

Evaluation of recent model submissions with AeroCom tools

Michael Schulz

Jan Griesfeller (LSCE),

Stefan Kinne (MPI), Paul Eckhardt(NILU)

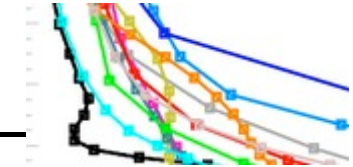
Toshihiko Takemura (Kyushu Univ), Mian Chin (NASA)

Graham Mann (Univ Leeds), Alf Kirkevag (Univ Oslo)



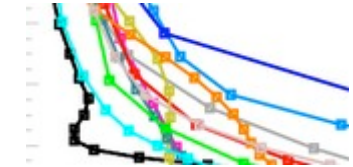
Laboratoire des Sciences du Climat et de l'Environnement

AeroCom phase II final planning



EXPERIMENTNAME	EXPERIMENT_NUMBER	Short Description	YEAR
IND2	CTRL / PRE	Indirect effect diagnostics	2000 / 1860
A2	CTRL	AeroCom phase II reference	2006
A2	SIZ1	As CTRL but with condensation switched off	2006
A2	SIZ2	As CTRL but with coagulation switched off.	2006
A2	SIZ3	As CTRL but with primary BC/OC and SO4 emissions switched off	2006
A2	SIZ4	As CTRL but with new particle formation switched off	2006
A2	CTRL	Prolongation of A2 run to allow comparison with CALIOP and campaigns in 2007-2008 (eg EUCAARI, EMEP, ARCTAS)	2007-2008
A2	PRE	AeroCom Phase II // Preindustrial emissions, meteo as in CTRL	1860
A2	ZERO	AeroCom Phase II // no aerosol radiative effect , meteo as in CTRL	0000
A2	FIX	AeroCom Phase II // Prescribed aerosol optical properties drive forcing calculation independent of aerosol module	2006
A2	TROP/ARCTIC	Radiative code is forced by albedo = 0.2 and two Standard atmospheres (TROP & ARCTIC)	Two one day simulations // 1st of January 2006
HCA	0	Complete hindcast , with preliminary AeroCom HC emissions	1860+1980-2007 (if cpu limited do 2000-2007 period)
HCA	IPCC	Complete hindcast but with IPCC emission scenario (available summer 2009?)	1860+1980-2007 (if cpu limited do 2000-2007 period)
HCA	FIX	Hindcast as HCA-0 but with fixed emissions corresponding to year 2000	1860+1980-2007
HCA	MET	Hindcast with IPCC emissions BUT only SST prescribed; free running GCMs required, aerosol-climate interactions activated	1860+1980-2007
ACCMIP - IPCC		Coupled Climate aerosol simulation, Time slice experiments, see ACCMIP description	1860-2100 // 1860, 1930, 1970, 2000, 2030, 2050

Commitment Experiment Model

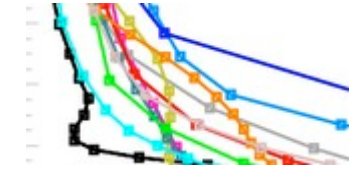


EXPERIMENT	Models
A2	CTRL 2006 HADGEM / SPRINTARS / INCA / TM5 / GISSX / NorAGCM / ECHAM5 / GLOMAP-bin / GLOMAP-mode / UKCA? / CAM3-MAM? / ECHAM-MESSY? / CCCma-GCM4? / GOCART
A2	SIZ1-SIZ4 TM5 / GISSX / NorAGCM / ECHAM5 / GLOMAP-bin / GLOMAP-mode / UKCA? / CAM3-MAM? / ECHAM-MESSY? / CCCma-GCM4?
A2	CTRL 2007-2008 HADGEM / SPRINTARS / INCA / ECHAM5
A2	PRE HADGEM / SPRINTARS / INCA / GISSX / NorAGCM / ECHAM5
A2	ZERO HADGEM / SPRINTARS / INCA / GISSX / ECHAM5
A2	FIX HADGEM / SPRINTARS / INCA / ECHAM5
A2	TROP/ARCTIC HADGEM / SPRINTARS / INCA / ECHAM5
HCA	0 SPRINTARS / INCA / GISSX / GISSM / NorAGCM / ECHAM5?00-06 / GOCART
HCA	IPCC HADGEM / SPRINTARS / INCA / GISSX / GISSM / NorAGCM / ECHAM5?00_06
HCA	FIX HADGEM / SPRINTARS / INCA / NorAGCM / ECHAM5?00_06 / GOCART
HCA	MET HADGEM / SPRINTARS / INCA / NorAGCM / ECHAM5?00_06

**EUCAARI
Models**

Commitment

Diagnostics Model



QUICKLOOK	HADGEM / INCA / SPRINTARS / GISSX / GISSM / NorAGCM / GOCART
MICROPHYSICS	INCA / TM5 / GISSX / NorAGCM / GLOMAP-bin? / GLOMAP-mode? / UKCA? / CAM3-MAM? / ECHAM-MESSY? / CCCma-GCM4?
ORGANICS	INCA / SPRINTARS / GISSM/ NorAGCM
DIRECT FORCING	HADGEM / INCA / SPRINTARS / GISSX / GISSM / NorAGCM / GOCART
HINDCAST	HADGEM / INCA / SPRINTARS / GISSX / GISSM / NorAGCM / GOCART
VERTICAL	HADGEM / INCA / SPRINTARS / GOCART
DUST	HADGEM / INCA / SPRINTARS / GOCART

**EUCAARI
Models**

AeroCom web interface



- AEROCOM PRELIMINARY RESULTS - MODEL versus SURFACE OBSERVATIONS

UPDATE - limit choices -> **ALL DATA** - change webpage -> **presently on nansen surfobs interface**

-> **see info** -> **Explicit One image Interface** - performance? -> **menus & images updated after selection change (slower but little failure)**

menus: graph type ---- data source ---- species ---- parameter ---- station ---- year ---- period

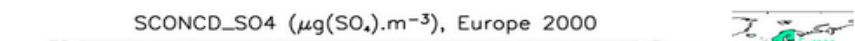
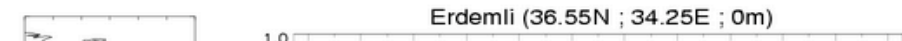
SERIES **IIICA LSCE** **AER** **OD550**

Erdemli **an2000** **mALLYEAR**

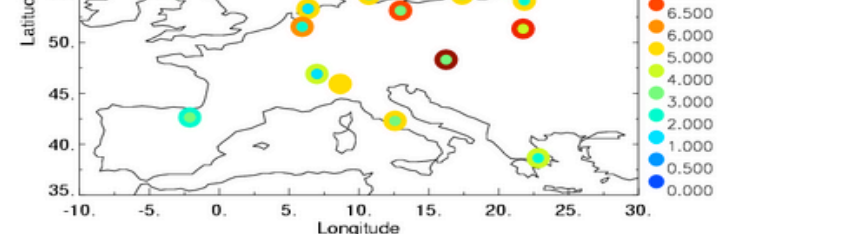
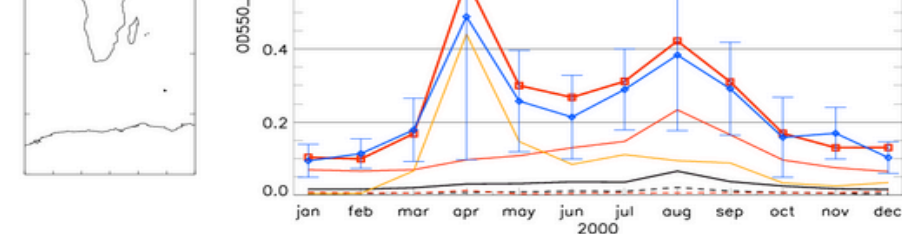
menus: graph type ---- data source ---- species ---- parameter ---- station ---- year ---- period

