Thanks to:

Bryan Duncan
for inspiration
and for letting
me stealing his
slides

Steve Steenrod
Steven Pawson
Hiroo Hayashi
for GEOS-4
data

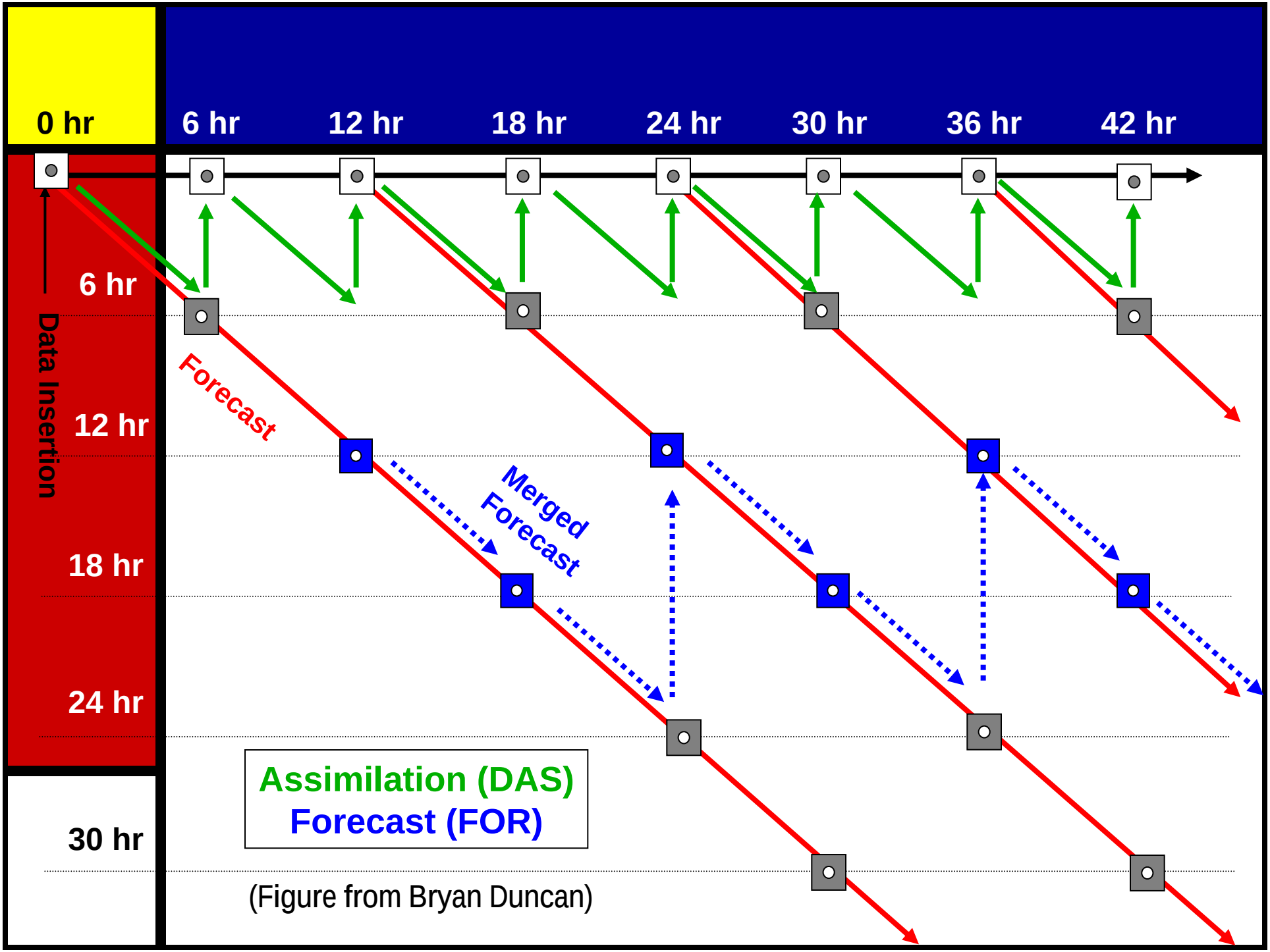
NASA MAP
for "funding "

Preliminary results of GOCART aerosol simulations with the GEOS-4 assimilated and forecast fields

Mian Chin & Thomas Diehl
NASA GSFC

Purpose

- Estimate the differences in simulated aerosols from two GEOS-4 meteorological fields:
  - GEOS-4 assimilated fields
  - GEOS-4 "band aid" forecast fields
- Evaluate "Which one is better?"



(Figure from Bryan Duncan)

GOCART model experiments

- Identical model set-up and emission inventories but using two met fields: assimilated or meteorological fields "band aid" 12-18 hour forecast meteorological fields
- Three-month runs from 200102 to 200104, only 200104 results are used here
- Simulated species are:
  - DMS, SO_2, Sulfate, MSA
  - BC, OC
  - Dust
  - Sea-salt

