IMPACT/DAO Model Description

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IMPACT/DAO

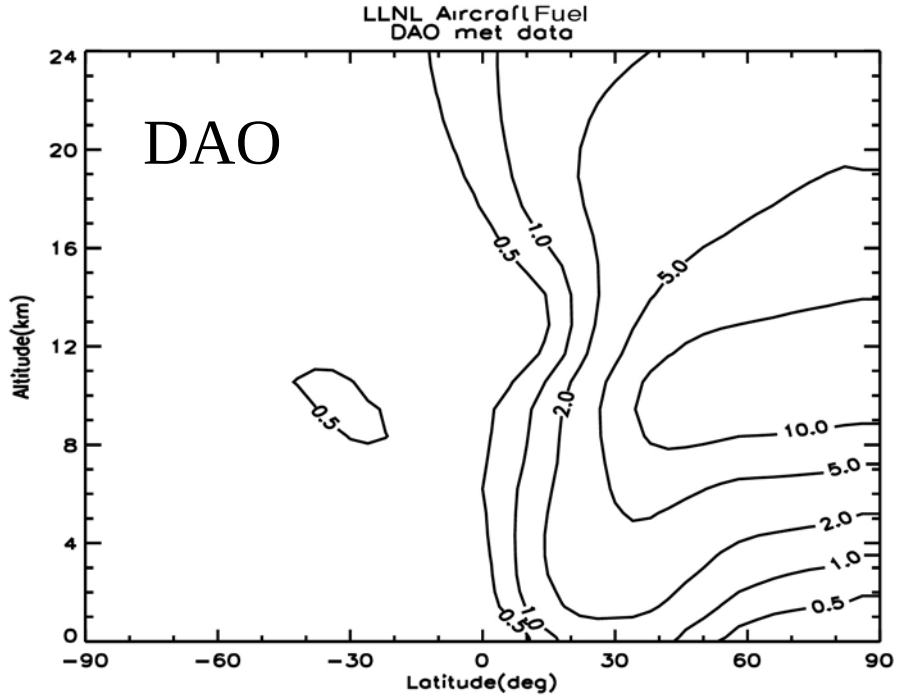
- Uses NASA DAO 1997 meteorological fields
  - No soil moisture, no 10 m wind fields
  - Dust, sea salt not interactive
- Uses IPCC-recommended emissions inventories except for dust (from Ginoux for 1997 DAO winds)
- Emissions put into BL for dust and biomass burning
- Wet scavenging as in Harvard GEOS-CHEM model except that large scale scavenging uses 0.5 g/m3 for LWC
- Dry deposition as in Zhang, Gong et al. [AE, 2001]

