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Interactive comment on "Satellite Mapping of PM2.5 Episodes in the Wintertime San Joaquin Valley: A "Static" Model Using Column Water Vapor" *by* Robert B Chatfield et al.

Anonymous Referee #2

Received and published: 12 September 2019

GENERAL COMMENTS

The manuscript describes the derivation and application of a method that transform satellite observations into a map of surface PM2.5 concentrations. The satellite data consists of Aerosol Optical Thickness (AOT) and Column Water Vapor (CWV), both obtained from MODIS. Using a limited number of PM2.5 surface observations a statistical relation between the satellite AOT and CWV and the PM2.5 is derived, which could then be applied to an entire scene. The application is bounded to a winter season in the San Joaquin Valley, but is potentially of interest to other regions in the world too.

A novel aspect of the method is that the set of coefficients in the statistical relation is

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Discussion paper

a combination of values that are constant over the entire season (representing general valid relations), and values that are valid for a single day (to account for day-to-day varying weather conditions). The reasoning behind this formulation is explained well. Especially the step-by-step extension of the formulation illustrated by Table 1 and Figure 5 is of great help to understand the method, and provides high trust in the quality and robustness of the result. The information provided in the figures is extensive but informative, and the text provides useful description of the relevant features. The manuscript therefore deserves to be published in ACP after some minor clarifications and technical corrections.

SPECIFIC COMMENTS

The description of the mapping method mentions a number of data sources: MODIS (or specific the MAIAC retrievals of AOT and CWV), AERONET (same), the DISCOVER-AQ campaign with surface and air craft observations, EPA PM2.5 observations, and meteorological data from the RAP model. At first glance, and also at second, it is not completely clear which data is in the end used for the mapping procedure. Is that indeed just the MODIS and EPA (and campaign) surface data? To what extend does the application depend on the other data, is that just for validation, or is there also some 'hidden' usage? This could be better clarified. For example, the campaign aircraft data seems not used at all, but is mentioned already in the abstract.

Further, could some kind of physical meaning be assigned to the mapping parameters? For example, the paper clearly describes the development and presence of elevated layers of aerosol and water vapor, and how these impact the PM2.5/AOT relation. Does one of the parameters actually account for the AOTe/AOT ratio on a particular day? Not necessary for this study, but could such be validated using the aircraft observations for example?

In addition, the daily variation in aerosol concentrations and other variables is almost entirely attributed to the meteorological conditions. But what about variations in emis-

sions? Domestic wood burning and agriculture are mentioned as important emissions sources, but these might also strongly depend on the meteorological conditions. Would strongly varying emissions have an impact on the mapping procedure, or would this simply end up in a higher RMSE? Some discussion on this would be useful.

TECHNICAL CORRECTIONS

Line 16: "Dec 11" should be "Feb 11" ?

Figure 1: For non-US citizen, could the SJV region be marked on the map? Maybe refer to Figure 6 for detailed view.

Line 137: Wrong parenthese in "(Choice" ?

Line 140: Instead of "temporal resolution", is "temporal variation" ment?

Line 142: What is "P3-B", a weather fenomena?

Line 143: Mispositioned dot in ") .AOT"

Line 234: This seems a mixture of two sentences, what is ment?

Figure 3: Time axis is unreadable.

Line 264: Which figure is ment here?

Table 1: A column with references to panels a-f in Figure 5 would be useful. Also a column with index numbers would be useful for reference. For example, line 316 could refer to the table and Figure 5 instead of "third regression".

Line 326: "The fifth estimate ...": isn't the "fourth (5d)" ment?

Line 326: "below" depends on formatting, better refer to table or figure.

Line 326: "8.03" is a different number than shown in the figure.

Line 333: "Figure 4e" should be "Figure 5e" ?

Figure 6: caption mentions "360 m agl", but figures "100 m"

Figure 6: What doe the time stamps indicate, UTC ?

Line 361: Strange sentence, should it be "Here we describe just one episode" ?

Figure 7: Caption does not correspond to figures.

Line 377: "Section 7" should be "Figure 7" ?

Line 486: "focusrd" should be "focused"

Line 514: "We attribute this primarily *to* (a) ..."

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-262, 2019.