

Interactive comment on “Ozone and fine particle in the western Yangtze River Delta: an overview of 1-yr data at the SORPES station” by A. J. Ding et al.

A. J. Ding et al.

dingaj@nju.edu.cn

Received and published: 7 April 2013

The authors would like thank Referee # 1 for an overall positive comment on this manuscript and for many detailed specific and technical comments. We give response to each point that raised, and the manuscript will be modified accordingly.

Specific comments: 1. Section 2.1: You did not mention the construction works in the campus (Herman et al., 2013). This could be a significant source of aerosols. Please discuss the potential impact on your results.

Response: We will add this point in our discussion and mention the potential impacts in some paragraph. Briefly, the influence from construction works (ground soil dust) is

C1066

weak because these activities were not in the prevailing wind direction and may only influence coarse particles but not fine particles.

2. Page 2840, lines 11-13: It would be great to give the reader an idea of spatial distances, either by adding a length scale to Figure 1c, or by mentioning distances in the text.

Response: We will add a length scale for both Figure 1a and 1c.

3. Page 2840, line 19: what was the measurement height? 40 m above ground level? Or 40 m above the surrounding landscape?

Response: It's 40m above the ground in the foot of the hill.

4. Section 2.1: How about meteorological measurements? What equipment was used, and which variables were measured?

Response: The meteorological measurement were made by using Automatic weather station made by CAMPBEL co. (AG1000). We will add some descriptions in that paragraph.

5. Section 2.1: Please mention the inlet lines length, material, and potential losses. Response: We will add two sentences to describe the inlets.

6. Page 2840, line 25: Was the SHARP-5030 aerosol mass analyzer operated under dry conditions? How did the RH vary inside the instrument along the year? This could have a great impact over aerosol mass, since the aerosols are quite hygroscopic in China (e.g., Eichler et al., 2008; Liu et al., 2011; Meier et al., 2009). Please discuss the potential impact of relative humidity on PM_{2.5} mass concentration. Response: The SHARP-5030 aerosol mass analyzer was operated under dry conditions. An one meter long DHS heater was settled up to keep the RH of samples no larger than 35%. We will mention the uncertainty and cite relevant papers to discuss the uncertainty.

7. Page 2841, line 15: Did you mean 3000 particles per cubic centimeter? Why did

C1067

you assume this specific number? What was the release duration?

Response: No. It is 3000 air particle or air parcels. The particle release is not the concept as air concentration. We release 3000 air masses parcels at the grid of receptor, and calculate the source-receptor relationship according to the temple-spatio distribution of particles. The release duration is 7 days backward. We will revise relevant sentences to make the concept more clearly.

8. Page 2843, line 4: The observed O₃ season behavior is quite similar to the one observed by Lin et al.(2009) near Beijing: peak in summer.

Response: We will add the reference and make a comparison with the two locations.

9. Page 2843, lines 12-16: Does solar radiation availability in summer could also contribute to the observed O₃ summer peak?

Response: Yes, Solar radiation is an important factor, we will also mentioned this point in the manuscripts.

10. Page 2843, lines 22-28: Increased vertical mixing in summer may also play a role on PM_{2.5} seasonal pattern. Response: Okay. We will add this point.

11. Page 2844, line 3: How long does the winter break last?

Response: It's about ten days up to 1 month for different factories and workers.

12. Page 2845, line 25: The positive correlation between PM_{2.5} and O₃ under high temperatures does not seem "pronounced" to me, at least in the scale used on Figure 4d. Be careful with the use of adjectives in a scientific text.

Response: We will change the word.

13. Page 2845, line 27: On page 2843 (lines 19-28) you attribute PM_{2.5} variations to season emission and deposition patterns. You could also discuss the relationship between PM_{2.5} and NO there, or add a plot of the PM_{2.5}-NO correlation to Figure 4.

C1068

Response: We will add some discussion on the PM_{2.5}-NO correlation, which does support that combustion sources, but not construction works, are the main contributor to PM_{2.5}.

14. Page 2845, line 29: The data you show do not characterize a statistically significant polynomial behavior. You should remove the polynomial fit from Figure 4d, unless you have a good reason for that.

Response: We will remove the polynomial fit line.

15. Page 2846, line 1: The positive correlation between PM_{2.5} and O₃ under high temperatures does not indicate a substantial formation of secondary aerosols by itself. Later in the same paragraph you point out a number of facts that support the hypothesis of secondary aerosol formation. Nevertheless, you don't have a definite proof, so please be careful with the use of strong adjectives like "substantial".

