Atmos. Chem. Phys. Discuss., 8, S2759–S2761, 2008
www.atmos-chem-phys-discuss.net/8/S2759/2008/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Analysis of aircraft and satellite measurements from theintercontinental chemical transport experiment (INTEX-B) to quantifylong-range transport of East Asian Sulfur to Canada" *by* et al.

**et al.**

Received and published: 16 May 2008

Thank you very much for your comments.

1. Uncertainties associated with the model / SO2 Comparisons - We now include updated model emissions over Canada, reducing the measurement-model bias to just 2.5%, suggesting the model well-captures conditions in the Whistler region. As suggested, we now include comparison with the DC-8 SO2 measurements, which support previous findings for an overestimate of SO2 oxidation. This effect decreases with plume age, contributing to the excellent agreement now found between modelled and measured Cessna SO4=. We now include an error estimate for the Asian influence on

Western Canada based upon our inter-comparisons with the C-130 and Cessna.

2. Estimate of Asian sulfate emission growth - We no longer refer to trends in MISR and MODIS AOD, but rather refer to trends in the difference between simulated and retrieved AOD.

The same trend in SOx growth could indeed be inferred by using the Streets 2006 values in GEOS-Chem and observing a relatively constant difference between the modelled and retrieved AOD. The intent of this part of our study, however, was to provide an independent validation of the Streets 2006 estimate.

We now quantify the contribution of sulfate (56%) and dust (17%) to the simulated AOD during the July-December period used to estimate SOx emission growth. Since non-sulfate anthropogenic aerosols contribute only 26% to total AOD during this time in this region, changes to the difference between simulated and retrieve AOD are most sensitive to changes in SOx emissions.

3. Asian sulfate over the last two decades - We now clarify that meteorology and measurement technique could contribute to the differences between the two years. Therefore we use simulations to examine how sensitive the results are to changes in location and meteorology. We find that meteorology played an important role in the elevated contribution of East Asian emissions during INTEX-B, and that a 72-85% increase in their relative contribution has occurred since 1985. This estimate includes simulation over two entire months to ensure that day-to-day variability does not impair our conclusions.

4. Asian plume transport - we have clarified that this event is dominated by dust, but also carries SO4=.

5. Asian influence on local air quality - Excellent suggestion. We now include updated emissions over Canada, removing the systematic bias between the Cessna and model SO4= concentrations. We also make note of the episodic nature of aerosol transport



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events, and estimate surface concentration enhancements of more than 1.5 $\mu$g/m3 due to East Asian emissions, based upon both surface and aircraft measurements. We now cite Yu et al. (2008) for an estimate of the seasonal variation in transpacific transport.

Specific Comments: 1. We now expand this text to clarify that, while we use a scale factor of 1.4 to compensate for the sulfate size distribution, the 1985 measurements of Andreae et al. may suggest it is appropriate to use an even larger factor. 2. We now specify that this statement refers to all East Asian anthropogenic emissions. 3. This comment has been addressed within the adjustment made for Specific Comment #2. 4. We no longer make any reference simulated or retrieved AODs exceeding particular thresholds. 5. Changed. 6. Corrected. 7. We now scale the Mist chamber data outright and use the resulting agreement to collaborate the validity of the 1 $\mu$m scale factor. 8. We now more clearly group our discussion of Figures 8 and 9, demonstrating a clear improvement in modelled mean plume representation (RMSD = 0.25 $\mu$g/m3) as compared to individual flights (RMSD = 0.39-0.87). 9. We now state that this is relative to western continental regions. 10. We correct this to state “in East Asia”. 11. These panels are grouped into a single figure as they convey one single thought process. They move from a simple comparison of modelled and retrieved AOD through to an interpretation of the same data. Each panel aids in the clearer understanding of the previous. The overall purpose of this figure is the final panel, but without the others, the path to that end becomes unclear. By combining these panels, the reader is presented relevant data together, aiding in a lucid presentation of how we have estimated emission growth.

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 4017, 2008.