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## ***Interactive comment on “Size-dependent wet removal of black carbon in Canadian biomass burning plumes” by J. W. Taylor et al.***

**Anonymous Referee #3**

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This paper presents a case study of the removal of black carbon aerosol from biomass-burning plumes based on aircraft measurements from one particular field campaign. In particular, it uses back-trajectory analysis to distinguish plumes which have encountered precipitation from those which have not. The difference in microphysical, chemical and optical properties is then used to investigate the role of wet removal.

The paper is clear and well written, and presents useful new observational constraints on the impact of wet removal on biomass-burning aerosol. I would recommend publication subject to the following minor and technical points.

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## 1 Introduction

**Page 19471, line 22.** IPCC AR5 (fig. 8.17) suggests that other well-mixed GHGs (in particular CH<sub>4</sub>) may also have a stronger RF than black carbon.

**Page 19472, line 8.** Textor et al. shows that wet deposition dominates *in models*. The models are probably correct in this regard, but nevertheless this should be made clear, or reference made to a study validating this aspect of the models with observations.

## 2 Experimental

**Page 19478, line 25.** Please explain the significance of a correlation between CO and CH<sub>3</sub>CN.

## 3 Results

**Page 19479, lines 17–23.** While it is reasonable to expect HYSPLIT to resolve the large-scale ascent associated with a front, and the associated vertical tracer transport due to the lifting of the warmer air mass, it is not clear from either the explanation given or the reference (Stohl et al.) that the model will capture the full extent of the transport due to unresolved deep convection triggered by the resolved frontal ascent (which is the type of precipitating cloud encountered by the plume, as described on page 19480, line 24). Please clarify the extent to which the model can be expected to capture this deep convection, as opposed to the frontal ascent with which it is associated, and the implications of this for the analysis presented.

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**Page 19482, lines 6–8.** The sample size (three plumes, one of which encountered precipitation) seems too small to justify the strength of conclusion (“It is therefore clear that ... were largely the result of the wet removal”) without demonstrating that the result cannot be due to variability between plumes. Please clarify why the result is robust despite the small sample size, or qualify the statement.

**Page 19483, line 4.** Change “was likely have had” to either “would likely have had” or “was likely to have had”.

## 4 Discussion

**Page 19488, line 20.** Change “by (Schwarz et al., 2010b)” to “by Schwarz et al. (2010b)” (i.e. `\citep` to `\citet` if using L<sup>A</sup>T<sub>E</sub>X).

## 5 Conclusions

**Page 19490, line 14.** Change “remove” to “remote”.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 19469, 2014.

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