

**AUSTRALIAN RESEARCH COUNCIL
Discovery Projects - Expression of Interest
Application for Funding Commencing in 2025**



Project ID: DPEI250100794

First Investigator: Dr Kerry Nice

Admin Org: The University of Melbourne

Total number of sheets contained in this Application: 43
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Part A - Administrative Summary (DPEI250100794)

A1. Application Title

(Provide a short title. (Up to 75 characters, approximately 10 words).)

Note – The answer to this question will auto-populate into the full application and is a locked field.)

Mapping climate (in)justice in Australian cities

A2. Person Participant Summary

(Add all named participants who will be participating in the application. These will include personnel who may be Chief Investigators (CIs) or Partner Investigators (PIs). Refer to the Grant Guidelines and the Instructions to Applicants for personnel eligibility requirements.)

Note – The answers in this question will auto-populate into the full application as a set of locked fields.)

Number	Name	Participant Type	Current Organisation(s)	Relevant Organisation
1	Dr Kerry Nice	Chief Investigator	The University of Melbourne	The University of Melbourne
2	Dr Negin Nazarian	Chief Investigator	The University of New South Wales	The University of New South Wales
3	A/Prof Fiona Johnson	Chief Investigator	The University of New South Wales	The University of New South Wales
4	Prof Jason Byrne	Chief Investigator	University of Tasmania	University of Tasmania

A3. Organisation Participant Summary

(Add all organisations participating in this application. Refer to the Instructions to Applicants for further information.)

Note – The answer to this question will auto-populate into the full application and is a locked field.)

Number	Name	Participant Type
1	The University of Melbourne	Administering Organisation
2	The University of New South Wales	Other Eligible Organisation
3	University of Tasmania	Other Eligible Organisation

A4. Application Summary

(Provide an Application Summary, focusing on the aims, significance, expected outcomes and benefits of this project. Write the Application Summary simply, clearly and in plain English. If the application is successful, the Application Summary, along with the National Interest Test, will be used to give the general community an understanding of the research. Avoid the use of acronyms, quotation marks and upper-case characters. Refer to the Instructions to Applicants for further information. (Up to 750 characters, approximately 100 words).)

Note – The answer to this question will auto-populate into the full application and is a locked field.)

Urbanisation exacerbates climate hazards, particularly excess heat and flooding. This magnifies climate injustice in cities, where high-risk areas coincide with vulnerable populations lacking adequate resources to adapt. There are, however, critical gaps in accurate, multi-hazard mapping of climate risks and injustice in Australian cities. This project will address this gap by precisely mapping hazards and vulnerabilities in urban areas using advanced methods, including novel datasets and machine learning. By understanding the spatial dynamics, it seeks to reveal the impact of urban-induced climate hazards and support equitable adaptation strategies under present-day conditions as well as future urbanisation and climate scenarios.

A5. Field of Research

(Select up to 3 (6-digit) classification codes that relate to the application. Note that the percentages must total 100.

Note – The answer to this question will auto-populate into the full application and is a locked field.)

Code	Percentage
330410 - Urban analysis and development	20
410103 - Human impacts of climate change and human adaptation	60
420602 - Health equity	20

Part B - Participant Details including ROPE (Dr Kerry Nice)

B1. Personal Details

(To update Personal Details, click the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure you 'Refresh' the page to capture the changes made to your profile.

Note - The date of birth, country of birth, and Indigenous status will not appear in the PDF version of the form and will not be visible to assessors. Data may be shared with other Commonwealth Entities. All information contained in Part B is visible to the Administering Organisation on this application.

Note - The answers to questions B1 – B16 will auto-populate into the full application and will be locked fields.)

Participation Type

Chief Investigator

Title

Dr

First Name

Kerry

Middle Name

Alan

Family Name

Nice

B2. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
08/03/2017	Doctoral Degree	Doctor of Philosophy	Science	Monash University	Australia
13/10/2011	Masters Degree	Master of Environment and Sustainability	Geography	Monash University	Australia
31/05/1990	Bachelor Degree	Bachelor degree	English and Film Studies	University of Colorado at Boulder	United States of America

B3. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2024 to 2030 inclusive.)

Uploaded PDF file follows on next page.

Description (All named investigators on any application or grant/fellowship in which the candidate is involved, project title, source of support, scheme and round)	Same Research Area (Yes/No)	Support Status (Requested/Curent/Past)	Application Project ID (for NHMRC applications only)	2024 \$'00	2025 \$'00	2026 \$'00	2027 \$'00	2028 \$'00	2029 \$'00	2030 \$'00
2023, GC22011 Hort Innovation: Re-imagining streets with green infrastructure, Professor Sarah Bell (UoM), Dr Kerry Nice (UoM), Dr Nano Langenheim (UoM), Dr Marie Dade (UoM), Thami Croeser (RMIT), Dom Blackham (Mosaic Insights)	Yes	C		783	783					
2023, UoM – CNRS Graduate Research Projects Scheme 2023-2024, Climate benefits and tradeoffs of urban greening: evaluation and impact of management practices at parkscape and streetscape, UoM: Prof. Stephen Livesley, Dr. Kerry Nice, Dr. Paul Cheung, CNRS: Pr Pierre-Emmanuel Bournet, Dr. Sophie Herpin, Pr Patrice Cannavo	Yes	R			30	30	30			
2023, NHMRC 2023 Global Alliance for Chronic Diseases. Air pollution and non-communicable disease: City-wide implementation to reduce transport emissions. Prof. Mark Stevenson (UoM), A/Prof. Cuong Viet Pham (Hanoi University of Public Health), A/Prof. Jason Thompson (UoM), Dr. Dang Ngoc Tran (University of Medicine and Pharmacy at Ho Chi Minh City), Dr. Kerry Nice (UoM), Dr. Thanh Ho (UoM), Dr. Nhung Thi Trang Nguyen (Hanoi University of Public Health).	Yes	R			513	513	513			

B4. What will your time commitment be to research activities related to this project?

(Enter your time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.3

B5. Employment Details as at grant commencement date

(Confirm your employment status at all organisations that you will be associated with as at the grant commencement date. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of Melbourne	Yes	Employee	1

B6. Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as of 1 January 2025. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in B5 for this question to validate.)

Relevant Organisation

The University of Melbourne

B7. Currently held ARC Projects

(This information is automatically populated from RMS. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

Identifier	Investigators	Admin Organisation	Project Title	Funding	End Date	Final Report Due Date	Final Report Status
DP210102089	A/Prof Ben Beck ; Prof Christopher Pettit ; A/Prof Meead Saberi ; Dr Simone Zarpelon Leao ; Dr Kerry Nice ; Prof Tarek Sayed ; Prof Trisalyn Nelson ; A/Prof Meghan Winters	Monash University	Sustainable mobility: city-wide exposure modelling to advance bicycling	\$422,000	10/08/2024	10/08/2025	Draft

B8. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract	Employment	Start Date	End Date	Organisation
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		Type	Type			
Research Fellow	Faculty of Architecture, Building and Planning	Permanent	Full Time	01/01/2022		The University of Melbourne
Research Fellow	Faculty of Architecture, Building and Planning	Contract	Full Time	14/11/2016	31/12/2021	The University of Melbourne
Research Fellow	School of Earth Atmosphere and Environment	Contract	Part Time	01/04/2019	31/12/2020	Monash University
Research Fellow	School of Earth Atmosphere and Environment	Contract	Part Time	14/06/2017	31/12/2018	Monash University
Research Assistant	School of Earth, Atmosphere and Environment	Contract	Part Time	01/06/2012	01/10/2016	Monash University
Doctoral Researcher	School of Earth, Atmosphere and Environment	Contract	Full Time	01/04/2012	01/08/2016	Monash University
Practical session teaching/lecturing	School of Earth, Atmosphere and Environment	Contract	Part Time	01/08/2013	01/11/2015	Monash University

B9. Research Opportunity and Performance Evidence (ROPE) - Career Interruptions

(You must read the ROPE Statement <https://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-roppe-statement> before filling out this section. The following fields will not be visible to assessors: From when; To when; FTE of career interruption and Interruption category. RMS will automatically calculate the total career interruption in the field 'Total Period of Career Interruptions which will be visible to assessors.)

Has the participant experienced a significant interruption that has impacted on research opportunity?

No

Total Period of Career Interruptions

B10. Research Opportunity and Performance Evidence (ROPE) - Career Highlights

(Include up to 10 career highlights including a short context statement for each highlight, where relevant (up to 1,500 characters, approximately 200 words).)

1. PhD thesis resulting in the VTUF-3D model, one of the few micro-scaled urban models to include the influence of urban vegetation (published in Urban Clim)
2. Collaborations to develop the TARGET and UT&C urban models (both published in Geosci Model Dev), both highly cited and widely used by academics and consultants.
3. High profile evaluation (QJR Meteorol Soc) of my models in the Urban Plumber urban land surface model

- intercomparison project
4. Supervision of PhD students in using irrigation of urban vegetation for urban heat mitigation (and four publications)
 5. Devised computer vision methods to generate urban modelling input from street view imagery (published in Urban Climate), using neural networks to assess global pollution reductions during COVID-19 (published in Atmos Pollut Res) and impacts of urban design on public health (Lancet Planetary Health)
 6. Numerous consultancies using my urban heat expertise for AU Dept. Agriculture, WSROC, Qld DES, ACT, VIC State government
 - 7, Recipient of the 2016 Graham Treloar Early Career Researcher Fellowship
 8. Chief Investigator on 2020 NHMRC/UKRI Build Environment and Prevention scheme for computer vision and public health, 2021 ARC Discovery for computer vision and cycling infrastructure, and 2023 Hort Innovation Tender for urban redesign using green infrastructure.
 9. Service on Graduate Research Subcommittee for Melbourne School of Design
 10. 13 years as a senior level software engineer in industry

B11. Research Opportunity and Performance Evidence (ROPE) - Details of participant's career and contributions to the field, including evidence of high-quality outputs, collaboration and excellence in research training and mentoring (where appropriate).

