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Discussions

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Interactive comment on "Development of a three-dimensional variational assimilation system for lidar profile data based on a size-resolved aerosol model in WRF-Chem model v3.9.1 and its application in PM$_{2.5}$ forecasts across China" *by* Yanfei Liang et al.

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Responses to the comments of Reviewer #2: We are truly grateful to yours' positive comments and thoughtful suggestions. Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. Based on these comments and suggestions, we have studied comments carefully and have made correction which we hope meet with approval. All

changes made to the text are marked in blue color. Below you will find our point-by-point responses to the reviewers' comments/ questions:

Specific Comments:

1. The abstract should be rewritten as it is really unclear.

Response: We followed the suggestion, and the abstract has been rewritten as following in the revised manuscript.

2. L171-175: you should specify it is the EARLINET network. L200-201: you should specify that the aerosol types will be described later. L392-393: Can you write PM10=PM2.5+... for more clarity. Chapter 3: for each figure you have written "the figure demonstrates", figure can demonstrate nothing...

Response: We are truly grateful to your thoughtful suggestions and changes in the revised manuscript are as following: In L169-175, we have specified that the data are "captured by 12 lidars positioned in the Mediterranean Basin from the ACTRIS (Aerosols, Clouds, and Trace Gases Research InfraStructure)/EARLINET (European Aerosol Research Lidar Network) and one lidar positioned on the French island of Corsicain from the framework of the pre-ChArMEx (Chemistry-Aerosol Mediterranean Experiment)/TRAQA (TRAnsport àlongue distance et Qualité de l'Air)." In L201-203, we have specified that "This scheme, which will be described in Section 2.4, can be used to predict the profiles of eight aerosol types." In L403-404, we have write that PM10=PM2.5+SO42.5-10+NO32.5-10+NH42.5-10+OC2.5-10+EC2.5-10+CL2.5-10 +NA2.5-10+OIN2.5-10 The expression "the figure demonstrates" have been removed or replaced by "as showed in figure".

3. Except in the paragraph 3.4, no numbers are given, you just make qualitative comparison. Some more precise results will be welcome.

Response: We really appreciate this suggestion and follow the suggestion. We have added more quantitative results in the Abstract section (L45-53) and Conclusion sec-

tion (L795-801)

4. Figure 4: It is not easy to read, may be you should change the symbol color for the station.

Response: The symbol color for the station has been changed to black and the line of wind vector and the map province boundary has been set thinner in the revised manuscript.

5. Figure 7: What are the green triangles?

Response: We are so sorry for that our lack of clear description of the mark in figure 7 has troubled readers. These two green triangles mark the locations of the two cities mentioned in the description for figure 7 but without lidar. We have added "green triangles mark the locations of the two cities without lidar " in the revised manuscript.

6. L691-694: You are doing 2 sentences to repeat the same just with the diurnal specification. You could do it in only one sentence.

Response: We followed the suggestion. The original expression has been changed in L646-648 as " Figure 8 shows the variation of the regional mean of the PM2.5MC over time from the four experiments. The regional mean of the PM2.5MC (black line) exhibited a notable diurnal pattern." Redundant expressions similar to this have also been changed in the revised manuscript.

7. The results behind looks interesting but I got a little bit frustrated that you have not been more precise on the results. Can you put some effort on adding some quantitative results (ie. increase by 10%, decrease by 0.2. . ..).

Response: We have added more quantitative results in the Abstract and Conclusion section(L45-53 and L795-801). Also, please allow us to explain why few quantitative results are introduced in the article except in the paragraph 3.4. Firstly, the quantitative analysis of direct effects of DA in the paragraph 3.3 have been given in paragraph 3.4, as the end of DA period is the initial time of forecast period. In addition, the focus of this

article is to accomplish the assimilation of AEC by establishing the AEC observation operator, verify the feasibility of the assimilation scheme and find some factors that may affect the assimilation effect. And to what extent the assimilation improves the forecasting effect are not what we trying to emphasize.

8. I would like to encourage you to ask an English native to review your article.

Response: We followed the suggestion. We have carefully revised the manuscript. In addition, we have asked a freelance English editor to improve the presentation.

We would like to express our great appreciation to you for the valuable and pertinent comment on our manuscript, which is crucial to improve the quality of our work. We hope that these revisions are satisfactory and that the revised version will be acceptable for publication in Geoscientific Model Development. Thank you very much for your work concerning our paper.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2020-223/gmd-2020-223-AC2-supplement.pdf

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Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-223, 2020.