

Impacts of Remotely-Sensed Vegetation Dynamics on Distributed Soil Moisture Simulation in a Small Mountainous Watershed

Taufique H. Mahmood¹ and Enrique R. Vivoni¹
1. Department of Earth and Environmental Science
New Mexico Institute of Mining and Technology

In forested mountain watersheds, the vegetation dynamics may play an important role in the seasonal distributed hydrologic response. For example, the seasonal dynamics of plant albedo and leaf area would affect the energy and mass balances in the hydrologic system through incoming radiation and rainfall interception. In this study, we attempt to capture the seasonal variations in mountain vegetation, including its albedo and areal fraction, from remotely-sensed datasets and then investigate its impact on the predictions of a distributed hydrological model. The study site is a small mountainous basin known as the Redondo Creek of the Valles Calderas National Preserve, New Mexico. Our initial focus is on distributed simulations of the 2005 summer monsoon period using the TIN-based Real-time Integrated Basin Simulator (tRIBS). We have modified tRIBS to incorporate remotely sensed vegetation parameters at prescribed temporal intervals. The vegetation observations are derived from two sensors: (1) fine spatial resolution Landsat 5 TM at 16-day intervals, and (2) coarse spatial resolution MODIS composites at 8-day intervals. To force the distributed hydrologic model during the monsoon period, we utilize in-situ hydrometeorological forcing from a nearby weather station and gauge-corrected NEXRAD radar observations. The comparisons between model results with field observations show good agreement between simulated soil moisture and observed soil moisture. The spatial surfaces of simulated soil moisture indicate strong control of soil properties and precipitation in soil moisture simulation. The model simulation results using the dynamic vegetation exhibit more realistic soil moisture, evapotranspiration and outlet node discharge compared to model simulation using static vegetation. Our study points to the importance of capturing spatiotemporal vegetation dynamics in hydrological simulations of forested ecosystems.

Bibliography

Taufique Mahmood was born and raised in Dhaka, Bangladesh. He attended University of Dhaka, where he got his B.Sc. in Geology (2003) with research project focusing on geologic mapping from Landsat imagery in forested mountainous terrain. He also got his MS in Geology (Remote sensing and GIS, 2006) from The University of Mississippi with extensive research works in remote sensing image calibration. He came to New Mexico Tech at Fall, 2006 to begin his Ph.D. Taufique's interests are in remote sensing image processing, Land use mapping, change detection, hyperspectral remote sensing, flood monitoring, RADAR remote sensing, hydrologic modeling and biophysical remote sensing. He is currently investigating the impacts of seasonal fluctuations of vegetation in ecohydrologic responses using numerical simulator.