

Interactive comment on “RH and O₃ concentration as two prerequisites for sulfate formation” by Yanhua Fang et al.

Anonymous Referee #3

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General points: This study provides long-term continuous filter sampling and composition analysis data of PM_{2.5}. Many previous studies usually conducted such kind of observation intermittent for a short period, but such long-term uninterrupted observations are quite scarce. Thus, the data is of scientific value for analysis of variation characteristics of PM_{2.5} compositions and model validation. Moreover, this paper focus on identifying the possible factors on sulfate formation, which is helpful for understanding of mechanism of sulfate formation. If the general and specific points below are addressed, I recommend this paper for publication. 1. The authors investigate the relationship of SOR and RH/O₃, and conclude that RH and O₃ are two “prerequisite” for sulfate formation. But the further speculation of “H₂O₂ oxidation was proposed to be the major route” seems lack of sufficient evidence without the H₂O₂ data and

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laboratory experiment results support. The refs. (Sievering et al. 2004; Alexander et al., 2005) are also not solid enough to back your speculation. 2. The authors should adjust the structures of the paper to make more clear and concise statement. Although the overview of the data is needed for the readers, the discussion in Sect3.1 is concentrated on the source appointment of PM2.5, which is abundant and deviate away from the theme. I suggest this Sect. discuss the variations of the components concentrations and contribution ratios using the classification method based on season or pollution levels. Sulfate can be focused on. 3. The order of the figures and tables in the main text and SI is confusing, the authors should rearrange the figures and tables according to the main text. 4. The authors should carefully go through the whole manuscript to avoid mistakes.

Specific points: 1. Avoid duplicated sentences and definitions. E.g. Page1, line18-20 vs Page 2, line 1-2; Page 1, line 25-26 vs Page2, line 23-26, and the definition of “self-catalytic” is vague. 2. Page 2, line 14, what is “various parameters” refer to? 3. Page 4, line 6, Figure 1 should be “Fig. 1”; Page 4, line 15, give the location information (lat, long) of the site; Page 5, line 4-10, rewrite the first sentence “The chemical (TEOs).” There actually 8 categories including “others” and the category is not according to the source type. Why you start with Fig. S2 not S1? Page 6 why you put Fig. 4 before Fig.3 in your text. Check the orders as mentioned in general points 3. 4. Sect. 3.2 How do you give the definition of threshold? The SOR or Δ SOR exceed certain value? The authors also compared the results with previous studies in this Sect., what is the reason for the difference in these studies? 5. Page 9, line 5-8 and Page 9, line 12-14 the sentences are contradictory. 6. Use “clear”, “formation”, “evolution” etc. to represent different pollution level is improper, because you do not conduct case or course study in the paper. 7. How about other factors such as wind speed and wind direction impact on SOR except RH and O3? 8. Is all the data in this paper daily data? Please give make it clear in the paper. 9. SOR is the conversion ratio of SO2, I doubt whether it can indicate the conversion rate (or speed) as you mentioned in your paper (e.g. Page 1, line 21, Page 10, line 14 etc.) What is the relationship of O3 and

atmospheric oxidative capacity? AWC and RH? Please reconsider in your statement and discussions? (Page 8, line 10, Page 9, line 10-11 etc.). 10. The fitting methods were used in this paper (Fig. 5 and Fig. S5), please give the evaluation parameters (such as p-value and R) of the fitting method to prove the validity and accuracy of the fitting. Also in Fig 5b, the last 2 box bins only have 1-2 points, does the results make sense? 11. Give the right form of the author's name in Page 1 and Page 12. There should be a space between units and the quantity.

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