MAP **LOA Lille ExpA** **S04** **SCONCD**

Europe **an2000** **mALLYEAR**



[http://nansen.ipsl.jussieu.fr/
cgi-bin/AEROCOM/aerocom/surfobs_annualrs.pl](http://nansen.ipsl.jussieu.fr/cgi-bin/AEROCOM/aerocom/surfobs_annualrs.pl)

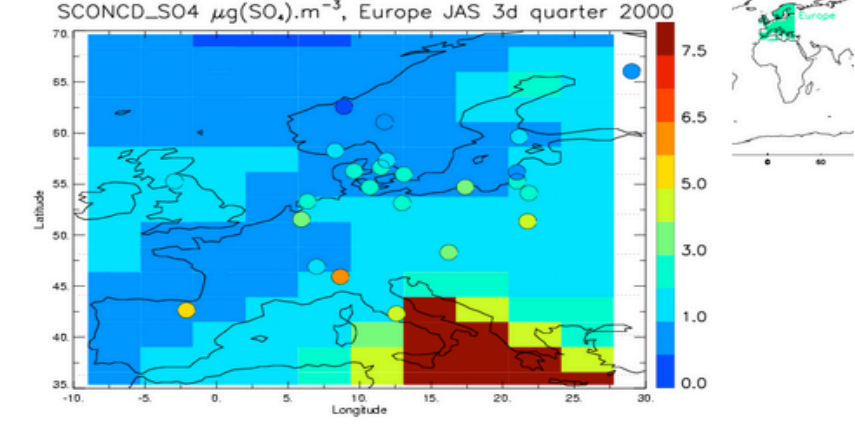
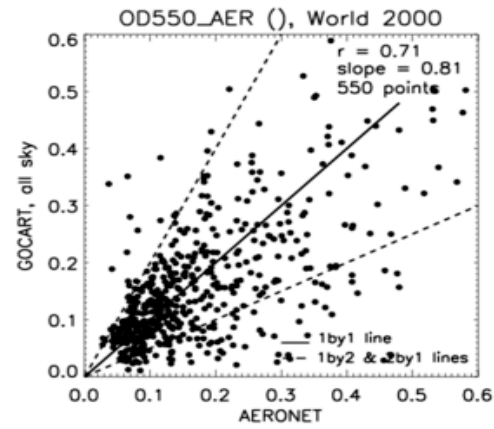


SCAT **GOCART** **AER** **OD550**

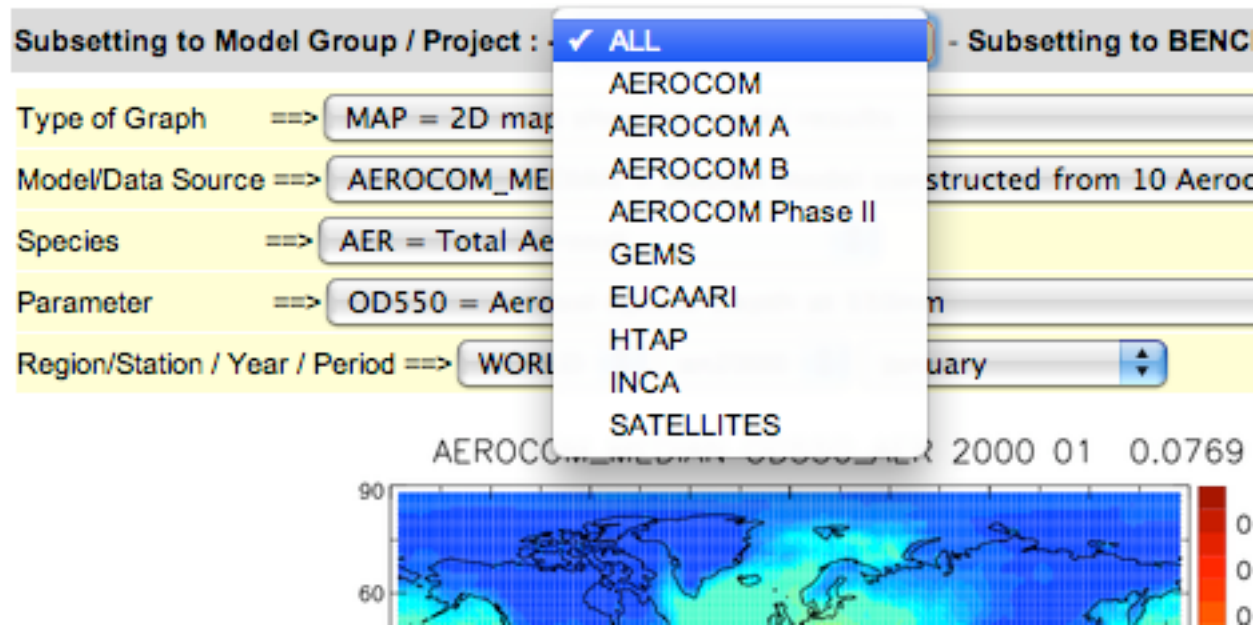
WORLD **an2000** **mALLYEAR**

FIELDCOMPA **LOA Lille ExpB** **S04** **SCONCD**

Europe **an2000** **mJAS**



Selecting groups of models/satellites



Selecting the model/satellite to be compared To station data

Subsetting to Model Group / Project : -> AEROCOM Phase II - Subsetting to BENCHMARK test ==>

Type of Graph ==> MAP = 2D map showing model results

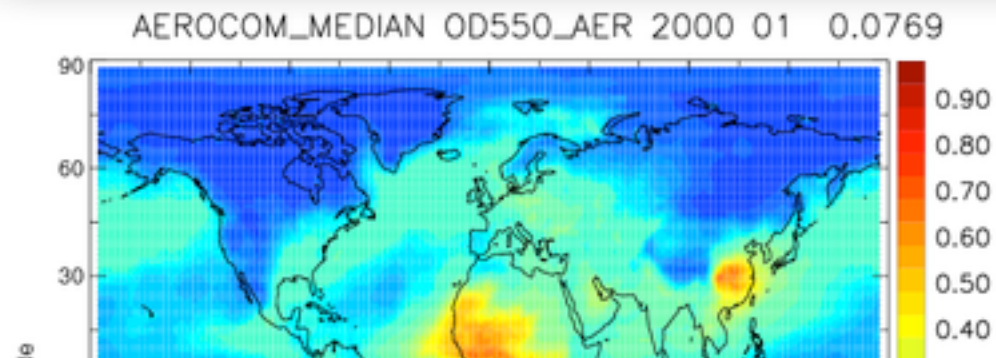
Model/Data Source ==> AEROCOM_MEDIAN = Median model constructed from 10 Aeroacom A models

Species ==> CAM-OSLO_A2-CTRL

Parameter ==> GLOMAPmode-v4_A2-CTRL

Region/Station / Year ==> SPRINTARS_A2-CTRL

SPRINTARS_HCA-0



Reducing choices to selected sites or parameter

Group / Project : -> AEROCOM Phase II - Subsetting to BENCHMARK test ==

> MAP = 2D map showing model results

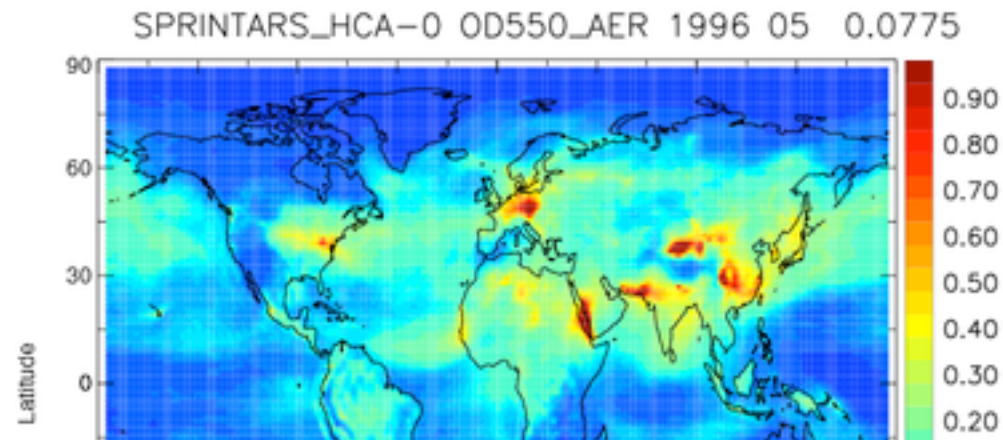
> SPRINTARS_HCA-0

• AER = Total Aerosol

> OD550 = Aerosol optical Depth at 550nm

Period ==> WORLD an1996 May

- ✓ ALL DATA
- FORCING
- ==Selected Photometers==
- NAmerica-sites
- Europe-sites
- Asia-sites
- BiomassBurning
- Dusty-sites
- Ocean-sites
- Polar-sites



