

Atmos. Chem. Phys. Discuss., author comment AC1  
<https://doi.org/10.5194/acp-2021-83-AC1>, 2021  
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## Reply on RC2

Zhenzhen Wang et al.

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Author comment on "Measurement report: Saccharide composition in atmospheric fine particulate matter during spring at the remote sites of southwest China and estimates of source contributions" by Zhenzhen Wang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-83-AC1>, 2021

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### General comments:

This manuscript presents measurement results of particulate sugar compounds from a rural region in Southwest China. Individual sugar species concentrations, correlations among each other, as well as diagnostic ratios were utilized together with meteorological parameters, back trajectories, and fire counts to constrain the main emission sources, including biomass burning, microorganisms and plant emissions. Biomass burning emissions were the dominant contributor to the ambient  $PM_{2.5}$ , derived from both local burning activities and long-range transport from surrounding countries.

The results presented in this paper are interesting as they give insight into the sources of ambient aerosols in this part of China for which limited data have been reported. The results are based on a sound measurement approach, and include a large number of chemical PM components, while the measurement period is relatively short and doesn't show seasonal patterns. Overall, the manuscript is fairly well written and structured, and should therefore be published in ACP following minor revision based on the comments given below.

**Reply:** We appreciate the positive comments and suggestions about the manuscript. We agree with the reviewer's comments, and have updated the manuscript on the basis of these suggestions.

### Specific comments:

- It is good to see the utilization of the Metrohm sugar columns (requiring substantially lower eluent concentrations), instead of the usual CarboPak columns from Dionex used in most other studies. Did the authors encounter any co-elution problems of certain sugar species with this system?

**Reply:** We have encountered some co-elution problems when using the Metrohm sugar column. At first, we prepared twenty standard saccharide compounds for the method test,

and found that several saccharides co-eluted. By changing the concentration of the eluent and the flow rate, there were still some saccharides compounds that cannot be separated well.

For example, it was difficult to separate glycerol and sorbitol, the retention times of which were respectively 5.82 and 5.97 under the condition of the method in this paper. Because there could be a ~5% deviation of the peak location, data of sorbitol was not accurate and was not included in this paper. When testing the outfield samples, the sorbitol peak might be attributed to glycerol.

Under the same condition, we repeated the experiment many times to carefully identify the peak location for every saccharide. The relative deviation of retention time and peak area were less than 1%. When it showed a good linear relationship between peak area and concentration value ( $R^2 > 99.9\%$ ), the saccharides were selected to measure. We finally decided to test thirteen kinds of saccharide compounds in this article. The selected saccharides were inositol, glycerol, erythritol, arabitol, trehalose, manitol, mannose, glucose, fructose, galactosan, levoglucosan, mannosan and sucrose, the retention times of which were 4.88, 5.82, 6.22, 7.84, 8.96, 9.58, 10.93, 11.97, 14.59, 16.94, 17.96, 19.32 and 22.54, respectively.

- Lines 276-278: Do the authors know what are the traditional burning practices during the Qingming Festival, i.e., what types of biomass the local residents may be burning that are special for that holiday or is it just enhanced cooking activity, perhaps with more outdoor BBQ cooking?

**Reply:** The weather around Qingming Day is not very suitable for barbecue. We think the sudden increase in biomass burning may not be a significant cooking activity. The most likely activity is the sacrifice around the Tomb-Sweeping Day, during which large quantities of ghost money, candles and firecrackers were burned. The main raw materials of ghost money are bamboo and wood.

- Lines 416-418: While erythritol may have been used as surrogate for the 2-methyltetrols, I believe it was mainly for quantification of the 2-methyltetrol peaks when no authentic standards were available, rather than representing the ambient 2-methyltetrol levels. Since the 2-methyltetrols can be separated by HPAEC-PAD, did the authors see any unidentified peaks in the sugar alcohol region of the chromatogram that could potentially be attributed to the 2-methyltetrols?

**Reply:** The usage of erythritol was due to the lack of the standard 2-methyltetrols. The retention time of erythritol was very short when using the Metrohm sugar columns. The peak positions of erythritol and sorbitol were often overlapped, so it was difficult for us to find other substances in the peak location of the erythritol.

- Lines 495-500: What are the typical crops that are planted in this region? And what kind of burning practices do the local farmers have, e.g., post-harvest burning of straw or other agricultural residues? Knowledge of these practices would be helpful for explaining the BB patterns and specifically the anhydrosugar diagnostic ratios.

**Reply** □ Thank for the reviewer's suggestion. This region abounds with black tea, nuts, coffee and sugar cane. The main crops in this region are rice, wheat and corn. Crop straw

burning is a common phenomenon after the harvest, including the indoor combustion and open burning. We've put these information into the analysis.

"Previous results showed the emissions from the combustion of crop residuals such as rice straw, wheat straw and corn straw exhibited comparable L/K<sup>+</sup> ratios, typically below 1.0. The averages of L/K<sup>+</sup> ratios in this study was  $0.48 \pm 0.20$ , which was higher than the ratio for wheat straw ( $0.10 \pm 0.00$ ) and corn straw ( $0.21 \pm 0.08$ ), but was lower than the ratio for Asian rice straw ( $0.62 \pm 0.32$ ) (Cheng et al., 2013). In this study, higher L/K<sup>+</sup> ratios were observed during 8-10 March ( $1.20 \pm 0.19$ ) than those during 31 March-1 April ( $0.40 \pm 0.13$ ), which suggested that the open fire event during 8-10 March was more possibly due to smoldering combustion of residues at low temperatures."

**Technical corrections:**

- Throughout the manuscript, grammar and wording needs to be polished.

**Reply** □ Thank for the reviewer's correction. We'll try the best to polish the grammar and wording of this manuscript. The writing has been updated with the help of a colleague scientist whose native language is English.

- Lines 144-145: Please, check the correct supplier of the DRI Model 2015 analyzer -- I don't think that it is "Atmoslytic" anymore but "Magee" or "Aerosol"

**Reply** □ We rechecked the relevant information and found that DRI Model 2015 analyzer was produced by the Aerosol Inc.

Thank for the reviewer's correction. "Atmoslytic Inc." have been changed to "Aerosol Inc."

Please also note the supplement to this comment:

<https://acp.copernicus.org/preprints/acp-2021-83/acp-2021-83-AC1-supplement.pdf>