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Understanding and adapting to flood risk in a variable and changing climate

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Abstract Flooding over the last three years in various parts of eastern Australia, following more than a decade with very little flooding, has highlighted the fact that the risk of flooding is not the same from one time period (e.g. season, year, or decade) to the next and that traditional assumptions of hydroclimatic stationarity are invalid. Compounding this is the potential for non-stationarity in flood risk due to projected impacts of anthropogenic climate change. That is, under projected global warming the resulting changes to ocean–atmospheric circulation patterns are likely to lead to shifts in the location, magnitude and frequency of extreme precipitation events and the associated flooding. Therefore it is clear that "stationarity is dead" and that work is urgently required to: (a) re-evaluate current (or baseline) flood risk estimates to take into account the influences of natural climate variability, (b) develop estimations of future flood risk that take into account both the role of natural climate variability and the projected impacts of anthropogenic climate change, and (c) develop positive adaptation strategies and policy frameworks based on these re-evaluated (and more realistic) flood risk estimates. This study concentrates on the first task (re-evaluation of baseline flood risk estimates) by quantifying inter-annual to multi-decadal variability of flood risk in eastern Australia. Climate variability and climate change both play an important role in influencing flood risk but that role is not yet properly understood or quantified. In order to move towards a more resilient, well adapted world this paper addresses the fundamental, but as yet unanswerable, question of whether flood risk will increase or decrease by first understanding the mechanisms that cause flood risk to vary over time.

Key words non-stationarity; uncertainty; El Niño/Southern Oscillation (ENSO); Interdecadal Pacific Oscillation (IPO)