Atmos. Chem. Phys. Discuss., 6, S4355–S4357, 2006
www.atmos-chem-phys-discuss.net/6/S4355/2006/

Atmospheric Chemistry and Physics Discussions

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

A. Lauer and J. Hendricks

Received and published: 3 November 2006

Reply to anonymous referee #3

We thank the referee for the review of our manuscript, which helps us to improve the quality of the paper.

Specific comments:

1. We omitted the budget of NO3 in the abstract because of its high uncertainty. HNO3 required to calculate the gas/aerosol partitioning is currently implemented in form of a prescribed climatology only. However, budget and average residence time of NO3 can be found in table 1. We added some more details on ammonium and nitrate to section

3.2 and 3.3 in the manuscript:

Sect 3.2 (particle composition):

"As long as free excess ammonia is present in the atmosphere, the increase in sulfate causes an increase in ammonium (7.7% in the accumulation mode at 1000 hPa to 9.1% at 850 hPa) as additional ammonium sulfate is formed. If no excess ammonia is left, the relative contribution of ammonium decreases again (6.7% at 500 hPa and 4.9% in the accumulation mode at 250 hPa)."

and

"Aerosol nitrate plays only a minor role on global annual average. The contribution in the near surface layer is rather low (about 1% in the accumulation mode) and further decreases with height."

Sect. 3.3 (atmospheric residence time and global burden):

Actually, residence times of NH4 and NO3 are not left out, but given in combination with SO4: "sulfate, ammonium, and nitrate (4.6-5.2d)". The exact residence times of the individual compounds can be found in table 1.

2. We agree with the reviewer that it is a good idea to mention current work on global aerosol models performed within AeroCom. We added two further examples of GCMs including aerosol microphysics and we included the following paragraph in the introduction as well as in section 3. and 4.:

"Due to the high relevance to climate research, the representation of aerosols is currently also subject to improvement in some other general circulation models. Different approaches and techniques are applied regarding the representation of the aerosol size-distribution (modal with fixed standard deviation or bin scheme), the number of modes or bins, the aerosol components considered and the number of aerosol microphysical processes included. The progress achieved so far is well documented under the framework of the AeroCom Aerosol Model Intercomparison Initiative (Textor et al.,

ACPD

6, S4355–S4357, 2006

2006). Model results and further information can also be found on the AeroCom web page http://nansen.ipsl.jussieu.fr/AEROCOM/."

The differences between MADE and M7 are already discussed in the first part. We do not think these have to be repeated again. In Part I we wrote: "The major differences between HAM and MADE can be characterized as follows: HAM considers seven log-normally distributed modes, each representing a specific aerosol composition in a fixed size-range. In contrast, MADE considers a trimodal log-normal size-distribution and assumes a perfect internal mixture of the different aerosol compounds. The log-normal modes predicted by MADE are not fixed to prescribed size-ranges as in the case of HAM. The computer capacities saved by MADE due to the smaller number of modes is spend to simulate a larger number of aerosol compounds. While MADE predicts the full SO4/NO3/NH4/H2O system, HAM currently neglects nitrate (NO3) and considers a prescribed degree of SO4 neutralization by ammonium (NH4)."

3. Sea salt has been left out accidentally and is included now.

Technical corrections:

1.+2. Done.

3. We reformulated the sentence: "These northern hemispheric oceanic concentrations are slightly larger than typical concentrations simulated above the oceans in the southern hemisphere ($<$20cm-3) and Antarctica ($<$10cm-3)."

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