Aerocom phase II submissions evaluation against observation

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Jan Griesfeller, Brigitte Koffi, Stefan Kinne

& Aerocom modellers, CALIOP science team, Aeronet Pis, EMEP contributors

support through grants from
CNES, EU-EUCAARI, EU-MACC, and EU-GEOMON

[#]LSCE/France => MetNo/Norway

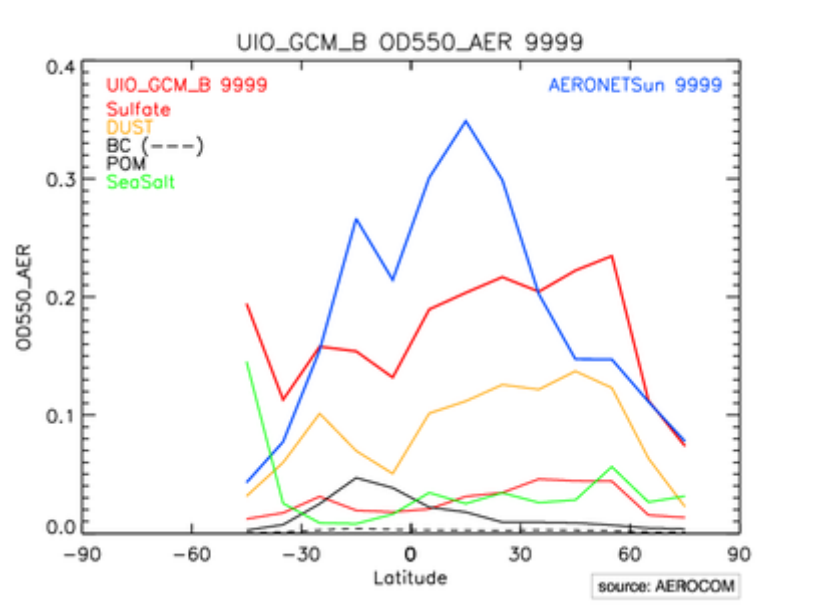
AeroCom phase II final planning

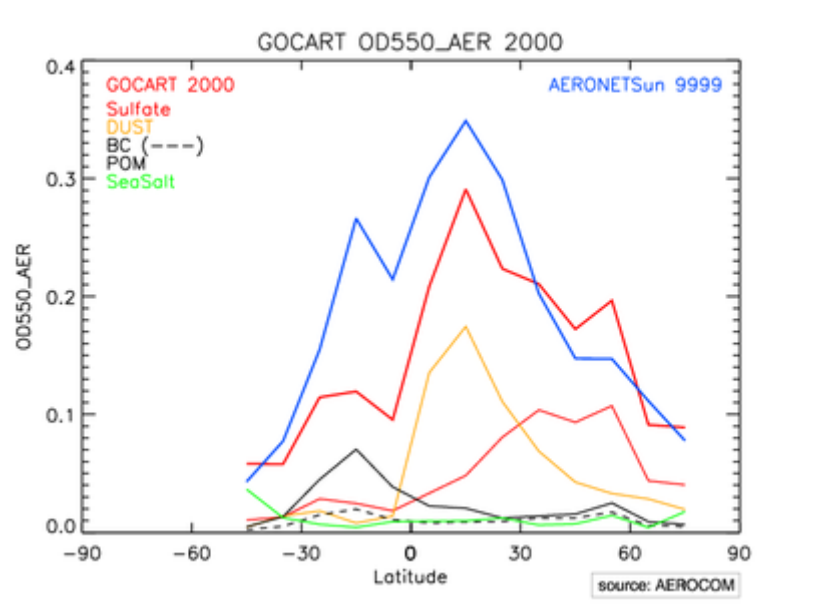
EXPERIMENTNAME	EXPERIMENT_NUMBER	Short Description	YEAR
IND2	CTRL / PRE	Indirect effect diagnostics	2000 / 1860
A2	CTRL	AeroCom phase II reference	2006
A2	SIZ1	As CTRL but with condensation switched off	2006
A2	SIZ2	As CTRL but with coagulation switched off.	2006
A2	SIZ3	As CTRL but with primary BC/OC 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

Evolution of models !?

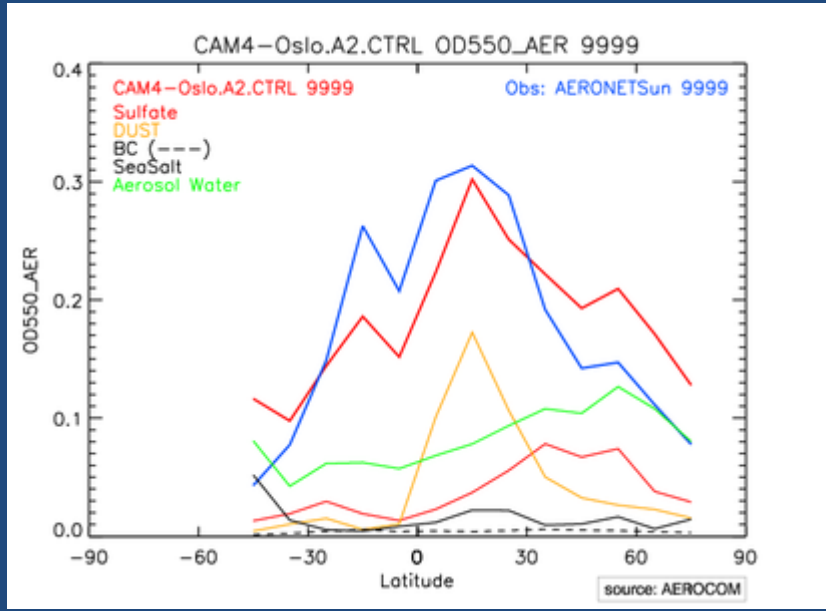
- How evolve models of Aerocom A/B to Phase II ?
- How do they perform against new data from Aeronet & HTAP and derived climatology ?
- In which regions are major differences?

