Validation of aerosol vertical profiles in the AeroCom models

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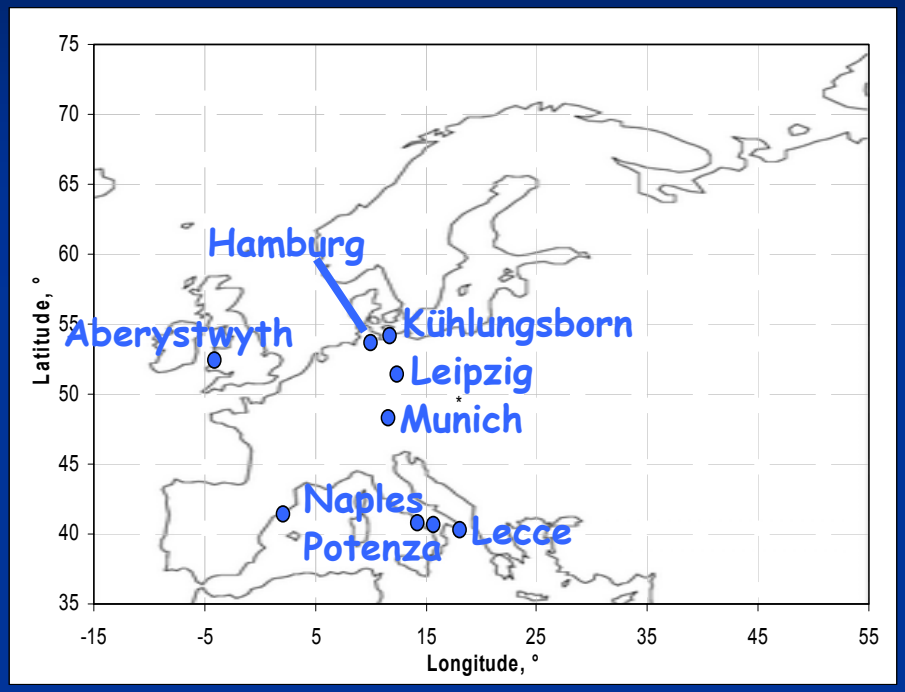
Lidar measurements

EARLINET stations



- Use of measurements for 2000 and 2001
- Measurements twice a week : Monday and Thursday
- Measurements at sunset
- Raman lidar : extinction coefficient without hypothesis on lidar ratio

ARM program

- Use of measurements for 2000 and 2001
- Measurements : each day (except specific months) each 10 minutes
- Measurements of : extinction coefficient, scattering ratio, backscatter coefficient, optical depth relative humidity, cloud detection

Questions

1. Document the differences between the different models and the EARLINET and SGP aerosol extinction profiles

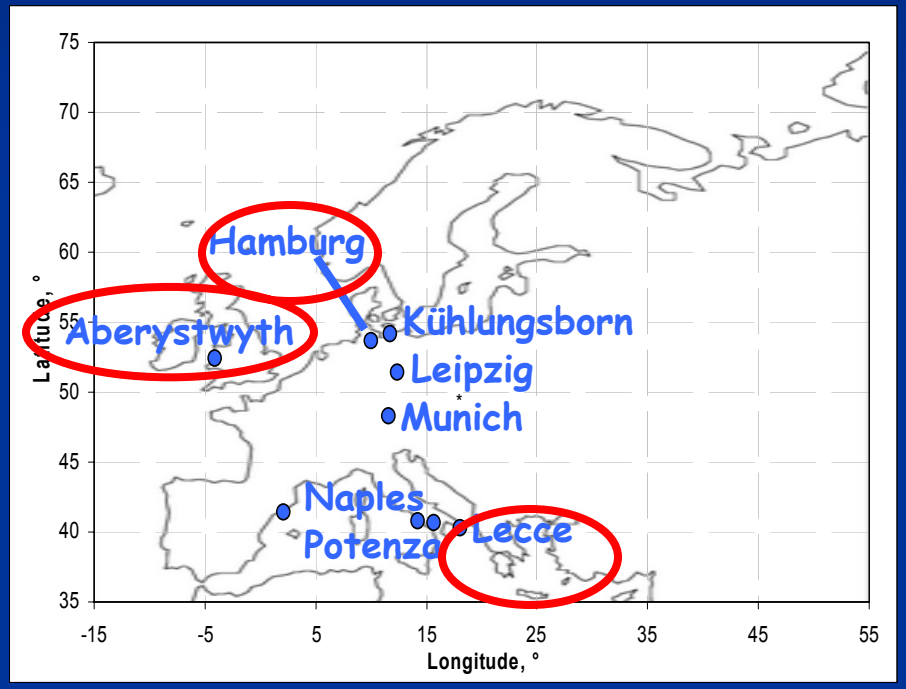
2. Classify and establish for the different aerosol regimes [mid-continetal remote (SGP), continental (Hamburg), coastal/marine (Aberystwyth), southern european/dusty (Lecce)] the bias between individual models and observed extinction profiles

