



Australian Government

Bureau of Meteorology

Australian Climate Observations Reference Network – Surface Air Temperature (ACORN-SAT)

Bureau of Meteorology response to the recommendations of the Technical Advisory Forum's third annual report

October 2017



Cover image: Rural landscape near Longreach, Queensland

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The Bureau of Meteorology welcomes the release of the third annual report of the Technical Advisory Forum established to advise the Bureau on the development and operation of the Australian Climate Observations Reference Network – Surface Air Temperature (ACORN-SAT) dataset.

The Technical Advisory Forum was established in response to one of the recommendations of an independent peer review of the dataset undertaken in 2011, which expressed overall confidence in the Bureau's practices and found its data and analysis methods to be among the best in the world.

In January 2015, the Forum members were announced by the Parliamentary Secretary to the Minister for the Environment to serve for a three-year period to meet annually and provide recommendations on further development of ACORN-SAT. The Forum met in March 2015 and released its first annual report in June the same year. The Forum found that the ACORN-SAT dataset was complex and well maintained, making five recommendations to support and inform the Bureau's continuous improvement activities. The Forum met for a second time in June 2016 to consider the Bureau's progress to date against the five recommendations and, in view of that progress, provide additional advice.

The third and final meeting of the Forum occurred in May 2017. The Forum's third report provides the Bureau with further valuable suggestions on the future management of the dataset and we are fully supportive of all recommendations as noted in our response that follows. This report supports the conclusion of the Forum's previous reports that the ACORN-SAT dataset is well maintained and represents an important source of information on the climate trends affecting Australia. We note that the Forum commends the Bureau for their progress in addressing recommendations over the previous three years.

The third and final report makes three new recommendations which serve to extend those made previously. In doing so the Forum notes that the three recommendations replace their previous recommendations. These recommendations can be grouped in the same three themes as for 2016: (1) improving the communication and accessibility of the ACORN-SAT dataset; (2) supporting continued engagement with the Australian and international statistical community; and (3) handling of the ACORN-SAT metadata and homogenisation. The three new

recommendations, together with their sub-points, align well with the Bureau's own plans and priorities for ACORN-SAT development going forwards. The Bureau's detailed response to the recommendations of the Forum is provided in the following table.

The Bureau wishes to record its sincere appreciation to the Forum members and the valuable and specific insights they have provided over the past three years. We also acknowledge and thank the support provided to this work from the Department of the Environment and Energy. As highlighted by progress since the 2011 independent peer review and the 2015 Forum meeting, the Bureau is committed to a process of continuous improvement drawing on the best of climate science, mathematics and statistics. Noting the opportunities and challenges that climate change pose for all Australians, ensuring accurate and accessible information to inform decision making is a high priority for the Bureau. We note the continued strong demand which exists for quality climate information to support climate science and adaptation, across many parts of society.

As highlighted at the Forum meetings and in the case studies under preparation, ACORN-SAT and related data feature widely in many decisions, including disaster risk reduction, mitigating human health impacts of extreme heat, and mapping regions suitable for agriculture. These applications have very real relevance for safety of life, property, economic security and sustainability, and it is only through providing the very best information that the Bureau can fulfil its responsibilities to the nation.

In closing, we note that this is the last report of the Technical Advisory Forum. As well as engaging with the statistical community, engaging with scientific experts in the field also remains a priority for the Bureau. We note that the Forum recommends the development of a new assurance advisory mechanism comprising independent experts to advise the Bureau on the handling of ACORN-SAT and related data. The Bureau will establish this forum in the coming months, continuing the practice of rigorous and multi-tiered scientific peer review which supports all of our climate services.

1. To support continued progress on improving the communication and accessibility of the ACORN-SAT dataset, the Forum recommends that the Bureau:

