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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A data assimilation method of the Ensemble Kalman Filter for use in severe dust storm forecasts over China" *by* C. Lin et al.

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Thanks for valuable comments. We will accept and revise them in the revised manuscript for ACP.

1. page 17512 Abstract: What does model errors mean ?

Response: Model errors represent the uncertainties in meteorological fields, dust emissions, dry deposition process, etc. we have added more dedail description in the abstract and text in the revised version (Page 1 Line 19-20).

2. page 17513 line 5: significant errors must be replaced by significantly model dependent.

Response: Thanks for point it out. We will revise it.

3. page 17516 Section 3: this section is very much reader-unfriendly, and need more careful descriptions i) What is parallel assimilation? ii) What is H in equation (1) iii) What is a, lx, ly and lz iv) What is a range of alpha in equation (5), especially in your application?

Response: We will add more careful description in section 3 in the revised version. i) We will change "parallel assimilation" to "similar assimilation" for easier understanding (Page 5 Line 22). We learn "parallel assimilation" from the review of ensemble-based data assimilation by Hamill. In fact, it means that the assimilation cycle for each ensemble member is same except with somewhat different realization of observation and so it is easy to do parallelization for each ensemble member. Therefore, we can call it en ensemble of parallel assimilation. ii) H is the observation operator mapping the model states to the observation space (Page 5 Line 25). iii)a represent the perturbations of phase and are assumed to be 2 grid points in this study, while the amplitude perturbation is assumed to be 20% of the first guess(Page 6 Line 18-20). In the study here, the inflation parameter increases with time from 1 to 640 (estimated according to the likely minimal root mean square error). (Page 7 Line 4-5)

4. page 17518 lines 24-25. Improvement in vertical distribution might be due to vertical diffusion not in background error covariance ?

Response: From the point view of dust modeling without assimilation, the improvement in vertical distribution might be due to vertical diffusion. While the improvement by assimilating observations is mainly due to the background error covariance, especially when there is no observation at that grid point and only updated according to surrounding observations.

5. Lidar observation in Figure 6 (most upper panel) needs more careful description. Lidar data is restricted only near the surface on March 20. This might be a missing observation because the dust layer to too thick to prevent the penetration of lidar signal

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above ?

Response: The lidar observation below 500m clearly shows two maximum centers on March 20. For higher layers about 500-1000m above we agree with you that it might be a missing observation on March 20 because the dust layer is too thick to prevent the penetration of lidar signal. We have added more careful description in the revised version. (Page 8 Line 7-20)

6. Figure 11 and 12 is difficult to capture the difference (or improvement by EnKF) between with and without EnKF. I recommend preparing the model difference contour additionally.

Response: We have added the model difference contour in Figure 11(b) and 12(b).

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 17511, 2007.