projects, like roads and bridges, be designed to survive rising sea levels and other consequences of climate change.

The executive order was meant to protect taxpayer dollars spent on projects in areas prone to flooding and to improve "climate resilience" across the U.S. — that is, communities' ability to cope with the consequences of global warming.

President Barack Obama signed the order in 2015, but the changes have not taken effect; FEMA has been soliciting input and drafting new rules.

Now, the order has been revoked as part of an effort to "slash the time it takes" to approve new infrastructure projects, as Transportation Secretary Elaine Chao put it in a statement.

Speaking at Trump Tower in New York City, Trump said, "We're going to get infrastructure built quickly, inexpensively, relatively speaking, and the permitting process will go very, very quickly." Few details were revealed in that news conference, but the text of the order has since been published and it specifically revokes Obama's flood risk rules.

Supporters say the Obama flood rules would protect lives, by positioning new roads and buildings on safer ground, and protect financial investments by ensuring that infrastructure projects last as long as they were intended. Some business advocates have objected, saying the new rules would increase the cost of new construction.

Trump's decision to roll back the policy was denounced by environmental groups as soon as it was first reported.

"This is climate science denial at its most dangerous, as Trump is putting vulnerable communities, federal employees, and families at risk by throwing out any guarantee that our infrastructure will be safe," Sierra Club Executive Director Michael Brune said in a statement ahead of Trump's remarks.

The Obama administration's order covered only public infrastructure projects. But revoking it could have implications for private development as well — for example, if the government builds a road in a flood-prone area, residential development might follow.

In an op-ed in Politico, an environmental advocate and an insurance industry advocate — Robert Moore of the Natural Resources Defense Council and Franklin Nutter of the Reinsurance Association of America — urged Trump to maintain the standards. They said climate resilience is crucial across the country: "While many Americans may think flooding is only a problem for coastal regions prone to hurricanes and tropical storms, it is far more widespread than that and can devastate any state or region across the country. In just the past five years, all 50 states have experienced flood damage."

This is not the first time Trump has reversed an Obama order and pushed the U.S. government not to factor climate change into decisions. As Jay Price of member station WUNC reported for NPR earlier this year, the president told the federal government that it didn't need to treat climate change as a national security threat — despite the fact that rising sea levels pose a flooding hazard to military bases.

"The risks were highlighted in a report last summer by the Union of Concerned Scientists. It said 128 American military installations are at risk from sea level rise," Price reported. *Source:* http://www.npr.org

South Asia floods kill 1,200 and shut 1.8 million children out of school

August 2017 — Heavy monsoon rains brought Mumbai to a halt for a second day as the worst floods to strike south Asia in years continued to exact a deadly toll.

More than 1,200 people have died across India, Bangladesh and Nepal as a result of flooding, with 40 million affected by the devastation. At least six people, including two toddlers, were among the victims in and around India's financial capital.

The devastating floods have also destroyed or damaged 18,000 schools, meaning that about 1.8 million children cannot go to classes, Save the Children warned on Thursday.

The charity said that hundreds of thousands of children could fall permanently out of the school system if education was not prioritised in relief efforts.

"We haven't seen flooding on this scale in years and it's putting the long-term education of an enormous number of children at great risk. From our experience, the importance of education is often under-valued in humanitarian crises and we simply cannot let this happen again. We cannot go backwards," said Rafay Hussain, Save the Children's general manager in Bihar state.

"We know that the longer children are out of school following a disaster like this the less likely it is that they'll ever return. That's why it's so important that education is properly funded in this response, to get children back to the classroom as soon as it's safe to do so and to safeguard their futures."

On Wednesday, police said a 45-year-old woman and a one-year-old child, members of the same family, had died after their home in the north-eastern suburb of Vikhroli crumbled late on Tuesday, and a two-year-old girl had died in a wall collapse.They said another three people had died after being swept away in the neighbouring city of Thane.

The rains have led to flooding in a broad arc stretching across the Himalayan foothills in Bangladesh, Nepal and India, causing landslides, damaging roads and electric towers and washing away tens of thousands of homes and vast swaths of farmland.

The International Federation of the Red Cross and Red Crescent Societies (IFRC) says the fourth significant floods this year have affected more than 7.4 million people in Bangladesh, damaging or destroying more than 697,000 houses.

They have killed 514 in India's eastern state of Bihar, where 17.1 million have been affected, disaster management officials have been quoted as saying. In the northern state of Uttar Pradesh, about 2.5 million have been affected and the death toll stood at 109 on Tuesday, according to the Straits Times. The IFRC said landslides in Nepal had killed more than 100 people.

The IFRC – working with the Bangladesh Red Crescent Society and the Nepal Red Cross – has launched appeals to support almost 200,000 vulnerable people with immediate relief and long-term help with water and sanitation, health and shelter.

A passenger bus moves through a waterlogged road in Mumbai.. *Source:* https://www.theguardian.com

Streets in Mumbai have turned into rivers and people waded through waist-deep waters. On Tuesday, the city received about 12.7cm of rain, paralysing public transport and leaving thousands of commuters stranded in their offices overnight.

Poor visibility and flooding also forced airport authorities to divert some flights while most were delayed by up to an hour.

The National Disaster Response Force has launched a rescue mission with police to evacuate people from low-lying areas but operations were thwarted by the continuous rain.

"The heavy rains, flooding, are delaying our rescue work. Even we are stranded," said Amitesh Kumar, the joint police commissioner in Mumbai.

Images and video posted on social media showed the extent of the flooding.

Rainwater swamped the King Edward Memorial hospital in central Mumbai, forcing doctors to vacate the paediatric ward.

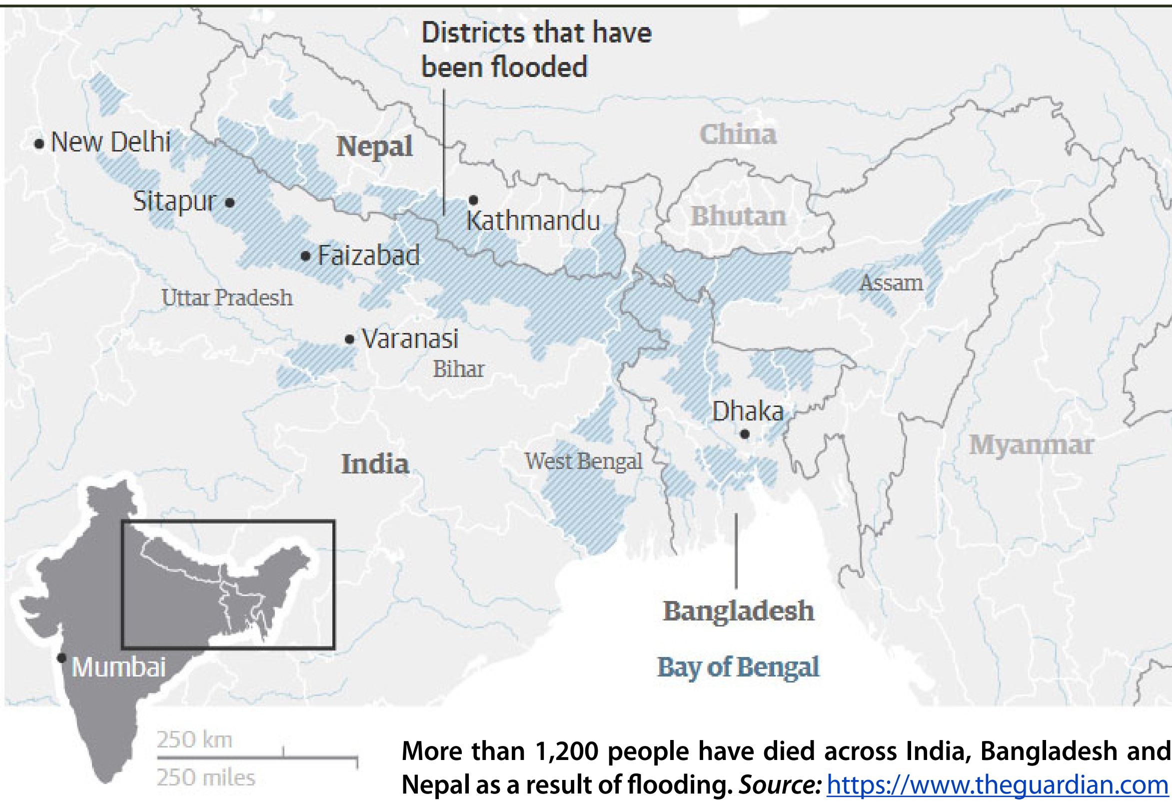
"We are worried about infections … the rain water is circulating rubbish that is now entering parts of the emergency ward," said Ashutosh Desai, a doctor in the 1,800-bed hospital.

Although Mumbai is trying to build itself into a global financial hub, parts of the city struggle to cope during annual monsoon rains.

Floods in 2005 killed more than 500 people in the city. The majority of deaths occurred in shanty town slums, home to more than half of Mumbai's population.

The meteorological department warned that the rains would continue for another 24 hours.

Unabated construction on flood plains and coastal areas, as well as storm-water drains and waterways clogged by plastic garbage, have made the city increasingly vulnerable to storms.



More than 1,200 people have died across India, Bangladesh and Nepal as a result of flooding. *Source:* https://www.theguardian.com

An urban waterfall in Mumbai, India. *Source:* https://www.theguardian.com

Snehal Tagade, a senior official in Mumbai's disaster management unit, said 150 teams were being deployed to help the population in low-lying residential areas.

Low-lying parts of the city with a population of more than 20 million people experience flooding almost every year but large-scale flooding of this magnitude has not been seen in recent years.

"We are mapping all the flooding zones to launch a project to build emergency shelters to make evacuation easy," said Tagade.

Many businesses asked employees to leave early in expectation of worsening traffic jams. Rains and a high tide in the western coastal city threaten to overload an ageing drainage system.

Several companies have arranged for food and resting facilities for employees stuck in offices. Temples and other Ganesh pandals have been offering food and water to people stranded on streets.

People on social media have been offering help to strangers who have been stuck at various locations.

The education minister has asked all schools and colleges in the city to remain shut on Wednesday.

The flooding led to some power outages in parts of the city and the municipal corporation warned of more such cuts if water levels continued to rise.

A spokeswoman for Mumbai international airport said flights in and out of the airport, India's second busiest, were delayed while some had had to be diverted. *Source:* https://www.theguardian.com/world/2017/aug/30/mumbai-paralysed-by-floods-as-india-and-region-hit-by-worst-monsoon-rains-in-years

Planet Earth II: why most animals can't hack city living


www.theguardian.com

December 2016 — The grand finale of the BBC's Planet Earth II showcased the ingenious strategies that some animals use to thrive in urban environments. Though impressive, these species are in the minority. As the number of people living in cities around the world continues to rise, we should really be turning our attention to those animals that find city living too hard to handle.

Urbanisation represents the most extreme form of habitat loss for most plants and animals. As towns and cities grow, human beings live together in higher densities, and natural habitat is removed and replaced with hard, impermeable structures such as roads and buildings. Harmful pollution increases, as does the noise from industry and traffic, the amount of artificial lighting and the number of introduced predators such as cats.

As remaining pockets of natural or semi-natural habitat (such as remnant native habitat or man-made parks) become more isolated, city-dwelling animals are prevented from venturing out to look for food, resting places or mates, or may risk dying in the attempt. All together, these changes make cities impossible places for many species to live in.

Life in the urban jungle

Typically, we find a lower variety of plants and animals in more built-up areas; and this applies to all groups of wildlife. In a recent global study, researchers estimated that cities accommodate only 8% of the bird species and 25% of the plants that would have lived in those areas prior to urban development. As a vertebrate's territory becomes more urban, it's also more likely to be threatened with extinction. In fact, it's estimated that urban development is responsible for the listing of 420 vertebrate species around the planet as threatened.

It's the generalist, opportunistic species such as foxes and rats – and, as we see on the programme, some monkeys – which can adapt to a wide variety of environmental conditions. By contrast, creatures that require large areas to source enough food, have specialist habitats or dietary requirements, or those with narrow geographic ranges tend to fare poorly during urban development.

In 2011, the Center for Biological Diversity released a list of ten US species facing extinction as a result of human population growth. Several of these have been directly affected by urban development; including the Florida panther and the Mississippi gopher frog, and the Lange's metalmark butterfly. There are only 150 of these butterflies left in the world, living in a small coastal refuge in California which, incidentally, is also home to the last natural populations of a number of wildflower species including the Antioch Dunes evening primrose and Contra Costa wallflower.

Bats are another group of animals that frequently lose out from urbanisation. This is partly because many species are reliant on forests for their food and roosting spots. Yet even bats which we often see in cities can find it difficult to cope with the most built-up areas.

For example, the common pipistrelle is widespread throughout Europe – it can often be spotted roosting in buildings and flying around urban parks. But research at the University of Stirling, using citizen science as part of the Bat Conservation Trust's National Bat Monitoring Programme, found that this bat was far less likely to be recorded in densely built-up areas, compared to less built-up ones.

Growing greener cities

About half the world's human population currently live in urban areas, which cover about 3% of the earth's land surface. Both of these figures are increasing rapidly. At the same time, urban areas are likely to spread fastest in some of the most biologically diverse areas of the world, including parts of Africa and Asia, which will place even more species at risk. For example, one of the areas predicted to undergo the fastest levels of urban development is Africa's Eastern Afromontane, home to an astonishing array of plants and animals that do not exist anywhere else. Several species of giraffe, which were recently listed as threatened, are also found in this area.

Losing a species to extinction is not just a tragedy for the animal kingdom. Humans rely on biological diversity for a huge array of "services", which they provide us with; whether directly for food or timber, or indirectly, through nutrient cycling, pollination and the provision of clean water and air.

Yet the situation is not entirely hopeless. There are many courses of action we can take, as individuals on a local level, and as a society by developing sustainable strategies for urban planning. Many studies show that maintaining and expanding green spaces in cities assists with wildlife conservation and enhances human health and well-being. And green roofs and walls can provide habitats for wildlife and reduce the impact of the urban heat island, as well as absorbing rainwater and improving building insulation.

While it's incredible to see hyenas living in harmony with humans, falcons soaring between skyscrapers and monkeys leaping through the urban jungle, we must also spare a thought for those species which can't handle city living. As urban environments continue to expand and develop around the world, it's worth remembering this: if we can make cities more habitable for wildlife, then we humans will benefit too. Source: http://theconversation.com/planet-earth-ii-why-most-animals-cant-hack-city-living-69957

Model of impact of changing precipitation patterns in northern European, North American cities

September 2017 — Southern cities such as Houston and Tampa -- which faced the wrath of hurricanes Harvey and Irma, respectively -- may not be the only urban environments vulnerable to extreme weather. Northern cities also face the potential for flooding as global temperatures continue to warm.

In fact, higher temperatures have been found to disproportionately affect northern land areas, particularly the Arctic, which has already experienced fallout from climate change.

A new study by a group of international researchers, including UC Santa Barbara's Joe McFadden, combines observations and modeling to assess the impact of climate and urbanization on the hydrological cycle across the distinct seasons in four cold climate cities in Europe and North America. Their findings appear in the journal *Scientific Reports*.

"In general, the amount of precipitation is increasing but also the kind of precipitation is changing," said McFadden, an associate professor in UCSB's Department of Geography. "While more precipitation may fall in a year, it arrives as rain rather than snow because temperatures are rising. A shorter period covered by snow, more spring rain and faster snow melt can combine to release large amounts of runoff that have the potential to stress urban hydrologic systems and cause flooding in urban areas."

The scientists used measurements taken in Minneapolis-St.Paul, Minnesota; Montreal, Canada; Basel, Switzerland; and Helsinki, Finland. Lead author Leena Järvi of the University of Helsinki coupled those with an urban hydrological model -- the Surface Urban Energy and Water balance Scheme (SUEWS) -- to perform a multiyear analysis. The investigators found that after snow melt, urban runoff returns to being strongly controlled by the proportion of built-up versus vegetated surfaces, which can absorb water. However in winter, the presence of snow masks this influence.

