**Atmospheric
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Discussions**

Interactive
Comment

Interactive comment on "Identifying the sources driving observed PM$_{2.5}$ variability over Halifax, Nova Scotia, during BORTAS-B" *by* M. D. Gibson et al.

Anonymous Referee #3

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General comments The paper entitled "Identifying the sources driving observed PM2.5 variability over Halifax, Nova Scotia, during BORTAS-B" by Gibson et al., discusses PM2.5 concentrations and chemical composition recorded over Halifax (Nova Scotia) from 11 July to 26 August 2011. The campaign was performed in the framework of the B Phase of an experiment directed towards the quantification of the impact of BO-Real forest fires on Tropospheric oxidants over the Atlantic using Aircraft and Satellites (BORTAS). The United States Environmental Protection Agency (US EPA) Positive Matrix Factorization (PMF) receptor model was used to determine the average mass as well as percentage source contributions to the PM2.5 measured during the sampling campaign. The factor identification was based on chemical markers typical of spe-

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Interactive Discussion

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cific sources and was supported by air mass back-trajectory analysis and local wind direction.

I read the manuscript in depth and I am afraid that no real advance can be found in this study, in addition the work highlights no original or new findings. In fact, the methodology applied is not so new, and similar studies have already been carried out. However, the major remark is that the interpretation of the results appears quite weak. To my mind, much effort has been made to explain both of the instrumentation technical details and the well-known methodologies applied rather than discuss the results obtained. Moreover, the study, as it is presented, seems to be of local rather than regional or global interest. To end with, I think that the entire discussion needs to be improved and better contextualized in order to be made suitable for publication on the Atmospheric Chemistry and Physics, particularly on a special issue.

Specific comments 1.Introduction The introduction does not fit well with the aim of the study. Please revise it. 2.Measurements General comment: Excessive technical details were provided. This section needs a deep revision. In particular, it should be considerably shortened. Page 4495 lines 8-10: the Authors fixed the sampling period from 19:00 UTC to 19:00 UTC of the following day. This choice should be explained. Page 4496 lines 3-6: The Authors say: "The flow is then split, with 15.0 lmin-1passing through the PM2.5 collection filter and 1.67 lmin-1passing through the PM2.5-10 collection filter providing a dichotomous sample of fine and coarse PM (Dabek-Zlotorzynska et al., 2011)" but they only discuss the PM2.5 fraction. Why? In my opinion, it should be interesting to evaluate what happens both in coarse and fine fractions and compare the results obtained. Page 4497 line 4 "14 of the measured elements , were not detected in any of the samples": this result, at least for some elements such as Pb, Cd, is quite unusual. Could the Authors try to explain this finding here or in another paragraph? 3.Models Page 4500, line 4: The Authors should explain why they used 2-day back trajectories. Would longer back-trajectories have influenced the results? Page 4500, lines 8-22: Please move the sentences indicated in the "results and discussion"

section. Page 4500, line 23 and following: Too many details are provided for the United States Environmental Protection Agency (US EPA) Positive Matrix Factorization (PMF) receptor model. This method is well-known and widely applied in this type of studies, so it is not necessary to explain it with so many details. The Authors should shorten this part leaving only the details concerning the choices they made when they applied this method. 4. Results and discussion General comment: the discussion is very confused and hard to follow. It is very difficult to understand what contributions the Authors considered local or long-range transport-related. This part needs a deep revision. Table 1: An outlier value of temperature was reported in table 1. Why didn't the Authors leave it out of the statistical analyses? How did they evaluate the outliers? Did they find only this outlier? Page 4505 line 21: Why did the Authors consider Se and Pb as indicative of LTR pollution? Please ,provide some references Page 4510 lines 9-20: I suggest moving the sentences indicated in Models paragraph 5.Conclusion Page 4510: Palmer et al.(Atmos.,Chem.,Phys.,Discuss.,12,4127-4181,2013) report "The timing of the BORTAS-B experiment during 12 July–3 August 2011 reflects the climatological maximum of burning over this geographical region" and " Halifax, Nova Scotia was one of the climatological loci of burning outflow over eastern Canada". How can the authors explain that during their measure campaign no impact is found at the surface in Halifax regarding the Boreal wildfire smoke plumes? In particular, can their result be justified only because of the low PM2.5 amount measured ? Please, explain it thoroughly

Technical corrections Page. 4495, lines 15-16: Please, provide the list of chemical species measured and reported in brackets following the alphabetical order. Page 4495 line 8: the information on the sampling period is confused. Please, specify better when the sampling stopped on 11/12 July. On this day, how many hours did the filter sample? Page 4498 line 14: the sentence contains a misprint: the term "organic" was repeated twice. Page 4498 line 27: the Authors say: "Meteorological data at the BORTAS-B DGS was collected every 15min using a Davis Vantage Pro II weather station" but the caption of Table 1 reports "Descriptive statistics for the meteorological variables obtained at the DGS during the PM2.5 sampling period based upon 5-min average data". Please,

check. Page 4499 lines 6-8: Note that figures must be numbered consecutively as they appear in the text. As a consequence, it is quite unusual to find in the text figure 9 after figure 1 and before figure 2. Please, move this sentence to the "results and discussion" paragraph. Page 4500, line 5: Please, check the sentence. Page 4503 lines 1-2: The Authors say "Potassium is our preferred marker of long-range wildfire smoke plumes as it is conserved from source to receptor". Please provide a reference for this statement. Page 4504 lines 5-8: Please, revise the sentence that appears bad-framed in its first part. Page 4504, line 22. The NAPS abbreviation must be defined. Figure 2 caption: The Authors said: "Two trajectories were obtained for each 24-h sampling period (07:00UTC and 19:00 UTC)" (page 4500, lines 5.7) but the caption of figure 2 reports that trajectories were initialized 08:00UTC. Please, check and rectify. Figure 3 reports the HYSPLIT 2-day air mass back trajectory vertical profiles but it does not specify the back-trajectories they refer to (i.e., 07:00UTC or 19:00 UTC). Page 4519, Table 1: the number of observations of the meteorological parameters is 42, while those related to PM2.5 are 45. Why? Please provide a brief explanation in the text.

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