(Provide details of the participant's research impact and contributions. This should not include information provided elsewhere in the application (up to 1,500 characters, approximately 200 words).)

I am internationally recognised expert in urban climate modelling, especially in examining heat mitigation strategies at neighbourhood and household scales utilising the cooling benefits of vegetation and water, and in assessing human thermal stress in increasingly overheated cities. This expertise is evidenced by numerous requests for reviews of publications, consultancies utilising my urban heat knowledge, invited and other presentations at international climate conferences, and my wide range of publications in Q1 journals with a large network of researchers across multiple fields.

I have developed three urban climate models through my career, actively maintaining them, and assisting both established researchers and emerging students around the world in their use and in making further improvements. State and local governments are currently utilising my research and my advice to formulate appropriate public health measures and urban planning recommendations.

I have secured \$2.8 million in research income through competitive grants, enabling my research to expand, bringing new innovative methods (machine learning/computer vision) into climate research as well the impacts of urban systems on public health and on spatial disadvantage.

I have supervised 3 PhD students (2 completions), 1 visiting CSC PhD, 10 Masters of IT, and 1 honours student. As a senior member of my research lab (Transport, Health and Urban Systems), I serve as a mentor to some of the junior members.

B12. Research Opportunity and Performance Evidence (ROPE) - How many PhDs, Masters and Honours students that the participant has supervised have completed their degree?

(Provide total numbers under each category for completions where you have been the principal supervisor.)

PhD student completions as principal supervisor:

2

Masters student completions as principal supervisor:

0

Honours student completions as principal supervisor:

1

B13. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context - Provide clear information that explains the relative importance of the participant's research outputs in disciplinary context. This can include publication and citation metrics and other content relevant to the discipline (up to 1,500 characters, approximately 200 words).)

My model development and climate science research has been mostly (92%) published in acclaimed Q1 journals. This is evidence of my expertise in designing, building, and use of local and micro-scale models that account for urban surface energy balances, influence of blue green infrastructure, and processes of urban hydrology and vegetation physiology.

My urban heat knowledge has been utilised in a number of government consultations and planning reports through the Department of Agriculture, Water and the Environment (DAWES), the Western Sydney Regional Organisation of Councils (WSROC) Cool Suburbs Rating and Accreditation tool, urban heat analysis for the Queensland Department of Environment and Science (DES), and urban heat assessments for the Victorian government's Fishermans Bend Urban Ecology Strategy.

I have presented my research at 19 international conferences (3 of those as invited talks). My research has also been featured in 13 collaborative presentations at 10 international conferences (1 invited talk).

My 31 peer reviewed publications also include research in the use of machine learning, computer vision, and generative AI in analysing climate data, generating modelling data, or in modelling the impacts on public health of other urban factors (i.e. transportation systems or urban structures). This range of both specific urban climate knowledge combined with the ability to use a wide range of innovative techniques will be of high importance in this project.

B14. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide up to 10 research outputs and provide clear information regarding the research impact of the researcher's chosen career-best outputs. Mark the research outputs that are most relevant to this project categorised under the following headings: Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs and preprints or comparable resources). CVs and theses should not be included in this list. Each text box allows up to 150 characters, approximately 20 words annotation per output.)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Kerry A. Nice, Andrew M. Coutts & Nigel J. Tapper 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*, vol. 24, pp. 1052–1076, doi:10.1016/j.uclim.2017.12.008 (Refereed Journal Article)

Research Outputs Annotation Describes climate model I developed, one of the few that examines cooling impacts of blue-green infrastructure at a micro-climate scale. (IF: 6.4)

[2] * Naika Meili, Gabriele Manoli, Paolo Burlando, Elie Bou-Zeid, Winston T. L. Chow, Andrew M. Coutts, Edoardo Daly, Kerry A. Nice, Matthias Roth & Nigel J. Tapper et al. 2020, 'An urban ecohydrological model to quantify the effect of vegetation on urban climate and hydrology (UT&C v1.0)', *Geoscientific Model Development*, vol. 13, no. 1, pp. 335–362, doi:10.5194/gmd-13-335-2020 (Refereed Journal Article)

Research Outputs Annotation Urban climate model I contributed to the development, local scaled with advanced hydrology and vegetation modelling. Highly cited. (IF: 5.2)

[3] * Ashley M. Broadbent, Andrew M. Coutts, Kerry A. Nice, Matthias Demuzere, E. Scott Krayenhoff, Nigel J. Tapper & Hendrik Wouters 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*, vol. 12, no. 2, pp. 785–803, doi:10.5194/gmd-12-785-2019 (Refereed Journal Article)

Research Outputs Annotation Local scaled climate model I co-developed and maintain, to allow quick assessments of the air temperature impacts of water and vegetation. (IF: 5.2)

[4] * Cheung, Pui Kwan, Jim, C.Y., Tapper, Nigel, Nice, Kerry A. & Livesley, Stephen J. 2022, 'Daytime irrigation leads to significantly cooler private backyards in summer', *Urban Climate*, vol. 46, pp. 101310, doi:10.1016/j.uclim.2022.101310 (Refereed Journal Article)

Research Outputs Annotation Describing my research into urban cooling effects of irrigation of vegetation at a household scale. (IF: 6.4)

[5] * Naserikia, Marzie, Hart, Melissa A., Nazarian, Negin, Bechtel, Benjamin, Lipson, Mathew & Nice, Kerry A. 2023, 'Land surface and air temperature dynamics: The role of urban form and seasonality', *Science of The Total Environment*, vol. 905, pp. 167306, doi:10.1016/j.scitotenv.2023.167306 (Refereed Journal Article)

Research Outputs Annotation The relationship between satellite measured land surface temperatures and ground level air temperatures, informs method for this project. (IF: 10.9)

[6] * Kerry A. Nice, Negin Nazarian, Mathew J. Lipson, Melissa A. Hart, Sachith Seneviratne, Jason Thompson, Marzie Naserikia, Branislava Godic & Mark Stevenson 2022, 'Isolating the impacts of urban form and fabric from geography on urban heat and human thermal comfort', *Building and Environment*, vol. 224, pp. 109502, doi:10.1016/j.buildenv.2022.109502 (Refereed Journal Article)

Research Outputs Annotation Utilising VTUF-3D to model 10,000 urban configurations to comprehensively assess impacts of morphologies and material types on urban heat. (IF: 7.9)

[7] * Jasper S. Wijnands, Kerry A. Nice, Sachith Seneviratne, Jason Thompson & Mark Stevenson 2022, 'The impact of the COVID-19 pandemic on air pollution: A global assessment using machine learning techniques', *Atmospheric Pollution Research*, vol. 13, no. 6, pp. 101438, doi:10.1016/j.apr.2022.101438 (Refereed Journal Article)

Research Outputs Annotation Machine learning to quantify changes in air pollution (NO₂, O₃, PM_{2.5}, PM₁₀) due to COVID-19 in 800 cities. Informs method for this project. (IF: 4.9)

[8] Kerry A. Nice, Jasper S. Wijnands, Ariane Middel, Jingcheng Wang, Yiming Qiu, Nan Zhao, Jason Thompson, Gideon D.P.A. Aschwanden, Haifeng Zhao & Mark Stevenson 2020, 'Sky pixel detection in outdoor imagery using an adaptive algorithm and machine learning', *Urban Climate*, vol. 31, pp. 100572, doi:10.1016/j.uclim.2019.100572 (Refereed Journal Article)

Research Outputs Annotation Extracting sky view factors from imagery of urban areas can help provide this parameter for urban climate research and urban modelling. (IF: 6.4)

[9] Jason Thompson, Mark Stevenson, Jasper S Wijnands, Kerry A Nice, Gideon DPA Aschwanden, Jeremy Silver, Mark Nieuwenhuijsen, Peter Rayner, Robyn Schofield & Rohit Hariharan et al. 2020, 'A global analysis of urban design types and road transport injury: an image processing study', *The Lancet Planetary Health*, vol. 4, no. 1, pp. e32–e42, doi:10.1016/s2542-5196(19)30263-3 (Refereed Journal Article)

Research Outputs Annotation Utilising neural networks to discover urban typologies from maps of 1700 global cities and discovering how urban design impacts road trauma. (IF: 9.4)

[10] * Lipson, Mathew J., Grimmond, Sue, Best, Martin, Abramowitz, Gab, Coutts, Andrew, Tapper, Nigel, Baik, Jong-Jin, Beyers,

Meiring, Blunn, Lewis & Boussetta, Souhail et al. 2023, 'Evaluation of 30 urban land surface models in the <scp>Urban-PLUMBER</scp> project: Phase 1 results', *Quarterly Journal of the Royal Meteorological Society*, doi:10.1002/qj.4589 (Refereed Journal Article)

Research Outputs Annotation High profile intercomparison of 30 urban land surface models, including my models VTUF-3D and TARGET. (IF: 9.8)

B16. Partner Investigator – upload a CV in no more than one A4 page

(Provide a CV of up to one A4 page relevant to the project noting that Partner Investigators are not required to complete Research Opportunity and Performance Evidence (ROPE) questions B10 to B14. The PDF should not include qualifications, current and previous appointment(s)/position(s), employment or career interruptions as this will be automatically populated from your profile at questions B2, B8 and B9.)

