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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation of hurricane response to suppression of warm rain by sub-micron aerosols" *by* D. Rosenfeld et al.

Anonymous Referee #1

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General: This paper addresses a very important and timely societal issue–is it scientifically feasible to beneficially weaken hurricanes prior to landfall? The paper is well-written and uses a reasonable and new approach to the problem, with a community-developed mesoscale NWP model, the WRF. The authors assert that by seeding the outer rainbands of a hurricane with large quantities of submicron CCN, warm rain would be suppressed at low-levels. The net result would be greater precipitation production at colder temperatures aloft, resulting in more latent heat of freezing there. I appreciate the fact that the authors identified the important role of sea spray generation in offsetting the seeding aerosol influence. However, it appears to this reviewer that KATRINA is a poor choice for this first effort: the storm intensified rapidly to a Category 5 hurricane over the southeast Gulf of Mexico, and then weakened significantly to Category

3, prior to landfall near just east of New Orleans. Moreover, the authors totally neglect the fact that KATRINA's intensification was likely related to its passage over the warm loop current in the Gulf of Mexico, and its weakening may be explained in part to its moving toward cooler waters and possible entrainment of drier air off the Gulf Coast. In any attempt to compare model control runs to seeded runs, it is imperative to pick a hurricane that is near steady-state for several hours, with uniform SST's underneath. Otherwise, it will be very difficult to minimize the natural variability that plagued the earlier STORMFURY experiments. Finally, previous research has shown that there is not always a direct correlation between hurricane intensity and smaller eyes (e.g.,WILMA, 2005).

Specific Comments:

Section 5650,lines 19-25: What prev. studies in hurricanes show that a significant fraction of raindrops freezes above the -10C isotherm? Don't some recent studies show that in continental clouds, there can be significant amounts of supercooled water down to -38C or colder?

Section 5650, lines 24-26: The statement that "clouds developing in a polluted atmosphere turn out to be more intense and reach higher levels than clouds developing in a less polluted air mass" seems to contradict earlier studies by these same authors on continental clouds! Please explain.

Section 5652, Lines 4-7: Which version of the WRF model was used, the NMM(NCEP version) or the ARW(NCAR version)? There are very few observations over the Gulf of Mexico(other than ships and satellite data), so environmental influences like entrainment of drier air into KATRINA may not be well represented by the GFS Reanalysis data at 30km. The use of a constant 27degC sea surface temperature field underneath KATRINA is also a severe limitation here.

Lines 24-29: What observational studies support the assertion in hurricanes that "wind-driven sea spray particles serve as giant CCN that initiate early rain even when large

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concentrations of small CCN exist"? Neither of the two references cited provide such direct evidence.

Some additional specific comments will follow soon. Some of the figures are so small as to be nearly illegible!

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 5647, 2007.