Correcting Multivariate Biases in RCM Boundaries: Implications for Compound Events

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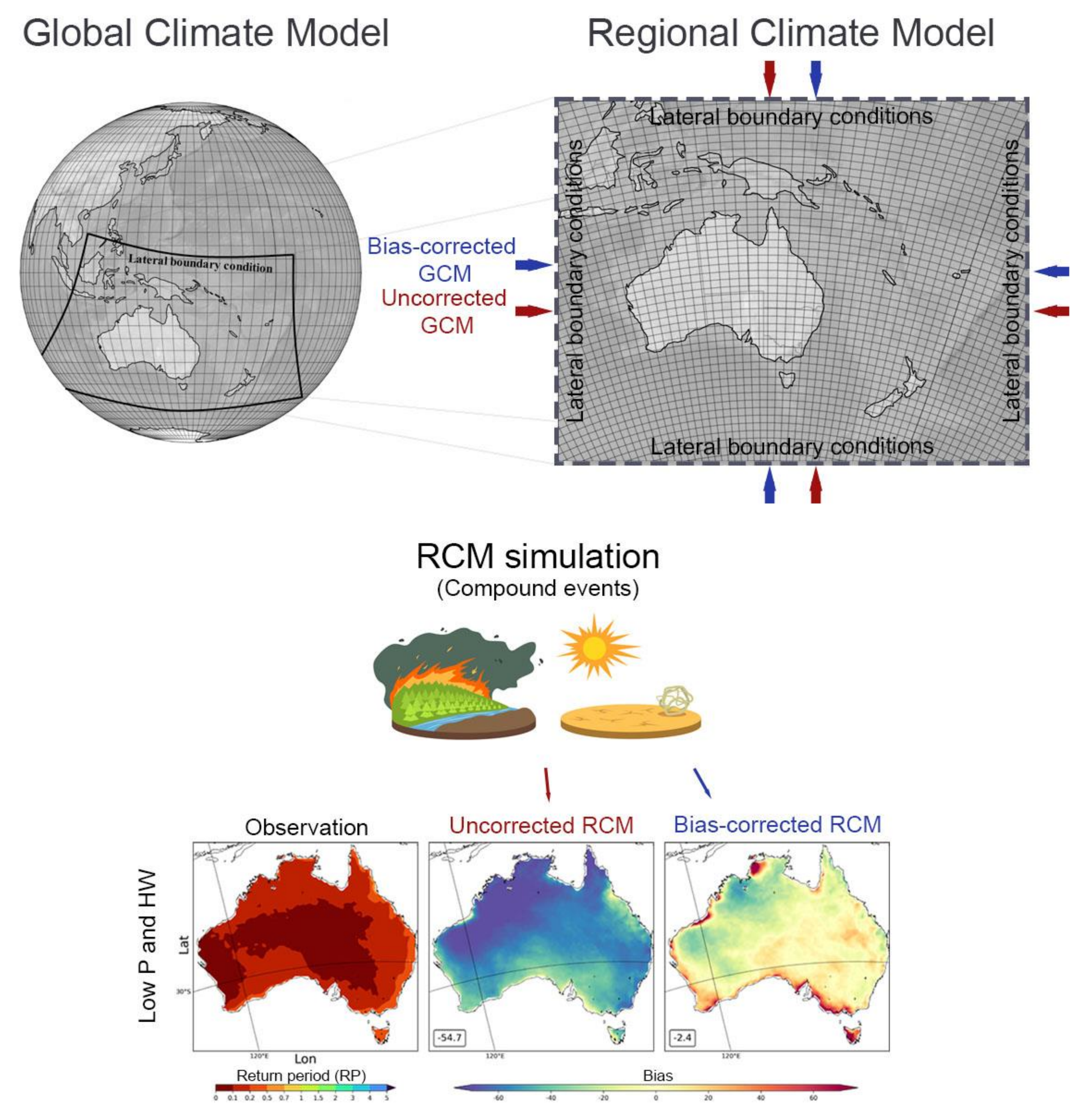
The presence of multiple hazards or driving factors, known as compound events, threatens society and ecosystems globally. Here, we investigates a new alternative to correct biases in the boundaries used as inputs for RCMs. This improves the representation of physical relationships amongst variables, essential for accurate characterisation of compound events.