Forum recommendation	Bureau response
<p>1a</p> <p>Develop communication material for public release alongside Version 2 of the ACORN-SAT dataset by the end of 2017 that:</p> <ul style="list-style-type: none"> i. Outlines the rationale for developing Version 2 of the ACORN-SAT dataset, and what criteria would be applied to warrant future major version updates beyond Version 2; ii. Outlines the key updates made to Version 1 of the ACORN-SAT dataset that have been implemented within Version 2, and explains both scientifically and in lay terms any potential changes in estimated temperature trends between the two versions; iii. Explains the basis and rationale for legacy rounding practices utilised within homogenisation algorithms that were applied in development of Version 1 of the ACORN-SAT dataset, how this issue has been revised to conduct all interim calculations without rounding to reflect current computing practices, and what implications this revised approach has had for Version 2 of the dataset; iv. Outlines how the Forum's previous recommendations have been incorporated in the development of Version 2 of the ACORN-SAT dataset. 	<p>Accepted.</p> <p>Much of this material was already planned for release in conjunction with the Version 2 release of the ACORN-SAT dataset. Amendments have already been made to the operational ACORN-SAT code to remove the last areas in which rounding still occurred during intermediate calculations, and this will be implemented in the final version of Version 2. It is expected that Version 2 will be completed for internal testing in October 2017, with a scheduled release in autumn 2018 following quality assurance and review.</p>
<p>1b</p> <p>Finalise and publish a set of case studies presented to and discussed at the Forum following appropriate quality control and peer review processes.</p>	<p>Accepted.</p> <p>This work is already well advanced with case studies to be released by the end of autumn 2018.</p>
<p>1c</p> <p>Develop a new case study which outlines how the ACORN-SAT dataset may be used alongside the Bureau's climate models to compare observed temperatures with those predicted by physical climate modelling.</p>	<p>Accepted in principle.</p> <p>The Bureau agrees that it is important that such a study is carried out, but would also be open to the work being done (and published) by another institution. Historically, most climate model evaluation work in Australia is carried out by the CSIRO and the universities. The complexity of comparing model projections with observations may delay publication until autumn 2018.</p>

Recommendation 1

Forum recommendation		Bureau response
1d	<p>Publish the same version of the ACORN-SAT source dataset used by the Bureau on the Australian Data Archive for Meteorology (ADAM) and the Climate Data Online portal.</p>	<p>Accepted.</p> <p>The original issue which prompted this recommendation was that when Version 1 of the ACORN-SAT dataset was released, it drew in part on recently digitised data which had not yet been ingested into the Bureau's main climate database tables and was therefore not accessible to Climate Data Online. This issue has now been largely addressed and should be fully addressed by the time of the Version 2 release. As noted above, it is expected that Version 2 will be completed for internal testing in October 2017, with a scheduled release in autumn 2018 following quality assurance and review.</p>

2. To support their continued engagement with the Australian and international statistical community, the Forum recommends that the Bureau:

Forum recommendation		Bureau response
2a	Proceed with the Bureau's proposal to establish a new assurance advisory mechanism comprising independent experts to advise the Bureau on the handling of data. The proposed mechanism could provide ongoing oversight of any outstanding matters from the Forum's process, including the Bureau's responses to the 2017 recommendations.	Accepted. Ongoing engagement with the broader science community and rigorous peer review is an important activity for the Bureau across all of its endeavours.
2b	Continues to engage with appropriately qualified statistical experts to understand and quantify the uncertainty inherent in measuring temperature within a geographically dispersed network of weather stations. The aim of quantifying this uncertainty is to produce a coherent description of Australian temperature patterns at national and regional levels, and the variability associated with these patterns, so that the confidence that can be placed in conclusions from related analyses can be assessed.	Accepted.
2c	Organise and host the proposed one-day homogenisation research workshop with relevant climate and statistics experts.	Accepted. There are two meetings involved. One, a one-day homogenisation research workshop, took place as a standalone event on 7 August 2017. The second is a special session in conjunction with the Australian Meteorological and Oceanographic Conference in February 2018. Abstracts for this special session are being solicited at the time of writing.
2d	Make the pre-1910 historical climate data available on the Bureau's website, and develop appropriate communication materials to promote this development as an adjunct to ACORN-SAT in providing a more complete description of Australia's long-term temperature record and to place ACORN-SAT in a broader historical perspective.	Accepted. We expect this will be implemented by autumn 2018.
2e	Engage an appropriately qualified statistician to: (1) advise the Bureau on the experimental design and implementation of the project to update the screens at ACORN-SAT weather stations with the goal of quantifying any systematic effects of the new screens on temperature measurements; and (2) support the Bureau in modelling and analysing uncertainty in the data and assisting in producing appropriate estimates of standard error.	Accepted, subject to finding a suitable expert. The recent and forthcoming workshops will be a good opportunity to identify suitable candidates.

3. To support continued progress in the handling of ACORN-SAT metadata and homogenisation, the Forum recommends the Bureau:

Forum recommendation		Bureau response
3a	Finalise and publish the fact sheets for all 112 ACORN-SAT reference stations following appropriate quality control processes. The factsheets should be released alongside the release of Version 2 of the ACORN-SAT dataset.	Accepted. These are already largely in place, subject to finalisation of the reported adjustments once the final version of Version 2 is completed.
3b	Continues to explore options to develop an automated homogenisation process in the long-term.	Accepted in principle. The challenges of this are well-known and have been identified by the TAF in their report.