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Atmospheric Measurement Techniques Discussions

Interactive comment on "Aerosol data assimilation in the chemical transport model MOCAGE during the TRAQA/ChArMEx campaign: Lidar observations" *by* Laaziz El Amraoui et al.

Anonymous Referee #2

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I - General comments

This manuscript aims to present, for a case study of a desert dust outbreak in June 2012, the impact of the assimilation of LIDAR observation on a simulation performed with the chemistry transport model MOCAGE. This manuscript has a companion paper (amt-2016-60) focused on the assimilation of aerosol optical depth from MODIS.

Its a topic of scientific interest and within the scope of Atmospheric Measurement Techniques due to the large and rich set of aerosol observations from multiple instruments used to perform the analysis. The presentation of the work is globally very clearly organized, but appears sometimes too limited to a simple superficial description. A more

in depth presentation of the results and of some crucial choices would be very useful to improve the added value of this manuscript. In particular, I have been deeply surprised to find only in the conclusion a mention of a comparison between the previous analysis reported in the companion paper. From my point of view this should be included in the present manuscript.

On the other hand a large part of the text, providing the general description of the assimilation method (globally not new), the model (not new), the observation database used (not new) which is common with the companion paper could be certainly limited.

II - Detailed Comments

The sections 2.2 and 2.3 are largely common with the sections 2 and 3 of the companion paper. They could be largely reduced (or at least put in annex) to focus on the change performed to assimilate LIDAR observation. However, emission used should be mentioned.

p7, line 1 and 2 : The determination of the background error variances and the observation error covariance should be on contrary more detailed. These are results specific to the case study presented.

p7, line 4-7 : This paragraph should be more detailed also. What is the vertical correlation length? How the link between observation with a vertical resolution of 30 to 60 m and model with a vertical resolution of 400 to 800 m is made?

Section 3 : I suggest to merge each paragraph of this section with the corresponding one in the section 4 to avoid a dilution effect for the readers.

section 4.1 : Could the definition of observation minus analysis and observation minus forecast be recalled? I understand it is verification of the good behavior of the minimization process. In this case, it could be simply presented like this. Moreover, I think it would be interesting to compare the free forecast and the analysis also in terms of AOD. It could then be more directly compared to the results obtained with the

measurements data from MODIS and AERONET.

p12, line 11: "...bias between MOCAGE and MODIS data." I guess?

p13, line 5-6: It is clear that the assimilation of LIDAR data allows a better representation of high values. However, I believe that a comment here on the fact that the positive bias for low values is increased (as shown in figure 5) would be welcome.

figure 6 and figure 7: It appears the number concentrations values observed with the ballon flight ($\sim$0.5 cm-3) are much lower than those observed with PCSAP instrument on board the ATR aircraft in the desert dust plume ($\sim$5 cm-3). Any comments on this?

figure 7: The horizontal axes could be set to the same scale to ease the comparison between the two flight.

p8, line 12 : assimilated <-> assimilate

p8, line 26 : "http://thesesups.ups-tlse.fr/2667/1/2014TOU30293.pdf" <-> Sic (2014)

p11, line 24 si <-> is

p34, line 5 the reference to the companion paper should be updated.

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