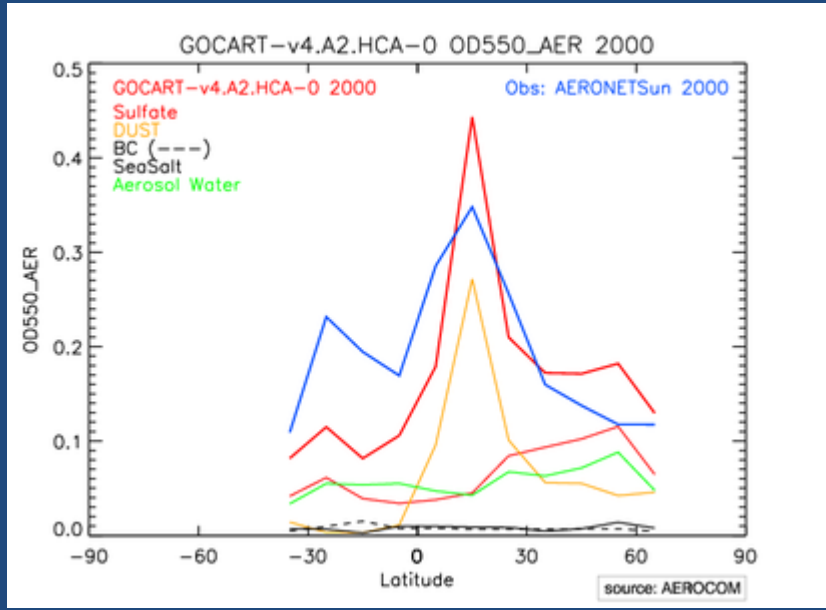
Aerosol Optical Depth
Aerocom A/B





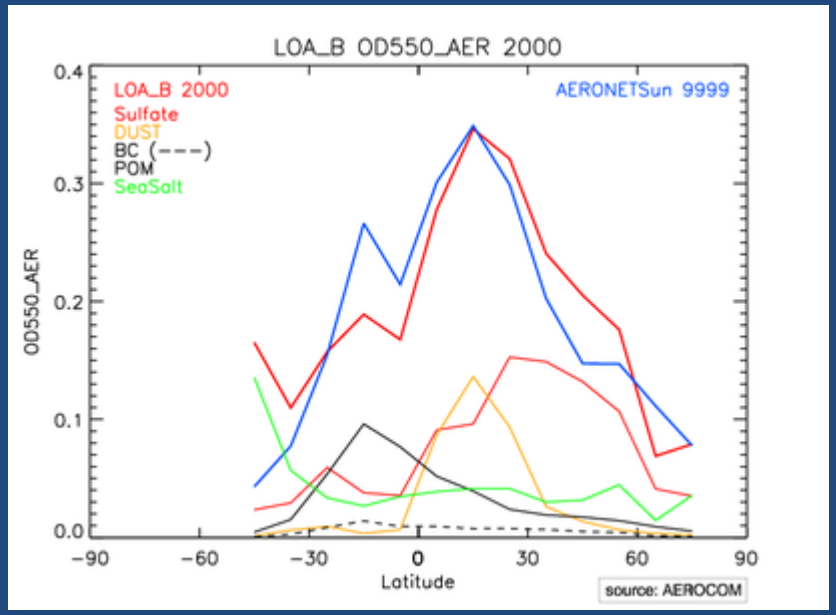
AeroCom phase II

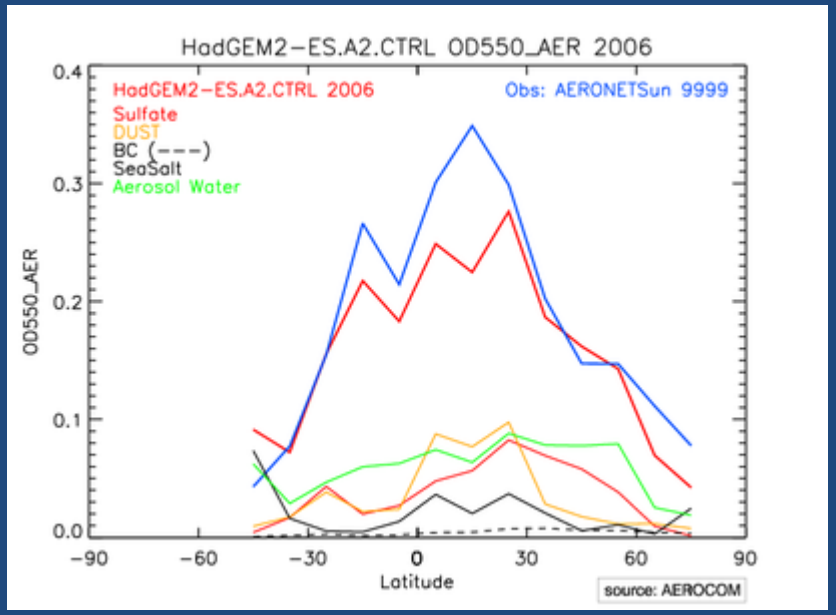


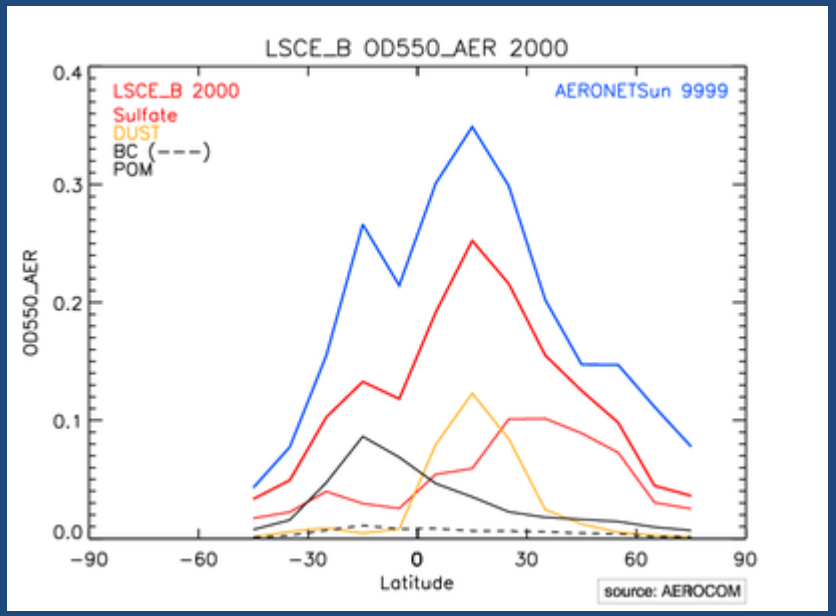


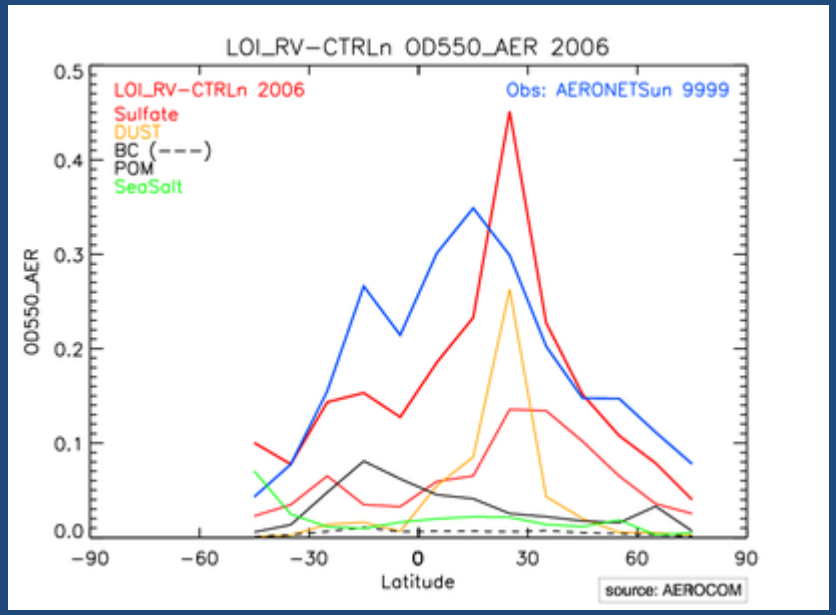
Aerosol Optical Depth
Aerocom A/B

AeroCom phase II

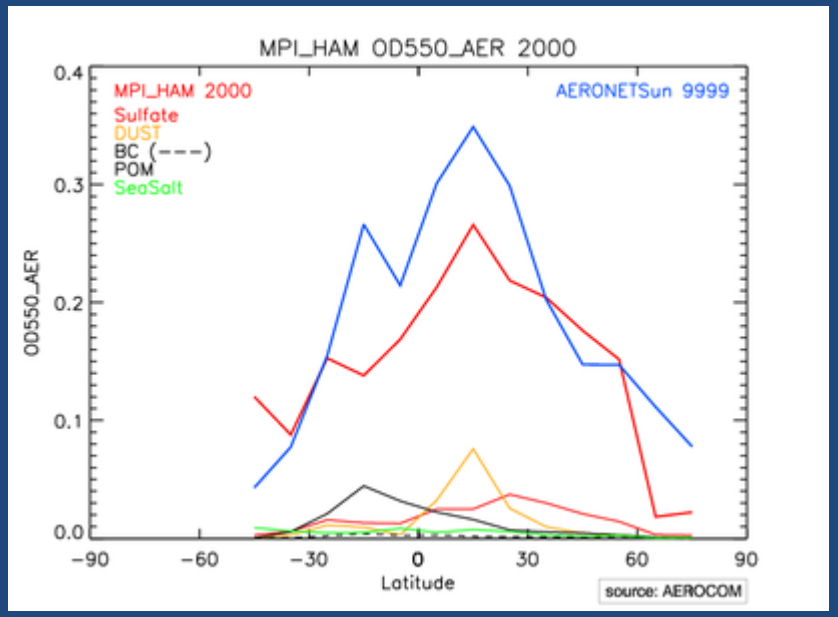


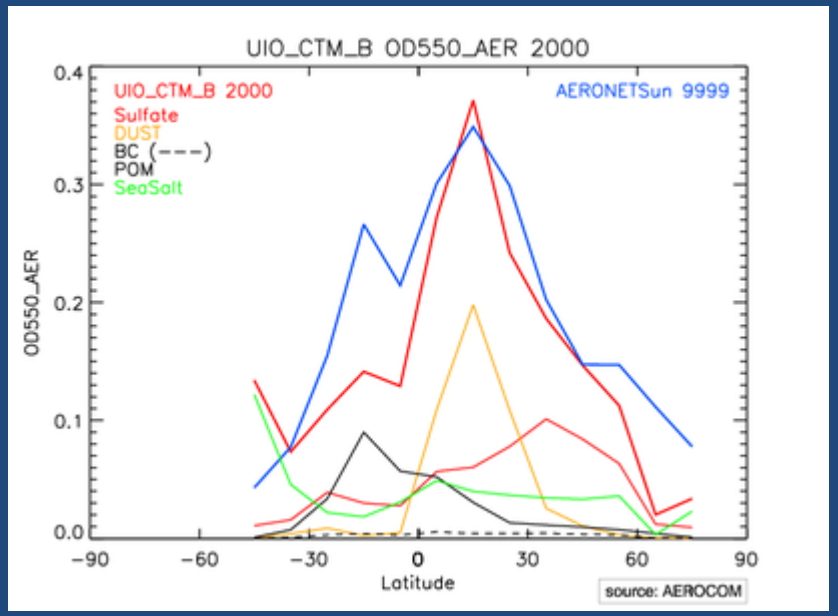




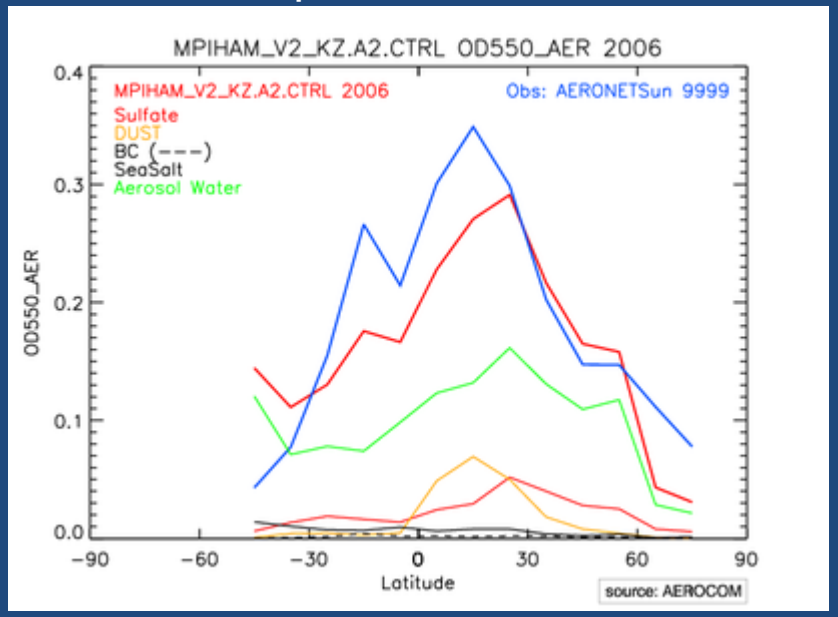


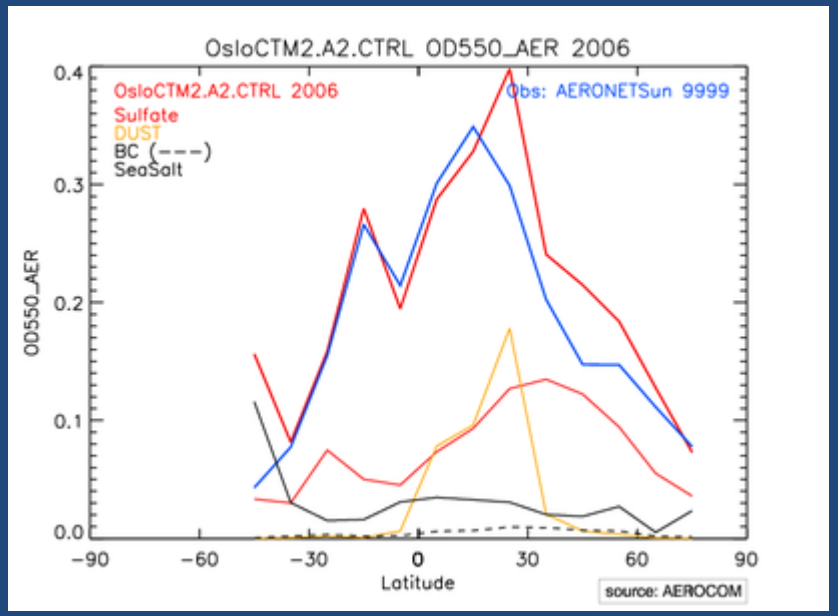
Aerosol Optical Depth
Aerocom A/B





AeroCom phase II



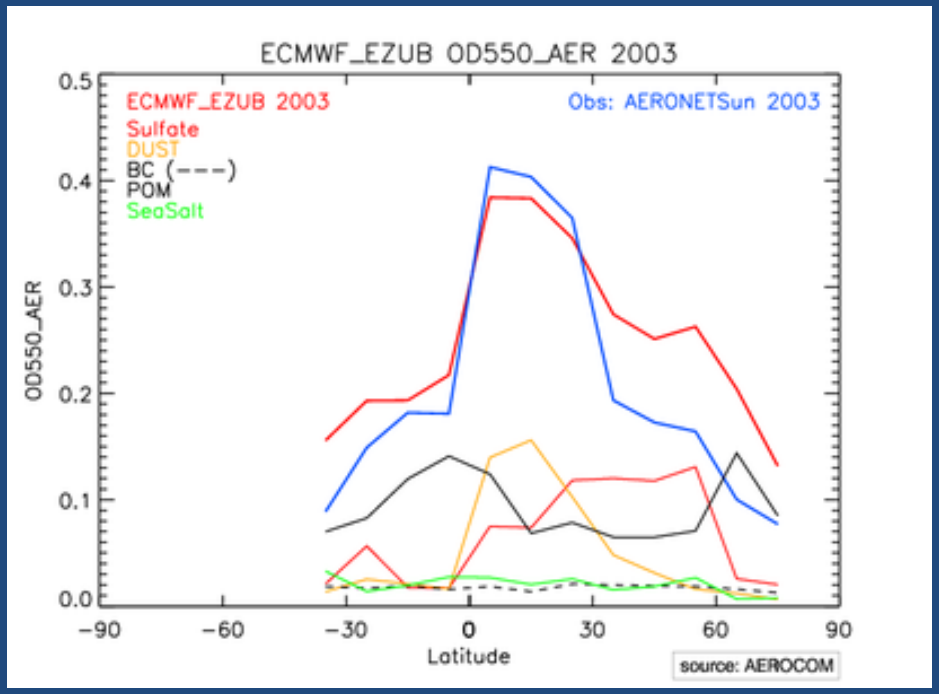


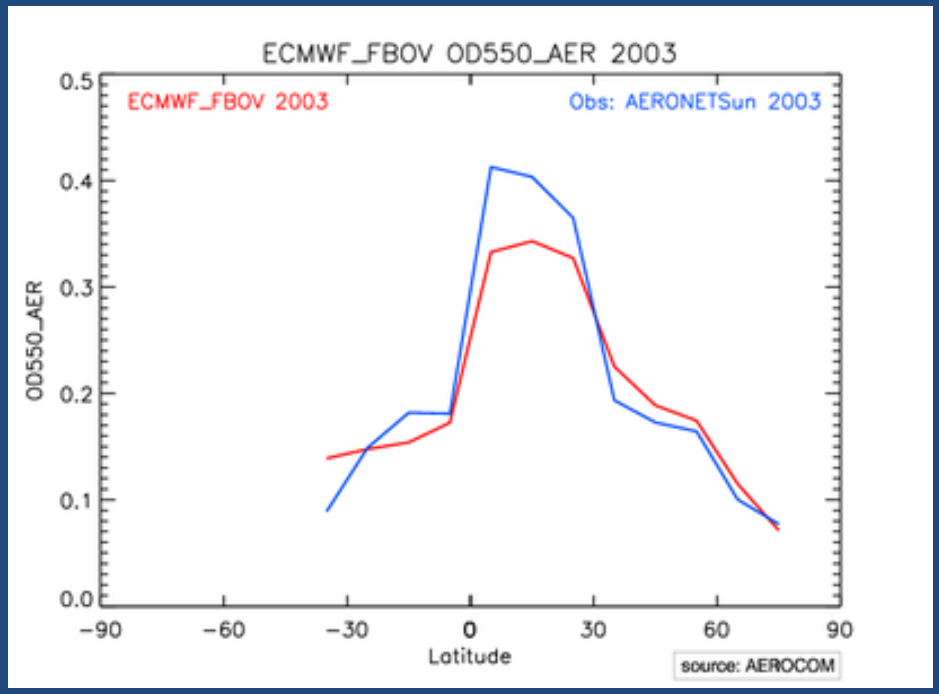
Progress of ECMWF-model assimilation MODIS-AOD into IFS

Aerocom global benchmarking against Aeronet+GAW+SKYNET – 1079 months / 2003 daily data / Stations below 1000m

	Correlation	RMS	Bias
1st forward model,SO4?	0.70	0.13	+0.034
1st assimilation GEMS, SO4?	0.83	0.11	+0.057
2nd GEMS assimilation, SO4?	0.82	0.11	+0.047
1st MACC assimilation, Higher res, SO4 corrected, fire emissions new, less dust	0.86	0.09	+0.005

Latitudinal distribution of AOD bias
Old GEMS < and > New MACC

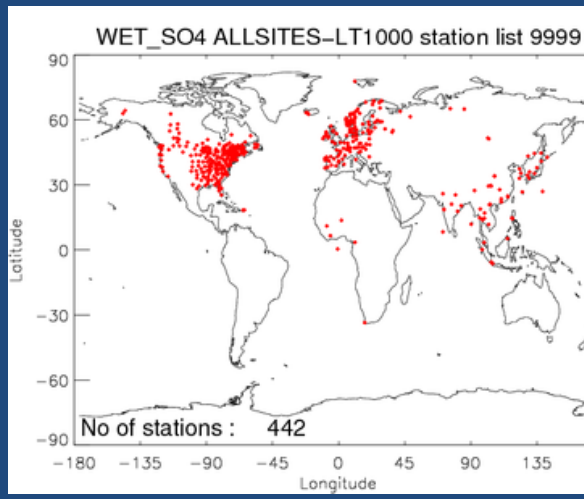




ECMWF (RED) against Sun photometers (BLUE)