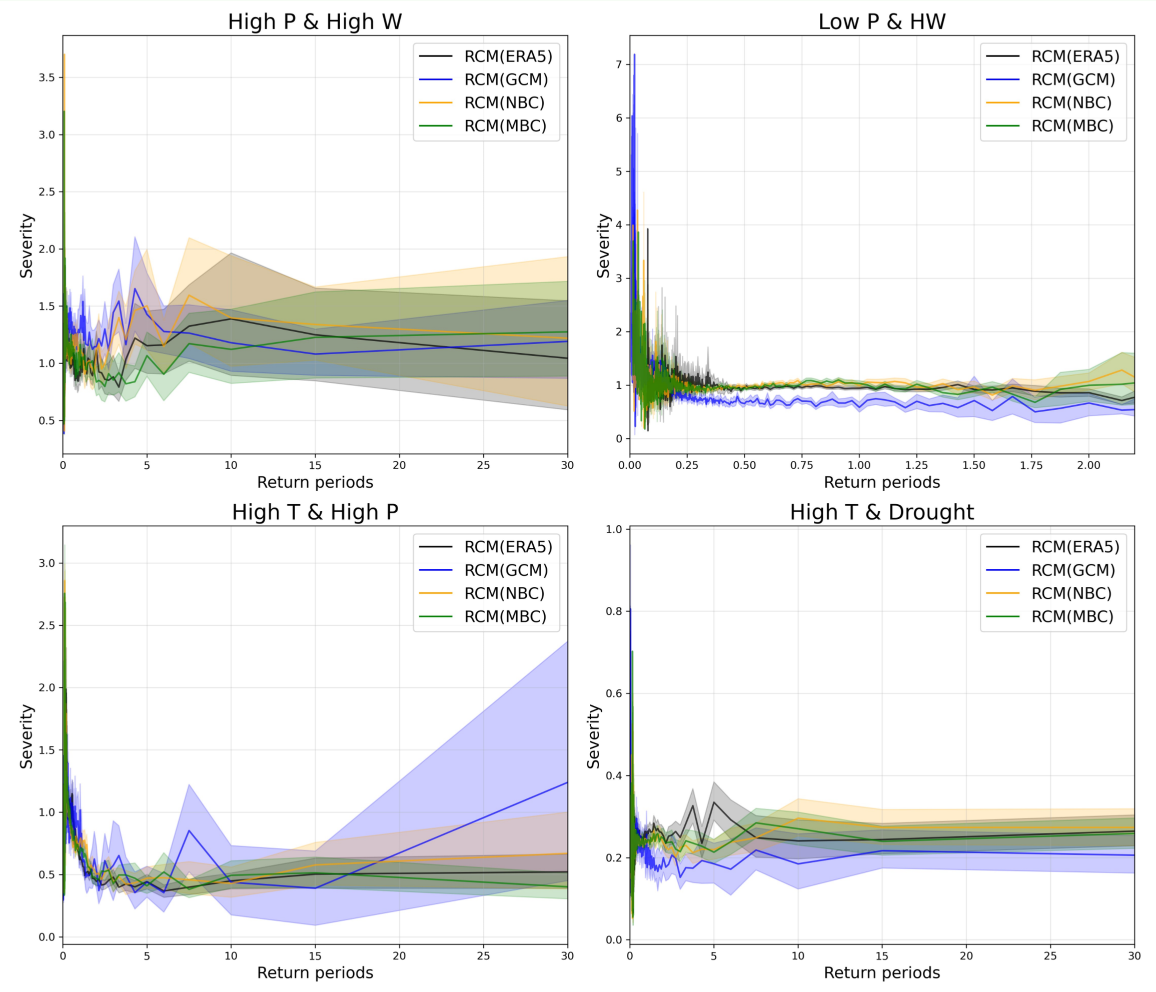


Definitions of the extreme events and indices

Variable	Name	Threshold	Definition
Maximum wind speed	High W	> 95th percentile	95th percentile of daily maximum wind speed of 3-hourly data
High precipitation	High P		95th percentile of daily precipitation sum of 3-hourly data
Maximum temperature	High T		95th percentile of daily maximum temperature of 3-hourly data
Low precipitation	Low P	<10th percentile	10th percentile of daily precipitation sum of 3-hourly data
Excess Heat Factor (EHF)	HW	>0	Anomaly over three consecutive days against an extreme temperature threshold (90th percentile of the calendar day) and the anomaly of the same window against a recent (prior 30-day) temperature
3-month Standardized Precipitation Index (SPI)	SPI	<-1.3	A drought measure specified as a precipitation deficit

The combination of hazards and/or extreme events.

Variable pair	Possible impact
High P and High W	Wind gusts with severe thunderstorms and associated damages
Low P and HW	Crop failure, soil desiccation, water shortages
High T and Drought	Wildfires, agricultural loss, water shortages
High T and High P	Flash flooding, widespread landslide, massive snowfall



Severity (S) was defined as a ratio of the magnitude of each event and the 95th percentile threshold of observation.

The bias of compound events in four climate zones across Australia

Conclusion

- This study investigated the impact of multivariate bias correction of the RCM boundary conditions with regard to compound events.
- While the RCMs with uncorrected and bias-corrected boundaries produced similar biases in some event types, multivariate bias correction broadly represented the compound event frequency better, particularly for high temperature and high precipitation.
- This study provides preliminary insights into the possibility of using multivariate bias correction prior to RCM simulation for compound risk assessments.

Reference

- Kim, Y., Evans, J. P. & Sharma, A. (2023). Correcting Systematic Biases in Regional Climate Model Boundary Variables for Improved Simulation of High-Impact Compound Events. iScience.
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- Kim, Y., Evans, J. P., Sharma, A., & Rocheta, E. (2021). Spatial, temporal, and multivariate bias in regional climate model simulations. Geophysical Research Letters, 48.