

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

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Comments on the manuscript entitled “Nitrate aerosols today and in 2030: importance relative to other aerosol species and tropospheric ozone” by Bauer et al.

This is a nicely written manuscript that addresses an interesting and important topic, the role of nitrate aerosols as climate change driver in present and future. The contents of manuscript are in the scope of the Atmospheric Chemistry and Physics. However, a few things are not clear and should be taken care of before publication. I recommend the acceptance of this MS after proper corrections.

Nitrate Chemistry: Everywhere in the manuscript, the nitrate aerosols are considered

as ammonium nitrate, which is not always true. If all nitrate aerosols are in the form of ammonium nitrate (formed by reaction of ammonia and nitric acid), then they are expected to be present in fine mode. On regional scale, some ammonium nitrate can be produced in coarse mode by the fertilizers sources. But in general, coarse mode of nitrate aerosols is formed by the uptake of nitrate and nitric acid by mineral dust and sea-salts, and thus exists mainly as calcium and sodium nitrate. These heterogeneous processes should also be included in this section.

Model description: The uptake of acidic species (sulfate, nitrate and their precursors) by mineral dust and sea-salts is observed and reported by many researchers. There are many laboratory simulation studies also. It is appreciable that authors have considered the uptake of nitrate and nitric acid by mineral dust in their model but why the uptake by sea-salts is ignored? Estimated annual loading of mineral dust (1748 Tg) and sea-salts (1859 Tg) in the atmosphere are comparable. On regional scale (such as arid/semi-arid regions), sea-salts may not be relatively important in comparison to mineral dust for the acid uptake but at global scale, they can not be neglected. Therefore, either they should also be considered in the model or the possible effects on the observed results should be discussed.

Emissions distribution: If the global BC and OC emissions will decrease due to decrease in industrial and biomass emissions then it shall also affect the fraction of NO_x, SO₂ and NH₃ that is contributed by the these sources. Are these fractions considered in projected emissions of NO_x, SO₂ and NH₃ in Table 1?

A few more points need attention: Figure 2: Whether it exhibits ammonium nitrate or only fine/coarse nitrate? Figures 3 and 4: As per axis label, it is nitrate aerosols while as per caption, it is ammonium nitrate! Figure 5: In several campaigns, the modeled total ammonium nitrate (red line) is significantly higher than fine mode of ammonium nitrate (black dotted line). What could be the possible sources and/or processes contributing such a significant coarse mode ammonium nitrate, even up to very high altitude in a few campaigns? Figure 6: How much different is fine mode nitrate than the

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total nitrate? Page 5570, lines 5-8: How does the solubility/insolubility of mineral dust would leads to more wet deposition of dust? Wet deposition physically removes the aerosol particles from the atmosphere. If the aerosols are water-soluble then they will be present in soluble phase in rainwater otherwise they will be appeared as insoluble particles. However, the solubility of mineral dust may affect its capability to act as CCN.

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