No PDF file uploaded.

Part B - Participant Details including ROPE (Dr Negin Nazarian)

B1. Personal Details

(To update Personal Details, click the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure you 'Refresh' the page to capture the changes made to your profile.

Note - The date of birth, country of birth, and Indigenous status will not appear in the PDF version of the form and will not be visible to assessors. Data may be shared with other Commonwealth Entities. All information contained in Part B is visible to the Administering Organisation on this application.

Note - The answers to questions B1 – B16 will auto-populate into the full application and will be locked fields.)

Participation Type

Chief Investigator

Title

Dr

First Name

Negin

Middle Name

Family Name

Nazarian

B2. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
20/07/2022	Certificate IV	Certificate in Executive Management and Development (CEMD)	The Authentic Communicator: Activating Presence	University of New South Wales	Australia
28/09/2021	Certificate IV	Certificate in Executive Management and Development (CEMD)	Relationship Networking Program (RNP)	University of New South Wales	Australia
26/04/2021	Certificate IV	Certificate of Completion	Beyond Smart Cities: Emerging Design and Technology	Massachusetts Institute of Technology	United States of America
01/02/2020	Certificate IV	Certificate of Completion	Machine Learning in Python for Environmental Science	American Meteorological Society (AMS)	United States of America
30/12/2015	Doctoral Degree	Doctorate of Philosophy	Engineering Science	University of California San Diego	United States of America

01/06/2012	Masters Degree	Master of Science	Engineering Science	University of California San Diego	United States of America
01/06/2011	Bachelor Degree	Bachelor of Science	Mechanical Engineering	University of Tehran	Iran

B3. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2024 to 2030 inclusive.)

Uploaded PDF file follows on next page.

Funding from non-ARC sources

Description (All named investigators on any application or grant/ fellowship in which a participant is involved, project title, source of support, scheme and round)	Same Research Area (Yes/No)	Support Status (Requested/Current/Past)	Application ID (NHMRC applications only)	2024 (\$'00 0)	2025 (\$'00 0)	2026 (\$'00 0)	2027 (\$'00 0)	2028 (\$'00 0)	2029 (\$'00 0)	2030 (\$'00 0)
Mathew, S., Klerck, M., Wakerman, J., Brearley, M., Hart, M., Nazarian, N., Maharaj, A. "Air in Alice: a community response to reduce future environmental risks", Citizen Science Grants, Department of Industry, Science, Energy and Resources, Sep 2021 - 2024.	Y	C	N/A	166						
Nazarian, N., Pettit, C. "CAPS: Clean Air Project Sydney - Smart Sensing for Improved Ventilation, Air Quality, and Performance in Buildings", City of Sydney Council, 2022-2023	N	C	N/A	50						
Nazarian N., Hart, M., Australia-Germany Joint Research Co-operation Scheme "Global Analysis of Spatio-temporal Variability in Surface Urban Heat", 2023 - 24	Y	C	N/A	25						
Paolini, R., Pfautsch S., Nazarian N., Hart, M., WSU-UNSW Project Mezze partnership seed funding "Too hot to play: quantifying the impacts of urban climate change on playground activity", 2023 - 24.	N	C	N/A	25						
Mathew, S., Klerck, M., Hart, M., Nazarian, N., Maharaj, A. "Air in East Arnhem: Crowdsourcing Air Quality, Temperature, and Health Data with Yolngu Citizen Scientists", MRFF Indigenous Health, 2024 - 26.	Y	C	N/A	260	260	260				

B4. What will your time commitment be to research activities related to this project?

(Enter your time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.2

B5. Employment Details as at grant commencement date

(Confirm your employment status at all organisations that you will be associated with as at the grant commencement date. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of New South Wales	Yes	Employee	1

B6. Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as of 1 January 2025. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in B5 for this question to validate.)

Relevant Organisation

The University of New South Wales

B7. Currently held ARC Projects

(This information is automatically populated from RMS. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

Identifier	Investigators	Admin Organisation	Project Title	Funding	End Date	Final Report Due Date	Final Report Status
CE170100023	Prof Andrew Pitman ; Prof Lisa Alexander ; Prof Michael Reeder ; A/Prof Gabriel Abramowitz ; Prof Nerilie Abram ; Prof Julie Arblaster ; Prof Dietmar Dommengeset ; Prof Jason Evans ; Prof Andrew Hogg ; Prof Neil Holbrook ; Prof Todd Lane ; Prof Steven Sherwood ; Prof Peter Strutton ; Dr Elizabeth Ebert ; Dr Simon Marsland ; Dr Richard Matear ; Dr Alain Protat ; Dr Yingping Wang ; Dr Matthew Wheeler ; Mr	The University of New South Wales	ARC Centre of Excellence for Climate Extremes	\$30,050,000	31/12/2024	31/12/2025	Draft

	Martin Best ; Dr Sandrine Bony ; Dr Wojciech Grabowski ; Dr Stephen Griffies ; Prof Dr Nicolas Gruber ; Prof Hoshin Gupta ; Dr Robert Hallberg ; Dr Cathy Hohenegger ; A/Prof Reto Knutti ; Dr Gerald Meehl ; Mr Sean Milton ; Dr Nathalie de Noblet-Ducoudré ; Dr Jon Petch ; Dr Christa Peters- Lidard ; A/Prof Joellen Russell ; Dr Joseph Santanello ; Prof Dr Sonia Seneviratne ; Prof Dr Bjorn Stevens ; Dr Peter Stott ; Dr Rachel Law ; A/Prof Ali Behrangi ; Prof Craig Bishop ; A/Prof Andrea Taschetto ; Prof Sarah Perkins- Kirkpatrick ; Dr Ailie Gallant ; Dr Amelie Meyer ; Dr Claire Vincent ; Dr Andrew Marshall ; Dr Callum Shakespeare ; Dr Negin Nazarian ; Dr Anna Ukkola ; Dr Yi Huang ; Dr Kate Saunders ; Dr Martin Singh ; Ms Vilia Co ; Dr Nicola Maher					
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B8. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Scientia Senior Lecturer	School of Built Environment	Contract	Full Time	01/07/2021		The University of New South Wales
Scientia Lecturer	School of Built Environment	Contract	Full Time	18/07/2018	01/07/2021	The University of New South Wales
SMART	Singapore-MIT	Contract	Full Time	08/01/2016	17/05/2018	Massachusetts Institute

Scholar	Alliance for Research and Technology					of Technology
Graduate Research Associate	Department of Mechanical and Aerospace Engineering	Contract	Part Time	01/09/2011	15/12/2015	University of California, San Diego
Graduate Research Associate	Department of Atmospheric Compositions	Contract	Part Time	01/10/2014	01/02/2015	Centro de Investigaciones Energeticas Medioambientales y Tecnologicas

B9. Research Opportunity and Performance Evidence (ROPE) - Career Interruptions

(You must read the ROPE Statement <https://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rop-statement> before filling out this section. The following fields will not be visible to assessors: From when; To when; FTE of career interruption and Interruption category. RMS will automatically calculate the total career interruption in the field 'Total Period of Career Interruptions which will be visible to assessors.)

Has the participant experienced a significant interruption that has impacted on research opportunity?

No

Total Period of Career Interruptions

B10. Research Opportunity and Performance Evidence (ROPE) - Career Highlights

(Include up to 10 career highlights including a short context statement for each highlight, where relevant (up to 1,500 characters, approximately 200 words).)

1. Scoping author for IPCC Special Report on Climate Change & Cities, the only SR planned in 7th Assessment report & likely the sole contribution to the second Global Stocktake
2. 2023 Timothy Oke Award for Original Research in Urban Overheating (highest achievement for early-career urban climatologists)
3. First ECR and PoC Chair of the largest urban climate gathering (Intl Conference on Urban Climate). ICUC11 at UNSW brought together >650 delegates
4. Only ECR Associate Editor of leading Urban Climate journal in 2021. Contributed to peer-review of 110+ scholarly outputs in 3 years
5. Appointed to the National Committee for Earth System Science, developing the ten-year national priorities for urban climate projections in Australia.
6. Elected Chair of the Urban Environment Board at the American Meteorological Society, serving as a focal point for disseminating and supporting urban climate research globally
7. Appointed to GAW Urban Research Meteorology and Environment at the World Meteorological Organization (GURME), helping enhance global capabilities in urban pollution research
8. Appointed as Chief Investigator at the ARC Centre of Excellence for Climate Extremes for continuous contribution to understanding extremes in cities
9. Cohort 8 of Homeward Bound, a ground-breaking, global leadership initiative, set against the backdrop of Antarctica, empowering women in environmental decision-making
10. UNSW Gender Equity Champion with substantial input on university policies

B11. Research Opportunity and Performance Evidence (ROPE) - Details of participant's career and contributions to the field, including evidence of high-quality outputs, collaboration and excellence in research training and mentoring (where appropriate).

(Provide details of the participant's research impact and contributions. This should not include information provided elsewhere in the application (up to 1,500 characters, approximately 200 words).)

