# Urban Climate News

*Quarterly Newsletter of the IAUC*

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## From the IAUC President

Although there are still considerable problems with COVID-19 in many parts of the world, there seems to be a growing glimmer of light at the end of what has been a long, dark tunnel. I sincerely hope that this is the case for you, wherever you may be.

The pandemic has promoted a number of innovations and activities within the IAUC that will continue into the future and which we hope enhance your interactions with the Association. The IAUC Board recently approved the formation of an Outreach Committee that will assume responsibility for all of the IAUC's outreach activities (Newsletter, Webinars, Website, etc.) as well as canvas other possible activities to enhance interactions between the organisation and its members as well as between members. The new IAUC Outreach Committee will soon send out a questionnaire to you all to gather community input on plans and possibilities for the future.

Following on from two very successful Webinars late last year, the 2021 series will commence on April 15 with presentations from Gerald Mills and myself on The Journey of Modern Urban Climate, where Gerald will discuss the origins of modern urban climatology and I will provide some thoughts on the relevance and future directions of urban climatology. Following our short presentations, we look forward to an engaging discussion with members that will be facilitated by Dev Nyogi. If you have not already done so you can register for this event at https://www.eventbrite.com.au/e/iauc-webinar-3-the-journey-of-modern-urban-climate-tickets-148130697905.

This Newsletter includes information about the IAUC's Luke Howard and Timothy Oke Awards that was also recently circulated via the met-urbclim list and is also posted on the IAUC website. These important awards are a great way for us to recognise excellence in research within our community and I strongly encourage nominations from/for our senior (Luke Howard Award) and early-mid career researchers (Timothy Oke Award).

World Meteorological Day was recently celebrated on March 23. You may be interested to know that the IAUC was one of more than 40 meteorological societies and associations to support and sign a Joint International Climate Communiqué to reiterate the critical importance of addressing global climate change. It was great to see our logo proudly displayed alongside other key organisations that included the AMS, RMetS and DMG and ECMWF. For your information, the Communique is included in this Newsletter.

Finally, I hope that you enjoy another terrific Newsletter put together by David Pearlmutter and his team. I particularly want to acknowledge and welcome Dr. **Dragan Milosevic** from the University of Novi Sad, who has taken responsibility for compiling the *In the News* section of our Newsletter.

Best Wishes,

– Nigel Tapper,
IAUC President
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### *Inside the March issue...*

# Are cities finished?

*Far from rendering cities obsolete, the pandemic has unlocked an ever-broader potential for renaissance – what the economist Joseph Schumpeter famously called 'creative destruction' on an urban scale.*

*March 2021* — Rue de Rivoli, a boulevard running through the heart of Paris, has been developed in fits and starts. Napoleon Bonaparte initiated construction in 1802, after years of planning and debate, but work stalled following the emperor's abdication in 1814. he boulevard remained in limbo until another military strongman, Napoleon III, completed the project in the 1850s. The next century, construction began again – this time, to accommodate cars. But this past spring, Rue de Rivoli experienced its fastest transformation yet.

With Paris traffic subdued by a Covid-19 lockdown, Mayor Anne Hidalgo decided on April 30 to close the nearly two-mile-long road to cars, in order to create more space for pedestrians and bicyclists. Workers repainted the road and transformed a major artery in central Paris – home of the world-renowned Louvre museum – virtually overnight.

It was not just Rue de Rivoli. Using only paint and screw-in markers, nearly 100 miles of Parisian roads were temporarily reallocated to cyclists in the early months of the pandemic – a revolution in urban reprogramming. It was later announced that the changes would become permanent.

The Parisian example highlights the extent to which the pandemic has accelerated the pace of urban innovation, compressing what would have taken years into months or even weeks. Beyond highlighting the flaws in pre-pandemic urban systems – such as high levels of pollution – it has allowed city leaders to bypass cumbersome bureaucracy, and respond much more efficiently to the needs of people and businesses.

Those needs are changing fast. One of the most discussed changes relates to the separation of home and work. In the early days of urbanisation, people walked to work. Later, they began to take public transport. It was only after World War II and the rise of suburbanisation that people began to drive cars from their homes to giant factory complexes and office towers.

During the pandemic, remote work has become the rule in many industries – and many companies plan to keep it that way, at least to a large extent. This re-integration of work and home threatens one of the last remaining vestiges of the Industrial Age: central business districts that pack and stack office workers in skyscrapers. With many workers unlikely to return to their cubicles, old office towers may be transformed into much-needed affordable housing after the pandemic. One-dimensional business districts could become vibrant neighbourhoods.

Non-work activities have been transformed as well. Dining, entertainment, and fitness have increasingly been moving into the open air, occupying space that used to be designated for cars. So, as with the bike lanes in Paris, the pandemic is creating prototypes for a permanently post-automobile, human-centric city.

In fact, the changes in Paris are part of a broader plan to create a "15-minute city" (ville du quart d'heure), where core daily activities – including working, learning, and shopping – can be carried out just a short walk or bike ride from home.

**Pop up cycle-ways in Paris during the Covid-19 pandemic. Nearly 100 miles of Parisian roads were temporarily reallocated to cyclists in the early months of the pandemic – a revolution in urban reprogramming. *Source:* eco-business.com**

So, far from rendering cities obsolete, as some predicted early on, the pandemic has unlocked an ever-broader potential for renaissance – what the economist Joseph Schumpeter famously called "creative destruction" on an urban scale.

The crisis left governments with little choice but to adopt a fast-paced, trial-and-error approach. The extraordinary innovations in pedestrianisation, affordable housing, and dynamic zoning that have emerged highlight the power of positive feedback loops. Nonetheless, a Schumpeterian approach is fundamentally experimental, and even the best-designed experiments sometimes fail. Moreover, the costs of those failures are not borne equally: those with the least influence tend to suffer the most. The Covid-19 pandemic, for example, has disproportionately affected the poor and vulnerable.

In this new age of urban innovation, leaders must take great care to minimise the risks to – and redistribute the returns toward – disadvantaged and vulnerable groups. That means, first and foremost, listening to them. The Black Lives Matter movement in the United States is a powerful example of a disadvantaged group demanding to be heard. Leaders everywhere should pay attention and address racial and class divides head-on. Urban design is central to any such strategy.

To support this process – and help maintain flexibility and speed in urban innovation after the pandemic – leaders should consider creating participatory digital platforms to enable residents to communicate their needs. This could encourage policies that improve quality of life in cities – especially disadvantaged neighbourhoods – including by limiting problematic trends like rising pollution and gentrification. Only with an agile and inclusive approach can we seize this once-in-a-century opportunity – or, rather, meet our urgent obligation – to "build back better."

A stroll along Rue de Rivoli today reveals none of the desolation and dullness we have come to expect on city streets during the pandemic. Instead, the storied boulevard is bustling with masked Parisians, zooming along on bikes, scooters, e-bikes, and rollerblades, or pausing for coffee at cafes and restaurants.

A street deadened by the pandemic has been revived. With thoughtful planning, bold experimentation, and luck, such transformations can be just the start for cities everywhere.

— By CARLO RATTI and RICHARD FLORIDA. *Source:* https://www.eco-business.com/opinion/are-cities-finished/

# 'Inequalities will become even more entrenched': Why climate change is a feminist issue

*Climate change is already here, and it's having a disproportionate impact on women around the world. Natasha Preskey asks experts why.*

*March 2021* — There's an old saying that guns make us all the same size. Similarly, the climate emergency feels – by definition – like something that should be a universal experience, a unifying threat to the home that we all share. But, like almost all other crises, we might all be floating in the same sea of uncertainty but we are certainly not in the same boat.

Just as with coronavirus, which disproportionately impacts black, Asian and minority ethnic communities (and has hit women harder economically than men), the climate crisis poses more urgent problems for some people than for others. The effects will be felt more quickly, and more deeply, by some, and solutions that are accessible to many are a world away for others.

In 2021, as we get ever closer to the Paris Agreement deadline of 2050 for a climate-neutral world, we can already see that women, particularly women of colour, are experiencing the climate emergency's worst effects. And for some, this half-century point will come too late.

In much of the global north, climate change isn't yet impacting everyone's day-to-day lives in a way that inspires sufficient urgency. Although we are seeing more localised events like historic flooding and freak storms in places like Texas, the situation is much worse in many other regions where the climate emergency is already affecting people's livelihoods.

Figures from the United Nations (UN) suggest that 80 per cent of people displaced by climate change worldwide are women. According to a review of 130 studies by the Global Gender and Climate Alliance in 2016, women are more likely to suffer food insecurity as a result of the climate crisis. Following extreme weather events, women are also more likely to experience mental illness and partner violence.

Professor Nitya Rao of the University of East Anglia (UEA) researches gender equality in parts of Africa and Asia which have already been severely affected by climate change. She says in many of the rural areas where she conducts research, in countries like Nepal and India, droughts and floods can decimate crops and make the outcomes of agricultural labour unpredictable.

The climate crisis means that these sorts of unusual weather events are becoming more common – increasing the likelihood of this change in working status.

In order to reduce overall risk to the household's income, men, who have access to a wider range of jobs, will often migrate to other areas – particularly urban areas away from land-based incomes – with women staying to care for children and continue agricultural work. When this work isn't fruitful, women often end up having to take on multiple jobs, says Rao.

"They will have their farm, but they will also try and do something else: set up a small shop or some kind of enterprise or maybe wage labour for a richer landlord in order to ensure that there is at least some income in the household for their everyday needs," Rao tells *The Independent* from India, where she is currently conducting research.

She goes on to explain that, although men will often send money home from their new jobs, this change in circumstance means women are under pressure: "Especially at the time when men are absent, they may send money once a month, or once in two months, or three months. In the meantime, women will have to manage – so they end up working much harder."

Although these effects of the climate crisis are already a day-to-day reality for women in some parts of the globe – and are starting to impact their economic output and options, women in the UK haven't yet felt noticeable disparities in how they are affected against their male peers.

But Professor Julie Doyle of the University of Brighton, whose work involves examining the role of media and communication in fighting climate change, says that this will likely manifest with time. Drawing on the pandemic to illustrate how crises affect people differently across existing power lines of gender, race and class, Doyle points out that "inequality is rife in the UK".

"Women have borne the brunt of caring, housework and homeschooling responsibilities in the UK [during the pandemic], and are more likely to have lost their jobs than men," she tells *The Independent*.

Research from the Women's Budget Group, published in November 2020, found that around 133,000 more women were furloughed than men across the UK during the first wave of Covid. Similarly, a study from the University of Exeter, published in July, found women were twice as likely to have lost a job during the first lockdown.

Dr Clare Wenham, assistant professor of global health policy at LSE, previously told *The Independent* that, during times of crisis, "gender norms become more entrenched". She cited examples of pandemics including coronavirus, Ebola and Zika, in which women's employment was disproportionately affected.

Doyle says, just as we've seen the pandemic change circumstances for women, as the pressure of the climate crisis increases, we will likely see this again. "As climate change increasingly impacts the UK in relation to localised flooding, heatwaves and ability to access food and other resources from climate impact countries across the globe, then these inequalities will become even more entrenched, limiting our ability to respond to such impacts in equitable and just ways."

**As climate change worsens in the UK, we will continue to see increased flooding. *Source:*** www.independent.co.uk

A 2010 study, published in the journal *Environmental Health*, found that women in several European cities, including London, were already more likely than men to die during heatwaves. Its authors suggested possible reasons for this may be "attributable to the social conditions of elderly women living alone and to physiological differences, such as a reduced sweating capacity that affects the ability to respond to heat stress".

What, if anything, can be done to mitigate the impact of climate change on women? According to Doyle, it's important we frame the climate crisis as "an issue of justice" and teach it in schools from primary age onwards with this in mind. In taking action against global warming, we mustn't treat "climate action as separate from gender equality", she says, encouraging people to view these as intersectional issues.

Rao emphasises that women are "resilient" and are adapting to cope with climate change but that they need support on a structural level to help mitigate the issues they face. She points to things like improving public health and sanitation, as well as food access. "I'm very against the view that women are, somehow, becoming the victims of climate change," she says. "They are showing resilience, but we need to support and enable them to do what they're doing."

Doyle adds that, in order to fight the gendered impacts of climate, we need more women in power. In fact, research earlier this year by the Centre for Economic Policy Research and the World Economic Forum found that countries led by women experienced significantly fewer Covid deaths, with women being more "risk averse" around loss of life but "more willing to take risks in the domain of the economy".

"Women and girls, particularly of colour, need to be at the forefront of decision-making on climate change at the local, regional, national and international level," Doyle concludes. "Climate change should not be discussed without reference to gender, racial and class inequalities."

Links between gender inequality and the impacts of the climate crisis aren't always immediately obvious to those whose day-to-day lives haven't yet been upturned by global warming. But to prevent gender disparities further deepening, an understanding of climate change and its complex relationship to human power structures is key. *Source:* https://www.independent.co.uk/climate-change/sustainable-living/climate-change-gender-equality-feminism-b1816507.html

# The Texas blackouts showed how climate extremes threaten energy systems across the US

*March 2021* — Pundits and politicians have been quick to point fingers over the debacle in Texas that left millions without power or clean water during February's deep freeze. Many have blamed the state's deregulated electricity market, arguing that Texas prioritized cheap power over reliability.

But climate extremes are wreaking increasing havoc on energy systems across the U.S., regardless of local politics or the particulars of regional grids. For example, conservatives argued that over-regulation caused widespread outages in California amid extreme heat and wildfires in the summer of 2020.

As an engineering professor studying infrastructure resilience under climate change, I worry about the rising risk of climate-triggered outages nationwide. In my view, the events in Texas offer three important lessons for energy planners across the U.S.

### Not enough attention to climate extremes

Experts widely agree that the Electric Reliability Council of Texas, or ERCOT, the nonprofit corporation that manages the power grid for most of the state, failed to anticipate how sharply demand would spike prior to the February cold wave. ERCOT has a record of lacking capacity to meet winter demand surges. The state grid nearly collapsed during a 2011 winter storm and experienced another close call in 2014, narrowly avoiding rolling blackouts.

But grid operators elsewhere have also underestimated how climate extremes can influence electricity demand. I see many similarities between California's summer 2020 power crisis and recent events in Texas.

In both cases, extreme weather caused an unexpected increase in demand and reduced generation capacity at the same time. Because energy operators did not foresee these effects, they had to resort to rolling blackouts to avert even bigger disasters.

In studies I have conducted in my research lab and in collaboration with hydroclimatologist Rohini Kumar, we have found that energy planners in many parts of the U.S. substantially underestimate how sensitive electricity demand is to climate factors. This tendency has significant implications for the security and reliability of the power systems.

For example, in a study published in April 2020 we analyzed the use of artificial intelligence models for energy forecasting that accounted for the role of humidity in addition to air temperature. We found that such models could make forecasts of energy demand for air conditioning on hot days significantly more accurate across the U.S. More accurate demand forecasts help energy planners understand how much power they will need to meet peak demand during weather extremes.

