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Regionalisation of flow-duration curves for calibration of a Central American water-balance model

Ida Westerberg (1), Lebing Gong (1,2), Jan Seibert (2,3), Keith Beven (1,4), Alvaro Semedo (1), and Sven Halldin (1)

(1) Uppsala University, Uppsala, Sweden (ida.westerberg@hyd.uu.se), (2) Stockholm University, Stockholm, Sweden, (3) University of Zurich, Zurich, Switzerland, (4) Lancaster University, Lancaster, UK

Although many catchments in Central America are gauged, stream-flow records are often of limited duration, associated with large uncertainty or non-accessible. The estimation of available water resources and their relation to climate variability is of key importance for water-resources management in the region, especially considering the frequency of water-related disasters like floods and droughts. Water-balance modelling can be useful to overcome temporal and spatial data gaps and obtain a comprehensive estimation of the regional water resources, but is challenged by the temporally varying availability of precipitation and discharge data and the sometimes large uncertainties in these datasets. We developed a distributed regional water-balance model that takes advantage of the globally available high-resolution HydroSHEDS hydrographic dataset both for the spatial representation and for the routing algorithm. The discharge and climate input data were a combination of local and globally available data and rating-curve analysis was used to estimate discharge uncertainty.

There is a wide variety of methods for regionalisation of flow-duration curves (FDCs), but few previous studies have estimated the uncertainty in the regionalised curves and we have found no studies that account for the uncertainty in discharge data. We developed a method for regionalising FDCs and estimating the uncertainty in the FDCs – both relating to uncertainty in the discharge data and to the regionalisation method. The regionalised uncertain FDCs were then used to calibrate the regional water-balance model. The regionalisation method was evaluated both for the accuracy in the prediction of the regionalised FDCs and in the simulation of discharge using model parameters calibrated to the regionalised FDCs.