School of Earth and Environment

INSTITUTE FOR CLIMATE AND ATMOSPHERIC SCIENCE

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First results from the AEROCOM aerosol microphysics working group

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National Centre for Atmospheric Science

NATURAL ENVIRONMENT RESEARCH COUNCIL

Making better use of the expanding number of detailed aerosol observations

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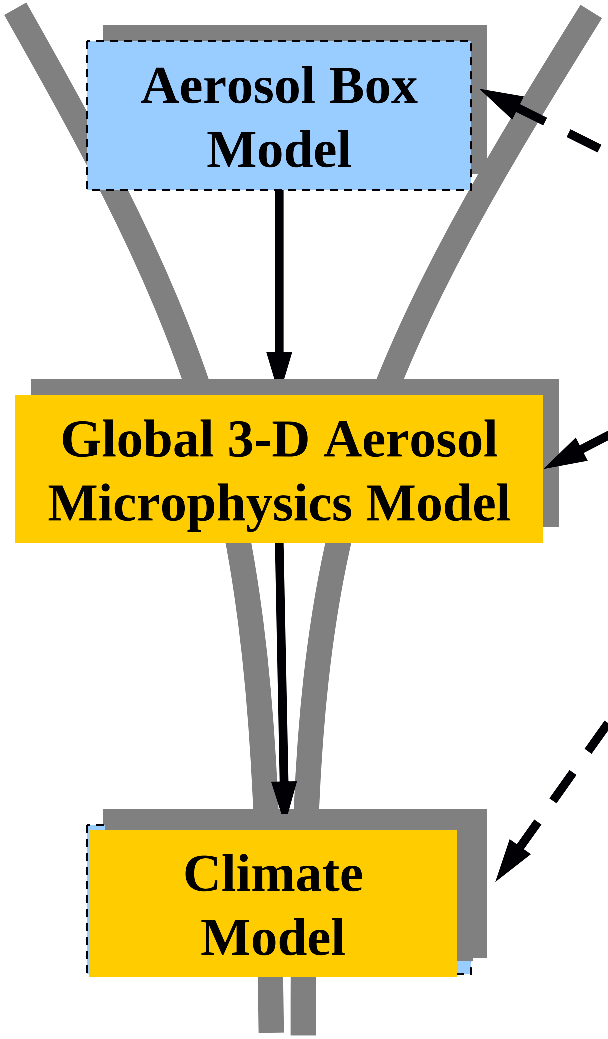
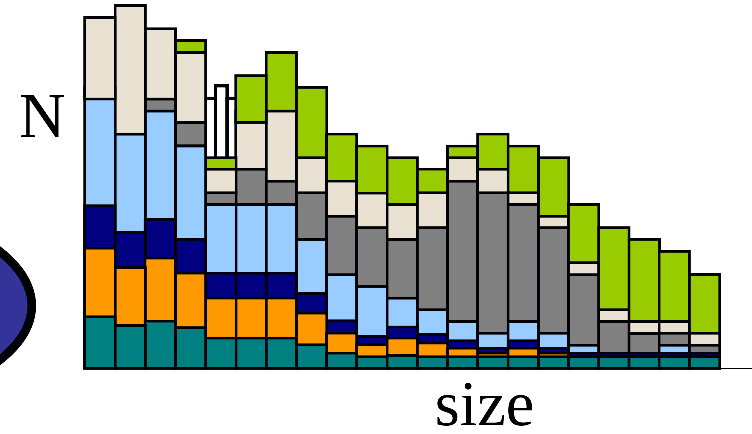
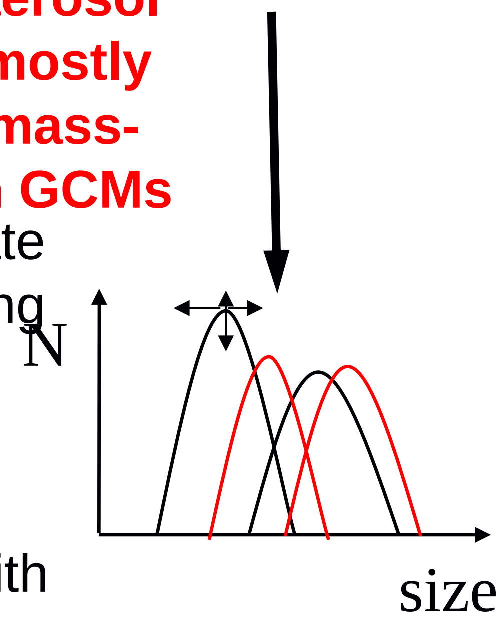




Detailed n-situ aerosol measurements mostly inaccessible to mass-only schemes in GCMs



Many composition-climate models now implementing aerosol schemes with aerosol-microphysics.

UKCA sub-model of HadGEM3 developed with GLOMAP-mode scheme.

Global Model of Aerosol Processes (GLOMAP)

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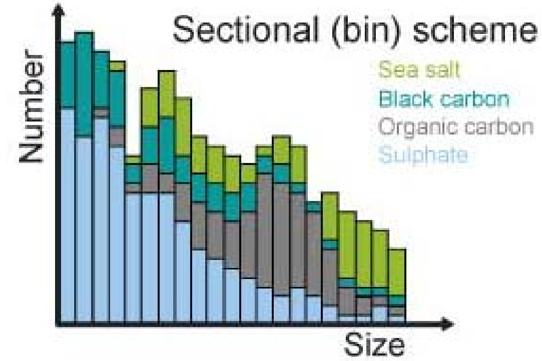
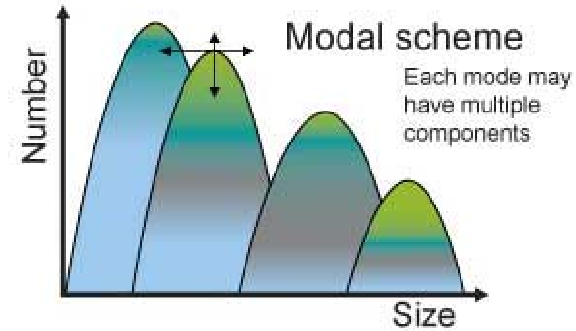


Global CTM forced by 6-hourly ECMWF winds

Usually run at T42L31 (2.8^ox2.8^o) resolution

Sectional aerosol scheme: 20 bins, 3 nm – 20 μm
Modal scheme: 7 or 4 log-normal modes



Chemistry usually driven by offline oxidants,
now coupled to CTM chemistry

Aerosol transport, new particle formation, growth
by coagulation, condensation, cloud processing.

Wet and dry deposition of gases & aerosol particles

Emissions of DMS → SO_2 → H_2SO_4; monoterpenes → biogenic SOA

Primary emissions of sea salt, dust,
black & organic carbon (fossil and biofuels, vegetation fires)

Nucleation via binary homogeneous nucleation of H_2SO4-H_2O
and also now implemented boundary layer nucleation mechanism

GLOMAP-bin : Spracklen et al. (ACP, 2005), Spracklen et al (GRL, 2008)
GLOMAP-mode: Mann et al (GMD, 2010), Woodhouse et al (2010), Schmidt et al (2010)

Family of models using GLOMAP-mode

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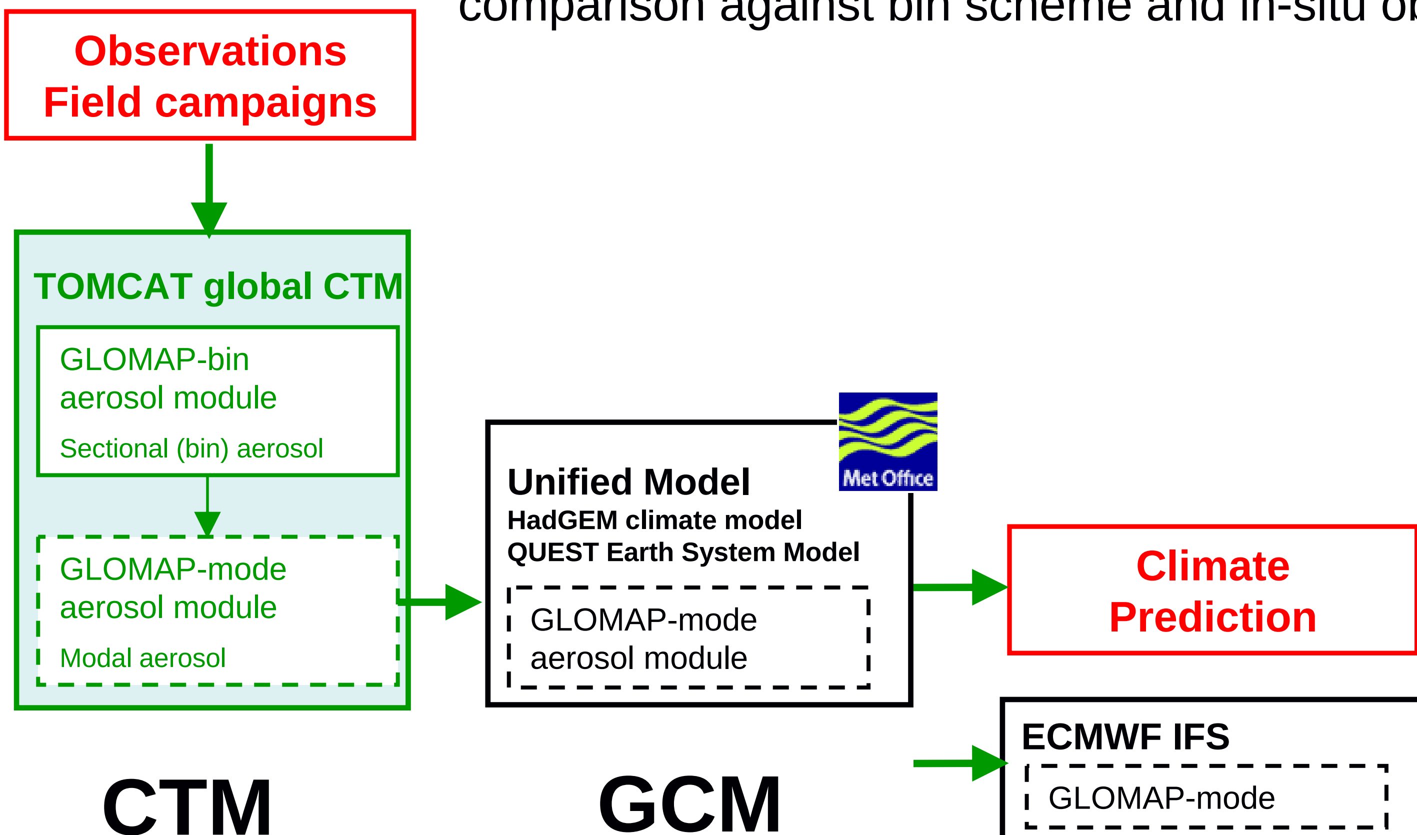
Simplified GLOMAP version (GLOMAP-mode) benchmarked in chemistry transport model (CTM) against detailed GLOMAP-bin scheme.

UKCA composition-climate model uses GLOMAP-mode as aerosol scheme.

Link to CTM enables climate model aerosol to be improved by comparison against bin scheme and in-situ observations



Assembled benchmark observational datasets.

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Wide range of observational datasets being used at Leeds to understand processes and to evaluate the bin and modal versions of the GLOMAP aerosol microphysics model.

1) CN concentrations from CPC observations at GAW & other sites
2) size-resolved number concentrations & mean size against compilations of multiple field campaign measurements (e.g. Heintzenberg et al, 2000, 2004).
3) CCN concentrations from field campaigns and monitoring sites.
4) vertical CN, CCN profiles from models against compilations of aircraft observations (e.g. TRACE-P, PEM-Tropics, INCA, UFA-EXPORT, LACE field campaigns)
5) size distributions against DMPS observations at EUSAAR sites

Evaluate AEROCOM size-resolving global aerosol models.

Do some models with certain processes compare better?

1. CN concentrations from GAW and other sites

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Station Name	Location	Altitude (m)	Observation period	Min. cutoff diameter (nm)	Reference
			Free troposphere		
Jungfraujoch	8.0E , 46.6N	3580	1995-1999, 2003-2007	10	Weingartner et al. (1999)
Puy de Dome	3.0E, 45.8N	1465	2005-2008	3	Venzac et al. (2009)
Nepal C.O.	86.8E, 28.0N	5079	2007-2008	10	Venzac et al. (2008)
Mauna Loa	155.6W, 19.5N	3397	1975-2000	10	Bodhaine (1996)
South Pole	24.8W, 90S	2841	1974-1999	10	
Pico Espejo	71.1W, 8.5N	4775	2007-2009	10	
Mount Washnigton	71.3W, 44.3N	1910	2002-2005	10	
			Marine boundary layer		
Mace Head	350.1E, 53.3N	0	2000, 2002-2007	10	O'Dowd et al. (1998)
Neumayer	8.3W, 70.7S	42	1993-2006	10	Weller and Lampert (2008)
Point Barrow	156.6W, 71.3N	11	1994-2007	10	Bodhaine (1989)
Samoa	170.6W, 14.2S	77	1977-2006	10	
Trinadad Head	124.2W, 41.1N	107	2002-2007	10	
Cape Grim	144.7E, 40.6S	94	1996-2007	3	Gras (1995)
Sable Island	60.0W 43.9N	5	1992-2000	10	

Spracklen et al, (ACP, 2010)

1. CN concentrations from GAW and other sites

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Station Name	Location	Altitude (m)	Observation period	Min. cutoff diameter (nm)	Reference
			Continental boundary later		
Hyyti¨al¨a	24.3E, 61.9N	180.	2000-2004	3	Aalto et al. (2001)
Pallas	24.1E, 68.0N	340.	2000-2004, 2007	10	Komppula et al. (2003)
Finokalia	25.7E, 35.3N	0	1997, 2006-2007	10	
Hohenpeissenberg	11.0E, 47.8N	995	2006-2007	3	Birmili et al. (2003)
Melpitz	12.3E, 51.2N	86	1996-1997, 2003	3	
Bondville	88.4W, 40.1N	213	1994-2007	10	
Southern Great Plains	97.5W, 36.6N	320	1996-2007	10	
Tomsk	85.1E, 56.5N		2005-2006	3	Dal Maso et al. (2008b)
Listvyanka	104.9E, 51.9N		2005-2006	3	Dal Maso et al. (2008b)
Harwell	359.0E, 51.0N	60	2000	10	
Weybourne	1.1, 53.0N	0	2005		
Botsalano	25.8E, 25.5S	1424	7/2006-6/2007	10	Laakso et al. (2008)
India Himilaya	79.6E, 29.4N	2180	2005-2008	10	Komppula et al. (2009)
Aspvreten	17.4E, 58.8N	25	2000-2006	10	Dal Maso et al. (2008a)
Ut¨o	21.4E, 59.8N	8	2003-2006	7	Dal Maso et al. (2008a)
Varri¨o	29.6E, 67.8N	400	1998-2006	8	Dal Maso et al. (2008a)
Thompson Farm	289.1E, 43.1N	75	2001-2009	7	Ziemba et al. (2007)
Castle Springs	71.3W, 43.7N	406	2001-2008	7	

1. CN concentrations from GAW and other sites

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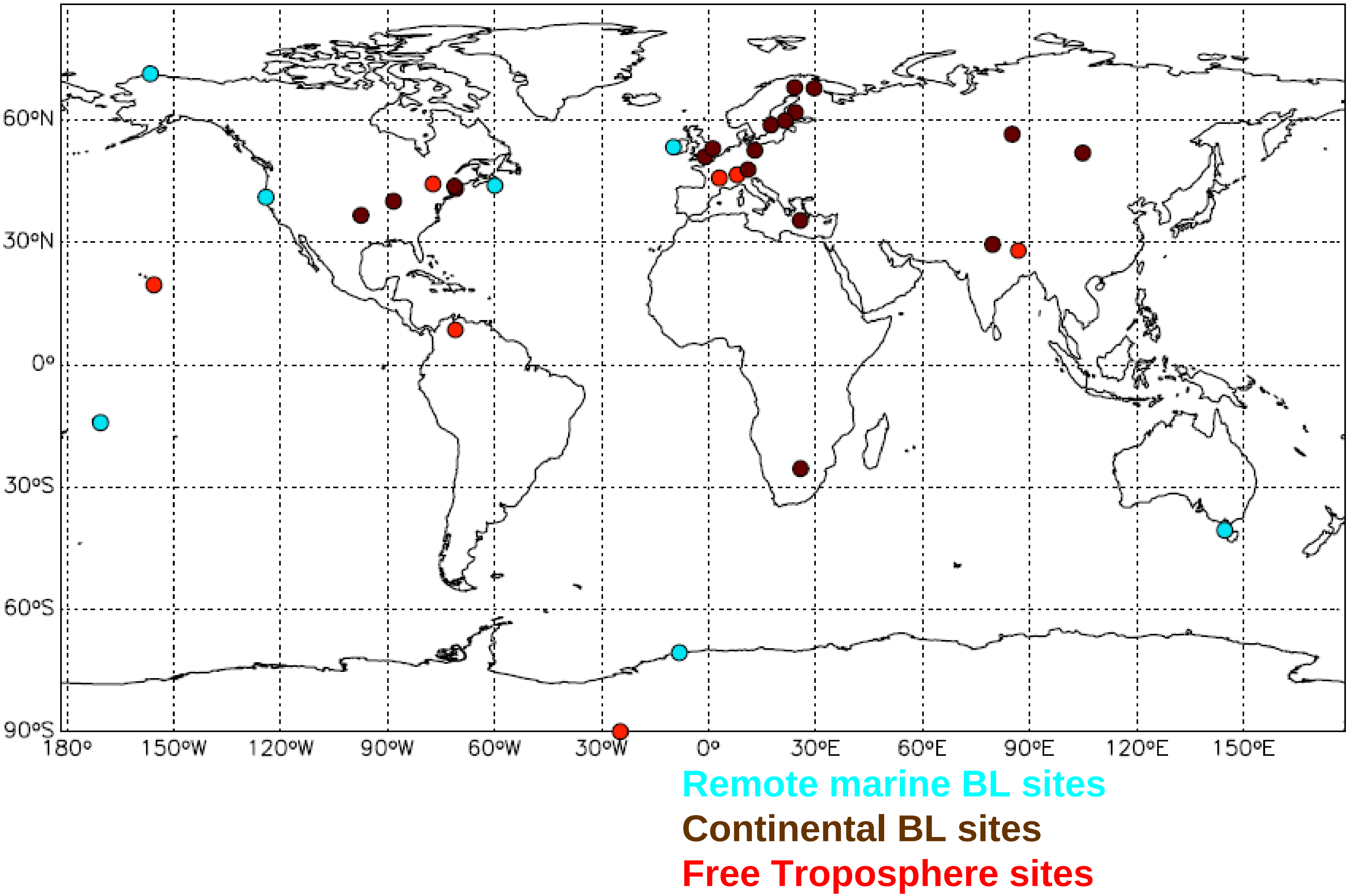

