Interactive comment on "**$PM_{2.5}$ Source Apportionment using Organic Marker-based CMB Modeling: Influence of Inorganic Markers and Sensitivity to Source Profiles**" by Yingze Tian et al.

The manuscript demonstrates the investigation of the sources of $PM_{2.5}$ in a Southern China city Chengdu, using offline techniques and CMB modeling. Regarding the highlight, this study compares the organic markers only CMB (OM-CMB) and a combination of organic and inorganic markers (IOM-CMB), shows agreement between two methods. However, this manuscript spends too much text reporting the result, rather than making this comparison and discussing the possible reason for the difference (only a subsection in the result part). Therefore, compared to other papers in source apportionment topic recently accepted by ACP, this paper lacks depths and detailed interpretation. It reads like an experiment report rather than a scientific literature, especially the Result part.

As a conclusion, the manuscript provides a comparison of the results two different marker based CMB modelling, however, the manuscript is not carefully written from the perspective of science and scientific writting, with certain degree of improvement for publication in ACP. Therefore, this manuscript needs a major revision globally in terms of major context scientifically, until it meets the ACP standard.

Major comments:

- Title: the title uses the term sensitivity, which is too nebulous. The author should make the much more clear, like what the meaning of sensitivity is here.

- Abstract: the abstract should always be kept simple and conclusive, to summarise the the motivation and how the work solves the unsolved questions by showing result using salient points. Here, the author does not clarify the unsolved scientific questions or his/her motivation, but only writes this study explores the the sensitivity of CMB results to source profiles by comparing CMB modeling based on organic markers only (OM-CMB) with a combination of organic and inorganic markers (IOM-CMB). Some readers only read the title and abstract, or at most the result, to see if this paper is an interesting one, so it is important to keep the highlight in the abstract.

- Introduction: the introduction is poorly written and need to be re-write. If I were you, I would write the introduction based on this outline: 1) introduction of atmospheric aerosols, including sources, type, chemical composition and impacts on air quality, human health and climate, 2) summarise other studies on PM source apportionment using various of methods, you must state what has been achieved, what is the current challenges of those methods and why you choose CMB method compared to other methods, 3) what is your paper about, how this paper can narrow the gap.

In the current version, the point 1) is addressed, but should be introduced in smoother and more logical way. In the first paragraph, the author mentions the PM and CMB in the same parapgrah, and in the second paragraph, the author mentions PM and CMB again. The author can mention the PM, types, chemical composition and impacts on air quality, human health and climate in the first paragraph and then mention that retrieving the sources is a problem and then summarise the trials of source apportionment to understand the sources qualitatively and quantitatively. The author only introduces the CMB, so s/he does not address why CMB is used in this paper compared to other methods. Finally, the thrid paragraph cannot lead the final paragraph in the introduction. The author mentions the profiles are not acquired in China but used in the source apportionment in China, however, logically, readers will assume the author uses the profiles acquired from China in this study, but the author does not mention this but mentions OM-CMB and IOM-CMB in the paragraph instead.

- Methodology: the methodology part is written in a reasoble logic, but the author needs to pay more attention to speficy the technical details. Sect 2.2 should be carefully re-written a little bit, especially making the usage of different fraction of quartz filters more clear.

- Result and discussion: this part also very straighforwardly and logically reports the results. However, the interpretation of results should be more comprehensive and backed up by previous studies and/or solid evidence, which is absent now and needs to be added. In addition, the discussion of the result is very superficial, lacking depths, which should also be improved. The main focus of the paper is to compare OM-CMB and IOM-CMB, but most of the Result part is about the straighforward reports of the contributions from different CMB results. This part should be re-written and focus on the comparison and interpretation of the similarity and difference, finally give the reader a clear signal when to use IOM-CMB and when to use OM-CMB.

- Conclusion: it summarises the significance of the study, but it needs to be re-written, because it looks like the duplication of abstract.

- Figures and Table: unfortunately, figures don't follow the ACP figure styles here, and need to be revised according to ACP standard. In terms of the content, the figures has too much information, making it different for reader to identify the salient information from the figures. Captions are not very descriptive, nor the context in the manuscript when the author tries to interpret the figures.

Other comments:

Title:

As discussed in the major comments, the title has the expression of "Influence of Inorganic Markers and Sensitivity to Source Profiles", but the meaning of "sensitivity" should be defined. Plus, it is the first time that the abbreviation of "CMB" appears, so better to use "chemical mass balance (CMB)" in the title, as the authors does in the abstract.

Abstract:

Apart from the points addressed in the major comments, there are still some points the author should improve:

-Line 25-28: the author lists so many numbers to justify the two models agree well for those sources, but this can be summarised in one sentence without number. After all, the the good agreement between two methods is not the main point to address, the point to be addressed is the how the inorganic marker influence the quality of source apportionment.

-Line 34: the author uses the word "overestimated". Two points here: 1) the author should have a reference so that s/he can say over- or underestimated, is it compared to other studies, or other methods, or compared to the scenario that the profile is not replaced, 2) the author should also indicate to what extent the contributions of resuspended dust and coal combustion are overestimated.

