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Evaluation of two bias-corrected regional climate models for water budget simulations in a Mediterranean basin

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Abstract This study seeks to assess runoff response to bias-corrected rainfall from regional climate models (RCM) using a water balance model. Hydrological data of observed rainfall time series and mean daily discharge observations at a basin outlet in northern Tunisia are available. In addition, meteorological data from three surrounding stations with air temperature, air pressure, wind speed, air relative humidity and sunshine length series are considered to estimate monthly potential evapotranspiration (ETP). RCM simulations of the SMH model driven by the ECHAM5 (SMH-E) and BCM (SMH-B) global climate models, provided by the European Union funded project ENSEMBLES are also considered for a control period, 1961–2000. The RCM rainfall outputs of the control period were corrected for bias by adjusting month by month the daily rainfall cumulative distributions, using a parametric quantile-mapping method with gamma distributions. A modified version of the single store water budget model BBH is considered, introducing soil texture information through pedotransfer parameters. Model parameters were calibrated using both observed runoff data at the basin outlet and the ratio of actual evapotranspiration to potential evapotranspiration. Considered as a basin signature, the latter is integrated in the calibration process. The water budget model is run at the daily time step successively with the daily observed rainfall and the daily bias-corrected RCM data series. Then, comparison of runoff impacts is performed examining simulated runoff and actual evapotranspiration statistics at the monthly resolution. It is found that simulated runoff and actual evapotranspiration responses are very similar. However, both models underestimate the runoff production during the winter season which raises the problem of water balance model calibration and validation with climate model data.

Key words RCM; climate change; bias correction; impact studies; water budget; evapotranspiration