A Physically Based Parsimonious Approach for Spatial Disaggregation and Recovery of NEXRAD Precipitation Data in Mountainous Terrains

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Problem and Research Objectives

The temporal and spatial variability of precipitation controls many terrestrial hydrologic processes and states. Common remotely-sensed precipitation products used to estimate precipitation have a spatial resolution that is often too coarse to reveal hydrologically important spatial variability. NEXRAD precipitation fields are one such product. This study is aimed at further developing and testing a physically based statistical approach to spatial disaggregation using NEXRAD precipitation data.

Methodology

A parsimonious physically based multivariate-regression algorithm, referred to as multi-level cluster-optimizing ASOADeK regression, will be developed for downscaling low-resolution spatial precipitation fields. This algorithm auto-searches precipitation spatial structures (e.g., rain cells) and atmospheric and orographic effects to estimate precipitation distribution without prior knowledge of the atmospheric setting. The only required input data for the downscaling algorithm are a large-pixel precipitation map and the DEM map of the area of interest.

Principal Findings

The proposed study provides a tool to improve the quality of NEXRAD precipitation estimation, in terms of spatial resolution and spatial continuousness as well as other coarsely resolved precipitation products. The study will be valuable for and interesting to hydrologists, water resource managers, water regulators, planners, and political decision makers (e.g., the N.M. State Engineers Office, Interstate Stream Commission). This work will be presented at the American Meteorological Society 32nd Conference on Radar Meteorology and at a hydrology session of the American Geophysical Union Fall meeting. A computer code and a manuscript are expected. This work, together with our past work on mountain precipitation mapping based on gauge data, can be extended to create a regional mountain precipitation database that assimilates remote-sensing precipitation products and gauge precipitation measurements. We will leverage this WRRI project, assuming that it demonstrates feasibility, and propose new work for wide scale implementation (e.g., NOAA) and further methods development (e.g., NSF).