

1 **Responses to the comments of Reviewer #2:**

2 We are truly grateful to yours' positive comments and thoughtful suggestions.
3 Those comments are all valuable and very helpful for revising and improving our
4 paper, as well as the important guiding significance to our researches. Based on these
5 comments and suggestions, we have studied comments carefully and have made
6 correction which we hope meet with approval. All changes made to the text are
7 marked in blue color. Below you will find our point-by-point responses to the
8 reviewers' comments/ questions:

9 **Specific Comments:**

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

11 **Response:**

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

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

18 **Response:**

19 We are truly grateful to your thoughtful suggestions and changes in the revised
20 manuscript are as following:

21 In L169-175, we have specified that the data are " captured by 12 lidars
22 positioned in the Mediterranean Basin from the ACTRIS (Aerosols, Clouds, and Trace
23 Gases Research InfraStructure)/EARLINET (European Aerosol Research Lidar
24 Network) and one lidar positioned on the French island of Corsicain from the
25 framework of the pre-ChArMEx (Chemistry-Aerosol Mediterranean

26 Experiment)/TRAQA (TRANsport àlongue distance et Qualité de l'Air).".

27 [In L201-203](#), we have specified that "This scheme, which will be described in
28 Section 2.4, can be used to predict the profiles of eight aerosol types."

29 [In L403-404](#), we have write that

$$30 \quad \text{PM}_{10} = \text{PM}_{2.5} + \text{SO}_{42.5-10} + \text{NO}_{32.5-10} + \text{NH}_{42.5-10} + \text{OC}_{2.5-10} + \text{EC}_{2.5-10} + \text{CL}_{2.5-10}$$
$$31 \quad \quad \quad + \text{NA}_{2.5-10} + \text{OIN}_{2.5-10}$$

32 The expression "the figure demonstrates" have been removed or replaced by "as
33 showed in figure".

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

36 **Response:**

37 We really appreciate this suggestion and follow the suggestion. We have added
38 more quantitative results in the Abstract section ([Line 45-53](#)) and Conclusion section
39 (Line 795-801)

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

42 **Response:**

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

45 *5. Figure 7: What are the green triangles?*

46 **Response:**

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

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

53 **Response:**

54 We followed the suggestion. The original expression has been changed in
55 [L646-648](#) as " Figure 8 shows the variation of the regional mean of the PM_{2.5}MC
56 over time from the four experiments. The regional mean of the PM_{2.5}MC (black line)
57 exhibited a notable diurnal pattern." Redundant expressions similar to this have also
58 been changed in the revised manuscript.

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

62 **Response:**

63 We have added more quantitative results in the Abstract and Conclusion
64 section([Line 45-53](#) and Line 795-801). Also, please allow us to explain why few
65 quantitative results are introduced in the article except in the paragraph 3.4. Firstly,
66 the quantitative analysis of direct effects of DA in the paragraph 3.3 have been given
67 in paragraph 3.4., as the end of DA period is the initial time of forecast period. In
68 addition, the focus of this article is to accomplish the assimilation of AEC by
69 establishing the AEC observation operator, verify the feasibility of the assimilation
70 scheme and find some factors that may affect the assimilation effect. And to what
71 extent the assimilation improves the forecasting effect are not what we trying to
72 emphasize.

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

74 **Response:**

75 We followed the suggestion. We have carefully revised the manuscript. In

76 addition, we have asked a freelance English editor to improve the presentation.

77

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

83

84 Wish you all the best!

85 Yours sincerely,

86 Yanfei Liang, Wei You and Zengliang Zang

87 05/10/2020

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