

The Role of IOCI in Understanding WA's Changing Climate

Stage 3 of the Indian Ocean Climate Initiative (IOCI) is committed to establishing and maintaining state-of-the-art and regionally-specific knowledge of past and projected future climate trends in the State of Western Australia, and making such knowledge available in a form helpful for appropriate sectoral decision-making and for public information processes.

IOCI will continue to pursue strategic research to better understand the drivers of the weather and climate of south-west and north-west WA. One component of IOCI's research aims to identify a 'fingerprint' of global warming relevant to WA and thus confirm if observed changes are primarily caused by such warming and might continue into the future.

How will IOCI add to the current available knowledge?

The number of high-quality rainfall observation stations in WA is relatively small, particularly in the north-west. Even fewer of these stations have high-quality daily rainfall records (**Figure 1(a) and 1(b)**). IOCI aims to re-assess data quality and availability for WA sites and broaden the high-quality network so that the observed trends can be more confidently described. Climate change has an impact on extreme rainfall events, and thus extending the network of daily rainfall is very important for the detection of changes to short duration events. Once these extended data are available, statistical models will be built to enable large-scale climate model results to be used to provide information at fine time and space scales.

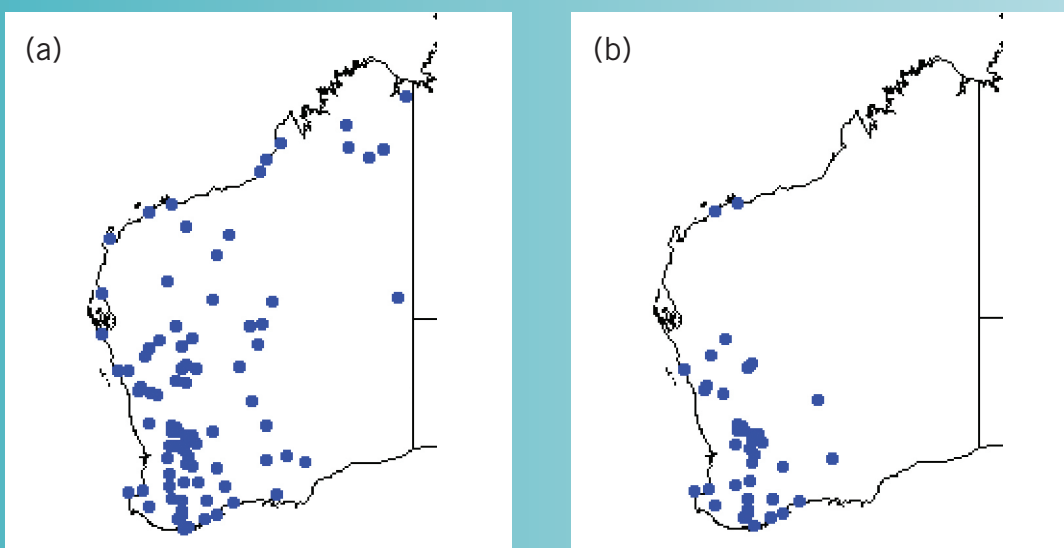


Figure 1 Stations with long-term rainfall data (a) monthly, and (b) daily (BoM, 2009)



South-west WA

Large-scale weather systems in the mid-latitudes, such as cold fronts and low pressure systems, are generally well-represented in climate models while rainfall and tropical processes are less well-represented. Improving our understanding of the causes of variability in rainfall and its associated weather systems improves our confidence in the rainfall projections produced by climate models.

The reduction in the potential for storm development over south-west WA, caused by the shift in storm tracks, and the consequent reduction in the number of deep low pressure systems affecting the region is responsible for the early winter rainfall decline since the 1970s. Most climate models' projections for the middle of this century clearly show this decline. IOCI will examine the causes of the shift in the storm tracks and the reduction in the potential for storm development to determine if these changes will continue or have now reached their full extent.

Although future projections of rainfall change are consistent across the southwest, the magnitude of change varies between climate models. The large spatial resolution of a global climate model means that the rainfall over a small area such as south-west WA is unlikely to be well-represented. Techniques known as 'downscaling' can provide far more useful estimates of the pattern and magnitude of rainfall changes and IOCI will continue to develop these techniques to more accurately characterise future rainfall over the south-west.



