Evolution of Asian Aerosols during Transpacific Transport in INTEX-B

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(Supporting Information)

Section S.1 – C-130 Aerosol Instrument Intercomparisons with other aircraft

Two intercomparisons of the C-130 and DC-8 were performed, one on 4/17/2006 and one on 5/15/2006. The two planes flew side-by-side in a linear flight pattern for a total between the two flights of more than 2 hours of flight time covering the altitude range between 1,000 and 20,000 ft. The DC-8 had two measurements of aerosol composition on board: a mist chamber (Cofer et al., 1985) with a size cutoff ~ 1 μm and bulk aerosol filters with a size cutoff ~ 4.5 μm. Time series plots of the C-130 aerosol measurements during these intercomparison periods reveal relatively good agreement amongst all instruments for the inorganic aerosol mass measurements. Again, all data have been converted to STP as above. Supplemental Table S1 lists the average sulfate concentrations by all instruments for each of the three altitudes. Supplemental Figure S1 shows an example comparison for sulfate on 5/15/2006, which shows the typical level of agreement for these intercomparisons under these low ambient concentration conditions. Note a plume of sulfate near 7:05 PM which is apparent in the nephelometer data but is only captured by the AMS due to its higher time resolution. The subsequent plume in the nephelometer data is not reflected in any of the other instruments; there was no indication of dust during this time. We note that NASA frequently performs blind measurement intercomparisons throughout field experiments to assess data quality. During these measurement periods investigators submit data in the field to an independent reviewer without investigator access to other data. During this study the PILS and DC-8 instruments submitted data to these intercomparisons. The AMS was not able to participate in these field intercomparisons as it was a new instrument, and its calibration

and data analysis software were still under development during and after the field campaign. For the intercomparisons reported here the analysis was performed after all data had been submitted.

Table S1 – Average sulfate concentrations measured during C-130 and DC-8 intercomparison flight on 5/12/2006 divided up for the three level flight legs of the intercomparison time period. Uncertainties for are the combination of 1 sigma standard deviation of the average during the time period and instrument uncertainty.

Measurement	Alt 1 (18 kft)	Alt 2 (5.5 kft)	Alt 3 (1 kft)
AMS SO4	0.28 ± 0.08	0.49 ± 0.14	0.68 ± 0.22
Filter SO4	0.12 ± 0.09	0.35 ± 0.10	1.11 ± 0.22
MC Fine SO4	0.17 ± 0.08	0.26 ± 0.08	0.86 ± 0.23
PILS SO4	0.30 ± 0.10	0.35 ± 0.12	1.02 ± 0.31

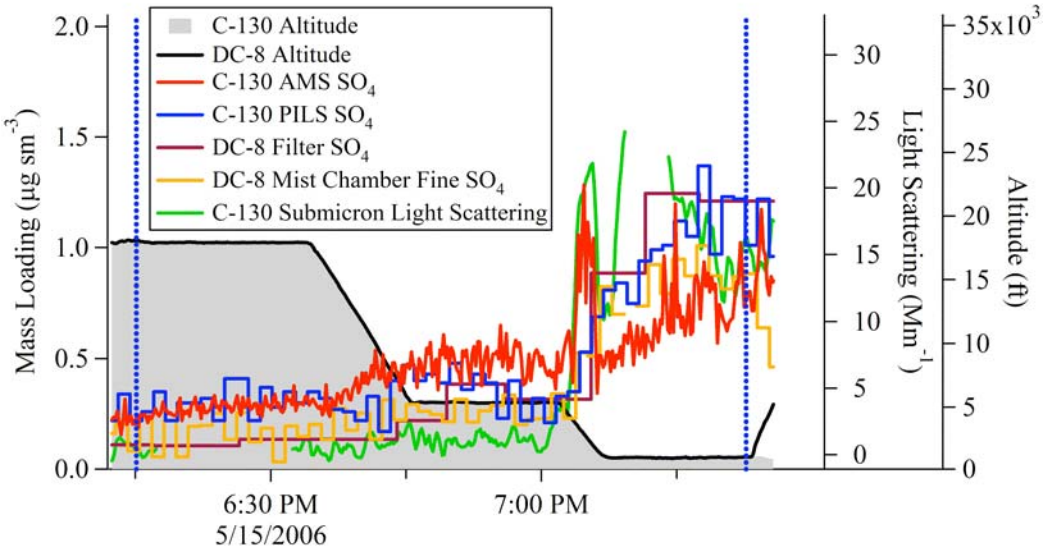

Figure S1 – Example time series plot from one of the two intercomparison flights on 5/15/2006. Measurements of sulfate from various instruments on board the C-130 and DC-8 aircrafts are shown (see text for description of instruments) along with the altitude of the C-130; the DC-8 altitude closely matched that of the C-130. The dashed vertical lines denote the start and end times of the intercomparison. The time is in UTC. In general, the agreement of the various sulfate measurements is relatively good.

