**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Data assimilation of dust aerosol observations for CUACE/Dust forecasting system" *by* T. Niu et al.

Anonymous Referee #2

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Data assimilation of dust aerosol observations for CUACE/Dust forecasting system By T. Niu, S. L. Gong, G. F. Zhu, H. L. Liu, X. Q. Hu, C. H. Zhou, and Y. Q. Wang

General Comment

This paper describes an ambitious new data assimilation method for Asian dust phenomena based on Chinese satellite FY-2C and surface visibility observation. Dust forecasting in East Asia is a very important environmental requirement and the assimilation system is nice and reasonable. However, many parts of the descriptive contents of the manuscript are not well written and important information is missing. For those reasons, the text requires substantial revision.

The model evaluation is very qualitative and very poor. Please strengthen it to include

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what we can learn from data assimilation methods to improve the dust model. It will be difficult to publish this current version of the manuscript in the ACP.

Furthermore, I have noticed that the authors have submitted at least five papers simultaneously to ACPD for publication in a special issue. Each paper refers to the others (in some cases, very deeply, and in some cases to papers of very low quality), which makes it very difficult for the reviewer to understand and then accept each of the presentations as a full story. Please consider reducing the number of papers greatly. I strongly recommend that some or all of the contents of this paper be folded into or otherwise combined with the other submitted papers before publishing.

Finally, please note the more specific comments presented below.

Individual comments

Page 8310 line 18: Reference Uno et al. 2006 must be changed to Uno et al. 2004 (JGR, which is not in the reference list).

Page 8311 line 26: Please include Yumimoto et al. (2007; published in GRL) for the most recent 4d-var dust data assimilation results.

Page 8311 line 28: Seifeld (2001) must be changed to Seinfeld (2006).

Page 8312 line 2: What is the meaning of 'algorithm depending closely on a model'? Can that be clarified or rephrased?

Page 8313 Section 2.1.1 Based on Hu's paper, IDDI = Ts - Tbb. The authors must describe what IDDI stands for, what we can get from IDDI, and how reliable it is in a short sentence. The current version of the text is difficult to accept.

Page 8314 Section 2.1.2 I believe that the system is using the surface SYNOP visibility data. In most cases, the surface visibility includes effects of anthropogenic air pollution. How do you discriminate between dust-related and air-pollution-related visibility?

Page 8315 Section 2.1.4 I checked the paper by Hu et al. They showed a scatter

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plot of IDDI and visibility (having a very big scatter!) and reported that the correlation coefficient depends on the location. I cannot understand why the correlation depends on location so strongly. Is this dependent upon the dust size distribution or the air pollution level? I also have a question. The system estimates the IDDI value based on the surface visibility. Actually, the IDDI might be a function of dust-column loading, but the surface visibility is only a surface value. How do you treat a vertical profile?

Page 8316 Section 2.2.1 Why does the data assimilation produce a negative concentration? The system assimilates IDDI (>0), so I wonder if the setting of background error has some problems.

LBFGS must be BFGS (L is not necessary)

Page 8316-8317 Section 2.2.2 The authors describe a method to estimate the background error matrix B. They show two equations, eqs. (2) and (3). Nevertheless, it is very difficult to understand how to establish the B matrix based on those two equations. More detailed descriptions must be included here.

Page 8318 Section 2.3 I have very great difficulty understanding this section as it is presented. What is dust matter 40 (DM 40)? How do you convert DM40 to IDDI (IDDI is based on temperature differences from satellite sensors. The definition is completely different from dust concentration.)? Judging from the text here, the control variable (x) of eq. (1) is IDDI. If that is so, please insert the statement at the definition of eq. (1). The authors are also changing the dust size bin information to obtain an optimal solution. I believe that there are many different size bin distributions that give the same DM40 (which means that we can not obtain unique size bin information from IDDI or DM40). How do you treat this problem?

Page 8318-8319. Section 3 Assimilation experiments Figures 3a-3c only show qualitative results. We can obtain more reasonable results if we use additional observation data such as satellite observations and surface observations. What can we get from your discussion? The most important information is why traditional dust modeling

methods (which use no data assimilation) are wrong (i.e., desert area estimates and surface condition estimates are wrong) and state what we have to do to improve the dust model? I want to advance the same comments to the discussion of Figs. 5, 6 and 7. The present discussion is very poor and seems like an internal model evaluation report.

Page 8319 Section 3.2 What are O-B and O-A? How do you define each and what are their units? I cannot understand what the authors want to show.

Page 8320 Section 4.1 In the analyses related to Fig. 5, do you include surface visibility data from Korea and Japan?

Page 8321 Section 4.2 How do you define the dust forecast as YES or NO in order to calculate the Threat Score?

Figure 4(b) What does the horizontal axis show?

Figure 8 Please change the color from blue to red (for triangle line).

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 8309, 2007.

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