Being used at Leeds to evaluate GLOMAP models

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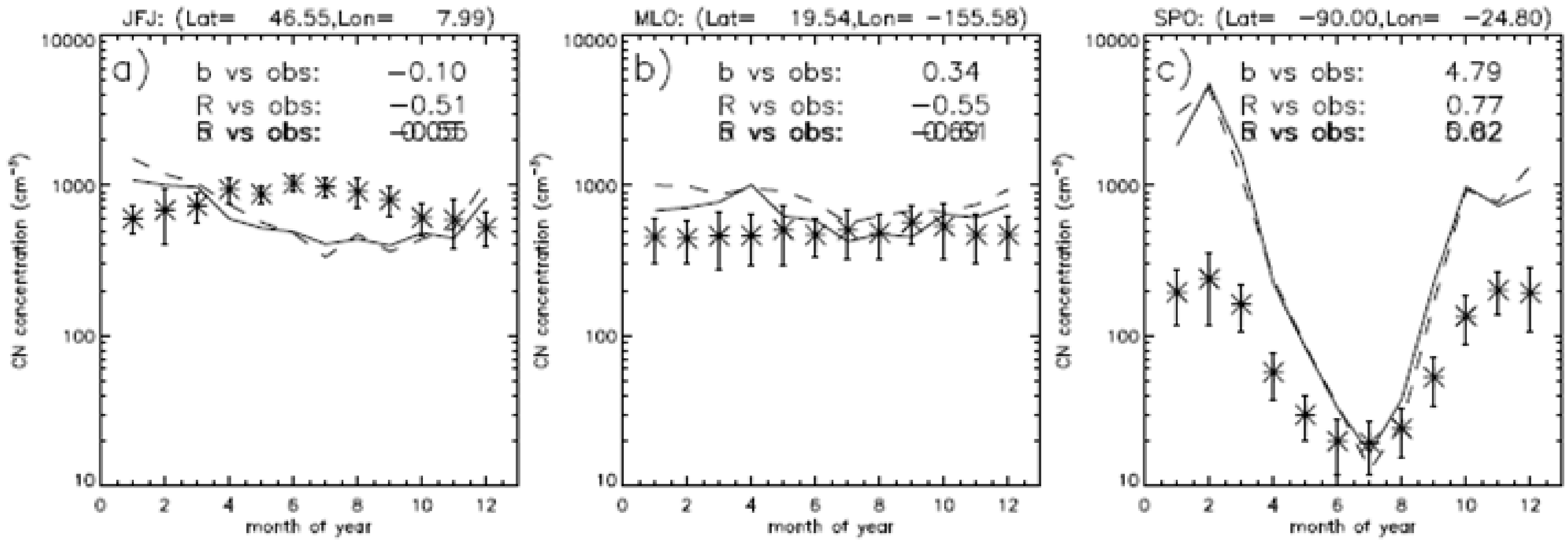

Free Troposphere sites

Mann et al (in prep 2010)

Being used at Leeds to evaluate GLOMAP models

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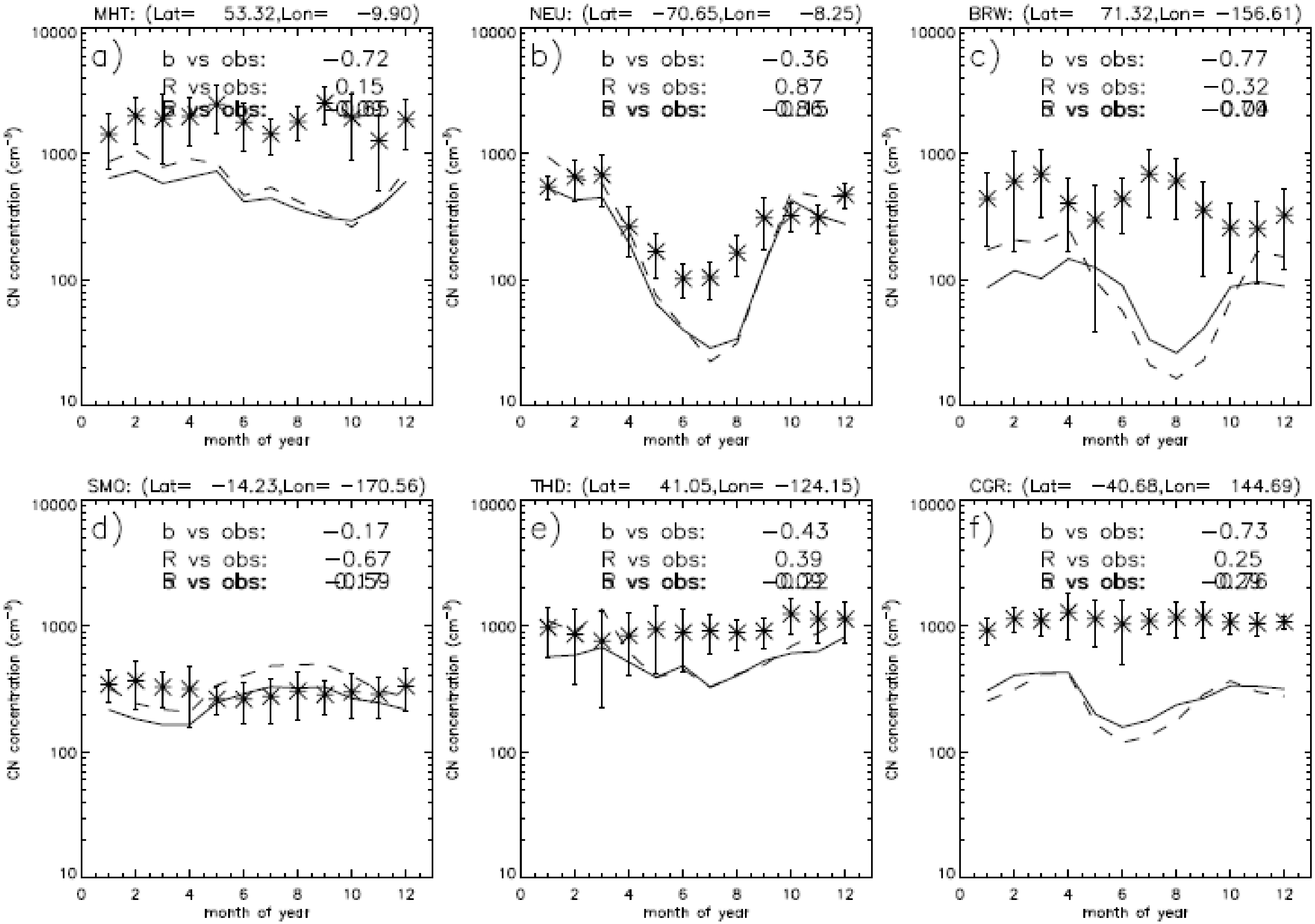

Marine BL sites

Mann et al (in prep 2010)

Being used at Leeds to evaluate GLOMAP models

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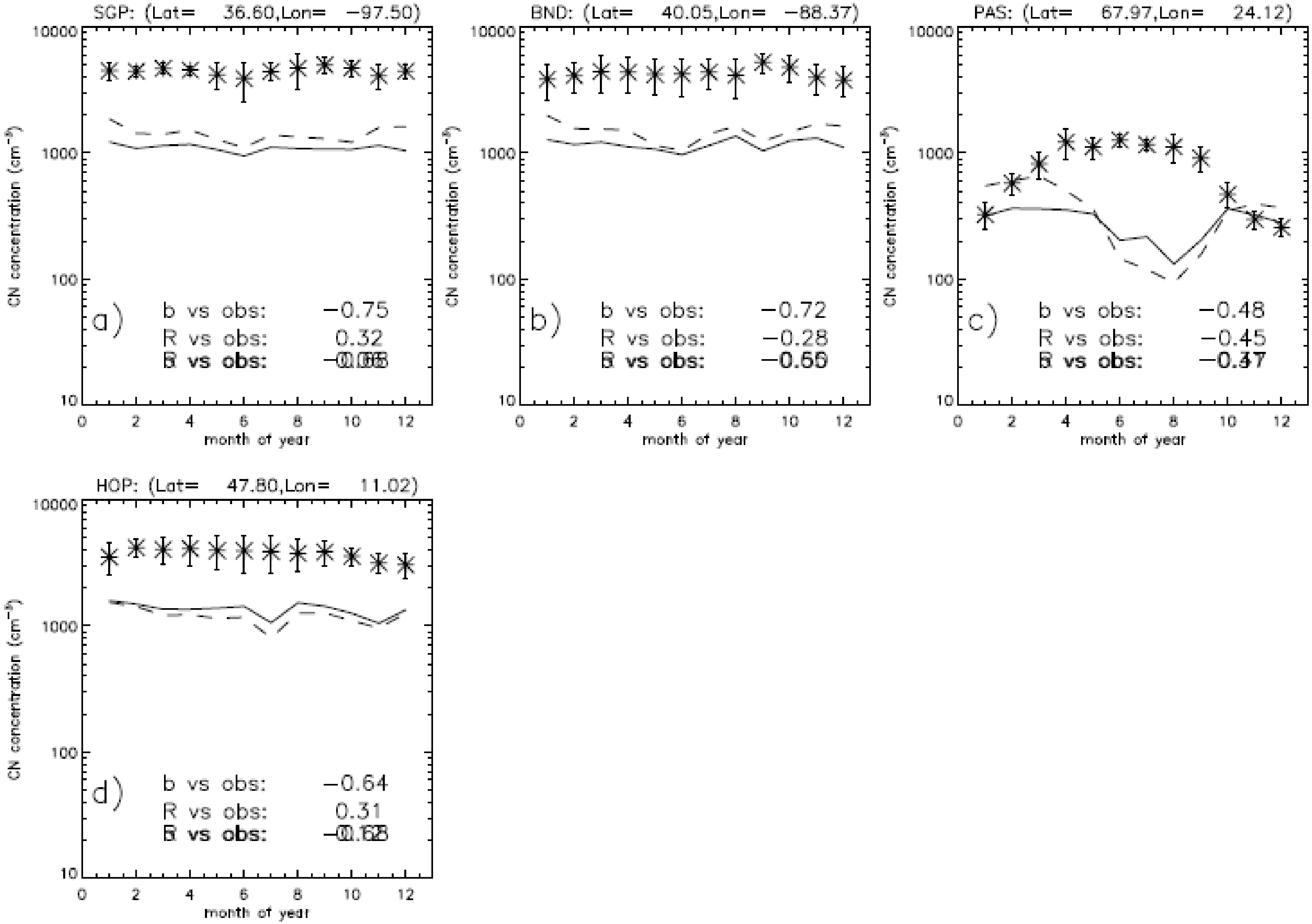

Continental BL sites

Mann et al (in prep 2010)

Also used to understand processes

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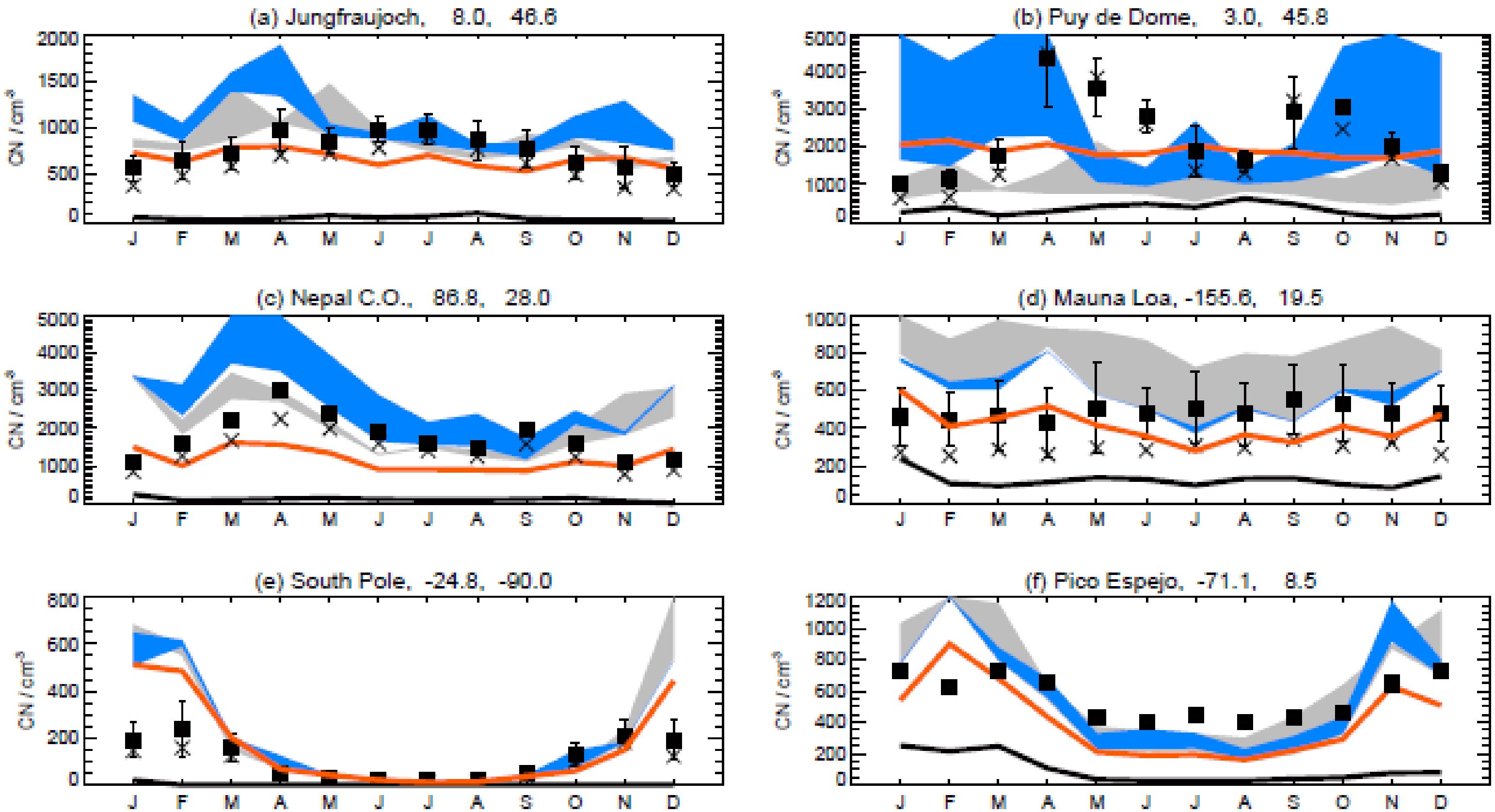

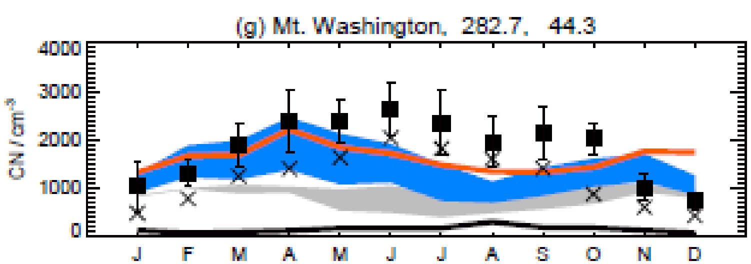

Primaries only (no nucleation)

Enhanced primaries only (no nucleation)

Primaries & binary homogeneous nucln (BHN)

Primaries, BHN & Boundary Layer nucleation

Spracklen et al, (ACP, 2010)

