Dr. Kerry Nice
Urban climate scientist; Urban systems modelling

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CV

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Publications
Reports
Conference Presentations
Climate models
Datasets
Peer Reviews
Grants
Professional Actitivies
Supervision
Media/Awards
Consulting
Teaching
Stuff I'm working on

- **Senior Research Fellow**
  Faculty of Architecture, Building and Planning
  University of Melbourne, 2016-Present.
- **Deputy Director**
  Transport, Health and Urban Systems (THUS) research lab

Research Areas

Research in urban climates and human thermal comfort (HTC) with a focus on urban micro climate modelling and WSUD (water sensitive urban design).
Research in urban design, transport, health, micro-climates, and urban green space typology using neural network machine learning, agent based modelling, and climate modelling.
Software engineering using Java J2EE for application development and architecture.

Affiliations

Transport, Health and Urban Systems (THUS) research lab

ARC Centre of Excellence for Children and Families

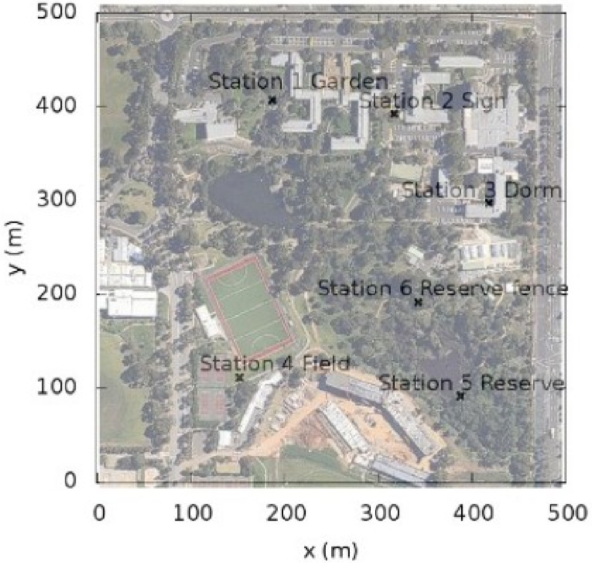
over the Life Course (Life Course Centre)

Urban Forests for Resilient Communities, Climate and Environment (UrbanFORCCE)

Research Areas (mostly quantitative)

- Climate model development
- Urban climate observations (cooling with vegetation)
- Modelling urban heat scenarios
- Analysis of infrastructure with GANs (intersections/public health)
- Neural networks (active transport mode shares/driver drowsiness/urban typologies impact on public health/pollution prediction)
- Climate informatics/urban analytics (Sky view detection)
- Agent based modelling (COVID-19)
- Built form impact on active transport/quantifying cycling mode share
- Analysis of spatial disadvantage
- City design/mode share/health risks
- Tools to guide climate sensitive development
- Community co-design

Climate models



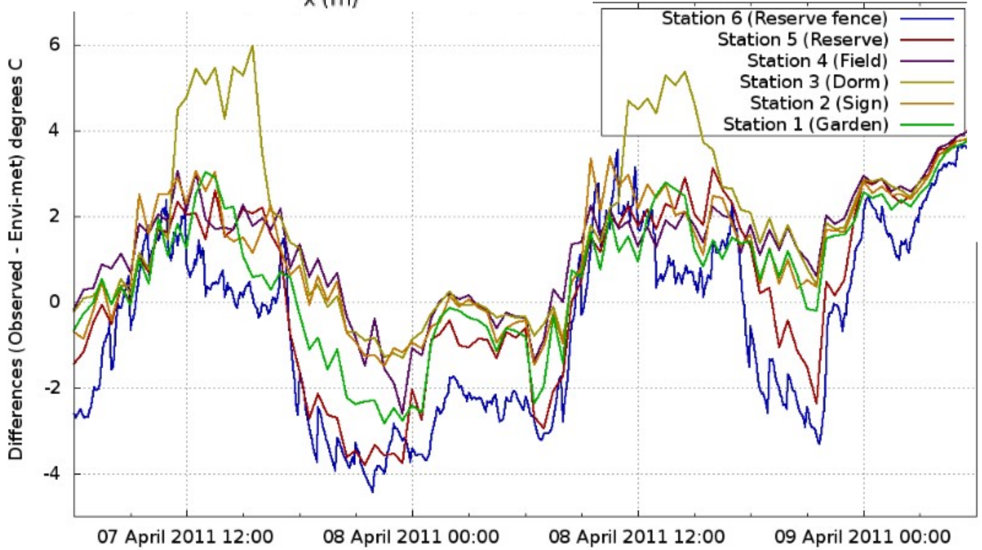


Figure 15–Differences in temperature between observation sites and ENVI-met model results, 7-8 April 2011

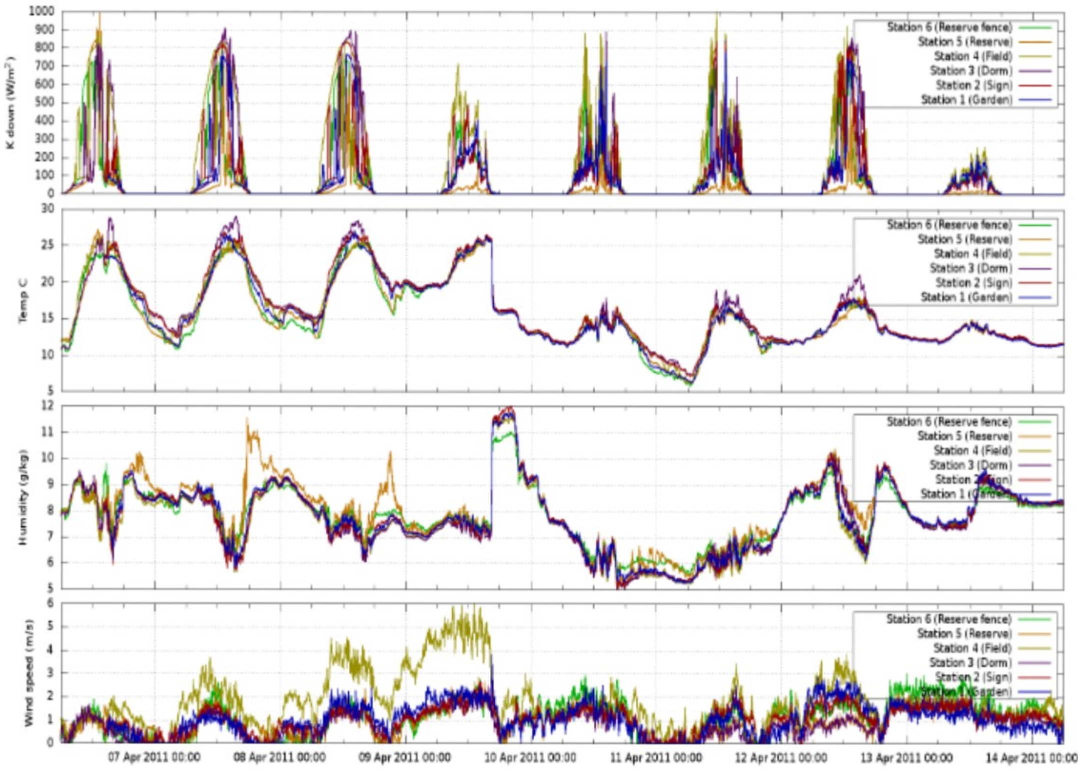


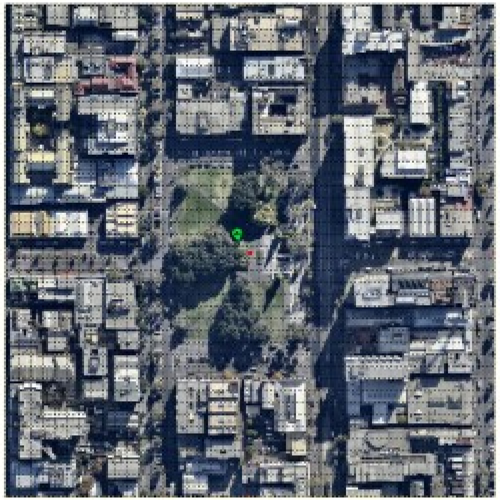
Figure 9–Observation data (K down, temperature, humidity, wind speed) for study site 7-14 April 2011

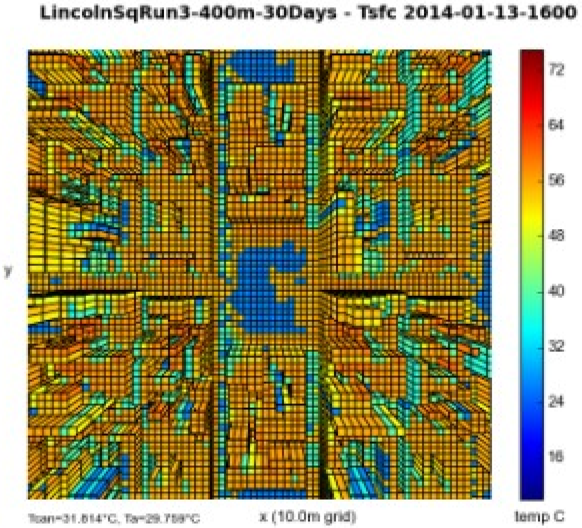
1) What is the temperature variation across a mixed urban-parkland environment and is this significant enough to warrant adoption of such morphologies to mitigate the UHI effects?

2) Can an urban micro-climate model reproduce the observed temperature variation across a mixed urban-parkland environment?

Nice, K.A., 2011. The micro-climate of a mixed urban parkland environment (Masters Thesis). Monash University.

VTUF-3D, a tool to model the cooling effects of trees at a microscale





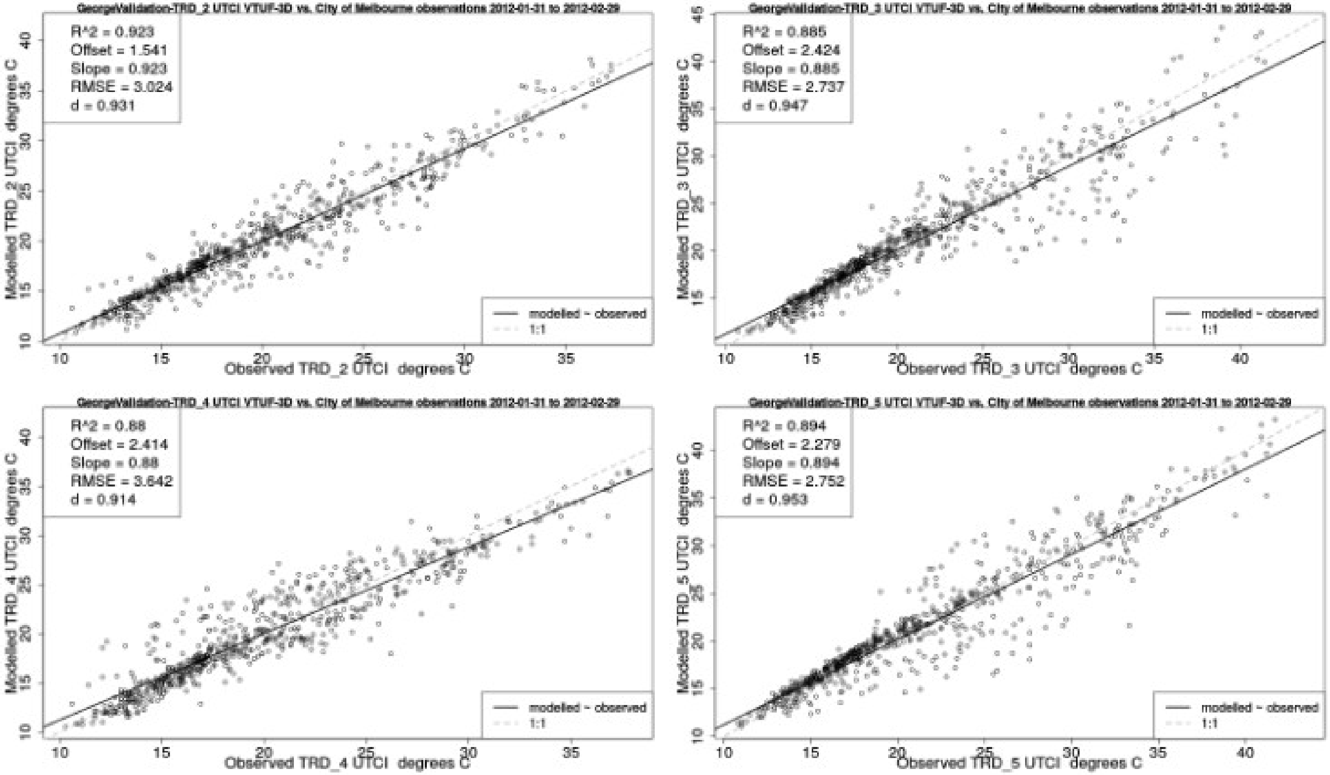
Lincoln Square, Melbourne

- **Can a model be devised for HTC assessments of WSUD?**
- **Can this new model be shown to be accurate and suitable for these assessments?**
- **Finally, can this new model be demonstrated as capable to answer questions and supply urban climate knowledge to the planning process about how to best utilise urban greening for maximum HTC impacts?**

Nice, K.A., 2016. Development, validation, and demonstration of the VTUF-3D v1.0 urban micro-climate model to support assessments of urban vegetation influences on human thermal comfort (PhD Thesis). Monash University.

Model testing and validation using City of Melbourne, George and Gipp St datasets

30 day comparison of predicted UTCI to observed - George St



Nice, K.A., 2016. Development, validation, and demonstration of the VTUF-3D v1.0 urban micro-climate model to support assessments of urban vegetation influences on human thermal comfort (PhD Thesis). Monash University.

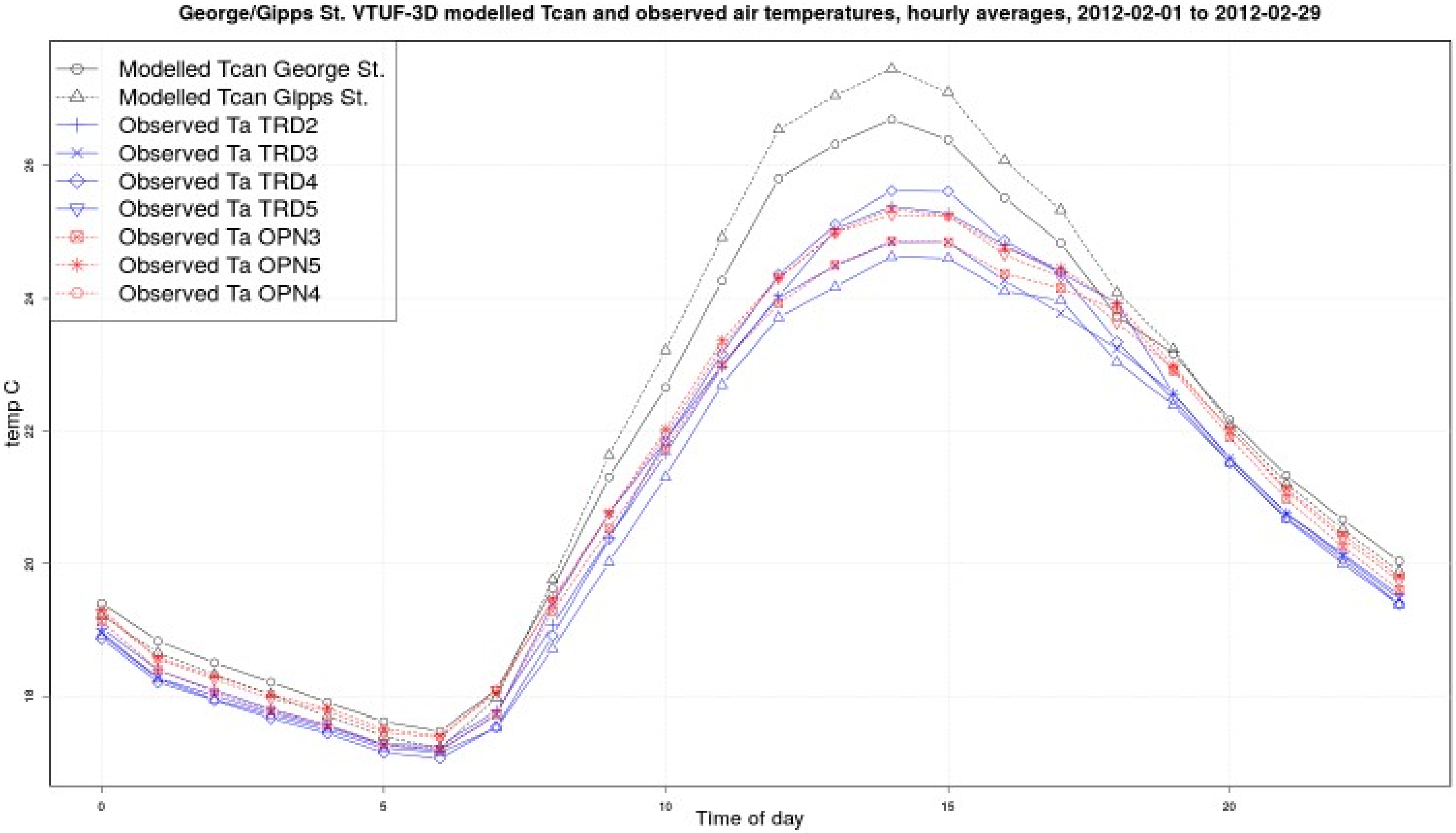


Figure 14: George/Gipps St. modelled T_{can} from scenarios GeorgeValidation and GippValidation compared to observed T_a of George St. 4 treed canopy stations and Gipps St. 3 open canopy stations, aggregated into hourly averages over February 2012 modelled period.

