# Urban Climate News

*Quarterly Newsletter of the IAUC*

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## From the IAUC President

It is a busy time in the climate arena – the IPCC Special Report on Climate Change and Land released six weeks ago, and the Special Report on Cryosphere and Ocean in a Changing Climate released last week, along with last week's Climate Change Summit in New York and Global Climate Strike marches all around the world. Additionally, the First Order Draft (FOD) of chapters for the IPCC AR6 WGII are all due next week. A number of individuals within our urban climate community are involved in various of these reports and I wish to thank them for their efforts.

Many of our members are also involved in the "World Urban Database and Access Portal Tools" (WUDAPT) project that seeks to acquire and store urban data using a common framework, linking those data to available methods for climate analysis and scenario development. This work has attracted a huge amount of interest, including much interest from outside our community. Jason Ching is currently leading an important new phase of that work that involves developing a methodology for computing urban canopy parameters (UCPs) based on the outputs of the WUDAPT Digital Synthetic City (DSC) tool and evaluating outputs using data for ~40 global cities. This is a huge effort involving Leads in each city. Initial results will be presented at the AMS 15th Symposium on the Urban Environment in Boston in January. It is great to see the IAUC networks contributing to such important global initiatives.

With financial support from the IAUC, a number of European institutes organized the 3rd edition of the Bucharest Urban Climate Summer School. Over the course of a week, 18 students from 8 different countries joined the lectures and hands-on exercises covering a wide variety of topics such as urban climate modelling, remote sensing and crowdsourcing, urban ecology, and bio-meteorology. A full report is provided later in the Newsletter. We are delighted to support similar initiatives organized by our members. Details of our sponsorship policy and procedures for applying can be found at https://www.urban-climate.org/awards/sponsorships-by-the-iauc/ under the "Awards" tab of the IAUC website. The maximum amount of sponsorship funding for any one event will be 2500 EUR.

Finally, an update on ICUC-11 – Co-chairs Nazarian and Hart are actively planning the **11th International Conference on Urban Climate in Sydney** (30th August - 3rd September 2021). The general theme of the conference is **"Cities as Living Labs: Climate, Vulnerability, and Multidisciplinary Solutions"** with 4-5 parallel (oral and poster) presentation sessions conducted to cover a diverse range of topics related to urban climatology. Additionally, as the committee and host institutions are committed to the professional development of early-career scientists and students, several events will be focused on this. The organisers are committed to providing an inclusive and diverse environment at ICUC-11, which will be reflected in the representation of keynote speakers, session chairs, and scientific committee members. They welcome any proposal and contribution from the IAUC community with regard to proposed session themes and workshops. In particular, the organisers **strongly encourage IAUC members from historically underrepresented regions such as the Middle East, Africa, and Central/South America to submit an expression of interest to be a part of the ICUC-11 Scientific Committee. Contact Dr. Negin Nazarian** (n.nazarian@unsw.edu.au).

Once again, thanks to David Pearlmutter, Paul Alexander, Helen Ward, Joe McFadden and Matthias Demuzere for providing a Newsletter full of useful and interesting material.

– Nigel Tapper,
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### *Inside the September issue...*

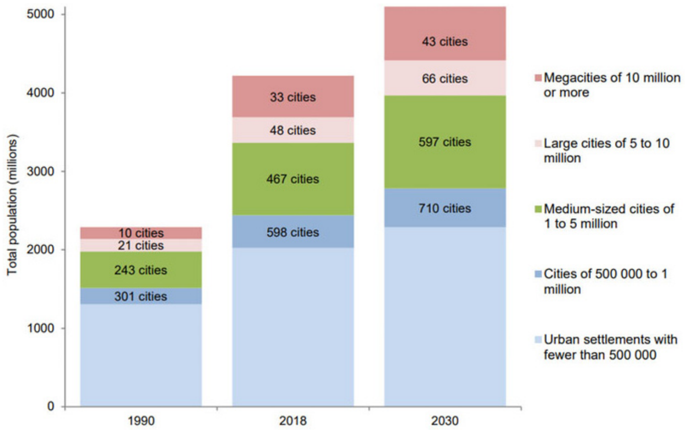
# Urban growth, heat islands, humidity, climate change: the costs multiply in tropical cities

*September 2019* — Some 60% of the planet's expected urban area by 2030 is yet to be built. This forecast highlights how rapidly the world's people are becoming urban. Cities now occupy about 2% of the world's land area, but are home to about 55% of the world's people and generate more than 70% of global GDP, plus the associated greenhouse gas emissions.

So what does this mean for people who live in the tropical zones, where 40% of the world's population lives? On current trends, this figure will rise to 50% by 2050. With tropical economies growing some 20% faster than the rest of the world, the result is a swift expansion of tropical cities.The populations of these growing tropical cities already experience high temperatures made worse by high humidity. This means they are highly vulnerable to extreme heat events as a result of climate change.

For example, extremely hot weather overwhelmed Cairns last summer. By December 3 2018, the city had recorded temperatures above 35°C nine days in a row. Four consecutive days were above 40°C. For our research, temperature and humidity sensors were strategically placed in the Cairns CBD to represent people's experience of weather at street level. These recorded temperatures consistently higher than the Bureau of Meteorology (BoM) recordings, reaching 45°C at some points.


**The layout and structures of Cairns CBD alter local microclimates by trapping heat and altering air flows. State of Queensland 2019. *Source:* theconversation.com**




**Population and number of cities of the world, by size class, 1990, 2018 and 2030. *Source:* theconversation.com**

### Local effects magnify heatwave impacts

Urban environments in general are hotter than non-urbanised surroundings that are covered by vegetation. The trapping of heat in cities, known as the urban heat island effect, has impacts on human health, animal life, social events, tourism, water availability and business performance.The urban heat island effect intensifies the impacts of increasing heatwaves on cities as a result of climate change. But it is important to remember that other local factors also influence these impacts. These include the scale, shape, materials, composition and growth of the built environment in a particular location and its surrounding areas.

The differences between the BoM data recorded at Cairns airport and the inner-city recordings show the impacts of urban expansion patterns, built form and choice of materials in tropical cities.

The linear layout of Cairns has, on one hand, enabled the formation of attractive places for commercial activities. As these activity centres evolve into focal points of urban life, they in turn influence all sorts of socioeconomic parameters. On the other hand, the form the built environment takes changes the patterns of wind, sun and shade. These changes alter the urban microclimate by trapping heat and slowing or channelling air movements.

### Shifting the focus to the tropics

To date, a large body of research has explored the undesired consequences of climate change and urban heat islands. However, the focus has been on capital and metropolitan cities with humid continental climates. Not many studies have looked at the economic and social impacts in the tropical context, where hot and humid conditions create extra heat stress.

Add the combined effects of climate change and urban heat islands and what are the socio-economic consequences of heatwaves in a tropical city like Cairns? We see that climate change adds another dimension to the relationship between cities, economic growth and development. This presents a huge opportunity to start thinking about building cities that are not superficially greenwashed, but which instead tackle pressing issues such as climate variability and create sustainable business and social destinations.

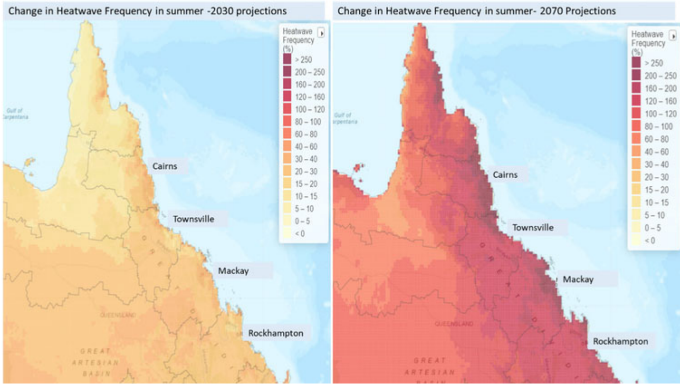
In cold climates, heatwaves and urban heat islands are not necessarily undesired, but their negative impacts are more obvious and harmful in warmer climates. And these harmful impacts of heatwaves on our economy, environment and society are on the rise.

We have scientific evidence of the increasing length, frequency and intensity of heatwaves. The number of record hot days in Australia has doubled in the past five decades.

**What are the costs of heatwaves?**

Increased exposure to heatwaves amplifies the adverse economic impacts on industries that are reliant on the health of their outdoor workers. This is in addition to the extreme heat-related fatalities and health-care costs of heatwave-related medical emergencies.

As a PwC report to the Commonwealth on extreme heat events stated: *"Heatwaves kill more Australians than any other natural disaster. They have received far less public attention than cyclones, floods or bushfires — they are private, silent deaths, which only hit the media when morgues reach capacity or infrastructure fails."* Heat also has direct impacts on economic production. A 2010 study found a 1°C increase resulted in a 2.4% reduction in non-agricultural production and a 0.1% reduction in agricultural production in 28 Caribbean-basin countries. Another study in 2012 found an 8% weekly loss of production when the temperature exceeded 32°C for six days in a row.




**Projections of changes in heatwave frequency for northern Queensland in 2030 and 2070. *Source:*** theconversation.com

The 2017 Farm performance and climate report by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) states: *"The recent changes in climate have had a significant negative effect on the productivity of Australian cropping farms, particularly in southwestern Australia and southeastern Australia."*

It's not just farming that is vulnerable. A Victorian government report this year estimated an extreme heatwave event costs the state's construction sector A$103 million. The impact of heatwaves on the city of Melbourne's economy is estimated at A$52.9 million a year on average. According to this report, economic costs increase exponentially as the severity of heatwaves increases. This has obvious implications for cities in tropical regions.

As the next step in our research, we are examining the relationship between local urban features, urban heat islands, the resulting city temperatures and their direct and indirect (spillover) effects on local and regional economic activities. *Source:* http://theconversation.com/urban-growth-heat-islands-humidity-climate-change-the-costs-multiply-in-tropical-cities-120825

**During a heatwave in late 2018, Cairns temperatures topped 35°C nine days in a row and sensors at some points in the CBD recorded 45°C. *Source:*** theconversation.com

# Amazon fires could accelerate global warming and cause lasting harm to a cradle of biodiversity

*The number of wildfires have skyrocketed compared to recent years, increasing deforestation*

*August 2019* — Huge tracts of the Amazon, which serves as the lungs of the planet by taking in carbon dioxide, storing it in soils and producing oxygen, are ablaze. Smoke from the widespread fires have turned day into night in Sao Paulo, and intensified a controversy over the Brazilian government's land use policies.

