The role of geomorphology in identifying climate extremes: prospects for the 21st century

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- **This abstract is for an Oral**
- **Indicate the Proposed Session – Landscapes and Climate**

ABSTRACT

It has been over a decade since the catastrophic 2011 floods in Queensland and 2022 was characterised by a continuation of the 'big wet', as Australia entered its third consecutive La Niña year. This was a rare triple-dip La Niña event, only the fourth triple-dip since 1900 and the first for 22 years resulting in huge economic, environmental and social impacts including the tragic loss of nine lives. The continuation of La Niña culminated in Sydney's wettest year on record since 1859. In total, 2022 saw at least AUD $6.95 billion of industry reported losses, with the SE Queensland and NSW floods now being the largest insured loss event for Australia on record, with a reported industry loss of AUD 5.81 billion, surpassing the 1999 Sydney hailstorm (AUD $5.57 billion). Insurance claims spanned 35 river catchments, covering a 1600 km north to south extent. River flood peaks occurred over a 16-day period, and many rivers experienced more than one peak. Flood depths varied greatly between river catchments. In Brisbane, Queensland and in areas of the Sydney basin, the flood depth had a 20-year recurrence interval, in areas of Lismore (northern NSW) flood depths exceeded the predicted 800-year recurrence interval. New Zealand also experienced cyclone Gabrielle in February 2023 resulting in $8 billion in damages with the loss of 11 lives.

So what role can geomorphologists play in better assessing risk associated with these kinds of events? This talk summarises the challenges and the prospective value in using sedimentary archives deposited by lakes and rivers. Using slackwater deposits (SWD) in riverine settings and palaeoshorelines of playa lakes across the Australian continent (e.g. from diverse moisture sources) extreme events all > 1% annual exceedance probability (AEP) are examined. The sedimentary signature from these geomorphic landforms provides unambiguous evidence for extreme runoff conditions, helping to identify climate extremes (and their associated landscape responses). Integrating this kind of data into revised flood frequency analyses and risk assessments is a forum for which geomorphology should be actively contributing but the reality is very different.