Urban Climate News

Quarterly Newsletter of the IAUC

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From the IAUC President

Dear colleagues,

As I write this introductory column for the 89th issue of our Urban Climate Newsletter, I have flashbacks of ICUC-11. It was wonderful to meet in person again after five years, and the conference was an outstanding opportunity to refresh old friendships and create new ones. The diverse ICUC-11 participation, especially from early-career researchers, is inspiring. We are witnessing a generational shift and, with that, a community that has grown richer in diversity, bringing new methods, technologies, and perspectives.

I want to thank ICUC-11 co-chairs **Melissa Hart** and **Negin Nazarian** and their team for their enormous efforts in organizing an outstanding conference! More than 640 delegates from 49 countries made 430 oral presentations in five parallel sessions, together with 300 posters. Please read the "ICUC11 Reflections and Achievements" feature as you delve into this newsletter!

This newsletter features several of the student award winners from ICUC-11 in the "Urban Projects" section. Please check out research from Taihan Chen and colleagues on the thermal environment effects of street trees, from Joseph Karanja on heat-health outcomes, from Shuang Liu et al. on building façade temperature impacts of reflective paving, from Austine Stastny's critical look at tree effects on microclimate, and from Anie Lal and team who explore urbanization and fog patterns.

The Special Report section of this newsletter focuses on the future of IAUC. "The Sydney Roadmap" sets the course for actionable climate science, and the "Future of IAUC" summarizes outcomes from a panel at ICUC-11 to engage the broader community in envisioning and contributing to the next stages of our association's growth.

The "Urban represents!" report by Negin Nazarian and Melissa Hart shares insights from the WCRP Open Science Conference, underscoring the essential role urban climate research plays in broader scientific dialogues.

As we acknowledge the efforts and achievements of our community, we must also pause to honor the memory of a distinguished colleague. The sudden passing of **Jason Ching**, the Luke Howard Award recipient, is a profound loss to our community. Jason's work and spirit left a permanent mark on the urban climate community, and his absence will be deeply felt. Our thoughts are with his family and friends. Please read Gerald Mills' IAUC tribute to Jason at the end of this newsletter.

Let me end this column on a positive note, celebrating the achievements of our **Tim Oke Award** winners. Their exceptional contributions are pushing the boundaries of our field. Please see Vincent Luo's summary of each of the recipients' achievements.

"Before ICUC is after ICUC", so voting is underway for **ICUC-12**, which will take place in 2025 in either Glasgow, Rio de Janeiro, or Rotterdam. If you have not done so, please vote before the extended deadline (November 21).

Inside the post-ICUC11 issue...

Warm regards,

Ariane Middel

President, International Association for Urban Climate

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Copernicus Climate Change Service: Summer 2023 was the hottest on record

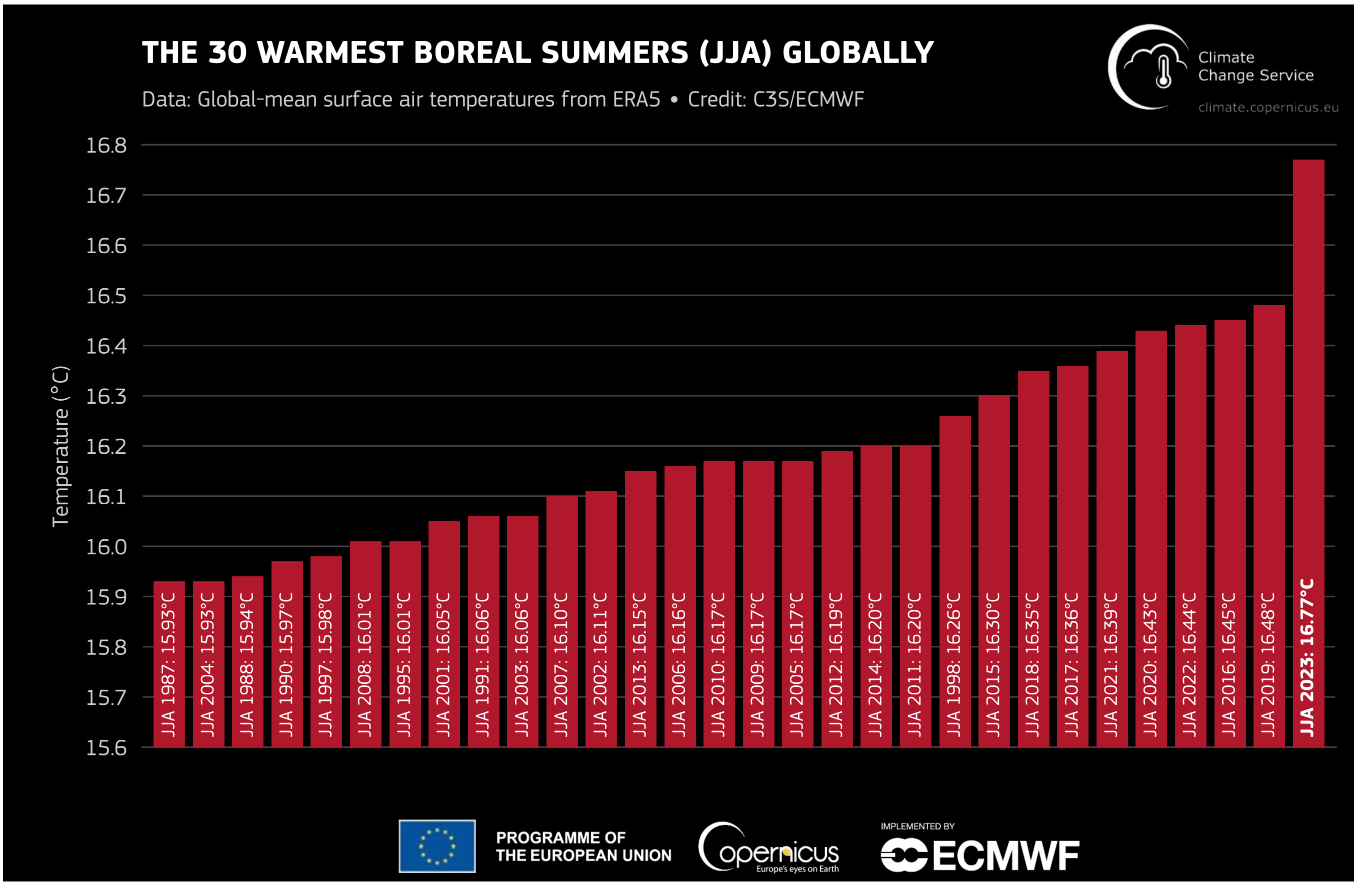
September 2023 — The [Copernicus Climate Change Service (C3S)](https://climate.copernicus.eu), implemented by the European Centre for Medium-Range Weather Forecasts on behalf of the European Commission with funding from the EU, routinely publishes monthly climate bulletins reporting on the changes observed in global **surface air temperature**, **sea ice cover** and **hydrological variables**. This month, highlights on the **boreal summer 2023** and **sea surface temperature** are also included in this press release. All the reported findings are based on computer-generated analyses using billions of measurements from satellites, ships, aircraft and weather stations around the world.

2023 June-July-August Season highlights:

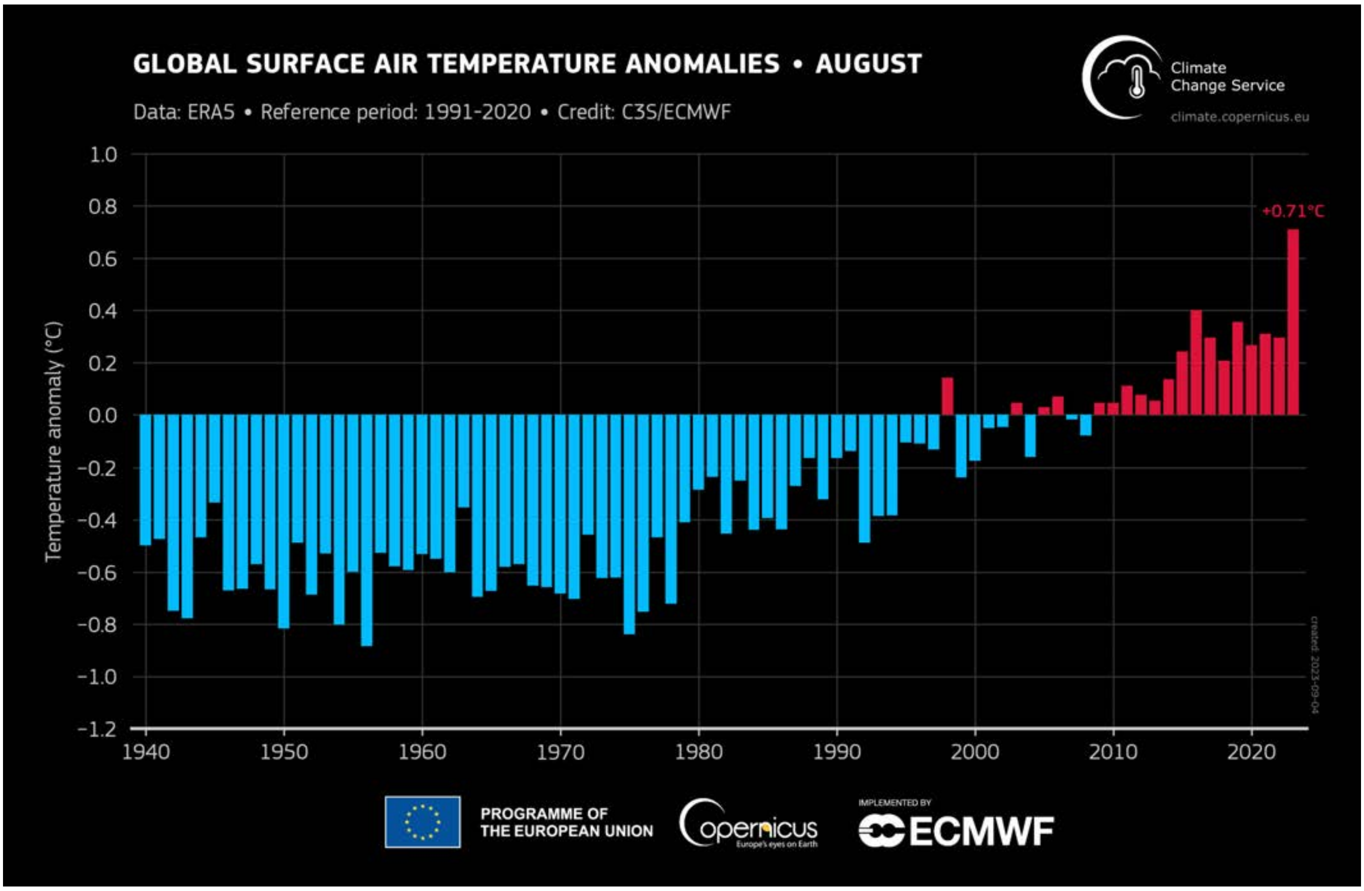
- The June-July-August (JJA) season for 2023 was the warmest on record globally by a large margin, with an average temperature of 16.77°C, 0.66°C above average.
- The European-average temperature for summer was 19.63°C, which at 0.83°C above average, was the fifth warmest for the summer season
- JJA 2023 saw record-breaking high sea surface temperature anomalies in the North Atlantic and the global ocean.
- Summer 2023 saw marine heatwaves in several areas around Europe, including around Ireland and the UK in June, and across the Mediterranean in July and August.
- JJA 2023 saw above-average precipitation over most of western Europe and Türkiye, with local rainfall records broken leading to flooding in some cases, and in western and north-eastern North America, parts of Asia, Chile and Brazil, and north-western Australia
- In contrast, Iceland, the Alpine arc, northern Scandinavia, central Europe, large parts of Asia, Canada, southern North America and most of South America experienced drier-than-average conditions. In some regions, these dry conditions led to significant wildfires.

August 2023 – Surface air temperature highlights

- August 2023 was the warmest August on record globally, and warmer than all other months except July 2023.
- The global-mean surface air temperature of 16.82°C for Augu st 2023 was 0.71°C warmer than the 1991-2020 average for August, and 0.31°C warmer than the previous warmest August in 2016.
- The global temperature anomaly for the first 8 months of 2023 (Jan-Aug) ranks second-warmest on record, only 0.01°C below 2016, currently the warmest year on record.



Global-mean surface air temperatures for the 30 warmest boreal summers (June-July-August) in the ERA5 data record, ranked from lower to higher temperature. *Source:* https://climate.copernicus.eu/summer-2023-hottest-record



Globally averaged surface air temperature anomalies relative to 1991–2020 for each August from 1940 to 2023. Data: ERA5. Credit: C3S/ECMWF. *Source:* https://climate.copernicus.eu/summer-2023-hottest-record

- The month is estimated to have been around 1.5°C warmer than the preindustrial average for 1850-1900.
- Heatwaves were experienced in multiple regions of the Northern Hemisphere, including southern Europe, the southern United States, and Japan.
- Well-above average temperatures occurred over Australia, several South American countries and around much of Antarctica.
- Marine air temperatures were well above average in several other regions.

August 2023 – Sea surface temperature highlights

- Global average sea surface temperatures continued to rise in August, after a long period of unusually high temperatures since April 2023.
- Every day from 31st July to 31st August 2023 has seen global average sea surface temperatures exceeding the previous record from March 2016.
- August as a whole saw the highest global monthly average sea surface temperatures on record across all months, at 20.98°C, and was well above average for August, with an anomaly of 0.55°C.
- North Atlantic sea surface temperatures broke the previous daily record of 24.81°C, set in September 2022, on the 5th of August, and almost every day since has remained above this level, reaching a new record of 25.19°C on the 31st of August.
- Marine heatwave conditions developed in the north Atlantic west of the Iberian Peninsula, but reduced across most of the Mediterranean.
- El Niño conditions continued to develop over the equatorial eastern Pacific.

August 2023 – Hydrological variables highlights

- August 2023 saw wetter-than-average conditions over a large part of central Europe and Scandinavia often with heavy rainfall leading to flooding. It was wetter than average also in a longitudinal band in Eastern Europe.
- Over the Iberian Peninsula, southern France, Iceland and much of Eastern Europe, including the southern Balkans, it was drier than average, with wildfires occurring in France, Greece, Italy, and Portugal.
- It was wetter than average in northeast and western North America, with Hurricane Hilary hitting California and western Mexico and triggering floods. It was also wetter than average in large regions of Asia, with rainfall causing landslides in Tajikistan, and parts of Chile and Brazil.
- Drier-than-average regions included the southern USA and Northern Mexico, two latitudinal bands across Asia, and much of South America. *Source:* https://climate.copernicus.eu/summer-2023-hottest-record

Air pollution: Nearly everyone in Europe breathing bad air

With the EU voting on new air quality rules, satellite data shows that 98% of people face pollution above WHO recommended limits

Urban areas such as Sofia are particularly affected.

September 2023 — Virtually everyone in Europe lives in polluted towns, cities and rural areas where annual average levels of fine particulate matter are higher than the World Health Organization's (WHO) recommended limit.

In practical terms, this means that almost everyone on the continent is breathing bad air that has been shown to be fatal. Air pollution increases the risk of respiratory and heart disease and lowers life expectancy. "With the current levels of air pollution, many people [are getting] sick. We know that lowering air pollution levels reduces these numbers," said Mark Nieuwenhuijsen, director of the Barcelona Institute for Global Health (ISGlobal).

How bad is air pollution in Europe?

DW partnered with the European Data Journalism Network to analyze satellite data from the Copernicus Atmospheric Monitoring Service (CAMS).

We found that in 2022, almost everyone in Europe — 98% of people — lived in areas where the concentration of fine particulate matter, commonly abbreviated as PM 2.5, was over the limit set by the WHO.

The WHO recommends that the annual average concentration of fine particulate pollution should not exceed five micrograms per cubic meter of air. A microgram is a thousand times less than a milligram.

Pollution levels differ from region to region in Europe. It can be especially severe in parts of Central Europe, the Po valley in Italy and in larger metropolitan areas, such as Athens, Barcelona and Paris.

Our analysis shows that the most polluted regions in Europe reach annual average PM 2.5 concentrations of about 25 micrograms per cubic meter. High air pollution levels for individual European cities have been reported before, but this new data analysis offers a first Europe-wide comparison of pollution in different regions. We show where air quality has improved and where it's gotten worse.

We also used the data to identify two places with similar problems but a different outlook. In northern Italy, pollution levels are high and seem to remain so. In southern Poland, they are also high yet appear to be falling. We looked at how mitigation strategies are helping or not.

What is fine particulate matter?

Fine particulate matter is a combination of very small solid and liquid particles of different materials and pollutants.

The pollutants are invisible to the naked eye. They have a diameter of less than 2.5 micrometers, or around 30 times thinner than a single strand of hair.

Even though there are many other pollutants that affect human health, it's common to focus on these kinds of particles as there is consistent scientific evidence of their negative effect on public health.

How does Europe compare to other parts of the world?

European air quality is generally better than in other regions of the world.

In northern Indian cities, such as New Delhi, Varanasi and Agra, for example, average PM 2.5 values can get as high as 100 micrograms per cubic meter. In Europe, our data shows pollution levels of up to 25 micrograms per cubic meter.

But even at Europe's comparatively lower levels, pollution can have a significant impact on people's health.

What's the EU's proposed limit and what do experts say?

Europe's new air quality rules would allow an annual average concentration of 10 micrograms of fine particulate matter per cubic meter of air.

The European Parliament's Environment Committee had suggested adopting the WHO recommendations, which are stricter at five micrograms of fine particulate matter per cubic meter of air.

But even at 10 micrograms, it would be stricter than the current standards, which allow annual PM 2.5 concentrations at 20 micrograms per cubic meter — four times higher than the current WHO recommendation. Health researchers and environmentalists argue that the new European air quality rules should mirror the WHO's guidelines but acknowledge that that would be a challenge.

"EU limits are not only [about] health, they're also about economic arguments, [whereas] the WHO limits are made by experts that only take health into account," said Nieuwenhuijsen. "I hope they'll go with the WHO, but probably some will argue that it would be too expensive."

Air quality consistently bad in northern Italy

In mid-February 2023, many cities in Italy's Po valley were covered with pollution. The regions of Lombardy and Veneto were especially affected.

The daily PM 2.5 average concentration in cities such as Milan, Padova and Verona surged above 75 micrograms per cubic meter, according to Copernicus researchers. Geography is partially to blame: the region is surrounded by mountains and pollution created by heavy traffic, industry, agricultural emissions and residential heating is trapped in the area.

Environmental agencies report that many thousands of people die prematurely every year due to pollution-related illnesses. A study published in the science journal The Lancet used pollution data from 2015 to estimate that around 10% of deaths in cities like Milan could be prevented if average PM 2.5 concentrations dropped by around 10 micrograms per cubic meter.

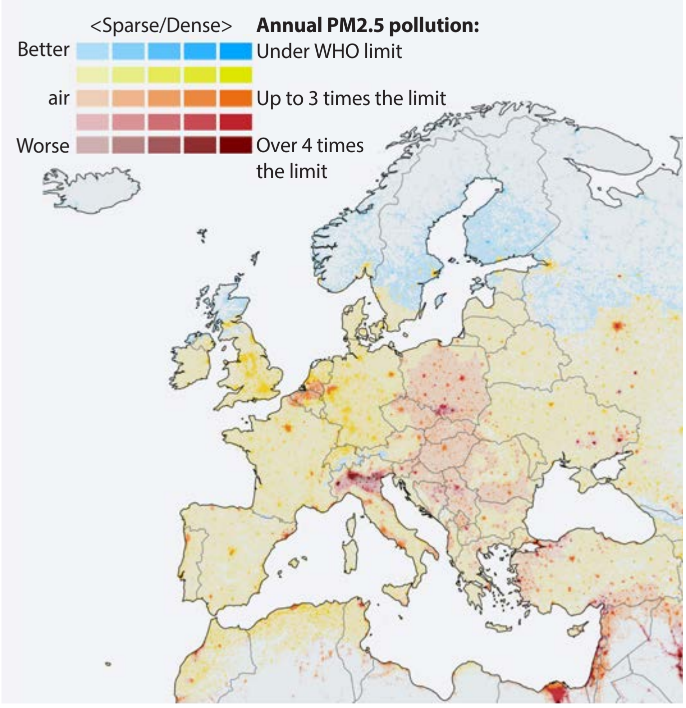
If Europe's major cities were able to hit the five micrograms per cubic meter target, the researchers concluded there would be 100,000 fewer pollution-related deaths every year. But that's not the direction that the Po valley is headed. "On top of having a negative geographical situation, we've been doing exactly the opposite of what we should do," said Anna Gerometta, a lawyer and president of Cittadini per l'Aria, an NGO that advocates for stricter air quality policies in Italy. Gerometta said that measures to limit emissions from cars, residential heating and meat factories were too weak to face the scale of the problem.

