Evaluation of precipitation extremes in ERA5-driven regional climate simulations

F. Ji [a], G. Di Virgilio [a], N. Nishant [b], E. Tam [a], J.P. Evans [b], J. Kala [c], J. Andrys [c], C. Thomas [b] and M. Riley [a]

[a] New South Wales Government Department of Planning and Environment, Sydney, Australia
[b] Climate Change Research Centre and ARC Centre of Excellence for Climate System Science, University of New South Wales, Sydney, Australia
[c] Murdoch University, Perth, Australia
Email: fei.ji@environment.nsw.gov.au

Abstract: Reanalysis driven regional climate simulations are used to assess whether regional climate models can accurately simulate observed climate. In NARCliM2.0 (NSW and Australian Regional Climate Modelling), ERA5 reanalysis was used to drive seven selected regional climate models (seven combinations of physics parameterizations in WRF version 4.1.2 refer as R1-7) at 20 km for Australia and 4 km for Southeast Australia from 1979 to 2020.

Table 1. Combinations of physics parameterizations for seven regional climate models

RCMs	PBL	MP	CU	SW	LW	SF	LSM	Aerosol
R1	YSU	WSM6	BMJ	New Goddard	New Goddard	Monin-Obukhov	Unified Noah	False
R2	MYNN	WSM6	KF	RRTMG	RRTMG	QNSE Monin-Obukhov	Noah-MP (1)	False
R3	MYNN	Thompson	BMJ	RRTMG	RRTMG	QNSE Monin-Obukhov	Noah-MP (1)	1
R4	MYNN	Thompson	BMJ	RRTMG	RRTMG	QNSE Monin-Obukhov	Noah-MP (2)	False
R5	ACM2	Thompson	BMJ	RRTMG	RRTMG	QNSE Monin-Obukhov	Noah-MP (1)	1
R6	ACM2	Thompson	BMJ	RRTMG	RRTMG	QNSE Monin-Obukhov	Noah-MP (1)	False
R7	ACM2	Thompson	BMJ	RRTMG	RRTMG	QNSE Monin-Obukhov	Noah-MP (2)	False

In this study, we evaluate how well seven regional climate models (RCMs) simulate the spatiotemporal patterns of some selected precipitation extreme (ET-SCI climate extreme indices) over Australia by comparing the RCMs against gridded observations (Australian Gridded Climate Dataset). Some of the common and widely used metrics for evaluating the spatial climatology distribution such as bias, root mean square error and pattern correlation are used to quantify performance. Coefficient of variation and trend and interannual variability score are used to evaluate the performance of models with respect to temporal variations. We further consolidate all the metrics together to generate the mean normalised model performance score which helps in sorting the RCMs from best to worst performers.

We find that different RCMs have diverse bias pattern in precipitation extremes. However, biases for precipitation extremes are larger over northern Australia than southern Australia, summer than other seasons. R1 and R2 show a typical tendency of overestimating all precipitation extremes except consecutive dry day (CDD) whereas R6 and R7 show a typical tendency of underestimating all precipitation extremes except CDD over northern Australia. RCMs R3-R5 show smaller biases. Further analyses are on the way to quantify overall performance of those RCMs to simulate precipitation extremes.

Keywords: *ERA5, regional climate models, climate extremes, ET-SCI, evaluation*