I am internationally recognised as an emerging leader in my field, evidenced by the Timothy Oke Award for original research in urban heat. Leading UNSW's renowned Climate-Resilient Cities lab, my expertise spans urban physics, numerical modelling, and data science, enabling translational research in urban climate. I led a global effort to develop the first integrated framework for urban overheating and in 2021, our modelling work directly improved air temperature predictions in regional models. As a pioneer in urban climate informatics, I leveraged wearables for early heat stress detection and quantifying lifestyle impacts for the first time. My expertise is recognised by World Meteorological Organization, co-authoring and reviewing various reports including global guidance on urban heat modeling and monitoring. Nationally, I've contributed scientific reports to government bodies, including the NSW Chief Scientist and Engineer. Further, I hold leadership roles in the American Meteorological Society (Chair of the Urban Board) and the International Association of Urban Climate. I've supervised 6 PhD students at UNSW (3 completions) and 2 internationally, with students earning prestigious awards from intl organizations. Additionally, I've overseen 5 post-docs, 12 research assistants and scholars, including an NHMRC fellow. Lastly, I mentor early-career female academics with notable success (two securing USyd Horizon Fellowship and one Assistant Professor at the Pratt Institute).

B12. Research Opportunity and Performance Evidence (ROPE) - How many PhDs, Masters and Honours students that the participant has supervised have completed their degree?

(Provide total numbers under each category for completions where you have been the principal supervisor.)
PhD student completions as principal supervisor:

3

Masters student completions as principal supervisor:

4

Honours student completions as principal supervisor:

0

B13. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context - Provide clear information that explains the relative importance of the participant's research outputs in disciplinary context. This can include publication and citation metrics and other content relevant to the discipline (up to 1,500 characters, approximately 200 words).)

My research has been published in acclaimed journals in the fields of meteorology, urban climatology, and built environment, with the vast majority (85%) appearing in Q1 journals including Journal of Advances in Modeling Earth Systems (IF: 8.469), Earth's Future (IF: 8.2), Geoscientific Model Development (IF: 6.9), Environmental Research Letters (IF: 6.7), and Scientific Reports (IF: 5.0). I have been particularly successful in maintaining a high number of publications in top journals without jeopardizing the quality and impact of research, demonstrated by the high citation counts and Field-Weighted Citation Index (FWCI) of my publications. Since 2015 (date of first publication) I have published 34 peer-reviewed articles, two book chapters, 8 scientific reports for international and national government and private agencies, and currently have 4 preprints under review. Among these, 45% are first-author contributions, while another 22% represent the work done by students and postdocs under my supervision. This is highly regarded in the field of urban climatology and built environment, as it provides evidence of critical thinking and leadership in various aspects of project design, implementation, and result interpretation. My average FWCI between 2015-2022 is 3.6, indicating that on average my articles are cited 3.6 times the world average in my field, and article FWCI ranges from 1.2-19. I have 2 articles ranked in the top 1% and 12 articles in the top 10% cited.

B14. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide up to 10 research outputs and provide clear information regarding the research impact of the researcher's chosen career-best outputs. Mark the research outputs that are most relevant to this project categorised under the following headings: Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs and preprints or comparable resources). CVs and theses should not be included in this list. Each text box allows up to 150

characters, approximately 20 words annotation per output.)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * N. Nazarian, E. S. Krayenhoff, B. Bechtel, D. M. Hondula & R. Paolini et al. 2022, 'Integrated Assessment of Urban Overheating Impacts on Human Life', *Earth's Future*, vol. 10, no. 8, doi:10.1029/2022ef002682 (Refereed Journal Article)

Research Outputs Annotation Established 1st integrated framework for urban overheating impacts, leading review across 10 sub-fields through discussions among 17 global experts

[2] Nazarian, N., Acero, J.A. & Norford, L. 2019, 'Outdoor thermal comfort autonomy: Performance metrics for climate-conscious urban design', *Building and Environment*, vol. 155, pp. 145-160 (Refereed Journal Article)

Research Outputs Annotation A novel framework to translate climate model outputs into practical metrics & guideline maps for architects & planners, simplifying design decisions

[3] * Lipson, M.J., Nazarian, N., Hart, M.A., Nice, K.A. & Conroy, B. 2022, 'A Transformation in City-Descriptive Input Data for Urban Climate Models', *Frontiers in Environmental Science*, vol. 10 (Refereed Journal Article)

Research Outputs Annotation An open access building morphology dataset for Australian Cities that enables regional climate models to accurately represent city characteristics

[4] * Middel, A., Nazarian, N., Demuzere, M. & Bechtel, B. 2022, 'Urban Climate Informatics: An Emerging Research Field', *Frontiers in Environmental Science*, vol. 10 (Refereed Journal Article)

Research Outputs Annotation Establishing the field of urban climate informatics, revolutionising urban climate analyses by deploying innovative sensing, datasets, and analytics

[5] Nazarian, N., Liu, S., Kohler, M., Lee, J.K.W. & Miller, C. et al. 2021, 'Project Coolbit: Can your watch predict heat stress and thermal comfort sensation?', *Environmental Research Letters*, vol. 16, no. 3 (Refereed Journal Article)

Research Outputs Annotation Early detection of heat stress achieved through innovative wearables, also presenting the 1st quantification of heat impact on activity and lifestyle

[6] * Julia Potgieter, Negin Nazarian, Mathew J. Lipson, Melissa A. Hart & Giulia Ulpiani et al. 2021, 'Combining High-Resolution Land Use Data With Crowdsourced Air Temperature to Investigate Intra-Urban Microclimate', *Frontiers in Environmental Science*, vol. 9, doi:10.3389/fenvs.2021.720323 (Refereed Journal Article)

Research Outputs Annotation Demonstrating how citizen weather stations can be a major boon to health monitoring and urban planning in Australian Cities

[7] * Nice, K.A., Nazarian, N., Lipson, M.J., Hart, M.A. & Seneviratne, S. et al. 2022, 'Isolating the impacts of urban form and fabric from geography on urban heat and human thermal comfort', *Building and Environment*, vol. 224 (Refereed Journal Article)

Research Outputs Annotation Demonstrating how non-linear changes in urban form and fabric can change urban heat exposure in Australian cities

[8] * Marzie Naserikia, Melissa A. Hart, Negin Nazarian & Benjamin Bechtel 2022, 'Background climate modulates the impact of land cover on urban surface temperature', *Scientific Reports*, vol. 12, no. 1, doi:10.1038/s41598-022-19431-x (Refereed Journal Article)

Research Outputs Annotation Providing a global analysis of land surface temperature and its spatial variability based on urban form and fabric

[9] * Krayenhoff, E.S., Jiang, T., Christen, A., Martilli, A. & Oke, T.R. et al. 2020, 'A multi-layer urban canopy meteorological model with trees (BEP-Tree): Street tree impacts on pedestrian-level climate', *Urban Climate*, vol. 32 (Refereed Journal Article)

Research Outputs Annotation Ranked as "top 1% cited" in the field, it provides one of the most comprehensive representation of street trees to date

[10] * Martilli, A., Krayenhoff, E.S. & Nazarian, N. 2020, 'Is the Urban Heat Island intensity relevant for heat mitigation studies?', *Urban Climate*, vol. 31 (Refereed Journal Article)

Research Outputs Annotation Challenging the most common indicator (mis)used in the field, Urban Heat Island, offering critical assessment of when/how it should be used or avoided

B16. Partner Investigator – upload a CV in no more than one A4 page

(Provide a CV of up to one A4 page relevant to the project noting that Partner Investigators are not required to complete Research Opportunity and Performance Evidence (ROPE) questions B10 to B14. The PDF should not include qualifications, current and previous appointment(s)/position(s), employment or career interruptions as this will be automatically populated from your profile at questions B2, B8 and B9.)

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Part B - Participant Details including ROPE (A/Prof Fiona Johnson)

B1. Personal Details

(To update Personal Details, click the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure you 'Refresh' the page to capture the changes made to your profile.

Note - The date of birth, country of birth, and Indigenous status will not appear in the PDF version of the form and will not be visible to assessors. Data may be shared with other Commonwealth Entities. All information contained in Part B is visible to the Administering Organisation on this application.

Note - The answers to questions B1 – B16 will auto-populate into the full application and will be locked fields.)

Participation Type

Chief Investigator

Title

A/Prof

First Name

Fiona

Middle Name

Family Name

Johnson

B2. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
14/12/2010	Doctoral Degree	PhD	Civil Engineering	University of New South Wales	Australia
21/05/2002	Bachelor Degree	Bachelor of Engineering (Honours)	Civil Engineering	University of New South Wales	Australia

B3. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2024 to 2030 inclusive.)

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B3: Funding from non-ARC sources

Funding from non-ARC sources										
Description (All named investigators on any application or grant/fellowship in which a participant is involved, project title, source of support, scheme and round)	Same Research Area (Yes/No)	Support Status (Requested/Current/Past)	Application /Project ID (for NHMRC applications only)	2024 \$'000	2025 \$'000	2026 \$'000	2027 \$'000	2028 \$'000	2029 \$'000	2030 \$'000
CI's Johnson, Liu, Tamburic, Marshall, Glamore, WaterRA, "Satellite remote sensing for the calibration of the WaterNSW Integrated Water Quality Model"	N	C	n/a	80						
CI Boer, Gallagher, Gill, James, Keith, Price. Sharples, Weir, Johnson et al., NSW Government, "NSW Bushfire and Natural Hazards Research Centre"	Y	C	n/a	1,565	1,698	1,660	1,615			
CI Johnson, Ball, Cinque, Huber, NSSN Grand Challenge, "Flood height predictions for western	Y	C	n/a	120						

NSW catchments”										
CI Johnson, Higgins, NSW DPE “Paleo informed climate scenarios for water management”	N	C	n/a	94						
CI Johnson, Gallant, CIN Sensing for Disasters	Y	R	n/a	36						

B4. What will your time commitment be to research activities related to this project?

