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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evolution of aerosol optical thickness over Europe during the August 2003 heat wave as seen from CHIMERE model simulations and POLDER data" *by* A. Hodzic et al.

Anonymous Referee #1

Received and published: 1 September 2005

This paper describes an interesting comparison of atmospheric aerosol measurements by the POLDER satellite instrument and the surface network, with the CHIMERE regional-scale model. The episode chosen, the 2003 heat wave, is a key event for air-quality model evaluation and has the additional advantage of an improved coverage of the satellite measurements due to the absence of clouds. CHIMERE is a state-of-the-art aerosol model and the POLDER instruments are dedicated to measuring aerosols. The comparison is presented well and provides considerable insight into the shortcomings of the model and measurements. I am in favour of publication in ACP.

A few general remarks to be considered by the authors before publication:

- Did the authors consider to compare with other existing satellite aerosol data sets? For instance the MODIS AOT data is available, and MODIS is already referred to in the context of the Portugal fires. Adding such a MODIS aerosol image (if this can be easily done) would give the reader a good impression on how well satellite retrievals agree, helping in the interpretation of the results. Or alternatively: motivate why the focus is on POLDER only. Why is the focus on the smallest aerosol particles?

- The authors discuss long-range transport aspects. Please provide a short discussion to convince the reader that a top level at 500 hPa is sufficient to describe free troposphere tracer transport, or mention possible problems due to this 500 hPa upper level. The lidar measurements suggest that there is still a considerable aerosol signal at about 5km.

- The lidar measurements show an interesting development of aerosol over the 24 hour period with a pronounced peak at 18:00. Such detailed measurements ask for a more detailed analysis. It would be quite interesting to see how well the tracer version is able to capture both the timing and vertical distribution. Is it possible to produce a plot of the 24 hour period over Cabauw, to be added as a panel 6b in the paper?

- On page 4117, l 9-20, the authors make a strong statement about model formulations which are not well suited for extreme weather conditions. Such a statement asks for further discussion in the paper, but such a discussion is missing (the discussion section could be a good place). Are the authors able to estimate how these aspects influence the aerosol levels modelled by CHIMERE during the heat wave ?

- On page 4120 the POLDER retrieval is discussed, and an accuracy of 20-30% is claimed. This seems to be in conflict with the large differences found between POLDER and AERONET in sec. 4.4. Please comment. Does the 20-30% number need adjustment? How is this 20-30% estimate obtained?

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Specific remarks:

- Please write the name "Angstrom" correctly.

- Past and present tense is mixed in the paper. Please check that present tense is used everywhere.

- p4118, l 15-16: Replace "because aerosols signature is small in comparison to surface one" by e.g. "because the aerosol signature is small compared to the surface reflectivity"

- p 4118, l 18: replace "new generation of POLDER instrument" by e.g. "new generation satellite instrument"

- p 4118, l20: replace "are producing maps" by "are also producing maps"; "even if the time overlap between those"

- p 4119, l8: "data sets .. are presented"

- p 4119: consider to replace the word "issued" by something like "retrieved".

- p 4119, l 19: "field of view"

- p 4119, l 20: replace "instantaneous" by "simultaneous" ?

- p 4119, l 21: "land and ocean"; "with a local overpass time"

- p 4120, l 3 : "..thickness) and surface condition"

- p 4121, l 8 : "sectional approach" - what does this mean?

- p 4121, l 24: "accounted for by the model"

- p 4124, l 25: Is this the time correlation of the mean of the 9 cells, or of all values within the nine cells?

- p 4126, l 4: ".. that the POLDER underestimation .."

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- p 4127, replace "long-ranged transported" by (e.g.) "transported over long distances".

- p 4128: "classical convective scheme .. is not efficient": As hinted by the authors, the heat of the fires causes its own convection. I would say that this is not so much a shortcoming of the convection scheme in the model, but it requires an alternative formulation how to distribute biomass burning emissions over the vertical layers of the models. In fact schemes exist that add emissions to higher layers in case of biomass burning.

- p 4128, l 6: remove ","

- p 4128, l28: ".. emitted as a function of the.."

- p 4129, l1: "function of the atmospheric stability": what is meant by this statement. I guess the tracer is simply injected at a certain altitude (fig8), but this statement suggests that the convection parameterization in the model is tuned.

- caption fig 8: "ransport"

- p 4129, l4: replace "could be long-ranged transported" by e.g. "could be subject to long-range transport"

- p 4129, l8: "in the POLDER data", "experiment constitutes"

- p 4129, l 16: "an exceptionally"

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4115, 2005.