Choosing the graph type

UPDATE - Synchron Scroll - # of frames -> Explicit-1-image - links -> presently

Subsetting to Model

Type of Graph == **SITELOCATION**

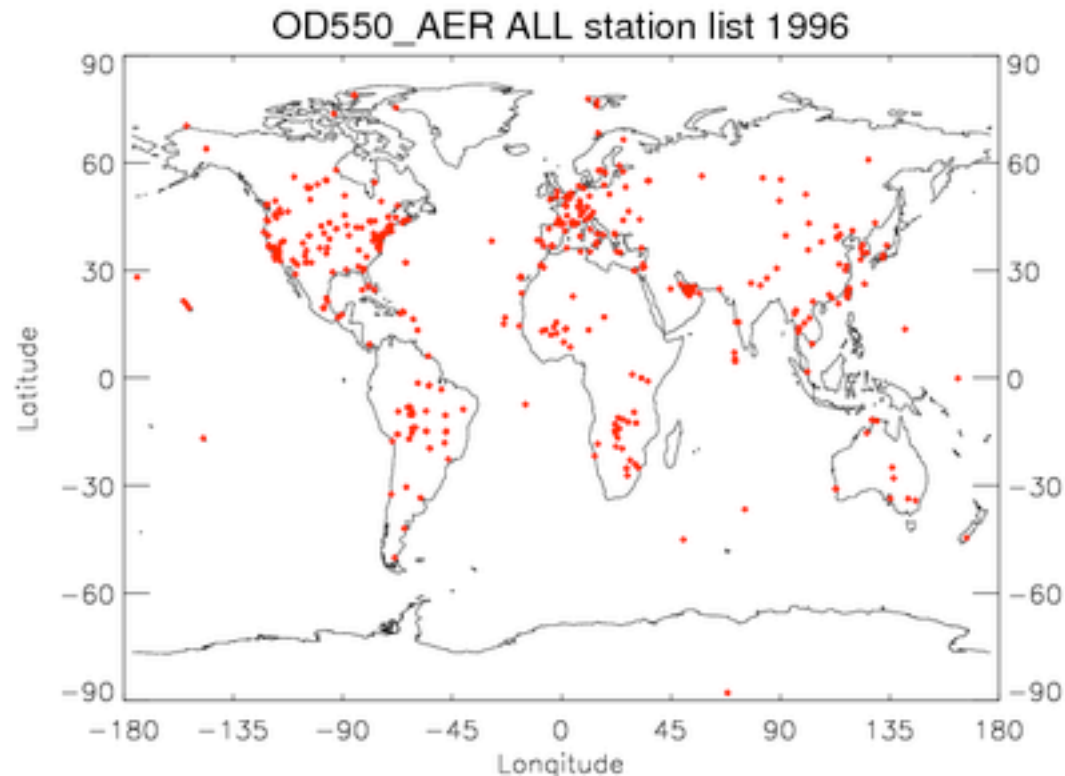
Model/Data Source ==

Species ==> AER = Total Aerosol

Parameter ==> OD550 = Aerosol optical Depth at 550nm

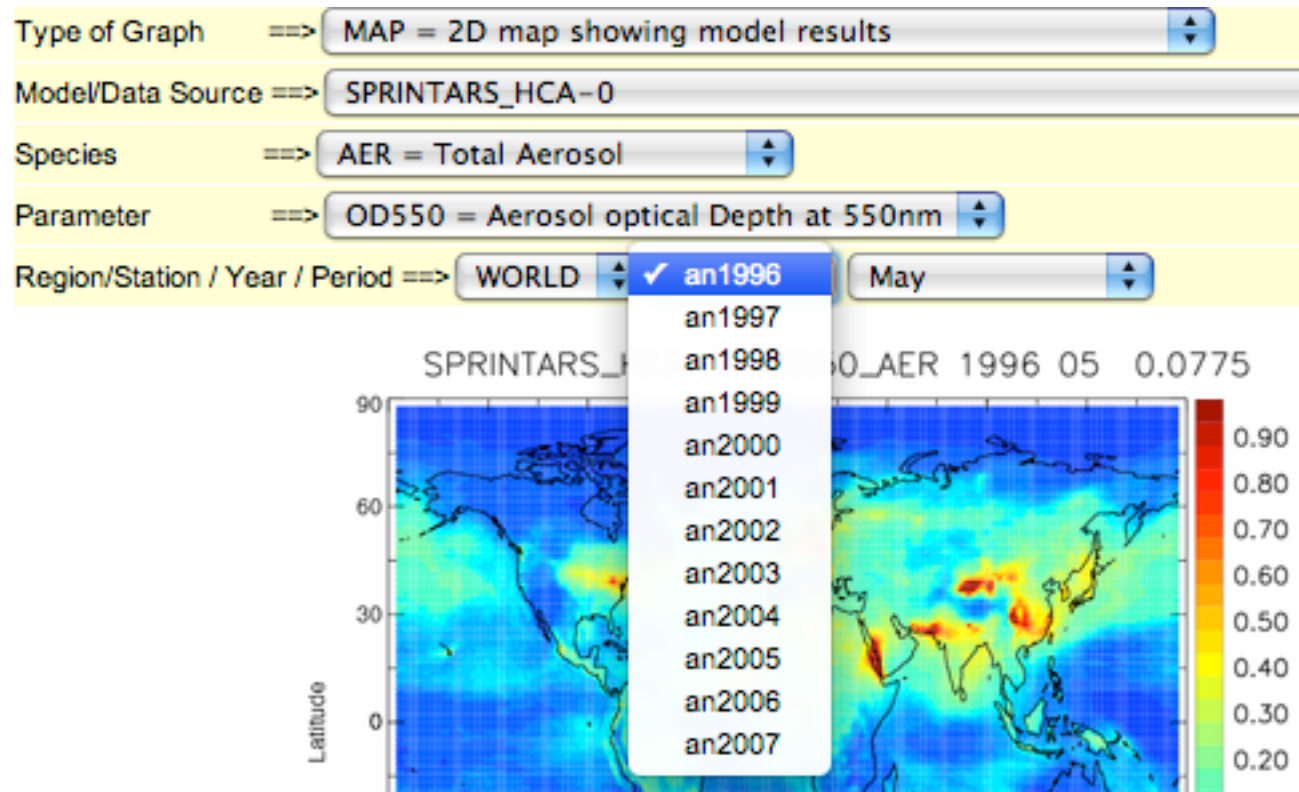
Region/Station / Year / Period ==> ALL regions -> an1996 -> Annual Average ->

MAP = 2D map showing model results
SERIES = time series at specific station site
HISTO = Histograms of observed/modelled values
SCORE = Summary statistics for model-data comparison



