Geophysical Fluid Dynamics Laboratory Review

June 30 - July 2, 2009

Aerosol Modeling and Evaluation

Presented by

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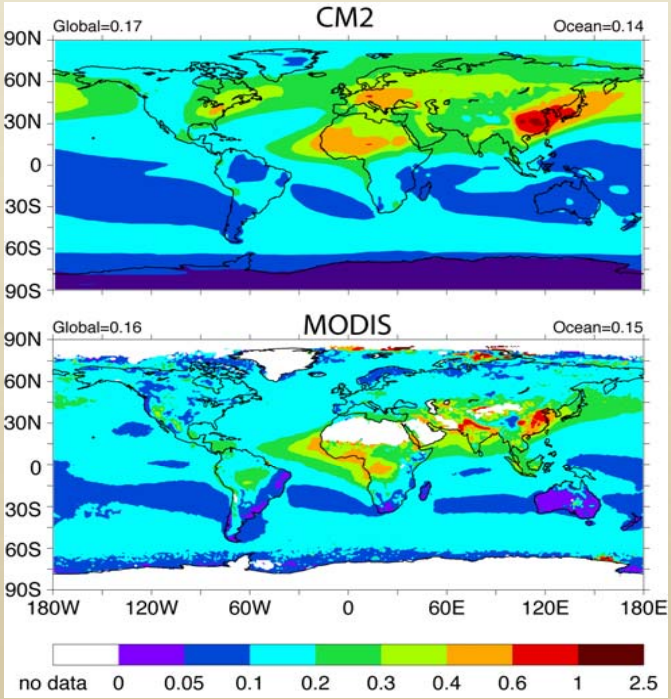
Off-line Aerosols in CM2

CM2 forcing for AR4 with off-line aerosols

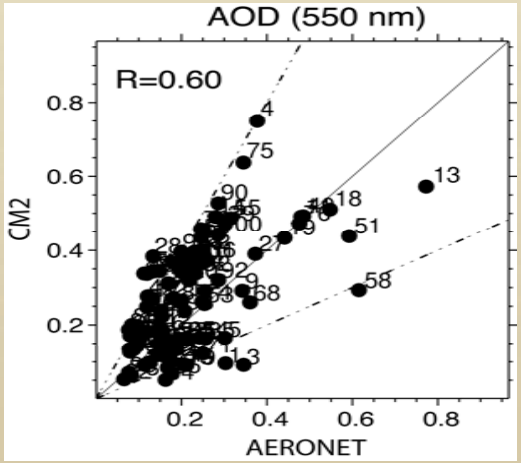
- Monthly mass distribution for $SO_4^=$, OC, BC, dust from MOZART (*Horowitz et al., 2003*), fixed sea-salt
- Anthropogenic emission (*Horowitz 2006*)
- Hygroscopicity for $SO_4^=$ only
- External mixing



AOD (550nm)

CM2 > 2 x Obs. in polluted area

CM2 < 0.5 x Obs. in biomass burning area



Ginoux et al., 2006

On-line aerosols in AM2n

- Nudging capability with NCEP re-analysis for u, v, T, q, p_s
- Emission, transport, and removal of $SO_4^=$, OC, BC, sea-salt and dust on-line
- Simplified S chemistry (O_3, OH, HO_2, NO_3, jH_2O_2 prescribed)
- Anthropogenic emission from AeroCom
- Hygroscopicity of $SO_4^=$, OC, sea-salt
- Updated optical properties

Comparison with ground-based network or satellite data:

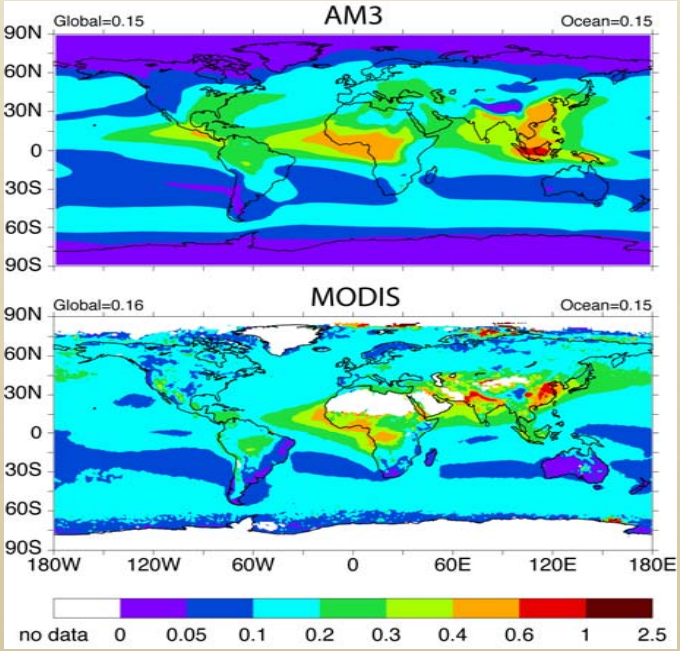
- Surface concentration: NOAA PMEL, U. Miami data, IMPROVE, EMEP
- Column burden: AERONET, SCIAMACHY for SO_2
- Size distribution: AERONET
- Extinction coefficient profile: MPLNET, CALIPSO
- Optical properties (AOD, Scattering, Absorption)
  - Ground-based: NOAA ESRL, AERONET
  - Satellite: MODIS, MISR, OMI, AVHRR, PARASOL

