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An inverse approach to perturb historical rainfall data for scenario-neutral climate impact studies

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Scenario-neutral approaches are used increasingly for climate impact assessments, as they allow water resource system performance to be evaluated independently of climate change projections. An important element of these approaches is the generation of perturbed series of hydrometeorological variables that form the inputs to hydrologic and water resource assessment models, with most scenario-neutral studies to-date considering only shifts in the average of each variable. In this study a stochastic generation approach is used to perturb not only the average of the relevant hydrometeorological variables, but also attributes such as the intermittency and extremes. An optimization-based inverse approach is developed to obtain hydroclimatic time series with uniform coverage across the range of possible rainfall attributes (referred to as the 'exposure space'). The approach is demonstrated using a widely used rainfall generator, WGEN, at a case study at Adelaide, Australia, and is shown to be capable of producing evenly-distributed samples over the exposure space. The inverse approach expands the applicability of the scenario-neutral approach in evaluating a water resource system's sensitivity to a wider range of plausible climate change scenarios.