Basel had more than 80 percent impermeable surfaces, whereas the American site -- a first ring suburb in Minneapolis-St.Paul -- had the lowest amount of impermeable surface, about 10 percent.

Watered streets of Houston. ***Source:*** https://www.sciencedaily.com/releases/2017/09/170911150930.htm

"Combining measurements and modeling in this way is very valuable because it gives us a starting point to compare different cities, gradations between the city and the suburbs or changes in the city as it grows over time," McFadden said. "Once we understand how that works, that knowledge is portable and can be used to understand other problems."

According to McFadden, not only does this analysis demonstrate that wintertime climate can be important for northern cities, it also shows the effects in terms of flood risks. However, he noted, how this plays out within each city is a complex interaction.

"We showed that the model accurately represents what we measured in cities, so now we can use it to conduct sensitivity studies, where only a single variable -- the percentage of the city covered by impervious versus pervious materials -- changes," he said. "Then we can examine how the melt of the snow and the runoff changes in light of the percentage of each city's impervious surface. This is really important because it helps us understand how the built environment of the city modifies the effects of global climate factors." Source: https://www.sciencedaily.com/releases/2017/09/170911150930.htm

Mitigating urban heat islands: Does research support the needs of policy makers?

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What is urban heat island mitigation?

The "urban heat island" (UHI) effect is a commonly used term that describes the tendency of urban areas to experience higher outdoor air temperature levels (up to 12 K higher) compared to their contiguous rural periphery (Landsberg, 1981; Oke, 1982, 1987; Voogt, 2002). This globally documented phenomenon is mainly attributed to the special characteristics of the urban landscape, including building density, size and orientation, open space configuration, and the use of heat absorbing construction materials, irrespective of global warming trends (Santamouris, 2001; Gartland, 2008; Erell et al., 2011).

The challenges imposed by the formation of UHIs can be met with the application of a variety of informed actions commonly referred to as "adaptation" and "mitigation"measures (terms borrowed directly from climate change terminology). The term "adaptation" denotes short-term adjustments of human behaviours and systems (changing of clothing, turning on the air conditioning, etc.) in a way that provides at least a partial and temporary relief from the negative effects of overheating. As such, adaptation measures constitute the most basic set of immediate responses to thermal discomfort. UHI adaptation is not supposed to affect the "natural systems" (i.e. the urban microclimate) but rather the "human systems" that respond to excessive heat (Solecki et al., 2005).

The inherent limitations of UHI adaptation measures highlight the importance of a second set of actions typically subsumed under the term "mitigation". Ideally speaking, mitigation measures (or "strategies", as they are sometimes referred to) are well-conceived, comprehensive, and collective actions, involving both governmental bodies and affected stakeholders, that are aimed at the transformation of urban microclimate through modifications of the physical environment (Solecki et al., 2005; Gago et al., 2013). Such well-prepared and consistently realized measures are believed to leave a positive impact on urban microclimate and to remedy the negative phenomena associated with UHIs.

Scientific research on UHI mitigation has a history of more than three decades, beginning with the pioneering work of Hashem Akbari, Arthur Rosenfeld, and Haider Taha at the Lawrence Berkeley National Laboratory (Rosenfeld, 1999). Nevertheless, implementation of the accumulated knowledge still lags behind the products of scientific research, mainly because of the complex nature of implementation, the inherent difficulties of communicating scientific knowledge to all major (non-scientific) stakeholders (municipalities, urban planners, governmental agencies, developers), and the need for continuous coordination between them in order to achieve effective results. Many mitigation measures can leave substantial impact on urban microclimate only if implemented on a scale large enough to encompass the urban environment as a whole. Their success is therefore highly dependent not only on the availability of financial resources and suitable physical conditions, but also on political action of governmental and local authorities (see for example City of Los Angeles, 2006; Rosenzweig et al., 2006; Design for London, 2008; U.S. Environmental Protection Agency, 2008; Forkes, 2010; Synnefa and Santamouris, 2012; Chen, 2013; Silvera Seamans, 2013). Since implementation is based on initial understanding of the mechanisms behind the warming of cities, political action must follow the products of scientific research. Arguably, this interdependence between politics and pure science may influence research trends and direct them towards political interests and priorities, leaving other, more effective but harder to implement, mitigation measures relatively under-researched and under-discussed. Our research attempted to critically map current research trends in the field of UHI mitigation for understanding where research efforts are directed and to what extent they are following the interests of governmental and municipal bodies.

Classifying UHI mitigation types

The lack of a commonly accepted classification system of UHI mitigation measures presents a challenge when trying to map current research trends. We attempted to base our analysis on a classification system that would best fit the goals of our own inquiry by being extensive but not overwhelmingly detailed, a system that would include well-defined and distinguishable measures without giving unproportioned weight to miniscule differences. The classification system we developed was based on the grouping of measures according to their physical domain of intervention, adopting an action-oriented selection criteria that reflect the common perspective of policy makers. Since policy makers are expected to promote UHI mitigation through a series of concrete actions that are based on real-world possibilities and limitations, we thought that a proper classification system should consist of the actual measures commonly available for policy makers while following the physical path of intervention (i.e., on which part of the cityscape the action is applied). This led us to define four major intervention categories (building envelope, urban landscaping, pavements, and street geometry) to which specific measures could be related. The definition of a specific measure as distinctive was based on the existence of solid scientific evidence for its positive impact on UHI intensity reduction, regardless of other measures that may be additionally applied. This led us to identify the following 11 mitigation measures that reflect the main measures regularly appearing in current literature as well as in official guidelines: cool building envelopes, green roofs, green facades, shade trees, ground vegetation, water bodies, cool pavements, water retentive pavements, built environment typical section, built environment orientation to prevailing winds, and built environment orientation to the sun.

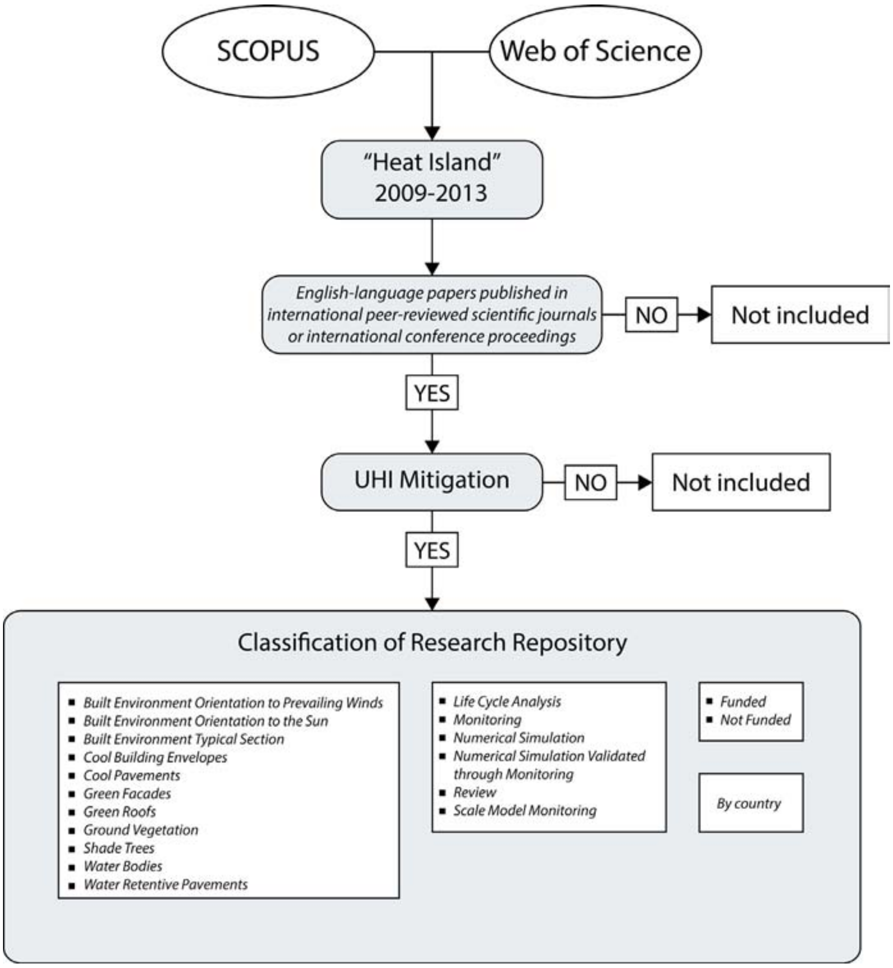

Figure 1. Flowchart showing the generation of the repository used for analysis.

Reviewing current research trends

Our study assumed a direct correlation between increased scientific interest in a given mitigation measure and the sheer number of scientific publications on it. To quantify the prevalence of certain mitigation measures in current scientific literature, a comprehensive and systematic literature survey was conducted (Figure 1), resulting in a research repository large enough (411 unique items from the years 2009-2013) for producing significant assessment of research trends. To identify relevant papers, we first searched two of the most comprehensive scientific bibliographic databases available today (SCOPUS and Web of Science) using a generic term ("heat island"). This enabled us to retrieve only papers where the study of mitigation measures was done explicitly in the context of urban heat island mitigation or where the authors found the mitigation measures to have an effect on urban heat islands.

Query results not dealing with at least one of the classified mitigation measures were removed from the repository, as well as papers not written in English or papers not published in international, peer-reviewed scientific journals or in international conference proceedings. Since the study tried to identify the prevalence of research activity on certain measures, it was decided not to go through any critical assessment of the papers; papers were therefore included in the repository regardless of their scientific quality, innovation, depth, or length. Following the filtering process, the repository papers were classified in four different ways: according to the predefined 11 UHI mitigation measures; according to research methodologies

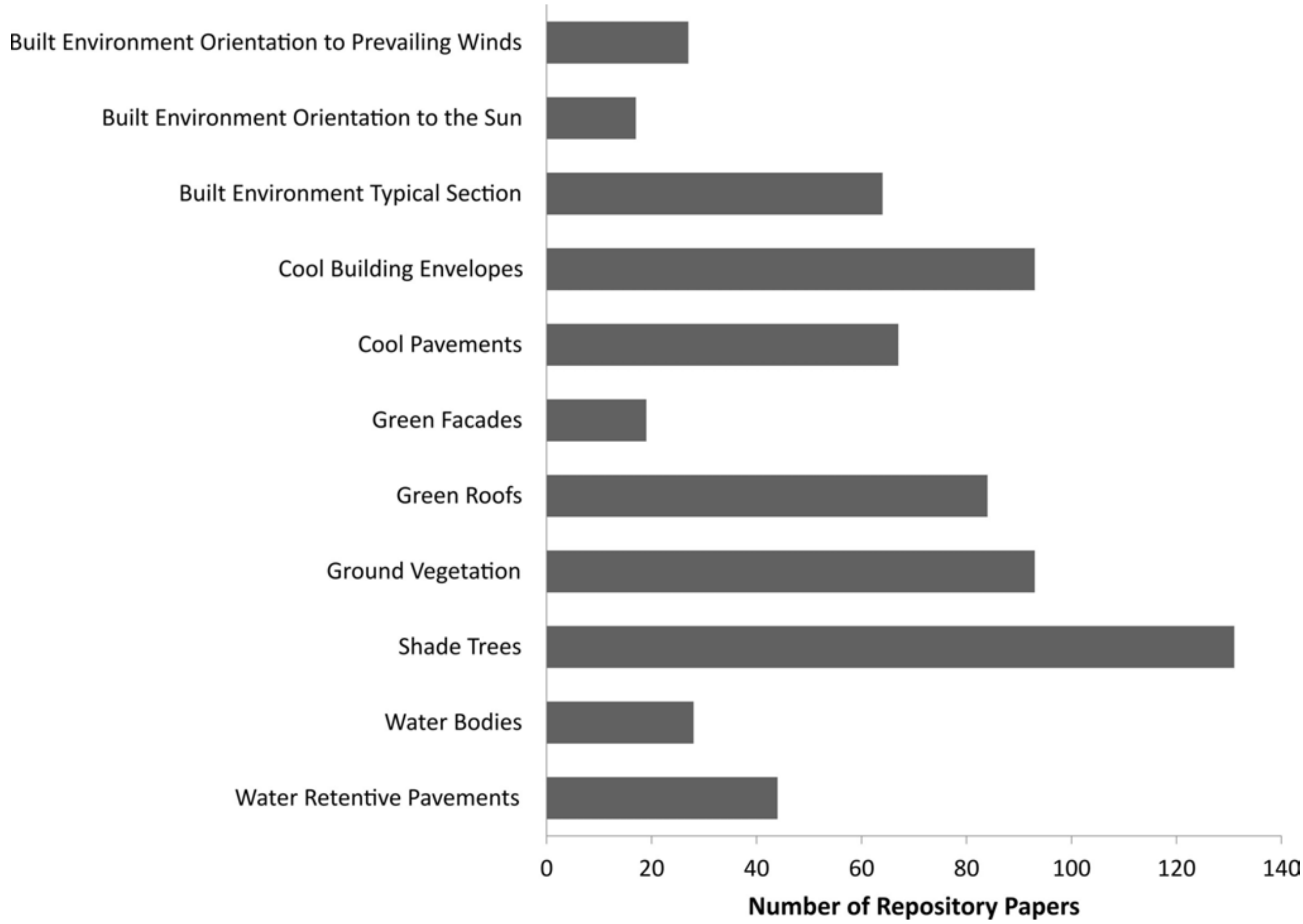

Figure 2. Quantity of research papers on different mitigation measures published in 2009-2013.

(monitoring, simulation, etc.); according to the availability of external funding for the study; and according to the country in which the study was conducted. Here we present only the findings that resulted from the classification into different mitigation measures.

Results and discussion

Analysis of the research repository composition revealed a clear inclination, or even bias, towards the study of certain UHI mitigation measures (Figure 2). Papers dealing with the four most researched measures (shade trees, cool building envelopes, ground vegetation, and green roofs) constituted almost 70% of the total number of the repository papers (288 papers), while the four less researched measures (water bodies, built environment orientation to prevailing winds, green facades, built environment orientation to the sun) appeared in only 20% of the total number of papers (80 papers). The four most researched measures were also the ones that produced the highest number of papers which relied on monitoring. Three out of these four measures (219 papers, more than 50% of the repository) depended on the intensive use of vegetation for the mitigation of UHI, which is arguably easier to implement in affluent and developed countries or countries not suffering from water scarcity (mainly northern hemisphere countries of temperate climate). In these countries, the effects of UHI (as well as global warming) are usually much less pronounced than in countries which might be less suitable for using vegetation for mitigating the effects of overheated urban areas. In other words, while the "vegetative" strategies attract substantial research efforts, these efforts might be of lesser relevance to many areas around the world suffering from the effects of urban heat islands as well as of water scarcity.

