



## **Probability of Daily Precipitation Extremes Over North America**

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We have developed an efficient automated method to distinguish between heavy and exponential precipitation probability tails from high-frequency data by considering the Pareto/Exponential log likelihood ratio for local exceedances over threshold. Using this method, we examine daily precipitation data at hundreds of stations over the North American continent. Results of these studies suggest that precipitation probability tails at the vast majority of stations are heavy, not exponential. In other words, statistical distributions traditionally used to model daily rainfall, all with exponential tails, distort the true probabilities of heavy and extreme precipitation events, as a rule. The degree of this distortion depends on peculiarities of regional climates. The most strongly exponential tails are found at stations where frequent rain is produced by similar systems and consistent processes; for example stations located at the western-facing slope of the Sierra Nevada range receive precipitation mainly from frontal systems arriving from the Pacific which are consistently enhanced by the gently rising topography. Most stations' pdf tails are not exponential, at least the heavy tailed model clearly better represents their threshold exceedance probabilities, but how far from exponential they are depends on location and season. Places and seasons that receive precipitation from a variety of systems tend to exhibit heavy tailed behavior. This behavior is especially strong in arid regions and seasons of which it may be said, "When it rains, it pours". In such cases, heavy tails are vastly superior to the exponential. However, Pareto tails do not describe probabilities of threshold excesses perfectly everywhere. There are notable exceptions that will be investigated.