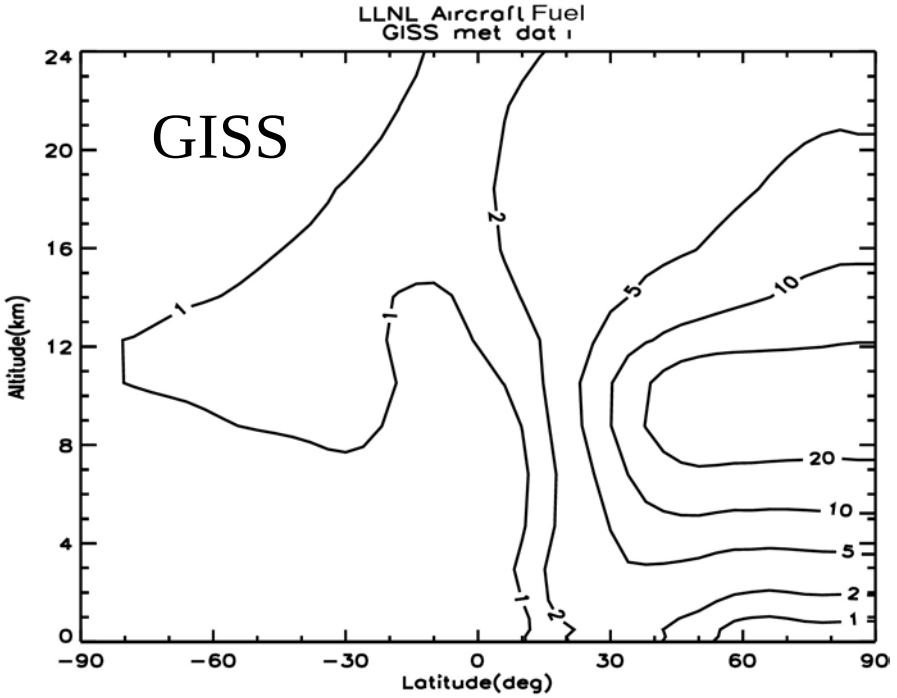
Unique features

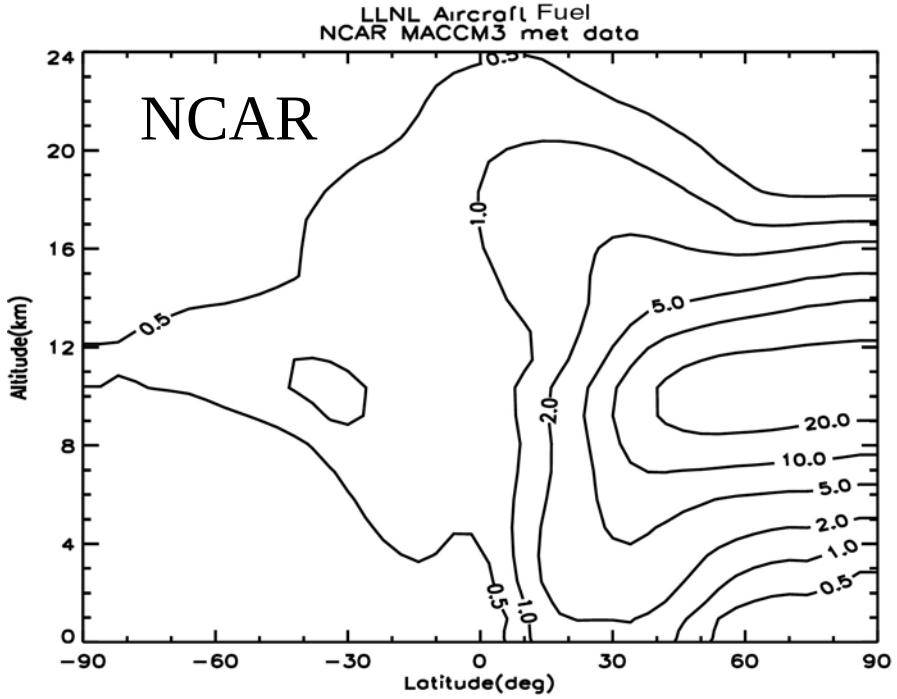
- DAO version has improved LWC for sulfate chemistry
- GMI model is based on IMPACT
- Will run with more than one meteorological fields:
  - IMPACT/DAO
  - GMI/MACCCM3
  - GMI/GISSII’

Comparison of burdens

	Burden (Tg)	wet (Tg/yr)	dry (Tg/yr)	Lifetime (days)
DAO	0.058	7.17	1.75	2.40
GISS	0.080	6.92	2.04	3.26
NCAR	0.060	7.31	1.88	2.4
GRANTOUR/CCM1 ffBC+bbBC:				
	0.20	9.56	2.66	5.97
DAO*	0.14	5.00	1.65	7.52







NCAR MACCM3 met data maintain highest gradients for a “fuel tracer” introduced as aircraft emissions

Burdens:

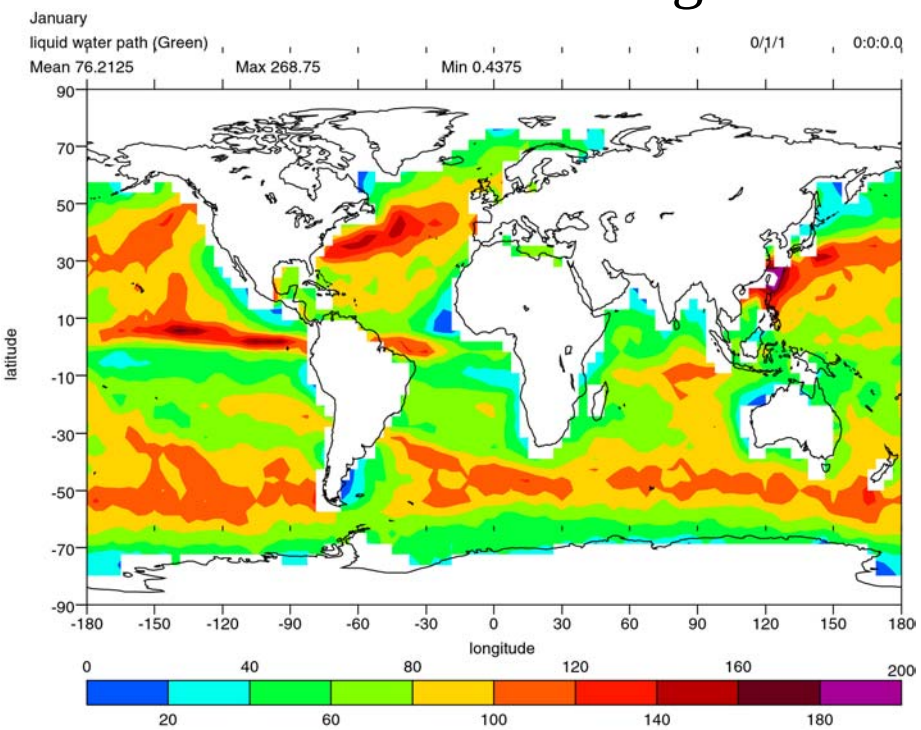
DAO	3.3e-4 Tg
GISS	5.7e-4 Tg
NCAR	4.1e-4 Tg

Adding sulfate to IMPACT/GMI

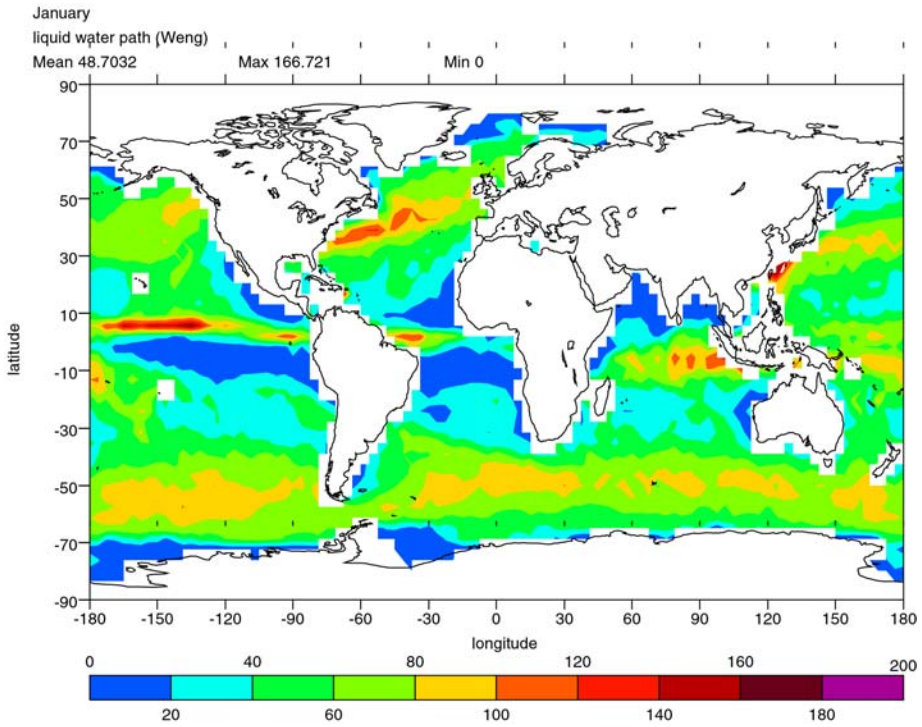
Need LWC of clouds to calculate aqueous conversion of SO_2 to SO_4

