

# Dr Mathew J. Lipson

Urban meteorology : modelling : evaluation : development

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## RESEARCH INTERESTS

I am an urban meteorologist and urban climate model developer. In my current role as a research scientist at the Bureau of Meteorology I am responsible for developing new sub-kilometre model configurations to improve weather forecasting in cities across Australia. In previous roles, I have:

- coordinated an international model intercomparison involving 65 scientists: <https://doi.org/10.1002/qj.4589>
- coordinated the release of the largest published open urban flux tower collection: 20 urban flux tower sites covering 50 site-years: <https://doi.org/10.5194/essd-14-5157-2022>
- created new datasets accurately describing urban areas for urban climate models, working with industry partners to allow data to be openly released: <https://doi.org/10.3389/fenvs.2022.866398>
- developed an integrated building energy and urban land surface model and undertaken city-scale simulations: <https://doi.org/10.1002/qj.3317>
- developed and undertaken 100 year model projections of building electricity and gas demand under 21<sup>st</sup> century climate change projections: <https://doi.org/10.1088/1748-9326/ab5aa5>

## ROLES

2021-current **Modelling Research Scientist.** Bureau of Meteorology, Australia  
2019-2021 **Research Associate.** Centre of Excellence for Climate System Science. Based at UNSW Sydney and University of Reading, United Kingdom.  
2011-2019 **Undergraduate and postgraduate study** (see below)  
2005-2011 **Architect** (various roles in Australia and Papua New Guinea)

## EDUCATION

2015-2019 **PhD: Climate Science Research.** UNSW Sydney, Australia  
2011-2014 **Bachelor of Science (Advanced).** UNSW Sydney, Australia  
Majored in Physics and Astronomy. Honours in Climate Science (1<sup>st</sup> Class).  
2009 **Architect Professional Registration.** NSW Board of Architects No. 8364.  
2002-2005 **Bachelor of Architecture.** University of Sydney, Australia.  
1999-2001 **Bachelor of Science (Architecture),** University of Sydney, Australia.

## PUBLICATIONS

2023 *Evaluation of 30 urban land surface models in the Urban-PLUMBER project: Phase 1 results.* **Lipson**, Grimmond, Best, Abramowitz, Coutts, Tapper, Baik, Beyers, Blunn, Boussetta, Bou-Zeid, De Kauwe, de Munck, Demuzere, Fatichi, Fortuniak, Han,