Also used to understand processes

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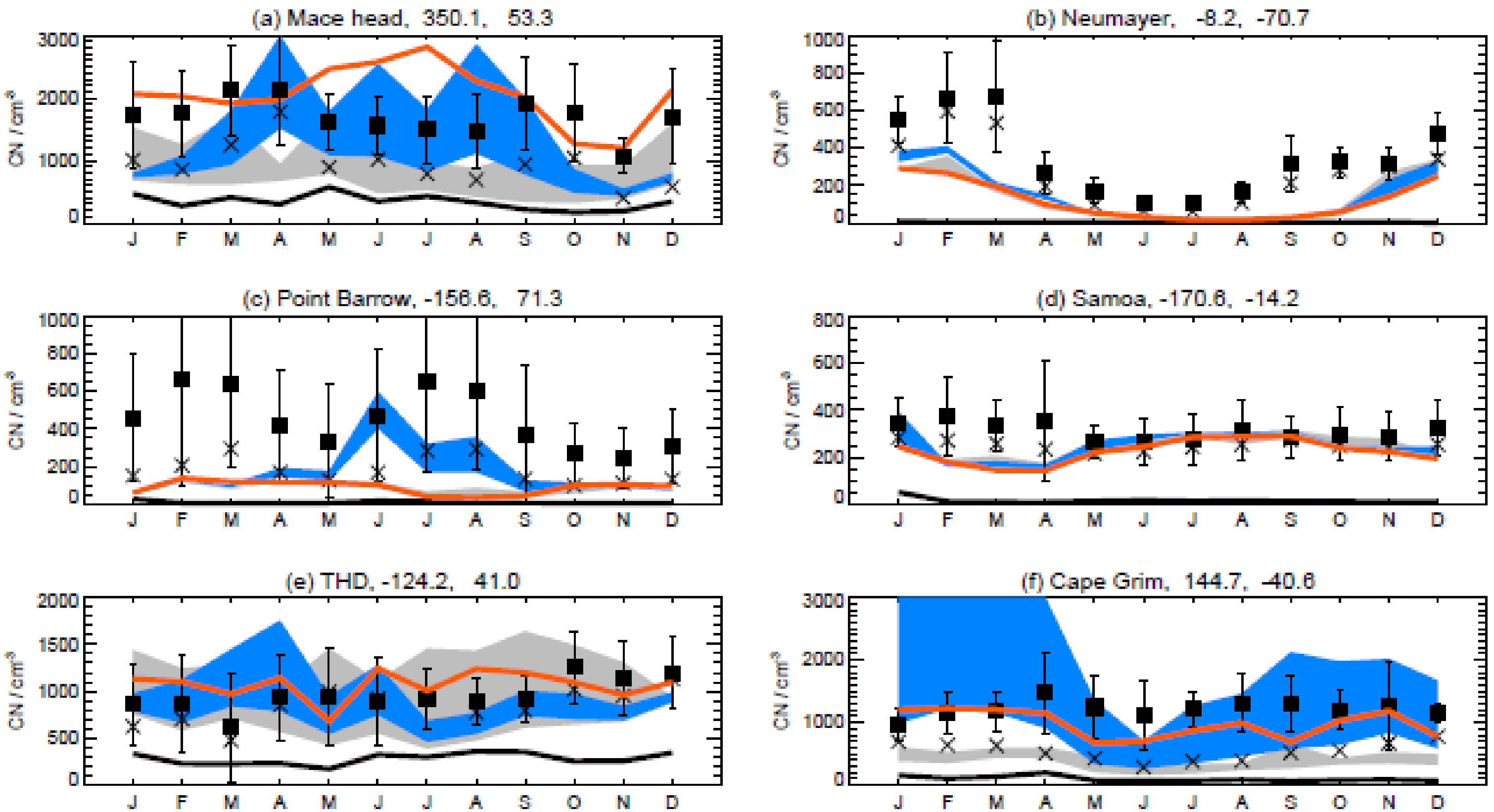
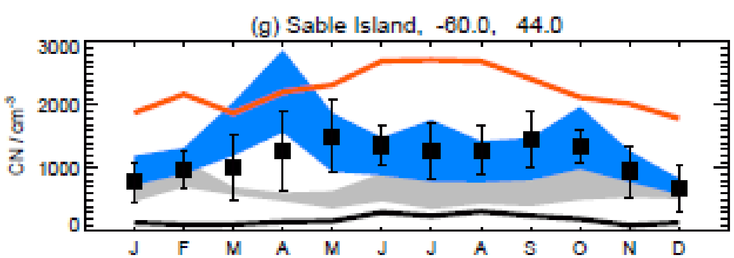




Primaries only (no nucleation)

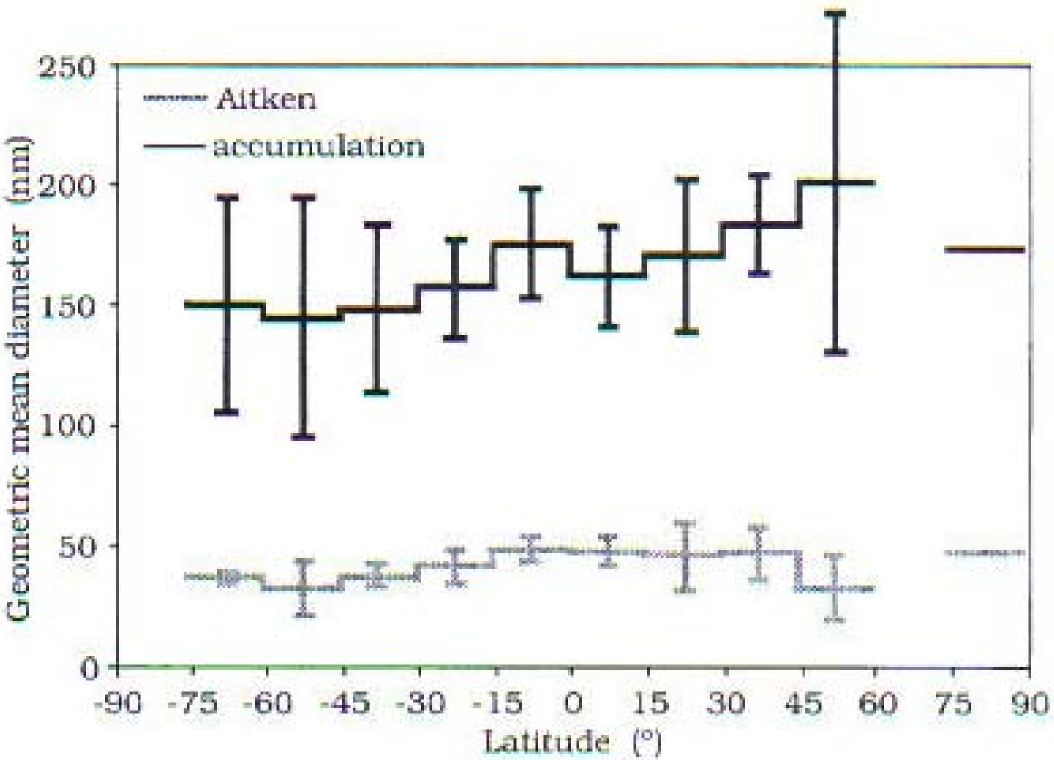
Enhanced primaries only (no nucleation)

Primaries & binary homogeneous nucln (BHN)

Primaries, BHN & Boundary Layer nucleation

Spracklen et al, (ACP, 2010)

2. Compilation of MBL aerosol observations



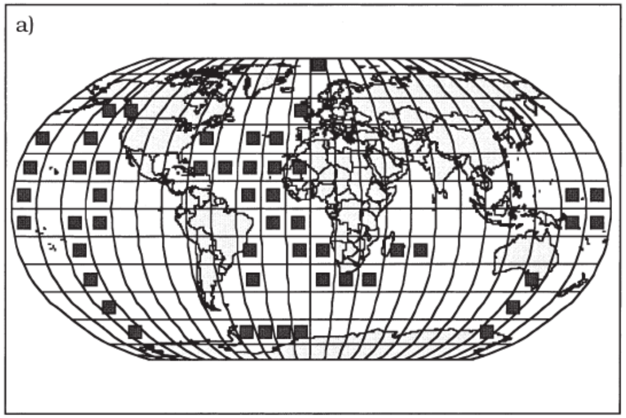


Table 1. *Sources of data on aerosol concentration and number-size distribution*

Source	Geographical area/ experiment
Bates et al., 1998b	Tasman Sea, Southern Ocean, ACE 1
Covert et al., 1996b	Arctic, IAOE91
Covert et al., 1996a	Central Pacific, MAGE
Covert et al. (unpublished data)	Equatorial Western Pacific, CSP
Davison et al., 1996a	Southern Ocean
Heintzenberg and Leck, 1994	Arctic
Jaenicke et al., 1992	Southern Ocean
Jensen et al., 1996	North E Atlantic, ASTEX
Leaitch et al., 1996	NW Atlantic
Quinn et al., 1990	Central N Pacific, MAGE
Quinn et al., 1993	Central Eastern Pacific, MAGE
Quinn et al., 1995	Central Pacific, MAGE
Quinn et al., 1996	Central Pacific, MAGE
Raes et al., 1997	Tenerife
Van Dingenen et al., 1995	North Atlantic
Van Dingenen et al. (unpublished data)	Tenerife, ACE 2
Wiedensohler et al. (unpublished data)	Tasman Sea, Southern Ocean, ACE 1
Nowak et al. (unpublished data	North and South Atlantic, Indic, AEROCRUISE 1999

Heintzenberg et al (2000, Tellus B)

GLOMAP-bin size distributions vs observations

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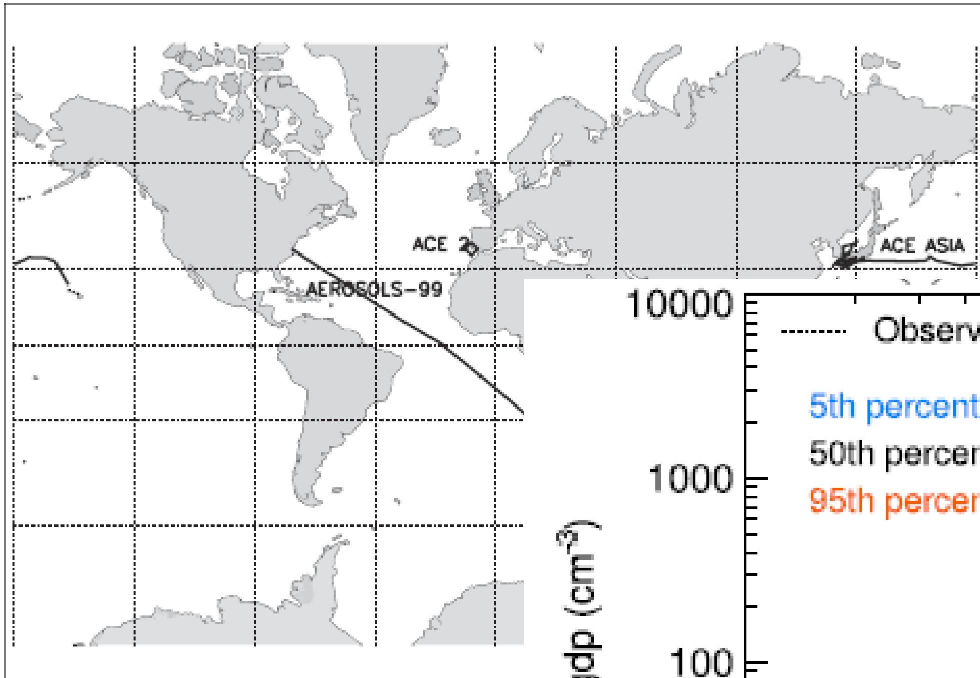
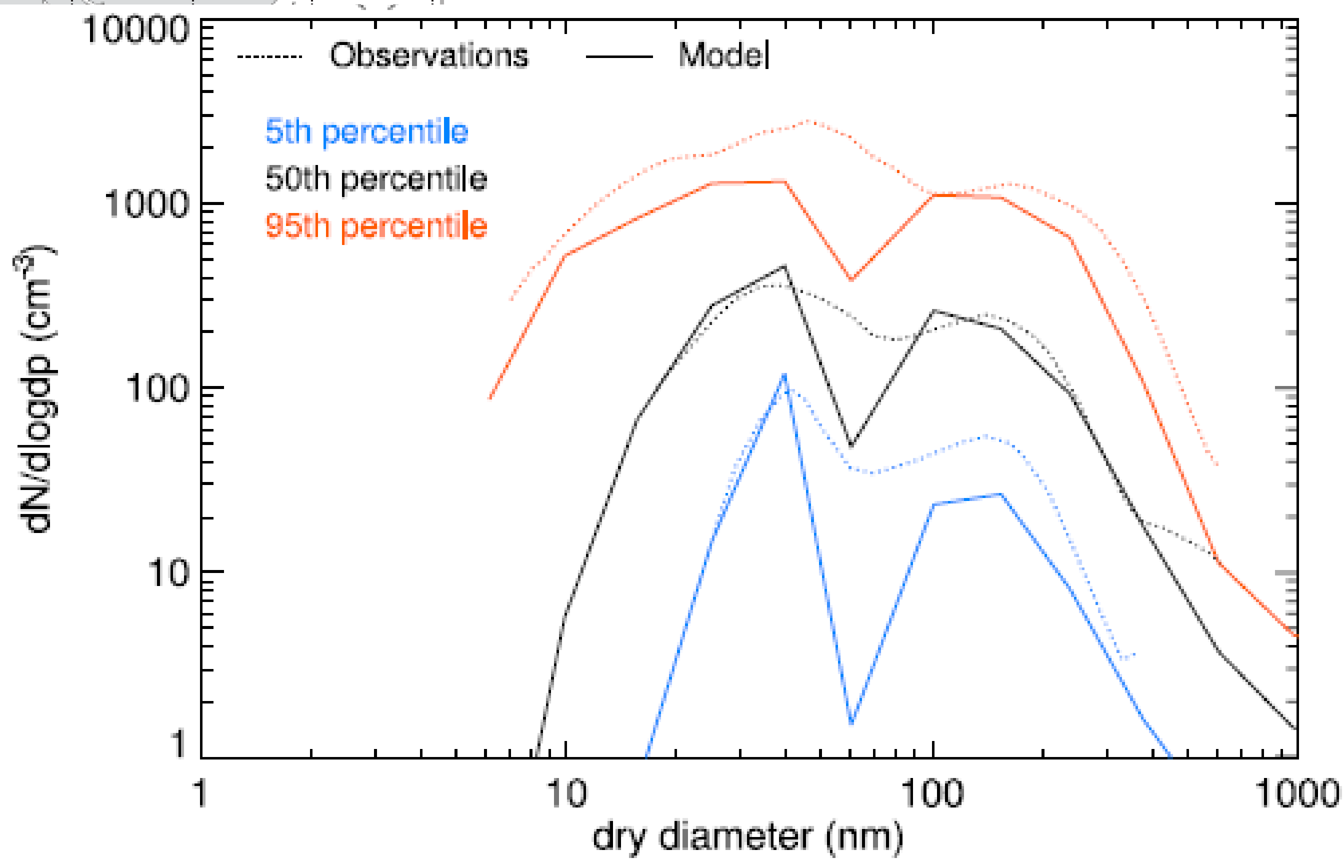
Spracklen et al. (2007)

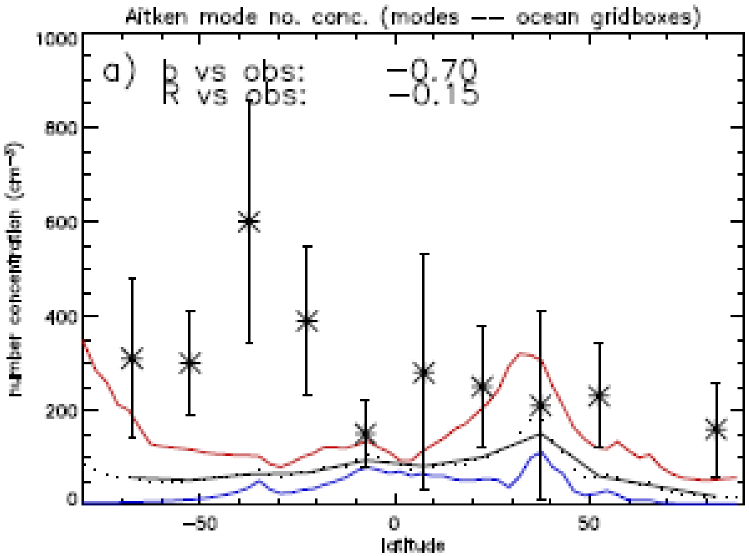
Here sample model daily-means and compare median & 5/95 pctile to observational climatology.