Budget 200104

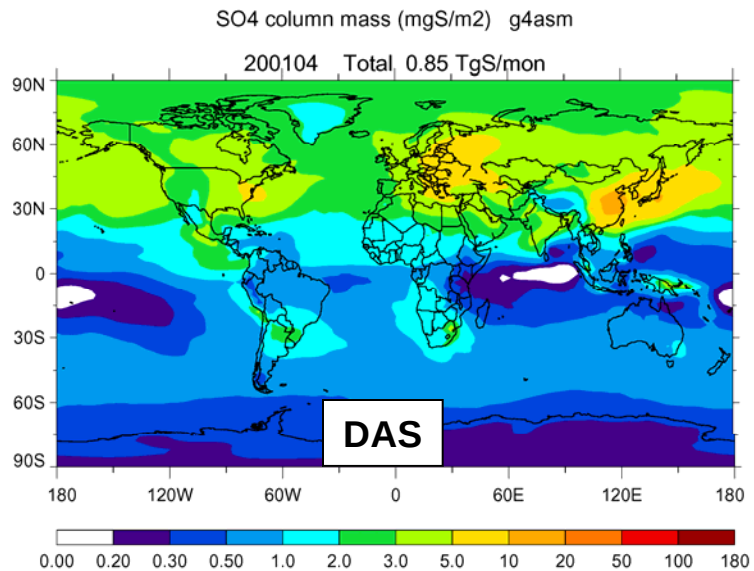
Sources

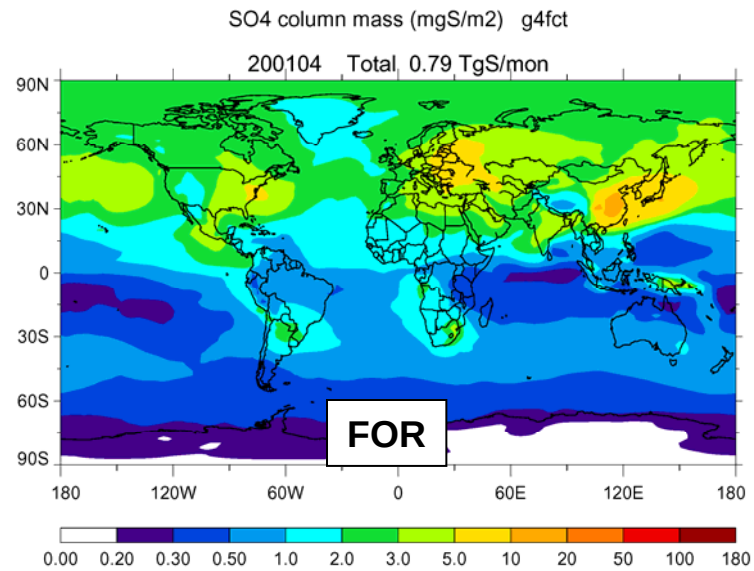
	DAS	FOR	FOR / DAS
BC (TgC)	0.90	0.90	1.00
OC (TgC)	4.59	4.59	1.00
SO_2 (TgS)	6.45	6.45	1.00
Sulfate (TgS)	4.87	5.06	1.04
Dust (Tg)	398.91	412.11	1.03
Sea-salt (Tg)	728.97	744.11	1.02

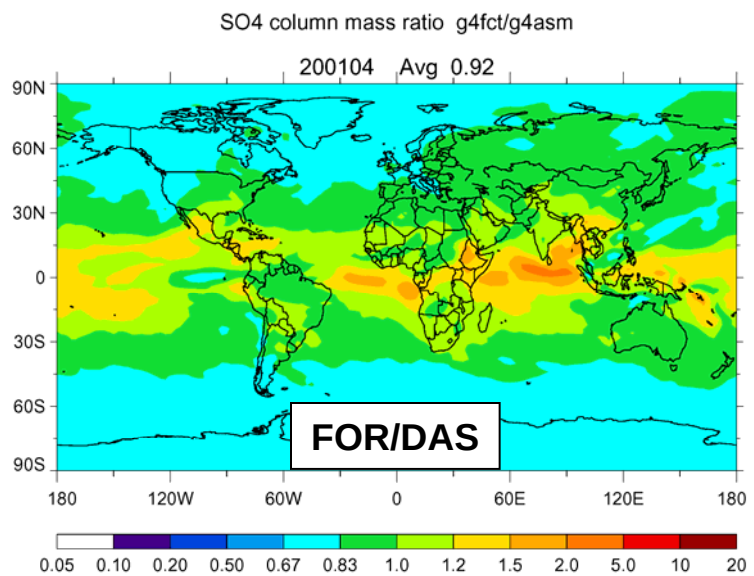
Mass Loading

	DAS	FOR	FOR / DAS
BC (TgC)	0.24	0.24	1.01
OC (TgC)	0.91	0.96	1.05
SO_2 (TgS)	0.45	0.39	0.87
Sulfate (TgS)	0.85	0.79	0.92
Dust (Tg)	67.45	67.93	1.01
Sea-salt (Tg)	18.09	15.23	0.84