Nice, K.A., Coutts, A.M., Tapper, N.J., 2018. Development of the VTUF-3D v1.0 urban micro-climate model to support assessment of urban vegetation influences on human thermal comfort. Urban Climate 1–25. https://doi.org/10.1016/j.uclim.2017.12.008

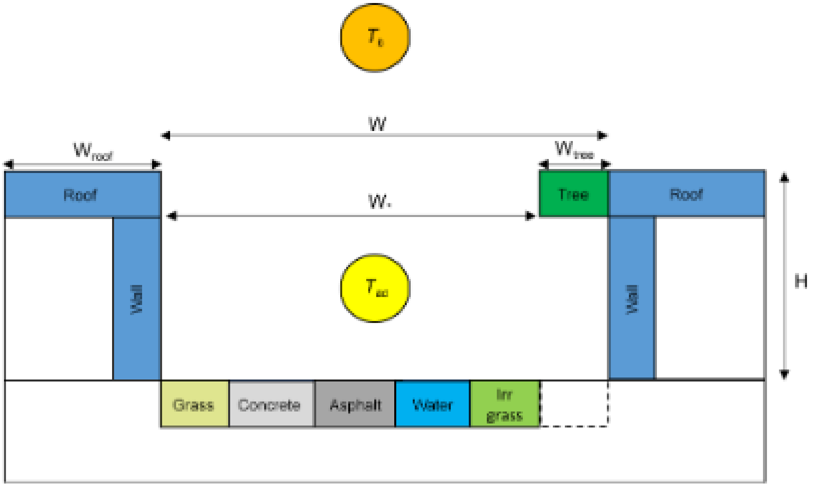


Figure 1. Schematic of TARGET urban canyon set-up. T_{ac} is the canopy layer air temperature, and T_b is the above-canopy air temperature, which is a uniform value across the whole domain. W_{roof} is the roof width, W_{tree} is the tree width, W is canyon width, and $W* = W - W_{tree}$. The surface beneath trees is assumed to be representative of canyon ground-level surfaces.

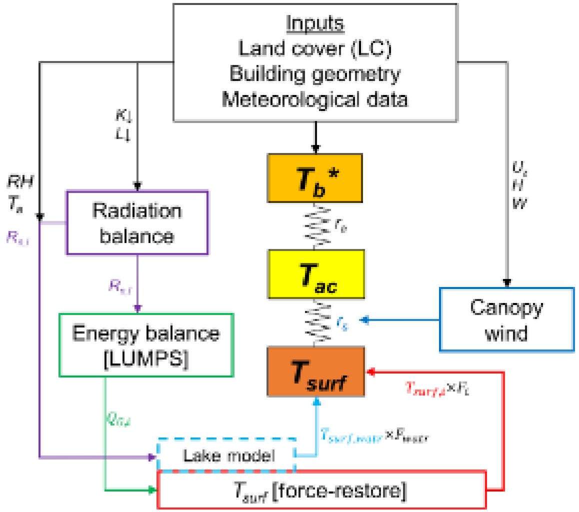


Figure 2. Overview of approach used in TARGET. T_{ac} is street-level (urban canopy layer) air temperature (°C), T_b is the air temperature above the urban canopy layer (°C), $T_{surf,i}$ is the surface temperature for surface type i, $K\downarrow$ is incoming shortwave radiation (W m^{-2}), $L\downarrow$ is incoming longwave radiation (W m^{-2}), T_a is reference air temperature (°C), R_n is net radiation (W m^{-2}), RH is rel-

Broadbent, A., Coutts, A., Nice, K.A., Demuzere, M., Krayenhoff, E.S., Tapper, N.J., Wouters, H., 2019. The Air-temperature Response to Green/blue-infrastructure Evaluation Tool (TARGET v1.0): an efficient and user-friendly model of city cooling. Geoscientific Model Development 12, 785–803. https://doi.org/10.5194/gmd-2018-177

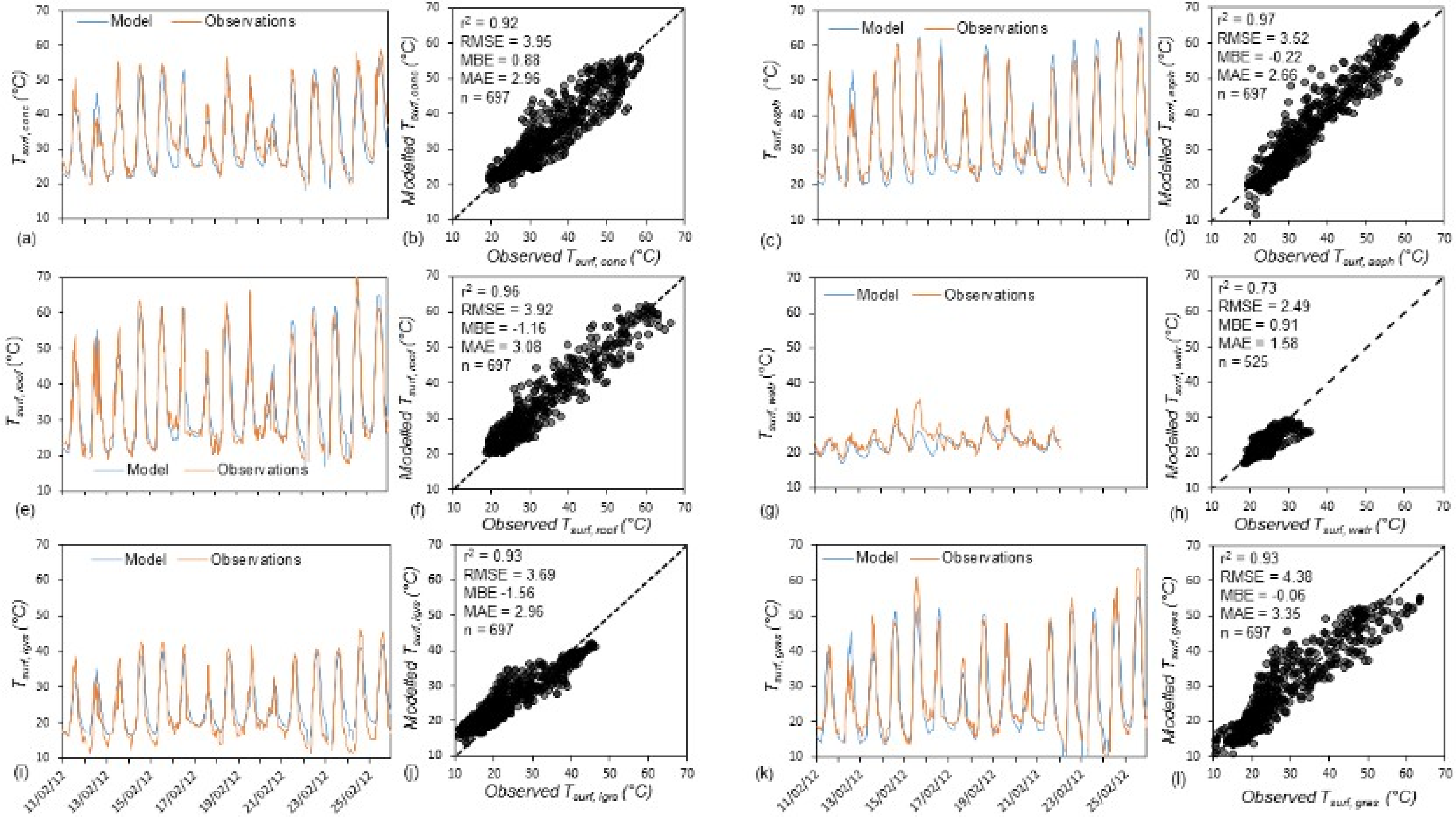


Figure 4. Observed vs. modelled **(a, b)** $T_{\mathrm{surf,conc}}$, **(c, d)** $T_{\mathrm{surf,asph}}$, **(e, f)** $T_{\mathrm{surf,roof}}$, **(g, h)** $T_{\mathrm{surf,watr}}$, **(i, j)** $T_{\mathrm{surf,irgs}}$, and **(k, l)** $T_{\mathrm{surf,gras}}$. All time series plots are for the period 11–25 February. Note that the water site only had observational data for the period 11–21 February due to instrument failure; r^2 is the correlation coefficient, RMSE is the root mean square error, MBE is the mean bias error, and MAE is the mean absolute error.

Broadbent, A., Coutts, A., Nice, K.A., Demuzere, M., Krayenhoff, E.S., Tapper, N.J., Wouters, H., 2019. The Air-temperature Response to Green/blue-infrastructure Evaluation Tool (TARGET v1.0): an efficient and user-friendly model of city cooling. Geoscientific Model Development 12, 785–803. https://doi.org/10.5194/gmd-2018-177

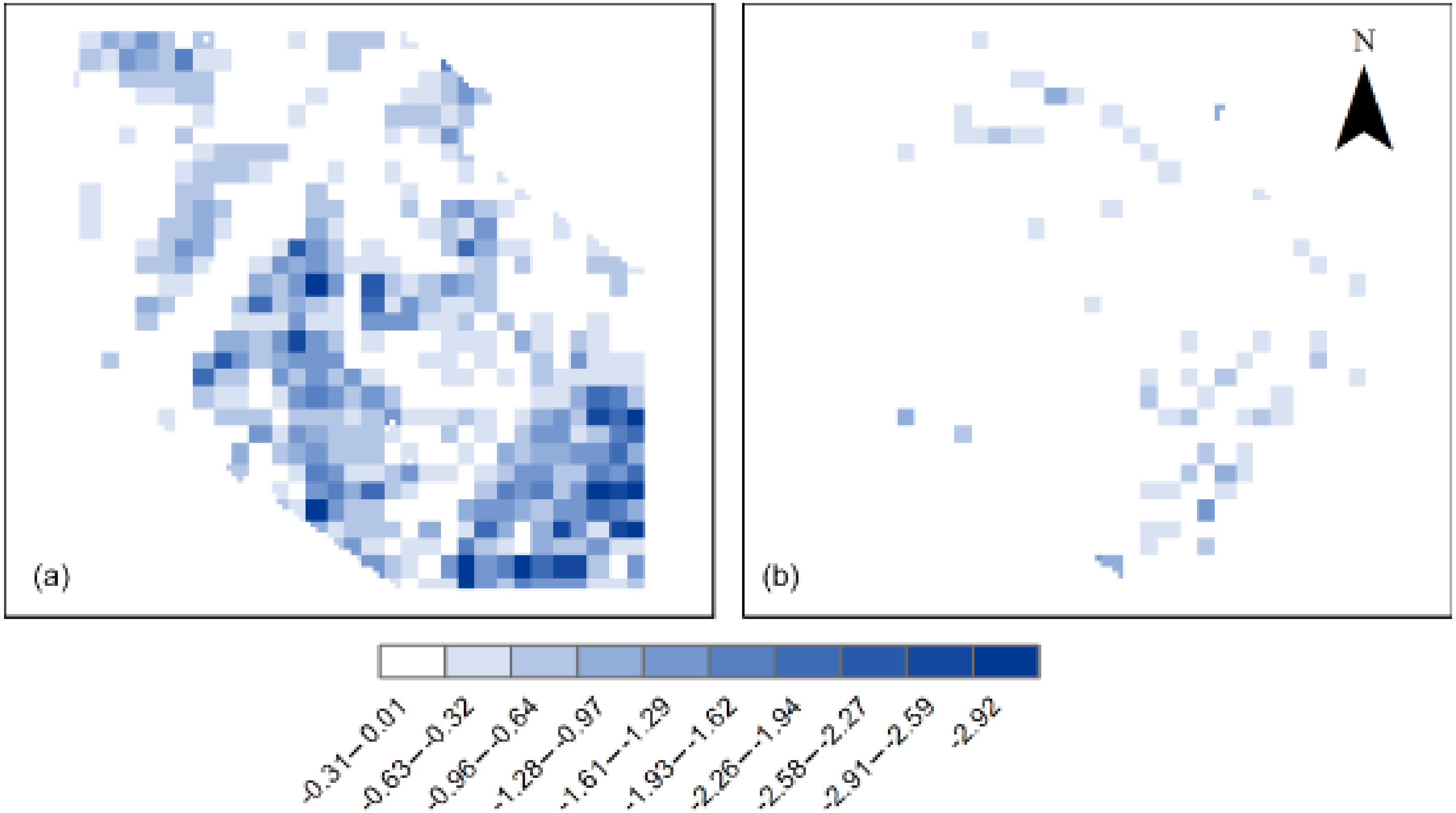


Figure 10. The ΔT_{ac} (°C) for 2×TREE − BASE at **(a)** 15:00 and **(b)** 03:00 for the Mawson Lakes domain.

Broadbent, A., Coutts, A., Nice, K.A., Demuzere, M., Krayenhoff, E.S., Tapper, N.J., Wouters, H., 2019. The Air-temperature Response to Green/blue-infrastructure Evaluation Tool (TARGET v1.0): an efficient and user-friendly model of city cooling. Geoscientific Model Development 12, 785–803. https://doi.org/10.5194/gmd-2018-177

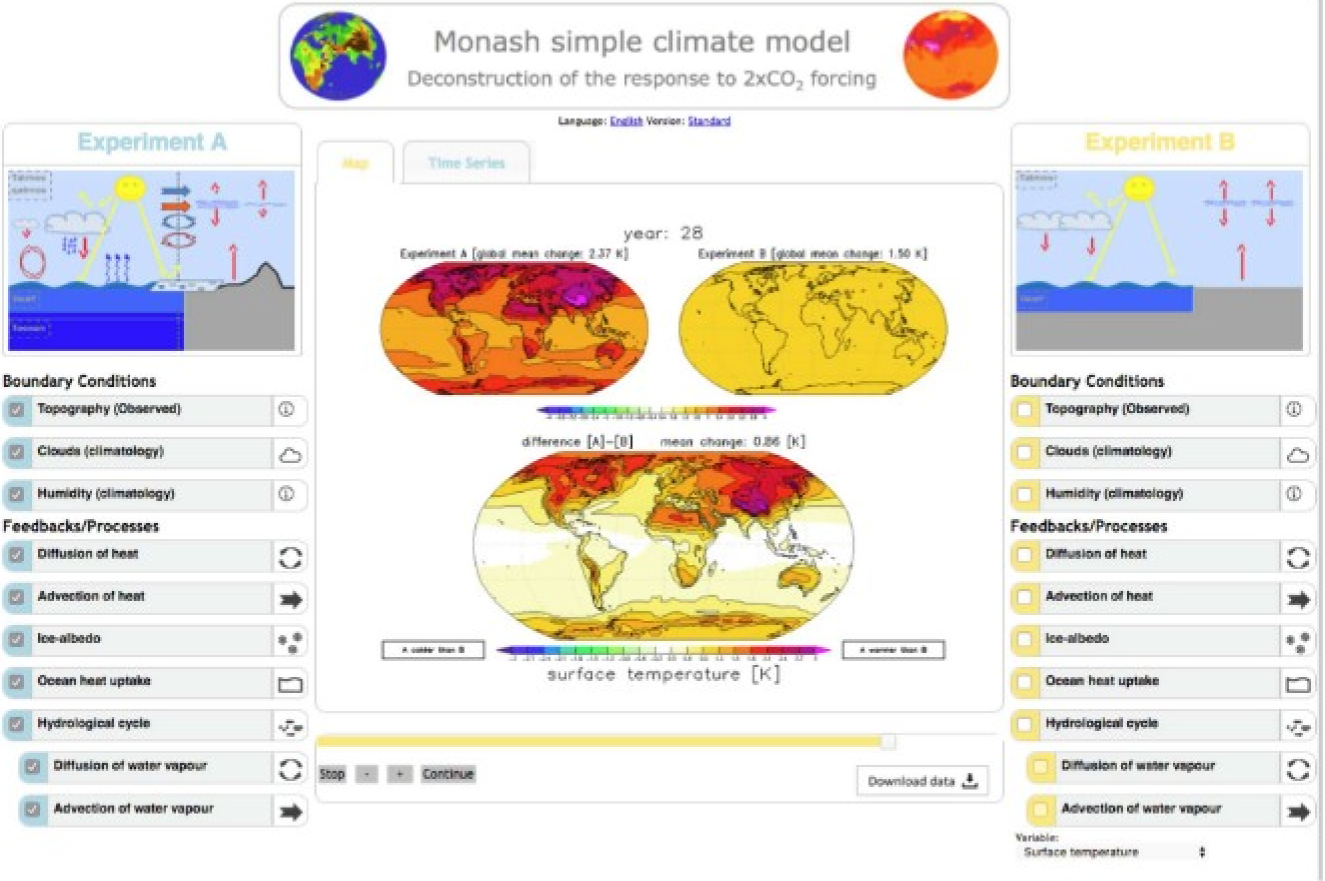
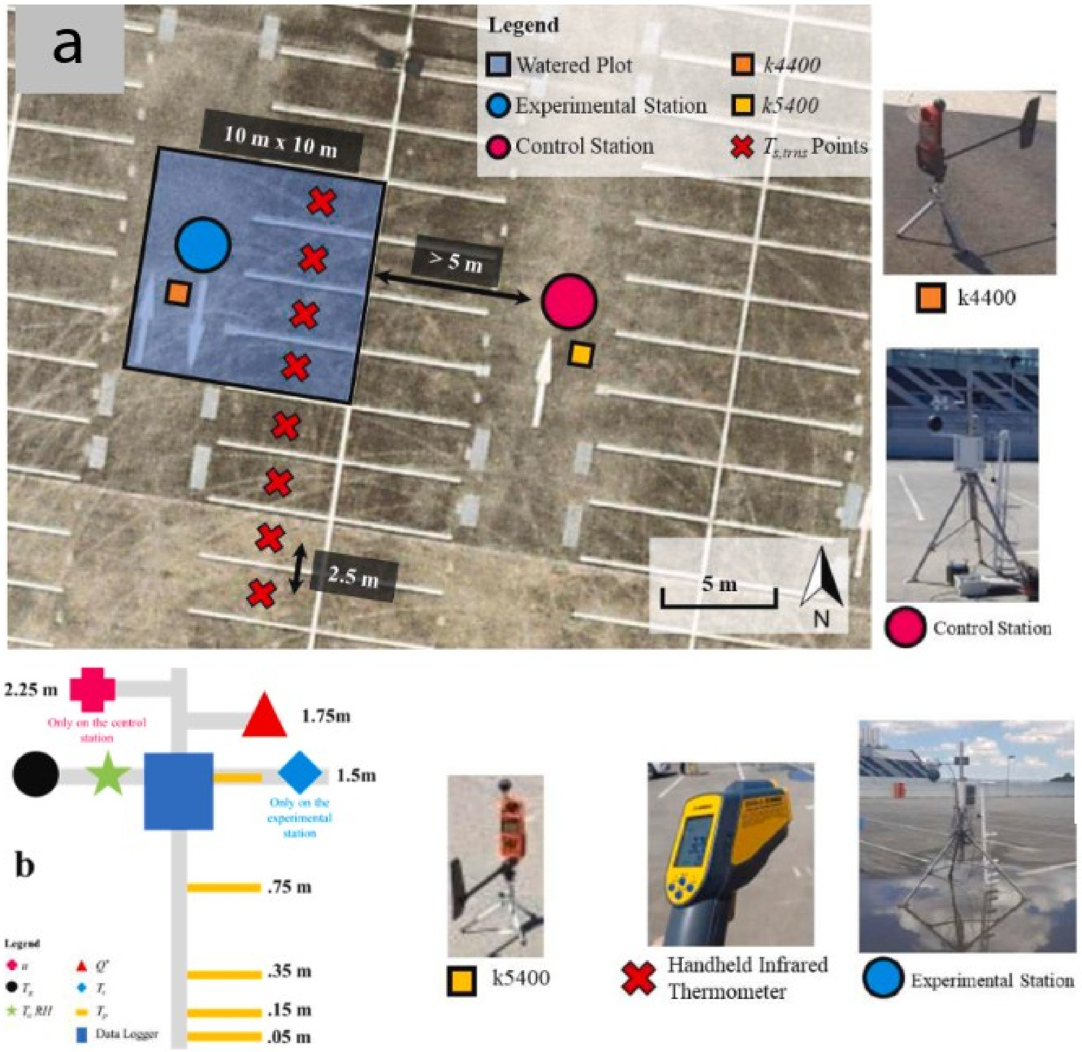
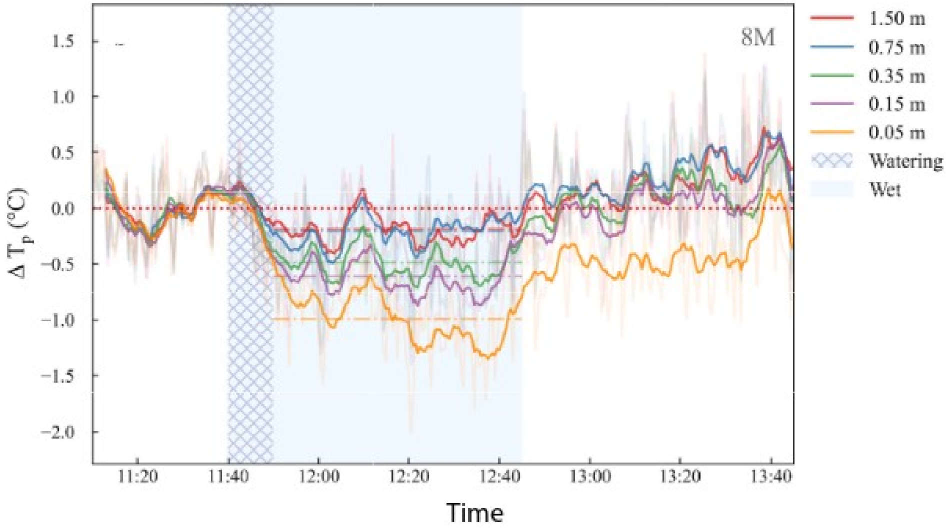


