

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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The authors present work on the implementation and the evaluation of a simplified ammonium and nitrate module in the TACTIC aerosol scheme, to be utilized in the ALADIN regional climate model and to assess the direct radiative effect and climatic impact of the ammonium and nitrate aerosols over the Euro-Mediterranean region. In general, the work presented covers a scientifically sound topic, is well written, structured and the results included are original and discussed. Please find below several comments that can be taken into account before the manuscript is accepted

C1

for publication.

I thank the second anonymous referee for his reviewer's comment which mentions different points listed below.

I cannot find any explanation on the statistical figures used for the model validation against the different observational sources included in the study. Further discussion should be elaborated on the validation methodology.

In Figure 9 and Figure 10, we have calculated the confidence interval (light blue spread), associated with observations, using the number of years available for each station with a significant level of 95%. A sentence has been added in the text to mention that (section 4.5).

The limited number of bins can hamper the interpretation of results. Especially for dust, the coarsest bin ranges from 2.5 to 20 micrometers. Because of the domain of study, including several important sources of dust emissions, a large fraction of particles are excluded from the analysis. Further discussion should be devoted to the selection of the bins and why a range like that has been selected.

We only use 3 dust bins to keep a simple model with a relatively low computational cost. We are aware that excluding the coarsest dust particles is a limit for our study and a sentence has been added in the article to inform of this limit (section 2.2.3). Moreover the dust affecting Europe and the Mediterranean are mainly fine aerosols (coarse particles will fall quickly) and are therefore taken into account.

Page 9, Line 25 "These 25 stations do not have continuous data over the period 1994-2014 and we selected those with a minimum of 5 years of data, which may be non-continuous but a minimum of 5 observations is necessary for every month.". I think that 5 observations is not representative of a monthly average. How is the comparison with model results done? Do you estimate a monthly average from those

C2

5 observations? Or do you extract model data for those 5 time steps and then compare with observations?

The sentence may not be clear enough but it is monthly data. We select only the stations with at least 5 data for each month (so with at least 5 months of January, 5 months of February ...). A new sentence has been added to the article (section 3.1).

Are the evaluation results different for MODIS and AERONET at AERONET sites? Or, better side, is there any significant difference when evaluating the model against satellite and AERONET in those locations where you have AERONET observations?

Figure 5 has been redone by adding the AOD annual cycle of the different satellites (MISR, MODIS Aqua and MODIS Terra). A comparison between AERONET and the different satellites has been added to the text (section 4.2).

Can you do some partitioning between ammonia and nitrate? Can you somehow estimate which is the individual contribution of each component to the direct radiative forcing?

Ammonium represents about 35% of the nitrate AOD over Europe and Mediterranean Sea, their optical properties being relatively close, we can estimate that ammonium represents about one third of the direct radiative forcing shown over the Euro-Mediterranean region (Figure 13 and 15). A sentence has been added to the article (section 5.1).

Last, it would help readability if equations are numbered within the manuscript.

Done.

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