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Long-term flood frequency analysis in the Mekong and Yellow River basins

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The quantification and understanding of hydrological variability is of considerable importance for the estimation of flood risk and for flood forecasting. At present, traditional methods are largely empirical in that annual maximum floods are assumed to be independent and identically distributed. These traditional flood frequency analysis techniques do not acknowledge the possibility of serial correlation within periods of elevated or reduced flood risk. However, recent research has highlighted the persistence of multi-decadal epochs of enhanced/reduced flood risk in eastern Australia that is related to naturally occurring ocean-atmosphere circulation processes that cause significant hydro-meteorological variability in many parts of the world, namely the El Niño/Southern Oscillation (ENSO) and the Inter-decdal Pacific Oscillation (IPO). In this study, long-term flood frequency analysis is performed in the Mekong and Yellow River basins using the University of Yamanashi Distributed Hydrological Model (YHyM) to simulate streamflow where and when observed discharge records are unavailable from 1920 to 2000. It is found that the flood risk estimates obtained using the observed data (which are only available after 1972 for both the Mekong and Yellow River basins) are markedly different to those obtained when the 'extended' streamflow records are used. This implies that multi-year periods of elevated or reduced flood risk also exist in the Mekong and Yellow River basins and that traditional flood frequency analysis techniques, applied to the limited observed discharge data that is available, significantly misrepresent the actual flood risk. The impact of recent reservoir construction on the frequency and magnitude of flood events is also assessed. These results have marked implications for achieving robust flood risk estimation and enabling improved long-term probabilistic flood forecasts.