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Constraining the predictive uncertainty of a Central-American water-balance model using regionalised flow-duration curves.

Few regionalisation studies have accounted for uncertainties in the hydrologic model and regionalisation method, and discharge uncertainty is usually not considered at all. In this study a regional water-balance model was applied to 36 basins in Central America using regionally and globally available precipitation, climate and discharge data. A rating-curve analysis for 35 Honduran discharge stations was used to estimate discharge uncertainty for the region. Uncertain flow-duration curves (FDCs) were calculated for each of the 36 basins, accounting for both discharge uncertainty and, in some cases, uncertainty stemming from the use of short time series, which were potentially not representative for the modelling period. These uncertain FDCs were then used to regionalise a FDC for each basin, treating it as ungauged, and this regionalised FDC was used to constrain the uncertainty in the model simulations for the basin. Four of the basins had to be rejected before the modelling as a result of unrealistic relationships between runoff and precipitation data. No behavioural simulations were found when the model was locally calibrated in nine of the remaining basins – a data analysis indicated that this resulted from poor agreement between the precipitation and discharge data in these large-scale datasets. Where the regionalisation of the FDC worked best, the uncertainty bounds for the regionalised simulations were only slightly wider than those for a local calibration. The predicted uncertainty was greater for basins where the result of the FDC-regionalisation was poorer, but the simulations were still reliable. The initial model uncertainty, from the unconstrained prior parameter ranges, was reduced by around 70% on average.