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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparisons of urban and rural $PM_{10-2.5}$ and $PM_{2.5}$ mass concentrations and semi-volatile fractions in Northeastern Colorado" *by* N. Clements et al.

N. Clements et al.

nsclements@gmail.com

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Anonymous Referee #2 Comment: This manuscript reports on the three-year CCRUSH study that investigated PM10-2.5and PM2.5 mass concentrations and SVM for several sites in urban Denver and comparatively rural nearby Greeley. Diurnal, weekday/weekend, seasonal, and annual concentrations are reported and interpreted. The data were related to meteorological variables such as relative humidity, wind speed, and direction. The authors have presented a thorough analysis in a well-written and well-organized paper. The strengths of the paper include the detailed analyses of differences/similarities in the various measured parameters at each site and their

relation to each other and meteorological variables. A weakness of the paper is the absence of the greater overall implications of the work. A statement at the end of the abstract along these lines would help place the importance of the work in a greater context. This is also true for the summary. I recommend the paper be published after addressing a few minor comments listed below.

Response: We appreciate the recommendations of the reviewer and their careful reading of our manuscript. We have added the following sentences to the manuscript to add detail regarding the overall implications and importance of the findings:

Abstract (last sentence added) ". . . PM10-2.5 and PM2.5 concentrations corresponded to morning and afternoon peaks of traffic activity, and were enhanced by boundary layer dynamics. SVM2.5 concentrations peaked around noon on both weekdays and weekends. PM10-2.5 concentrations at sites located near highways generally increased with wind speeds above about 3 m s-1. Little wind speed dependence was observed for the residential sites in Denver and Greeley. The mass concentration data reported here are being used in ongoing epidemiologic studies for PM in northeastern Colorado."

Conclusions (second sentence added to the section, new start to 3rd sentence) "The CCRUSH study characterized PM10-2.5, PM2.5, SVM2.5, and SVM10-2.5 mass concentrations in urban and rural communities in northeastern Colorado. The CCRUSH data are being used in ongoing epidemiologic studies investigating associations between coarse PM concentrations and health responses in northeastern Colorado. The measurements presented here show that traffic influenced sites in Denver had the highest PM10-2.5 concentrations and PM10-2.5/PM10 ratios. . . ."

Minor Comments

Comment: Abstract, line 7: Please provide years.

Response: The sentence has been changed to: "The Colorado Coarse Rural-Urban Sources and Health (CCRUSH) study measured PM10-2.5 and PM2.5 mass concen-

trations, as well as the fraction of semi-volatile material (SVM) in each size regime (SVM2.5, SVM10-2.5), from 2009 to early-2012 in Denver and comparatively rural Greeley, Colorado."

Comment: Page 24590, line 15: Stating the greater purpose of the study here would be helpful. Will this work ultimately be used for health research, regulatory work, emissions reductions, etc.

Response: This sentence has been changed to: "This paper examines the full three-year data set for PM10-2.5 and PM2.5 mass concentrations and their semi-volatile fractions, which will be used in ongoing epidemiologic studies comparing urban and rural health effects of PM10-2.5."

Comment: Page 24598, line10: Please list Greeley value.

Response: The Greeley value has been added: "The average Denver PM2.5 mass concentration over the whole CCRUSH campaign was 8.74 μg/m3, which is similar to the average PM2.5 concentrations of 8.42 μg/m3 measured in Greeley."

Comment: Page 24600, line 4: Can the authors comment on the similarity of PM2.5 SVM at both Denver and Greeley sites? One might expect these concentrations to be somewhat higher in Greeley (and also higher fraction) given the nearby agricultural activity.

Response: Without aerosol composition data to assess the impact of ammonium nitrate and semi-volatile organic compounds, we are hesitant to infer too much from the similarity in PM2.5 SVM measured in the two cities. The temporal signature of PM2.5 SVM suggests it is secondary in nature in both areas, peaking at noon throughout the year, but without compositional data it is difficult to assess which species are driving the temporal variability.