Figure 2. MSCM interface running the deconstruction of the response to a doubling of the CO_2 concentration in experiments. Experiment A, on the left, has all processes turned ON, and experiment B, on the right, has all turned OFF. The T_{surf} response of experiment A is shown in the upper left map, experiment B in the upper right, and the difference between the two in the lower map. The example shows the annual mean values after 28 years.

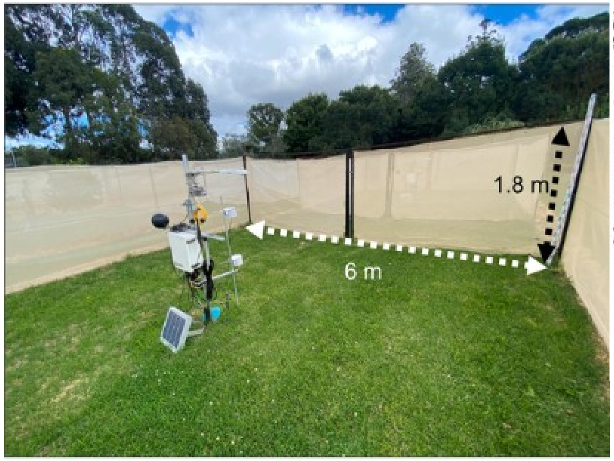
Dommenget, D., Nice, K., Bayr, T., Kasang, D., Stassen, C., Rezny, M., 2019. The Monash Simple Climate Model experiments (MSCM-DB v1.0): an interactive database of mean climate, climate change, and scenario simulations. Geoscientific Model Development 12, 2155–2179.

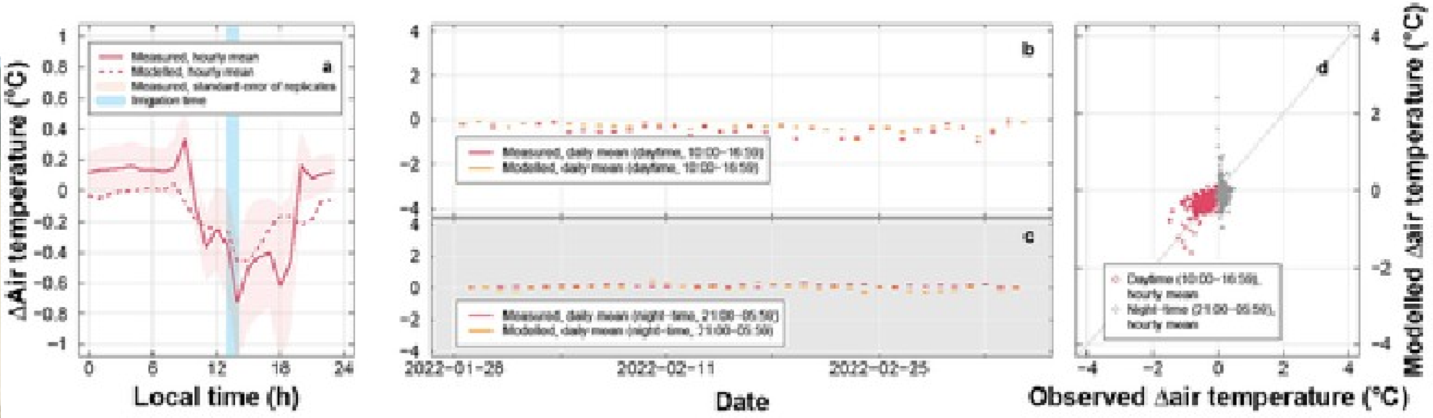
Urban cooling observations

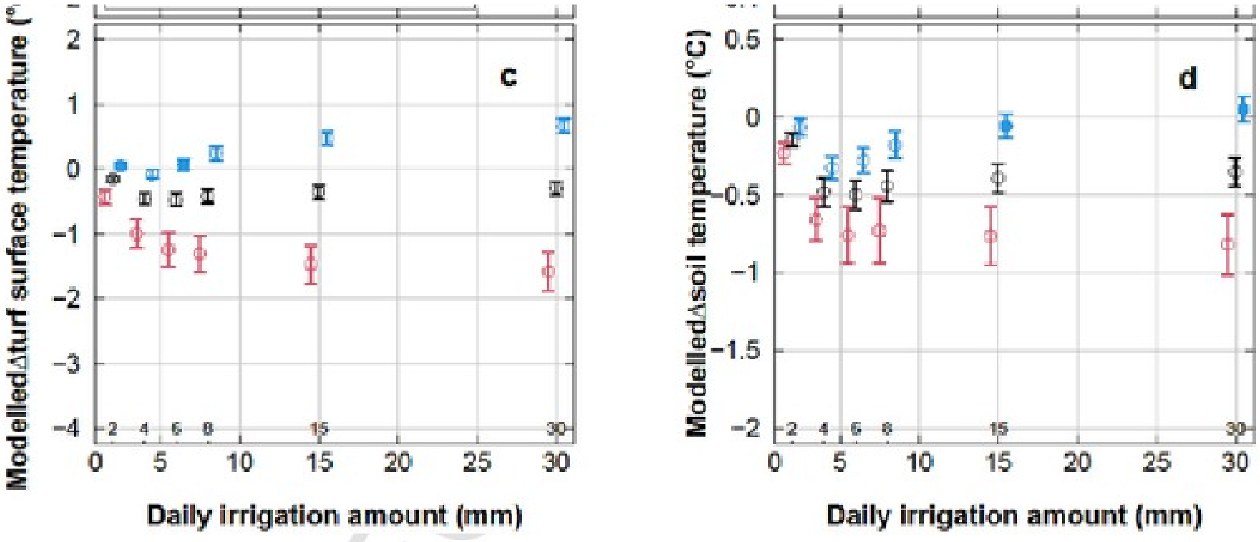




Traill, E., Nice, K.A., Tapper, N., Arblaster, J.M., 2024. Pavement watering as an urban heat mitigation technique. Urban Climate 56, 102042. https://doi.org/10.1016/j.uclim.2024.102042





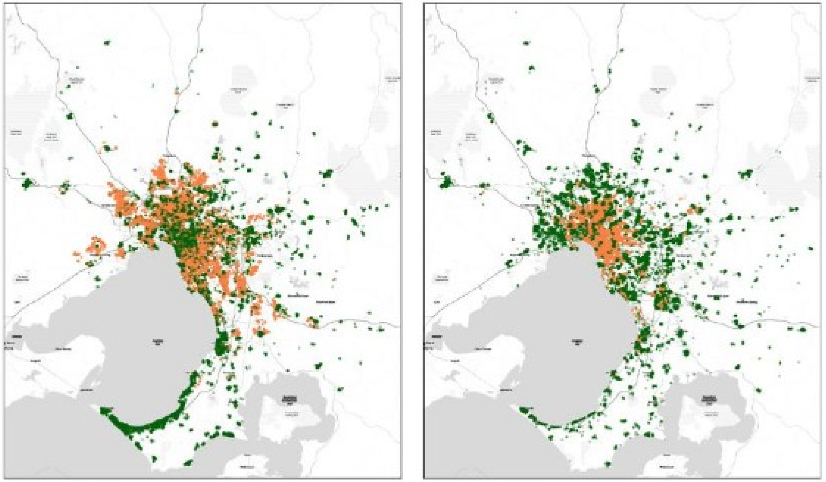


Chueng, P.K., Meili, N., Nice, K.A., Livesley, S.J., 2024. Identifying the mechanisms by which irrigation can cool urban green spaces in summer. Urban Climate 55, 101914. https://doi.org/10.1016/j.uclim.2024.101914

GANs/Autoencoder/Neural networks

Augmented analysis through computer vision

- Use of generative computer vision models (GANs) to highlight characteristics of areas with good vs. bad outcomes.

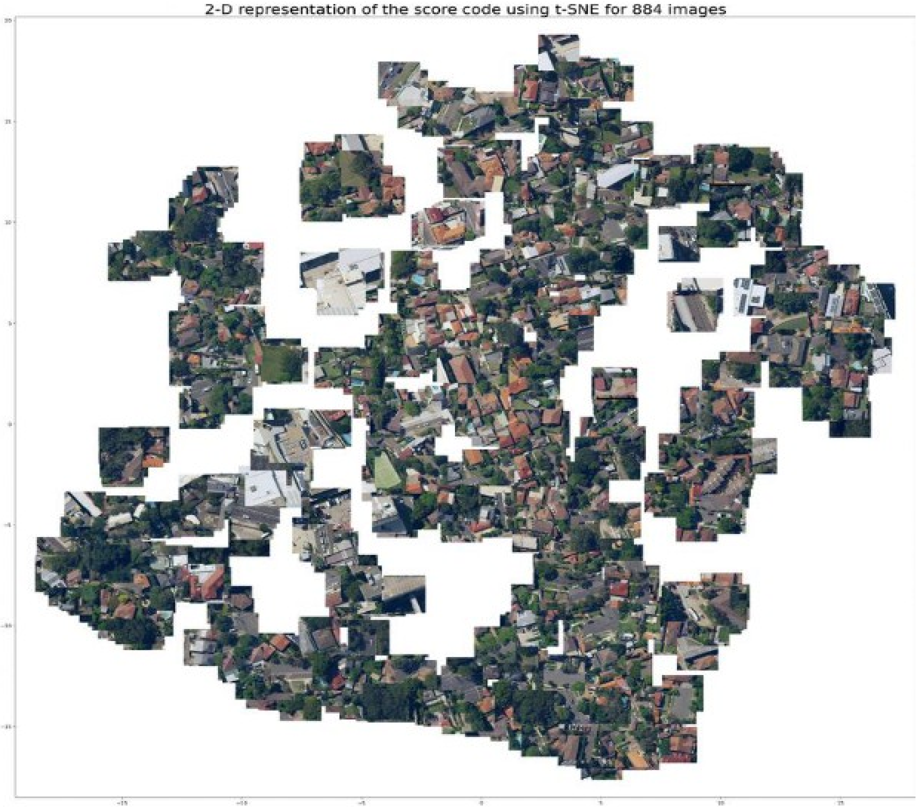


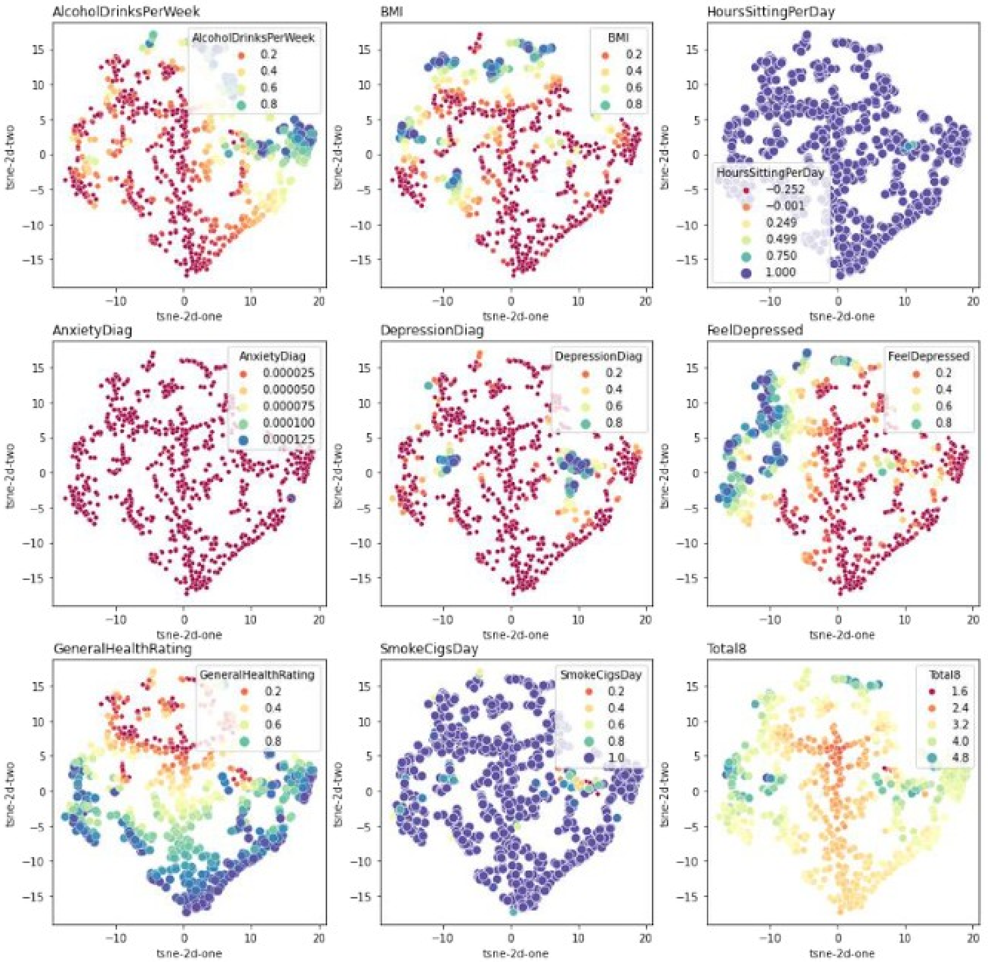
(a) General health (b) Social capital

Good general health to bad

Wijnands, J.S., Nice, K.A., Thompson, J., Zhao, H., Stevenson, M., 2019. Streetscape augmentation using generative adversarial networks: insights related to health and wellbeing. Sustainable Cities and Society. https://doi.org/10.1016/j.scs.2019.101602

Analysing self-reported health indicators with GANs





Zhao et al. in preparation.

