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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol effects on clouds and precipitation during the 1997 smoke episode in Indonesia" *by* H.-F. Graf et al.

Anonymous Referee #2

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The paper reports a study of the effect of smoke aerosols on cloud and precipitation using a limited area model over Indonesia. A unique convection parameterization, i.e., the "convective cloud field model" (CCFM) developed by the authors was adopted in the model. Two simulations are done respectively with and without the loading of smoke aerosols and the differences between the two model runs are interpreted as the effects of smoke aerosols.

The paper addresses the issue of aerosol-cloud-precipitation interaction in a scale apparently larger than those in most recent cloud-resolving modeling works. However, in my opinion, there is still a large room for the authors to improve the manuscript in particular to provide more in-depth analyses. I believe that the authors need to adequately address several issues before the acceptance of the paper for publication.

General Comments

The major issue I have about this paper is its lack of in-depth analyses. The authors made their arguments basically from several rather less informative snapshots of longitude vs. latitude distributions of parameters. The differences in modeled parameters between the two model runs that were often interpreted as aerosol effects were provided without statistical significance. At least the authors could use good graphical presentations of useful diagnostic parameters to answer questions such as what are the correlations between statistical results of key parameters and whether the modeled effect of smoke aerosols exceeds the model's "natural variability"?

It is also hard to judge whether the model is capable in handling the aerosol-precipitation issue. The embedded 1D cloud model has not been clearly described in this paper and previous ones. Based on the current literatures, the major effects of aerosols on convective clouds are often related to or reflected in dynamics. The authors should demonstrate the performance of the 1D model in responding to different aerosol loadings and the comparisons with results of cloud-resolving models.

Specific Comments

Page 17101, line 25: "there is still enough (order of 50 mm per month) to allow for the investigation", it is hard to understand what the authors were trying to express here.

Page 17102, line 14: "the total particulate matter", please describe what is the model prognostic variable, mass mixing ratio or number concentration of aerosols, or both?

Page 17103, line 7-11: "... three cloud types ... a modified cloud microphysics scheme was used ...", the authors should clearly define the three cloud types and also describe the modified along with the original microphysics scheme. The reader needs to know whether the model is capable in handling the aerosol-cloud interaction issue.

Line 25: "no cm-3", what does this mean?

Page 17104, line 9-10: "However, the impact of CCN on the cloud droplet number con-

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centration is not well known", this statement is not accurate. I guess what the authors meant here is that the relationship between aerosol mass and CDNC adopted in many (climate or global) models is rather arbitrary. The reason for such a relationship to exist is that many models only predict the mass but number concentration of aerosols.

Page 17106, line 4-8: "The main precipitation ... any observations", these two sentences could be rewritten.

Line 9: "The inclusion of TPM in the model simulation changes the microphysical structure ...", the statistical significance of the results should be provided, and the same applies to several later discussions as well.

Line 19: The distribution of aerosol loading should be shown here.

Line 23 and also Eq. (3): was CDNC distributed uniformly throughout the entire cloud?

Page 17107, line 4: "particle column concentration", please define the particle here.

Line 11-16: Did the authors suggest that the fact that the model appears to be too wet has nothing to do with dynamics but aerosol loading? In addition, the CDNC values used in the control run (Page 17105, line 5) seem low, what if higher values (certainly lower than the smoke loading) were used?

Page 17108, line 3-4: "few 100 m", please be precise.

Line 23: "when CAPE is strongly increased in the polluted case" and a few later sentences seem leaving the reader with an impression that the authors suggested that aerosol loading might affect CAPE. Please clarify the sentences.

Page 17109, line 14-21: These sentences appear to be not consistent.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 17099, 2007.

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Interactive Comment