Comare LWP from models to data:

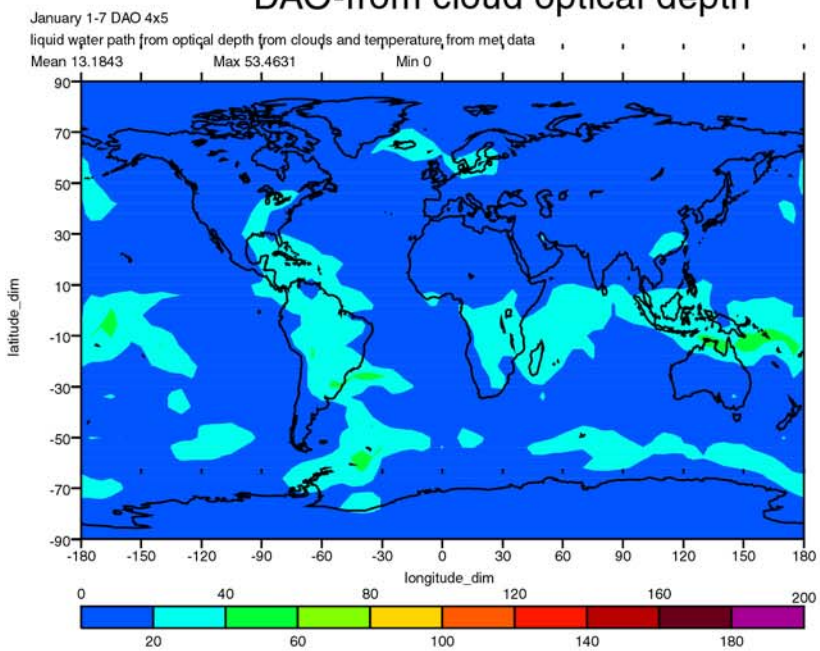
Greenwald: 76.2 g/m2



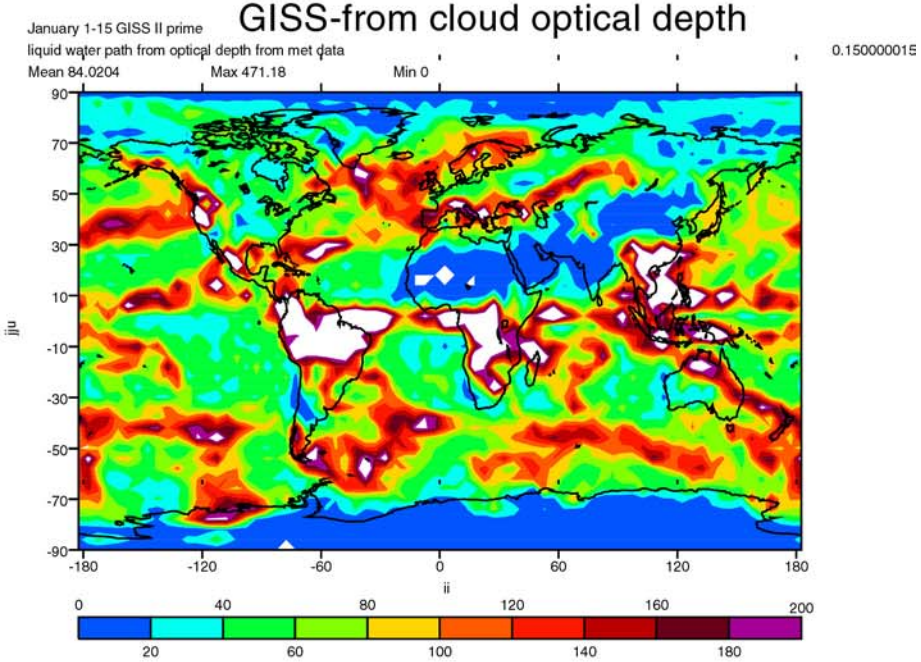
Weng: 48.7 g/m2



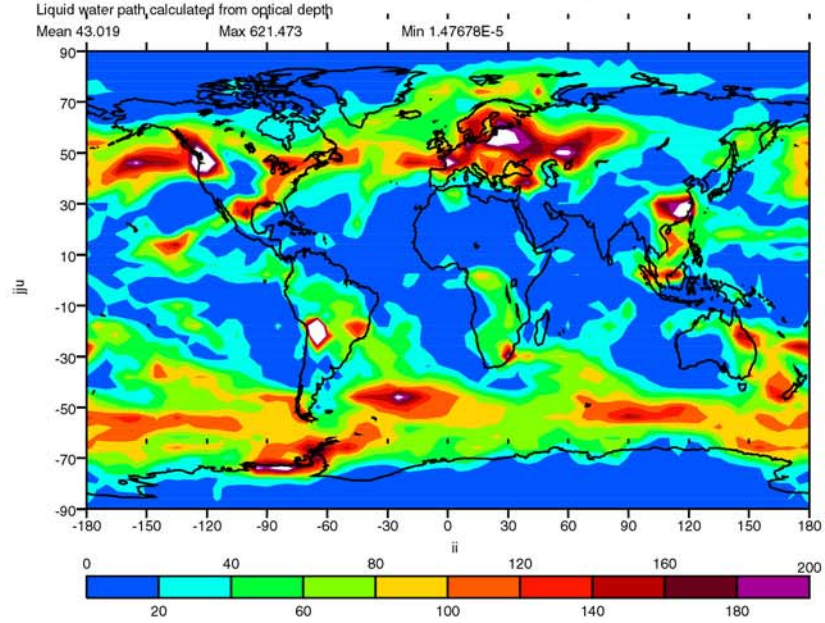
DAO-from cloud optical depth



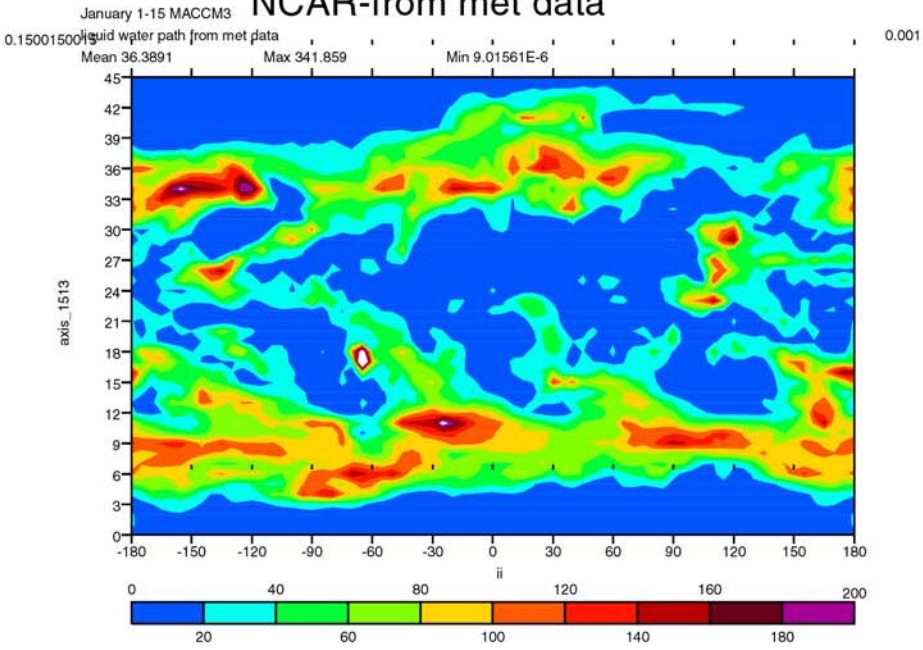
GISS-from cloud optical depth



