AOD Assimilation
AVHRR Advanced Very High Resolution Radiometer
OR
MODIS Moderate Resolution Imaging Spectrometer

AOD
λ = 630 nm
OR 550 nm
Optimal Interpolation

1° by 1° gridded aerosol product
Stowe et al 1997
Kaufman et al 1998

D. Fillmore, W. Collins, P. Rasch, D. Bundy and A. Conley
National Center for Atmospheric Research
AEROCOM Meeting
Paris, June 2 – 3 2003

MATCH
Model for Atmospheric Transport and Chemistry
Rasch et al 1997

SO_2/DMS/Carbon Aerosol Emission Inventories
monthly climatologies
Benkovitz et al 1996
Cooke et al 1999
Liousse et al 1996

Meteorological fields
NCEP/NCAR Reanalysis
resolution T62 ~ 1.9°, 28 levels
OR **NCEP Aviation Analysis**
resolution T126, 42 levels
OR **CAM** (NCAR Community Atmosphere Model)
resolution T42, 28 levels

MATCH Configuration

Dust Aerosol
Mobilization and deposition
Zender et al 2003
Mahowald et al 2003
4 size categories
0.005 – 0.5 μm (radius), 0.5 – 1.25 μm,
1.25 – 2.5 μm, 2.5 – 5.0 μm

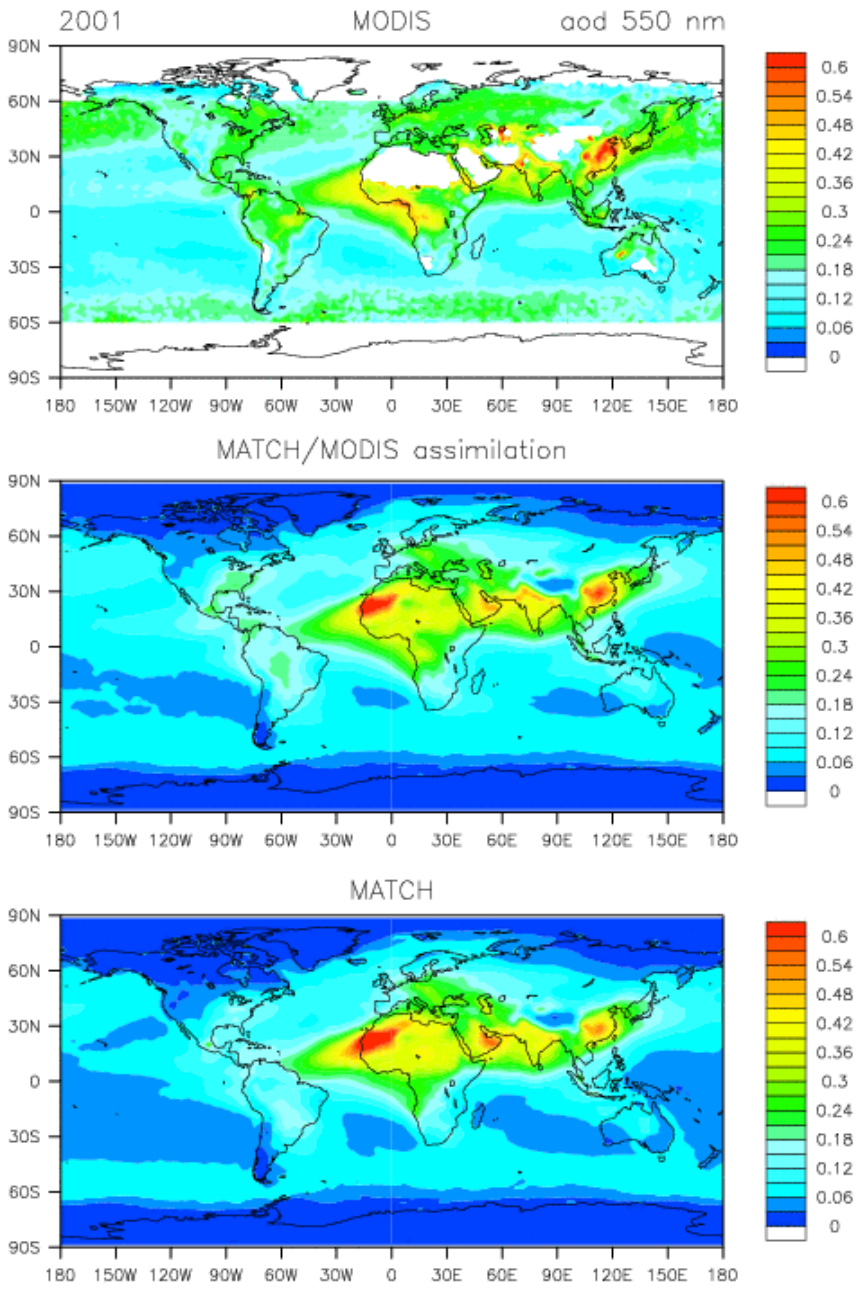
Sulfur Cycle/ Sulfate Aerosol
Gas phase/aqueous chemistry
Barth et al 2000
tracers DMS, SO_2, SO_4, H_2O_2
monthly climatologies for O_3, OH, HO_2, NO_3
from MOZART (Model for Ozone
and its Precursors in the Troposphere)