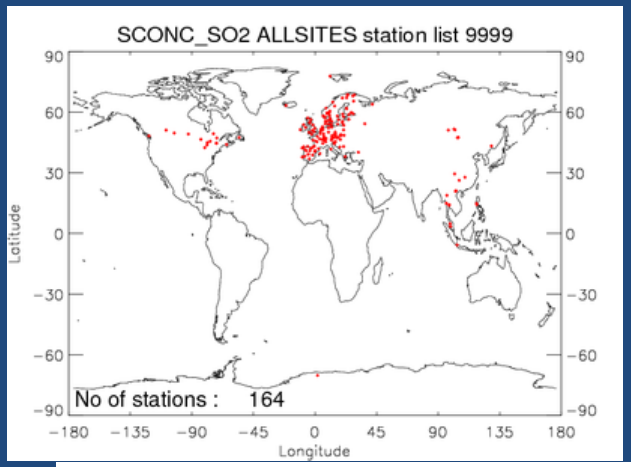
Sulphate wet deposition

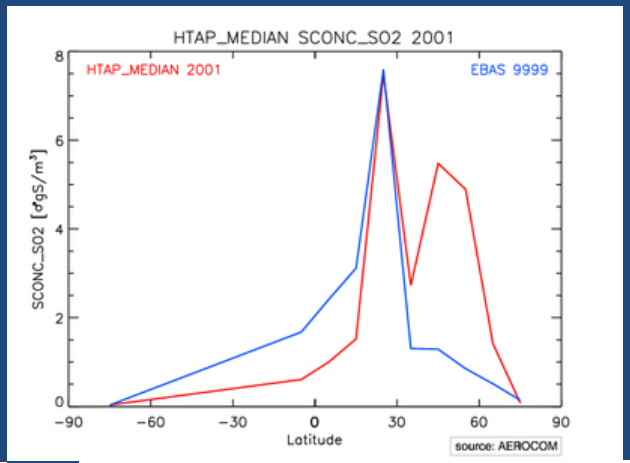
Comparison of sulphate wet deposition to EBAS HTAP worldwide data
Stations below 1000 m altitude
# of months in 9999 with observations: 5198



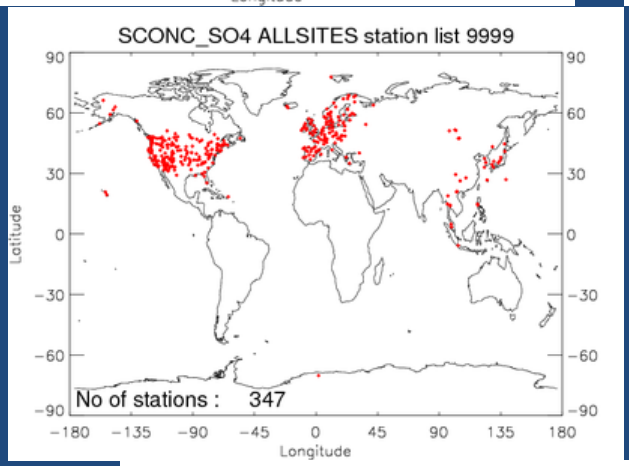
	Rank Correlation	Mean gS m^{-2} y^{-1}
EBAS		0.47
CAM4-OSLO	0.65 (0.52)	0.36 (0.40)
GLOMAP	0.60	0.23
GOCART	0.61 (0.63)	0.27 (0.32)
HADGEM2	0.47	0.47
LSCE	0.34 (0.48)	0.35 (0.49)
ECHAM	0.45 (0.49)	0.54 (0.60)
OsloCTM	0.47 (0.60)	0.24 (0.35)
Sprintars	0.54 (0.46)	0.42 (0.36)

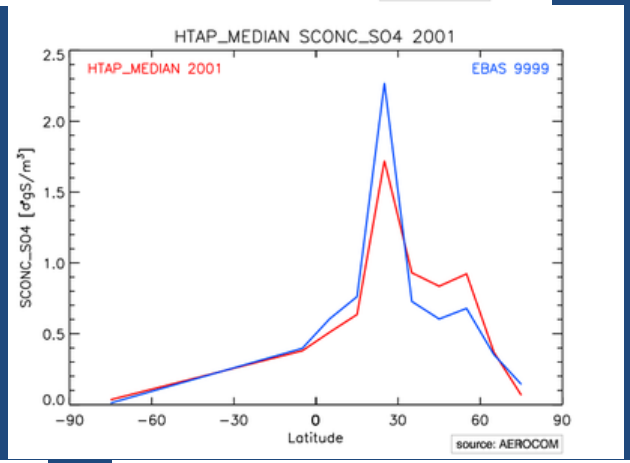
Aerocom Phase II (Aerocom A or B in brackets)



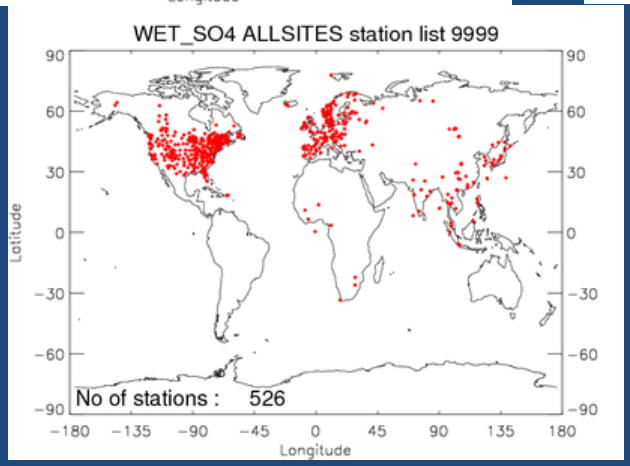


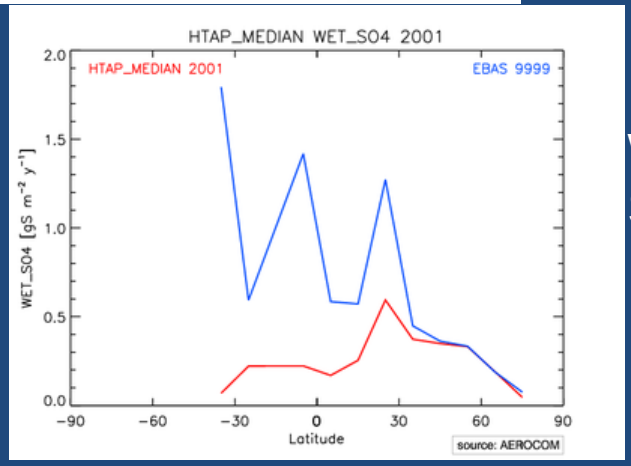
Surface
SO2 air concentration





Surface
SO4 air concentration





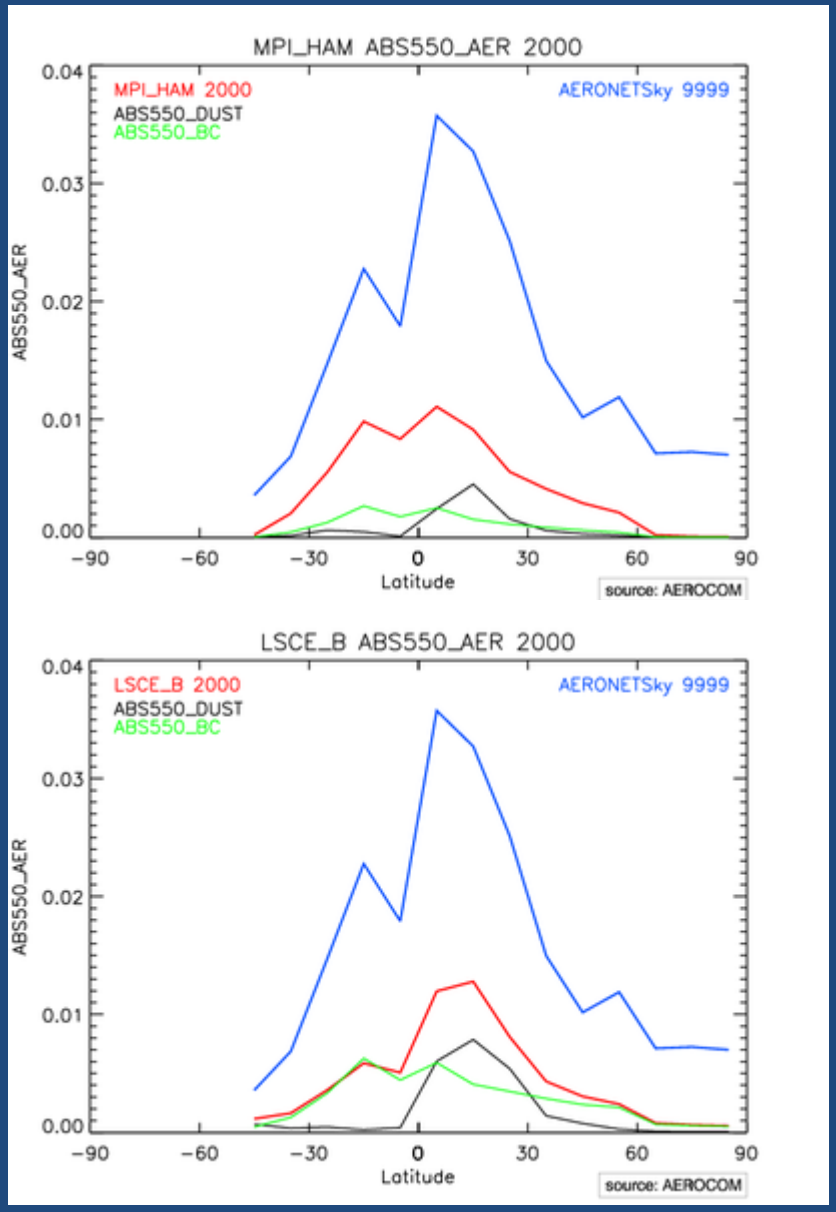
Wet deposition
SO4

BC forcing !?

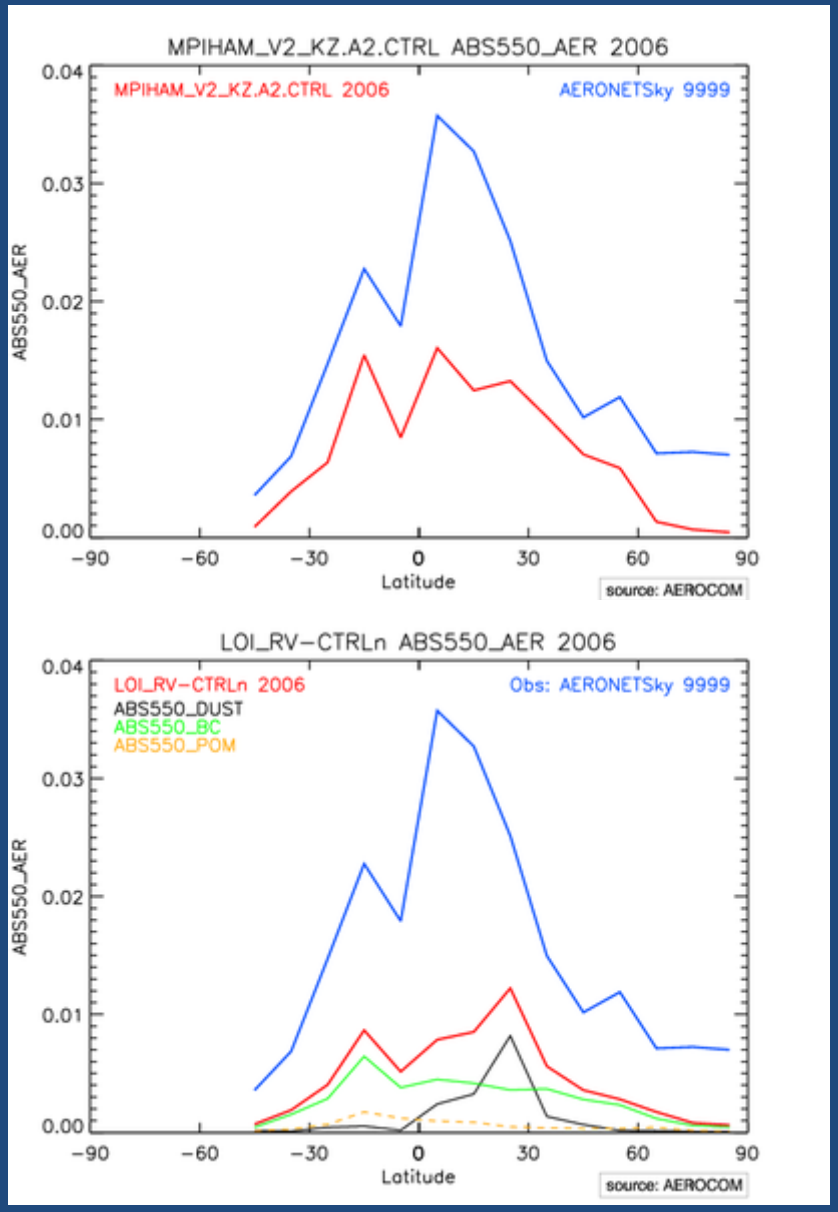
- How compare models to Aeronet absorption?
- How much contributes dust to absorption?
- Anthropogenic fraction of BC?
- What forcing results ? => talk Gunnar Myhre
- How much forcing contribution from above clouds? => poster Raffaella Vuolo
- How much difference from model environment? => talk Philip Stier
- Indirect effects? => Susannes talk