The most researched mitigation measure is the application of shade trees: 131 papers considered the planting of shade trees in relation to UHI mitigation. Shade trees, while contributing more than merely shading from direct solar radiation, arguably represent a convenient measure that local authorities can implement, mainly because such a measure does not interfere with issues of private property ownership and can be integrated into existing streets almost without disrupting the existing physical layout of a city. The second most researched measure, cool building envelopes, can also be regarded as a measure that local authorities would happily adopt, in spite (or conversely because) of the fact that its implementation depends on a large-scale cooperation from numerous private property owners. By recommending or even regulating the use of "cool" materials, municipalities can suggest they are pro-

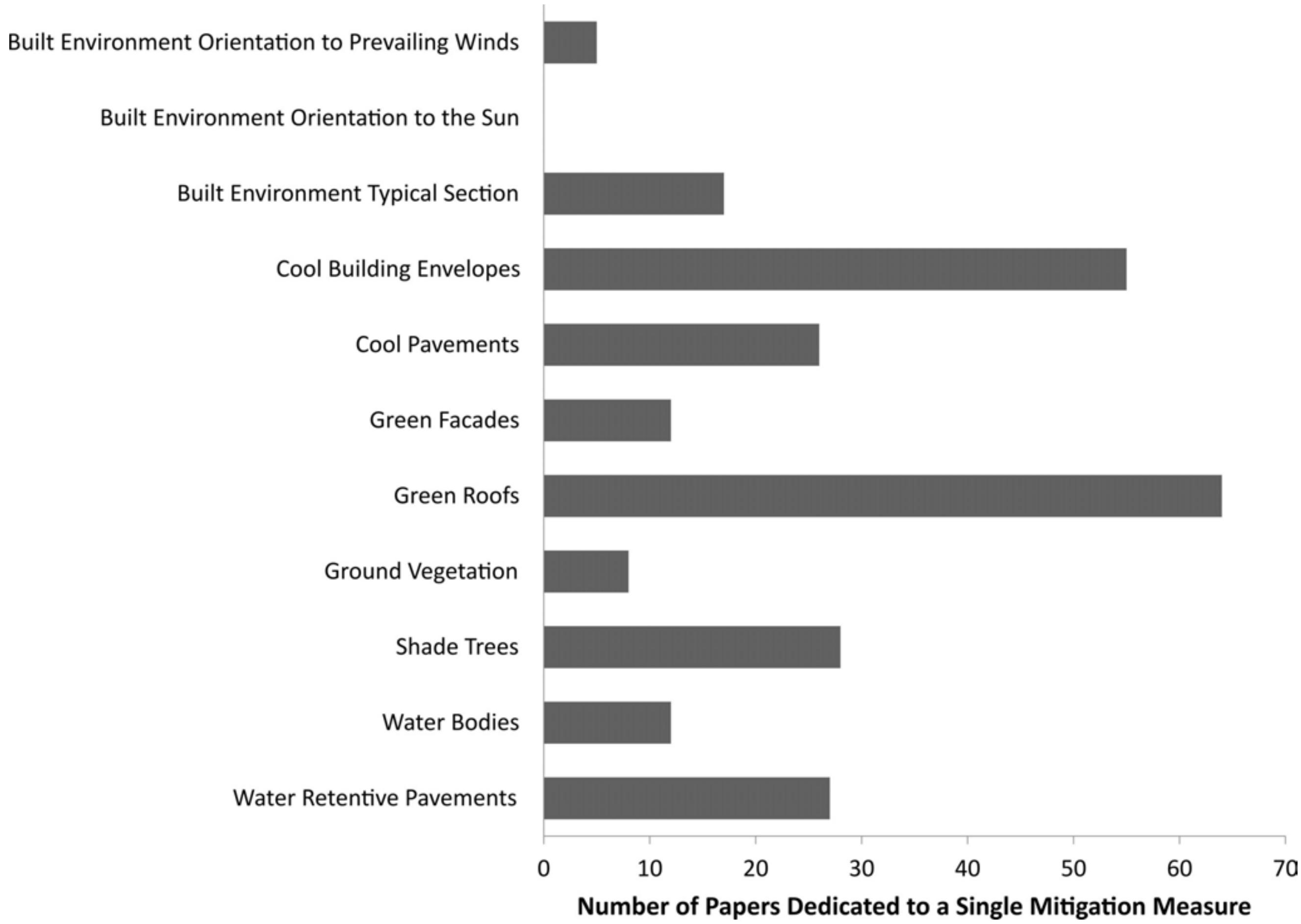

Figure 3. Quantity of research papers on a single mitigation measure published in 2009-2013.

moting UHI mitigation plans without having to spend public money on the actual implementation of such plans, making it a win-win option for local stakeholders.

When examining the number of papers that deal exclusively with a single mitigation measure (Figure 3), two measures (green roofs and cool building envelopes) stand out from the others. In terms of their share in the total papers on specific mitigation measures (Figure 4), water retentive pavements and green facades are likewise much more researched in isolation from other measures. This "isolated" study of mitigation measures, while justified in itself, may be of lesser value for policy makers who are usually requested to choose between several alternatives, each having its own costs and effects. The fact that more than 60% of the repository papers are dealing exclusively with only a single mitigation measure, in addition to the scarcity of cost-benefit analysis of such measures, may thus reveal a "weak spot" in current UHI mitigation research in terms of the applicability of its products to urban decision-making processes and in providing a rigorous scientific basis for assessing the impact and efficacy of competing mitigation strategies.

Another issue arising from analysing current research trends is the relative marginality (18% of the repository papers) of research dedicated to the fundamental components of urban design, namely urban canyon geometry (e.g. street aspect ratio) and orientation of buildings to the prevailing winds and the sun. This marginality may be partly attributed to the relative complexity of analysing and attributing the effects of street geometry to UHI intensity. At the same time, it may also reflect difficulties in the large-scale application of such measures through their integration into urban masterplans, taking in mind the power of economic and political pressures shaping cities, as well as other planning considerations and the complexities involved in transforming the geometry of an existing urban area only for the sake of UHI mitigation.

While our study outlines current research trends and offers some possible explanations for them, we feel that further understanding of the relation between research on UHI mitigation and political implementation of its outcomes is still needed. Because of the reliance of UHI mitigation on actions mandated by governmental or local authorities, it is still important to understand how UHI mitigation research corresponds to the needs, priorities, and limitations of the political domain and to ask whether this relation promotes research on mitigation measures or impedes it. This, in turn, might contribute to the more effective harnessing of research resources towards cooling down cities around the world.

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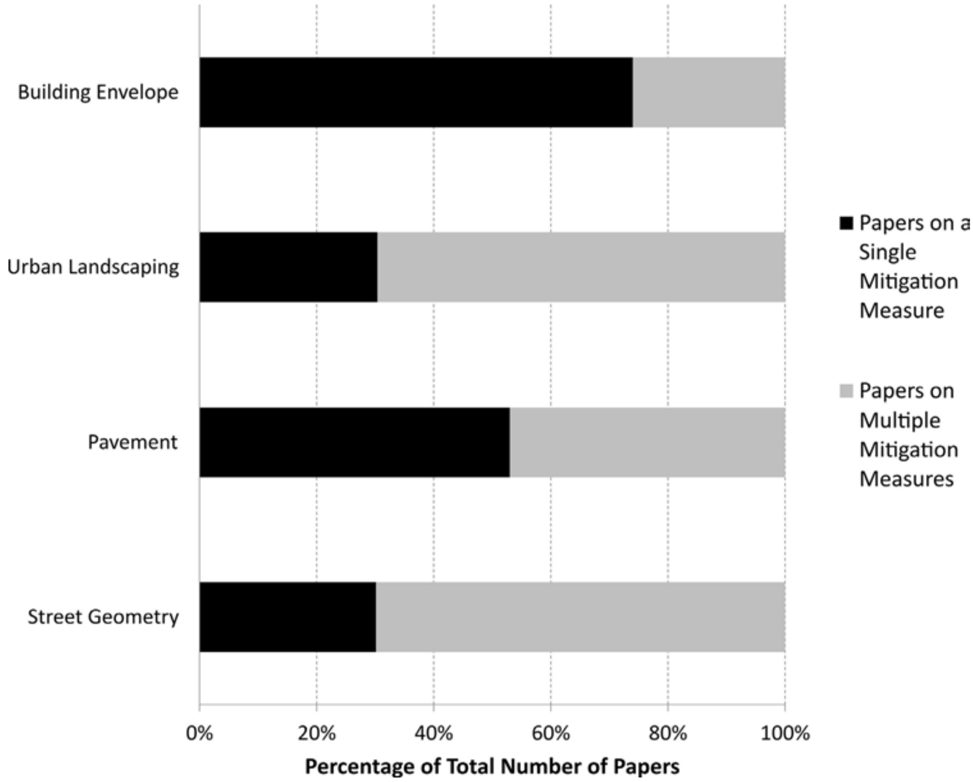

Figure 4. The relation between the number of papers that deal exclusively with a single mitigation measure and the number of papers dealing with multiple mitigation measures (for the years 2009-2013), split according to the main groups of measures.

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Urban Climate Summer School (Romania) – Key Outcomes, Lessons Learned and Future Directions

Summary

The Research Institute of the University of Bucharest (ICUB) recently hosted its first Urban Climate Summer School on August 21-25, 2017, in Bucharest (Romania). The Bucharest Urban Climate Summer School (BUCSS) was jointly organized by ICUB and the Urban Climate Research Center at Arizona State University, Society for Urban Ecology, and Interdisciplinary Center of Advanced Research on Territorial Dynamics (University of Bucharest). The objectives of BUCSS were to provide a comprehensive synthesis of central themes of significance associated with contemporary urban climate challenges. BUCSS was designed to target doctoral students and post-doctoral researchers possessing at least a basic understanding of topical subject matter. The multi-disciplinary spectrum of topics covered ranged from the familiar meteorological and climatological modeling of the built environment (e.g., mesoscale modeling) to emerging themes currently receiving correspondingly reduced attention such as crowdsourcing data (e.g., utility of smartphones) and urban conflict (e.g., causes thereof). Our intent was to illustrate the most pressing issues, highlight evolving concepts, promote discussion of solutions leading to multiple benefits while acknowledging unintended consequences, all the while helping participants gain new skills, perspectives, and initiate relationships that we hope will benefit their future career. BUCSS 2017 hosted 31 participants from 17 countries and 4 continents with a broad variety of academic backgrounds and scientific interests within the urban domain. The four primary areas covered by the 16 invited lecturers included:

1. Modern monitoring of urban environments;
2. Modeling tools used in urban meteorology and climatology;
3. Adaptation and mitigation strategies;
4. Critical linkages among environmental factors and health threats in urban areas.

The five-day event included an in-class mix of lectures, interactive exercises, and field trips. BUCSS concluded with a last day trip to Brașov, intended to provide added social interaction between participants and lecturers. Brașov is a medieval city with a metro-area population in excess of 350,000 inhabitants that is snuggled in the Romanian Carpathian Mountains. Details about this past summer's Urban Climate Summer School, including the Daily Program, Invited Lecturers and accompanying biographical sketches may be found at unibuc.ro/~conference/urbanclimate/.

To provide insight beyond that information which can be found at the above website, and which may be useful for others within the International Association for Urban Climate (IAUC) community considering similar events, BUCSS conveners conducted an anonymous post-assessment survey of all 31 participants (of which 23 filled out responses as of this writing). This survey was geared toward all aspects of the Urban Climate Summer School and will form the basis of forthcoming discussion as well as inform preparation for future renditions of BUCSS. The survey consisted of 22 questions, 14 of which required fill-in responses whose five options ranged from Strongly Disagree to Strongly Agree (see Figure 1 below) to a posed statement, and 8 open-ended questions.

Key Outcomes

The statement geared to measure the degree of overall success of BUCSS is presented in Figure 1. Twenty of the 23 participants that responded to the survey (87%) indicated they strongly agreed with the statement that they "would recommend this program to others interested in research within the urban climate domain". Two of the respondents (8.7%) agreed with the statement and one (4.3%) was neutral. The high degree of agreement/strong agreement (22 out of 23 respondents: 95.7%) provides confidence that the overall objective of BUCSS was met and successfully delivered.

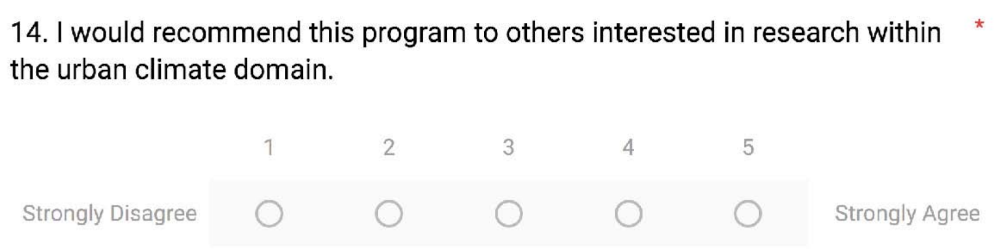


Figure 1. Questions 1-14 from the post-assessment survey required the participant to select the degree to which he/she agrees with the statement indicated.

In addition to quantitative measures highlighting the overall success of BUCSS, as determined by the participants (it is important to note that Lecturers were not asked to fill out the post-BUCSS survey), one of the open-ended questions attempted to draw out individual, independently determined, characterizations. The objective of this question was to seek participant response that could not be categorized using formal distinctions that are part and parcel of fill-in responses with predetermined options. Therefore, this particular question asked participants to describe BUCSS using their desired three words. Figure 2 illustrates the resultant word cloud obtained from participant entries and indicates a broad variety of descriptors ranging from "eye-opening" to "instructive". The highest frequency of words entered included "interesting", followed by "broad", "inspiring", "informative" and "useful".

In addition to ascertaining the degree of overall success from a quantitative and descriptive perspective, the conveners devised a number of survey questions intended to seek assessment of individual aspects of BUCSS. Rather than focusing on the overall success of the Urban Climate Summer School, this set of questions included a variety of inquiries ranging from the quality of food served during lunches and the principal social dinner, to facility/venue quality, to the appropriateness of timing of relevant communication from the conveners leading up to the event. To succinctly summarize these elements, one of the statements queried whether participants believed they received a good value for their workshop fee of 100 euros (i.e., everything ranging from the quality of instruction to the food and service). Of the 23 respondents, 18 (78.3%) strongly agreed with the following statement: I received a good value for the tuition charge of 100 euros. Four participants agreed with the preceding statement (17.4%) and one participant (4.3%) was neutral. The significance of this question cannot be overemphasized as the program consisted of a suite of events intended to advance intellectual scholarship, promote dialogue between lecturers and participants through interactive exercises, and encourage social interaction that stimulates critical thinking and forges professional relationships, all without a prohibitive financial cost of attendance.

Figure 2. Word cloud obtained from open-ended participant response.

Lessons Learned

While the BUCSS objectives were considered successfully accomplished, there are opportunities to improve that were communicated by the participants and will serve to refine future versions of the Urban Climate Summer School. For example, the assessment of the duration of the 90-minute lectures varied considerably. While 56.5% (13 out of 23) agreed or strongly agreed with the following statement, 21.7% (5 out of 23) disagreed or strongly disagreed: The duration of the lectures was excellent. Five (21.7%) of the responses were neutral. This raises important concerns regarding agenda development, the relative mix of traditional lectures and hands-on interactive sessions, and their scheduling. One of the more common responses to our request for "additional comments and suggestions" was (underlined emphasis added by authors):

More activities and group work would be nice, *especially at the beginning of the week*, to get to know each other better (ice breaking).

Indeed, the initial interactive session, which was highly regarded by participants, was not held until day 3 of the event. Enhancement of social cohesion among participants could have been aided had such "ice breaking" occurred during the initial day.

The initial two days of the event were composed of introductory topical lectures as well as examination of two of the academic focus areas (i.e., modern monitoring of urban environments and modeling tools utilized; see Summary). While the lectures were informative and well received, future versions of BUCSS will benefit from the advice of participants suggesting a stronger mix of activities, especially during early portions of the Summer School. All participants provided valuable suggestions on how to improve the timing of individual events, but three key responses to our request for "additional comments and suggestions" stood out:

1. Keep half a day or so for a poster session for the participants. The 2-minute introductions were great, but it would have been nice to have a poster session afterwards to get more details about the research of the participants.

Figure 3. BUCSS lecturers and participants enjoying their time in Brașov (Romania), which was the culmination of the five-day Urban Climate Summer School.

2. To be focused on more application classes, e.g., to have one lecture at the beginning of the day and after that, practical classes until the end of the day.

3. It would have been interesting to know a bit more about the work and projects of the participants as they are all in the field of urban climate.

The timing of the activities (e.g., one of the participants stated that "I would like to see something that is more a two-way interaction, that involves lecturers and students (e.g. C. Iojă's talk) or that stimulates discussion a bit more.") is one component that requires attention in the delivery of this and similar events. It is therefore not sufficient to simply include a mix of traditional and interactive events, but also to consider their scheduled timing in the program agenda.

Nevertheless, the principal objective of BUCSS, intended to illustrate the most pressing issues and highlight evolving concepts was met. This was effectively summarized by one of the participants:

"I think the strength of this summer school is the wide range of topics that are covered. If I want to learn a technique I already know of, I can do it reading the papers – so there is no need to go in a lot of detail explaining techniques, [as] I do not think it would be very useful. For me, this summer school was all about learning about all the things related to urban climate I did not know about yet. Now it is time to sit down, have a look at the slides again and read those resources highlighted by the lecturers to get more detailed knowledge!"