(Enter your time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.2

B5. Employment Details as at grant commencement date

(Confirm your employment status at all organisations that you will be associated with as at the grant commencement date. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of New South Wales	Yes	Employee	1

B6. Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as of 1 January 2025. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in B5 for this question to validate.)

Relevant Organisation

The University of New South Wales

B7. Currently held ARC Projects

(This information is automatically populated from RMS. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

Identifier	Investigators	Admin Organisation	Project Title	Funding	End Date	Final Report Due Date	Final Report Status
IC190100031	Prof Rutger Vervoort ; Prof Lucy Marshall ; Prof Fabio Ramos ; Prof Glenda Wardle ; Prof Dacheng Tao ; Prof Robert Kohn ; A/Prof Edward Cripps ; Dr Mark Lindsay ; Prof Jody Webster ; A/Prof Tristan Salles ; A/Prof Fiona Johnson ; Dr Rohitash Chandra ; Dr Aaron Greenville ; Prof Mark Jessell ; Prof Mark Girolami ; Dr Milan Korbelt ; Mr Jeffrey Bell	The University of Sydney	ARC Training Centre in Data Analytics for Resources and Environments (DARE)	\$3,973,202	25/08/2025	25/08/2026	Draft

	; Dr Karol Czarnota ; Dr Lesley Gibson ; Mr Neil Symington ; A/Prof Minh-Ngoc Tran ; A/Prof Tongliang Liu ; Prof Matthew Cleary ; Dr Clara Grazian ; Prof Judy Kay ; Dr Sahani Pathiraja ; Ms Carolyn Robinson ; Dr Lisa Hamilton ; Prof David Warton ; Prof John Close ; Prof Dr Subhas Mukhopadhyay ; Mr Joel Fossilo ; Dr Bryony Horton						
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B8. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Associate Professor	School of Civil and Environmental Engineering	Permanent	Part Time	03/07/2023		The University of New South Wales
Associate Professor	School of Civil and Environmental Engineering	Permanent	Full Time	31/12/2022	30/06/2023	The University of New South Wales
Associate Professor	School of Civil and Environmental Engineering	Permanent	Part Time	01/01/2020	31/12/2022	The University of New South Wales
Senior Lecturer	School of Civil and Environmental Engineering	Permanent	Full Time	01/01/2019	31/12/2019	The University of New South Wales
Senior Lecturer	School of Civil and Environmental Engineering	Permanent	Part Time	01/07/2016	31/12/2018	The University of New South Wales
Senior Lecturer	School of Civil and Environmental Engineering	Permanent	Full Time	01/07/2015	30/06/2016	The University of New South Wales

Lecturer	School of Civil and Environmental Engineering	Permanent	Full Time	17/09/2012	30/06/2015	The University of New South Wales
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B9. Research Opportunity and Performance Evidence (ROPE) - Career Interruptions

(You must read the ROPE Statement <https://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-robe-statement> before filling out this section. The following fields will not be visible to assessors: From when; To when; FTE of career interruption and Interruption category. RMS will automatically calculate the total career interruption in the field 'Total Period of Career Interruptions which will be visible to assessors.)

Has the participant experienced a significant interruption that has impacted on research opportunity?

Yes

Total Period of Career Interruptions

Researcher A/Prof Fiona Johnson has reported a career interruption of 3 years and 4 months since 2015.

B10. Research Opportunity and Performance Evidence (ROPE) - Career Highlights

(Include up to 10 career highlights including a short context statement for each highlight, where relevant (up to 1,500 characters, approximately 200 words).)

1. Elected as a Fellow of Modelling and Simulation Society of Australia (2023) and New Zealand and Fellow of Engineers Australia (2021) for contributions to modelling and water engineering.
2. 2023 invited presentations - Global Flood Partnership meeting (Singapore), European Centre for Mid Range Weather forecasting and UK Met Office, demonstrating international expertise relevant to the project.
3. Appointed as an independent hydrological adviser to the Victorian Department of Energy, Environment and Climate (2021-2024) to provide oversight on the second Victorian Water and Climate Initiative
4. Recognised expertise in flood and rainfall extremes through peer review consultancies e.g. InfrastructureNSW, Sunwater.
5. Appointed as a Scientia Associate Professor at UNSW due to research strength and leadership.
6. Editor in Chief for the Journal of Humanitarian Engineering (2020-), Associate Editor for Journal of River Basin Management (2017-2023), International Advisory Board for Journal of Climate Change and Water
7. Director of the UNSW Water Research Centre since 2023, deputy director since 2021.
8. Developed the bias correction approach (206 citations) adopted by the Bureau of Meteorology for Australia wide climate projections of water availability.
9. Led hydrological input to IFD design rainfalls used across Australia in industry through Australian Rainfall and Runoff.
10. Invited to present at Juukan Gorge senate inquiry on best practice environmental assessments.

B11. Research Opportunity and Performance Evidence (ROPE) - Details of participant's career and contributions to the field, including evidence of high-quality outputs, collaboration and excellence in research training and mentoring (where appropriate).

(Provide details of the participant's research impact and contributions. This should not include information provided elsewhere in the application (up to 1,500 characters, approximately 200 words).)

CI Johnson has internationally recognised expertise in rainfall extremes, flood hazards and humanitarian engineering. She was appointed as the Climate and Weather extremes node co-leader of the NSW government funded Bushfire and Natural Hazard Research Centre (2023-2028), highlighting her expertise in flood hazard research and leading a program of 10 masters projects to provide future workforce capability to the NSW government. She is currently collaborating with the State Emergency Service to provide information on flood wave timing and its uncertainty to allow SES to better manage flood response logistics. CI Johnson ability to deliver practical research project outcomes is demonstrated by the Australian BoM contracting CI Johnson's team in 2019 to collaborate on bias correcting climate projections for Australia at 5 km resolution as part of the Australian Water Outlook product which is now publicly available from the BoM. CI Johnson is best known for her research in designing methods to remove biases to enable impact relevant climate change assessments to be undertaken. CI Johnson has supervised 12 PhD candidates to completion (5 as primary supervisor, 7 as joint or co-supervisor)

since commencing as an academic in 2012. CI Johnson is currently supervising 6 research students (5 PhD and 1 MPhil) and is the primary supervisor for 4 of these students. CI Johnson is currently mentoring 4 postdoctoral researchers and has mentored a further 5 during her career.

B12. Research Opportunity and Performance Evidence (ROPE) - How many PhDs, Masters and Honours students that the participant has supervised have completed their degree?

(Provide total numbers under each category for completions where you have been the principal supervisor.)
PhD student completions as principal supervisor:

5

Masters student completions as principal supervisor:

5

Honours student completions as principal supervisor:

25

B13. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context - Provide clear information that explains the relative importance of the participant's research outputs in disciplinary context. This can include publication and citation metrics and other content relevant to the discipline (up to 1,500 characters, approximately 200 words).)

CI Johnson has published 80 journal articles, 5 book chapters and 21 conference papers. Her H-index is 26 (Scopus, 31/1/2024) with more than 3100 citations. Over 90% of her publications are in the top 10% of journals and 10 of her publications are in the top 10% most cited publications.

The convention in her discipline is that the PhD student or Research Associate is the first author and the PhD supervisors are listed after this with no particular difference between the position of the second and third authors. For multi-author review papers, the first author generally has led the work, with substantial input from the second author and all others listed alphabetically.

CI Johnson have a relatively high number of conference presentations which reflects the time she spent working in industry, specifically at the Bureau of Meteorology, where the primary focus of the work was on developing industry relevant rainfall products. Therefore disseminating these outcomes at the Hydrology and Water Resources Symposium, the leading Australian conference for practicing water engineers was vital. The industry relevance of her continued research is demonstrated by her honours students publishing and presenting at this conference as well. CI Johnson has also published several conference papers on Humanitarian Engineering education to help build a network of practitioners and scholars in this young discipline.

B14. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide up to 10 research outputs and provide clear information regarding the research impact of the researcher's chosen career-best outputs. Mark the research outputs that are most relevant to this project categorised under the following headings: Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs and preprints or comparable resources). CVs and theses should not be included in this list. Each text box allows up to 150 characters, approximately 20 words annotation per output.)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] Johnson, F. & Sharma, A. 2012, 'A nesting model for bias correction of variability at multiple times scales in general circulation model precipitation simulations', *Water Resources Research*, vol. 48, pp. W01504, doi:10.1029/2011WR010464 (Refereed Journal Article)

Research Outputs Annotation Influential method for bias correction that has been widely adopted internationally in research and practice (FWCI 5.76)

[2] Westra, S., Fowler, H. J., Evans, J. P., Alexander, L. V. & Berg, P. et al. 2014, 'Future changes to the intensity and frequency of short-duration extreme rainfall', *Rev. of Geophysics*, vol. 52, no. 3, pp. 522-555 (Refereed Journal Article)

Research Outputs Annotation First paper to holistically examine changes to sub-daily rainfall extremes which are vital to understand flood hazard in urban areas (FWCI 6.92)

[3] Stephens, C.M., Johnson, F.M. & Marshall, L.A. 2018, 'Implications of future climate change for event-based hydrologic models', *Advances in Water Resources*, vol. 119, pp. 95-110 (Refereed Journal Article)

Research Outputs Annotation This work showed the impact of pre-event moisture and hydrological model structure on flood predictions under climate change (FWCI 2.37)

[4] Wasko, C., Sharma, A. & Johnson, F. 2015, 'Does storm duration modulate the extreme precipitation-temperature scaling relationship?', *Geophysical Research Letters*, vol. 42, no. 20, pp. 8783-8790, DP150100411 (2015-2018) (Refereed Journal Article)

