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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ozone and aerosols tropospheric concentrations variability analyzed using the ADRIMED measurements and the WRF-CHIMERE models" *by* L. Menut et al.

Anonymous Referee #1

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Review of the ACPD paper "Ozone and aerosols tropospheric concentrations variability analyzed using the ADRIMED measurements and the WRF-CHIMERE models" by L. Menut, S. Mailler, G. Siour, B. Bessagnet, S. Turquety, G. Rea, R. Briant, M. Mallet, J. Sciare, and P. Formenti

In this paper the authors look at the levels of ozone and aerosol over N. Africa and Mediterranean region in the period of June-July 2013, discussing their temporal and spatial variability. The study is based on the combined use of observational data and modelling results. The measuments included data from European Climate Gridded dataset (E-OBS) for meteorological parameters, EEA air quality monitoring data

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from AirBase, AERONET sun-photometer AOD measurements and aircraft measurements of ozone during the ADRIMED campaign. The calculations were performed by CHIMERE CTM driven by off-line meteorology from WRF meteorological model. To evaluate the accuracy of meteorological parameters from WRF, the paper compares calculated and E-OBS measured daily surface temperature (which indicated in general a slight negative bias) and accumulated precipitation (showed reasonable agreement in terms of the amount and occurence). Then the results of comparison of CHIMERE calculated ozone and PM10 concentrations, as well as AOD, with the available measurements for the studied period are discussed. Further, the authors present CHIMERE calculated aerosol chemical composition, showing the dominance of mineral dust, both at surface and through most of the troposphere, at most sites in the region. Also, aerosol size distribution from CHIMERE is compared with derived data from AERONET.

In general, the presented material is quite interesting and the work represent a valuable contribution to air quality study in the Mediterranean region which is influenced in a complex way by the emissions from anthropogenic and natural sources. The work is well suited to be published in ACP, but the text and content of some parts of the paper should be thoroughly revised and edited by the authors.

For the most, the paper is written following a certain logical structure, still there are several paragraphs/parts if the text (some of them are pointed below) which need some improvements in terms of clarity. In particular, the main findings and conclusions should be better summarized. It is also strongly recommended to do a thorough check of the correctness of English language use before the paper is re-submitted for publication.

Overall comments:

My main concern is that the paper seems to lack a clearly defined goal which in several places leads to somewhat superficial analysis and eventually to the lack of profound conclusions. For example, ”the ozone and aerosols concentrations are studied. . .” (Abstract), ”The main purpose of this study is to better understand ozone

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and aerosols content ” (p. 3067), ”The goal of this paper being to evaluate the ability of a model to estimate hourly pollutants concentrations. . .” (p. 3080), ”One goal of this paper is to calculate and discuss the chemical speciation of the aerosols” (p. 3083), "A focus was done on aerosol size distribution" (p. 3090), etc.. In adition, there several ”questions to answer” listed in Introduction. I’d highly recommed to the authors to establish one well-defined goal for the paper, clearly specified sub-goals/questions and to make sure that the paper follows its main purpose and that the answers to the posed by the authors questions are given in Discussions/Conclusions.

In its present form, the paper does not really study the ozone/aerosol pollution in Mediterranean, but rather presents CHIMERE comparison with the measurements, thus appearing as a model evaluation work. Then doing so, the paper does not offer much of analysis of the reasons for disagreement between the model and observations, supported e.g. by sensitivity studies/trajectory analysis and other axiliary matarial in order to better interpret the results, but rather describes them hypothizing on the explanations, and it does not either propose ideas on how to improve the model. As the authors are widely using the term ”analyze the results”, I’d recommend to include more in-depth analysis, or change the word to ”discuss/look at. . . the results”.

Hourly measurements were available for the studied period. Those are valuable for diurnal analysis for getting better insight in chemical/meteorological processes. It is strange and disappointing that the authors have not made a better use of the hourly measurements, choosing to average them, though they state ”The goal of this paper being to evaluate the ability of a model to estimate hourly pollutants concentrations”. # Two meteorological surface parameters from WRF are evaluated with observations, but the evaluation results have not been used for further interpretation of CTM results.

Other general comments: # Several places: misleading use of ”close to sources” and ”remote” (refering here to the proximity to erosion dust sources, but not anthropogenic). This should be formulated more precisely. # The choice of the dates for maps and timeseries should be better justified. Sometimes they seem random (16, 20, 24 June,

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and then 17, 21 for ozone and aerosols) # Almost nothing noted on anthropogenic component of air pollution at the selected sides # The aerosol composition vertical profiles show rather high dust concentrations aloft, till very high altitudes, suggest a significant dust source on the top of the model domain. Please explain.