Absorption Aerosol Optical Depth

Aerocom A/B

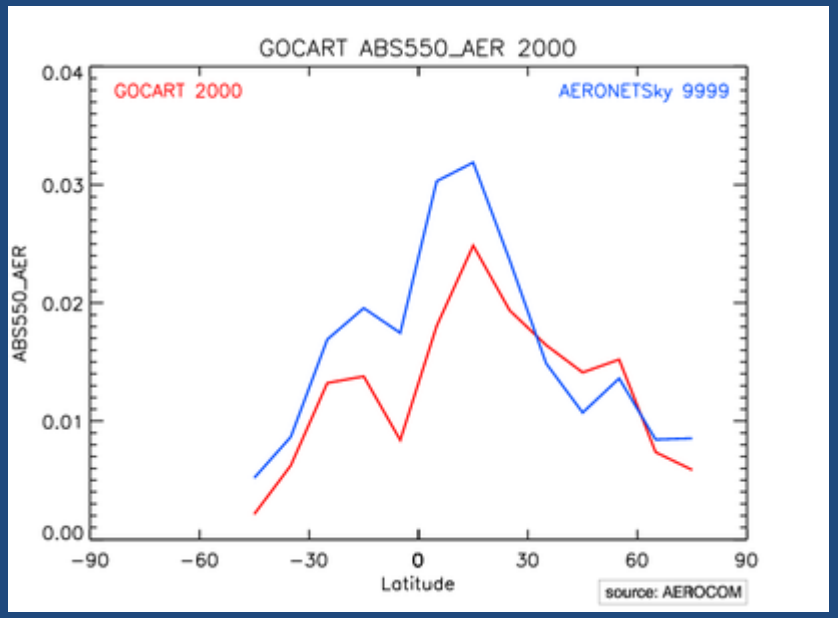


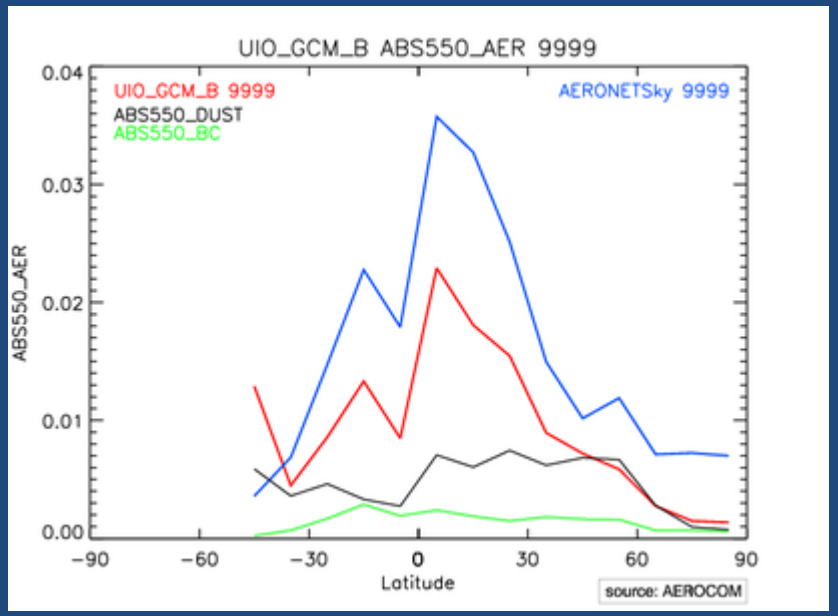
AeroCom phase II



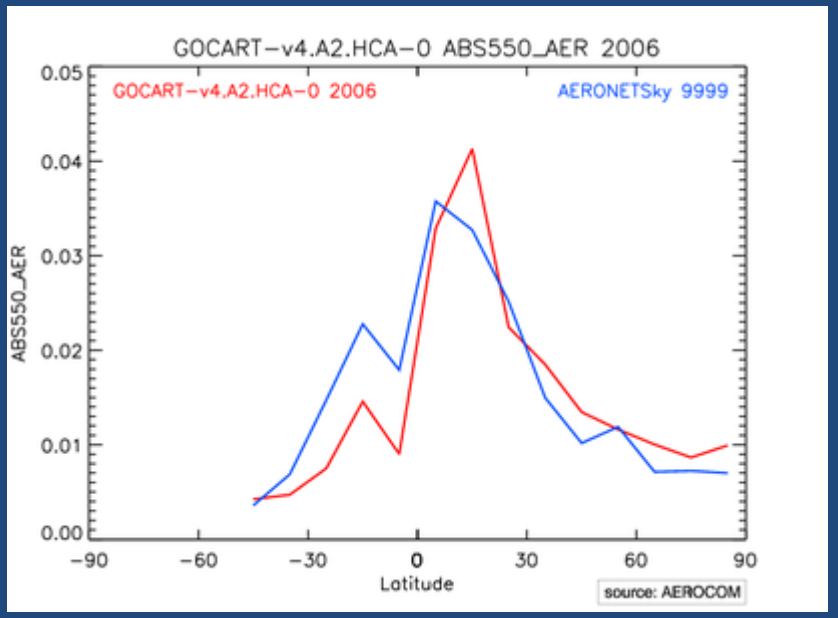
Absorption Aerosol Optical Depth

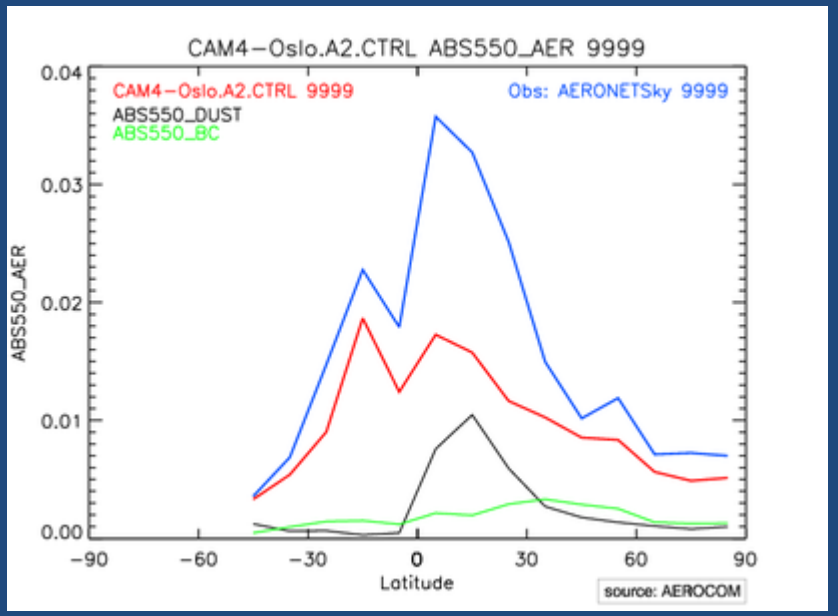
Aerocom A/B





AeroCom phase II





Trends !?

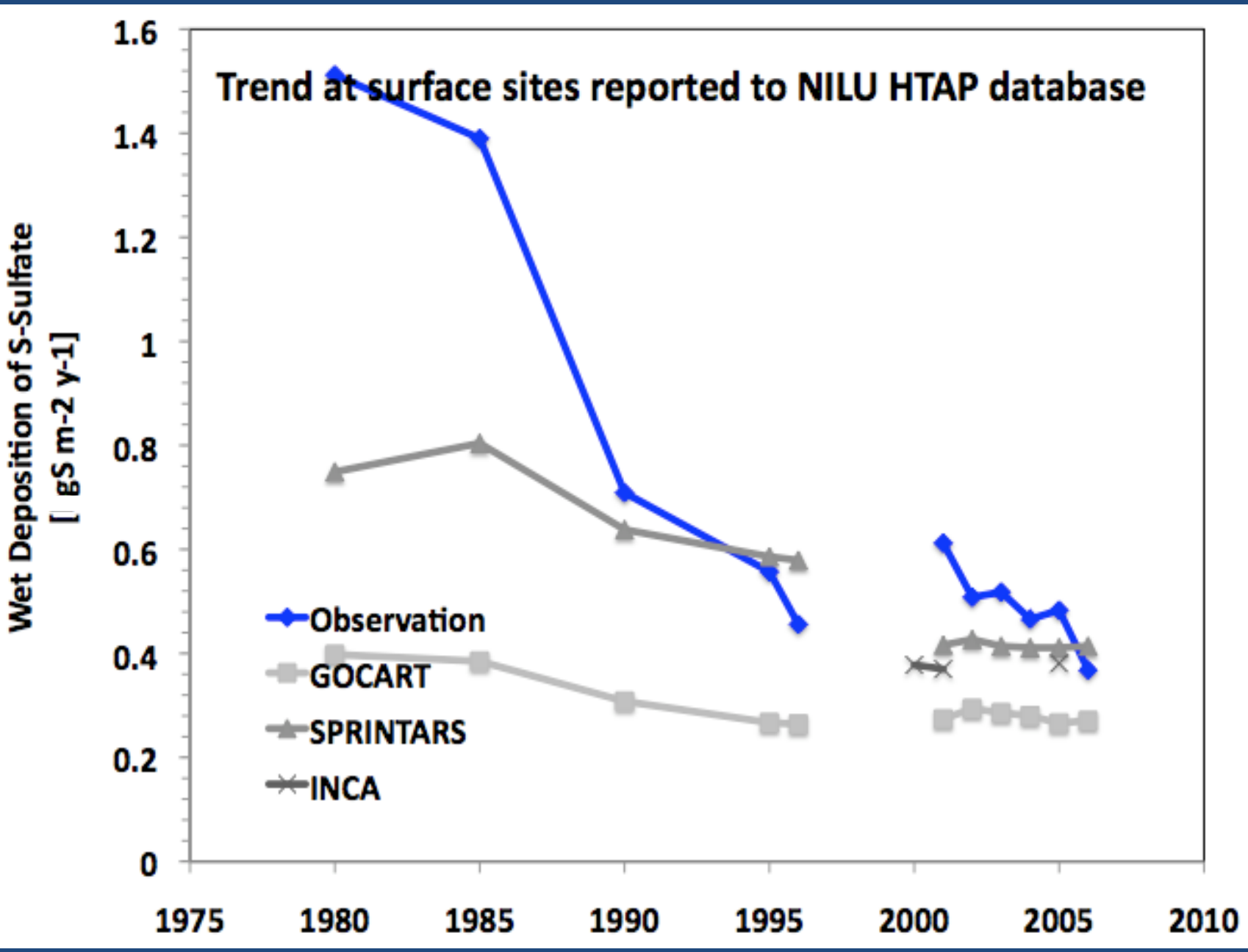
- Do we simulate trends ?
- Do they compare to observations?
- Can we infer emission trend verification?

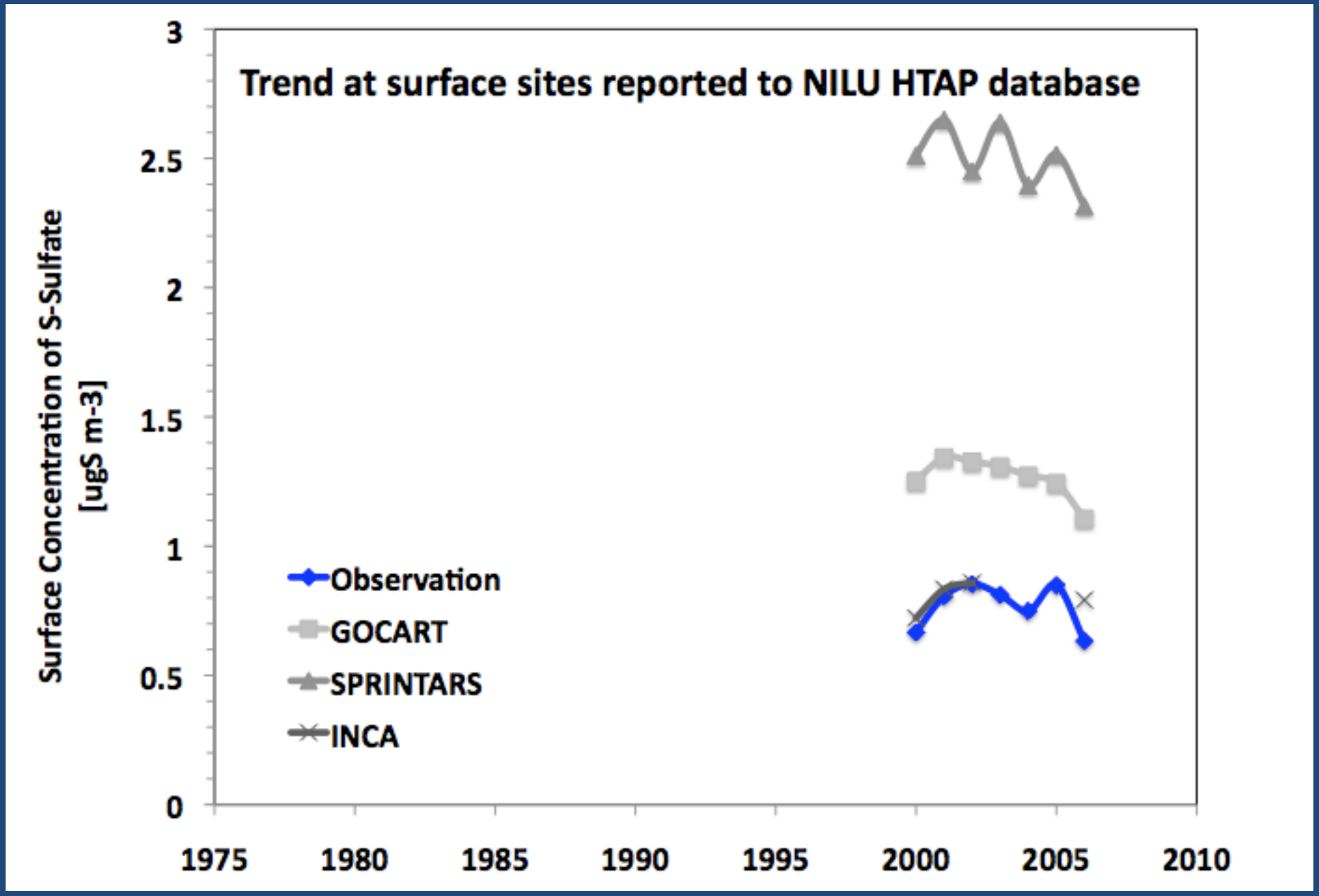
- Caveat: Inhomogeneous network development