Sulfate mass loading

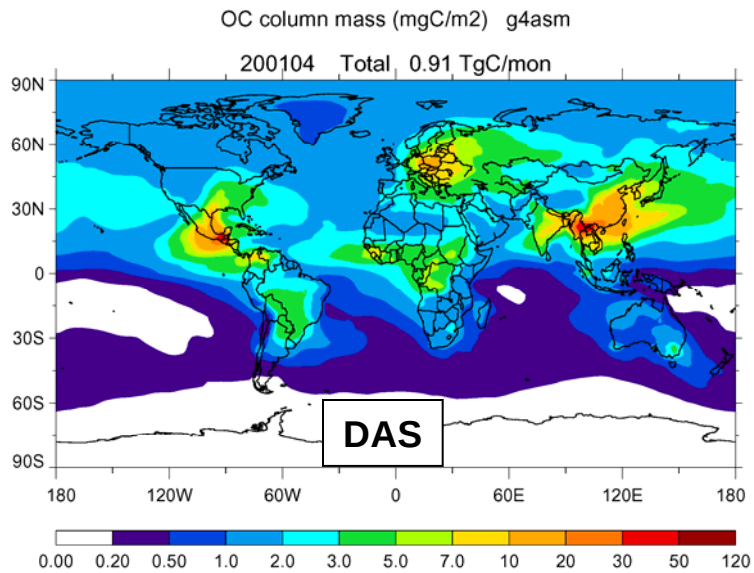


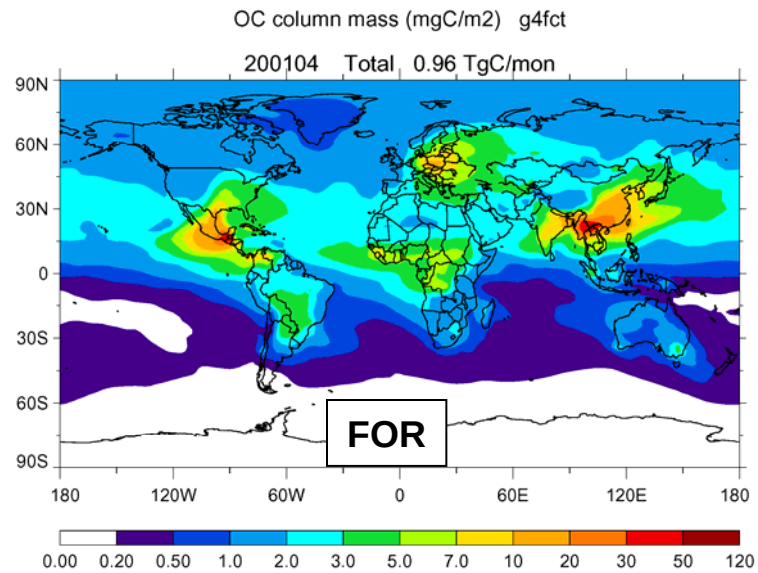


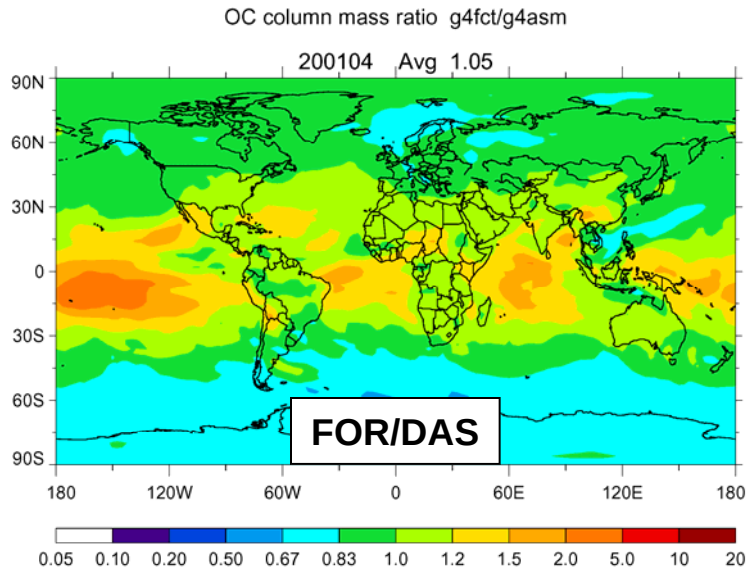


- ▲ Tropics: FOR > DAS by 0 to >100%
- ▼ Extra tropics: FOR < DAS by 0 to 50%

OC mass loading

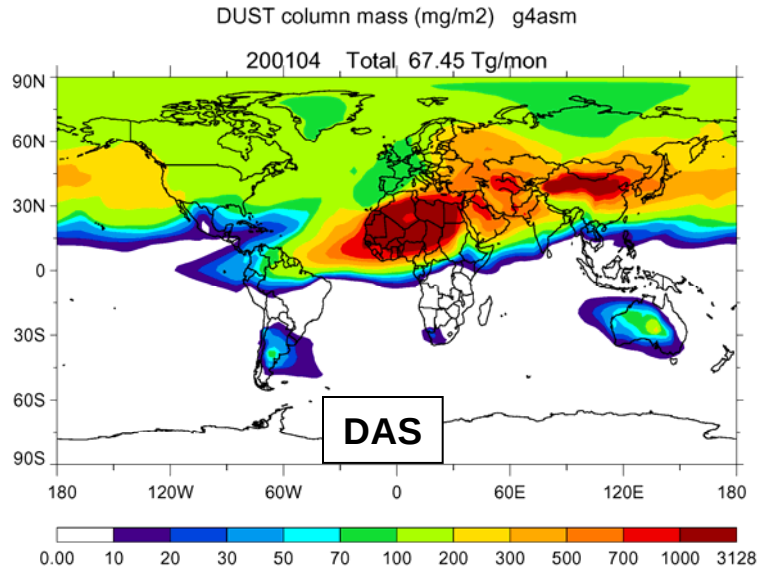


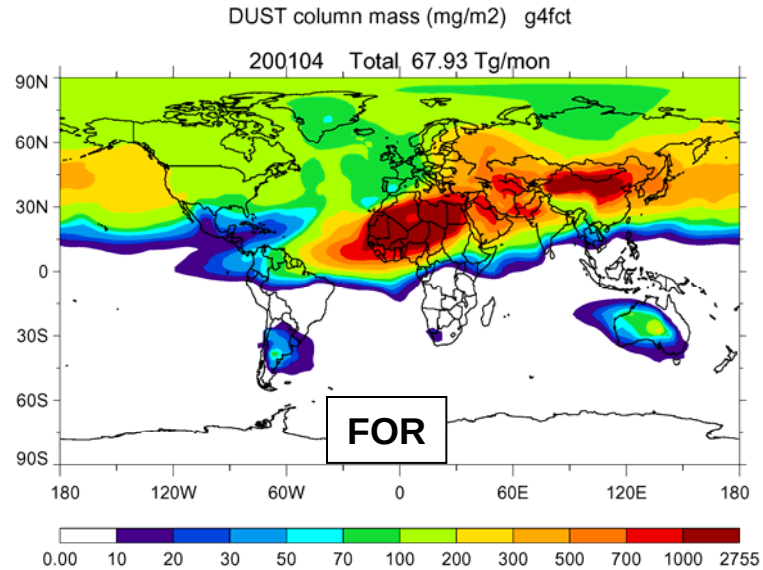


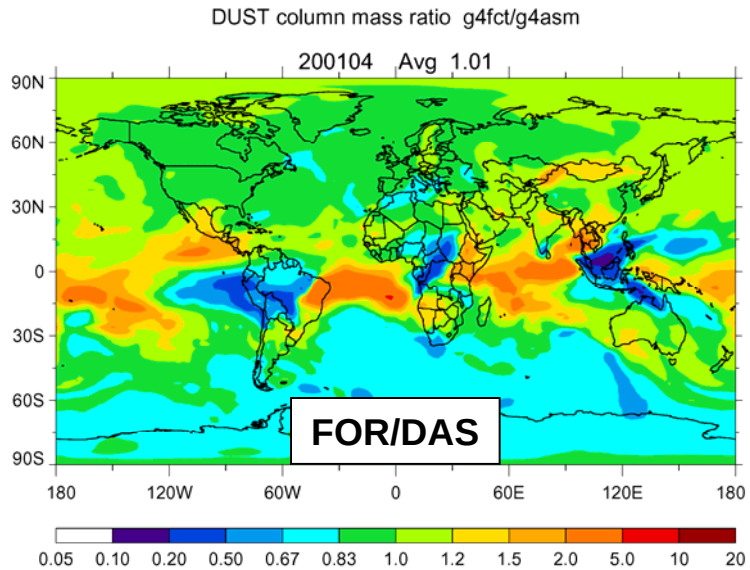


- ▲ Tropics: FOR > DAS by 0 to >100%