Selecting a year of observation

Attention year 9999 => climatological



Selecting score statistics or histograms for filtered data

- AEROCOM INTERFACE - MODEL versus DATA

UPDATE - Synchron Scroll - # of frames -> Explicit-1-image - links -> present

Subsetting to Model Group / Project : -> HTAP - Subsetting to BENCHM

Type of Graph ==> SCORE - Summary statistics for model-data comparison

Model/Data Source ==> TM5JR

Species ==> SO4

Parameter ==> WET

Region/Station / Year / Period ==> EUROPE-LT1000 an2001 Annual Average

- ALLSITES
- ALLSITES-GT1000
- ALLSITES-LT0500
- ALLSITES-LT1000
- EUROPE-GT1000
- EUROPE-LT1000
- NAMERICA-GT1000
- NAMERICA-LT1000

```
TM5JR 2001 EBAS AT01L_wados_
2001
only Stations EUROPE-LT1000m
# of valid observations:          1091
OBS mean                        0.354
MODEL mean                       0.425
Spearman Rank Correlation        0.534
Pearson Correlation Coefficient  0.516
Spatial yearly mean Corr Coeff   0.531
Seasonal Anomaly Corr Coeff      0.776
RMS error                        0.346
Slope fit forced through zero    0.745
Regression coefficient, Slope    0.586
Regression Constant, Offset:    0.106
STDDEV(Model)/STDDEV(Data):     0.880
Score (mean relative bias )      65%
Taylor Score                      0.785
```

Model-Data Comparisons available on surfobs website

EBAS-NILU database extract 1980-2007

- SO₄ Wet Deposition & Rain Concentration
- Precipitation
- SO₄+SO₂ Surface concentration
- O₃ concentration
- (in prep: extinction, BC,POM,NO₃,PM₂₅)

Aeronet/GAW/EANET compilation « Kinne »; 1996-2007

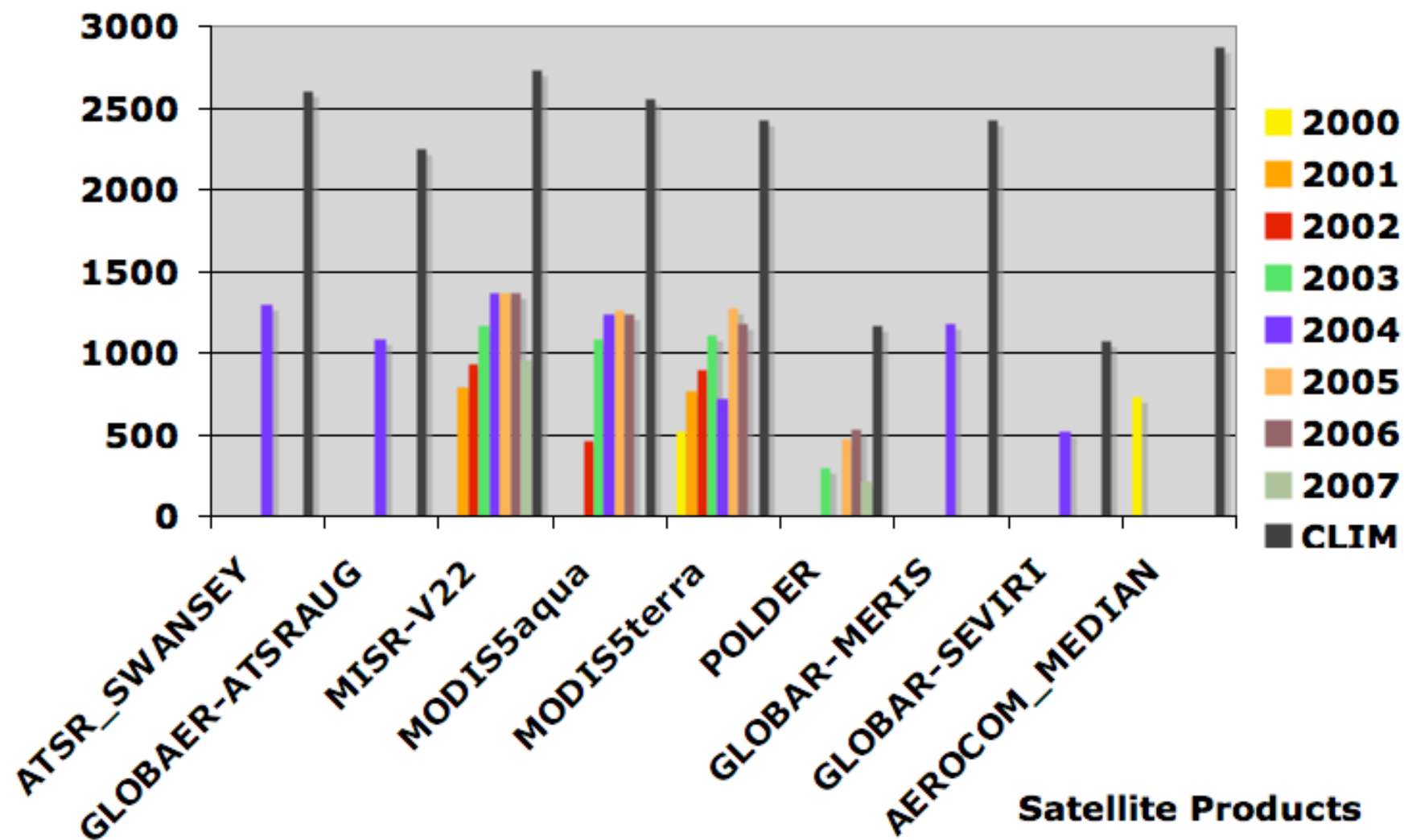
- Total, Fine, Coarse AOD; Angstroem Component
- Total, Anthropogenic SWTOA-Clear/Cloudy Forcing

Satellite 1996-2007

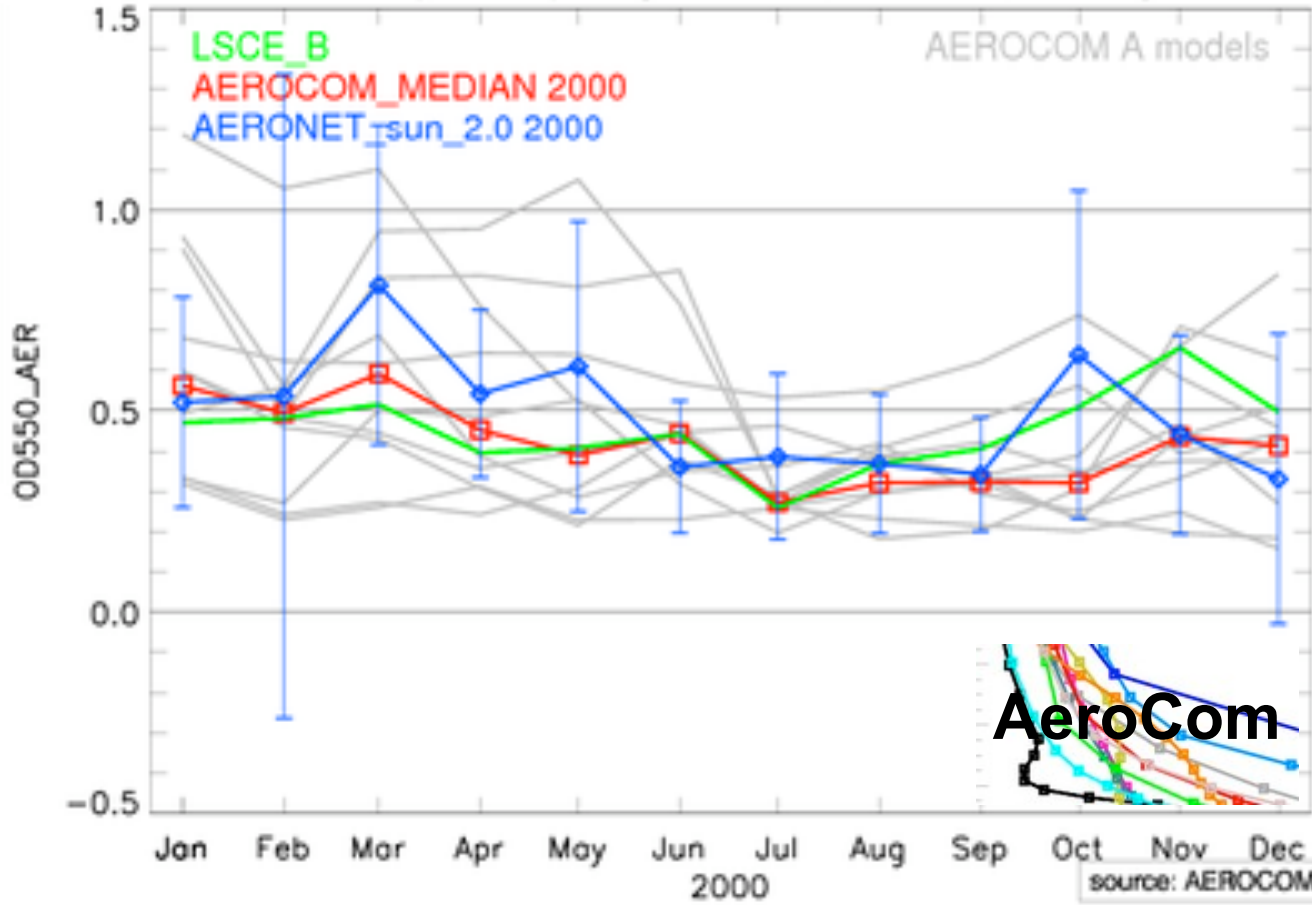
(MODIS,MISR,Polder,Globaler, Modis-CERES Forcing Bellouin)

