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Can annual streamflow volumes be characterised by flood events alone?

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Abstract: Can total annual streamflow in any given year be largely characterised by a relatively small number of high flow events? A comprehensive assessment of this is of high value as there is evidence to suggest that as flood events increase in rarity a more consistent response between streamflow extremes and temperatures increases can be established — providing greater reliability in projections of rare events. We propose here a novel methodology to characterise streamflow regimes in the context of total annual streamflow for water supply. Using the Australian Bureau of Meteorology's Hydrologic Reference Station database, we developed annual event flow distributions that standardise the relationship between total annual streamflow and event flows. It was found that the annual event flow distributions are primarily a function of local climate and catchment size and were largely insensitive to interannual variability represented by the El Ni˜no Southern Oscillation Index, mean annual temperature, or total annual rainfall volume. Statistically significant trends were found in the timeseries of annual event flow distribution values, signalling a move to a less even distribution in the southern latitudes and a more even distribution in the northern latitudes. Our results show that total annual streamflows can be characterised by a small number of high flow events. This suggests that for Australia's most critical surface drinking water supply catchments the streamflow yields can be represented by changes in a few, high flow events, independent of interannual variability. As these relationships are non-stationary, they may provide a basis for understanding changes in water supply into the future.

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