Atmospheric
Chemistry
and Physics

Discussions

Interactive comment on "Nitrate formation from heterogeneous uptake of dinitrogen pentoxide during a severe winter haze in southern China" *by* Hui Yun et al.

Anonymous Referee #2

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Yun et al. present a suite of measurements related N_2O_5 formation and subsequent uptake to aerosol that take place in a semi-rural area of China. They show through interpretations of their measurements and some master chemical modeling that nocturnal NOx chemistry can likely account nearly 50% of aerosol nitrate mass loadings during these heavy pollution events.

This paper is written and presented well for the most part. The measurement methods portion is lacking even considering that an associated reference may describe additional details. Assuming my comments are appropriately addressed and some changes are made that would help to clarify the methods and the paper in general, I

would recommend publication.

Comments:

Line 97: recommend changing "highest ever reported value" to something that will age better like "largest reported value to date".

Line 100: recommend changing "aerosol formation" to "aerosol nitrate formation"

Line 128: the SI would be a great place to see the results of these instrument backgrounds and the extent to which they worked.

Line 129: "standard gas of N_2O_5" sounds like you can purchase a standard cylinder of N_2O_5 (which you can't). Even if Wang et al. 2016 outlines these calibrations in more detail, a brief explanation is needed at the minimum. The description of these calibrations needs to be expanded and include $ClNO_2$ calibrations as well.

Line 132-133: How were detection limits calculated? What signal-to-noise was used, etc.? I think the authors only mean the uncertainty is +/- 25% not the precision.

Line 169: Here and throughout the paper it's probably best to change "aerosol surface density" to "aerosol surface area density" for clarity's sake.

Line 182: consider changing "calculate" to "estimate"

Line 214: change "matters" to "matter"

Line 265/284: k' is often used for a pseudo first order rate constant. Consider using that to help differentiate from other rate constants.

Line 307/309: make pNO3- and p(NO3-) consistent. Use one or the other. p(NO3-) is used in the rest of the paper.

Line 313/320 and Figure 6: Do the authors have a firm definition of what is considered "early nighttime" vs "late nighttime"? What times correspond to each period? Are these the same as provided in Table 1?

Line 343-345: please change "cm-3" units to commonly used "molec cm-3".

Line 359: certainly this approach is relevant to areas outside of China as well? Suggest removing "China".

Table 1: Addition average aerosol nitrate loadings and PM2.5 loadings for these periods would very useful. Consider adding all aerosol data (sulfate, ammonium, OM, etc.).

Figure 5: Why not include the other aerosol data in this figure? NO3- does not track with Sa, so what is driving up Sa? The other data should explain this.

Have the authors considered boundary layer effects in any of their analyses? With a shallow nighttime inversion layer and little mixing many of these species could be further concentrated. Are there any measurements taken during the study that would give boundary layer information (sondes, etc.)?

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