Estimating uncertainties in simulations of natural and modified streamflow regimes in South Africa

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Abstract The Pitman rainfall–runoff model is applied in an uncertain framework to simulate the natural and modified hydrology of two regions in South Africa using physically-based parameter estimation procedures, uncertainty in the quantification of the characteristics of small farm dams, and input rainfall uncertainty. While the parameter uncertainty dominates the final model outputs in both cases, the degree of uncertainty varies between low and high flows. The relative contribution of the water use and rainfall uncertainties is different between the two study areas, the latter being very important in areas of steep topography where rainfall variations are poorly defined. While some of the uncertainties can be reduced (notably water use and rainfall), this can only be achieved through substantial investments of human and financial resources. The results suggest large uncertainty in natural and impacted low flows, which has serious implications for water management related to environmental flow legislation.

Key words hydrological modelling; uncertainty; water use; water resources management