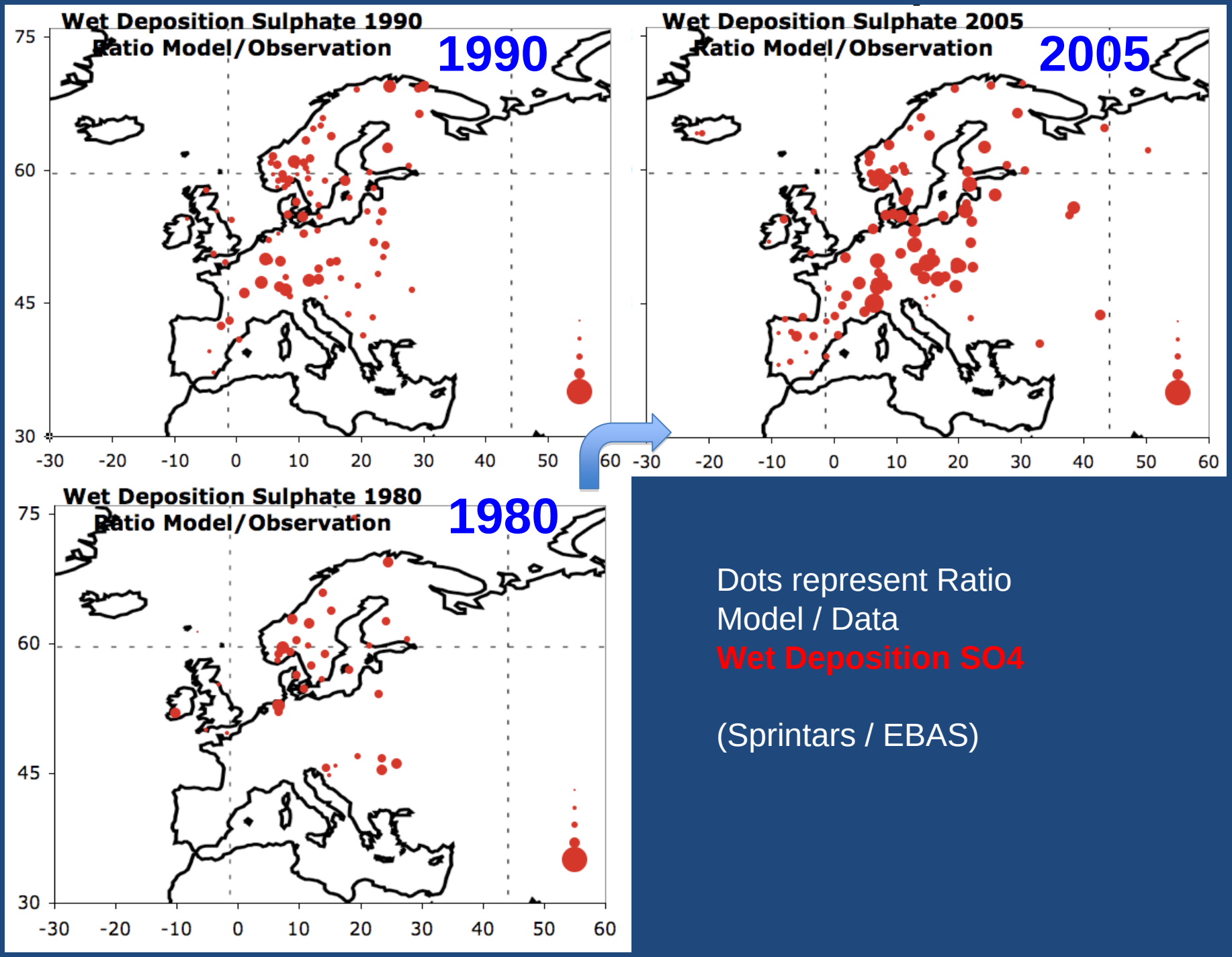
Hindcast analysis, example 1, AOD

Trend analysis AOD@550nm

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


Trend at surface sites reported to NILU HTAP database
Wet Deposition of S-Sulfate
[gS m-2 y-1]
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1975
1980
1985
1990
1995
2000
2005
2010
Observation
GOCART
SPRINTARS
INCA

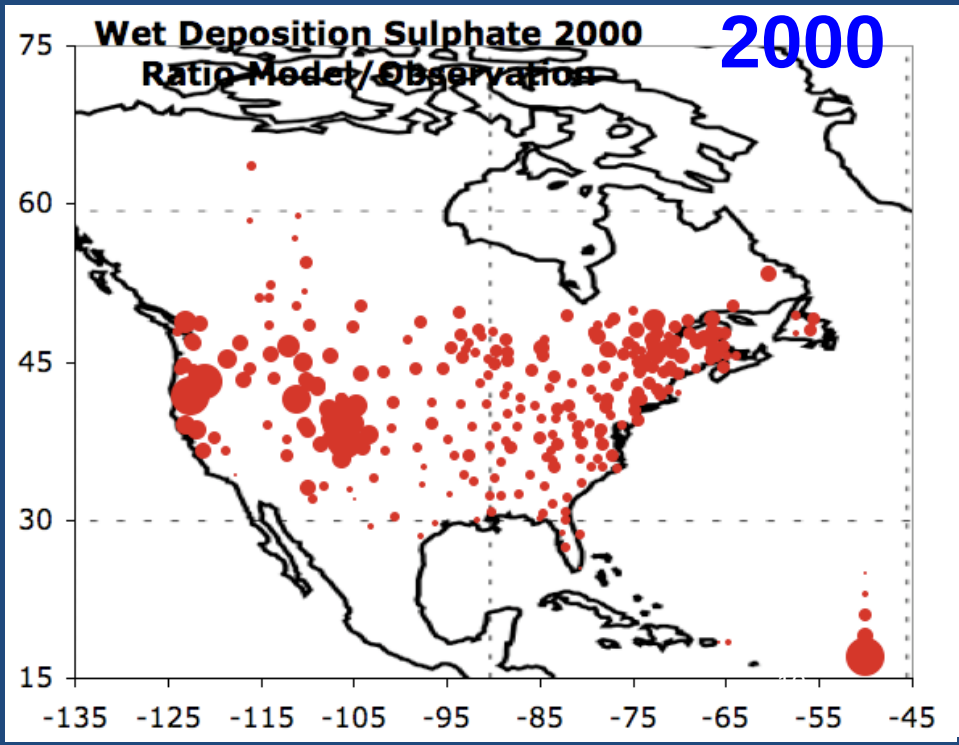

Trend at surface sites reported to NILU HTAP database
Surface Concentration of S-Sulfate [ugS m-3]
3
2.5
2
1.5
1
0.5
0
1975
1980
1985
1990
1995
2000
2005
2010
Observation
GOCART
SPRINTARS
INCA

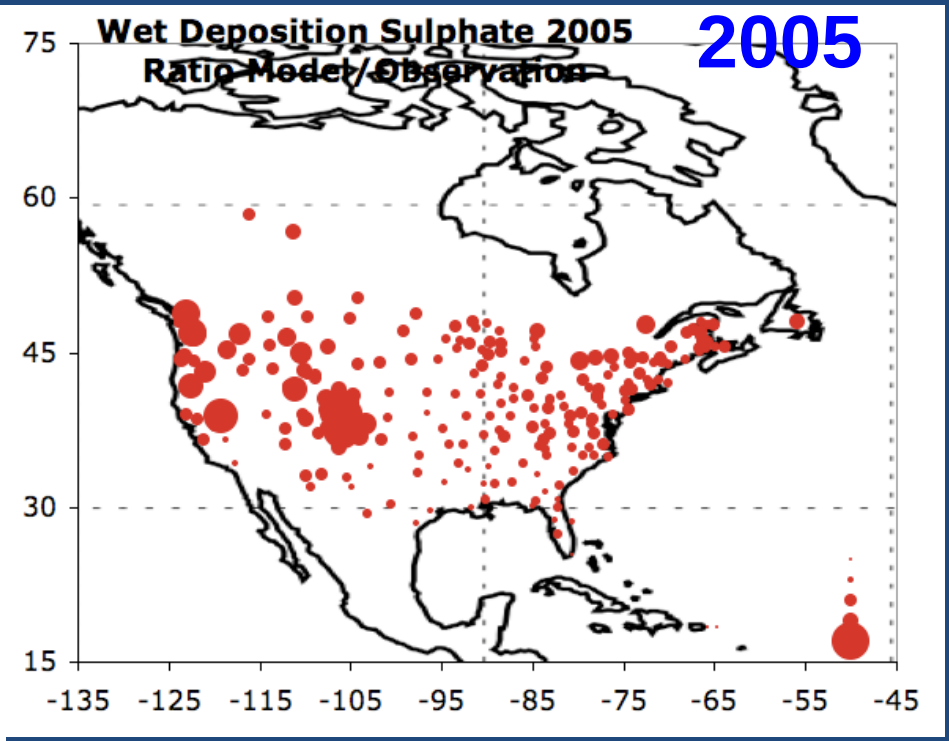


Dots represent Ratio Model / Data

Wet Deposition SO4

(Sprintars / EBAS)





Dots represent Ratio Model / Data

Wet Deposition SO4

(Sprintars / EBAS)

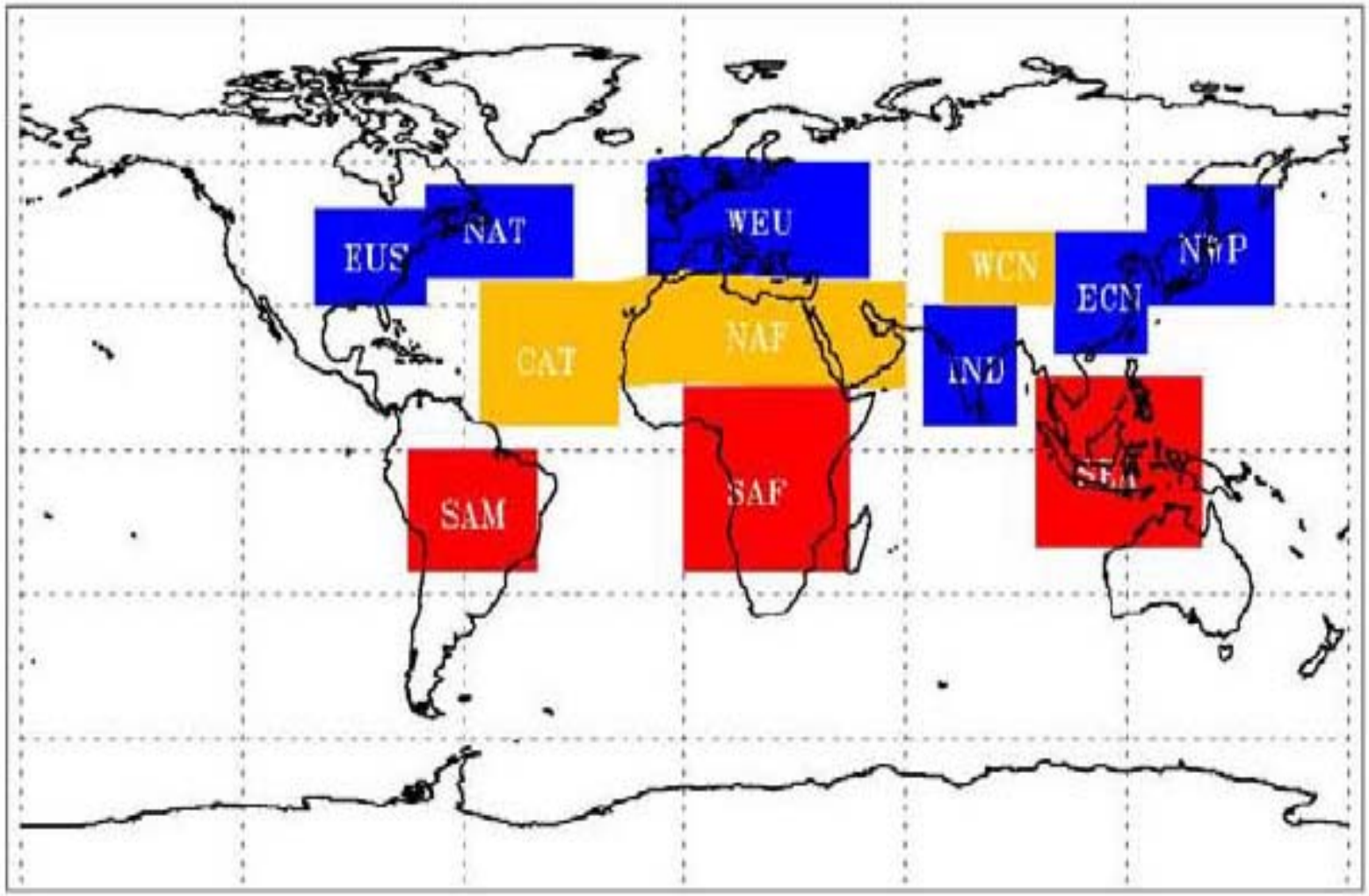
Vertical profiles of aerosols

- How do CALIOP profiles compare to models?
- Can we use night-time Caliop to evaluate profiles and/or regional AOD differnces?
- Does the profile form change from region to region?
- Can we find characteristic climatological profiles?
- Interannual variability of profiles?
- Difference Caliop 2 vs 3?