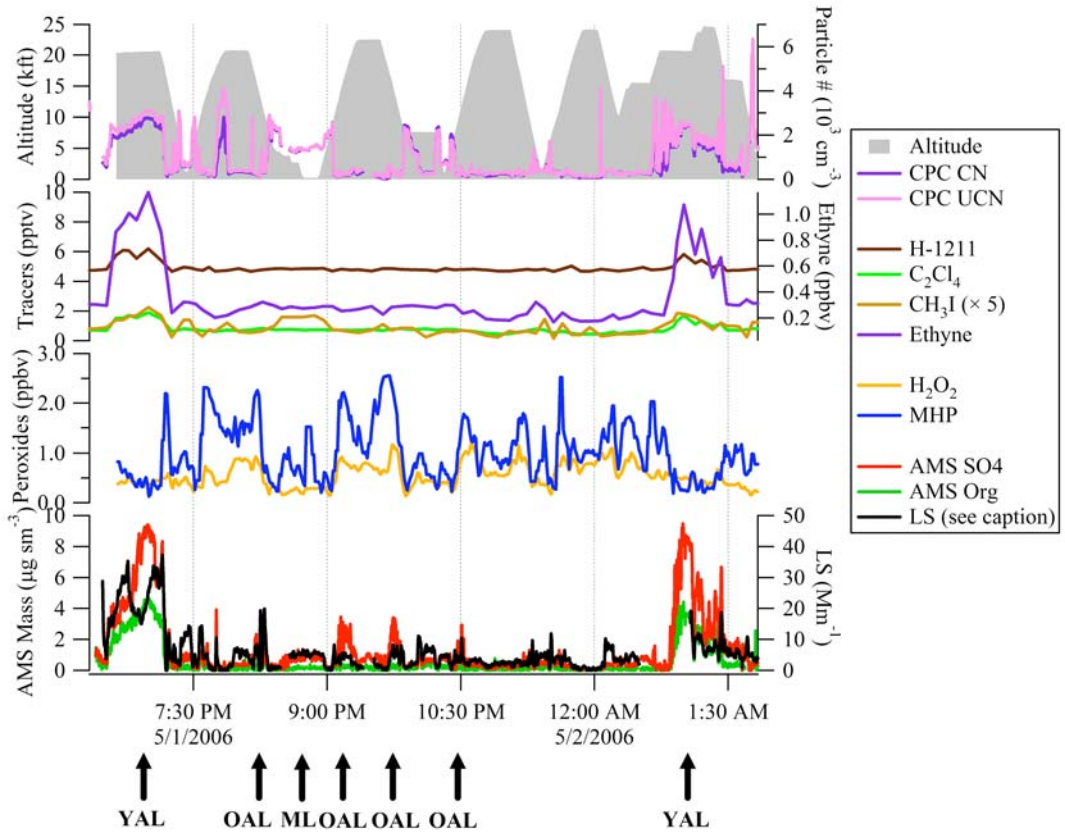

Figure S2 – Time series of additional measured species during the 5/1/2006 research flight, which are not displayed in Figure 9. Again, two intercepts of the Younger Asian Layer (YAL), several intercepts of the Older Asian Layer (OAL) and the one Marine Layer (ML) that are discussed in the text are labeled. LS is an abbreviation for submicron light scattering from the nephelometer instrument; CN is condensation nuclei and UCN is ultrafine condensation nuclei; time is in UTC.