Infrastructure detection through computer vision

- Use of computer vision to quickly generate infrastructure inventories extracted from urban imagery across all of Australia
- How are different types of infrastructure used and what the public health outcomes

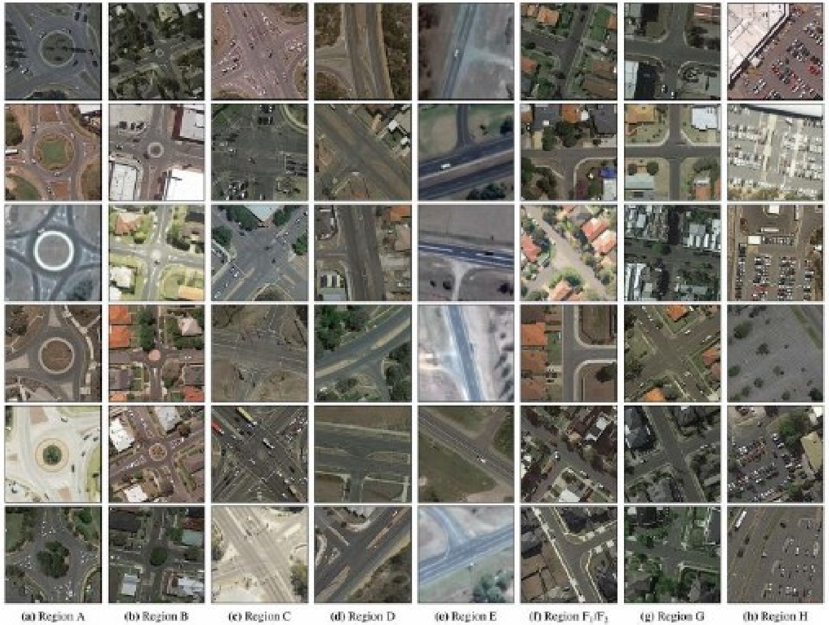
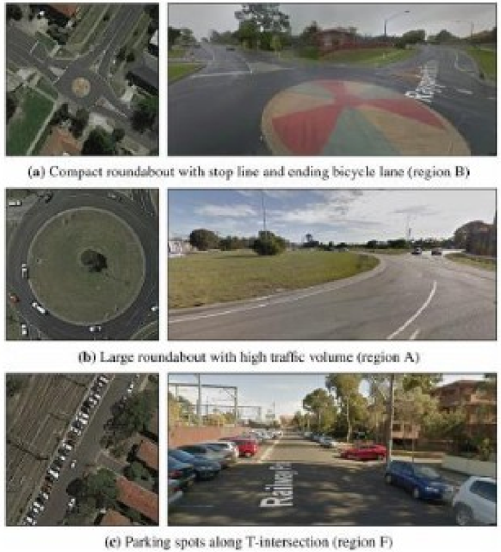


FIGURE 6 Each column provides sample images for the corresponding region in Figure 5. (a) Region A, (b) Region B, (c) Region C, (d) Region D, (e) Region E, (f) Region F_1/F_2, (g) Region G, and (h) Region H



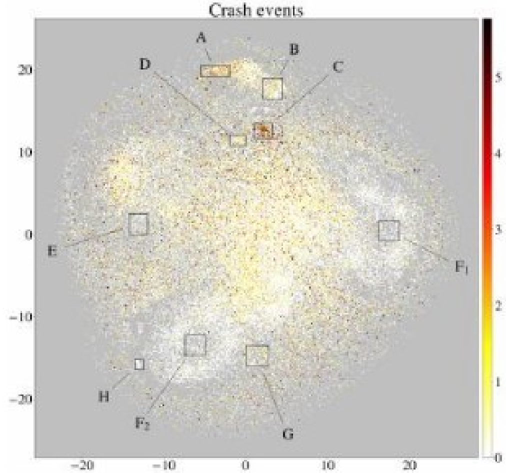
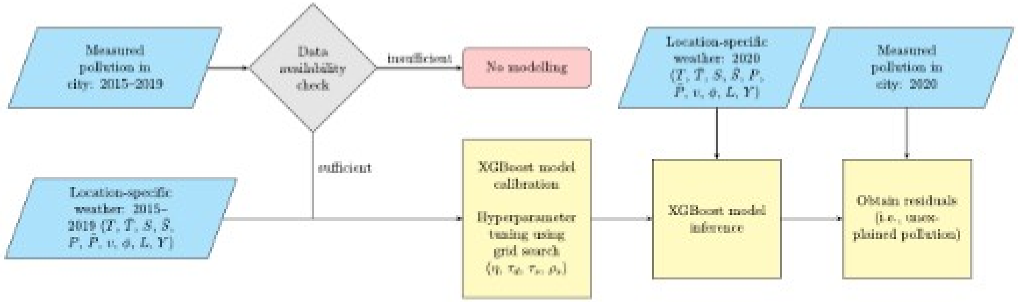


FIGURE 9 t-SNE clusters with matched crash events

900,000 intersections in Australia clustered by their design and relationships to safety outcomes (crashes) and unsafe driving behaviours (hard acceleration/braking)

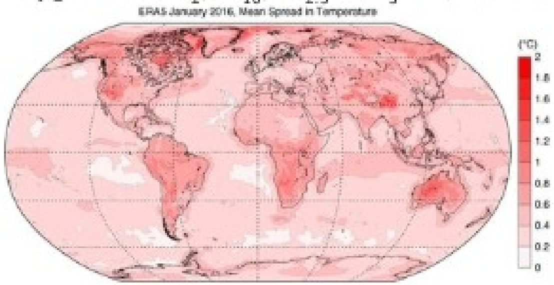
Source: Jasper S. Wijnands, Haifeng Zhao, Kerry A. Nice, Jason Thompson, Katherine Scully, Jingqiu Guo, Mark Stevenson, Identifying safe intersection design through unsupervised feature extraction from satellite imagery, Computer-Aided Civil and Infrastructure Engineering, 2020

Pollution reductions during COVID-19

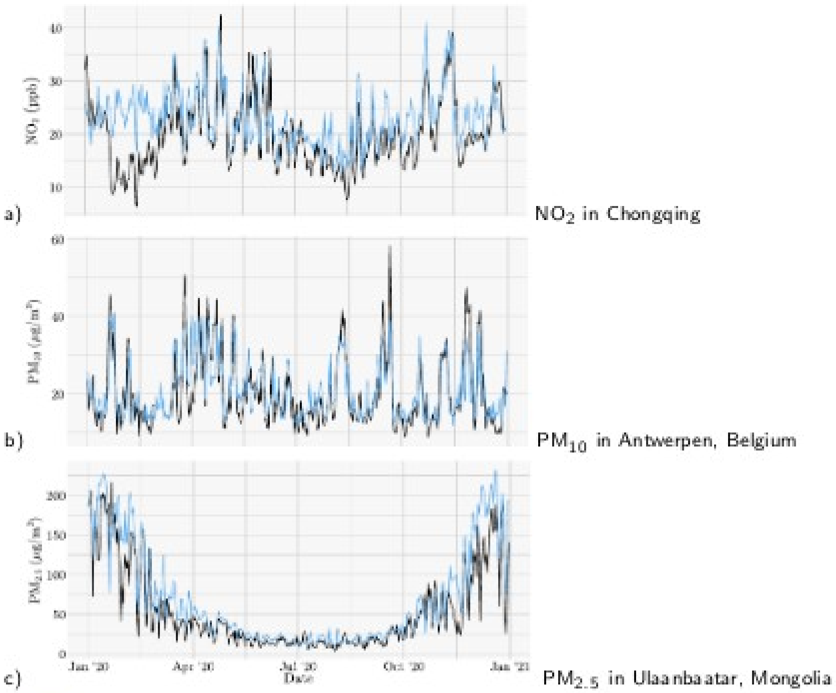


Combining ERA5 weather data with ground level pollution data, creating pollutant and city specific XGBoost model for 700 cities. Calculate 2020 pollution anomalies in the absence of the COVID-19 pandemic.

Daily ground level NO_2, PM_{10}, $PM_{2.5}$ and O_3 for 132 countries from AQICN.

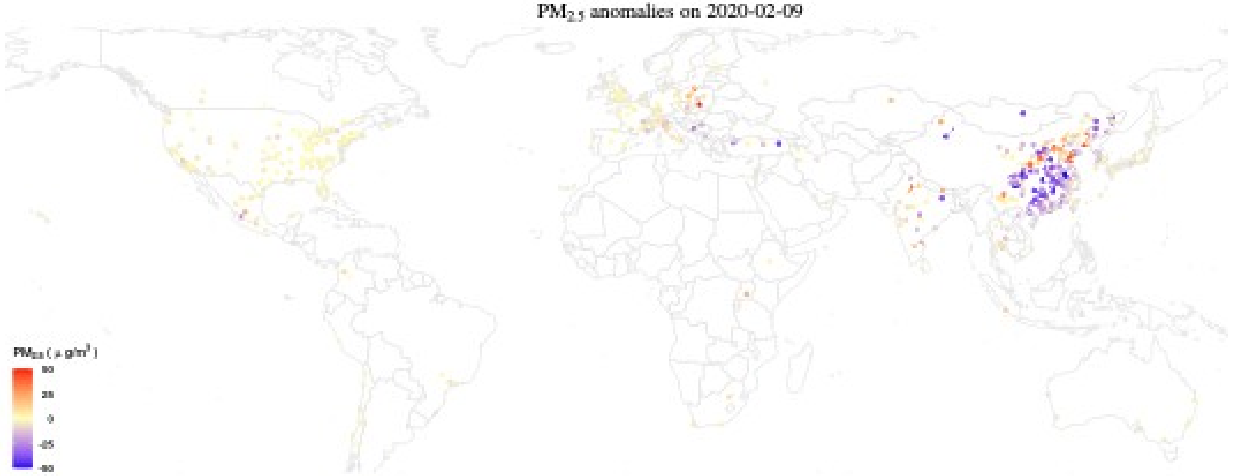


Actual (black) and forecasted (blue) pollution levels

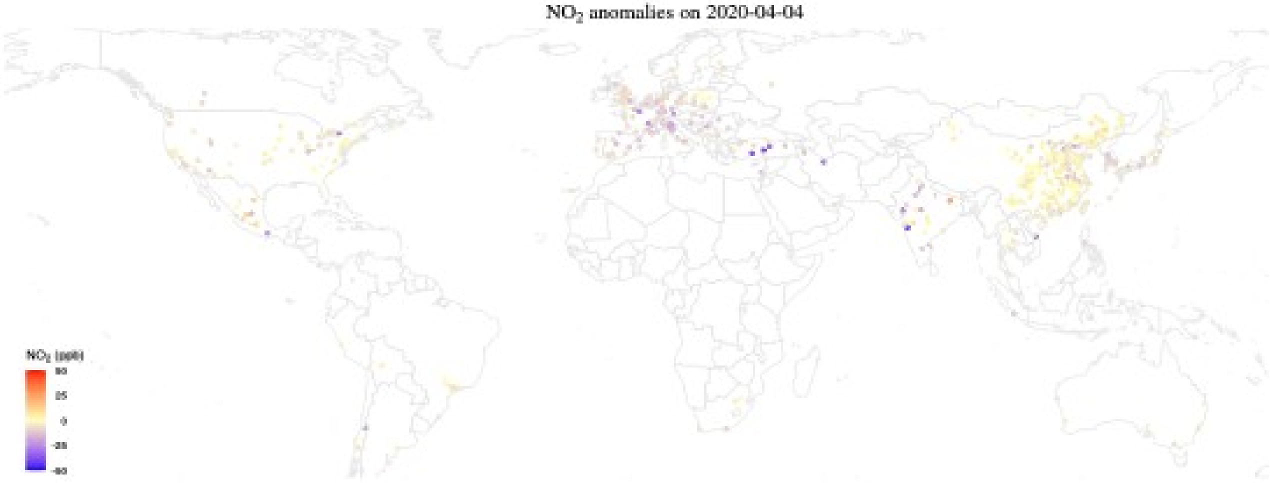


- Large February NO_2 reductions in China resulting from lockdowns.
- Aug 2020 Belgium heatwave accurately reflected through increased PM_{10} levels.
- Temperature influence on pollution: seasonal trends of $PM_{2.5}$ in Mongolia from winter heating.

Wijnands, J.S., Nice, K.A., Seneviratne, S., Thompson, J., Stevenson, M., 2022. The impact of the COVID-19 pandemic on air pollution: A global assessment using machine learning techniques. Atmospheric Pollution Research 13, 101438. https://doi.org/10.1016/j.apr.2022.101438



Reductions of $PM_{2.5}$ in China



Reductions of NO_2 in Europe

Climate informatics

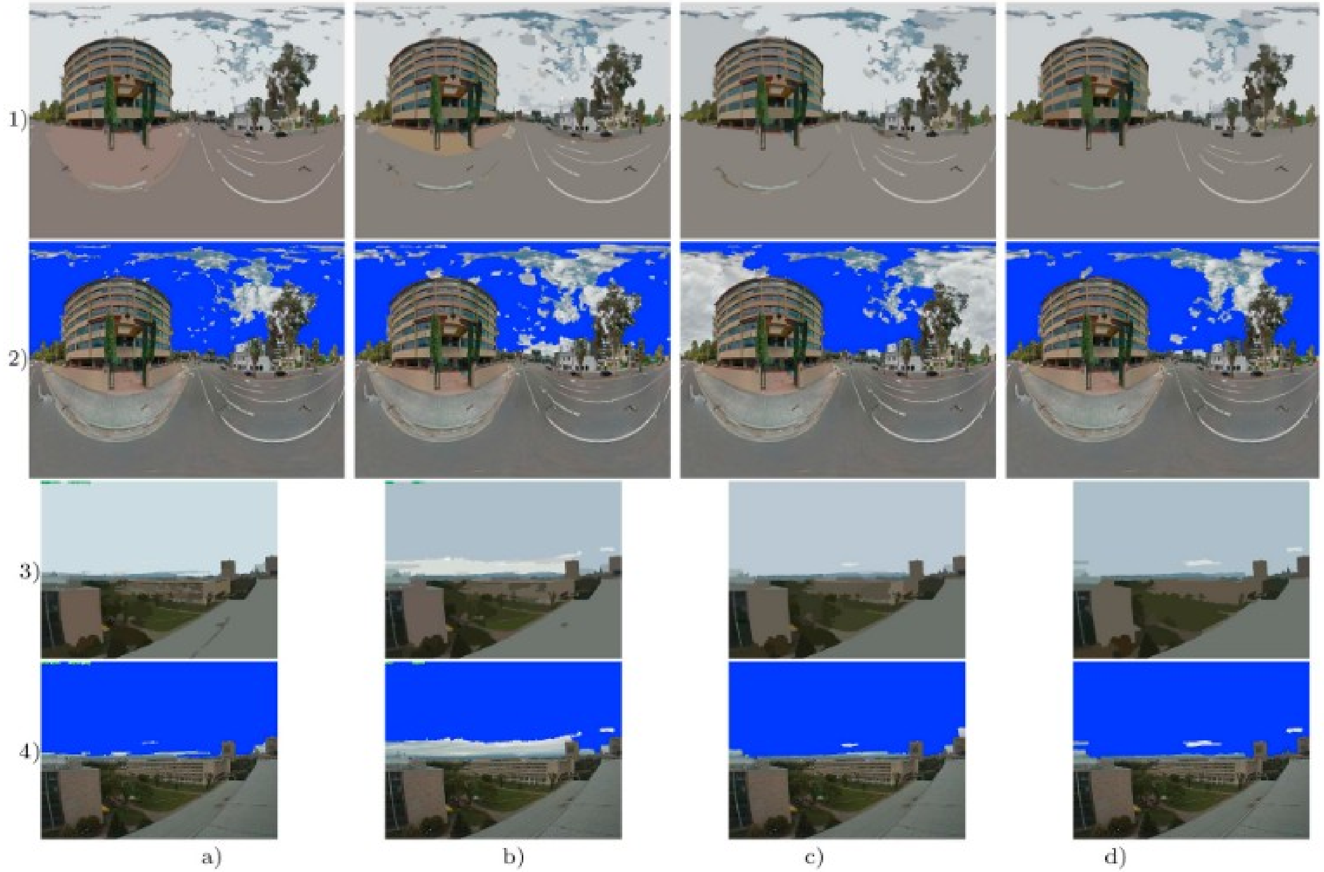
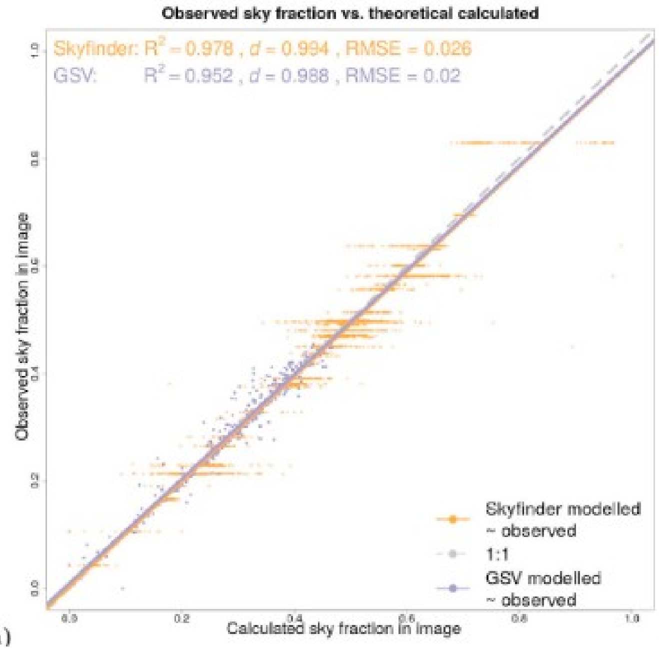


Fig. 4. Comparison outputs of intermediate mean shift segmentation algorithm processing steps using varying parameters, showing columns a) Mean_3_6_100, b) Mean_7_6_100, c) Mean_5_7_210, d) Mean_7_8_300 and intermediate mean shifted (GSV row 1, Skyfinder row 3) and the final marked images (GSV row 2, Skyfinder row 4).



a)

Nice, K.A., Wijnands, J.S., Middel, A., Wang, J., Qiu, Y., Zhao, N., Thompson, J., Aschwanden, G.D.P.A., Zhao, H., Stevenson, M., 2020. Sky pixel detection in outdoor imagery using an adaptive algorithm and machine learning. Urban Climate 31, 100572. https://doi.org/10.1016/j.uclim.2019.100572

Urban typologies

Figure 1: Four sample images for Paris, France
The images show combinations of rail transit networks (A, orange), green space (B, green), water bodies (C, blue), and road infrastructure (D, black).

