Atmos. Chem. Phys. Discuss., 9, C3248–C3251, 2009
www.atmos-chem-phys-discuss.net/9/C3248/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cluster analysis of an impact of air back-trajectories on aerosol optical properties at Hornsund, Spitsbergen" *by* A. Rozwadowska et al.

Anonymous Referee #1

Received and published: 24 July 2009

This paper presents an analysis of multi-spectral aerosol optical thickness (AOT) measurements taken at the Hornsund station, Svalbard, using trajectory calculations. The paper could in principle make a nice contribution to the ASTAR special issue by embedding the ASTAR 2007 campaign results into a broader multi-annual perspective and studying the transport patterns responsible for clean versus less clean conditions. In fact, the paper clearly shows that the campaign period was characterized by lower AOT value than what is normal at Svalbard at that time of the year. This is quite an important finding and should be considered by other papers in this special issue. However, the paper suffers from a large number of shortcomings and, therefore, I cannot recommend publication in its present form. It will at least require very major revisions

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

to eventually become publishable.

1) The authors perform a cluster analysis of trajectories and test several set-ups by clustering trajectories with varying lengths from 1 to 8 days and for various altitudes. They then present their results by calculating the fraction of variance explained by the cluster analysis as a function of the length of trajectories used for the clustering (Fig. 2-4). They then argue that a particular length (8 days in spring, 1 day in summer) gives optimal results. However, I am concerned that no statistical test is being performed. The number of data points available for clustering is relatively small, the number of clusters large (10) and some clusters seem to be populated by only one or two trajectories. The dependence of explained variance on trajectory length appears to be not very systematic and I am simply wondering whether this dependence is even statistically significant. A statistical test is urgently needed before any conclusions can be drawn.

2) Even more severe is that while the statistical results are presented, no real physical explanation for them is given. The fact that a trajectory length of 1 day seems to be optimal in summer is "mainly related to local atmospheric conditions", whereas the optimal 8-day length in spring is explained by the importance of long-range transport. However, what are the physical mechanisms? For instance, are strong winds and sea-salt generation important in summer? Or what else drives the AOT variability in summer? Why is that not important in spring, too? The results need a lot more explanation, interpretation and discussion.

3) Figure 1 is referred to with one sentence at the end of section 2.1 but the text makes no use of this Figure, does not discuss it, etc. The figure could be important but without discussing it, it can just as well be removed!

4) Symbol names in the equations: The symbols are named like in a computer code, not as in equations in a scientific article. Names like "N_traj_j" or "i_j" are not acceptable.

ACPD

9, C3248–C3251, 2009

5) Sections 3.2.1 and 3.2.2 describe on nearly 4 pages what Fig. 5 and 6 show. However, they do not interpret these figures but literally describe what the reader can see anyway. Again, physical interpretations are needed here instead of descriptions of the figures.

Minor points:

P15425, l1 (and other places): I assume you mean the Arctic front, not the polar front, which is located much further south.

Why have trajectories at 1, 2.5 and 5 km been used and for which arrival time were they calculated? Do the arrival times coincide exactly with observation times? Especially if you speculate that local effects are important in summer, I suppose that lower-level transport might be quite important!

The use of the English language should be improved. While I could understand most sentences, the paper just doesn't read very well. One example is P15431, l10-11: "Relative variances of AOT and alpha strongly depend on a number of clusters, i.e., they decrease with an increase of a number of clusters." Why not simply write: "Relative variances of AOT and alpha strongly decrease as the number of clusters increases."? There are many more examples and I do not list them all.

P15424, l7: by the at least 8-day trajectories of air: What do you mean here? It becomes clear after reading the paper but the abstract should be self-explanatory and the sentence is almost unreadable.

P15425, l1 (and other places): I assume you mean the Arctic front, not the polar front, which is much further south.

P15426, l21: Why are locally generated aerosols less effective with regard to light attenuation? Do you mean absorption? Sea salt, for instance, is very effective at scattering!

P15428, l25: I do not agree that a trajectory started at 1 km is representative of the

ACPD

9, C3248–C3251, 2009

boundary layer (BL). The Arctic BL over snow or ice is typically only a few dozen to a few hundred meters high.

Equation 1: I am wondering why you haven't calculated the distances on a sphere. After all, Euclidean distances on a projection are an approximation. Even if the error is probably negligible, this is just an unnecessary approximation.

Language, style, etc.: P15424, l4: AOT(500) should not be used like this in the abstract without explanation. P15425, l16: Engval et al.(2007) reference does not exist. Do you mean Engvall (double l) (2008)? P15428, l19-20: Sentence entirely unreadable.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 15423, 2009.