-Line 36: "Different source profiles for gasoline vehicles were also evaluated", what is the result of this evaluation? Does the result show some difference? Is the difference related to the points that you would like to address?

-Line 37: what does "superiority" mean here? Does it mean "substantial improvement in source apportionment quality"?

-Line 40: these words are quite common in studies using CMB model, try to find other ones to highlight this study.

Introduction:

Apart from the points addressed in the major comments, there are still some points the author should improve:

-Line 43-47: these sentences need some word to link them logically, and need to be restructured in a more logical way.

-Line 47-55: it is good to mentione different methods to understand sources, but the author should mention the weakness of those methods, which can naturally lead to the reason why CMB is under consideration in this study, and why not PCA or PMF for instance.

-Line 57-80: The other should introduce the types of PM in the first paragraph as suggested in the major comments, and focus only on the different CMB strategies, e.g., what they are, what are the strenghts and weakness, and what are the problems or unsolved questions in these CMB strategies and why OM-CMB and IOM-CMB are used in this study.

-Line 76-80: this paragraph can be merged into the previous paragraph.

-Line 82-92: good to summarise what the author does in the study, but in the current version, this paragraph does not say what question to solve. The previous paragraphs cannot logically lead this paragraph.

Methodology:

-Line 96-100: Here better to introduce the geographical conditions of Chengdu, like is it in the mountain area or not, and is it influenced by manson season, etc, because these aspects are related to meteorological condition and therefore the transport of pollutants. Better still, a map can be added.

-Line 125: “carbon component” here means OC and EC, presumbly? Please justify.

-Line 129-141: these two paragraphs can be merged into one paragraph.

-Line 135: “a” here should be larger.

-Line 144: “Fifteen ml” should be “15 ml” presumbly, as this is a number.

-Line 148: “2 h”, here you have inconsistency usage of “h” and “hours”. Please check throughout the manuscript.

-Line 154: are these markers from the last ¼ quartz filters?

-Line 211-213: why vegetation detritus didn't work in the IOM-CMB?

-Line 221: why are the r^2 and chi^2 in the manuscript selected? Is it subjuctive? Please justify or add reference if there is any.

Result and discussion:

-Line 253-264, 267-282: Looks like an experiment report in the high school, rather than a scientific literature to explore scientific questions from a mature scientist. Please avoid simply reporting only the numbers, the author should extract information from those numbers and/or interpret these numbers, and also compare these numbers to other studies if possible. For example, the author states that "The percentage contributions of industrial coal combustion were higher during the dry season" in Line 277, but the author does not try to explain why this source contributes higher during the dry season, nor try to compare her/his observation to other studies in Chengdu or similar cities in the mansoon area in China.

-Line 285-300: again, these two paragraph are also the simply number report, lacking further interpretation.

-Line 302-314: the author tries to make comparison and to interpret the result, however, when making comparison, it is better to indicate the number, e.g., industrial coal combustion shows higher contribution in dry season than wet season (dry xx % vs. wet yy %). Also in Line 311-314, the author states that the vegetation detritus and soil dust are associated with vegetation and meteorological condition, but this statement should be supported by some reference or some data.

-Line 316: the word "sulphate" should be "sulfate" in ACP. Please change it throughout the paper and the figures.

-Line 316-321: Yes, these are obvious reasons, but the author should cite previous studies to explain how the strong illumination, less precipitation and high temperature can cause strong SOA formation particularly in Chengdu.

-Line 337-340: Is this the reason for the fact that sulfate and nitrate from OM-CMB is higher than IOM-CMB? If yes, please add some word to link the explanation and the observation.

-Line 345: "in agreement", how does the author make statement like this without any measure e.g., Pearson correlation coefficient?

-Line 347: "more consistent", how does the author determine the consistency and how does s/he compare them? It is better to indicate the some correlation coefficient from IOM-CMB vs OM-CMB.

-Line 352: again, "generally consistent" does not mean anything without a meaningful measure.

-Line 353: "larger differences" here, larger than what? Why is it larger?

-Line 355 and 356: is the R^2 calculated from the Pearson correlation? The author knows to indiate the correlation coefficient here, but s/he should also use this in comparsions when it is necessary.

-Line 361: “consistent” here should be backed up by the correlation coefficient.

-Line 374: the author still does not identify the meaning of “sensitivity”. Presumbly s/he means that how the result may vary when two different profiles are used.

Conclusion:

-Line 394-409: the conclusion looks like a duplication of abstract. It should summarise the main result in a concise way and/or also discuss the corresponding atmospheric implication.

Figures:

-Figure 1: too much information, especially in subfigure a), and all subfigures are too small.

-Figure 2: subfigure a) and b) have labels in the pie chart, making it hard for readers to recognise. Subfigure d) also has very long labels for x-axis, resulting in the bar plot relatively small.

-Figure 3: three subfigures have too much labels on the y-axis using 10 % as the step, try 20 %. The author does not have to repeat the year in the x-axis.

-Figure 4: the subfigures are too small, better to make it bigger and add the correlation of each line in each subfigure somewhere.