Research Outputs Annotation Highly cited paper examining changes in rainfall extremes related to storm duration which is vital to understand for flood hazard (FWCI 3.22)

[5] Johnson, F., White, C.J., van Dijk, A., Ekstrom, M. & Evans, J.P. et al. 2016, 'Natural hazards in Australia: floods', *Climatic Change*, vol. 139, no. 1, pp. 21-35, DP150100411 (2015-2018) (Refereed Journal Article)

Research Outputs Annotation Highly cited paper on flood risk in Australia and developed a research agenda identifying flood research gaps under climate change (FWCI 2.68)

[6] Kim, S., Liu, Y., Johnson, F.M., Parinussa, R.M. & Sharma, A. 2015, 'A global comparison of alternate AMSR2 soil moisture products: Why do they differ?', *Remote Sensing of Environment*, vol. 161, pp. 43-62, DP140102394 (2014-2017) (Refereed Journal Article)

Research Outputs Annotation First paper to consider the differences in remotely sensed soil moisture algorithms (FWCI 5.34)

[7] Stephens, C.M., McVicar, T.R., Johnson, F.M. & Marshall, L.A. 2018, 'Revisiting Pan Evaporation Trends in Australia a Decade on', *Geophysical Research Letters*, vol. 45, no. 20, pp. 11,164-11,172, LP150100548 (2015-2018) (Refereed Journal Article)

Research Outputs Annotation Important paper revising the pan evaporation paradox and showing that decreasing trends had mainly reversed (FWCI 2.38)

[8] Earl, Eleanor, Johnson, Fiona, Marshall, Lucy & Sanderson, David 2023, 'A critical review of Natural Flood Management application and spatial prioritisation approaches in tropical island catchments', *Science of The Total Environment*, vol. 878, pp. 162776, doi:10.1016/j.scitotenv.2023.162776 (Refereed Journal Article)

Research Outputs Annotation First paper to identify gaps in Natural Flood Management in the Pacific particularly around modelling and user acceptance of these flood options

[9] Johnson, F. & Sharma, A. 2009, 'Measurement of GCM skill in predicting variables relevant for hydroclimatological assessments', *Journal of Climate*, vol. 22, no. 16, pp. 4373-4382, doi:10.1175/2009JCLI2681.1 (Refereed Journal Article)

Research Outputs Annotation Highly cited paper showing that rainfall projections from climate models are highly uncertain (FWCI 2.74)

[10] Pham, H.T., Marshall, L., Johnson, F. & Sharma, A. 2018, 'Deriving daily water levels from satellite altimetry and land surface temperature for sparsely gauged catchments: A case study for the Mekong River', *Remote Sensing of Environment*, vol. 212, pp. 31-46, DP140102394 (2014-2017) (Refereed Journal Article)

Research Outputs Annotation Model to improve flood information in sparsely gauged areas using satellite data (FWCI 1.76)

B16. Partner Investigator – upload a CV in no more than one A4 page

(Provide a CV of up to one A4 page relevant to the project noting that Partner Investigators are not required to complete Research Opportunity and Performance Evidence (ROPE) questions B10 to B14. The PDF should not include qualifications, current and previous appointment(s)/position(s), employment or career interruptions as this will be automatically populated from your profile at questions B2, B8 and B9.)

No PDF file uploaded.

Part B - Participant Details including ROPE (Prof Jason Byrne)

B1. Personal Details

(To update Personal Details, click the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure you 'Refresh' the page to capture the changes made to your profile.

Note - The date of birth, country of birth, and Indigenous status will not appear in the PDF version of the form and will not be visible to assessors. Data may be shared with other Commonwealth Entities. All information contained in Part B is visible to the Administering Organisation on this application.

Note - The answers to questions B1 – B16 will auto-populate into the full application and will be locked fields.)

Participation Type

Chief Investigator

Title

Prof

First Name

Jason

Middle Name

Antony

Family Name

Byrne

B2. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
19/12/2007	Doctoral Degree	PhD	Geography	University of Southern California	United States of America
19/12/2007	Bachelor Honours Degree, Graduate Certificate, Graduate Diploma	Graduate Certificate	Geographic Information Science	University of Southern California	United States of America
15/12/2004	Bachelor Honours Degree, Graduate Certificate, Graduate Diploma	Graduate Certificate	Environmental Science, Policy and Engineering Sustainable Cities	University of Southern California	United States of America
16/12/1998	Bachelor Honours Degree, Graduate Certificate, Graduate Diploma	Bachelor of Arts (Hons.)	Urban and Regional Planning	Curtin University	Australia
07/03/1991	Bachelor Honours Degree, Graduate Certificate, Graduate Diploma	Bachelor of Arts (Hons.)	Anthropology	University of Western Australia	Australia

B3. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2024 to 2030 inclusive.)

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B3. Research Load (non-ARC Grants and Research)

Funding from non-ARC sources

Description (All named investigators on any application or grant/fellowship in which the participant is involved, project title, source of support, scheme, and round)	Same Research Area (Yes(Y)/No(N))	Support Status (Requested (R) /Current (C)/ Past (P))	Application/Project ID (for NHMRC applications only)	2024 \$'000	2025 \$'000	2026 \$'000	2027 \$'000	2028 \$'000	2029 \$'000	2030 \$'000
Flies E, Sahajwalla V, Byrne JA, Anders RJ, Williamson G, Kendal DJ, Jones PJ, Johnston F, Marsh P, Vince JZ, Prahalad V	Y	C	n/a	50.5	50.5	50.5	50.5			
Byrne JA, Adams VM	Y	C	n/a	28.7						

B4. What will your time commitment be to research activities related to this project?

(Enter your time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.1

B5. Employment Details as at grant commencement date

(Confirm your employment status at all organisations that you will be associated with as at the grant commencement date. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
University of Tasmania	Yes	Employee	0.8

B6. Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as of 1 January 2025. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in B5 for this question to validate.)

Relevant Organisation

University of Tasmania

B7. Currently held ARC Projects

(This information is automatically populated from RMS. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

Identifier	Investigators	Admin Organisation	Project Title	Funding	End Date	Final Report Due Date	Final Report Status
FT220100652	Prof Jason Byrne	University of Tasmania	Urban greening to protect vulnerable people and promote thermal equity	\$1,059,390	31/12/2027	31/12/2028	Draft

B8. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Professor of Human Geography and Planning	Geography and Spatial Sciences	Permanent	Full Time	16/12/2017		University of Tasmania
Associate Professor	Griffith School of Environment	Permanent	Full Time	01/01/2015	15/12/2017	Griffith University

Senior Lecturer	School of Environment, Urban and Environmental Planning	Permanent	Full Time	01/01/2010	31/12/2014	Griffith University
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B9. Research Opportunity and Performance Evidence (ROPE) - Career Interruptions

(You must read the ROPE Statement <https://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rop-statement> before filling out this section. The following fields will not be visible to assessors: From when; To when; FTE of career interruption and Interruption category. RMS will automatically calculate the total career interruption in the field 'Total Period of Career Interruptions' which will be visible to assessors.)

Has the participant experienced a significant interruption that has impacted on research opportunity?

Yes

Total Period of Career Interruptions

Researcher Prof Jason Byrne has reported a career interruption of 1 year and 7 months since 2006.

B10. Research Opportunity and Performance Evidence (ROPE) - Career Highlights

(Include up to 10 career highlights including a short context statement for each highlight, where relevant (up to 1,500 characters, approximately 200 words).)

1. ARC Future Fellowship (2022) Urban greening to protect vulnerable people and promote thermal equity - \$1,960,887
2. Awarded State Emergency Service grant (2021) for developing a rapid assessment tool and policy framework for improving heatwave resilience in Tasmania
3. Co-recipient National Environmental Research Program 2: Sustainable Communities and Waste Hub - NESP 2 (2021) \$20,456,150
4. Recipient of Planning Institute Australia awards for cutting edge research (2014, 2015, 2017 & 2018)
5. Co-edited award-winning book on Australian Environmental Planning (2014) which is used nationally by Australian planning programs
6. Cutting-edge paper in top-ranked journal in field (2014) circa 4,000 citations - shaped international research agenda on environmental equity and greenspace
7. Associate Editor of Q1 field leading journal - Landscape and Urban Planning (2021-2024) - recognition of my standing in field internationally
8. PhD from University of Southern California on greenspace and environmental inequality (2007) working in Center for Sustainable Cities under mentorship of field-leading urban geographer Prof. Jennifer Wolch. Recipient of doctoral research citation.
9. Established NExUS research lab at University of Tasmania, with team of PhD students & a Post-Doc examining climate change, cities, and equity
10. Fellowship at Johns Hopkins University, USA researching environmental justice and greenspace (1999-2000), working with renowned geographer Prof. David Harvey

B11. Research Opportunity and Performance Evidence (ROPE) - Details of participant's career and contributions to the field, including evidence of high-quality outputs, collaboration and excellence in research training and mentoring (where appropriate).

(Provide details of the participant's research impact and contributions. This should not include information provided elsewhere in the application (up to 1,500 characters, approximately 200 words).)