- Total, Fine AOD; Angstroem Component, CS-RF

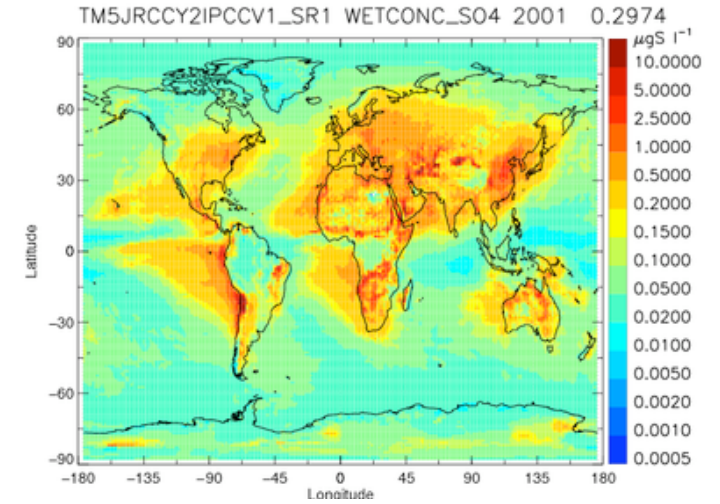
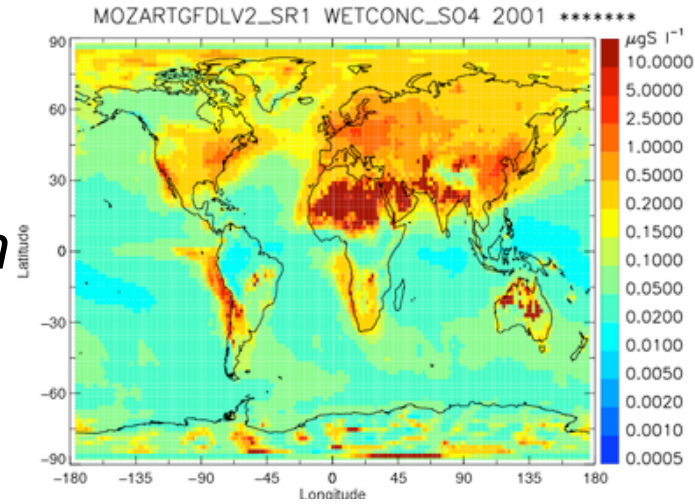
Number of valid months
from all Aeronet stations



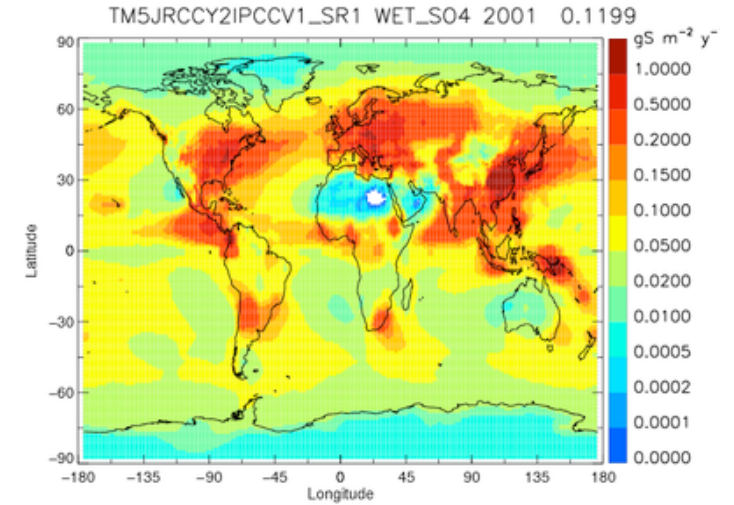
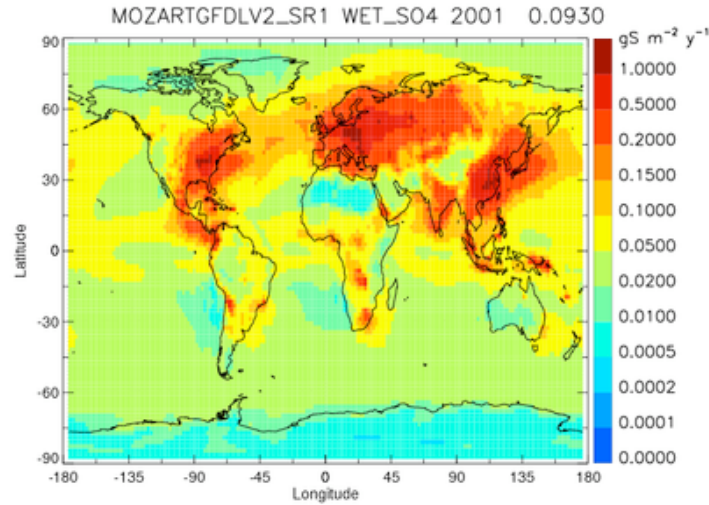
Ouagadougou (12.20N ; 1.40W ; 290m)



*SO4
Rain
Concentration*



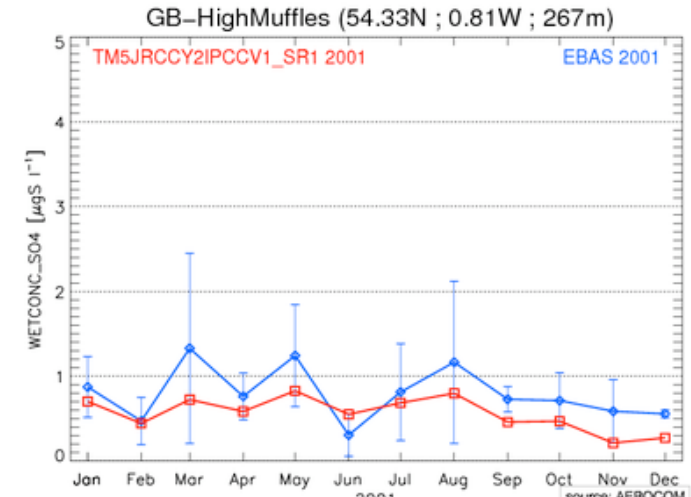
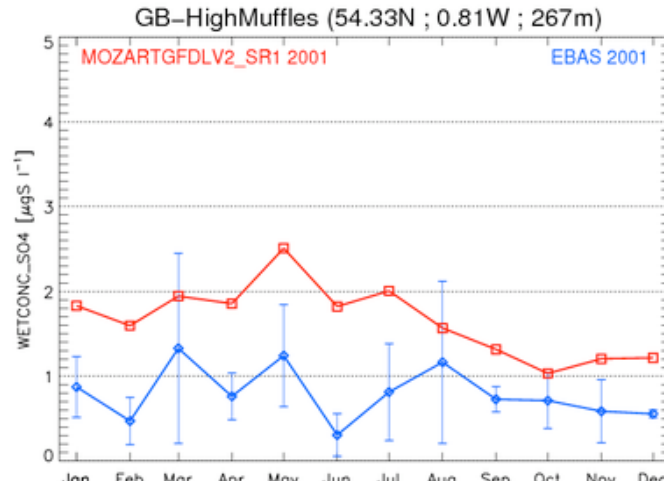
*SO4
Wet
Deposition*



