The ECHAM5 Aerosol Model

AEROCOM Meeting, Paris, 03/06/2003


(1) Max Planck Institute for Meteorology, Hamburg, Germany
(2) Institute for the Environment and Sustainability, European Commission Joint Research Centre, Ispra, Italy
(3) Laboratoire des Sciences du Climat et de l’Environnement, Gif-sur-Yvette, France
(4) Max Planck Institute for Chemistry, Mainz, Germany
(5) Max Planck Institute for Biogeochemistry, Jena, Germany

1) Results

2) Issues
1) Preliminary Results

- 1 year climatological simulation
- 3 months spin up
- Horizontal resolution: T42 (spectral) ↔ 2.8° on Gaussian grid
  Vertical resolution: 19 levels
The ECHAM5 Aerosol Model

Mixing State

Dominant Surface Mass Regimes – Mixed Accumulation Mode

Sulfate
Sea Salt
Carbonaceous
The ECHAM5 Aerosol Model

Column Burden

Total Burden of Sulfate
Global Total: 1.75901 [Tg(S)]

Total Burden of Black Carbon
Global Total: 0.494374 [Tg]

Total Burden of Sea Salt
Global Total: 27.4789 [Tg]

Total Burden of Dust
Global Total: 24.1209 [Tg]
The ECHAM5 Aerosol Model

Surface Aerosol Mass

Modelled near-surface annual-mean total sulfate mass concentration. Sulfate is assumed fully neutralised by ammonia.

3-year annual-mean fully neutralised PM2.5 sulfate mass concentration [µg m⁻³]. From IMPROVE network (Malm et al.; 1994).
Simulated Dust Cycle (Ina Tegen, Martin Werner)

Dust emission computed by ECHAM5 with Jena scheme

Dust deposition from ECHAM5
Surface Aerosol Mass

RSMAS, Univ. of Miami: Whatman-41, 25.7500N 279.750W

- Prospero / Savour
- ECHAM5 (Tegen 2002)
Surface Aerosol Mass

The ECHAM5 Aerosol Model
Surface Aerosol Mass

The ECHAM5 Aerosol Model

Prospero / Savour

ECHAM5 (Tegen 2002)
Surface Particle Mass

MAWSON – ANTARCTICA (DOE) -67.6000S 62.5000E

Prospero / Savour
ECHAM5

nssSO4 [µg/m³]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
The ECHAM5 Aerosol Model

Pacific measurement composite
(From Clarke and Kapustin; JAS; 2002)

Number Concentrations

Total aerosol number annual mean
Pacific profile;
Averaged over 70S - 20S and 130 E - 90 W
2) Discussion

- Relative high column burdens
  (compared to literature – further evaluation)

- Surface mass concentrations show relatively good agreement with measurements
  (spatial and temporal consistency necessary)

- Need for vertically integrated / resolved data
  - Measurement campaign data for nudged simulations
  - Coupling with radiation scheme facilitates evaluation with remote sensing data
Acknowledgements

- Erich Roeckner and the ECHAM developers team
- Part of this work was performed within the EU project PHOENICS

PHOENICS Partners:
- University of Crete, Greece
- EU Joint Research Centre, Italy
- Max Planck Institute for Meteorology, Germany
- Max Planck Institute for Chemistry, Germany
- LSCE, France
- CNRS-LOA, France
- University of Utrecht, The Netherlands
- CNR, Italy