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Discussions

Interactive comment on "Source contributions to 2012 summertime aerosols in the Euro-Mediterranean region" *by* G. Rea et al.

Anonymous Referee #1

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The manuscript by Rea et al. address a very important and urgent matter: the quantification of the contribution of different sources to the aerosol budget in Europe and the related contribution of natural events to PM10 exceedances. Model evaluation presented for summer 2012 illustrates good model performance, in line with the best state-of-the-art models. However, in this reviewer opinion, the manuscript may be enriched with more data from the Central and Eastern Mediterranean region and the final analysis relative to PM10 exceedances needs revision.

My two main concerns are:

1. In the manuscipt only data from the AirBase database for North and Western Europe are used. However, I accessed the AirBase portal on 14th April 2015 and PM10/PM2.5

data for e.g. Italy, Greece and Turkey are apparently there for the year 2012:

http://www.eea.europa.eu/themes/air/interactive/pm10

The inclusion of these data is of overwhelming importance, since they include the regions where the greates part of the monitoring stations apparently report PM10 exceedances, and highest levels in general. Probably at the beginning of their work the authors couldn't find those data in the database, but now they're there (I am not sure when they were uploaded), so I would seriously encourage their use in the revised work. I understand that this will put significant efforts on the authors, but I feel this is determinant for the quality of the proposed analysis.

2. In this reviewer opinion the analysis on the contribution of natural events to PM10 exceedances is not robust and may carry misleading final messages. The weakest point is the lack of the quantification of the uncertainty associated to the percentages of naturally-occurring exceedances. In the model validation sections, the general bias of the model in terms of average and peak levels of PM10, PM2.5 and AOD is well characterized (for those regions covered by AirBase data), and some model limitations are discussed but not quantified, such as dust positive bias. This complicates the interpretation of the final results. Let's, for example, consider the MED-We region (basically the Iberian Peninsula). There is systematic low bias in the PM10 and PM2.5 simulations, say -24% for PM10 and -33% for PM2.5 (Table 3). This is apparently related to some missing regional source, since the background levels are constantly underestimated (Figure 5). However, many peak values of PM during episodes are overestimated (Figure 3 and 5), and the model predicts that most of those peaks are mainly due to dust (Figure 10). It results that 92.5% of the exceedances are attributed to natural events (dust). This number, however, could be much less with a better simulation of PM10: the -24% bias may entirely due to anthropogenic emissions (we don't know it actually) and the dust concentration may be overestimated by a factor of 2 during some episodes. This would drastically change the number of exceedances explained by dust. In conclusion, I thus strongly suggest to entirely revise the analysis presented in section 6

and discuss further (and perhaps attempt to quantify) the uncertainties associated to the percentage of exceedances attributable to natural sources.

Other minor comments/suggestions:

P8192, L5: "if yes" would probably better be "if so"

P8192, L9: perhaps is worth adding a quick information on the horizontal resolution of CHIMERE.

P8192, L13-14: "The sensitivity simulations are ...". This sentence is redundant and may be omitted.

P8192, L15: Since the region defined in parentheses is the whole domain, I suggest to move its definition above, near L9.

P8192, L29: "...particularly when diverse sources are mixed". Why should be that? There is no clear evidence of that in the paper.

P8193, L1-4: The meaning of the last sentence of the abstract is completely obscure, must be completely revised.

P8194, L18: "... because of mineral dust in addition to local anthropogenic pollutants". Perhaps rephrase as "because of a combination of mineral dust and anthropogenic pollutants from local sources"

P8194, L28: "PM10 pollution" is referred to sea salts: can this natural source be termed as pollution?? I would prefer to see words such as "levels", "concentrations" when referring to natural sources, not "pollution".

P8196, L9: the underestimation of PM10 at the European scale was also recently confirmed by Im et al. (2014), Evaluation of operational online-coupled regional air quality models over Europe and North America in the context of AQMEII phase 2. Part II: Particulate Matter, Atmos. Environ., doi:10.1016/j.atmosenv.2014.08.072

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P8196, L14: An additional uncertainty in the model to obs comparison is the conversion of aerosol concentrations to optical depths, a process that is subject to its own assumptions and uncertainty. See e.g. :

Péré et al. (2010), Evaluation of an aerosol optical scheme in the chemistry-transport model CHIMERE, Atmos. Environ., doi:10.1016/j.atmosenv.2010.06.034

Curci et al. (2014), Uncertainties of simulated aerosol optical properties induced by assumptions on aerosol physical and chemical properties: an AQMEII-2 perspective, Atmos. Environ., doi:10.1016/j.atmosenv.2014.09.009

P8198, L5: suggest not to skip the units here and throughout the text, e.g. add ug/m3 after 80 here.

P8108, L11: "(80 of the daily mean values)", perhaps the authors meant "daily mean value of 80 ug/m3"? Not clear.

P8202, L28: please specify what assumption on the mixing state of aerosol is used for AOD calculations (external, internal, . . .)

P8203, L4: ". . .linear interpolation. . ." this sounds strange, since usually AOD is scaled with wavelength using a log-scale interpolation (Angstrom exponent), please correct and clarify.

P8203, L16-19: references to the procedures used to disaggregate model species and establish hourly profiles seem appropriate here.

P8205, L17: "(zone of influence. . .)", the zone of influence cannot be detected removing diffuse sources, I would remove this comment in parenthesis.

P8206, L13-14: please define the mathematical formulas used for MFE and MBE (and maybe also for other statistical indices used in the paper).

P8207, L10: Add "%" after -21.2

P8207, L16: change "adapted" to "appropriate for"

P8207, L25: "(but lower)" it is not clear what is referring to, the model?

P8208, L10: add "s" to "dataset".

Figure 1: the top panels are very difficult to read. Please redraw, e.g. removing the black circles around each point.

Figure 13: What is N in the titles? The total number of stations/points exceeding PM10 limits? Please clarify.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 8191, 2015.