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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Development towards a global operational aerosol consensus: basic climatological characteristics of the International Cooperative for Aerosol Prediction Multi-Model Ensemble (ICAP-MME)" *by* W. R. Sessions et al.

Anonymous Referee #1

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'Development towards a global operational aerosol consensus: basic climatological characteristics of the International Cooperative for Aerosol Prediction Multi-Model Ensemble (ICAP-MME)' by Sessions et al.

This paper summarizes the effort to develop and evaluate a global multi-model ensemble aerosol forecast system, i.e. ICAP-MME. The study is quite interesting and also useful to improve our understandings on aerosol processes. More importantly, it is beneficial to the predictions of dust events and significant air pollution events. This

work is relevant to the scope of Atmos. Chem. Phys and deserves publication after the authors address the general comments and a number of specific comments as below.

General comments:

1.All individual aerosol models in this study are based on bulk approach. Size-resolved models, however, can predict the aerosol properties including size distribution more precisely, which thus impact the predicted aerosol optical properties and radiative forcing. In recent years quite a few model groups have developed size-resolved aerosol models, so I suggest that the authors include at least one size-resolved model in their study.

2.The results in Fig.10 indicate that in general the model creates large biases and RMSE for the cases with AOT>0.6. Have you ever attempted to increase the spatial resolution to see if it makes any differences?

3.It would be interesting to show some results on the heavy air pollution events. Compared to the individual models, how does the ensemble model perform in capturing such significant and unusual events?

Specific comments:

Abstract:

Line 8: what is bulk error statistics? Please give some explanations.

The advantage of using multi-model ensemble relative to the individual model is NOT shown in abstract. Model bias in specific regimes, e.g. biomass burning, have been previously found by many aerosol models. It would be more interesting to highlight what the ICAP-MME model can do better than individual models.

Introduction:

Line 24: 'as an artifact' what does this mean?

Line 6-9: 'while single-model probabilistic ensemble forecasting is clearly enhancing model solutions (particularly in data sparse regions), multi-model ensembles are an ever increasing tool for forecasters'. As you stated that the former can clearly enhance the model solution, why the latter is becoming an increasing tool?

Methodology

2.1 input models: I would suggest separating this sub-section into two parts, with one for aerosol models and other for dust-only model, to make the description more clearly.

If I understand correctly these aerosol models are all bulk-based, it would be interesting to include at least one size-resolved aerosol model into this ensemble forecast.

Does the same emission inventory is employed in all the aerosol models? It is not clear. Please include the information on the emissions, especially anthropogenic emissions.

p.14940, line 5: why not simply examine the seasonal mean like JJA, DJF, MAM, and SON?

p.14943, line 15: 'MODS', should be 'MODIS'?

sec. 2.3 line 27: 'Instances of cirrus contamination (Chew et al., 2011) were evident in the level 1.5 (and to a lesser extent) level 2 products'. This sentence seems incomplete. Do you want to say 'Instances . . . level 1.5 (. . .) COMPARED TO level 2'?

Bottom line in p. 14951: when you removed the top five percent of coarse observations in NA and EA. Is that possible to remove the data in clear sky but with the heavy dust event?

Sec. 3

Fig. 2: AOD in Winter/Spring is higher than in Summer/Fall over North Africa, which is contrary to what we expect, any explanations?

Table 1 and 2: It would be good to have a map plot showing the locations of these sites.

Fig. 5 and top line on p.14957: bias in Baegnyeonng improves with time, why? Does that imply there is problematic in the analysis?

Table 4 and line 13 on p.14957: what metric shown in Table 4? biases or RMSE?

Fig. 6 and line 14 on p.14957: small dots are each model's value. What value? AOT?

Line 3-5 on p. 'On average, the RMSE's of the 1 day forecasts of ICAP-MME run approximately 50% of the climatological mean. Dust AOT forecasting is superior to overall fine and coarse mode 5 AOT, running approximately 1/3rd of climatological AOT.' How do you come up to this conclusion? Please show more details.

Line 13 on p.14958: please give the definition of fractional gross error.

Line 20 on p.14958: 'although the dominance of the ICAP-MME generally increases in time, particularly for dust'. What do you mean?

Fig.8. Beijing shows the highest RMSE in Jun-Nov than other sites. Could you give some explanations? Do you have any clues on which contribute more? for example emissions, secondary aerosol production, or remote sensing.

Fig.9. how is the rank and histogram computed here? Did you put all the results from the individual models and the ensemble together for this calculation? Please add more details on how you obtain the results in order to help the readers to understand.

Discussion and conclusions

Line 20 on p.14966: if 'Experience has shown however that equal weighting in a consensus style appears to provide the most robust results overall, and this is backed up on both practical and theoretical grounds (DelSole et al., 2013)', Then why 'we intend to convert the ICAP-MME to a super ensemble where models are weighted by their scores (e.g., Krishnamurti et al., 1999; Casanova and Ahrens, 2009)'. It is confusing here. Also, can you give some explanations on why equal weighting is most robust?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 14933, 2014.