Poland gets rid of coal furnaces and improves air quality

In parts of Poland, pollution levels are among the highest in Europe. But they have decreased steadily since 2018 — the first year in the data we analyzed.

Take the city of Krakow, the second largest city in the country. Back in 2018, the region saw annual pollution levels of nearly 25 micrograms per cubic meter. By the end of 2022, it had dropped by more than 20%.

Neighboring cities Katowice, Gliwice and Tychy, and also Poznan and the capital Warsaw, saw a drop in pollution, too. The improvements came after Polish authorities launched a plan to modernize household heating systems, known commonly as "smokers." The process has been ongoing for ten years.



With the exception of sparsely populated regions, the entire territory has pollution levels above WHO guidelines. *Source:* www.dw.com

"We call them 'smokers' as they produce a lot of smoke, but they are old furnaces," said Piotr Siergiej at the environmental organization Polish Smog Alert. "Nearly 800,000 have been replaced, but there are still around 3 million left. It's a slow process."

In the Krakow area, where a ban on burning coal and wood for domestic heating came into effect in 2019, almost all the old heaters have been replaced.

How do public attitudes affect air quality policy?

"Ten years ago, if you talked about air pollution in Poland, people said it was not a big deal it felt like banging your head against the wall," Sierjiej said. "But after years of constant banging, the biggest success is the change in perception. The law is important, but politicians will only do what [voters want]."

In Italy, environmental campaigners have noticed a similar problem in bridging a gap between science and daily life: "People don't understand the issue with air pollution. As you often don't see it, you don't realize what the impact is," said Gerometta.

But things are changing.

According to a 2022 Eurobarometer survey, a majority of Europeans see respiratory diseases caused by air pollution as a serious problem now. While many respondents said they didn't feel well informed about the current standards, the large majority of those that are aware think that air quality rules should be strengthened. *Source:* https://www.dw.com/en/air-pollution-nearly-everyone-in-europe-breathing-bad-air/a-66657048

The scorching divide: How extreme heat inflames gender inequalities in health and income

Arsht-Rock's new report examines the impact of climate-driven extreme heat on women's unpaid domestic labor, paid employment, and health in India, Nigeria, and the United States—paving the way for gender-informed interventions, investments, policies, and research.

July 2023 — Extreme heat affects us all, but it does not affect us equally. It's becoming painfully clear that some are more exposed to its devastating impacts than others. One of those groups is women and girls. Women face structural, systemic barriers, which are now being exacerbated by heat. From earning less income to their lower labor force participation, women are financially and economically disadvantaged. As a consequence, they are more vulnerable to economic losses when rising temperatures make it physically difficult—if not impossible—to work.

This new research examines the profound and unequal impact of heat on women's unpaid domestic labor, paid employment, and health in India, Nigeria, and the United States—examining current and projected 2050 conditions. Drawing on original research on socioeconomic variables such as population, employment, health, and economic activity, and deploying best-in-class climate models, it builds an understanding of this critical issue.

Beyond the numbers, we share the firsthand experiences of women across these three countries to unveil the very human cost of extreme heat—paving the way for gender-informed interventions, investments, policies, and research.

What did our economic analysis reveal?

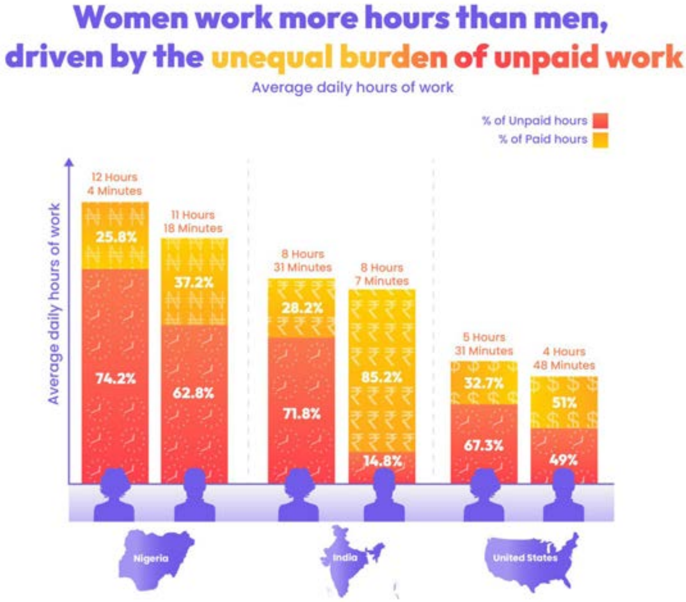
As global temperatures rise, it is increasingly evident that women bear the disproportionate burden of heat's devastating physical, social, and financial effects. With targeted interventions, these risks and impacts can be reduced.

Continue reading for a closer look at the report's key findings, to discover the story of extreme heat in India, Nigeria, and the United States, and to understand how our analysis can inform protective and preventative actions that safeguard women around the world.

The "invisible" dimension of worker productivity: Unpaid labor

Across the world, unpaid domestic work plays a key role in meeting many of the most fundamental human needs—from childcare and basic education to nutrition and healthcare. Despite its importance, it is usually invisible among economic data and national accounts and often neglected by policymakers as a consequence.

A substantial body of literature confirms that women bear a disproportionate share of unpaid work, leading to what is commonly known as "time poverty." Often, unpaid domestic work is unequally allocated to women, which can make it harder to access or succeed in the labor market, leading to lower productivity and lower salaries. It



also reduces the time available for healthcare and personal well-being. For example, in South Africa, women who spend time fetching water as a daily activity experience lower rates of prenatal care, potentially posing risks to their baby's health, as well as their own.

This study quantifies the unequal impact of heat on unpaid labor productivity through a gender lens and fills a critical gap in the existing literature. This new data will enable responses to longstanding gender inequalities.

While women have fewer paid working hours than men in all three countries, they work more unpaid hours, ranging from 27 percent more in Nigeria to 500 percent more in India. Because of this unequal share of unpaid labor, women work more total hours than men in all three countries, from 5 percent more in India to 15 percent in the United States. Even worse, this unpaid work is often heat exposed. While women tend to spend less time than men working outdoors, in Nigeria only 4 percent of women's working hours are in air-conditioned environments. This number jumps to 9 percent in India.

Unpaid domestic labor accounts for between 40 to 70 percent of working hours across the three countries. Surprisingly, previous studies that estimate heat-related labor productivity losses have not taken unpaid labor into account, leading to an incomplete understanding of the full burden of heat's impacts.

When we factor in unpaid work, women's heat-related productivity losses increase by 260 percent; men's losses only increase by 76 percent. When extreme heat strikes, women need to work significantly longer to perform the same volume of paid and unpaid work: from an additional working day per month in the United States; to 90 more minutes per day in India; and 150 additional minutes per day in Nigeria.

Strikingly, over 70 percent of male productivity losses occur in the workplace, whereas up to 75 percent of women's productivity losses are in unpaid labor across the three countries. These losses—which are not directly accounted for in GDP statistics and fall most heavily on marginalized groups—often go unnoticed by policymakers despite their significant knock-on effects on childcare, family nutrition, and long-term impacts on female education, labor market inclusion, income, and broader economic development.

In unusually hot years, these losses will be even worse. Without action to reduce emissions or adapt to climate impacts, the average daily hours lost to heat are set to increase by 30 percent by 2050. This will be even worse in unusually hot years, defined as a 1-in-40-year event. By 2050, the losses could be 13 to 26 percent worse in those years than the losses in current conditions.

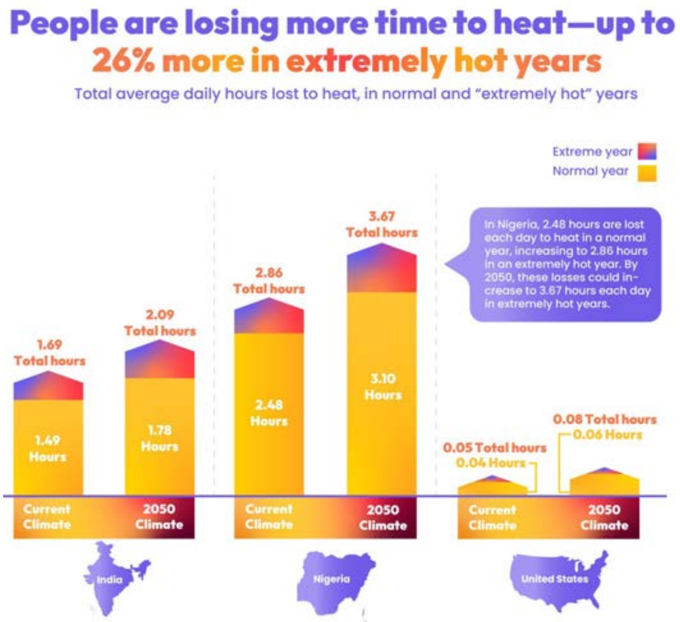
As the heat continues to rise, the time women have to spend on unpaid labor, and women's "time poverty" will also increase. The excessive burden of work in domestic, household, and unpaid activities will leave little time for paid work and leisure, which can hinder women's access to the workplace. The unequal division of domestic and care labor must be addressed to close the global gender gap.

Women bear the cost of climate-driven extreme heat

Heat costs the three countries $120 billion each year in losses to women's paid labor productivity. The heat-related productivity losses are equivalent to the average woman working eight uncompensated eight-hour shifts each year. While women lose less time to heat for paid labor than for unpaid labor, the impacts are nonetheless significant. In Nigeria, women lose 27 minutes per day under baseline climate conditions, rising to 31 minutes in an extreme year. In India, they lose 41 minutes per day, increasing to 47 minutes in an extreme year. In the United States, they lose 6 minutes per week, rising to 8 minutes per week in an extreme year.

Cumulatively, this represents the time that, in the absence of extreme heat, could be used to earn extra income, acquire additional skills, complete domestic work, or enjoy leisure or rest. The lost productivity has systematic and economy-wide impacts through reduced outputs and lower aggregate incomes. Without action to mitigate or adapt to climate change, time losses in paid work experienced by women are projected to increase by 18 to 44 percent by 2050.

These losses often impact the women least able to bear them. Across the three countries, women in the poorest 40 percent of households lose 40 to 55 percent more paid working hours to heat than those in the wealthiest 40 percent. This is in part because women in poorer households are more likely to work in manual labor or outdoor settings instead of environmentally controlled conditions.



Globally, women earn at least 20 percent less than men. In each of the three countries studied, the gender pay gap is visible in most sectors of the economy, with women earning between 24 to 45 percent less than men. As a consequence, income losses from heat are typically less affordable for women than for men—a fact exacerbated by other structural inequalities such as reduced access to financial services.

Women from marginalized groups are even less resilient to heat-related labor productivity losses. In the United States, for example, Black women are paid 67 cents for every dollar earned by white, non-Hispanic men. For many women, heat may determine whether or not they live in poverty.

In Nigeria, heat-related labor productivity losses are a key reason that average wages have fallen below the minimum wage in the sectors that account for 75 percent of female employment—affecting 22 million women.

The dual health burden

Heat is already a major global public health risk. By 2050, extreme heat could claim the lives of 204,000 women annually across India, Nigeria, and the United States in hot years. Heat waves can cause exhaustion, heat stroke, cramps, headaches, lethargy, severe dehydration, and blood clots, as well as increased morbidity and mortality. By 2050, heat could pose a similar burden to female health as breast cancer now does in Nigeria (1.8 percent of female deaths), road injuries in India (1.0 percent), and cervical cancer in the United States (0.6 percent).

Due to physiological differences and disparities in access to air conditioning, women face a 1 percent higher risk of heat-related death than men. Further, in extreme years, heat could account for 2.2 percent of total female deaths by 2050.

Heat also has a pronounced impact on maternal and neonatal health. It has been linked to lower birth weights, pre-term births, stillbirths, gestational diabetes, dehydration and endocrine dysfunction, and placental abruption. This is a particularly critical concern in both India and Nigeria where most maternal mortality occurs globally—over 8 percent in India and 28 percent in Nigeria. It could also exacerbate pre-existing racial inequalities in maternal health outcomes in the United States, where Black women are over three times more likely to die from pregnancy-related causes than White women.

Heat creates a double burden for women: they suffer a higher share of the harmful health effects and are still expected to take on a greater share of the resulting care burden. Currently, women already spend between 6 to 10 percent of their time on unpaid care work across the three countries. Additionally, they are also over-represented in paid care work, accounting for between 47 percent (India) and 75 percent (United States) of all hours worked in the health sector.

As the heat rises, people will be more exposed to its dangerous health impacts. Some of the most vulnerable groups—children and people over sixty-five—are often cared for by female family members. Climate-driven extreme heat will increase the need for care inside and outside the formal health care system, and women will shoulder the heaviest burden.

Informing and enabling a cooler, more equitable future

From India to Nigeria to the United States, climate-driven extreme heat has become inescapable.

The rising temperatures are punishing, record-breaking, and dangerous, and the intensity of heat and its consequent losses are only projected to increase.

Climate change is clearly worsening gender inequality and left unchecked it can have devastating consequences for households and entire economies. In our study, we uncovered heat's calamitous impacts on unpaid labor, the "invisible dimension" of worker productivity. Women lose significantly more productive hours to heat than men do, driven by their unequal share of unpaid, domestic work.

Our study only considers a fraction of the ways in which extreme heat can impact gender equality, but it builds understanding around this critical issue. By quantifying the ways heat impacts women's paid and unpaid labor, we can identify a way forward.

We already know the policies and resources we need to protect people from the impacts of climate-driven extreme heat. There are solutions already implemented in Ahmedabad, Freetown, and Miami-Dade County that are making a difference.

This study shines a light on the path forward. To effectively address climate-driven extreme heat, we must understand the extent of its economic and financial impacts while investing in solutions that confront the urgency of this crisis, and protect people from its scorching effects. When we understand the impacts and invest in gender-informed solutions, we can build toward a cooler, more equitable future—especially for women and girls.

See the full report, including illustrated case studies on India, Nigeria and the United States, at: https://onebillionresilient.org/extreme-heat-inflames-gender-inequalities/

The next steps: Possibilities for future research

This study does not aim to be exhaustive, and there are several areas that could be explored in future research:

• Further analysis into the impacts of heat on marginalized female communities. Women from marginalized communities are expected to be disproportionately impacted by heat.

• More granular subnational research. India, Nigeria, and the United States have diverse, large populations. There are key differences between state and local social protections that could mediate the impact of heat on women, children, and families.

• Additional research on the disproportionate impact of heat on informal workers. Women in India and Nigeria work predominantly in the informal sector, which means that they are excluded from labor and social protections.

• Analysis of the impacts on female morbidity. Women, especially pregnant women, could be negatively impacted months after experiencing a heat event, increasing health risks for themselves and their babies.

• Assessment of the long-term, systemic impacts of heat in perpetuating inequality and inhibiting economic development. This may account for impacts on labor force participation, female education, and poverty reduction.

Source: https://onebillionresilient.org/extreme-heat-inflames-gender-inequalities/

At UN talks, global mayors lead the way to a fossil-free future

- *Clean energy transition will create millions of good, green jobs by expanding renewable energy generation, phasing out fossil fuels from buildings and expanding public transport, among other things.*
- *Investment in urban climate action pays off, with new evidence showing more than 14 million green jobs created in 53 C40 cities alone.*
- *Three-quarters of C40 cities are cutting per-capita emissions faster than their respective nation-states.*

September 2023 — In a resounding display of unity and purpose, mayors from around the globe have come together at the United Nations Climate Ambition Summit to highlight their groundbreaking efforts to usher in a new era: one devoid of fossil fuels and powered by clean, affordable energy. These visionary leaders, while prioritising the well-being of their residents, are charting a course that not only curbs the impact of climate breakdown, but also fosters good-quality jobs and a skilled workforce.

Evidence collected for the first time, by C40 Cities, shows the payoff of well-designed policies and strategic investments, with more than 14 million green jobs already created in 53 C40 member cities alone, helping to halve fossil fuel use by 2030 while improving livelihoods. This includes more than 9 million direct green jobs and more than 5 million indirect green jobs — a clear indication that green investments are boosting demand for materials and inputs, thus increasing jobs in supplier industries. More than 60 C40 member cities now have green jobs and just transition programmes to ensure better access to jobs and improved livelihoods, including 26 new policies or programme expansions announced in just the past 12 months, to be delivered with business, unions, workers and youth.

Led by its Chair and Mayor of London Sadiq Khan, C40 is bringing a large and geographically diverse mayoral delegation to make an indelible mark in New York this week. By presenting a compelling case for the elimination of fossil fuels, C40 mayors are underscoring the transformative influence of city-led climate actions around the world. A select group of C40 mayors will address the UN Climate Ambition Summit on 20 September and engage in discussions with world leaders on the fringes of the 78th session of the UN General Assembly.

C40 Chair and Mayor of London Sadiq Khan said: "I am proud to stand alongside fellow global Mayors at the UN Climate Ambition Summit. London and other cities around the world are leading the way when it comes to taking bold climate action. We need to end our reliance on fossil fuels and usher in a new era of clean, affordable energy. I am honoured to be speaking during the United Nations General Assembly about climate change, the biggest global threat we face today. The evidence is clear: our cities are engines of progress, generating more than 14 million green jobs and cutting fossil fuel consumption by half within a decade. Now we need national governments to step up too and deliver on the promises they have made to tackle the climate crisis."

C40 cities like Tokyo race to zero carbon. *Source:* https://www.c40.org/news/at-un-talks-global-mayors-lead-way-fossil-free-future/

Milan Mayor Giuseppe Sala said: "As the level of government closest to citizens, cities are States' best allies in building a fossil-fuel free future. City residents ask for viable responses to current challenges – from the energy crisis to the cost of living – that must not turn out to be false solutions tying us to polluting models. By working together, local and national authorities can boost the implementation of forward-looking policies that generate multiple benefits, including carbon emissions' reduction, the creation of good green jobs, the elimination of energy poverty and the protection of health. I am hopeful that the participation of global mayors in the UN Climate Ambition Summit be a further step towards a closer meaningful cooperation at all levels of government."

Freetown Mayor-elect Yvonne Aki-Sawyerr said: "With almost 60% of the world's population living in cities, it is imperative that cities play a critical role in tackling the climate crisis in a manner that leads to sustainable improvements in the lives of our residents, our communities and our planet. I am excited because the potential for transformative change to be achieved in cities has already been proven with many cities leading on ambitious investments in nature-based solutions, the transition to renewable energy, the creation of green jobs and the building of resilience in communities. In order for more climate solutions to be delivered quickly and at scale, there must be effective collaboration between cities and national governments and more direct access to climate finance for cities. I am thrilled that the participation of mayors at the UN Climate Ambition Summit will help unlock the potential for cities to play an even greater role in tackling the climate crisis."

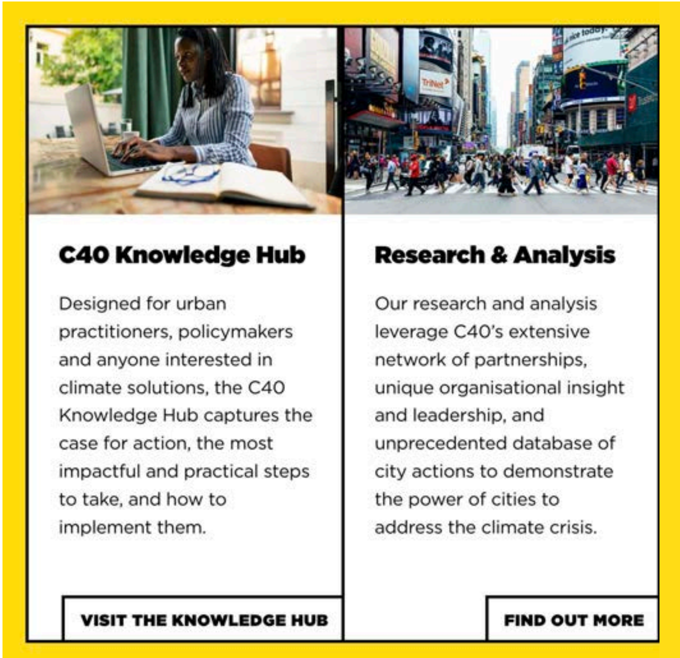
New York City Mayor Eric Adams said: "As a global leader in equitable sustainability and resiliency, New York City is honored to welcome mayors from around the world this week. Our administration has delivered bold action and critical investments that can serve as a model for how large cities across the globe can meet ambitious climate goals. And I look forward to working alongside fellow government leaders to gain their insight and continue working together to advance this important work."