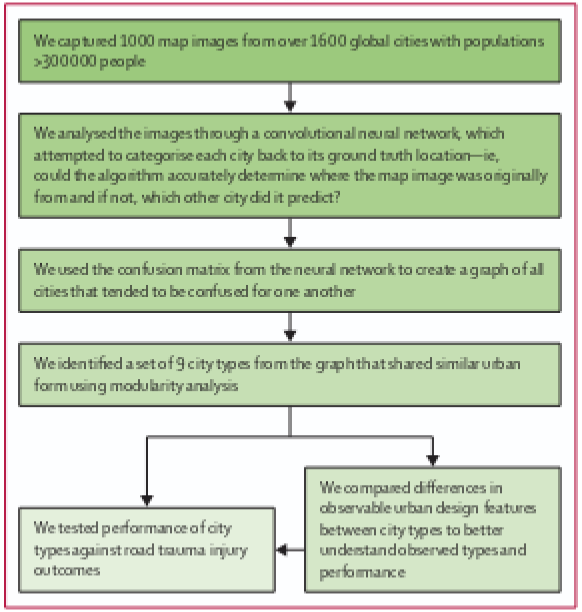


Figure 2: Methods and analysis

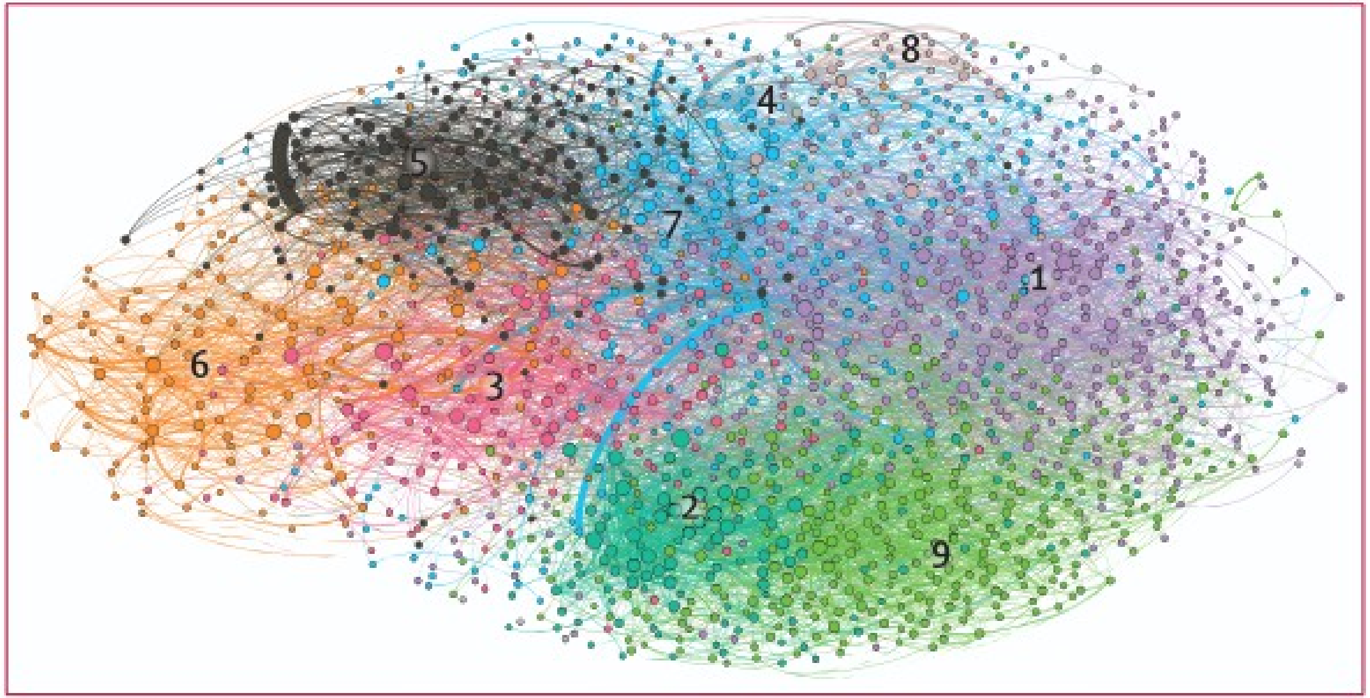


Figure 3: Network graph of the model's confusion matrix
Featuring all 1632 cities and identified city types identified by colour with approximate locations from one to nine (1=informal, 2=irregular, 3=large block, 4=cul de sac, 5=high transit, 6=motor city, 7=chequerboard, 8=intense, 9=sparse); a searchable version of the chart containing city names is available in the appendix (p 1).

Thompson, J., Stevenson, M., Wijnands, J.S., Nice, K.A., Aschwanden, G.D.P.A., Silver, J., Nieuwenhuijsen, M., Rayner, P., Schofield, R., Hariharan, R., Morrison, C.N., 2020. A global analysis of urban design types and road transport injury: an image processing study. Lancet Planetary Health 4, 32–42. https://doi.org/10.1016/S2542-5196(19)30263-3

Type 6. Motor Cities (MOT)

Medium to low density, high capacity, grid-based, road networks, medium railed transport
(n=158)

Estimated Total Population
240,350,903

City examples
Detroit, USA (pictured)
Melbourne, Australia
Toronto, Canada

Geographic Distribution
MOT cities were consistently organised, grid-based networks present throughout North America and Australia and exemplified the 'Manhattan grid' or 'motor city'. They were also punctuated by the 2nd highest levels of levels of railed, mass transit networks. Although formal and regular in a manner not dissimilar to CHQ cities, MOT cities were comprised of larger, rectangular blocks and lacked the presence of plazas that created additional triangular road networks in the street pattern. MOT cities averaged just over 10 blocks per map image, which was mid-range for all cities.

Type 7. Chequerboard (CHQ)

High density, medium capacity mixed formal and informal road networks, medium public transport
(n=257)

Estimated Total Population
390,232,514

City examples
Mexico City, Mexico (pictured)
Rome, Italy
Sao Paulo, Brazil

Geographic Distribution
CHQ cities demonstrated a mix of formal, regular, square-grid-based networks and smaller, tight, informal and disconnected roads typical of cities developed in line with the 'Laws of the Indies'[1]. Triangular shapes and angled intersections associated with central plazas appeared frequently. CHQ cities extended from the Mediterranean Sea from Italy through Spain, Portugal and across the Atlantic Ocean into Latin America. CHQ cities contained the third highest number of blocks per image at 11.3.

Design 8. Intense (INT)

Very high density, mixed formal high capacity and informal road networks, high public transport
(n=22)

Estimated Total Population
120,612,196

City examples
Osaka, Japan (pictured)
Tokyo, Japan
Manizales, Colombia

Geographic Distribution
INT cities were primarily typical of Columbian, Japanese and other high-density Asian island cities such as Singapore. They featured very high density small, irregularly shaped networks overlaid with a larger, high capacity freeways network. Railed public transport networks were also frequently observed, ranking second among city types behind HTR cities. Intense cities averaged just under 16 individual blocks per map image, the highest of all city types.

	Driver and passenger injuries	Motorcyclist injuries	Cyclist and pedestrian injuries	Total road transport injuries
High transit*	1·00	1·00	1·00	1·00
Intense	1·03 (0·82–1·23)	1·83 (1·51—2·14)	1·40 (1·16–1·63)	1·28 (1·09–1·47)
Motor city	1·55 (1·35–1·76)	1·19 (0·87–1·51)	0·80 (0·56–1·04)	1·56 (1·37–1·76)
Large block	1·22 (1·12–1·33)	1·96 (1·80–2·12)	2·17 (2·05–2·29)	1·92 (1·82–2·02)
Irregular	0·89 (0·82–0·96)	2·02 (1·91–2·13)	2·47 (2·39–2·55)	1·93 (1·86–1·99)
Chequerboard	1·44 (1·35–1·52)	1·75 (1·62–1·88)	1·54 (1·44–1·64)	1·93 (1·85–2·01)
Sparse	0·81 (0·70–0·92)	2·19 (2·02–2·36)	2·70 (2·57–2·83)	2·00 (1·90–2·11)
Informal	1·20 (1·12–1·27)	1·86 (1·75–1·97)	1·56 (1·48–1·65)	2·02 (1·96–2·09)
Cul de sac	1·91 (1·68–2·14)	2·27 (1·91–2·62)	1·90 (1·63–2·16)	2·05 (1·84–2·27)

Data are risk ratio (95% CI). *Risk ratios relative to high transit city type.

Table 1: Road user transport injuries and total road transport injury by city type

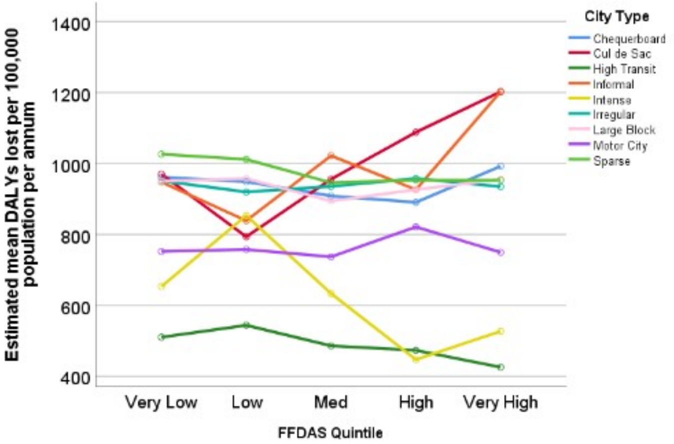
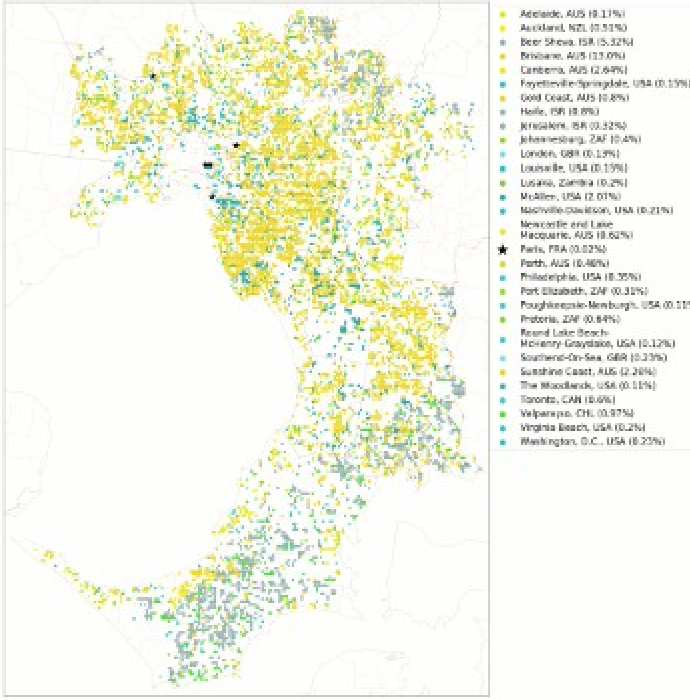


Figure 3. Estimated Disability Adjusted Life Years (DALYs) lost to road transport injury associated with City Type and FFDAS quintiles.

Thompson, J., Stevenson, M., Wijnands, J.S., Nice, K.A., Aschwanden, G.D.P.A., Silver, J., Nieuwenhuijsen, M., Rayner, P., Schofield, R., Hariharan, R., Morrison, C.N., 2020. A global analysis of urban design types and road transport injury: an image processing study. Lancet Planetary Health 4, 32–42. https://doi.org/10.1016/S2542-5196(19)30263-3

Figure 1. Sample neural network training images for (**a**) GM (from Paris, France [51]), (**b**) GS (from Adelaide, Australia [51]), and (**c**) for GSV-BSV after mean shift pre-processing (from Sydney, Australia [52]).

Figure 8. Gallery of "Paris-like" locations in Melbourne (**A** and **B**) and Sydney (**C**) using the GSV-BSV neural network.



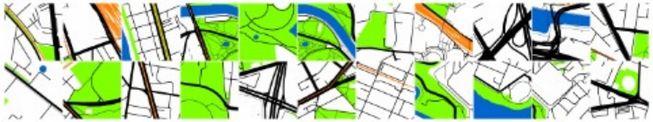
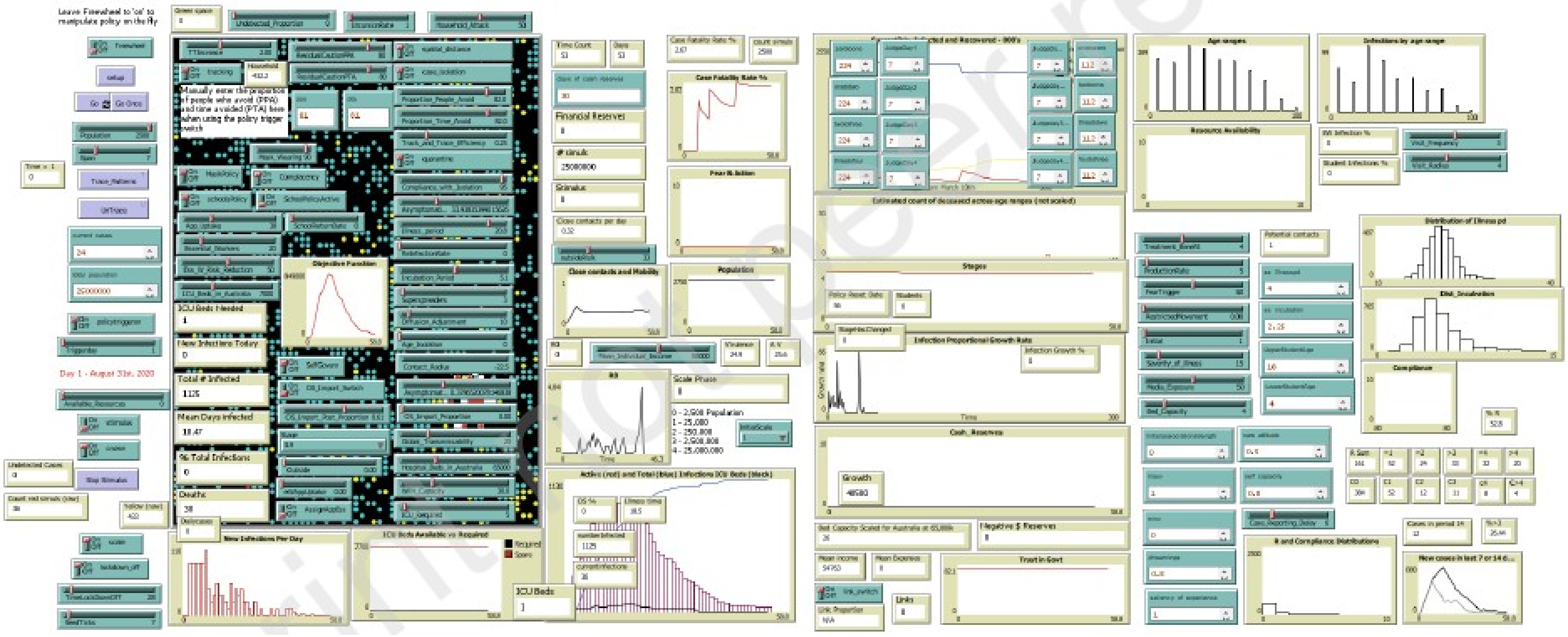


Figure 6. Gallery of "Paris-like" locations in Melbourne using the GM neural network.

Nice, K.A., Thompson, J., Wijnands, J.S., Aschwanden, G.D.P.A., Stevenson, M., 2020. The "Paris-end" of Town? Deriving Urban Typologies Using Three Imagery Types. Urban Science 4, 27–27. https://doi.org/10.3390/urbansci4020027

Agent Based modelling



Thompson, J., McClure, R., Blakely, T., Wilson, N., Baker, M.G., Wijnands, J.S., de Sa, T.H., Nice, K., Cruz, C., Stevenson, M., 2022. Modelling SARS-CoV-2 disease progression in Australia and New Zealand: an account of an agent-based approach to support public health decision-making. Australian and New Zealand Journal of Public Health. https://doi.org/10.1111/1753-6405.13221

The fewer cases of coronavirus in the community when we ease, the lower the chance of locking down by Christmas.

University of Melbourne modelled several policy scenarios.

If we ease restrictions when the average number of cases over the previous fortnight is 25 (350 cases total) then it's more likely than not that cases will get out of hand and restrictions will have to be reinstated to regain control and protect the health system.

Waiting until the average is 5 cases a fortnight – or 70 cases total - reduces the chance of increased restrictions before Christmas to just 3 in 100.