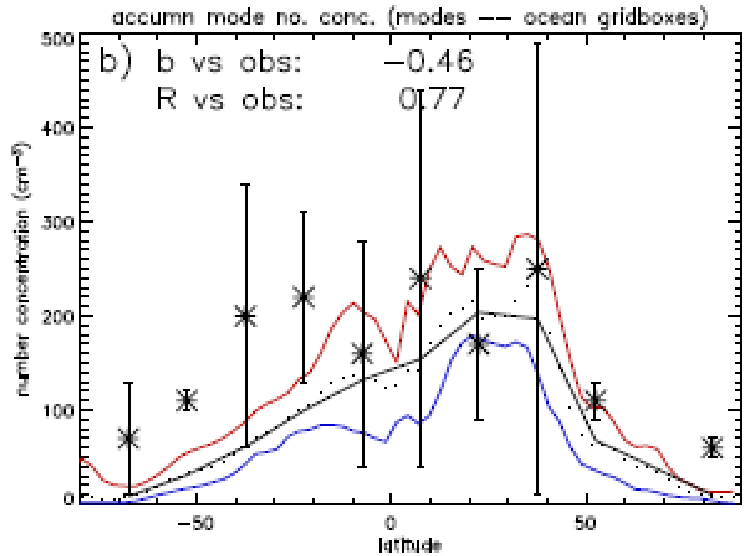


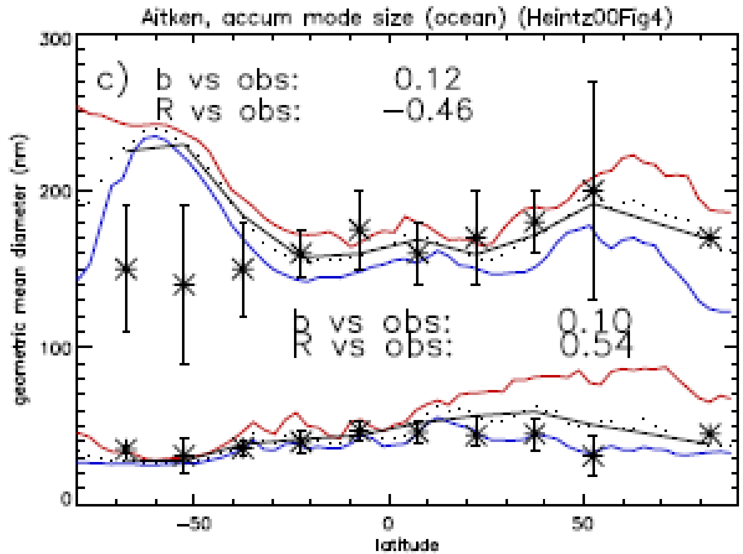
Experiment	Locatic
ACE-1	Cape Grim, Sout 40.8° S, 14
ACE-2	Sagres, NE A 37° N, 9
Aerosols99/ INDOEX	Atlanti Indian Oc
ACE-Asia	Pacific Oc



Use climatologies to evaluate size-resolved aerosol







Mann et al (2010, GMD)

3. Compilation of CCN counter measurements

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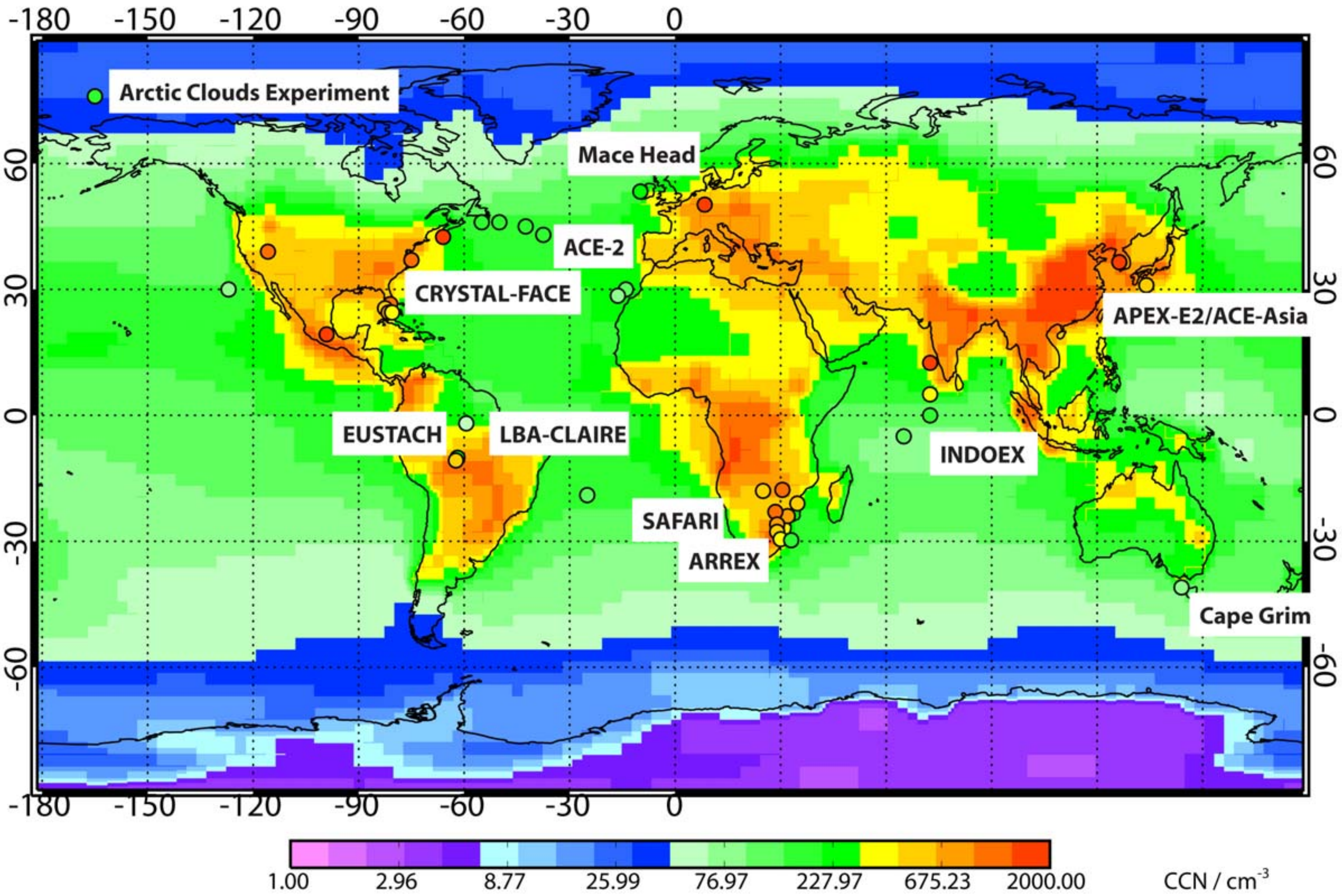
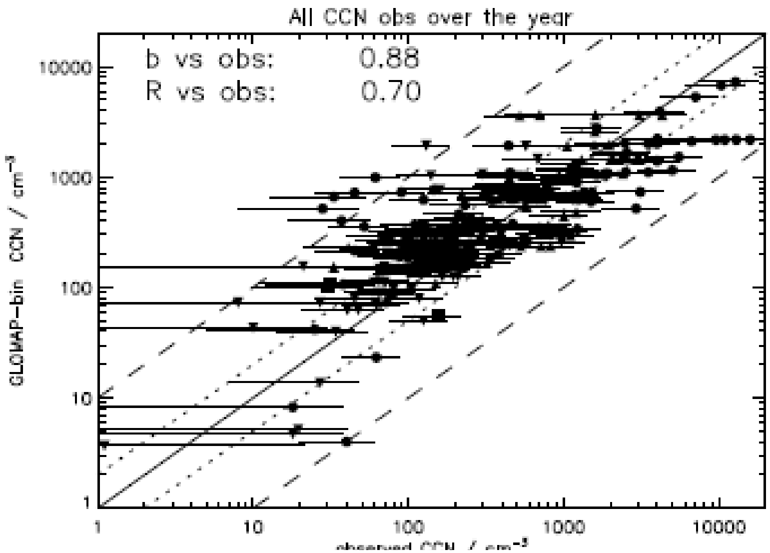


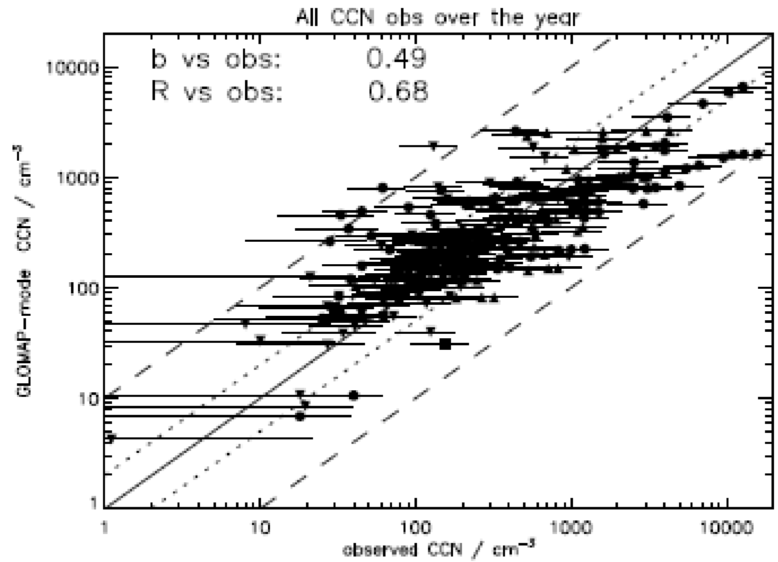
Compilation of CCN observations gathered by Dominick Spracklen (Leeds) (Spracklen et al, submitted, 2010)

GLOMAP CCN being evaluated vs CCN dataset

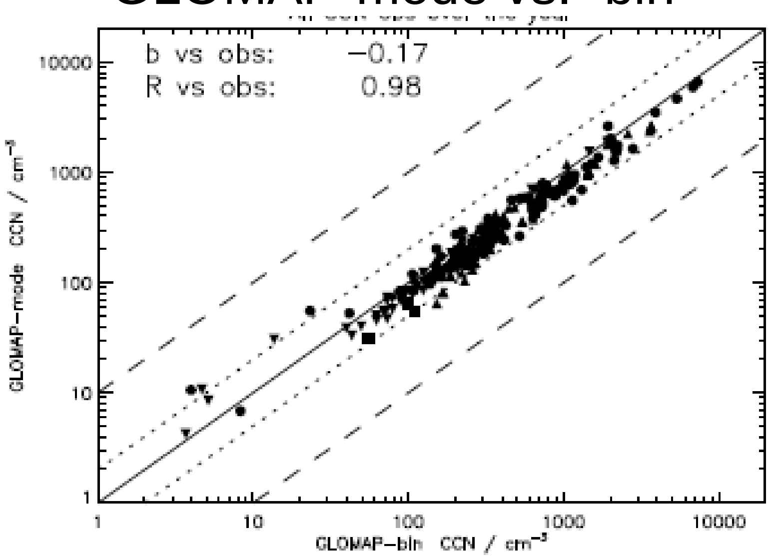
GLOMAP-bin vs. observations



GLOMAP-mode vs. observations



GLOMAP-mode vs. -bin



Mann et al (in prep, 2010)

GLOMAP CCN being evaluated vs CCN dataset

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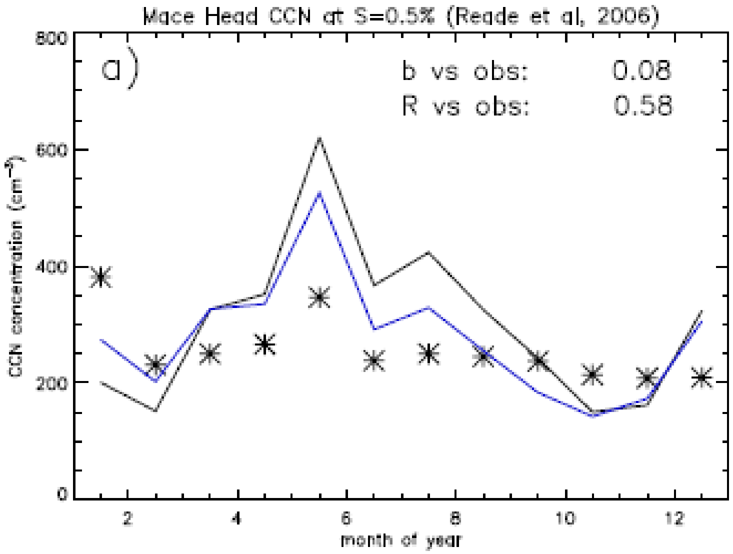
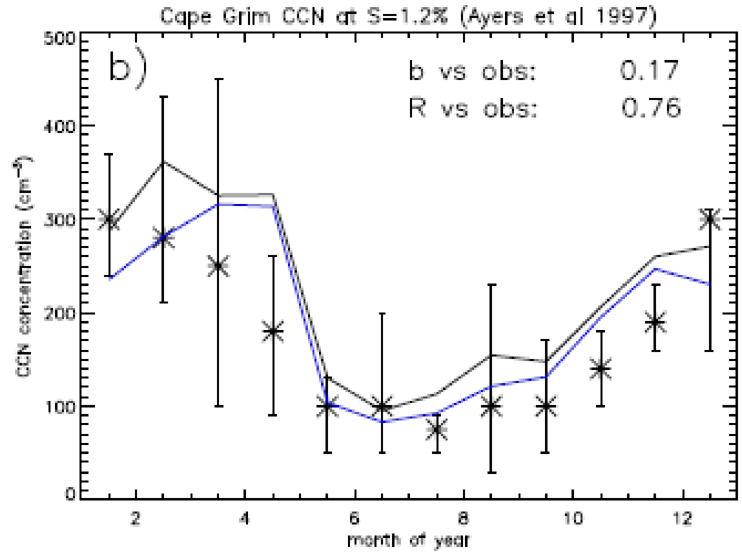
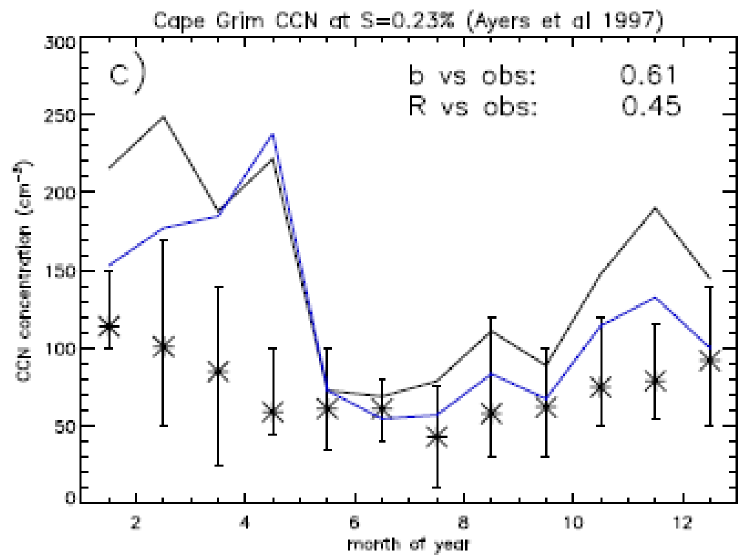




GLOMAP-bin

GLOMAP-mode



Mann et al (in prep, 2010)

Use CCN observations to understand processes

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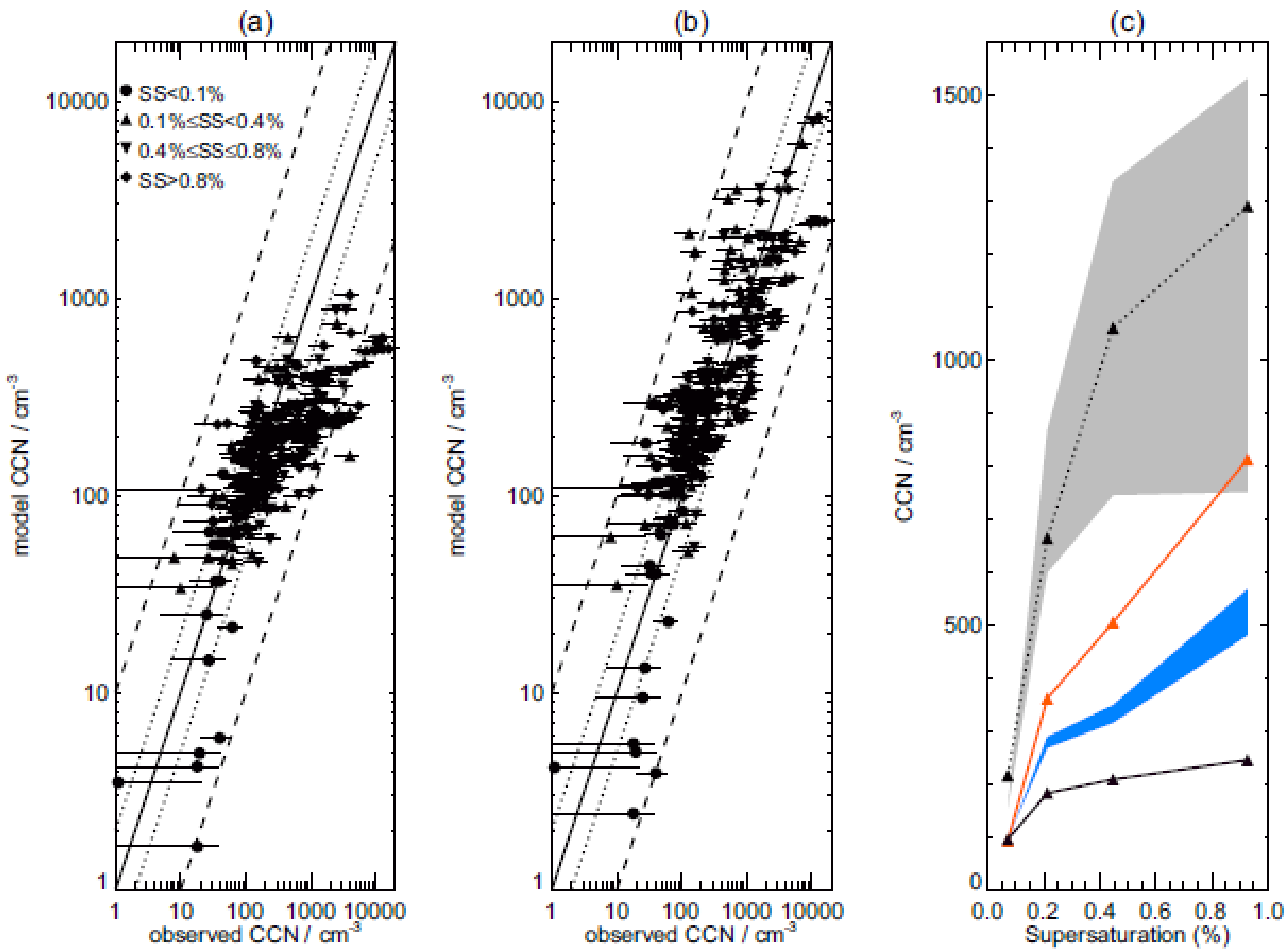