3. Understand modeled extinction and its bias to data as a function of optical calculation in the models

3. Document the PBL EC values

Stations considered

EARLINET stations

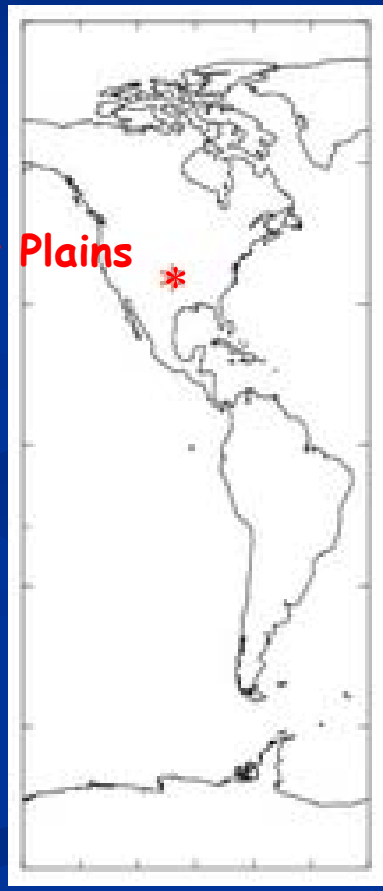


Aberystwyth : coastal/marine
Hamburg : continental (coastal)
Lecce : dusty

ARM program

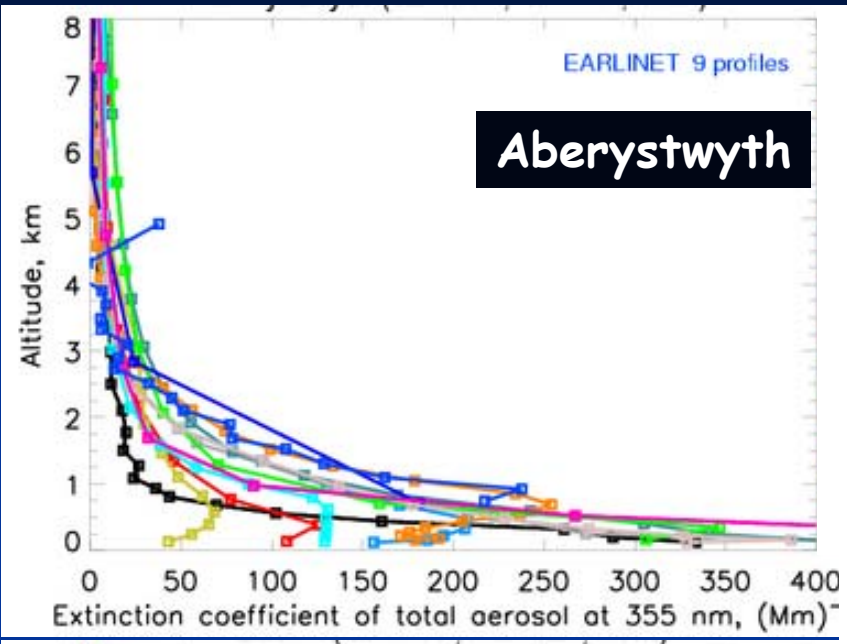
South Great Plains

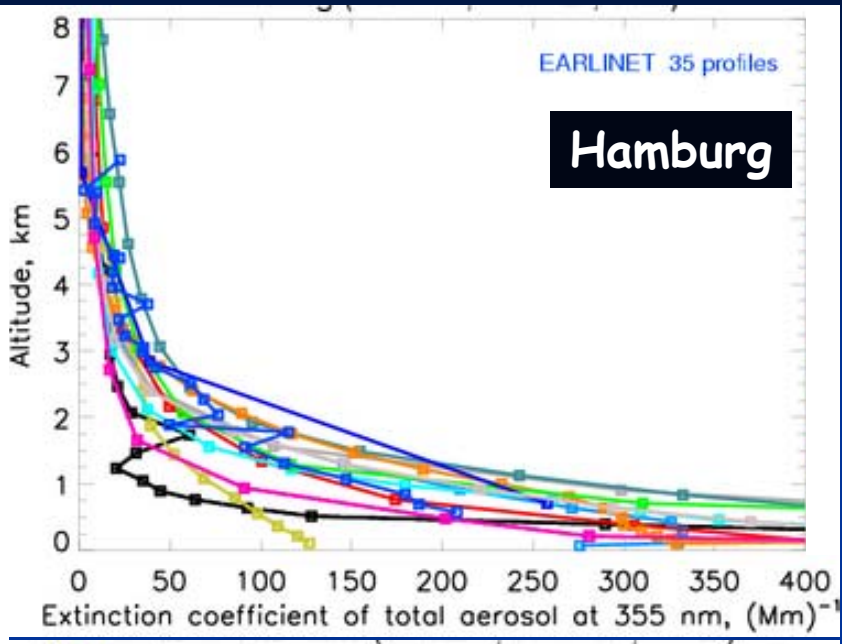
SGP : remote



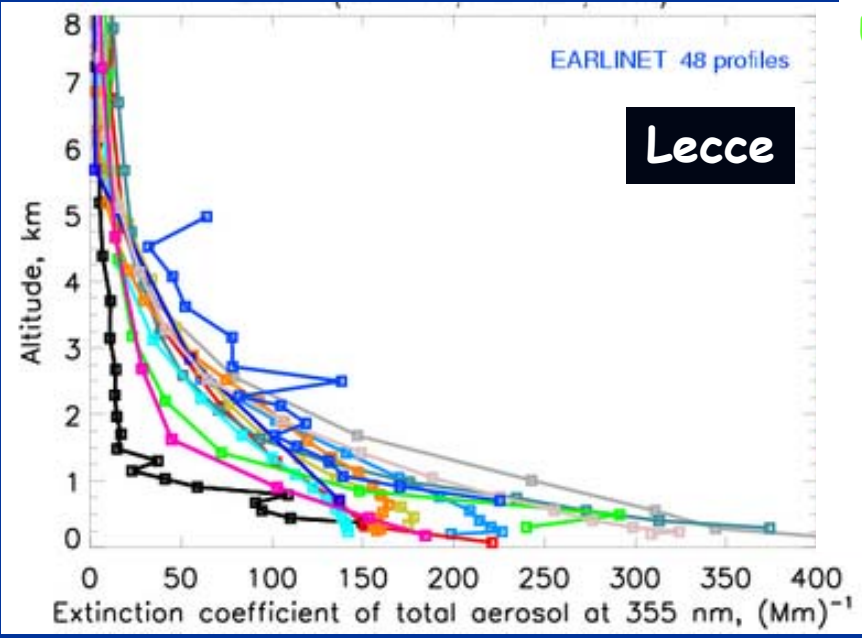
Extinction profiles at 355nm

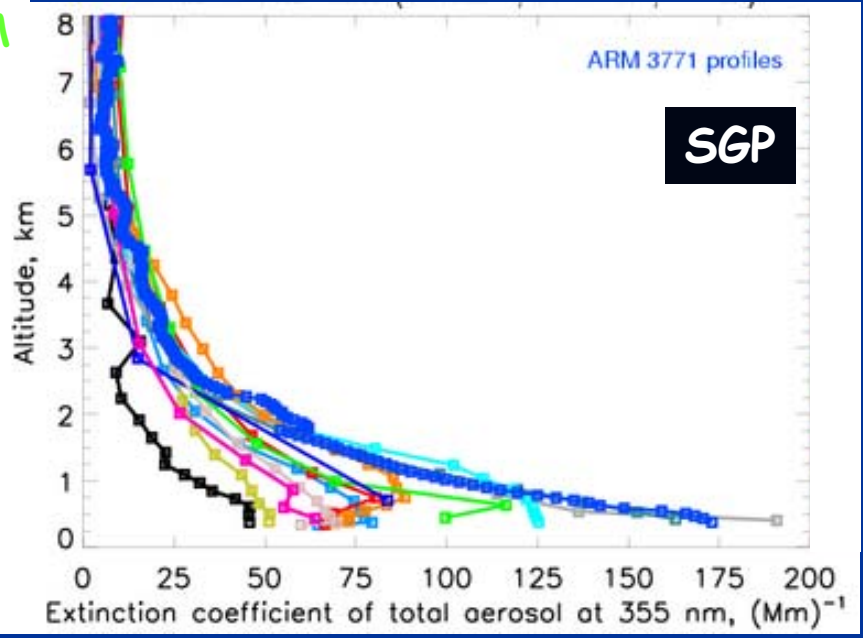
Experiment A





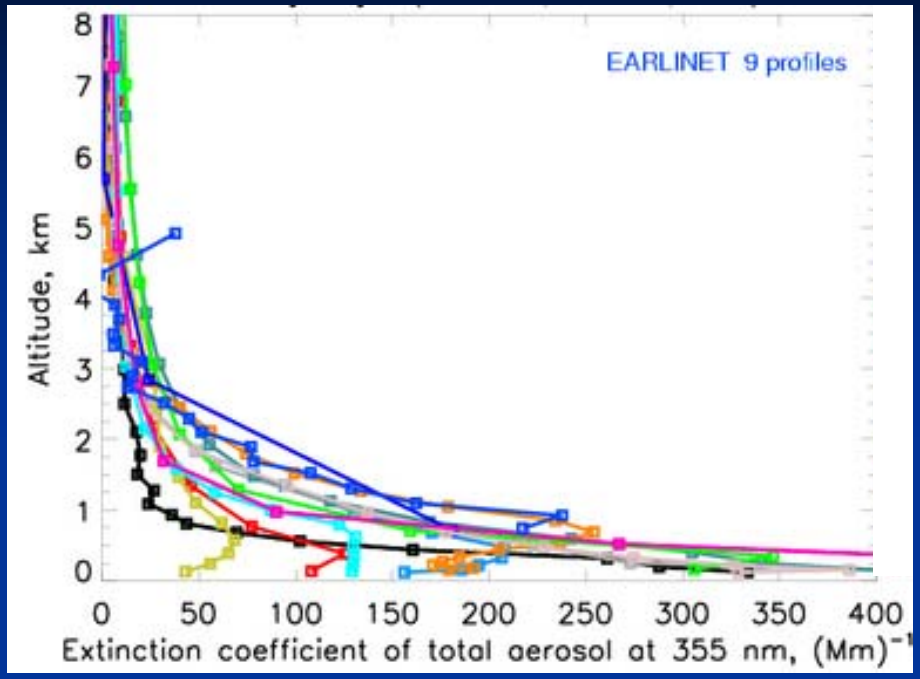
ARQM
GISS
GOCART
KYU
LSCE
MATCH
MOZGN
PNNL
UIO_CTM
UIO_GCM
ULAQ
UMI





Marine station : Aberystwyth (1)

Experiment A



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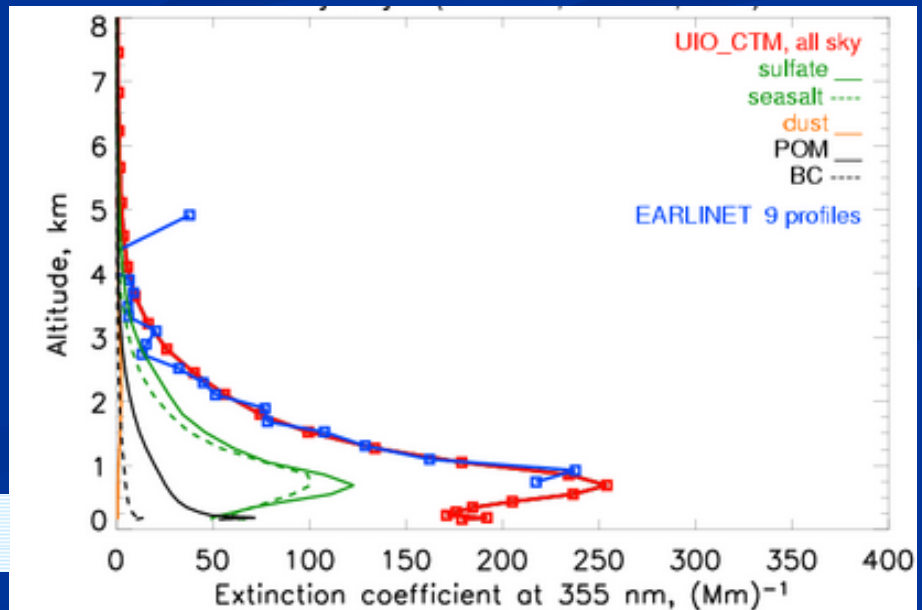
All models with smaller EC355 profiles than the data above 1 km

