Atmos. Chem. Phys. Discuss., 8, S5261–S5264, 2008
www.atmos-chem-phys-discuss.net/8/S5261/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Transpacific transport of ozone pollution and the effect of recentAsian emission increases on air quality in North America: an integratedanalysis using satellite, aircraft, ozonesonde, and surface observations" *by* et al.

et al.

Received and published: 25 July 2008

We thank the reviewer for the detailed and helpful comments and suggestions. We have addressed all the comments in our revised manuscript. Please see below for our response to each comment:

Comment: This paper provides a very good modeling study of ozone and CO transport to North America during the INTEX-B experiment, spring, 2006. It makes good use of the available aircraft, ozonesonde and surface measurements to verify and constrain

the model. While this type of analysis isn’t necessarily new (there are now quite a few papers on the transport of Asian pollution to North America), it builds on the earlier work by calculating the impact of the rapidly increasing Asian emissions on western North America, which is a very interesting and important result. I recommend this paper be published after a minor revision, as described below.

Introduction Page 8147 lines 9-11 When discussing transport times it is important to clarify the altitude. Transport times of 5-10 days are typical for the free troposphere, but the 2-3 week transport time applies to North American sites at the surface.

Response: We have clarified it in the revised manuscript. It now reads "It can then be transported across the Pacific in 5-10 days in the free troposphere (Yienger et al., 2000; Jaffe et al., 2001; Stohl et al., 2002). The mean transport time to the surface of western North America is of the order of 2-3 weeks (Liu and Mauzerall, 2005)."

Comment: Page 847 line 27 would sound better as "Satellites provide a growing resource...."

Response: We changed the wording as suggested.

Comment: Page 8156 I find it difficult to accept that just because two models have a similar NO/NO2 ratio then it can be concluded that the measured values must be in error. As it stands there is good agreement between the modeled NOx and the measured NOx. But if there is a problem with either the NO or the NO2 measurements then the true values of NOx would not match the modeled NOx, and therefore one would have to conclude that the model was in error. This issue needs further attention and discussion.

Response: Please see response to Comment 5) from reviewer 1.

Comment: Page 8156 line 29 and Page 8157 lines 1-2 these 3 lines are repeated at the end of section 4 and need to be deleted.

Response: We deleted the repeated sentence at the end of section 4.

ACPD

8, S5261–S5264, 2008

Comment: Page 8158 line 23 would sound better as: "It splits into two air streams ....";

Response: We changed the wording as suggested.

Comment: Page 8159 The discussion of the TES retrievals and their relationship to ozone pollution is fine, but you should qualify this discussion by stating that the analysis only applies to 680 hPa (the relatively warm lower troposphere), and that strong ozone production at higher, colder altitudes may not occur due to NOx being tied up in PAN. When discussing ozone production in descending air masses of the eastern Pacific credit needs to be given to Nowak et al. [1994] who describe this chemical process for the May 17, 2002 event and to: Brock, C. A., and et al. (2004), Particle characteristics following cloud-modified transport from Asia to North America, J. Geophys. Res., 109, D23S26, doi:10.1029/2003JD004198, who describe the transport process.

Response: We have added on page 8159, line 9 that Figure 8 (right panel) shows the pollution plume "at 680 hPa.". We also state that "suggests continuous ozone production in the lower troposphere during transport across the Pacific". We now cite Nowak et al. (2004) on page 8160, line 3 for ozone production in descending air masses, and cite Brock et al. (2004) on page 8147, line 9 for the transport process.

Comment: Page 8160 line 26 Please describe why 800 hPa is most relevant for North American air quality. Is it because it is in the free troposphere so that transport is relatively rapid, and also because it is low enough so that it can be entrained into the North America boundary layer?

Response: We state in the text that "we show 800 hPa in Fig. 11 as pollution transported at this level can be entrained into the boundary layer and hence most relevant for North American air quality".

Comment: Page 8161 You state that PAN has a relatively long lifetime. This needs to be qualified by stating that it only has a long lifetime in the mid and upper troposphere. In the lower troposphere its lifetime is fairly short as shown in Figure 12. For example, at

ACPD

8, S5261–S5264, 2008

800 hPa CO decreases by less than a factor of two from Japan to the western USA. But over the same distance PAN decreases by a factor of four. Figure 12 can be improved by placing the trace gas names beneath the color bars instead of above the plots.

Response: We have deleted the statement that "CO and PAN have relatively long lifetime". It is not important to state here. The sentence becomes "CO and PAN have little production over the Pacific; their transport is mainly north of 35N." As suggested, we have changed Figure 12 so that trace gas names now place beneath the color bars instead of above the plots.

Comment: Page 8162 line 14 should be "Asian ozone pollution";

Response: We corrected it as suggested.

Comment: Page 8163 line 15 should be "5-7 ppbv in the west";

Response: We corrected it as suggested.

Comment: Page 8163 lines 22-24 The 700 hPa surface is a poor demarcation of the atmospheric boundary layer. Above Asia the boundary layer would only be this high under very warm, unstable and mid-afternoon conditions. All other times, especially at night, the boundary layer would be much lower. And above the Pacific the boundary layer is easily less then a few hundred meters deep. To be accurate, use the term "lower troposphere"; for regions below 700 hPa, and mid- and upper troposphere for regions above 700 hPa

Response: We changed the definition as suggested in the text and Fig. 15.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 8143, 2008.

ACPD

8, S5261–S5264, 2008

Interactive Comment