The Brazilian Amazon has experienced 74,155 fires since January, according to data from Brazil's National Institute for Space Research, known by the acronym INPE. That's an 85 percent increase from last year and significantly higher than the 67,790 blazes up to this point in the year during 2016, when there were severe drought conditions in the region associated with a strong El Niño event.

"There is nothing abnormal about the climate this year or the rainfall in the Amazon region, which is just a little below average," INPE researcher Alberto Setzer told Reuters. Speaking of the fires, he said, "The dry season creates the favorable conditions for the use and spread of fire, but starting a fire is the work of humans, either deliberately or by accident."

The fires have covered the Brazilian city of Sao Paulo in dark smoke, and are raising concerns that the rainforest, which is one of the most biologically diverse regions on Earth, may be shifting into a newly fragmented regime from land-clearing operations and other activities intended to transform the land for agricultural use. "People stored black water from the rainfall after the massive smoke cloud reached São Paulo," says Vitor Gomes, an environmental scientist at the Federal University of Pará in Brazil, via email.

According to the European Union's Copernicus Climate Change Service, the fires have led to a clear spike in carbon monoxide emissions as well as planet-warming carbon dioxide emissions, posing a threat to human health and aggravating global warming.

INPE tracks deforestation in Brazil, and its data has shown a huge increase in the Amazon this year. In early August, INPE found that 1,330 square miles of rainforest had been lost since January alone, which is a rate 40 percent higher than in 2018.

The release of those statistics and ensuing media coverage earned the ire of Brazilian President Jair Bolsonaro. Bolsonaro, who favors increased agricultural and mining development in the Amazon, called those numbers "a lie" and then fired Ricardo Galvão, a physicist who served as the director of the scientific agency.

**Satellite image of a wildfire in the Brazilian state of Pará. (Planet Labs).** ***Source:*** **washingtonpost.com**

**Why so many fires are occurring now**

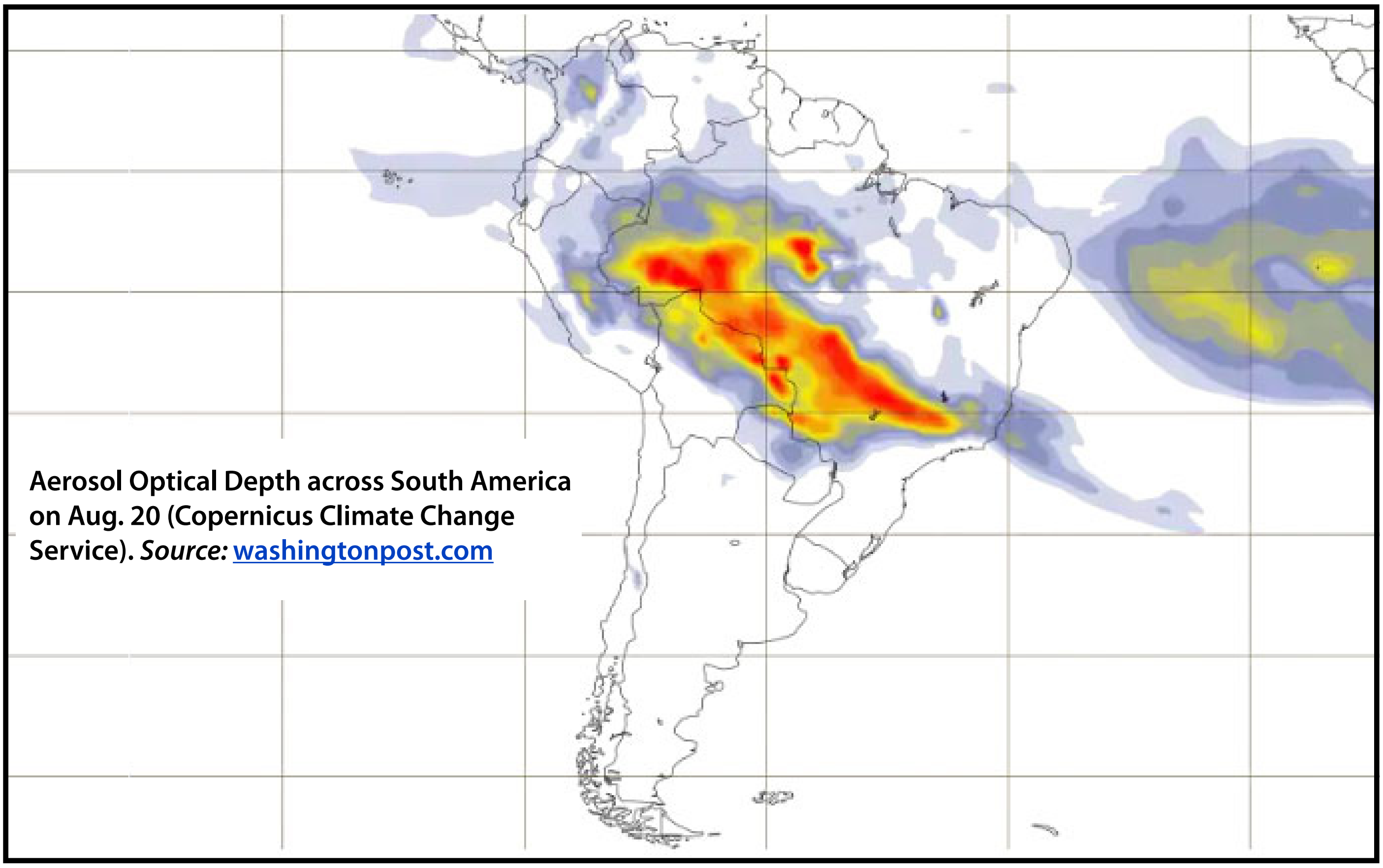
The recent Amazon fires have been widespread and some came on rather suddenly. In the state of Pará, for example, a wildfire surge occurred last week that was linked to a call by farmers for a "day of fire" Aug. 10, according to local news reports. INPE, using satellite-based sensors and other instruments to locate fires and track the amount of acreage burned, recorded hundreds of fires in the state as farmers cleared land for agriculture and also burned intact areas of rainforest for further development. Cleared rainforests in this region are typically used for cattle farming and growing soybeans, and much of the land-clearing is done illegally.

The fires there and in other states sent a plume of smoke drifting far southeastward across Brazil, darkening the skies over some cities and towns.

One contributing factor to the spate of fires in the Amazon is the fact that it is the dry season there, the time of year when wildfires tend to break out from human activities. The dryness acts to make the environment particularly receptive to fires, but most of the blazes are started by people, either intentionally or by accident. "The dry season certainly adds to fires, but we had more intense dry seasons in the past... and never experienced such big fires," Gomes said.

"This large number of fires… is because we have more deforestation not because we have more drought this year," said Paulo Moutinho, a senior fellow at the Woods Hole Research Center.

In addition, this is not yet the peak of the fire season in Brazil, according to Mikaela Weisse, a program manager with Global Forest Watch, who closely tracks fire and deforestation trends through satellite imagery. Weisse said so far, it seems most of the fires are taking place on pre-cleared agricultural land, but satellites may be missing flames burning beneath tree canopies.



Aerosol Optical Depth across South America on Aug. 20 (Copernicus Climate Change Service). *Source:* washingtonpost.com

The fire season in Brazil peaks between August and October, Weiss said, and so far this year is tracking close to 2016's high wildfire and tree cover losses. "It's early in the season, so what happens in the next couple of months is crucial for determining how significant this is."

**Without the Amazon, climate change would accelerate**

An increase in fires and ensuing deforestation in the Amazon make it even more difficult, if not impossible, for countries to hold global warming to "well below" 3.6 degrees (2 degrees Celsius) compared with preindustrial levels, as called for in the Paris climate Agreement.

The Amazon, which spans 2.12 million square miles, sucks up about a quarter of the 2.4 billion metric tons of carbon that global forests absorb each year. However, the ability of the rainforest to pull in more carbon than it releases is diminishing, weakened by changing weather patterns, deforestation and increasing tree mortality, among other factors. The ongoing fires will further degrade its function as a carbon sink.

Moutinho says the Amazon stores a cumulative total of about a decade's worth of carbon when using current global annual emissions rates. This amounts to about 90 billion metric tons of carbon.

"If you continue to deforest… you are releasing this huge amount of carbon to the atmosphere," he said. According to Moutinho, the spike in deforestation via wildfires this year follows years of progress on protecting the Amazon. He noted that deforestation was reduced by 80 percent between 2004 and 2012, for example.

If the Amazon were to turn into a consistent net source of carbon emissions, it would accelerate global warming while also leading to a huge loss in species that are not found anywhere else on Earth.

A study Gomes co-authored this year found that while deforestation is the main threat to Amazonian tree species, climate change may exceed it within a few decades. The research found that a combination of climate change-related impacts, such as increased dryness, along with deforestation to make way for agriculture, could cause a decline in Amazon tree species richness of nearly 60 percent.

In a worst-case scenario, without any effective climate policies or programs to limit deforestation, the study found that by 2050, the Amazonian lowland rainforest could become fragmented, harming biodiversity and making the Amazonian ecosystems far less capable of soaking in and storing carbon. The study warned of a "tipping point" beyond which the forest cannot recover.

"According to the results of our studies, even in the "best-case" scenario (optimistic), half of Amazonian tree species will be threatened in the future. The trends we've seen today could be beyond our "worst-case" scenario," Gomes said. *Source:* https://www.washingtonpost.com/weather/2019/08/21/amazonian-rainforest-is-ablaze-turning-day-into-night-brazils-capital-city/ — ANDREW FREEDMAN

# Europe's Cities Weren't Built for This Kind of Heat

*A record-breaking heat wave across London, Paris, and Amsterdam is signaling an urgent need for design and cultural changes to combat climate change.*

**A man cools off in a fountain in Brussels, where temperatures approached 100°F (>37°C). *Source:* citylab.com**

*July 2019* — For anyone worried about global warming, this week's weather reports in Northern Europe will only further that anxiety.

Paris recorded its highest temperature ever at 1:42 p.m. on Thursday July 25th, reaching over 41 degrees C. Further north, London may also break past records by reaching 39°C, while Germany recorded its highest-ever temperature of 40.5°C. All of this is coming on the heels of a June heat wave that broke previous record highs for that month in seven countries.