My top papers are among the most downloaded papers in the field, among the most highly cited in Landscape and Urban Planning and Urban Forestry and Urban Greening. My co-edited, multi-award winning, Australian Environmental Planning book advanced new directions. A co-developer of 'Just Green Enough' theory, I have pioneered paradigmatic urban planning, greenspace and environmental inequality research. Acclaimed environmental justice scholar Prof. Julian Agyeman stated that I am the 'go to scholar' for environmental justice and planning, especially my work on racialised landscapes (Social Science Research Council Insights, 2017). I have been named among the 'who's who' of environmental inequality scholars (Prof Frank Biermann, Copernicus Institute of Sustainable Development, 2020). The Conversation listed me as one of their top thinkers (2018). My research has informed UNICEF and the American Public Health Association, as well as being adopted by state

and local government in Australia, guiding Infrastructure Australia, and the Health Department, Victoria.

B12. Research Opportunity and Performance Evidence (ROPE) - How many PhDs, Masters and Honours students that the participant has supervised have completed their degree?

(Provide total numbers under each category for completions where you have been the principal supervisor.)
PhD student completions as principal supervisor:

8

Masters student completions as principal supervisor:

10

Honours student completions as principal supervisor:

14

B13. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context - Provide clear information that explains the relative importance of the participant's research outputs in disciplinary context. This can include publication and citation metrics and other content relevant to the discipline (up to 1,500 characters, approximately 200 words).)

I am an internationally recognised field leader in urban geography and planning. I am 16 years post-PhD and have more than 150 publications including peer-reviewed journal papers, co-edited books, book chapters, encyclopedia entries, and scientific reports and monographs. I am first author on 61 publications and senior author 30 others. My top 3 publications rank in the top 1% in my field; my top 5 in the top 2%. My Field Weighted Citation for T.1410 (Greenspace, green infrastructure & cultural ecosystem services) is 5.86 at 99.9 prominence percentile (2013-22) placing my work at the leading edge (SciVal metrics). I have 24 papers with more than 100 citations (GS 21/02/2024). My Google Scholar H-index is 43 with 14,013 citations; Scopus is H-31, 7,604 citations. Scopus captures fewer social science research outputs. I have published 24 articles in The Conversation with an international readership of 362,992. My research is applied, emphasising co-design with partners. For this reason, it has wide impact, and is adopted into policy and practice. For example, recent research on heat, inequality and urban greening has directly underpinned the City of Launceston's new urban greening strategy. The University of Tasmania provides excellent facilities, high end computing facilities, as part of the Climate Futures Institute of which I am a member, include a full suite of software including NVIVO and Leximancer (text analysis), SPSS statistical analysis software, and ARCGIS.

B14. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide up to 10 research outputs and provide clear information regarding the research impact of the researcher's chosen career-best outputs. Mark the research outputs that are most relevant to this project categorised under the following headings: Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs and preprints or comparable resources). CVs and theses should not be included in this list. Each text box allows up to 150 characters, approximately 20 words annotation per output.)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Steele, W, Hillier, J, MacCallum, D, Byrne, J & Houston, D 2021, 'Quiet Activism: Climate Action at the Local Scale', Palgrave Macmillan, Cham, Switzerland, DP150100299 (2015-2019) (Authored Book)

Research Outputs Annotation Co-authored book reporting findings from ARC DP research on environmental inequality, climate change and citizen responses in Australia's cities

[2] * Wolch, J, Byrne, J & Newell, J 2014, 'Urban green space, public health, and environmental justice: the challenge of making cities 'just green enough'', *Landscape and Urban Planning*, vol. 125, pp. 234-244, doi:10.1016/j.landurbplan.2014.01.017 (Refereed Journal Article)

Research Outputs Annotation Paradigm-changing paper charting new agenda for environmental justice research and theoretical framing for the greenspace paradox & social inequality

[3] * Baldwin, C, Matthews, T & Byrne, J 2020, 'Planning for older people in a rapidly warming and ageing world: The role of urban greening', *Urban Policy and Research*, vol. 38, no. 3, pp. 199-212, doi:10.1080/08111146.2020.1780424 (Refereed Journal Article)

Research Outputs Annotation One of the first papers reporting on challenges of heat for marginalised and disadvantaged communities in Australian cities, pointing to key issues

[4] * Ambrey, C, Byrne, J, Matthews, T, Davison, A & Portanger, C et al. 2017, 'Cultivating climate justice: green infrastructure and suburban disadvantage in Australia', *Applied Geography*, vol. 89, pp. 52-60, doi:10.1016/j.apgeog.2017.10.002 (Refereed Journal Article)

Research Outputs Annotation The first international study to identify suburban thermal inequity arising from city planning decisions

[5] * Byrne, J, Ambrey, C, Portanger, C, Matthews, T & Baker, D et al. 2016, 'Could urban greening mitigate suburban thermal inequity?: The role of residents' dispositions and household practices', *Environmental Research Letters*, vol. 11, no. 9, doi:10.1088/1748-9326/11/9/095014/meta (Refereed Journal Article)

Research Outputs Annotation A cutting edge study that identified how heat can impact suburbanites, not just city dwellers, and magnify social inequalities

[6] * Byrne, J & Houston, D 2014, 'Environmental justice in Australian cities' in Byrne, J, Sipe, N & Dodson, J (eds.), *Australian Environmental Planning: Challenges and Future Prospects*, Routledge, United Kingdom, pp. 206-218 (Book Chapter)

Research Outputs Annotation Chapter in my multi-award-winning book that identified the dimensions of environmental inequality in Australian cities and their causes

[7] * Byrne, J, Lo, A & Yang, J 2015, 'Residents' understanding of the role of green infrastructure for climate change adaptation in Hangzhou, China', *Landscape and Urban Planning*, vol. 138, pp. 132-143, doi:10.1016/j.landurbplan.2015.02.013 (Refereed Journal Article)

Research Outputs Annotation High impact paper in field-leading journal showing the dimensions of heat-equity planning and greening responses in China. Identified greening limits

[8] * Byrne, J & Wolch, J 2009, 'Nature, race, and parks: past research and future directions for geographic research', *Progress in Human Geography*, vol. 33, no. 6, pp. 743-765, doi:10.1177/0309132509103156 (Refereed Journal Article)

Research Outputs Annotation Highly cited paper in top-ranked journal, showing how environmental costs and benefits are produced through social, cultural and governance processes

[9] * Steele, W, MacCallum, D, Byrne, J & Houston, D 2012, 'Planning the Climate-just city', *International Planning Studies*, vol. 17, no. 1, pp. 67-83, doi:10.1080/13563475.2011.638188 (Refereed Journal Article)

Research Outputs Annotation Highly cited paper that laid the conceptual foundation for understanding environmental inequalities in Australian cities

[10] * Byrne, J 2021, 'Urbanisation: Towns and cities as sites of environmental (in)justice' in Coolsaet, B (ed.), *Environmental Justice: Key Issues*, Routledge, New York, pp. 193-206 (Book Chapter)

Research Outputs Annotation Invited chapter in acclaimed book - shows how processes of urbanisation lead to spatial and social distribution of environmental harms and benefits

B16. Partner Investigator – upload a CV in no more than one A4 page

(Provide a CV of up to one A4 page relevant to the project noting that Partner Investigators are not required to complete Research Opportunity and Performance Evidence (ROPE) questions B10 to B14. The PDF should not include qualifications, current and previous appointment(s)/position(s), employment or career interruptions as this will be automatically populated from your profile at questions B2, B8 and B9.)

No PDF file uploaded.

Part C - Project Description (DPEI250100794)

C1. Project Description

(Upload a brief Project Description as Detailed in the Instructions to Applicants and as required format (Up to 2 A4 pages)).

Note – The answer to this question will not auto-populate into the full application.)

Uploaded PDF file follows on next page.

PROJECT TITLE:

Mapping climate (in)justice in Australian cities

PROJECT QUALITY AND INNOVATION

Several climate hazards threaten cities but two have particularly strong links to urbanisation patterns: excess heat [27] and flooding[8]. Changing natural surfaces to built materials creates a highly variable spatial distribution of heat, where urban form, fabric, and function determine the location of hot and cool spots across the city. Similarly, urban structures, materials, and infrastructures directly contribute to urban flooding by exacerbating surface runoff, accelerating river discharge rates, and triggering flash floods. These hazards come with high costs. The Insurance Council of Australia reported[10] \$12.3 billion in claims during 2020-2023 from storms and flooding, with 1 in 25 adult Australians making damage claims. The 2022 QLD/NSW flooding alone accounted for \$4.3 billion in claims, the 4th most costly disaster in Australian history. Urban heat is also both deadly and costly. 2296 deaths were associated with heat over 2000-2019[30] with future healthcare costs due to heat in Sydney projected to rise to \$390 million in 2030 and over \$500 million in 2050[28]. Despite these significant impacts, there remains a gap in multi-hazard assessments that connect spatial variability of these hazards with the populations exposed to these risks.

Future urbanisation growth and projected climate change are expected to exacerbate the frequency, intensity and duration of heat[20] events. There is already clear evidence of increasing short duration rainfall extremes [12] and in urban areas this will generally increase the frequency and severity of flooding [e.g. [2]]. However, when mapping the spatial variabilities of these climate hazards, often there are three limitations. First, we are still not accurately mapping the heat and flooding hazards due to insufficient resolutions of existing datasets or inadequate spatial coverage to inform high-resolution mappings. In the case of heat, for example, spatial maps often come from satellite-sensed land surface temperatures (LST) which are of limited relevance to heat exposure[18, 17] of people. We also lack fine-grained data representing flood hazards consistently across cities. Flood hazard mapping is generally prepared on a catchment scale and can be variable in its spatial resolution and coverage because local government boundaries do not align with catchments. In addition, flood hazards are dependent on the size of the catchment. This means that there can be substantial computational challenges associated with estimating high-resolution flood hazards for very large river systems, such as the Hawkesbury-Nepean River in the Sydney basin. The second deficiency pertains not only to the mapping of hazards but also to the precise overlay of these maps with population vulnerability. This requires integrating the varying degrees of population sensitivity to these hazards along with the adaptive capacities of individuals. Factors such as socioeconomic status, the integrity of built environment infrastructure, and population sensitivities contribute to the intricate human response to climate hazards[13, 14], a quantification that remains elusive in Australian cities. The final gap, due to the deficiencies of the last two components, is a lack of accurate projections of changes to these spatial hazards for future urban and population growth in the face of climate projections.

