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Global investigation of the multi-scale probabilistic behaviour of dry spells from rainfall records

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Understanding and modelling the rainfall process at fine timescales has been a classic endeavor of hydrology, particularly because of its importance in everyday life, hydrological design and water resources management. At fine timescales, the rainfall process alternates between wet and dry states exhibiting pronounced clustering behavior. Herein, we employ a probabilistic characterization of rainfall intermittency as a two-state process and estimate the probability-dry across a range of timescales from minutes to months. To model the resulting multi-scale behavior, we employ a stochastic model derived from an entropy maximization framework at a multi-scale setting, which was previously found to successfully describe sub-daily rainfall in single case studies. We investigate whether the proposed model is able to capture the wide range of rainfall regimes observed worldwide and discuss its potential generality. Furthermore, we show how such a modelling approach of rainfall intermittency can prove valuable for practical purposes, such as the derivation of ombrian (intensity-duration-frequency) curves.
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