Atmos. Chem. Phys. Discuss., 6, S6848–S6851, 2007
www.atmos-chem-phys-discuss.net/6/S6848/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The T1-T2 study: evolution of aerosol properties downwind of Mexico City" *by* J. C. Doran et al.

J. C. Doran et al.

Received and published: 16 February 2007

General Comments

We appreciate the favorable comments and the constructive suggestions of the reviewer. As noted, our values for specific absorption, extrapolated to 550 nm, are indeed somewhat higher than some (but by no means all) values reported in the literature. We speculate that the rapid coating of EC in the polluted Mexico City urban environment may contribute to this effect (e.g., see Bond et al. 2006) and are hopeful that future analyses will provide more insight in this area. We also note that we have slightly revised our values of specific absorption in our latest version of the manuscript. Previous values were derived from hourly averages of absorption while current values are derived from 46-minute averages that more closely correspond to the actual sampling times for OCE and EC concentrations. Our responses to the more detailed comments

are provided below.

Specific Comments

1. In general we believe that the transport days would be similar for either forward or backward trajectories but we expect that there would be some differences for some of the individual hours included in the transport and non-transport categories. However, rather than investigating this in detail, in the revised analysis that we are now beginning we are adopting a somewhat different and potentially more useful categorization. Using a mesoscale model with data assimilation from the radar wind profilers and sodars deployed at T0, T1, and T2, we will be releasing inert tracer particles from urban areas and roadways at a rate proportional to the expected emissions of black carbon from those areas. We will then determine the mean age of those particles at T1 and T2 for each hour of our sampling period and characterize the measured specific absorption at the two sites as a function of the simulated mean age of the particles. This is actually the dependence we ultimately hoped to determine, and it should avoid confusion associated with forward and backward trajectories possibly yielding differing categories for transport and non-transport conditions.

2. A number of the trajectories shown for Day 79 in Figure 4 miss the 5-km box constructed about the T2 site but some do pass through it as well. Moreover, the trajectories in Figure 4 are only for one height and during the daylight hours, while material can find its way from T1 to T2 at various elevations and times. By examining the time required for air parcels that were at T1 to arrive at T2, as described in the text, we find that day 79 did indeed have extended periods of good transport between the two sites.

3.The times for the sounding results are already shown in the figure legend. The days will be added in the Figure caption, as follows: "Ĕ days for which nearly simultaneous releases were made at the two sites: 11 LST (DOY 68, 74, 77-78), 13 LST (DOY 68, 69, 76-79), and 15 LST (DOY 68 and 79)."

4. Although we have concentrated on the changes in the optical properties of the

ACPD

6, S6848–S6851, 2007

aerosols in this paper, the T1-T2 deployment of instruments will also allow some aspects of the aerosol composition to be examined. Thus, we 'd prefer to keep our original title so that this paper can also provide a perspective for those other results as they become available.

5. DOY 83 has a number of interesting features. The OC and EC concentrations at T1 are low throughout the night, but the OC values are considerably higher during the day while the EC values are not. At T2 both OC and EC are low at night but both increase substantially shortly after sunrise. Rain fell at T1 and T2 just after sunset the previous night (DOY 82) and during the afternoon of DOY 83. The rain undoubtedly contributed to the lower carbon concentrations and the specific absorption values are somewhat higher than the median values found for other transport periods. While this is consistent with the results found by Redemann et al. (2001) and Mikhailov et al. (2006), the sampling period is rather small and we hesitate to attach too much significance to this result at this time. As recommended, we will add a discussion covering these points in the text and list the additional Redemann reference.

6. Figure 8 contains the data from the full time series that we collected; descriptions of the differences between the data gathered during transport and non-transport periods commence in the paragraph following the introduction of Figure 8. The figure shows that reasonably robust fits to the data at each site can be obtained with linear fits that go through the origin. The Rˆ2 values in each case are ˜0.95. The slopes of these lines then correspond to the mean values of specific absorption at the two sites, with the value at T2 about 9% higher than that at T1. One can also obtain a least squares fit to the data at each site while leaving the intercept as a free parameter. The results are virtually unchanged at T1 but result in a smaller slope at T2 and an intercept on the order of 0.6. A non-zero intercept is unphysical (if the EC concentration is zero the absorption should be zero) and may indicate errors in the measurements or that the specific absorption is not necessarily independent of concentration. At this time we have no way of distinguishing between these two possibilities. Partly for this reason,

ACPD
6, S6848–S6851, 2007

EGU

and partly to mitigate the effects of possible outliers in the data, we prefer to use the median values of specific absorption at T1 and T2, and these are what are presented in the manuscript and in Table 1. Given the skewed nature of the distributions of specific absorption shown in Figure 9, the median is a more robust indicator of the behavior than the mean.

We will include this additional information in the text.

Technical Corrections

1. The reviewer is correct regarding the number of days. We have included all of the data from which we felt we could make a good estimate of boundary layer heights from the radiosonde profiles alone. Since the time our analysis was done, others at our laboratory have taken a closer look at the radiosonde data and also folded in wind profiler data from T1 and T2 and lidar returns from T1 to produce a much more comprehensive picture of the boundary layer structure at the two sites. Their analysis is nearly complete and will be the subject of a paper that will be submitted to ACPD in the very near future.

2. The connecting lines between the indicated points have been removed in our revised figure. Their inclusion was an oversight that we should have caught (as we did for the T1 data) but did not.

3. We have reworked the table and hope that it now looks better.

4. There are 264 hours represented in the T1 histogram and 236 hours in the T2 histogram. We have added that information to the figure caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12967, 2006.