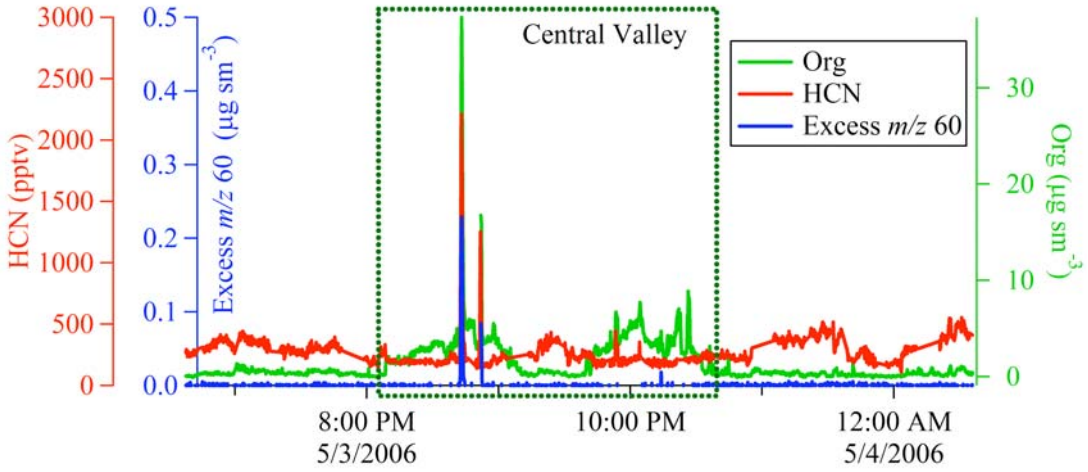

Figure S3 – Time series of biomass burning markers and organic aerosol during research flight 07 (5/3/2006), where the time period defined as the Central Valley is designated by the dashed green box. Both gas phase HCN and aerosol phase organic aerosol signal at *m/z* 60 are indicative of biomass burning. Excess m/z 60 is defined as (m/z 60 – 0.3% * total organics) in order to isolate the portion due to biomass burning (DeCarlo et al., 2007).The influence of biomass burning during the Central Valley time period (Section 3.2) is apparent in only two very short duration plumes and is minimal overall for the Central Valley air mass.

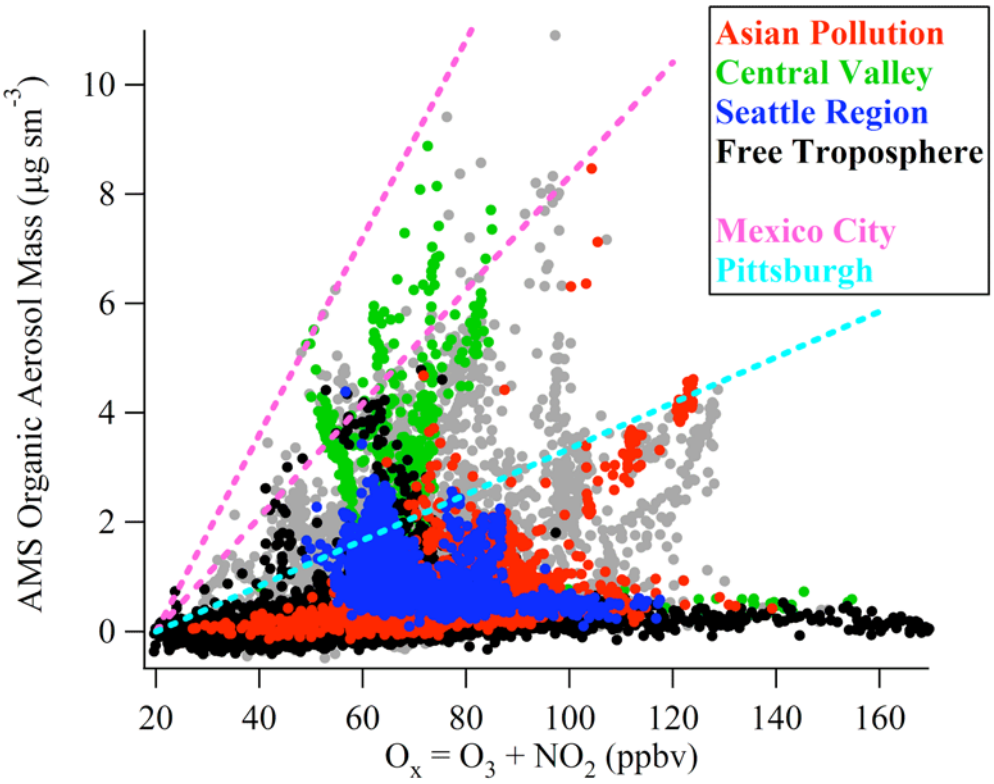

Figure S4 – Comparison of measured organic aerosol mass from the AMS on board the C-130 with the measured O_x, defined as the sum of $O_3 + NO_2$. Unclassified points are in gray. Dashed pink lines represent ratios of OA/O_x from (Herndon et al., 2008) of (104-180) µg sm^{-3} $ppmv^{-1}$ and the dashed cyan line represents the ratio from (Zhang et al., 2005) 38 µg m^{-3} $ppmv^{-1}$ (adjusted by 10% to account for STP).

