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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Nitrate aerosols today and in 2030: importance relative to other aerosol species and tropospheric ozone" *by* S. E. Bauer et al.

Anonymous Referee #1

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Review of the manuscript "Nitrate aerosols today and in 2030: importance relative to other aerosol species and tropospheric ozone" by Bauer et al.

General comments The paper addresses the topic of the role of nitrate aerosols at global scale in the present time and in the future. The topic is within the scope of ACP. However parts of the manuscript are not clear: the model description as well as the comments of the results. I would suggest major changes in the manuscript prior acceptance.

Specific comments

Title. "... importance relative to other aerosol species and tropospheric ozone" it is not clear to which importance the title refers. Please rephrase the title.

Model description. The paragraph needs to be rewritten in a clear form. The paper studies the role of aerosol particles. The authors refer to other papers for the aerosol description in the model and it makes it very difficult to understand how the model treats the aerosol system without having the other papers. Therefore this paragraph should explain clearly how the aerosols are described. Are the particles treated as bulk?

Are they in internal or external mixtures? Here it is very difficult to understand if the system sulphate-ammonium-nitrate is coupled in internally mixed particles. It is said only that "The aerosols are approximated as externally mixed for radiative calculations." And a description of size distributions is done after that sentence, so it is not clear if this refers only to the radiative calculations. And in the conclusion is it reported that "In our simulation most of the aerosols are treated as external mixtures, only nitrate and sulphates can mix with mineral dust, therefore this is only one step towards the representation of truly internally mixed and coated aerosol particles."

In the abstract it is said "Furthermore, microphysical processes that lead to aerosol mixing play a very important role in sulphate and nitrate aerosol formation.", which processes the authors refer to? Are they taken into account in the used model set-up?

If nitrate and HNO3 uptake on sea salt is so important, as reported in the article, why it has not be taken into account? Neglecting it can have then a large impact at global scale, can the authors comment on that?

Emissions. In model description it is said that methane concentrations are prescribed according to the used scenario and here methane is considered in the emissions, the concentrations are prescribed or calculated?

Again here, since dust and sea salt fields are important for the simulations their emission parameterization should be explained briefly.

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How can the author calculate the estimated decrease in BC and OC of biomass burning emission inventories as reported in Table 1?

What about emissions of NOx, SO2, NH3 from biomass burning? They don't seem to be included. Please comment on the impact of their exclusion on the global nitrate aerosol.

Current aerosol evaluation. Figure 2. The modelled concentrations are presented in the figure, are they ammonium nitrate or nitrate in the fine mode? And what are the measurements? Figure 3. The same here. Why reporting in the figure the modeled ammonium nitrate? Please comment in the text the use of it and the comparison in the figure. How can it be compared to the nitrate measurements? Figure 4, The same here.

What about the importance of NH3 emissions, which carry large uncertainties, in the modelled nitrate?

Sensitivity studies. Can you explain the reason of performing the experiment of future emissions-present day climate and the future climate-2000 emissions of SO2, NOx and NH3? It is not clear how these sensitivity studies help in understanding the nitrate system now or in 2030.

Conclusions. The part "Note for the studies estimating the smallest nitrateĚ.and -1.28 W/m2." should go in the introduction.

References. Missing reference: Bauer et al, 2006, van der Werf et al. 2004

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 5553, 2007.

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Interactive Comment