Quezon City Mayor Josefina "Joy" Belmonte said: "Our commitment to clean and sustainable energy is rooted in our vision to create a tangible and inclusive impact on the lives of our citizens. A just transition from fossil fuels is expected to yield immeasurable positive effects on both our environment and economy. For this reason, our local investment plan is focused on transforming our energy infrastructure and adopting clean and efficient transportation. To date, we are solarising our local government buildings and facilities, and are transitioning to an eco-friendly fleet. Soon, we will be extending these efforts to the private sector through our Green Building ordinance. Along with our fellow cities, Quezon City is aggressively pursuing decarbonisation for a sustainable future, where communities thrive without fossil fuels, but are instead powered by clean and affordable energy. Together, we hope our collective voices serve as a clarion call to the global community to vigorously strive for a lasting, fossil-free future."

Rio de Janeiro Mayor Eduardo Paes said: "Local governments and our citizens are on the frontline in dealing with the impacts of climate change. Collaboration between all levels of government and the support of international networks and organisations is key to achieving a fossil-free future. Cities have clearly shown their commitment and potential to contribute in this process and require now, more than ever, the appropriate level of financial and political support to go even further."

A staggering three-quarters of C40 cities have outpaced their respective nation-states in per-capita emission reduction, illustrating the clout of city-led policies and initiatives. With nearly 50 influential global megacities already undertaking proactive measures that reduce gas and fossil fuel demand and enhance energy efficiency and renewable energy adoption, from passing green building codes to installing solar on public housing, the journey toward a sustainable future without fossil fuels has gained unprecedented momentum.

Mayors offer today to work with governments, civil society and businesses to close the intolerable gaps in action



C40 Cities climate action resources. *Source:* www.c40.org

identified in the Global Stocktake, the most comprehensive overview of climate action since the Paris Agreement was adopted in 2015, released 8 September by the UN Framework Convention on Climate Change. The report makes clear that scaling up renewable energy and phasing out all unabated fossil fuels are indispensable elements of just energy transitions – and mayors are acting to make this transition both faster and fairer.

The world's first comprehensive global energy roadmap to net zero, released by the International Energy Agency in 2021, stated there should be no new investment in fossil fuel supply projects and that by 2030, global coal demand should be reduced by 50% from 2020 and by 2035, global fossil fuel use should be 50% of 2020 levels. C40's research shows that fossil gas, culpable for 20% of energy-related CO2 emissions, is an unsustainable transition between coal and renewables. Furthermore, the data demonstrates that renewables, trumping fossil fuels in affordability, can yield substantial economic gains. For every US$1 million invested in residential retrofits and solar, six times more jobs are generated compared to fossil gas power plants. Covering 10% of all rooftops in C40 cities with solar panels could generate 135 TWh of electricity, more than all the solar power generated in 2022 by Germany, France, Spain and the UK combined; this urban solar expansion would generate 5.5 million jobs globally.

In this decade of action, mayors stand united, driving a paradigm shift towards a fossil fuel-free future. The UN Climate Ambition Summit and the 78th session of the UN General Assembly offer the global stage for cities to assert their influence, beckoning federal governments, youth activists and stakeholders to partake in this momentous journey toward a sustainable, resilient world. *Source:* https://www.c40.org/news/at-un-talks-global-mayors-lead-way-fossil-free-future/

ICUC11 Reflections and Achievements: Advancing our Research and Fostering our Community

As Conference Chairs and on behalf of the International Association for Urban Climate, we proudly present this statement of outcomes from the **11th International Conference on Urban Climate (ICUC11)**. ICUC meetings have consistently stood as pivotal moments in disseminating urban climate research, drawing in scholars, urban planners, designers, policymakers, and experts from across the globe. We are proud to say that ICUC11 made a significant contribution to this critical vision.

ICUC11, held at UNSW Sydney from Aug 28th to Sep 1st, 2023, was an extraordinary gathering that brought together over 640 attendees from 49 countries. The conference presented an impressive array of over 800 abstract submissions, encompassing more than 430 oral presentations and 300 posters delivered throughout 68 enriching sessions. In addition, our event featured five plenary keynote presentations and panels, three engaging Australian Stories, alongside a series of stimulating workshops and engagement events, including an urban climate walking tour organized in partnership with the Australian Museum.

Close to 40% of presentations were delivered by Early Career Researchers (ECR). The vital contribution of this next generation of urban climate leaders was further highlighted via an ECR program led by our ECR committee. This included a data visualization and communication workshop, a networking event, and a panel discussion on work-life balance. Many of the community's ECRs also acted as volunteers. The conference could not have run smoothly without their efforts.

Finally, 16 excellent presentations by students were recognized with outstanding presentation awards. Congratulations to the winners!

ICUC11 Student Prize Winners	
Joyce Yang Univ of Illinois at Urbana-Champaign, USA	**Bin Chen** Nanjing University, China
Shuang Liu South China University of Technology, China	**Joseph Karanja** Arizona State University USA
Aveek Ghosh Visvesvaraya Institute of Technology, India	**Melissa Poupelin** University of Burgundy, France
Arnaud Forster CNRM, France	**Asahi Kawaura** Tokyo University of Science, Japan
Wenhua Yu Monash University, Australia	**Austine Stastny** Western University, Canada
Harro Jongen Wageningen, The Netherlands	**Pui Kwan Cheung** University of Melbourne, Australia
Hamesh Patel University of Auckland, New Zealand	**Taihan Chen** National University Singapore, Singapore
Anie K Lal Indian Institute of Technology, Delhi, India	**Vitor Lavor** University of Reading, UK

Furthermore, as a memorable highlight, we hosted a gala dinner that included a boat ride across our glorious Sydney Harbour. We are confident that this was a memorable experience for our participants.

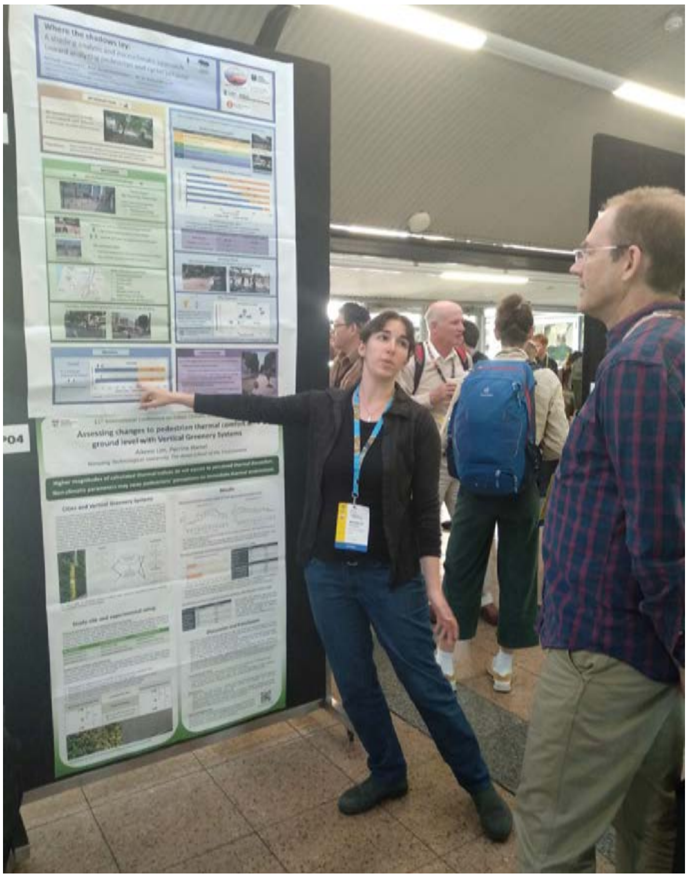
Negin Nazarian and Melissa Hart

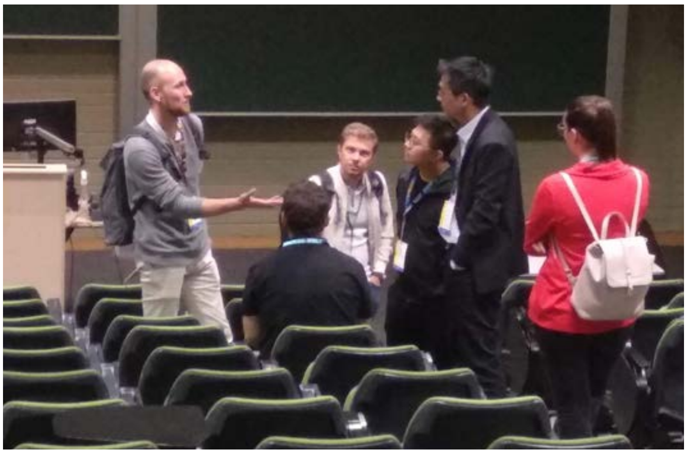
ICUC 11 Memories from Sydney

Among the highlights of ICUC11 was a series of keynote speakers including Simone Kotthaus, above, discussing advances in urban climate observations. Below, Negin Nazarian moderates a panel discussion on climate change and cities with Winston Chow, Xuemei Bai and Andy Pitman.

Over the course of 68 conference sessions, more than 430 oral presentations were given at the UNSW campus in Sydney – with 640 attendees from 49 countries crowding into classrooms, lecture halls and the main auditorium.

Interactive communication was stimulated by session chairs, 300+ presenters of posters, novel tools and technolgies, and casual debate over cutting edge issues.





After a pandemic-induced hiatus of five years, ICUC proved once again to be a valuable opportunity for reuniting with old acquaintances and meeting new ones. Among the collection of older and newer faces was a virtual Mount Rushmore of past and present IAUC presidents (above, bottom right, from the left): Matthias Roth, Gerald Mills, Jamie Voogt, Nigel Tapper and Ariane Middel. It also made the anticipation of visiting Sydney worth the long wait.

Enhancing urban canopy building energy models through the integration of social big data: Improvement and application

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This report is based on the following three papers:

Nakajima, K., Y. Takane, S. Fukuda, K. Yamaguchi, and Y. Kikegawa, 2022: Urban electricity-temperature relationships in the Tokyo Metropolitan Area. *Energy and Buildings*, 256, 111729. doi: 10.1016/j.enbuild.2021.111729

Nakajima, K., Y. Takane, Y. Kikegawa, and K. Yamaguchi, 2023: Improvement of WRF–CM–BEM and its application to high-resolution hindcasting of summertime urban electricity consumption. *Energy and Buildings*, in press. doi: 10.1016/j.enbuild.2023.113336

Takane, Y., K. Nakajima, and Y. Kikegawa, 2022: Urban climate changes during the COVID-19 pandemic: Integration of urban-building-energy model with social big data. *NPJ Climate and Atmospheric Science*, 5, 44. doi: 10.1038/s41612-022-00268-0

Background

As many readers know, various urban physical parameterisations have been proposed and used globally (e.g. Grimmond et al. 2010; 2011; Lipson et al. 2023). Since the late 1990s we have developed a pioneering multi-layer urban canopy model CM (one of the UCMs) (Kondo and Liu 1998; Kondo et al. 2005) coupled with a building energy model CM-BEM (one of the UCM+BEMs) (Kikegawa et al. 2003). The same concept underlies models of CM and CM-BEM (BEP [Martili et al. 2002) and BEP+BEM [Salamanca et al. 2010; Salamanca and Martili 2010]) that have been developed and adopted in the Weather Research and Forecasting (WRF) model, which many users use. Overall, UCM+BEMs are becoming more common, as with UCMs.

Compared with UCMs, UCM+BEMs have numerous advantages, such as the ability to conserve the energy balance within the urban canopy space, and the ability to simulate dynamic anthropogenic heat (Q_F) from buildings (Q_{FB}) and electricity consumption (EC) by air-conditioning (AC) use with Q_{FB}-driven positive feedback, which affects the urban-building-energy-climate system (e.g., Takane et al. 2019; 2020; Kikegawa et al. 2022). However, these advantages sometimes become disadvantages because verifying the simulated Q_{FB} and EC is generally tricky. Another disadvantage of UCM+BEMs is that they require numerous realistic parameters for accurate simulations.

Verifying Q_{FB} remains challenging since direct measurement thereof is not yet possible. On the other hand, verification of EC, which is used for Q_{FB} estimation, has been performed in previous studies. However, most of those studies compared the simulated EC against the total EC in relatively large regions (e.g., the whole area of a specific metropolitan area). One issue with this approach to verification is the vast scale gap between EC per model grid and EC for the entire region, 10–100 times larger than the model grid. A reasonable approach to verification is the direct comparison of EC simulated per model grid with observed EC per nearly model grid. However, only a few studies (e.g.,

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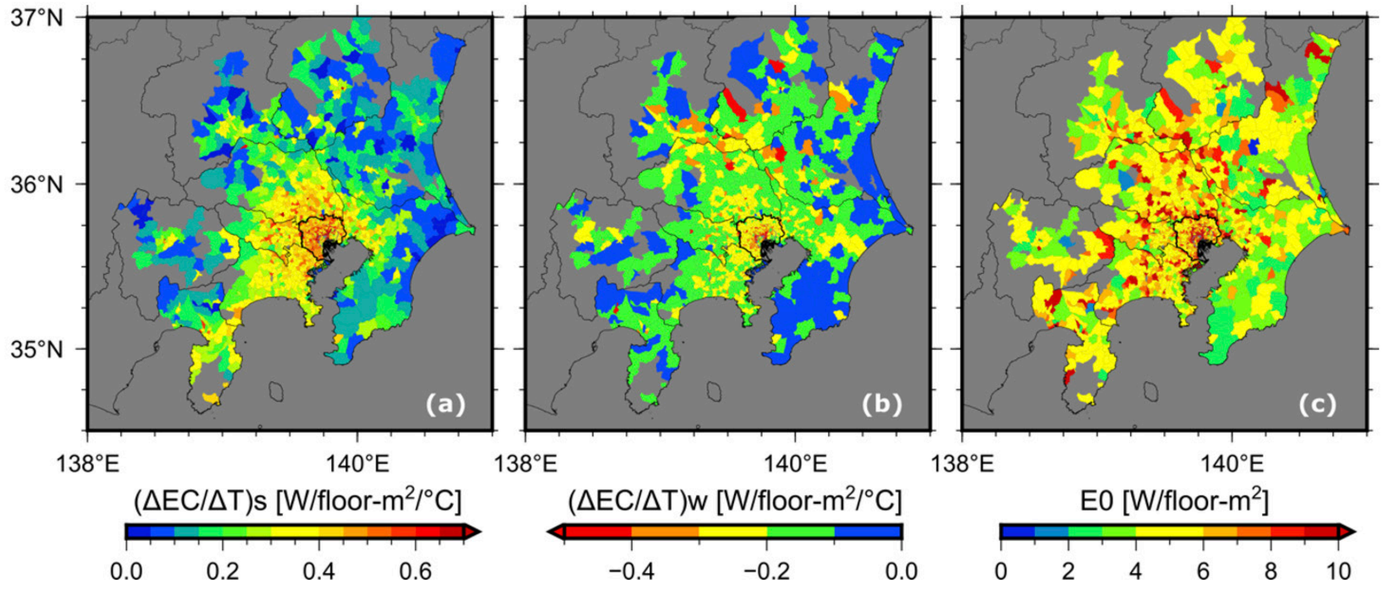

Figure 1. Weekday daily average (a) (ΔEC/ΔT)s, (b) (ΔEC/ΔT)w, and (c) E0.

Takane et al. 2017; Kikegawa et al. 2022) have performed this type of verification because fine-scale EC data per nearly model grid is generally limited worldwide.

We obtained fine-scale EC data in Tokyo metropolitan area, which can be directly compared with the simulated EC using the UCM+BEM. These EC data could help to use UCM+BEMs to facilitate the development regarding the above verification of UCM+BEMs, including the problem that the model requires many multiple realistic parameters. In this report, we assess the effectiveness of EC data (as a kind of social big data) for development of UCM+BEMs and apply the approach to social problems.

Fine–scale EC data

The fine-scale EC data in this study encompass the Kanto region, inclusive of Tokyo. The horizontal resolution is approximately 1.86 km^2, which corresponds to the average size in Tokyo's 23 central wards, with a 1-hour temporal resolution from April 2015 to December 2019.

Nakajima et al. (2022) presented the actual EC sensitivity to temperature changes for the cooling season ((ΔEC/ΔT) s, Fig. 1a) and heating season ((ΔEC/ΔT)w, Fig. 1b), as well as EC values for appliances that remain unaffected by temperature changes (E0, Fig. 1c).

The values for both (ΔEC/ΔT)s (Fig. 1a) and (ΔEC/ΔT)w (Fig. 1b) near the centre of Tokyo are higher compared to those in the surrounding areas, which have relatively low population density. This is attributed to the dense population in the centre. The (ΔEC/ΔT)s and (ΔEC/ΔT)w estimates of Nakajima et al. (2022) can serve as a reference for verifying values simulated by UCM+BEMs.

Figure 1c illustrates the estimated EC for appliances, which is independent of temperature changes. As with (ΔEC/ΔT)s (Fig. 1a) and (ΔEC/ΔT)w (Fig. 1b), values closer to the centre of Tokyo are generally higher than those in the surrounding areas, despite some variance. These EC data can be utilised as input for UCM+BEMs.

Improvement of CM-BEM and verification using the fine–scale EC data

Our in-progress CM-BEM can input parameters related to human behaviour, including (1) the number of occupants inside the buildings, (2) EC for appliances, and (3) AC operation schedule (Fig. 2). By incorporating these parameters, the model can estimate the indoor heat load and its process by AC systems. Generally, typical values of parameters (1)-(3) are incorporated into the model for each of three building uses: commercial and business use, flat-type residential use, and detached-type residential. This study defines the simulation case, the typical way, as $\mathrm{CASE_{OLD}}$.

We have observed that the EC for appliances (parameter [2]) varies by area even within the same building use category, such as commercial and business (as demonstrated in Fig. 1c). As such, we used the EC data from Fig. 1c as input for parameter (2) on a grid-by-grid basis (Fig. 2). This more nuanced approach to input values is expected to be more accurate than the previous method (one average value per building use as in $\mathrm{CASE_{OLD}}$). We denote this refined simulation scenario $\mathrm{CASE_{NEW}}$.

Figure 3 shows the accuracy of the total EC simulated by $\mathrm{CASE_{OLD}}$ and $\mathrm{CASE_{NEW}}$. The observed EC within the centre of Tokyo exhibits significant heterogeneity. While $\mathrm{CASE_{OLD}}$ somewhat successfully replicates the general trend of higher EC in the centre than in the surrounding areas, it fails to capture the nuanced variability within the centre of Tokyo. In contrast, $\mathrm{CASE_{NEW}}$ accurately reproduces

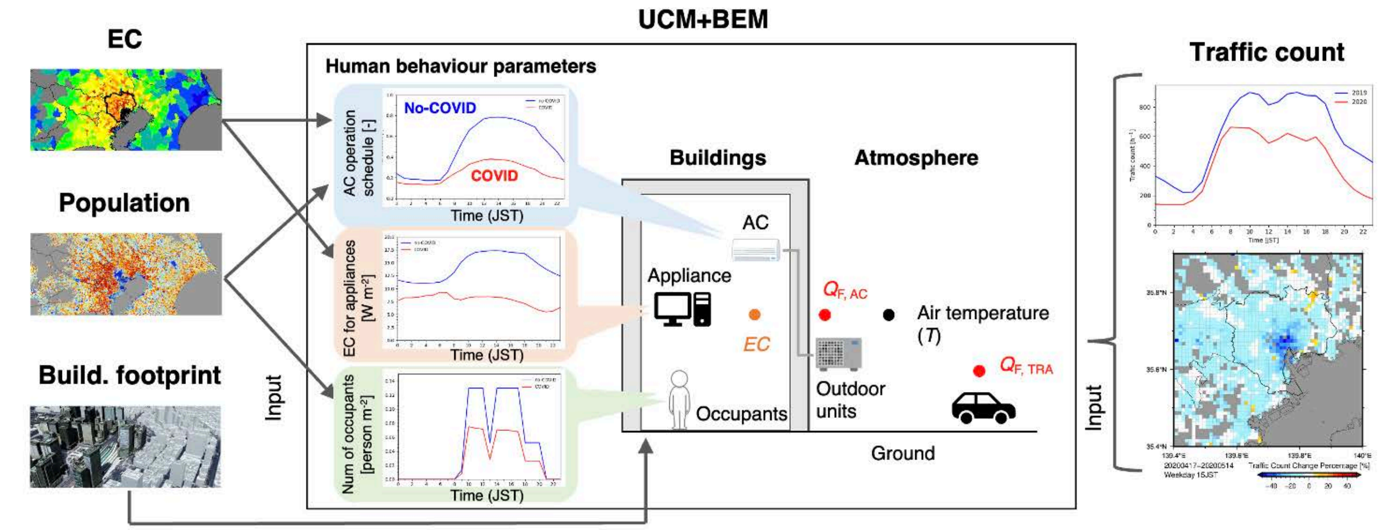

Figure 2. Schematic of the integration of UCM+BEM (CM-BEM) with social big data, including EC, population, building footprint, and traffic count.