South-west WA remains an important focus for the current IOCI research program. Further questions on the trend of winter rainfall in recent years, the spatial extent of the rainfall trend and trends in the intensity of rainfall events will be examined.

For further
information on
the IOCI research
program, go to

www.ioci.org.au

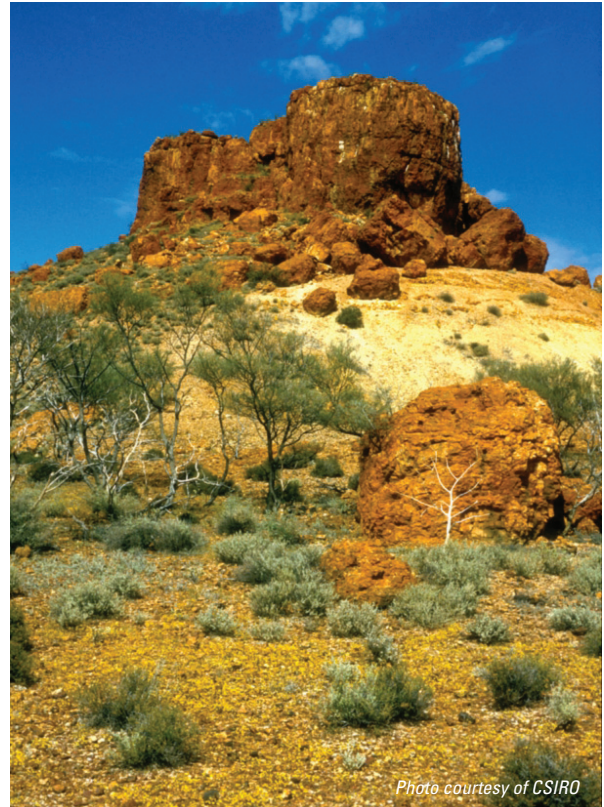
North-west WA

Previous work of the IOCI research program has been focused primarily on the climate of south-west WA. From March of 2008, the IOCI program was extended to study the impacts of climate change on the resource-rich north-west WA.

Downscaling global model projections for WA's north-west provides useful information to WA's resource industries in the region to enable them to adapt to the impacts of climate change. Examining the climate of the north-west poses some new challenges due to fewer climate observation stations and the fact that climate models have more difficulty representing tropical processes and variability in the north-west than the large-scale weather systems that influence the climate in the south-west.

The observed trend of increased rainfall in WA's north-west is not reflected in global models in the Intergovernmental Panel on Climate Change's Assessment Report 4. Rainfall predictions over north-west WA from these models are varied. Further work is therefore required to produce meaningful rainfall projections for north-west WA.

A hypothesis on the observed increased rainfall in north-west WA is that the aerosols from South-east Asia have modified the temperature gradients that drive the Australian monsoon. Very few of these climate models factor in the full and complete impact of aerosols on rainfall. IOCI scientists are therefore working to include the impact of aerosols in the CSIRO model to test this hypothesis. Aerosol levels are projected to change as industries in South-east Asia become cleaner. Thus, if the aerosols are causing the increase in north-west WA's rainfall, this increase may reverse in the future.



The projections of rainfall have relevance for the projections of temperature in the north. For example, the more subtle warming (and even cooling in some parts) in observed temperature in the north-west compared to the south-west is likely due to the observed increase in rainfall in the north-west. The increased rainfall is likely to have muted temperature increases that might have otherwise occurred had the rainfall remained at previous average levels.

In addition, tropical cyclones (TCs) are not captured at the scale of most climate models. However, IOCI scientists have been successful in using the outputs of climate models as inputs for a fine scale model to predict TCs. The number and intensity of TCs off the north-west coast of WA have been simulated under present day and future conditions. A major component of the study of the north-west is examining the variability, dynamics and predictability of tropical cyclones in the Indian Ocean that impact WA.



Useful links

www.ioci.org.au

www.bom.gov.au

www.csiro.au

www.dec.wa.gov.au/climatechange

www.climatechangeinaustralia.gov.au

Reference

Bureau of Meteorology (BoM)

Australia's high-quality climate change datasets

Commonwealth of Australia 2009, Bureau of Meteorology,

<http://www.bom.gov.au/climate/change/datasets/datasets.shtml>

(Accessed 27 January 2009)