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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Fossil vs. non-fossil sources of fine carbonaceous aerosols in four Chinese cities during the extreme winter haze episode in 2013" *by* Y.-L. Zhang et al.

Anonymous Referee #1

Received and published: 26 November 2014

General comments:

This manuscript describes radiocarbon source apportionment of organic aerosols during winter-time smog episodes in China. Air quality is a big concern in Chinese cities and especially the sources and formation mechanisms of organic aerosol are still uncertain. Using radiocarbon for source apportionment of organic aerosols is a very useful method, because, unlike tracer ratios, the 14C signature of the sources is not changed by chemical transformations in the atmosphere.

The methods and results are described clearly. The results are very relevant, showing

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that winter haze episodes do not necessarily result from an increase of specific fossil or non-fossil sources, but from an accumulation of pollutants accompanied by strong formation of secondary organic aerosol.

Given these results, the manuscript could be made significantly stronger, if the authors would additionally investigate meteorological conditions and air mass histories and their potential role in the pollution episodes. If the conditions could be identified that favor the accumulation of pollutant and secondary organic aerosol formation, this would give important insight into the pollution episodes.

However, the presented results are sufficiently interesting and important to be published and therefore I recommend acceptance with minor revisions, detailed below.

Specific comments:

p26264, line 10ff: Is the uncertainty for fm(OC) based on the reproducibility of the sunset OC/EC measurements and the uncertainties of the fraction modern? If, yes, please state so explicitly. In principle the uncertainty of EC-OC determination is much larger than the reproducibility derived from using one particular protocol. Inter-laboratory comparisons using different protocols for EC-OC determination show much larger uncertainties, on the order of 30% for EC. Please discuss this and estimate a resulting uncertainty for fm(OC).

p26272, line 7: What are the uncertainties given here (standard deviation, standard error of the mean, propagated experimental uncertainties)?

p26272, line 11: You mean the variability between different cities? Because within each city the fraction of OCf in OC still seems relatively constant

p26273, line 11: Please give a reference for the lev-to-K ratio in hardwood burning.

p26273, line 25: Please note that in the corresponding figure, OCother,nf is called OC bio. Please correct

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p26273, line 27ff: In this sentence it is already assumed that OCother,nf is mainly secondary aerosol. This is discussed in more detail later. Please state this more clearly here, or maybe already on page 26267, line 5ff.

p26274, line 22ff: Here you state very generally that SOC from non-fossil sources is mainly from biomass burning. However, this need not necessarily be true for SH and GZ, where temperatures during this time period are well above 0 degrees.

p26275, line 9: Do you mean here the fossil contribution to primary aerosol?

P26276, line 10: Given that Huang et al., 2014 reached similar conclusions for total PM2.5, I think comparing the results and conclusions between these two studies, should go further than just comparison of the source apportionment methods. Please compare the results of this study to Huang et al., 2014 in more detail.

P26276, line 25: A slope of 1.13 is usually not called a 13% offset. More often, the intercept of the regression line is called 'offset'. In general, it is better not to force the regression line through 0, because the intercept also contains information. Please change this.

Figure 5: The labeling in this Figure is much too small. I had to use 400% magnification to read the subscripts. Maybe using on general legend for all the figures (e.g. on the top) would be a solution. . .

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 26257, 2014.