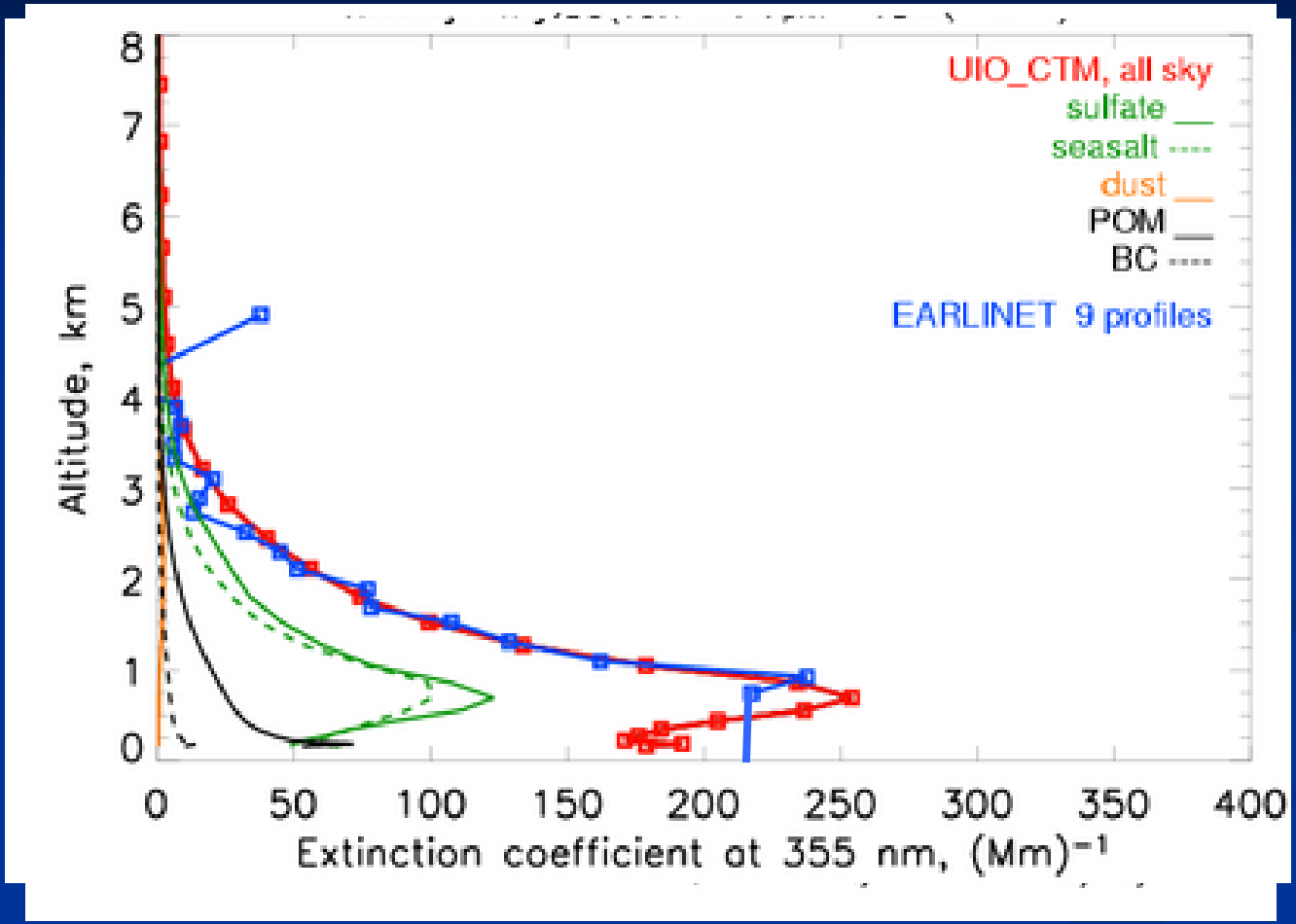
Some models with very large values in the PBL : GISS, KYU, UIO_GCM, UMI, MOZGN

Perfect agreement with UIO_CTM



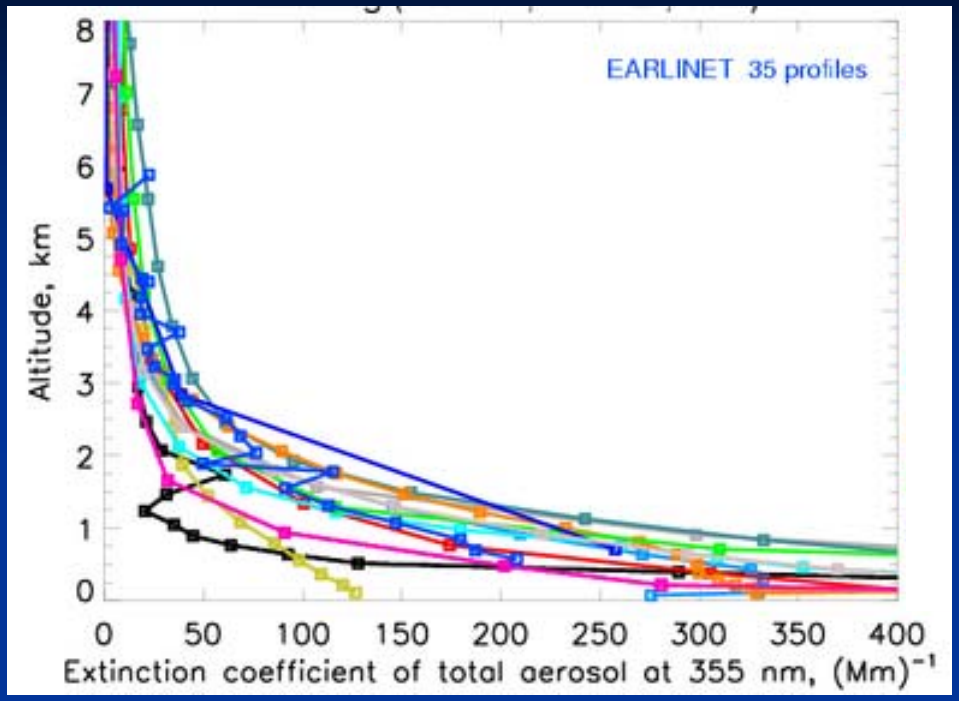
Marine station : Aberystwyth (2)

Experiment A



Continental station : Hamburg (1)

Experiment A



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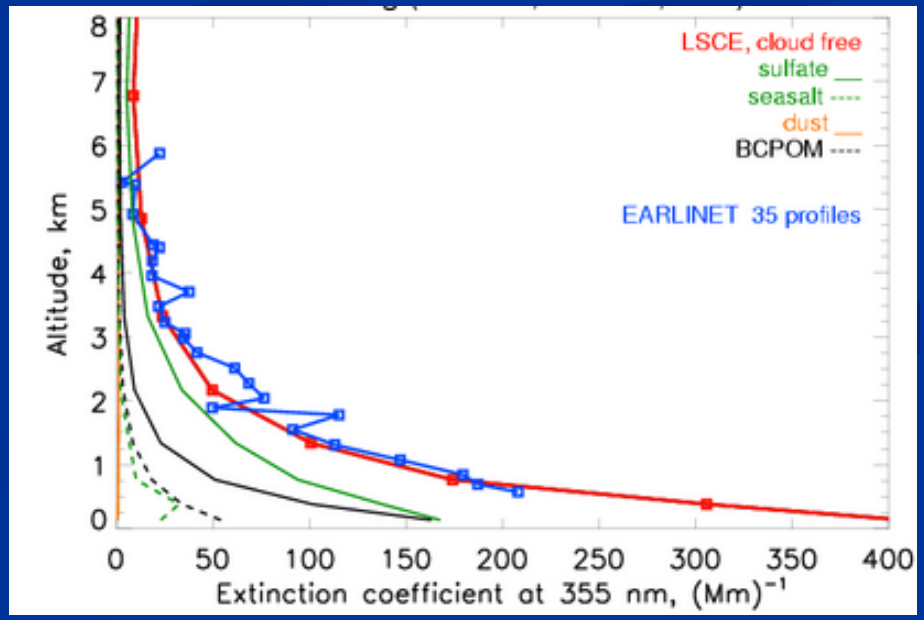
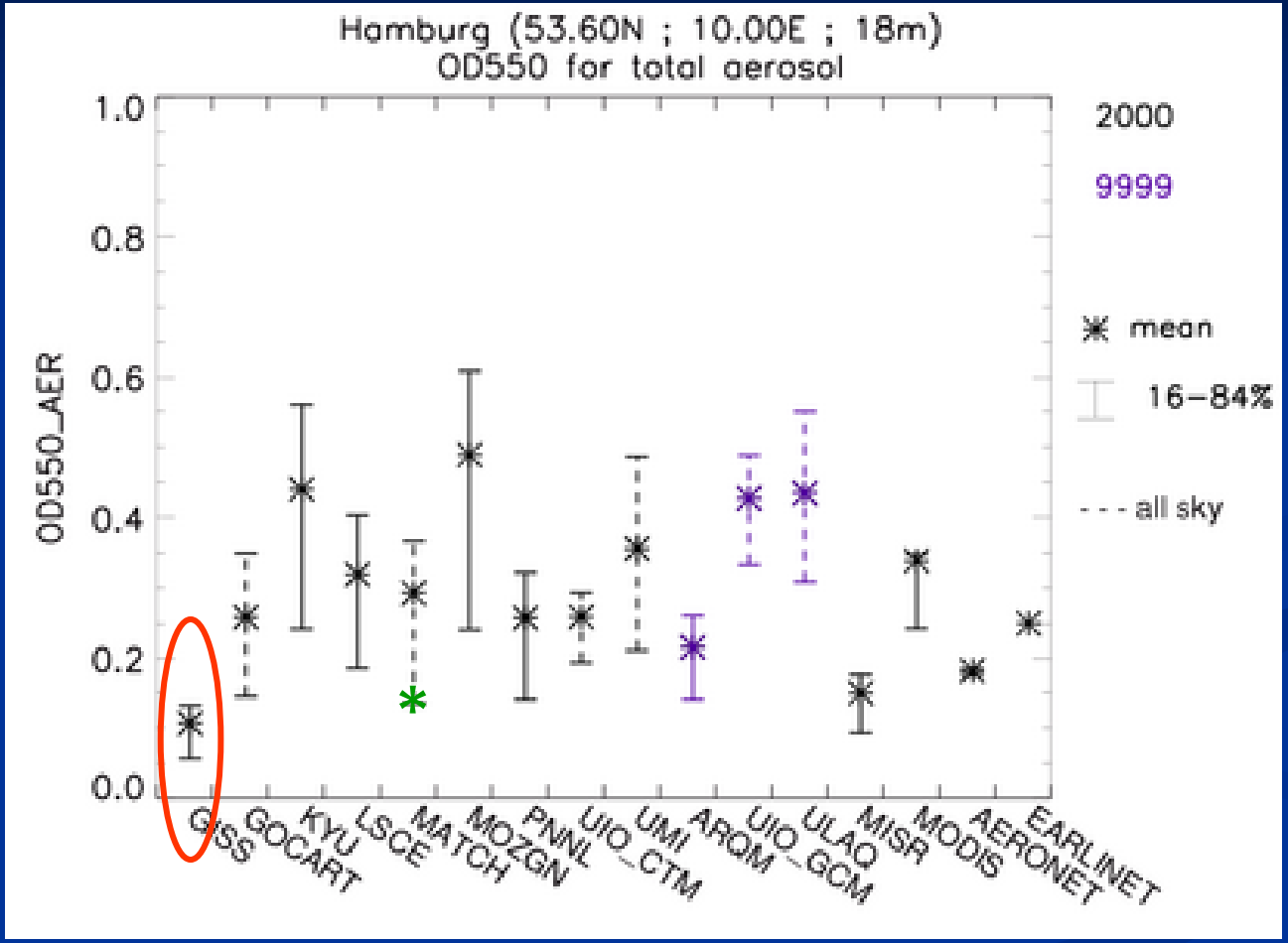
All models with larger EC in the PBL, except MATCH