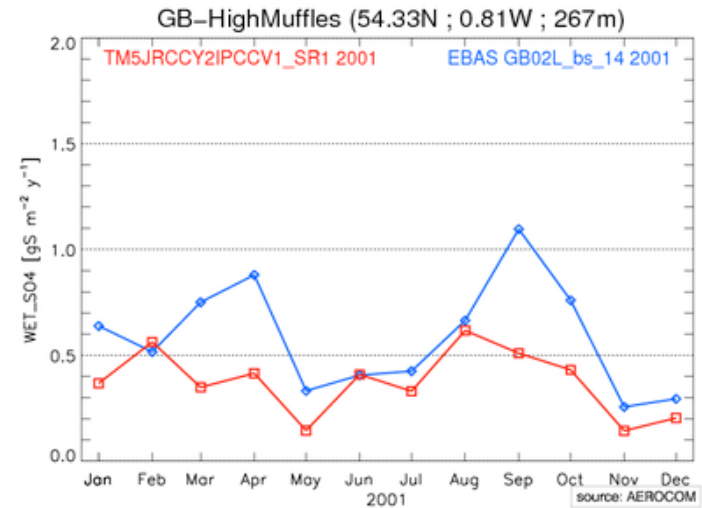
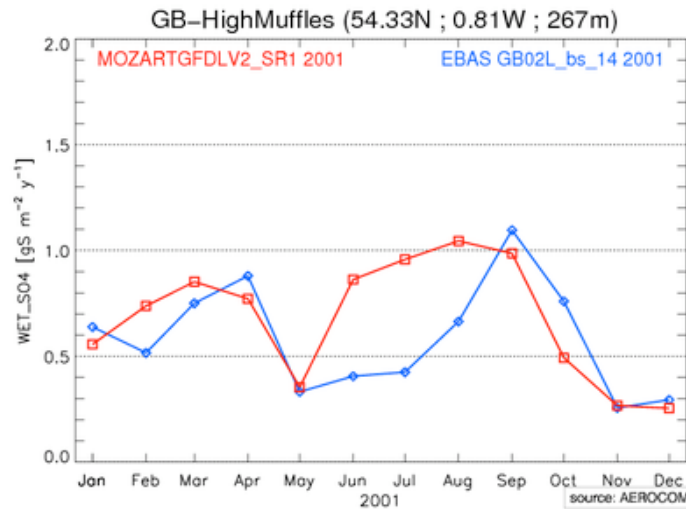
*MOZART-GFDL
HTAP-SR1*

*TM5-JRC
HTAP-SR1*

**SO₄
Rain
Concentration**



**SO₄
Wet
Deposition**



**MOZART-GFDL
HTAP-SR1**

**TM5-JRC
HTAP-SR1**

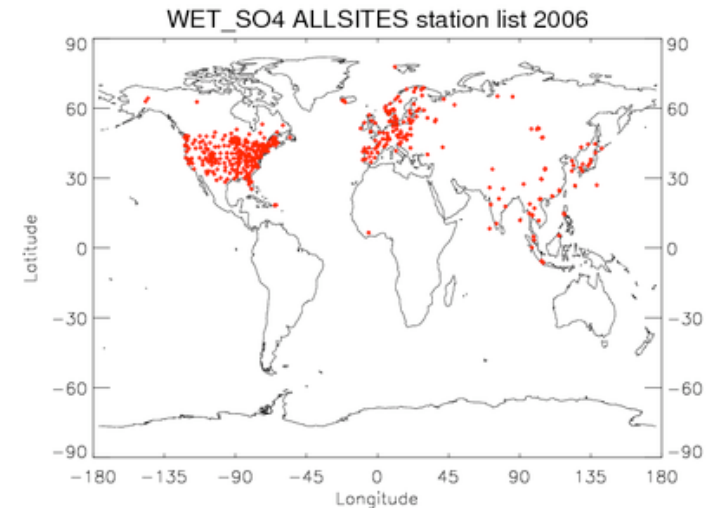
AeroCom phase II new model submissions

Comparison of sulphate wet deposition to EBAS HTAP worldwide data

Stations below 1000 m altitude

of months in 2006 with observations: 3944

	<i>Sprintars HCA-0</i>	<i>GLOMAP-mode</i>	<i>CAM-OSLO</i>
<i>Mean (obs: 0.37)</i>	0.42	0.27	0.36
<i>Rank Correlation r</i>	0.55	0.55	0.49
<i>Pearson Correlation r</i>	0.27	0.37	0.36
<i>Spatial Correlation r</i>	0.39	0.65	0.58
<i>Seasonal Anomaly r</i>	0.78	0.81	0.80