NCAR-from cloud optical depth



NCAR-from met data

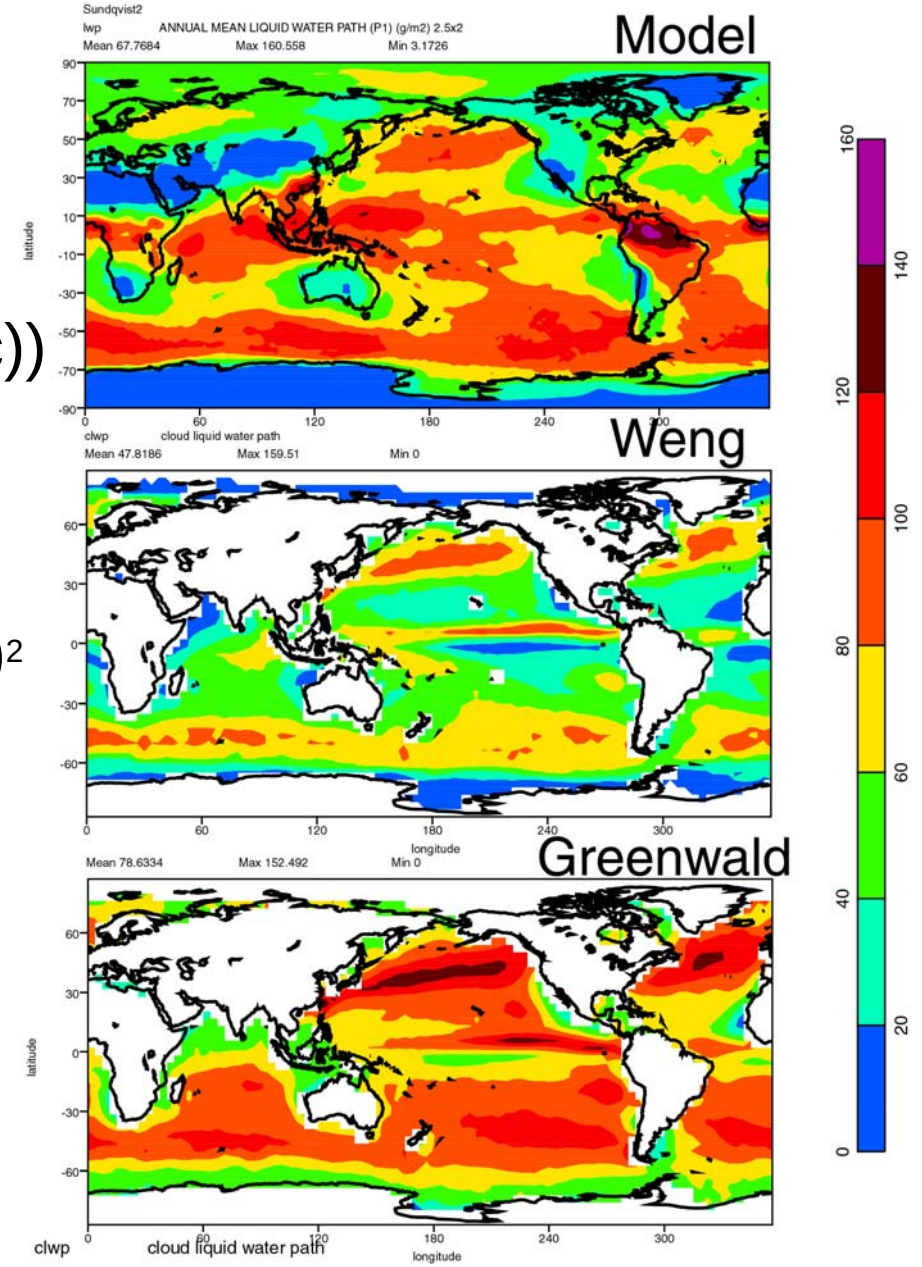


Comparison of LWP from IMPACT/DAO and data

$LWC=0.18(g/m3)e^{-Z/H}$

Large scale:
CF=1-sqrt(1-(RH-RHc)/(1-RHc))
(Sundquist et al 1989)

Convective:
$CF=C_0+C_1\log(Mc)+C_2(\log(Mc))^2$
(Xu and Krueger, 1991):