- ▼ Extra tropics: FOR < DAS by 0 to 50%

Dust mass loading

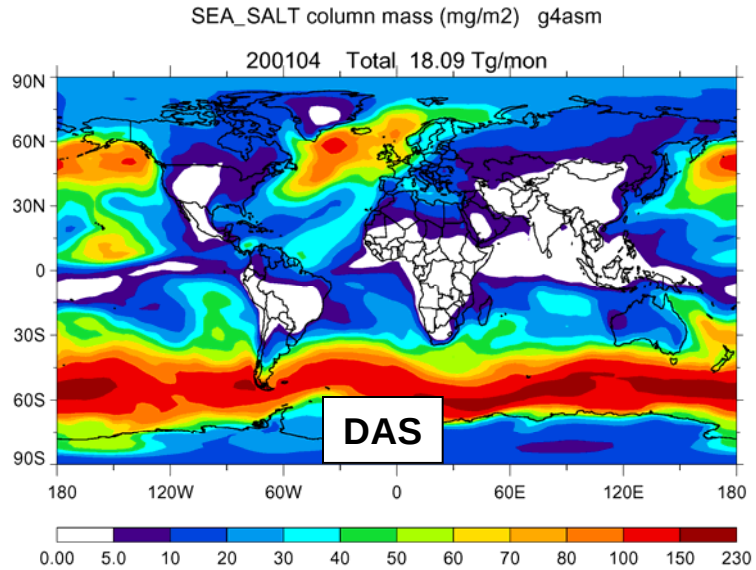


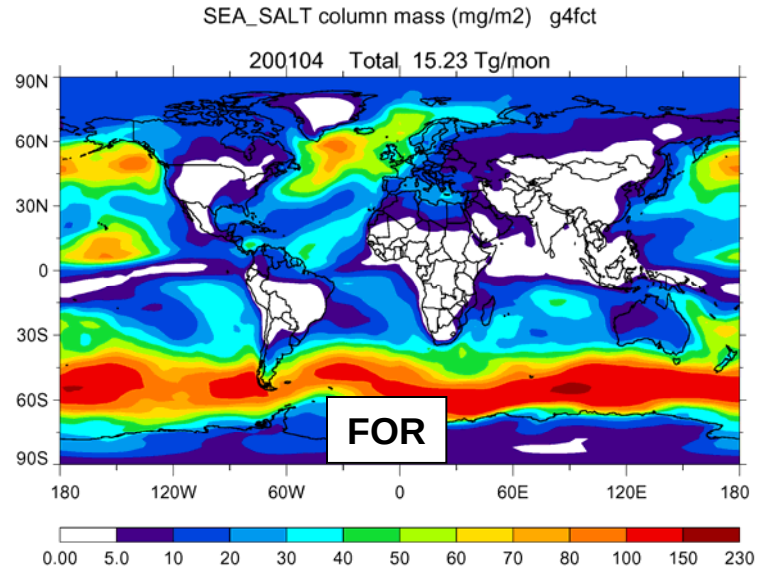


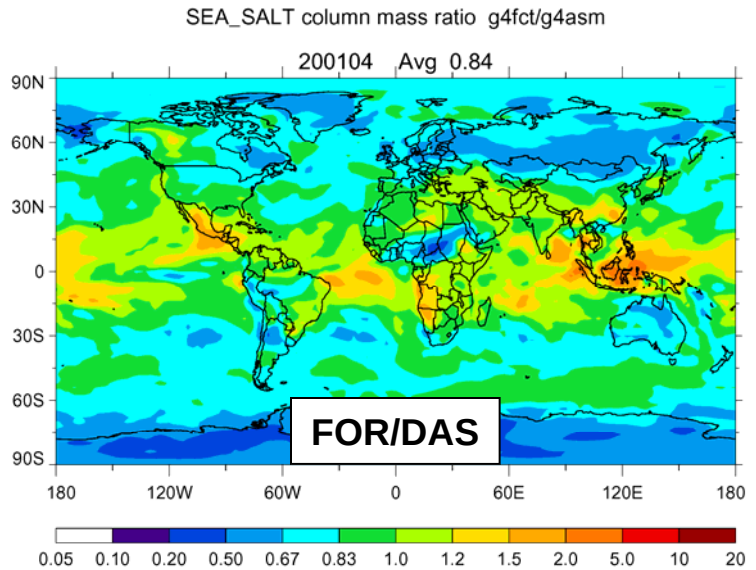


- ▲ Tropical ocean: FOR > DAS by 20 to 400%
- ▼ Tropical land: FOR < DAS by 0 to 400%
- ■ NH Extra tropics: FOR and DAS comparable, within 20%
- ▼ SH Extra tropics: FOR < DAS by 20 to 50%

