Atmos. Chem. Phys. Discuss., 7, S4690–S4693, 2007
www.atmos-chem-phys-discuss.net/7/S4690/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Intercontinental transport of pollution and dust aerosols: implications for regional air quality" *by* Mian Chin et al.

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Received and published: 5 September 2007

This paper compares observations of reconstructed fine mass (RCFM) at IMPROVE sites in the continental U.S. with predictions of a comparable product (sulfate+OC+BC+dust) from the GOCART model. The authors find that sulfate predictions match well with observations whereas carbonaceous aerosol is frequently underpredicted, and fine dust is frequently overpredicted. In general, the model captures the seasonal and spatial variations observed in RCFM at IMPROVE sites quite well. The model can therefore be used to attribute aerosol sources, and this analysis is applied not only to aerosol observed over North America, but also other continents and re-

gions in the Northern Hemisphere. The topic of this paper is appropriate for ACP and I recommend that it be published after addressing the following comments:

General Comments

Abstract

Are you defining the sum of ammonium sulfate, black carbon and organic matter as 'pollution'? Since you use this term as a distinction from 'dust' you should define it. Is sulfate with a volcanic source or organic matter with a biogenic source still defined as 'pollution'? This issue arises again in Sections 2 and 4.

Section 2

No emissions from the Southern Hemisphere are listed in Table 1, yet the GOCART results in Figure 2 clearly demonstrate emissions. Does Figure 2 represent a model run with emissions not listed in Table 1? This should be explained more clearly.

Section 3

While RCFM is perhaps the most appropriate quantity to compare to GOCART output, which also doesn't consider nitrate, some estimate should be given regarding the importance of neglecting nitrate. In the U.S., nitrate may only be significant in California, however the analysis then goes on the consider Europe and Asia, where nitrate concentrations may be more significant. Furthermore, since the formation of particulate nitrate can occur more quickly that the formation of sulfate for NOx and SO2 emissions respectively, the relative importance of intercontinental transport is likely to be different. What kind of impact might this have on your conclusions regarding the extent to which pollution from major source regions affects PM surface concentrations on a hemispheric scale? By neglecting nitrate, you may be biasing the results towards attributing more of the aerosol loading to distant sources.

Is it appropriate to assume that the sulfate is fully neutralized, even at sites downwind of power plants? Additionally, the analysis essentially assumes that the sources of

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ammonia and sulfur are collocated, for the purposes of attributing an observed mass loading to an original source region. Is it not possible that acidic sulfate could be advected from one continent and neutralized by ammonia from another?

The relatively coarse spatial resolution of the model is probably another source of discrepancy between the model results and measurements. The degree to which we can expect the model output to match the observations at any given site could perhaps be quantified by comparing pairs or group of sites within the same model grid cell to assess the actual range of measurements within that area which is assumed to be homogeneous in the model.

Section 4

The distinction between different aerosol sources seems different here to earlier in the paper. It seems to discount the possibility of intercontinental transport of aerosol from natural sources other than dust. Is it not possible that volcanic sulfate or biogenically-derived organic matter can contribute to aerosol loadings on downwind continents?

Section 5

It might be useful to note that colour scales for Figures 8a and 8b are different.

Technical comments

Section 1

P 9016, line 6, Insert ‘an’ in the sentence beginning with ’Recently’, that is ’from which the trans-Pacific transport can bring ‘an’ increasingly significant amount of pollution and dust to North America.’

P 9016, line 12, Consider breaking up the sentence starting with ’Previous global modelling studies’ as it contains several ideas. Also, ‘peaked’ should be ‘peak’.

P 9016, line 18, Change some prepositions and don’t capitalize ‘haze’: It is estimated that the Southeast Asia is the largest contributor ’of’ black carbon over the Arctic and

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is also partially responsible 'for' the 'Arctic haze' problem.

P 9016, line 18, Explain Arctic haze in Paragraph 2, rather than the second time it's discussed, in paragraph 3.

Section 3

P 9020, line 11 Remove comma after e.g. in sentence starting with 'While sulfate' P 9020, line 11 Remove both instances of 'would' in sentence starting with 'As such'

P 9023, line 13, remove 'the' before air quality P 9023, line 13, change 'those' to 'the amount'

Figures

Figure 2 - Aug 22 is printed twice by colour bars for no reason.

Figure 6 caption - specify that this is the model output

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 9013, 2007.