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A guide to future climate projections for water resource management in Western Australia

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Abstract: A guide to future climate projections for water resource management in Western Australia has been recently developed. The guide provides a practical framework for using climate change projections in climate impact and risk assessment for planning and decision-making for water-resource application. In the guide, it is recommended to use the latest generation of downscaled future climate projections from the Australian Water Outlook – the Bureau of Meteorology's National Hydrological Projections (BoM 2022). A framework is developed for using climate information in risk-based decision making for water resources in Western Australia. The framework is underpinned by the concept of 'storylines' to decide how to best use future climate projections for each assessment.

The National Hydrological Projections are the Bureau's local-scale climate projections data for Australia. The data are produced on a 5 km grid to provide application-ready data at a temporal and physical resolution useful for local water resource modelling and planning. The data are produced from a subset of the CMIP5 representative concentration pathways (RCPs) and global climate models (GCMs) as well as one regional climate models (RCMs). The downscaling and bias correction processes applied to the GCM data improve the representation of local climate conditions and reduce biases relative using observed data stemming from AWAP. The National Hydrological Projections are produced from, two RCPs (RCP4.5 and RCP8.5 – medium to high greenhouse emission scenario), four GCMs (ACCESS 1-0, CNRM-CM5, GFDL-ESM2M, MIROC5), and three bias correction methods (QME, ISIMIP2b, MRNBC). In addition, the Bureau used the CCAM-r3355 regional climate model (RCM) to produce dynamically downscaled data from the GCMs, and this was bias-corrected using the ISIMIP2b method. The climate data (16 ensemble members per RCP) was then run through the Bureau's operational Australian Water Resources Assessment Landscape hydrological model (AWRA-L) to project changes in hydrological variables including assessments of hydrological impacts, such as extremes. This resulted in the development of nationally consistent, 32 spatially downscaled gridded datasets for all of WA, for the variables rainfall, PET, maximum and minimum temperature, solar radiation, wind speed, soil moisture and runoff. These datasets are application ready for use in climate projections, impact assessment and subsequent risk-based decision-making approaches for most water resource applications.

Most climate-dependent water management decisions will have some level of risk. There are large uncertainties in projections of future climate, so climate risk management relies on our capacity to be comfortable with the level of risk and respond with effective adaptation strategies. The level of acceptable risk will vary for different water sector assessments and according to the risk appetites and tolerances of decision-makers and stakeholders. Here we present a framework that guides users in using hydrological projections data in the context of different risk levels. The guide recommends using the concept of 'storylines' to decide how to best use future climate projections for each assessment. Storylines also provide a clear narrative for proponents, stakeholders and government departments to assess the risk from changes in future climate variables to the impact on the water system and inform adaptation planning. The climate assessment framework takes the user through the process of understanding their hydrological system and problem, to making a future climate assessment and choosing how to use projections, and finally communicating their findings. The framework is formulated as a series of questions provided to help water resource managers and decision-makers understand, assess and report on appropriate climate projections for their application.

REFERENCES

Department of Water, 2023. Guide to future climate projections for water resource management in Western Australia, Surface Water Hydrology Series HY38, 2023.

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