Microphysical Transience of Warm Season Precipitation in the Southern Appalachians: Toward Physical Retrieval

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1. Introduction - Study Area

2. TRMM PR 2A25, V6 vs. V7

3. Model Description

The explicit rainfall population dynamics model simulates the microphysical processes occurring in the rainshaft between the cloud base and the ground surface, which may include not only interactions between rainbands but also raindrops with cloud water from lower level cloud or fog. A simple representation of the idealized column model is shown at right. Observations from the vertically pointing radar are used to provide boundary conditions for the model, which solves the stochastic collection-breakup equation in order to simulate the evolution of microphysical properties (drop size distribution, rain intensity and hydrometeor). The model is in good agreement with data from the aircraft and ground-based sensors, and can be useful for improving our understanding of rainfall processes.

4. Methodology

Top Boundary Condition: Two methods are used to find the top boundary condition. Method 1: When there is a clearly defined bright band, the maximum reflectivity (Z) above 1 km is found. Then, the level observing at least 10% less than that value in DBZ is chosen as the top boundary condition. The threshold for bright band follows Zhang et al. 2008. Method 2: When there is not a clearly defined bright band, the top boundary condition is chosen based on the Z gradient throughout the column, as in the simplified schematic below.

Low Level Forcing: This area has a persistent fog regime; without including this forcing it is impossible to achieve the observed vertical structure and rain intensity and accumulation at the ground. A sensitivity study was conducted to determine how low level forcing and upper level Z interact. The plot at left shows Z differences across the column after equilibrium has been achieved in each simulation. The sensitivity of the model to low-level forcing is demonstrated by the sensitivity of the results to different boundary conditions.

5. Case Study – 29 May 2012

In the case study described in this panel, there is not a clearly defined bright band throughout most of the event. This case is an evening, warm season shallow convective event. Method 2 is used until 1951 local time, and Method 1 is then used for the rest of the simulation.

6. Results/Discussion

This model is a valuable tool for improving our understanding of rainfall processes and for improving models of microphysical processes. It is important to note that these results are preliminary and that further research is needed to fully understand the mechanisms of rainfall.

7. Acknowledgements/References

The research was supported by the NASA EPSCoR program and is based upon work supported by the National Science Foundation (NSF Grant No. 1843400).