It might be a shock to learn that Amsterdam's high temperatures are surpassing highs even in Las Vegas or Albuquerque. Not only are temperatures exceeding pretty much everywhere in the United States right now, they are doing so in an environment that is notably ill-equipped to deal with such extremes.

In London, July highs are typically around 24°C. Home builders' priority is often to fit in as many exterior windows as possible, bringing in light to leaven the gothic weight of the country's autumn-to-spring perma-gloaming. Verandas are all but unheard of, shutters are a rare olde-worlde affectation, and awnings are exclusively for shops. Air conditioning is for commercial premises, while fly screens are something you'll only find at an old-fashioned butcher. Our homes have always focused on keeping heat in. There's been little thought expended on how to keep it out.

If such extremes are the new normal – and it looks as if they are – then things will have to change, a lot. Better ventilation and such additions as green roofs could improve things, although most roofs are pitched to deal with all our rain. Another basic step would be getting sunshades for windows of the type that are typical in Europe's south (in Greece they often don't bother taking them up even in winter). Managing rising temperatures in environments will still require not just retrofitting housing, but also undergoing a cultural shift – even simple things like keeping the blinds down during the day are novel in Britain, and we only have a month or so a year to learn the ropes.

Belatedly, cities that have historically had less-than-blazing summertime climates are catching up with the pressures of scorching summers like 2019's. As CityLab has previously reported, Paris's heat resilience plan is a little ahead of the game, and Brussels (37°C on July 25) has also introduced a heat wave plan that, like Paris's, involves health professionals checking regularly on vulnerable people. It also has some other measures that straddle the boundary between sensible and tokenistic, such as giving people over 65 free entry to six air-conditioned museums. Germany is also learning from other recent heat crises. Last year, hot weather caused many fish in rivers and lakes to die as oxygen levels dropped. Accordingly in Hamburg (34°C on July 25), authorities have set up a hotline for people to warn them of dying fish (so far, things seem fine).

In London, people are being cooked anew on the city's notorious Boris buses just as their promoter, Boris Johnson, becomes prime minister. Mayor Sadiq Khan has used the heat to promote the city's various anti-climate-change actions on Twitter. At the very least, high temperatures like the city is currently enduring could bolster attempts by London and other cities to slash carbon emissions and pollution by reducing the number of cars circulating.

Even under heat, however, there are still some European urbanites out there using the warmth to have a good time. Some commuters in Basel, Switzerland, have found an ingenious way to keep cool in its current heat (36°C): They're swimming to or from work down the River Rhine. At this point the river is fairly clean, while in high summer it's also warmish and not particularly fast. Locals who float into town on the river regularly use a simple form of kit called a Wickelfisch, a waterproof, fish-shaped bag that you can put your stuff in and then inflate as a float. (You can see how a Wickelfisch works in this video.)

Such pleasures might seem a poor consolation for the mix of discomfort and anxiety for the future that the hot summer has brought – but I suppose that if Northern Europe is close to burning, someone might as well fiddle.*Source:* https://www.citylab.com/environment/2019/07/europe-heat-wave-temperature-cities-climate-change-plan/594811/ — FEARGUS-O'SULLIVAN

# 'There's no scenario that stops sea level rise in this century,' dire U.N. climate report warns

*September 2019* — Water, liquid and frozen, occupies most of Earth's surface, with oceans covering two-thirds of it and ice another 10th. All is being transformed by climate change, posing greater threats to life and human society than scientists had realized, according to a special assessment of climate science focused on oceans and ice released by the United Nations.

The report, from the Intergovernmental Panel on Climate Change (IPCC), comes during a time when the world is fixated on what many now call the climate crisis. The planet has already warmed 1°C since preindustrial times, and July was the hottest month in the modern record. Last week, crowds including many schoolchildren turned out in cities worldwide to demand action. And in New York City, the United Nations convened its first climate summit since 2014, calling on nations to commit to more ambitious carbon cuts than they did under the 2015 Paris agreement. Without such commitments – followed by action – the world could experience 2.5°C of warming above preindustrial levels, or more, in coming decades.

The new Special Report on the Ocean and Cryosphere in a Changing Climate stresses that the watery parts of the planet are already entering a new state. After 0.2 meters of sea level rise since the late 1800s, some coastal cities flood routinely during high tides. With the Arctic warming at double the global rate, sea ice is in rapid decline, causing severe disruption to Indigenous communities and wildlife. Permafrost is thawing, undermining infrastructure and releasing uncertain amounts of buried carbon. The ocean is warming at all depths, and heat waves increasingly strike its inhabitants. "There are changes in the ocean we can't stop," says Nerilie Abram, a report author and paleoclimatologist at Australian National University in Canberra.

Compared with the last U.N. climate report, in 2014, the new assessment paints a grimmer picture of the future. By 2100, within the lifetime of those striking children, global sea level would likely rise by up to 1.1 meters if greenhouse gas emissions continue unabated; the last IPCC report had set the upper limit at 0.98 meters. Even with steep cuts in fossil fuel burning, the oceans will rise between 0.29 and 0.59 meters, the report adds. "There's no scenario that stops sea level rise in this century. We've got to deal with this indefinitely," says Michael Oppenheimer, a report author and climate scientist at Princeton University.

Without action, rare, catastrophic storm surges will become common within 30 years, Oppenheimer says. "What was a 100-year event is a yearly event by 2050."

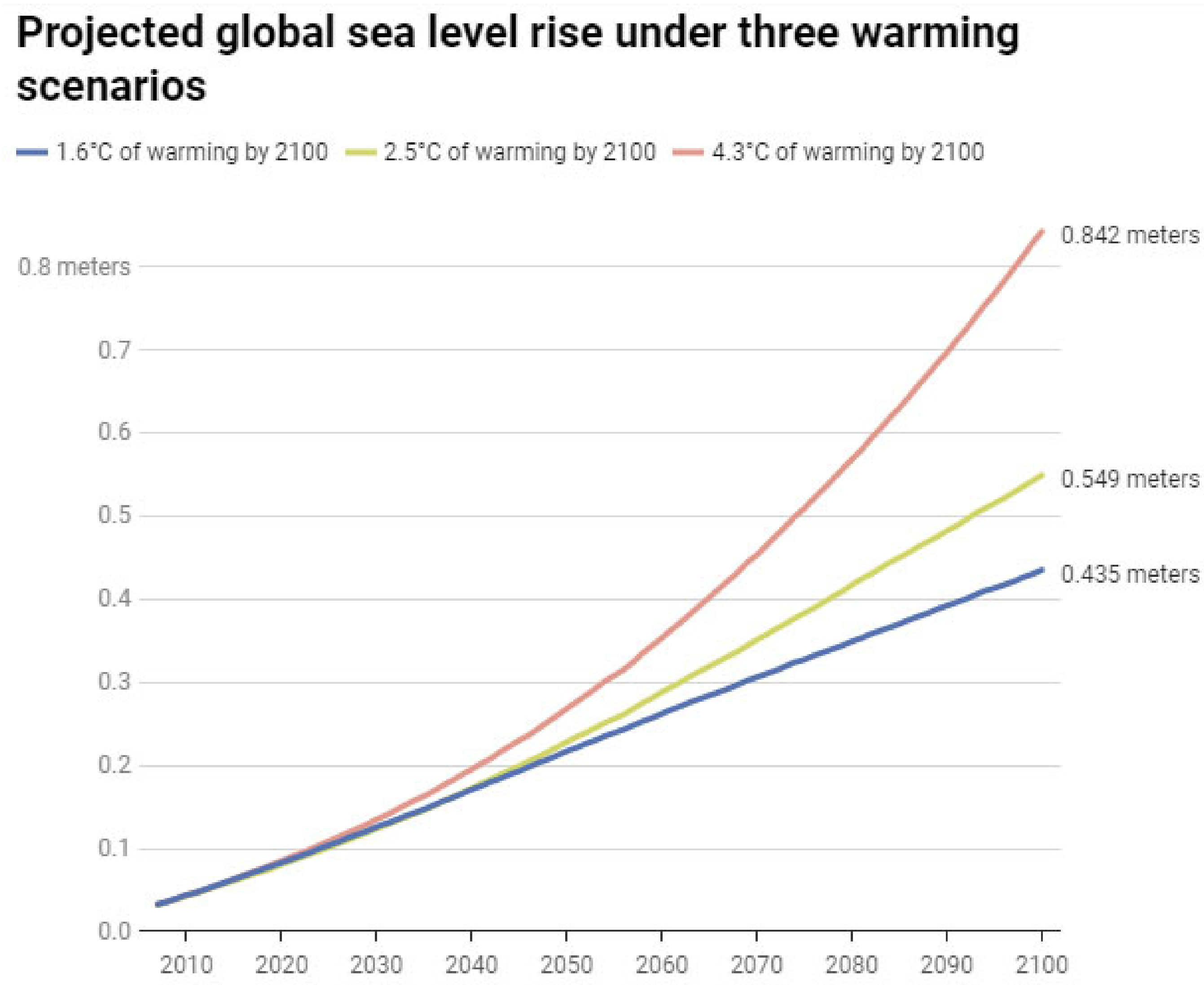
**As permafrost thaws, riverbanks in Alaska are slumping, and releasing long-sequestered carbon. *Source:*** sciencemag.org

Rising waters pose a particular threat to small island nations near the equator, where storms are rare and sea level typically varies little, allowing infrastructure to be built close to the ocean. There are also examples of resilience: Shanghai, China, for example, pumped water back into its underground aquifers to counteract subsidence that had made the city more vulnerable to sea level rise – a challenge also facing many other coastal cities.

The ocean's structure and composition are changing in less obvious ways, says Nathan Bindoff, a physical oceanographer at the University of Tasmania in Hobart, Australia, and a report author. Over the past 15 years, an array of 4000 autonomous floats has documented steady, continuous warming extending to the ocean depths. This warming makes surface waters less dense and more buoyant and reduces mixing with deeper layers. Fewer nutrients well up from the deep, and less oxygen mixes downward. "The oxygen minimum zones are expanding," Bindoff says. In warmer, oxygen-poor waters, "The fish aren't remaining the same size, they're getting smaller," he says. "The less valuable fish are more common, and the more valuable fish are less common."

Across the Arctic, the thawing permafrost could amplify climate change by releasing carbon it has held for millennia. But when the impact of those extra emissions will be felt is unclear. Warmer temperatures are causing the Arctic to become greener, and the increasingly luxuriant plants are capturing extra carbon and storing some of it in the soil. At some point, however, the carbon released is likely to overwhelm the carbon absorbed, says Ted Schuur, a report author and permafrost ecologist at Northern Arizona University in Flagstaff. "When will that switch take place? Or is it already taking place?"