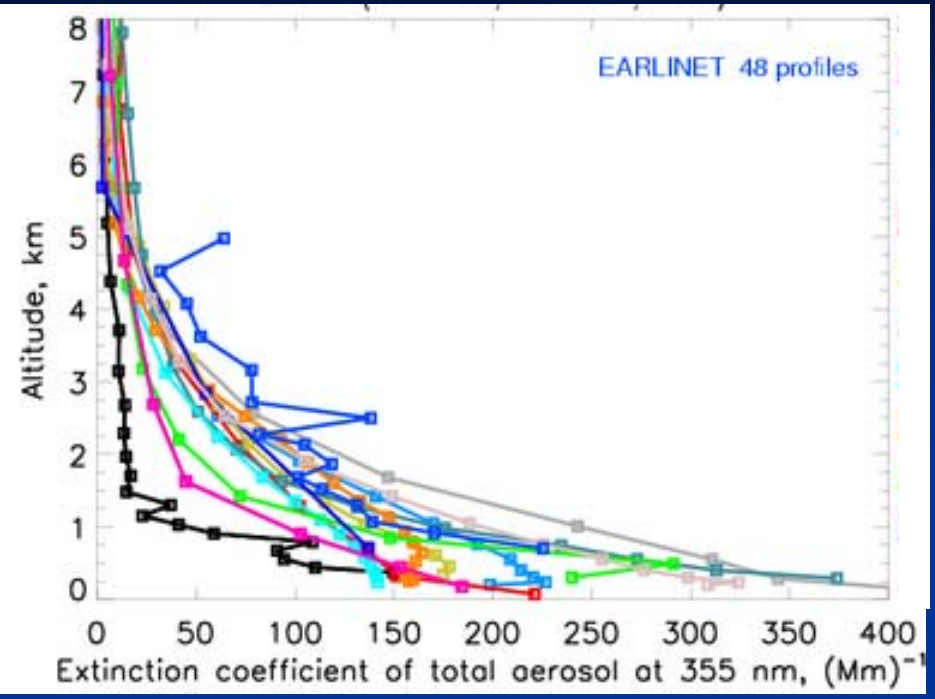
Continental station : Hamburg (2)

Experiment A



Dusty station : Lecce (1)

Experiment A



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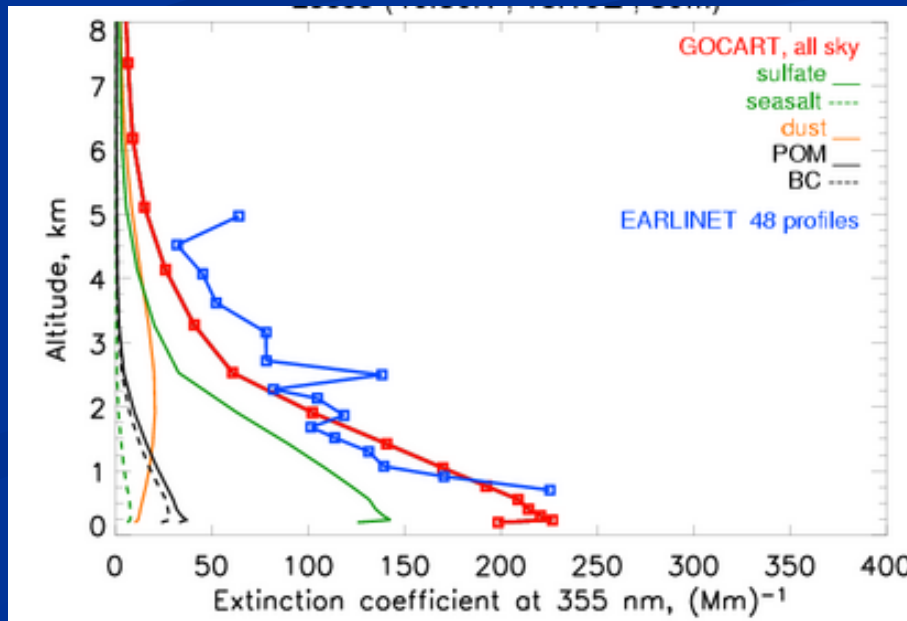
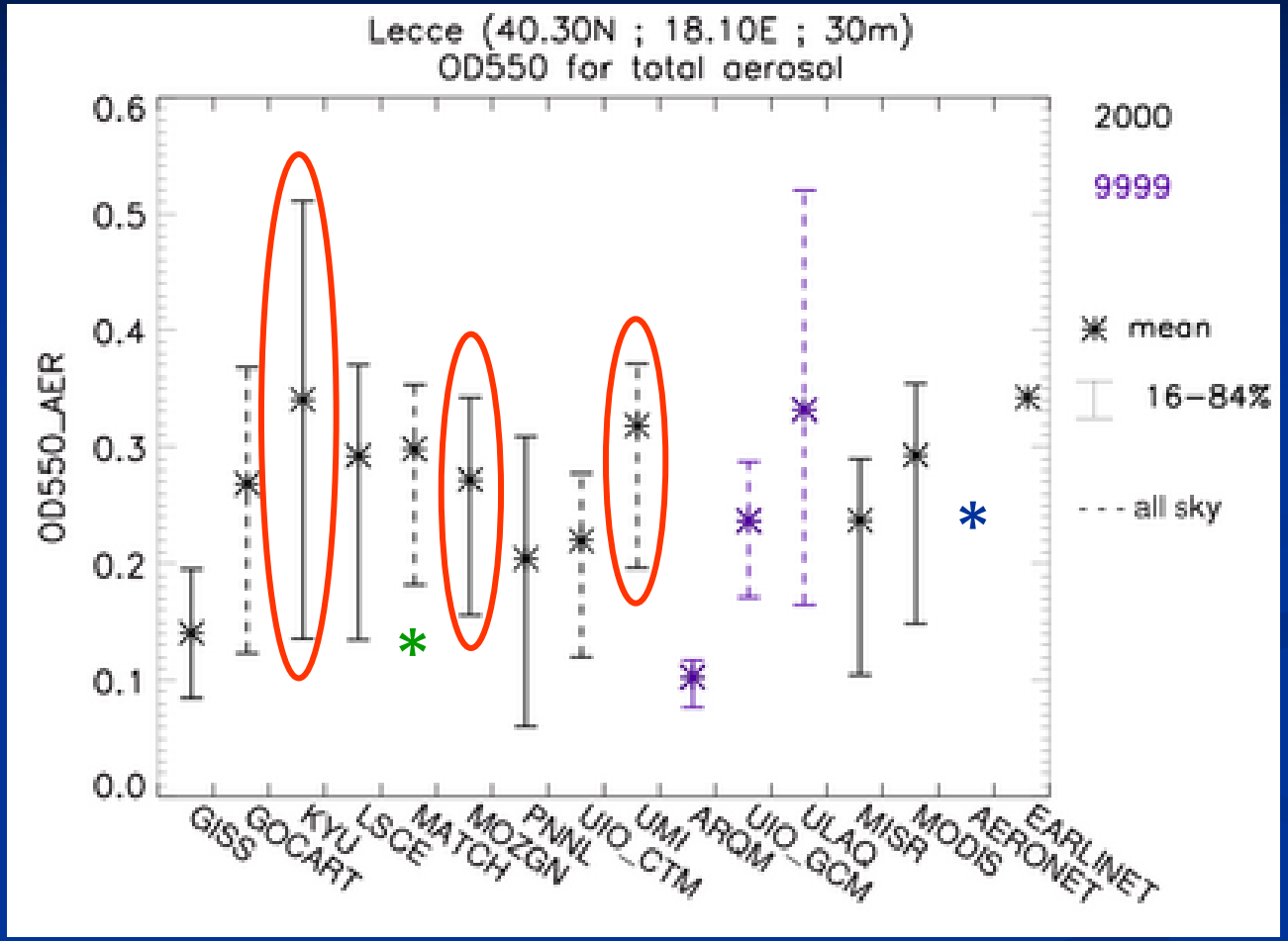
Smaller values in the PBL than for other stations, except for KYU