**Electric service trucks line up after a snow storm in Fort Worth, Texas, on Feb. 16, 2021. *Source:* theconversation.com**

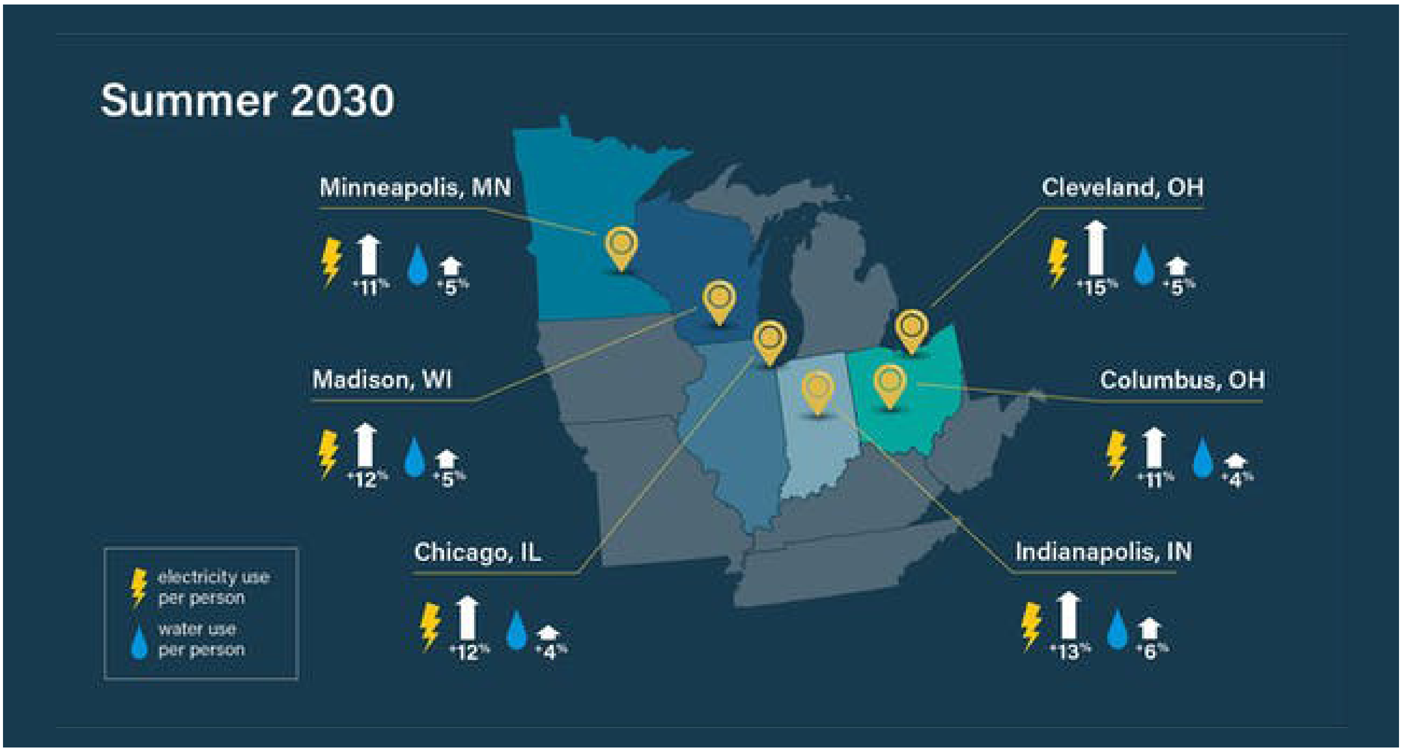
Grid operators can prepare more effectively for the effects of climate change on both supply and demand by using forecasting models and software that academic researchers have already developed. Many of these new solutions have been published in open-access journals.

### Water, electricity and natural gas are connected

Electricity, water and natural gas are essential resources, and it's hard to have any of them without the others. For example, drilling for natural gas consumes electricity and water. Many power plants burn natural gas to generate electricity. And transporting water and gas requires electricity to pump them through pipelines.

Because of these tight connections, outages in one system are bound to ripple through the others and create a cascade of service disruptions. For example, during the Texas cold wave, pumps used to extract gas in West Texas could not operate because of electricity outages. This cut state gas field production in half, which in turn strained gas-fired electricity production. Power failures also hampered water pumping and treatment, potentially allowing bacteria to seep into water supplies.

In a collaborative project connecting researchers at Purdue University, the University of Southern California, and the University of California-Santa Cruz, we are analyzing ways to prevent this kind of cascading outage. One promising strategy is to install distributed generation sources, such as solar panels or small wind turbines




**Results published in the journal Climactic Change from a model that predicts how much summertime electricity and water use in Midwest cities could increase due to climate change between 2030 and 2052. These projections only consider climate effects, not other factors such as population growth or technological shifts.** ***Source:*** **theconversation.com**

with batteries, at critical interconnection points between energy, water and natural gas systems.

For their part, consumers also need to understand these connections. Taking a hot shower or running a dishwasher consumes water, along with electricity or gas to heat it. These crunch points often cause trouble during crises. For instance, recent advisories urging Texans to boil their water before using it put extra pressure on already-scarce energy supplies.

Our research shows that utilities need to pay more attention to connections between natural gas and electricity, and between water and electricity. By doing so, planners can see more accurately how climate conditions will affect demand, particularly under climate change. Rampant gas shortages and electricity and water outages in Texas are a sign that infrastructure operators need to understand more clearly how tightly related these resources are, not only during normal operation but also during crises that can disrupt all of them at once.

**The future will be different**

Some commentaries on the Texas disaster have called it a "black swan event" that could never have been predicted – or even worse, a "meteor strike." In fact, the state published a hazard mitigation plan in 2018 that clearly warned of the potential for severe winter weather to cause widespread outages. And it noted that such events would be far more disruptive in Texas than in other regions that experience harsher winters.

In a 2016 study, several colleagues and I warned that current grid reliability metrics and standards across the U.S. were inadequate, especially with respect to climate risks. We concluded that those standards "fail to provide a sufficient incentive structure for the utilities to adequately ensure high levels of reliability for end-users, particularly during large-scale climate events."

As I see it, a dominant paradigm of "faster, better, cheaper" in energy planning is placing increasing pressure on our nation's aging infrastructure. I believe it is time for energy planners to be more proactive and make smart investments in measures that will help power systems handle extreme weather events.

Key steps should include leveraging predictive analytics to inform disaster planning; accounting for climate uncertainty in infrastructure management; upgrading reliability standards for power transmission and distribution systems; and diversifying the mix of fuels that all states use to generate electricity. Without such steps, frequent disruptions of critical services could become the new norm, with high costs and heavy impacts – especially on the most vulnerable Americans. — ROSHANAK (ROSHI) NATEGHI. *Source:* https://theconversation.com/the-texas-blackouts-showed-how-climate-extremes-threaten-energy-systems-across-the-us-155834

# The New European Bauhaus: Combining Art and Science to a Sustainable End

*"The New European Bauhaus movement is intended to be a bridge between the world of science and technology and the world of art and culture… it is about a new European Green Deal aesthetic combining good design with sustainability."*

— President of the European Commission Ursula Von der Leyen

*January 2021* — Last September, progress towards a European Green Deal was accelerated following the inaugural speech of Ursula Von der Leyen as the new President of the European Commission, before the European Parliament (Sept. 16, 2020). Von der Leyen called explicitly for a cleaner and more sustainable Europe within a 2030 target of net-zero carbon emissions, which she deems as "ambitious, achievable, and beneficial for Europe." The address outlined continued plans for NextGenerationEU, suggesting that 37% of the €750bln fund will be spent directly on European Green Deal objectives, with up to 30% of NextGeneration EU to be raised through green bonds.

Amongst plans for European Hydrogen Valleys and further digitalisation, Von der Leyen took her speech as an opportunity to announce the launch of the New European Bauhaus – a project designed to transform the built environment (housing, infrastructure, architecture) into one fit for the future, with fewer emissions, and long-term social value.

The Bauhaus school was a product of post-war Weimar Germany, whereby an interdisciplinary group of artists, architects and creatives sought a new way of imagining the material world in the face of social upheaval. Recalling this period of crises and turmoil a century ago, it is clear that Von der Leyen is seeking to engage all, from designers and architects to digital experts and entrepreneurs, in a process of social transformation, much like that which took place under the guise of Walter Gropius, Mies van der Rohe and more. It is difficult to believe that politicians and bureaucrats have the ability to speak into existence an artistic movement (especially given the disruptive proclivities of early 20th century cultural practitioners that did away with Victorian ostentation in favour of clean lines and minimal decoration), but it should be noted that the Bauhaus school was a glad recipient of state support during its infancy.

This week, the design phase of The New European Bauhaus was launched by the European Commission. As the project gets underway, with an open call for proposals to be expected this autumn, we look more closely at what The New European Bauhaus might entail.


**Form Over Function?**

What will operate as the cultural component of the EU building renovation strategy, "A Renovation Wave for Europe," has garnered interest within the European Parliament. The strategy highlights three main areas of focus: tackling energy poverty, renovating public buildings, and decarbonising heating and cooling. Ultimately, the strategy aims to engender a shift whereby "buildings will be the microcosms of a more resilient, greener and digitalised society, operating in a circular system by reducing energy needs, waste generation and emissions at every point and reusing what is needed."

Where the project has been met with great enthusiasm, sceptics have posed the question that is asked of many arts or "green" initiatives: is it worth it?

As planning for the New European Bauhaus commences (entailing five Bauhaus projects that look at art, culture and design through the lens of energy efficiency and environmental sustainability), MEP Dace Melbarde – former Latvian Culture minister – suggested that as a society we need less consumption rather than more production. Having recognised the value of the project, with its links to a Green Deal, MEP Domènec Ruiz Devesa reminded the Parliament of just how crucial it is in this moment to rescue the cultural sector before directing funding to other projects.

Fears that the direction of funding towards the Bauhaus project does not constitute a proper cultural recov-

ery should not be downplayed; The European Culture Foundation and Culture Action Europe addressed President Von der Leyen and others in a statement that calls for at least 2% of the Recovery fund to be delivered to cultural and creative enterprises to ensure their survival post-Covid.

**Together Is Better**

What is clear about the New European Bauhaus, however, is its ambition and focus on co-creation and experimentation. Such an interdisciplinary effort should be considered as long-term cultural policy with the potential to work explicitly, funding and promoting art and culture, and implicitly, changing the way we interact with the environment and reducing the harm we cause to it. Much like many sustainable architecture projects and transitions to green energy, the upfront cost is large, but when funding is ready and available, as is the case, the downstream pay-off in financial, environmental and social terms will be considerable.

Moreover, the carbon-saving potential and social value of a project of this ilk is precedented, having delivered results across a number of case studies. The New European Bauhaus will look to emulate the carbon-saving ability of the "Passivhaus," whose efficient insulation and heat recovery systems drastically reduce energy demand, allowing houses to be powered by renewable sources at a low cost. Likewise, innovative examples of sustainable architecture that incorporate art and design exist aplenty: from cutting edge affordable housing in Denmark, to functional work and office-space in the form of Manchester's One Angel Square.

It is yet to be seen whether Von der Leyen's desire to co-create a sustainable future will catalyse a green cultural transition for Europe, or fall foul of red tape, but the ambition and desire for change is evident. — DOM BAKER

*Source:* https://impakter.com/the-new-european-bauhaus-combining-art-and-science-to-a-sustainable-end/

## Would you like your work featured in *Urban Climate News*?

If you would like to write an article for the IAUC newsletter, please contact the Projects Editor **Helen Ward** (helen.ward@uibk.ac.at). Our Project articles usually provide a short summary of recent work and can be a good way to advertise a recent journal publication to a wide audience, perhaps including additional information, figures or photographs. Our Feature articles offer the opportunity to highlight results from a particular project or collection of projects, often bringing together findings from a series of complementary publications in a concise overview. We are always happy to receive suggestions for future issues of the newsletter – please get in touch!

# Crowdsourcing Urban Wind Data




**By Arjan Droste (arjan.droste@wur.nl)[1,2], Daniel Fenner[3,4,5], Bert Heusinkveld[1] and Gert-Jan Steeneveld[1]**

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*This work summarises the recent publication:*

Droste, AM, Heusinkveld, BG, Fenner, D, Steeneveld, G-J. (2020) Assessing the potential and application of crowd-sourced urban wind data. *Q J R Meteorol Soc.* 146: 2671– 2688. (https://doi.org/10.1002/qj.3811)

Crowdsourcing has been used to obtain urban air temperature, air pressure, and precipitation data from sources such as mobile phones or personal weather stations (PWS), but so far wind data from crowdsourcing has not been researched. Urban wind behaviour is highly variable and challenging to measure, since observations strongly depend on the location and instrumental setup. Crowdsourcing can provide a dense network of wind observations and may give insight into the spatial pattern of urban wind. We evaluate the skill of the popular Netatmo PWS anemometer against reference instruments for a rural and an urban site. Subsequently, we use crowdsourced wind speed observations from 60 PWSs in Amsterdam, the Netherlands, to analyse wind speed distributions of different Local Climate Zones (LCZs; Stewart & Oke, 2012).

## Data & Methods

For Amsterdam, 60 Netatmo PWSs measuring wind speed were present within the period January 2016 to July 2018. Not all stations were active for this whole period: at most 52 stations actively measured in a single day, but we see a general increase of active stations over time (with marked increases after Christmas and Father's Day). The wind module is a cylindrical 2-dimensional sonic anemometer of 11 cm height and 8.5 cm in diameter, using 4 nodes in an opening in the middle of the cylinder to measure the zonal and meridional wind components (Figure 1).

To evaluate the PWS wind speed measurements against a known reference, without the complexity of an urban environment, one Netatmo station was installed at the experimental rural weather field in Wageningen, the Netherlands. As a second reference, located in an urban setting, we utilise observations of three Netatmo anemometers (Figure 1, right panel), installed on the rooftop of the Chair of Climatology building of the Technische Universität Berlin, Germany. The reference network to which we compare the crowdsourced urban PWS observations consists of 25 stations covering the city centre of Amsterdam and suburbs (the AAMS network). These are installed on lampposts, with the anemometer at a height of 4.30 m above ground level.

We use LCZs as an indicator for urban morphology, which has a strong impact on wind speed (especially the ratio between building height and street width), so comparing stations within similar LCZs is required. We assume that morphology strongly determines a certain wind speed distribution, and by pooling the individual station data into one overall distribution per LCZ we are more likely to sample the 'true' wind speed distribution for a given LCZ, and not the microscale wind climate of one particular station.