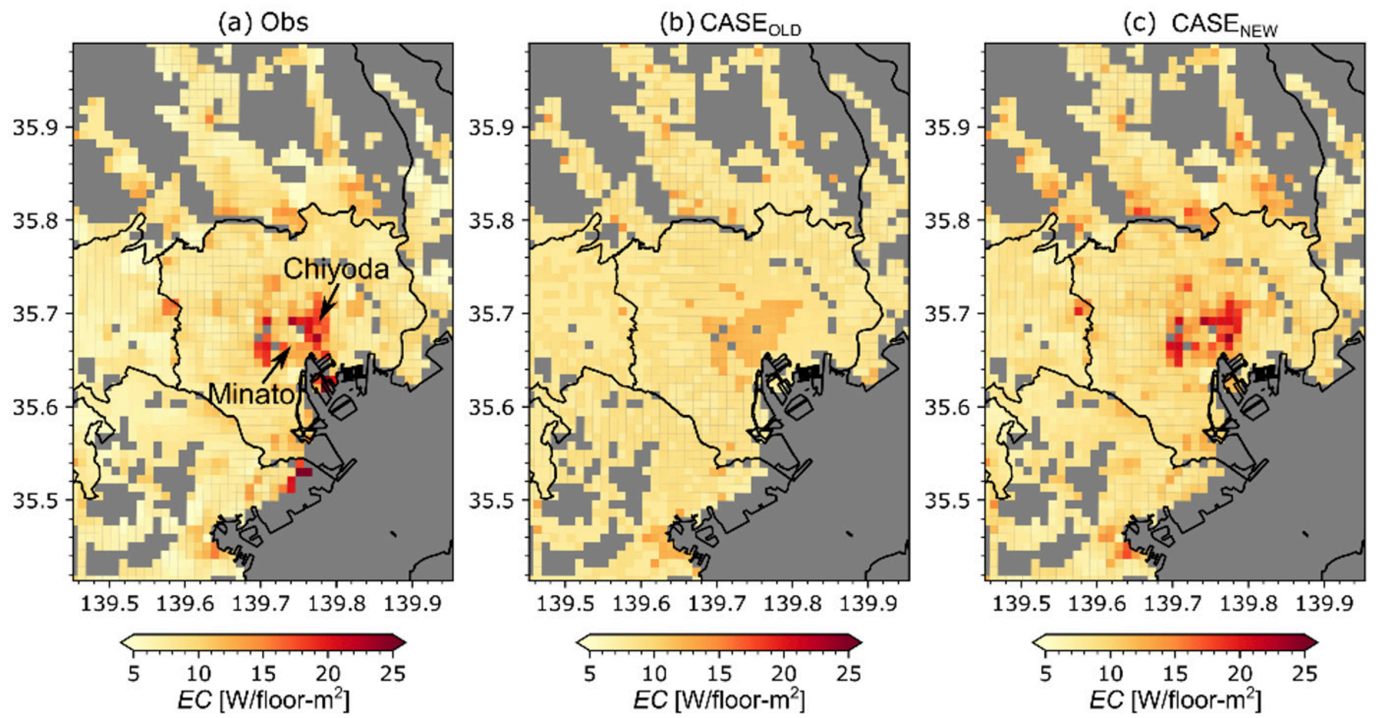

Figure 3. Distribution of daily EC: (a) observations, (b) CASEOLD, and (c) CASENEW.

this variability. CASE$_{NEW}$ also correctly simulates ($\Delta EC/\Delta T$)s for each type of building use on a typical grid, as illustrated in Fig. 1a, which CASE$_{OLD}$ could not achieve.

Given these findings, our EC data hold significant promise for future development of UCM+BEMs. We are planning a new intercomparison project of UCM+BEMs in Tokyo (https://kaken.nii.ac.jp/en/grant/KAKENHI-PROJECT-23H01544/) and encourage any interested model developers and users to participate.

In summary, we have demonstrated that social big data are instrumental for the development and verification of UCM+BEMs. In the future, we aim to apply this model and additional social big data to solve societal issues.

Application of CM–BEM to a major event involving human behaviour change: The COVID–19 pandemic

The validated CM-BEM model, refined through EC big data, was applied to the COVID-19 pandemic, an event that significantly altered human behaviour. The aim was to understand the impact of human activities on EC, Q_F, and near-surface temperature (Nakajima et al. 2021; Takane et al. 2022). Two simulation scenarios were implemented to gauge the impact: the typical ("usual") scenario and the COVID-19 "stay-at-home" scenario. For the usual scenario, we used the same human behaviour parameters (1)–(3) as in the previously mentioned validation: CASE$_{NEW}$ (Nakajima et al., 2023). For the stay-at-home scenario, we leveraged real-time population data with 500-m horizontal resolution (another form of social big data) to compare changes in population density during the COVID-19 pandemic and a typical year (Fig. 4). These changes were then applied to human behaviour parameters (1)–(3) in each CM-BEM grid for the stay-at-home scenario (Fig. 2).

The impact of human behaviour changes resulting from COVID-19 on EC, Q_F, and near-surface temperature T (difference between the stay-at-home and usual scenarios) is depicted in Fig. 5. The data suggest that EC (CO_2 emissions) and Q_F could be reduced to 30% and 33% of pre-COVID levels respectively, in response to stay-at-home advisories. This reduction corresponds with a decrease in T by approximately 0.2°C, consistent with T decreases estimated through observations and statistical analyses (e.g., Fujibe 2020; Liu et al. 2022).

As demonstrated, integrating UCM+BEM and social big data allows us to evaluate the impact of significant social events. This integration enhances both the reproducibility and applicability of UCM+BEM. While we have focused on the Tokyo metropolitan area, similar methods could be applied to other cities worldwide. Gathering and utilizing more social big data will advance urban climate and related research, which is our next goal. We look forward to potential collaborations.

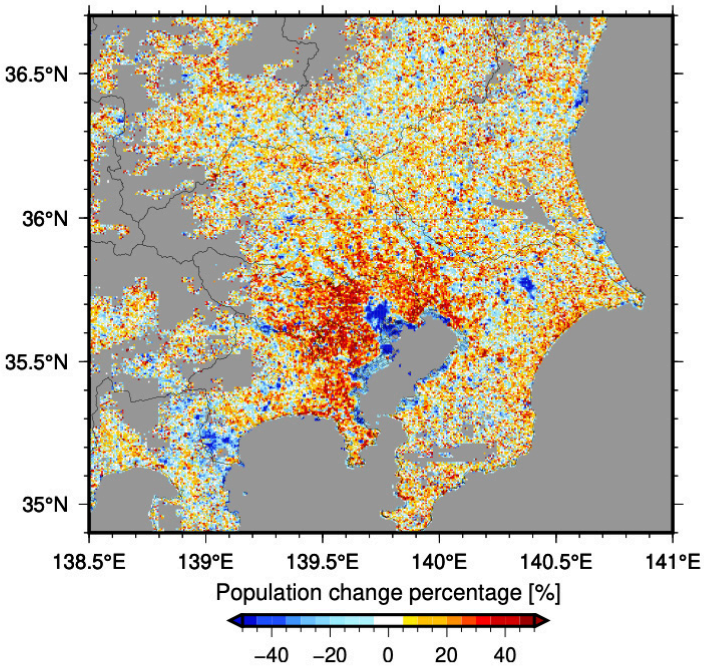

Figure 4. Horizontal variation in population densities (pop km^{-2}) at 15:00 Japan Standard Time (JST) on the Kanto Plain, including the Tokyo Metropolitan Area (TMA): comparison between 18 April–14 May 2019 and 2020.

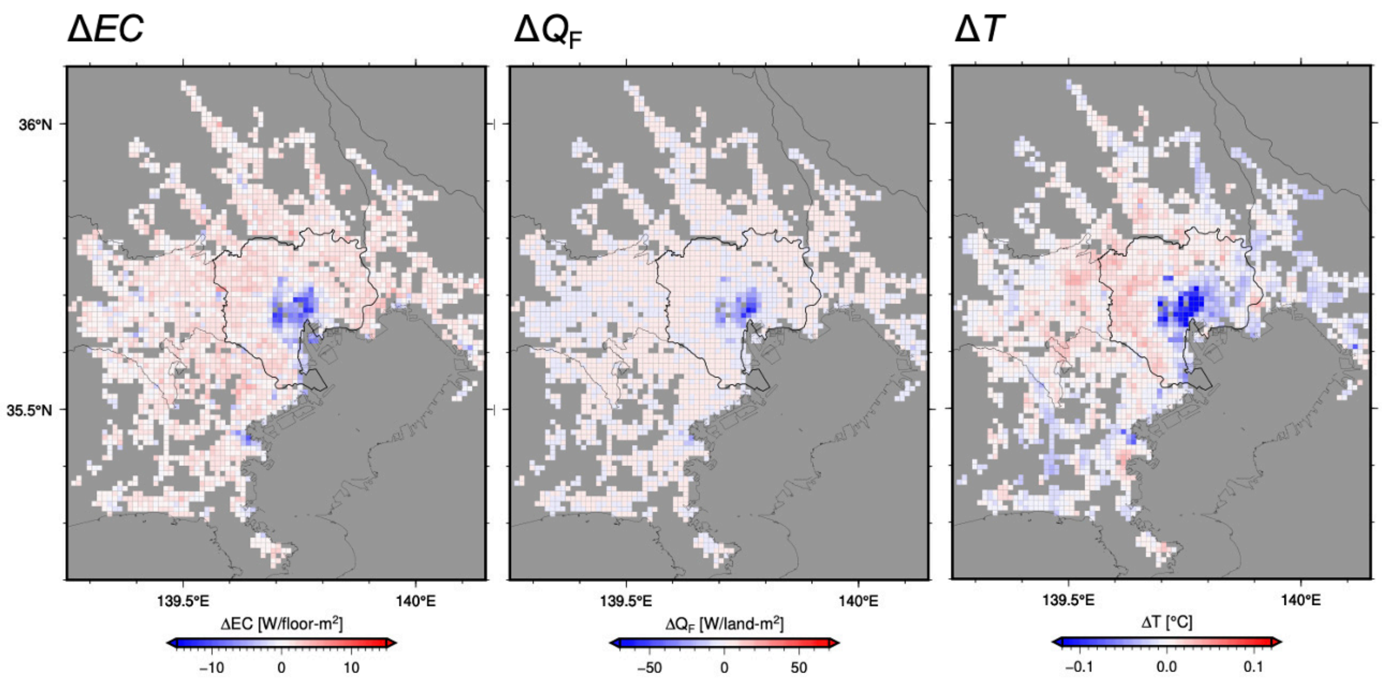

Figure 5. Spatial variation in the impact of COVID-19 on EC (ΔEC, left), anthropogenic heat (Q_F) (ΔQ_F, middle), and near-surface air temperature (T) (ΔT, right), averaged over daytime hours for the period of 18 April to 14 May 2020.

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Effects of tree plantings with varying street aspect ratios on the thermal environment using a mechanistic urban canopy model

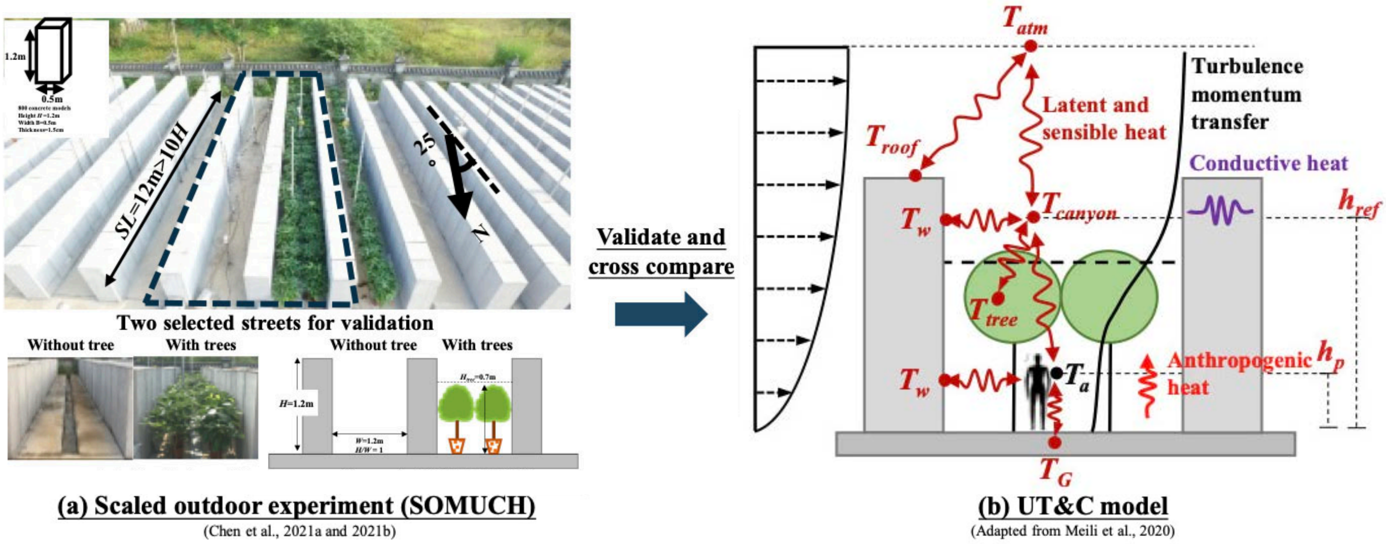

Figure 1. (a) Selected streets (with and without trees, H/W=1) of the scaled outdoor experiment (a cotrollable model under real weather conditions, with verified similarities); (b) Turbulent energy transfer in the UT&C model.

Context

As an effective strategy to mitigate Urban Heat Island (UHI) effects, urban vegetation, especially street tree planting, has been widely adopted in urban design to improve the thermal environment and alleviate pedestrian heat stress (e.g., Wong et al., 2021). However, there are also possible negative impacts, such as high humidity and wind obstruction that may lead to overall thermal discomfort and pollutant accumulation (Wang et al., 2018). Therefore, it is important to pursue a balance of thermal comfort, which is an optimal combination of air and mean radiant temperature, relative humidity, and wind velocity (Jendritzky et al., 2012).

Furthermore, the impacts of trees on microclimate are affected by the characteristics of trees and street morphologies, especially in high-density cities. Street morphological indicators, represented by aspect ratio (H/W, the ratio of street height to width), not only govern the solar radiation that can reach the ground level but also enhance or weaken the impact of trees on microclimate (Morakinyo et al., 2017). Therefore, it is essential to evaluate the coupling effects of tree characteristics and street morphologies on the thermal environment in high-density cities.

Method

In this study, we adopted a mechanistic urban canopy model, Urban Tethys-Chloris (UT&C) (Fig. 1b), as the primary modeling approach with low computational demand (Meili et al., 2020). Furthermore, a semi-empirical model (Yuan et al., 2017) that was developed to estimate the drag force of trees on airflow was integrated within the original UT&C model. The unique scaled outdoor experiment SOMUCH (Scaled Outdoor Measurement of Urban Climate and Health) (Chen et al., 2021) was selected to provide high-quality validation data for modified UT&C validation (Fig. 1a).

Validation study

The comparison between the modified UT&C model and the SOMUCH experiment shows a good agreement for wind speed (V), air temperature (Ta), relative humidity (RH), as well as two important thermal comfort indices, i.e., mean radiant temperature (Tmrt) and universal thermal climate index (UTCI). As an example, Fig. 2 shows significant improvements in the V calculation from newly adopted wind speed module in both streets, with and without trees.

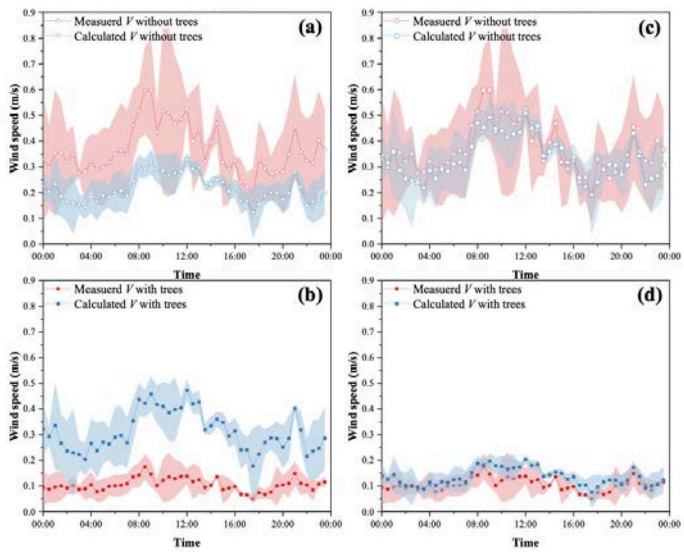

Figure 2. Measured and calculated wind speed (V) based on the original model: (a) street without trees; (b) street with trees; and modified model: (c) without trees; (d) with trees.

This report is based on the manuscript: Chen TH, Meili N, Fatichi S, Hang J, Tan PY, Yuan C. Effects of tree plantings with varying street aspect ratios on the thermal environment using a mechanistic urban canopy model (under review).

Parametric study

Based on the validation study, a parametric study was conducted using the modified UT&C model to investigate the coupling effects of tree characteristics (leaf area index LAI and tree radius r_{tree}) and street morphologies (aspect ratio H/W) on the pedestrian-level thermal comfort. Specifically, both LAI (1.0-6.0) and H/W (1.0-5.0) were varied with fixed r_{tree} value (3.4 m) to examine the coupling effects of LAI and building forms. Furthermore, both r_{tree} (2.0-5.0 m) and H/W (1.0-5.0) were varied while LAI was fixed as 3.0 to study the coupling effects of r_{tree} and H/W. Fig. 3 shows the daily maximum reduction of UTCI ($\Delta UTCI_{max}$) in different cases.

Our results (Fig. 3) show that increasing H/W significantly weakens the cooling effects of trees, and the reduction of $\Delta UTCI_{max}$. This is because building shading dominates the microclimate at higher H/W values. Therefore, fewer additional shaded areas can be provided by trees and less radiation can be absorbed by the tree canopy for photosynthesis and transpiration. Fig. 3 also supports tree-based strategies to maximize the cooling effect in urban areas with various building densities. Firstly, LAI=4.0 is identified as the threshold value to achieve the most effective UTCI reduction in both wide and narrow streets. As shown in Fig. 3a, for H/W=1.0-5.0, increasing LAI from 1.0 to 4.0 can enhance $\Delta UTCI_{max}$ from 2.0 to 3.9°C. However, if we further increase LAI from 4.0 to 6.0, $\Delta UTCI_{max}$ can only be improved by about 0.2°C. This is mainly caused by the poor ventilation in narrow streets.

Secondly, we suggest adopting r_{tree}=5.0 m or larger for wide streets and r_{tree}=3.4 m for narrow streets, respectively. For wider streets (H/W=1.0-3.0), Fig. 3b shows that increasing r_{tree} enhances $\Delta UTCI_{max}$ (up to 4.4°C). For narrower streets (with H/W=3.0-5.0), planting trees with r_{tree} >3.4 m almost obtains the same $\Delta UTCI_{max}$ of about 3.7°C, which is mainly due to the overlapping shade of trees and buildings. Furthermore, larger r_{tree} could even cause a lower wind speed, higher pollutant concentration, and higher humidity. Therefore, smaller tree crown should be adopted for narrow streets to provide effective cooling effects and avoid an excessive reduction in wind speed and increase in humidity.

Conclusion

This study aims to better understand the coupling cooling effects of trees and building forms and develop landscape design strategies accordingly. A parametric study is conducted to investigate the coupling impacts of trees (LAI and r_{tree}) and street morphology (H/W) on pedestrian-level thermal comfort. We use the mechanistic urban canopy model UT&C and integrate it with an urban building-tree wind module. The integrated model has been validated well with a unique scaled outdoor experiment (SOMUCH). Our results show that the cooling effects provided by trees can be weakened in dense street canyons with larger H/W. LAI-based strategies are not sensitive to H/W, and LAI=4.0 is identified as the optimal value for balancing the trees' thermal comfort and aerodynamic benefits; r_{tree} =5.0 m and 3.4 m are recommended for wide (H/W=1.0-3.0) and narrow (H/W=3.0-5.0) streets to maximize UTCI reductions (of about 4.0 and 3.7°C, respectively).

