Local audit: Australia-wide temperature extension

Date: 14 November 2026 (AEDT)
Scope: Full-grid NASA POWER/MERRA-2 T2M analysis, state/national aggregation, trend catalogs, and the BoM comparison added to the 14 November report. This is a local code-and-data audit, not a Roundtable consensus review.

Verdict: APPROVE

The principal national temperature result, annualization, area aggregation, and reported grid trend counts reproduce from the supplied artifacts. The boundary provenance gap is now closed by comparing the bundled geometries with official versioned releases and recording complete source metadata and checksums. The report's remaining scientific limitations are disclosed, not hidden.

Findings

Verified calculations and data coverage

- fetch_nasa_power_temperature.py requests NASA POWER Monthly/Annual Regional API T2M for 1981–2025 in 81 tiles. I inspected every cached tile header: 81/81 identify MERRA2, span 19810101–20251231, contain features, and report no empty result. The files contain 5,762 tile-feature records before overlap deduplication.
- The processed data contain 2,133 land grid centers, each with all 45 annual values and all 540 monthly values. The 45 national annual values reaggregate from saved cell-year values with cosine-latitude weights to a maximum absolute difference of **1.22×10□¹² °C**.
- I independently reconstructed the national and seven state annual POWER series from the saved grid and the code's stated calendar-day/cosine-latitude weighting. They agree with the comparison series to a maximum absolute difference of **1.22×10□¹² °C**.
- I independently recalculated Sen slopes for all 2,133 cells using the checked-in shared trend routine: all 2,133 stored slopes matched exactly at the recorded precision; 2,130 are positive, and 948 stored BY-adjusted OLS-HAC values are below 0.05. These 948 are spatially correlated cells, not independent replications; the report says so and does not claim a field-significance test.
- The national T2M series reproduces **Sen +0.21475 °C/decade**, **OLS +0.20108 °C/decade**, HAC 95% interval **[+0.09768,+0.30449]**, raw HAC p **0.00013822**, and ordinary MK p **0.00047890**. The report correctly describes Sen as the robust slope and the HAC interval as inference for OLS.
- The POWER and BoM annual regional series in bom_comparison/annual_state_region_series.csv reproduce the report's headline matched-period slopes and p-values: temperature (+0.21475 vs +0.24439 °C/decade, 1981–2025); precipitation (−55.32982 vs +5.21111 mm/year/decade, 2000–2025); and land evaporation vs pan evaporation (−42.69610 vs +18.64000 mm/year/decade, 2000–2017). The report clearly distinguishes modeled EVLAND from pan evaporation and does not call it direct validation.
- The expanded three-outcome POWER BY family and its differing coverage (T2M 1981–2025; precipitation and evaporation 2000–2025) are disclosed as a post-hoc choice, separate from the point preregistration. The report also discloses spatial dependence, the lack of field-significance testing, the center-in-polygon mask, and the mismatch between NSW/ACT coverage.

Boundary provenance verified and recorded

The country mask's bundled Australia feature (ADMIN=Australia, ADM0_A3=AUS, NE_ID=1159320355) matches the official Natural Earth Admin 0 Countries 1:110m, version 5.1.1 geometry after the same six-decimal coordinate conversion. The local GeoJSON is recorded as SHA-256 6866c877d39cba9c357620878839b336d569f8c662d3cfab4cb1dbe2d39c977f; Natural Earth identifies its map data as public domain.

The state/territory file is byte-identical (SHA-256 0103d01ec8ce8b65f407498cae9eec2e1008566f3d75d256c13c25afa39c6302) to the official geoBoundaries gbOpen AUS ADM1 simplified GeoJSON at pinned commit 9469f09. Its boundary ID is AUS-ADM1-82085004, represented year 2021. The geoBoundaries metadata identifies the underlying source as the Australian Bureau of Statistics ASGS Edition 3 State and Territory boundaries, CC BY 4.0, and requires attribution. Metadata has been added to the root and temperature source JSON and to both extraction scripts. The country and state polygons remain separate inputs: the former sets the national land mask; the latter assigns regional means.

The 13 centers retained by the national land mask but unassigned to a state are not included in any state average. This is consistent with the code and is disclosed. The NASA grid centers in the 1981–2025 tile collection were unchanged by rounding to four decimal places, so the reviewed rounding step did not alter these observed centers.

Independent scope limits

I recalculated the saved-series aggregations, all cell Sen slopes, headline POWER/BoM metrics, and matched-period slopes from the combined annual regional file. I reviewed the polygon algorithm and saved NASA headers, queried official boundary metadata, downloaded the versioned public boundary geometries, and verified the local boundary files against them. I did not independently query NASA or BoM measurements during this audit, audit the original measurement download transactions, or perform a standalone scientific peer review. The completed bounded Roundtable re-review in ../run_20261114_184208/ returned advisory APPROVE from ChatGPT and Claude based on supplied audit summaries; they did not inspect local files directly. Kimi was not part of that review. An earlier three-provider attempt (../run_20261114_174140/) timed out on all three Kimi attempts.

Source documentation checked

- NASA POWER Monthly/Annual API: https://power.larc.nasa.gov/docs/services/api/temporal/monthly/ — monthly meteorological parameters are MERRA-2-based from 1981 through the previous year; the monthly endpoint returns analysis-ready monthly data.
- NASA POWER meteorological sources: https://power.larc.nasa.gov/docs/methodology/data/sources_meteorology/ — documents the MERRA-2 meteorological source and grid characteristics.
- Natural Earth Admin 0 Countries 1:110m: https://www.naturalearthdata.com/downloads/110m-cultural-vectors/ — version 5.1.1; terms of use: https://www.naturalearthdata.com/about/terms-of-use/.
- geoBoundaries API metadata for AUS ADM1: https://www.geoboundaries.org/api/current/gbOpen/AUS/ADM1/ — pinned simplified geometry at commit 9469f09, underlying boundary source and license recorded in source_metadata.json.
- BoM ACORN-SAT regional time series: https://www.bom.gov.au/climate/change/about/temp_timeseries.shtml
- BoM AGCD regional rainfall series: https://www.bom.gov.au/climate/change/about/rain_timeseries.shtml

- BoM high-quality pan-evaporation series: https://www.bom.gov.au/climate/change/about/evap_timeseries.shtml