## Quality Assurance

To set up a quality assurance (QA) protocol to improve the quality of the crowdsourced wind observations we follow Meier et al. (2017). We adapt and extend their QA

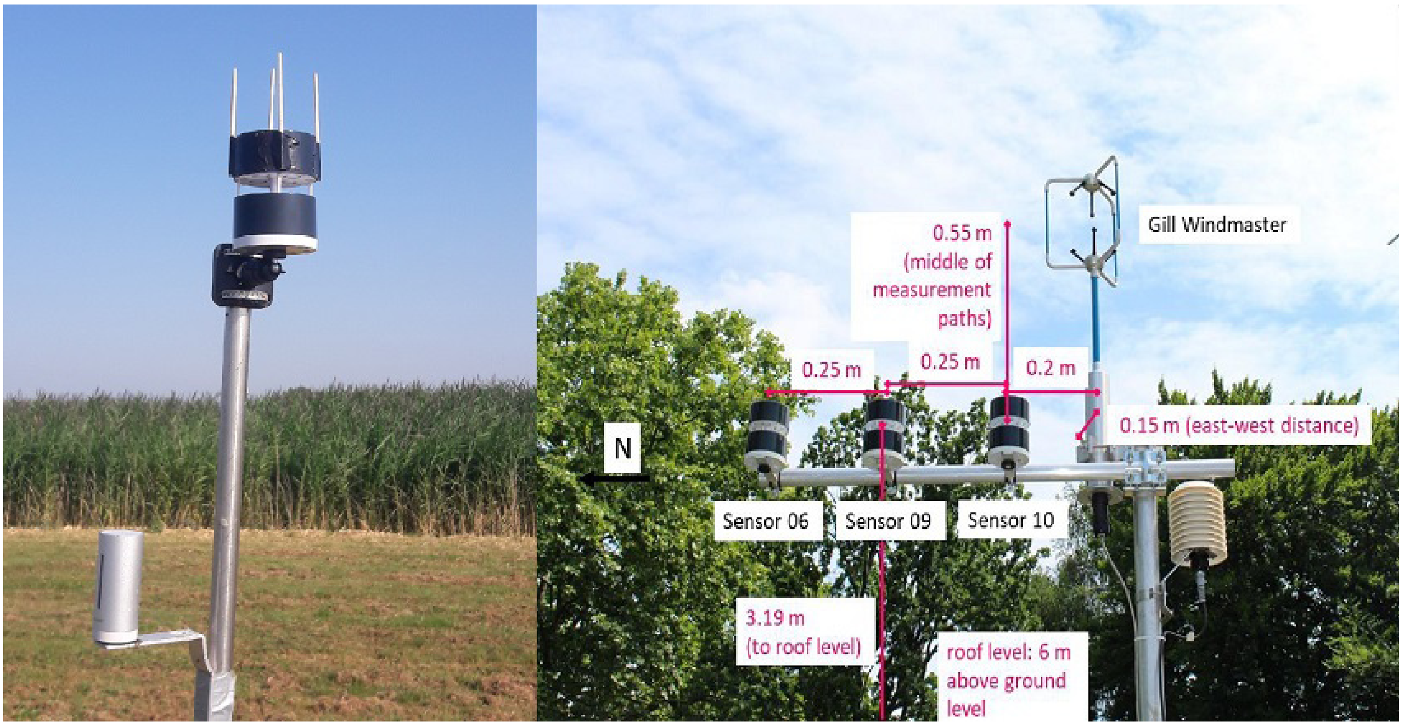


**Figure 1. Left: Netatmo wind module at the Wageningen weather field (top sensor) outfitted with spikes to prevent birds from resting. Right: Netatmo setup at Technische Universität Berlin.**

protocol to be suitable for wind data, as follows:

- **A. Location requirement & morphology.** Odd/duplicate locations are flagged (such as a station in the middle of a canal). The initial crowdsourced dataset was filtered according to these criteria, leaving 60 PWSs. These stations are then classified into LCZs, using the LCZ map of Figure 2.
- **B. Data averaging & filtering.** The PWS data is provided in integer km/h, at roughly 5-minute resolution. This QA step aggregates the data into hourly means. According to the Netatmo website, the minimum wind speed measurement is 0 m/s, with an accuracy of 0.5 m/s (1.8 km/h). However, having placed the wind module indoors for a period of time, we found the minimum measurement tends to be 1 or 2 km/h rather than 0 km/h, meaning very low wind speed or calm conditions are not well captured by the sensor. This is also often reported by users at the official Netatmo forums. These null-values comprise a significant part (up to 20 % for some locations) of the wind distribution. To eliminate this large bias in the wind distribution, all hourly means below 1.0 km/h are excluded from the analysis.
- **C. Filtering for meteorological conditions.** From the field experiments we determine whether meteorological circumstances, such as rain or humidity, negatively influence the measurements. Netatmo users report that rain disturbs the measurements, and that the stations are prone to collecting moisture inside the sonic module. For the Amsterdam data set we use observations of precipitation and relative humidity from the Schiphol airport station.
- **D. Systematic bias correction.** Any systematic deviation from the actual wind speed as measured during the comparison measurements at the experimental sites will be corrected for. The bias correction based on the experimental setup will be applied to the (filtered) crowdsourced data from Amsterdam.

**Wind Statistics**

A direct comparison between the crowdsourced data and the reference AAMS data is complicated by the urban heterogeneity and the contrasting setup between PWSs and the AAMS stations. The exact PWS setup is unknown, which adds uncertainty. Hence, the wind statistics, rather than instantaneous values, are compared with each other. Under idealised, undisturbed conditions, wind speed follows a 2-parameter Weibull distribution. This distribution is invalid below 0, has a peak at low values, and a long tail. The distribution is determined by a shape (a) and a scale (b) factor:

$$f(x) = \frac{a}{b}\left(\frac{x}{b}\right)^{a-1} e^{-(x/b)^a}$$

However, observations do not always fit the Weibull distribution for sites with disturbances, for instance where the wind speed distribution shows a bimodal pattern, or where there is a high probability of null (near-zero) wind speeds. This may occur in mountainous regions, but also in complex environments such as cities. A mixture Weibull distribution can represent a wind speed regime with a large probability of null winds (Carta et al., 2009), which is what we would expect in a city. Such a distribution combines two Weibull distributions into one overall mixture distribution, one representing the peak, and one representing the tail end of the distribution:

$$f(x) = \omega_1 \frac{a_1(x)^{a_1-1}}{b_1^{a_1}} exp\left[-\left(\frac{x}{b_1}\right)^{a_1}\right] + \omega_2 \frac{a_2(x)^{a_2-1}}{b_2^{a_2}} exp\left[-\left(\frac{x}{b_2}\right)^{a_2}\right]$$

Here $a_{1,2}$ and $b_{1,2}$ are shape and scale parameters, respectively, for the first and second mixture components. $\omega_{1,2}$ is the proportionality of the two mixture components, and their total sums to 1. We assess the performance of the PWS data against the AAMS reference data through the resulting probability density distribution (PDD).

### Comparison to reference

For the comparison of measurements in Wageningen the unfiltered PWS data (Figure 3a) show a systematic underestimation of the wind speed which increases with the actual wind speed. Also, the PWS frequently measures 1.0 km/h when the actual wind speed is higher. Thus, hourly mean wind speeds of 1.0 km/h and lower are excluded from all crowdsourced datasets (QA step B).

Moisture can collect inside the device, which appeared not completely watertight, and which can influence the measurements (a common issue according to the Netatmo users' forums). This problem appeared after three months when the PWS stopped measuring, at which point we dismantled the module, cleaned and dried it, and reinstalled it in the field. After rain and humidity filtering, and removing the 1.0 km/h data, 64 % of the data remain for analysis (2294 hours from 3570). We correct for the systematic bias based on the wind speed measured by the PWS, not on the 'ground truth' of the reference sonic. Hence, the correction is independent from reference data and can be used universally. The data is corrected with a linear regression model, optimised for the median absolute error (MDAE) of resulting corrected wind speed, to give high outliers less weight.

The majority of the corrected data follows the 1:1 line (Figure 3b), though a portion of positive outliers remains. MDAE amounts to 0.78 km/h, down from 2.5 km/h in the uncorrected set. However, the root mean square error (RMSE) of the corrected data is still 1.95 km/h, compared to 3.46 km/h in the uncorrected dataset, indicating the spread still visible in the corrected dataset.

### Amsterdam crowdsourced data

A linear fit to the reference AAMS data is decent ($R^2$ = 64%) since the centre of the PWS PDD is much lower than the reference. Removing the 1.0 km/h values (QA step B) strongly improves the fit (to $R^2$= 85.8%, Figure 4b) but the peak at low wind speeds is still prominent. Filtering for rain and humidity (QA step C, Figure 4c) does little to improve the peak values, since rain events tend to coincide with relatively high wind speeds, and as such the main data reduction occurs at the tail end of the PDD. Applying the bias correction (QC step D, Figure 4d) results in a strong improvement ($R^2$= 91.6%), though some overestimation of the higher wind speeds is introduced through the linear correction method.

The bias correction does not seem to perform well during periods with very low wind speeds, and in those cases when just the data filtering (QA steps A through C) is enough to obtain a good fit to the reference network. The PWS's tendency to underestimate wind speed seems to only become an issue when wind speeds are not low (median wind ~2 km/h), so QA step D for these situations is not recommended. Applying QA step D should therefore be dependent on the mean wind speed. The strong relative error introduced by the integer data resolution and the measurement accuracy of 1.8 km/h (0.5 m/s) is more dominant for low wind speed cases.

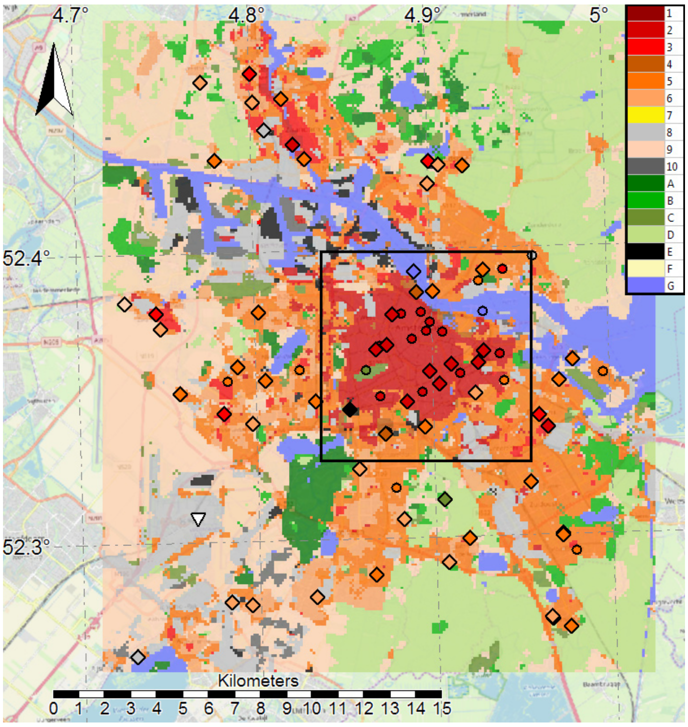


**Figure 2. LCZ map of Amsterdam. The diamonds indicate the PWSs; the circles the AAMS stations, and the white triangle WMO station Amsterdam Airport. The black rectangle indicates the city centre containing the used stations for analyses.**

### Discussion

The greatest issue with crowdsourcing data is its lack of metadata (Muller et al., 2015). Especially the station setup

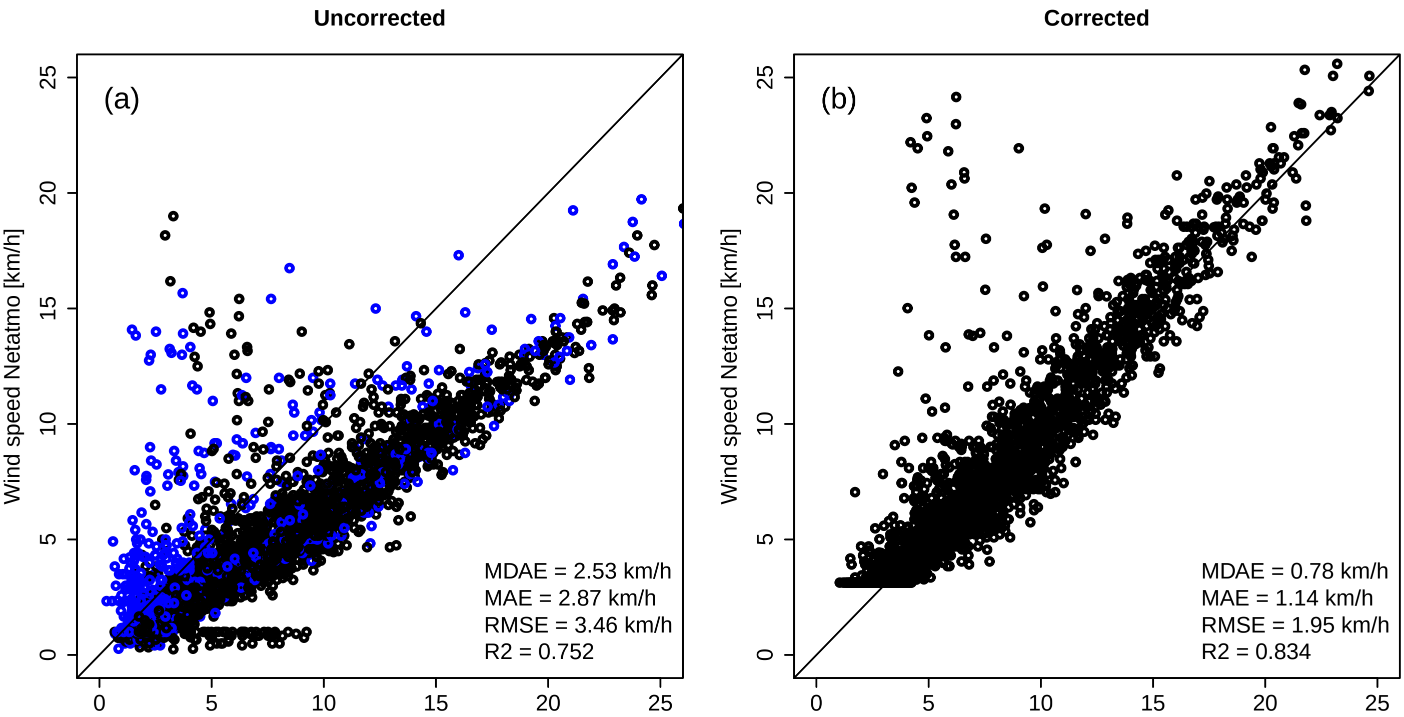


**Figure 3. Scatterplots of hourly averaged wind speeds as observed by the sonic reference instrument (x-axis) and Netatmo (y-axis) at Wageningen weather field. (a) shows the uncorrected data, with rain & high humidity events marked in blue; (b) shows the corrected data.**

is a crucial factor: wind speed is affected not only by orientation (the sonic anemometer needs to be level), and strongly by shelter and obstacles (inducing turbulence and flow blocking), but also the measurement height, which is unknown. It is easy for inexperienced PWS users to make small mistakes during station setup, such as angling the sonic anemometer. Only the most basic location information is given by Netatmo, which does not contain any information regarding setup, calibration, or height of the measurements. We expect the PWSs to be usually mounted at some height above the ground, at best 2 m, but also on balconies, windowsills, or wherever it is most suitable for the respective owner. A more ambitious weather hobbyist might install the anemometer on a pole or on top of a shed, for example, to better measure the actual wind. Stations installed on balconies or rooftops will give a completely different signal in time than a station in a sheltered garden. When installing the anemometer, the software offers the opportunity to report the station's height above ground. However, this information cannot be extracted from the Netatmo data obtained through the API, so we cannot check whether any correction towards a standard value (e.g. 10 m) is performed prior to data storage.