Responding to these gaps, this project aims to leverage innovative urban climate informatics methods, from citizen weather stations and machine learning (ML) algorithms, for capturing and developing spatial data on urban climate justice. In particular, it proposes to address the following research questions:

- 1) Can spatial variability of heat and flooding hazards in Australian cities be mapped using emerging innovative sensing and ML methods?
- 2) Can we map spatial disadvantage and climate injustice in response to heat and flooding by integrating population vulnerability (that includes demographic sensitivity and adaptive capacity) in hazard maps?
- 3) How are the spatial patterns of climate injustice in Australian cities expected to change in response to future urbanisation growth as well as projected climates and extremes in the future?

Methodology

Phase 1 will address the first research question by generating present-day heat and flooding hazard maps for Australian urban areas. Heat maps will be developed based on the methodology outlined in [22, 18, 16], leveraging quality-controlled, crowd-sourced citizen weather observations from cities across Australia. The upscaling of these data, along with other relevant sources, will employ machine learning algorithms following the approach outlined in [29, 5]. For flooding risks, ML techniques will be employed to reconcile the differing scales between existing local and catchment

flood hazard mapping (typically at 5-20 metres resolution based on hydrodynamic modelling) with the driving rainfall input data (at a coarser resolution of 2.5 kilometres), specifically Intensity, Frequency, Duration (IFD) data optimised to provide comprehensive information at the national level [25].

Phase 2 will generate spatial vulnerability mapping through a combination of demographics and socio-economics statistics from Australian Bureau of Statistics census data[3] and other urban spatial datasets available through the Australian Urban Research Infrastructure Network (AURIN)[21]. Important factors contributing to population response and adaptation to heat and flooding[13, 14] include age, gender, language, literacy, income and economic status, assets, social support, housing status, education, community composition (including access to green or blue space, built conditions, pollution levels), access to social services (childcare, education, primary health), transportation infrastructure, and community health indicators. The intersection of hazards generated in Phase 1 with spatial vulnerability will be quantified to address the second research question.

Phase 3 will quantify future patterns of climate injustice that integrate climate projections together with anticipated changes in urbanisation and demographic profiles. Future climate projections will be generated through Coupled Model Intercomparison Project Phase 6 [7, 26] (CMIP6) data. A future climate change signal is superimposed onto present-day time series and generated future heat hazard mapping via a ‘morphing’ process, shifting (in mean) and stretching (in minimum and maximum) the observed time series, changing both the mean and the variance [4, 24]. Future flood hazard maps will be generated by bias correcting the newly developed NARClIM 2.0 rainfall simulations[15] to provide estimates of future IFDs combined with sea level rise projections and then using ML methods to map the changes in IFDs into future flood hazards. ML methods are vital for this mapping due to non linearity in the catchment response to flooding. ML methods have been used to emulate high-resolution flood hazard assessments based on low-resolution models under historical climate conditions, but have not yet been used to estimate future flood risk where changes in both rainfall extremes and tailwater conditions will combine to add additional complexity to the problem[9]. Future urbanisation trends and demographic shifts will transform Phase 2 mappings of spatial vulnerability into future 2050 and 2080 projections that can be applied to analyse future hazard risks for the last research question.

Anticipated Outcomes and Benefits

Australia faces many challenges from climate hazards. Heat is the most dangerous natural hazard[6] whilst the 2022 floods in Queensland and NSW led to damages of almost \$5 billion. For both heat and flooding, these impacts are disproportionately experienced by vulnerable populations[19]. Future climate change will only intensify those impacts[11]. Mitigation and adaptation to these changes require both knowledge about the hazards and the ability to locate those will be most impacted by these hazards[23].

This project will result in high-resolution mapping of urban-induced climate hazards across all Australian urban areas. As single and compound events[1] (overlapping-concurrent hazards) occur in the present and are expected to increase in the future, our methodology can be used globally for multi-hazard mapping and aid decision making with direct economic benefits, generating significant new knowledge on their occurrence and impacts. Integration of population-level vulnerabilities will identify patterns of spatial disadvantage and communities subjected to climate injustice and provide guidance to how best mitigate impacts of climate hazards and quantify the contribution of urban-induced climate hazards to climate injustice. Additionally, projections of shifting spatial patterns will account for changes in demographics, future urbanisation, and a changing climate.

REFERENCES

- [1] A. Aghakouchak et al. 10.1146/annurev-earth-071719-055228. [2] K. Alexander et al. 10.1016/j.jhydrol.2019.124201. [3] Australian Bureau of Statistics. 2021 Census Community Profiles, 2021. [4] S. Belcher et al. 10.1191/0143624405bt112. [5] O. Brousse et al. 10.1175/JAMC-D-22-0142.1. [6] E. Coffel et al. 10.1088/1748-9326/aaa00e. [7] V. Eyring et al. 10.5194/gmd-9-1937-2016. [8] B. Feng et al. 10.1007/s11069-020-04480-0. [9] N. Fraehr et al. 10.1038/s44221-023-00132-2. [10] Insurance Council of Australia. [insurancecouncil.com.au/resource/three-year-weather-bill-reaches-12-3-billion/](https://www.insurancecouncil.com.au/resource/three-year-weather-bill-reaches-12-3-billion/), 2021. [11] IPCC. *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Cambridge University Press, 2022. [12] L. Jayaweera et al. 10.1016/j.jhydrol.2023.129872. [13] D. Johnson et al. 10.3390/w15193408. [14] A. Li et al. 10.1016/S2542-5196(23)00216-4. [15] J. Li, F. Johnson, et al. [16] M. J. Lipson, N. Nazarian, K.A. Nice, et al. 10.3389/fenvs.2022.866398. [17] A. Martilli, N. Nazarian, et al. 10.1016/j.uclim.2019.100541. [18] M. Naserikia, N. Nazarian, K.A. Nice, et al. 10.1016/j.scitotenv.2023.167306. [19] N. Nicholls et al. 10.1007/s00484-007-0132-5. [20] S. E. Perkins et al. 10.1029/2012GL053361. [21] C. Pettit et al. 10.1007/s12061-015-9133-7. [22] J. Potgieter, N. Nazarian, et al. 10.3389/fenvs.2021.720323. [23] Productivity Commission. *Natural Disaster Funding Arrangements*, Canberra. Technical report, 2014. [24] J. Pulkkinen and J.-N. Louis. 10.1016/j.dib.2021.107209. [25] F. Johnson et al. 10.1016/j.jhydrol.2015.12.035. [26] K.A. Nice et al. *Front Environ Sci (Under Review)*. [27] N. Nazarian et al. 10.1029/2022EF002682. [28] M. Tong et al. 10.1016/j.uclim.2021.101028. [29] J. Wijnands, K.A. Nice, et al. 10.1016/j.apr.2022.101438. [30] Y. Wu et al. 10.1016/S2542-5196(22)00073-0, 2022.

Certification

Certification by the Deputy/Pro Vice-Chancellor (Research) or their delegate or equivalent in the Administering Organisation

I certify that—

- I have read, understood, and complied with the *Discovery Program Grant Guidelines - (2023 edition)*, (Grant Guidelines) and, to the best of my knowledge all details provided in this Expression of Interest application form and in any supporting documentation are true and complete in accordance with these Grant Guidelines.
- Proper enquiries have been made and I am satisfied that the participants and the organisations listed in this Expression of Interest application meet the requirements specified in the Grant Guidelines.
- I will notify the ARC if there are changes to any named participant or organisation after the submission of this Expression of Interest application.
- The listed participants are responsible for the authorship and intellectual content of this Expression of Interest application and have appropriately cited sources and acknowledged significant contributions to this Expression of Interest application.
- To the best of my knowledge, all material personal and financial interests and Conflicts of Interest relating to parties involved in or associated with this Expression of Interest application are disclosed to this Administering Organisation, and, if the Expression of Interest application is successful, I agree to manage all Conflicts of Interest relating to this Expression of Interest application in accordance with the Australian Code for the Responsible Conduct of Research (2018), the ARC Conflict of Interest and Confidentiality Policy located on the ARC website and any relevant successor documents.
- The application, including all parties involved in or associated with this Expression of Interest application, has undergone due diligence to assess risks from foreign interference in line with the Guidelines to Counter Foreign Interference in the Australian University Sector (2019) developed by the University Foreign Interference Taskforce.
- I consent, or where necessary, I have obtained the necessary consent(s) concerning all the parties, to this Expression of Interest application being referred to third parties, who will remain anonymous, for assessment purposes.
- I consent, or where necessary, I have obtained the necessary consent(s) concerning all the parties, to the ARC copying, modifying and otherwise dealing with information contained in this Expression of Interest application.
- I acknowledge, or where necessary have informed all the parties, that information from this application may be provided to other Commonwealth agencies to seek advice on national security or other matters.
- To the best of my knowledge, the Privacy Notice appearing at the top of this form was drawn to the attention of all the participants whose personal details are provided in the Participant section of the Expression of Interest application.

Note - Certification from the DVCR or Delegate will not auto-populate into the full application.