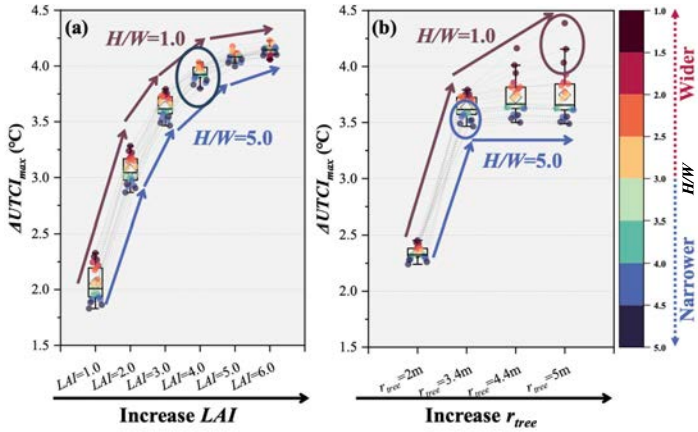

Figure 3. Daily maximum reduction of universal thermal climate index ($\Delta UTCI_{max}$) for various H/W=1.0-5.0 and (a) LAI=1.0-6.0; (b) r_{tree}=2.0-5.0 m.

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Modeling the impacts of reflective paving on building façade temperatures for typical residential neighborhoods in Phoenix Arizona

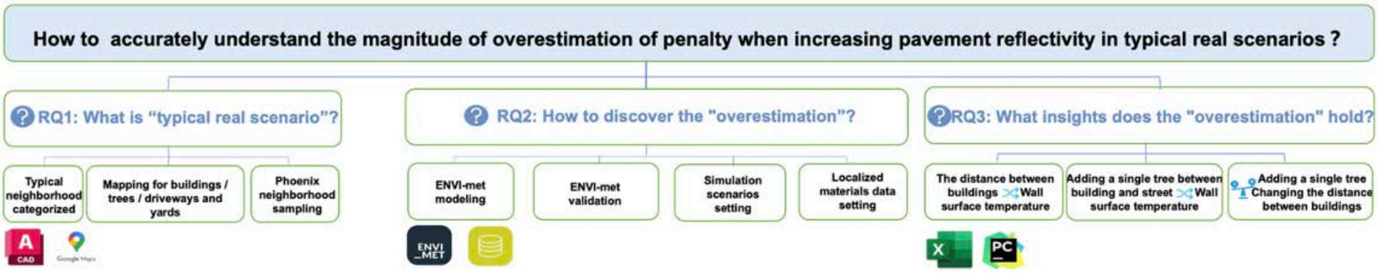

Figure 1. Research question and workflow.

Introduction

Several recent modeling studies reported that, even though increasing the solar reflectivity of pavements reduces the pavement surface temperature, the reflected solar radiation increases the building wall temperature, and hence building energy consumption. These studies, however, represent the neighborhood structure in an overly simplistic manner, ignoring the fact that residences often are separated from the paved streets by yards. Thus, prior results may not apply for all neighborhood scenarios (Fig. 1).

Methods

Phoenix neighborhood sampling and prototype

Taking the residential neighborhoods of Phoenix, Arizona as a research case, this study summarized a typical residential neighborhood configured with a 10-meter-wide front yard and 10-meter-wide backyard, with the building itself spanning 12 meters in width. The front yard typically features a single tree. In terms of length, the house is 16 meters long, with a 4-meter-long entryway path.

ENVI-met modelling and validation

To validate ENVI-met's suitability for simulating Phoenix neighborhood models, this study conducted modeling with the identical model configuration and meteorological conditions utilized in prior research with the UCM model. Subsequently, ENVI-met was employed to conduct simulations for 10 different scenarios with varying albedos (0.1 and 0.7), front yard widths (0m/5m/10m), and tree presence, under each albedo condition (Fig. 2).

Results

Compared to the results of previous papers [1-4], the model reasonably approximates the building wall surface temperature (Fig. 3). Regardless of whether the albedo is 0.1 or 0.7, the results exhibit a high degree of correlation (R^2 & d>0.90) and low error values (RMSE<4.50°C, MBE<4.50°C). The $RMSE_S$ value of road surface temperature (∂0.1 & ∂0.7), and wall surface temperature (∂0.1)is always higher than the $RMSE_U$, while the wall surface temperature (∂0.7) is on the contrary. This indicated that the defects of the software itself account for a large proportion of the prediction error of surface temperature.

Results of increasing pavement albedo from 0.1 to 0.7 show up to a 5°C elevation in wall temperatures when there is no yard. This matches well with previous studies [1-4]. However, for more realistic cases that include a front yard with a single tree, we found that the same increase in pavement albedo resulted in only a 2°C increase in wall surface temperature (Fig. 4). Thus, while increasing pavement albedo can have adverse effects on the surface energy balance of nearby buildings, the extent of the impact depends significantly on context and the types of neighborhoods involved. The increase of the distance between buildings and the setting of trees has different effects on the wall temperature of buildings on the north and south sides. The temperature on both sides of the wall is decreasing at noon. The north wall of the south building is more affected. Compared with increasing the spacing, the cooling area caused by the setting of trees is relatively small.

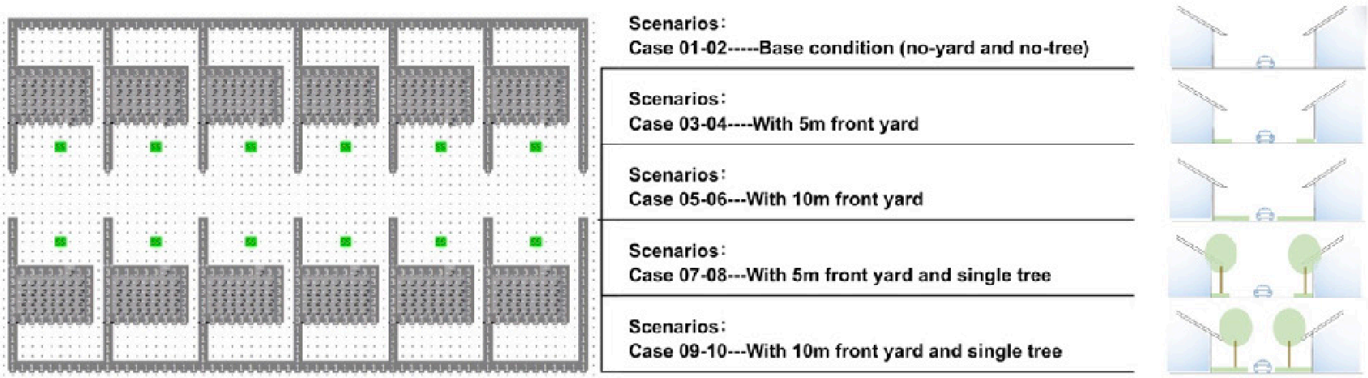

Figure 2. ENVI-met model plane and simulation scenario description.

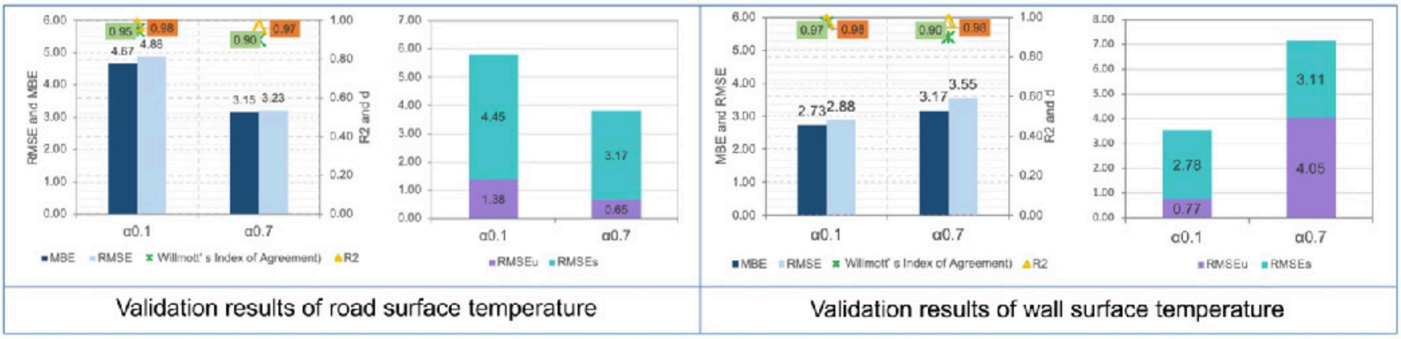

Figure 3. Validation results compared with previous studies.

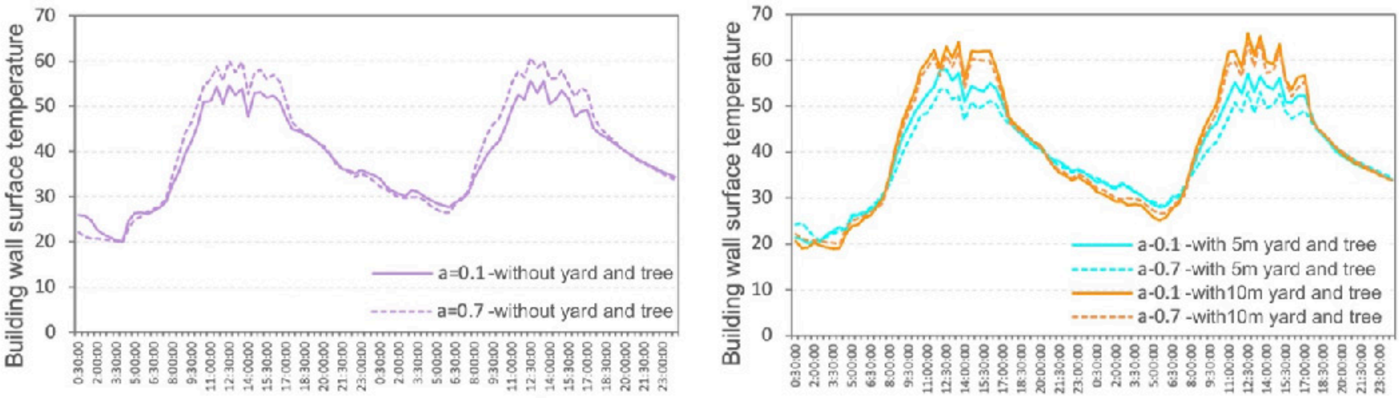

Figure 4. Comparative analysis of different simulation scenarios.

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No *trees*, No *shade* - characterizing street tree effects on near road surface microclimate variability in residential neighbourhoods in London, Canada

Contextualizing the Problem:

Vegetation, particularly trees, are known for their ability to mitigate temperatures and have been a conscious choice in urban design practices in urban environments (Kim et al., 2020; Coutts & Tapper, 2017; Armson et al., 2013). However, limited research exists that focuses particularly on street tree effects of road surfaces and their microclimate variability in residential neighbourhoods over a diurnal period (Zaki et al., 2020; Blankenstein & Kuttler, 2005; Nunez et al., 2000). Roads are of particular interest because of the direct control that cities have over them. Understanding the effects of street trees on road microclimate can help to better inform planting strategies to help make neighbourhoods comfortable.

At the same time, advances in urban climate modelling that integrate vegetation within the urban canyon provide outputs at a finer resolution (Krayenhoff et al., 2020). These demand observational datasets in vegetated urban environments to match the spatial scales of model outputs for model evaluation. Thus, this research aimed to answer the following:

1. How do street trees effect the diurnal cycle of road surface temperatures and their radiative forcings in residential neighbourhoods with varying amounts of tree canopy coverage?

2. Can we demonstrate our traverse samples representative values of T_{Road} and incident radiative fluxes ($K\downarrow$ and $L\downarrow$)?

Project Methodology

Observations

Answering the proposed research questions required the use of a mobile traverse methodology (Oke et al., 2017) (MTM; Figure 1). Neighbourhoods for study (Figure 2) were selected based on street tree canopy coverage (High Tree – HT, Moderate Tree – MT and Low Tree – LT) and proximity to one another to limit the temporal effects on measured data. August 20th, 2020 was selected as an observation day due to clear sky conditions. In total, there were eight traverses at various times throughout the morning, afternoon, and evening to capture absolute temperature differences and rates of warming and cooling. Traverses took 15-20 minutes to complete at a target speed of ~20 km hr^{-1} (Hilland & Voogt, 2020). Two measurements of T_{Road} were made, one using a horizontal field of view Apogee infrared radiometer (HFOV IRT) with a $9m^2$ sampling area set to sample every 0.5s and the second with a FLIR T650-SC (FOV=640X480 pixels) thermal imaging camera sampling every 1s. Three measurements of $K\downarrow$ and $L\downarrow$ were measured using Apogee pyranometers and pyrgeometers spaced equally across the width of the truck's bed. Radiation measurements were made every 0.5s yielding an approximate spatial sampling interval of ~ 10 m.

Figure 1. MTM set-up with instruments measuring air temperature, humidity, location, surface temperature, and incoming radiative fluxes.

Spatially Complete Values

To test the ability of the MTM, we constructed spatially complete (SC) datasets of T_{Road}, $K\downarrow$ and $L\downarrow$. Thermal Composites (TCs) were created to provide SC values of T_{Road}. TCs

Figure 2: Study sites located in London, Ontario, Canada. Yellow lines represent the traverse routes the vehicle followed while making observations.

were constructed by reprojecting, cropping, and mosaicking extracted images from thermal video. To compare measured and SC T_{Road}, TCs were sampled using a derived FOV like that of the HFOV IRT used to measure T_{Road}.

ENVI-Met 5 was used to derive $K\downarrow$ and $L\downarrow$. A domain (65m by 115m by 50m) was designed to replicate a north-south street segment from the HT. Within the domain, buildings are crudely represented with a focus on capturing the true extent of street tree canopy coverage. A prefabricated, dense, cylindrical tree was selected for the model domain. Trees were scaled to best represent geometries found in the street canyon (Figure 3). Simulations were run for a 24-hour period starting at 6:00EDT for the same observation day with forcing based on local climate data.

Results

For each traverse, the HT had the lowest average T_{Road}- compared to the MT and LT, except for the 6:00EDT traverse (Figure 4). Average T_{Road} of the HT at 14:00EDT was 2.9°C and 9°C cooler compared to the MT and LT respectively. Throughout the day the HT saw the lowest average incoming solar radiation and highest average thermal radiation which can be attributed to the high sky obstruction due to tree canopies. The greatest difference in average incident solar radiation was during the 10:45EDT traverse, the HT averaged 309Wm^{-2} and 402Wm^{-2} lower than the MT and LT respectively. Thermal radiation in the HT was highest compared to the MT and LT for each traverse time with the greatest difference in average values measured during the 17:30EDT traverse: 29Wm^{-2} and 40Wm^{-2} respectively.

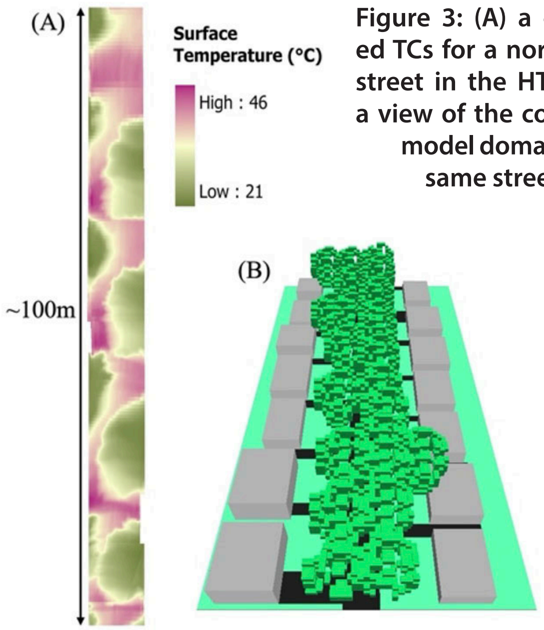

Figure 3: (A) a completed TCs for a north-south street in the HT and (B) a view of the completed model domain for the same street in (A).

Preliminary results show good agreement between measured T_{Road} and $K\downarrow$ and their respective SC values. Average measured T_{Road} for a north-south street segment at 14:00EDT was 35.9°C and average sampled T_{Road} from TCs was 33.7°C, a difference of 2.2°C. Figure 5 illustrates agreement between distributions of measured and representative T_{Road} showing the method's ability to adequately measure shaded and sunlit surfaces.

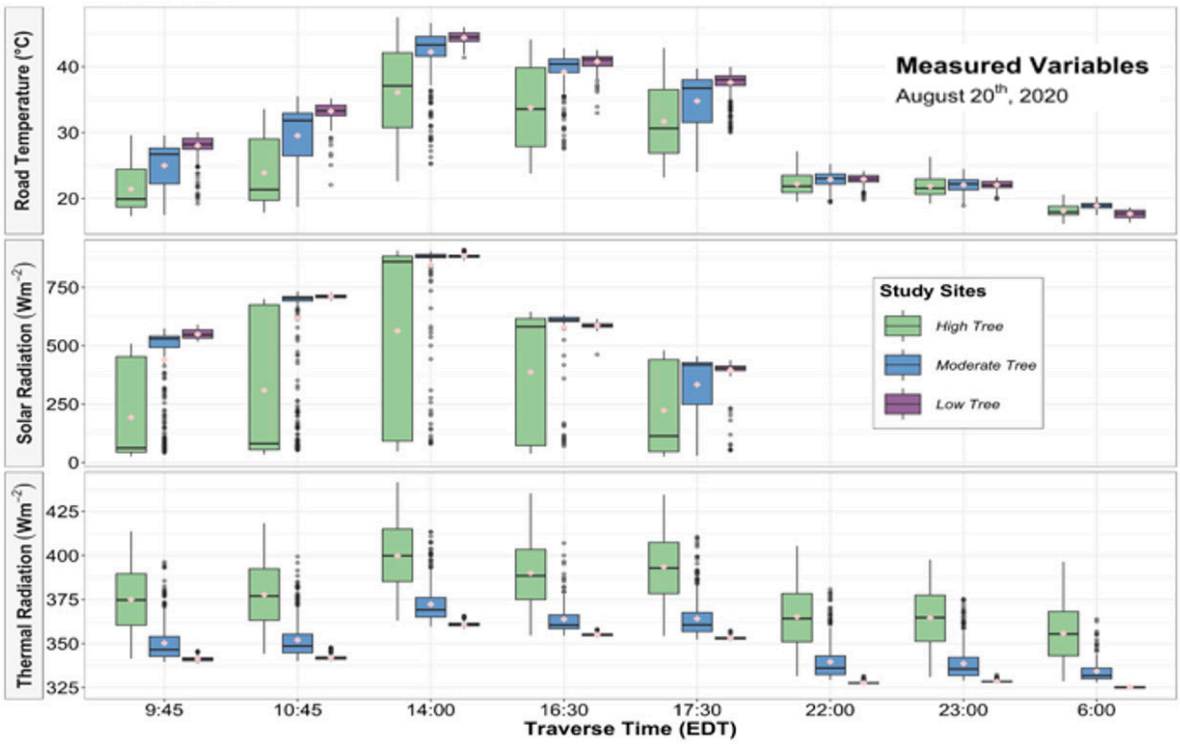

Figure 4. Box plots showing observed T_{Road}, $K\downarrow$, and $L\downarrow$ over a diurnal cycle. Black centre lines represent median values and pink diamonds represent mean values. Patterns in all three measured variables are consistent with expectations given the extent of tree canopy coverage within each site.

Finally, distributions of measured $K\downarrow$ show good agreement with values of SC $K\downarrow$. Similarly to T_{Road}, distributions of measured and modelled $K\downarrow$ show the method's effectiveness in measuring sunlit and shaded $K\downarrow$. However, distributions in Fig. 6 suggest that measured values may not capture portions of the surface dappled due to the structure and density of tree canopies - this can be seen where the SC dataset shows high frequencies of lower $K\downarrow$ classes compared to measured values.

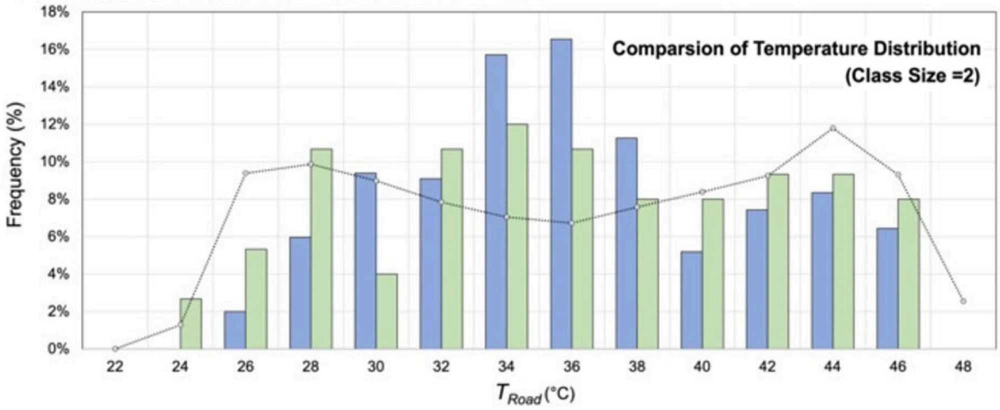

Figure 5. Distributions comparing measured (green) and extracted T_{Road} from the SC TCs. Black dotted line represents distribution of T_{Road} if every pixel was taken from the TCs.

