

Review of: “Radiocarbon and PMF based source apportionment of PM_{2.5} at a regional background site in North China: insight into the contribution of biomass burning”

General comment:

The manuscript has undergone significant improvement in terms of written language and clarity. The manuscript does have a potential to be a very good paper as the authors have collected a large amount of data and provided extensive analysis of sources of PM_{2.5} using both measurements and modeling. However, there are still major problems left in the manuscript to be addressed. In their response to the comments from the first round of review, often times they have not provided any new information that was not already in the manuscript to really address the referee’s comments. There are still typos throughout the manuscript and some major references missing.

In my opinion, the main problem with the paper is the accuracy and interpretation of the radiocarbon measurements. The authors make conclusions about the sources of carbonaceous aerosols from large regions of China based on only two samples from different air masses. I don’t think that one sample per cluster is representative of what the sources are in a particular region. Further the authors do not report uncertainty in their source apportionment estimates, which makes it very hard to interpret the accuracy of these measurements. The title of the manuscript suggests that radiocarbon was a major part of the source apportionment study, and I don’t think that is fair to say that based on what they report in the manuscript. I cannot comment on the PMF interpretation of the 14C and PMF results in general, however the 14C alone is not enough to interpret the sources.

Further the manuscript lacks a comprehensive discussion of the results. Maybe some part of the results can be moved into the discussion, but even so a more comprehensive interpretation of the results is necessary. The conclusions only provide a summary of the results, but not actual conclusions.

Minor comments:

Abstract

- Typos
- No errors on 14C source app.

Introduction

- Paragraph I:
 - references for climate, health etc.

-Paragraph II:

- Line 30 page 3 : “while its contemporary level in non-fossil carbon sources is relatively constant.” This is not quite the case as the Bomb Spike provides a high resolution interpretation of the excess ^{14}C in the atmosphere since the 1950s, which has been steadily declining.

Methods

- Sampling site and sampling collection

- Equilibrium process – Can the sample absorb VOCs during this time? How do you account for that?

-Chemical analysis

- Page 6 line 13 – M1 and M2 not defined.

-Page 7 line 6: why is the conversion to f_c different between OC and EC and where did you get these numbers? Either a citation is missing or more detailed explanation is needed.

- Principle for selecting ^{14}C samples – this section is hard to understand
 - Don't know what a perfect synoptic process means, don't know what the accuracy of the model is and that is why using one samples per cluster doesn't seem reasonable

Results

- General characteristics and chemical composition
 - Page 9 line 17 : Is this $\text{avr} \pm \text{st. dev}$ and how is the uncertainty in the $\text{pm}_{2.5}$ measurement accounted for? $77-59 = 16 \text{ ug}/\text{m}^3$ if we take the min and apply 20 ug measurement error... how does this 20ug compare to ug/m^3 ?
 - Also, lacking consistency in significant digits
 - It would be really nice if the section describing the concentrations and percentage in $\text{PM}_{2.5}$ of the different chemical components is summed into a figure e.g. a pie chart so that the reader can better visualize the relative contributions. Very difficult to follow
 - Page 10 line 4: citations
 - In general the names of the chemical species should be written out first, so the chemical formula is defined. This is missing throughout the manuscript.
 - Last paragraph belongs to discussion
- Cluster Analysis
 - Very difficult to follow which cluster corresponds to which region.
 - “Low temperature burning, such as agricultural residue burning, emits more OC compared with high temperature burning, e.g. vehicle exhaust.” Citation

- 14C source app
 - o No errors reported throughout the second paragraph. It is unclear what the uncertainty in the measurement is, which makes it not clear how reliable the measurement actually is.
 - o P. 14 line 27 typo
 - o Last paragraph should be in discussion
- PMF analysis
 - o Generally – many repeating citations from one authors. A lot of major citations are missing.

Implications for alleviation (lack of discussion)

While this section presents an interesting discussion on the role of biomass burning, it is only one part of a discussion section. The manuscript lacks a comprehensive discussion of the results and their importance.

- P. 19 line 25/6 – unclear
- Typos/ language
- Discussion on Shandong Peninsula p 20 line 6-14 – citations?

Figures and Tables

The tables of the manuscript are significantly better than the first version and are much easier to understand now. Some of the figures however need improvement. Figure 2 is cut at the bottom and the font of figure 4 is too small to be read. The manuscript can definitely benefit from the addition of figures summarizing the results.