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Rain as a passive scalar with multifractal intermittency

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Analysis of data collected during the AMMA (African Monsoon Multidisciplinary Analyses) campaign shows that rain storms typical of the African monsoon have multifractal properties, and can be modelled by fractionally integrated multiplicative cascades. The originality of this study lies in the constraint that only the interiors of the storms are investigated, so that the multifractal analysis is not biased by the presence of numerous zero values. The model is validated in the time domain by means of disdrometer measurements, and in the spatial domain with co-localized meteorological radar rain maps. The parameter H obtained in the spatial domain is found to be consistent with the passive scalar prediction, derived from the Corrsin-Obukhov law, including a correction due to the multifractal intermittency of the fluxes. Comparison of the value of this parameter with the one obtained in the temporal domain indicates the presence of a space-time anisotropy characterized by the relation t≈lˆ2/3, as it could be expected in the case of turbulent atmospheric advection. This result is in contradiction with the classical hypothesis of an energy gap at mesoscales.