

Australian meteorological drought: a review of process understanding, research gaps and model development needs

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Abstract: The understanding of Australian meteorological drought has evolved over the last decade, from an understanding of the mechanisms causing droughts to develop, to include an understanding of how they intensify and terminate.

Drawing on observational, earth system model and machine learning-based research, this review shows that the understanding of Australian meteorological drought has evolved from one that considers drought as primarily resulting from large-scale processes typically related to low precipitation, towards an understanding of the importance of synoptic processes that promote heavy precipitation.

It is now understood that Australian meteorological droughts develop and intensify largely through a sustained absence of synoptic systems responsible for strong atmospheric moisture transport and uplift, together with an absence of wet phases of large-scale modes of climate variability. The return of these heavy precipitation-promoting processes is key to drought termination and can play a role in post-drought flooding.

Recent impactful droughts, combined with projections of future drought changes, have motivated the research that underlies this evolving understanding of meteorological drought. However, Australian droughts are changing, and further research is urgently needed to address persistent knowledge gaps and model shortcomings. Consequently, this review identifies priorities for drought research, highlighting the value of multidisciplinary research and expanded observational networks. The review also highlights the urgent need to improve the representation of drought in earth system models and proposes a set of model development target areas to achieve this.

This presentation will summarise the latest process understanding of how Australian meteorological droughts develop, intensity and terminate, and will outline a research agenda to address knowledge gaps and model shortcomings to improve the understanding, simulation and prediction of Australian droughts.

Keywords: *Drought, review, climate modes, weather systems, model evaluation*