This of course leads to important consideration and subsequent decisions that need to be made by the conveners (of BUCSS and others in the IAUC community that are considering similar events). What is the value added by meeting the ever-growing demands of multi-disciplinary challenges relative to focused subject rigor that requires hands-on and topically motivated learning and skills building? Outside of a one-month Summer School (which has practical implications for lecturers and par-

Figure 4. BUCSS lecturers and participants posing for a group image in the Brașov Council Square (Brașov, Romania) during the last day of the Urban Climate Summer School.

ticipants alike) that can sensibly cover both aspects, the relative mix of topic coverage, and the actual themes covered, requires consideration. Indeed, when asked "What particular urban related topics would you like to see covered in depth in the future?" 7 out of 22 respondents (one participant did not enter a response), more than any other sub-field, stated they desired some form of improved comprehension associated with modeling (e.g., mesoscale climate modeling).

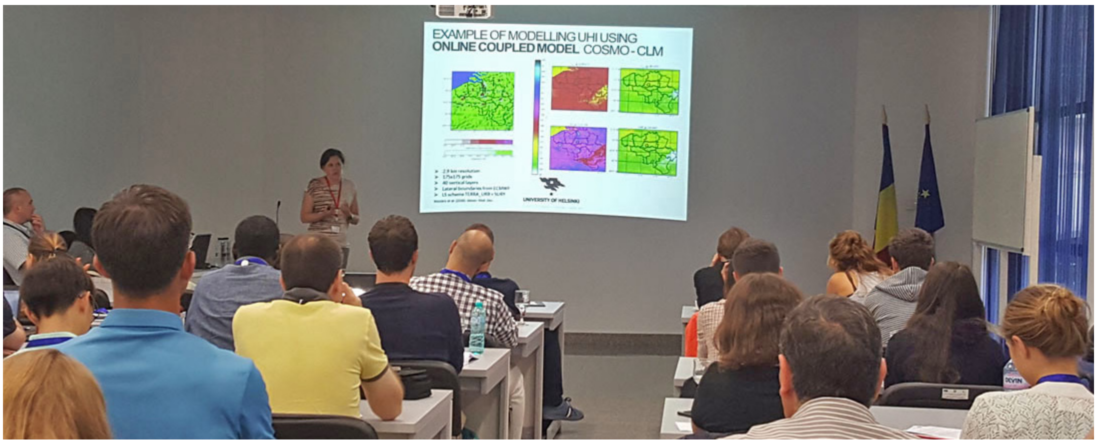
Future Directions

The post-BUCCS survey provided an invaluable opportunity to retrospectively consider key outcomes, lessons learned, and act on future directions of the Urban Climate Summer School. The survey-oriented approach was an invaluable mechanism in refining and improving upon this initial version of BUCSS, and we highlight this method as indispensable when attempting to advance the delivery of similar endeavors (e.g., Summer Schools or Workshops, Conferences, etc.). The valuable feedback received is fundamental for the launching of next year's Urban Climate Summer School. We are committed to maintain the excellence of the scientific lectures, the vibrant workplace atmosphere, and to enhance participant involvement through daily research activities. Notably, broad diversity of the group will be maintained, and we will make every effort to facilitate the participation of students from less developed countries. The challenges posed and lessons learned offer four key avenues of opportunity for the Bucharest Urban Climate Summer School of 2018 and we hope that our lessons learned will be of mutual benefit to the IAUC community at large:

1. Maintain focus on topic(s) of high relevance at the forefront of scientific understanding and deliver concrete skills and techniques to participants;
2. Enhance interaction among participants and facilitate the promotion of their research activities through active learning instruments;
3. Create a regional interest for participation, while maintaining global coverage;
4. Continue a collegial and professional atmosphere through organization of field activities and social events that promotes future cooperation in the field of urban climatology.

Left: BUCSS participants and lecturers are "all ears" during the field trip to the Văcărești Nature Park, one of the biggest natural urban parks in Europe. Vlad Cioflec, one of the founders of the park and a herpetologist by training (facing the camera and immediately to the right of the poster board), explains the need for active management of vegetation and wildlife species within the park (e.g., snakes). Such strategies, amongst others, increase biodiversity in plant and animal life and help to provide an optimal balance between nature and humans. Right: Vlad describes his 10-year battle with authorities, officials, and poachers, as he and his colleagues embarked upon a seemingly impossible mission. Recently, Văcărești area was declared a Nature Park in Bucharest, making a dream come true for Vlad and his crew. This will prevent development in the area and promote the region as a biodiversity hot-spot. His efforts and perseverance in making his dream come true, against overwhelming odds, provided a sense of inspiration.

BUCSS participants immersed in role-playing. Left: Activities focused on "Environmental conflicts in urban areas", designed by Dr. Iojă. Everyone was assigned a role in the city council (e.g., mayor, private landowner, Director of the Environmental Protection Agency, etc.) and the goal was to agree upon a future land use of abandoned urban land (mixed, protected area, sports center, urban park, etc.). The exercise creatively illustrated the importance of negotiation, advocacy and mutual understanding in trying to reach a unanimous agreement. Right: Activities focused on how a city administration should install urban green infrastructure to adapt to climate change. A great exercise designed by Dr. J. Breuste, exposing the complexity of decision making when finding an approach to define vulnerable areas and areas of high temperature regulation capacity by vegetation for a whole city.



Dr. Leena Järvi explaining the "tools for modeling the bi-directional relation between urbanization and climate extremes" in front of an attentive BUCSS audience.

Participants, lecturers, and organizers of the Bucharest Urban Climate Summer School (2017).

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Insights from more than ten years of CO_2 flux measurements in the city of Basel, Switzerland

Introduction

Urban micrometeorology has a long tradition in Basel, Switzerland. Flux tower measurements started as early as in 1992 with the installation of a 15 m high tower on the terrace at the 5th floor of the former location of the institute of Meterorology, Climatology and Remote Sensing of the University of Basel (MCR) at Spalenring (BSPA in Fig. 1). Though the site was far from ideal (the building had a pitched roof and the chimney was pretty close to the sensors…) and latent heat flux was only sporadically measured, the tower was an important symbol for the institute's activities and attracted several urban climatology and turbulence projects.

In these early years, the main research topic was the vertical structure of turbulence in and above the urban canopy layer, also strongly influenced by the early work of M.W. Rotach in Zurich (e.g. Rotach, 1993a,b). With the help of Rotach's group, a 51 m high antenna tower (BMCH in Fig. 1) was equipped with sonics at three levels (z/h = 1.5, 2.1 and 3.2) on a 21 m high building at Messe Schweiz (BMCH in Fig. 1) between July 1995 and February 1996. Results of this campaign described for the first time the vertical dependence of velocity spectra in the urban roughness sub-layer (RSL) by the analysis of a large number of simultaneously measured multi-level turbulence time series (Feigenwinter et al., 1999). This study also confirmed that profiles of velocity variances and spectra of wind components could be parametrized within the framework of Monin-Obukhov similarity theory (MOST), if local scaling is applied. Feigenwinter and Vogt (2005) analyzed the same dataset with respect to profiles of coherent structures and showed that organized motions are not only a feature of vegetation canopies but can also be detected over rough urban surfaces.

With BUBBLE (Basel UrBan Boundary Layer Experiment) in 2002, Basel and MCR became definitely established in the Urban Climatology community. Despite no common funding, Roland Vogt and Andreas Christen accomplished to bring world leading urban climatologists to Basel for one of the longest and most detailed urban boundary layer programs (Rotach et al., 2005), including flux towers at Spalenring and Sperrstrasse (BSPA and BSPE in Fig. 1). The open data policy of BUBBLE led and still leads to numerous publications using the BUBBLE dataset, notably also for the validation of LES and CFD models (e.g. Gartmann et al., 2012). Christen and Vogt (2004) provide a comprehensive overview of the main findings of BUBBLE in terms of the urban energy and radiation balance. Within the framework of BUBBLE, research of MCR also started to focus on profiles of urban CO_2 concentration and fluxes. Vogt et al. (2006) tested the applicability of MOST to CO_2 flux-gradient relationships and found acceptable agreement for the top level at the upper boundary of the roughness sub-layer at 2 z_h (e.g. Feigenwinter et al., 2012). As a main conclusion they stressed the need for detailed analysis of surface properties (i.e. vegetation fraction) and anthropogenic CO_2 emissions (traffic, combustion) in the source area of flux towers when comparing with other urban studies.

As a consequence, research in Basel further concentrated on the analysis of CO_2 fluxes and concentrations with respect to the underlying urban structure. Simultaneously with the movement of MCR in 2003 to its present location, the flux tower from Spalenring was re-installed on the roof of the new building at Klingelbergstrasse (BKLI). An additional flux tower was installed on a slim 36m high building at Aeschenplatz (BAES) in 2009. In the following, the main findings from three papers analyzing data from the two flux towers BKLI and BAES are discussed, considering spatial scales from street canyon to neighborhood and temporal scales from months to years to decades.

Basel flux towers

Figure 1 shows the locations of active (BKLI and BAES) and former flux towers (BSPA-Spalenring, BSPE-Sperrstrasse and BMCH-Messe Schweiz) in the context of a digital object model (DOM) for buildings and trees. Footprints are calculated by the Kormann and Meixner (2001) algorithm and show the annual mean flux footprint of the respective flux tower. All flux towers were and are equipped with state of the art Eddy Covariance (EC) systems including an open path infrared gas analyzer (IRGA) and measurement devices for extended standard meteorology (temperature, humidity, wind and radiation (4 components)). At the BKLI site, numerous additional measurements are performed, including e.g. measurement of direct and diffuse radiation. Up to date instrumentation of BKLI and BAES flux towers is described in detail in Schmutz et al. (2016) and Lietzke et al. (2015), respectively; for further details about BMCH, BSPE and BSPA sites and instrumentation please refer to the respective papers.

The street canyon view

For the study of Lietzke and Vogt (2013) an additional 18 m high flux tower (B) with 5 levels of turbulence measurements was installed at the center of the adjacent

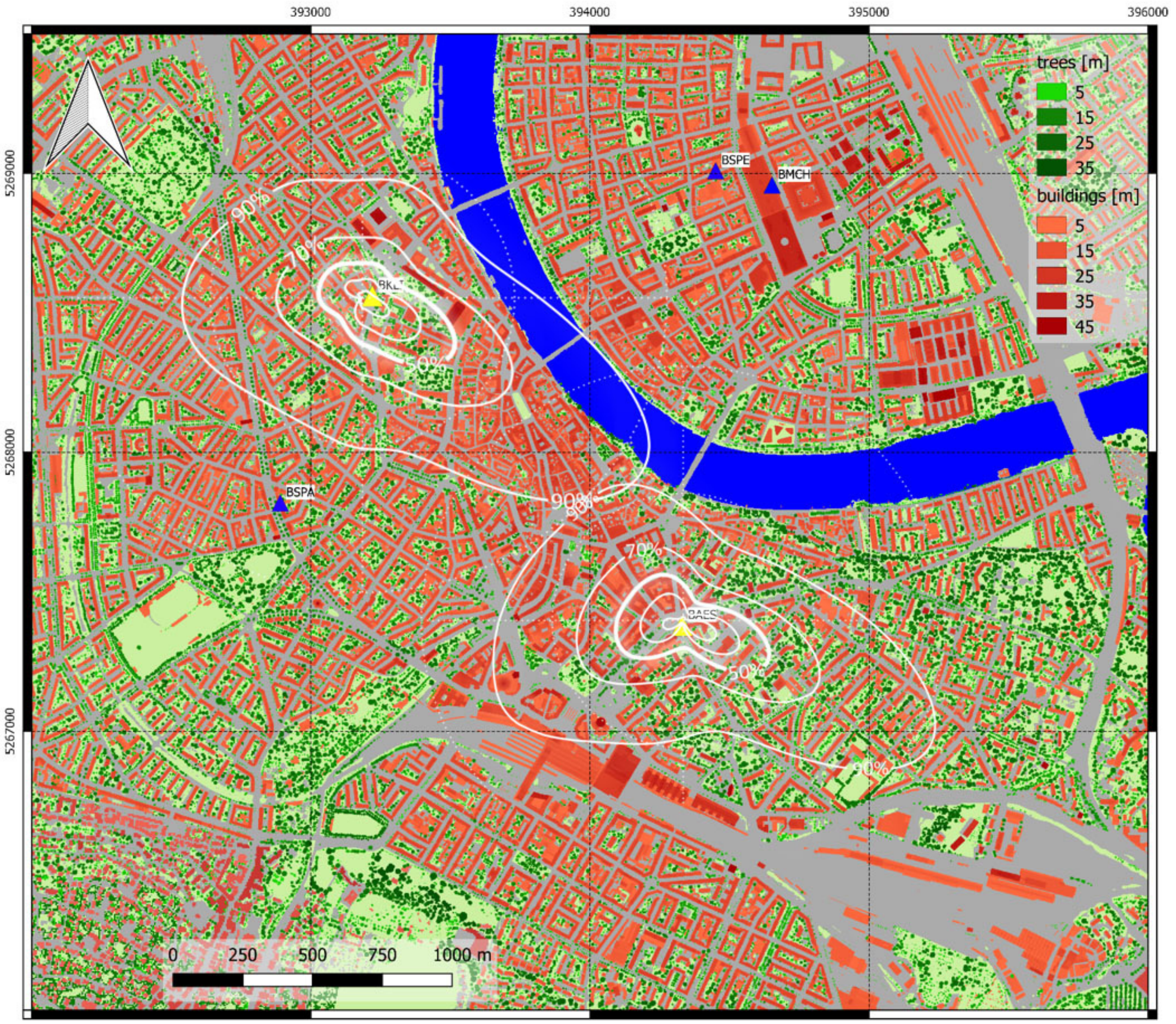

Figure 1. BASEL digital object model DOM with building heights (red), tree heights (green) and flux towers: former (blue) and active (yellow) towers with mean annual footprints. Light green areas refer to low vegetation (lawn), gray areas refer to impervious surfaces (roads, plazas) and railway tracks. Coordinate system is UTM 32N (EPSG: 32632).

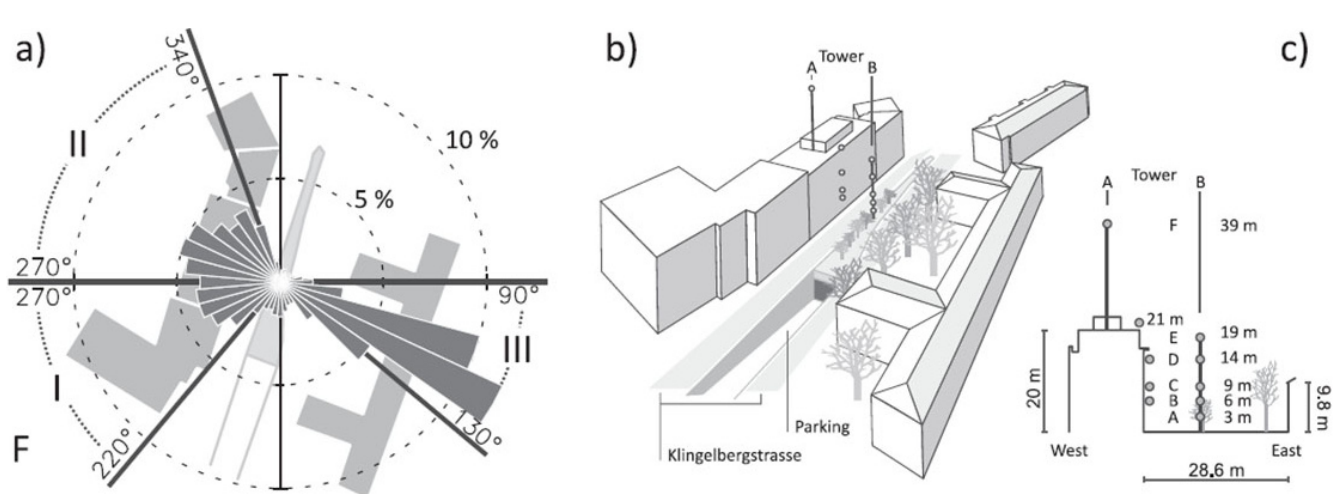

Figure 2. (a) BKLI Wind rose at 39 m (F) and plan area of the surrounding buildings. (b) 3D-view from the south. (c) cross section at the tower location (adapted from Lietzke and Vogt, 2013)

street canyon to BKLI flux tower (A), providing a full-year dataset for 2010. Figure 2 gives an overview of the experimental setup. The street canyon orientation (20°) is approximately perpendicular to the main wind directions. As a result, in-canyon air flow forms a vortex that shows a corkscrew-like lateral motion, the direction of which is dependent on the direction of the wind above. Eastern (90-130°) and western winds from less than 270° lead to northward flowing air masses inside the canyon whereas western winds from directions greater than 270° result in a southwards directed flow, as shown in Figure 3. The flow regime of wind coming from the area west of the site is expected to be 'skimming flow' (Oke, 1987) as the underlying building structure is relatively dense. The street canyon itself has a non-ideal cross section. The height to width ratio is 0.7 for the building to the west and 0.34 for the building to the east. Thus, the local flow regime for the canyon for east wind situations might be characterized as 'wake interference flow' (Oke, 1987).