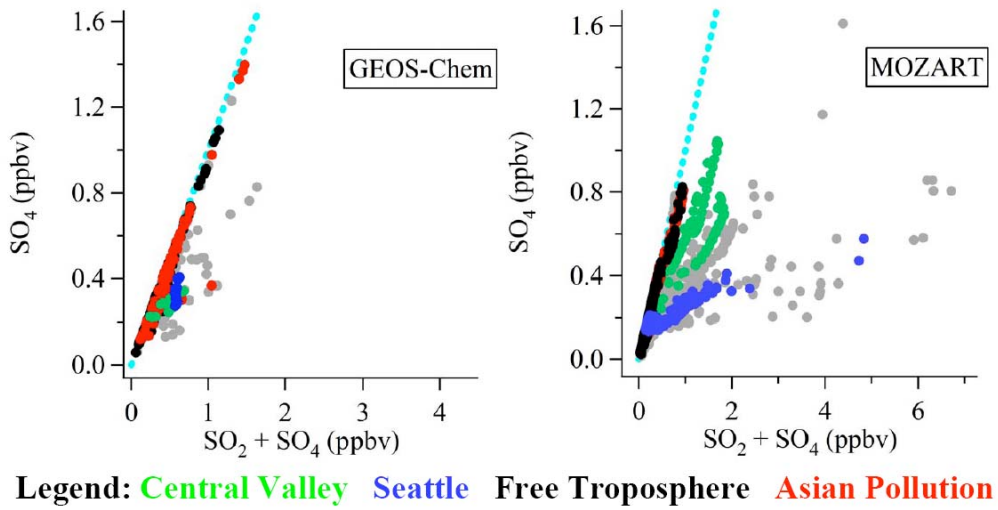

Figure S5 – Scatter plots of modeled aerosol sulfate levels converted to equivalent gas phase ppbv versus the total sulfur from the modeled aerosol sulfate plus the gas phase SO_2 from GEOS-Chem (left panel) and MOZART (right panel). The dashed lines indicate the 1:1 line where all sulfur is aerosol sulfate. Unclassified points are in gray.

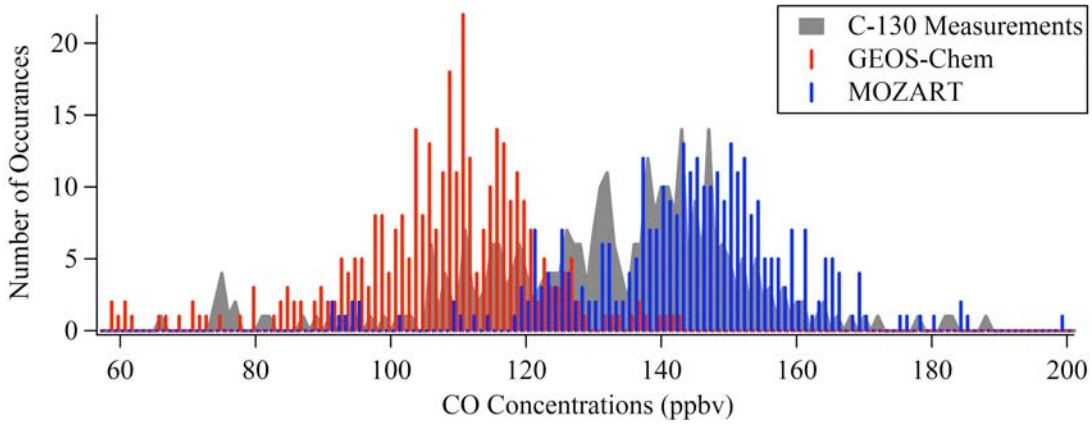

Figure S6 – Histograms of CO values from C-130 measurements, GEOS-Chem and MOZART modeled products for the entire INTEX-B campaign.

References

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