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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Trajectory-based source area analysis of atmospheric fine particles, SO_2, NO_x and O_3 for the SMEAR II station in Finland in 1996–2008" *by* M. Hulkkonen et al.

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We thank Referee 2 for good comments. We agree with the Referee that we have not been clear enough in our formulation when explaining the method and our conclusions from the results. We agree that the method has not succeeded in mapping point sources or source distributions. The method reveals air mass origins and transport climatology related to point-measurements of high vs low concentrations, not the actual emissions.

We will modify the title, explanation of the method and interpretation of the results according to that.

RC: " . . .the relative impact that air mass transport over different areas have on measured values. . ."

We thank Referee 2 for better formulation.

RC: "what improvements that would be necessary to take the method one step further."

To produce emission source maps, all sink processes of a certain compound should be taken into account. Effect of meteorological parameters (rain and transport height) was studied by the authors (Hulkkonen 2010) and was not noted to significantly affect the presented maps. To otherwise assess the sink processes, a chemical model would be needed to quantify photo-chemical processes and transformation that strongly affect the characteristic life times of the studied compounds.

RC: "Minor comments: In the RSCF plots per month and year, to what number is the maps normalized? Annual maximum? Monthly maximum? This is not clear."

It is the yearly maximum of the monthly RSCF grids cells in the map in question.

RC: P. 1657, line 27: "groud"->"ground"

Will be corrected.

RC: "Page 1658, lines 1-3: 1996 is included in the study, but not in the trajectory calculations!? I guess the reasons for having two datasets is that the FNL archive ends in 2007. Please clarify/revise how and for which years the datasets were used. Why partially overlapping?"

NCEP/NCAR reanalysis data has been used also for year 1996. We will add this information to the text.

RC: "Page 1664, line 15: suggest rephrasing"

"The twofold origin of air masses that is optimal for Aitken mode particles to occur" -> "The two main pathways of Aitken mode particles to Hyytiälä"

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RC: “Page 1666, line 14-15: As with nucleation mode particles, speaking about source areas in terms of ozone does not make sense. Ozone is formed in situ in the atmosphere based on availability and proportions of both NOx and VOC (and solar radiation of course).”

We agree with the Referee. We will reformulate the expression. We want to show Figure 9 as we think the different nature of O3 can be seen in these maps: majority of ozone is formed in the vicinity of the station, and the preferred air mass origins are not so clear as in the case of nucleation mode particles.

RC: “Section 4.2.1: How much has the annual average of SO2 observed at the receptor changed during the studied period?”

The annual average of SO2 has a slope of -0.054 +- 0.021 ppb/year between 1996 and 2008 and -0.018 +- 0.0062 ppb/year between 1997 and 2008. This means a decrease of 12.1 +- 4.8 %/year and 5.2 +- 1.8 %/year on the average.

RC: “Think figure 5 can be omitted as the information is already provided in figure 3-4 and 6”

We disagree. To correctly interpret statistics behind Figures 3-4 and 6 we think it is necessary also to show the strong yearly variation in transport directions of 3-1000 nm particles.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 1653, 2012.

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