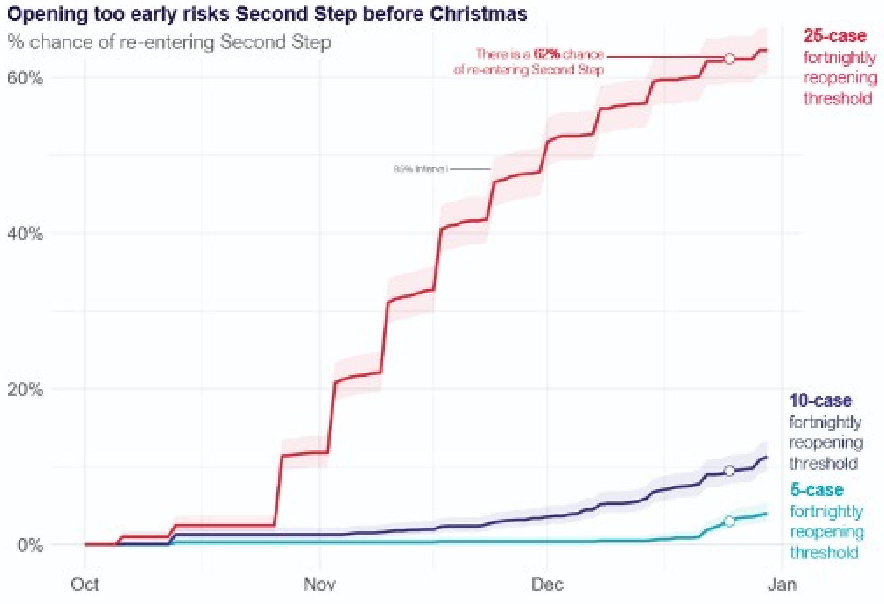
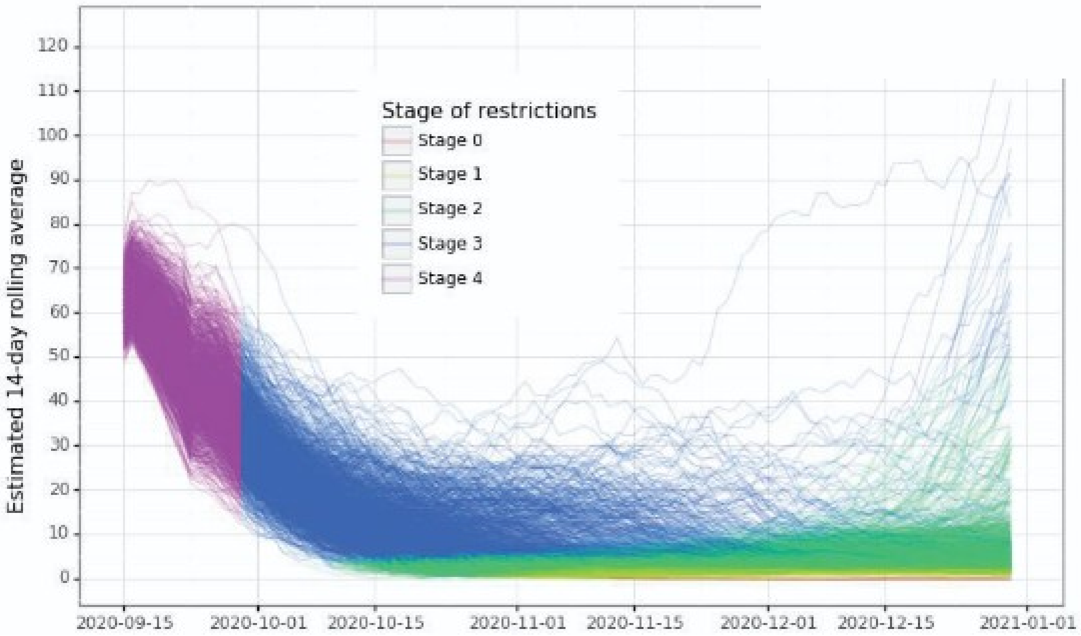


Figure 7: Estimated outcomes from 1,000 model runs from mid-September to 25 ... represents different stages as set out in the Victorian Roadmap.[38]

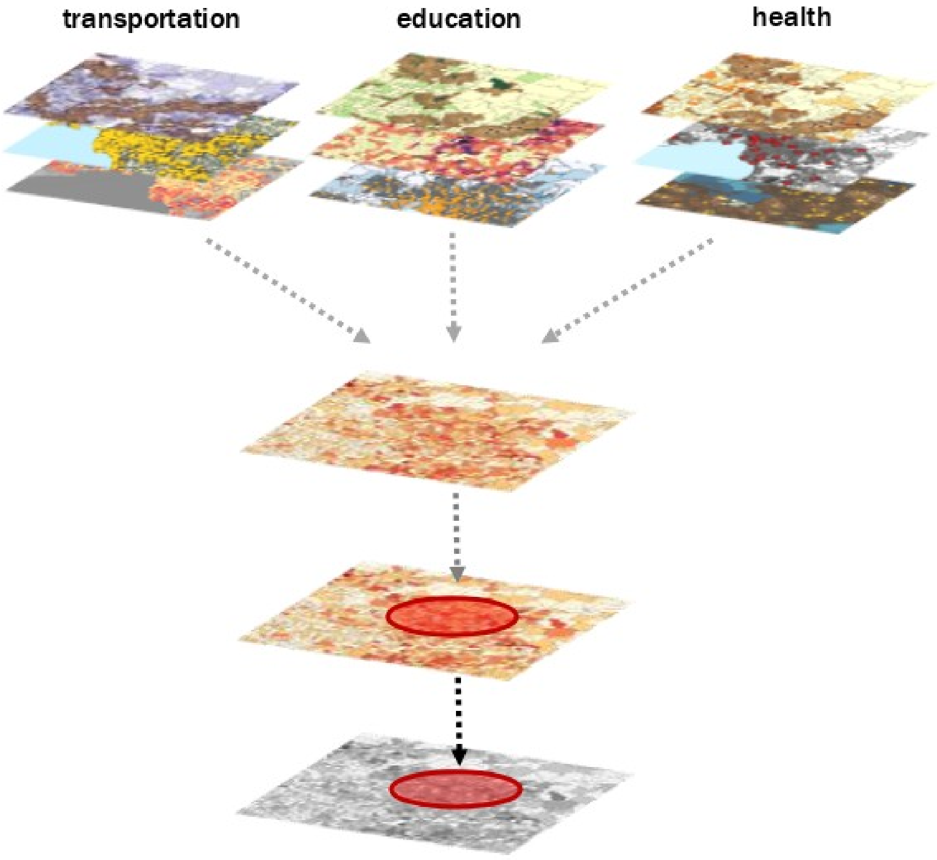


Thompson, J., McClure, R., Blakely, T., Wilson, N., Baker, M.G., Wijnands, J.S., de Sa, T.H., Nice, K., Cruz, C., Stevenson, M., 2022. Modelling SARS-CoV-2 disease progression in Australia and New Zealand: an account of an agent-based approach to support public health decision-making. Australian and New Zealand Journal of Public Health. https://doi.org/10.1111/1753-6405.13221

Spatial analysis/spatial disadvantage

Social Service Access Index

Process



Aggregate access indicators for each domain a
SA1 level

Calculate SSAI at SA1 level using different weights to create indexes

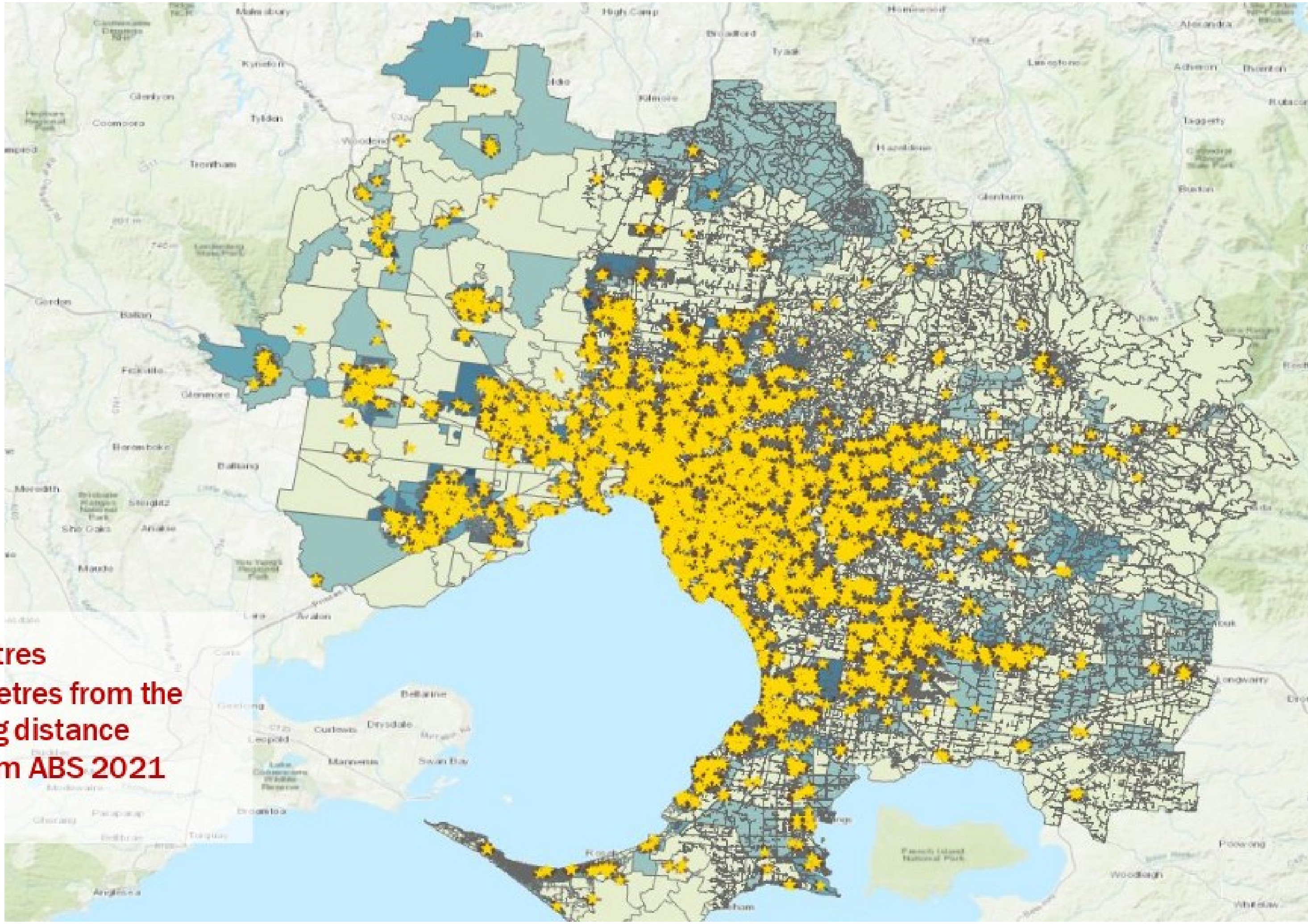
Identify potential service deserts in the target areas

Assess access level by different population groups (i.e., young families, elderly, etc.) in potential service deserts

Kerry Nice, Sachith Seneviratne, Youjin Choe, Mark Stevenson, Place-based Data Approaches: Data for analysis of spatial inequities in access to services, Life Course Centre Data For Policy Summit, Canberra, 15-16 August 2023.

Scenario example

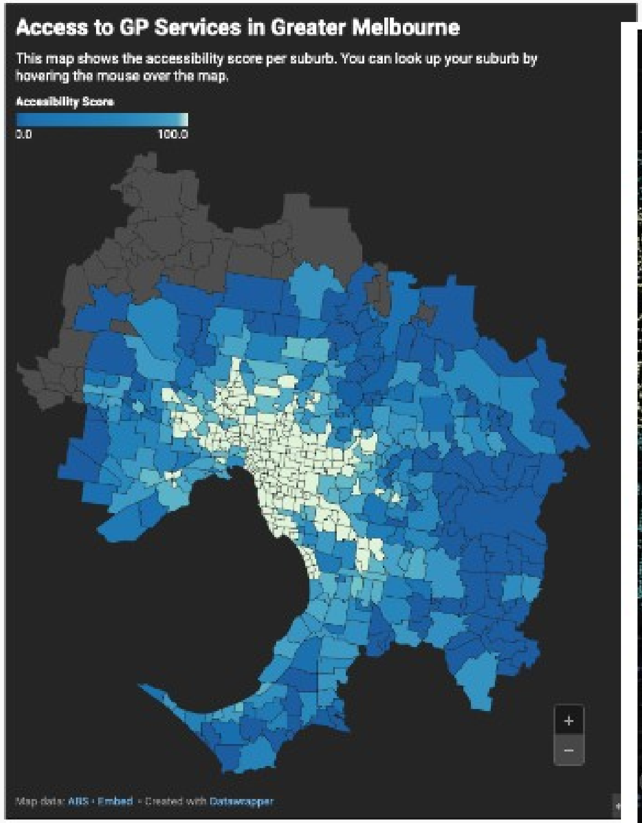
Access to childcare in Greater Melbourne area

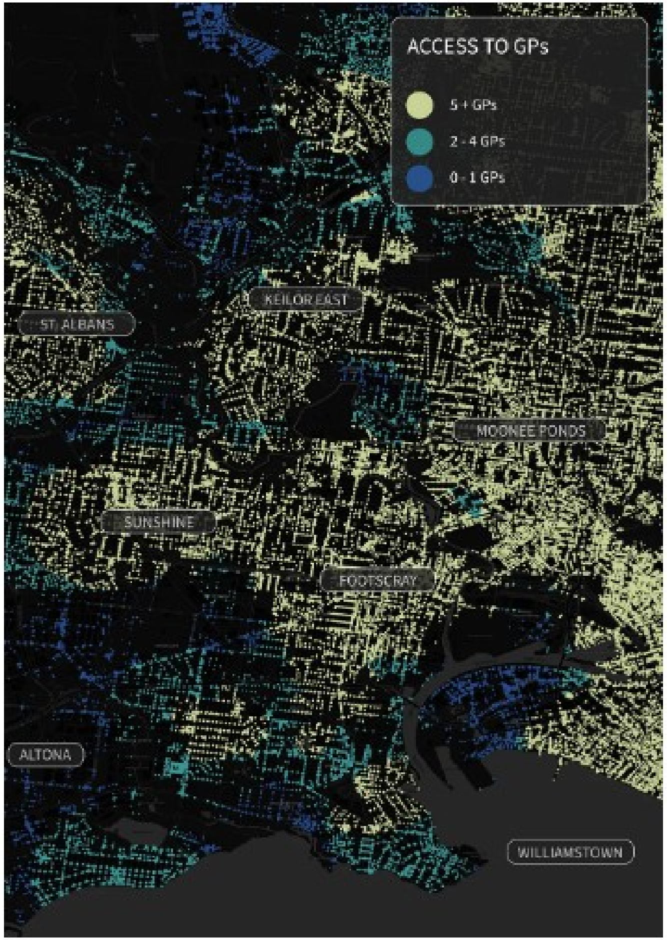


- Yellow stars: locations of childcare centres
- Service areas: 400, 800, and 1,000 metres from the centres (5-, 10-, and 15-minute walking distance
- SA1 areas: selected characteristics from ABS 2021 population census

Kerry Nice, Sachith Seneviratne, Youjin Choe, Mark Stevenson, Place-based Data Approaches: Data for analysis of spatial inequities in access to services, Life Course Centre Data For Policy Summit, Canberra, 15-16 August 2023.

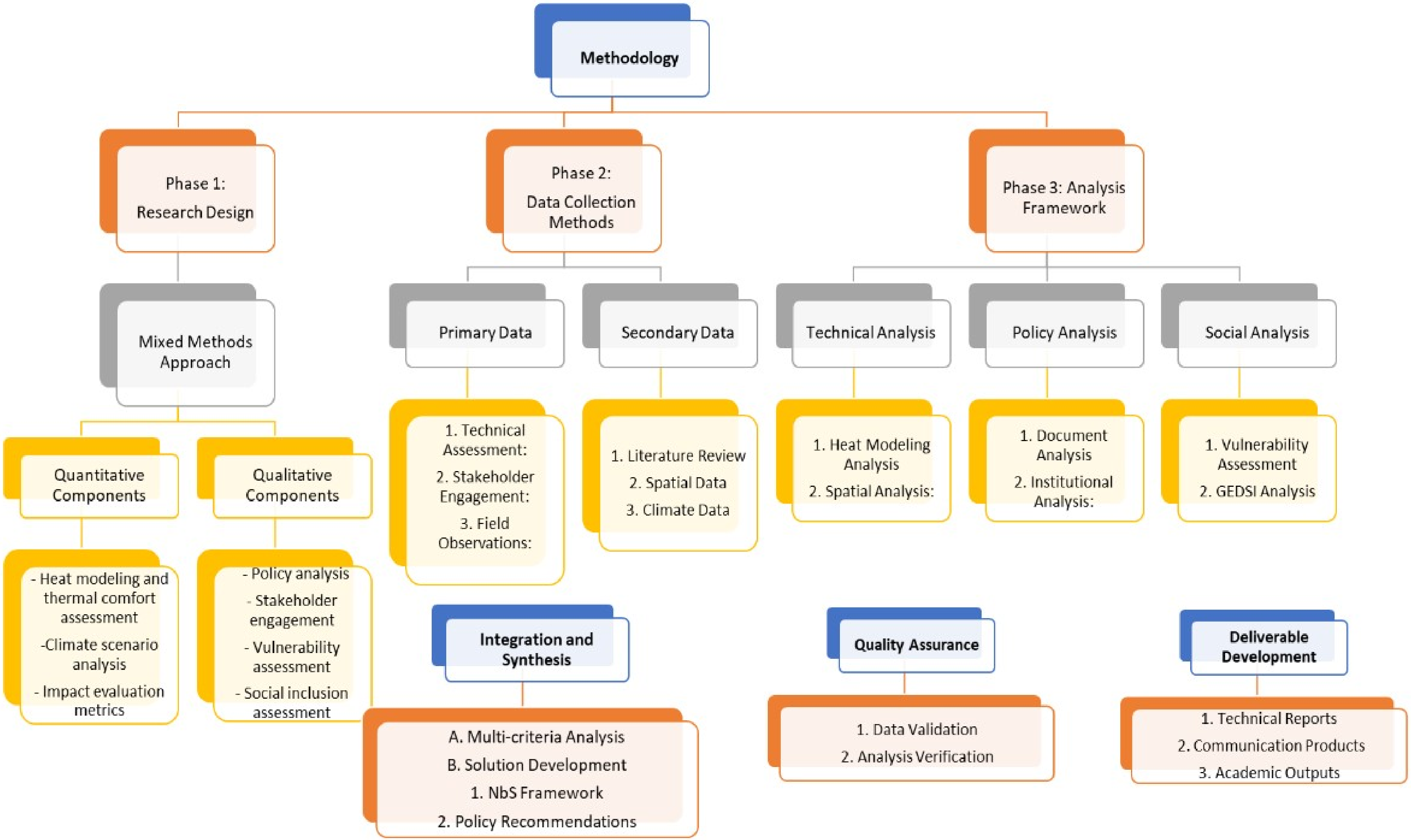
Figure 3: This shows the shortest path analysis of access to services (represented by red dots) from every intersection in the region. Grey areas have no 20-minute access, dark green areas have access to one option and light green areas can access both options.





Nice, K., Seneviratne, S., Stevenson, M., 2024. How many 20-minute neighbourhoods does Melbourne really have? University of Melbourne.

Climate sensitive urban development tools



Gupta, N., Bhatia, A., Dutta, R., Basanayake, S., Hammer, S., Demuzere, M., Nice, K., Duc, T.T., Sakkhamduang, J., 2025. Urban Heat Resilience: Bridging Science, Policy, and Sustainable Design, Flagship Report (No. 978-616-91999-4–6). Asian Disaster Preparedness Center, Bangkok, Thailand.

