



Linking stochastic downscaling to hydrological modelling in southern Australia

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A stochastic downscaling framework linking the nonhomogeneous hidden Markov model (NHMM) to hydrological models allows probabilistic quantification of the impacts of projected climate change on catchment water yield. The NHMM simulates multi-site, daily precipitation conditional on large-scale atmospheric forcing. When driven by atmospheric predictors from the NCEP/NCAR Reanalysis, the NHMM reproduces the observed out-of-sample intra-seasonal, interannual and interdecadal precipitation variability for several regions in southern Australia.

We highlight issues that limit confidence in the projected catchment yields from hydrological models driven with NHMM precipitation projections obtained using atmospheric predictors from GCM scenarios. In the case of the semi-arid catchments of southern Australia, the rainfall-runoff relationship is highly non-linear. Thus the correct simulation of precipitation event timing and magnitude is crucial if the observed catchment response to precipitation is to be replicated. We investigate the effect on simulated catchment yield of (i) GCM biases in atmospheric predictor seasonal cycles, and (ii) under-estimation of the multi-day precipitation distribution upper tail. Methods for overcoming these limitations are presented.