Specific comments (just some): Abstract should clearly define the purpose of the paper and summarise the main findings of the study of air quality-concentration variability in the Mediterranean region (rather than a few, arbitrary selected notes on model performance). - p. 3065, line 7-8: "..not highly pollutted" – compared to what? Typical levels? Critical levels?... - line 12-13: Suggested: change "quantified" with "calculated by the model" as it's not verified line 14-15: it was just shown that for a few hours the modelled aerosol size distribution is shifted.... line 16-17: remove "even if". There is no prove of "correctly reproduced total mass of aerosols" - whatever the authors mean by that, whereas AOD indeed compares better with observations, but is not quite "correct". Besides AOD calculations can include some error compensation

p.3066 line22-23: aerosol composition does not depend, but means or can be quantified by the relative contribution of the individual species

line 26: aerosol life cycle or aerosol properties?

line 27: sun-photometers do measure AOD

p. 3067 line 7: "significant development" or "significant modelling efforts to assess...", or perhaps "singnificant development of the CHIMERE"?

Lines 20-23: is not this is a prerequisite for accurate modelling in many (or any) regions?

p. 3068 line 10-11: "having in mind the strength and weakness(es)" – I could not say this was discussed in sec. 8

line 23-24 : repetition

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line 25: analyze meteorological parameters?? Perhaps characterise met. Situation, or evaluate WRF??

p.3069 line 7 : In order to the modelled meteorology???

Line 15: what is meant by ”homogeneous databases”? Harmonized? Coordinated??

p. 3070 line 14-15: the surface measurements of temperature and precipitation are not in the paper

l. 18 : perhaps ”year day” instead of Julian day (check definition)?

p. 3071 line 6 : NCEP/GFS – reference?

p. 3072 line3-4 : precalculated by WRF

line 6-7: what was the horizontal resolution?

line 13-15: what about aerosol growth by condensation of gases? Wet scavenging and dry deposition

lines 18-20 and there after: explain id modelled AOD is dry or the effect of aerosol hygroscopic growth is taken into account

p. 3073 line 21 Analysis of meteorology?? Meaning WRF evaluation?

Line 23: ”..and use of CHIMIRE model” is probably irrelevant information here;

Line 25-25: meteorological parameters; ”realistic enough fields” – explain better please

Line 27: rather that the model performance is variable for different regions/locations

p. 3074 line 18-20 : rather thin conclusion

p. 3075 lines 15-23: somewhat unclear formulations

p. 3076 line 4-5: ”correctly” or fairly well?

p. 3077 line 17-18 : Function of the station type sounds strange.. Perhaps function of

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the distance from the coast? Proximity to the coast line? line 20-21: Rather that the performance is variable between the sites; Any finding regarding at what locations the model is best/worst and why?

p. 3079 line 20: which models? Explain better ”the lack of deposition”

p. 3081 line 4-5: rather speculative explanation; any tragectory analysis to support this? AOD

line 26: Better to say that AOD quantifies, or IS, aerosol extinction. . ..

Line 27: ”well and often measured” should be exchanged by more meaninful and precise formulation

p. 3081 line 1-4 : should be discussed that CHIMERE underestimates AOD over Europe where anthropogenic sources dominate

line 11: perhaps ”often influenced by dust pollution/outbreaks..” would be better

lines 24-27: rather superfician explanation; any supporting studies/tests?

p. 3083 line 1: really ”satisfactory”? No improvements needed?

line 14: comparison model vs. measured PM10 for ”the understanding of the aerosol life cycle” ?

p. 3083 lines 12-14: Better agreement for AOD could also be due to other reasons, e.g. compensation from the effect of relative humidity . . . please discuss.

line 14,16: better ”overestimated” or ”exaggerated” instead of ”too important”; correct ”diffusion”

p. 3084 line 5-8: no need, should be enough with model description section

line 19: Please explain how can we see that the ”local dust emissions” are too large?

p. 3085 lines 7-14: should be it observation/sites description chapter

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line 21: better ”most likely du to the proximity. . .”

line 26: how representative this instance?

Page 3086 line 4-5 : check the statement

Line 15-17: ”The understanding is sensitive the the size distribution”???

p. 3088 line 21: perhaps should be ”period was studied within the framework. . .”

p. 3089 line 4: ”Meteorological parameters, namely. . ..”; Better to write ”Compared with available measurements. . ..”

Line 18: ”correct”? Looks like the model tends to overestimate ozone, especially aloft

p. 3090 line 7: dust sources

Tables 5, 6: what is mean by ”representative”?

Figure 16: for PM40, right?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 3063, 2015.