Performance and process-based evaluation of the BARPA Australasian regional climate model

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Downscaled Climate Projections using BARPA

- ACS aims to improve individual hazard intelligence, across all scales (national, regional and local), to assist all hazard prevention and preparedness.
- This requires fine resolution (4–20 km) climate information, including reanalysis of historical/present conditions and downscaled climate projections, to support modelling of hazards and climate extremes.
- The Bureau is producing downscaled climate projections with BARPA, an ACCESS-based limited area regional climate model (RCM).

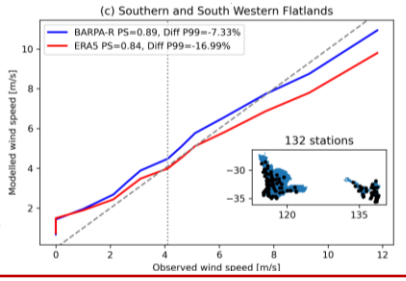
Methodology

- Evaluation of BARPA-R performance downscaling ERA5.
- Config: 17km grid spacing, CORDEX-Australasia, GA7
- Period: 1985 – 2014.
- Reference: AGCD/station winds.
- Benchmark: comparable to or improved against ERA5.
- Spatial Aggregation: Australian NRM clusters.

Key Results

- BARPA-R generally performs on par with ERA5, despite not using data assimilation.
- Overall biases: underestimation of winter diurnal temperature range, wet rainfall bias in summer
- Winds improved compared to ERA5 (compared to stations)
- Long-term trends and modes of variability (ENSO, SAM, IOD) well captured in rainfall and near surface temperature)

Fig 1: Wind speed QQ plot comparing wind speeds to station observations in SSW flatlands NRM cluster indicates BARPA-R improvement over ERA5.



This work was funded by the Australian Climate Service

Fig 2: Temperature and rainfall biases are generally comparable to those of ERA5. Reduced diurnal temperature range in winter. X-axis labels are NRM clusters (see fig3). BARPA: filled bars, ERA5: unfilled bars.

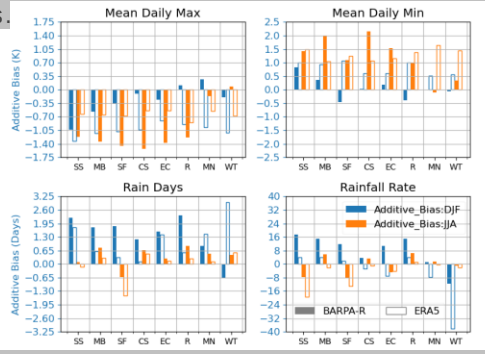


Fig 3: Decadal trends. Annual Tmax warming and winter precip drying trends comparable to observed. Tmin trend is stronger than obs but not significant

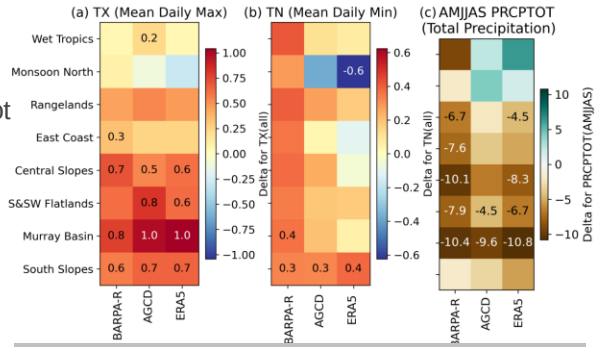
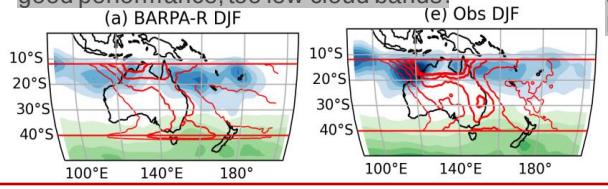


Fig 4: Tropical Cyclone, extra-tropical cyclone and NW Cloud Band distributions compared to obs – good performance, too few cloud bands.



Experiment	Hist	SSP 370	SSP 126
ERA5			
ACCESS-CM2			
ACCESS-ESM1-5			
EC-Earth3			
CMCC-ESM2			
NorESM2-MM			
CESM2			
MPI-ESM1-2-HR			

Current data status

- Run not started
- Run in progress
- Postproc & QC
- Data released

Data available at NCI

BARPA-C: Hazards Sneak Peak

The next stage of BARPA is downscaling to 4km, anticipated to deliver a step-change improvement in hazard processes. Early results:

- Improved tropical cyclone wind/pressure relation
- More intense ECL case study rain and winds.
- Trial sample size prevents direct comparison with observations

Fig 5: central pressure vs wind speed in BARPA-R and BARPA-C. BARPA-C shows the correct observed relationship

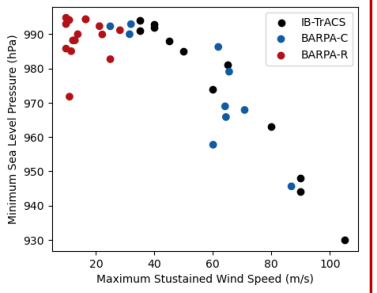


Fig 6: Maximum wind gust over the life of a 3 day East Coast Low event. Extreme winds are more wide-spread and coastal in BARPA-C.