WHY **Aerosol optical depth (aot) comparisons to data from ground and space are preferred ways to demonstrate the skill of aerosol modules in global modeling. Comparisons among aerosol module detail demonstrate strong differences at sub-components, which may goes unnoticed when looking at integrated properties. Specifically we have to wonder: *Are 'good' aot totals skillful, just luck (off-setting errors) or a matter of tuning?* Investigations of detailed aerosol output of control experiments as proposed in AEROCOM will tell.**

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Simulated aerosol components

global fields of yearly averages and evaluations

Models	Resolution	Simulation	authors
♦ LO LOA	3.8/2.5deg	yr 2000	*Reddy / Boucher*
♦ LS LSCE	3.8/2.5deg	yr 2000	*Schulz / Balkanski*
♦ UL ULAQ	22.5/10deg	yr 2000	*Pitari / Montenaro*
♦ SP SPRINTARS	1.1/1.1deg	yr 2000	*Takemura*
♦ CT CANADA	2.8/2.8deg	yr 2000	*Gong*
♦ MI MIRAGE	2.5/2.0deg	1yr avg	*Ghan / Easter*
♦ EH ECHAM5 HAM	1.8/1.8deg	3yr avg	*Stier / Feichter*
♦ NF NCAR MATCH	1.9/1.9deg	yr 2000	*Fillmore / Collins*
♦ OC OSLO-CTM	2.8/2.8deg	yr 1996	*Myhre / Isaksen*
♦ OG OSLO-GCM	2.8/2.8deg	3yr avg	*Iversen et al.*
♦ IM IMPACT	2.5/2.0deg	yr 2000	*Liu / Penner*
♦ GM GFDL MOZART	2.5/2.0deg	yr 2000	*Ginoux / Horrowitz*
♦ GO GOCART	2.0/2.5deg	yr 2000	*Chin / Diehl*
♦ GI GISS	4.0/5.0deg	yr 2000	*Koch / Bauer*
♦ TM TM5	4.0/6.0deg	yr 2000	*Krol / Dentener*
♦ EM ECHAM4 MADE	3.8/3.8deg	10yr avg	*Lauer / Hendricks*
♦ GR GRANTOUR	5.0/5.0deg	1yr avg	*Herzog / Penner*
♦ NM NCAR MOZART	1.9/1.9deg	1yr avg	*Tie / Brasseur*
♦ NC NCAR CAM	2.8/2.8deg	1yr avg	*Mahonwald*
♦ EL ECHAM4	3.8/3.8deg	3yr avg	*Lohmann / Feichter*
♦ HA HADAM4	3.8/2.5deg	3yr avg	*Roberts / Jones*

Human activity has increased atmospheric concentrations of greenhouse gases and aerosol. Our understanding of associated climatic impacts is largely based on global modeling. With respect to aerosol, though, uncertainties remain large. For an improved representation, new aerosol modules in recent years started to distinguish between sulfate, organic carbon, black carbon, dust and sea-salt components. Here, simulations of 21 modules are presented (most of them participate in the AeroCom model diagnosis). Here simulated global fields of mass (m) and optical depth (aot) are compared (both are intermediate products on the way to radiative forcing – quantifying the climatic impact). Model diversity for totals (m, aot) is smaller (!) than for almost all sub-components. Contributing factors are also differences for m ⇨ aot conversion factors (mass ext. eff.), which rely on assumptions (size, humidification, available water) that need to be further investigated. Thus, (dis-) agreement of aot totals among models and to measurements from remote sensing (samples are below) are insufficient for model evaluations. Moreover, as different component contributions are expected to increase model diversity for aerosol absorption, the diversity of simulated radiative forcing (influenced by both aot and absorption) is a poor measure for the real diversity in modeling.

RESULTS

- **better mode agreement on source location, but differences in strength**
- **large differences in simulated transport (incl. removal processes)**
- **large differences in modeled aerosol water impacts m ⇨ aot conversions**
- **simulated (total) aot seems low over tropical oceans and tropical biomass**

RESULTS

OPTICAL DEPTH | **MASS** | **Median Fields** | **Diversity-Fields**

STATISTICS

total

(su+oc+bc)/total

sulfate

org. carbon

black carb.

sea-salt

dust

oc/bc mass ratio

MASS EXT.EFF.
m ⇨ aot conversion factor

scale multiplicators are Indicated below the field Identifier label

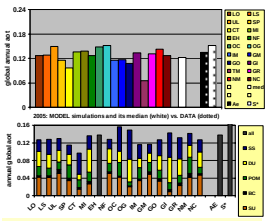
m_: mass _S :sulfate An: Angstrom cr:bc/oc ratio
a_: aot _O: org. carbon _N: seasalt _f: fraction of
r_: mee _B: black carbon _D: dust sizes < 1μm
W: aero. water ab : absorption [a(1-w0)] w0: ssalbedo*

value of 83% PDF model
value of 17% PDF model

most likely data … from monthly median fields

climatology

aot comparisons – among models



comparsions annual global aot averages (totals in upper panel and distinction by component in lower panel)
***Also indicated are sampling corrected averages of remote sensing: AERONET sunphotometer data [AE] and satellite composite data [S*]** *(more comp. below)*

(M - median) / med

aot comparisons – to remote sensing

(M - data) / data

next **AEROCOM project** ⇨ **detailed evaluations**

- to understand reasons for differences in mass to optical depth conversions among models: ***identical year, identical water uptake***
- to identify major causes for differences in mass distribution, including transport: ***identical inventories (sources), identical meteorology***
- to understand observed seasonal and regional patterns of aerosol/chemistry: ***satellite data, field studies, long-term monitoring***