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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Climatic factors contributing to long-term variations of fine dust concentration in the United States" *by* Bing Pu and Paul Ginoux

**P. Chuang (Referee)**

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Review of "Climatic factors contributing to long-term variations of fine dust concentration in the United States"

Authors: Bing Pu and Paul Ginoux

Reviewer: Patrick Chuang

The manuscript examines the meteorological factors responsible for surface fine dust (deduced from IMPROVE network measurements). They build upon earlier work that shows that primary factors affecting dust optical depth include precipitation (which



leads to wet scavenging), surface bareness and wind speed (which are associated with dust emissions). This work focuses specifically on PM2.5 dust, and examines the times of year and locations within the US where CIN and CAPE add predictive power to fine dust, and the larger meteorological context that leads to these new factors being important. Overall, the manuscript represents a useful contribution to our knowledge of dust aerosol in the US. Before it is appropriate for publication, however, the figures need to be improved, and some methodological issues clarified and/or fixed.

Main comments:

* The title should read "surface fine dust" since this is the focus of the observations. You should emphasize this once in a while within the text and figures as well.

* You mention pattern correlation but there is no description of the method. Please add a clear description of what is done.

* Why is the reconstructed pattern called "REG"? This is unintuitive.

* Section 3.3.1: your usage of various two-variable regressions seems like a poor choice of methodology. Is there some reason why you don't use multi-variate regression as in the rest of the paper? Also, the lines 450 to 452 basically state that the entire section up to this point is not supported by the NARR reanalysis. If this is so, then is your hypothesis really worth mentioning? To the reader, it feels like I spent a bunch of time working hard to understand a complicated set of figures, tables and text, and in the end, it may be completely spurious which makes me feel like I just wasted my time. Please delete this part if you can't get NARR to tell a consistent story.

* I found the examples using CALIOP data (Figs 7 and 8, and text from lines 453 to 467) unconvincing. Unless there was an objective choice for these cases, these are snapshots that could pretty much mean anything. I'm sure one could find two cases that represent the opposite of what you want to show. Please delete. It's a long enough manuscript as it is. I don't think this part adds anything.

* Your analysis ignores advection, as you state in your methods. Given the spatial scale of your analysis regions, expected transport patterns and the lifetime of fine dust, can you defend doing so? There are certainly places in the world where there are times of year (say, Korea in the spring) when dust is almost entirely due to advection. I note that surface wind speed, precipitation, CIN and CAPE could all plausibly correlate with advective transport.

* For all figures where you want the reader to focus on a specific region (Figs 1, 2, 3, 4 and 5), you MUST put the boxes into each panel, not just one of them. Otherwise it is impossible to compare the boxes (I just about went crazy trying to do so). Note that you do have boxes in all panels in in Figs 9 and 11. Also, please consider using different kinds of boxes to outline the Southwest, GP and CGP (say, solid, dashed and dotted or black, blue and green). That way when I see a box in a new figure, the color or line used to draw the box tells me exactly which box it is.

* Overall the text can be a bit tough to follow since your analysis has three regions and four seasons = 12 choices. Exactly which of these 12 you are discussing at any one time keeps changing. I don't have any specific suggestions, but I do recommend that you think about editing the paper to help the reader more easily keep track of exactly what your analysis refers to.

There are minor comments (and some repeats of the above comments) in the attached marked-up PDF file. Please ignore any comments that are redundant with the above.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2017-821/acp-2017-821-RC2-supplement.pdf

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