Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-616-RC2, 2017

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigating the Impacts of Saharan Dust on Tropical Deep Convection Using Spectral Bin Microphysics" *by* Matthew Gibbons et al.

Anonymous Referee #2

Received and published: 11 October 2017

General comments

Gibbons et al simulate an observed case of tropical deep convection under the influence of a dry and dusty Saharan Air Layer with spectral bin microphysics. The detailed cloud microphysical information is used to emulate the radar reflectivity from the model output. When correcting for a wet bias in the driving reanalysis data, the simulated radar reflectivites are found to be in accordance with the observations. With this observationally validated modeling framework, the authors investigate the effect of IN perturbations on the distribution of total cloud water into different hydrometeor classes and the corresponding changes in latent heat release. The microphysical re-

distributions are discussed in terms of the changes in cloud top height, precipitation and radar reflectivity that they correspond to. The paper constitutes a solid case study contribution but its presentation needs to be improved.

Specific comments

- The current manuscript seems to be a somewhat hasty merge of what was originally intended to be two companion papers. This is especially evident in the order of the figures and their referencing (for example, the text jumps from fig2 to fig7), and in the conclusion, which still contains the phrase "in the first of a two part study". This makes the manuscript in its current form hard to read such that it should be revised, especially in terms of reducing redundancies.
- The microphysical redistributions of cloud water between different hydrometeor classes and precipitation formation pathways in response to IN perturbations described in the manuscript should be discussed in the context of the existing literature, including literature on IN effects on other cloud types like cirrus and orographic clouds.
- The authors mention microphysical as well as thermodynamic effects on cloud height. Since this is a fundamental question in understanding convective invigoration, it would be desirable to put more focus on discussing the competition of the two mechanisms.

Technical corrections

1. p4 l4f: Do van den Heever et al (2006), Ekman et al (2007) and Tao et al (2012) consider prognostic IN?
2. section2: Are simulations performed with saturation adjustment or interactive supersaturation?

3. eq1: The definition of F_M is not completely clear and it might help to define it using an equation.

4. fig3,5: Difference plots instead of the direct plots would be helpful.

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