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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Western african aerosols modelling with updated biomass burning emission inventories in the frame of the AMMA-IDAF program" *by* C. Liousse et al.

Anonymous Referee #2

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General comments

This paper describes a new African biomass burning inventory, which is evaluated with the ORISAM-RAD-TM4 CTM and measurements from the AMMA program. This inventory has the potential to be very useful for regional and global operational modeling and assimilation systems, as well as for regional air quality studies. However, there are a number of serious flaws in this paper, which need to be addressed before it should be considered for publication in ACP.

Generally, I find the number of non peer-reviewed references in this paper to be excessive. I find it specifically problematic that, in order to evaluate the inventory, the authors

are using several measurements, which have not been described in a refereed publication yet (Doumbia et al. 2009, Galy et al. 2007, Pont et al. 2009, Serca et al. 2007). To a lesser extent, this also applies to some of the model-related references (Pere (2010), Tummon, Zakey), but at least the core components (TM, ORISAM, ORISAM-RAD) have been described in peer-reviewed journals. This combination (evaluation of a new inventory with non-refereed measurements) adds too much uncertainty to the validity of the inventory. I suggest that the paper should not be accepted for publication in ACP before the referenced non-reviewed datasets have been published. Alternatively, the authors could evaluate their model with datasets already published in the open literature.

Also, some references referred to in the paper are not listed in the references section (Galy et al. 2010, Pont et al. 2010, Barret et al. 2010, Konare et al. 2010). This should be corrected.

An evaluation of model results should generally include some discussion of vertical profiles and their comparison with observations, which is missing in this paper. There is a plethora of data available for the AMMA SOP-0 period, which the authors can choose from. Some suggestions are listed below.

I also suggest that the following paper should be referenced, since it gives a broad overview of the AMMA activities:

Haywood, J. M., et al. (2008), Overview of the Dust and Biomass-burning Experiment and African Monsoon Multidisciplinary Analysis Special Observing Period-0, J. Geophys. Res., 113, D00C17, doi:10.1029/2008JD010077.

The paper contains a number of grammatical errors and some phrases, which are bad English and which make it difficult to read through the article. The style of the paper needs a general touch-up. Some examples are given below.

Suggestions, questions, and comments

P 7349 L11-13: This statement contains too many specifics in order to be meaningful. Besides, the comparison with satellite data is inconclusive. The sentence should be removed, or be replaced with something like “To our knowledge, this is one of the first studies in which a global model treating core/shell mixing for optical calculations has been evaluated with observations.”. In this case, the authors should also acknowledge the following paper on ACPD:

Bauer, S. E., S. Menon, D. Koch, T. C. Bond, and K. Tsigaridis (2010), A global modeling study on carbonaceous aerosol microphysical characteristics and radiative forcing, Atmos. Chem. Phys. Discuss., 10, 4543–4592, 2010.

P7349 L24: It should be mentioned that dust shows some seasonal variation.

P7350 L13: A citation for AERONET should be given. I suggest:

Holben, B. N., T. F. Eck, I. Slutsker, D. Tanre, J. P. Buis, A. Setzer, E. Vermote, J. A. Reagan, Y. J. Kaufman, T. Nakajima, F. Lavenu, I. Jankowiak, and A. Smirnov (1998), AERONETâĂŤA federated instrument network and data archive for aerosol characterization, Remote Sens. Environ., 66, 1–16.

P7350 L13: The sentence “First global . . .” has an awkward structure and should be rephrased.

P7351 L4: A quantitative estimate (number) should be given for the burden of the atmosphere.

P7351 L24: experimental data -> measurements

P7352 L25: It should be indicated that the total emission is derived by summation over the vegetation classes.

P7354 Equation (2): Why is there no uncertainty for GLC included?

P7355 L18-21: This is not a complete sentence. Maybe rephrase as “It was the aim . . . to analyze CO emissions derived from . . . in detail (Stroppiana . . .).” (If that is the

intended meaning.)

P7356 L6: 9 vertical levels seem like a very low vertical resolution. Why was the number of levels chosen so low? Does the model allow for a larger number of levels?

P7356 L27: Particle core -> The particle core

P7357 L11: Which year was chosen from the anthropogenic emission inventory? I expect that the actual anthropogenic emissions during 2004-2007 have increased somewhat compared to the emissions chosen for this study. What impact could this increase have on the model results?

P7357 27: It is known that the ERA-40 reanalysis contains excessive precipitation over the tropical oceans (as well as an excessive Brewer Dobson circulation). Is it possible that this might have an impact on the coastal region of the Guinean gulf, by removing too much aerosol (P 7382, Fig 7)?

Uppala, S. M., et al. (2005), The ERA-40 re-analysis, Q. J. R. Meteorol. Soc., 131, pp. 2961–3012, doi: 10.1256/qj.04.176.

For future studies, the authors may wish to take a look at ERA INTERIM data.

P7358 L17: experiments -> observations

P7358 L25: concentrations -> concentration

P7360 L17-18: This statement is incorrect and should be removed. A number of other global models have this feature as well, e.g.:

Stier, P., J. Feichter, S. Kinne, S. Kloster, E. Vignati, J.Wilson, L. Ganzeveld, I. Tegen, M.Werner, Y. Balkanski, M. Schulz, O. Boucher, A. Minikin, and A. Petzold, The aerosol-climate model ECHAM5-HAM, Atmos. Chem. Phys., 5, 1125–1156, 2005.