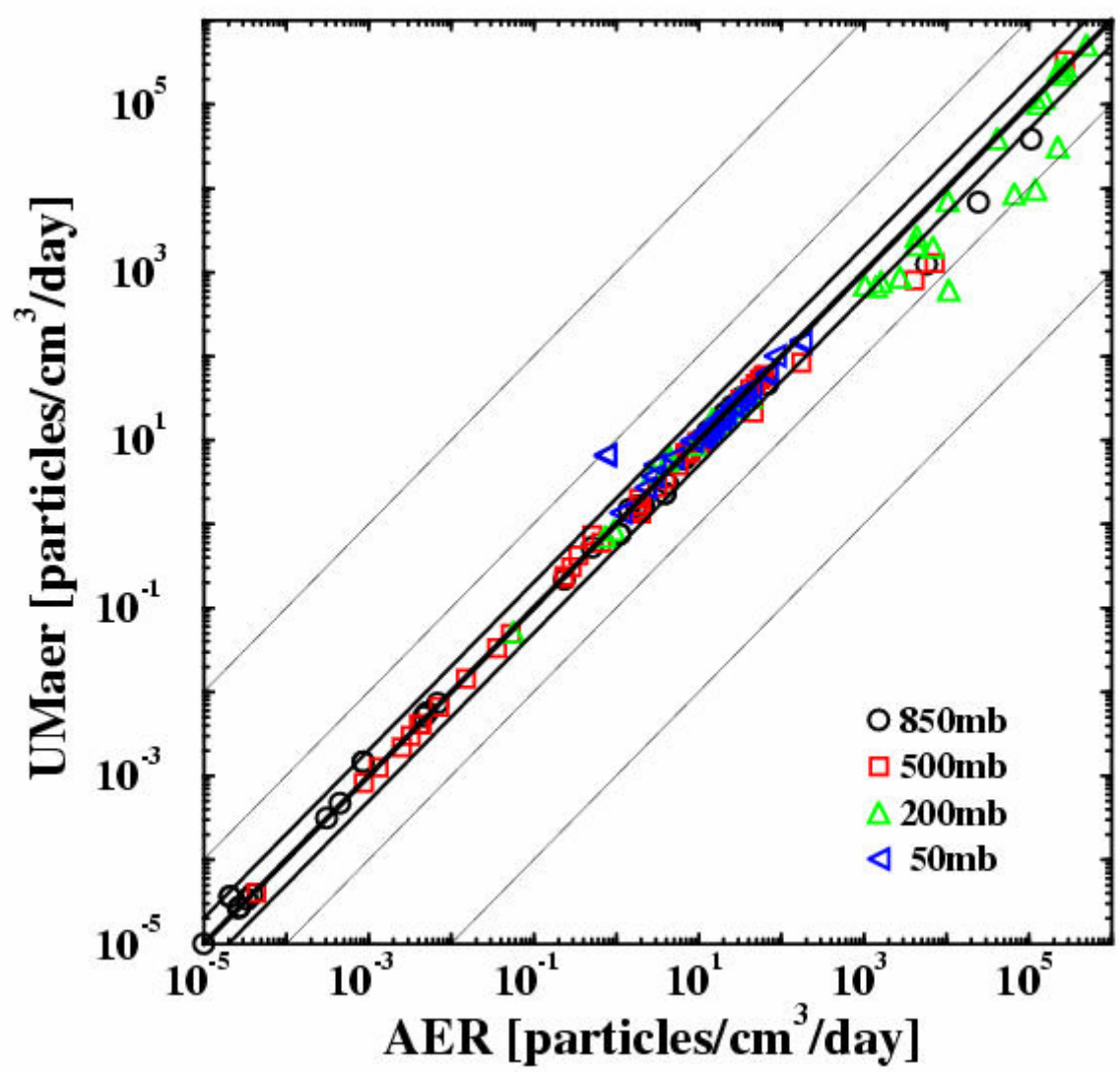


Near term plans: Implement aerosol dynamic model

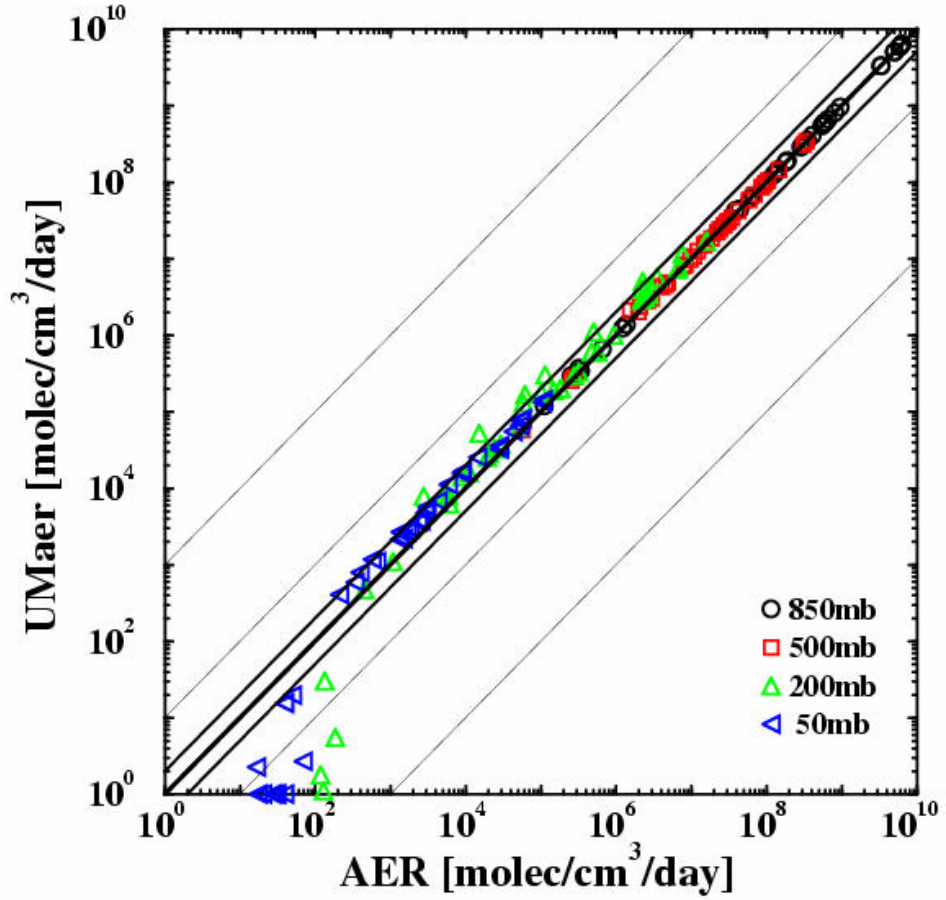
Aerosol dynamic modules