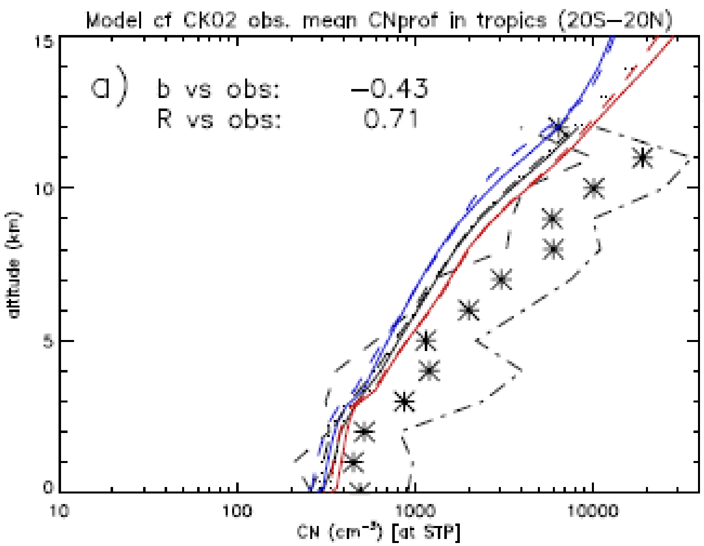
Without soot acting as CCN

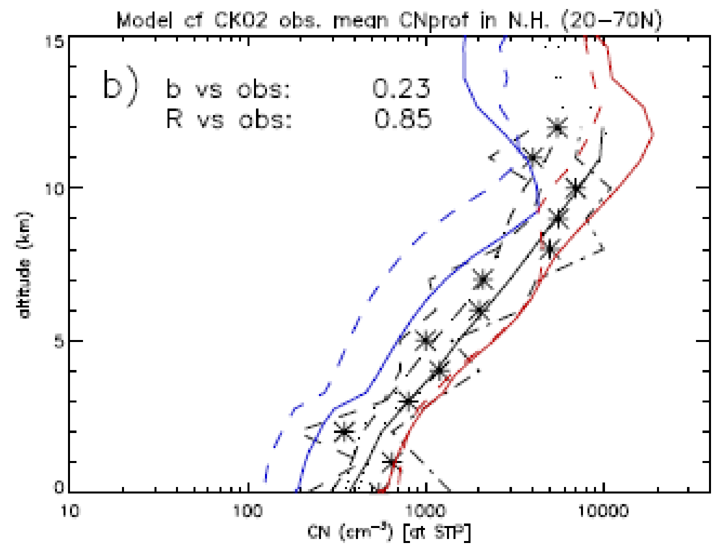
Without soot acting as CCN but with BLN

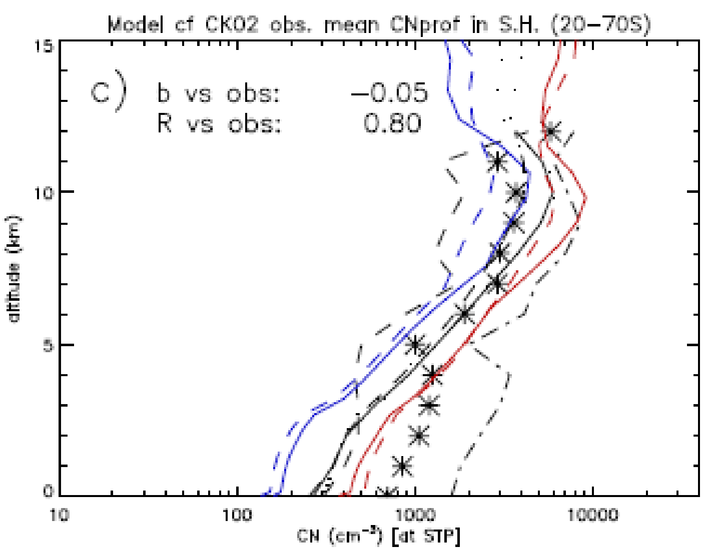
Without soot as CCN and max primary SO4

With soot as CCN (shading: size assumptions)

Spracklen et al, (submitted, 2010)







----- GLOMAP-bin

- - - GLOMAP-mode

Blue/red = min/max from monthly-means

Mann et al (in prep, 2010)

Observations from Clarke & Kapustin (2002)

5. DMPS observations EUSAAR supersites

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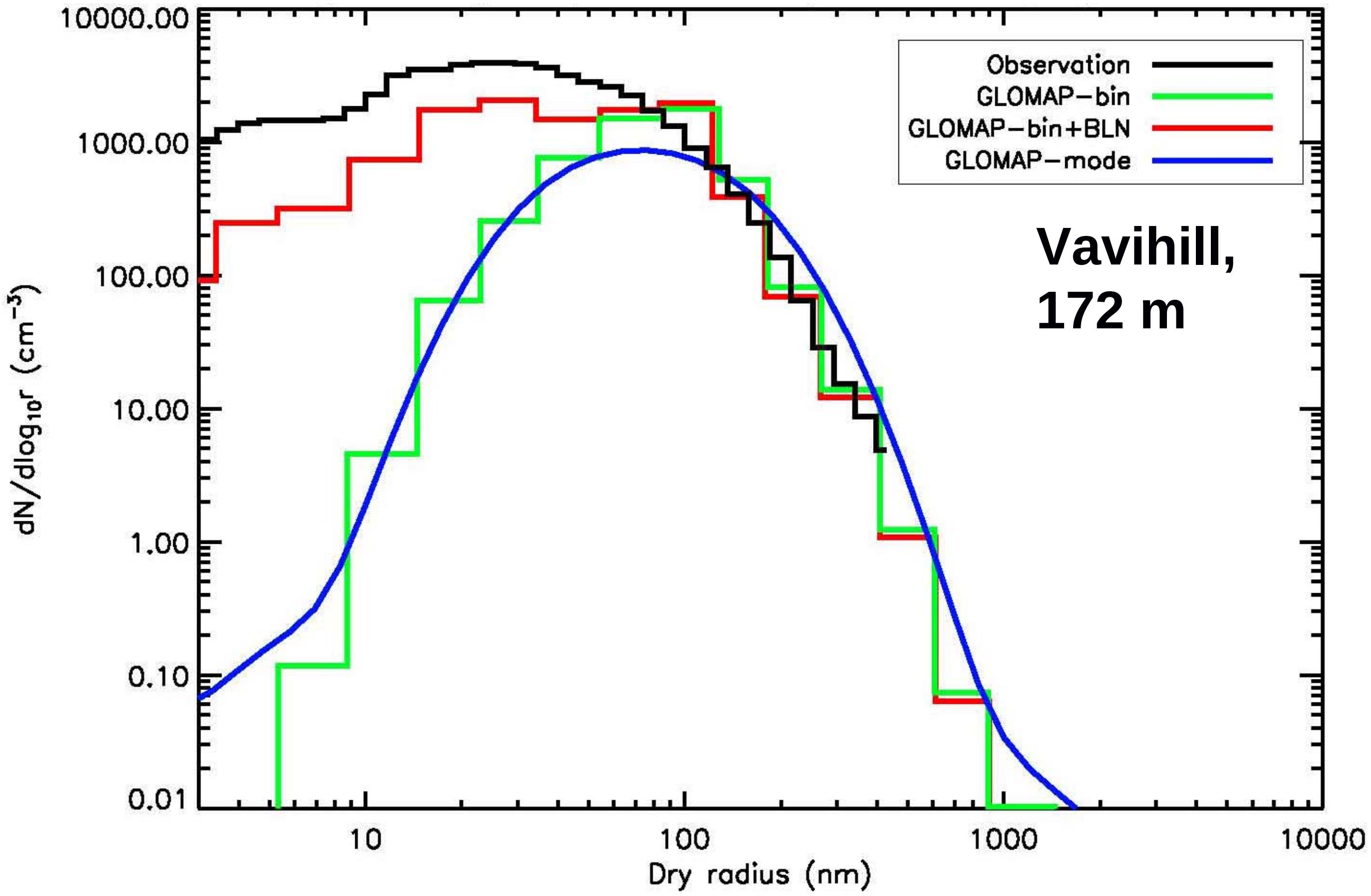

Maria Frontoso and Carly Reddington (University of Leeds)

5. DMPS observations EUSAAR supersites

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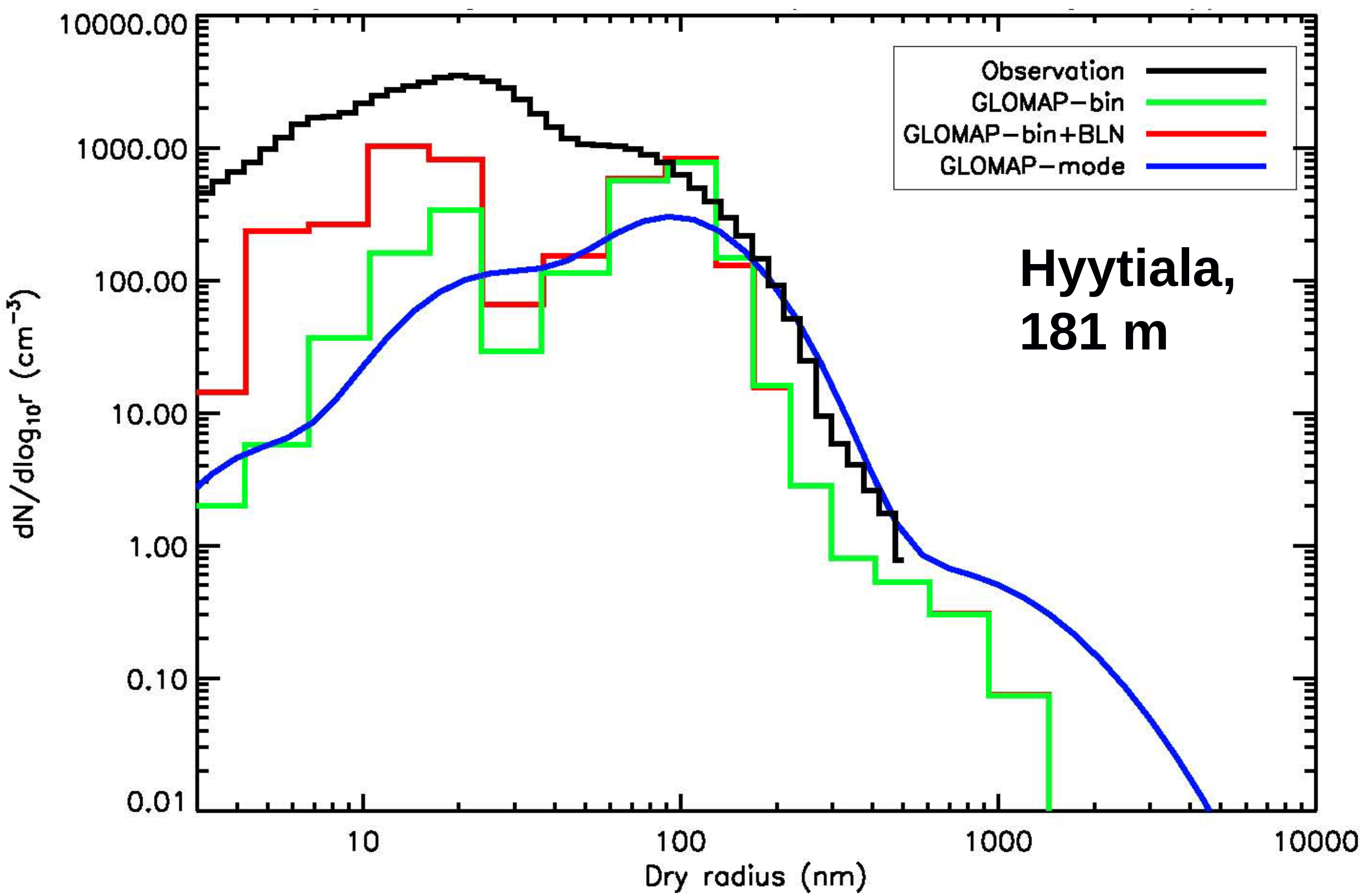

Maria Frontoso and Carly Reddington (University of Leeds)

AEROCOM microphysics working group

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At 2008 AEROCOM workshop in Iceland, working group established to evaluate aerosol microphysics models against range of available in-situ observations.

I offered to extend evaluation activity to encompass AEROCOM size-resolved models

Evaluate & document diversity of AEROCOM models in simulated number conc'n

<u>Common modelling experiments set up</u>:

-- Control simulation reference year 2006 (A2-CTRL-2006)
-- As CTRL but with condensational growth switched off (A2-SIZ1-2006)
-- As CTRL but with coagulation switched off (A2-SIZ2-2006)
-- As CTRL but with primary emissions of SO4 and BC/OC off (A2-SIZ3-2006)
-- As CTRL but with new particle formation switched off (A2-SIZ4-2006)

A2-SIZ1,A2-SIZ2 compare role of growth processes in different models.

A2-SIZ3 allows multi-model assessment of contribution of primary particles to CCN

A2-SIZ4 allows multi-model assessment of nucleated CCN in different models.

Use HCA-0 emissions in models to minimise differences between model simulations.

Ask models to extend A2-CTRL-2006 through 2007 and 2008 to run through EUCAARI period with EUCAARI Different models

Influence of microphysics on CN and CCN,

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In addition to scoring vs observations, evaluate diversity in simulated influence of primaries/nucleation/coagulation/condensation on simulated CN and CCN

Table 2. Summary of ground level contribution from primary particles (PR), boundary layer nucleation (BLN) and upper tropospheric nucleation (UTN) to ground level total number (CN) and cloud condensation nuclei (CCN) concentrations at 0.2% and 1.0% supersaturations. The marine regions refer to west of North America (NAM), west of South America (SAM), west of North Africa (NAF), west of South Africa (SAF), and East of North-East Asia (NEA) (see Figure 7).

	CN		CCN(1.0%)		CCN(0.2%)	
Region	Tot [cm^{-3}]	PR-UTN-BLN [%]	Tot [cm^{-3}]	PR-UTN-BLN [%]	Tot [cm^{-3}]	PR-UTN-BLN [%]
Total Global	1064	27-25-47	513	49-33-18	314	61-31-8
Total Marine	758	19-33-48	331	41-44-15	204	52-40-9
NAM	596	20-63-18	384	28-63-8	396	36-56-9
SAM	567	14-41-45	273	31-58-11	148	41-53-7
NAF	1003	12-31-57	413	28-52-20	414	36-48-15
SAF	619	23-41-36	345	40-50-10	266	48-45-7
NEA	1423	35-35-30	877	52-35-13	886	62-30-8
Total Continental	1921	36-18-46	1024	57-23-20	625	69-23-7
Europe	2611	47-11-42	1647	63-15-22	932	67-24-10
Africa	1279	50-20-29	900	63-25-12	719	71-24-6
N. America	2600	20-12-69	1079	40-24-36	554	51-32-17
S. America	1713	36-15-49	922	61-25-14	613	71-26-3
N. Asia	1119	22-26-53	554	38-34-28	288	56-31-13
SE Asia	4543	46-14-40	2443	70-15-14	1384	83-13-4
Oceania	1335	21-20-59	778	34-31-36	431	51-38-11

Merikanto et al (ACP, 2009)

CN concentrations (GLOMAP-mode)

