Projections of southern hemisphere storm formation to support adaptation in the face of a variable and changing climate.

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Large changes in the southern hemisphere circulation over the last sixty years have impacted on the properties of weather systems associated with mid-latitude storms and consequently led to reductions in rainfall, particularly over southern Australia.

Whether these trends are likely to continue into the future under increasing anthropogenic greenhouse gas forcing is an important question with direct consequences for rainfall over southern Australia.

This information is vital for enhancing our capability to identify and respond to emerging issues including agriculture and water sectors such as implications for water resource management, food security, crop losses, and floodplain planning and management.

Disaster risk management planners as well as those working in the impacts and adaptation space need to be well informed of the full range of possible future scenarios in order to effectively manage risks for their respective communities. Here we present results from a carefully selected set of the seven “best” models and examine how the observed 20th century trends in storm formation continue in a stabilisation mitigation scenario compared with a high emission world.

High resolution, dynamically downscaled simulations of tropical cyclones

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The dramatic and damaging effects of tropical cyclones (TCs) are already clearly apparent in the current climate, making potential changes in the frequency or intensity of these storms in the future of immense interest. The present study concentrates on the south-west Pacific where many island nations are strongly affected by TCs through loss of life and damage to crops and infrastructure due to heavy rainfall, strong winds and storm surge. The Weather and Research Forecasting (WRF) model is used to downscale to a resolution of 4km; firstly from reanalysis data and secondly using output from a global climate model (GCM). Some recent TCs such as TC Yasi (QLD), TC Pam (Vanuatu) and TC Winston (Fiji) are downscaled to show the ability and limitations of this methodology.

Since global climate models are relatively coarse and unable to properly resolve TCs, they are unable to reproduce the observed intensities. However, they are able to simulate TC-like features. Using a detection algorithm allows us to detect these TC-like vortices directly from the climate model data. In order to analyse changes in intensities, the individual events detected in the GCM (ACCESS1.0) were downscaled using WRF. The ability of WRF to simulate the TCs in the current climate is assessed and changes in wind speed, pressure, size and rainfall under a future climate scenario are examined. Preliminary results show an increase in the size and intensity of TCs occurring in the future. These will have likely knock-on effects on waves, storm surge and coastal erosion.