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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigating the sensitivity of high-resolution mesoscale models to microphysical parameters by the use of polarimetric radar observations" *by* R. Ferretti et al.

Anonymous Referee #2

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Review: "Investigating the sensitivity of high-resolution mesoscale models to microphysics parameters by the use of polarimetric observations"

Authors: Ferretti et al.

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Summary comments:

This manuscript describes sensitivity of model results to graupel / hail parameters much as was done in a thee-ice-category model, much as was done by Gilmore et al. 2004 (Mon. Wea. Rev, AMS). Two mesoscale models were used for the sensitivity tests using 1 km horizontal resolution. Comparisons with polarimetric observations are made, which is very difficult for graupel (Straka et al. 2000, J. Appl. Meteor. 2000), are made. Marzano et al. (2008, IEEE), a co-author of the paper under review, shows this for C-band radar while Straka et al. (2000) shows this for S-band radar. Graupel and hail are essentially indistinguishable for sizes of 5-10mm, which are sizes probably most accountable for graupel and hail (certainly much graupel may be a few mm smaller, such as 2-4 mm.) Even the paper by Marzano et al. (2008) uses a classification based on graupel / small hail as a category.

My recommendation is that there is not enough new or adequately presented material for publication in a highly referenced journal.

Major Comments:

Why are two 'high-resolution' mesoscale models really needed for these types of studies? Richard Feynman would not joke about how unscientific this is-it is akin to 'cargo-cult science'. How do the authors separate differences owing to differences in the models other than the microphysics? For this reason, little to the author's knowledge, Table 1 becomes one kiss-of-death for this paper. The authors should have started off with the use one model, and a model with one adequate microphysics scheme to examine graupel and hail if the authors want to study graupel and hail. Certainly, previous models for almost 25 years (e.g, Ziegler 1985, J. Atmos. Sci.; Ferrier 1994, J. Atmos. Sci.; Meyers et al. 1997, Atmos. Res.; Milbrandt and Yau 2005, J. Atmos. Sci.) have shown how important it is to split graupel and hail categories to adequately assess their growth parameters. In addition, all of the previously mentioned models incorporated two moments, with the latter incorporating three moments to capture a supposedly adequate shape parameter for the gamma distribution used to represent the size distribution function of particles. Interestingly, kiss-of-death number two for this

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paper is that the two models used use different members of gamma-size distribution functions.

Verisimilitude at its best is very unlikely to produce adequate simulations, hind-cast predictions at the convective scale with 1km resolution for all practical purposes (see papers by George Bryan formerly of Penn State University and now NCAR on importance of resolution), especially for comparison with observations, such as polarimetric ones of graupel and / or hail. Also, what defines a correctly simulated hail fields as opposed to an incorrectly simulated graupel fields? If valid recommendations from this paper were to be made in this paper then the authors should have done a comprehensive parameter space study with idealized soundings in my honest opinion. Certainly some observations are useful for 'comparison' but 'validation'. Where are the error computations of the models (why models I still don't know), of the microphysics? Is this done in the section on 'spectral analysis of hydrometeor spatial fields '. I don't think we know enough about polarimetric signature and modeling microphysics of storms, so they can't be computed at this stage in history of observational and modeling technology. Perhaps the kiss-of-death number three for the paper.

I don't understand the usefulness or methodology of the short section on spectral analysis of hydrometeor spatial fields and cannot comment further without further information or references.

The final conclusion that polarimeric data should be used to study the vertical structure of storms and not rain at the ground is not the real final conclusion in my opinion. Geeze, we live at the ground. I would have though knowing rainfall amounts accurately would have been an essential component of accurately modeling preciptation, especially in NWP. The real conclusion in my opinion is that graupel and hail need to be predicted as independent variables. Or conversely, the real conclusion is that this type of study should not use two different models, each with a different microphysics package than the other.

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Interactive Comment