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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Primary aerosols and secondary inorganic aerosols budget over the Mediterranean basin during 2012 and 2013" *by* Jonathan Guth et al.

Anonymous Referee #3

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Primary aerosols and secondary inorganic aerosols budget over the Mediterranean basin during 2012 and 2013 by Jonathan Guth, Virginie Marécal, Béatrice Josse, and Joaquim Arteta

In this article, the authors present the results of MOCAGE CTM simulations of aerosol concentrations and burdens in the Mediterranean basin for 2012-2013. The model evaluation was performed against Airbase and EMEP surface monitoring data and MODIS and AERONET AOD measurements. The authors present model calculated contribution of different aerosol types to the aerosol columns and surface concentrations and the aerosol budget for a selected area, both on the annual and monthly basis,

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focusing the study on primary (anthropogenic and natural) and secondary inorganic particles. An additional test was performed to estimate the importance of Mediterranean shipping emissions (referred to as anthropogenic in the paper) and land-based coastal anthropogenic emissions for the region of the study.

The paper is concerned with an interesting and challenging issue of characterizing the tropospheric aerosol in the Mediterranean region which is influenced by the emissions from a variety of anthropogenic and natural sources. Thus, the subject of the work is quite relevant for better understanding the nature of the aerosol pollution and the role of different sources and processes in the area, and could potentially contribute to design more optimal strategies to improve air quality.

The material is presented relatively clear and supported/illustrated amply (maybe even too many) by the tables and figures, though the manuscript needs more work to check on the grammar and correct awkward formulations.

The results definitely contain interesting assessments, but still I have a big problem to see the purpose of the publication and usefulness of the results with respect to aerosol budgets for a seemingly random rectangle area, and also the purpose of performing the "sensitivity (?) test" for "marine and coastal areas". Perhaps the authors should clarify/justify the aim of the work. As a part of that, try to better explain their choice of the study region (the red rectangle) for the "Mediterranean basin" (this is only mentioned for dust on p. 12, line 22) and also 50 m wide coast line. I'd recommend that the authors make a better effort to show the added value of the obtained results and their scientific and/or practical usefulness and implication.

Other general comments:

1. The authors should make more clear the connection to the ChArMEx and the choice of the years, since they have not at all made any use of the campaign's data.

2. I'd recommend to use (international) shipping or ship emissions instead of anthro-

pogenic emissions from the sea. By the way, would not it be more useful to assess separately the role of international shipping and land-based emission in the aerosol pollution in the region?

3. Please, specify what were aerosol sizes included in the study (p.3 l.30-31), in particular for sea salt and dust (p.4)

4. Why have not you limited your model evaluation with EMEP data to secondary inorganics. Why would not you also evaluate PM10, PM2.5, elemental carbon, Na+ (perhaps even dust)?

5. to p. 9. African dust is often transported at higher levels in BL and free troposphere. Please justify the use of 200m hight winds for describing dust transport here. Have you looked at 3d dust concentrations/vertical profiles?

6. How sensitive the results of the study to the choice of the study area (the location and size of the red rectangle)? See p. 12 line 22

7. Almost half of the Conclusions section is actually Outlook. I'd recommend to improve the Conclusions, avoid general statements and highlight your findings.

8. Decide whether to use "sea salt" or "sea salts"; better to use import/export than importation/ exportation

Minor/editing comments:

Page 1

L 4-5: why not write like 29°N , 10°W

L 8: this is quite "normal" seasonal variation – not sure it should be in Abstract

L11: "with high values for some of them" - specify or drop out; Maybe better to give a range of values for different aerosols than just BC example (40%).

L 17-18: I'm not sure it's quite true for dust, since you approach doesn't distinguish

between export and import.

L 22: on weather (meteorology is a scientific study)

L 23: What do you mean by “sensitive to atmospheric pollution”? In what terms? What is the difference here between atmospheric pollution and air quality?

Page 2:

L 1-2: experiences periodic/sporadic pollution from forest fires? Complex topography? Check the sentence – geography/topography associated with the flows? Are you sure/What do mean by “it’s especially sensitive to climate change”?

L 7: in summer months in 2012 and 2013

L 13-14: strange sentence

L 9-19: not sure these details about weather during those short periods are relevant, but more information about “data collected” could be.

L 20-24: aerosol contribution to what? Edit: composed of; were the second large contributor. anthropogenic emissions were the major part of PM2.5 composition.

L 25-26: re-write the sentence

L 28: aerosols.. were dominated by. . .

L 32: ..two years .. include the the intensive periods. . .

Page 5

L 15: the importance of SOA - inconsistent with p. 3 (31032)

L 22 (also p.6 l.3): Are you discussing here MOCAGE vs CHIMERE? Is it in the paper’s scope?

L 31: for 2012 and 2013

Page 6

L 8-14: not sure it's needed if just only the data format was changed, unless there were more essential changes affecting the data consistency

L 15: periurban?

L 16: for model evaluation..;

L 18-19: rural station; 1 to 5 are kept in order to assure a set of representative sites (or whereas 6 to 10 that are not representative are removed)

L 22: "similar behaviour" - awkward formulation; aerosols should be PM10 and PM2.5

L 24: PM2.5 is better. . .

L 26: you mean that the natural aerosols are accurately calculated?

L 28-29: "slightly less good" = worse

Page 7

L 1-5: If you used EMEP monitoring data (from ebas.no data base), you should write that explicitly. There is no need to list US, Asian etc networks/databases.

L 6: ..use measurements of secondary inorganic aerosols. . .

L 23: can you specify the errors?

Page 8

L 8 and 14: Inconsistency: All terms...directly computable, but indirect estimation Ttran ???

Page 9

L 3: primary carbonaceous

L 5-7: since you are discussing the hypothesis, how sound/unsound you mean it its,

how much uncertainty in the results it causes?

L 15: What about the export from the Atlantic? Could it be that import/export are considerable, but compensate each other in the budget?

L 19: to further facilitate the analysis. . ..

L 22: “north of the southern boundary” sounds strange, maybe along the southern boundary of the domain;

L 23: I do not understand how E/N-E winds can transport dust from the south.

L 24-25: for carbonaceous aerosols; across the eastern border

L 26: Explain that you compare the precipitation amount and wind speeds in 2012 and 2013

L 30: sea salt aerosol levels

L 31: less precipitation, in exactly which area – impossible to tell from Fig. 6

l 33: higher speeds of the wind advecting/bringing transporting the pollution

Page 10

L 2-3: the monthly variations of budgets, better use the Figure present or show

l 5-6: may be to talk about larger and smaller emissions, or higher and lower dust levels instead of active/less active season

L 10. winds were stronger in North Africa. . .

L 14: not in summer, but in July month

L 19: likely reason for the enhanced BC concentrations in July 2013

L 26: bad formulation. Suggested: there are considerable differences in the tropospheric (?) load of the different aerosols.

L 29-31: does not the same (emissions and meteorological conditions within the domain) applies to sea salt; also explain “meteorological conditions within the domain”

L 33: Re-write sentence starting with Another source...

Page 12

L 17. The model does not equally “well represents the aerosols”. Please, make more precise summary. L 21: ..all considered in the study aerosols are exported

L 22-25: Re-write awkward sentences: We observed an annual cycle... (what’s new about this?) and The annual cycle can also be affected.. (has to be more specific; what difference in primary emissions?...)

L 31: Re-write the last sentences

Fig 2: make the circles visible

Figs 4-5: difficult to see the differences. Maybe to plot the difference instead?

Fig 7: correct caption: sea salt

Table 7 caption: comparison MOCAGE simulations with EMEP observations

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