

# HOW HAVE THE LATEST GLOBAL CLIMATE MODELS IMPROVED?



Climate Systems



National Environmental Science Program  
Extreme events explained

## Climate models are the best available tools to investigate and understand possible future climates

The World Climate Research Programme coordinates the international Coupled Model Intercomparison Project (CMIP). CMIP makes model outputs from global modelling groups available to researchers and decision-makers every 6 to 7 years. The latest suite of outputs, CMIP6, combines the best available information from more than 100 global climate models. Researchers worldwide continue to develop and improve climate models. This is a complex, iterative and incremental process, often resulting in an improvement in some aspects of a model.

### What's new in CMIP6?

Overall, CMIP6 models are better at simulating historical global temperature extremes. CMIP6 models also tend to project a larger global temperature increase than previous CMIPs, however these higher temperature projections are being evaluated by scientists as some 'hot' models are present in the suite.

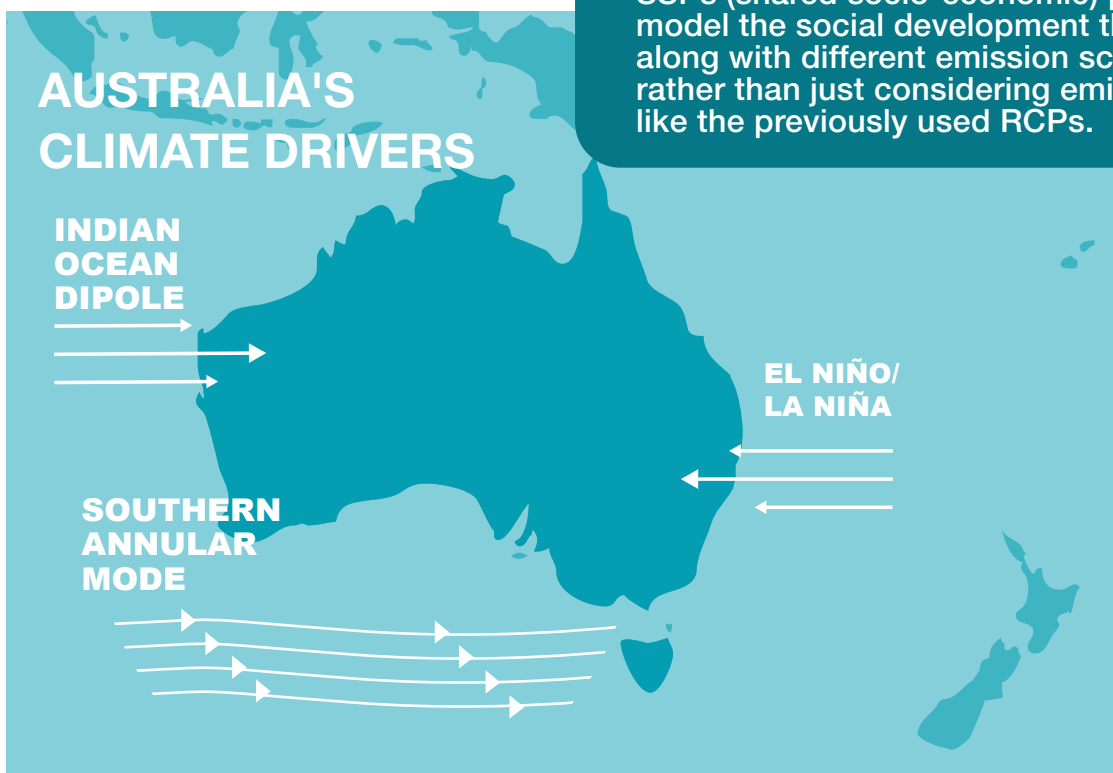
Australia's climate is influenced by a range of climate drivers, including the El Niño Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD), and the

Southern Annular Mode (SAM). These drivers have varied seasonal and regional influences on Australian rainfall. Understanding the relationship between these drivers and how well they are represented in climate models provides critical information to support many sectors including emergency, infrastructure, agriculture and environmental decision-making.

### How well do CMIP6 models simulate Australia's rainfall?

Climate Systems Hub researchers evaluated CMIP6 models to understand how well they represent climate processes and how their variability influences regional rainfall.

