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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source apportionment and seasonal variation of $PM_{2.5}$ in a Sub-Sahara African city: Nairobi, Kenya" *by* S. M. Gaita et al.

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Interactive comment on "Source Source apportionment and seasonal variation of PM2.5 in a Sub-Sahara African city: Nairobi, Kenya" by Gaita et al.

In this research, PM2.5 concentrations in urban areas in Sub-Sahara Africa were studied. Filter samples were analyzed by EDXRF for trace elements and black carbon concentrations were measured using BC reflectometer. Furthermore trajectories and positive matrix factorization (PMF) were applied for aerosol source analysis.

The paper is an important enhancement of aerosol characterization in insufficiently investigated regions like sub-Sahara. The paper provides long-term measurements which allow comparison of wet and dry seasons and transport pathways. Regional aspect and length of campaign are the most valuable information of the manuscript, while

the paper needs wider and deeper discussion of results and supporting information for analysis.

Major comments:

1.Back trajectory analysis should be improved and expanded (see e.g. Markou et al., 2010; Heyes et al., 2009). Clustered back trajectory analysis should be described in more detail and the validity of analysis should be estimated. One of the challenges in this method is handling of varied trajectory speeds from the same directions. It has to be noticed that back trajectory analysis is also useful tool for analyzing specific time periods like Sahara dust or biomass burning episodes.

2.Supporting information is needed in order to make conclusions based on PMF results. It looks that there might be mixed factors or a number of factors that should be considered more carefully, e.g. secondary aerosol factor looks unclear (see e.g. Polissar et al., 2001).

3.There is no organic aerosol data available in this study even though OA is one of the major aerosol compounds in atmosphere, e.g. OA frequently dominate aerosol mass during dry season in Southern Africa (see e.g. Formenti et al., 2003, Tiitta et al., 2014). So the lack of OA might cause overestimation of traffic and mineral dust fractions in PM2.5 concentrations and should be considered in the paper.

Specific comments:

Abstract:

Abstract should be partially rewritten to reflect the major changes in the text

Introduction:

P9568 lines 3-8: Chapter should be extended significantly by adding discussion about biomass burning episodes (see e.g. Swap et al., 2003, Vakkari et al., 2014) and domestic combustion (see e.g. Venter et al., 2012).

Materials and methods:

Sampling sites

-Wind rose/roses including the wind velocities for the both measurement sites would be valuable

Data treatment and analysis:

Supporting material is needed to confirm PMF solutions (see e.g. Comero et al., 2009) including at least:

-Analysis of residuals and fpeak

-Q/Qexp and MaxRotMat vs. factor number plot

-G space plotting

-Show the PMF results of the different number of factors (e.g. 4-6) in supplementary material and add discussion about the results when the number of sources/factors has been changed.

Results and discussion:

-I propose that PM2.5 mass, elemental concentration and mass concentration variation (seasonal/weekdays) results are in the same chapter and trajectory + PMF analysis are in the new chapter named as “PM2.5 source apportionment”.

-Add a new table for the dry season/wet season comparison (mean concentrations) -Plot separate ternary diagrams for the dry and wet seasons and use more easily distinguishable colors/markers (Fig 2).

-Add new graph for PM2.5, BC and major trace element concentrations (time series) including mean percentage seasonal compositions (see Figs. 9, 10 and 11).

-Add more trajectory analysis, e.g. try to find typical time periods for the sources like biomass burning events traffic, dust event and domestic burning and compare these

source identified results to other results like seasonal averages.

-Check PMF analysis carefully with the supporting information and rewrite results/conclusions when necessary.

-Add percentage compositions for each period to Figs 10 and 11.

-Present the relationships between the source contributions and wind directions (see e.g. Zhou, et al., 2005).

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