# Ensemble methods for drought projections

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**Abstract**

The term ‘drought’ generally refers to a period with a deficit of water relative to normal conditions. Defining the norms can be problematic since they are ‘not absolute’, particularly in the non-stationary context of climate change. Also, different systems (or applications) use water in different ways and at different periods. Thus, there are hundreds of drought indicators (or indices) available, which are commonly categorized into four types of drought: meteorological drought (below-normal rainfall), agricultural or soil moisture drought (below-normal storage in saturated zone), hydrologic drought (below-normal water availability in streams, lakes and/or groundwater) and socioeconomic drought (when water supplies cannot meet the demand). Likewise, the approach to define the onset, end and degree of severity of the drought event can vary and is usually arbitrary.

There is no single agreed definition of drought, and some form of rainfall deficit in a region relative to the long-term average is commonly used. In the context of climate change impact and vulnerability assessment, a useful definition of drought may depend on what is appropriate to the activity, time and place under consideration.

Work on projections for drought in Australia commenced in early 1990s, after which there was little activity on this topic until the late 2000s, continuing to the present. The projections of drought characteristics (e.g. duration, frequency and intensity) are usually informed by climate projection data from of Global Climate Models (GCMs). The range of possible futures should represent, at least, two broad modelling uncertainties: method used to develop climate change scenarios, and the drought indicator and/or model(s) used to estimate the future drought. There are also sub- and sub-sub-uncertainties within each of these sources of uncertainty that need to be taken into account.

Ensemble results often vary with methods and regions, according to studies. For example, the projected future drought frequency calculated from raw and bias corrected GCMs simulations data can differ widely. In some cases, projections informed by better performing GCMs can result in a decreased ensemble range and in a clearer sign of the likely change in drought intensity in some regions in Australia compared to those built on all available GCMs data. Projections also depend on the drought indicator used, drought characteristic and timescale under consideration. Other methodological challenges, including how to communicate ensemble projections, will also be highlighted in the talk along with some thoughts about the future.