They found an improvement in how well CMIP6 models simulate the relationship between ENSO and IOD events and Australia's springtime rainfall. While CMIP6 models have also improved their representation of SAM variability, the simulated relationship between SAM and Australian rainfall will improve further in future CMIP models.



SSPs (shared socio-economic) pathways model the social development that goes along with different emission scenarios rather than just considering emissions like the previously used RCPs.

## How well does CMIP6 simulate key climate drivers?

Climate driver	What has improved in CMIP6	Areas for further improvement
El Niño-Southern Oscillation (ENSO)	Springtime influence of ENSO on Australian rainfall.	Simulations of autumn and wintertime ENSO influence.
	Simulations of La Niña influence over northern and north-east Australia in spring and summer.	The seasonal cycle of ENSO.
	The average state of the tropical Pacific Ocean and the amount of year-to-year variability along the eastern equatorial Pacific.	Large variation between model simulations of ENSO impacts.
Indian Ocean Dipole (IOD)	The overall strength of IOD influence in winter and spring.	IOD influence on Australian rainfall and its spatial scale.
	IOD influence in the Southern Australia and Rangelands Natural Resource Management regions.	Simulations of Indian Ocean processes and IOD influence on Australia's climate.

## Climate modelling to support action on climate change

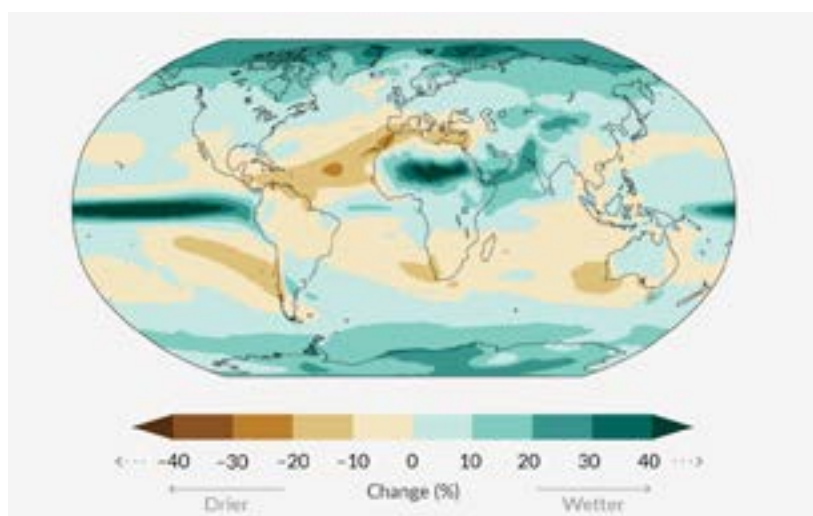
Model improvements following CMIP6 will result in greater confidence in projections of future changes to Australia's climate, water availability, flood risk, drought and fire risk. However, the large spread in model-to-model behaviour remains a source of uncertainty.

The scientific community continues to investigate how climate drivers and their interactions will change under a changing climate to provide the best possible information to support action on climate change.

### CMIP6 provides the most up to date information about possible future climates

### ACCESS in CMIP6

The Australian Community Climate and Earth System Simulator (ACCESS) is Australia's contribution to CMIP6. There are two versions of ACCESS in use for climate research – ACCESS-CM2 and ACCESS-ESM1.5. Both models are better than previous versions in some aspects, with more realistic rainfall over land (ACCESSCM2) and an improved carbon cycle representation (ACCESS-ESM1.5). Climate Systems Hub researchers are working towards improving the representation of ENSO and further increasing the accuracy of ACCESS.



CMIP6 allows us to visualise rainfall shifts over Earth. This IPCC graphic (2021) shows projected average rainfall change in a 2 °C world relative to 1850-1900.

### References

- Chung, C. T. Y., Boschat, G., Taschetto, A. et al. (2023) Evaluation of seasonal teleconnections to remote drivers of Australian rainfall in CMIP5 and CMIP6 models. JSHSS, in press.
- Masson-Delmotte, V., P. Zhai, A. Pirani, et al. (eds.) IPCC, 2021: Summary for Policymakers. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

Learn more about the Climate Systems Hub and Extremes events explained at <https://nesp2climate.com.au>

