



Investigating the complexity of precipitation sets within California via the fractal-multifractal method

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A deterministic geometric approach, the fractal–multifractal (FM) method, is adapted in order to encode highly intermittent daily rainfall records observed over a year. Using such a notion, this research investigates the complexity of rainfall in various stations within the State of California. Specifically, records gathered at (from South to North) Cherry Valley, Merced, Sacramento and Shasta Dam, containing 59, 116, 115 and 72 years, all ending at water year 2015, were encoded and analyzed in detail. The analysis reveals that: (a) the FM approach yields faithful encodings of all records, by years, with mean square and maximum errors in accumulated rain that are less than a mere 2% and 10%, respectively; (b) the evolution of the corresponding “best” FM parameters, allowing visualization of the inter-annual rainfall dynamics from a reduced vantage point, exhibit implicit variability that precludes discriminating between sites and extrapolating to the future; (c) the evolution of the FM parameters, restricted to specific regions within space, allows finding sensible future simulations; and (d) the rain signals at all sites may be termed “equally complex,” as usage of k-means clustering and conventional phase space analysis of FM parameters yields comparable results for all sites.