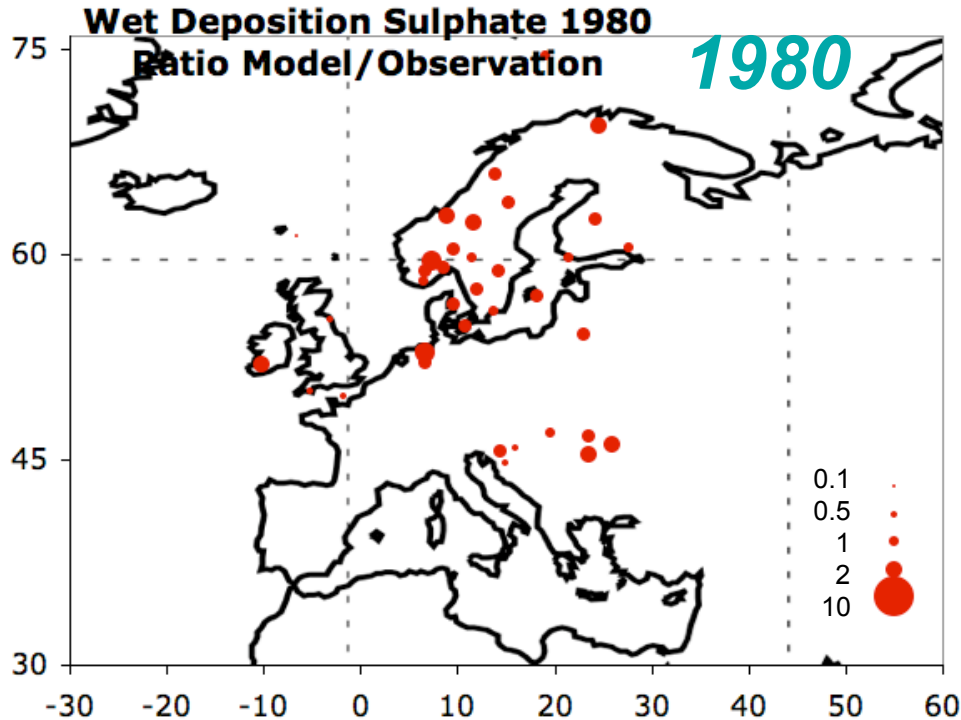
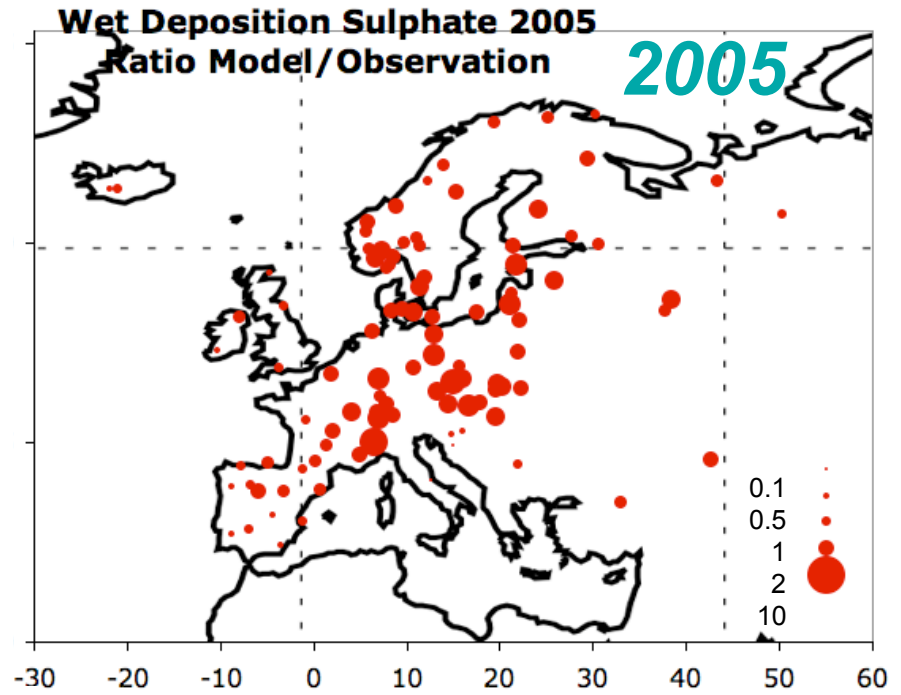
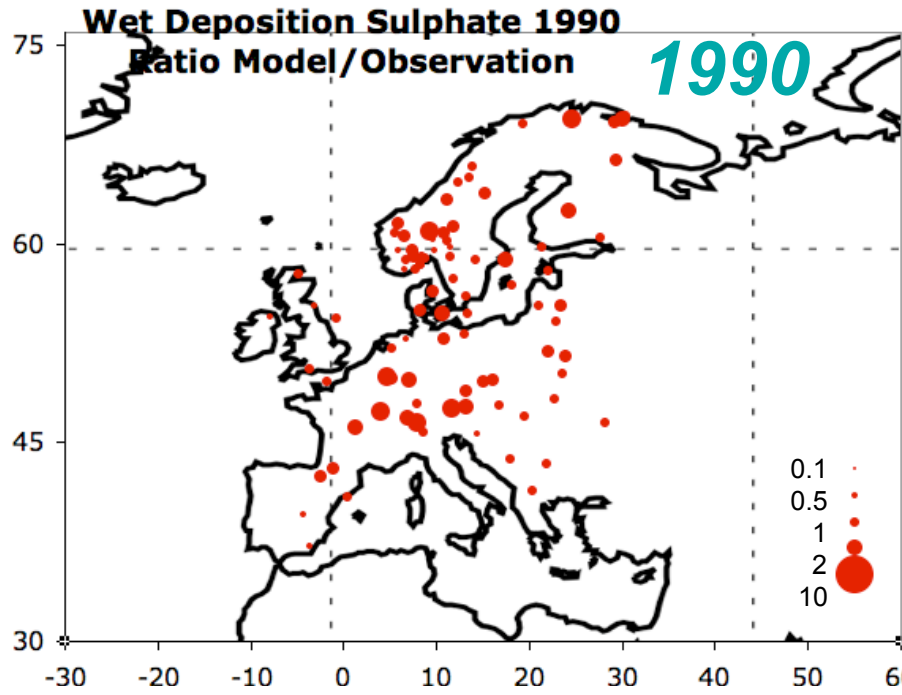
Hindcast analysis

How does the relation between observations and model change over time?

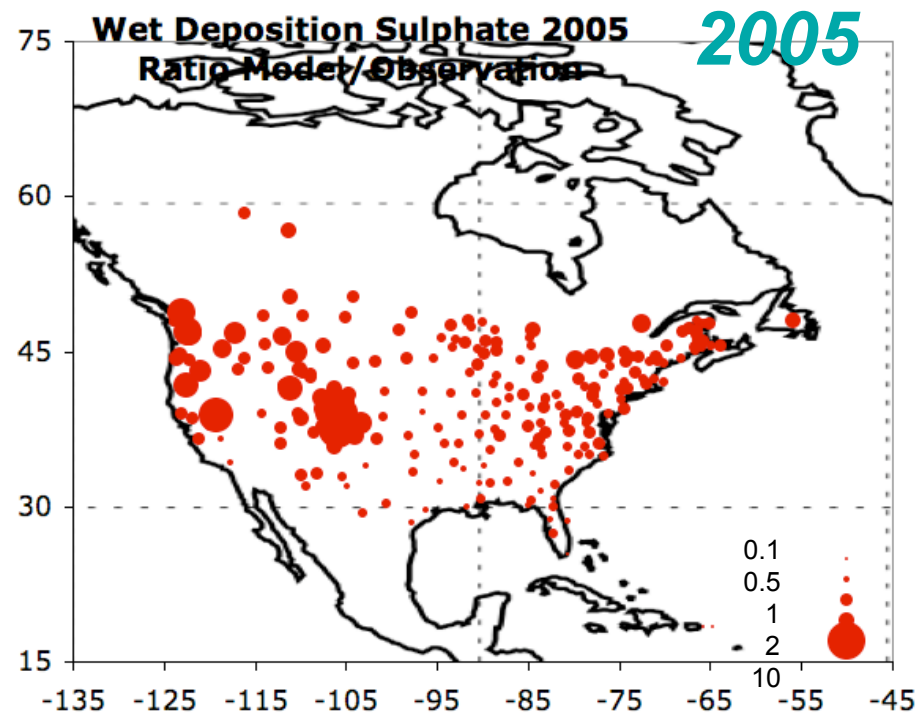
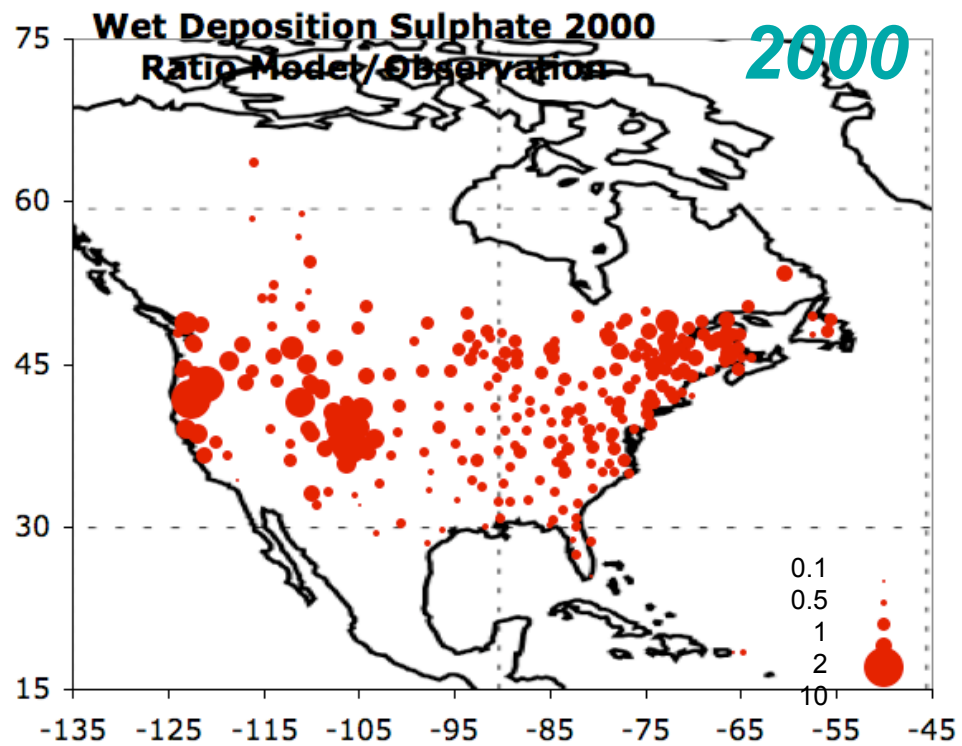
Model changes reflect emission inventory and Meteorology analysis