A large uncertainty lies within the Netatmo PWS itself: our bias analysis and experimental setup shows that the station tends to underestimate relatively high wind speeds, and substantially underestimates very low (< 2 km/h) wind speeds due to the coarse output resolution. We know that the measurement frequency is roughly 0.16 Hz and that these measurements are then aggregated into the 5-minute output obtained through the API, so potentially the raw unprocessed data could provide a solution to the low wind speed errors. Other PWS brands might not suffer from the issues at low wind speeds combined with coarse output, which could make QA level B unnecessary for these cases.

## Applications & perspectives

Due to the uncertainty of station setup, the data obtained from individual PWSs cannot give an accurate representation of the urban wind speed climate. A 1-to-1 time series for individual PWSs compared to their closest matching AAMS stations displayed large deviations around the mean, even for daily averages, indicating the strong microscale character of the measured wind speed. The mixture Weibull distribution successfully captures the variability of wind within a city and provides insight into the wind speed differences between neighbourhoods and LCZs. For a more quantitative temporal assessment of wind speed, PWSs appear not to be the right tool, and specialised measurement networks setup by professionals are still necessary. While a technique like Generalized Extreme Value statistics of thermal comfort like in Steeneveld et al. (2011) would be possible using the substantial length of the crowdsourced dataset, this is usually not applied by policy makers, but could be in the future with increasing number of PWSs in cities worldwide.

The sensitivity of the station to errors in the setup (i.e. tilting, sheltering, measurement height) needs to be investigated in a systematic way, as Bell et al. (2015) did for air temperature and humidity. Wind tunnel experiments using several Netatmo anemometers could investigate the influence of the angle of tilt of the station on the reported wind speed values, and the threshold wind speed when the measurements are of sufficient quality. A long-term urban experimental setup of the Netatmo anemometer next to a known reference station could give some insight into expected sensor drift, the cause of errors for the low urban wind regimes, and a more robust estimate of the bias correction parameter needed.

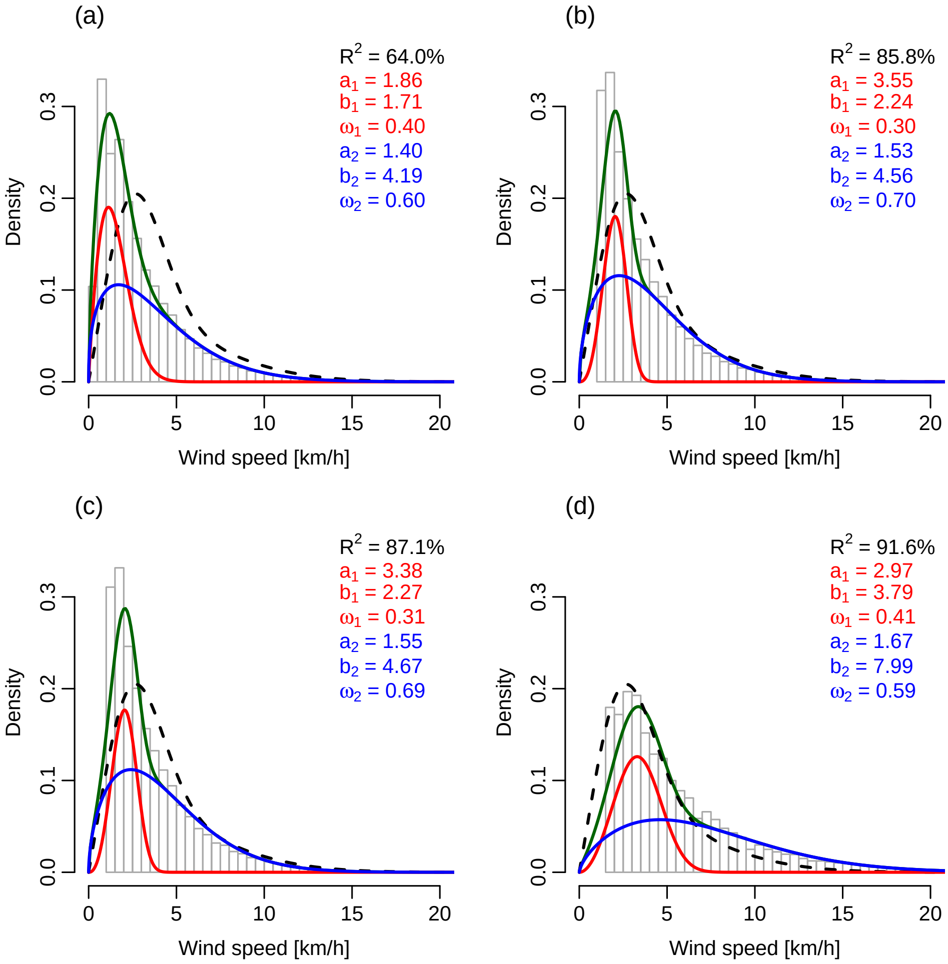


**Figure 4. QA steps applied to the crowdsourced urban wind data. Bars indicate the PWS data; red and blue lines are the two mixture Weibull components that make up the final distribution (green). Black, dashes line is the AAMS reference PDD. Panel label is equal to the QA step applied (going from A to D).**

## Conclusions

Based on the results obtained, we conclude that Netatmo PWS wind speed data are useful for urban climate research under the following conditions:

- The record is of sufficient length (> two months) to have a large amount of data and document meaningful probability density distributions.
- The mean wind speed in this period is not low (> 2 km/h): inherent issues with the Netatmo hardware induces substantial errors at low wind speeds, and the output of the stations in integer km/h increases the relative error made.
- External data of rain and humidity is available to apply the QA protocol, which filters out rain and high relative humidity (RH > 95%) events. Humidity impacts the sonic anemometer and reduces its quality. Humidity and rain data could also be collected from (QA controlled) PWSs.
- The research in question is interested in the distribution of wind, rather than the wind at one given moment in time or space.

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# LCZ Generator: a web application to create Local Climate Zone maps

*Reference:* Demuzere, M., Kittner, J., & Bechtel, B. (2021). LCZ Generator: a web application to create Local Climate Zone maps. Accepted in *Frontiers in Environmental Science - Urban Climate Informatics Special Issue* (https://www.frontiersin.org/articles/10.3389/fenvs.2021.637455/). *Link to the web-application:* https://lcz-generator.rub.de/

At the international level, cities are becoming of increasing concern, exemplified by the urban focus of the new United Nations Agenda and Sustainable Development Goals, the recognition of the role of cities in climate change by the Intergovernmental Panel on Climate Change, and two urban related challenges identified by the World Meteorological Organisation World Weather Research Program. Yet despite this new focus on cities as a critical scale for climate change management, we know very little about most cities on the planet – being generally ignorant of their extent, how they are constructed and how they are occupied (Demuzere et al., 2020). First and foremost, climate-relevant urban data consistent in coverage, scale and content are needed to support risk assessment and its management and to enable effective knowledge transfer between cities. A number of projects have mapped the global urban extent at finer and finer detail, but these efforts need to be complemented by a wider range of information-rich intra-urban classes that describe different types of urban land covers and land uses: the Local Climate Zone (LCZ) typology is a good example of such a classification scheme (Stewart and Oke, 2012; Reba and Seto, 2020).

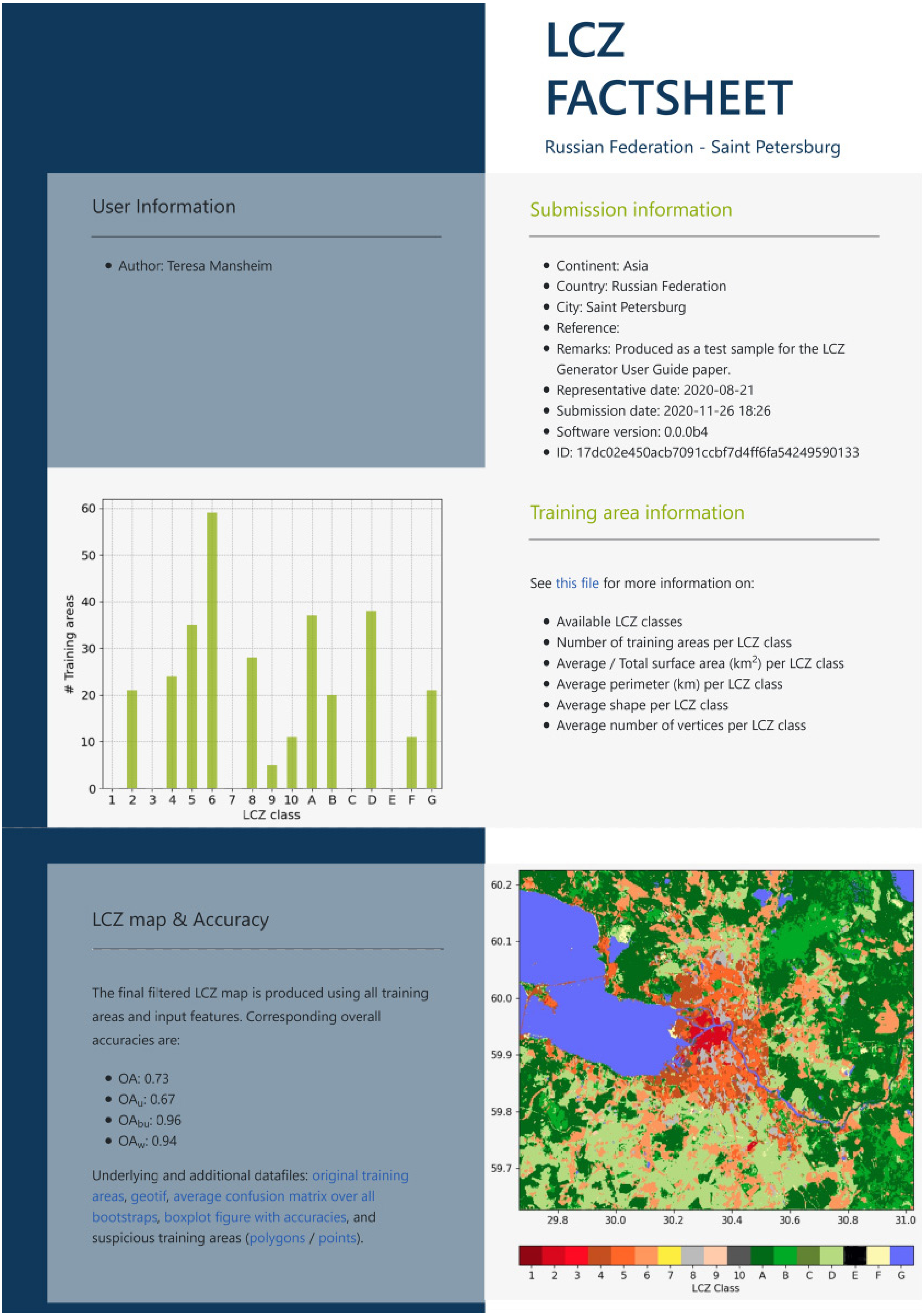
Local Climate Zones refer to a classification system that exists out of 17 classes, 10 of which can be described as urban. The system is originally designed to provide a framework for urban heat island studies, allowing the standardized exchange of urban temperature observations (Stewart and Oke, 2012). Its universality has important advantages, as it allows a systematic comparability of global intra- and inter-urban heat island studies, provides a common platform for knowledge exchange and the description of urban canopy parameters in urban ecosystem processes, and supports model applications, especially for cities with little or insufficient data infrastructure. In the early 2010s, Bechtel (2011) and Bechtel and Daneke (2012) first proposed mapping entire cities into Local Climate Zones. This procedure was formalised by Bechtel et al. (2015), relying on an 'off-line' workflow that integrates training areas (TAs, a set of LCZ labelled polygons) and Landsat 8 (L8) imagery within the SAGA software package over a limited spatial domain.

While this framework is valuable, it will not result in a database that could support urban decision-making globally in a reasonable time frame. Therefore, Demuzere et al. (2019a,b; 2020) developed a number of strategies to expand LCZ coverage rapidly. The first recognises that much of the information contained in TA data for one city is transferable to other cities for which no TA data is available. The second employs Google's Earth Engine (EE; Gorelick et al., 2017) because of its computational power, access to a range of geospatial datasets and a large number of predefined algorithms. Among others, this cloud-based approach resulted in high-resolution Local Climate Zone maps for global cities, Europe and the continental United States of America (e.g. Demuzere et al., 2019a,b; 2020; Brousse et al., 2020). The 'LCZ Generator' web application described here further simplifies this process, as it provides an online platform that maps any city of interest into LCZs, solely expecting a valid TA file and some metadata as input. The application integrates all of the above-mentioned developments and procedures, and simultaneously provides an automated accuracy assessment, TA data derivatives and a novel approach to identify suspicious TAs.

When accessing the LCZ Generator, the user is directed to a submission form that consists of two sections: personal information and TA information. The personal information consists of the author's first and last name and e-mail address, the latter being required since the results of the LCZ Generator are sent via e-mail. The second section queries about the TA file[1], and additional metadata, such as continent, country, city name, the date for which the training polygons are representative, and the non-required 'Reference' and 'Remarks' fields.

