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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical, physical, and optical evolution of biomass burning aerosols: a case study" *by* G. Adler et al.

Anonymous Referee #1

Received and published: 26 November 2010

Review 10-24371-2010 This paper presents a case study of a widespread biomass burning event associated with an Israeli festival, using a combination of an AMS, SMPS and WELAS to study the aerosols. Changes in the physical and chemical properties are noted and attributed to atmospheric processing. While individual festivals are unlikely to contribute significantly to regional or global climate effects, discrete events such as this provide good case studies for the characterisation of the lifecycle of biomass burning aerosols. Given the current need to accurately represent these aerosols in meteorological and climate models, observations such as these are highly relevant and help to provide a valuable basis for model development. I feel that this paper is certainly ACP material, although may benefit from a number of modifications,

as described below. I therefore recommend that this paper be published subject to minor revisions.

General comments A major assumption apparently made during this analysis is that changes in the aerosol composition observed at the receptor site are due to chemical ageing of the particles. However, alternative explanations could be changes in the burning phases, fuel types (changing with source region) or ambient temperature (causing changes in the partitioning of semivolatiles). The authors need to discount these possibilities more thoroughly or caveat their conclusions accordingly. Throughout the paper, the authors refer to the optical properties by their complex refractive indices. While this is unquestionably more fundamental to the physical properties of the aerosols, it would be very informative if they could report equivalent single scattering albedos (SSAs) in addition. In spite of the fact that an HR-TOF-AMS was used, the authors do not attempt to analyse any of the sub-unit mass resolution (UMR) data. Some of this could be very insightful for the study of the chemical properties of the organics, through the provision of data products such as the O:C ratio and the relative contributions of oxygenated ions to m/z channels such as 57 (see below). While this paper is still publishable with the analysis of UMR data alone, it would be greatly strengthened if the authors were to include some sub-UMR statistics as well. Note that some of this analysis should still be possible with V (rather than W) mode data.

Specific comments P 24372, L 26: Rather than just the IPCC report, a specific reference to inventory estimation works would be appropriate. P 24373, L 1: A reference for previous BC composition work would be appropriate here. P 24373, L 5: Specific numbers with references should be used to back this statement up. P 24373, L 21: The authors give a slightly misleading (albeit common) description of the treatment of SV-OOA and LV-OOA. The separation into two discrete groups is merely a product of the data model used in factorisation. The SV- and LV-OOA data products are thought to be describing a continuum of various chemical states of OOA (this is described in detail in the cited Jiminez and Ng papers). Along these lines, I would reword P24383, L1 to get

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rid of the term 'switched'. P24380, L20: The RIE used for the PAHs should be given. P24383, L17: If an HR-TOF-AMS was used in this study, can the authors not estimate the relative abundances of C4H9 and C3H5O from these data? P24385, L10: Can the authors be sure that this is due to nucleation and is simply not coincident with a primary source (e.g. transport)? It might be expected that the ambient surface area would tend to suppress potential nucleation events. Figure 3: Suggest showing the peaks as mass fractions rather than absolute masses Figure 11: It would be very useful to show the size-resolved SPMS data alongside the total number concentrations.

Technical corrections P 24372, L 5: 'H-TOF-AMS' or 'HR-TOF-AMS' are the preferred acronyms for the instruments (this is used elsewhere) P 24372, L 7 (also P24379, L1): This sentence seems to contradict itself. Is BB common or not? P 24372, L 25: When the authors say 'carbonaceous emissions', they should specify whether they mean particulate or total emissions. P 24373, L18: A technical reference for the HR-TOF-AMS should be given here (suggest doi: 10.1021/ac061249n or 10.1002/mas.20115) P 24374: L 14: I would suggest referring to the direct radiative effect specifically. P24374, L 13: Although is given elsewhere, I would give the date here. Also, is Lag BaOmer the name of the festival? P24375, L 17: Would "extinguished" be more appropriate than "turned off"? P24375, L20: Because fly ash may be contributing to the PM10 concentrations, the authors should qualify that it is submicron POA that is being characterised here. P24376, L6: The 3022's lower size cut is normally quoted as around 5 or 7nm P24376, L7: The material the 'conductive tubing' was made of should be specified P24376, L19: The operator of the monitoring site should be given here. P24376, L23: The Drewnick et al. reference describes the C-TOF-AMS, not the HR (DeCarlo et al. should be used here). P24377, L13: Allan et al. is not an appropriate reference for RIEs. Suggest doi: 10.1016/j.atmosenv.2004.01.054 P24378, L20 (and elsewhere): It would be more conventional to place the 'i' after the numbers (as the authors do on P24389). It should also be italicised. P24379, L12: Recommend changing "we had" to "there were" P24379, L14: Reword "massive amount" to something less chatty (e.g. "large number") P24380, L14: Correct "updateing" to "updating" P24382, L2: Replace

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"delta" with the corresponding Greek symbol P24383, L16: Correct "Previews" to "Previous" P24387, L22: For the sake of formality, recommend changing "there's" to "there is" P24388, L13: The location should be more specific than "the Middle East" Figures (general): Suggest increasing the font sizes for the sake of legibility. Also, superscripts should be consistently used when quoting "μg/m3"

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