Like all IPCC reports, this week's assessment reflects only science submitted for publication, which means it is




**These data represent the mean projected range, relative to 1986-2005 averages. Chart: Elijah Wolfon for TIME.**
***Source:* IPCC Special Report on the Ocean and Cryosphere in a Changing Climate**

already out of date. In a study due out later this year, for example, a team led by Schuur estimated that the rapid collapse of some permafrost landscapes as they thaw could increase emissions from permafrost by 50%. Nor could the current report draw on next-generation climate models developed for the next major IPCC report, due in 2021. Most of those models forecast faster warming than their predecessors. Robert DeConto, a glaciologist at the University of Massachusetts in Amherst, calls their omission "a little bit frustrating."

Perhaps the biggest struggle for IPCC scientists has been assessing the speed of future sea level rise, which hinges largely on the fate of the West Antarctic Ice Sheet. The odds are low that the ice sheet will collapse this century, which would eventually drive meters of extra sea level rise. But in recent years, several of its vital buttressing glaciers have slid toward the sea, and an international team is now studying its most at-risk glacier, Thwaites. Scientists continue to debate whether an unstoppable collapse has already begun. But it's a risk people need to know about, DeConto says. "Antarctica has big potential to do something really scary. It may be low likelihood outcome, but the impacts would be monumental."

It's one more reason for the world to make big cuts in carbon emissions, right away. "We can save the cryosphere," Schuur says. "The rapidity of change sometimes leads people to think it's too late, and it's not." *Source:* https://www.sciencemag.org/news/2019/09/there-s-no-scenario-stops-sea-level-rise-century-dire-un-climate-report-warns

# Indoor thermal comfort in the tropics


**By Carolina M. Rodriguez[1] and Marta D'Alessandro[2]**

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## Context

The current demographic growth indicates that by 2050, nearly 50% of the world's population will reside in the tropics, which hosts some of the most populated and hottest regions on earth (Edelman et al. 2014). As a consequence, the global demand for air conditioning (AC) multiplies every year, particularly in middle-income and low-income countries with warm climates (JRAIA 2017). This leads to increases in energy consumption, carbon emissions and environmental damage (Yang et al. 2014), with the aggravation that many of these regions are located in territories of high vulnerability to climate change. These conditions make the tropics a strategic frontier to investigate indoor thermal comfort (ITC), energy use and sustainable development. However, research on these fields in tropical countries is very limited compared to the rest of the world. Various academic articles have highlighted this issue, but no previous literature review has comprehensively studied it before. The review article summarised here (Rodriguez and D'Alessandro 2019) uses critical comparison and cross-analysis of data from various sources. These include 54 general reviews on thermal comfort, 61 field studies from ASHRAE databases, 75 selected documents on thermal comfort in the tropics, as well as records from 111 tropical countries, 33 mega and large cities and 43 fast-growing cities. The findings from this work reveal significant boundaries of research in terms of volume, origin, impact, focus and content. It also underlines research gaps for further development.

## Methodology

The review was carried out through the analysis of six different samples during two stages: a broad review and a focused review (Figure 1). The first stage compiled evidence from multiple review papers on ITC (sample 1) and available information on the ASHRAE RP-884 database and the ASHRAE Global Thermal Comfort Database II (sample 2). The second stage (samples 3-6) concentrated on collecting and studying selected information on ITC in the tropics and related general data.

A multiple-reviewers' system was set in place to collect and evaluate the information, which was mostly limited to peer-review documents in scientific journals, databases from recognised organisations and established standards. The tools used for the bibliometric search were Scopus, Web of Science, Engineering Village and Google Scholar. Mendeley reference manager was the chosen tool for classifying and coding documents, and Excel pivot tables were used for statistical analysis.

## ITC research trends and gaps

General bibliometric searches evidenced that the study of thermal comfort has received significant academic attention, especially since the beginning of this century. However, ITC research in the tropics is still minimal for 84% of countries, 39% of mega and large cities (MLC) and 95% of fastest-growing cities (FGC). Most of the academic data focus on very few countries, such as Singapore, Malaysia, India and Brazil. Tropical Africa was identified as the region with less ITC research overall, closely followed by tropical America and the Caribbean.

As the equatorial zone gets most of the sun exposure, it is often assumed as being hot and humid, when in fact it hosts vast environmental and climatic diversity. According to the data studied for the review, by 2030 most population in the tropics will likely live in climates categorised as Aw followed by BSh, Am, and Cwb, in the Köppen-Geiger Climate Classification System. However, the climates that have been studied the most are Cwa and Af. Aw has been relatively investigated, but little research was found for other

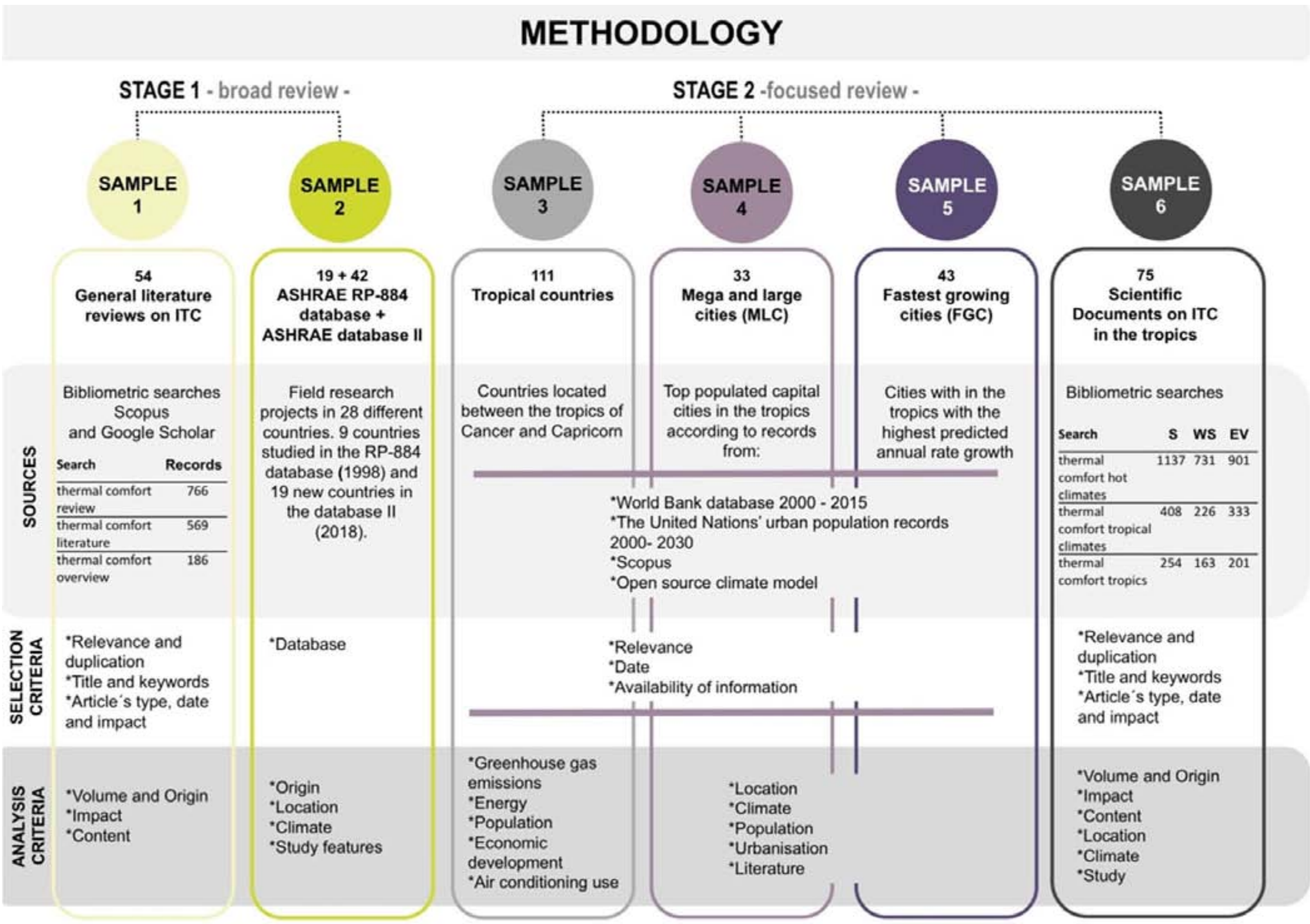


**Figure 1. Methodology map.**

climates in the B and C categories (Figure 2). During the review, marked climatic and geographical differences between areas classified within the same Köppen-Geiger category were noticed. For example, there was some variance between average temperatures, more dispersion between rainfall data and a very wide spread between altitude values. This generates uncertainties regarding the suitability of this classification for the study of thermal comfort.

Established thermal comfort standards such as the ASHRAE Standard 55, the ISO 7730 or the CSN EN 15251 are the most commonly used worldwide, despite being explicitly developed for northern latitudes in the United States and Europe (Olesen, 2004). These standards include two main models for assessing thermal comfort in buildings: the static model developed by Fanger (1970) and the adaptive model generated from a collection of studies (de Dear et al., 1997). The former focuses on the assessment of set physiological variables related to the heat exchange between humans and the environment; while the latter includes other dynamic variables related to human behaviour and outdoor climate. As both models were initially promoted by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), it is claimed that their content and wording may suggest the superiority of mechanical conditioning over other alternatives.

Some authors argued that the static model has often overestimated the thermal sensation of occupants, especially in naturally ventilated (NV) buildings (Humphreys and Hancock, 2007). Therefore, the adaptive model is deemed to be more suitable for these cases. The adaptive model was developed and updated using information from two databases: the ASHRAE RP-884 database published in 1998 comprising 23 field research projects (de Dear et al., 1997) and the ASHRAE Global Thermal Comfort Database II released in 2018 including 42 field research projects (Földváry Ličina et al., 2018). A closer look at these databases evidences their limited amount of information from tropical regions and climates of Africa, South America, Central America, and the Caribbean. Only 23% of the studies considered climates in tropical areas. Most of them were office buildings, and a relatively small percentage were NV buildings, particularly in the first database (Figure 3).