In addition to the TAs, one needs earth observation data and a supervised classifier (Bechtel et al., 2015). The default WUDAPT workflow relies on Landsat 8 data as input to the random forest classifier, embedded as an 'LCZ classification tool' in SAGA GIS. Yet here, the LCZ Generator builds further upon the findings of Demuzere et al. (2019a,b, 2020) and Brousse et al. (2020), and uses a total of 33, globally available, input features, on a 100 m resolution, stored in EE's online WUDAPT asset folder (3 TB of data). They consist of 16 features derived from Landsat 8, 5 features from Sentinel-1, 8 features from Sentinel-2, and four additional features reflecting terrain and forest canopy height. Note that the list of input features used in Demuzere et al. (2019a, 2020) is expanded with Sentinel-2 red edge bands to improve the mapping of wetlands (Brousse et al., 2020), and a Sentinel-2-based combina-

[1] http://www.wudapt.org/wp-content/uploads/2020/08/WUDAPT_L0_Training_template.kml



# LCZ FACTSHEET

Russian Federation - Saint Petersburg

## User Information

- Author: Teresa Mansheim

## Submission information

- Continent: Asia
- Country: Russian Federation
- City: Saint Petersburg
- Reference:
- Remarks: Produced as a test sample for the LCZ Generator User Guide paper.
- Representative date: 2020-08-21
- Submission date: 2020-11-26 18:26
- Software version: 0.0.0b4
- ID: 17dc02e450acb7091ccbf7d4ff6fa54249590133



## Training area information

See this file for more information on:

- Available LCZ classes
- Number of training areas per LCZ class
- Average / Total surface area (km$^2$) per LCZ class
- Average perimeter (km) per LCZ class
- Average shape per LCZ class
- Average number of vertices per LCZ class

## LCZ map & Accuracy

The final filtered LCZ map is produced using all training areas and input features. Corresponding overall accuracies are:

- OA: 0.73
- $OA_u$: 0.67
- $OA_{bu}$: 0.96
- $OA_w$: 0.94

Underlying and additional datafiles: original training areas, geotif, average confusion matrix over all bootstraps, boxplot figure with accuracies, and suspicious training areas (polygons / points).



**Figure 1. Factsheet example for Saint Petersburg (Russia). Note that in reality, the factsheet also contains a 'Terms of Service' and 'Attribution' section; these are omitted here for clarity.**

tional shadow index (CSI) and shadow enhancement index (SEI) median composite (Sun et al., 2019).

On top of an automated cross-validation quality control using 25 bootstraps and accuracy metrics described in Demuzere et al. (2020), an additional automated 3-step TA quality control is added, that aims to facilitate the revision of the original TA submission and to improve the resulting LCZ map with additional iterations. In a first step, polygons with a surface area below 0.04 km$^2$ (too small) or a shape ratio 3 (too complex shape) are flagged. In a second step, the non-parametric density-based spatial clustering of applications with noise (DBSCAN) (Schubert et al., 2017) is used to identify whether the average spectral value of a polygon of LCZ class *i* is considered as an outlier compared to the average spectral values of all other polygons of that class *i*. A third and final QC step is similar to step 2, but takes into account all individual pixel values of all polygons.

The output of the LCZ Generator is listed in an online search- and sortable submission table including information about the city, country, continent, date of the submission, overall accuracy, and a button (Show Factsheet) linking to the factsheet that provides a visual summary of all results (Figure 1). By checking one or multiple entries using the left-hand side check-boxes of the submission table, one can also download the corresponding *.zip* archive(s).

Feeding the random forest in a bootstrapping manner with the submitted TAs and the earth observation input features results in a raw and filtered LCZ map, a pixel probability map, and overall accuracy metrics (Figure 2).

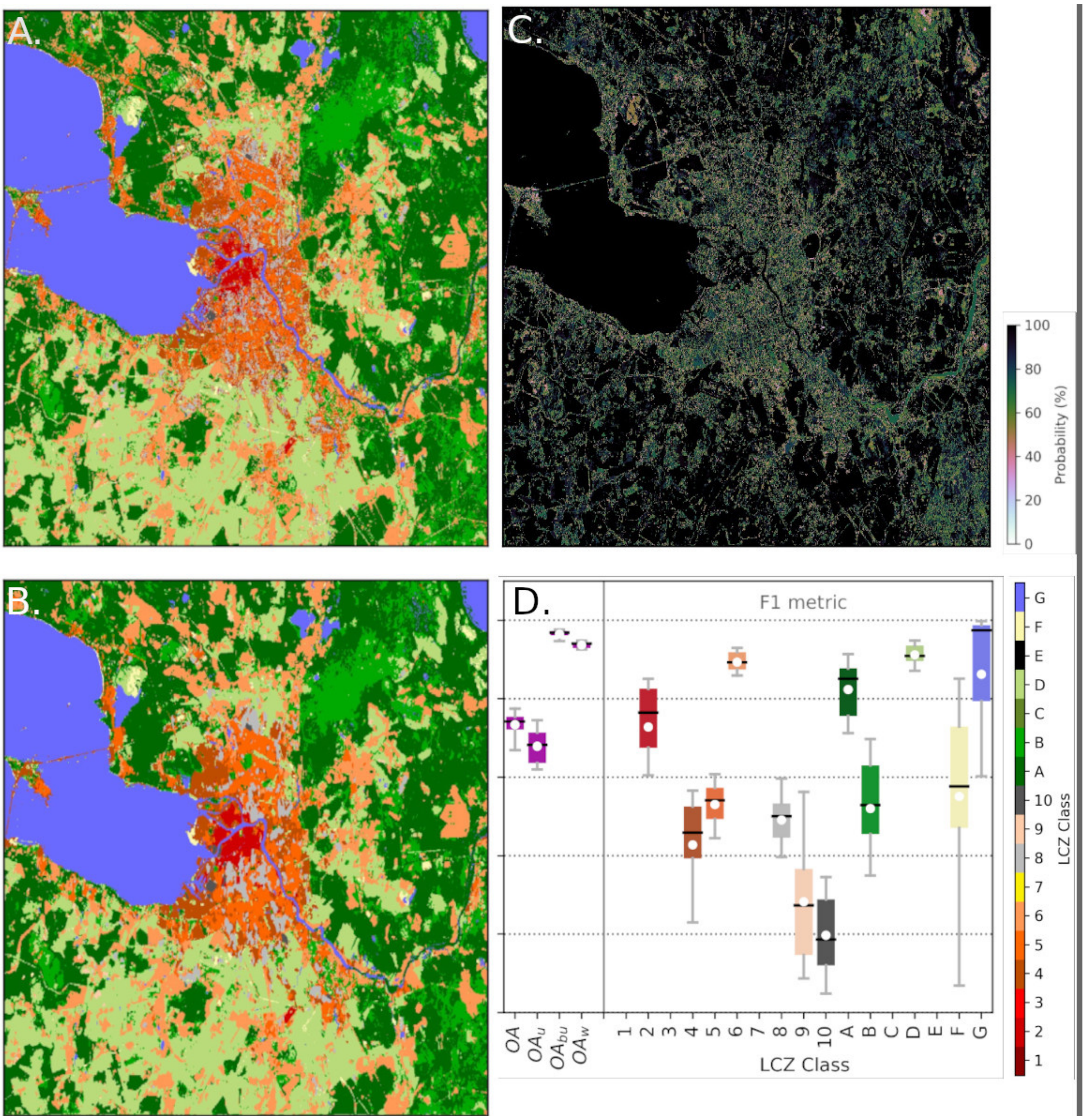



**Figure 2. Raw (A) and filtered (B) LCZ map, probability map (C) and accuracy assessment (D) for Saint Petersburg (Russia).**

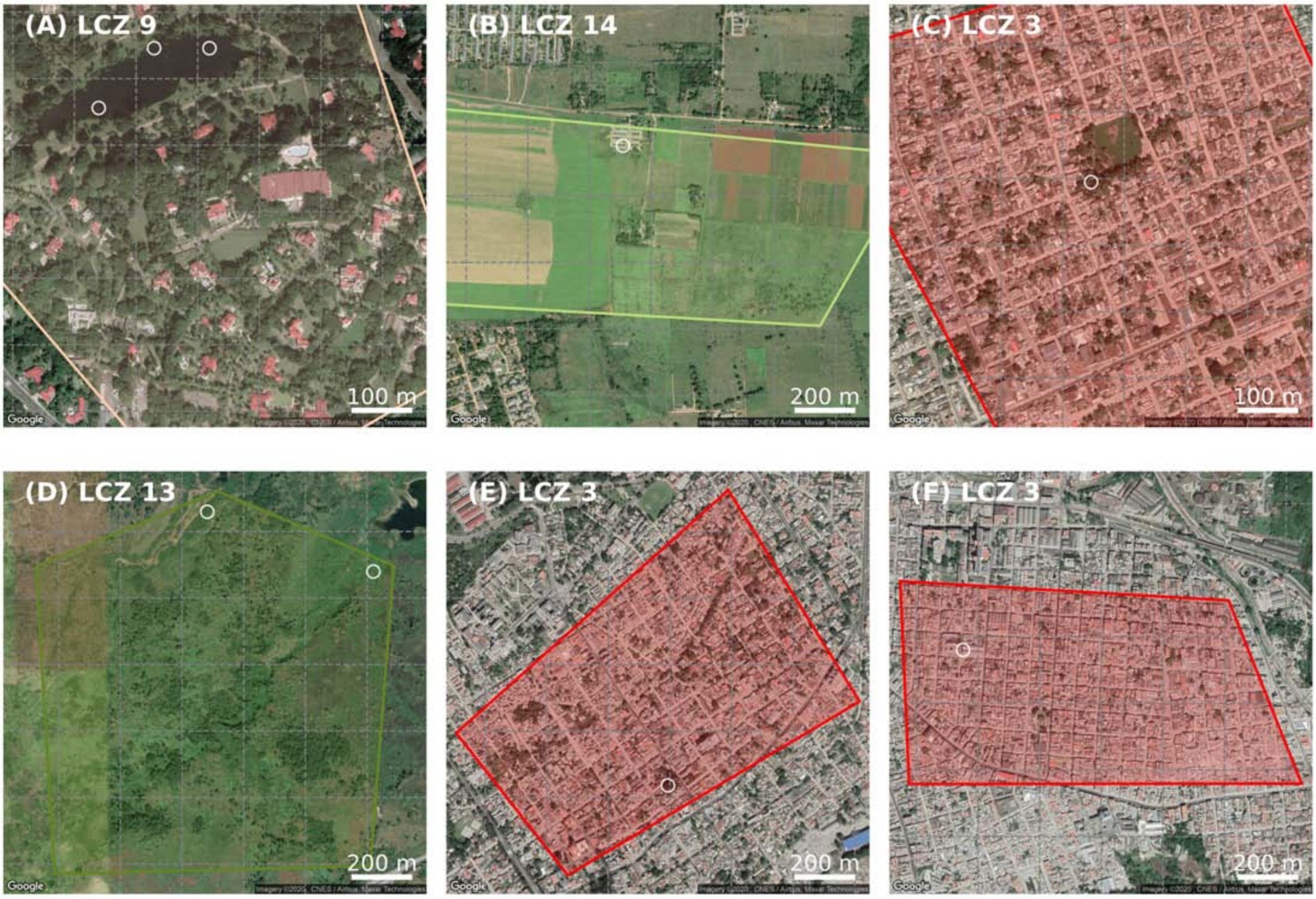



**Figure 3. A selection of TA polygons tagged as suspicious during the third quality control step, for Havana (Cuba).**

Results for the third quality control step are shown in Figures 3 and 4 for Havana (Cuba). The first polygon (Figure 3A) is labelled as LCZ 9 (Sparsely built), reflecting the small or medium-sized buildings widely spaced across a landscape with abundant vegetation. Yet the polygon also includes a water body large enough to be detected by the 100 m input feature pixels. Visualising the normalized difference water index (NDWI) values of these pixels against e.g. the combined shadow index derived from Sentinel-2 (S2 CSI) reveals the outlier position of these pixels (Figure 4A). A similar analysis can be done for the other selected polygons: the LCZ 14 polygon in Figure 3B mostly constitutes agricultural land, yet also contains a farm flagged as suspicious. The compact lowrise LCZ 3 polygon in Figure 3C contains a park in the middle surrounded by trees, being flagged as suspicious. Figure 3D is labelled as LCZ 13 (Bush and scrub) even though it should probably be LCZ D (Low plants). The flagged dots in this case refer to areas with seasonal waters.

Finally, Figures 3E and 3F are two additional examples of compact lowrise polygons. And even though some of the spectral signatures tend to be outliers compared to all other pixel values for this LCZ class (Figures 4E and 4F), it is not self-evident to pin-point the exact reasons for the polygons to be flagged. In Figure 3E., a pixel is flagged with abundant vegetation, yet elsewhere in the polygon similar areas can be found that are not flagged. The polygon in Figure 3F represents a homogeneous neighbourhood in terms of urban form, yet here the flagged pixel is on top of a large-scale warehouse, potentially large enough to influence the pixel's spectral values with its different radiative characteristics.

Since their introduction in 2012, Local Climate Zones (LCZs) emerged as a new standard for characterising urban landscapes, providing a holistic classification approach that takes into account micro-scale land-cover and associated physical properties. The default LCZ mapping procedure, adopted as Level 0 (lowest level of detail) by the WUDAPT grass-root effort (Ching et al., 2018), and relying only on open-source data (Landsat 8) and software, has been instrumental to the success and global dissemination of this framework. However, some features of this default procedure inhibit global up-scaling in a reasonable time, e.g. the need to download and pre-process Landsat 8 data from the United States Geological Survey (USGS) Earth Explorer, the processing of the LCZ classifier embedded in SAGA GIS on your local computer, the unavailability of an automated cross-validation, and the manual review by an experienced operator before the data is made publicly available (Bechtel et al., 2015, 2019).