Conclusions and Continued Work

It does not come as a surprise that street trees are effective at mitigating T_{Road}. This study found that tree canopy can provide upwards of 9°C of daytime cooling on road surfaces in areas with dense canopy structures. Based on the study sites selected and their varying degree of tree canopy coverage, observed distributions of T_{Road} and $K\downarrow$ were effective at capturing a range of values. Additionally, comparisons of measured T_{Road} and $K\downarrow$ against SC values suggest that the MTM is effective at capturing the spatial variability resultant from varying tree canopy coverage. Continued work will look to analyze the method's ability to measure $L\downarrow$ and asses the method's efficacy at measuring variability when factors such as vehicle speed and position within the street are modified. Assessing the limits of the method's performance will provide insight that will in-turn help to develop a prescriptive method for future applications.

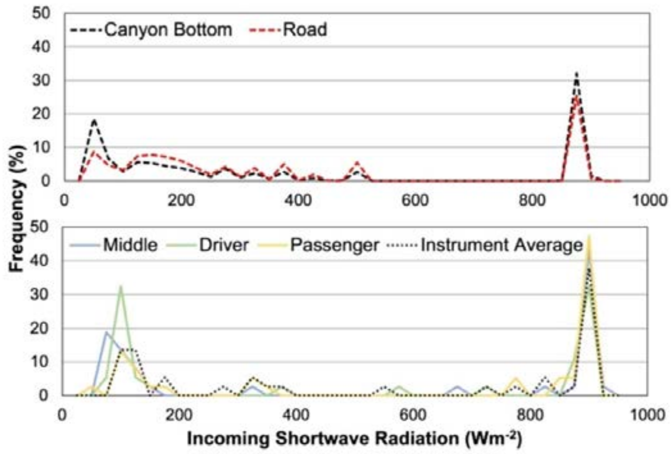

Figure 6. Distributions of measured and modelled K↓. Distributions suggest good agreement between measured and modelled values.

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The Role of Urbanization in Shaping Fog Patterns in the Urban Areas

Introduction

Ranking among the world's most populated and polluted regions, one of the major concerns in North India, particularly over the Indo-Gangetic Plain (IGP), is the widespread fog that occurs annually during winter. This meteorological phenomenon blankets most of the IGP, ranking as one of the most persistent fog systems globally. Dense fog episodes are most witnessed during December and January each year, with occasional appearances in November and February.

Fog are tiny water droplets suspended in the atmosphere near the Earth's surface, causing the visibility to drop below 1000m. It can significantly impact the transportation industry, particularly aviation and road transport. Between 2011 and 2016, the Indira Gandhi International Airport reportedly incurred an estimated economic loss of USD 3.9 million due to fog-induced disruptions (Kulkarni et al., 2019). Coupled with high pollution in these regions, fog episodes result in smog, leading to various health issues, agricultural loss, and poor air quality (Bharali et al., 2019; Takemoto et al., 1988).

Numerous studies worldwide show varying trends in fog (visibility) occurrences in long-term datasets from observational platforms. The fog frequency has increased since the 1960s but decreased after the 1980s in large, old cities like California Central Valley (USA), Munich (Germany), Los Angeles (USA), and Anhui Province (China) (Lee, 1987; Sachweh and Koepke, 1995; Steve, 2005; Shi et al., 2008). Most of these studies discussed an increase in air temperature due to the intensification of *Urban Heat Islands* (UHI) and the resulting drop in relative humidity (the *Urban Dry Islands*) as the reason for the decreasing trends in fog. Some studies also concerned changes in regional circulation patterns as potential causes, but no conclusive assertions were presented.

India consistently demands enhanced fog prediction methods, particularly in city environments. Additionally, the intricate link between weather patterns, human activities, and their effects on fog, commonly called "**fog holes**," – open patches in the widespread fog cover, remains a relatively unexplored field of research in India (Gautam and Singh, 2018).

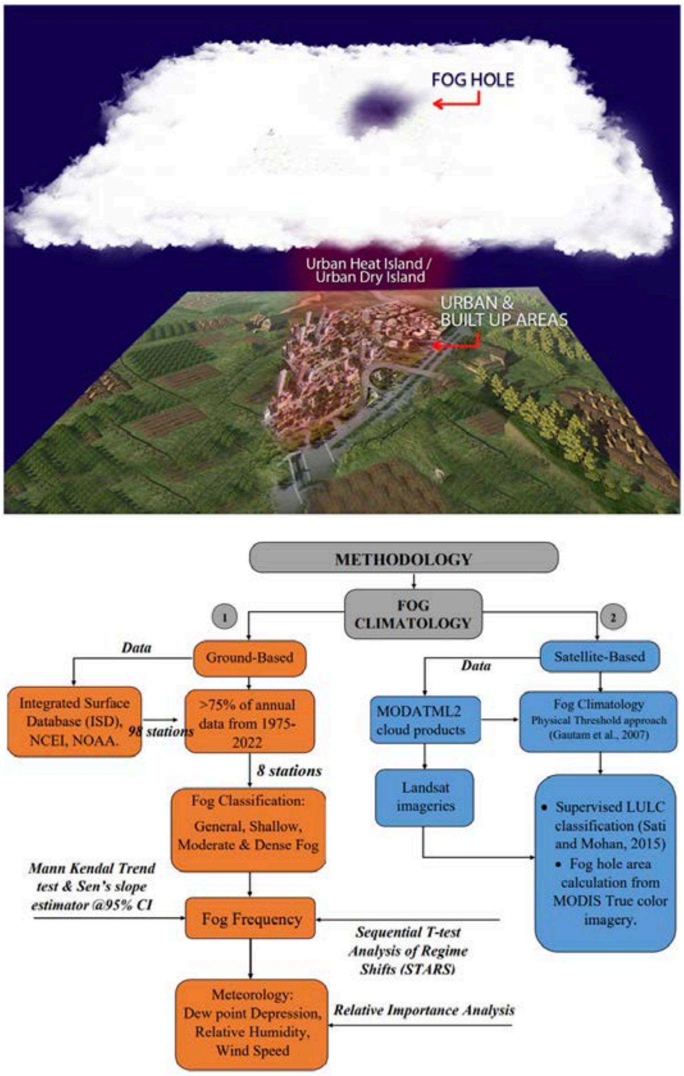

Figure 1. Graphical representation of fog holes (top) and flow chart of Data and Methods (bottom).

Findings and Conclusion of the study

• Over the past 48 years, an overall increase in general fog frequency (visibility ≤1km) was observed at all IGP stations except Kolkata. Notably, Delhi experienced a substantial annual increase of 1.429% yr^{-1} in general fog episodes, while there was a 2.32% decrease in mean dense fog frequency from Regime 2 (1997-2014) to Regime 3 (2015-2022) (Fig 2). This has also been noted from the spatial distribution of fog over the Indo-Gangetic plain from the satellite imagery (Fig 3).

• Satellite observations over Delhi (2003-2020) demonstrated a strong positive correlation (0.88) between the fog-hole area and urban and built-up regions (Fig. 4).

• Rapid urbanization significantly influenced fog frequencies due to the combined impact of anthropogenic factors related to population growth and urban infrastructure expansion. Intriguingly, these influences, beyond a certain threshold, led to a reversal of feedback effects, as exemplified by the decline in dense fog occurrences in Delhi.

• The study identified dew point depression as a prime factor influencing the reduction in fog. The elevated dew point depression correlated with reduced humidity, creating unfavorable conditions for dense fog formation in Delhi.

• The expansion of rapidly growing cities in the upper IGP and several towns in the middle IGP region resulted in new fog holes. We found a strong positive correlation of 0.94 between the fog hole areas in these regions and their respective urban and built-up land cover area.

The study emphasizes the significance of land use changes, especially the expansion of urban areas, in shaping the local fog conditions in any region. In addition to land use changes, urban fog frequencies may be linked to rising air pollution levels, which can trigger atmospheric reactions, generating secondary pollutants and higher aerosol number concentrations, consequently fostering the formation of water aerosols under conducive meteorological conditions and increased relative humidity (Mohan and Payra, 2009). All these factors are interconnected, and interactions and feedback mechanisms between them are complex. Using regional/global models with atmospheric chemistry would help better understand the processes involved and quantify the multifaceted influences of various factors on fog variation, thus forming the future scope of this study.

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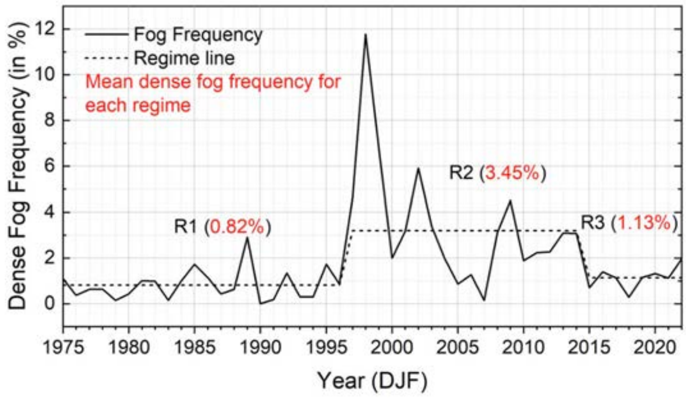

Figure 2. Time series of dense fog frequency in Delhi overlaid with the Regime line.

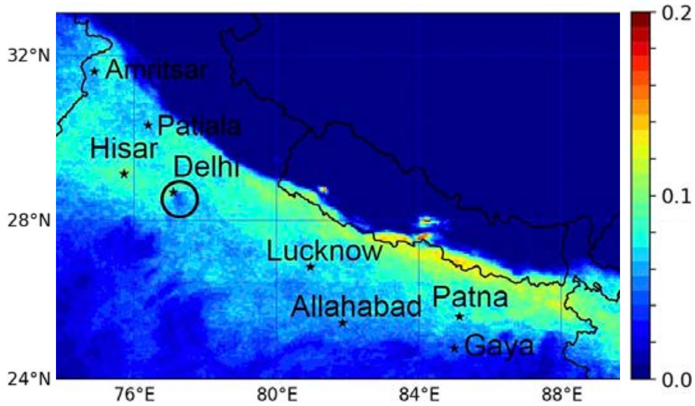

Figure 3. Spatial distribution of Fog/low cloud fraction (climatology (2002-2022)) using Terra/MODIS satellite data at ~10.30 am for DJF. Delhi shows a sharp contrast relative to its surroundings.

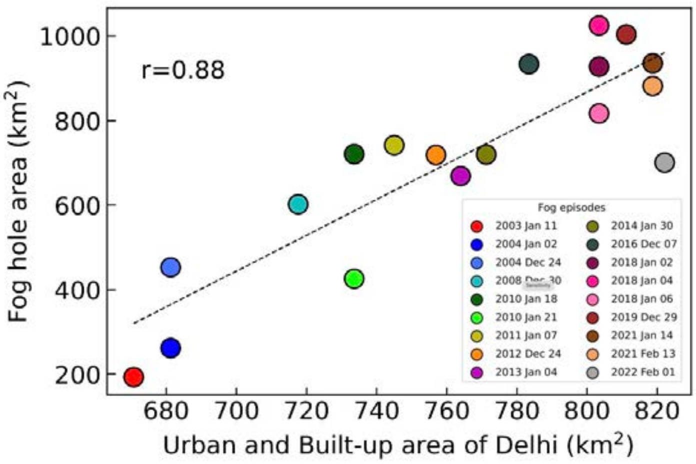

Figure 4. Relationship between fog holes and urban and built-up area (in km²) extracted from satellite imagery corresponding to Delhi for different dates from 2003 to 2022. The correlation is statistically significant (r=0.88, p-value<< 0.05)

Implications of Model Types and Input Variables for Understanding Heat-Health Outcomes

Background

Heat hazard persists as a contemporary human challenge, although the determination of the most vulnerable populations is inconsistent, undermining targeted response (Ho et al., 2015). The determination of heat vulnerability is anchored on general conceptualizations of vulnerability that are not hazard-specific or place-specific, leading to the fuzzy understanding of the specific key drivers and processes driving heat health outcomes across geographies. Moreover, the scale of operation of the dominant drivers of vulnerability could vary across geographies, a phenomenon referred to as spatial non-stationarity or spatial heterogeneity (Fotheringham and Li, 2023). Two profound implications of spatial non-stationarity are that: 1) Neighborhoods are unique and the value or effect associated with a given input variable is non-uniform across locations. 2) Each neighborhood has a context that should be accounted for in the determination of vulnerability. However, the implications associated with the inconsistent choice of input variables and (not) accounting for the geographical context for different model design types are not well understood in heat studies, undermining the understanding of the full spectrum of heat vulnerability.

Variability in input variables and or model design across studies has ramifications in understanding the associations between explanatory variables and heat health outcomes (e.g., Spielman et al., 2020). Therefore, this study addresses these two fundamental considerations which are critical for the assessment of vulnerability by attempting to answer the following research questions: 1) Does heat vulnerability manifest at different geographical scales in Phoenix? 2) How do variable selection and model design influence the understanding of heat-related 911 emergency calls? Our objective is to understand how the geographical context and physical and socioeconomic processes systematically contribute to heat-related 911 emergency calls in Phoenix.

Methods

Our research design is underpinned by two choices where we vary the input variables and model design. Regarding the input variables, we applied deductive (used 41 actual variables from the US census datasets informed by literature) and inductive (employing the Principal Components Analysis (PCA) to reduce the dimensionality of the 41 variables) approaches. Secondly, we employed global and local modeling designs for both the deductive and inductive approaches (Figure 1A). Here, the global model refers to the ordinary least squares which computes a single average across all spatial units within the city of Phoenix limits. On the other hand, the local model (the Multiscaled Geographically Weighted Regression) (MGWR) has two primary distinctions from the global model. First, it has a covariate-specific bandwidth that informs the scale of operation for each input variable. Secondly, it allows for the computation of the geographical context; which captures the intrinsic characteristics of a place explaining differential vulnerability. The chosen research design is critical in addressing several questions emerging in vulnerability literature such as: What is the relative influence of input variables across geographies? How do disparate modeling decision criteria influence heat vulnerability determination? How do the different modeling decisions compound to influence the determination of heat vulnerability? All these questions are crucial for informing how we respond to heat hazards and who should be targeted in the response strategies. Our research focuses on the city of Phoenix in Arizona, United States where heat-related deaths continue to rise over time (Maricopa County saw a 25% increase in heat-related mortality between 2021 and 2022) (Maricopa County Department of Public Health, 2023).

Results and Discussion

Our results indicate that local models were more robust than global models, where they explained a higher variance for both the Principle Component (PC)-based model and the actual variable model (Figure 1B and 1C). Additionally, we observed inconsistencies in the critical determinants of vulnerability across model designs and between the PC-based and actual variables models. Vulnerability literature relies on both deductive and reductive approaches (e.g., Hondula et al., 2015), yet they result in inconsistent determination of vulnerable populations and locations. Given these findings, resource mobilization could be impaired attributable to uncertainties in the research design. These findings imply that the optimal allocation of resources to the most vulnerable may not be achieved as variability in model types or input variables could mask as much as they reveal the most vulnerable. In addition, we found evidence of local variability for the different input variables. This finding demonstrates the need to account for contextual effects (Figure 1D) and determine how they impact the determination of vulnerability. More so, the influence and effects attributable to a determinant of vulnerability are non-uniform across geographies and subsequent studies should attempt to incorporate variable weighting as a function of distance decay. Another crucial finding was that physical variables (e.g., bareness and built-up indices), which are supposed to be proxies for heat hazard were found to be statistically non-significant in explaining the 911 emergency calls. For example, Landsat Surface Temperature and Normalized Difference Vegetation Index (NDVI) failed the test of multicollinearity and could not be

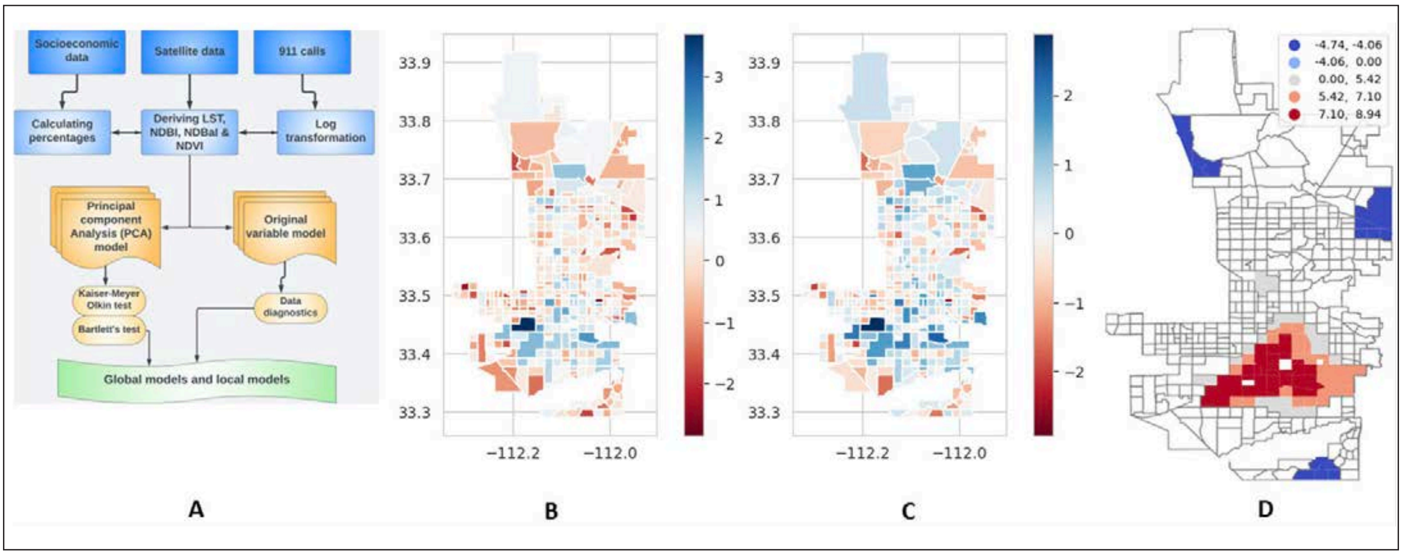

Figure 1. 1A shows the methodological flow chart where we had PCA-based and actual variable models. A global and local model type was applied to each model resulting in four different model types. 1B and 1C visualize the residual for PCA-based and actual variable models at the global level, respectively. The actual variable model had less variance in the residuals. 1D shows the geographic context for the PCA-based model.

used as explanatory variables. We speculate that how we discretize data from satellite imagery into spatial units of analysis could result in loss of data through adjustments in resolution, impacting the usefulness of these variables in the model. Also, it could be that the pre-existing intrinsic vulnerability informed by sociodemographic characteristics constitutes the first-order determinant of vulnerability. We concluded that both the choice of input variables and model type influence the understanding of heat-related 911 calls. Future studies could vary the outcome variable while specifically addressing how scale choices impact the understanding of vulnerability.

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Future of IAUC

By Victoria Ramsey, Simone Kotthaus, Natalie Theeuwes and Benjamin Bechtel

The **International Association for Urban Climate** (IAUC) has long been established as a vital community that brings together researchers working on the challenging environments of cities. Acting as an encouraging platform for knowledge exchange, the International Conference on Urban Climate (ICUC) has helped us to discuss high-impact research findings, to identify new research areas and to establish fruitful collaborations – it is a core event for the engagement of our urban climate community.

During ICUC11 in Sydney, an interactive panel session was held with the IAUC community to discuss how we can further strengthen the ability of IAUC to respond to the variety of current and future global challenges. Members were asked to share their ideas and feedback to help IAUC to develop sustainable community engagement strategies and to become more inclusive to urban climate researchers from all parts of the world - while being conscious of our carbon footprint.

The panel comprised of five experts, namely Alvin Varquez, Antonio Carlos Oscar Junior, Ariane Middel, Gerald Mills and Simone Kotthaus, who represent a range of early career members to long serving board members and (former) IAUC presidents. Moderated by Natalie Theeuwes and Benjamin Bechtel the panellists were asked three questions before the floor was opened to the rest of the IAUC community for discussion. The following sections summarise both the panel and floor discussions.

- *What does IAUC mean to you?*
- *How can community engagement be improved with our limited resources and sustainability constrains?*
- *What is needed to increase our impact on the transformation of cities?*

Panellists stressed the importance of IAUC as a framework for a global community to come together to share ideas, find solutions to common problems and work together - an "academic family". It brings together transdisciplinary aspects of urban climate, inspiring research ideas and providing a platform for discussion within the international community. It provides opportunities for career development and making connections within the urban climate community, especially for Early Career Researchers (ECRs).

