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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Summertime fine particulate nitrate pollution in the North China Plain: Increasing trends, formation mechanisms, and implications for control policy" *by* Liang Wen et al.

Anonymous Referee #2

Received and published: 10 March 2018

The manuscript "Summertime fine particulate nitrate pollution in the North China Plain: Increasing trends, formation mechanisms, and implications for control policy" by Liang Wen and Co-Authors presents the results from measurements conducted in three sites in the North China Plane (urban, rural and remote), in the summertime of 2014 and 2015. Mass and composition of inorganic soluble ions of PM2.5 were measured, together with aerosol size distributions, NO, NO2, O3, CO, SO2 concentrations and meteorological parameters. The measurements were compared to previous studies to infer temporal trends of the aerosol nitrate. Additionally, the measurements were com-

pared to the output of the RACM2/CAPRAM2.4 model. The model results were also used to infer the dominant nitrate formation mechanism during the day and at night. Ultimately, the Authors performed a sensitivity analysis, modifying the concentrations of precursor gases (NOx or NH3) in their model to probe which scenario would be the most effective in order to reduce PM2.5 pollution in the area.

The Referee thinks that the paper addresses relevant scientific questions within the scope of ACP, presenting data of interest to the scientific community. However, 1) the abstract should be rephrased and made clearer; 2) Additional references should be included to give proper credit to related work; 3) some of the methods and assumptions used in the paper should be better outlined and clarified; and 4) some of the figures should be improved for a more straightforward interpretation. The Referee recommends publication in ACP after the comments below are properly addressed.

Abstract

The Referee thinks that the abstract should be improved. In the current version, a few long sentences and some confusing passages prevent an efficient understanding of the interesting results of the study. In particular:

Page 1, Line 14: The Referee suggests braking the sentence in two parts. One sentence telling about the measurements and one describing the NCP

Page 1, Line 14-16: the expression "... downtown and downwind Ji'nan ..." can be confusing for the Reader that approaches for the first time the description of the measurements sites. Please reword the sentence to make sure that it is clear that those are two distinct sites and that the urban site is downtown Ji'nan and the rural site is downwind of Ji'nan.

Page 1, Line 24-27: The Referee recommends braking the sentence. One sentence for the day time results and one for the night time results. Additionally, please reword the expression "... plays a slightly negative role ..." The word negative is vague and

a possible source of confusion for the Reader. Consider using “contributes to a slight decrease in nitrate” or similar.

Introduction

Page 2, Line 21: The authors should consider adding a reference to Song, C. H. and G. R. Carmichael (2001). "Gas-particle partitioning of nitric acid modulated by alkaline aerosol." Journal of Atmospheric Chemistry 40(1): 1-22.

Page 2, Line 24: The authors should consider adding a reference to Brown, S. S. and J. Stutz (2012). “Night-time radical observations and chemistry”. Chem. Soc. Rev., 41, 6405-6447. doi: 10.1039/c2cs35181a.

Page 2, Line 25: The authors should consider adding a reference to Dentener, F. J. and P. J. Crutzen (1993). "Reaction of N2O5 on Tropospheric Aerosols - Impact on the Global Distributions of Nox, O3, and Oh." Journal of Geophysical Research-Atmospheres 98(D4): 7149-7163.

Material and methods

Page 7, Line 8-11: The Referee strongly suggests that the Authors indicate the VOC average data used. This is an important information that is omitted in the manuscript and without which it is not possible to reproduce the model results.

Page 7, Line 11-12: The Referee strongly suggests that the Authors indicate the range used for the VOC concentrations in the sensitivity test. Additionally, the statement “. . . the nitrate formation was insensitive to the input VOC concentrations.” should be quantified.

Results and discussion

In the manuscript, there is no mention of chloride in the aerosol particles. Is it because there was none? The Referee recommends that the Authors add a sentence on the amount of chloride in the particles measured during the study.

Page 8-9, Line 29-2: “. . . nitrate formation process throughout the nighttime with a NO3- increase of 16.9 ug m-3, . . .” it is hard to understand where this number comes from. This is because the nighttime is not clearly defined in the manuscript. The Referee suggests to add a definition of night time (maybe using the solar elevation angle) and to add to figure 2 a visual aid (maybe a shaded area) to visually separate night time and daytime.

Page 11, Line 5-11: It is not clear if the RMA slope is from simulated vs observed or vice versa. I guess it is the former case, but it would be advisable to specify if the model over or under predicts the measurements.

Page 11, Line 19-24: I suggest moving this sentence to the next paragraph. The Reader is left hanging at the end of this sentence that,I feel, is a preamble to the first sentence of next paragraph.

Figures and Tables

The Referee recommends adding an additional table with 3 columns: 1)time of the measurements, 2)location name, and 3)description (urban/rural/remote). This would help the reader navigate the paper more easily.

Table 1: The Referee thinks it would interesting for the Reader if the Authors would add mean values and standard deviations for O3, SO2, CO, mean diameter and mean number, as the Authors state that those data were available. Additionally, adding the values for the ratio of the sum or the inorganic species divided PM2.5 would be a valuable information that would avoid extra work for the reader.

Figure 2: Please specify if those are averages over all period and add the x-axis label.

Figure 3: Please add x-axis label and standard deviation.

Figure 4 and 5: Please add uncertainty bars to the histograms in the top panel.

Figure 8 and 9: Please explain in the caption what are the dashed lines.

Page 2, Line 27 and Page 11, Line 12: I suggest removing “Obviously”. It is unnecessary and condescending towards the Reader.

Page 3, Line 28: Please specify that in the notation “nitrate/PM2.5” and “nitrate/sulfate” the Authors is referring to ratios.

Page 3, Line 4 and Page 8, Line 10: I suggest removing “relatively”. It is unnecessary unless the Authors are able to specify relatively to what.

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