

Response to anonymous Referee number 1 review

The authors would like to thank referee #1 for his/her useful comments. Each response to the referee's question is organized as follows: (1) comment from the referee in bold, (2) authors' response and changes in the manuscript in normal font. The changes in the revised manuscript, except the small edit corrections, are in green color in the revised manuscript. Moreover, the manuscript has been proofread by a native English speaker.

1. **Some key findings of the observations from the three campaigns can be provided in this section.**

It is a good suggestion. Nevertheless, the different published results mainly concern radiative aspects, secondary organic aerosols or look at very small scale. This is then difficult to fit key findings into the scope of our study to add in the introduction. However, we compared our results to pertinent studies into the main part on the manuscript. In addition, the introduction has been completed with details about measurements made during the ChArMEx related campaigns.

2. **Page 3, line 3-4; this sentence can be removed to materials and methods or results, it is not relevant in this part of the introduction**

The sentence has been removed.

3. **Can the author explain how the vertical and temporal distributions of emissions are done? Does MOCAGE run on hourly resolution input? How about the speciations of NMVOCs in the model?**

In the model, all emissions are distributed on the 5 lowest model layers using an exponential decay with a decay constant of 5. The temporal distribution is based on the monthly variations provided in the inventory chosen on top of which are added the variations linked to the day of the week and the time of the day (following EMEP profiles). The NNMVOCs speciation is based following Stockwell et al., (1997) based on Middleton et al, (1990). This information has been added to the manuscript.

4. **Please use the full names (e.g. MNMB and other similar acronyms) when they first appear in the text**

The acronyms for MNMB and FGE have been added to the text when they first appears.

5. **What are the units in Tables 1 and 2? Is MNMB in % ? Use these units in the text too (e.g. MNMB is lower, between -0.5% and -1%).**

AOD being a dimensionless quantity, the bias is also dimensionless. MNMB and FGE are always dimensionless measures. This has been added in the text.

6. **Figure 2 shows that AODs are generally underestimated in the eastern Mediterranean in 2013 compared to 2012. Can you comment on this? is it the meteorology?**

Emission inventories are not well known in this area and likely underestimated leading to a systematic negative bias of the model over this region. The year 2012 has more rainfall in this area, leading to more wet deposition (Fig. 6). The mean concentrations in 2012, and also the AOD, is then lower and closer in the simulation to the reality since wet deposition reduces the impact of emission uncertainty. This has been added in the text.

7. **Figure 3 can be moved to materials and methods as it does not present any results but the information about the stations and what they measure. The first 3 paragraphs of section 3.3 also fits better to materials and methods section as it introduces the data used for evaluation.**

We think that Figure 3 can be kept in the main part of the manuscript since the reader can easily refer to it when reading the associated comment. For the first 3 paragraphs of section 3.3, we agree that they are not essential in the analysis of the results. They have been moved to the appendix.

8. **"Is it more correct to say that class 10 represents urban than highly polluted?"**

The classification method uses the temporal variation of the time-series at each station to determine its class and the class 10 corresponds to stations characterized as traffic. The text has been changed.

5 9. **The bias in AOD is much smaller compared to bias for the surface stations. Can the authors discuss the reason for this?**

The AOD is a measure of the integrated column of aerosols while surface stations aim at evaluating the aerosol concentrations at one specific level. There can be a good agreement with AODs while not with surface stations if the vertical distribution is not correct and/or if the particles are not well distributed in size.

10. **Can the authors explain why they only use EMEP Stations**

10 There is a problem with the words employed. What we wanted to say is that the choice of the domain makes that only EMEP stations are located into the simulation domain. It has been corrected in the text.

11. **Some evaluation on deposition using e.g. EMEP stations could be useful as the budget is dependent on this term**

Following your advice, we added a comparison to wet deposition data from the EMEP stations to the manuscript.

12. **Figure 10 fits better to Materials and method**

15 We think that Figure 10 can be kept in the main part of the manuscript since the reader can easily refer to it when reading the analysis of the results of the test experiment.