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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Summertime nitrate aerosol in the upper troposphere and lower stratosphere over the Tibetan Plateau and the South Asian summer monsoon region" *by* Y. Gu and H. Liao

Anonymous Referee #1

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General Comments:

This is a well written and, in general, clearly presented paper that seems to present a good case for the dominance of nitrates for aerosols concentrations in the upper troposphere and lower stratosphere over the Asian summer monsoon sector. I have made suggestions for minor revisions.

My primary criticism concerns the comparisons of observed and modeled concentrations of O3 and HNO3. The authors claim that observed concentrations are well

represented by the model, but offer no context for that comparison. I think the authors should answer the question: Given the discrepancies between observed and modeled O3 and HNO3 – what are the uncertainties of modeled nitrate concentrations?

Sec. 4.2 and Fig. 8, which compares modeled concentrations to in situ surface observations, should be deleted. While it is interesting to see such comparisons, the sampling is poor, which, together with the mismatch of sampling time, makes the comparisons difficult to interpret.

Sec. 4.3 shows the comparison of vertical distributions of aerosol extinction from the model with SAGE observations. Comparisons of horizontal distributions in the UTLS should be performed as well.

Specific comments:

Page 32050, Lines 9-10: Mention that PM2.5 is the sum of the previous aerosols listed

Page 32050, Line 12: It would be better to state that nitrate is of secondary importance near the surface. There are other aerosols that have as large (or nearly as large) concentrations; stating that nitrate has the second largest concentration without acknowledging that other aerosols are as important is not a fair assessment.

p. 32050, l. 22: Change 'time to 'times'

p. 32050, l. 22: Change 'which influence' to 'influencing'

p. 32051, l. 16,17: Remove 'M.' from 'M. Park'

p. 32053, l. 1: Remove '(> 75%)'

p. 32056, l. 17-18: Seasonal cycles if SO2, OC and BC are very weak.

p. 32057, Fig. 3a: Why are concentrations high (the highest of any region) over south equatorial Africa?

p. 32058, Fig. 4: There are factor of 2 (and greater) discrepancies between model

and observations – how does this uncertainty translate into an uncertainty in nitrate aerosol?

p. 32060, l. 25: Concentrations of ammonium and organic carbon are just as (or nearly as) large as nitrate – though technically accurate, it is misleading to state that nitrate is the second largest without acknowledging that other aerosols are just as important.

p. 32062, l. 8: Change '8b-j' to '8b-f'

p. 32064, Table 2: Certain values in Table 2 do not make sense and indicate that the calculations of concentration are not performed consistently among constituents. This is most obvious for values of concentrations averaged over TP/SASM that are smaller than the corresponding values for the individual TP and SASM. If the concentrations are calculated in a consistent manner then the values for TP/SASM have to lie between the values for TP and those for SASM. Please check these the accuracy of the calculations or, if the calculations are not consistent by design, please explain why.

p. 32065, l. 16-17: Explain why you are not using winds used in GEOS-CHEM

p. 32066, Sec. 6.2: Explain why you are not able to use GEOS-CHEM chemistry to determine precisely what the mechanisms for nitrate formation are.

p. 32066, l. 17: Change 'in consistent' to 'consistent'

p. 32066, l. 21-22: Delete the sentence 'Besides being . . .'. It is not clear that cold temperatures near the tropopause have a casual influence on upwelling there nor is it important to your study for that to be the case.

p. 32067, l. 19: Change 'scarcely' to 'are not' or change 'particles in the UTLS of the TP/SASM scarcely composed of coarse and aspherical particles such as NAT' to 'coarse and aspherical particles such as NAT are scarce in the UTLS of the TP/SASM'.

p. 32067, l. 23: Delete 'by simulation'.

p. 32067, l. 26: Change 'capability in simulating' to 'ability to simulate'.

p. 32068, l. 1: Regarding 'agree well'. You need to put the model-observations comparisons into the context of nitrate formation in order to say they agree well. That is, you need to determine what the uncertainties of nitrate concentrations are given the uncertainties of O3 and HNO3 concentrations (as determined by the model-observation discrepancies).

p. 32068, l. 8: Regarding 'second largest'. See above comment for p. 32060, l. 25.

p. 32068, l. 17: Instead of 'the GEOS-CHEM model reproduces well', state how well it reproduces (e.g., with 10% or whatever) observed values.

p. 32068, l. 29: Change 'convections' to 'convection'.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 32049, 2015.