Observations trends are subject to instrument change, errors in database, reality

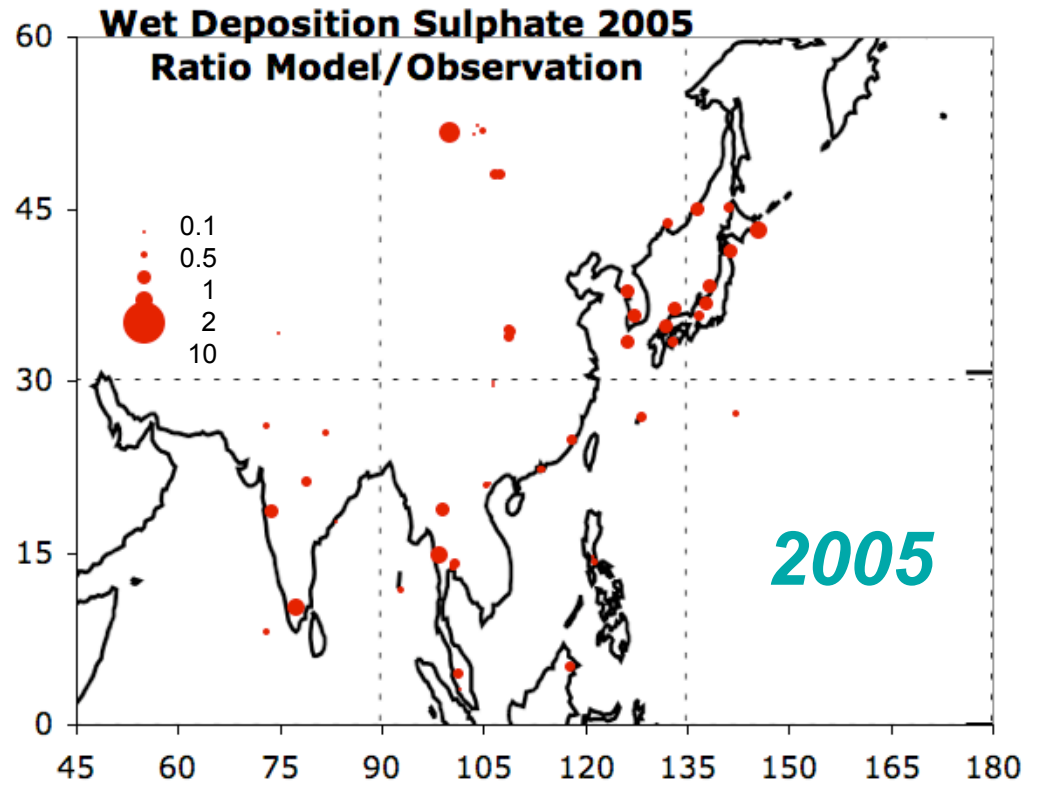
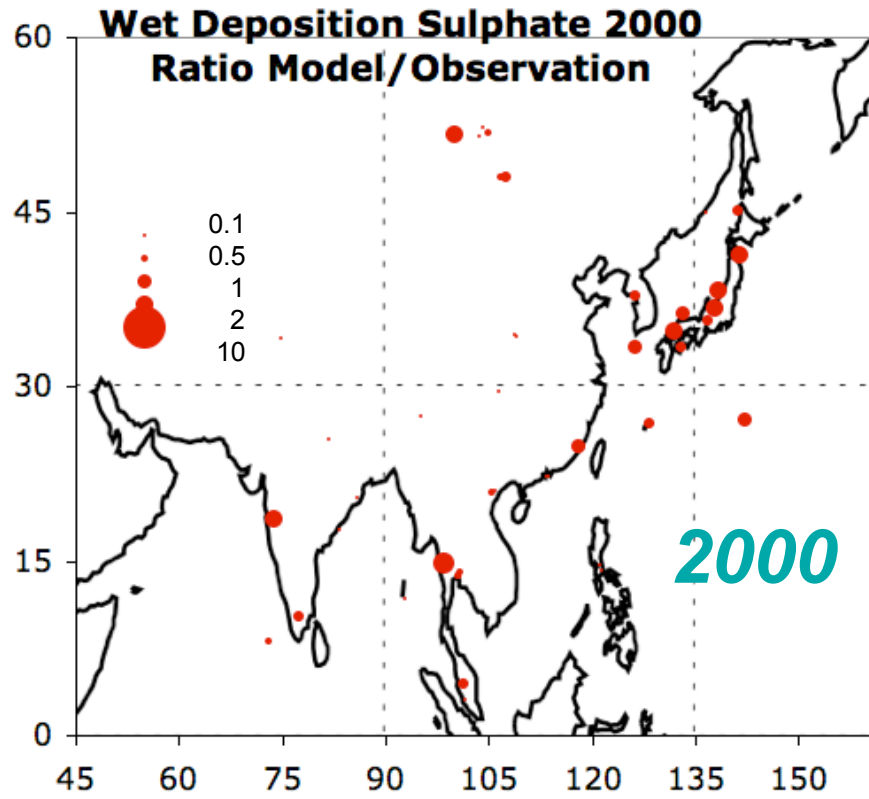
EXAMPLE: SO₄ Wet deposition in Sprintars hindcast run



*Ratio
Sprintars-HCA-0
Over
EBAS
Wet Deposition SO4*



Ratio
Sprintars-HCA-0
Over
EBAS
Wet Deposition SO₄



*Ratio
Sprintars-HCA-0
Over
EBAS
Wet Deposition SO₄*

mean AOD@550nm at stations

	<i>#months</i>	<i>Aeronet</i>	<i>Sprintars HCA-0</i>
<i>1996</i>	<i>204</i>	<i>0.24</i>	<i>0.14</i>
<i>1997</i>	<i>141</i>	<i>0.29</i>	<i>0.17</i>
<i>1998</i>	<i>235</i>	<i>0.19</i>	<i>0.15</i>
<i>1999</i>	<i>535</i>	<i>0.19</i>	<i>0.15</i>
<i>2000</i>	<i>731</i>	<i>0.18</i>	<i>0.15</i>
<i>2001</i>	<i>837</i>	<i>0.19</i>	<i>0.15</i>
<i>2002</i>	<i>984</i>	<i>0.21</i>	<i>0.16</i>
<i>2003</i>	<i>1225</i>	<i>0.22</i>	<i>0.16</i>
<i>2004</i>	<i>1422</i>	<i>0.22</i>	<i>0.18</i>
<i>2005</i>	<i>1421</i>	<i>0.22</i>	<i>0.17</i>
<i>2006</i>	<i>1423</i>	<i>0.23</i>	<i>0.18</i>
<i>2007</i>	<i>1004</i>	<i>0.24</i>	<i>0.20</i>

Model & Model version Documentation tool

<http://www.mi.uni-hamburg.de/costmodinv>



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Model Inventory

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Critical steps ahead

- Common understanding of required aerosol diagnostics
 - email list «aerocom-output » ??
- Modeler Commitment until autumn/winter 2009
- Model output analysis on several shoulders
 - Feedback to modellers on « model problems »
 - Joint analysis & publications
 - Feedback of analysis into AeroCom web platform
- Preparation of consolidated observational datasets
- Link of AeroCom - ACC - HTAP - IPCC:CMIP5
 - IPCC Emissions usage
 - Transient versus Time slice versus Hindcast