Atmos. Chem. Phys. Discuss., 10, C9723–C9727, 2010
www.atmos-chem-phys-discuss.net/10/C9723/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Airborne observation of aerosol optical depth during ARCTAS: vertical profiles, inter-comparison, fine-mode fraction and horizontal variability" *by* Y. Shinozuka et al.

Anonymous Referee #2

Received and published: 14 November 2010

Review of

Airborne observation of aerosol optical depth during ARCTAS: vertical profiles, inter-comparison, fine-mode fraction and horizontal variability

Lead Author: Y. Shinozuka

Summary

This is an interesting paper in that illustrates the sources of variability of observed AOD. By combining information from an in-situ platform for characterization of microphysical properties, an onboard and a ground based sunphotometer, the authors had most

of the tools needed to assess different aspects of passive aerosol remote sensing. Specifically, this works compares fine-mode fraction retrievals with the same information from in-situ measurements, assess the reason why there are differences between in-situ and retrieved AOD and reports average optical properties of aerosols found in Arctic hazes, Canada fires and Monterrey area aerosols.

Overall there is good and useful information and it makes a good contribution to the field of aerosol remote sensing and linkage with observed in-situ properties.

I have no major objections for this paper and I think it should be published. I have, however, several comments and clarifications that I think they should be added to the text since there are sections that I found a bit confusing to read.

Specific/technical comments.

One general major concern is that figures were too cluttered and they way ACP formats the draft papers is such the figures are very small and I was not able to follow the text because I could not identified the features in the figure (this is based on reading a printed version of the paper).

The following comments are based on the version of the paper available online at : http://www.atmos-chem-phys-discuss.net/10/18315/2010/acpd-10-18315-2010-print.pdf

Abstract

The abstract should include an introductory paragraph or a sentence stating the aerosol or region of observations " spring and summer Arctic hazes, biomass burning in Canada and continental/pollution aerosols near Monterey".

Line 25: the AOD variability should be reported over similar spatial ranges. Line 22-24 talks about high aerosol variability over a 20 km range in Canada fires whereas for Alaska fires the variability is reported over 6km range. So in order to compare aerosol in the different areas I think the spatial ranges should be the same.

Introduction

page 18318, line 7-10: There are a few studies that appear to be missing and were amongst the first to compare in-situ integrated aerosol properties and remote sensing: Clarke et al., 1996, Remer et el , 1996; Gasso and Hegg, 2002 .

page 18319:, line 11: the authors should consider or compare with the results of Gasso and ONeill study where they compared the insitu SMF and AATS retrieved FMF.

18322, line 6: what is a non-zero field of view? please clarify.

18326, Section 3: before starting with this section, there should be a brief description/discussion of the aerosol types typical of the 3 regions studied. This is just to put into context the subsequent results and discussions.

Section 3.1.1: two points :

1) this section is the only one that mentions anything about clouds and possible contamination. The particular situation of cirrus mentioned in this section is just briefly mentioned and it appears the authors did not make an effort to discriminate for it. Can you expand more on why cirrus could not be properly screened?

2) another possible aerosol type present in this environment are those aerosols generated at the open leads and polyanas by organic precursors such as bacteria, organic gases and organic gels. Another possibility are very fine aerosols from nucleation in the clean atmosphere. Both aerosols are probably present; they are probably at very low concentration although not clear how low and not known optical signature. However, and for example, some episodes of high Angstrom coefficient, low extinction could be related to such aerosols.

18328, line 13. I've never heard of a flight "suffering from dirt" , Please use a more appropriate language.

18329, line 5: replace "affected" with "was located" or "touched"

18332 lines 0-25 : this is an interesting discussion but it lacks any consideration to cloud contamination . Please expand.

Section 3.3 : Add an introductory sentence indicating what aerosol data was considered in this section: all Arctic, Canada and Monterey? or a subset of them? The idea is just to indicate what aerosol types are included in the analysis.

18336, line 25. Not clear why the "discrepancies are largely attributable to horizontal structure" statement? what is the evidence to back this up or is it an expectation of the authors? Please clarify.

18337 line 5-8. Similar as previous comment. The statement does not make clear the origin of the "expectation" , a reader expectation can be a very different than the writer's. Please, clarify this statement.

18337 line 16. Add (SMF) next to Submicron fraction.

18338 line 10-15. The authors should consider the fact that the aerosols observed do not have much of a signal in the 2.1um channel since there wasn't much dust in these flights. Compare w/Gasso and O'Neill 2006 study which had quite a bit of dust in the ACE-Asia mission.

18339, line 11-12 : Not clear what a "segment of flight" is? are you referring to a constant altitude transect , an spiral/straight ascent/descent, all of them? Please clarify. On a similar note, what are the "potential number of data points"? are they all the points in a segment?

Section 3.4.1 and 3.4.2: I found these sections a bit obscure and difficult to follow. Particularly, section 3.4.2 tries to explain with words a concept that is relatively new and I think warrants more space . Although I find the approach outlined to study horizontal variability impact as correct and sensible, I think there are a number of points missing in this discussion which is the connection with actual aerosol dynamics such as wind direction (or air mass motion) and direction of aircraft motion (perpendicular or parallel

to wind), measurements of state of mixing of aerosol layer and impact of cloud contamination. Because of this, I think these two sections with the additional discussion is worth a small, separate publication probably. In summary, my suggestion is that authors expand this section to make it clearer (probably an additional figure would help) or remove it all together for use in separate paper.

18343, line 7: where it says “(dotted curves)” , what figure you are referring to?

References

Remer, L. A., Gassó, S. Hegg, D., Kaufman , Y.,Holben, B., 1997: Urban/industrial aerosol: Ground-based sun/sky radiometer and airborne in situ measurements. J. Geophys. Res., 102, 16849-16859

Gassó, S., and N. O’Neill, 2006: Comparisons of Remote Sensing Retrievals and In-Situ Measurements of Aerosol Fine Mode Fraction during ACE-Asia. Geophys. Res. Lett., 33, L05807, doi: 1029/2005GL024926.

Clarke, A. D., J. N. Porter, F. P. J. Valero, and P. Pilewskie (1996),Vertical profiles, aerosol microphysics, and optical closure during the Atlantic Stratocumulus Transition Experiment: Measured and modeled column optical properties,J. Geophys. Res., 101(D2), 4443–4453, doi:10.1029/95JD03140.

Gassó, S., and D. A. Hegg, 2003: On the retrieval of columnar aerosol mass and CCN concentration by MODIS. J. Geophys. Res., 108 (D1), 4010, doi: 10.1029/2002JD002382.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 18315, 2010.