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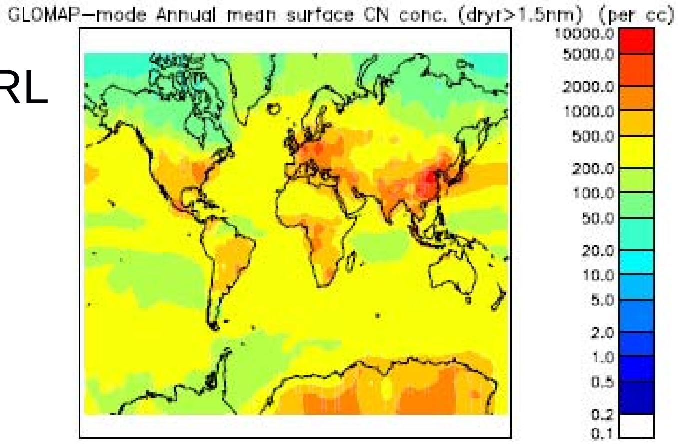
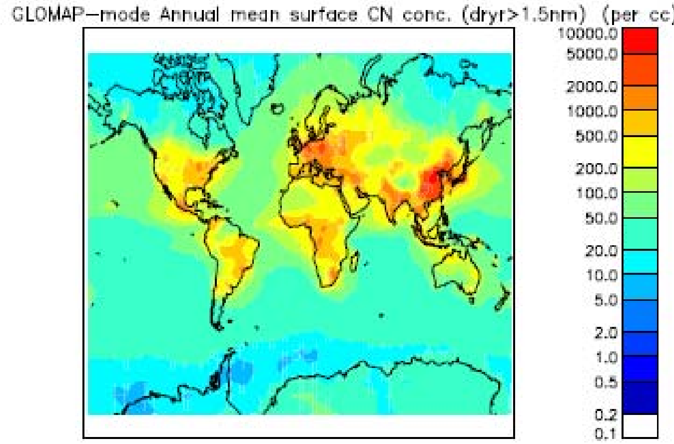
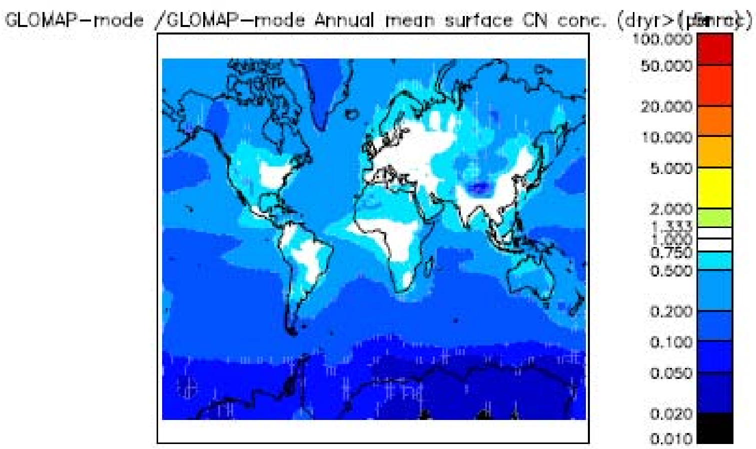
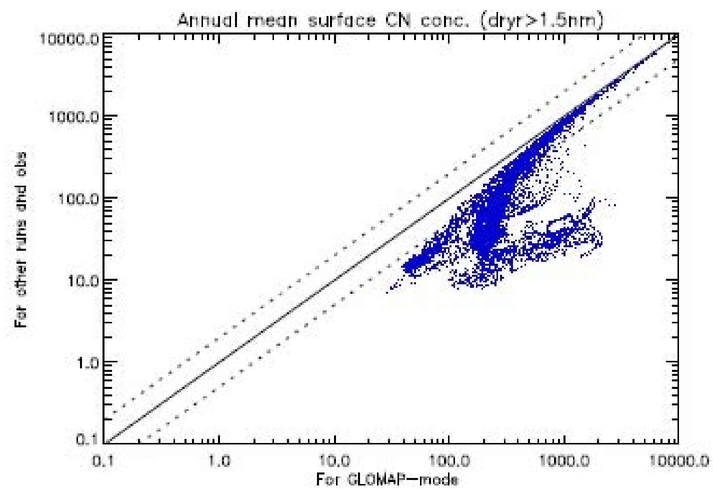
A2-CTRL
2006





A2-SIZ4
2006
(nucleation
switched off)





Secondary aerosol particles > 50% of surface CN in almost all marine regions
Continental CN mostly from primary emissions (no BL nucleation in these runs).

CCN concentrations (GLOMAP-mode)

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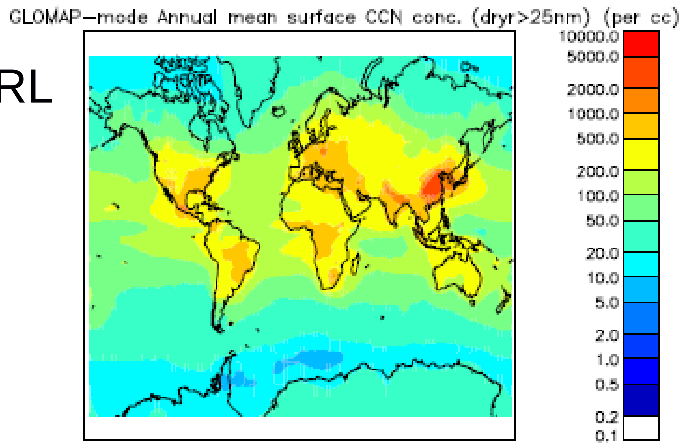
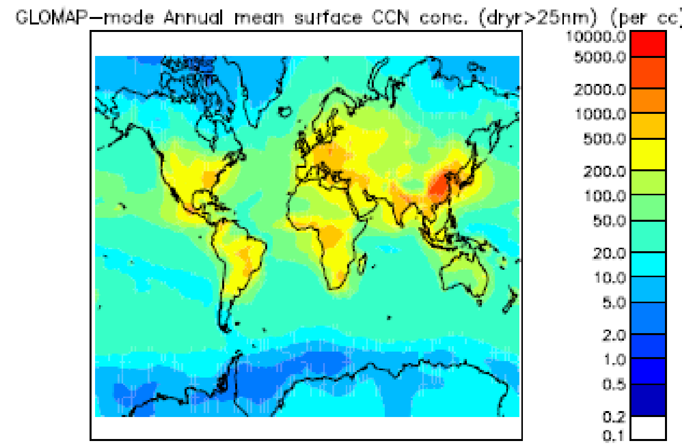
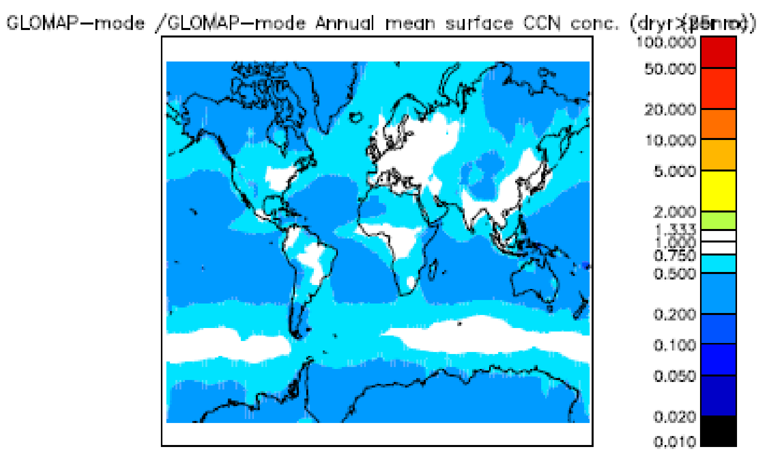
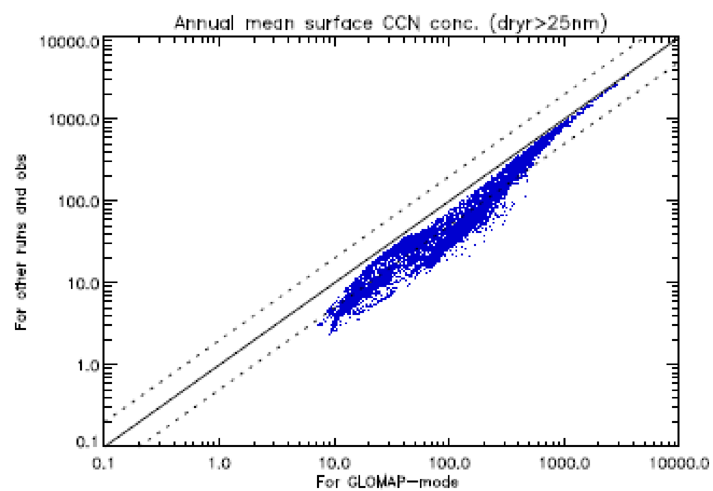
A2-CTRL
2006





A2-SIZ4
2006
(nucleation
switched off)





30-50% surface CCN in most MBL regions from secondary aerosol
Sea-spray dominated regions and continental regions dominated by primaries.

SO4 mass concentrations (GLOMAP-mode)

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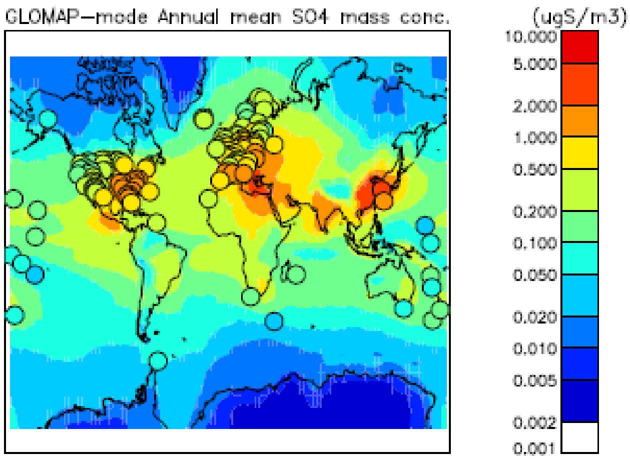
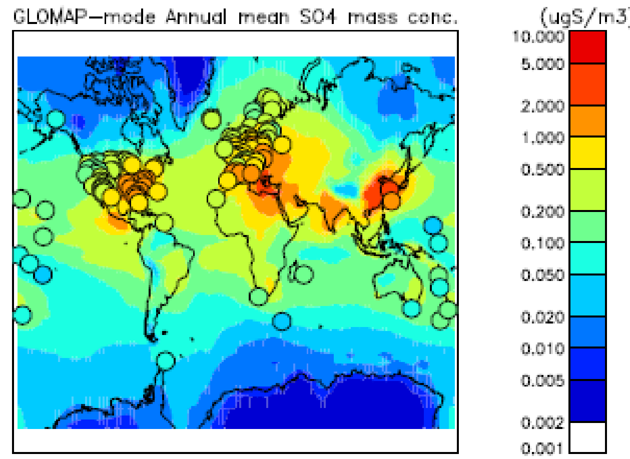
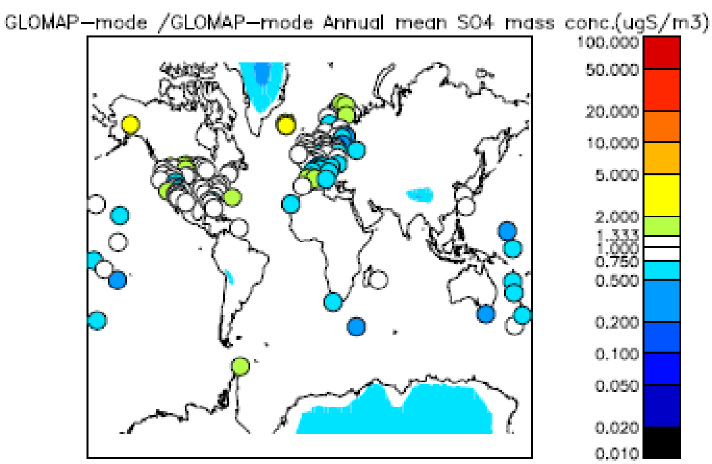
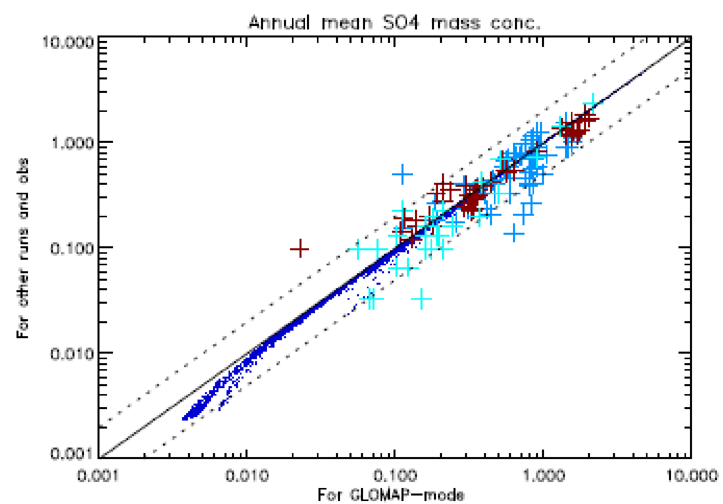
A2-CTRL
2006





A2-SIZ4
2006
(nucleation
switched off)





Switching off nucleation makes no difference to simulated mass concentrations

CCN concentrations (GLOMAP-mode)

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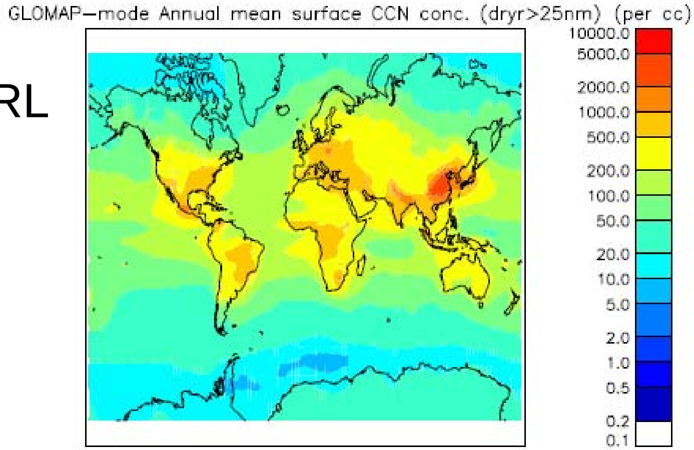
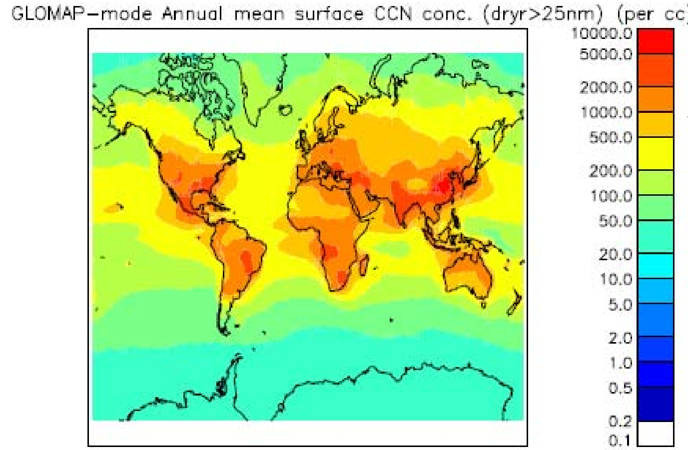
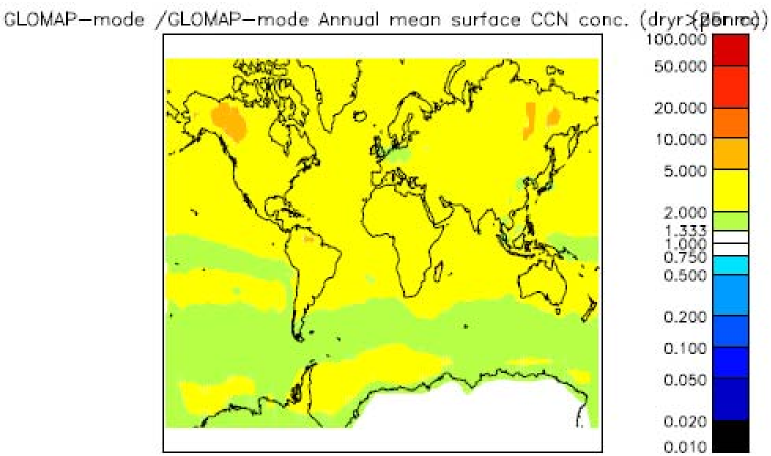
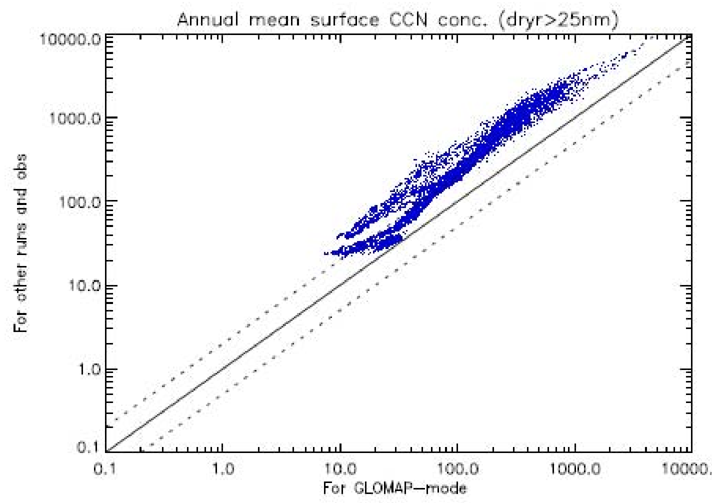
A2-CTRL
2006





A2-SIZ2
2006
(coagulation
switched off)





Switching coagulation off increases CCN concentrations by > 100%.

Challenges when evaluating number concentrations

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Models characterise size distribution in many different ways
-- mass-only in aerosol types each with fixed size distribution (~10 aerosol tracers)
-- number & mass concentrations in size modes (20-30 aerosol tracers)
-- number & mass in concentrations size bins (100-200 aerosol tracers)

CCN observations retrieve CCN at many different supersaturations
(Different models use different methods to calculate CCN concentrations).

CN measurements can use different minimum diameter (e.g. 3nm or 10nm).

Size distribution observations made across different size ranges.

<u>Approach settled on at 2008 workshop:</u>
Instead of asking for extra complicated diagnostics, just make life simple:
Ask modelers to <u>write "all-aerosol-tracer" output</u> to AEROCOM database
And to provide README file with information on how size is handled in model.

Then can compare CN, CCN, size-resolved N ensuring consistent methodology.

