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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Multifractal evaluation of simulated precipitation intensities from the COSMO NWP model" *by* Daniel Wolfensberger et al.

Anonymous Referee #1

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General comments

Wolfensberger et al. interpret precipitation pattern as universal multifractals and explore the feasibility of this approach with regards to (i) investigating the sensitivity of precipitation pattern to orography and the choice of the cloud microphysics scheme (ii) evaluating a NWP model with observations. Multifractal methods have never been presented in ACP so that an application of this technique within the scope of atmospheric chemistry and physics is very interesting. The analysis of Wolfensberger et al. is somewhat unsatisfactory, however. It remains in large parts descriptive and only touches on interpreting the results of the multifractal analysis in relation to the underlying dynamics and physics. In particular, it does not become completely clear, what practical insights

can be gained from the multifractal analysis as compared to the simple scaling analysis. By elaborating on these issues, the manuscript could be strongly improved and make the potential of multifractal analyses accessible to a broad readership of ACP.

Specific comments

- The analysis of liquid water contents (Section 4) seems to be strongly hampered by the non-conservativity of the fields. Given also the weak conclusions on the sensitivity to orography ("the dynamics of the weather event are more important than orography") and microphysics scheme ("the more complex scheme results in more variability"), it might be worth a thought if this section really strengthens the analysis or if the paper could be reduced to the surface analysis in Section 5.

- Given that many readers of ACP might not be familiar with multifractals, it might be helpful to expand Section 3 with an example that shows how the appearance of a field changes for changing values of α, C_1 and γ_s.

- What can be learned from the (non)-conservativity of a field?

- The locations of the scaling breaks differ between the scaling and the multifractal analysis. What are the corresponding interpretations and which scale should, e.g. a model developer take into account when trying to identify the responsible model process?

- Neither the model nor the radar data are in agreement with the simple space-time scaling model. This result should be discussed, especially in view of the correspondence between CAPE and multifractal parameters. This correspondence indicates a close relationship between precipitation pattern and dynamics, similar to the assumption underlying the simple space-time scaling model. In addition,

the agreement found by Gires et al. (2011) for Meso-NH and corresponding radar data should be addressed.

- I could not quite follow the interpretation of Fig 12 and Table 2 (see below). For Fig 14, I wonder how relevant (although presumably significant) observed differences are (see below).

Technical corrections

- p7, L16 and 18: Should this read Zone 2 and Zone 3 instead of Zone 1 and 2?
- p9, L11: Isn't this an upper threshold that the values of ϵ_λ fall below rather than to exceed it?
- p9, L13: $c(\gamma)$ instead of $c(\lambda)$
- p9, Eq 5: K_c instead of K
- p6, Eq 6: What is D?
- p12, Eq 14: no italics for subscript "time"
- p13, Fig 5: indicate that the different colors correspond to different levels
- p14, L5-L8: refer to zones in Fig 2
- p16, L7: April 8 instead of 4
- p16, Fig 8: Is the legend for flat and steep terrain flipped here?
- p17, L29: terms instead of term
- p19, L7: refer to Eq. 13 or 14, respectively

- p20, L2: To me, there seems to be a scaling break in the radar data at 4km
- p21, L6: Doesn't the spectrum show an under-representation of large features in the model as compared to the radar?
- p21, L8: Both, the one and two moment scheme have $\beta \approx 0$ for the last event.
- p21, L16: several cases = all except for one
- p21, L18: In space, QPE H is smallest for April 8 with a value of 0.342, not for March 26
- p21, L23: Equation 12, not 14; I assume, this time the resulting fields are conservative? This should be mentioned.
- p22, L7: event instead of events
- p22, L14: How meaningful is a "clear difference" of 1.34 or 1.35, respectively, compared to 1.28 for practical purposes? Asked differently, what is the accuracy of these values?
- p28, L7: Equation 12 instead of 14

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