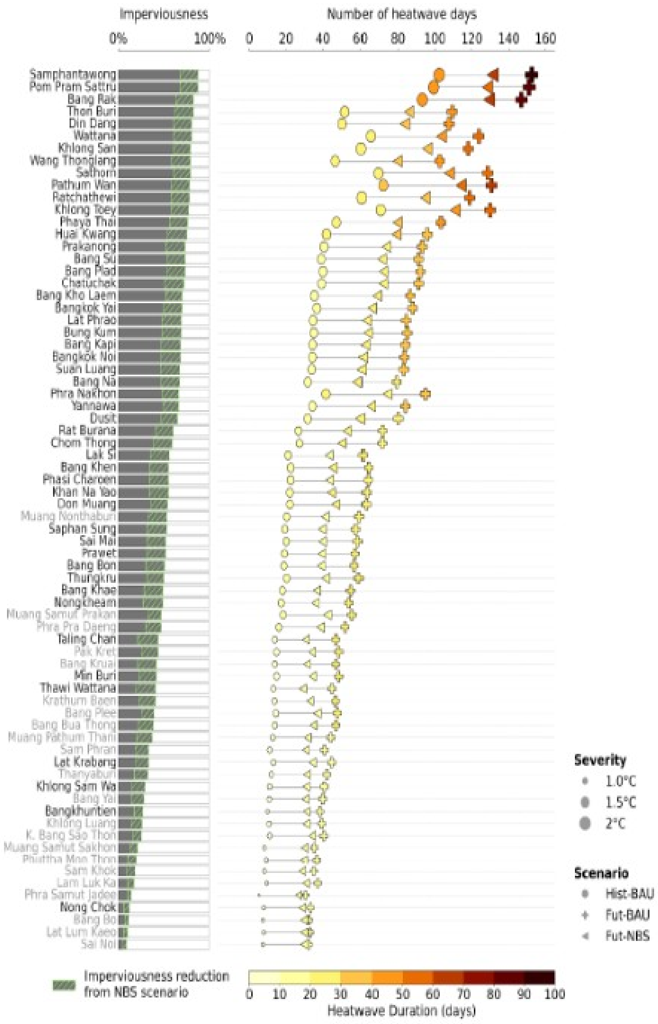
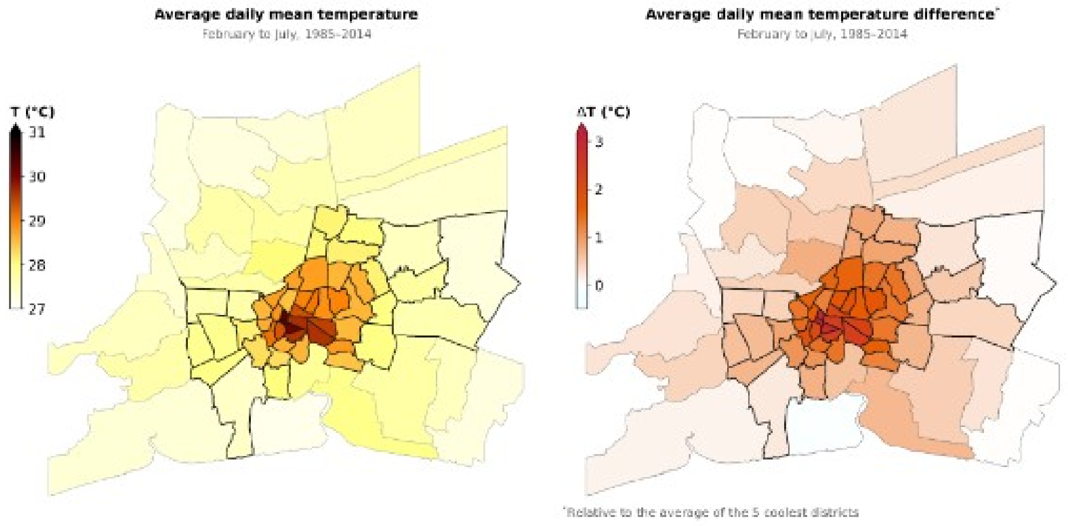


Figure 15 . Heatwave trends in Bangkok: past, future, and the NbS impact.(B-Kode, 2025)



Notes: The five coolest districts are white-colored in the right panel, and are Sai Noi (THA.36.6_1), Lat Lum Kaeo (THA.37.3_1), Phra Samut Jadee (THA.57.6_1), Bang Bo (THA.57.1_1), Nong Chok (THA.3.28_1). Values in brackets refer to the GID_2 id from the gadm database.
Source: B-Kode analysis based on TARGET simulations.

Figure 16 Central districts within the Bangkok Metropolitan area exhibit significantly higher temperatures compared to their surrounding less urbanised districts (B-Kode, 2025

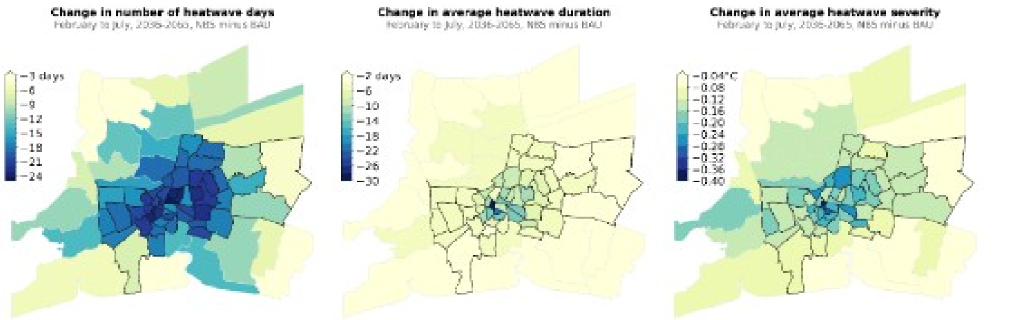


Figure 17 Extreme heatwave characteristics dampened by nature-based solutions (BKode, 2025)

Gupta, N., Bhatia, A., Dutta, R., Basanayake, S., Hammer, S., Demuzere, M., Nice, K., Duc, T.T., Sakkhamduang, J., 2025. Urban Heat Resilience: Bridging Science, Policy, and Sustainable Design, Flagship Report (No. 978-616-91999-4–6). Asian Disaster Preparedness Center, Bangkok, Thailand.

Heat Vulnerability ranking- Bangkok Districts

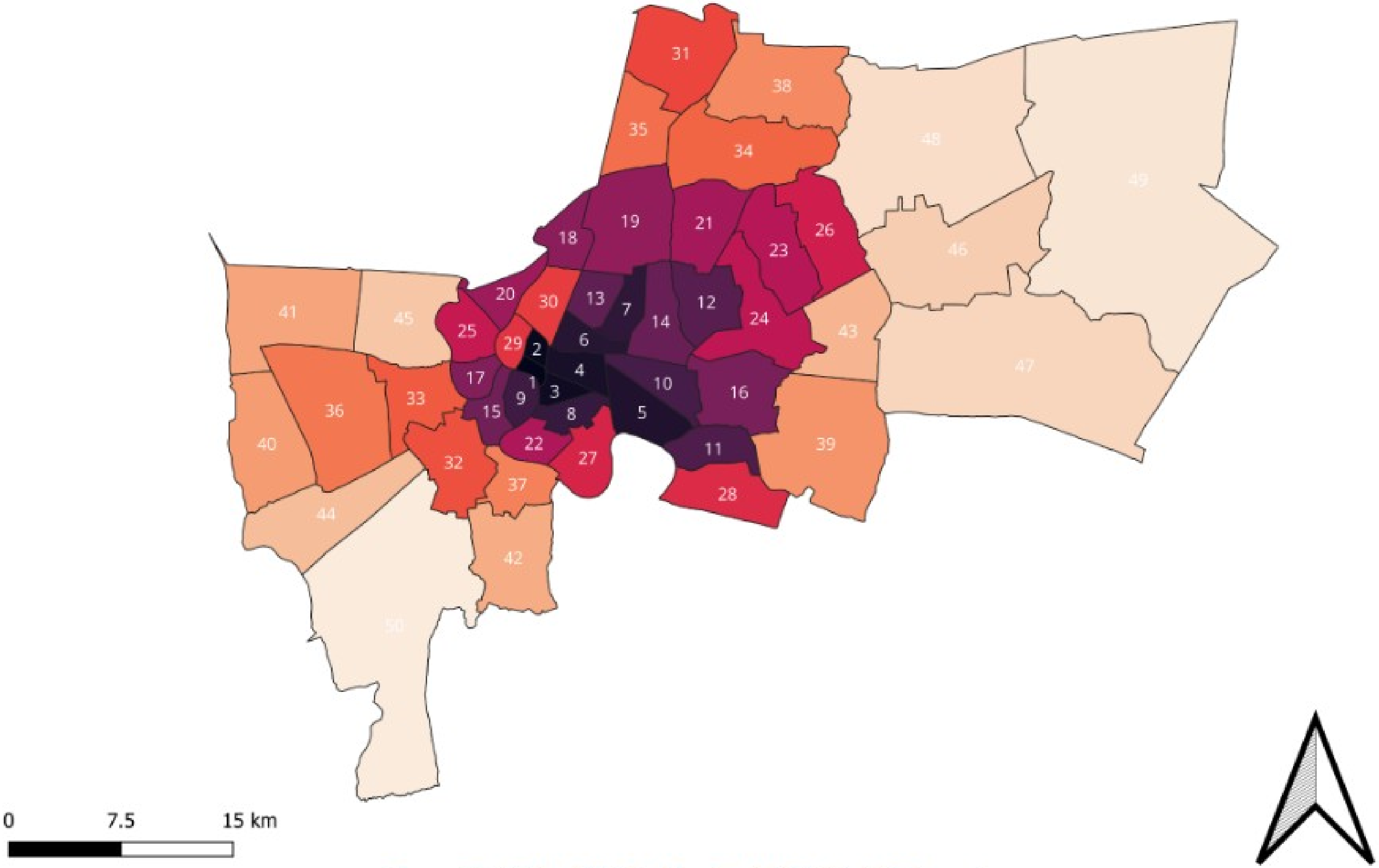


Figure 22 Heat Vulnerability Rankings Bangkok Districts (ADPC, 2025)

Gupta, N., Bhatia, A., Dutta, R., Basanayake, S., Hammer, S., Demuzere, M., Nice, K., Duc, T.T., Sakkhamduang, J., 2025. Urban Heat Resilience: Bridging Science, Policy, and Sustainable Design, Flagship Report (No. 978-616-91999-4–6). Asian Disaster Preparedness Center, Bangkok, Thailand.

3.3 CALCULATING THE RATING

The CST uses a point scoring system that reflects each Credit's relative impact on the following urban heat metrics (having regard to both day and night-time impacts):

- Neighbourhood air temperature;
- Street /allotment air temperature; and
- Street /allotment scale thermal comfort

Credit points and impact scores for each Credit are shown in Table 5.

Table 5. Summary of credits and available points and impact scores.

CATEGORY / CREDITS	CREDIT POINTS	* IMPACT SCORES 0 = NO IMPACT, 3 = HIGHEST IMPACT						TEMPORAL IMPACT SCORES 0 = NO IMPACT, 3 = HIGHEST IMPACT		
		NEIGHBOURHOOD AIR TEMP.		LOCAL AIR TEMP.		LOCAL THERMAL COMFORT		SHORT-TERM (0-10 YRS)	MID-TERM (10-20 YRS)	LONG-TERM (20+ YRS)
		DAY	NIGHT	DAY	NIGHT	DAY	NIGHT			
Urban Design Credits:										
UD1: Wind paths	3	1	1	1	1	3	3	2	2	2
UD2: Wind buffering/filtering	2	1	1	1	1	2	2	1	2	2
UD3: Street canyons	4	3	3	3	3	2	2	2	2	2
UD4: Green and blue open space	8	3	3	3	3	2	2	2	2	2
UD5: Retention of existing tree canopy	7	3	3	3	3	3	1	2	2	2
UD6: Water sensitive urban design	6	2	2	2	1	2	1	1	2	1
Cool Streets Credits:										
CS1: Shade	6	3	0	3	1	3	0	1	2	2
CS2: Irrigation	4	2	1	2	1	2	0	1	2	2
CS3: Cool and/or porous pavements	5	2	1	3	1	2	1	2	1	1
Cool Parks Credits:										
CP1: Shade	6	3	1	3	1	3	0	2	2	2
CP2: Irrigation	6	3	1	3	1	2	1	1	2	2
CP3: Cool and/or porous pavements	3	2	1	2	1	2	1	2	1	1
Cool Homes Credits:										
CH1: Site coverage	2	2	1	2	1	2	1	2	2	2
CH2 Site shade	3	2	1	3	2	3	1	2	2	2
CH3: Site irrigation	1	2	1	1	1	2	1	2	2	2
CH4: Passive cooling	2	0	0	0	0	3	2	2	2	2
CH5: Cool Roofs, green roofs and green Walls	3	2	2	2	1	0	0	2	2	2
CH6: Cool and/or porous pavements	1	1	0	2	0	2	0	2	2	2
CH7: Alternative energy supply	3	0	0	0	0	3	3	2	2	2
Cool Buildings Credits:										
CB1: Site coverage	3	2	1	2	1	2	1	2	2	2
CB2: Site shade	3	2	1	3	2	3	2	2	2	2
CB3: Site irrigation	1	2	0	1	0	2	1	2	2	2
CB4: Passive design	2	0	0	0	0	3	2	2	2	2
CB5: Cool envelope (including green roofs/walls)	2	3	3	2	2	2	2	2	2	2
CB6: Cool and/or porous pavements	1	2	1	2	1	2	1	2	2	2
CB7: Alternative energy supply	3	0	0	0	0	3	3	2	2	2
Innovative New Technology Credits:										
INV1: New technologies	5	2	2	2	2	2	2	2	2	2
INV2: Data collection	5	2	2	2	2	2	2	2	2	2

* Impact scores are for regular hot summer conditions (max day temperature < 37°C) and not for extreme heat conditions (max day temperature >37°C)

An important aspect of the CST's point scoring system is the weightings applied to the six categories of Credits. The weightings reflect the relative priority (importance) of each category of Credits in achieving the best overall urban heat resilience outcomes. The weightings are defined in the CST by the total quantum of Credit points available to each of the six category of Credits, as shown in Table 6.

Table 6. Summary of default tool category weightings and total available points per category.

CATEGORY	RELATIVE WEIGHTING OF CATEGORY	TOTAL CREDIT POINTS ALLOCATED TO CREDITS IN CATEGORY
Urban Design	30%	30
Cool Parks	15%	15
Cool Streets	15%	15
Cool Homes	15%	15
Cool Buildings	15%	15
Innovative New Technologies	10%	10
TOTAL	**100%**	**100 points**

As an example, a large-scale master planned community with design controls over the full development cycle would be in a position to implement urban heat resilience Credits across all of the six categories of Credits. If the project team decides not to implement any of the Urban Design Credits, the development would forgo 30 points (out of a possible total of 100). It is not possible for the development to "do more" in other categories to compensate. This approach reflects the high relative importance given in the CST to a well-designed urban morphology to achieve the best possible urban heat resilience outcomes for larger scale developments.

Additionally, to account for variable land use cover within a development the CST applies a weighting adjustment to the calculated performance (impact) of each Credit to reflect the relative spatial cover of land use(s) to which the Credit applies. For example, if street reserves cover 40% of the total development area, the relative performance (impact) of the Cool Streets Credits needs to be adjusted (factored up) from the default weighting of 15% in Table 5, which assumes the spatial cover of Cool Streets, Cool Parks, Cool Homes and Cool Buildings within a development are all equal. Note, this factoring only applies to the calculated Credit performance (impact) and not to the value of the Credit Points earned, the former being used by the CST to derive the Cool Suburbs Rating as described later.

The CST also considers development type and scale as a key determinant of the urban heat resilience Credits that can be directly influenced by the development and therefore which Credits should be used to rate the development.

Table 7 outlines the relationship between the development type/scale and the urban heat resilience Credits used for rating the development.

Table 7. Relationship between development type/scale and the urban heat resilience Credits used for rating the development.

DEVELOPMENT SCALE	APPLICABLE CREDIT CATEGORIES
Large precinct (>1000 lots)	All
Medium precinct (100-1000 lots)	All
Small precinct (10-100 lots)	All (except Urban Design Category)
Local (1-10 lots)	All (except Urban Design Category and Innovative New Technologies Category)
Single lot (Residential)	Cool Homes only
Single lot (Non-residential)	Cool Buildings only
Local street	Cool Streets only
Local park	Cool Parks only

Siebentritt, M., Eadie, M., Watson, T., Day, S., Tapper, N., Nice, K., Nazarian, N., Pfautsch, S., 2022. Cool Suburbs: User Guide and Science Rationale. Western Sydney Regional Organisation of Councils.

Community co-design

Workshop 1
Capturing Requirements

Goal: building a shared vision for a street greening retrofit

What are the priorities for a future street? How does the street function now and how should it function in future?

Researchers develop suite of options and technical data to support community requirements

Workshop 2
Analysing options

Goal: mapping changes in alignment with shared vision

What core elements should be included in a future street? Where should they be included and how do they align with the shared vision?

Researchers produce a new street layout, showing greening, shade and other resilience outcomes

Workshop 3
Crafting solutions

Goal: refining the design and trade-offs for maximum benefit

How should the street look in detail to deliver the desired outcomes? Can we push the design further to get more improvements?

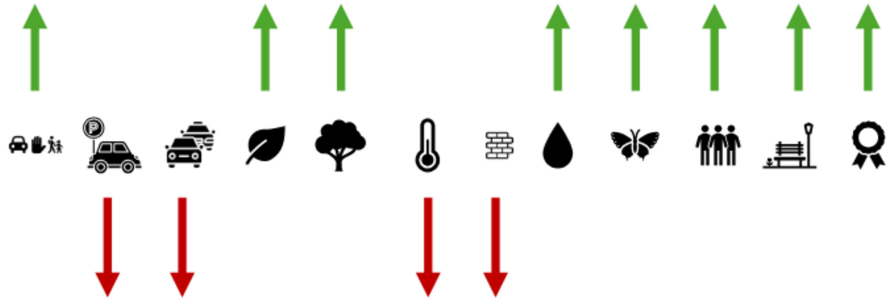
Researchers produce final, co-designed street that aligns with community vision

DURING WORKSHOP

POST WORKSHOP

BREESE STREET SHOULD BE A PLACE THAT IS...

