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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A case study on long-range transported aerosols of biomass burning: effects on aerosol optical properties and surface radiation levels" *by* A. Arola et al.

Anonymous Referee #1

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Review of: "A case study on long-range transported aerosols of biomass burning: effects on aerosol optical properties and surface radiation levels". By: A. Arola, A. Lindfors, A. Natunen, and K. E. J. Lehtinen in Atmos. Chem. Phys. Discuss., 7, 6631-6653, 2007

General Comments: The paper presents a case study on transported aerosols of biomass burning and their effects on aerosol properties and surface radiation levels. The presentation of the results and the discussion presented are clear and well structured. The manuscript demonstrates the expertise of the authors in this field and should be published after some minor revisions that are described below. The paper demon-

strates substantial contribution to scientific progress within the scope of Atmospheric Chemistry and Physics, providing evidence of aerosol transport related effects. In addition, it demonstrates a link of satellite and ground based measurements of various atmospheric parameters, in a short temporal scale.

Specific comments

Title: The case study presented here can not be considered as “long-range” transport. The distance of the transported aerosols that is described here is in the order of 200 - 300 Km. Searching the bibliography for the term “long-range” aerosol transport someone ends up in cases describing transport of distances of thousands of Kilometres. So it is suggested that “long-range” should be deleted from the title.

Introduction

You might consider the publication by D. S. Balis et al “Study of the effect of different type of aerosols on UV-B radiation from measurements during EARLINET” Atmospheric Chemistry and Physics 4, 307-321, 2004, that is directly related with the aspects of this work.

Data and methods

The extrapolation of the AOD from 550nm (MODIS) to 340nm using the MODIS Angstrom exponents (taken from 470 nm and 660 nm) could introduce an error on the retrieved AOD at 340 nm due to the assumption of the constant Angstrom exponent alpha from 340nm up to 660nm. A comment on the issue would be useful. (See also below).

The pyranometer wavelength range and type could be given instead of the reference Lindfors et al., submitted.

Results

MODIS data as shown in figure 3 could be just (larger) symbols as the connecting line

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is misleading at least for the first days shown. Concerning figure 7, I would suggest that the two panels could be combined to one. The information on the cloud presence or absence is proven showing the sunshine duration and the pyranometer data. So, I suggest that the octas could be eliminated and the pyranometer and the sunshine duration data can be combined to one plot.

Concerning the aerosol effects on UV and global irradiance

The radiative effects of the aerosol have to be quantified with more detail: The reduction of the UV irradiance due to the aerosol optical depth is solar zenith angle dependent. (Due to the optical path difference of the direct component contributing to the direct+diffuse UV irradiance). The 35% (and 25%) reduction have to be clarified in the text if it is calculated for local noon on the specific day (s). If so, the solar zenith angle at local noon have to be reported.

What is the purpose of the polluted model run when ground based measurements of UV exist? Is it only for measurement validation-verification purposes ?

If you use only local noon data then the uncertainty introduced in the UV and global irradiance analysis is inherited from the use of a constant AOD and Single scattering albedo (SSA) for the whole period. For other solar zenith angles using these constant numbers the difference should be different that 35% (25%) for the two days.

The use of the polluted run does not take into account the SSA and AOD diurnal variability (You could comment on that analyzing the daily variability of the CIMEL data from Estonia).

So, I suggest that you could clarify if the percentages in the UV reduction are calculated for local noon and if so, the single AOD values (taken from a satellite overpass time quiet close to local noon) can be considered the best available choice.

If you aim for an analysis for various solar zenith angles, you have to assume constant daily AOD and SSA and to quantify the errors inserted by this assumption.

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Finally, from my point of view the larger uncertainty in the calculation is inherited from the Angstrom exponent alpha use for the AOD scaling (se also comment above). I suppose that MODIS AOD at 550 nm and 340 nm for April 30 should be really ˜1.2 and ˜ 2 respectively while for the clean run the numbers are 0.09 and 0.18. A small error in alpha will introduce an uncertainty in the calculated UV reduction. Summarizing, the Angstrom a choice have to be discussed more considering the sensitivity on the UV reduction that is finally calculated.

Some of the comments above refer to the use of the “polluted” model run. So in case that this is used only for verification purposes (and only for local noon) they can be neglected.

Conclusions

The paper demonstrates this episode and quantifies the aerosol radiative effects. In addition the fact that the analysis presented “captures” such short temporal (day to day from April 29th to April 30 AOD variability. If the authors agree, this have to be mentioned too in the conclusions.

Technical comments:

Figure 1 caption refers to “Jokioinen” while figure legend to “Tampere”

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