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Incorporating realistic land-surface complexity in water availability forecasts for the Latin America and Caribbean region

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Advances in computing have made it possible to run a distributed hydrological model of a large river basin with detailed grid resolution in a few hours on a personal computer. There is a mismatch, however, between the ability to create a highly intensive representation of surface features and land use on the one hand and, on the other hand, the very low resolution of observed hydrometeorological data such as precipitation, temperature and stream flow data available for model calibration. To bridge this gap, the Inter-American Development Bank initiated the development of Hydro-BID hydrological and climate modeling platform. Hydro-BID incorporates three innovative features: (1) it uses high resolution digital elevation and land use data obtained from remote sensing to incorporate realistic levels of complexity in the land-surface component; (ii) it applies a pseudo-physical hydrological model, the parameters of which are linked to high resolution land-surf ace data; and (iii) it incorporates novel tools for scaling and flow routing to support the effective use of limited ground observations at any location within a basin at which such data have been collected. The approach supports the simultaneous application of a basin model at multiple scales. Hydro-BID is an integrated quantitative simulation of hydrology and climate change based on the Analytical Hydrography Dataset (AHD). Hydro-BID utilizes the data structure and catchment and stream network topologies of AHD and applies the enhanced Generalized Watershed Loading Function (GWLF) and the RTI lag-routing model. The average size of the catchments is 90 km^2 which is relevant to directly use of downscaled climate data. Hydro-BID is a unique, flexible and powerful tool to predict future river flows in user-defined areas from the catchment to basin scale, with robust geographic/hydrologic algorithms, data layering and an ability to use “off-th e-shelf” international datasets. We applied Hydro-BID in two case studies to assess the potential impacts of climate change on water availability. The first case study is for the Rio Grande basin in northwest Argentina. Hydro-BID was used to simulate future flow time series and analyze basin-wide water stresses under several projected climate scenarios. The second case study is for the Rio Piura basin in northern Peru. We used Hydro-BID to develop and calibrate a basin model that national water authorities will use to assess the potential impact of climate change on water availability over the next several decades, as part of its national water resources planning process.