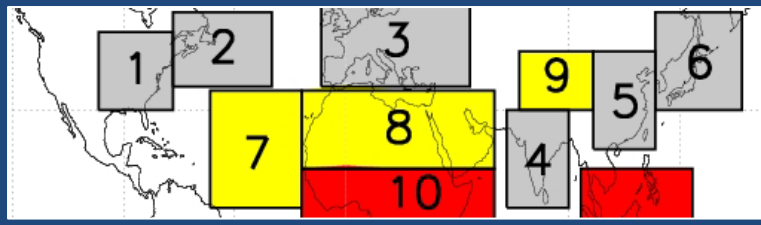
=> Poster Brigitte Koffi !!

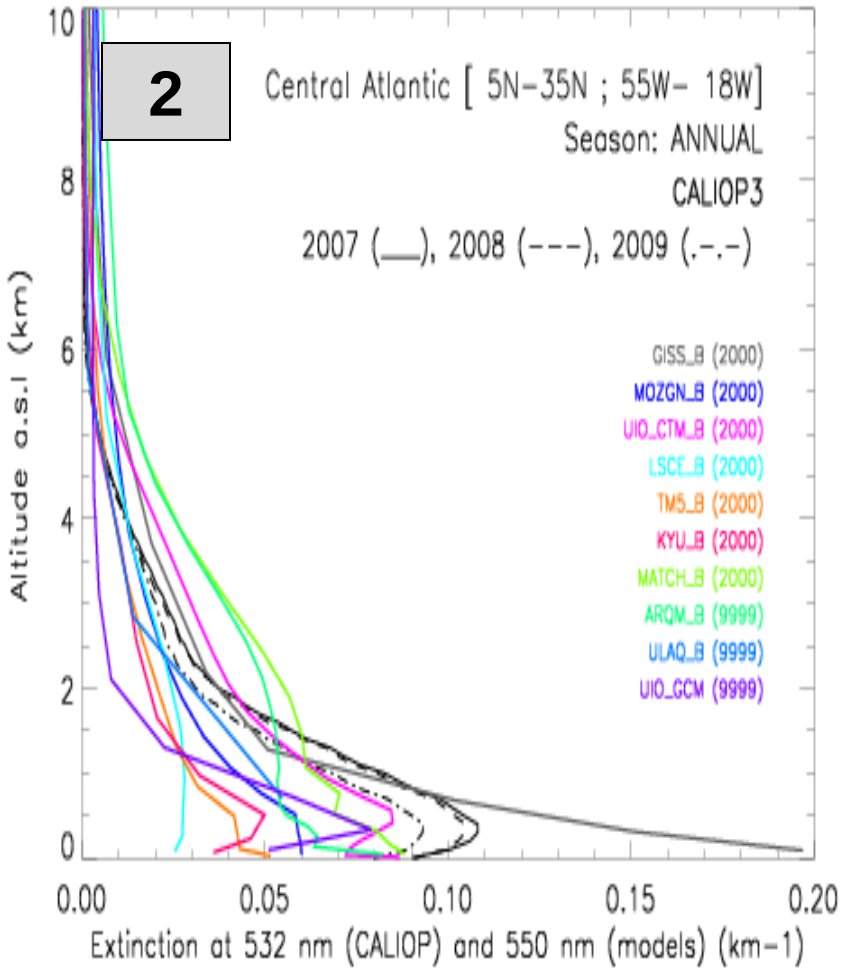
Regional Averaging CALIOP & Models

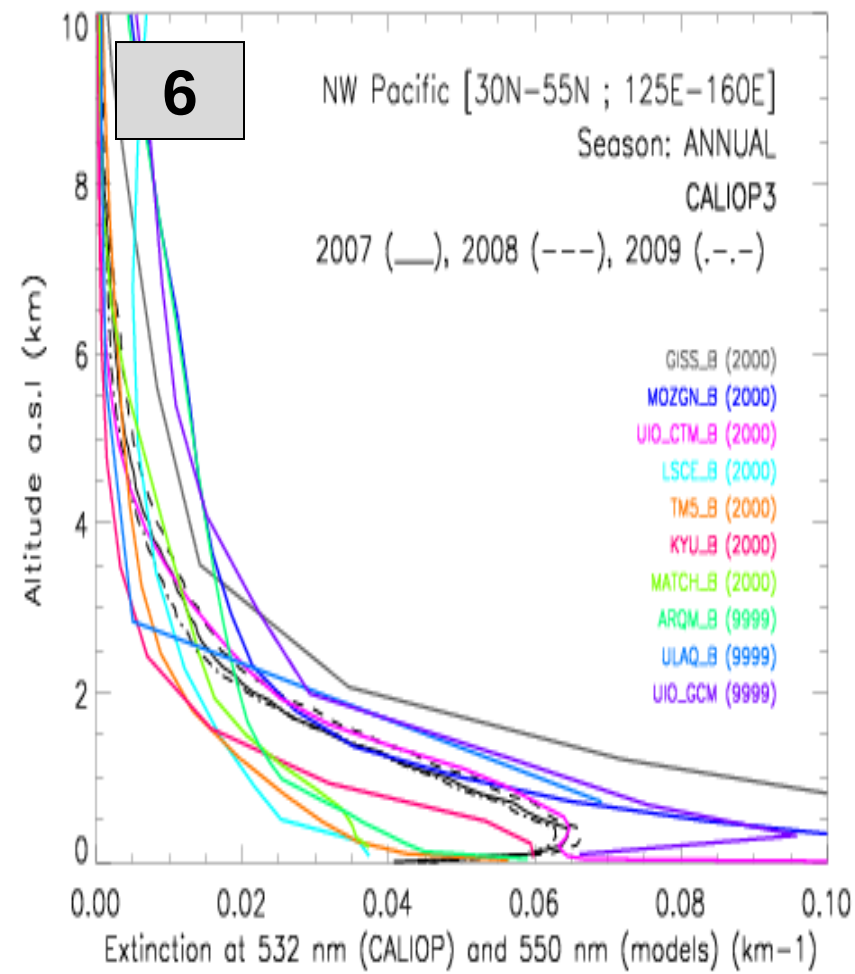
following Hongbin Yu and colleagues



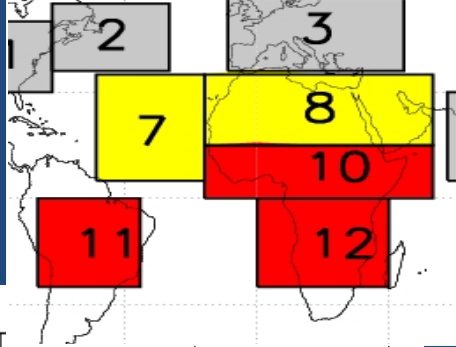
Caliop (07-09) vs Aerocom models
Central Atlantic and NW Pacific

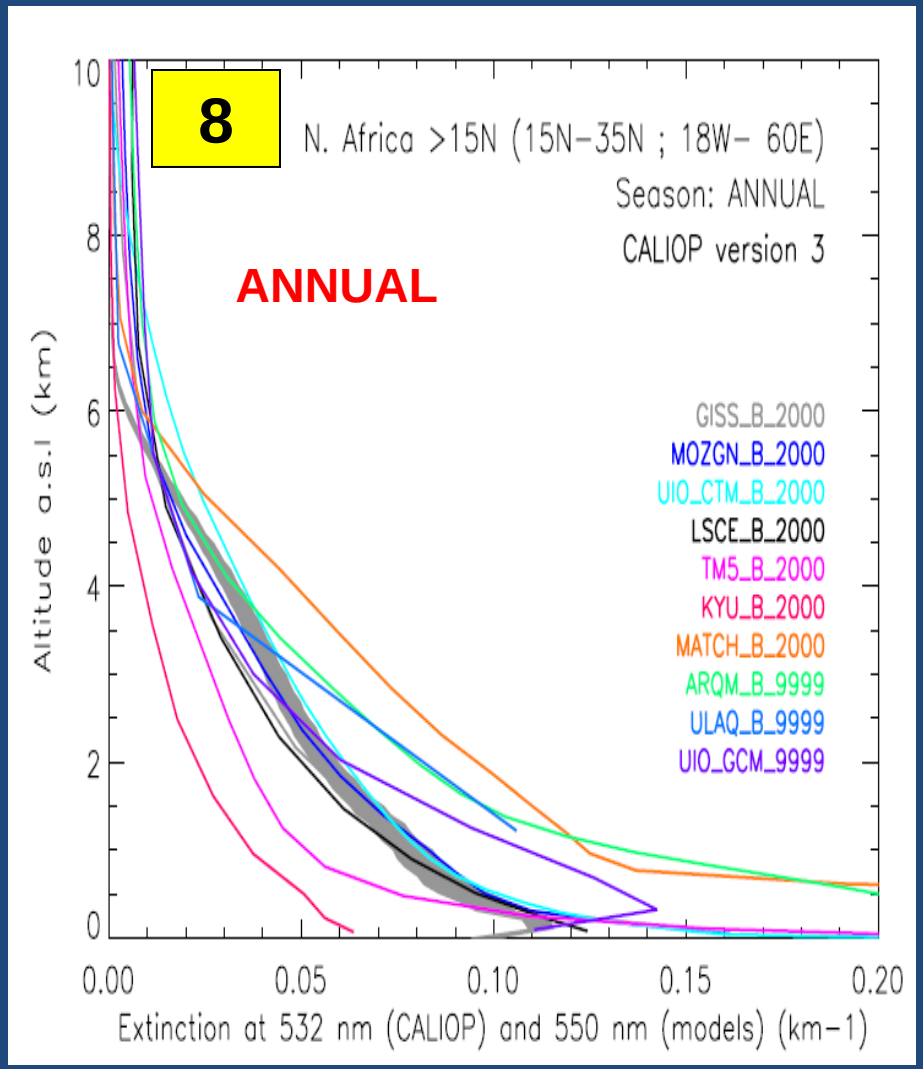


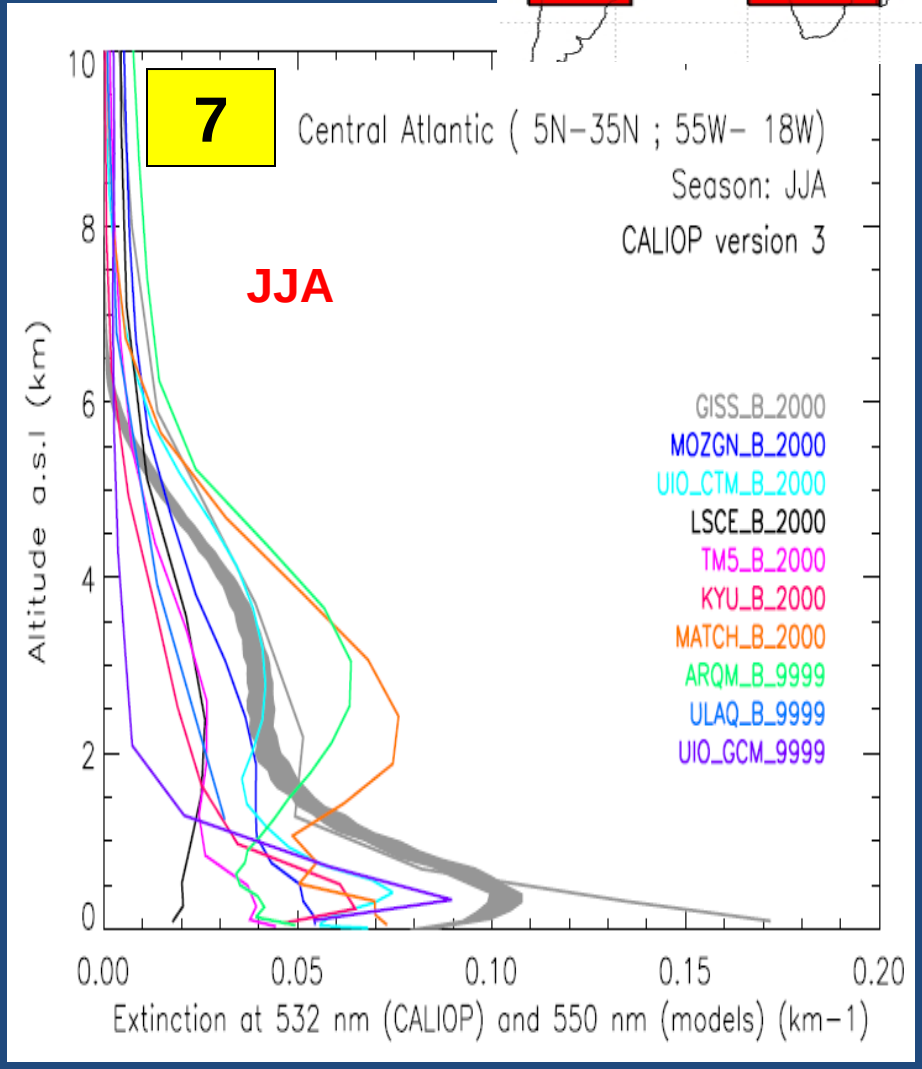




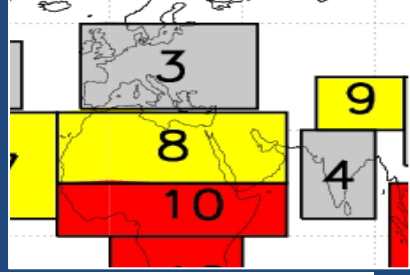
Caliop (07-09) vs Aerocom models (00)
Northern Africa versus Central Atlantic

