

## ***Interactive comment on “A comparison of four receptor models used to quantify the boreal wildfire smoke contribution to surface PM<sub>2.5</sub> in Halifax, Nova Scotia during the BORTAS-B experiment” by M. D. Gibson et al.***

### **Anonymous Referee #1**

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#### General comments.

As encapsulated by its title, this paper reports on the comparison of the results of applying four receptor models to apportion the source contributions to daily PM<sub>2.5</sub> samples collected in Halifax, Nova Scotia during the period 11 July – 26 August 2011. The sample collection was part of the BORTAS-B field campaign. Chemical composition and source apportionment analysis was undertaken on 45 daily PM<sub>2.5</sub> samples. The PM<sub>2.5</sub> chemical component analysis is comprehensive and has been described in an

C8203

earlier ACP publication: Gibson et al. (2013) Identifying the sources driving observed PM<sub>2.5</sub> variability over Halifax, Nova Scotia, during BORTAS-B, ACP 13, 7199. This earlier paper also describes the results of application of the PMF source apportionment technique to these data. The current paper includes comparison of the results of the PMF source apportionment with Absolute Principal Component Scores, Chemical Mass Balance, and Pragmatic Mass Closure source apportionment methods. Some emphasis is placed on the quantification of a wildfire source of PM<sub>2.5</sub>, given this was a key focus of the BORTAS-B project, but, as is apparent in the Gibson et al. (2013) paper, the PM<sub>2.5</sub> in Halifax during the collection period was comparatively little impacted by boreal wildfires.

The data content of this paper is relatively light for an ACPD submission – given that PMF analyses of these data have been presented previously – but nevertheless it is an interesting comparison across 4 source receptor models the authors have undertaken, which, aside from anything else, reinforces that PM source apportionment methods require decisions and judgements and do not provide unequivocal quantification of all contributing sources.

The text, table and figures are generally neatly and clearly presented, and the paper suitable for consideration by ACP.

#### Scientific comments.

Table 7 is not required. The RMSE values from this table can be added to the respective Figures 5, 6, 7 and 8. The n, R<sup>2</sup> and bias values from this table are already on the relevant figures and the mean obs and mean predicted data do not provide useful insight – the nature of the scatter plots in the figures provide the informative insight into model performance.

#### Technical comments.

P24045, I25: It is not clear what is meant by the statement that burning forests is a

C8204

significant source of secondary trace gases. By definition, secondary species are not emitted. Is it meant that burning forests is a significant source of precursor gases for formation of secondary components of PM? Rephrase as appropriate.

P24045, I26: The phrasing that forest fires are a source of 'size-resolved particulate matter' also does not make scientific sense. Rephrase along the lines of "...and particulate matter (PM) of different size fractions to the..."

P24046, I17: Change "will explore" to "explores".

P24046, I20: Rephrase the start of the sentence more directly as: "A number of different receptor modelling approaches are utilized..."

P24048, I17 & I18: Rephrase to avoid repetition of "quantitative comparison"

P24048, I27: Replace "DGS" here with "Dalhousie Ground Station (DGS)", as this is the first point in this section when DGS is used.

P24049, I2: Replace "Dalhousie Ground Station (DGS)" with "DGS".

P24048, I5: Delete the sentence beginning "The PM2.5 mass..."; this sentence restates what the reader already knows about this paper.

P24049, I8: delete the word "ion" (It is superfluous as the chemical formula shows it is an ion; also the word ion is not used after nitrate).

P24049, I9: delete "ion".

P24051, I9: reverse the words "PM2.5" and "the" to make grammatical sense.

P24051, I11: The sentence beginning "With the GEOS-5..." does not make grammatical sense. Rephrase.

P24051, I15-I17: The two sentences of this opening paragraph can be deleted as simply repeating what the reader already knows about the work in this paper.

P24051, I20-I23: The two sentences starting "Leveglocosan was added..." and "The C8205

addition of levoglucosan..." repeat almost the same thing. Replace with a single sentence.

P24052, I7: Replace "included" with "were".

P24054, I19: Add the unit after the bias value 1.3.

P24054, I23: The sentence starting "From Fig. 3..." does not make grammatical sense. Rephrase.

P24054, I25: Add the unit after the bias value 4.3.

P24054, I28: Insert "for" before "CMB".

P24055, I3: I don't think "parsimonious" is the appropriate word here. Parsimonious indicates most restricted or most efficient. Perhaps most "useful" is more appropriate.

P24055, I9: The start of this sentence can be written more directly as "Tables 3-6 show that..."

P24055, I10: The word "co-vary" is probably better hyphenated, otherwise it looks odd.

P24056, I14: The sentence starting "Because..." is too long. Suggest starting a new sentence after "source" with "Instead, the LRT..."

P24056, I23: Replace "related to" with "from".

P24057, I4: The sentence beginning "To identify..." is both too long and doesn't make grammatical sense. Rewrite.

P24057, I12: The "(c)" should come after "DGS".

P24057, I20: Replace the word "parsimonious" with a more appropriate word.

P24057, I22: Should read "contained in"?

P24057, I28: USA is the name of the country, so better to replace "from the NE US" with "from NE USA".

P24058, I2: Replace “from the NE US” with “from NE USA”.

P24058, I4: Replace “from the NE US” with “from NE USA”.

P24058, I11: Two sentence here can be joined and many words cut: “. . .come from the aircraft column profiles for CO, acetonitrile and aerosol backscatters shown in Figure 10d.”

P24058, I25: See comment above, delete Table 7 and reference to it, and add (and cite to) statistical data to Figures 5-8 as appropriate.

P24059, I9: Insert “and its” before “known”.

P24059, I27: Delete “relative” (the sentence presents absolute PM<sub>2.5</sub> contributions, not relative contributions).

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 24043, 2014.