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A snapshot of climate change impacts for Queensland and regions using high-resolution downscaled CMIP6 projections

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Abstract: Understanding the impact of climate change is vital to ensure infrastructure planned today will be resilient to future natural hazards. It is also important to inform emergency and health services, as well as for the development of adaptation policies around agriculture, water supply and other industries. Global Climate Models (GCMs) provide climate projections at a coarse spatial resolution. Therefore, high-resolution downscaled regional scale projections are recommended to support regional and local adaptation planning. We have downscaled 15 CMIP6 simulations using the global variable resolution Conformal Cubic Atmospheric Model (CCAM) to a 10 km spatial resolution over Australia. Evaluation of downscaled simulations show that they add value compared to their host GCMs especially for coastal and mountainous regions and for climate extremes (Chapman et. al., 2023; Syktus et al., 2023).

Here, we assess the impact of climate change on precipitation and mean temperature from downscaled models for two different future periods (2040-2059 and 2080-2099) in comparison with the historical period (1981-2010) for three different Shared Socioeconomic Pathways (SSPs) – SSP1-2.6, SSP2-4.5 and SSP3-7.0 (low, moderate and high emissions scenarios respectively). We evaluate the impact of climate change over Queensland as a whole, and for Queensland's Regional Plan Areas (RPAs).

We found that under these emission scenarios the annual average warming for Queensland is 1.4°C (0.6 to 1.9°C) for SSP1-2.6, 1.7°C (1.0 to 2.3°C) for SSP2-4.5 and 1.9°C (1.4 to 2.5°C) for SSP3-7.0 by 2050. By 2090 temperatures warm by 1.6°C (0.6 to 2.2°C) for SSP1-2.6, 2.7°C (1.8 to 3.4°C) for SSP2-4.5 and 3.9°C (3.0 to 4.6°C) for SSP3-7.0. In general, the warming over summer (DJF) is higher and in winter (JJA) is lower. Projected changes in annual precipitation show a decrease of less than 10% for the SSP3-7.0 scenario and similar decreases for summer rainfall for the SSP1-2.6 and SSP2-4.5 scenarios by 2090. In contrast, summer precipitation for the SSP3-7.0 scenario is projected to slightly increase by 2090 in comparison to the historical period. When comparing the downscaled projections to those for the corresponding CMIP6 host models, projected temperatures show slightly greater warming and smaller precipitation decline across all seasons over Queensland. The projected range of temperature and precipitation changes are also smaller for the downscaled projections than for their host CMIP6 GCMs. The projected changes in climate vary substantially across Queensland's RPAs and climate domains. This analysis explores the spatial patterns and other regional variations in the projected climate for Queensland's RPAs under different SSPs.

REFERENCES

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