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On the derivation of fundamental probability distributions for extreme precipitation

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Understanding and quantifying the behavior of extreme precipitation is essential to diagnosing climate change and making weather risk assessments. But the physical understanding of the statistics of heavy rainfall is currently not clear. This work focuses on the derivation of probability distributions for extreme precipitation. Others studies already concluded that the tail of the distribution can be predicted from the product of mass flux, specific humidity, and precipitation efficiency, which leads to a stretched exponential form with a shape of parameter 2/3. Following this concept, we show that a more complex view is required. By using a basic cloud model and less restrictive distributional assumptions of specific humidity and vertical wind velocity it can be verified whether heavy precipitation follows a stretched exponential form or not. The results are tested on daily station data. Since estimating extreme precipitation from data is often required the results of this study help to find the proper class of distribution.