Most of the models have too small values between 1 and 3 km



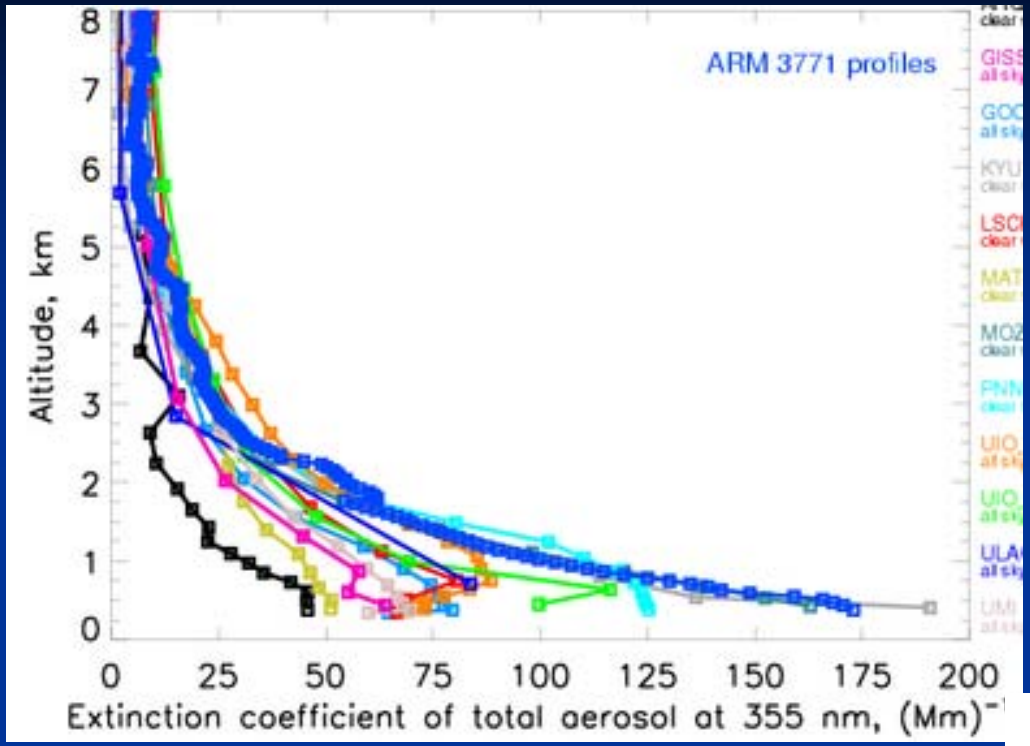
Dusty station : Lecce (2)

Experiment A



Remote station : SGP (1)

Experiment A



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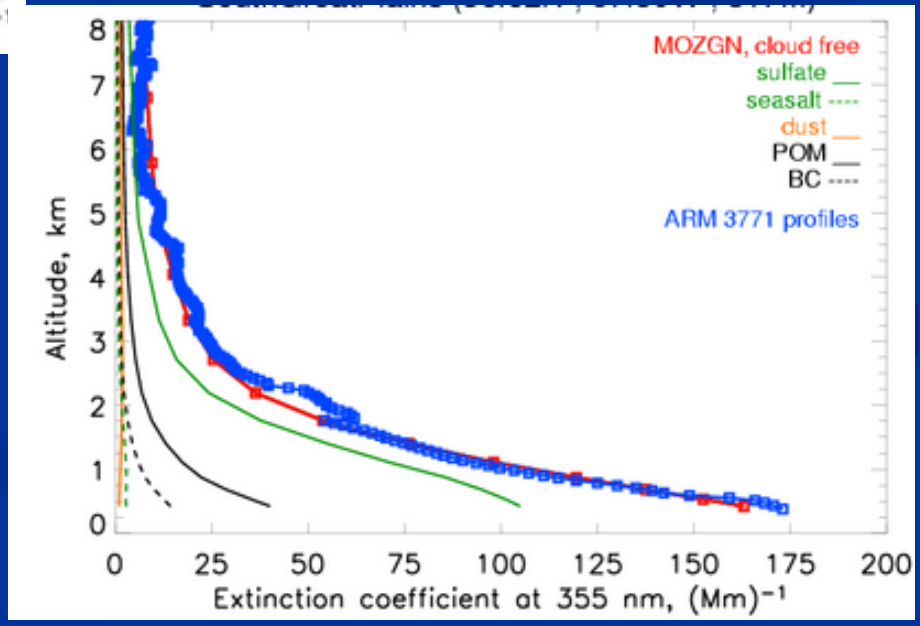
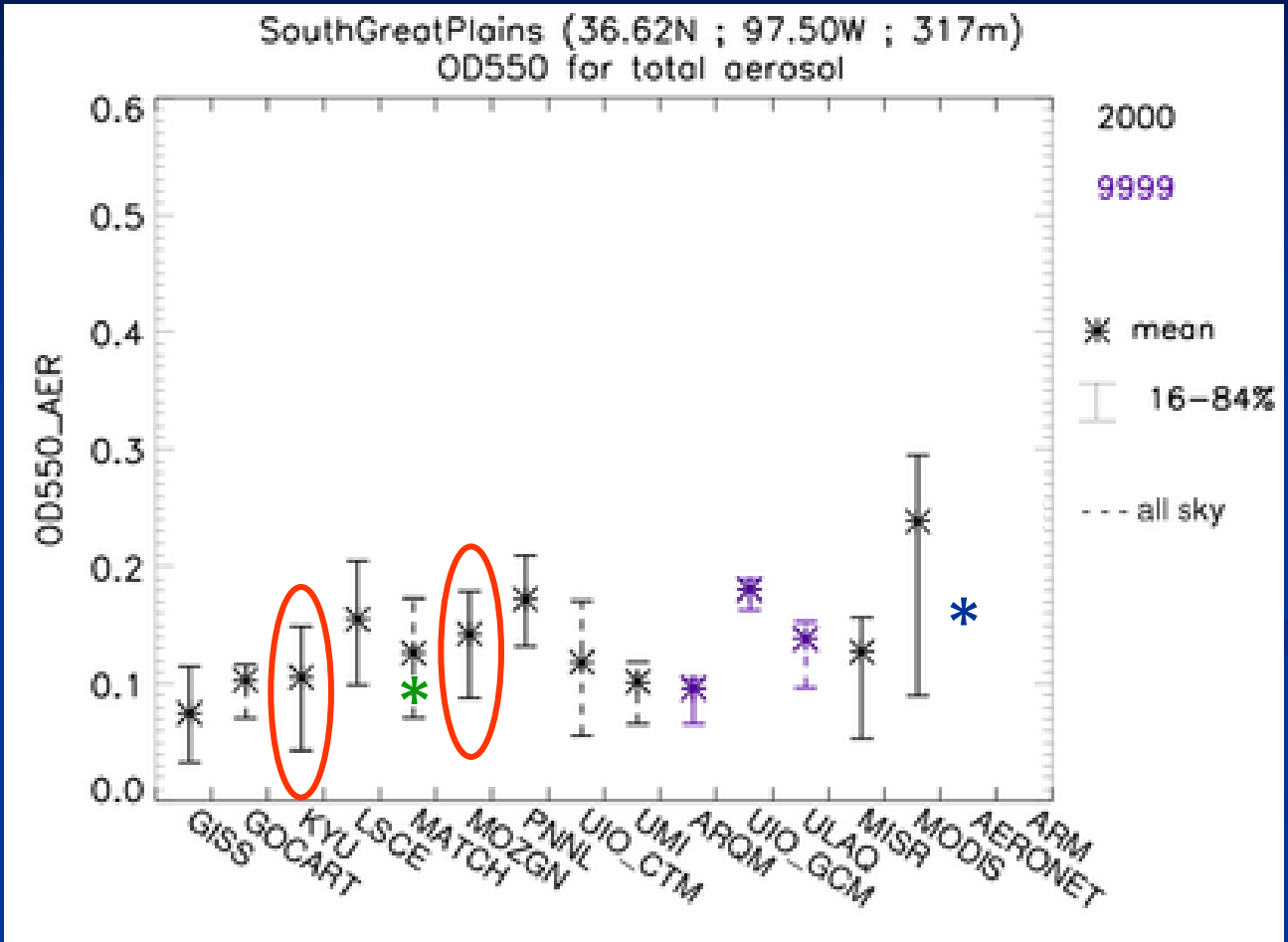
All models have smaller EC in PBL than data, except KYU and MOZGN