Diagnosed sea-salt aerosol
Blanchard and Woodcock 1980
No nitrate aerosol

Carbon Aerosol
Black Carbon (Soot)
Organic Carbon hydrophobic ⇨ hydrophilic
Cooke and Wilson 1996

Hydrological Cycle
Prognostic cloud water
Rasch and Kristjansson 1997
Vertical convection
Zhang and McFarlane 1995
Precipitation - bulk microphysical
Flatau 1989

Aerosol Optics
Sulfate*, Sea-Salt, Organic Carbon, Soot
Optical Properties of Aerosols and Clouds
Hess et al 1998
Dust
Zender et al 2003
*Currently based on H_2SO_4
future $(NH_4)_2SO_4$

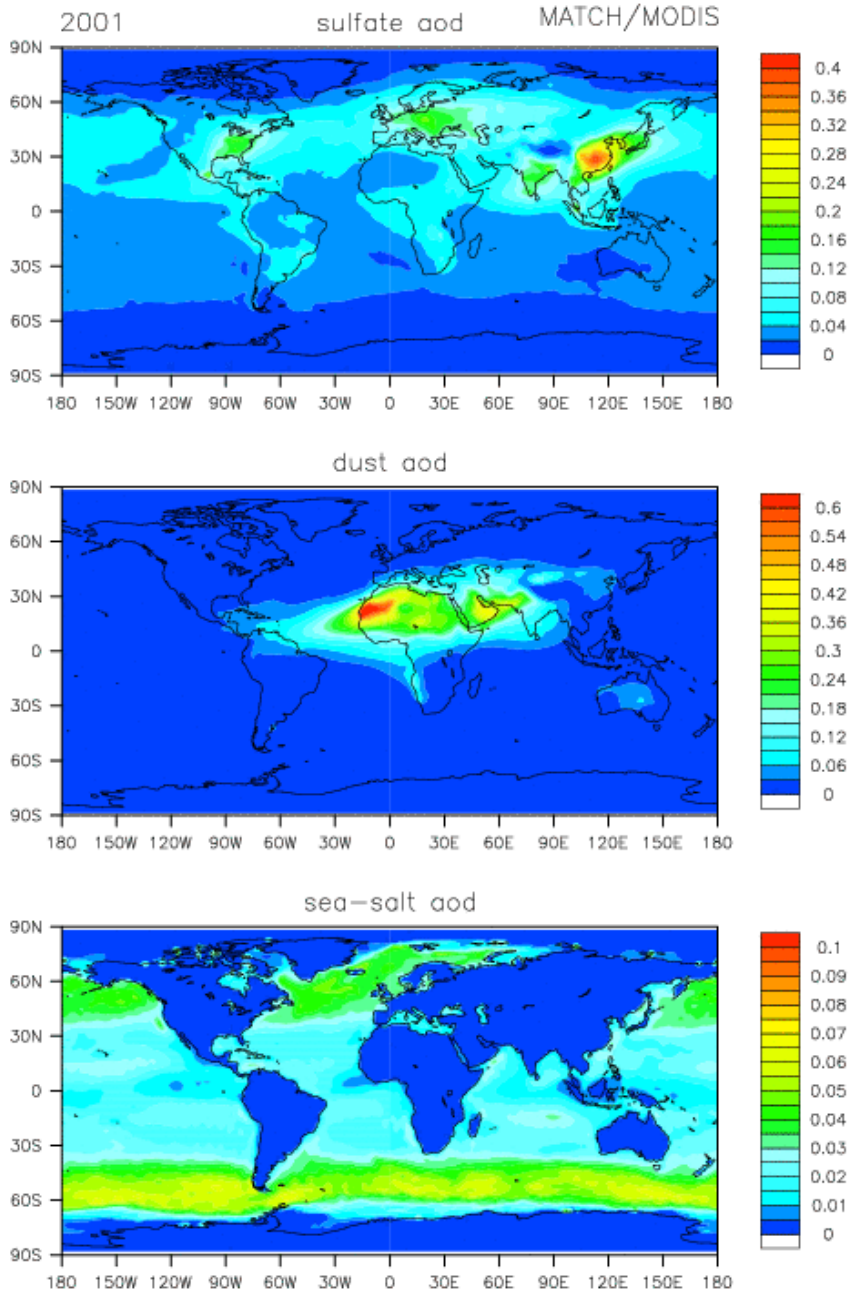


Mean aerosol optical depth for 2001

Top – MODIS