CO_2 concentrations

Daytime in-canyon distribution of CO_2 concentration depends heavily on these vortex structures and traffic emissions. Mean diurnal courses of CO_2 concentrations are comparable to that of other cities but spatial differences reveal some interesting patterns. Basically, the concentration level is coupled to the height of the urban boundary layer. Traffic as the dominant CO_2 source in the street canyon has only a minor influence on absolute concentrations at all heights. However, traffic emissions result in a superimposed effect that is generally stronger closer to the ground. This fact is represented by the vertical differences between the bottom or top of the canyon and 39 m as shown in Figure 4. These differences reflect the diurnal course of traffic density well and also allow for a clear distinction between working day and weekend courses.

CO_2 fluxes

Traffic is obviously the determining factor for CO_2 fluxes (F_C) since mean diurnal courses of traffic density and $F_C(19)$ in Figure 5 have almost identical characteristics. In accordance with traffic density, $F_C(19)$ shows distinct working day/weekend differences and the one hour shift in morning traffic increase during periods with/without daylight saving time. Strong linear correlations support the assumption of a distinct relationship. We are well aware that $F_C(19)$ is measured in the roughness sub-layer (RSL) and the influence of individual roughness elements cannot be avoided. A height dependency of turbulent fluxes in the urban canopy layer (UCL) was expected and the sensor at 19 m was intended to capture the influence of the traffic of this busy street and to see how far up this influence reaches. The excellent qualitative agreement of the $F_C(19)$ flux patterns with the diurnal patterns of traffic confirms this approach and demonstrates the applicability of the EC method for such a specific purpose. Obviously sufficient mixing blends the traffic emissions to a representative flux.

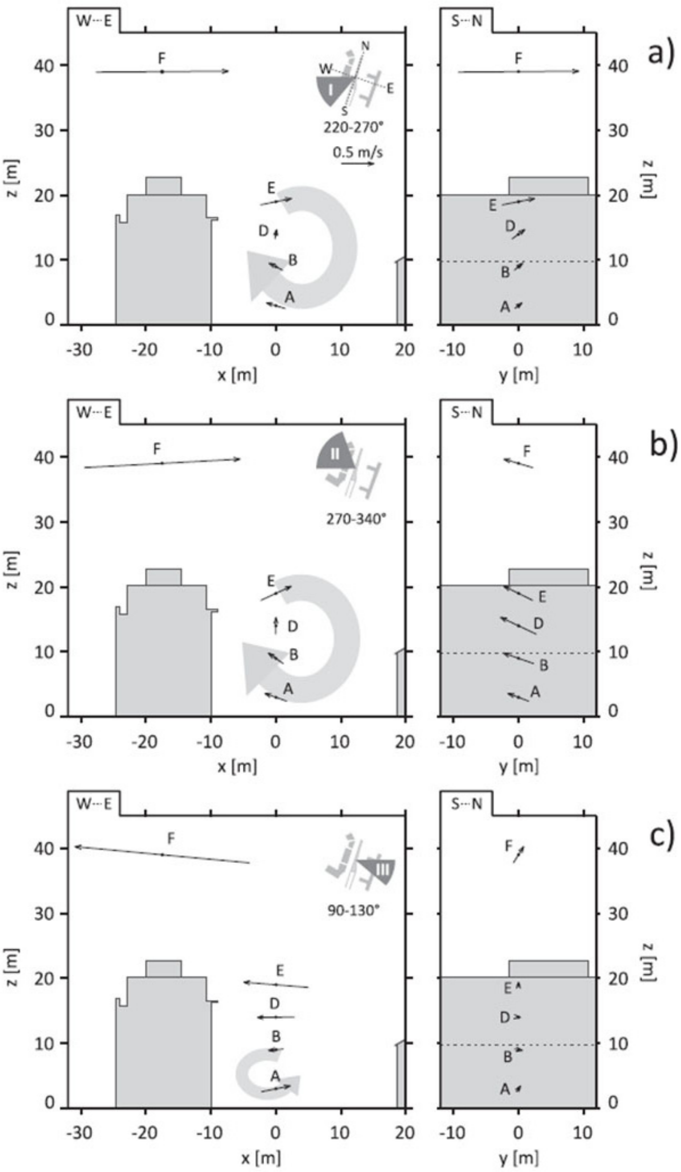

Figure 3. Cross (left column, W-E) and lateral (right column, S-N) sections of the street canyon for three different ambient wind sectors (a, b & c). Arrows depict average wind vector components in the respective planes at the measurement locations A, B, D, E and F. Typical expected vortex structures are shown for each wind sector (adapted from Lietzke and Vogt, 2013).

As a first consequence, it can be argued that urban CO_2 fluxes at a height of approximately 2 z_h are extremely sensitive to the placement of the tower. A few tens of meters of horizontal displacement may lead to totally different diurnal regimes depending on prevailing wind directions combined with the given canyon orientation and configuration. The authors therefore stress the need for reliable source area determination in order to compare flux towers at different locations.

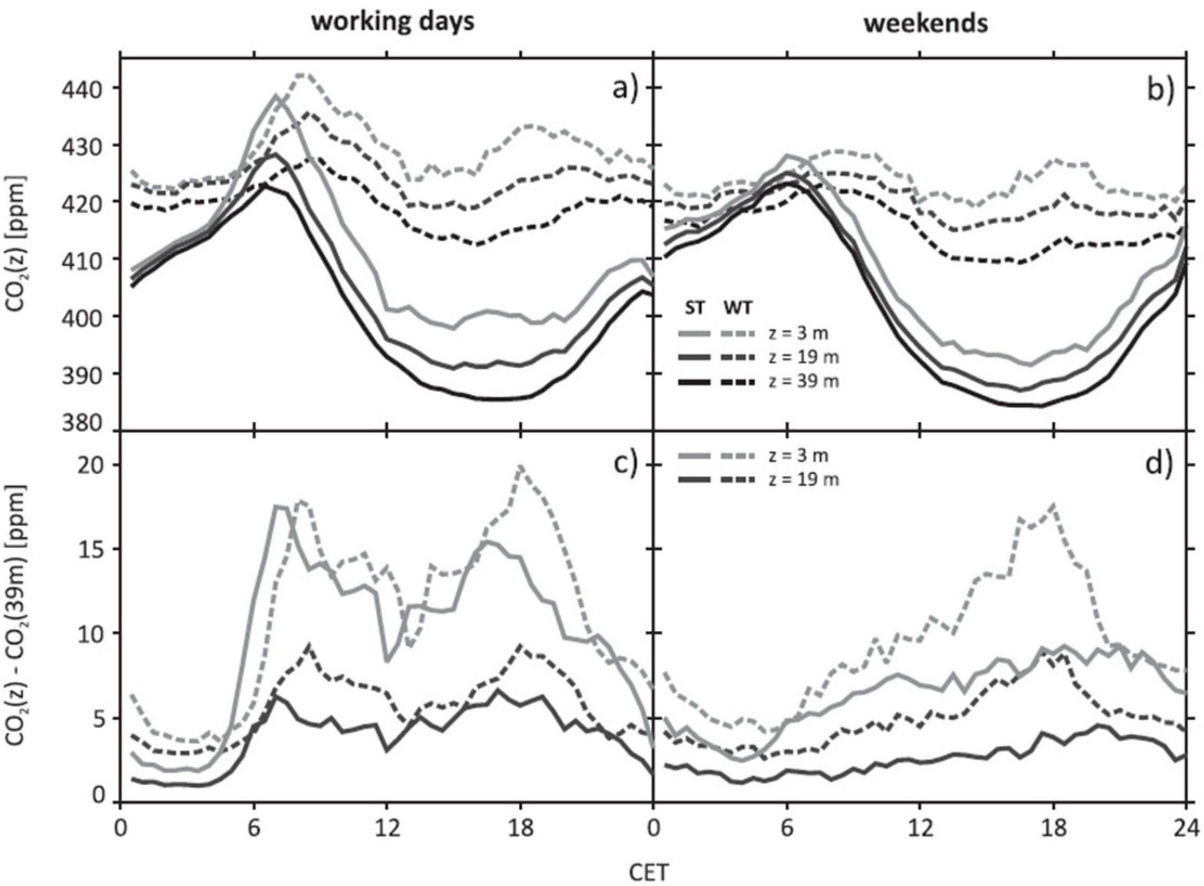

Figure 4. Mean diurnal courses of CO_2 concentrations at two heights in the canyon center and above the roof for working days (a) and weekends (b). Data is separated for summer-(ST) and wintertime (WT). (c) & (d): Corresponding differences relative to top level (adapted from Lietzke and Vogt, 2013)

The neighborhood view

Lietzke et al. (2015) analyzed the controlling factors responsible for the variability of urban CO_2 fluxes based on a 4-year dataset of Basel flux tower BAES. In their study the authors provide a review of more than 40 urban studies trying to find a common relationship between CO_2 flux, traffic density and land cover fraction (Figure 6). Despite the huge uncertainties resulting from non-standardized methods for measurement procedures (reference height, tower location, data processing) and for determination and classification of surface characteristics, even the greenest locations with high vegetation fractions show a positive CO_2 budget and fossil fuel emissions (traffic and heating related combustion) have a strong influence on the size of CO_2 fluxes.

In order to make results from different locations and different cities better comparable, the authors for the first time introduced the concept of "expected fluxes" eF_C based on the sectoral analysis of F_C. Ideally a dataset provides an equal representation of each sector, which is never the case in the real world. The method is based on the gap filling method with mean diurnal cycles (MDC) (e.g. Järvi et al., 2012), where missing F_C data are replaced based on a set of MDC for the existing data. Each MDC accounts for different conditions (e.g. season, working days/weekends, wind sectors, etc.). Sectoral eF_C is derived by splitting F_C into nine sectoral datasets and filling the missing values with MDC data derived for the respective sector. The average of all sectoral eF_C is the average expected flux and the sum of all sectoral *eNEE* ("Net (urban) ecosystem exchange") is the average expected *eNEE*, respectively. eF_C as an up-scaled measure is expected to give a more accurate average representation of the heterogeneous surroundings than F_C as the latter represents only a patchwork of single, temporally restricted and wind direction dependent images of the surroundings.

Relating sectoral eF_C instead of F_C to urban surface fractions of buildings and vegetation results in a better agreement (also with data from other studies), as shown in Figure 7.

Provided sufficient data availability (EC fluxes, Land Use/Land Cover maps (LULC), morphology, urban form, etc.) the concept of eF_C and *eNEE* may be of help for the interpretation of measured carbon fluxes at other urban sites, especially those surrounded by areas with different emission characteristics and unequally distributed wind directions. As eF_C relies on statistical up-scaling, its application is restricted to long-term measurement sites. An interesting option for future applications would be the combination with LCZ classification (Stewart and Oke,

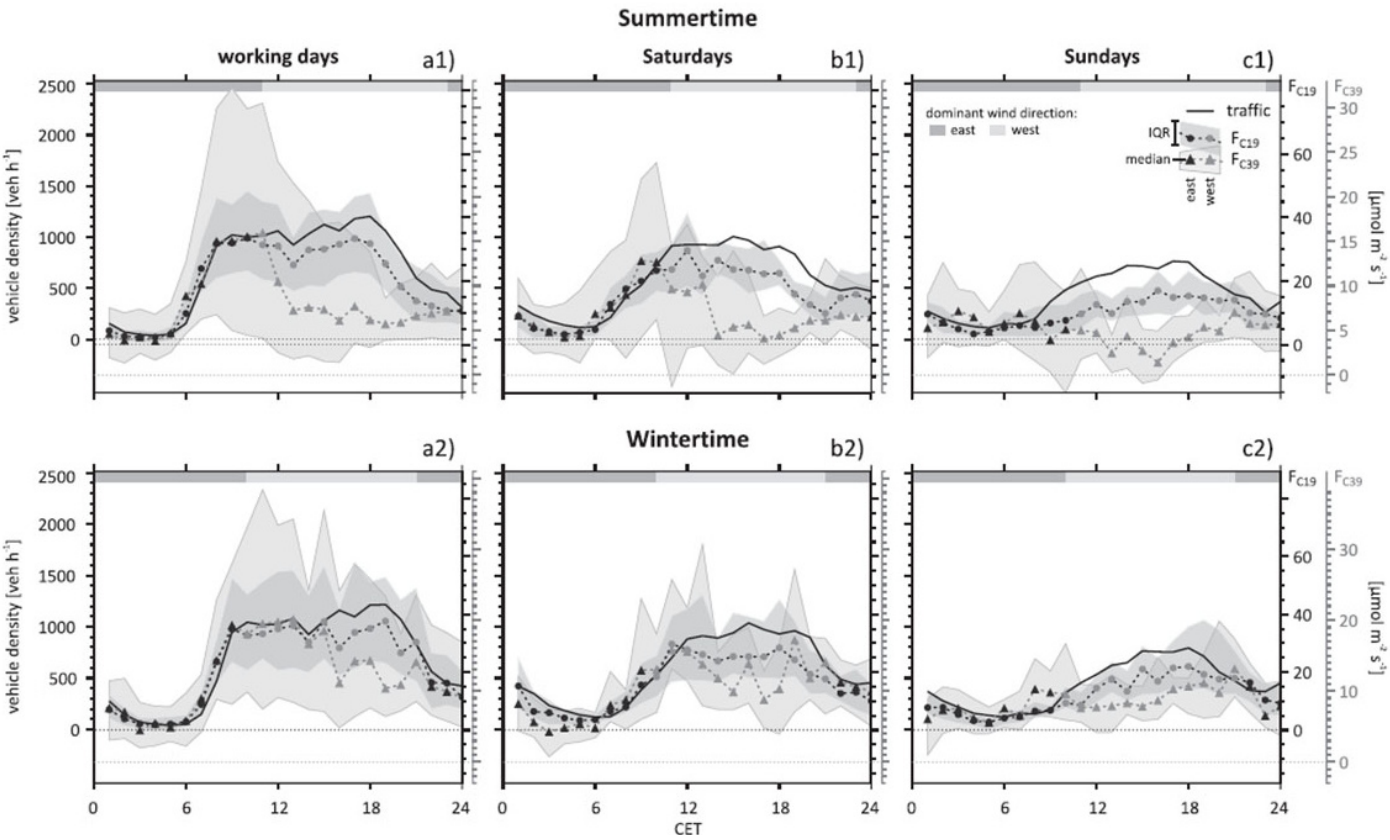

Figure 5. Average diurnal courses of vehicle density (black line), F_C(19) (circles) and F_C(39) (triangles) for ST (upper row) and WT period (lower row). Hourly averaged median data for (a) working days, (b) Saturdays and (c) Sundays. Shaded areas represent the interquartile ranges. The light gray bar at the top of each plot denotes > 50% winds from western directions (20-200°), the dark gray > 50% from eastern directions (200-20°). Correspondingly, F_C values measured under west wind (east wind) influence are marked with lighter gray (darker gray) symbols (adapted from Lietzke and Vogt, 2013)

2012) which could lead to a more standardized implementation.

