Design, evaluation and future projections of the NARCLiM2.0 CORDEX-CMIP6

Australasia regional climate ensemble

Supporting Information

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Table S2. List of WRF parameterisations used in the phase I (N=36) tests. PBL = planetary boundary layer; SW = shortwave radiation; LW = longwave radiation.
**Fig. S1** WRF namelist settings for the CORDEX-CMIP6 NARCClim2.0 RCMs R3-R5: left panel shows physics settings for each RCM; right panel shows settings universal to the RCMs.

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Fig S2. Australia, its states (NT=Northern Territory; QLD=Queensland; NSW=New South Wales; ACT = Australian Capital Territory; VIC = Victoria; SA = South Australia; WA = Western Australia), and major cities. Inset: Natural Resource Management (NRM) regions/climate zones (NA = Northern Australia; EA = Eastern Australia; SA = Southern Australia; RA = Rangelands).
Fig S3. Natural Resource Management (NRM) regionally averaged soil moisture time series (1950-1954) for the EC-Earth3-Veg-forced R3 RCM (top) and MPI-ESM1-2-HR-forced R3 RCM (bottom) simulations. NA=Northern Australia, EA=Eastern Australia, R=rangelands, and SA=Southern Australia.
Fig. S4 Annual mean near-surface atmospheric maximum temperature biases for NARCliM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Stippled areas indicate locations where an RCM shows statistically significant bias ($P < 0.05$). Significance stippling for the ensemble mean bias follows Tebaldi et al. (2011). Statistically insignificant areas are shown in colour, denoting that less than half of the models are significantly biased. In significant agreeing areas (stippled), at least half of RCMs are significantly biased, and at least 70% of significant RCMs in each ensemble agree on the direction of the bias. Significant disagreeing areas are shown in hatching, which are where at least half of the models are significantly biased and less than 70% of significant models in each ensemble agree on the bias direction. Panel boundaries for ensemble means ($b,m,t$) in green (red) indicate the RCMs with lowest (highest) area-averaged mean absolute biases.
Fig. 5 DJF mean near-surface atmospheric maximum temperature biases for NARCCiM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Stippling as per Fig.54.
Fig. S6 JJA mean near-surface atmospheric maximum temperature biases for NARCliM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Stippling as per Fig.S4.
Figure S7. GCM annual mean maximum temperature bias relative to AGCD observations.
Fig. S8 Annual mean near-surface atmospheric minimum temperature biases for NARCliM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Panel boundaries for ensemble means (b,m,t) in green (red) indicate the RCMs with lowest (highest) area-averaged mean absolute biases. Stippling as per Fig.S4.
Fig. S9 DJF mean near-surface atmospheric minimum temperature biases for NARClM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Stippling as per Fig.S4.
Fig. S10: JJA mean near-surface atmospheric minimum temperature biases for NARClM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Stippling as per Fig.S4.
Figure S11. GCM annual mean minimum temperature bias relative to AGCD observations.
Fig. S12 Annual mean precipitation biases for NARClM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Panel boundaries for ensemble means (b,m,t) in green (red) indicate the RCMs with lowest (highest) area-averaged mean absolute biases. Stippling as per Fig.S4.
Fig. S13 DJF mean precipitation biases for NARClM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Stippling as per Fig.S4.
Fig. S14 JJA mean precipitation biases for NARClM2.0, 1.5 and 1.0 ensemble means and individual ensemble members with respect to Australian Gridded Climate Data (AGCD) observations for 1990-2009. Stippling as per Fig.S4.
Figure S15. GCM annual mean precipitation bias relative to AGCD observations
Fig. S16 Climate change signals (1990-2009 versus 2060-2079) for annual mean precipitation for CMIP6 GCMs under SSP1-2.6 (left panel) and CMIP6 GCMs under SSP3-7.0 (right panel) used to force NARClIM2.0 RCMs.