

Comparative study of the statistical features of random cascade model for spatial rainfall downscaling

Boosik Kang

Ph.D. student, Civil Engineering Department, Colorado State University

Jorge A. Ramirez¹

Associate Professor, Civil Engineering Department, Colorado State University

Abstract. Due to scale differences, rainfall downscaling is required for coupling global (or regional) climate models and hydrologic models. In downscaling rainfall, in addition to preserving the space-time scaling characteristics across scales, at least the following characteristics must be preserved at each scale: rainy fraction, cluster formation in rainy areas, and covariance of rainfall intensity within rainy area. Two kinds of random cascade model, the β -lognormal model with variable variance exponents and a new nonparametric hierarchical model with scale-invariant rainy fraction were compared in reproducing the statistical features of spatial rainfall field. The 2×2 km resolution NEXRAD daily precipitation data of July 1997 were used for analyzing the multifractal nature of the precipitation of the central United States (1024×1024 Km²) ranging from the east of Rocky mountain to the lower Missouri and Arkansas river basin. The nonparametric hierarchical model conforms significantly better to the observed density function, and performs better in maintaining the scaling characteristics and the spatial correlation structure of the original rainfall fields.

¹ Water Resources, Hydrologic and Environmental Sciences Division
Civil Engineering Department
Colorado State University
Ft. Collins, CO 80523
Tel: (970)491-7621
e-mail: bskang@engr.colostate.edu
e-mail: ramirez@engr.colostate.edu