The longterm view

After moving the flux tower from BSPA to its current location at Klingelbergstrasse BKLI in 2003, a lot of effort was put into maintenance work and sensor calibration. Numerous recalibrations of the EC system as well as several wind tunnel experiments with the sonic anemometer have been performed (Vogt & Feigenwinter, 2004), which made it possible to run the EC system without considerable gaps up to the present day, covering almost 14 years of continuous flux data. Schmutz et al. (2016) present results from the first decade of CO_2 flux measurements, which is the longest urban CO_2 flux time series currently published in literature.

Decadal trends of CO_2 flux and concentration

Comparing the CO_2 concentration at BKLI to regional background concentration records from Global Atmosphere Watch (GAW) stations Schauinsland (SAL, 40 km north of BKLI, 1205 m asl) and Jungfraujoch (JFJ, 120 km south of BKLI, 3580 m asl) reveals good agreement of the data in terms of seasonal patterns and long term trends (Figure 8). At all three sites an average linear trend near 2.0 ppm y^{-1} was calculated, which is in good agreement with results reported in the IPCC report 2013 (IPCC, 2013) derived from Mauna Loa and South Pole data. The seasonal course of the CO_2 concentration is mainly shaped by the varying photosynthetic activity of the vegetation. However, the average concentration level is around 10 ppm higher in the city compared to the reference sites. Interestingly, the coupling between local and background concentration follows a hysteresis, whereas the winter peak is delayed by up to three month and the summer peak by around one month at JFJ and SAL (Figure 9). This shows the time needed to mix the signal of the ongoing source and sink processes within the boundary layer into the lower troposphere during stable conditions in wintertime and convective conditions in summertime.

In order to analyze the long-term trend of F_C, the concept of "expected fluxes" introduced by Lietzke et al. (2015) was refined and further developed in Schmutz et al. (2016). The use of moving look-up tables increases the statistical robustness and eliminates the need of multi-year time series for the calculation of what is now called horizontal averages (denoted by angle brackets). While

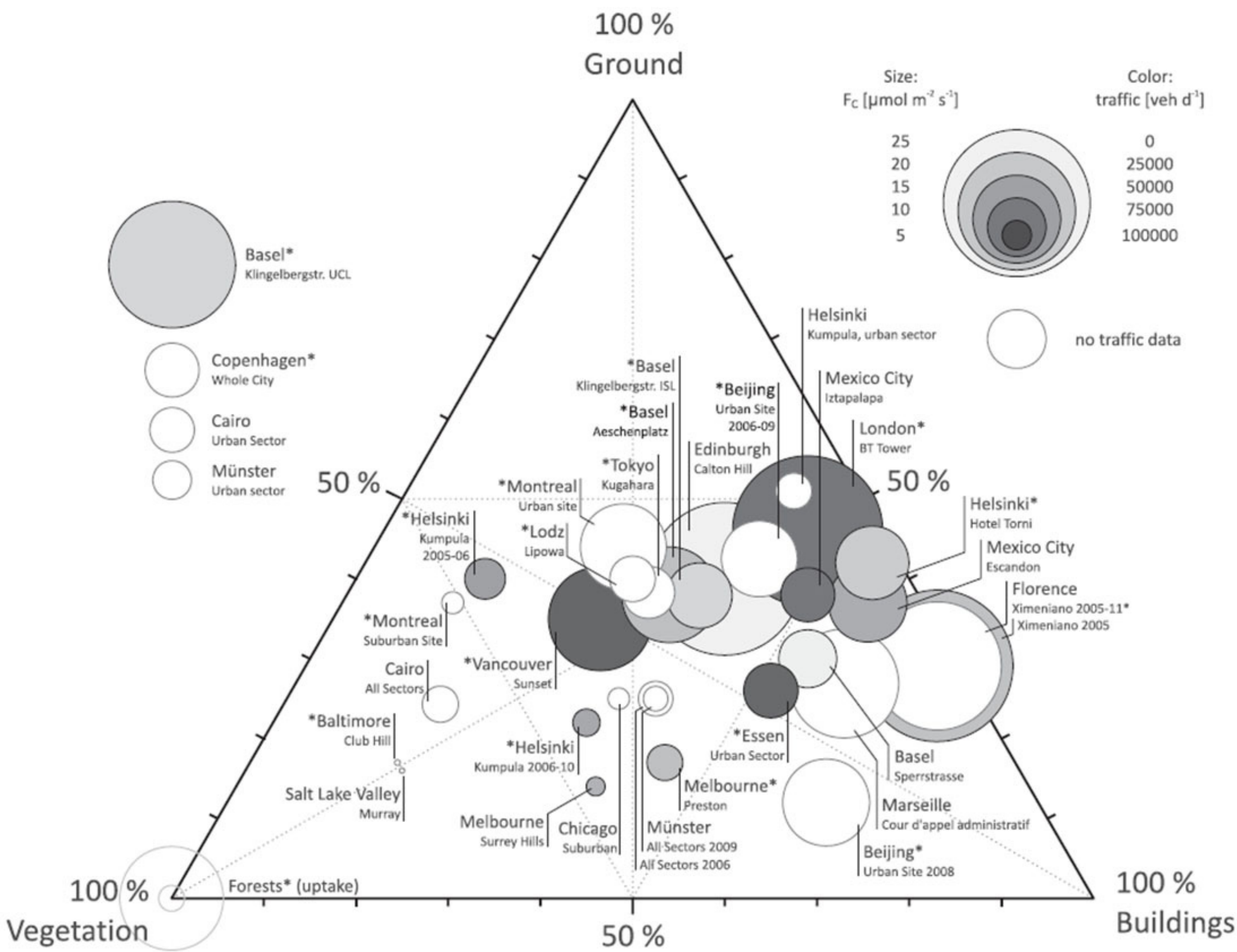

Figure 6. Ternary plot of selected urban studies. The centre point of each circle gives the plan area fractions. The size represents F_C and the gray tone represents the reported traffic density if available in vehicles per day (see legend). An asterisk indicates that the F_C data coverage was at least one whole year. Where only vegetation cover was listed, the remaining fraction was assumed to be equally split between buildings and ground. For circles outside the plot no plan area fractions were reported. Refer to Tab. 1 in Lietzke et al. (2015) for full references. (Adapted from Lietzke et al., 2015)

varying wind systems may considerably superimpose the measured CO_2 fluxes by advecting the signal of varying sources over the course of time, horizontal averages mostly eliminate this effect and reveal the effective variability and long-term trends at the measurement site. F_C at BKLI was thereby reduced by 5 % between 2005 and 2014, which can be explained by the reduced traffic volume around BKLI due to new city bypass roads. Still, the year-to-year variability of F_C is much larger than the calculated linear trend (compare Fig. 8), which makes it difficult to further discuss long-term tendencies of F_C at BKLI. Despite the large inter-annual variability, a lower limit of F_C was found around 5 µmol m^{-2} s^{-1} consistent over the entire measurement period. This implies a base-load of the urban metabolism during minimal source activity in early morning, especially in summertime, introduced by e.g. human respiration and the fact that main sources like traffic or heating activity are never zero.

Outlook

A short history and the most recent research from the flux towers in Basel, Switzerland, were presented. As the value of long-term flux measurements is evident, also considering the enormous efforts and investments in long-term infrastructure and monitoring programs like ICOS (www.icos-ri.eu) and NEON (www.neonscience.org), we are confident to find future funding to continue our high quality measurements in Basel. Long-term EC measurements in urban environments are essential for the assessment of urban climate models and remote sensing applications. Currently, the Basel flux towers BKLI and BAES provide invaluable data for the evaluation of satellite derived sensible and latent heat fluxes (Feigenwinter et al., 2017) in the frame of the Horizon 2020 URBANFLUXES project (Chrysoulakis et al., 2017; www.urbanfluxes.eu). Since the number of urban flux towers is still increasing and a lot of the permanent urban flux tow-

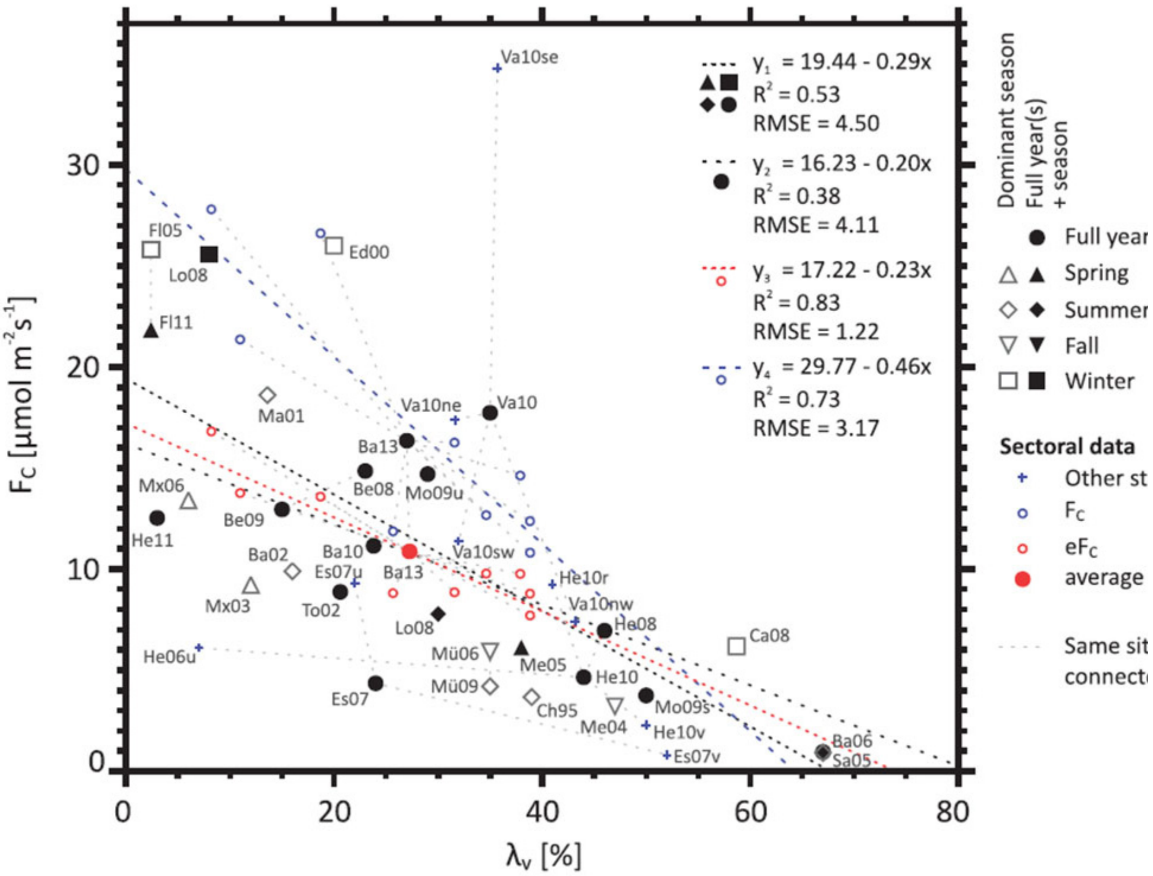

Figure 7. Average F_C as a function of vegetation fraction λv for selected studies. Open symbols define the season of measurements. Filled circles represent measurements of one or more full years, all other filled symbols stand for full years plus an additional part of the respective season. Sectoral average F_C and eF_C (derived from *eNEE*) of this study are denoted by the small open circles. Regression equations (y1-y4) are for the respective groups of data as labelled. Other dashed lines connect different results from one single site (e.g. for sectors or years) and show site-specific variability. (Adapted from Lietzke et al., 2015)

ers meanwhile have time series of more than a decade, it may be time for a refreshment of the URBAN FLUX NETWORK (see also IAUC Newsletter from June 2009), e.g. in form of a La Thuile–like synthesis dataset (http://fluxnet.fluxdata.org/data/la-thuile-dataset/).

Acknowledgements

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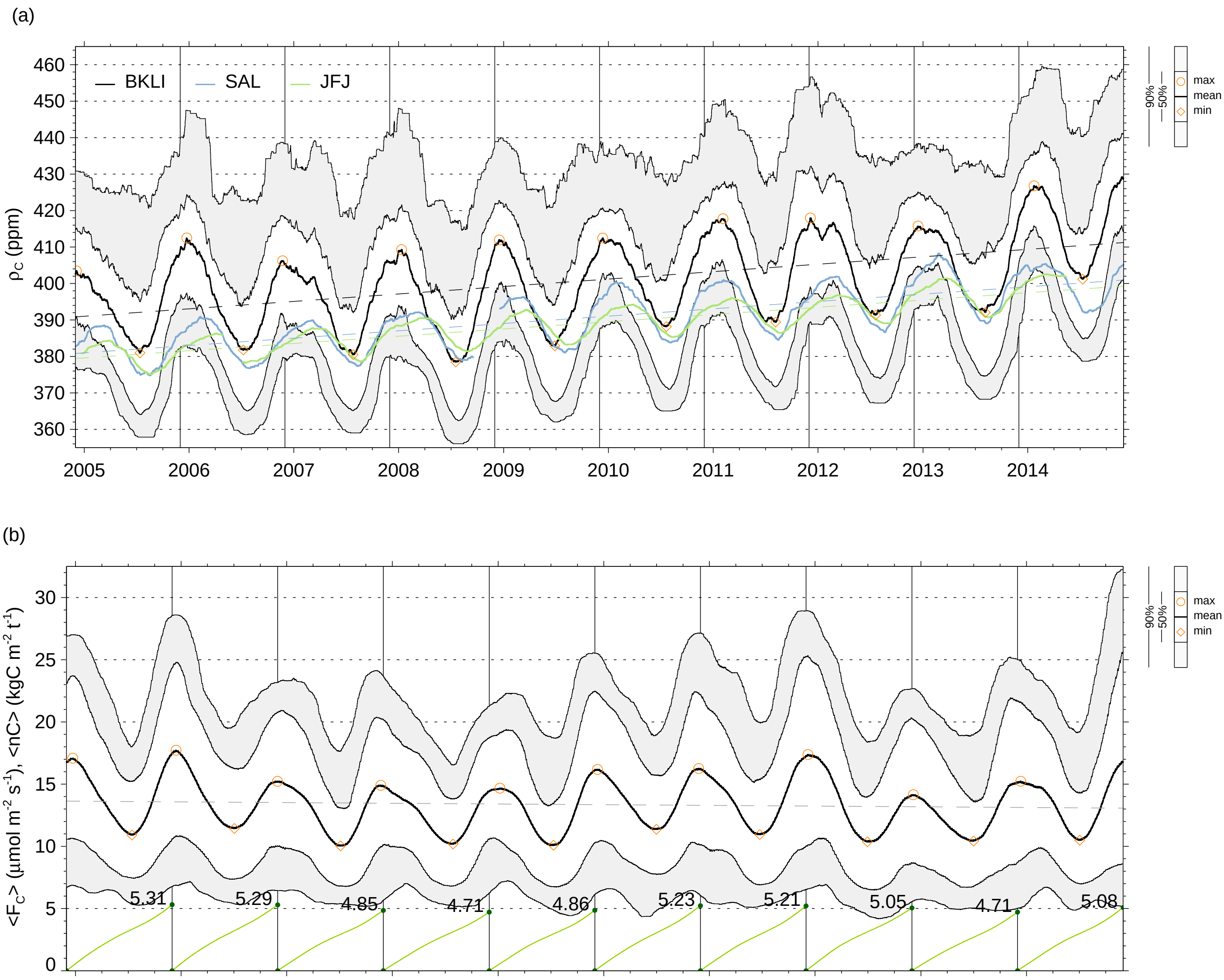

Figure 8. (a) Time series of CO_2 concentration at BKLI, Schauinsland (SAL), and Jungfraujoch (JFJ) and (b) time series of <F_C> (horizontally averaged F_C) and yearly cumulative <n_C> (green lines from 2005 until 2014). The solid lines are 90 days running means of half hourly data. Statistics for BKLI are indicated by grey shaded areas. The dashed lines show the linear regression for each time series. Additionally, winter maxima (circles) and summer minima (diamonds) are drawn (adapted from Schmutz et al. 2016).

