

Building for the Future

Designing homes for tomorrow's climate instead of yesterday's

Most Australian homes are designed and rated using past weather data, but as the climate is warming heatwaves are becoming more frequent and severe. This means homes may need more cooling and pose overheating risks to occupants. As homes built today will last around 50 years, designers need to plan for the climate of the 2070s, including extreme heat (Figure 1).

Co-designed with industry and government

Through the NESP Climate Systems Hub, we brought together climate scientists, government policy teams, building simulation experts and industry groups. Together, we co-designed a practical method to include future climate projections, including heatwaves, into the weather files used in building simulation.

We created prototype future average (Typical Meteorological Year, TMY) and extreme (eXtreme Meteorological Year, XMY) weather files for eleven locations across Australia. The files use projections from seven global climate models, for lower and higher emissions pathways and three future periods: 2030s, 2050s and 2070s. Building designers and assessors tested the files in NatHERS-accredited software, including HERO, FirstRate5 and AccuRate. The files worked in existing workflows but using several future files instead of one create new challenges for practitioners.

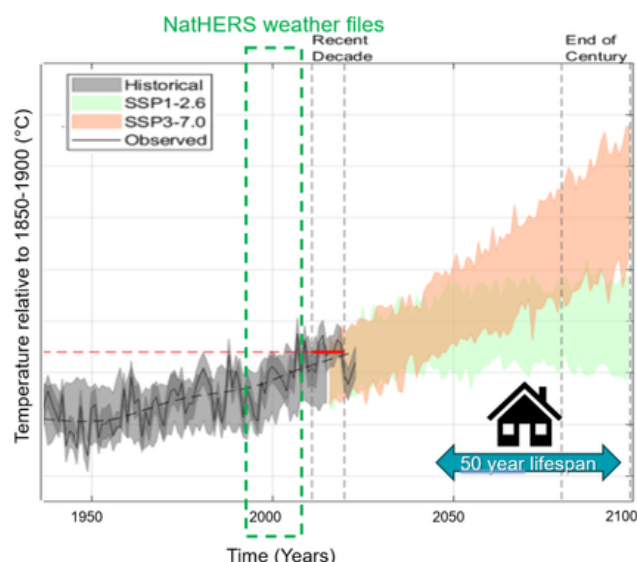


Figure 1: Observed trends and projections for Australia show a warming trend continuing. The green box shows that the Nationwide House Energy Rating Scheme or NatHERS weather files are based on 1995-2014, which means that houses built today, with an average lifespan of 50 years, will likely experience a much warmer climate than they were designed for (adapted from Round, et al 2024).



What we found

The results match the clear warming trend across Australia, with differences between regions (Figure 2). Under future average conditions (TMY), every location tested is projected to need more cooling. Darwin, Cairns, Brisbane and Longreach, which are already cooling-dominated, see large increases in cooling demand. Sydney, Perth, Adelaide and Mildura, which are currently balanced, shift towards more cooling and less heating. In Melbourne, Canberra and Hobart lower heating demand may offset higher cooling under typical conditions, but more testing is needed to understand heatwave performance and the health risks to occupants.

The new extreme (XMY) files let us assess future heatwave impacts on thermal comfort, peak cooling demand and occupant health, something the current NatHERS files can't do. These files show heatwaves becoming more frequent, long-lasting and severe.

Results also varied widely across emissions pathways and between climate models. Under the same emissions scenario, cooling loads for Sydney varied by up to 259% between models, so a home design that meets compliance under one model may not under another. Relying on a single weather file can hide the range of future conditions, including overheating risk. Testing homes against a range of future conditions, including heatwaves, is essential for building climate-resilient homes.

Therefore, to enable the appropriate application of these new data and information insights will require practical guidance, agreed use cases, further testing of the prototype files, and an ongoing partnership between climate scientists, building simulation experts, policymakers and industry practitioners.

259% variation

in Sydney's projected cooling loads between climate models under the same emissions scenario. Demonstrating one weather file can hide the range of future conditions.

For more information

Scan the QR code for more information about the project.



Future heating and cooling demand at the 11 test locations

Prototype future average (TMY) and extreme (XMY) weather files, relative to current NatHERS files



Figure 2: Map of Australia showing the 11 locations where the prototype future average (TMY) and extreme (XMY) weather files were produced and tested. Arrows show the trend in future cooling and heating demand relative to current NatHERS files, with locations grouped by climate region.

Where to next

This project showed that future weather files can help inform climate-resilient building design. It also confirmed that co-design is critical to producing usable files, and that it can't be a one-off exercise.

Australia is only at the start of this journey, but these prototype files are a significant step forward. A long-term national capability linking climate science, building simulation, software development, policy and industry practice would help ensure Australian buildings are designed for tomorrow's climate instead of yesterday's.

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The prototype files are available for research, testing and feedback purposes only. They should not be used to inform building design, regulatory compliance, policy, NatHERS assessments or operational energy efficiency assessments or to assess current regulations.