Sea-salt mass loading

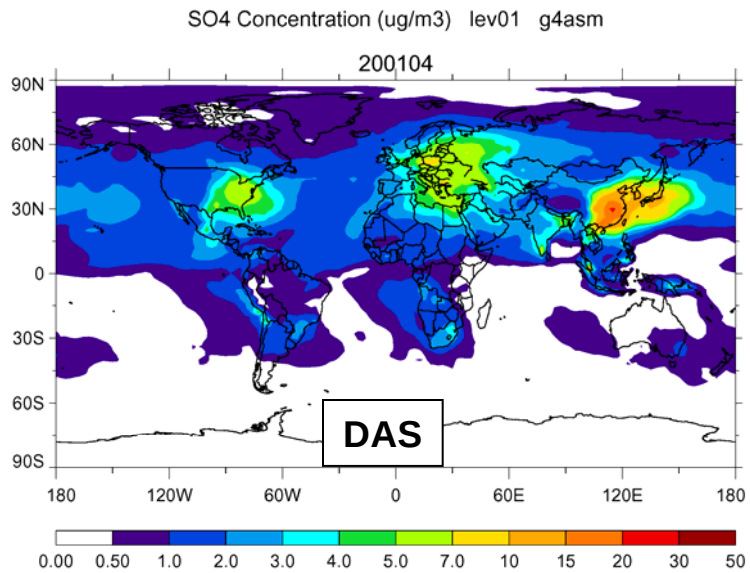


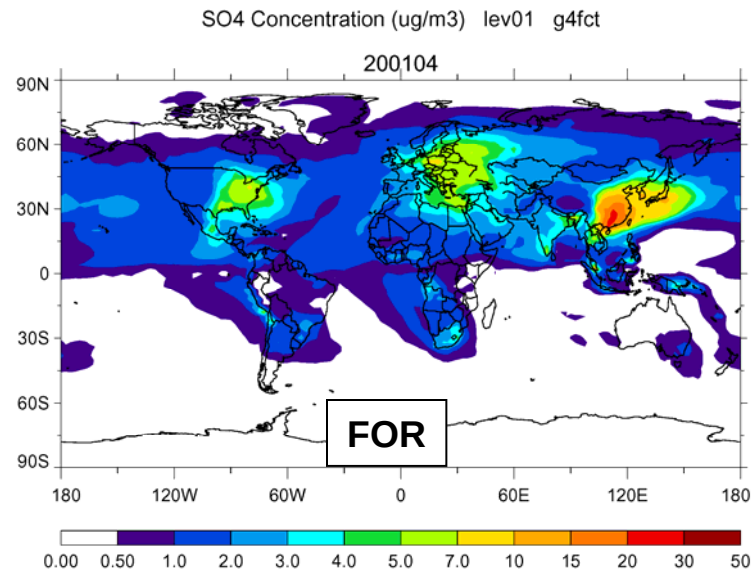


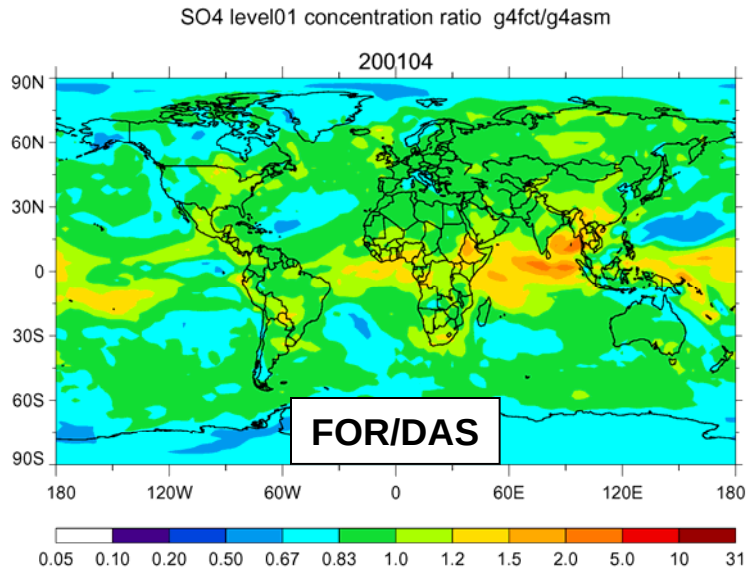


- ▲ Tropics: FOR > DAS by 0 to 100%
- ▼ Extra tropics: FOR < DAS by 20 to 400%

Sulfate surface concentrations

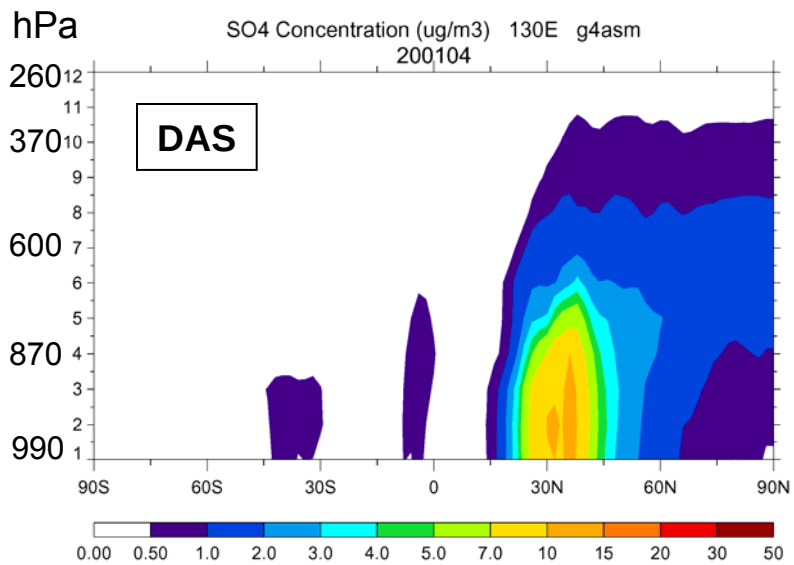


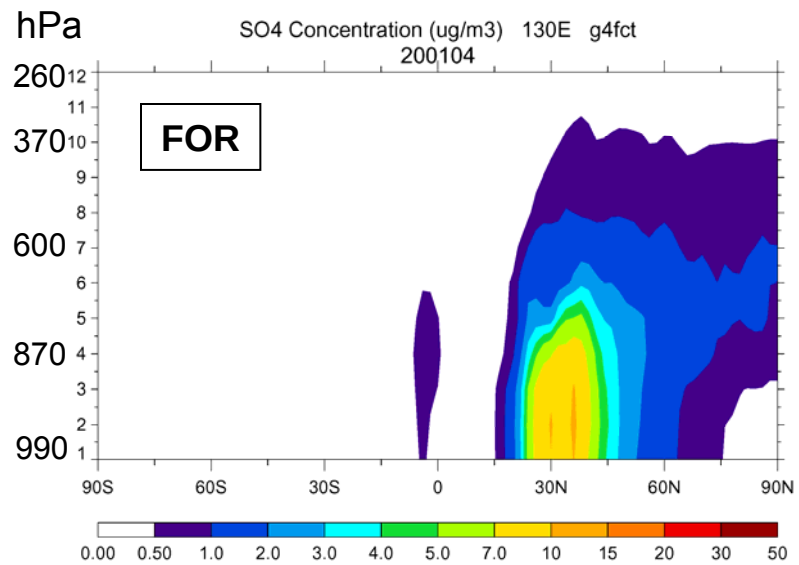


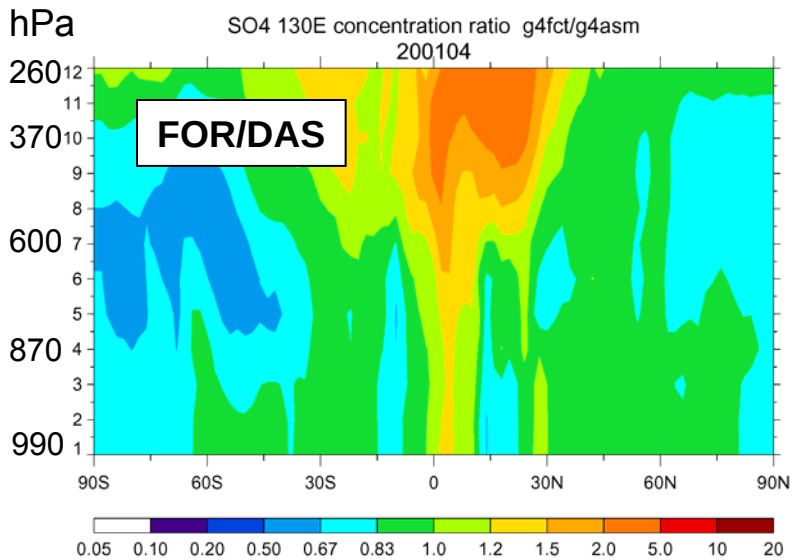


