

Interactive comment on “Model simulation of ammonium and nitrate aerosols distribution in the Euro-Mediterranean region and their radiative and climatic effects over 1979–2016” by Thomas Drugé et al.

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Thanks for correcting your initial version. I suggest that you consider the following points for further revision:

I would like to thank François Dulac for his interactive comment which mentions different points listed below.

Could you apportion ammonium between nitrate and sulphate? Did you check if the

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introduction of ammonium impact the sulphate content in the NIT simulation compared to the REF?

In the ALADIN-Climate model, ammonium sulphate aerosols are not affected by ammonium nitrate production because ammonium nitrate aerosols are formed only after sulphates in case NH₃ has not been entirely consumed by sulfate formation. The formation of ammonium sulphate takes priority over ammonium nitrate formation due to the low vapor pressure of sulfuric acid (Hauglustaine et al. 2014).

I find that you somehow miss to relate the behaviour of the model at the surface and in the column. Even if times series were more limited, it could be informative to look for as close as possible places with simultaneous AERONET and EMEP data in order to check concurrently the model at the surface and in the column. If there were no such interesting possibility from the datasets, it would be worth stating it.

The area around Cabauw is represented by one AERONET station (Cabauw) and two EMEP stations (De Zilk and Vredepeel; 60 and 100 km respectively). At this site, there are a total aerosol AOD and a surface A&N concentration that are well reproduced by the model. A sentence was added in the article to show the good consistency between those two parameters over this area (section 4.2).

The title of Section 4 (“Evaluation of the new AN aerosol scheme”) indicates that it is dedicated to evaluating the new model aerosol scheme; but it also includes analyses of the aerosol distribution and trends that I believe go well beyond the simple model evaluation; according to me, to better valorise your results regarding the distribution of these aerosols, it is worth reorganizing this section in order to make a new one following the evaluation section, that will be dedicated to the analysis of the spatio-temporal variability and trends of ammonium and nitrate aerosols, and their impact on particulate air quality (not only their direct radiative impact and related effects on climatic parameters); for instance, Figure 2 could be completed with maps of surface

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PM (e.g. PM1 at least) for discussing the relative contributions from the A&N species. To better valorise the results, the title of Section 4 has been changed by "Evaluation of the new aerosol scheme and analysis of the spatio-temporal variability and trends of A&N aerosols". Concerning the impact of aerosols on particulate air quality, our model is not very suitable for answering this question. Indeed, PM1 is not a diagnostic and anthropogenic aerosols do not have speciation in size but a bulk approach with 1 bin for sulphate particles and 2 bins (hydrophilic and hydrophobic particles) for organics and for black carbon.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-1101>, 2018.

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