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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Detailed cloud resolving model simulations of the impacts of Saharan air layer dust on tropical deep convection – Part 1: Dust acts as ice nuclei" *by* W. Gong et al.

W. Gong et al.

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We would like to thank the reviewer for his positive perspective regarding our study. Here we provide our replies to his suggestions and corrections

Major comments: I'm overall pleased with this study. My only concern is that conclusions are being drawn based on a single tropical convective storm. The results would be much more robust if 1 or 2 additional storms with varying thermodynamic profiles were simulated. And there needs to be consistency in IN effects across a range of tropical convection before the conclusions are absolute.

We fully agree with the reviewer about the need to investigate more thermodynamic

profiles before having absolute conclusions. Not many past studies challenged the role of ice particles and dust acting as Ice Nuclei on tropical convection using the bin microphysics approach. In our study, large effort was made to implement the new ice forming processes into the Tel Aviv cloud model. This manuscript is only the first out of few studies we plan to carry out in the near future using the current scheme and, as stated in the conclusion, we plan to investigate other atmospheric conditions as well. Furthermore, additional test simulations with varying background CCN concentrations would be beneficial, since this will control the number of cloud droplets and will provide greater competition for vapor growth between CCN and IN. This will also impact the potential for greater homogeneous nucleation by droplet freezing. Again, we agree with the reviewer and his suggestion is already implemented in our research plan.

Minor comments: 1. Figure 2 is confusing with regard to the figure caption. Please clarify. You mention using dashed and long dashed, but I see only one type of dashed line in the figure. Corrected.

2. Page 12908, Line 11: The first part of this sentence uses incorrect grammar: "Because of the lower in the saturation over ice" Corrected.

The lower saturation over ice and the increase freezing rate of droplets caused an increase of the latent heating and consequently a stronger updraft velocity.

3. Page 12908, Lines 21-23: Sentence grammar needs correcting. Corrected.

4. Page 12910, Line 27: Should use the phrase "the accumulated precipitation" Corrected.

Nevertheless, simulations of van den Heever et al. (2006) suggested dust suppresses the accumulated precipitation in tropical storms.

5. Page 12913, Line 18: Should use the word "unitless" Corrected.

Unitless

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6. Page 12914, Line 18: Need to fix the phase: "calculation the number of contact freezing number" Corrected.

To simplify the calculation, we assumed the number concentration of available Ice Nuclei for contact freezing to be the available dust number concentration , with freezing efficiency of 1.

7. Page 12918, Line 26: "grid size" should be called "grid point spacing" Corrected.

The grid point spacing in both horizontal and vertical directions was 300 m . . .

8. Page 12919, Line 19: Should say "sensible heat flux" Corrected.

9. Page 12920, Line 22: Should say "domain as the grid points between" Corrected.

Hereafter, we defined the domain as the grid points between 100 and 200, with a width of about 30 km.

10. Page 12926, Line 20: Should say "deep convection brings large amounts of water" Corrected.

With strong vertical updraft, drop condensation and ice deposition, tropical deep convection brings large amounts of water vapor and cloud condensates to the tropopause, and release latent heat to the upper troposphere.

When you refer to "grids" it is typically understood that you are referring to the whole domain. "Grid size" refers to the size of the whole domain. "Grid spacing" or "grid point spacing" or "grid cell spacing" would be most appropriate to use to specify the distance between grid points (ie, the delta-X spacing).

All corresponding words are corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 12907, 2010.