Remote station : SGP (2)

Experiment A



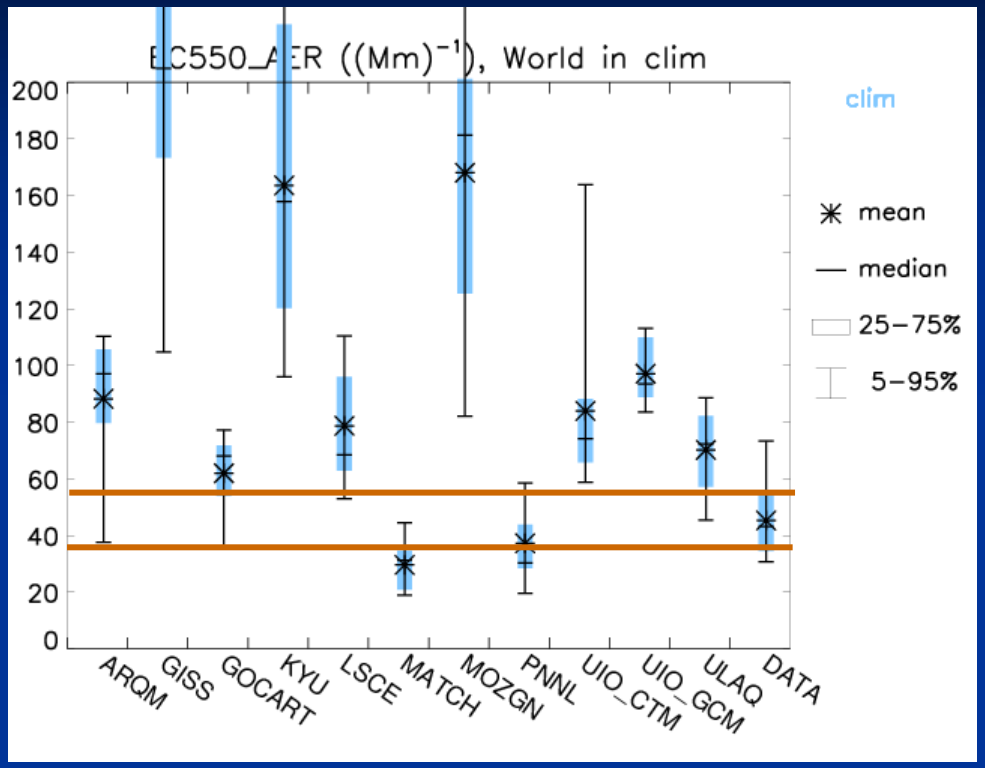
Caracterisation of the models

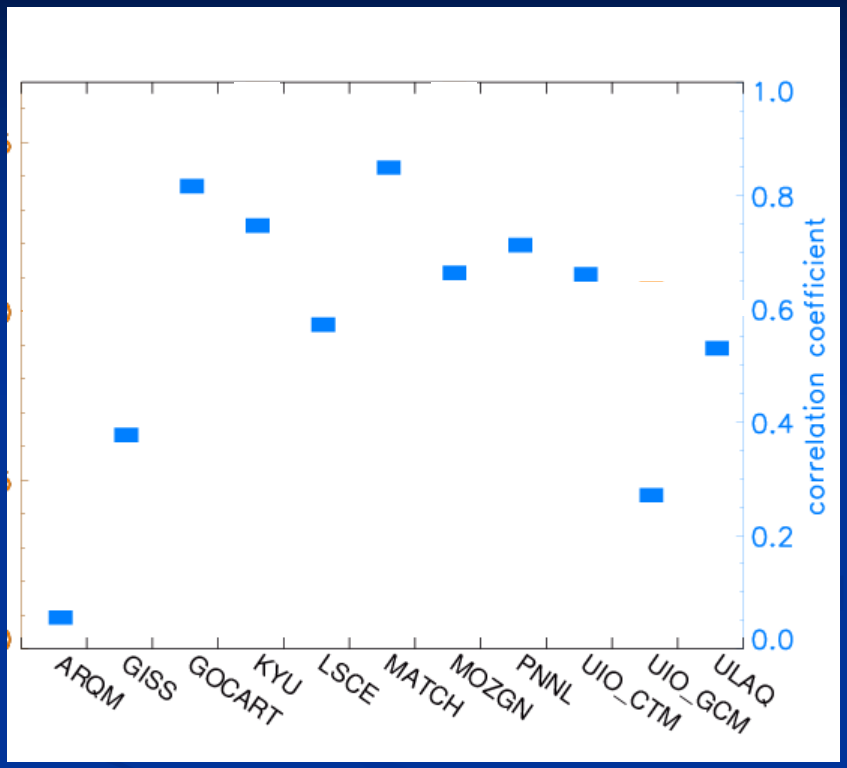
Experiment A

	Low EC values in PBL	Large EC values in PBL
Aberystwyth	GOCART, LSCE, MATCH, PNNL, UIO_CTM, ULAQ	GISS, KYU, MOZGN, UIO_GCM, UMI
Hamburg	GOCART, MATCH, UIO_CTM, ULAQ	GISS, KYU, MOZGN, UIO_GCM, UMI, LSCE, PNNL
Lecce	GOCART, LSCE, MATCH, PNNL, UIO_CTM, ULAQ, ARQM, GISS	KYU, MOZGN
SGP	GOCART, LSCE, MATCH, UIO_CTM, ULAQ, UMI, ARQM, GISS	

EC550 at ground level (1)