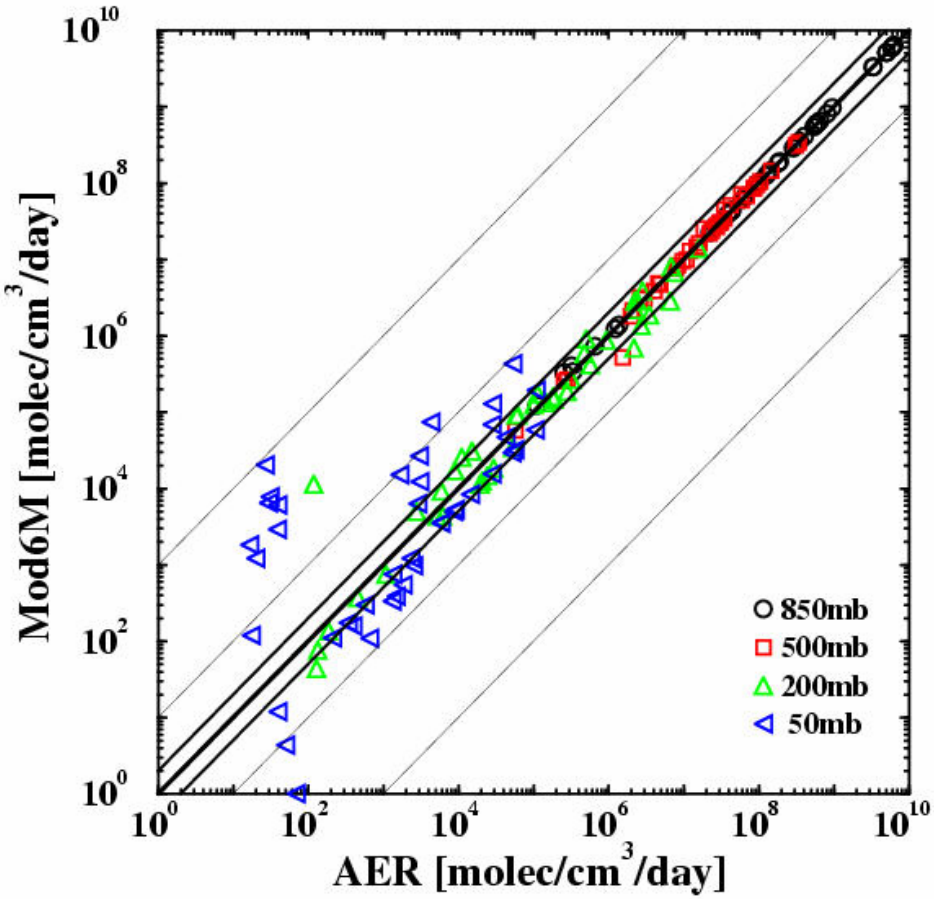
- AER: sectional model, 40 size bins (0.39nm < r < 3.2μm)
- Mod6M: quadrature method of moments
- UMaer: model of modes and moments