Response: We will change the word.

16. Page 2846, line 1 (again): According to Table 1, the highest RH levels are observed in the summer. If the RH inside the aerosol analyzer is also higher in summertime, water uptake by particles could produce a positive bias on aerosol mass concentration. Please discuss how this would affect your results.

Response: Thanks. We will mentioned the uncertainty.

17. Page 2846, line 8: Herrmann et al. (2013) do not clearly state that new particle formation occurred mostly under high O₃ concentrations. Moreover, they only show data between Nov2011 and Mar2012, when O₃ mixing ratios were smaller in comparison to summer (Figure 3a). What they say is that new particle formation is correlated with solar radiation, which, in its turn, may be correlated with O₃ to a certain extent.

Response: We will change the sentences.

18. Page 2846, line 22-23: Please mention what is the AAQS-CN national standard for

C1069

O3. Response: We already gave the standards in Note of Table 2, we will add the value in the discussion.

19. Page 2847, line 5: Are the diurnal cycles shown in Figure 5 average diurnal cycles?

Response: Yes. the diurnal cycles shown in Figure 5 are the "averaged" diurnal cycles. We will add the word "averaged" in the sentence to clarify this.

20. Page 2848, line 12: Maybe the "afternoon valley" during non-episode days is just not clearly seen in the y-axis scale used in Figure 6a.

Response: This is just in comparison with episode days. We will add quotation marks to the word "missing".

21. Page 2848, line 15: Refer to comment #17.

Response: We will change the sentences.

22. Page 2852, lines 2-3: For a "strong evidence of secondary aerosol formation" you would need on-line measurements of aerosol chemical composition. What you have are evidences of intense photochemical activity (high ozone mixing ratios) and SO₂ concentrations high enough to partition to particulate sulfate.

Responses: We will change the wording and rewrite the sentence.

23. Page 2852, line 18: Please define what you mean by "episode days" here: days in which O₃ mixing ratios exceeded the national standard of XXX?

Response: We will add the standard in the sentence.

24. Page 2854, line 22: " : : PM_{2.5}-O₃ correlations clearly demonstrated substantial formation of secondary aerosols: : :". Refer to comments #12, 15, 17, 22.

Response: We will change the word "substantial" instead of other word in a weaker tone.

25. Page 2854, line 24: Again, define what you mean by "episode days" here.

C1070

Response: We will add the standard in the sentence.

26. Table 1: By "statistics" you mean averages or medians? Does "Rainfall" refer to monthly accumulated precipitation? Response: Yes, Rainfall is different. We will add a note to distinguish them.

27. Figure 3f: In this paper you show measurements between Aug-2011 and Jul-2012. How do you explain the discontinuity on NO concentrations between December and January? Median NO mixing ratios in December reached 18 ppb, while in January it suddenly dropped to 2ppb. Was the data coverage similar in all months?

Response: The data coverage is similar, but in December there was a multi-day episodes with extremely high (up to 200 ppbv) concentration of NO, suggesting a possible sources from the nearby chemical industrial zone. Also, for late week of January, the holiday effects may also have some influence. These factors make the data look discontinuity. We will add few sentence to address this point.

28. Figure 4: a. What do the dashed lines mean on Fig 4b and 4c? b. The dependency shown in all of the four subplots is clearly non linear, considering all data points. Therefore, it is useless to fit trend lines. c. What does "R" mean on Fig 4b and "r" mean on Fig 4c? d. Remove polynomial fit (see comment #14)

Response: The dashed lines just show that highest and lowest ratio of CO/NO_y and SO₂/NO_y. Yes, this may be subjective. We will revise these figures according to the comments.

Technical corrections: 1. Page 2836, line 6: remove "but with contrast patterns", since the word "distinguished" has been used in the same sentence, with the same meaning. Response: We will delete these words.

2. Page 2838, line 14: define the acronym GAW. Response: Global Atmospheric Watch station. We will add the definition.

3. Page 2839, line 6: use "synthetic analysis" or just "synthesis". Response: We will

C1071

use "synthetic analysis".

4. Page 2839, line 7: use "sources" instead of "causes" Response: We will use the words "sources".

5. Page 2840, line 17: " : : measurements began in the summer of 2011". 6. Page 2840, line 27: " : : aerosol size distribution measurements were: : ." 7. Page 2841, line 6: " : : less precipitation and low RH was observed: : ." instead of "appeared" Response to 5-7: We will make these changes.