(Ganguly et al., 2009a, and 2009b; Li et al., 2008, and 2009; Magi et al., 2009)

On-line aerosols in AM3

In addition to AM2n developments:

- Full O_3 chemistry (MOZART)
- Internal mixing of $SO_4^=$ with BC
- Prognostic equation for cloud droplet number
- Anthropogenic emission from IPCC AR5
- New transport schemes for convection and advection

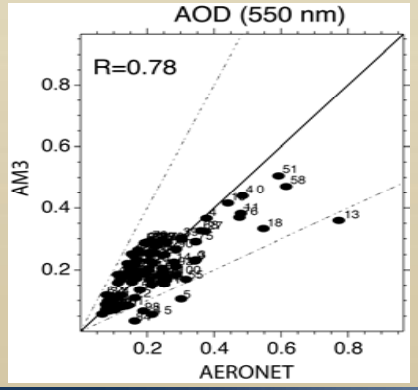


AOD (550nm):

AM3 ~ Obs. in polluted and biomass burning area

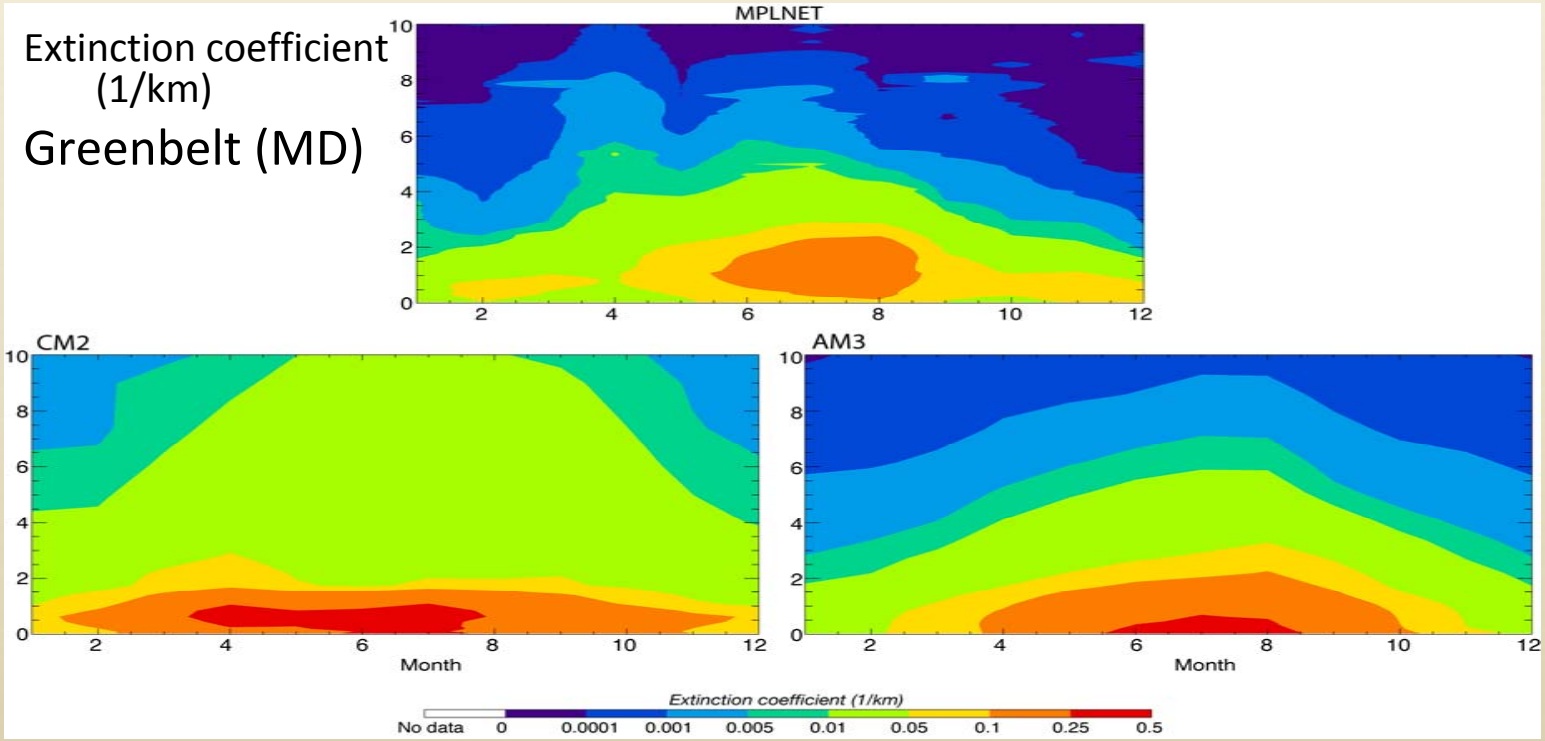
AM3 > 2 Obs. over volcanoes

AM3 < 0.5 Obs. In high latitudes



CM2 / AM3 Aerosol Extinction Profile

Importance of realistic profiles for atmospheric heating by absorbing aerosol and long range transport of tracers.



As observed, extinction coeff. decrease by 2-3 orders of magnitude in troposphere for AM3 (compare to 1 order for CM2)

Improvement essentially due to new convective and advective schemes

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