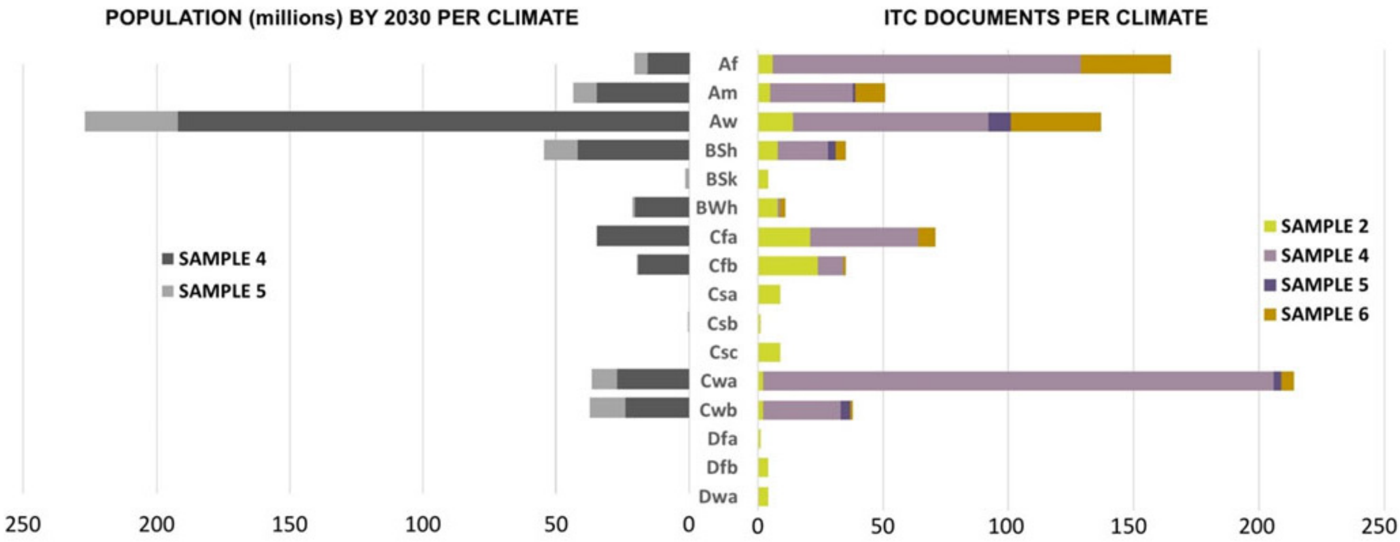


**Figure 2. Population (million people) per climate in samples 4 and 5 compared to ITC documents per climate in samples 2,4,5 and 6.**

Even when there is still no academic consensus on the applicability of any of these models within the tropics, many countries have directly implemented them without any adaptation to local economic, political, cultural or geographic conditions. However, there is now compelling evidence that these standards are not the most appropriate for buildings in tropical regions (Kwong et al., 2014). This is mainly because the perception of neutrality and comfort is subjective and can vary significantly between different climates and seasons (Zain et al., 2007) and amongst occupants according to age, (Zomorodian et al., 2016) gender (Karjalainen 2012) and cultural background (Karyono 1996). Consequently, alternative models to assess thermal comfort in buildings with natural ventilation or mixed ventilation have emerged in various regions, many of which are inspired by the adaptive model. For example, a model for hot and humid climates in general (Toe and Kubota, 2013); models for particular regions in Southeast Asia (Mishra and Ramgopal, 2015), México (Oropeza-Perez et al., 2017) and Brazil (Cândido et al., 2011); or specific models for residential buildings in different climatic zones of eastern China (Yan et al., 2017) and office buildings in hot and humid climates of India (Indraganti et al., 2014).

## Results regarding comfort temperatures

Most of the studied data confirmed that people in tropical hot and humid regions are generally quite tolerant to high indoor temperatures, heat stress (Lu et al., 2018) and humid environments (Zhang et al., 2010), while they have a lower tolerance to cold conditions than predicted (Lu et al., 2018). Temperature comfort ranges can vary from 22 to 27°C in Brazil (Caetano et al., 2017), 24.6 to 28.4°C in Madagascar (Nematchoua et al., 2018), 19.6 to 28.5°C in India (Manu et al., 2016) and 27.1 to 29.3ºC in Singapore (Wong and Khoo 2003). In Mexico, research suggested that people are capable of standing temperatures over 30°C, as long as they have control over avenues of adaptation (Oropeza-Perez et al., 2017).

Literature from tropical regions in China suggests that the ability to adapt is effective in the range of 10 to 35°C outdoor temperature, but it is limited beyond this range (Yan, et al. 2017). In this study, occupants' thermal sensation and acceptance were perceived differently according to the ventilation mode. Higher acceptable temperatures were found in NV buildings, while overcooling appeared to be a common phenomenon in office spaces, being the leading cause of thermal discomfort and energy waste (Chen and Chang, 2012). Furthermore, research in Thailand (Srisuwan and Shoichi, 2017) suggested 28°C as the neutral temperature for NV spaces and 25°C for AC spaces. On the contrary, comfort ranges varied from 25.4 to 26.5°C in Ghana (Koranteng and Mahdavi, 2011) and from 19.7 to 24.7°C in Zambia (Sharples and Malama, 1997) under NV mode, while the temperature range was wider (between 25.4 and 30.5°C) for MV spaces (Koranteng and Mahdavi, 2011). A study in Nigeria (Efeoma and Uduku, 2014) showed that when combining NV and MV systems, acceptable comfort temperature could reach up to 32.9°C.

## Results regarding relative humidity

Conflicting views were found on the impacts of relative humidity (RH) on thermal comfort. Some studies indicated that high levels of humidity could cause

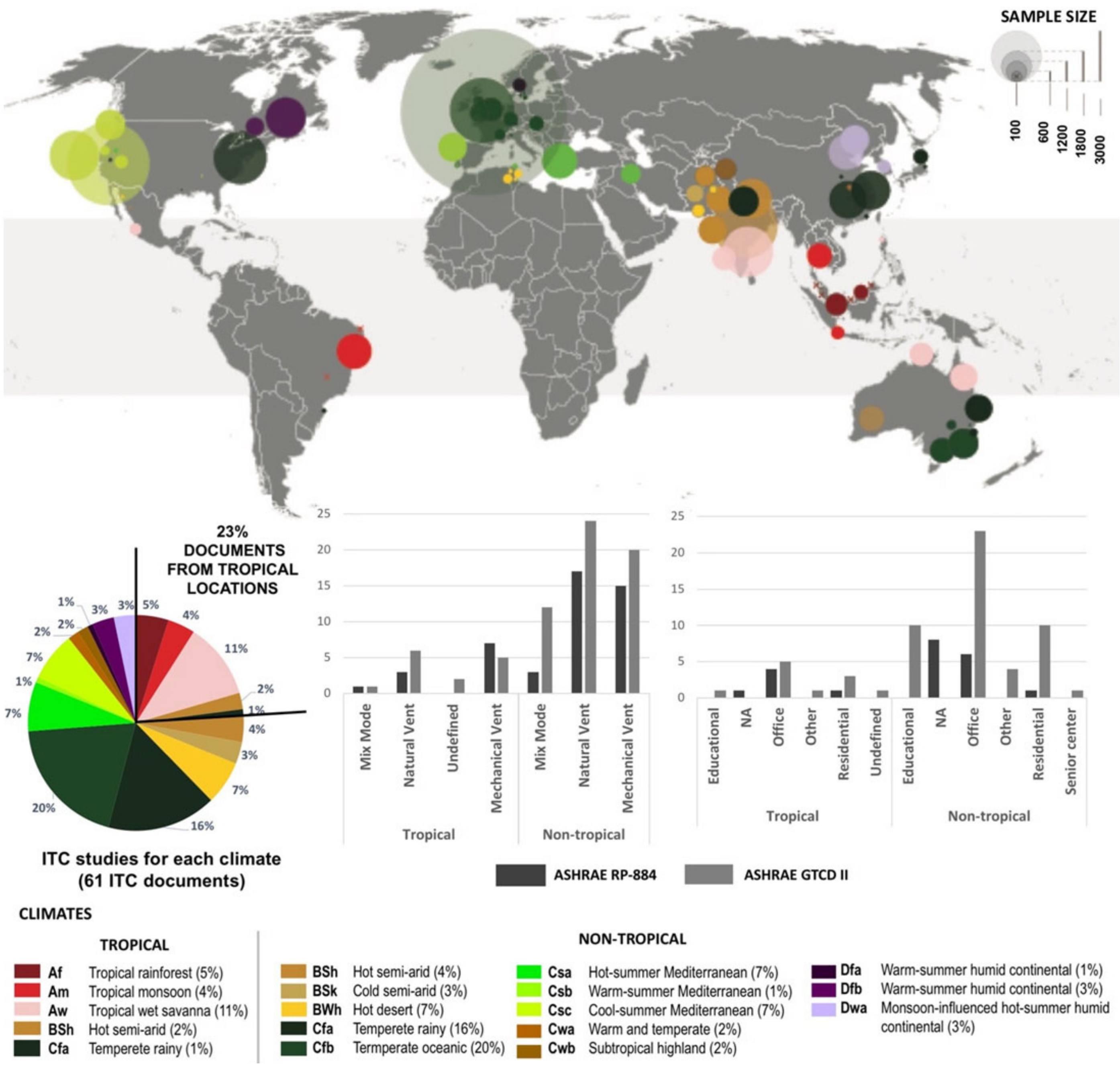


**Figure 3. Sample 2, type of climate and location of the samples included in the ASHRAE RP-884 database and the ASHRAE Global Thermal Comfort Database II.**

an adverse effect (Jing et al., 2013; Zhang et al., 2017). Therefore, it was suggested that optimal ranges could lie between 50 and 60% RH (Yau et al., 2011). Other studies argued that high relative humidity affects the thermal sensation of the occupants only when the indoor temperature is relatively high (26–27°C) (Yamtraipat et al., 2005). It was also found that the effect of RH on the thermal sensations could be typically minimal to negligible (Lu et al., 2018; Givoni et al., 2006). Therefore, indoor high relative humidity might be acceptable in the humid tropics, with optimum comfort close to 73% (Djamila et al., 2014). Literature from Thailand recommended a comfort zone with temperatures ranging from 25.6 to 31.5°C and RH between 62.2 and 90.0%. Further research based on the ASHRAE RP-884 database proposed an alternative RH-inclusive adaptive model that significantly extended the range of acceptable indoor conditions regarding humidity (Vellei et al., 2017).