Nucleated particles after 1 day

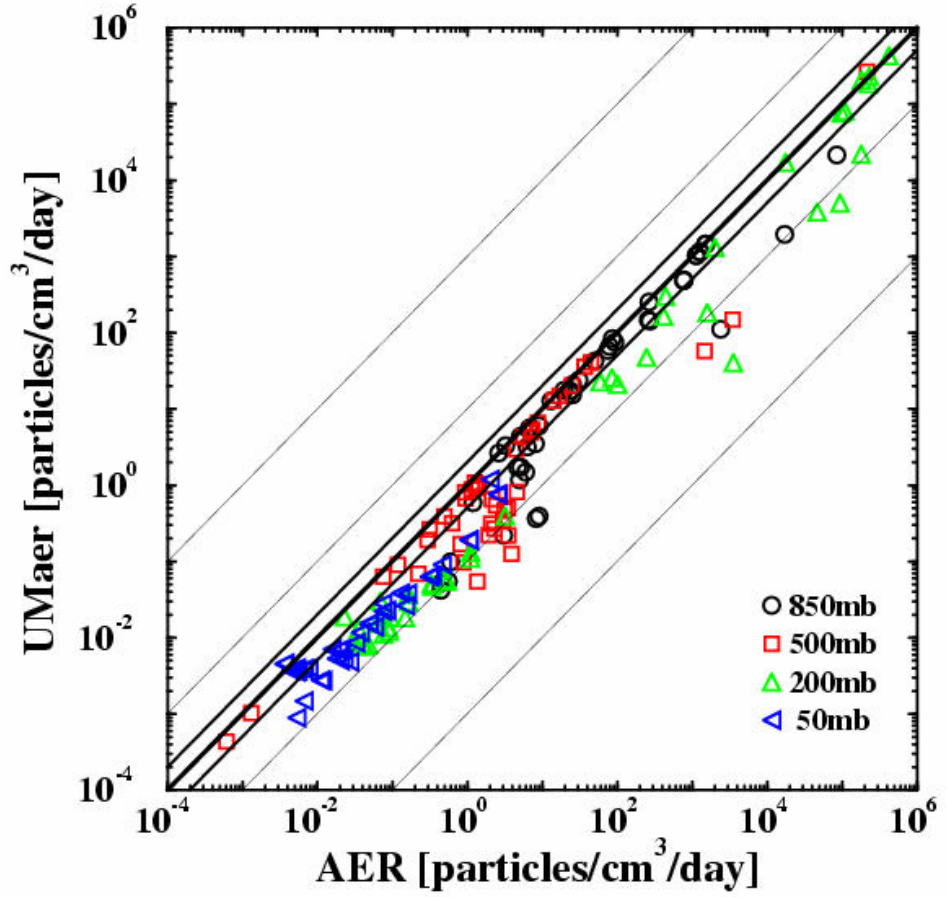


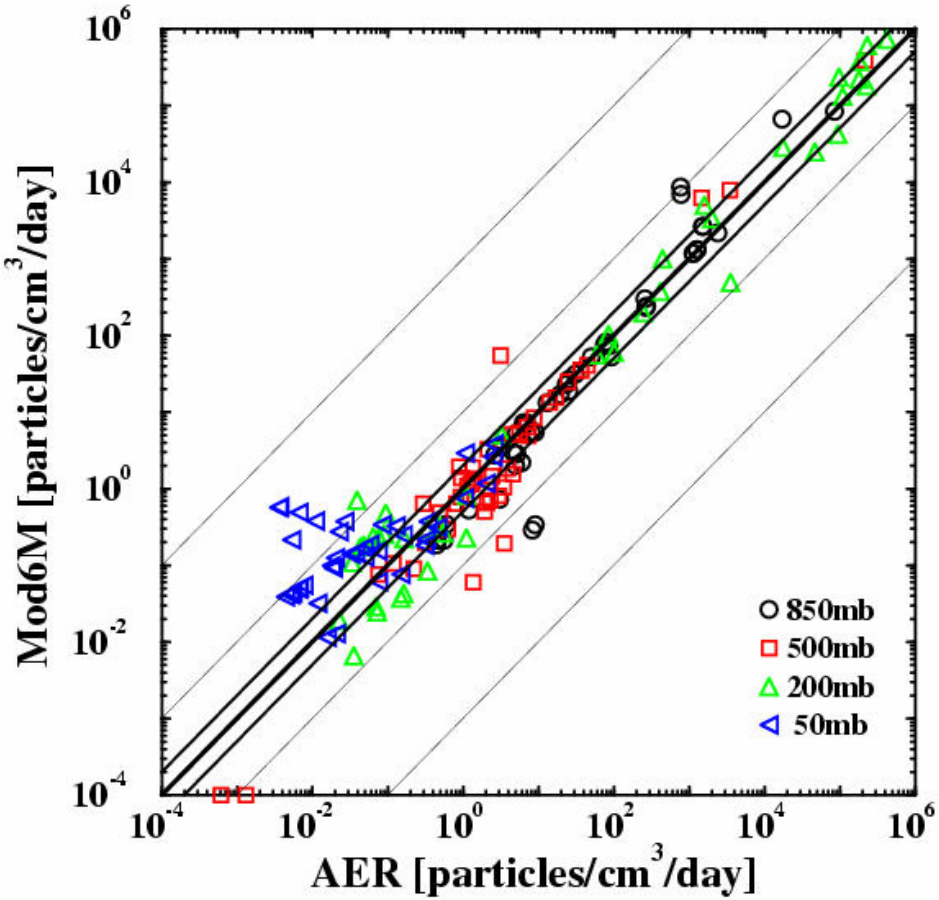
Condensation after one day