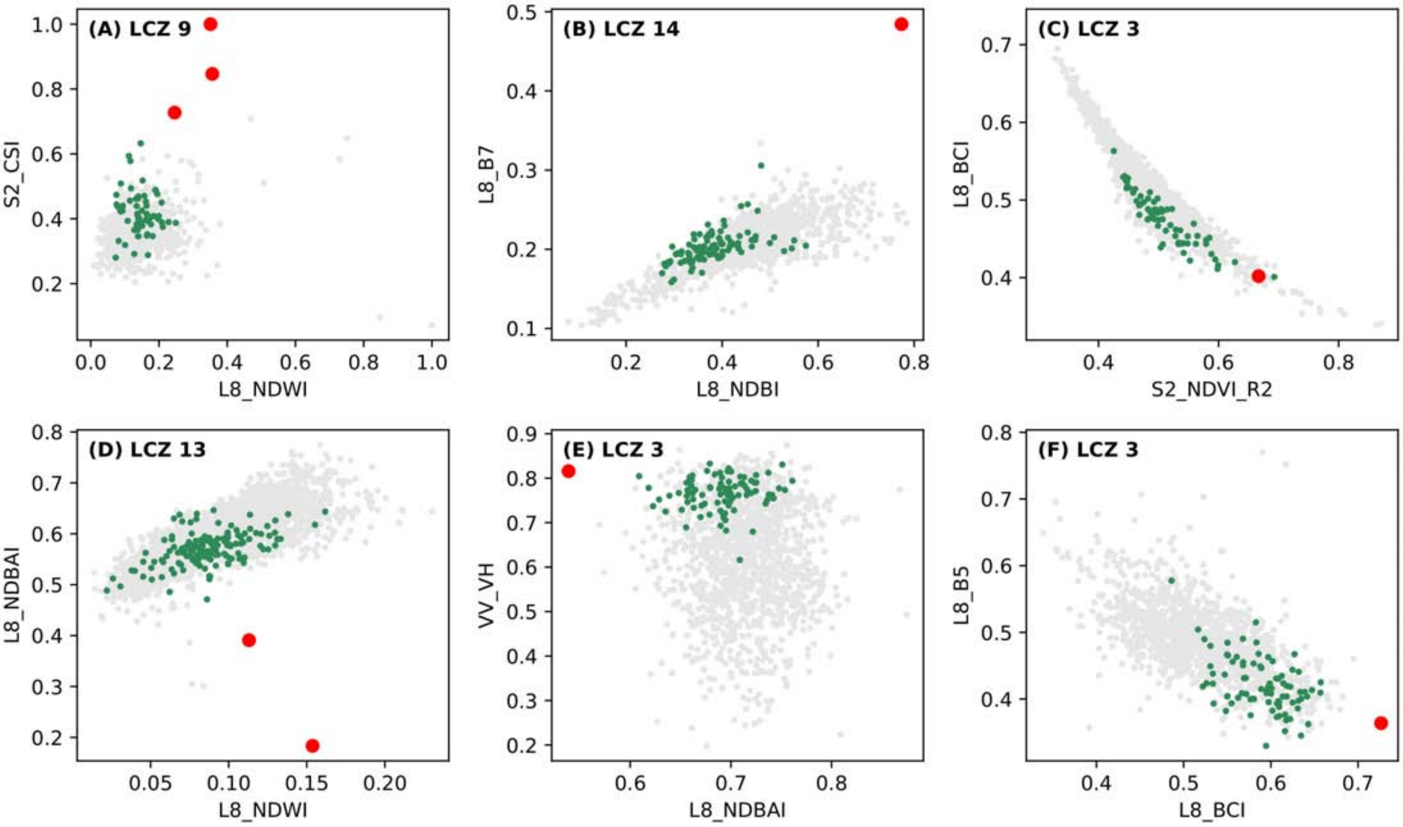



**Figure 4. Spectral values for all pixels in one LCZ class, corresponding to the subplots of Figure 3 (grey dots). Pixels flagged as outliers by DBSCAN are shown in red. Remaining pixels from the pixel's parent polygon are shown in green. Axis labels refer to: Near Infrared (B5), Shortwave Infrared 2 (B7), Biophysical Composition Index (BCI), Normalized Difference Bareness Index (NDBAI), Normalized Difference Built Index (NDBI), Enhanced Normalized Difference Wetness Index (NDWI), all from Landsat 8 (L8); Combinational Shadow Index (CSI) and Normalized Difference Vegetation Index Red Edge 2 (NDVI_R2), both from Sentinel 2; and mean Sentinel-1 backscatter (VV_VH).**

The LCZ Generator addresses these shortcomings, by adopting well-tested and -documented cloud-based LCZ mapping strategies using Google's earth engine. The result of this is an online platform that maps any city of interest into LCZs, solely expecting a valid TA file and some metadata as input. The web application simultaneously provides an automated accuracy assessment, and a novel 3-step TA quality control that facilitates the revision of the original TAs. We anticipate that the LCZ Generator will ease the production, quality assessment and dissemination of LCZ maps and related products. This easy-to-use and accessible online platform should therefore continue to support researchers and practitioners in using the LCZ framework for a variety of applications. Moreover, in line with the assessment of Creutzig et al. (2019), we firmly believe that this LCZ Generator has the potential to become a key part in mainstreaming and harmonising urban data collection, upscale urban climate solutions and effect change at the global scale.

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# Challenges of Urban Roughness Representation and Impacts on Regional Hydrometeorology

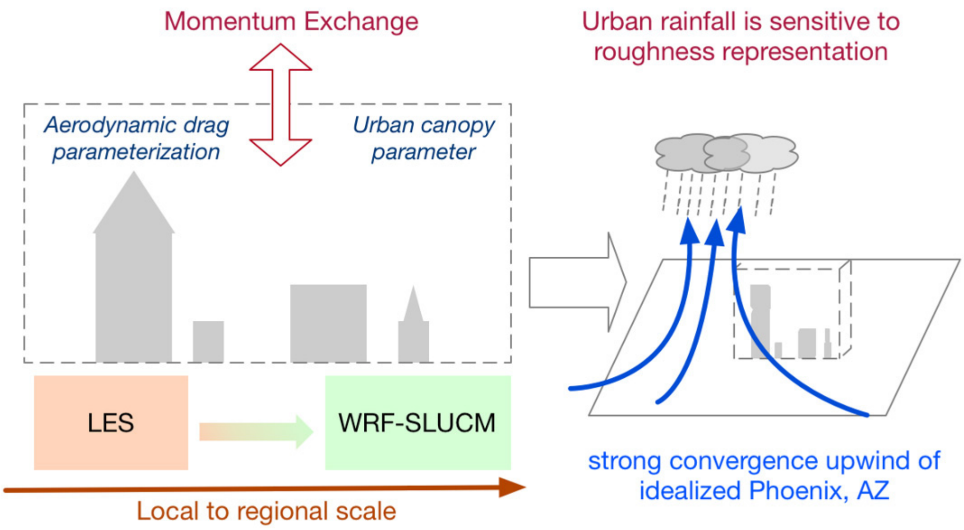


**Figure 1. The study of Li et al. (2021) integrates LES and WRF-SLUCM to understand the urban roughness representation at the local and regional scales, and examines the implications for urban rainfall. For an idealized representation of Phoenix, AZ in a mesoscale model, convergence is strong if urban aerodynamic drag is strong, producing rainfall upwind of the city.**

Mesoscale weather and climate models are indispensable tools in urban climate studies. The crux of representing urban land-atmosphere interactions in mesoscale modeling systems is to represent the exchanges of momentum, energy, and mass in urban land surface models, which are often referred to as urban canopy models. Significant research efforts have been spent to develop these models of different degrees of complexities and to couple them to mesoscale modeling systems. Despite the large progress in urban climate modeling during the past decade, some persistent challenges are common across all urban canopy models.

First, the presence of large bluff-body roughness elements in the urban environment presents a particular challenge in accurately quantifying the momentum exchange. Estimation of surface drag caused by complex urban morphology is crucial for accurately quantifying the exchange of energy, water vapor and other scalars between cities and the overlying atmosphere. Yet it is still a known challenge for urban canopy models to reproduce the drag effect of heterogeneous built terrain. For example, in the single-layer urban canopy model (SLUCM) implemented in the Weather Research and Forecast model, the parametrization scheme of momentum exchange is often derived from idealized laboratory experiments of building arrays of uniform height or is based on vegetation canopy flows, which may have limited accuracy for applications over complex urban landscape.

Second, detailed information of urban canopy parameters (UCPs) at the appropriate spatial resolution is still lacking over three-dimensional (3D) built-up environment. For example, UCPs relevant for momentum exchange such as the frontal area index can be inaccurately estimated. It is encouraging to see an increasing effort on retrieving high-resolution UCPs from satellite data and geographical information systems. Although we are moving towards making more refined UCPs readily available for urban climate simulations, there can be an inherent inconsistency in applying the 3D UCPs in parameterizations that represent cities as the prototypical two-dimensional "canyons".

Third, parameterization of momentum exchange depends on both the parameters and parameterization scheme. In fact, these two aspects related to momentum exchange parameterization and UCPs encompass two primary sources of uncertainty for a generic urban canopy model coupled to mesoscale weather models. Yet, their effects are often entangled. This makes it difficult to assess whether refining the urban canopy parameters (UCP) will lead to improved accuracy of the parameterization scheme. Especially for urban hydrometeorological studies, addressing the separate effects of parameters versus parameterizations has received relatively little attention.

Using the single-layer urban canopy model (SLUCM) implemented in the Weather Research and Forecast model (WRF) as an example, a recent research paper, "Impact of urban roughness representation on regional hydrometeorology: An idealized study," in *Journal of Geophysical Research: Atmospheres* examined these general challenges. It is well known that SLUCM produces positive bias in the mean horizontal wind in urban areas compared to more sophisticated schemes such as the multilayer model and the field measurements. However, the separate impacts of UCPs and momentum exchange parameterization schemes on such known bias in SLUCM remain elusive. Moreover, this study also examines how the influence of roughness representation cascades to boundary layer processes and hydrometeorological variabilities. To address these issues, a large eddy simulation model that resolves the urban canyon morphology is integrated with idealized WRF-SLUCM simulations over Phoenix, Arizona (See Fig. 1). At the local scale, LES that resolves the building morphology and hence pressure drag of the rough surfaces is found to be more sensitive to the urban geometry representation. At the local scale, results from this study further confirm the underestimation of surface drag in the default SLUCM in WRF and a wind direction dependence on the underestimation is shown, especially with a wind direction of about 45°.

An interesting finding is that if refined 3D urban morphology information is incorporated into the parameters in SLUCM, a further reduction of surface drag will be obtained, which even worsens the underestimation (overestimation) of the surface drag (near-surface wind speed). Nevertheless, using large-eddy-simulation-based results to improve the parameterization in SLUCM leads to reduced wind speed, especially at low-atmospheric level, at least for the idealized case investigated. In addition, compared to the clear days, urban roughness presentation more significantly impacts the spatial and temporal rainfall variabilities. This is due to high sensitivity of flow convergence transporting moisture in the lower atmosphere to distinct parameterizations of urban momentum exchange (See Fig. 1, right panel). This high sensitivity implies that it is critical to address challenges in representing urban roughness effects, especially for modeling regional hydrometeorology. Findings in this study provide an example that sometimes it may be counter-productive to only refine the urban canopy parameters. Improving momentum exchange parameterization can be more important than refining urban canopy parameters to capture the urban roughness effect in mesoscale modeling.


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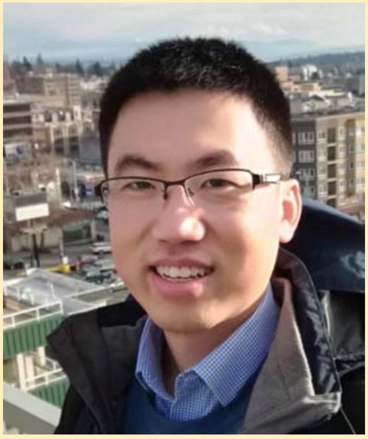

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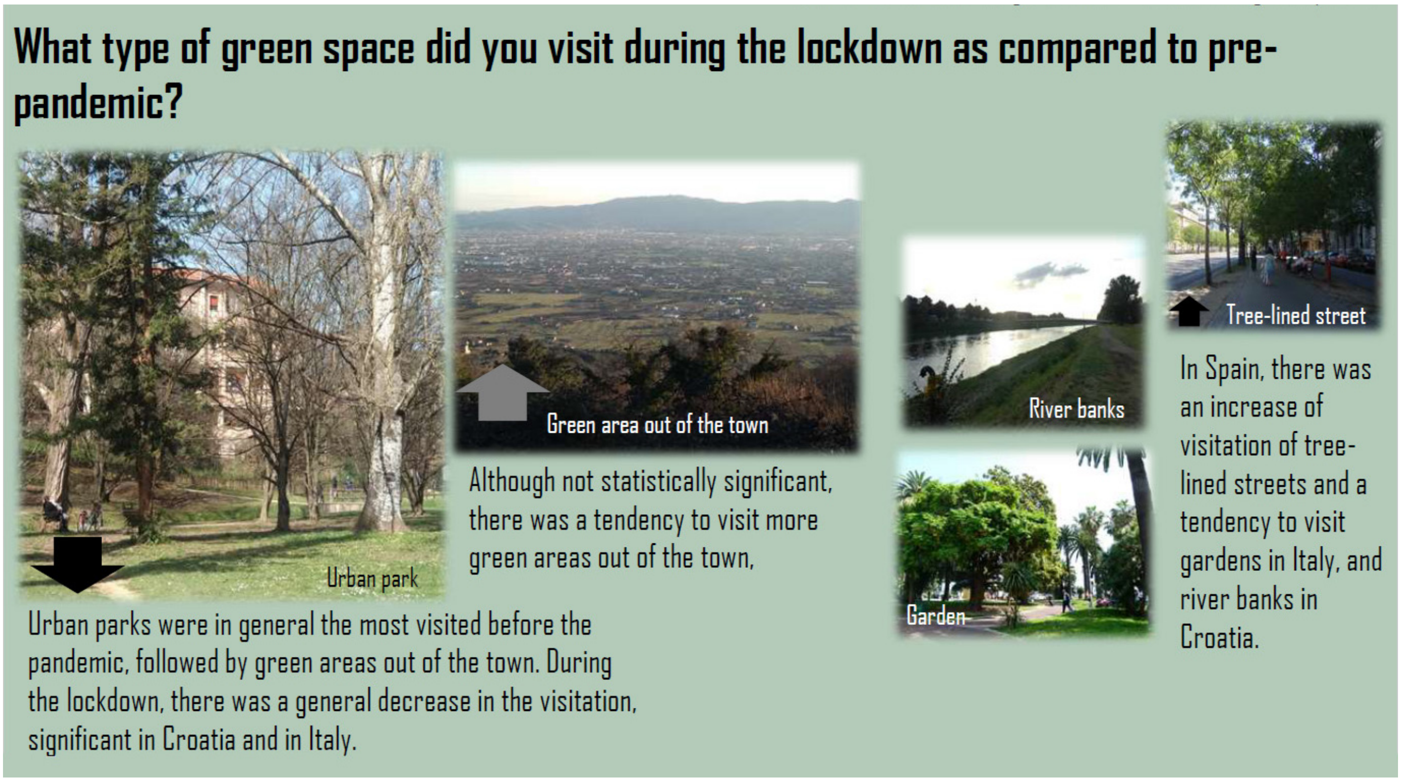
# Forests, nature, and public space during the global pandemic

*On March 19th 2021, the International Union of Forest Research Organizations (IUFRO) Division 6 hosted an online forum which highlighted cutting-edge research on the role of forests, nature, and public space in urban areas during the Covid-19 pandemic. The event, which included four presenters and a lively discussion, was the first in a series of IUFRO webinars entitled "Social Aspects of Forests and Forestry."*

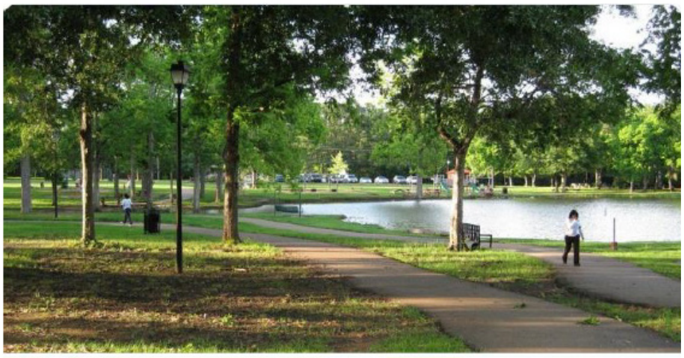
The webinar was introduced by Dr. **Cecil Konijnendijk**, the Coordinator of IUFRO Division 6 and Director of the Nature Based Solutions Institute in Barcelona, Spain. In his framing of the event, he raised a number of questions: How have our local green spaces helped us to cope with the public health crisis? Have we seen changes in the use and perception of urban nature? And will this affect the way in which we plan, design, and manage our urban green areas and public spaces, and perhaps even our cities?