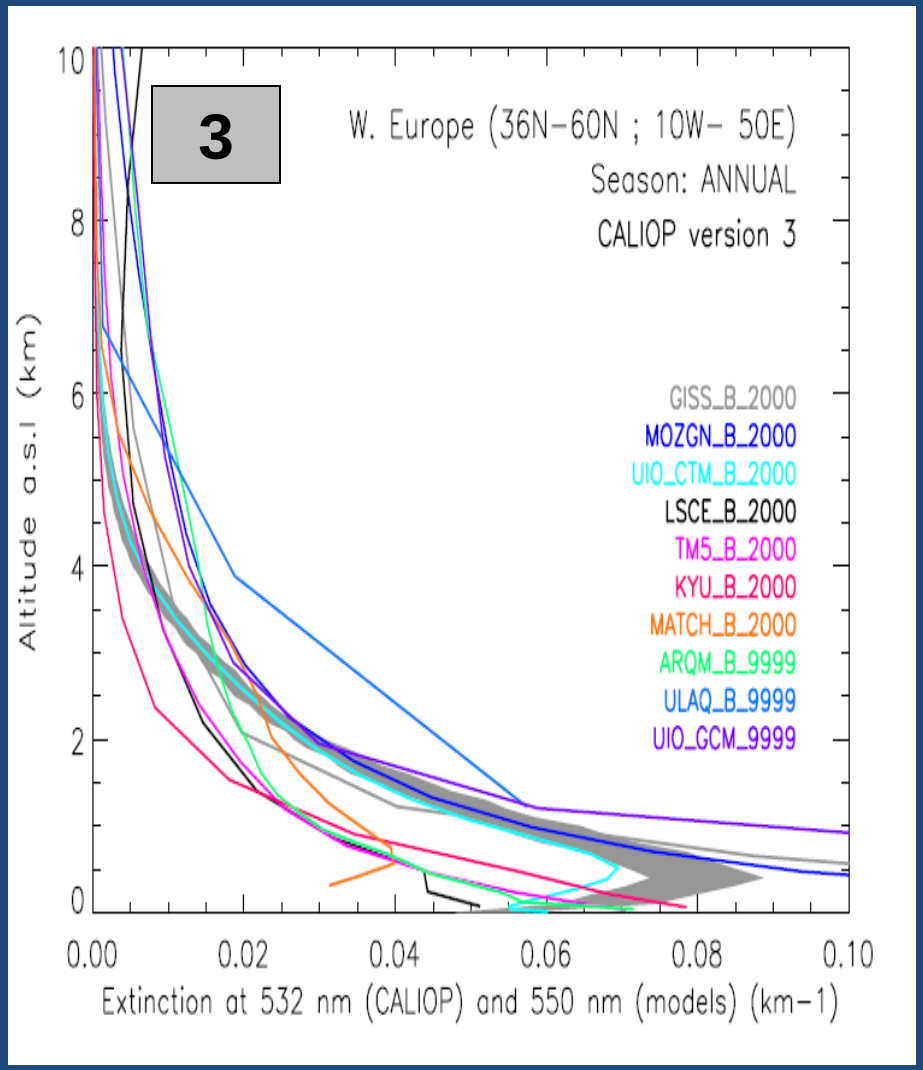


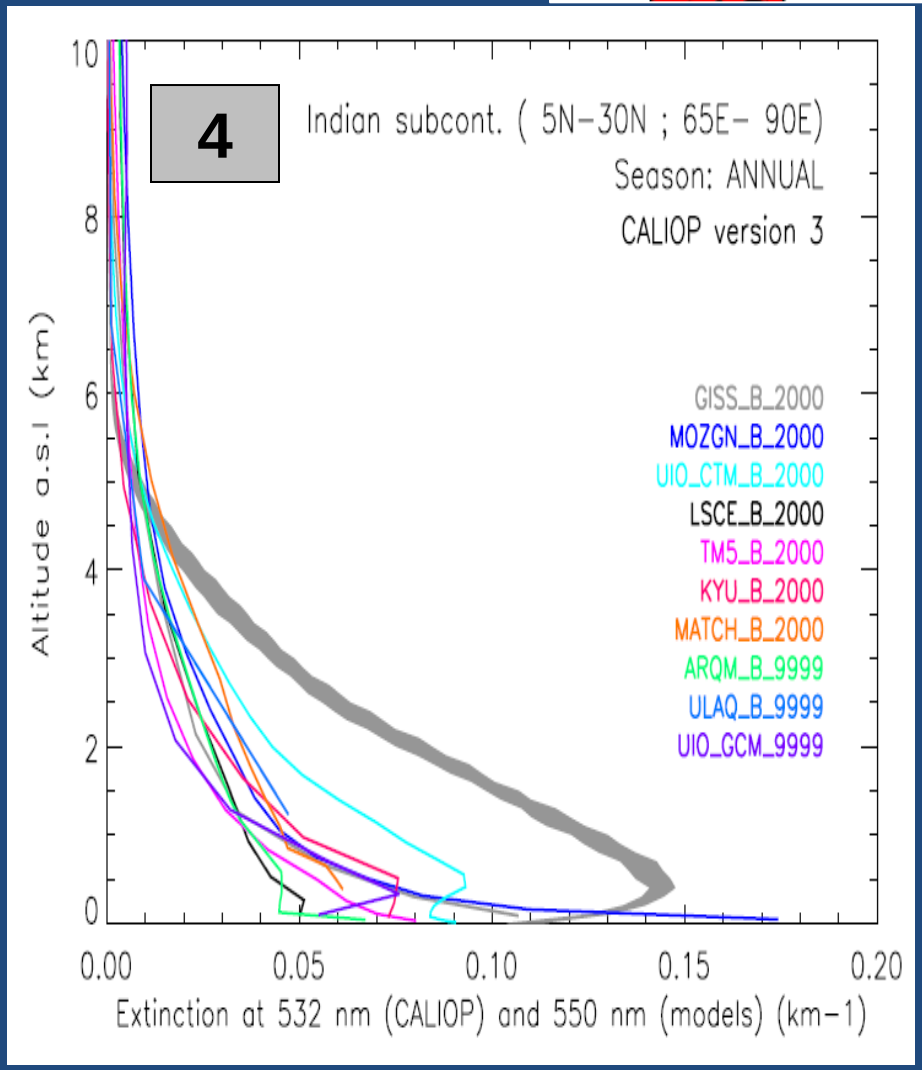




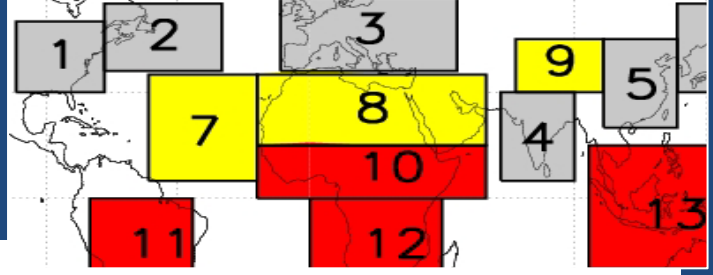
Caliop (07-09) vs Aerocom models (00)
Western Europe and Indian subcontinent

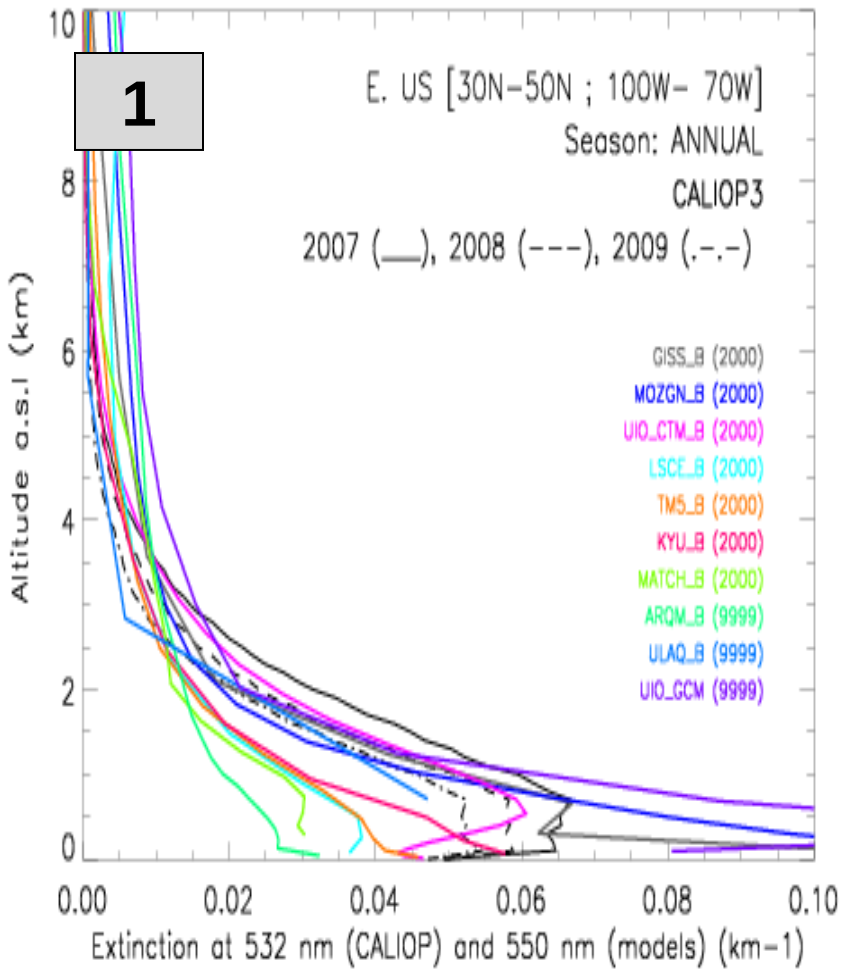


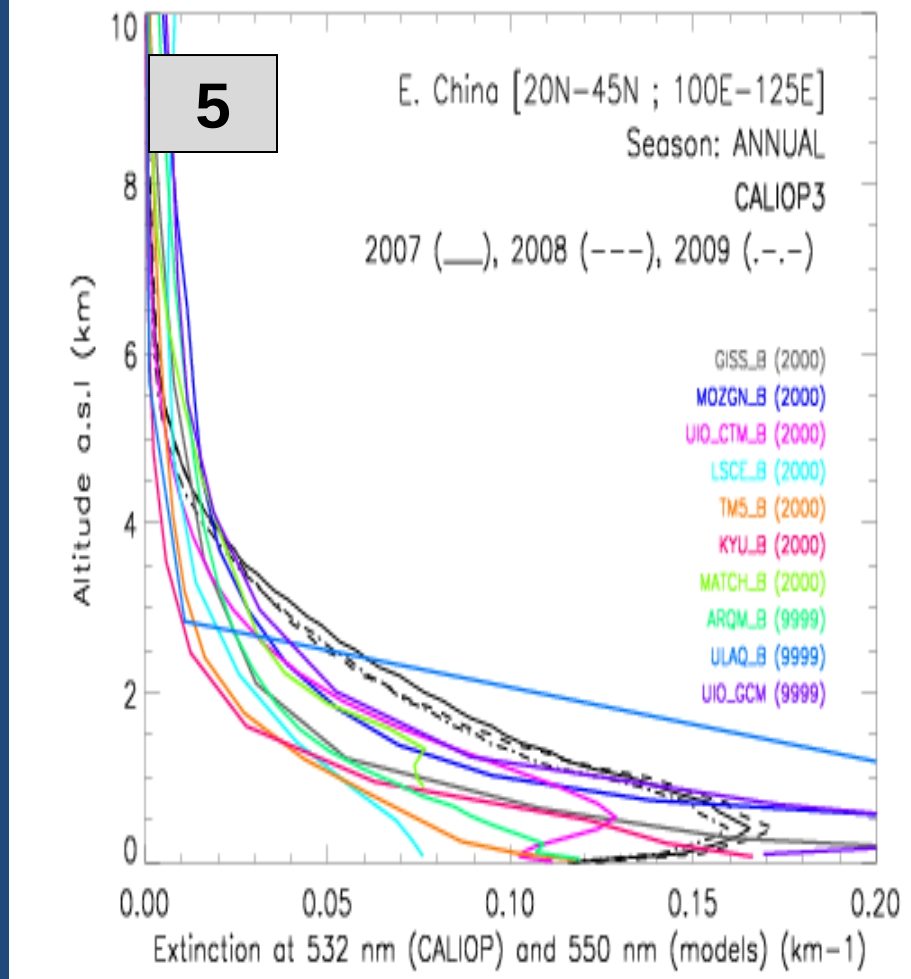




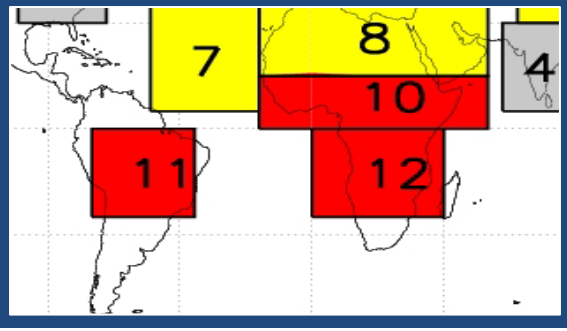
Caliop (07-09) vs Aerocom models Eastern US and Eastern China