- Hendry, Kikegawa, Kondo, Lee, Lee, Lemonsu, Machado, Manoli, Martilli, Masson, McNorton, Meili, Meyer, Nice, Oleson, Park, Roth, Schoetter, Simón-Moral, Steeneveld, Sun, T., Takane, Thatcher, Tsiingakis, Varentsov, Wang, Wang, Pitman, Quarterly Journal of the Royal Meteorological Society. <https://doi.org/10.1002/qj.4589>
- 2023 *Land surface and air temperature dynamics: The role of urban form and seasonality.* Naserikia, Hart, Nazarian, Bechtel, **Lipson**, and Nice. Science of The Total Environment, 905, 167306, <https://doi.org/10.1016/j.scitotenv.2023.167306>, 2023.
- 2023 *Multiscale modeling techniques to document urban climate change.* Nazarian, **Lipson**, Norford. Book chapter edited by Paolini and Santamouris. Elsevier, 123-164. <https://doi.org/10.1016/B978-0-12-818977-1.00004-1>
- 2022 *Harmonized gap-filled datasets from 20 urban flux tower sites.* **Lipson**, Grimmond, Best, Chow, Christen, Chrysoulakis, Coutts, Crawford, Earl, Evans, Fortuniak, Heusinkveld, Hong, Hong, Jarvi, Jo, Kim, Kotthaus, Lee, Masson, McFadden, Michels, Pawlak, Roth, Sugawara, Tapper, Velasco, Ward. Earth System Science Data. <https://doi.org/10.5194/essd-14-5157-2022>
- 2022 *Isolating the impacts of urban form and fabric from geography on urban heat and human thermal comfort.* Nice, Nazarian, **Lipson**, Hart, Seneviratne, Thompson, Naserikia, Godic, Stevenson. Building and Environment. <https://doi.org/10.1016/j.buildenv.2022.109502>
- 2022 *A Transformation in City-Descriptive Input Data for Urban Climate Models.* **Lipson**, Nazarian, Hart, Nice, Conroy. Frontiers in Environmental Science. <https://doi.org/10.3389/fenvs.2022.866398>
- 2022 *A citizen centred urban network for weather and air quality in Australian schools.* Ulpiani, Hart, Di Virgilio, Maharaj, **Lipson**, Potgieter. Scientific Data. <https://doi.org/10.1038/s41597-022-01205-9>
- 2022 *Meteorological influence on forecasting urban pollutants: Long-term predictability versus extreme events in a spatially heterogeneous urban ecosystem:* Ulpiani, Duhirwe, Yun, **Lipson**. Science of the Total Environment. <https://doi.org/10.1016/j.scitotenv.2021.152537>
- 2021 *Book chapter: The synergistic impacts of urban air pollution compounding our climate emergency.* Hart, Cooper, Green, **Lipson**. Urban Climate Science for Planning Healthy Cities. Springer. [https://doi.org/10.1007/978-3-030-87598-5\\_16](https://doi.org/10.1007/978-3-030-87598-5_16)
- 2021 *Combining high-resolution land use data with crowdsourced air temperature to investigate intra-urban microclimate.* Potgieter, Nazarian, **Lipson**, Hart, Ulpiani, Morrison, Benjamin. Frontiers in Environmental Science. <https://doi.org/10.3389/fenvs.2021.720323>
- 2021 *Resolving the influence of local flows on urban heat amplification during heatwaves.* Hirsch, Evans, Thomas, Conroy, Hart, **Lipson**, Ertler. Environmental Research Letters. <https://doi.org/10.1088/1748-9326/ac0377>
- 2021 *A global environmental crisis 42,000 years ago.* Cooper, Turney, Palmer, Hogg, McGlone, Wilmshurst, Lorrey, Heaton, Russell, McCracken, Anet, Rozanov, Friedel, Suter, Peter, Muscheler, Adolphi, Dosseto, Faith, Fenwick, Fogwill, Hughen, **Lipson**, Liu, Nowaczyk, Rainsley, Ramsey, Sebastianelli, Souilmi, Stevenson, Thomas, Tobler, Zech. Science. <https://doi.org/10.1126/science.abb8677>
- 2020 *Reimagining Hospitals as Sustainable Energy Hubs.* Gurieff, Green, Koskinen, **Lipson**, Baldry, Maddocks, Menictas, Noack, Moghtaderi, Doroodchi. *Healthy Power: Sustainability.* <https://doi.org/10.3390/su12208554>
- 2019 *Climate change impact on energy demand in building-urban-atmosphere simulations through the 21st century.* **Lipson**, Thatcher, Hart and Pitman. Environ. Res. Lett. <https://doi.org/10.1088/1748-9326/ab5aa5>
- 2019 *Model development for urban climates.* **Lipson**. Dissertation. UNSW Sydney. [https://primoa.library.unsw.edu.au/permalink/f/1uqach6/TN\\_cdi\\_nla\\_trove\\_235256129](https://primoa.library.unsw.edu.au/permalink/f/1uqach6/TN_cdi_nla_trove_235256129)