### Results regarding common adaptive practices

The most common adaptive practices found to improve comfort in hot and humid climates were: increasing the indoor air velocity, reducing clothing insulation and changing activity (Djamila et al., 2013; Mishra and Ramgopal, 2014; Gou et al., 2018). For example, a study from Brazil established different acceptable ranges, from 24 to 27°C with less than 0.4 m/s; from 27 to 29°C with 0.41 to 0.8 m/s, and 29 to 31°C with more than 0.81 m/s (Cândido et al., 2011). Regarding clothing insulation, a study in Cameroon (Nematchoua et al., 2014) identified that ranges could vary from 0.36 to 1.45 clo according to the season (wet or dry). These results were confirmed by different Chinese studies (Luo et al., 2015; Zhang et al., 2018) that indicated a 0.3 clo for the summer season and a range between 0.27 and 1.2 clo for the no-summer season in the city of Guangzhou. Clothing resistance of 0.78 clo on average was found within wet tropical climates (Am type) for 22.4–26.7°C comfort temperatures; while in tropical hot, humid climates (Aw type) it was 0.67 clo on average for 24.3–27.8°C comfort temperatures. No similar study was found in the sample regarding the specific impact of metabolic rates (met) on temperature acceptability. It was noticed that most comfort evaluations in NV environments adopted the range of 1.0–1.3 met, recommended by the adaptive model. Although, a study highlighted that met could noticeably change according to seasonal variations, as a result of physical activities usually being more intense in the dry than in the rainy season (Nematchoua et al., 2014).

There was evidence in the sample that climate adaptation was directly related to particular economic and physiological factors. For example, in office buildings occupants are generally inclined to favour the use of AC systems, while in housing, the preference is to increase air velocity by opening the windows or using electrical fans (Hwang et al., 2009). Therefore, housing residents generally tolerate higher temperatures because they have more adaptive options available (e.g. opening windows, changing their clothes, drinking beverages or using fans) (Djamila et al., 2013; Zhang et al., 2018). Additionally, they are usually responsible for cooling costs. The degree of the agency had been frequently cited as a critical factor influencing psychological adaptation to the thermal environment (Zhang et al., 2017). Furthermore, a study in hot and humid areas of southern China (Zhang et al., 2018) suggested that neutral and acceptable temperatures were significantly different between rural occupants and urban occupants due to variances in the local culture, expectations and environmental cognition.

Studies indicated that occupants frequently exposed to AC environments tend to acclimatise and adapt relatively quickly to lower temperatures (Ismail and Barber, 2001), but develop less tolerance to extreme thermal conditions and show a desire for "thermal indulgence" (Indraganti, 2011). Additionally, abrupt thermal changes caused when moving out of AC spaces and into hot-humid climates, or vice versa could cause discomfort by producing up to 2°C variations in skin temperature (Dahlan and Gital, 2016).

## Summary

It is argued in the feature review that improving research efforts on ITC is not only relevant for the particular regions where there is a shortage of studies, but also for humanity in general. As tropical countries rank amongst the most populated and climatically diverse in the world, how ITC is addressed now will have long-term global implications on sustainable development, energy use, climate change, $CO_2$ emissions, and related pollution. The review highlights different variables distinctive to tropical countries which cannot be addressed by applying standards designed for other regions. For example, relative humidity is not a primary variable for the adaptive model, but it is a defining feature in the tropics, being particularly high in wet tropical climates and extremely low in tropical desert regions. Another significant but overlooked variable is the altitude, which defines particular environments in mountain ranges located in the tropics, such as the Andes and the Ghats. Climatic conditions in cities located at high altitude vary significantly during the day due to changes in atmospheric pressure. Altitude also affects the oxygen concentration in the body and the function of the vascular system, resulting in alterations in metabolic rates (Wang et al., 2010; Bernardi, 2012). Furthermore, $CO_2$ levels are often overlooked as a core variable in thermal comfort. However, they can be found in relatively large concentrations within AC spaces and densely populated urban environments, both common scenarios in tropical regions. High levels of $CO_2$ have been associated with an over-stimulation of the respiratory system, resulting in increased metabolic rates and heat exchange with the environment, which suggests potential effects on thermal comfort. These and other social variables related to the perception of status, aspirations, and desires are also explored in the review. Additional tables and graphic material accompany the original article and are supplemented by raw and processed data.

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# Cities in eastern China facing larger loss in sunshine hours than rural areas

*This article summarizes a recently published paper and related work:*
Song et al. (2019) Effects of urbanization on the decrease in sunshine duration over eastern China. *Urban Climate* 28, 100471 (https://doi.org/10.1016/j.uclim.2019.100471)

## Introduction

Sunshine duration (SSD) measures the total number of sunshine hours over a given period (e.g., a day). Its variability and long-term changes have a close association with socio-economic activity, ecosystems, and the environment. For instance, decreasing SSD may increase the risks of suicidal behavior and mumps development and reduce the production of beta-endorphins (Vyssoki et al., 2014; Hu et al., 2018). The declining SSD also diminishes evaporation and affects photosynthesis, thereby greatly influencing plant growth and agricultural industry (Wu et al., 2006; Alemu and Henebry, 2017). Understanding the changes in SSD is essential for formulating mitigation and adoption approaches to alleviate its social and environmental impacts.

Over the past decades, many parts of the world have been experiencing reduced SSD, known as global dimming. Wang et al. (2017) reported that urban dimming is around 1.5 times as much as non-urban dimming, indicating that urbanization may act in shortening SSD. Currently, more than half of the population in China are living in urban areas, and the urban population is projected to continually grow in the coming decades (Grimm et al., 2008; United Nations, 2015). People in cites are facing fewer sunshine hours and a potentially higher risk of health problems. Although studies that reported the possible impact of urbanization on SSD in some parts of China have been carried out, how urbanization transforms SSD in eastern China remains a mystery.

Moreover, recent research estimated the urbanization effects by classifying meteorological stations into urban and non-urban/rural types based on administrative divisions of China and (or) the latest population and land use data [e.g., Jin et al. (2015), Wang et al. (2017)]. However, using this fixed classification may underestimate the effects of urbanization on the regional climate and environment, since some rural stations could have been transformed into an urban type during the urbanization process. Therefore, studies concerning SSD and urbanization using a dynamic station classification method enable a more accurate evaluation of urbanization effects.

## Data and Methodology

*Data* – We use quality-controlled daily SSD observations at 1,835 stations measured by the Campbell-Stokes Sunshine Recorder in eastern China from 1961 to 2014 from the China Meteorological Data Service Center (http://data.cma.cn). Time-varying land cover maps in 1980, 1990, 1995, 2000, 2005, 2008, 2010 and 2013 (http://www.resdc.cn/) at a spatial resolution of 30 m are also used to represent the development of urbanization and to classify urban and rural stations for evaluating the possible effects of regional urbanization on SSD changes.

*Dynamic classification of urban and rural stations* – The urbanization effects are estimated by comparing the difference in the trends of urban and rural stations, as suggested by previous studies [e.g., Ren and Zhou (2014), Luo and Lau (2018)]. Stations are dynamically classified into rural and urban categories utilizing land use/land cover maps. First, we calculate the built-up area fraction (BAF) around a station as the ratio of artificial urban built-up surfaces to the total area of the circle surrounding each station with a radius of 7 km. BAFs around the stations are calculated separately for different sub-periods (i.e., 1971–1980, 1981–1990, 1991–1995, 1996–2000, 2001–2005, 2006–2008, 2009–2010, and 2011–2014). Then, the stations with BAF > 20% are dynamically classified into urban stations and the others are defined as rural type. The classification of urban and rural stations varies across different subperiods (Figure 1). 158 and 1677 out of 1835 stations were urban and rural types, respectively, in 1980 (Figure 1a); whereas, there were 698 urban stations and 1137 rural stations in 2013 (Figure 1b). 540 rural stations have been transformed into urban-type during 1980 and 2013 (Figure 1c).

*Estimation of urbanization effect* – As suggested by previous studies (Ren and Zhou, 2014; Luo and Lau, 2017), the effect of urbanization is measured as the difference between the urban and rural trends, and the relative urbanization contribution (in percent) is defined as the proportion that urbanization effects account for in the overall trend at urban stations. Here the secular trends in SSD for national mean and urban and rural areas are estimated by simple linear regression. The significances of these trends are evaluated by the non-parametric modified Mann-Kendall test that takes the autocorrelation of the time series into consideration (Hamed and Rao, 1998). To obtain regional mean SSD series, the data are converted into 5-by-5-degree grids by natural neighbor interpolation to avoid the geographical weighting bias (consider-

