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Precipiation extremes in stochastic models based on the moisture budget

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Here, we study using stochastic models to which extent the moisture budget can account for characteristics of precipitation extremes. The moisture budget equation describes the transport of moisture in the atmosphere. Due to the limited water storing capacity of an atmospheric column precipitation extremes cannot emerge without sufficient moisture supply.
We assume a Gaussian model for the wind and humidity field and derive from it the spatial and marginal distribution of precipitation extremes using the moisture budget. The models can be efficiently simulated by circulant embedding.The budget equation is highly sensitive to the marginal distributions of wind and humidity, which suggests sensible distributional assumptions for these variables are essential. We study influence of Clausius-Clapeyron thresholding on precipitation extremes and discuss some parametrizations of autoconversion rate.
The moisture budget shows that heavy-tailed distributions of precipitation imply that either humidity or the wind field is heavy-tailed. At the same asymptotic properties could be impossible to infer from observational data. Penultimate approximations are derived. In a penultimate sense the multiplicativity of the budget equation is a very plausible generator of heavy-tailed distributions. The precipitation distribution is shown to be insensitive to correlation of wind and humidity. Further our models reveal no significant difference between precipitation extremes generated in roational or divergent flow.