- 2019 *Pleistocene glacial history of the New Zealand subantarctic islands*. Rainsley, Turney, Gollidge, Wilmshurst, McGlone, Hogg, Li, Thomas, Roberts, Jones, Palmer, Flett, de Wet, Hutchinson, **Lipson**, Fenwick, Hines, Binetti, and Fogwill., *Climate of the Past*, <https://doi.org/10.5194/cp-15-423-2019>
- 2018 *New breeding records of seabirds at Carnley Harbour (Auckland Islands), Cossack Rock (Campbell Island) and south coast of The Snares*. Wilson, Barthel, **Lipson**, Fogwill, and Turney., *Notornis*, 65(3), 168–173, 2018.
- 2018 *A building energy demand and urban land surface model*. **Lipson**, Thatcher, Hart, Pitman. *Quarterly Journal of the Royal Meteorological Society*. <https://doi.org/10.1002/qj.3317>
- 2018 *Global Peak in Atmospheric Radiocarbon Provides a Potential Definition for the Onset of the Anthropocene Epoch in 1965*. Turney, Palmer, Maslin, Hogg, Fogwill, Southon, Fenwick, Helle, Wilmshurst, McGlone, Ramsey, Thomas, **Lipson**, Beaven, Jones, Andrews, Hua. *Scientific Reports*. <https://doi.org/10.1038/s41598-018-20970-5>
- 2018 *Growth response of an invasive alien species to climate variations on subantarctic Campbell Island*. Palmer, Turney, Fogwill, Fenwick, Thomas, **Lipson**, Jones, Beavan, Richardson, Wilmshurst. *New Zeal. J. Ecol.* <https://www.jstor.org/stable/26538093>
- 2017 *Efficiently modelling urban heat storage: an interface conduction scheme in an urban land surface model (aTEB v2.0)*. **Lipson**, Hart, Thatcher. *Geosci. Model Dev.* <https://doi.org/10.5194/gmd-10-991-2017>
- 2017 *Tropical forcing of increased Southern Ocean climate variability revealed by a 140-year subantarctic temperature reconstruction*. Turney, Fogwill, Palmer, van Sebille, Thomas, McGlone, Richardson, Wilmshurst, Fenwick, Zunz, Goosse, Wilson, Carter, **Lipson**, Jones, Harsch, Clark, Marzinelli, Rogers, Rainsley, Ciasto, Waterman, Thomas, Visbeck. *Clim. Past*. <https://doi.org/10.5194/cp-13-231-2017>
- 2016 *Intensification of Southern Hemisphere westerly winds 2000–1000 years ago: evidence from the subantarctic Campbell and Auckland Islands (52–50°S)*. Turney, McGlone, Palmer, Fogwill, Hogg, Thomas, **Lipson**, Wilmshurst, Fenwick, Jones, Hines, Clark.. *J. Quaternary Sci.* <https://doi.org/10.1002/jqs.2828>
- 2016 *Multidecadal variations in Southern Hemisphere atmospheric 14C: Evidence against a Southern Ocean sink at the end of the Little Ice Age CO2 anomaly*. Turney, Palmer, Hogg, Fogwill, Jones, Bronk Ramsey, Fenwick, Grierson, Wilmshurst, O'Donnell, Thomas, **Lipson**.. *Global Biogeochem. Cycles*. <https://doi.org/10.1002/2015GB005257>

## CONFERENCE PRESENTATIONS

- 2023 *The Urban-PLUMBER model evaluation project: Phase 1 results*. 11<sup>th</sup> International Conference on Urban Climate (speaker)
- 2023 *Building-resolving urban data in next-generation convective-scale weather forecasts*. 11<sup>th</sup> International Conference on Urban Climate (poster)
- 2023 *A new open collection of 20 urban flux tower datasets, harmonized and gap filled for land surface model evaluation*. iLEAPS-OzFlux2023 Joint Conference 2023 (speaker)
- 2022 *Urban-scale NWP at the Bureau*. ACCESS-NRI Workshop (invited speaker)
- 2022 *An open collection of 20 urban flux tower datasets*. International Association of Urban Climate Poster Conference (poster)
- 2022 *Improved high resolution city-descriptive input data for urban meteorological modelling*. International Association of Urban Climate Poster Conference (poster)
- 2021 *Urban-PLUMBER model evaluation project: initial results and next steps*. CORDEX Flagship Pilot Study for urban environments and regional climate change (speaker).
- 2021 *Urban-PLUMBER model evaluation project: initial results*. EGU General Assembly 2021 (speaker).