Experiment A



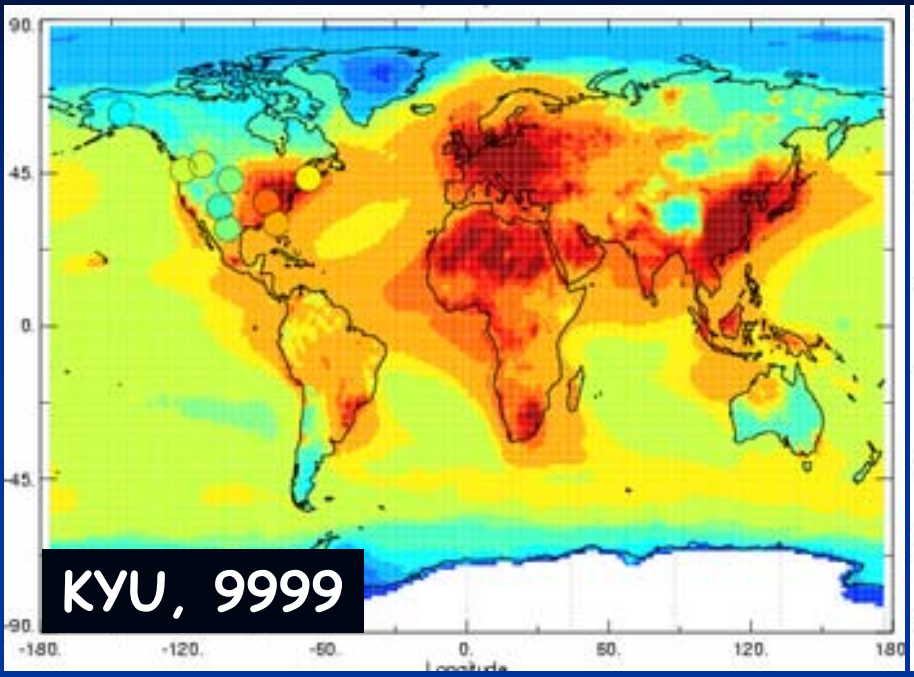


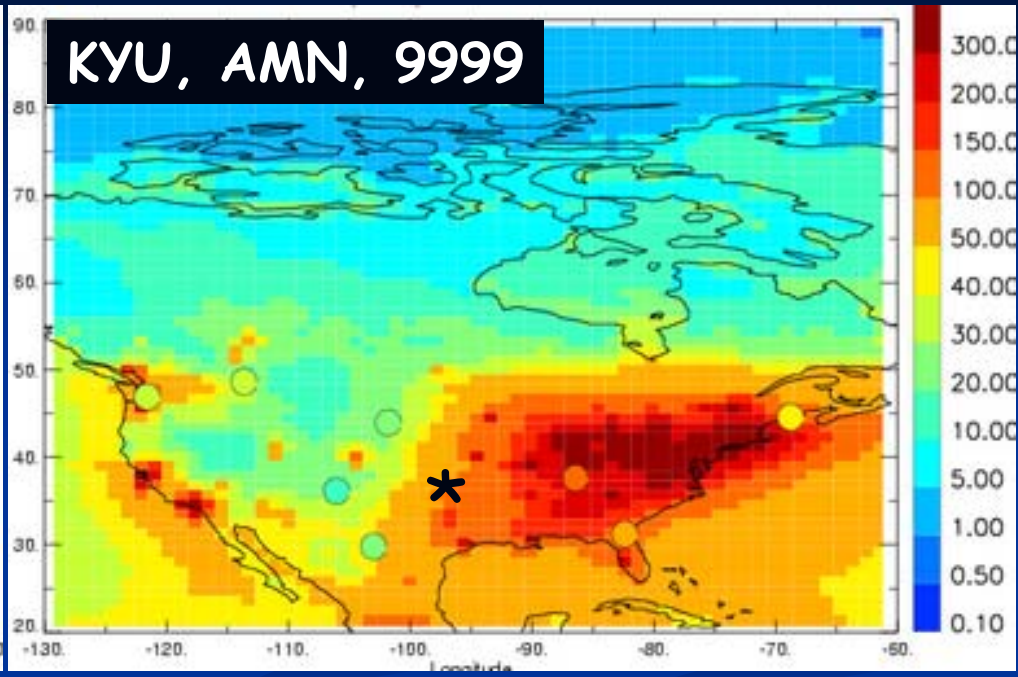
Models with overestimation of EC550 are models already identified : KYU, MOZGN, and also GISS and UIO_GCM

Clim comparison : average of all models output available years

EC550 at ground level (2)

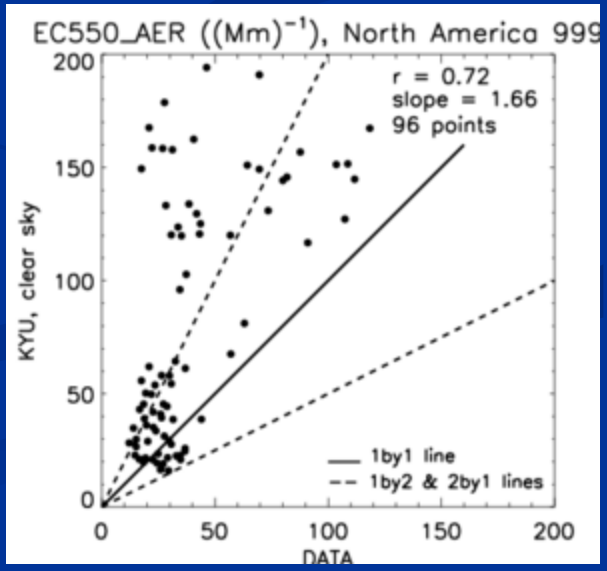
Experiment A





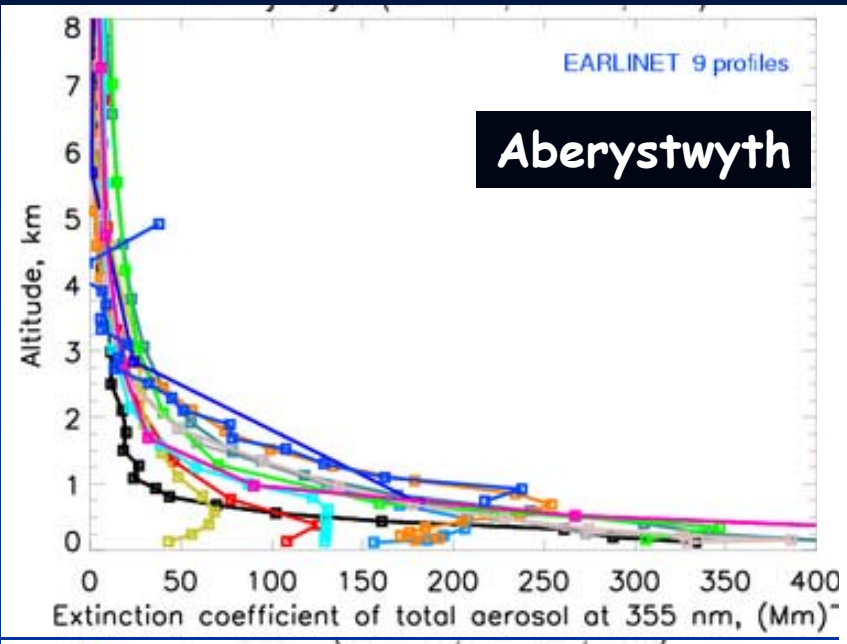
Overestimation at some stations only :
no contradiction with agreement at SGP

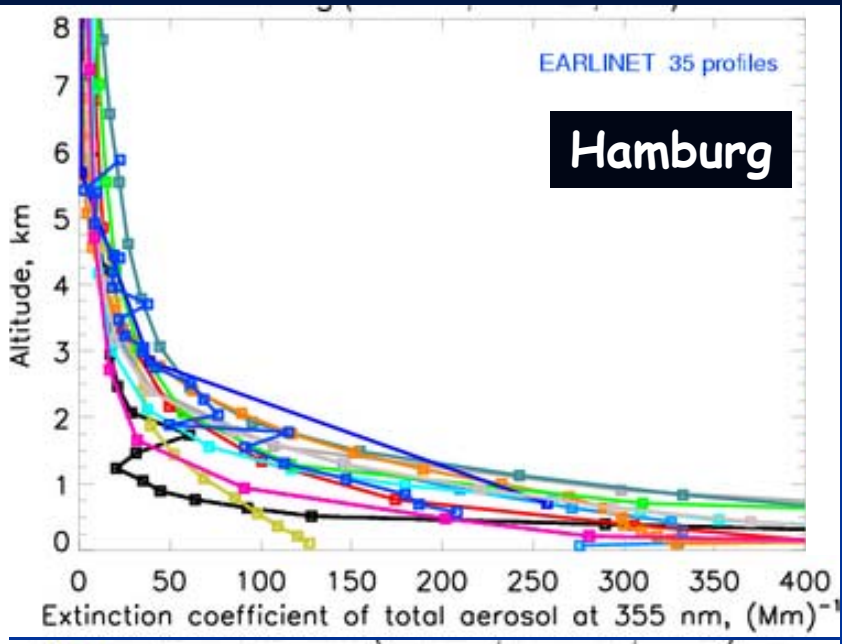
EC values at surface seem to be larger in Europe :
consistent with observations made
Same thing for other models



