

## ***Interactive comment on “Simulating aerosol microphysics with the ECHAM/MADE GCM – Part II: Results from a first multiannual integration” by A. Lauer and J. Hendricks***

**Anonymous Referee #4**

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General

The authors present an extension of their previous article based on the ECHAM/MADE model system describing the global aerosol budget including size resolved information, not only bulk properties which was common for several years in global aerosol modelling. This paper analyses the microphysical processes and compares their impact with emission and deposition. The paper clearly offers new insight in processes governing distributions of individual aerosol types. It is in general very well written, and the presentation is easy to follow. Thus the paper clearly deserves to be published, however after some revisions.

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## Specific comments

1) The paper leaves the impression that this is one of a very few models including microphysics (e.g. Introduction ‘Most current global climate models include aerosols in the form of prescribed climatologies or treat aerosol mass only’). There are other models with the same capacity now (ref AEROCOM), please word this more carefully.

2) The ECHAM/MADE system has the potential to study three modes of aerosols. However, in this paper only two modes have been used. This should be reflected, also throughout the paper.

3) The authors claim that the coarse mode has little impact on the two modes that are investigated. Some limited sensitivity results to demonstrate this would be preferable, but I understand if this will be difficult. As a minimum a stronger discussion is needed.

4) The terms “aerosol microphysics” and “aerosol dynamics” are used more or less as synonyms in this paper (and largely in the community). In this paper the latter term is used extensively in the paper, the first is used less frequently - but still in the title of the paper. My preference is to be careful with the term “aerosol dynamics” in a study like this where also dynamics in the sense “transport of aerosols” is important.

5) Throughout the paper it is said that the ECHAM/MADE system calculates particle number concentration and particle size-distribution explicitly. What is done is clearly an improvement over bulk calculations, but expressing the size-distribution with two modes (four parameters) is a strong simplification. This should be reflected in the wording (e.g. simplified) in the paper. Also, a discussion of the limitations and possible inaccuracies introduced by this simplified approach would be preferable.

6) The most novel results in this paper are the process analyses in Section 4. I would have liked to see more results (figures) to support the nice discussion in this section. Height resolved rates of changes of individual processes (at a few locations), perhaps also for some individual aerosol types (this is an example, there could alternatively be

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other plots) would strengthen the paper. On the other hand, the discussion in Section 3 (especially 3.1) could be much shortened, as much of what is shown is already well documented in the literature.

#### Technical corrections

- 1) Section 3.5, second last sentence: “should to be regarded” - remove “to”
- 2) Section 4.1, second paragraph: “at all” -> “overall” (?) (2 times in the paragraph)
- 3) Section 4.3, last sentence: “for both, the Aitken” - remove the comma
- 4) Figure 6, caption: the reference to Fig 1 could imply that Fig 6 is for sulphate only

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 7519, 2006.

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