<u>Also ask modellers to interpolate to selected sites outputting at hourly resolution</u>
-- makes separation into different air mass types possible
-- generate statistics of size distribution over daily cycle
-- how well do microphysics models reproduce new particle formation events?

Example model README file for GLOMAP-mode:

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```
The following describes the all-aerosol-tracer information for GLOMAP-mode.
Contact: Graham Mann (University of Leeds, U.K.) gmann@env.leeds.ac.uk

Model setup for AEROCOM simulations uses 7 log-normal modes
Mode 1 is   soluble nucleation   with cpts SO4,POM
Mode 2 is   soluble Aitken       with cpts SO4,BC,POM
Mode 3 is   soluble accumulation with cpts SO4,BC,POM,NaCl,dust
Mode 4 is   soluble coarse       with cpts SO4,BC,POM,NaCl,dust
Mode 5 is insoluble Aitken       with cpts BC,POM
Mode 6 is insoluble accumulation with cpts dust
Mode 7 is insoluble coarse       with cpts dust

Aerosol tracers then are  19 mmrtrnn  values for components    (nnn=01 to 19)
                           4 mmrtrnn  values for water-content (nnn=20 to 23)
                           7 conccnxx values for number concns (xx =01 to 07)

Aerosol tracer ordering in CMOR-compliant netCDF files are:
mmrtr01       --- SO4  mmr in soluble   nucleation   mode
mmrtr02       --- POM  mmr in soluble   nucleation   mode
mmrtr03       --- SO4  mmr in soluble   Aitken       mode
mmrtr04       --- BC   mmr in soluble   Aitken       mode
mmrtr05       --- POM  mmr in soluble   Aitken       mode
mmrtr06       --- SO4  mmr in soluble   accumulation mode
mmrtr07       --- BC   mmr in soluble   accumulation mode
mmrtr08       --- POM  mmr in soluble   accumulation mode
mmrtr09       --- NaCl mmr in soluble   accumulation mode
mmrtr10       --- dust mmr in soluble   accumulation mode
mmrtr11       --- SO4  mmr in soluble   coarse       mode
mmrtr12       --- BC   mmr in soluble   coarse       mode
mmrtr13       --- POM  mmr in soluble   coarse       mode
mmrtr14       --- NaCl mmr in soluble   coarse       mode
mmrtr15       --- dust mmr in soluble   coarse       mode
mmrtr16       --- BC   mmr in insoluble Aitken       mode
mmrtr17       --- POM  mmr in insoluble Aitken       mode
mmrtr18       --- dust mmr in insoluble accumulation mode
mmrtr19       --- dust mmr in insoluble coarse       mode
mmrtr20       --- H2O  mmr in soluble   nucleation   mode
mmrtr21       --- H2O  mmr in soluble   Aitken       mode
mmrtr22       --- H2O  mmr in soluble   accumulation mode
mmrtr23       --- H2O  mmr in soluble   coarse       mode
```

Example model README file for GLOMAP-mode:

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```
conccnmode01  --- no. conc in soluble   nucleation   mode
conccnmode02  --- no. conc in soluble   Aitken       mode
conccnmode03  --- no. conc in soluble   accumulation mode
conccnmode04  --- no. conc in soluble   coarse       mode
conccnmode05  --- no. conc in insoluble Aitken       mode
conccnmode06  --- no. conc in insoluble accumulation mode
conccnmode07  --- no. conc in insoluble coarse       mode

Molar masses (mm) and densities (rho) of the aerosol components used for the mmr are:
SO4  : mm=0.098   kg/mol, rho=1769 kg/m3
BC   : mm=0.012   kg/mol, rho=1500 kg/m3
POM  : mm=0.0168  kg/mol, rho=1500 kg/m3
NaCl : mm=0.05844 kg/mol, rho=1600 kg/m3
dust : mm=0.100   kg/mol, rho=2650 kg/m3

H2O  : mm=0.018   kg/mol, rho=1000 kg/m3

Geometric standard deviations (sigma) for the 7 modes are constant as:
sigma (soluble   nucleation  ) = 1.59
sigma (soluble   Aitken      ) = 1.59
sigma (soluble   accumulation) = 1.59
sigma (soluble   coarse      ) = 2.00
sigma (insoluble Aitken      ) = 1.59
sigma (insoluble accumulation) = 1.59
sigma (insoluble coarse      ) = 2.00

Geometric mean diameter (Dpi) for mode i is calculated as:
Dpi^3=6.0*dvoli/pi/explogsqsigmai

where explogsqsigmai=exp(4.5*alog(sigmai)*alog(sigmai))
and   dvoli=sumj(mdij*mmj/(avc*rhoj))
and   mdij=mmrtrnn*(mm_da/mm)*(aird/conccni)

(nn is the index of the tracer mmr for mode i component j).
(conccni is the number concentration in mode i)
```

Required output for aerosol microphysics group:

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-- Monthly-mean all-aerosol-tracer output on full 3D model grid (3D-M)
-- Daily-mean all-aerosol-tracer output over vertical profile at sites (1D-D)
-- Hourly-mean all-aerosol-tracer output at surface at sites (0D-H)
Use CMOR tables: Aerocom_table_1DD, Aerocom_table_0DH on website.

<u>50 selected sites for high-temporal resolution all-aerosol-tracer data:</u>

GAW & ARM sites (CPC, nephelometer, aethalometer, some with lidar)
Alert, Barrow, Bondville, Mauna Loa, Neumayer, Samoa, South Pole, Southern Great Plains,

21 EUSAAR supersites (many with DMPS, AMS, lidar)
Aspreveten, Auchenworth, Birkenes, Cabauw, Finokalia, Harwell, Hohenpeissenberg, Hyytiala, Ispra, Jungfraujoch, Kosetice, K-puzta, Mace Head, Melpitz, Montseny, Moussala, Pallas, Preila, Puy de Dome, Valvihill, Zeppelin.

Additional sites with observations
Cape Grim, Cape Point, Capo San Juan, Elandsfontein, Guangzhou, Manaus, Monte Cimone, Mount Waliguan, Paverne, Shang Dianzi, Sonnblick, Summit, Tahkuse, Trinidad Head, Varrio

<u>Need model README file giving full detail of size assumptions with model</u>

Models intending to submit results:

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Following email questionnaire, many groups committed to submit results:

Model	Aerosol Dynamics	# of aerosol tracers	Contact
GLOMAP-bin	Bin-resolved (N,m)	~200	Dominick Spracklen (Leeds)
GLOMAP-mode	Modal (N,m)	26	Graham Mann (Leeds)
UKCA-UM	Modal (N,m)	26	Graham Mann (Leeds)
ECHAM-HAM	Modal (N,m)	45 (20 SOA)	Kai Zhang (MPI-Hamburg)
ECHAM-HAMMOZ	Modal (N,m)	??	Kai Zhang (MPI-Hamburg)
GISS-MATRIX	Moments (N,m)	60	Susanne Bauer (GISS)
EMAC [ECHAM-MESSy]	Modal (N,m)	30+	Kirsty Pringle (MPI-Mainz)
NCAR CAM4-MAM	Modal (N,m)	31/15	Xiaohong Liu (PNNL)
TM5	Modal (N,m)	25	Elisabetta Vignati (JRC)
CCCma AGCM4	PLA-bin (N,m)	240	Knut Van Salzen (Env Canada)
GISS-TOMAS	Bin (N,m)	72	Yunha Lee (Carnegie Mellon)
Nor-AGCM	Modal (N,m)	~20?	Trond Iversen (Norway Met.)
GEOS5-GOCART	Mode & bin (m-only)	~20	Peter Colarco (NASA GSFC)
ECHAM-HAM* &-SALSA	Mode (N,m), Bin (N,m)	~25, ~70	Risto Makkanen (Univ Helsinki)

Models intending to submit results:

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Several global aerosol microphysics models now submitted A2-CTRL data

Model	Aerosol Dynamics	# of aerosol tracers	Contact
GLOMAP-bin	Bin-resolved (N,m)	~200	Dominick Spracklen (Leeds)
GLOMAP-mode	Modal (N,m)	26	Graham Mann (Leeds)
UKCA-UM	Modal (N,m)	26	Graham Mann (Leeds)
ECHAM-HAM2	Modal (N,m)	45 (20 SOA)	Kai Zhang (MPI-Hamburg)
ECHAM-HAMMOZ	Modal (N,m)	??	Kai Zhang (MPI-Hamburg)
GISS-MATRIX	Moments (N,m)	60	Susanne Bauer (GISS)
EMAC [ECHAM-MESSy]	Modal (N,m)	30+	Kirsty Pringle (MPI-Mainz)
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Preliminary Results: GLOMAP-mode (HCA-0 ems, T42)

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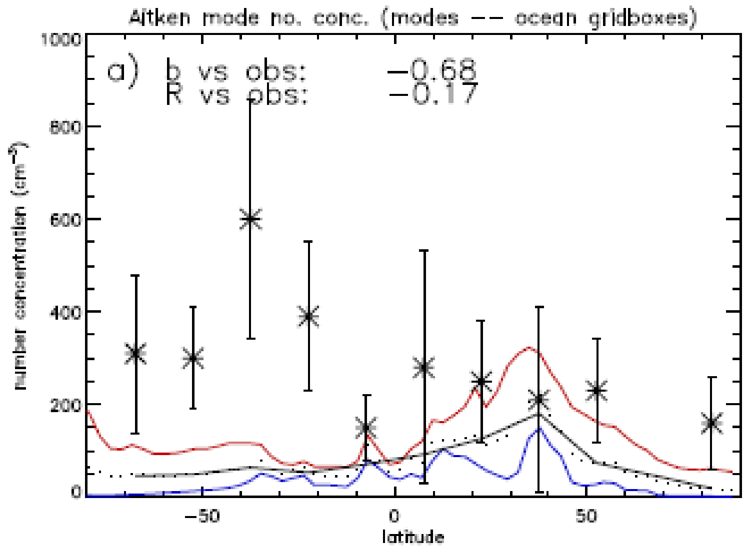

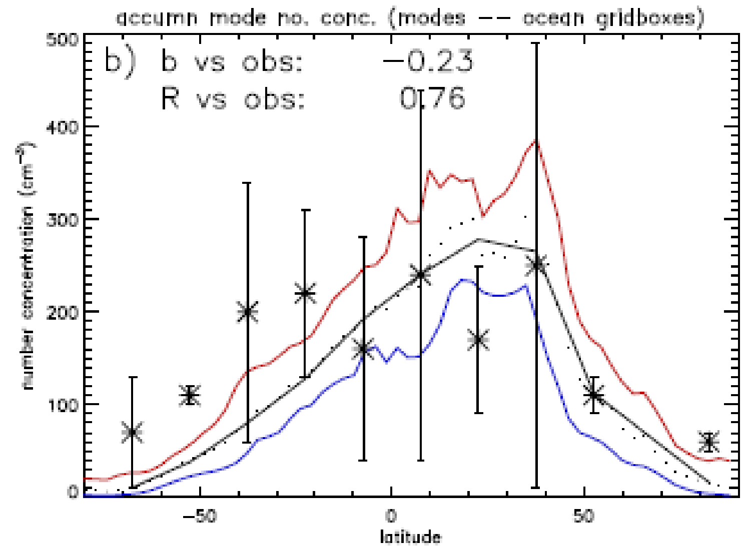

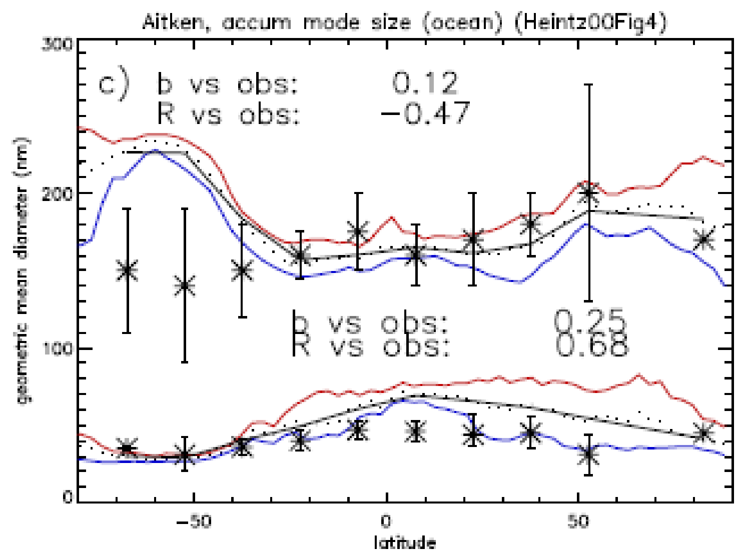

Aitken and accum mode number concns in Southern Oceans looks low in CLOMAP-mode vs obsvns.

Size of Aitken and accumulation modes compares well to observations except accumulation mode in S. Oceans

Preliminary Results: ECHAM-HAM2 (HCA-0 ems, T63)

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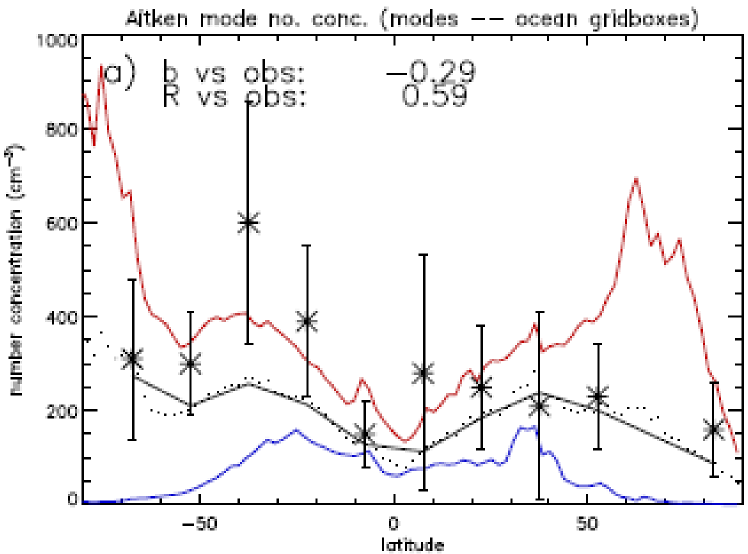

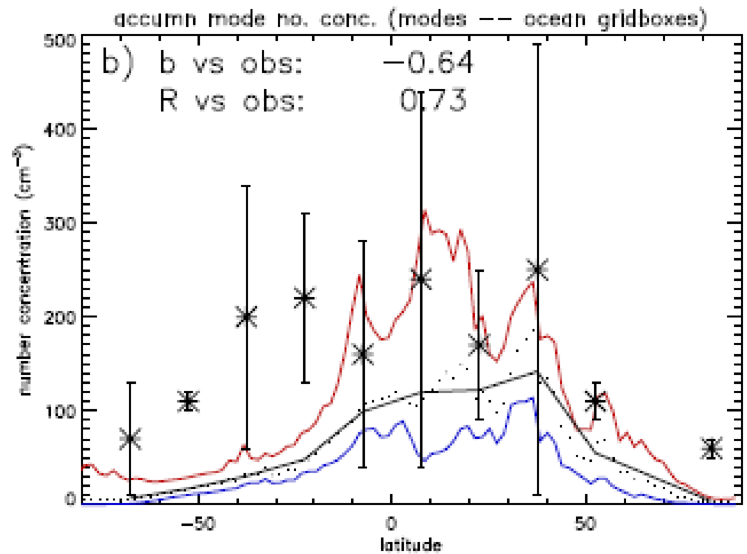

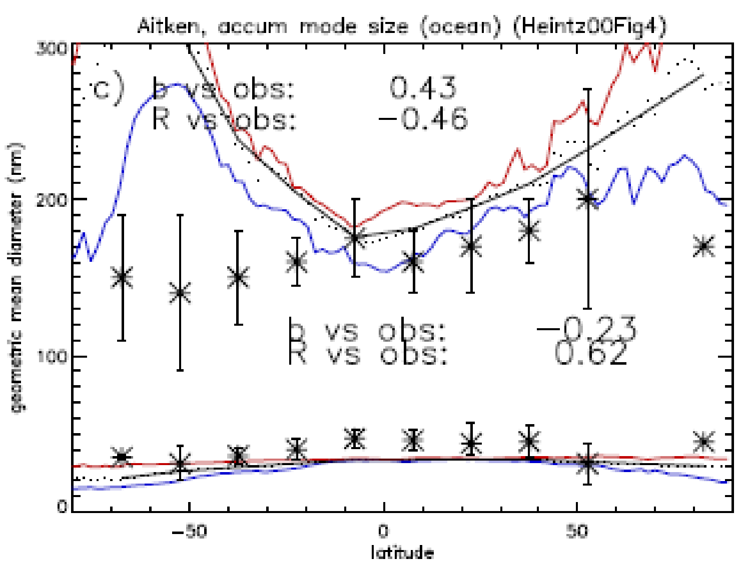

Aitken-mode in Southern Ocean looks better in HAM2 than in GLOMAP-mode.

But accumulation mode number concentrations have worse low bias than GLOMAP-mode.

