

## ***Interactive comment on “Light absorption by organic carbon from wood combustion” by Y. Chen and T. C. Bond***

**Anonymous Referee #2**

Received and published: 10 December 2009

I think this is a publication-worthy manuscript that pushes forward what is known about light absorbing aerosols. I have several comments/questions/suggestions that should be easy for the authors to address and may improve the manuscript.

TITLE: Can you make it more specific to the work featured in this paper? E.g., I think that it would be appropriate to replace COMBUSTION with PYROLYSIS.

ABSTRACT: I think it is important to make the Abstract crystal-clear b/c many will read only this part of the manuscript. I note here some things I think could be stated more precisely and/or clearly, without appreciably increasing the total number of words that make up the abstract. I first restate in quotes the author's sentence(s) and then below it provide one or more comments.

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"While BC is highly absorbing, some organic compounds also have significant absorption, which is greater at near-ultraviolet and blue wavelengths."

This sentence could be interpreted as meaning that some organic compounds are more absorbing than BC at near UV and blue wavelengths. It could also be inferred from this sentence that while OC absorption increases at near UV and blue wavelengths, BC absorption does not.

"To the extent that OC absorbs visible light, it may be a non-negligible contributor to direct aerosol radiative forcing."

This sentence seems to neglect the OC scattering of sunlight. Isn't it true that, even if OC does not absorb sunlight, OC may contribute non-negligibly to direct radiative forcing.

"To the extent that OC absorbs visible light, it may be a non-negligible contributor to direct aerosol radiative forcing." and subsequently "A simple model suggests that, despite the absorption, both high-temperature and low-temperature carbon have negative climate forcing over a surface with average albedo."

Are RADIATIVE forcing and CLIMATE forcing the same? (I think they are not.) I would reverse the usage and say something like this in the first: "It has become widely recognized that OC aerosols absorb ultraviolet and visible light, but the atmospheric science community has yet to reach a consensus on (or evaluate in detail) whether or not this absorption affects climate." In the last sentence, I would say "... negative RADIATIVE forcing ..." if you are referring only to predicted W/g, since climate is more comprehensive (including feedbacks that influence efficacy, impact on precip, etc).

"Higher wood temperature is the main factor creating organic aerosol with higher absorption, causing about a factor of four increase in mass-normalized absorption at visible wavelengths."

The first part of this sentence is qualitative while the second is quantitative. I recom-

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mend noting the magnitude of the temperature increase (E.g., Increasing temperature from ABC to XYZ degrees) that led to the x4 increase in absorption. This would be meaningful.

"A simple model suggests that, despite the absorption, both high-temperature and low-temperature carbon have negative climate forcing over a surface with average albedo."

In this sentence, I think you should add the word ORGANIC in front of carbon, unless you mean to include BC as well, in which case you should say so explicitly.

Minor point: "... have negative climate forcing" the word HAVE sounds odd to me. Should HAVE be replaced with RESULT IN A, or something similar.

I reiterate that CLIMATE forcing is not the same as RADIATIVE forcing, at least not to me and others I have spoken with.

Noting that the model is simple makes me wonder what a more sophisticated model would predict, and if the results of a simple model are worth much. I know this is mentioned in the discussion section, but it could be handled in the abstract as well. Perhaps instead of saying SIMPLE you might be a bit more descriptive. E.g., "A model that included features A and B predicted that light absorbing OC imparts a negative climate forcing over surfaces with average albedo." And perhaps add "It is recommended (or not?) that including climate-relevant features C and D using a more complex model be investigated."

If average albedo is simply a number, replace AVERAGE with the number (or a range).

How does this sentence relate to the global dimming phenomena. Isn't it true that both absorbing and scattering aerosols result in dimming at the ground? Is the negative climate (RADIATIVE) forcing to which this sentence refers a forcing that is calculated for the ground, top-of-the-atmosphere, or something else? Can this be clarified in the abstract (and in the body of the paper).

It may not be necessary for most readers, but OC and BC should be defined. Also it

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may be wise to use fewer terms when referring to the materials on which the paper focuses. In the abstract you have the following: organic compounds, OC, organic carbon, organic aerosol, and high- and low-temperature carbon - all of which apparently refer to the same thing.

GENERAL COMMENTS: The absorption (and scattering) of UV light by organic aerosols may influence photolysis-driven chemistry in the troposphere. Some have suggested impacts on ozone, for example. Can you add anything new to this discussion in addition to what you mention in the intro? Maybe the OC absorption is more important to include in predicting tropospheric chemistry than in direct-radiative forcing in general. Maybe not.

"... although this method measures the bulk liquid refractive index and not particulate absorption" - What if the interaction of light with the material in the particle phase is appreciably different than in the extracted phase? I think it is important to discuss this at least at some level, even if only to explicitly say that it is a source of uncertainty, or to say that the comparisons with other studies (e.g, in Fig 9) suggest that it is not a major caveat. Also, would the real-time 3-wave PSAP data be helpful to address this?

I find that the last sentence in the abstract does not have the same impact as the following sentences in the discussion, "Unless absorption by real ambient aerosol is higher than that measured here, representing it is probably not important for global average clear-sky forcing." and "The contribution of absorbing organic material could be important in energy balances over bright surfaces." I.e., perhaps the abstract misses the punchline.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 20471, 2009.

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