The first presenter was Dr. **Francesca Ugolini** of the Institute of BioEconomy at the National Research Council of Italy, who proposed the question *"What can we learn from people's usage and expressed need for urban green spaces during the lockdown?"* She reported the results of a novel exploratory survey carried out in six European countries during the first wave of the pandemic, when these countries had imposed different levels of restrictions on public activity. The findings accentuated urban dwellers' acute need for both accessible green pockets close to home, and wide-open green areas to counter the feelings of nature-deprivation during the lockdown. It was therefore suggested that a hierarchical planning approach – considering the density and typological diversity of green spaces within the urban fabric (including green corridors and neighbor gardens) – is crucial for satisfying a wide spectrum of users and needs, especially in time of pandemic when movement and gatherings are limited.




**Francesca Ugolini presented the results of a survey carried out in Italy, Spain, Israel, Croatia, Slovenia and Lithuania, examining what we can learn from people's usage and expressed need for urban green spaces during the lockdown.**

'It Sort of Gives You Hope': One Place New Yorkers Go to Escape Shutdo...
New Yorkers have headed outdoors to the parks to enjoy sunshine and nature — as long as they are 6 feet away from each other.
nytimes.com



What outdoor activities are safe to do during the coronavirus outbreak? Medical experts say outdoor activities are safe but to avoid large crowds and practice social distancing.
usatoday.com

**In a survey of 12 US cities presented by Clara Pregitzer, it was observed that the use of urban parks increased when COVID-19 arrived – and forested natural areas were seen to provide a feeling of safety and mental respite.**

Dr. **Clara Pregitzer**, Deputy Director of Conservation Science at the Natural Areas Conservancy in New York, followed with a presentation considering the *"Impacts of COVID-19 on America's Urban Natural Areas."* She acknowledged that outdoor activities are safe and healthy if they respect pandemic-related rules, such as avoiding crowds and practicing social distancing. A study carried out through the "Forests in Cities" network in 12 American cities found a marked increase of park users during the pandemic – and from interviews that were conducted, it appears that forested natural areas have the beneficial effect of making people feel safe and allowing them to experience a time of mental respite. Unfortunately, COVID-19 has impacted the public's access to such spaces, as budget cuts have restricted the ability of organizations to manage and care for their natural areas and led to the cancellation of public programs and decreased volunteering hours.

Next up was Dr. **Sreetheran Maruthaveeran**, Senior Lecturer in the Department of Landscape Architecture at the Faculty of Design and Architecture of the Universiti Putra Malaysia. In his presentation on *"Coping with Mental & Physical Health during the Covid-19 Pandemic: Views from Malaysian Leisure & Recreational Users"*, he showed how the lockdown and self-isolation have affected the routines and livelihoods of people in ways that may lead to an increase in loneliness, anxiety, depression, insomnia, harmful alcohol and drug abuse and self-harm or suicidal behavior. In a survey conducted among predominantly urban residents in Malaysia, the majority of respondents declared that they experienced some degree of disruption to their physical and mental health due to the situation. The study also identified that a sort of resilience may be found through the routine performance of practical physical activities, rather than just relying on intellectual pursuits.


**Sreetheran Maruthaveeran of the Department of Landscape Architecture at the Universiti Putra conducted a survey among predominantly urban residents in Malaysia, and found that the majority of respondents experienced some degree of disruption to their physical and mental health due to the COVID-19 isolation. He examined the potential benefits of recreational/leisure social media groups for easing their distress.**

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SPECIAL ISSUE: COVID-19

Check for updates

**The impact of COVID-19 on public space: an early review of the emerging questions – design, perceptions and inequities**

Jordi Honey-Rosés[a], Isabelle Anguelovski[b,c], Vincent K. Chireh[d], Carolyn Daher[e], Cecil Konijnendijk van den Bosch[f], Jill S. Litt[e,g], Vrushti Mawani[a], Michael K. McCall[h], Arturo Orellana[i], Emilia Oscilowicz[a], Ulises Sánchez[j], Maged Senbel[a], Xueqi Tan[k], Erick Villagomez[a], Oscar Zapata[l] and Mark J Nieuwenhuijsen[e]

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**ABSTRACT**
Restrictions on the use of public space and physical distancing have been key policy measures to reduce the transmission of COVID-19 and protect public health. At the time of writing, one half of the world's population has been asked to stay home and avoid many public places. What will be the long term impacts of the COVID-19 pandemic on public space once the restrictions have been lifted? The depth and extent of transformation is unclear, especially as it relates to the future design, use and perceptions of public space. This article aims to highlight emerging questions at the interface of COVID-19 and city design. It is possible that the COVID-19 crisis may fundamentally change our relationship with public space. In the ensuing months and years, it will be critical to study and measure these changes in order to inform urban planning and design in a post-COVID world.

**ARTICLE HISTORY**
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**KEYWORDS**
COVID-19; design; planning; public space

Lila and Maia. Lockdown in Barcelona. April 2020

**Jordi Honey-Rosés offered evidence that crowded streets, even if they are sufficiently green, may increase stress – and especially so for women. Will the pandemic re-calibrate our expectation of urban green spaces?**

The presentation session was culminated by Dr. **Jordi Honey-Rosés**, Associate Professor at the School of Community and Regional Planning of the University of British Columbia in Vancouver, Canada. In his presentation entitled *"The Impact of COVID-19 on Public Space: an early review of the emerging questions,"* he raised the question of what changes we may expect to see in the future regarding the design of public spaces, as well as their use and perception and the inequities they may evoke. Will the pandemic re-calibrate our expectation of urban green spaces? The study offered evidence that crowded streets, even if they are sufficiently green, may not be so beneficial since they can increase the feeling of stress and impact people's mood, with women's sense of well-being found to be affected more consistently than men's. He suggested that post-pandemic, we might take a closer look at total use levels in urban green spaces – going beyond a singular focus on "recreation."

In summary, several conclusions and highlights of the webinar may be mentioned:

- Urban nature has played a very important role during the pandemic, as a place for recreation, stress relief, and many other benefits. Research from across the globe – as shown in the case studies presented here from different European countries, the US, and Malaysia – has confirmed this.
- The importance of urban natural areas during the pandemic was highlighted by the fact that since many public parks were closed due to the risk of infection, people flocked to larger natural areas that were accessible from the city.
- There were interesting differences in the use patterns and preferences of women and men, with women showing higher levels of use and appreciation of public spaces.
- The use of urban nature and public space during the pandemic also raises questions about looking at these spaces differently in the future, in terms of their planning, design, and management. We may also have to reconsider our current knowledge and practices related to issues like crowding.
- In a society which is becoming progressively more isolated, local gardens and green streets that are in close proximity of residents have an important role to play by facilitating common activity in local communities.
- Cities and towns should also be provided with wider green spaces, by creating or restoring natural areas that offer a variety of physical and mental benefits alongside environmental services.
- In order to be accessible and to actually provide such benefits to the greatest extent, all green spaces need a certain degree of maintenance and care – which in turn requires not only volunteering programs but also guarantees through public investment. This has become painfully apparent, as the pandemic stresses the budgets of those whose mandate is to protect our urban green.

A recording of the full webinar is available for viewing at: https://us02web.zoom.us/rec/play/qcGrN9VI3OP6bukalgagjwebMFpu55s3Vs2nvxXyjW5Qz2FACZiW9tlgu9eshwCgw27rfJ7a3vm8UKYf.8jTPfkzh8gkoDOAV?startTime=1616157678000

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**2019-2020**


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In this edition is a list of publications that have generally come out between **November 2020 and February 2021**. If you believe your articles are missing, 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. Important: do so **in a .bib format.**

As of this month, we would like to warmly welcome Dr. Shreya Banerjee (Indian Institute of Technology Kharagpur, India), who joined the committee in November 2020.

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.

Happy reading,


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Zhifeng W, Yin R (2021) The influence of greenspace characteristics and building configuration on depression in the elderly. *Building and Environment* 188 107477.

Zou H, Wang X (2021) Progress and Gaps in Research on Urban Green Space Morphology: A Review. *Sustainability* 13 1202.

Zou J, Liu J, Niu J, Yu Y, Lei C (2021) Convective heat loss from computational thermal manikin subject to outdoor wind environments. *Building and Environment* 188 107469.

Zumwald M, Knüsel B, Bresch DN, Knutti R (2021) Mapping urban temperature using crowd-sensing data and machine learning. *Urban Climate* 35 100739.

## *Upcoming Conferences...*

*The information in this list is current as of the publication date of the newsletter, but readers should check for updated information online in the event of schedule changes due to the COVID-19 pandemic.*

**EUROPEAN GEOSCIENCES UNION (EGU) GENERAL ASSEMBLY**
Vienna, Austria • 25-30 April, 2021
https://www.egu2021.eu

**11TH INTERNATIONAL CONFERENCE ON THE CONSTRUCTED ENVIRONMENT**
Calgary, Canada • May 12-14, 2021
https://constructedenvironment.com/2021-conference

**BOCHUM URBAN CLIMATE SUMMER SCHOOL: URBAN CLIMATE INFORMATICS**
Bochum, Germany • September 13-17, 2021
https://www.climate.rub.de/bucss

**INTERNATIONAL CONFERENCE ON URBAN CLIMATE (ICUC-11)**
Sydney, Australia • August 29 -September 2, 2022
https://conference.unsw.edu.au/en/icuc11

## *Calls for Papers...*

**"ATMOSPHERIC PROCESSES AND APPLICATIONS IN URBAN, COASTAL, AND MOUNTAINOUS TERRAIN"**

*Special issue of Meteorological Applications*

Papers are welcome on all aspects of atmospheric processes and applications over urban, coastal and mountainous terrain, including, but not restricted to: eather forecasting and verification; Weather hazards and warning systems; Experimental measurements and data processing; Downscaling of climate projections; Mitigation and adaptation to climate change; Application in related fields, e.g., air pollution, agriculture, hydrology, renewable energy, urban planning.

*Guest editors: Lorenzo Giovannini & Meinolf Kossmann*

**Submission Deadline: 31 May 2021**
https://rmets.onlinelibrary.wiley.com/pb-assets/MetApps%20SI%20-%20Atmospheric%20Processes%20and%20Applications%20in%20Urban%20Coastal%20and%20Mountainous%20Terrain%20(002).pdf

**"OUTDOOR THERMAL COMFORT IN CITIES: ASSESSING AND DEVELOPING GREEN, BLUE AND GREY SOLUTIONS FOR HEALTHY AND SUSTAINABLE URBAN FUTURE"**

*Special issue of Atmosphere*

Topics of interest include, but are not limited to the following: Outdoor human thermal comfort conditions in diverse urban environments: field studies, modeling, and surveying; Urban climate conditions (e.g., UHI, humidity, wind, radiation); Climate-sensitive and nature-based solutions for healthy and sustainable neighborhoods and cities; Interactions between outdoor thermal comfort measures and related fields such as climate change mitigation and air quality; Heat and health in cities; Climate change and urbanization

*Guest Editors: Dragan Milosevic, Britta Jänicke, Yuliya Dzyuban & Michael Allen*

**Submission Deadline: June 18, 2021**
https://www.mdpi.com/journal/atmosphere/special_issues/urban_outdoor_thermal_comfort


**"URBAN MICROCLIMATE AND AIR QUALITY AS DRIVERS OF URBAN DESIGN"**

*Special Issue of Sustainability*

This Special Issue aims to collect works that improve on our knowledge and enrich our common understanding of how urban design can positively or negatively affect the quality of the urban environment. The focus is on outdoor thermal comfort and air quality, with emphasis placed on studies showing how research can be integrated into the design process and how policies can enhance the environmental effectiveness of concrete urban interventions.

*Guest Editors: Luciano Massetti & David Pearlmutter*

**Updated Deadline: September 21, 2021**
https://www.mdpi.com/journal/sustainability/special_issues/Urban_Microclimate_Air_Quality

**"EFFECTS OF THE COVID-19 PANDEMIC ON THE USE AND PERCEPTION OF URBAN GREEN SPACE"**

*Special issue of Land*

The aim of this Special Issue is to collect studies on the access and perception of green spaces (urban and non-urban) and the natural landscape in general during the time of pandemic, in order to provide governance actors with scientific evidence on which they can base policies for facing and coexisting with dramatic situations such as a pandemic—and for increasing the long-term resilience of the urban and rural landscape.

*Guest Editors: Francesca Ugolini & David Pearlmutter*

**Submission deadline: 30 September 2021**
https://www.mdpi.com/journal/land/special_issues/pandemic_ugs

## Bochum Urban Climate Summer School 2021

The Bochum Urban Climate Summer School 2021 (BUCSS21) is planned to take place in Bochum, Germany on September 13-17, 2021, if the pandemic situation allows.

BUCSS21 aims to provide a general introduction to different facets of urban climatology with a special focus on urban climate informatics. This is a newly evolving research field that uses artificial intelligence, e.g., machine learning or deep learning, to process non-traditional big data sources for urban climate applications. BUCSS21's goal is to provide structured information and skill-building capabilities related to urban climate monitoring, remote sensing and modelling, thereby strengthening an active pool of young scientists to tackle the major urban sustainability challenges of future generations. We plan state-of-the-art lectures and hands-on tutorials, on remote sensing in urban areas, crowd-sourcing and urban climate modelling at various spatial scales taught by young and senior researchers including Gerald Mills, Andreas Christen, Alberto Martilli and Ariane Middel.

The five-day event is hosted by the urban climatology team of the Ruhr-University Bochum (RUB). The summer school primarily addresses master and PhD students (ECTS available), but also PostDocs with general interest in urban climates. Basic background and skills in urban climate modelling, remote sensing and programming are an advantage, though not required.

According to the dynamic pandemic situation, we will decide as late as possible and will issue a call for participation in late May or early June. Likewise, the exact programme may change with the travel opportunities of lecturers. Please check our Website (climate.rub.de/bucss/) for updates.

*— Daniel Fenner, Matthias Demuzere, and Benjamin Bechtel*

BOCHUM URBAN CLIMATE SUMMER SCHOOL: URBAN CLIMATE INFORMATICS, RUHR-UNIVERSITY
Bochum, Germany • September 13-17, 2021

https://www.climate.rub.de/bucss

Contact: bucss@rub.de

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## EMS Tromp foundation travel award to young scientists (TFTAYS)

The EMS and the Tromp Foundation invite applications for the **Tromp foundation conference award to young scientists** (TFCAYS) to support the participation of young scientists at the virtual EMS Annual Meeting – European Conference for Applications of Meteorology and Climatology, 3-10 September 2021. This award is specifically for presentations in the area of biometeorology, and consists of a waiver for the registration fee and financial support for page charges for publishing the results presented at the event in the Open Access Journal *ASR* – the international journal of the EMS for contributions in applied meteorology and climatology. The deadline for award application and abstract submission is **16 April 2021**.