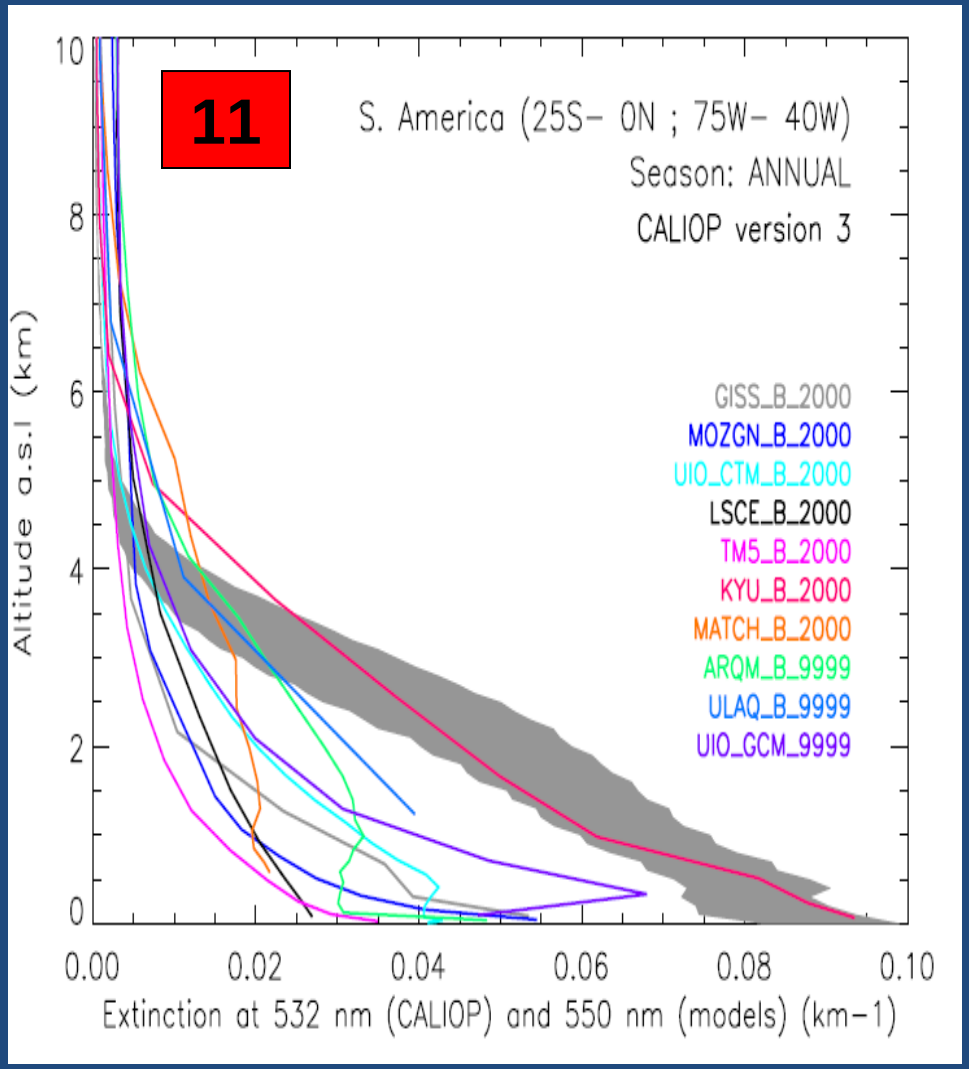


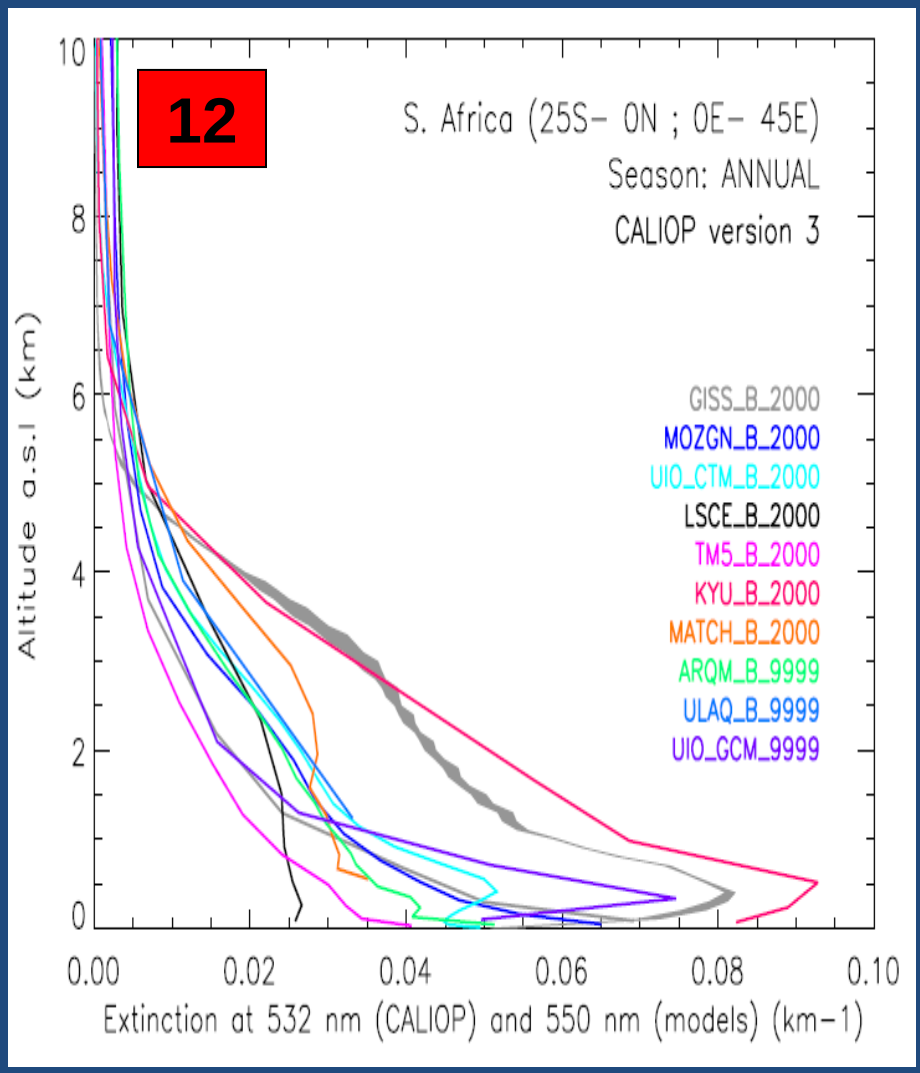




Caliop (07-09) vs Aerocom models (00)
South America & South Africa

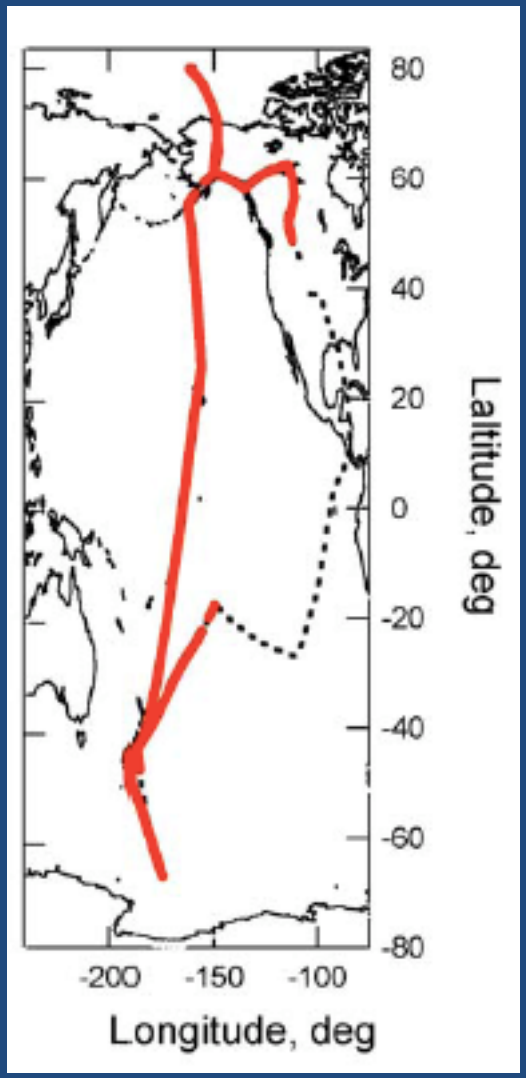


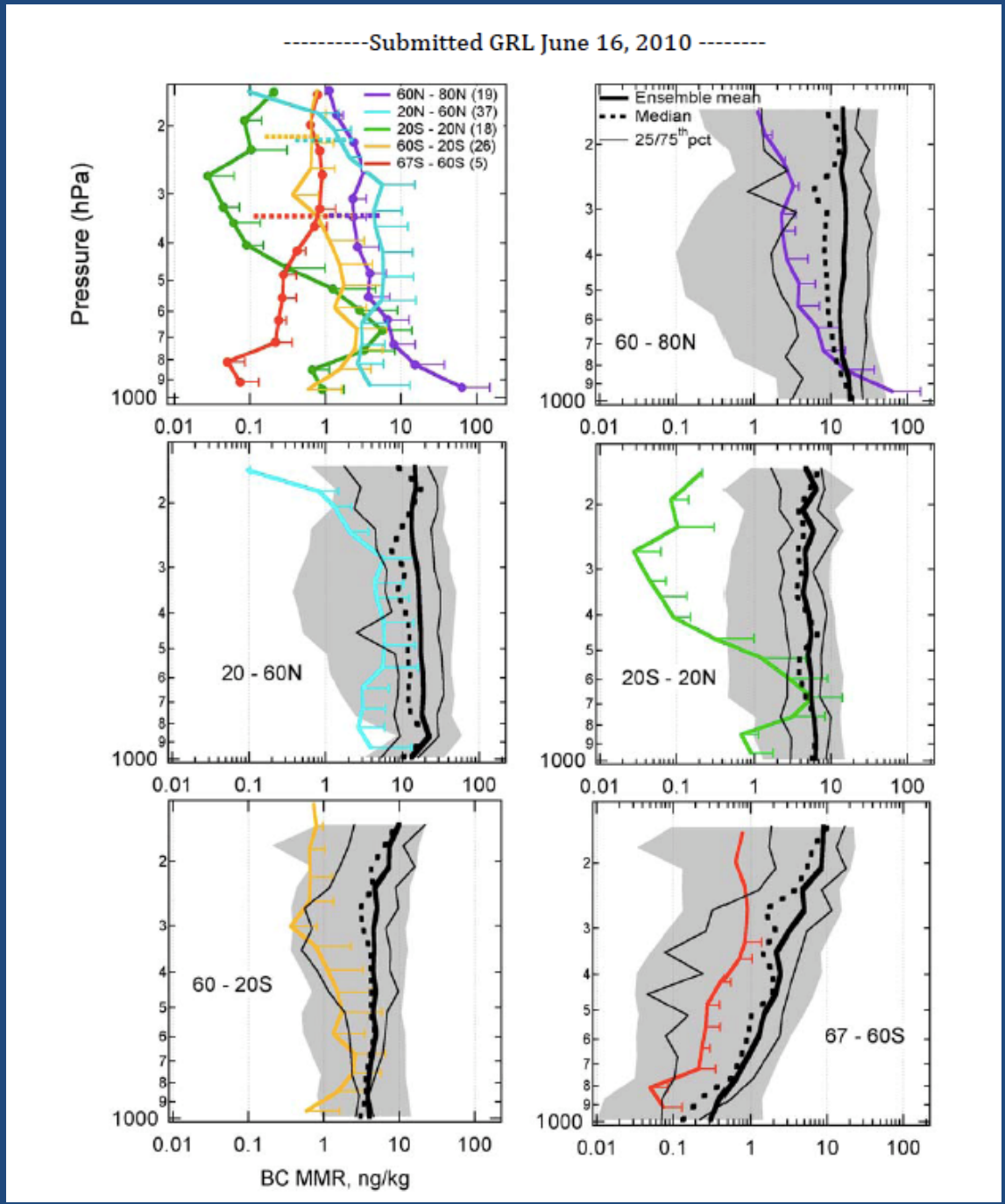




HIPPO flight campaign vs Aerocom models Black Carbon

Schwarz et al. in press GRL (Tollefson, Nature, 2010)





SUMMARY

Phase II results are coming in !!!

Model quality evolution not clear

Sulphur cycle still an issue

Trend analysis requires more data preparation

Absorption underestimate of some models

Utility of CALIOP (& Hippo) profiles seems clear

Too much simulated transport to upper troposphere?