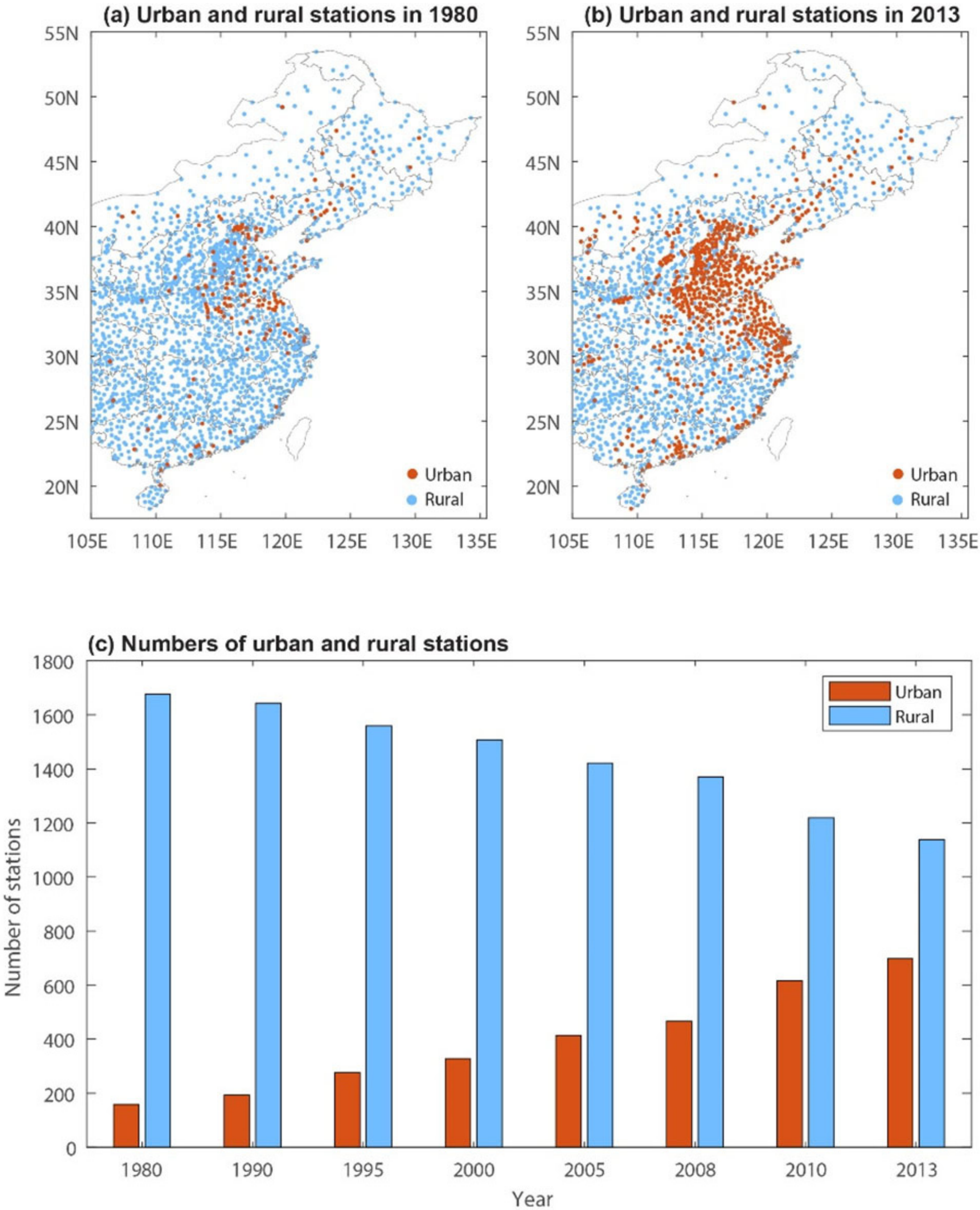


**Figure 1. Dynamic classification of urban and rural stations in eastern China. (a-b) Urban and rural stations in 1980 and 2013; (c) changes in the numbers of urban and rural stations from 1980 to 2013.**

**Table 1: Long-term trends of SSD in all, urban and rural areas of eastern China, and urbanization effect (UE) and relative urbanization contribution (UC) in urban areas over the period of 1961–2014. The unit of trend and UE is hour/day decade$^{-1}$, and the unit of UC is %.**

| | All | Urban | Rural | UE | UC |
|---|---|---|---|---|---|
| Annual | –0.132 | –0.184 | –0.119 | –0.065 | 35.3% |
| Spring (March-May) | –0.066 | –0.110 | –0.057 | –0.053 | 48.2% |
| Summer (June-August) | –0.218 | –0.283 | –0.203 | –0.080 | 28.3% |
| Autumn (September-November) | –0.103 | –0.153 | –0.089 | –0.064 | 41.8% |
| Winter (December-February) | –0.140 | –0.190 | –0.128 | –0.062 | 32.6% |

ing that stations are not evenly distributed across space), similar to Ren and Zhou (2014) and Sun et al. (2014).

**Main Conclusions**

SSD in eastern China declines throughout the year at an annual rate of –0.132 hours/day per decade, despite remaining nearly unchanged or even rising in the last three decades. The influence factors, including the complex land-atmosphere feedbacks, reduction of cloud formations and increase of aerosol loadings, countered each other and the aerosol loadings had more significant effects. On a seasonal scale, the largest decreasing trend in daily SSD appears in summer (i.e. –0.218 h/day per decade) and most moderate occurs in spring (–0.066 h/day per decade) (see Table 1).

The regional differences in the SSD trends are even

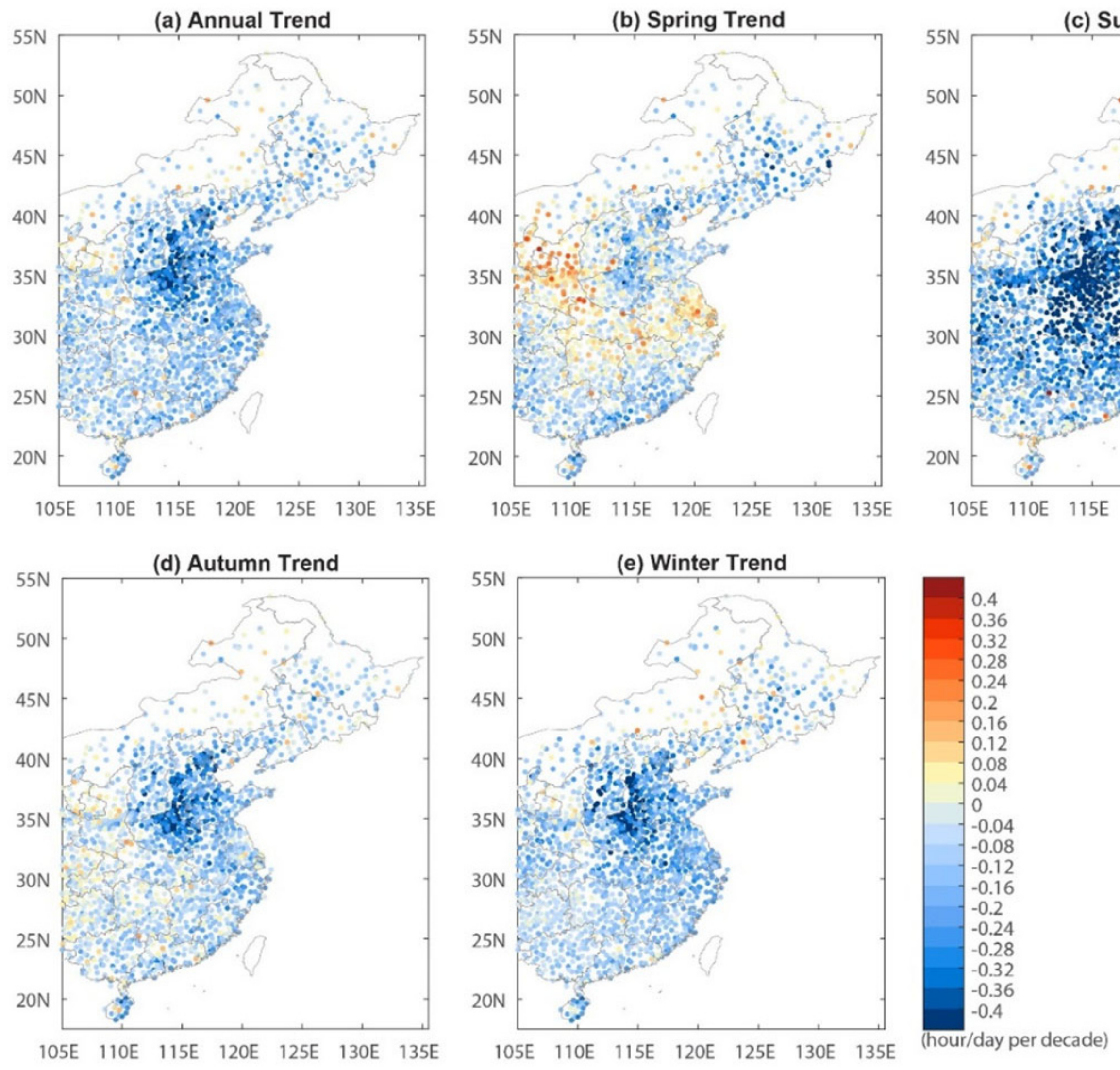


**Figure 2. Spatial distribution of the annual and seasonal SSD trends in eastern China.**

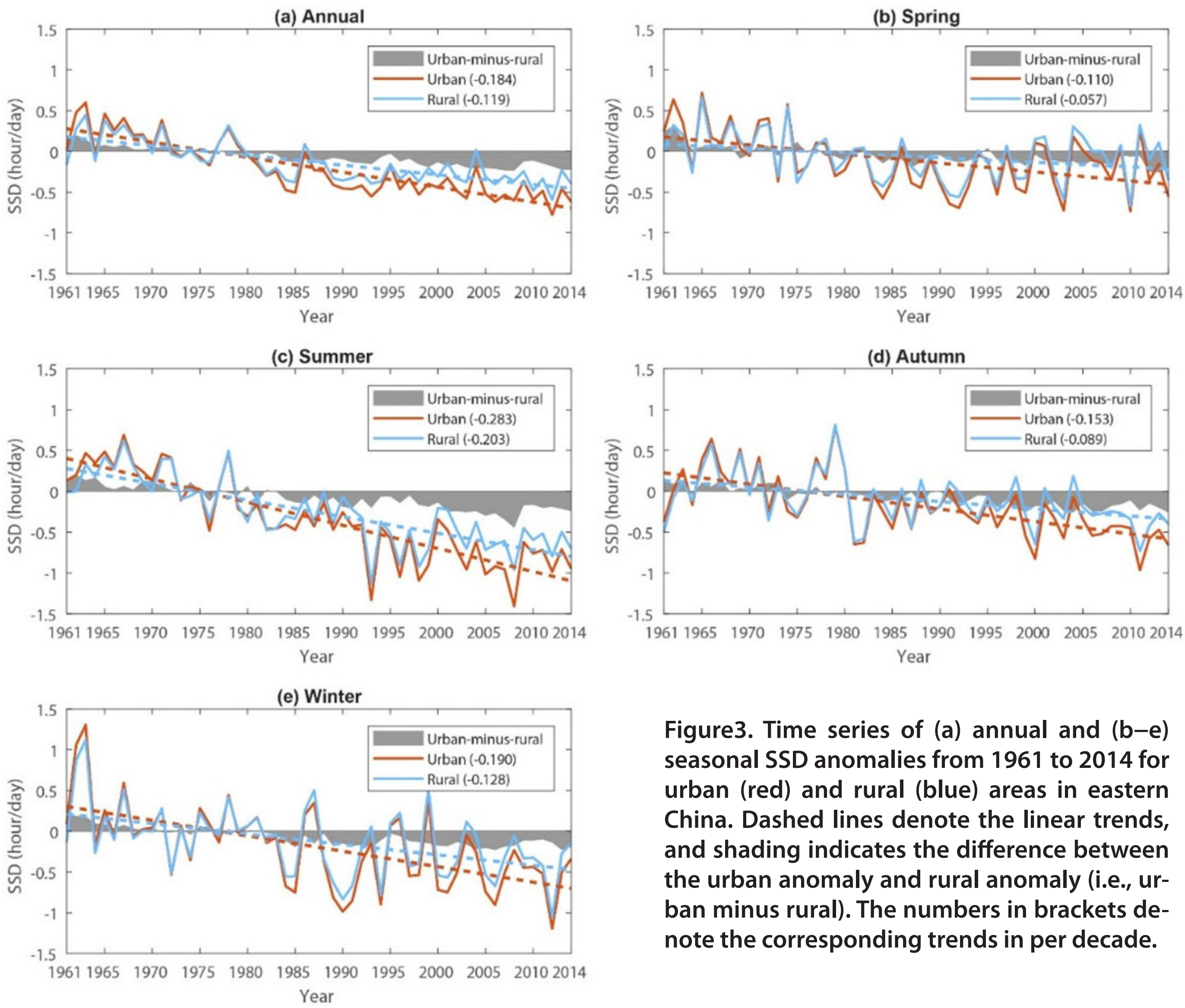


**Figure3. Time series of (a) annual and (b–e) seasonal SSD anomalies from 1961 to 2014 for urban (red) and rural (blue) areas in eastern China. Dashed lines denote the linear trends, and shading indicates the difference between the urban anomaly and rural anomaly (i.e., urban minus rural). The numbers in brackets denote the corresponding trends in per decade.**

