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Impacts of Spatial Climatic Representation on Hydrological Model Calibration and Prediction Uncertainty in the Three Gorges Reservoir Region, China

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Sparse climatic observation poses a great challenge on mountain hydrological modelling and output reliability for decision-making in water resources management. Employing elevation bands in the soil and water assessment tool-sequential uncertainty fitting (SWAT-SUFI2) model well represented the precipitation and temperature with altitude in Daning river catchment where meteorological inputs are limited in spatial extent and derived from observations in relatively low lying locations with orographic effects excluded. Inclusion of elevation bands produced a better model performance in 1984-1993 with the Nash-Sutcliff efficiency increasing by at least 0.11 prior to calibration. With the similar R-factors from the earlier iterations, 11% more of observations were included within the 95% prediction uncertainty (95PPU) level produced by the case "without elevation bands', and an increase of 3.9% of observations within the 95PPU earned a 7.6% reduction of uncertainty in the case "with elevation bands". The calibrated model reproduced the river discharges with the performance in the calibration period changing to "very good" from "poor" without elevation bands. The prediction uncertainty was satisfactory, having 85% of flow observations included within the 95PPU. Confronting a situation of sparse climatic observation in hydrological modelling is common in mountain areas over the world. It is highlighted that it is a good solution to address deficiencies in data availability by enabling orographic effects on precipitation and temperature in hydrological models for mountainous catchments.