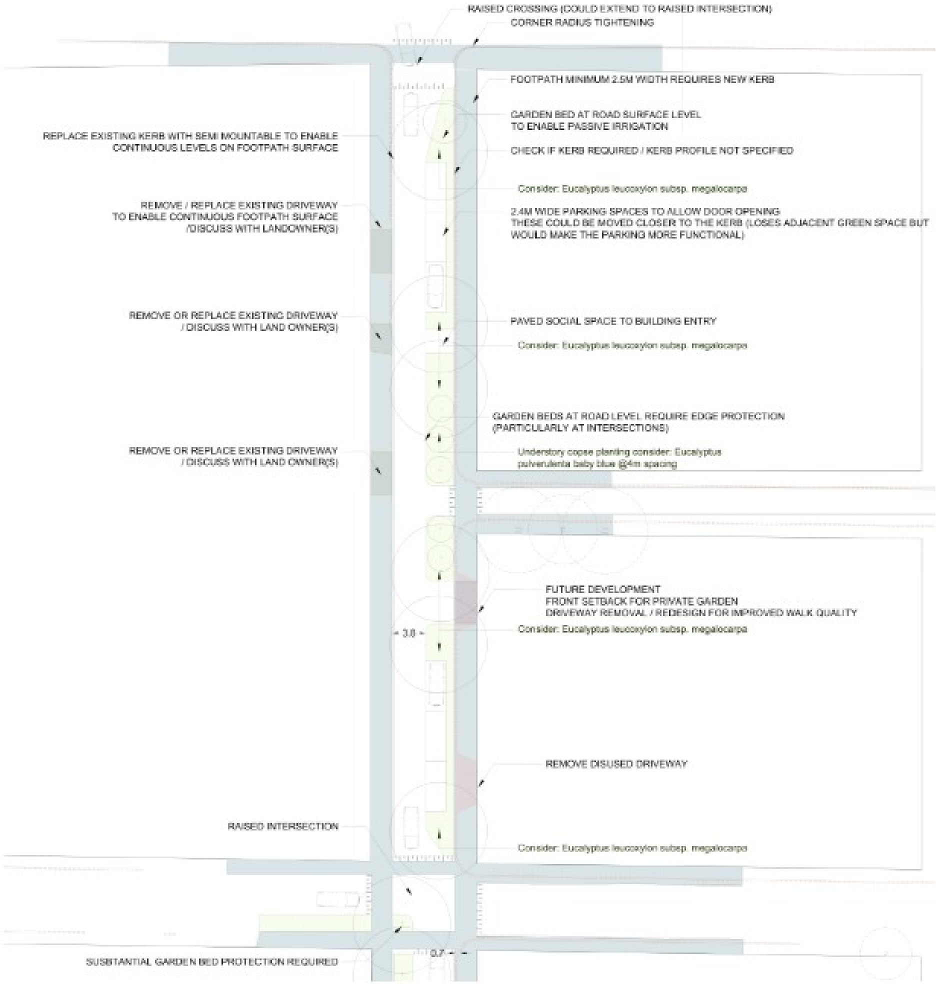
- Safe and accessible for pedestrians
- Not dominated by cars and parking
- Greener
- Tree-lined
- Shady
- Cooler
- Less concrete
- Water sensitive
- More biodiverse
- Beautiful and cared for
- A space for community
- Leading by example



ABOVE: PARTICIPANTS WORK IN GROUPS TO CRAFT THEIR FUTURE STREET

Kylie Soanes, Nano Langenheim, Marie Dade, Kerry Nice, Dom Blackham, Thami Croeser, Sarah Bell, 2025. Re-imagining Breese Street: A community co-design project. Melbourne centre for Cities, University of Melbourne.

SECTION 1: ALBION STREET (TOP) TO FLORENCE STREET (BOTTOM) INTERSECTION



SECTION 2: FLORENCE STREET (TOP) TO WEST STREET (BOTTOM) INTERSECTION.

Kylie Soanes, Nano Langenheim, Marie Dade, Kerry Nice, Dom Blackham, Thami Croeser, Sarah Bell, 2025. Re-imagining Breese Street: A community co-design project. Melbourne centre for Cities, University of Melbourne.

Urban form constraints/enabling of public health responses

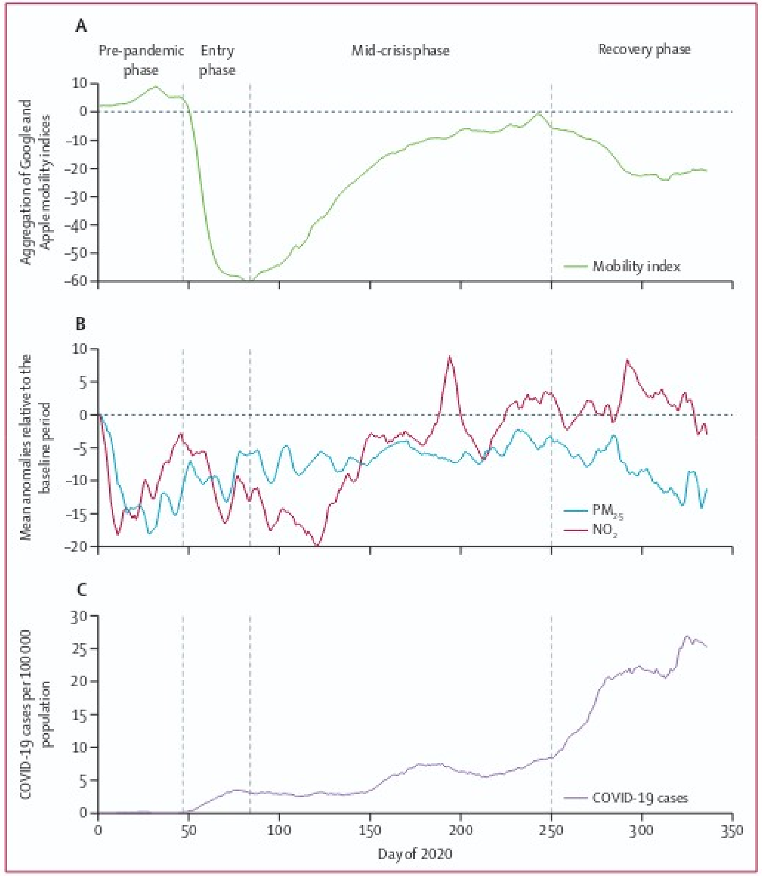
We analysed mobility and pollution data from more than 500 cities during the Covid-19 pandemic in 2020.

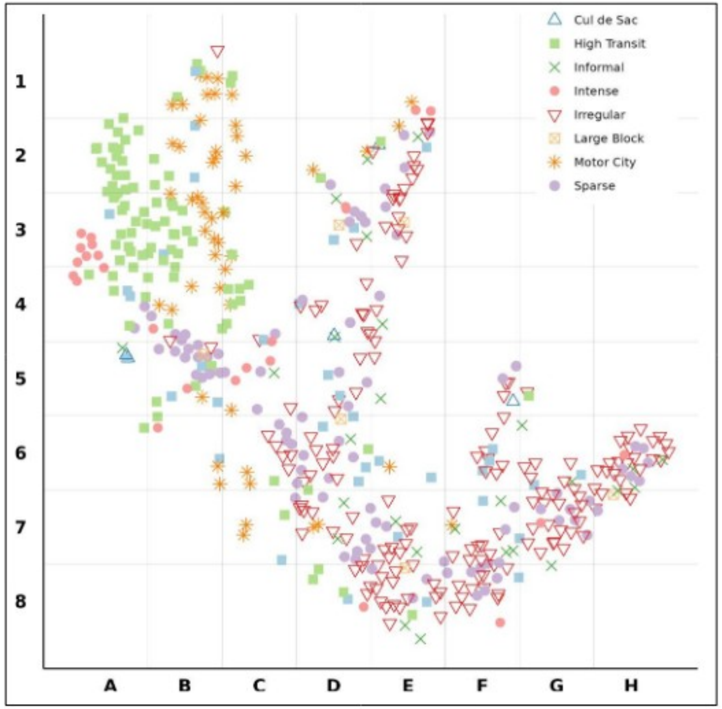
We compared trends in mobility and transport-related pollution data associated with pre-, mid-, and late-stage of the pandemic across all cities using previously identified urban design classifications.

We showed that mobility and associated transport-related air-pollution declined across all city types in the early to mid-stages of the pandemic, leading to reduced risk of chronic disease.

We show that in late 2020, levels of transport-related pollution and chronic disease risk rebounded most strongly in cities that afforded a mode shift toward private motor vehicles and away from public transit. We show this shift is also since associated with higher rates of road trauma.

We suggest that, in the face of infectious disease threats, city designs able to maintain levels of public transport and constrain growth in private vehicle use expose citizens to lower disease and transport injury risk.





Nice, K.A., Thompson, J., Zhao, H., Seneviratne, S., Zapata-Diomedi, B., Garcia, L., Hunter, R.F., Reis, R.S., Hallal, P.C., Millett, C., Wang, R., Stevenson, M., 2025. Effects of city design on transport mode choice and exposure to health risks during and after a crisis: a retrospective observational analysis. Lancet Planetary Health 9, e467-79.

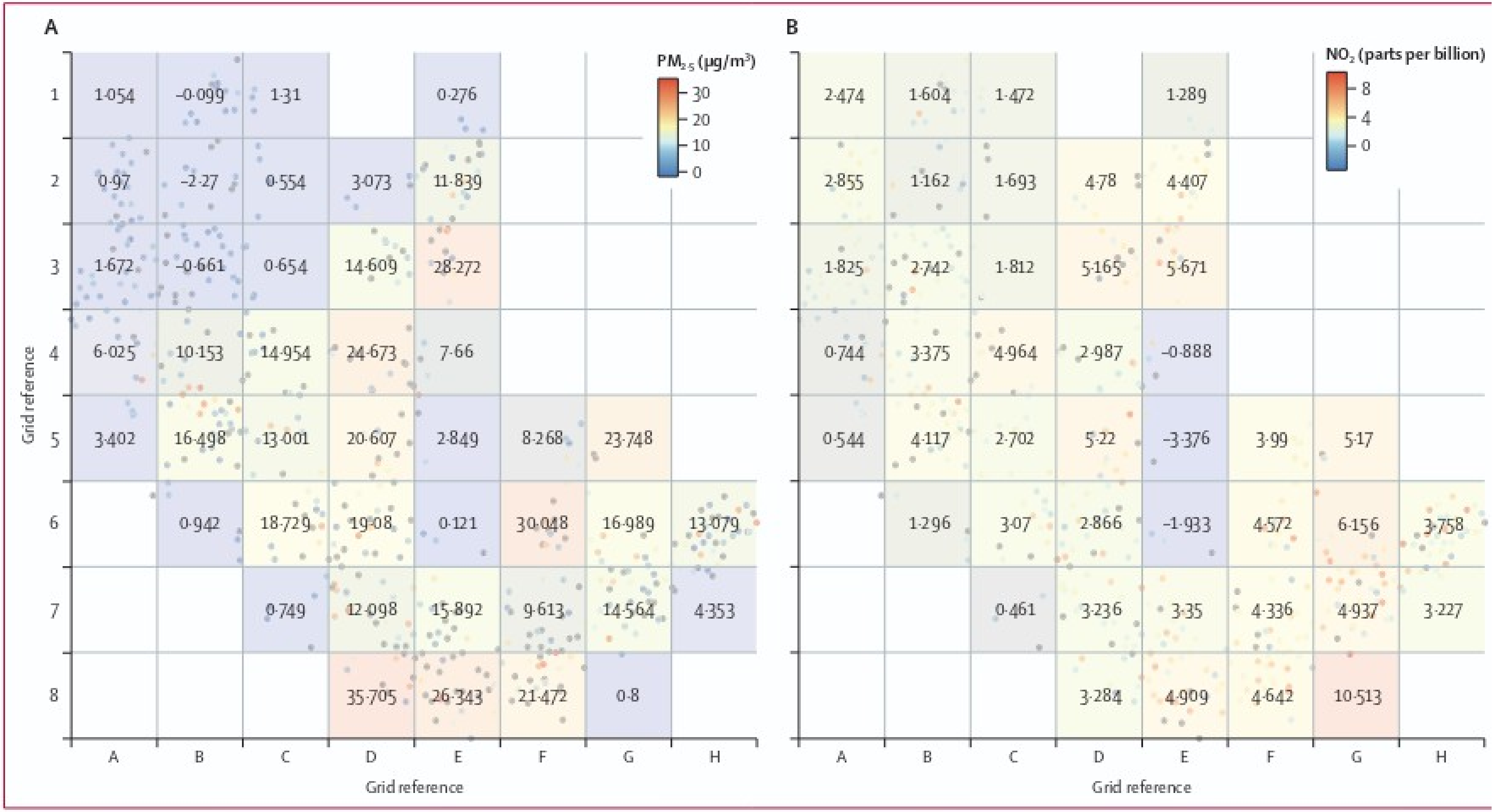


Figure 5: Mean anomalies of $PM_{2.5}$ (μg/m³; A) and NO_2 (parts per billion; B) across the period of days 84–250 in 2020 relative to the pre-pandemic baseline (ie, days 1–20 of 2020) for cities in each grid reference tile

Nice, K.A., Thompson, J., Zhao, H., Seneviratne, S., Zapata-Diomedi, B., Garcia, L., Hunter, R.F., Reis, R.S., Hallal, P.C., Millett, C., Wang, R., Stevenson, M., 2025. Effects of city design on transport mode choice and exposure to health risks during and after a crisis: a retrospective observational analysis. Lancet Planetary Health 9, e467-79.

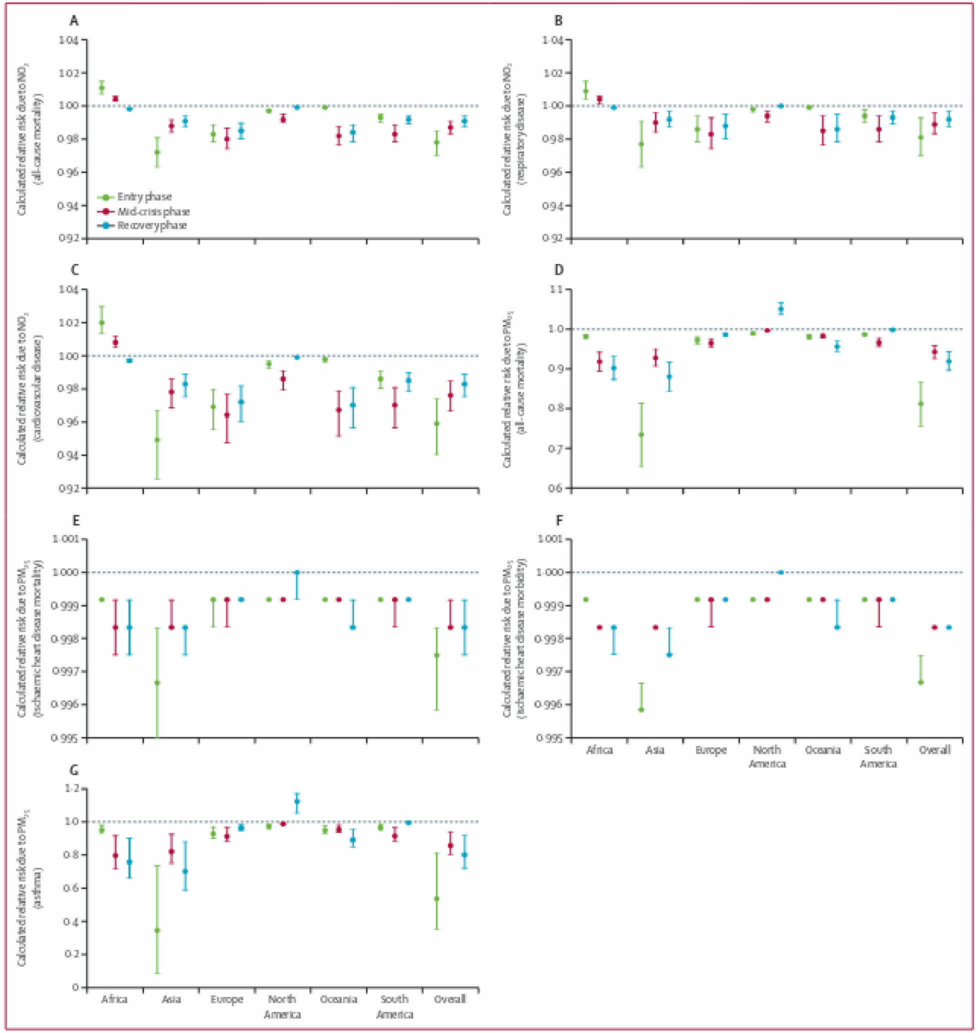


Figure 4: **Relative health risks associated with air pollution reductions across continents and pandemic phases due to NO_2 (A–C) and $PM_{2.5}$ (D–G)**

Values >1 indicate increased health risks. Bars indicate 95% CIs. NO_2=nitrogen dioxide.

Nice, K.A., Thompson, J., Zhao, H., Seneviratne, S., Zapata-Diomedi, B., Garcia, L., Hunter, R.F., Reis, R.S., Hallal, P.C., Millett, C., Wang, R., Stevenson, M., 2025. Effects of city design on transport mode choice and exposure to health risks during and after a crisis: a retrospective observational analysis. Lancet Planetary Health 9, e467-79.

Summary

- My methods have mostly been quantitative, calculate numerical values of things, quantify changes, what impact of changes on other things
- Note down what you have published/taught/presented
- Organise what you write, you will probably reuse some of it later
- Keep writing, first drafts are not perfect but that’s ok, they are something
- Keep reading, your research area will expand
- R makes the best graphs
- Worthwhile learning Latex (submitted papers do not need to look camera ready, but it doesn’t hurt)
- Version control? (git)
- Save everything locally, online stuff will disappear
- Collaborations, say yes (but also learn to say no)
- Try to focus your path, but you might not always end up where you think

Thank you

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THE UNIVERSITY OF MELBOURNE | msd Melbourne School of Design