more profound in the highly urbanized and densely populated areas, such as the North China Plain and the Yangtze River Delta, implying a considerable effect of urbanization (see Figure 2). We proceed to evaluate the urbanization effect on the changes of SSD, on the basis of dynamic classification of urban and rural stations using time-varying land use maps.

In Figure 3, all urban series of annual and seasonal mean SSD show steeper downward trends than rural series, suggesting that people living in more urbanized areas are facing even more decreasing sunshine than those in less urbanized areas, and the discrepancy has become even wider since the 1980s when China's economic reform began. It is estimated that urbanization induces an additional decreasing trend of 0.065 hours/day per decade for SSD, contributing to 35.3% of the total dimming trend in eastern China. A significant correlation of –0.48 also exists between the SSD trend and urban area fraction around the station. These results all demonstrate an essential influence of local urbanization on SSD changes.

## Discussion

The study dynamically categorized urban and rural stations to capture more precisely the possible effect of urbanization on SSD, and the conclusions are discussed as follows. First, due to rapid population growth and economic development, urbanization increases anthropogenic aerosols and air pollutant emissions (Wang et al., 2012; Zhao et al., 2012), thus increasing the amount of cloud and enhancing the backscatter, and thereby decreasing sunshine hours. Second, the decreasing of wind speed by urbanization (i.e., via increased roughness of urban land surfaces) and the weakening large-scale monsoon circulation in recent decades suppress the dispersion of aerosols and amplifies the impact of aerosol emission on solar dimming (Lin et al., 2015). Since the interactions of several factors would change SSD, and diminishing SSD accelerated by urbanization would bring about negative effects, it is suggested that policy-makers and urban planners should consider the future changes of SSD under global change and local urbanization.

**Acknowledgments**

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By J Zhiying Song[1], Liutao Chen[1], YijingWang[1], Xiaoping Liu[1], Lijie Lin[2] and MingLuo[1]*

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# Bucharest Urban Climate Summer School (Romania)


By
Sorin Cheval[1]
and
Matthias Demuzere[2]

The International Association for Urban Climate (IAUC) recently granted a scholarship for the organization of the 3rd edition of the Urban Climate Summer School held in Bucharest (Romania), on September 2-6, 2019. The Bucharest Urban Climate Summer School (BUCSS) was jointly organized by the Research Institute of the University of Bucharest (ICUB), Ghent University (Belgium), Ruhr-University Bochum (Germany), and the Romanian Association for Applied Meteorology and Education (Romania).

BUCSS 2019 provided a comprehensive synthesis of three central themes associated with contemporary urban climate challenges, namely (1) modelling tools used in urban meteorology and climatology, (2) urban ecology as an instrument for adaptation to climate change in cities, and (3) critical linkages among environmental factors and health threats. The multi-disciplinary spectrum of topics ranged from meteorological and climatological modeling of the built environment (e.g., mesoscale modeling) to emerging themes such as crowdsourcing data, cloud-computing for big earth observation data and causes of urban conflict. BUCSS2019 intended to provide the participants with a better understanding of the state-of-the-art via lectures and hands-on experience of (1) urban climate modelling, (2) urban ecology, and (3) bio-meteorology. A guided tour and a field trip to the Văcărești urban wetland were organized during the school.

BUCSS 2019 hosted 18 participants from 8 countries with a broad variety of academic backgrounds and scientific interests within the urban domain. Details about this summer's Urban Climate Summer School, including the daily program, invited lecturers and their biographies may be found at: https://unibuc.ro/conferences/bucss2019/.

At the end of the school, participants were asked to provide feedback via a survey. This information will help to further shape the next edition of the Urban Climate Summer School, which will likely be organized at the Ruhr-University in Bochum (Germany) in 2020. Hope to see you all there.

[1] Research Institute of the University of Bucharest, Romania, "Henri Coandă" Air Force Academy (Brașov), Romania and National Meteorological Administration (Bucharest), Romania
[2] Ruhr-University Bochum, Germany & Ghent University, Belgium

Hands-on urban climate modelling using WRF

Participants and instructors on last day of BUCSS 2019

## Recent Urban Climate Publications

Abbasabadi N, Ashayeri JKM (2019) Urban energy use modeling methods and tools: A review and an outlook. *Building and Environment* 161 UNSP 106270.

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In this edition is a list of publications that have generally come out between **May and August 2019**. If you believe your articles are missing, please send your references to the email address below with a header "IAUC publications" and the following format: Author, Title, Journal, Year, Volume, Issue, Pages, Dates, Keywords, URL, and Abstract. Important: do so **in a .bib format.**

As of this month, **Mathew Lipson** (UNSW Sydney, Australia / University of Reading, UK) and **Aditya Rahul** (Indian Institute of Technology, Roorkee-India) joined the BibCom team. Welcome! Note that we are always looking for (young) researchers to join and contribute to the Committee. If you are interested to join or would like to receive more information, please let me know via the email address below.

Happy reading,

**Matthias Demuzere**
Chair IAUC Bibliography Committee
Ruhr University Bochum (Germany)
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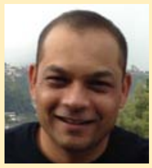
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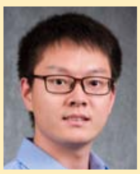
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## Symposium on Challenges in Applied Human Biometeorology

**March 2 -3, 2020**
**Freiburg, Germany**

The call for abstracts is open for the upcoming **"Symposium on Challenges in Applied Human Biometeorology"**, which will take place at Albert-Ludwigs-University Freiburg in Germany on March 2 and 3, 2020.

There are several themes covered that directly link to urban thermal comfort, heat stress, planning and climate adaptation in cities. Further the symposium aims to include aspects of crowdsourcing, big data, and observational systems in urban human biometeorology. The aim of the symposium is to setup and scout new directions and possibilities for future research and applications. The conference ist organised the Albert-Ludwigs-University Freiburg in collaboration with the German Meteorological Service (DWD), and the Society for the Promotion of Human Biometeorological Research in Germany.

Deadline for Abstract Submission is November 15, 2019.

**Conference topics:**

- Weather, climate, climate change and health
- Urban and indoor bioclimates
- Climate and tourism, Recreational climatology
- Heat health warnings & decision support systems
- Human biometeorological modelling at different scales
- Human biometeorological methods and models
- Planning & climate adaptation for future bioclimates
- Crowdsourcing, big data, and observational systems in human biometeorology

**Registration**

Registration fee is €75. Registration under:

https://www.medizin-meteorologie.de/index.php/16-register

**Support**

There will be a limited number of travel grants available for young scholars from less developed countries. For details see conference website.

*Upcoming Conferences...*

**5TH INTERNATIONAL CONFERENCE ON COUNTERMEASURES TO URBAN HEAT ISLANDS**
Hyderabad, India • December 2-4, 2019
http://ic2uhi2019.heatislandcountermeasures.org/

**AMERICAN GEOPHYSICAL UNION (AGU) URBAN CLIMATE SESSIONS**
San Francisco, USA • December 9-13, 2019
https://www2.agu.org/Fall-Meeting/Pages/Submit-an-abstract

**AMERICAN METEOROLOGICAL SOCIETY (AMS) 15TH SYMPOSIUM ON THE URBAN ENVIRONMENT**
Boston, USA • January 12-16, 2020
https://annual.ametsoc.org/index.cfm/2020/

**PLANNING POST CARBON CITIES: 35TH PLEA CONFERENCE ON SUSTAINABLE ARCHITECTURE AND URBAN DESIGN**
A Coruña, Spain • September 1-3, 2020
https://www.plea2020.org/

# ICUC-11 in Sydney

The next International Conference on Urban Climate **(ICUC-11)** will take place in **Sydney, Australia from August 30 to September 3, 2021**. The Board of the IAUC selected the team in Sydney with its proposal "Cities as Living Labs: Climate, Vulnerability, and Multidisciplinary Solutions."

The University of New South Wales (UNSW), who will host ICUC-11, has also received support from the American Meteorological Society (AMS) Board on the Urban Environment (BUE) to run ICUC-11 together with the Symposium on the Urban Environment (AMS-BUE). UNSW will collaborate with other Australian Universities and Research Institutes in hosting this conference. Dr. Negin Nazzarin, who leads the organising committee, welcomes the IAUC community to Sydney: "We greatly appreciate the vote of confidence from the IAUC members. We truly believe that Sydney is an ideal venue for bringing in the diverse and international Urban Climate community, and look forward to welcoming all members in Sydney, Australia, for the 11th International Conference on Urban Climate (ICUC-11) in 2021."

ICUC-11 will be hosted on the campus of UNSW. The Sir John Clancy auditorium offers tiered seating for up to 945 participants in plenary sessions. The adjacent Matthews Pavillions will provide a contemporary semi-enclosed space for exhibitions, poster display and catering. A number of nearby theatres and lecture rooms will offer spaces for concurrent sessions and workshops.

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- **Secretary**: Andreas Christen (Albert-Ludwigs Universität Freiburg, Germany), 2018-2022.
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The next edition of ***Urban Climate News*** will appear in late December. Contributions for the upcoming issue are welcome, and should be submitted by November 30, 2019 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.

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