The discussions and feedback around improving community engagement and increasing our impact in the transformation in cities can be grouped into three key areas for the IAUC to focus on and summarised below – evolving the structure of IAUC, enhancing community engagement and communicating our science.

IAUC Structure

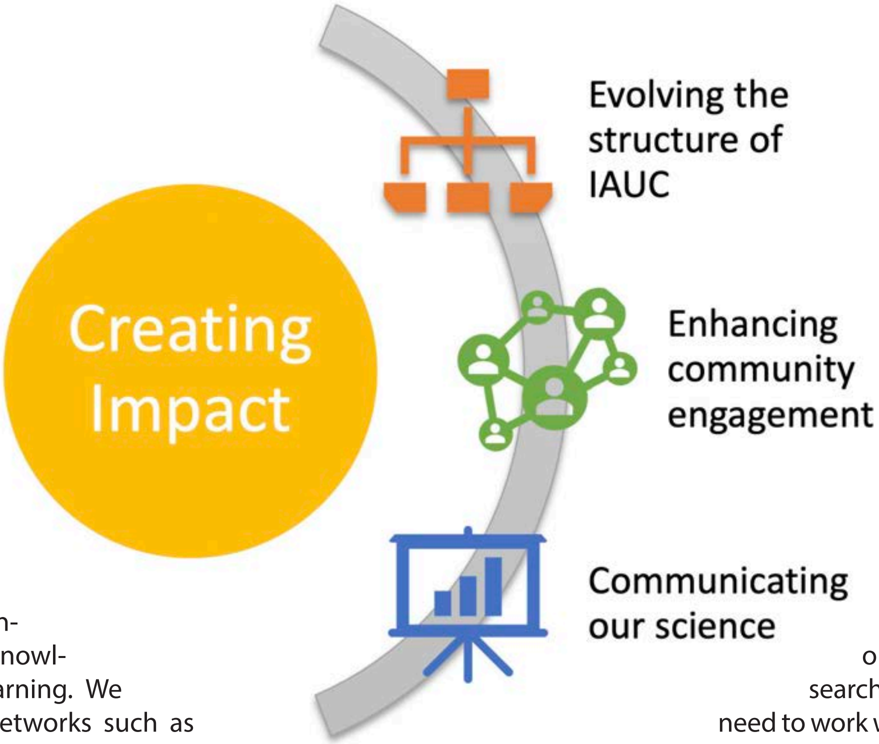
The IAUC was founded through the passionate engagement of its enthusiastic members who have since carried the association by acting on the IAUC board and/or through their voluntary contributions to several activities that work on different levels of strategic organisation, such as the awards committee, newsletter and bibliography, communication, outreach, diversity etc. However, the IAUC to date works with a rather loose framework, that might not always be most efficient or sufficiently transparent.

Increasing the visibility of the IAUC board and the structure of the association would enable the community to better understand the opportunities that are available to engage with the different committees. The development of regional committees could enhance our reach and diversity across the IAUC community. A diversity assessment was suggested to understand the current reach of the IAUC and to help identify areas that are under-represented. Regional committees were viewed as a key mechanism for supporting regional activities in between ICUC events and could help with enhancing the sustainability of future conferences. Our ECRs were identified as an inspiring part of the community that could be better utilised to help facilitate the work of IAUC.

Enhancing Community Engagement

To enhance engagement within the IAUC community there was a call for the development of some form of social network. Suggestions included a forum for sharing recordings of presentations and facilitating communication channels to enhance exchange within the community in between conferences. Webinars or TedX style talks could be organised through regional hubs and used as educational resources. It is envisaged that the new IAUC website (which is currently under construction), will present a platform for more efficient knowledge exchange and communication.

There was a clear requirement to reach out beyond the academic community to users of urban climate information such as the urban planning community and local governments to enhance the impact of our work. We need to facilitate opportunities for urban stakeholders to discuss the issues they are facing with the scientific community and inform future directions of the science. The IAUC community could also see the benefits of cross sectoral learning to enhance impact, drawing on expertise from the likes of health, urban planning etc.



There was interest in the development of committees to bring together those with shared interests to facilitate knowledge-sharing and learning. We could make use of networks such as ICLEI and C40, as well as other networks with similar interests to create impact.

Communicating our Science

The translation and communication of our science is key if our work is to inform decision making. We need to consider bringing in other actors to help with the translation of our science. ECRs were viewed as having a key role in science communication and bringing in fresh ideas of how to do things.

It is important to ensure future ICUCs continue to include sessions demonstrating the application of our science in decision making and inviting users of urban climate information to showcase the impact that our work is having on their decision making. In-between conferences this could be facilitated by the development of case studies to be hosted on the IAUC website.

The IAUC needs to develop strategies for the formulation of short and clear statements on key urban climate concepts to facilitate engagement with the public but also to provide clear messages to practitioners. The community requires a discussion framework that will enable us reaching a consensus on fundamental urban climate issues that can then be communicated more effectively to a wide range of stakeholders. Simultaneously, urban climate researchers around the world need to work with their local governments and stakeholders to develop solutions which match the specific requirements of cities and address the diversity of urban environments.

A key opportunity for communicating and creating impact with our science is through contributing to the next IPCC special report for cities (see also report on ICUC11 Highlights in this issue) as a community. Discussions evolved around how we best position as a community to feed into this process. Synthesising the work of the IAUC community into key themes could be helpful.

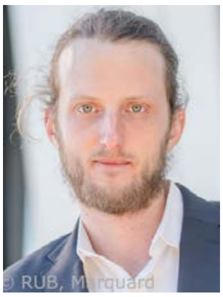
The IAUC has the objective to support more effectively pressing societal transitions through the rich expertise of our community. The fruitful discussions that we had at ICUC11 demonstrate the enthusiasm of the IAUC community in turning this into action. However, we need to be strategic with what activities we take on given limited resources. This summary along with responses from a survey* on engagement and the future or IAUC will be used to improve our structures and procedures to create additional opportunities for community engagement and interaction to leverage our impact on the transformation of cities globally.

* The survey is still open. If you want to participate, you can find the questionnaire here.


Victoria


Simone


Natalie


Benjamin

The path forward for impact: The Sydney Roadmap

By Negin Nazarian, Melissa Hart,
Ariane Middel, and Benjamin Bechtel

Our community takes pride in the significant research progress showcased at ICUC11, but also recognizes the gap between research advancements and their tangible impacts, both at a *local* and *global* level. At the ***local*** scale, a panel discussion at ICUC11 on the “Future of IAUC” recognized the need for effective communication, knowledge translation, and establishment of local expertise to develop translational research programs with more focus on impact assessments (aligned with Oke 2006, published after community discussions at ICUC5). These discussions will further inform future IAUC initiatives to engage, develop, and support training opportunities for the urban climate community.

On the ***global*** scale, ICUC11 provided the opportunity to critically assess how we, the urban climate community, are placed in the larger climate change discourse – from the physical science to impacts and adaptation and policy. During a prominent plenary discussion focused on "Cities and Climate Change," we discussed strategies to enhance our community's active involvement in shaping present and future global initiatives, including, but not limited to, the Intergovernmental Panel on Climate Change (IPCC). In this statement, we declare and underscore our collective commitment to achieve a broader impact, a commitment that was highlighted by the unique prospects presented by the **IPCC Special Report on Climate Change and Cities**.

During the panel, we noted the relatively recent inclusion of urban climate knowledge within the IPCC assessment reports. We acknowledge this historical context and commit to addressing the following pivotal aspects:

- **Technical advancement**: We recognize the pressing need to improve the resolution and capabilities of climate models, and, more importantly, better understand global climate interactions with city-scale processes. Capturing these interactions requires a range of observations across scales, from novel remote sensing platforms to fine-scale IoT sensor platforms, in addition to improved modeling capabilities. It is particularly important to better capture urban dynamics across spatial and temporal scales in larger (regional to global) climate models, and further develop a hierarchy of approaches (at different scales) that can assess and quantify the two-way interaction between cities and climate change.
- **Shift in Priorities**: The evolving focus on the impact of climate change on communities (including urban and informal settlements) necessitates integrating urban climate research into global climate assessments. The impact of climate change on cities, as well as the impact of cities on climate change, can no longer be assessed in isolation. There is a need for synergistic approaches that go beyond disciplinary focuses and put urban climate research into the context of not only climate impact assessments but also applications and policies that can be taken up by city governance.

From left: Ariane Middel, Benjamin Bechtel, Negin Nazari- and Melissa Hart at ICUC11 in Sydney.

- **Procedural Enhancements**: Streamlining the process for integrating urban climate research into IPCC assessments is imperative, requiring a stronger presence of urban climate experts across all three IPCC working groups. Furthermore, integration of our work requires not only better communication of aggregated knowledge in urban climate research (synthesized from various case studies in different cities and climatic contexts) but also better integration in the global sustainability context.

It is paramount that strategic and coordinated planning is needed from the IAUC community to take full advantage of this historic opportunity provided by the IPCC Special Report on Climate Change and Cities. To do so, we must be aware of, and engaged with, the report processes and associated timelines. As presented by **Winston Chow** (co-chair of Working Group II at IPCC), these proposed **steps and timeline** include:

- Scoping Meeting (early-mid 2024), where scoping experts from the minority and majority worlds representing different sectors collaborate to define each chapter’s framework and topic;

At ICUC11 in Sydney, Winston Chow, the co-chair of IPCC Working Group II, discussed the urban-related risks of climate change and the opportunities for global impact presented by the IPCC Special Report on Climate Change and Cities.

- Government Feedback (mid-late 2024), where government representatives provide feedback on chapter scoping and narratives, leading to the finalization of the report's structure and scope;
- Author Selection (from late 2024), where government agencies, scientific organizations, and IPCC focal points nominate and select authors with relevant expertise based on the IPCC's formal invitation;
- Draft Development (TBD), where authors meet regularly to develop comprehensive drafts of each chapter, incorporating input from expert reviewers and government; and
- Plenary Approval of Report Scope (TBD), where the final government draft and summary for policymakers are presented for plenary approval.

To inform various steps of this process, our community commits to 1) **highlighting ongoing initiatives and projects that Identify and address the most critical gaps** in research (for example, via ICUC11 special issues that are in progress), 2) **synthesizing and aggregating existing urban climate knowledge** in various subfields in ways that are robust, comprehensive, and accessible to IPCC authors with expertise in various climate disciplines, and 3) **contributing to the special report** in various capacities including as authors and reviewers.

To achieve the second objective, the IAUC commits to

I. Identifying critical subfields that should be integrated into the IPCC special report, including but not limited to urban climate modeling (including urban representation in global climate models as well as climate projections at the city scale), urban climate observations (including remote sensing and urban climate informatics methods), urban climate hazards and their compounding impacts (such as heat, air quality, flood), urban CO_2 emissions and climate neutral cities, urban climate justice and policy, as well as integrated urban climate services developed across global case studies; and

II. Assembling key expert groups (consisting of authors and reviewers) with diverse topical, career stage, and geographic representations that contribute to aggregating and synthesizing state-of-the-art knowledge in identified subfields, such that they are readily available for IPCC review of the special report. This will be through an inclusive and transparent process that enables the global participation and representation of our community and their diverse expertise.

In conclusion, the Sydney Declaration underscores our resolute commitment to bridging the gap between urban climate research and tangible global and local impacts. We recognize the need for enhancing technical capabilities, integrating urban climate insights into global assessments, and streamlining processes for impactful contributions, particularly within the context of the IPCC Special Report on Climate Change and Cities. Our community pledges to champion robust knowledge synthesis, inclusive representation, and active engagement, aiming to shape the discourse on climate change and urban environments for a sustainable future.

Urban represents! What we learned at WCRP Open Science Conference

The Open Science Conference (OSC) of the World Climate Research Programme (WCRP) took place in the vibrant city of Kigali, Rwanda, from the 23rd to the 27th of October. This event was co-chaired by none other than Dr. **Helen Cleugh**, a distinguished alumna and passionate advocate for urban climate research. Among the attendees were some of our members, including **Negin Nazarian**, **Melissa Hart**, **Fei Chen**, **Gaby Langendijk**, and **Shailendra Mandal**, representing cutting-edge research in our field. They were also there to remind the global community of regional and global climate modelers with high-resolution simulations at km scale that *cities do exist, and are indeed not rocks!*

Notably, meeting after 12 years, the OSC made history by choosing Africa as its location. This decision aimed to foster a deeper mutual understanding of addressing global challenges of climate, particularly those facing the global south. This decade-defining conference successfully brought together diverse communities involved in climate research, practice, and policy, enabling discussion on transformative actions essential for securing a sustainable future. Taking place at a critical moment in Earth's history, the outcome of all conference sessions culminated in the "Kigali Declaration" – a conference statement submitted to the 28th Conference of the Parties (COP28) taking place immediately after the Conference.

Here, we provide an update on WCRP initiatives of interest to the IAUC community.

• The WCRP Academy, co-chaired by IAUC's Melissa Hart, was launched as the research training advisory and coordination arm of the WCRP. Its mission is to equip scientists with the knowledge required to tackle the most pressing climate questions. The Academy assesses requirements for climate research training and builds enabling mechanisms to facilitate this. The Academy also provides a hub, the Academy catalog, connecting training providers and users of training. Check this out if you are in search of training opportunities or if you wish to register your training opportunities.

Dr. Helen Cleugh, a distinguished alumna and passionate advocate for urban climate research, co-chaired WCRP.

• Under the WCRP COordinated Regional climate Downscaling EXperiment (CORDEX) initiative, Gaby Langendijk is co-coordinating the Flagship Pilot Study URBan environments and Regional Climate Change (URB-RCC) on the interactions between cities and regional climate change. The URB-RCC evaluates regional climate models with urban parameterizations with around 30 partners globally. The first coordinated test simulations are underway for the selected city of Paris.

• My Climate Risk (MCR), a WCRP Lighthouse Activity, includes representation from our community, notably Fei Chen on the leadership team. MCR establishes regional hubs to address specific climate risks over various regions, including the Tokyo Urban Regional Hub led by Quang Van Doan. Alexis Lau at the Hong Kong University of Science and Technology is proposing a Tropical Urban Regional Hub in Hong Kong with a potential connection to the ever-growing Southeast Asian major metropolitans.

From left: Shailendra Mandal, Fei Chen, Melissa Hart, Negin Nazarian, and Gaby Langendijk at WCRP in Kigali, Rwanda on October 23-27, 2023.

• As an outcome of the conference, a series of Concept Papers are prepared as high-level discussions on future research and application. Negin Nazarian is leading the only Concept Paper on urban areas, *"Climate Information for Resilient Cities and Societies"*, which will integrate contributions from various IAUC community members. This paper will be instrumental in highlighting the role of urban climate research (including modeling and observational efforts) on building society resilience.

Recent Urban Climate Publications

Abdrabo KI, Kantoush SA, Esmaiel A, Saber M, Sumi T, Almamari M, Elboshy B, Ghoniem S (2023) An integrated indicator-based approach for constructing an urban flood vulnerability index as an urban decision-making tool using the PCA and AHP techniques: a case study of Alexandria, Egypt. *Urban Climate* 48 101426.

Aboagye PD, Sharifi A (2023) Post-fifth assessment report urban climate planning: Lessons from 278 urban climate action plans released from 2015 to 2022. *Urban Climate* 49 101550.

Abunnasr Y, Mhawej M (2023) Fully automated land surface temperature downscaling based on RGB very high spatial resolution images. *City and Environment Interactions* 19 100110.

Abuseif M, Jamei E, Chau H-W (2023) Simulation-based study on the role of green roof settings on energy demand reduction in seven Australian climate zones. *Energy and Buildings* 286 112938.

Acdan JJM, Pierce RB, Dickens AF, Adelman Z, Nergui T (2023) Examining TROPOMI formaldehyde to nitrogen dioxide ratios in the Lake Michigan region: implications for ozone exceedances. *Atmospheric Chemistry and Physics* 23 7867-7885.

Acosta MP, Dikkers M, Vahdatikhaki F, Santos J, Doree AG (2023) A comprehensive generalizability assessment of data-driven Urban Heat. *Sustainable Cities and Society* 96 104701.

*Adilkhanova I, Santamouris M, Yun GY (2023) Coupling urban climate modeling and city-scale building energy simulations with the statistical analysis: Climate and energy implications of high albedo materials in Seoul. *Energy and Buildings* 290 113092.

Afshari A (2023) Optimization of urban design/retrofit scenarios using a computationally light standalone urban energy/climate model (SUECM) forced by era5 data. *Energy and Buildings* 287 112991.

Ajith TC, Kompalli SK, Allan J, Coe H, Babu SS (2023) Formation pathways of organic aerosols over a tropical coastal atmosphere. *Atmospheric Environment* 309 119881.

Aktypis A, Kaltsonoudis C, Skyllakou K, Matrali A, Vasilakopoulou CN, Florou K, Pandis SN (2023) Infrequent new particle formation in a coastal Mediterranean city during the summer. *Atmospheric Environment* 302 119732.

Al Shammas T, Gullón P, Klein O, Escobar F (2023) Development of a GIS-based walking route planner with integrated comfort walkability parameters. *Computers, Environment and Urban Systems* 103 101981.

Alkhaja N, Alawadi K, Ibrahim HM (2023) Post-pandemic planning: Do we have enough and efficient access to parks? *Frontiers in Built Environment* 9 1158430.

Amiri AM, Dadaser-Celik F (2023) Multi-temporal assessment of land surface temperatures as an indicator of land

In this edition, we present a list of publications in the field of urban climate mainly published between May and August 2023. **Featured papers**, denoted by an asterisk symbol (*), are recommended by members of the Bibliography Committee. If you believe your articles are missing from this compilation, please send the references to my email address below with the subject line "IAUC publications" and the following format: Author, Title, Journal, Year, Volume, Issue, Pages, Dates, Keywords, DOI, and Abstract.

We are always seeking researchers at all career stages, particularly early-career professionals, to join our committee and actively contribute to the IAUC community. If you are interested in joining or would like to acquire further details, please do not hesitate to contact me via email.

Happy reading,

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use/cover changes and climate variability in the Develi Basin, Turkey. *Environmental Science and Pollution Research* 30 75549-75563.

*Anand J, Sailor DJ (2023) How can we combine urban cooling strategies to effectively cool cities over the entire diurnal cycle? *Building and Environment* 242 110524.

Apreda C, Schulz J-P, Reder A, Mercogliano P (2023) Survey of land cover datasets for updating the imperviousness field in urban parameterisation scheme TERRA_URB for climate and weather applications. *Urban Climate* 49 101535.

Assaf G, Hu X, Assaad RH (2023) Mining and modeling the direct and indirect causalities among factors affecting the urban heat island severity using structural machine learned Bayesian networks. *Urban Climate* 49 101570.

Azargoshasbi F, Ashrafi K, Ehsani AH (2023) Role of urban boundary layer dynamics and ventilation efficiency in a severe air pollution episode in Tehran, Iran. *Meteorology and Atmospheric Physics* 135 35.

Bai T, Fan L, Song G, Song H, Ru X, Wang Y, Zhang H, Min R, Wang W (2023) Effects of Land Use/Cover and Meteorological Changes on Regional Climate under Different SSP-RCP Scenarios: A Case Study in Zhengzhou, China. *Remote Sensing* 15 2601.

Bassirou Y, Bitondo D (2023) Analysis of rainfall dynamics in the three main cities of northern Cameroon. *Environmental Monitoring and Assessment* 195 640.

*Basunbul AI, Braham WW (2023) Climate responsive lessons from an architectural and ethnographic study of Hijazi traditional dwellings in Jeddah, Saudi Arabia. *Frontiers in Built Environment* 9 1127615.

Battista G, de Lieto Vollaro E, Ocłoń P, de Lieto Vollaro R (2023) Effects of urban heat island mitigation strategies in an urban square: A numerical modelling and experimental investigation. *Energy and Buildings* 282 112809.

Bazrafshan M, Spielhofer R, Hayek UW, Kienast F, Gret-Regamey A (2023) Greater place attachment to urban parks enhances relaxation: Examining affective and cognitive responses of locals and bi-cultural migrants to virtual park visits. *Landscape and Urban Planning* 232 104650.

Bekenshtein R, Price C, Mareev E (2023) Is Amazon deforestation decreasing the number of thunderstorms over South America? *Quarterly Journal of the Royal Meteorological Society* 149 2514-2526.

Bélair S, Alavi N, Carrera ML, Abrahamowicz M, Bilodeau B, Simjanovski D, Charpentier D, Badawy B, Leroyer S (2023) Evaluating the impact of land surface on medium-range weather forecasts using screen-level analyses. *Quarterly Journal of the Royal Meteorological Society* 149 2146-2175.

Belias E, Licina D (2023) Influence of outdoor air pollution on European residential ventilative cooling potential. *Energy and Buildings* 289 113044.