- ▲ Tropics: FOR > DAS in general
- ▼ Extra tropics: FOR < DAS in general

Sulfate vertical distribution along 130°E

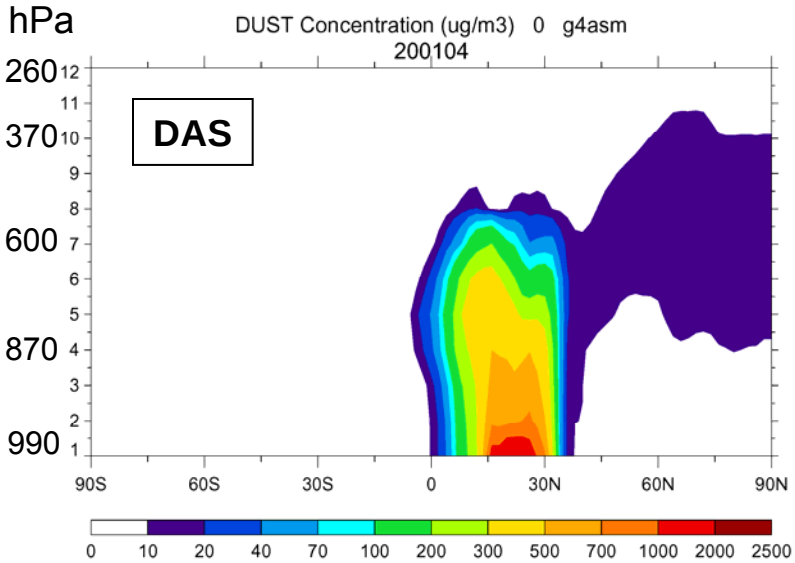


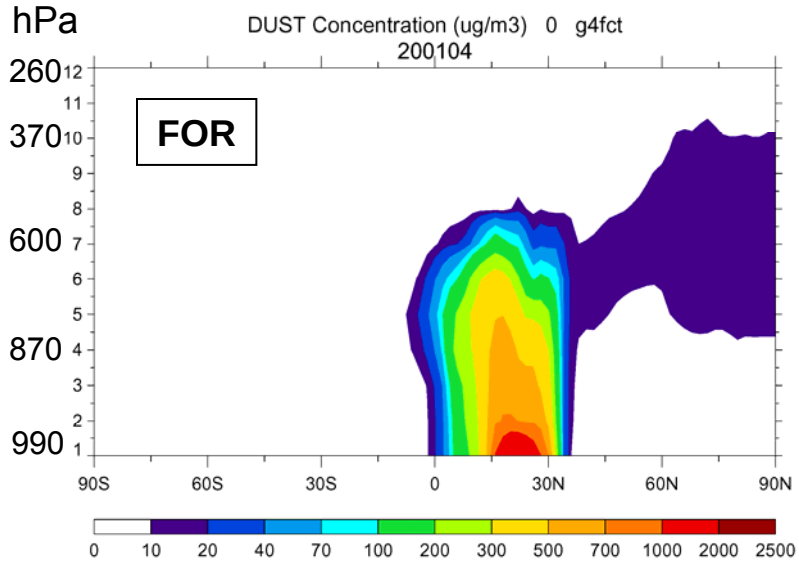


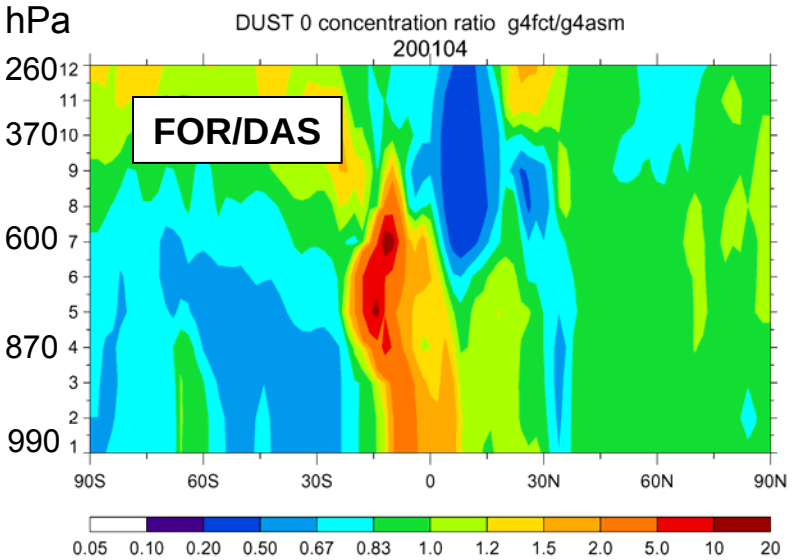


- ▲ FOR > DAS over tropics, by a factor of 2 to 5 at high altitudes (not much stuff there though)
- ▼ FOR < DAS over extra tropics all altitudes

