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# Incorporating palaeoclimate data into water security planning and decision making – a case study from southeast Queensland, Australia

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Decision makers in the water sector need to deal with existing hydroclimatic variability and uncertainty about future changes to climate and catchment conditions. Identifying solutions for hydroclimatic risk adaptation strategies that are both optimal and robust in the presence of variability and uncertainty presents a difficult challenge. A major reason for this challenge is the fact that the instrumental record in Australia is short (∼60-130 years) and fails to encompass enough climate variability to allow the calculation of robust statistics around the baseline risk of extreme events (e.g. multi-year droughts, decadal periods with clustering of major flood events). This climate variability is documented pre-1900 in palaeoclimate records from sources such as corals, tree-rings, freshwater and marine sediments. Despite being remote from Queensland, a high resolution and highly correlated palaeoclimate record from the Law Dome ice cores in Antarctica (Vance et al. 2015) is also now available and has identified eight mega-droughts (lasting from 5-39 years) during 1000-2009 AD. Most importantly, the palaeoclimate information confirms that the post-1900 instrumental period (i.e. the period on which all water resources infrastructure, policy, operation rules and strategies is based) does not capture the full range of variability that has occurred. Other work also clearly shows that, out to 2050 at least, impacts associated with natural variability significantly exceed even the worst-case climate change scenarios (i.e. obtained from Global Climate Models run under the highest emission scenarios).

This presentation will demonstrate how the Law Dome ice cores from Antarctica have been used to produce a highly accurate, 1000 year, annual and seasonal resolution, hydroclimate reconstruction (i.e. precipitation and streamflow) for the southeast Queensland region of Australia. We will then show how the palaeoclimate data has been incorporated into the South East Queensland Regional Stochastic Model (SEQRSM) of catchment hydrology to (a) demonstrate the utility of a palaeoclimate proxy approach in producing more robust estimates of hydroclimatic risk under climate variability and change; (b) gain improved insights into the characteristics (e.g. location, duration, frequency, magnitude, spatial extent, sequencing) of hydroclimate extremes for water security planning and (c) deliver optimised solutions for hydroclimatic risk adaptation strategies to water managers (e.g. optimal and sustainable supply of water to meet current and future urban requirements and also to nearby catchments to support irrigation for dairy, vegetable and forage crops).