Bhattacharjee S, Lekshmi K, Bharti R (2023) Evidences of localized coastal warming near major urban centres along the Indian coastline: past and future trends. *Environmental Monitoring and Assessment* 195 692.

Bian Y, Lin J, Han H, Lin S, Li H, Chen X (2023) Mitigation synergy and policy implications in urban transport sector: a case study of Xiamen, China. *Environmental Research Letters* 18 084030.

Biljecki F, Chow YS, Lee K (2023) Quality of crowdsourced geospatial building information: A global assessment of OpenStreetMap attributes. *Building and Environment* 237 110295.

*Boccalatte A, Fossa M, Thebault M, Ramousse J, Menezo C (2023) Mapping the urban heat Island at the territory scale: An unsupervised learning approach for urban planning applied to the Canton of Geneva. *Sustainable Cities and Society* 96 104677.

Brandt J, Ertel J, Spore J, Stolle F (2023) Wall-to-wall mapping of tree extent in the tropics with Sentinel-1 and Sentinel-2. *Remote Sensing of Environment* 292 113574.

Brusseleers L, Nguyen VG, Vu KC, Dung HH, Somers B, Verbist B (2023) Assessment of the impact of local climate zones on fine dust concentrations: A case study from Hanoi, Vietnam. *Building and Environment* 242 110430.

Bucquet Q, Calmet I, Perret L, Maché M (2023) Large-eddy simulation of the urban boundary layer using drag-porosity modeling. *Journal of Wind Engineering and Industrial Aerodynamics* 238 105432.

Budzyńska S, Budka A, Roszyk E, Niedzielski P, Mleczek M (2023) Trace of negative changes in environment recorded in cores of trees growing near busy city roads in Poznań, Poland–dendromonitoring of urban pollution. *Ecological Indicators* 149 110198.

Bush T, Bartington S, Pope FD, Singh A, Thomas GN, Stacey B, Economides G, Anderson R, Cole S, Abreu P, Leach FC (2023) The impact of COVID-19 public health restrictions on particulate matter pollution measured by a validated low-cost sensor network in Oxford, UK. *Building and Environment* 237 110330.

Buttazzoni A, Minaker L (2023) Exploring the relationships between specific urban design features and adolescent mental health: The case of imageability, enclosure, human scale, transparency, and complexity. *Landscape and Urban Planning* 235 104736.

Cao J, Peng X, Man X, Li Y, Liu J (2023) Measurements on the surface wind pressure characteristics of a thousand-meter scale megatall building by wind tunnel test. *International Journal of Ventilation* 22 168-192.

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Upcoming Conferences...

6TH INTERNATIONAL CONFERENCE ON COUNTER-MEASURES TO URBAN HEAT ISLANDS
Melbourne, Australia • December 4-7, 2023
https://www.ic2uhi2023.com

AMERICAN GEOPHYISCAL UNION (AGU) FALL MEETING
San Francisco, USA • December 11-15, 2023
https://www.agu.org/fall-meeting/

20TH INTERNATIONAL DAYS ON THERMAL SCIENCE AND ENERGY (JOURNÉES INTERNATIONALES DE THERMIQUE, JITH 2024)
Paris, France • October 29-31, 2024
http://www.jith.eu/index.php/jith-2024

EGU GENERAL ASSEMBLY 2024
Vienna, Austria • April 14-19, 2024
Session CL2.5: Urban climate, urban biometeorology, and science tools for cities
https://meetingorganizer.copernicus.org/EGU24/session/49167

Urban areas play a fundamental role in local- to large-scale planetary processes, via modification of heat, moisture, and chemical budgets.With urbanisation continuing globally it is essential to recognize the consequences of converting natural landscapes into the built environment. Given the capabilities of cities to serve as first responders to global change, considerable efforts are currently dedicated across many cities to monitoring and understanding urban atmospheric dynamics. Further, various adaptation and mitigation strategies aimed to offset impacts of rapidly expanding urban environments and influences of large-scale greenhouse gas emissions ar edeveloped, implemented, and evaluated.

This session solicits submissions from the observational, modelling, and science-based tool development communities. Submissions are welcome that cover urban atmospheric and landscape dynamics, urban-climate conditions under global to regional climate change, processes and impacts due to urban-induced climate change, the efficacy of various strategies to reduce such impacts, and human-biometeorological investigations in urban settings. We also welcome techniques highlighting how cities use novel science data products and tools, including those from humanities and social sciences, that facilitate planning and policies on urban adaptation to and mitigation of the climate change. Emerging topics such as citizen science, crowdsourcing, machine learning, and urban-climate informatics are highly encouraged.

Deadline for abstract submission: January 10, 2024.
https://www.egu24.eu/programme/how_to_submit.ht

Conveners:
Daniel Fenner | University of Freiburg, Germany
Gaby Langendijk | Deltares, The Netherlands
Rafiq Hamdi | Royal Meteorological Institute of Belgium, Belgium
Julia Hidalgo | Centre National de la Recherche Scientifique, France
Ariane Middel | Arizona State University, USA

A tribute to our friend and colleague, Jason Ching

Colleagues, the urban climate community lost a great friend this year with the passing of **Jason Ching**. Following ICUC11 at Sydney, Jason headed off to the Great Barrier Reef as part of his 'bucket list'. Following the visit, Jason fell ill and lost consciousness. We can be thankful that he passed having achieved a lifetime ambition following a conference with his friends at ICUC11 at which he received the Luke Howard Award. A more complete outline of Jason's career will be published in the next edition of the AMS Bulletin, but I hope a lighter description is a better fit in *Urban Climate News*. To help, I have selected a number of photographs to show him as most will remember him, smiling and engaging with colleagues.

To start, let me give a pen portrait of Jason's scientific journey. He attended Penn State University to study meteorology after getting an undergraduate degree in his home state of Hawaii. Thereafter, he completed his PhD at the University of Washington (PhD in 1974). During this period, he also worked on the Barbados Oceanographic and Meteorological EXperiment (BOMEX) project, which was designed to measure the rate of exchange of the properties of heat, moisture, and momentum between the tropical ocean and atmosphere; data from this project formed the basis of his PhD dissertation. Jason found out from the BOMEX project that he got sea-sick, and from that time on, he confined his work on planetary boundary layer (PBL) to land-based activities.

Jason as a young man, starting his career at NOAA-EPA.

Jason is flanked by colleagues at at ICUC8 in Dublin (2012), ICUC9 in Toulouse (2015) and ICUC11in Sydney (2023, with co-organizers Negin Nazarian and Melissa Hart).

Following his graduation, Jason joined NOAA as a meteorologist working in collaboration with the newly formed EPA; this period was initiated with the Clean Air Act, which set the context for much of what followed. Over the next four decades, he worked on many of the most significant large-scale mesoscale measurement and modelling projects that coupled atmospheric sciences and air quality. At the time of his retirement in 2010, Jason described his career by decades, each associated with scientific achievements. The 1970's were dominated by observational programmes (e.g., the Regional Air Pollution Study, RAPS) and the development of models suited to particular pollution problems. The 1980's were a period of improving AQ models to deal with new issues (e.g., acid rain) and to incorporate better treatment of atmospheric processes. The following decade was a period of reconstruction as individual AQ models were merged into a single multi-purpose model, the Community Multiscale Air Quality model (CMAQ). And then, in the first decade of the new millennium, the models improve (WRF) and have a greater capacity for high-resolution models and a need for equivalent emission and surface data. Jason postulated that the period after his retirement from NOAA-EPA would see improvements in AQ exposure models and greater links to global climate change science.

For much of his career, Jason was not directly involved in urban-scale climates, as the AQ field directed itself toward large-scale regional AQ issues. However, in the early 70's, the RAPS and METROMEX experiments shared St. Louis as a study area, and Jason was able to indulge his interest on key topics such as the heterogeneity of the urban landscape, the

Launch of the WUDAPT project at Chinese University of Hong Kong, hosted by Edward Ng. Jason is next to the 'G' in Global.

development of the urban boundary layer, and the storage of heat in the substrate. He was able to return to urban issues directly in the 2000's when the models had evolved to the point where detailed information on urban landscapes was needed. Jason initiated the National Urban Database and Access Portal Tools (NUDAPT) project to provide these urban canopy parameters to support the evolution of the next generation of models. Jason always remained an urban climate scientist at heart.

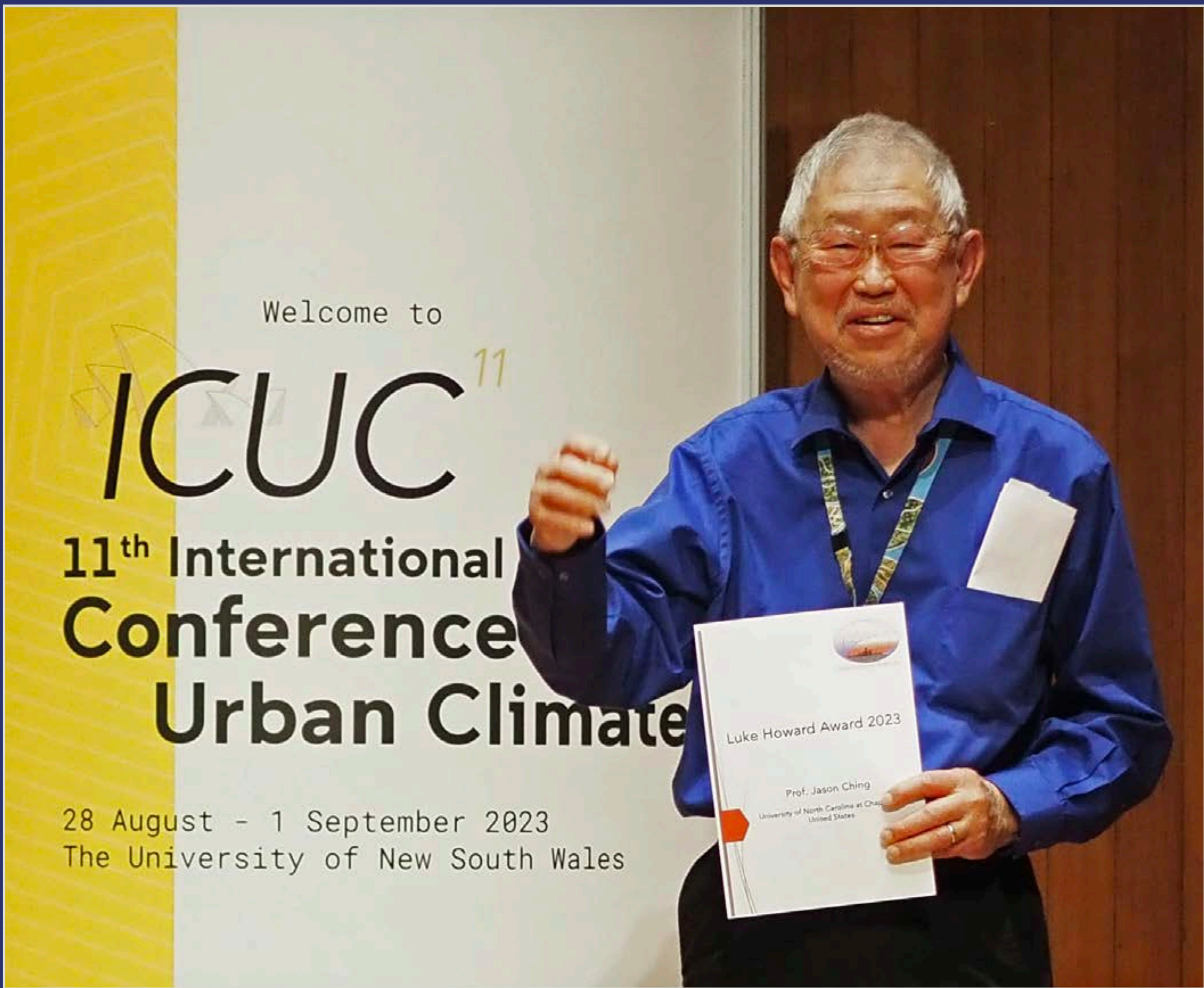
While I knew of Jason's urban work, I had never met him until Prof. Edward Ng organised a conference in Hong Kong on urban climates and its value for urban planning and design in 2010; Edward was to organise a series of following conferences and workshops that brought together an eclectic group of scholars who shared a common interest in the urban environment and the potential for (re) creating climate-responsive cities. It was at this conference that the idea for a global database on cities (WUDAPT) suited for climate research emerged. Jason was invited to give a keynote speech at ICUC8 (Dublin) in 2012 and thus began his re-introduction to the urban climate community! Jason attended every ICUC since Dublin, and he regarded the IAUC community as his own, especially because of its extraordinary diversity of intellectual curiosity and youthful endeavour.

Jason will be remembered in the IAUC as a real gentleman, a great listener and a wise mentor. He was fundamentally a humble man, who wore his career achievements lightly, mostly because he saw these as community (rather than individual) successes. He brought this approach with him, post 'retirement', into the urban field and worked diligently on the research topics that he cared deeply about. His modus operandum for pursuing this work relied on establishing networks of like-minded individuals and convincing these members of the need to co-operate on projects of mutual interest. His enthusiasm was infectious, and this was evident in his engagement with young scientists for whom he was always accessible. Most of all, they will recognise his endearing smile in these photographs, which immediately converted Jason from a colleague to a friend.

I was fortunate to attend a memorial service for Jason in North Carolina recently. I was originally going to Chapel Hill NC to attend the CMAS conference where Jason has organised sessions to initiative collaborations between WUDAPT and the air quality community. However, following his untimely death, these sessions were dedicated to Jason's legacy. At the memorial I met with Janice (who attended ICUCs 8 to 10 with Jason) and his three children (Todd, Jenifer and Ken) and five grandchildren. Although the occasion was very sad, the family were immensely grateful for the kind words of his IAUC friends and colleagues. The subsequent CMAS conference has a full day given over to Jason and, at the lunchtime on the final day, there was a lovely tribute to Jason, which is available at https://www.youtube.com/watch?v=3lOlQltiYWk.

Jason's passing has left a hole in the lives of many. He regarded his receipt of the Luke Howard Award as one of the proudest days of his career, and he went on his last journey as a very happy man. I know that I speak for many in saying that our community has lost a dear friend and a great advocate.

— *Gerald Mills*.



Jason receiving the Luke Howard Award for lifetime contributions to urban climate science at ICUC11 in Sydney.

2023 Luke Howard Award honors the life work of Jason Ching

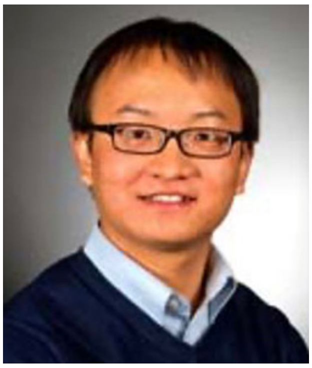
Throughout the span of four decades, Jason Ching has left an indelible mark on urban atmospheric studies, significantly shaping the landscape of atmospheric sciences and urban climate research. His noteworthy contributions have traversed various pivotal phases, beginning in the 1980s with the publication of five seminal papers that elucidated the intricate turbulence structures and spatial complexities of the urban boundary layer. These pioneering studies laid the foundation for subsequent generations of urban atmospheric scientists. Transitioning into the 1990s, his ground-breaking research on urban air quality led to the development of the widely-used WRF-Chem (formerly MM5) modeling system, originating from his pivotal work at the US National Oceanic and Atmospheric Administration (NOAA) and the US Environmental Protection Agency (EPA).

In recent years, Jason has spearheaded innovative methodologies aimed at capturing the intricate physical parameters of urban environments. Notably, his contributions have led to the establishment of the indispensable US National Urban Data Portal Tool (NUDAPT) and the World Urban Data Portal Tool (WUDAPT), integral for accurately representing cities in global weather, climate, and air quality models. Jason's legacy not only underscores his exceptional scientific prowess but also highlights his commitment to advancing research that serves the public interest.

Jason Ching obtained his Ph.D. from the University of Washington in 1974, and he then worked at NOAA and EPA from 1975 until he retired in 2010. Since then, he was a Senior Research Fellow at the University of North Carolina at Chapel Hill. — *Zhiwen (Vincent) Luo, Awards Committee Chair*

Four researchers recognized with 2023 Tim Oke Award

Zhihua Wang



As a distinguished mid-career researcher, Zhihua Wang has exhibited exceptional prowess in the realm of urban climate research, culminating in a prolific publication record of over 100 peer-reviewed articles. His significant scientific achievements notably encompass the decade-long, progressive advancement of physically based urban land surface models, notably the ASU Single-Layer Urban Models (ASLUM). Of particular significance is his comprehensive exploration of urban heat island (UHI) mitigation solutions within a holistic framework tailored to foster policy relevance, transcending the confines of abstract academic pursuits.

Zhihua's academic endeavors have not only enriched our comprehension of the intricate dynamics within the built environment but have also significantly contributed to fostering sustainable urban planning and informed decision-making processes. His pioneering research has notably heightened public awareness and preparedness for forthcoming urban climate changes. In addition to his groundbreaking research, Zhihua has exhibited exemplary mentorship, guiding and nurturing a cohort of highly successful students and postdoctoral scholars.

Negin Nazarian

Negin Nazarian has demonstrated exceptional contribution in urban climate research, achieving remarkable milestones within a relatively short span since obtaining her PhD from the University of California San Diego, USA, eight years ago. Her diverse body of work is characterized by a comprehensive research scope, seamlessly bridging fundamental and applied aspects while integrating both observational and modeling approaches. Notably, her research addresses the interplay between climate change, the built environment, and human health, with a keen focus on heat exposure.

Negin's pursuit of advancing our understanding of urban climate is underscored by her advanced proficiencies in micrometeorological modeling, meteorological and biometeorological observation and sensing, as well as urban climate informatics. These capabilities are anchored in her earlier training in mechanical engineering and geophysical fluid dynamics. Leveraging a formidable skill set alongside an innate creativity, insatiable curiosity, and unwavering diligence, Negin's work has already made a significant impact within the domain of urban climate.

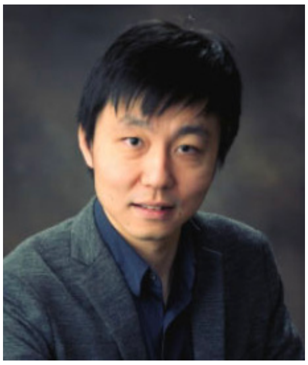
Ariane Middel

Ariane Middel, a distinguished mid-career scientist, has garnered significant international recognition for her groundbreaking research delving into the critical role of shade in shaping outdoor thermal comfort. Leveraging her robust background in computer science, her pioneering work encompasses a unique fusion of microclimate measurements and cutting-edge modeling techniques, integrating the application of machine learning methodologies.

Her pioneering efforts include the development of innovative sensing methods for comprehensive heat exposure assessment, epitomized by the transformative MaRTy and PanoMRT technologies. These innovations have revolutionized our understanding of the intricate thermal landscapes within urban environments. Furthermore, Ariane's unwavering dedication has culminated in the establishment of the emerging field of urban climate informatics, an interdisciplinary domain harmonizing urban climatology with the principles of data science and informatics.

Ariane's leadership within the urban climate community is evidenced by her esteemed position as the elected president of the IAUC for the term spanning 2022-2026.

Lei Zhao



Lei Zhao has emerged as an exemplary figure, dedicating his career to unraveling and combatting the intricate challenges associated with urban climate change. His pioneering research, which harmonizes physics-based modeling with data-driven machine learning approaches, has illuminated the far-reaching impacts of climate change on global urban environments. Notably, Lei's work has addressed pressing issues such as heightened heat risks and exposures, pervasive air pollution, and the formulation of effective mitigation strategies.

Since the culmination of his doctoral studies at Yale University in 2015, Lei has contributed a wealth of highly influential research, featuring prominently in prestigious journals including *Nature*, *Nature Climate Change*, and *Nature Geoscience*. His profound impact within the field of urban climate research is a testament to his unwavering dedication and innovative approach, positioning him as a leading figure in the quest for sustainable urban development amidst the challenges posed by a changing climate.

— Zhiwen (Vincent) Luo, Awards Committee Chair

Members of the IAUC Board at ICUC11 in Sydney (from left): Nigel Tapper, Alex Baklanov, Vincent Luo, Benjamin Bechtel, Victoria Ramsey, Jorge Gonzalez, Dev Niyogi, Ariane Middel, Simone Kotthaus, Natalie Theeuwes, Andreas Christen, Dan Li, Melissa Hart and Negin Nazarian.

Kudos! President Ariane Middel, Secretary Benjamin Bechtel, and ICUC11 Co-chairs Negin Nazarian and Melissa Hart.

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

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The next edition of *Urban Climate News* will appear in late March. Contributions for the upcoming issue are welcome, and should be submitted by February 28, 2024 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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