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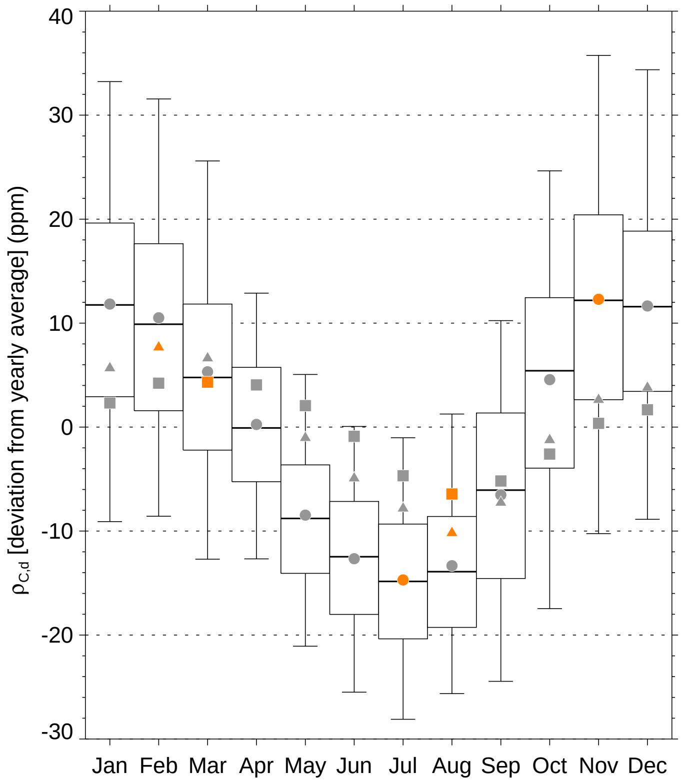

Figure 9. Average seasonal amplitude (deviation from yearly mean) of CO_2 concentration ($\rho_{C,d}$) for BKLI (circle), SAL (triangles), and JFJ (squares). Depicted are average monthly values of $\rho_{C,d}$ calculated from daily averages corrected for long-term trend of each station. Winter and summer peak values are marked in orange (adapted from Schmutz et al. 2016).




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This article is a basically a summary of three recent papers representative for the research on urban CO_2 fluxes and concentrations based on the Basel flux tower data: Lietzke & Vogt (2013), Lietzke et al. (2015) and Schmutz et al. (2016), but also shortly recapitulates the 25 years of flux measurements in the city of Basel, Switzerland. For more detailed information please refer to the full papers.

Urban Heat Islands and Cool Cities at PLEA2017 in Edinburgh

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Amelioration of urban heat islands provides a local narrative within which strategies for the enhancement of urban quality-of-life can find acceptance and even active support. A political difficulty with action against global climate change is the inability to see results in the here and now. Tackling urban climate change offers immediate and tangible benefits since the negative consequences of haphazard urbanization is plain to see. This is increasingly being recognised in international efforts. Examples include a greater focus on urban climate by the World Meteorological Organisation (such as the "WMO Urban Agenda" – http://public.wmo.int/en/our-mandate/focus-areas/urban-development-megacities/wmo-and-new-urban-agenda); the World Health Organisation's (WHO) greater attention to public health – especially ageing in a changing climate (http://www.who.int/globalchange/en/), and UN-Habitat III's smart city and quality of life agenda (http://unhabitat.org/wp-content/uploads/2015/04/Habitat-III-Issue-Paper-21_Smart-Cities-2.0.pdf).

The recently concluded **33rd Passive and Low Energy Architecture (PLEA2017)** conference in Edinburgh, 3-5 July 2017, provides further evidence of the growing importance of urban heat island mitigation among built environment researchers. A forum on 'Cool Cities and UHI' (Forum 11) at PLEA2017 elicited the second highest number of papers among the 32 Fora presented at the conference.

Participants at the Passive and Low Energy Architecture conference in Edinburgh came from across the globe to address the challenges of designing a sustainable built environment. (Photo: Adrian Arbib)

While simulation studies dominated the proceedings, there were a considerable number of cutting edge approaches to UHI mitigation and the promotion of 'cool cities.' Evyatar Erell (Ben Gurion University of the Negev, Israel) pointed out that while air temperature may be a good 'headline' indicator of weather conditions, mitigation approaches that exclusively focus on it may lead to inaccurate or even erroneous conclusions. Erell stressed that practical needs in two areas are the most pressing: improving human thermal comfort (especially in outdoor spaces) and conserving energy in buildings.

Hu Du (Cardiff University, UK) attempted to predict real-time UHI effects using the UK Met Office's postcode-level forecast data for better building energy consumption estimation. Based on a calibration of predicted vs measured temperatures he was able to show considerable differences in summer cooling loads (up to 42% more than a rural building) while also showing a slight reduction (–12%) in winter heating. This will have significant impact on the estimated carbon savings from building energy management approaches.

Chao Yuan (National University of Singapore) presented recent work on the development of a fine-scale morphological modelling-mapping approach to UHI studies. This approach could potentially make computational costs lower than those of Computational Fluid Dynamics simulations and wind tunnel experiments. At the same time, higher resolution mapping of the wind environment may also be feasible, providing fine-grained information about air flow between buildings.

Pan and Du (University of Hong Kong) showed that Sky View Factor plays a leading role in influencing UHI intensity and thermal comfort as measured by UTCI. They showed that an approach they termed 'urban villages' with high-density mid-rise buildings leads to better outdoor thermal conditions than modern high-rise but low-density blocks.

Several papers provided evidence from the field of the efficacy of UHI mitigation approaches from around the world. These include the evaluation of a sustainable urban redevelopment project in Thessaloniki, Greece focusing on microclimate improvement, by Chatzidimitriou, et al; the impact of increasing surface albedo on pedestrian thermal comfort in Delft, The Netherlands (Taleghani, University of Salford, UK); empirical results from cool roofs, cool pavements and trees by Werneck and Romero in Brasilia, Brazil; cool islands by small green spaces in central London (Hanrahan and Hill) and the moderating effects of shading and ground surface properties on thermal stress in Florence, Italy (Pearlmutter et al.).

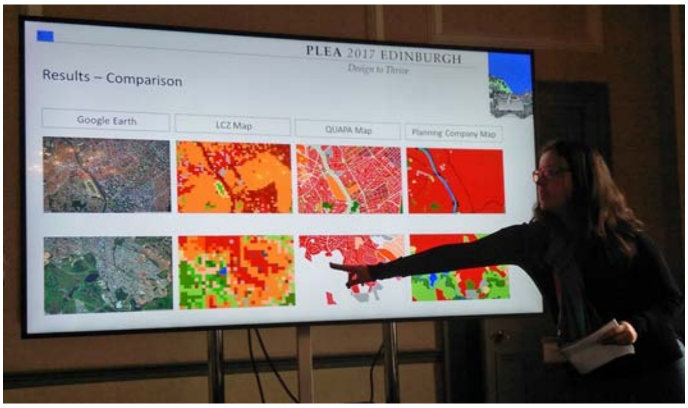
Gerald Mills, past president of IAUC, discusses the compilation of urban data for the WUDAPT project. PLEA2017 provided an unprecedented cross-disciplinary forum for architects and urban geographers to collaborate on the detailed description of world cities for the purpose of urban climate modeling. (Photo: Adrian Arbib)

PLEA-WUDAPT collaboration initiative

Perhaps the most exciting development at PLEA2017 is the potential for collaboration between the climate-sensitive design community as represented by PLEA and UHI researchers from the IAUC. This came in the form of a PLEA-WUDAPT collaborative initiated at PLEA2017.

Recent advancement in urban climate science has occurred through careful observation in controlled circumstances. While this knowledge is embodied in urban climate models, the absence of useful urban data that is consistent in scale and coverage is a major impediment to the development of an urban climate science that is useful globally. The WUDAPT framework (www.wudapt.org) can provide a great service to the emergence of urban climate science by gathering climate-relevant data and providing the tools to utilise these data.

As many among the IAUC community are aware, Level 0 of the WUDAPT protocols, based on LCZ maps and associated lookup tables for a range of values of form and function parameters, have gained wide currency across the world. It is now time to move up to Level 1 or 2 of



the protocols, which will provide an enhanced level of detail, specificity and precise values for form and function parameters. Crowd-sourcing methods based on building typology might provide a means for generating the desired details on building form and function. In particular, the meeting participants heard from several leading proponents of the WUDAPT process (Jason Ching, Gerald Mills, Julia Hidalgo) a proposal to use architectural archetypes as the basis for deriving information on building typology.

Such an approach could proffer mutual benefits by establishing a common but systematic guidance and approach to crowd-sourcing with a "Local Experts in LCZ paradigm." A call from the WUDAPT community was thus issued to the PLEA audience to join hands in this quest at a critical juncture in the 'Anthropocene' period. It was gratifying to note that several members of the PLEA community volunteered to serve on this initiative, which will be coordinated by Denise Duarte (University of Sao Paulo, Brazil).

The following approach was agreed upon as the way forward for a PLEA-WUDAPT collaboration:

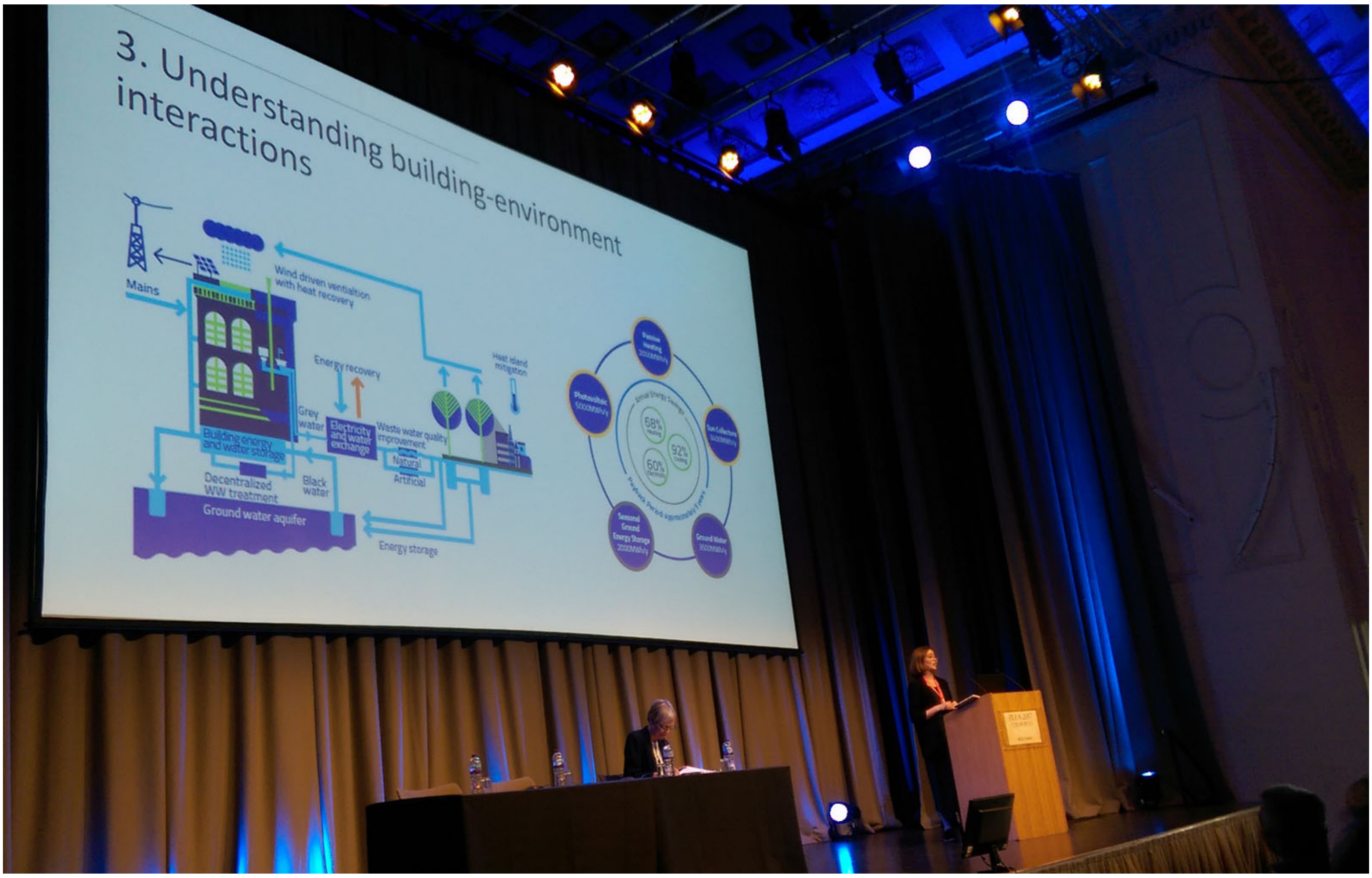
a. Providing guidance on building typology within city, regional and worldwide variability.

b. Crowdsourcing leadership and/or participation

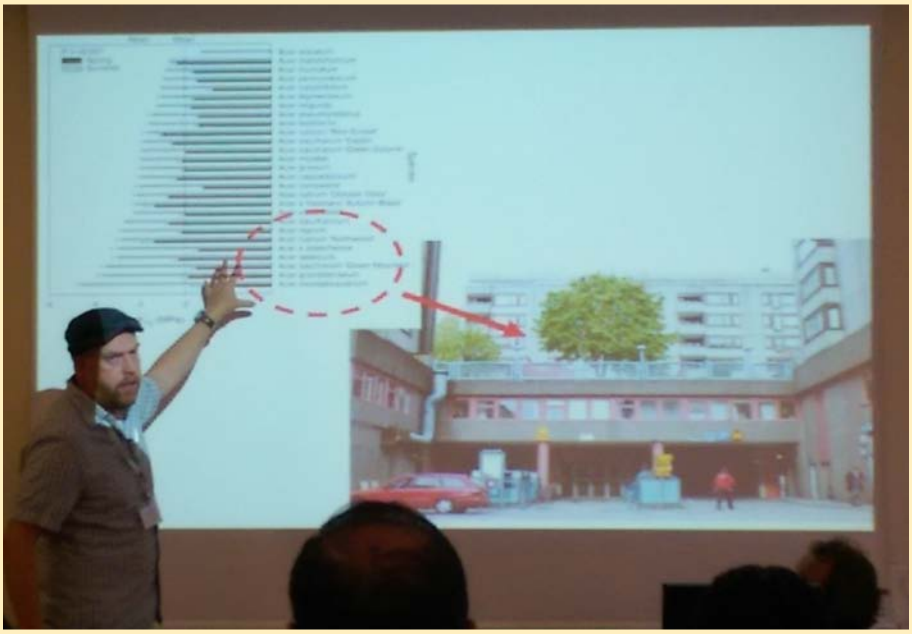
c. Sampling deployment strategies

d. Identifying and incorporating Cadastre, Metadata

It is hoped that this bottom-up approach might lead to a more formal linkage between the two communities (perhaps at the ICUC10?), leading to a long and fruitful collaboration in the years to come. (The full proceedings of PLEA2017 can be found at https://plea2017.net/)



Greener Cities for More Efficient Ecosytem Services: A focus on changing urban climates in Bologna



An international symposium on "Greener Cities for More Efficient Ecosystem Services in a Climate Changing World" was held in Bologna, Italy on September 12-15, 2017.

The symposium focused on themes related to the multifaceted ways in which green infrastructure can enhance a city's resilience to climate change, and brought together experts in fields ranging from architecture, urban planning and meteorology to horticulture and plant physiology.