8. Page 2841, line 13: include the acronym and country NOAA-USA Response: We will add a definition for the acronym.

9. Page 2841, line 15: remove "at": " : : with 3000 particles released 100 m a.g.l. over: : ." 10. Page 2841, line 20: " : : of long-living species: : ." 11. Page 2842, line 12: " : : from the Yellow Sea (NE) by clockwise : : ." Response to 9-11: We will make these changes.

12. Page 2842, line 13: did you mean " : : transported from Eastern China and adjacent oceans.?" Response: Yes. We will revise the sentence.

13. Page 2843, lines 24: Please be careful with the word "higher". Maybe it would be more precise to say that in the winter the dry weather and strong winds contribute to increased particle suspension and advection. Response: We will rewrite the sentence.

14. Page 2844, line 1: I think you meant Section 3.3. Response: Yes. We will correct it. 15. Page 2844, line 6: " : : increased in the end of autumn: : ." 16. Page 2844, line 15: " : : correlations between different species: : ." 17. Page 2844, line 24: " : : in cold seasons and at nighttime." 18. Page 2845, line 2: " : : than the previous: : ." 19. Page 2845, line 9: "clearly" sounds better than "obviously" 20. Page 2845, line 9: " : : that high O3 levels are: : ." Response to 15-20: We will make these changes accordingly.

21. Page 2845, line 20: please rephrase. Suggestion: " : : that since XXX NOx control C1072

policies have been implemented in China: : ." Response: We will rewrite the sentence.

22. Page 2845, line 23: remove "the two most important pollutants" 23. Page 2846, lines 2-6: the sentence is too long. Please rephrase, for clearness. 24. Page 2846, lines 22-23: use "occurring" instead of "occurred". 25. Page 2847, line 3: "As our measurements were conducted upwind from Nanjing: : ." 26. Page 2847, lines 21-22: for clearness, rephrase as: "Comparison of the diurnal patterns for episode and non-episode days: : ." 27. Page 2847, line 21: remove "etc" 28. Page 2849, line 6: "In the first day of the episode : : ." 29. Page 2849, lines 11-12: " : : relatively fresh emissions from the YRD region (Fig. 7c), also produced O3 mixing ratios up to 90 ppbv." Response to 22-29: We will revise the sentences accordingly.

30. Page 2849, line 13: Be careful with the recurrent and unnecessary use of the adjective "high". 31. Page 2849, line 22: " : : an extremely high concentration PM2.5 episode : : ." 32. Page 2849, line 29: " : : see the average retroplume : : ." 33. Page 2850, line 23-24: "Based on PM2.5 chemical composition, : : ." 34. Page 2850, line 29: "On 10-jun-2011 a low pressure was located: : ." 35. Page 2851, lines 5-8: Refer the reader to Figures 9c and 9e along the text. Response to 30-35: We will revise the sentences accordingly.

36. Page 2851, line 23: "on that day": since you are analyzing several days, specify what day you are talking about, for clearness. 37. Page 2852, lines 5-6: the statement "SO2 was at relatively high levels" is misleading. "SO2 mixing ratios were relatively high, between XXX and XXX ppb" is more precise. 38. Page 2852, lines 14-18: The sentence is too long. Please rephrase, for clearness. 39. Page 2854, line 5: typing error "Summary" Response to 36-39: We will revise these sentences.

40. Figure 3 (legend): did you mean "median values"? Response: We will correct the word.

41. Figure 3b: typographic error on y-axis title "ug". Use greek letter "mu" instead. The same on Figures 4d, 5b, 6a, 7a, 8a, 91, 10a, 12. Response: We will correct it.

42. Figure 7: in the figure caption you could mention that the red circle shows the site location. Response: We will add the note.

43. Figure 8a: a. Superposition of PM_{2.5} and NO_y y-axis labels. Same for Fig 9a. b. Use the same format on x-axis labels on Fig 7-10a c. There was no rain before 30 Nov? Response: We will make changes accordingly.

44. Figure 9: There was no rain after 7 Jun on Fig 9a? I cannot see the red circle marking the site location on Fig 9f. Response: We will make changes accordingly.

45. Figure 10a: Here you show the rain y-axis, but there seems to be no data points. Response: There were some data points with value near zero during the period, we will change the vertical scale.

46. Figure 11: Please state what is the region delimited by dashed lines. Same for Fig 12. Response: We will add a note.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 2835, 2013.