Geosci. Model Dev. Discuss., 7, C1530–C1531, 2014
www.geosci-model-dev-discuss.net/7/C1530/2014/

Geoscientific Model Development Discussions
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Interactive comment on "Sensitivity of aerosol extinction to new mixing rules in the AEROPT submodel of the ECHAM5/MESSy1.9 atmospheric chemistry (EMAC) model" *by* K. Klingmüller et al.

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Received and published: 29 August 2014

Answer to referee #2

We thank the referee for pointing out the important value of our study as indeed we quantify the difference between two common treatments in climate models, which is a major result of our study. In fact, most climate models consider external or homogeneous internal mixing (and possibly a combination of both). A listing of models and their aerosol mixing (internal, external or internal + external) can be found in, e.g., Easter et al. 2004, which we have now included as reference. The exact mixing scheme we compare to external mixing - namely homogeneous internal mixing within externally

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mixed modes - is used similarly by various models like ECHAM-HAM (Zhang et al. 2012), MIRAGE (Easter et al. 2004) and EMAC (Joeckel et al. 2005, 2006). Hence, our comparison is most valuable for the development of these and comparable models and in particular advancing the EMAC model is our main concern. We have added after line 25 on page 3369:

"..., possibly allowing a combination of both. Easter et al. (2004) list 16 models, five using external mixing, two internal mixing and the remaining models a combination of both. Also EMAC uses a combination by assuming internal mixing within externally mixed modes, similarly to, e.g., ECHAM-HAM (Zhang et al. 2012) and MIRAGE (Easter et al. 2004)."

For further clarification, we have changed line 19, page 3370, from

"A key aspect of this work is the comparison of internal and external mixing ..."

to

"A key aspect of this work is the comparison of internal and external mixing within the aerosol modes..."

In the context of the present study the comparison has the additional purpose of allowing the assessment of the results for our newly implemented core-shell treatment. As argued in the article, this treatment can be a more realistic representation of coated particles (even though in our case studies it yields results quite close to the results for homogeneous internal mixing). Thus, the core-shell column results are another major finding of our study introducing a new level of detail to the modelling of aerosol optical properties in EMAC.

Interactive comment on Geosci. Model Dev. Discuss., 7, 3367, 2014.