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Decision-Making for Adaptation Investment in a Highly Variable Climate

P. Enda O'Connell, Greg O'Donnell, Jim Hall, and Stephen Blenkinsop
School of Civil Engineering and Geosciences, Newcastle University, UK (p.e.oconnell@ncl.ac.uk)

Methodologies for determining flood protection investments have traditionally relied on past hydrological records being stationary and therefore statistically representative of future conditions. Due to climate change, it has been suggested that the hypothesis of stationarity for hydrological time series models is no longer tenable, and that non-stationarity must be invoked. However, while this proposition is very plausible, nonstationarity represents a highly intractable assumption in that it can take many different forms, and the usual processes of statistical averaging used in calculating means, variances and covariances can no longer be invoked. It is suggested that, before stationarity is discarded, its limits should be explored more fully by using stationary time series models that exhibit long-term variability/persistence to explore investment strategies as a function of increasing levels of variability in hydrological time series. One such model, the ARMA (1,1) model, is employed here in a virtual case study where a flood protection investment problem is formulated as the optimization of a cost-benefit function for different levels of persistence and knowledge of the pdf of annual flood maxima. Do nothing, reactive and proactive investment strategies are formulated, and results for each in terms of costs and damages will be presented.