

Interactive comment on “Saharan dust and ice nuclei over Central Europe” by H. Klein et al.

H. Klein et al.

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Reply to Reviewer 3:

The manuscript by Klein et al. is interesting; I recommend publication after minor revisions, as listed below. The authors thank the reviewer for his/her valuable comments.

Comment: 1. For clarity PM10-dust should be renamed PM10-model.

Reply: This was done throughout the manuscript.

Comment: 2. Model description (Section 2.2): The size bin should be left out of table 1 as it is not used, instead it can be noted in the text that the model can simulate dust up to 20 μ m. Since the different dust size fractions do not interact in the model (to my knowledge) just describing the 7 size bins that are actually used is sufficient.

Reply: I counted 8 places in the text and captions where bin numbers were used. We

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would thus rather like to keep bin numbers.

Comment: A sentence each on the dust emission and deposition parameterization in the model would be good

Reply: We have added a short paragraph on dust mobilization and deposition.

Comment: 3. Section 3.1: Showing the vertical distribution of dust concentration along the trajectory arriving at the measurement site on May 29 would be interesting (not urgent, just would be a nice addition helping to understand the dust transport

Reply: We have added and discussed a new Figure 4, which shows for an instantaneous time a vertical north-south transect along 10°E, close to the longitude of the trajectory. It demonstrates a rather unique character of the dust case, and aids in understanding the concentration pulses observed at the Taunus Observatory.

Comment: 4. Figure 4: The colour bars should be adapted to match each other at least crudely to get a better feel for model matches/mismatches with observations.

Reply: We have tried to match the colors and scales of panels a) and b) of the (new) Figure 5 as close as possible.

Comment: Case description: 5. Figure 5 (and Figure 7): The numbers and letters are hardly readable, please increase font size.

Reply: We have increased font size as much as possible.

Comment: 6. Figure 5: Please compare also with model size distribution to evaluate how well the size distribution at for the larger particles match, also to see if the argument that the small particles in the observations are not influenced by dust is shown in the model results.

Reply: We have added the modelled number size distribution (into panel a) of the measured size distributions of the (new) Figure 6. Both compare reasonably well.

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Comment: 7. The authors mention convection and thunderstorm development in the vicinity of the Taunus, is there an indication that the dust cloud itself encountered those conditions ?

Reply: There are large and rapid up- and downward fluctuations in the measured PM10 aerosol mass, arguing for vertical mixing by cumulonimbus convection.

Comment: 8. Figure 6: What is the time of day where peak concentrations are observed? Any indication for meteorological patterns modifying the peaks

Reply: The PM10 measurements (new Fig. 7) begin to rise at around 11:00* (Local time) and peak at 18:00 on 29 May, and rises at 9:00 and peaks at 16:00 on 30 May, both roughly in phase with diurnal mixing. But the pronounced structures in the modelled horizontal (Fig.3) and vertical (new Fig.4) concentration distribution argue for the travelling plume as the main driver of the surface concentration.

Comment: 9. The model results should also be compared with other data, notably modelled aerosol optical thickness with sunphotometer measurements from the Aeronet network rather than show just the results at the sampling site to strengthen the model credibility.

Reply: The objective of the article is to demonstrate connection of mineral dust transported over long distance and ice nuclei number observed away from dust sources. In this context, the dust model was used in the study to show what are characteristic spatio-temporal features of the dust cloud that caused increase in IN number. We showed that the model has simulated in a reasonable way horizontal features of the surface concentrations over Germany, when compared with the corresponding map of the German Federal Environment Agency made by analysing a number of in-situ PM observations. We consider that this is sufficient evidence on the model performance for the studied case, and that further extension of the model validation with other types of observations (and over a longer time period) could be a good subject for another study.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 14993, 2010.

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