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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Dominance of brown carbon in aerosol emissions from burning of boreal peatlands" *by* R. K. Chakrabarty et al.

Anonymous Referee #2

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Review of "Dominance of brown carbon in aerosol emissions from burning of boral peatlands" by Chakrabarty et al., 2015

General Comments

This paper reports the absorption properties of laboratory combusted peat samples in order to address the accelerated warming of the Artic as it relates to absorbing aerosol particles. It specifically address the smoldering phase of peat, which is known to produce brown carbon compounds very efficiently. These compounds have appreciable visible absorption and plausibly pose a threat to the Artic in terms of positive radiative forcing.

The paper is clear and well-written, with minor exceptions outlined below. Figures are

easy to follow. The inclusion of the direct radiative forcing calculation strengthens the impact of this paper, as it provides a means to compare other brown carbon measurements.

The main shortcoming of the manuscript as written is the absence of a sensitivity study on the surface albedo underlying the aerosol plume. Clearly that has a significant impact on the calculated forcing but it has not been done, or has not been included. The main result of the paper is hidden before the Conclusion section and should be brought explicitly into the abstract and introduction sections. I recommend this paper for publication with these revisions. I consider them minor.

Specific Comments

The abstract would benefit from additional quantitative results, especially with respect to radiative forcing and photochemistry.

pg 28796 - Are these fires burned intentionally? The statement that the burn area will increase "in response to climate change" indicates that there is some natural connection between temperature and burn area but that is not obvious to me as a reader.

The end of the introduction would benefit from the inclusion of the authors approach (in more detail) and findings, to help guide the reader as they follow the methods section. Specifically, what kinds of measurements were conduction (briefly) and what were the key findings?

It would be helpful for the authors to include an explanation of the atmsopheric transmission (0.79), beta (0.17), and cloud fraction (0.6) chosen for their estimation. If other studies wish to compare their results with these findings, they will need to understand the justification for those choices.

What kind of landscape has an albedo of 0.19?

The authors show that by including the observed absorption from these peat smoke aerosol particles, the net forcing over snow and low level clouds shifts from small, but

negative, to significantly positive. This seems like a major result, but is hiding buried in the paper. It should be in the abstract and in the end of the introduction.

Further, the title of the article does not describe the new and important findings of this work. It is doubtful that readers will be surprised that brown carbon dominates (predominates is the correct term) peatland smoke. However, readers may be surprised to find out the degree to which brown carbon compounds in the smoldering peat impact the radiative forcing of the aerosol in the Arctic region. I suggest the authors consider finding a higher profile title to represent their work.

The integrated forcing appears to be incredibly sensitive to the albedo of the surface below it. It would be incredibly useful to know the albedo at which the forcing goes from positive (as over ice and cloud) to negative (as over darker land surfaces). Further, it would be useful to know what fraction of the Arctic includes surfaces above which the smoke has a positive forcing (more than half?).

What is SFE of soot over those same surfaces? Comparing these numbers to soot particles would help readers put the particles into perspective.

Technical Comments

What was the fuel moisture content of the particles in Figure 1?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 28793, 2015.