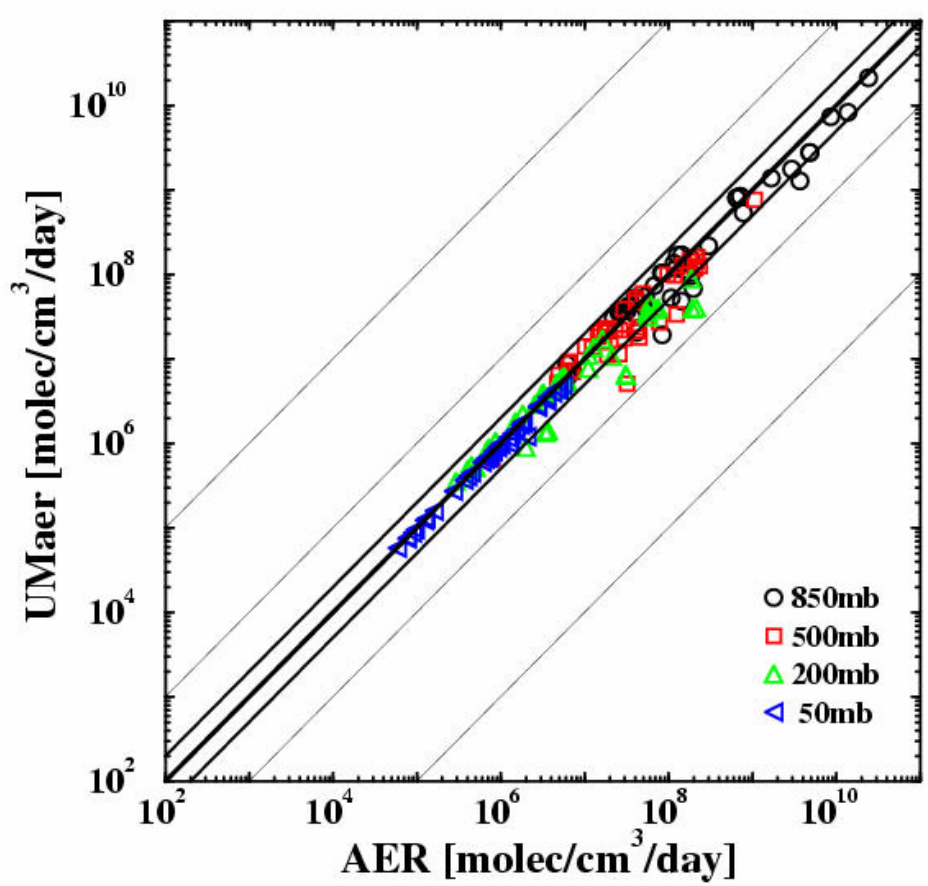


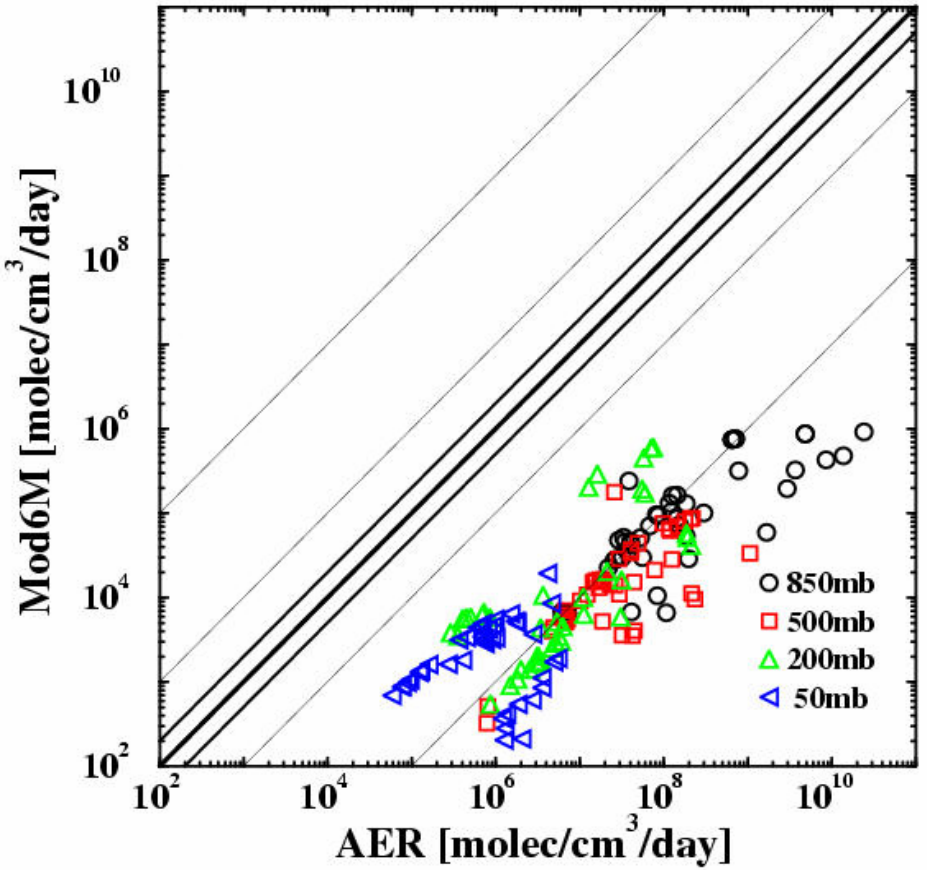
Coagulation after one day





Gravitational settling after 1 day





Accumulation mode after one day