Dust vertical distribution along 0°

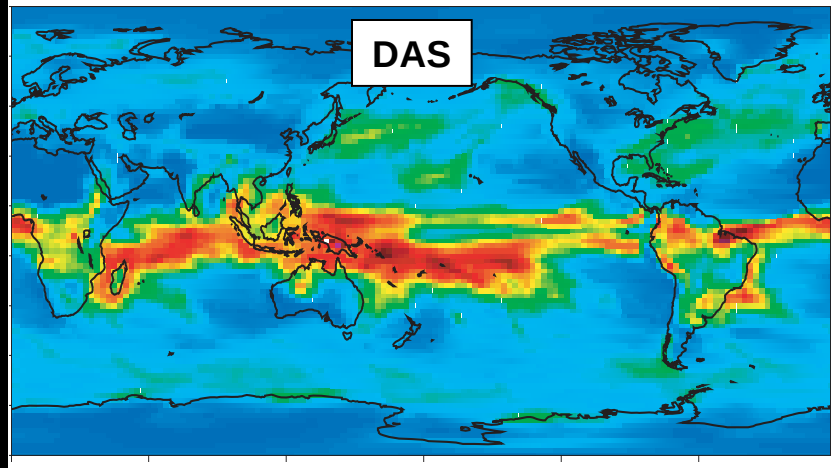


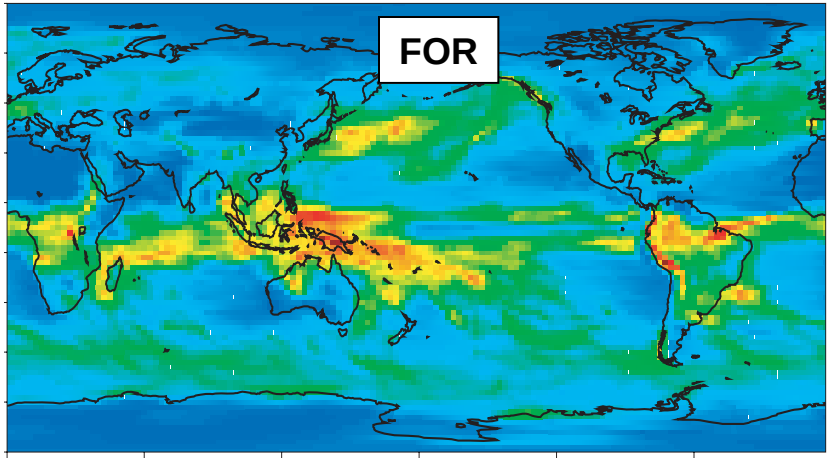


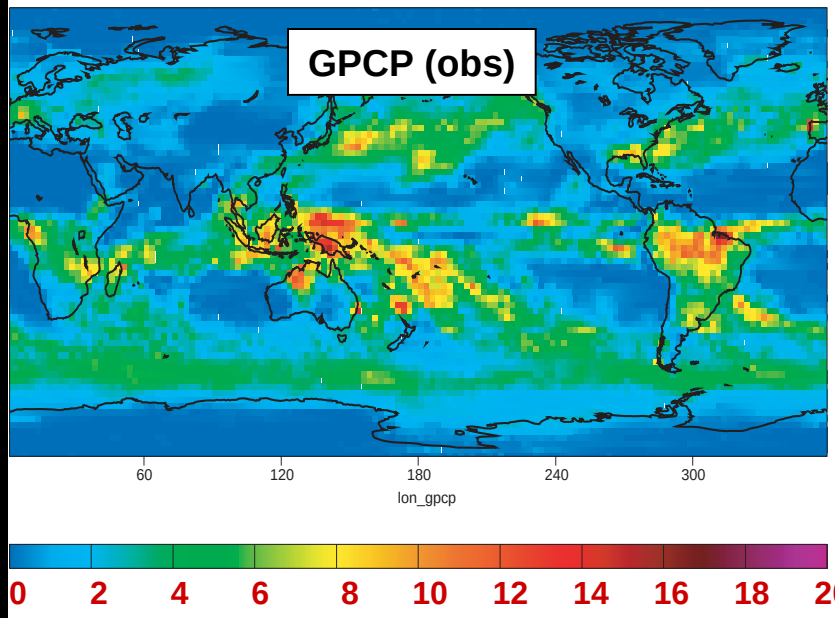


- ▲ FOR > DAS over tropics at altitudes lower than 370 hPa
- ▼ FOR < DAS over tropics at altitudes higher than 370 hPa (not much stuff there though)
- ▼ FOR < DAS over extra tropics at most altitudes

Precipitation

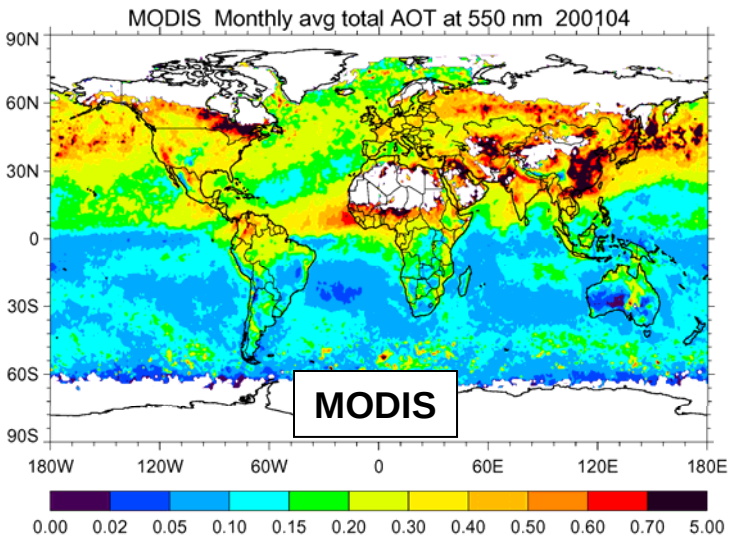


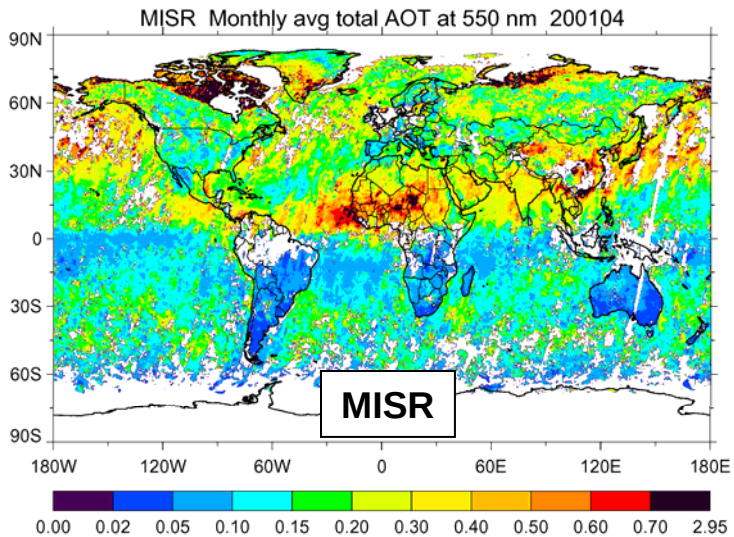


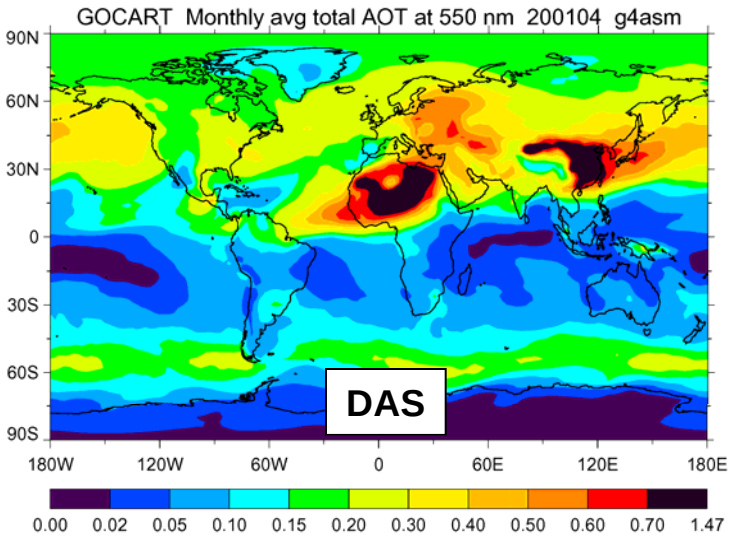


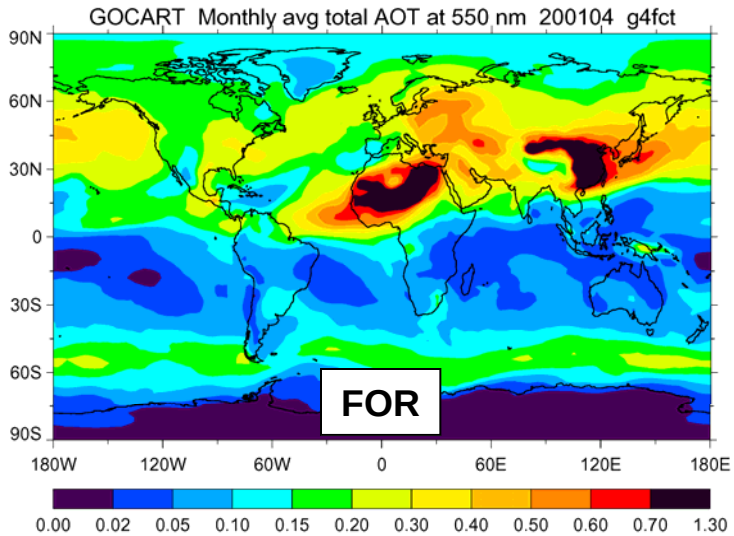
- Forecast shows much better precipitation than DAS compared with GPCP
- Precipitation from DAS is too high in the tropics but too low over the extra tropics