Bauer, S. E., D. L. Wright, D. Koch, E. R. Lewis, R. McGraw, L.-S. Chang, S. E. Schwartz, and R. Ruedy (2008), MATRIX (Multiconfiguration Aerosol TRacker of mIX-

ing state): an aerosol microphysical module for global atmospheric models, Atmos. Chem. Phys., 8, 6003–6035.

Ghan, S., et al. (2001), Evaluation of aerosol direct radiative forcing in MIRAGE, J. Geophys. Res., 106, D6, 5295-5316.

P7361 L3: experimental data -> measurements

P7361 L8-9: modelled and experimental results -> model results and observations

P7361 L17: experiments -> measurements

P7361 L26: in global agreement -> in agreement

P7362 L23: A reference should be provided for the fire radiative energy approach, e.g.:

Wooster, M. J., G. Roberts, G. L. W. Perry, and Y. J. Kaufman (2005), Retrieval of biomass combustion rates and totals from fire radiative power observations: FRP derivation and calibration relationships between biomass consumption and fire radiative energy release, J. Geophys. Res., 110. D24311, doi:10.1029/2005JD006318.

Roberts, G., M. J. Wooster, G. L. W. Perry, N. Drake, L.-M. Rebelo, and F. Dipotso (2005), Retrieval of biomass combustion rates and totals from fire radiative power observations: Application to southern Africa using geostationary SEVIRI imagery, J. Geophys. Res., 110, D21111, doi:10.1029/2005JD006018.

Wooster, M. J., B. Zhukov, and D. Oertel (2003), Fire radiative energy for quantitative study of biomass burning: derivation from the BIRD experimental satellite and comparison to MODIS fire products, Remote Sensing of Environment, Volume 86, Issue 1, 83-107, doi: 10.1016/S0034-4257(03)00070-1.

Wooster, M. J. (2002), Small-scale experimental testing of fire radiative energy for quantifying mass combusted in natural vegetation fires, Geophys. Res. Lett., 29(21), 2027, doi:10.1029/2002GL015487.

References section:

P7364 L15: Sauvage is at the wrong position within this section

P7365 L9: the expression for 1degree x 1degreed is corrupted

P7369 L28: The ACPD reference of Mallet should be removed (it is included as the final ACP reference)

P7372 L12-13: if this paper is in review, it should be given an ACPD citation

P7373 Table 1: in the EFBC column: gC/km -> gC/kg

P7374 Table2: burgets -> budgets

P7375 Fig 1: The text underneath the images is illegible.

P7379 Fig 4: The text and numbers are hard to read.

P7382 Fig 7: The numbers are hard to read.

Suggested references for vertical profiles from both lidar and in-situ measurements (AMMA SOP-0 and/or DABEX), aerosol optical properties, and size distribution/aerosol composition:

Chazette, P., J, Sanak, and F. Dulac (2007), New Approach for Aerosol Profiling with a Lidar Onboard an Ultralight Aircraft: Application to the African Monsoon Multidisciplinary Analysis, Environ. Sci. Technol., 41, 8335–8341.

Chou, C., P. Formenti, M. Maille, P. Ausset, G. Helas, M. Harrison, and S. Osborne (2008), Size distribution, shape, and composition of mineral dust aerosols collected during the African Monsoon Multidisciplinary Analysis Special Observation Period 0: Dust and Biomass-Burning Experiment field campaign in Niger, January 2006, J. Geophys. Res., 113, D00C10, doi:10.1029/2008JD009897.

Derimian, Y., J.-F. Le′on, O. Dubovik, I. Chiapello, D. Tanre′, A. Sinyuk, F. Auriol, T. Podvin, G. Brogniez, and B. N. Holben (2008), Radiative properties of

aerosol mixture observed during the dry season 2006 over M'Bour, Senegal (African Monsoon Multidisciplinary Analysis campaign), J. Geophys. Res., 113, D00C09, doi:10.1029/2008JD009904.

Heese, B., and M. Wiegner (2008), Vertical aerosol profiles from Raman polarization lidar observations during the dry season AMMA field campaign, J. Geophys. Res., 113, D00C11, doi:10.1029/2007JD009487.

Johnson, B. T., B. Heese, S. A. McFarlane, P. Chazette, A. Jones, and N. Bellouin (2008), Vertical distribution and radiative effects of mineral dust and biomass burning aerosol over West Africa during DABEX, J. Geophys. Res., 113, D00C12, doi:10.1029/2008JD009848.

Kim, S.-W., P. Chazette, F. Dulac, J. Sanak, B. Johnson, and S.-C. Yoon (2009), Vertical structure of aerosols and water vapor over West Africa during the African monsoon dry season, Atmos. Chem. Phys., 9, 8017–8038, 2009.

Pelon, J., M. Mallet, A. Mariscal, P. Goloub, D. Tanre′, D. Bou Karam, C. Flamant, J. Haywood, B. Pospichal, and S. Victori (2008), Microlidar observations of biomass burning aerosol over Djougou (Benin) during African Monsoon Multidisciplinary Analysis Special Observation Period 0: Dust and Biomass-Burning Experiment, J. Geophys. Res., 113, D00C18, doi:10.1029/2008JD009976.

Rajot, J. L., et al. (2008), AMMA dust experiment: An overview of measurements performed during the dry season special observation period (SOP0) at the Banizoumbou (Niger) supersite, J. Geophys. Res., 113, D00C14, doi:10.1029/2008JD009906.

Raut, J.-C., and P. Chazette (2008), Radiative budget in the presence of multi-layered aerosol structures in the framework of AMMA SOP-0, Atmos. Chem. Phys., 8, 6839–6864.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 7347, 2010.