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Interactive Comment

Interactive comment on "Coupling aerosol optics to the chemical transport model MATCH (v5.5.0) and aerosol dynamics module SALSA (v1)" *by* E. Andersson and M. Kahnert

Anonymous Referee #2

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General comments

The paper "Coupling aerosol optics to chemical transport model MATCH (v5.5.0) and aerosol dynamics module (SALSA)" addresses the issue of representation of morphology and mixing in chemical transport models.

An aerosol optical model is implemented based on core-grey shell theory, based on previous work from Kahnert and other authors. Results show the sensitivity of estimated radiative fluxes to aerosol morphology and mixing.

The paper discusses very nicely the issue of common approximations used, such as external mixing and its attractiveness due to linearity of the operators, useful for com-

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monly used data assimilation methods. The paper nicely highlights the importance of details of morphology and mixing to large scale impacts, such as estimates of AOD and radiative fluxes.

The paper presents novel methodology and data, and advance the capability of climate models. I believe that the manuscript can have a strong impact. Methods and assumptions are outlined clearly, and results presented support conclusions.

I had the general impression that the authors were crediting substantially the authors's work, while a larger relevant literature exists. I recommend the authors to cite more independent work from other research scientists in the field, as it would strength the manuscript itself and the external perception.

Many of the plots are not easy to read, neither in the screen or in a printed version. I would recommend to make labels of the axis with a larger font size. I would also suggest to add a description of the plots in the caption, so a reader does not need to go back a forward in the text to find relevant details. The manuscript does not provide any code to perform calculations, which seems strongly suggested by the journal.

I recommend the manuscript for publication after minor/technical revision.

Specific Comments

1. Page 10745 Please, state T-matrix estimated mass absorption coefficients (MAC) values and how close are to Bond and Bergstrom (2006) recommended values, in addition to SSA values.

The choose of monomers radius of 25nm might be legitimate, nerveless I would recommend a statement addressing the variability in the monomers radius 15-25 nm. Different monomer radii exist due to differences in sources, which mainly depend on burning materials (i.e. Weztner et al., 2003, China et al., 2014., Chakrabarty et al., 2014)

Optical properties of BC aggregates may vary depending on assumptions of BC

GMDD

8, C4053–C4056, 2016

monomers radius. One key manuscript addressing the issue at one wavelength is Liu et al., 2008, other papers based on observational driven constrains of BC particle aggregates may be worth to be cited, i.e., Scarnato et al., 2013, 2015. The choose of a Df=1.8 can be considered consistent with semi aged BC aggregates, i.e. China et al., 2015, China et al., 2014.

A good fitting of observed values of MAC and SSA with T-matrix simulations reside on the choice of aggregate physical constrains (aggregate size, monomer size and number, other than fractal dimension).

2. The paper mainly focuses on the impact of various treatments of optical modules to chemical transport models. Secondly, the paper discusses how various optical treatments can impact estimates of backscattering coefficients and Angstrom exponent. The authors should consider, at least for a site, to make comparison with observational data (i.e., A comparison between space born lidar backscattering values with those predicted).

3. Page 10756

Can you please provide an explanation for the statement:

“Over the Mediterranean (Fig.6), the EXT and CGS model have almost identical AOD profiles in the green part of the spectrum. However, at longer wavelengths (not shown) EXT predicts substantially higher AOD values than CGS”

4. Can you please provide an order of magnitude for the statement?

“TOA net flux in EXT as compared to the CGS model. Note that the differences in SSA between EXT and CGS are fairly small, while the differences in g are rather large“.

5. It might be useful to strength the perception of the paper, to add when possible in the abstract and conclusion a percentage (or order of magnitude) of the impact of different optical modules.

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8, C4053–C4056, 2016

Suggested references:

Wentzel M, Gorzawski H, Naumann KH, Saathoff H, Weinbruch S. Transmission electron microscopical and aerosol dynamical characterization of soot aerosols. J Aerosol Sci 2003;34:1347–70.

Chakrabarty, Rajan K. and Beres, Nicholas D. and Moosmüller, Hans and China, Swarup and Mazzoleni, Claudio and Dubey, Manvendra K. and Liu, Li and Mishchenko, Michael I., Soot superaggregates from flaming wildfires and their direct radiative forcing, 2014 .

S China, N Salvadori, C Mazzoleni, Effect of Traffic and Driving Characteristics on Morphology of Atmospheric Soot Particles at Freeway On-Ramps, Environmental science & technology 48 (6), 3, 2014.

S. China, B. V. Scarnato, R. C. Owen, B. Zhang, M. T. Ampadu, S. Kumar, K. Dzepina, M. P. Dziobak, P. Fialho, J. A. Perlinger, J. Hueber, D. Helmig, L. R. Mazzoleni, C. Mazzoleni Morphology and Mixing State of Aged Soot Particles at a Remote Marine Free Troposphere Site: Implications for Optical Properties, Geophysical Research Letters, 2015, DOI: 10.1002/2014GL062404

B.V. Scarnato, S.Vahidinia, D. T. Richard, T.W. Kirchstetter, Effects of internal mixing and aggregate morphology on optical properties of black carbon using a discrete dipole approximation model, Atmos. Chem. Phys., 13, 5089–5101, 2013

B. V. Scarnato, S. China, K. Nielsen, and C. Mazzoleni, Perturbations of the optical properties of mineral dust particles by mixing with black carbon: a numerical simulation study, Atmos. Chem. Phys., 15, 6913–6928, 2015 www.atmos-chem-phys.net/15/6913/2015/

Interactive comment on Geosci. Model Dev. Discuss., 8, 10735, 2015.