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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Wildfire particulate matter in Europe during summer 2003: meso-scale modeling of smoke emissions, transport and radiative effects" *by* A. Hodzic et al.

Anonymous Referee #1

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General Comments:

In conjunction with a meso-scale chemistry transport model, this paper examines the impact of the summer 2003 wildfire emissions on air quality in Europe. By incorporating satellite-derived smoke emission inventory and smoke particles injection altitude into the model, the authors demonstrated that the model performed better at simulating observed aerosol optical depth during the fire events. This study also showed that emissions from the intense summer wildfires resulted in a substantial increase in the surface concentrations of particulate matter, a 10 to 30 % decrease in photolysis rates as well as an increase in atmospheric radiative forcing of 10 to 35 W m^{-2} over Europe.

In general this paper is detailed, comprehensive and well written. It addresses an important scientific question on air quality, which is one of the core areas of ACP. The datasets used in this work are extensive and corroborate the goal of the study. The calculations, experimental set up, references and conclusions reached are adequate and reasonable. However, there is one main concern. Hodzic et al. (2006) published a paper which is somewhat similar to this current one in terms of objectives and data sets (except for the fact that their earlier paper did not quite include MODIS data, neither discussed the impacts of the wildfires as highlighted in the current paper). The authors would have to prove beyond reasonable doubts that this current work is indeed an entirely independent study with enough merits to be considered as a new work. If they could do this and also address the points raised below, I would recommend this paper for publication in ACP. Specific comments follow:

Pg 4706, Ln 17, add the year 2003 to (3-8, August) for completion.

Pg 4706, Ln 15-22 rather than make a general statement about the model perfomance, you need to specify (as in the text) the extent to which the model simulations and observed AOT agree by using standard statistical methods such as root mean square error (rmse), or mean bias error. This would lend a better weight to the model's efficiency. You may also want to mention that although the model generally reproduces the spatial dispersion of the plumes, the temporal variability of AOT data at specific AERONET locations is not well captured by the model

Pg 4706 Ln 23, replace "Firstly, directly" by "Firstly, directly"

Pg 4706 Ln 26, replace "Second, indirectly" by "Secondly, indirectly,"

Pg 4707 Ln1 Can you briefly substantiate the lower or upper limit in the radiative forcing by indicating what aerosol property or meteorological condition is mainly at play.

P4707, line 11-15, Provide the source for your estimate, otherwise change "according to our estimates generated" in Ln 12 to "according to our estimates could have

ACPD

7, S2126–S2130, 2007

generated”

Pg 4710, Ln 11, Include “atmospheric radiative forcing” as another indirect consequence.

Pg 4713: Ln 6, AERONET data products are classified according to levels based on quality assurance. In addition to stating that the AERONET data used in this work are corrected for cloud contamination, you should also indicate the level of AERONET data products used.

Pg 4717, Ln 22, Change “in the free troposphere within” to “in the free troposphere than within”

Pg 4720, Ln 17, Change “(reffered as the)” to “(reffered to as the)”.

Pg 4721, Ln 7, Rather than wait until page 4722 to define “summer” as being used in this paper, you should rather do so earlier on (particularly on page 4721 where the word was mentioned but undefined.

Page 4721, Ln 22, Page 4722, Ln 5, You need to state whether Fig 2 is a 3-month composite plot or whether the data is averaged out. There is a wide margin between the scale of emissions on Fig 2 in comparison to Fig 3. Why is that?

Page 4722, Delete Fig. 3 from Ln 10, since your claim that “wildfires emitted 220 kTons of primary) is not verifiable from Fig 3. Fig. 3 only presents estimates of PM2.5 wildfire emissions for August and September and not July. Rather, add “Fig. 3” to “Table 2” on Ln 14, where it is more appropriate.

Pg 4723, As claimed by the authors, low Ångstrom exponents denote the presence of large particles. Specifically the low Ångstrom exponents reported here were attributed to dust particles. Other than the low Ångstrom exponents, do the authors have any other way of verifying this claim (e.g. visual observation of dust by trained observers, satellite imagery, chemical trace study e.t.c.), since low Ångstrom exponents in some cases could also be indicative of aged smoke. In addition the authors should consider

ACPD

7, S2126–S2130, 2007

adding the aerosol single scattering albedo to the upper panels of Fig. 4. While aerosol optical depth reflects the aerosol burden and Ångstrom exponent provides information on the aerosol size, the aerosol single scattering albedo indicates whether an aerosol type is scattering or absorbing. Since biomass burning aerosols are mainly absorbing, the easiest way to show their presence and distinguish them from other aerosol types (such as dust) is to depict the aerosol single scattering (see for example Iziomon and Lohmann, 2003)

In addition, in discussing their results the authors should be reminded of the possibility of a mixture of dust and combustion aerosols as indicated by VanCuren [2003], who report that Asian dust is mixed with a substantial amount of combustion aerosols. Perry et al. [1999] also observe that black carbon is frequently mixed with dust over Hawaii in the springtime.

Page 4724, Lns 24-27: What are the sources of the anthropogenic pollutants during the stagnant heat wave conditions from 2-13 August, 2003?

Pg 4725, Is there any reason for the failure of the model to capture the high AOT in UK and Ireland on the 6th of August 2003 (see Figs. 5 and 6).

Pg 4725 Ln 19-22: Can you compare this finding with those reported by others.

Pg 4726, Ln 13-23, This claim does not appear to be quite substantiated by Fig 7.

Pg 4729, Section 4.2.3 does not belong here. Since it deals with the effect of biomass burning emissions, it fits better in the aerosol impact section (4.3). Accordingly, you should move it to section 4.3 and possibly denote it 4.3.1. In addition, rather than PM10, why not focus on PM2.5 which is more pertinent to smoke particles- the main focus of this paper. PM10 will include large particles such as dust aerosols.

Pg 4735, section 4.3.2, The atmospheric radiative forcing should be extended to include the fact that the difference in the direct solar radiation between the top of the atmosphere and the surface was done for clear sky (with and without biomass burning

ACPD
7, S2126–S2130, 2007

EGU

aerosols).

Pg 4736, Ln 3, replace “reinforced” by “reinforce”

Pg 4746, Place an asterisk beside AOT in the title of the Table to imply that there is a footnote below the Table.

References

Hodzic, A., Vautard, R., Chepfer, H., Goloub, P., et al.: Evolution of aerosol optical thickness over Europe during the August 2003 heat wave as seen from POLDER data and CHIMERE model simulations, Atmos. Chem. Phys., 6, 1853-1864, 2006.

Iziomon, M.G. and Lohmann, U., Characteristics and direct radiative effect of midlatitude continental aerosols: the ARM case, Atmos. Chem. Phys. 3, 1903-1917, 2003.

Perry, K. D., T. A. Cahill, R. C. Schnell, and J. M. Harris, Long-range transport of anthropogenic aerosols to the National Oceanic and Atmospheric Administration baseline station at Mauna Loa Observatory, Hawaii, J. Geophys. Res., 104, 18,521- 18,533, 1999.

VanCuren, R. A., Asian aerosols in North America: Extracting the chemical composition and mass concentration of the Asian continental aerosol plume from long-term aerosol records in the western United States, J. Geophys. Res., 108(D20), 4623, doi:10.1029/2003JD003459, 2003.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 4705, 2007.