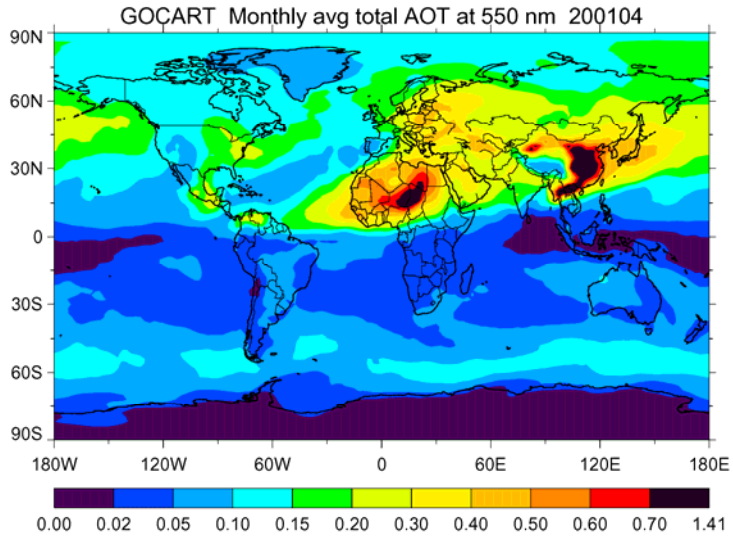
Comparison with MODIS and MISR





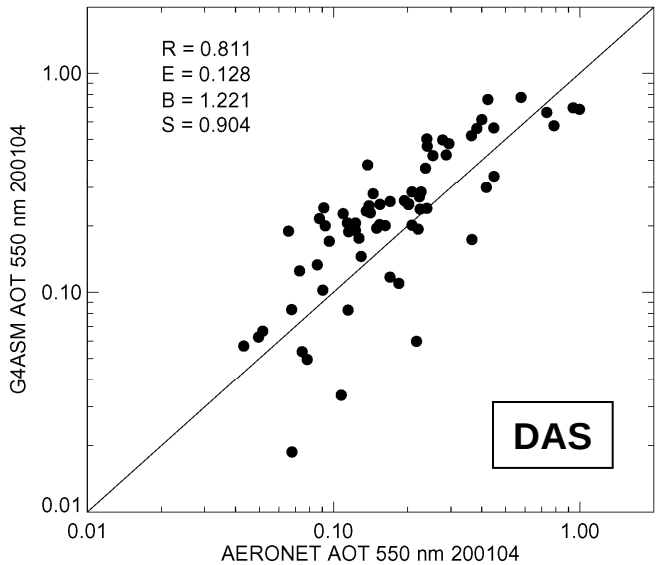


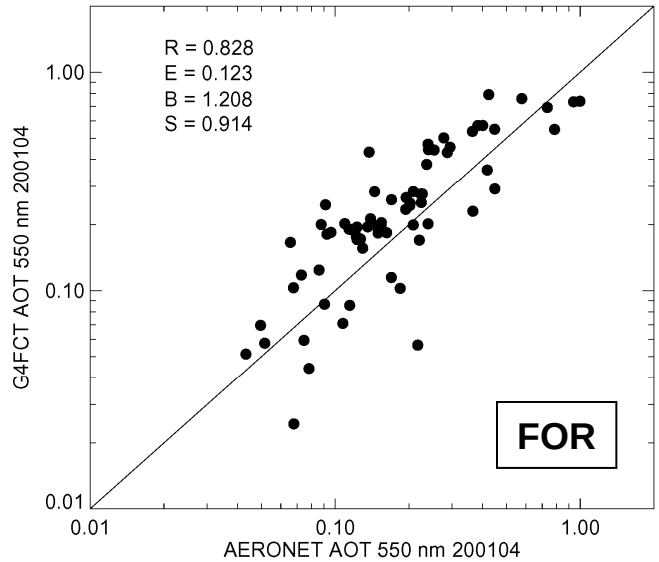


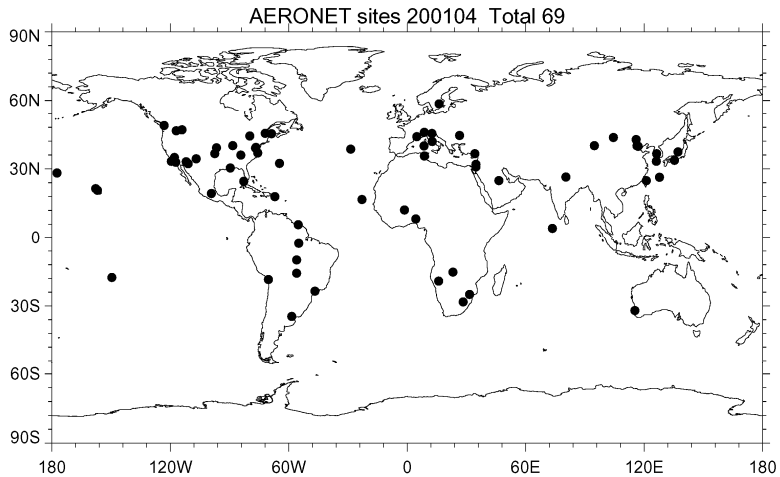


GEOS-3 version

Comparison with AERONET







Total column AOT:

☺ FOR is somewhat better than DAS

Conclusions

- Simulations with assimilated and "band aid" 12~18 hr forecast met fields show noticeable differences in aerosol distributions, with forecasted aerosols HIGHER in the TROPICS but LOWER in the EXTRA TROPICS
- This is mainly due to the differences in the convection and precipitation met fields
- AOT from the forecast met fields agrees better with the AERONET measurements than that from the assimilated met fields for 200104
- Comparisons in other seasons are needed
- Comparison with observed vertical distributions is the KEY
- More evaluations of the results with observations from aircraft (e.g. ACE~Asia) and surface (e.g. EPA) are in progress