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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Improving aerosol interaction with clouds and precipitation in a regional chemical weather modeling system" *by* C. Zhou et al.

Anonymous Referee #3

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General comments:

This manuscript presents the development and initial applications of an aerosol-cloud-interaction (ACI) scheme with the CMA GRAPES/CUACE modeling system. Considering the well-known heavy haze pollution over China, this work aims at tackling an important atmospheric process that may have significant implications for both meteorology prediction and climate assessment. The manuscript is well organized and the results are clearly presented. The findings from this study are interesting to the broad ACP readership. A number of outstanding revisions, however, are required before this manuscript can be considered for publication.

One of the major conclusions from this study is that the two-moment cloud scheme (WDM6) alone can be counter-productive, therefore, realistic aerosol information needs to be provided to capitalize on the strength of the newly introduced scheme in GRAPES/CUACE. Why is the predefined aerosol dataset not realistic, and how different is it from the "realistic" dataset provided by CUACE? Is this WDM6 previously parameterized for cleaner environment where the aerosol loading is considerably different from the study regions? Answers to these questions can be useful for modelers who want to apply such a scheme elsewhere.

The reviewer noticed that the model performance for PM2.5 simulations by CUACE is not excellent yet, indicated by the low correlation coefficient and the fork-shaped distribution of data pairs in the scatter plot (Fig 8a). As the ACI plays different roles in different parts of the model domain, it is desirable to evaluate the model performance for different regions, especially in regions where the effect of ACI is significant. This new information is necessary to uphold the claim made in the manuscript as explained in the comment above.

Specific comments: There are a number of formulas given but not all variables are explicitly denoted. Suggest a throughout checking of the manuscript on this matter.

P15756: Line 17: spell out "TS" Throughout the text: remove initials of first names in citations "R.H. Zhang et al". P15764 Eq 6, what is rco? P15771 Lines 11-13: How can one define "real aerosol size and number concentration"? Note the evaluation in the following section could not support this statement because neither size nor number concentration data are used to verify the model simulated aerosol information. P15772: What is CAWNET? Need reference and more information about the observation.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 15755, 2015.