Comment: Page 24602, line 21: Can the authors clarify what they mean by “regional shifts in meteorological conditions”?

Response: We mean that weather conditions like humidity levels and wind, which tend to be fairly consistent for the two cities, is what mostly drives daily temporal variability of the PM10-2.5 fraction. This sentence has been changed to: "Relatively high regional correlations for PM10-2.5 suggest that weather patterns moving through the region influence the temporal variability of this pollutant on daily timescales."

Comment: Page 24603, line 1: Perhaps change “around Colorado” to around either ‘Denver and the Front Range’ or ‘northeastern Colorado’ since these data do not necessarily reflect all of Colorado.

Response: We agree with the suggested correction and make the following change to this sentence: "Daily average PM10-2.5 concentrations in Denver and the Front Range tended to be more spatially correlated than observed in previous studies using continuous monitors in. . ."

Comment: Page 24606, line 3: Define first usage of “NPR”.

Response: The first usage of nonparametric regression appears first and was defined as NPR in the Methods section on page 24596, line 21.

Technical Corrections

Comment: Table 2: Please define SD, COV, and N in the caption or footnote. Also include the city next to the site identifier (e.g., ALS, Denver). A challenge when reading this paper is keeping track of all the sites and their locations as the reader doesn’t have the benefit of the familiarity that that authors have.

Response: SD, COV, and N have been defined in footnote a for Table 2. The monitoring site cities and site descriptions have also been added to the site identifier to aid in keeping track of these details.

Comment: Table 3: Define “Cb” in the caption.

Response: Definitions for the concordance correlation coefficient (CCC) and bias cor-

rection factor (Cb) have been added to the caption of Table 3.

Comment: Figure 1: The data in figure 1 are very hard to read and separate. This may be a function of the journal printing them very small, but increasing the legend font size would help. Also, for part (a), consider adding a second axis for the SVM data. They are completely unreadable.

Response: To make the SVM data more readable, it was pulled from Figure 1a and put in its own subplot, now Figure 1c. The axis range of Figure 1c was changed to -1 to 10, so the near zero SVM10-2.5 values are observable. The legend size has been increased, but due to the size and complexity of the figure it may still be small. Final figures with full resolution will provide detail required to identify all time series. The revised figure is attached as a pdf file.

Comment:

Figure 2: Same comment as figure 1 in that the text is tiny and very difficult to read.

Response: Legends were moved and font sizes were increased to improve readability of Figure 2. The revised figure is attached as a pdf file.

Comment: Figure 3: Define “NPR” in the figure caption.

Response: The definition of NPR has been added to Figures 3-5.

Comment: Table S1: Over what time period do the traffic data correspond?

Response: The corresponding dates for the traffic data have been added to the caption of Table S1.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 24587, 2015.

Figure 1.

Fig. 1. Figure 1. Smoothed ($\Delta\theta$=3 hours) time series of hourly average (a) PM10-2.5 mass concentrations, (b) PM2.5 mass concentrations, (c) SVM2.5 and SVM10-2.5 mass concentrations, (d) gas-phase pollutant con

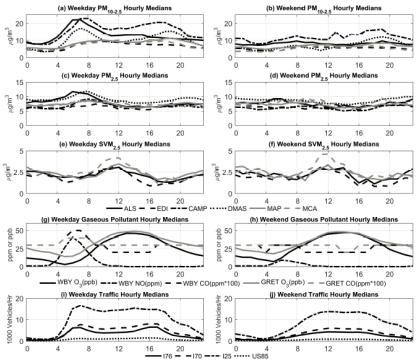

Figure 2.

Fig. 2. Figure 2. Diurnal trends (time-of-day medians) of (a) PM10-2.5 on weekdays, (b) PM10-2.5 on weekends, (c) PM2.5 on weekdays, (d) PM2.5 on weekends, (e) SVM2.5 on weekdays, (f) SVM2.5 on weekends, (g)