Evaluation of alternative weather forcing for hydrologic modeling in tropical basins of Puerto Rico

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Abstract. Scarce or poor quality weather observations compromise hydrologic model accuracy, weakening support for planning and management decisions. Climate model reanalysis products with high spatial and temporal resolution can help to overcome this basic challenge, a particularly important prospect for many tropical settings. Taking advantage of exceptionally high rainfall data density in the catchments of the Rio Grande de Loiza above San Juan, Puerto Rico, we compared hydrologic model performance under alternative weather inputs: Climate Forecast System Reanalysis (CFSR) records, a standard public weather station dataset available from the Global Historical Climate Network (GHCN), and a "best case" dataset provided by the USGS Caribbean Water Science Center. In a spatially distributed implementation of the Soil and Water Assessment Tool (SWAT; 11 subbasins defined at long-term discharge stations), uncalibrated measures of Nash-Sutcliffe efficiency for daily simulations over the period 1998-2013 were <0 in most subbasins for inputs other than the USGS precipitation data. Autocalibration of each of the available weather stations (21 GHCN and 24 USGS daily records) as forcing for individual SWAT models of each of the 11 streamflow gage basins demonstrated that the highest NSE values were achieved for the weather station closest to the geographic centroid in 5 of 11 cases. In this analysis, CFSR data performed as well or better than ground observations made further than 30 km, and sometimes better than weather stations <10 km from the basin centroid. These results reinforce the value of CFSR weather data as a means to rapidly assess a consistent baseline for hydrologic model performance and as a supplement to available records in data scarce settings.