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Atmospheric Chemistry and Physics Discussions

# *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 #1**

Received and published: 15 October 2019

General comments:

The authors investigated PM2.5 and AOT relationships that are affected by column water vapor (CWV) using multiple statistical model structures (including daily calibration from mixed effects model) in the San Joaquin Valley of California. As indicated by the authors, water vapor can be an important parameter to better estimate PM2.5 from AOT data because of the dry mass of PM2.5 vs. the hygroscopic property of AOT among others. It is interesting to see the authors use water vapor data retrieved along with AOT data. The authors tested multiple model structures to show the improvement of PM2.5 estimation by each model component, which is useful for readers. The San



Joaquin Valley shows high PM2.5 concentrations particularly during the winter, and therefore better understanding of PM2.5 distribution, which cannot be fully revealed by ground monitors, is important for health effect studies and air quality management. Complex terrains and meteorology (especially in winter) in the region have caused the AOT-derived estimation of PM2.5 to be a challenge, and this study investigates this critical air quality issue using a novel approach. I recommend this manuscript for publication in ACP after addressing my comments below.

Specific comments:

I suggest the authors clearly connect texts to figures and tables in the entire manuscript. I sometimes lost track of what tables or figures the texts are referring to.

Line 20: Please add the full name of rms because this is the first mention of the term.

Figure 1: This figure is based on ground observations. In the figure caption, it is better to say 'observed' or 'calculated' rather than 'estimated.'

Line 102: Please specify references.

Line 121: Satellite overpass times, 10:30 am (Terra) and 1:30 pm (Aqua), are local time not UTC.

Line 122: The period, November 2012-April 2013, is not consistent with the period mentioned in the abstract. Please also check all the periods indicated throughout the manuscript. There are lots of texts indicating study periods, but they are not always the same.

Line 143: Please clarify, RUC or Rapid Refresh (RAP)?

Figure 2: What are those three SJV PM2.5 stations? Please specify.

Line 214: This is the first mention of mixed effects model. It will be better to explain what this model is and what success the authors are referring to. Alternatively, this part

can be moved to the section after the general introduction of mixed effects model.

Line 237 (equation 5): Please use the terms, fixed slopes and intercepts and random slopes and intercepts, which are widely used. No fixed intercept included in this equation?

Figure 3(a): A boundary map of California including San Joaquin Valley is needed.

How do the colors indicate direction and distance from centroid? Also, what is the centroid here? It may be useful to include figure legends.

Line 273: Please specify what figure the authors are referring to.

Line 275: It is more useful to add references that used the aircraft data.

Figure 4: How many ground monitors are used to create this figure? There are two colored bars (dark red and light red). Does it mean there are 2 monitors for this analysis?

Table 1: The first three models do not show the full RMS error values (i.e., decimal points).

Please add a note explaining all components of the equations (e.g., i, s, a, c, alpha, and so on). The first two models need an error term and a fixed intercept.

Figure 5: For (a) and (b), values on x-axis should be indicated.

For (d), based on Table 1, R value is 0.85 and RMS error is 8.03 for this model. The authors may be confused with the fourth model in Table 1.

For (f), is this the same model as the last one in Table 1? If so, please correct the RMS error (6.48) which is indicated as 6.44 in Table 1.

Line 336: What estimate are you referring to?

Line 358 (equation 8): According to the texts, (AOT/CWV/PBL) needs to be changed to (AOT/PBL)?



Line 399: Cloud water vapor → column water vapor

Lines 431, 435, and 441: Readers do not know about specific figures included in previous research. It will be sufficient to summarize the previous research without mentioning the figure/panel numbers.

Line 446: I would remove the sentence "The whole Aqua . . .. . ." because all the MAIAC data (combined Aqua and Terra) are now available from NASA.

Figure 8 caption (lines 461 and 462): The following is true only on a given day: "There are the same for all geographical. . . The slope parameter. . . for all geographical locations." Please clearly mention it.

Line 491: Please add the full name of GOES.

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