

## ***Interactive comment on “The effects of mineral dust particles, aerosol regeneration and ice nucleation parameterizations on clouds and precipitation” by A. Teller et al.***

**Anonymous Referee #3**

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Comments: The subject is appropriate to ACP. This manuscript presents the results about the effects of aerosol particles on the formation of convective clouds and precipitation in the Eastern Mediterranean sea with a special emphasis on the role of mineral dust particles in these processes by using a new detailed numerical cloud microphysics scheme in the Weather Research and Forecast (WRF) model. The study found that the effect of mineral dust particles on clouds and total precipitation was limited by the properties of the atmospheric dynamics and the only effect of aerosol on precipitation may come from significant increase in the concentration of accumulation mode aerosols. This research is interesting. However, there are some issues in their explanations and conclusions that need clarifications. Therefore I recommend the acceptance for publi-

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cation of this manuscript in ACP after major revisions. Several comments for improving the information content and presentation of the paper are listed as follows.

1. P8226, line 7: what do you mean by “realistic meteorological data”? According to what I learn, you are using the meteorological field from the WRF model simulation but not the observational data. So please rewrite it.

2. P8230, lines 12-26: “Current official WRF version enables the user to select among microphysics schemes which are only based on bulk parameterizations” and “The current version of this scheme was coupled with version 3.2 of WRF package.”. So the authors are using WRF 3.2. As I checked, WRF Model Version 3.3 was released on April 6, 2011 and this paper was submitted on 7 February, 2012. The authors should be able to use WRF 3.3 in their research. As I know, in WRF 3.3, there are some available bin microphysics schemes such as Morrison et al. 2-moment cloud microphysics. It will be better if the authors can use the WRF 3.3 (latest is WRF 3.4) in their study and see how much your conclusions change when other schemes are used.

3. P8235, lines 3 to 14: “Neither of the bulk schemes currently implemented in WRF calculates the spatial and temporal evolution of the aerosol characteristics (i.e. concentration, size distributions. ....”. This is not true because if you use WRF-chem, you will be able to calculate the aerosol fields. Since you are studying the effects of aerosol particle (mineral dust particles in your case) on clouds and precipitation, authors are strongly encouraged to use the latest WRF-chem model in their study to get more realistic aerosol fields. This is the biggest shortcoming for this work.

4. P8238, 4.1. Overview: Do you have any observations such as meteorological data (precipitation and cloud) to evaluate your model performance for each sensitivity test? Otherwise, there is no way to figure out if your model simulations are reasonable or not. I know that some satellite observations are available to quantitatively evaluate your model performance for your study. No evaluation will make your conclusions very weak.

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5. P8241: why are the titles of 4.2, 4.3, 4.4 are exactly the same?
6. P8242, line 7: "The presence of GCCN had minor effect on the time variation of precipitation rate at all times during the simulations". What is the reason for this? I feel that this may be because the number concentration of GCCN is very small, leading to very small effect. Can you list the GCCN concentrations?
7. P8245, lines 1 to 16: "Though the ice crystals production rates are modified, the modified parameterization did not have significant effect on the total precipitation rate". There is a need for more explanations about this conclusion. Have you compared the ice number concentrations resulted from these two ice parameterization schemes? If the ice number concentrations are very small or very similar in the cases, this is the reason. "... Other factors such as the dust storm dynamics". What do you mean by "dust storm dynamics"? Is this not what you try to simulate here?
8. P8245, for aerosol regeneration: Again, I feel that it is very important to use WRF-chem in your study if you want to investigate the role of aerosol regeneration because the aerosol fields are so important in this sensitivity study. For your cases with very simplified aerosol treatment, your conclusions are questionable.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 8225, 2012.