Young scientists under 35 years of age as of 1 January 2021 working and/or studying in a European country are eligible for an award. All countries with an EMS Member Society or included in the WMO RA VI region are considered as European. Presentations in sessions *Atmospheric effects on humans, Agricultural and Forest Meteorology, Cities and urban areas in the earth-atmosphere system, and Interactions between air pollution, meteorology and the spread of COVID-19* are treated with high priority; presentations in other related sessions could be considered as well, but the decision on eligibility is to the selection committee.

Submit your abstract for the EMS Annual Meeting before 16 April 2021. Within the abstract submission tool, please tick that you would like to apply for the TFCAYS support scheme, and upload (in one pdf-file) a short curriculum vitae including an e-mail contact, a list of your most important publications (distinguish between peer-reviewed and other publications), and a document that proves the age of the candidate.The applicant must be the presenting author of the submitted contribution. Note that award applicants have to pay Abstract Processing Fees at the time of submitting the abstract. Applicants will be notified on the results of the selection process and will have to confirm their abstract and participation within the abstract handling system. Any inquiries about the Tromp foundation conference award to young scientists (TFCAYS) can be sent to ems-tromp-award@emetsoc.org.

**The EMS Tromp Award for an outstanding achievement in biometeorology** is normally presented during the EMS Annual Meeting. The awardee receives 1,000 € and a free registration to attend the EMS Annual Meeting. The awardee is expected to give a presentation at one of the sessions thematically related to biometeorology. It will be awarded to a scientist for an excellent scientific paper in the field of biometeorology, which must have been published in an international peer-reviewed journal with the nominee as first author, between 1 January 2019 and the deadline for this EMS Tromp Award: 18 April 2021.The nomination may be made by the scientist him-/herself or by others working in the field of biometeorology. The nomination needs to be accompanied by the PDF of the published scientific paper, Curriculum Vitae, and publication list. Nominations must be submitted electronically by email to ems-tromp-award@emetsoc.org until **19 April 2021**, 23:59 UTC.

# Call for nominations – 2021 Luke Howard Award

The IAUC is pleased to announce the call for nominations for the 2021 'Luke Howard Award for Outstanding Contributions to the Field of Urban Climatology.'

The Luke Howard Award may be given annually to an individual who has made **outstanding contributions to the field of urban climatology** in a combination of **research, teaching, and/or service** to the international community of urban climatologists.

The IAUC is committed to promoting equality and diversity. Therefore, we particularly encourage nominations for suitable candidates from under-represented groups.

The person making the nomination will act as the coordinator to put together a nomination package (including a CV of the nominee and three letters of recommendation). Self-nominations are not permitted and current Awards Committee members cannot be evaluated. Complete nomination packages should be submitted (as a single electronic submission) to the IAUC Awards Committee Chair, **Dr Helen Ward**: helen.ward@uibk.ac.at

Luke Howard Award Nomination Process:

• Inform the Awards Committee Chair of the intent to nominate an individual. The intent to nominate should be communicated via email to the Awards Committee Chair by **Friday 28 May 2021**;

• Nomination materials should be collected by the coordinator (i.e. the person notifying the Awards Committee Chair that a particular individual will be nominated);

• The coordinator should collect and submit the following documentation in a single pdf file:

a) a three-page candidate CV

b) three letters of recommendation (of no more than two pages in length) from IAUC members from at least two different countries;


• Complete packages should reach the Awards Committee Chair by **Friday 25 June 2021**.

The IAUC Awards committee will then recommend the name of a recipient for consideration and approval by the IAUC Board. Nominations will be active for three years, and updated information may be submitted for consideration in the second and third years.

*Previous winners include:*

2020 Dr Alberto Martilli, CIEMAT, Spain
2019 Prof Janet Barlow, University of Reading, UK
2018 Prof Wilhelm Kuttler, Univ. of Duisburg-Essen, Germany
2016 Dr Walter Dabberdt, Vaisala Group, USA
2015 Prof Emeritus Anthony Brazel, Arizona State Univ,. USA
2014 Prof Manabu Kanda, Tokyo Institute of Technology, Japan
2013 Prof Emeritus Yair Goldreich, Bar-Ilan University, Israel
2010 Prof John Arnfield, The Ohio State University, USA
2009 Prof Sue Grimmond, King's College, UK
2008 Prof Bob Bornstein, San José State University, USA
2007 Prof (Emeritus) Masatoshi Yoshino, Univ. of Tsukuba, Japan
2006 Professor Arieh Bitan, Tel Aviv University, Israel
2005 Professor Ernesto Jauregui, UNAM, Mexico
2004 Professor Tim Oke, UBC, Canada

# Call for nominations – 2021 Timothy Oke Award

The IAUC is pleased to announce the call for nominations for the 2021 'Timothy Oke Award for Original Research in the Field of Urban Climatology'.

The Timothy Oke Award was established in 2020 and is given annually to early- and mid-career researchers who have conducted original research with high impact in the field of urban climate science. Nominations should thus focus on a particularly relevant study or collection of papers and their impact. Eligible candidates should be approximately 3-12 years after PhD and will be assessed in accordance with their career stage. Nominations for candidates which fall outside these guidelines should be justified.

The IAUC is committed to promoting equality and diversity. Therefore we particularly encourage nominations for suitable candidates from under-represented groups. The person making the nomination will act as the coordinator to put together a nomination package (including a CV of the nominee and three letters of recommendation). Self-nominations are not permitted and current Awards Committee members cannot be evaluated. Complete nomination packages should be submitted (as a single electronic submission) to the IAUC Awards Committee Chair, **Dr Helen Ward**: helen.ward@uibk.ac.at

Timothy Oke Award Nomination Process:

• Inform the Awards Committee Chair of the intent to nominate an individual. The intent to nominate should be communicated via email to the Awards Committee Chair by Friday 28 May 2021;

• Nomination materials should be collected by the coordinator (i.e. the person notifying the Awards Committee Chair that a particular individual will be nominated);

• The coordinator should collect and submit the following documentation in a single pdf file: a) a three-page candidate CV; b) three letters of recommendation (of no more than two pages in length) from IAUC members from at least two different countries;

• Complete packages should reach the Awards Committee Chair by Friday 25 June 2021.

The IAUC Awards committee will then recommend the names of 0-3 recipients for consideration and approval by the IAUC Board. Nominations made this year will only be considered for the 2021 award but can be updated and resubmitted in subsequent years.

Two Timothy Oke Awards were made in 2020, to Scott Krayenhoff, Assistant Professor of Atmospheric Science at the University of Guelph, and Chao Ren, Associate Professor of Faculty of Architecture at the University of Hong Kong.

## JOINT INTERNATIONAL CLIMATE COMMUNIQUÉ BY NATIONAL METEOROLOGICAL SOCIETIES AND ASSOCIATES

As members of the global community of national meteorological societies, we are taking the occasion of World Meteorology Day 2021 to reiterate the critical importance of addressing climate change.

### The world continues to warm

The effects of human-produced greenhouse gases on the climate are increasingly and overwhelmingly evident. The three warmest years on record, including 2020 (at about 1.2°C higher than before the industrial revolution), have all occurred since the 2015 Paris Agreement to limit climate change. The global average temperature was near a record high in 2020 despite the presence of a temporary cooling of the Pacific due to La Niña, thus indicating a continued underlying warming trend.

In 2020, sea ice in the Arctic reached its lowest October extent on record. Both the extent and thickness of Arctic sea ice have decreased dramatically over the past 30 years.

Massive coastal glaciers in Greenland and Antarctica are losing more mass every year and permafrost is melting. Global sea levels are rising and ocean acidification is increasing at accelerating rates. Ocean temperatures, both near the surface and at depth, continue to increase globally with implications for the behaviour of storms, changes to ocean currents, and coral reef degradation. Also, freshwater resources and eco-systems are under pressure.

Evidence is growing that a wide variety of extreme events are now more likely to occur due to global climate change. Furthermore, increased extreme temperatures, rainfall, drought, and storms have been linked to a marked increase in the number of climate-related disasters between 2000 and 2019 compared to the preceding two decades.

### Limiting climate risks

In 2015 in Paris countries agreed to *holding the increase in the global average temperature to well below 2ºC above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5ºC above pre-industrial levels.* We note that to limit the increase to 1.5ºC the world needs to reduce carbon dioxide emissions globally at an unprecedented rate, likely reaching net zero by around 2050, as well as reducing other greenhouse gas emissions.

Many governments have announced their intention to markedly reduce emissions, including aiming to reach net zero greenhouse gas emissions by mid-century. However, overall, current commitments for emissions in 2030 still fall well short of the effort required to meet the Paris goals. Even if all reported commitments were implemented, temperatures could still rise to over 3ºC above pre-industrial levels by 2100 and there is a risk that the average temperature rise could exceed 1.5ºC within the next decade.

### Our message

We stress that to meet the Paris goals, the world needs to raise its ambition significantly to be in line with the findings of the Intergovernmental Panel on Climate Change. All governments will therefore need to strengthen their efforts by taking rapid and ambitious action, including supporting those who have less capacity. Increasing nations' mitigation ambitions ahead of the Paris Agreement "stock-take" scheduled for 2023 would help set the world on a track closer to meeting the Paris goals and reducing the risk of potentially devastating climate impacts.

As well as reducing the growing risks of climate change to a more manageable level, working to meet the Paris goals can advance additional societal needs, including the achievement of many of the United Nations Sustainable Development Goals.

We note that the impact of COVID-19 restrictions has led to a slight drop in carbon dioxide emissions. This, however, is likely to be temporary unless the actions taken to recover from the pandemic also support the Paris goals. A sustainable global recovery from COVID-19 could lead to employment opportunities in clean technologies and deal with energy poverty.

Weather and climate services and observations are essential to support the assessment of climate risk and inform mitigation and adaptation strategies. We urge governments to support service providers with appropriate resources to sustain these crucial services and observations.

**Further Reading**


- Explaining Extreme Events of 2019 from a Climate Perspective, Special Supplement to the Bulletin of the American Meteorological Society Vol. 102, No. 1, January 2021 www.ametsoc.net/eee/2019/EEEin2019.pdf
- The Human Cost of Disasters 2000-2019, The Centre for Research on the Epidemiology of Disasters, United Nations Office for Disaster Risk Reduction, 2020 www.reliefweb.int/report/world/human-cost-disasters-overview-last-20-years-2000-2019
- National Snow and Ice Data Center: Quick Facts on Arctic Sea Ice www.nsidc.org
- State of the Global Climate 2020, World Meteorological Organization www.public.wmo.int/en/our-mandate/climate/wmo-statement-state-of-global-climate
- Global Warming of 1.5C, Intergovernmental Panel on Climate Change (IPCC) Special Report, 2018 www.ipcc.ch/sr15/
- Emissions Gap Report 2020, United Nations Environment Programme (UNEP), 2020 www.unep.org/emissions-gap-report-2020
- International Energy Agency (IEA) Energy Outlook 2020 www.iea.org/reports/world-energy-outlook-2020


Icelandic Meteorological Society

## Next IAUC Webinar: April 15th

Dear Colleagues,

We are pleased to invite you to the **third IAUC webinar** featuring two thought leaders in our fields sharing their perspectives on the history and future directions of modern urban climate.

These are challenging times in which we live, both in terms of critical scientific questions to be resolved in urban climate, and in relation to the difficult global environment in which we currently operate. In these presentations, we plan to stimulate discussion by providing some reflections on the history, role, and responsibilities of the urban climatology community along with developing opportunities.

*Theme and Program:*

**"The journey of modern urban climate"**

**Professor Gerald Mills** (University College Dublin, Ireland) "The beginning of modern urban climatology" (~15 mins)

**Professor Nigel Tapper** (Monash University, Australia) "Some thoughts on future directions for urban climate and the IAUC" (~ 15 mins)

**Facilitated Q&A and discussions** (~30 mins)

We are looking forward to your joining this webinar and celebrating and engaging with the urban community. The details for joining are as follows:

*Date and time:* **15 April 11:00 UTC**.

*To register and find your local time:* https://www.eventbrite.com.au/e/iauc-webinar-3-the-journey-of-modern-urban-climate-tickets-148130697905

The webinar will be recorded and shared with the community, so that people who are unavailable or in inconvenient time zones are able to follow the presentations and discussion.

We are looking forward to seeing you there and hope for a lively discussion.

— *The IAUC community engagement committee:* Natalie Theeuwes, Negin Nazarian, Melissa Hart and Dev Niyogi

### IAUC Board Members & Terms

- **President**: Nigel Tapper (Monash University, Australia), 2018-22
- **Secretary**: Andreas Christen (Albert-Ludwigs Universität Freiburg, Germany), 2018-22
- **Treasurer**: Ariane Middel (Arizona State University, USA), 2019-22
- Alexander Baklanov (WMO, Switzerland), *WMO Representative*, 2018-22**
- Benjamin Bechtel (Ruhr-University Bochum, Germany), 2017-21
- Matthias Demuzere (Ruhr-University Bochum, Germany and CEO and Founder Kode), 2018-22
- Jorge Gonzalez (CUNY, USA): *ICUC10 Local Organizer*, 2016-21
- Melissa Hart (University of New South Wales, Australia), 2020-24
- Simone Kotthaus (Institut Pierre Simon Laplace, France), 2020-24
- Leena Järvi (University of Helsinki, Finland), 2016-20
- Dev Niyogi (Purdue University, USA): *ICUC10 Local Organizer*, 2016-21
- Negin Nazarian (University of New South Wales, Australia): *ICUC-11 Local Organizer,* 2020-24
- David Pearlmutter (Ben-Gurion University, Israel), *Newsletter Editor*, 2008-*
- Chao Ren (University of Hong Kong, Hong Kong), 2017-21
- David Sailor (Arizona State University, USA), *Past Secretary* 2014-2018*
- James Voogt (University of Western Ontario, Canada), *Past President*: 2014-2018*
- Helen Ward (University of Innsbruck, Austria), 2019-22

** non-voting, ** non-voting appointed member*

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  - News Editor: Dragan Milosevic
  - Urban Projects Editor: Helen Ward
  - Conferences Editor: Joe McFadden
- **Bibliography Committee**: Chenghao Wang
- **Teaching Resources**: Gerald Mills
- **Awards Committee**: Helen Ward

***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 June. Contributions for the upcoming issue are welcome, and should be submitted by May 31, 2021 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:** Chenghao Wang and BibCom members
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