Middle – MATCH with MODIS assimilation

Bottom - MATCH

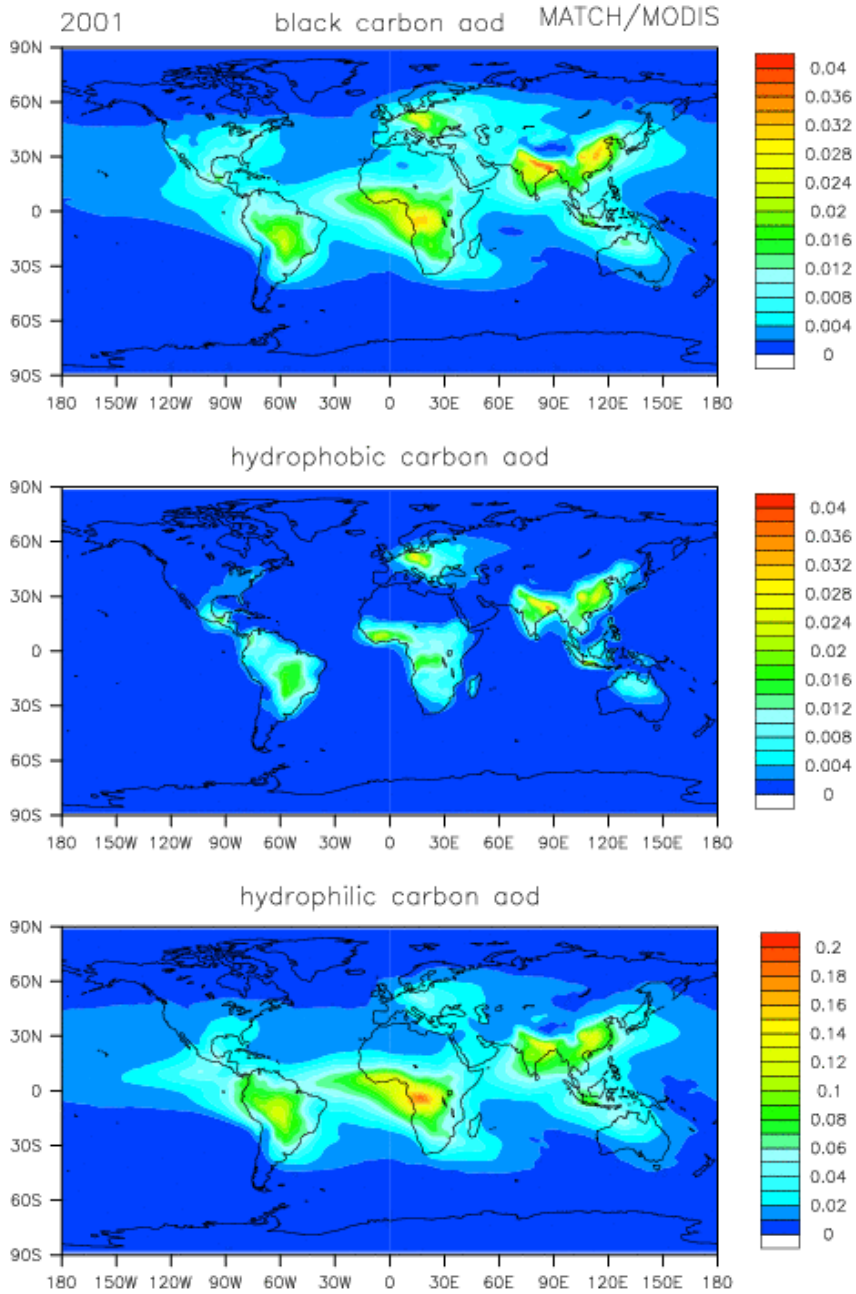


Mean aerosol optical depth by species for 2001

Top – sulfate

Middle – dust

Bottom – sea-salt



Mean aerosol optical depth by species for 2001

Top – black carbon

Middle – hydrophobic organic carbon

Bottom – hydrophilic organic carbon

Future Development

- Aerosol/chemical transport incorporated into **CAM** (NCAR Community Atmosphere Model) with switch between internal/external meteorology
- Size resolved sulfate aerosol
- Nitrate aerosol
- Prognostic sea-salt

- Multi-channel **MODIS/MISR** assimilation