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## Multifractal modelling and simulation of rain fields exhibiting spatial heterogeneity

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**Abstract.** Spatial multifractals are statistically homogeneous random fields. While being useful to model geophysical fields exhibiting a high degree of variability and discontinuity and including rainfall, they ignore the spatial trends embedded in the variability that are evident from large temporal aggregation of spatial fields. The modelling of rain fields using multifractals causes the information related to spatial heterogeneity, immensely important at some spatial scales, to be lost in the modelling process. A simple method to avoid this loss of the heterogeneity information is proposed. Instead of modelling rain fields directly as multifractals, a derived field  $M$  is modelled; this is the product of filtering observed rainfall snapshots with spatial heterogeneity as indicated by long term accumulations of rain fields. The validity of considering the field  $M$  as multifractal is investigated empirically. The applicability of the proposed method is demonstrated using a discrete cascade model on gauge-calibrated radar rainfall of central Japan at a daily scale. Important parameters of spatial rainfall, like the distribution of wet areas, spatial autocorrelation and rainfall intensity distributions at different geographic locations with different amounts of average rainfall, were faithfully reproduced by the proposed method.

**Keywords:** spatial rainfall, downscaling, multifractals

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