Satellite-derived potential evapotranspiration for distributed hydrologic runoff modeling

Ryan R. Spies, Kristie J. Franz, Angela Bowman, Terri Hogue, Jongyoun Kim

Distributed models have the ability of incorporating spatially variable data, especially high resolution forcing input such as precipitation, temperature and evapotranspiration in hydrologic modeling. Use of distributed hydrologic models for operational streamflow prediction has been partially hindered by a lack of readily available, spatially explicit input observations. Potential evapotranspiration (PET), for example, is currently accounted for through PET input grids that are based on monthly climatological values. The goal of this study is to assess the use of satellite-based PET estimates that represent the temporal and spatial variability, as input to the National Weather Service (NWS) Hydrology Laboratory Research Distributed Hydrologic Model (HL-RDHM). Daily PET grids are generated for six watersheds in the upper Mississippi River basin using a method that applies only MODIS satellite-based observations and the Priestly Taylor formula (MODIS-PET). The use of MODIS-PET grids will be tested against the use of the current climatological PET grids for simulating basin discharge. Gridded surface temperature forcing data are derived by applying the inverse distance weighting spatial prediction method to point-based station observations from the Automated Surface Observing System (ASOS) and Automated Weather Observing System (AWOS). Precipitation data are obtained from the Climate Prediction Center's (CPC) Climatology-Calibrated Precipitation Analysis (CCPA). A-priori gridded parameters for the Sacramento Soil Moisture Accounting Model (SAC-SMA), Snow-17 model, and routing model are initially obtained from the Office of Hydrologic Development are further calibrated using an automated approach. The potential of the MODIS-PET to be used in an operational distributed modeling system will be assessed with the long-term goal of promoting research to operations transfers and advancing the science of hydrologic forecasting.