Preliminary Results: GLOMAP-mode (HCA-0 ems, T42)

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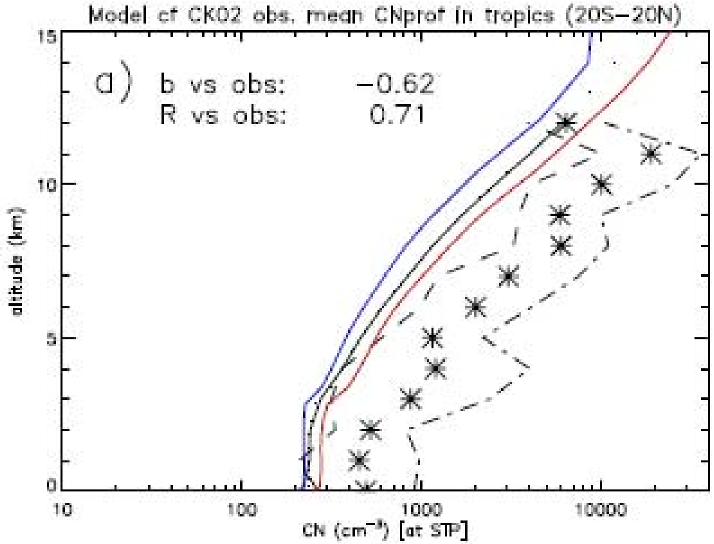

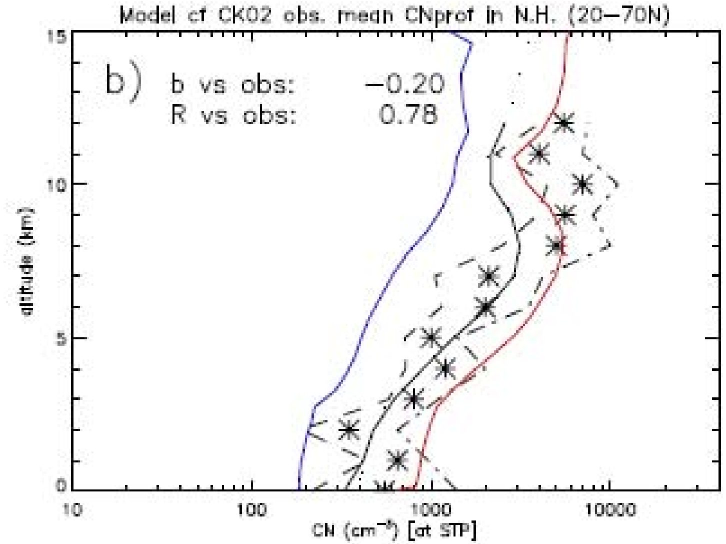

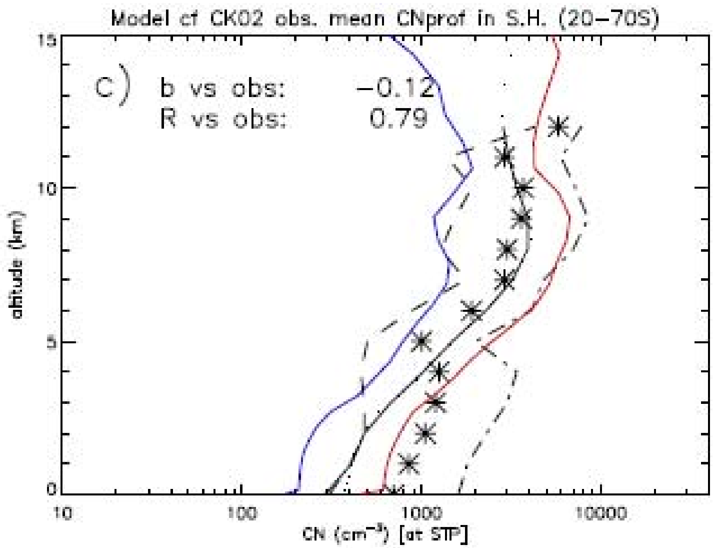

GLOMAP-mode simulation uses Kulmala et al (1998) binary H2SO4-H2O nucleation mechanism.

Preliminary Results: ECHAM-HAM2 (HCA-0 ems, T63)

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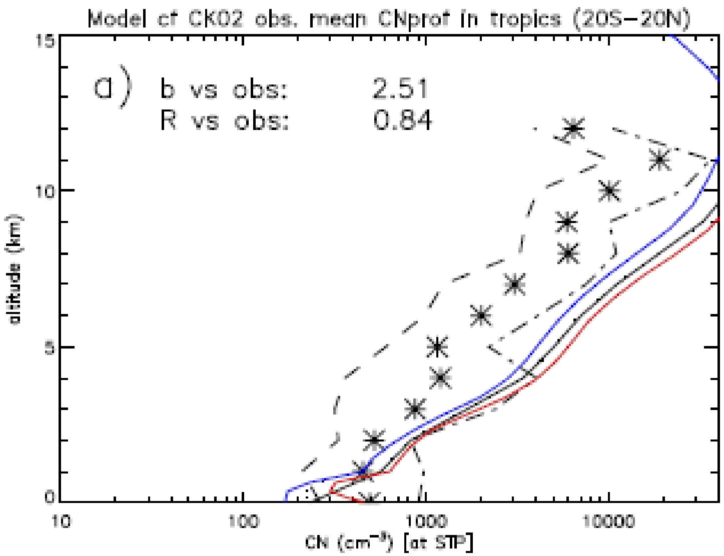

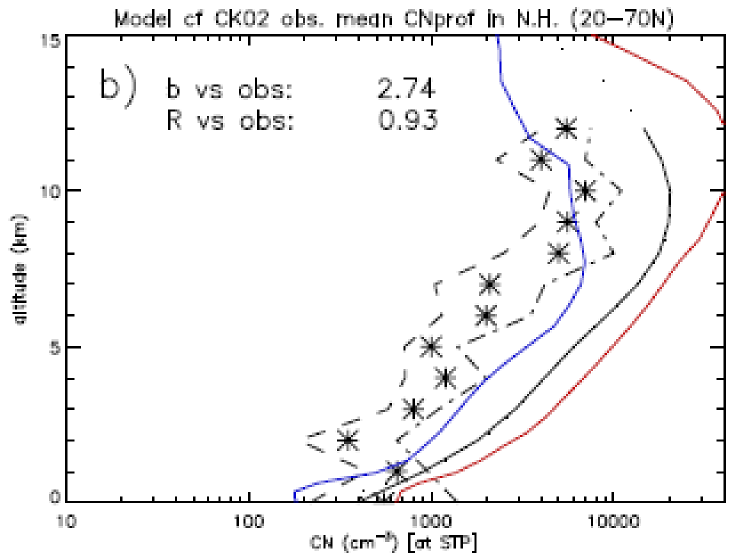

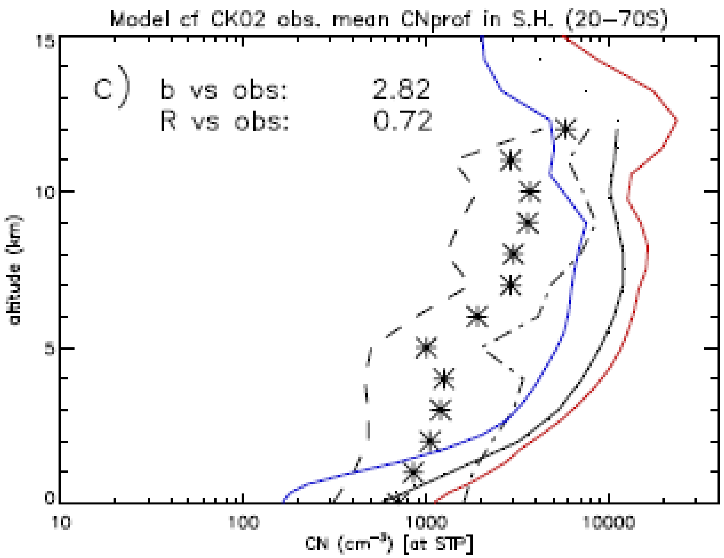

ECHAM-HAM2 simulation uses Kazil & Lovejoy (2006) ion-induced nucleation mechanism -- seems to over-estimate CN in FT.

Preliminary Results: GLOMAP-mode (HCA-0 ems, T42)

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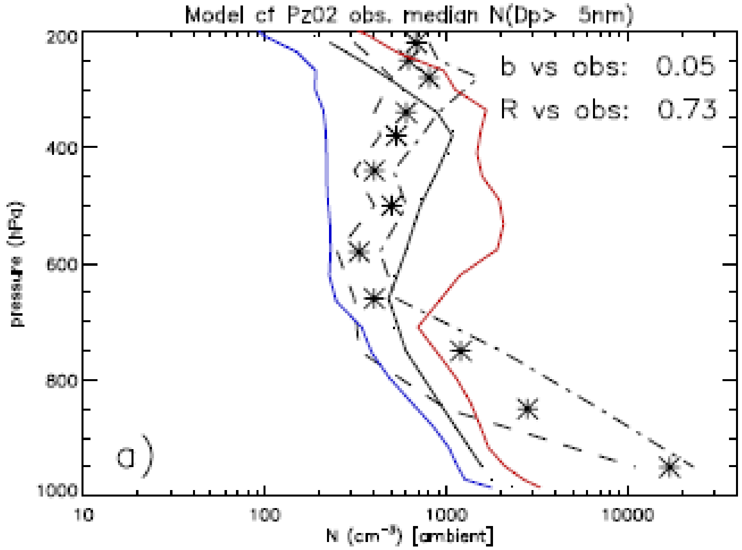

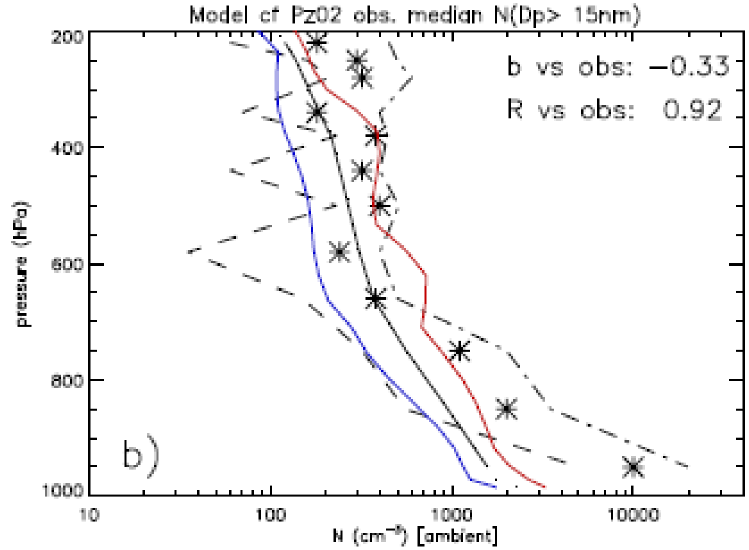

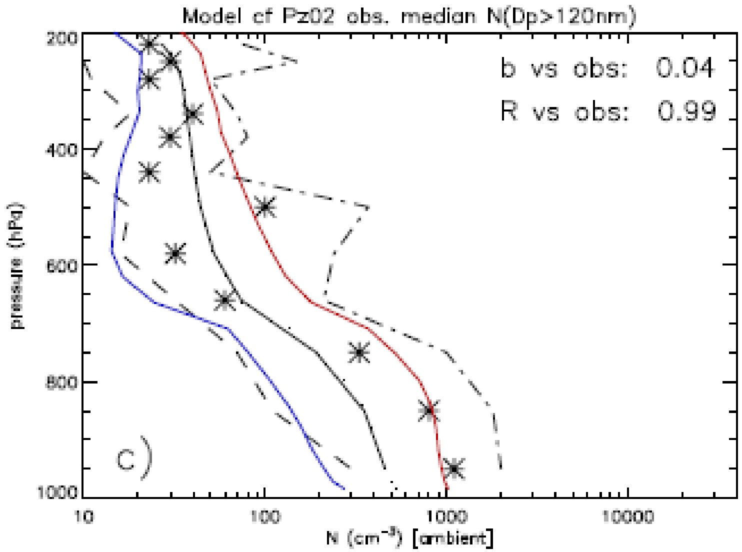

GLOMAP-mode simulates very well number concn profiles in a) Dp>5nm, b) Dp>15nm and c) Dp>120nm size range over Germany.

Preliminary Results: ECHAM-HAM2 (HCA-0 ems, T63)

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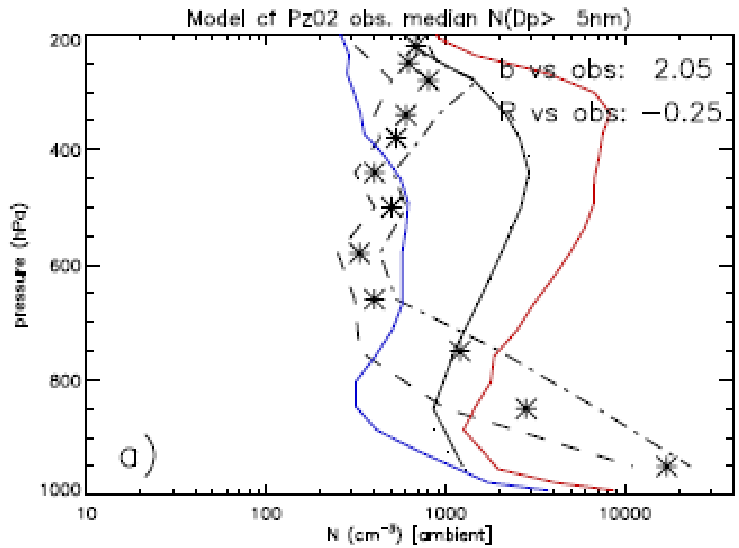

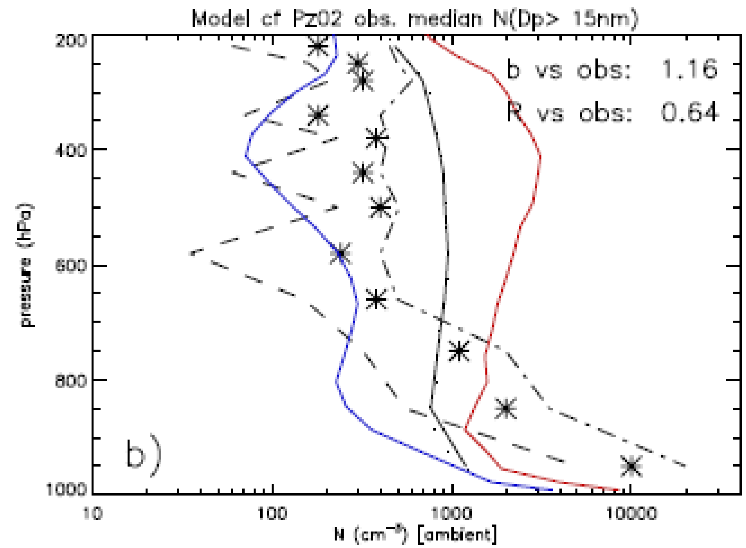

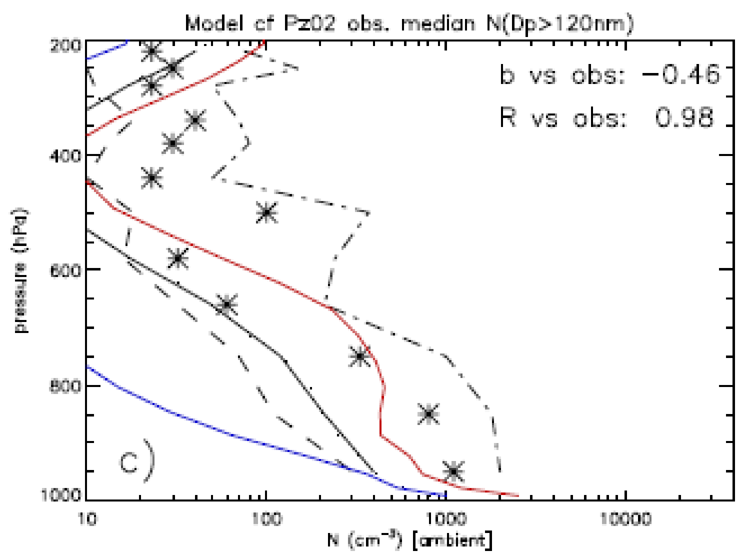

ECHAM-HAM2 simulation uses Kazil & Lovejoy (2006) ion-induced nucleation mechanism -- seems to over-estimate CN in FT. N(Dp>120nm) look better.

Summary

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Original timeline for microphysics has slipped, but plan still the same.
-- Please submit your model’s conccnxx and mmrtryy files to the AEROCOM server on 3D-M, 1D-D, 0D-H – use CMOR tables on website.
-- Please also provide your model’s README file with instructions with order of aerosol tracers & how to calculate size distribution from your model tracers.

All-aerosol-tracer 3D-M data for A2-CTRL-2006 simulation submitted by several models (GLOMAP-mode, ECHAM-HAM2, GISS-TOMAS, CCCma, EMAC),

Only GLOMAP-mode and CCCma submitted 0D-H data so far.

Please copy your models files over with A2-CTRL-2006 as soon as possible.

Assembled range of CN and CCN datasets at Leeds – can make available to AEROCOM for data server (assuming data PIs happy with this).

Wide range of new size distribution datasets from EUCAARI and EUSAAR now becoming available to help constrain models

Have started to compare each A2-CTRL vs current set of “number observations”

Then being multi-model examination of the influence of microphysical processes on CN, CCN, using model sensitivity simulations A2-SIZ1,SIZ2,SIZ3,SIZ4.

Timeline: give deadline of end-2010 for submitting A2-CTRL, May11 for SIZx?