A session devoted to "Cities and Climate Change" featured 20 speakers, each presenting evidence for the connection between green infrastructure and the urban atmosphere. Of special interest was a study by Codemo and Ricci, who analyzed the heat island of Trento City in northern Italy using a framework of Local Climate Zones to assess localized heat risk and its moderation by green space. They developed a set of tools related to the permeability, albedo and vegetative coverage of the urban fabric, introducing the concept of "urban acupuncture" – or the creation of thermally safe points within the city. In addition to regular lectures, the session included a series of brief talks which included an especially informative report on the study of Sjoman et al. on the microclimatic qualities of strategically placed trees in Lomma Harbour, Sweden – particularly as wind breaks under chilly conditions.

In a plenary presentation on urban greening and human bioclimate, Prof. Andreas Matzarakis described the application of various thermal indices and micro-scale models, highlighting their advantages and limitations and illustrating their use in a number of urban-intervention case studies.

For more information on the Greener Cities symposium program, see https://www.greencities2017.org/

Recent Urban Climate Publications

AbdelRahman MM, Moustafa WS, Farag OM (2017) Modelling of Egyptian low-cost-housing natural ventilation: Integration of geometry, orientation and street width optimization. *Urban Climate* 21:318 - 331.

Abiodun BJ, Adegoke J, Abatan AA, Ibe CA, Egbebiyi TS, Engelbrecht F, Pinto I (2017) Potential impacts of climate change on extreme precipitation over four African coastal cities. *Climatic Change* 143:399–413.

Ahmad NH, Inagaki A, Kanda M, Onodera N, Aoki T (2017) Large-Eddy Simulation of the Gust Index in an Urban Area Using the Lattice Boltzmann Method. *Boundary-Layer Meteorology* 163:447-467.

Aleksandrowicz O, Vuckovic M, Kiesel K, Mahdavi A (2017) Current trends in urban heat island mitigation research: Observations based on a comprehensive research repository. *Urban Climate* 21:1 - 26.

Aliabadi AA, Krayenhoff ES, Nazarian N, Chew LW, Armstrong PR, Afshari A, Norford LK (2017) Effects of Roof-Edge Roughness on Air Temperature and Pollutant Concentration in Urban Canyons. *Boundary-Layer Meteorology*164:249-279.

Allegrini J, Carmeliet J (2017) Coupled CFD and building energy simulations for studying the impacts of building height topology and buoyancy on local urban microclimates. *Urban Climate* 21:278 - 305.

Asakereh A, Soleymani M, Sheikhdavoodi MJ (2017) A GIS-based Fuzzy-AHP method for the evaluation of solar farms locations: Case study in Khuzestan province, Iran. *Solar Energy* 155:342 - 353.

Baklanov A, Korsholm US, Nuterman R, Mahura A, Nielsen KP, Sass BH, Rasmussen A, Zakey A, Kaas E, Kurganskiy A, Sorensen B, Gonzalez-Aparicio I (2017) Enviro-HIRLAM online integrated meteorology-chemistry modelling system: strategy, methodology, developments and applications (v7.2). *Geoscientific Model Development* 10:2971-2999.

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Broadbent AM, Tapper NJ, Coutts A, Demuzere M (2017) The cooling effect of irrigation on urban microclimate during heatwave conditions. *Urban Climate*

Brownlee J, Ray P, Tewari M, Tan H (2017) Relative Role of Turbulent and Radiative Flux on the Near-Surface Temperature in a Single-Layer Urban Canopy Model over Houston. *Journal of Applied Meteorology and Climatol.* 56:2173-2187.

In this edition is a list of publications that have come out between **June and August 2017**. 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, Year, Volume, Issue, Pages, Dates, Keywords, URL, and Abstract. Please send the references **in a .bib format**.

I would like to take the opportunity to introduce Peter Crank, a Geography Ph.D. student working under Dr. David Sailor at Arizona State University, mainly researching how effective climate adaptation and mitigation strategies are for the urban environment. Welcome to the Committee, Peter! Note that we are always looking for (young) researchers to join and contribute to the Committee. If you are interested to join or would like to receive more information, please let me know via the email address below.

Regards,

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Marie-Leen Verdonck


Hendrik Wouters

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Demuzere M, Harshan S, Јдrvi L, Roth M, Grimmond CS, Masson V, Oleson KW, Velasco E, Wouters H (2017) Impact of urban canopy models and external parameters on the modelled urban energy balance in a tropical city. *Quarterly Journal of the Royal Meteorological Society* 143:1581–1596.

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Gaitani N, Burud I, Thiis T, Santamouris M (2017) High-resolution spectral mapping of urban thermal properties with Unmanned Aerial Vehicles. *Building and Environment* 121:215 - 224.

Ghiassi N, Mahdavi A (2017) Reductive bottom-up urban energy computing supported by multivariate cluster analysis. *Energy and Buildings* 144:372 - 386.

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Upcoming Conferences...

INTERNATIONAL CONFERENCE FRIENDLY CITY 4
Sumatera Utara • Indonesia, October 11-12, 2017
http://www.friendlycity.usu.ac.id/

DRYLANDS, DESERTS AND DESERTIFICATION – THEORY AND PRACTICE
Sede Boqer Campus, Israel • November 6-9, 2017
http://in.bgu.ac.il/en/desertification

AMERICAN GEOPHYSICAL UNION (AGU) FALL MEETING
New Orleans, USA • December 11-15, 2017
https://fallmeeting.agu.org/2017/

AMERICAN METEOROLOGICAL SOCIETY (AMS) ANNUAL MEETING
Austin, USA • January 7-11, 2018
https://annual.ametsoc.org/2018/

14TH ASIAN URBANIZATION CONFERENCE
Bangkok, Thailand, January 11-13, 2018
http://www.arch.kmitl.ac.th/auc2018aura/

CITIES AND CLIMATE CHANGE SCIENCE CONFERENCE (CITIES IPCC)
Edmonton, Canada • March 5-7
https://www.citiesipcc.org/

10TH INTERNATIONAL CONFERENCE ON URBAN CLIMATE (ICUC10) AND 14TH SYMPOSIUM ON THE URBAN ENVIRONMENT (SUE) OF THE AMERICAN METEOROLOGICAL SOCIETY (AMS)
New York, USA • August 6-10, 2018
http://icuc10.ccny.cuny.edu

* Abstract submission:
By December 15, 2017 at the
ICUC-10/AMS14SUE abstract submission site

Professor Emeritus Masatoshi YOSHINO

A Tribute

Prof. Masatoshi Yoshino (1928-2017) and his wife, Prof. Kazuko Urushibara-Yoshino, at Heidelberg University in August 1993

Masatoshi YOSHINO, a Professor Emeritus of the University of Tsukuba, passed away of brain infarction on 4 July 2017 at the age of 89 at a hospital in Morioka City (North-East Japan). His notable contribution and leadership in the broad fields of climatology won him respect both nationally and internationally. It is still really hard to believe we shall never see him again.

Professor Yoshino was born in Tokyo in 1928. He graduated from the Department of Geoscience, School of Science at Tokyo University of Arts and Science* (Tokyo Bunrika University) in 1951, and entered the master course of the graduate school. He worked as an assistant professor in the Department of Geoscience at Tokyo University of Education* (Tokyo Kyouiku University) from 1953 to 1967 under the chief professor, Eiichiro Fukui, who was known as the "father of climatology" in Japan (Fukui Ed., 1977). He received a Doctor of Science degree from Tokyo University of Arts and Science in July 1961. The title of his dissertation was "Effect of small geomorphology on winds", which was published in a book entitled "Small-scale Climatology" (in Japanese, 274p.) by Chijin Shokan Co., Ltd in November 1961.

* *Currently University of Tsukuba*

Just after receiving his doctoral degree, Yoshino spent his Post-Doctoral time at the University of Bonn with an Alexander von Humboldt Scholarship from 1961 to 1963. During the Bonn period, Yoshino studied the classical European climatology under the supervision of Prof. Carl Troll. One day in Bonn, Troll advised Yoshino to translate his "Small-scale Climatology" (in Japanese) into English. Later Yoshino published his representative book entitled "Climate in a Small Area - Introduction to Local Meteorology" (University of Tokyo Press, 549p.) in 1975. This book covered various aspects of local and urban climatology, and thanks to its publication, he received the Fujiwara Prize in 1977 from the Meteorological Society of Japan.

After a period at Hosei University (1969 - 1974), he became a full professor at the University of Tsukuba from 1974 to 1991. His academic activity bloomed during the Tsukuba period. His research ranged from small to large-scale climatology, including local winds, topographic effects and global circulations. He visited many countries for his field research, including Yugoslavia, Germany, Switzerland, Sri Lanka, Java, Thailand, and the Hainan, Yunnan, Taklimakan and Gobi Desert regions of China. Editing the results of the Yugoslavia expedition, he pub-

Honorary membership of the Meteorological Society of Japan in May 2007 - Contribution to climatology by fruitful publications (measurement: 1 m 28 cm)

lished a book entitled "Local Wind Bora" (University of Tokyo Press, 289p.) in 1976. He chiefly edited "Dictionary of Climatology and Meteorology" (Ninomiya Shoten, 742p. in Japanese) in 1985. It is one of the best climatological dictionaries in the world because it has useful indexes of Japanese-to-Japanese, English, French, and German with 112 pages. He summarized the history of urban climate research, and reported it at the first joint International Conference on Urban Climate, held in Kyoto in 1989 (Yoshino, 1991).

In his retirement year, 1991, he held an International Conference on Climate Impacts on the Environment and Society (CIES). Many climatologists and meteorologists from around the world attended CIES, giving a total of 98 presentations. The proceedings of CIES were published in WMO TD – No.435.

After retiring from the University of Tsukuba, Yoshino became a professor at Aichi University (1991-1998), a senior adviser of United Nations University (2001-2010), and a Professor Emeritus of the University of Tsukuba (1991-2017). He was given the Luke Howard Award by the International Association for Urban Climate in 2007. In the same year, he became an honorary fellow of the Meteorological Society of Japan for his fruitful publications. Members of Yoshino's School celebrated him. The thickness of his total books was 1 m 28 cm (see photo above). In 2007, he published "History of Climatology from Ancient Times to the Present" (Kokon Shoin, 437p. in Japanese) at the age of 80. In 2013, his last book was "Extreme Climate and Life – Living with Global Warming" (Kokon Shoin, 216p. in Japanese) at the age of 85.

He received the Alexander von Humboldt Prize (1992), International Geographical Society Prize (2000), and Romanian Geographical Society Prize (2006). He served as a leader of academic societies as follows: President of the Geographical Society of Japan, President of the Association of Arid-Land Research, Member of the Science Council of Japan, Vice President of the International Geographical Union, and Member of the Romanian Academy of Science.

He was a good camera man. In 1990, a joint expedition of the University of Tsukuba, Meteorological Research Institute of Japan, American Academy of Sciences and Chinese Academy of Sciences went to the Taklimakan Desert for a desertification study. During the expedition, I found that Yoshino held three cameras at his neck. I asked him, "Why do you need three cameras in the desert?" He answered, "A black-and-white film is for academic publications, a slide film is for academic presentations, and a print film is a gift for friends in the field".

He was a good teacher. He educated students from China, Korea, Sri Lanka, Mongolia, Canada, Europe and Japan, and conferred a degree of doctor of science to 25 graduate students.

He was a good pianist. He took piano lessons in his teens, and wanted to be a composer in the future. He said, "The composition of a paper is the same as that of a symphony".

— Kenji Kai
Professor, Nagoya University

I received a Doctor of Science degree from Prof. M. Yoshino in 1981. He was a lifetime climatologist. He advised me, "When you write a scientific paper, compactness, speed and accuracy are important."

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ICUC10: August 6-10, 2018 New York, New York

Call for Abstracts

The 10th International Conference on Urban Climate (ICUC10), jointly with the 14th Symposium on the Urban Environment (SUE) of the American Meteorological Society (AMS), will be held August 6-10, 2018 at the historical campus of the City College of New York of the City University of New York in the Upper West Side neighbourhood of New York City.

The conference theme is ***Sustainable and Resilient Urban Environments***. The event is hosted and co-organized by the NOAA CREST Institute of the City University of New York, The International Association for Urban Climate (IAUC) and the AMS Board on the Urban Environment. ICUC10 is also supported by international organizations including the World Meteorological Organization (WMO). ICUC10 comes at a time when accelerated urban development is challenged by the risks and consequences of extreme weather and climate events and global socio-economic disparity. Resiliency and reduced vulnerability to all socio economic sectors have become critical elements to achieve sustainable development. ICUC10 will be the premier forum for these discussions.

The conference format will include: workshops, key note speakers, concurrent technical sessions, and discussion panels. Planned session-themes will include emerging and traditional topics in urban climate including, but not limited to, the following topics:

Extreme Weather in Cities
- Advances in weather forecasting for cities
- Storm surges modeling and prediction
- Tropical and extra-tropical storms in cities
- Modeling and observations of urban flooding
- Modeling/observations of extreme heat events in cities
- Emergency management for extreme weather in cities

Climate change mitigation & adaptation in urban environments
- Modeling and detection of climate changes in cities
- Intersections of climate change/land use for urbanization
- Mitigation & adaptation strategies for climate changes
- Climate information services for cities

Studies of urban climate and processes
- Boundary layer and canopy layer urban heat islands
- Surface and subsurface urban heat islands
- Surface energy and water balances
- Flows and dispersion in the urban canopy layer
- Precipitation/fog/clouds
- Air quality/aerosols/radiative transfers in the urban boundary layer
- Influence of urban vegetation

http://icuc10.ccny.cuny.edu/

New observational and modeling techniques and methods to study urban climates
- Field campaigns, sensor and networks development
- Satellite remote sensing of cities
- Wind tunnel & hardware model experiments
- Statistical models
- CFD/LES/Dispersion model
- Urban canopy parameterizations
- Urban databases and linkages with models
- Big data for urban climate studies

Bioclimatology and public health
- Outdoor microclimate and human comfort
- Indoor human comfort & air quality
- Human perception
- Health impacts of extreme weather events in cities

Transfer of urban climate knowledge
- Indicators and climate maps
- Storm surges and flooding maps
- Warning and communication plans for emergency response in cities
- Public policies that incorporate urban climate and processes
- Greenhouse reduction policies for cities
- Urban climate education

Urban design and planning with climate
- Buildings and urban climate
- Energy supply and demand in cities - the role of urban climates
- Sustainable design practices
- Morphological urban design
- Governance challenges for tackling urban heat
- Design of smart neighborhoods and cities
- Design for resiliency

Interdisciplinary topics
- Eco-system services and urban environments
- Socio-economics aspects of urban climate

Proposals for additional program suggestions are encouraged; please contact the program chairs to submit proposals for special sessions of interest.

Deadline for abstract submission for technical papers or special sessions is **15 December 2017**, using the ICUC-10/AMS14SUE abstract submission site.

Outstanding oral and poster student presentations will be recognized at the conference.

Submission Deadlines

Opens: Wednesday, August 1, 2017

Closes: Friday, December 15, 2017
23:59 pm Eastern US Time

Notification: Early February 2018

Helpful Information

Abstracts for the 10th International Conference on Urban Climate need to be submitted according to the instructions that will appear in the conference website. Only those abstracts submitted via the official submission website will be considered. There is no cost for submitting an abstract.

All abstract submissions will be peer reviewed and may be submitted as an oral presentation and/or a poster presentation. Each abstract should represent complete and original results. As in previous ICUC, authors are limited to participation as "Presenter" in a maximum of ONE (1) abstract submission. For additional information please contact the local organizers Jorge E. Gonzalez, Prathap Ramamurthy, and Dev Niyogi via the conference email: icuc10@ccny.cuny.edu.

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Urban Climate News – The Quarterly Newsletter of the International Association for Urban Climate

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The next edition of ***Urban Climate News*** will appear in late December. Contributions for the upcoming issue are welcome, and should be submitted by November 30, 2017 to the relevant editor.

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.

Bibliography: Matthias Demuzere and BibCom members
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