

# AN OPERATIONAL WATER AND ENERGY BALANCE ALGORITHM FOR PUERTO RICO

*Eric Harmsen*

Department of Agricultural and Biosystems Engineering  
University of Puerto Rico at Mayagüez  
harmsen1000@hotmail.com

In this study an operational water and energy balance algorithm for Puerto Rico (GOES-PRWEB) was developed. In the algorithm, an energy balance approach is used to estimate actual evapotranspiration, which is then incorporated into a water balance calculation. Solar radiation, the principal factor in the calculation, is derived from a physical model for estimating incident solar radiation at the surface from GOES satellite data. The ground level, 1-km resolution solar radiation product became available in Puerto Rico in March of 2009. Twenty-four hour rainfall is obtained from NOAA's Advanced Hydrologic Prediction Service (AHPS). In Puerto Rico, the source of the AHPS rainfall is NEXRAD radar and rain gauge data. Runoff is estimated using the Curve Number method of the USDA Natural Resource Conservation Service. Eight 3-hour values of wind speed for Puerto Rico, obtained from the National Weather Service's National Digital Forecast Database (NDFD), are averaged to obtain the daily average 10-m wind speed, and are then adjusted to the "virtual instrument height", depending on the height of the vegetation. Minimum, average, maximum and dew point air temperatures are obtained from a lapse rate approach calibrated for Puerto Rico using regression equations relating temperatures with surface elevation. These temperatures are adjusted daily with a nudging technique, using forecast temperature data from the NDFD.

The operational algorithm produces twenty-three hydro-climate variables, available to the public on a daily basis (<http://pragwater.com/goes-puerto-rico-water-and-energy-balance-goes-web-algorithm/>). Example results are presented which show the utility of GOES-PRWEB as an observational platform for evaluating hydrologic resources and climate change. This research represents a step in the development of a suite of hydro-climate products for Puerto Rico. Similar algorithms are under development for the island of Hispaniola and the U.S. Virgin Islands.