

Interactive comment on “Short-term variation in near-highway air pollutant gradients on a winter morning” by J. L. Durant et al.

Anonymous Referee #2

Received and published: 26 April 2010

General Comments

This study used a mobile instrumentation approach to study near-freeway air pollution concentrations for a large number of pollutants during winter morning hours near a freeway in Somerville, Massachusetts, near Boston. Their instrumentation appears state-of-the-art for such a study and the results appear of high quality. It is a well-written paper.

The primary weakness of the paper is having only a single day of sampling. The potential for a single day to have unusual meteorological or traffic characteristics is high, and without more details and more analysis of how representative this day was of typical, I feel it is incomplete and not ready for publishing. This is unfortunate because it seems to be a well-conducted study. Are more days of measurements available?

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If yes, they should be added and I think the paper will easily be publishable. If not, much more detail about the meteorological conditions are needed and an analysis of how they well they represent typical conditions is absolutely necessary. Also, if only one day of data is available, I would strongly recommend presenting more information about how well the different pollutants correlate with each other, what factors might be used to predict pollutant concentrations like particle number concentration (PCN) as a function of downwind distance, and how those compare to the other studies such as those listed in Table 1. For example, the relationship between CO₂ and particle number concentration (PNC) is as strong as I have ever seen. Could CO₂ (or other pollutants that are easier to measure than PNC) possibly function as surrogate PNC measures?

I agree with the authors' assertion that more information about the temporal variation in near-road traffic emissions gradients is needed for health-related studies, especially in areas like epidemiology of ultrafine particle exposures. This study would fit the bill if the number of days sampled were higher.

Specific Comments

Page 5, line 14: Jan. 16 was chosen out of how many days? Section 2.3: How many instances of data removal occurred? (Line 11, page 8). Were these confirmed by video?

Section 3.1. Do you have estimates of average vehicle speed during the times of measurements? (Sometimes traffic slows down during rush hour more than the vehicles per hour indicate, and vehicle speed can strongly influence dilution rate and PCN.)

Section 3.2. (line 19, page 9) Can you provide an estimate of what time the “surface boundary layer” lifted? Was this a nocturnal (radiation) surface inversion? Does it occur routinely over the winter season?

In Figure 3, you have a very nice set of gradient curves, but how were the specific times chosen? The largest drop in concentrations happens between 8:07 and 9:22.

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It might be worthwhile to tighten that interval (or else include one more curve) to better characterize this time of rapid change. How long an averaging time does each curve represent? Do they represent more than one reading as you imply in line 15 of page 8? You indicate that the spikes marked by arrows in figure 3 likely represent the plumes from vehicles passing nearby. Can this be checked by video? Can you make corrections using CO₂?

Figures 4a and 4b should be switched since 4b is referred to first on page 10, line 12. The multiple graphs of the C/C_{tot} might be better replaced with a single graph of the particle size distribution at multiple distances. Referring to the concave shape of the top curve of figure 4a, are your data sufficiently precise to make such inferences about the shape of the curves? I agree that in general they appear to show stable particle size over several hundred meters,

Minor Corrections

Lines 20 to 22 on page 6 looks like they might belong in the results section.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 5599, 2010.