- 2020 *Urban-PLUMBER: A new evaluation and benchmarking project for land surface models in urban areas.* EGU General Assembly 2020 (speaker).
- 2020 *Urban-PLUMBER – Evaluation and Benchmarking of Land Surface Models in Urban Areas.* AMS Annual Meeting 2020. Boston, 2019 (poster)
- 2019 *How will future global warming affect urban climate and building energy demand? Exploration through fully coupled and single column urban modelling systems.* EGU General Assembly 2019, Vienna (speaker)
- 2018 *Applications for a new city-scale building energy demand model.* 10<sup>th</sup> International Conference on Urban Climate/ 14<sup>th</sup> Symposium on the Urban Environment, New York, U.S.A., 2018 (speaker)
- 2018 *A mixed physical/statistical city-scale energy demand model for Australia.* 25<sup>th</sup> National Conference of the Australian Meteorological and Oceanographic Society, Sydney, Australia (speaker).
- 2017 *Efficiently representing thermal processes in urban canopy models.* 97<sup>th</sup> American Meteorological Society Annual Meeting, Seattle, U.S.A. (poster).
- 2017 *From room to regional scales: developing a coupled energy demand & urban climate model.* 5<sup>th</sup> ARC Centre of Excellence for Climate System Science Workshop, Canberra, Australia (poster).
- 2017 *Improving urban climate models.* GlobalTech Global Fellows Programme, Berghausen, Germany (poster and attendee).
- 2016 *Improving the representation of heat storage in urban climate models.* National Conference of the Australian Meteorological and Oceanographic Society, Melbourne, Australia (speaker).
- 2016 *Developments in the aTEB urban land surface model.* 4<sup>th</sup> ARC Centre of Excellence for Climate System Science Workshop, Lorne, Australia (poster).
- 2015 *Adequately and efficiently representing heat conduction and storage for urban surfaces.* 9<sup>th</sup> International Conference on Urban Climate, Toulouse (speaker).
- 2014 *Efficiently simulating the impact of Australian urban areas on climate.* 3<sup>rd</sup> Australian Earth System Outlook Conference, Canberra, Australia (poster).

## OPEN DATASETS

- 2023 *Benchmarks for the Urban-PLUMBER model evaluation project Phase 1 (AU-Preston).* <https://doi.org/10.5281/zenodo.7330052>
- 2022 *Site data archive for "Harmonized gap-filled dataset from 20 urban flux tower sites" for the Urban-PLUMBER project.* <https://doi.org/10.5281/zenodo.5517550>
- 2022 *Urban form data for climate modelling: Sydney at 300 m resolution derived from building-resolving and 2 m land cover datasets.* <https://doi.org/10.5281/zenodo.6565324>
- 2019 *CCAM-UCLEM model output for: Climate change impact on energy demand in coupled building-urban-atmosphere simulations across the 21st century v1.0.* <https://doi.org/10.25914/5d3e4a8074a5f>

## TEACHING

- 2021 Masters supervision: *Explore the different factors that affect albedo by comparing two urban sites.* Xiangyang Fan. University of Reading.
- 2020 Masters supervision: *Influences of energy demand on local meteorology in Central London: a modelling study.* Eleanor Pinches. University of Reading.
- 2017 *Introduction to Atmospheric Science:* Laboratory coordinator and tutor

## COMMUNICATION

- Weather website *Is it hot right now?* 2021; **Lipson**, Contractor and Goldie. <https://isithotrightnow.com>
- Blog *The Urbanist*. **Lipson**. <https://theurbanist.com.au>
- The Conversation *When the heat is on, we need city-wide plans to keep cool*; **Lipson** & Hart, The Conversation; 2017; <http://bit.ly/2jKN2Hu>
- Association newsletter article *A new multi-site evaluation project for modelling in urban areas*. **Lipson**, Grimmond, Best. Urban Climate News Issue 75. March 2020. <http://www.urban-climate.org/wp-content/uploads/IAUC075.pdf>
- Association newsletter article *A new open collection of 20 flux tower datasets from global cities*. Lipson et al. Urban Climate News Issue 86. December 2022. <http://www.urban-climate.org/wp-content/uploads/IAUC086.pdf>
- Project website *Urban-PLUMBER: A multi-site model evaluation project for urban areas*. **Lipson** Grimmond, Best. 2023; <https://urban-plumber.github.io/>