Extinction profiles at 355nm

Experiment A





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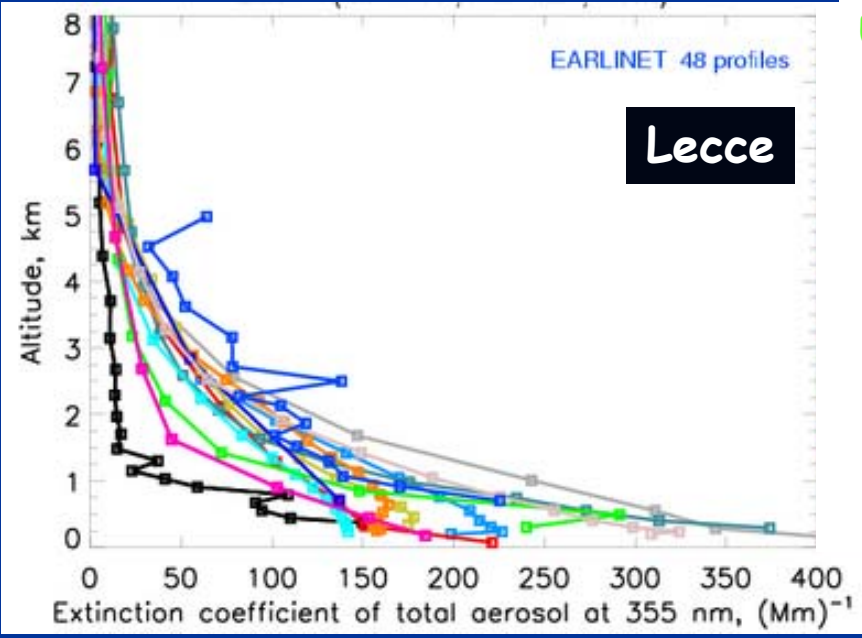
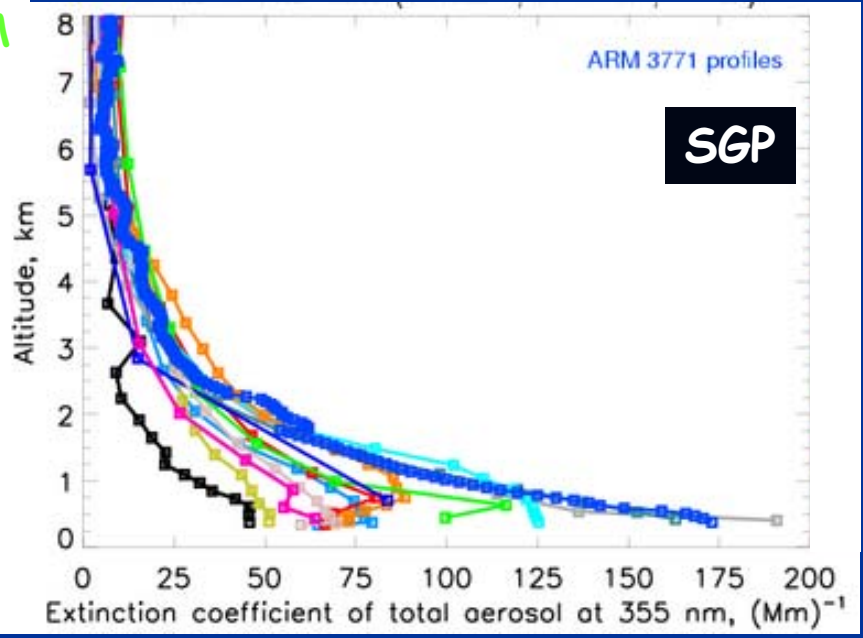
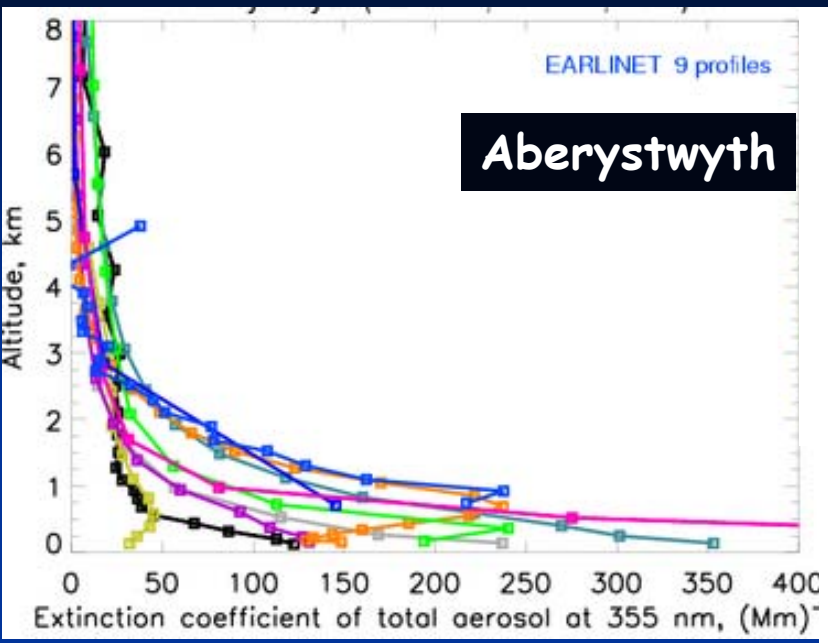
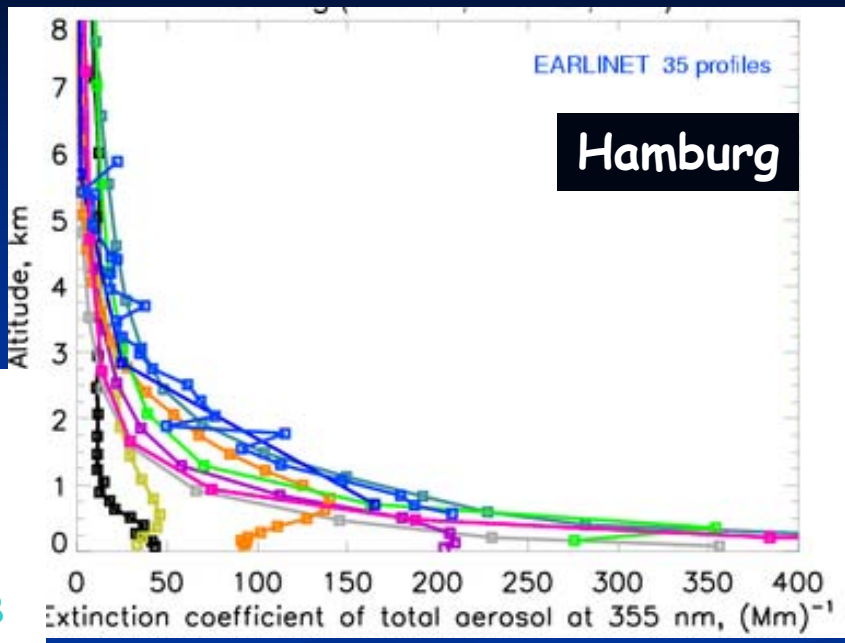




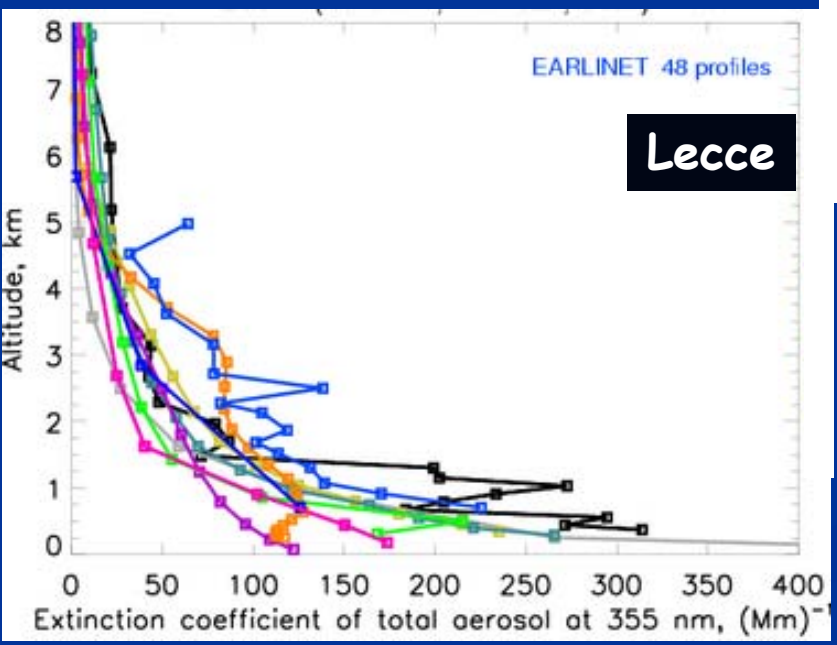
Extinction profiles at 355nm

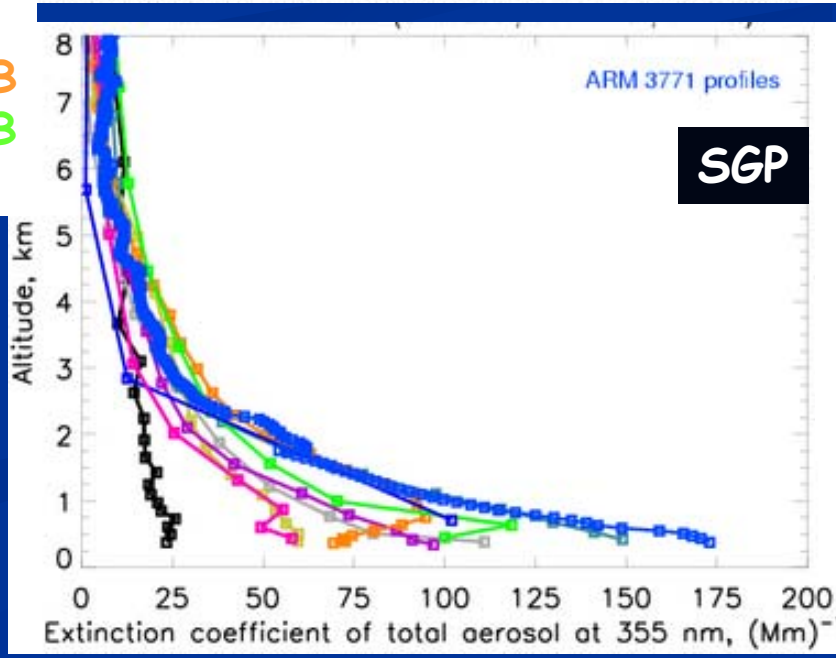
Experiment B





ARQM_B
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
UIO_GCM_B
ULAQ_B





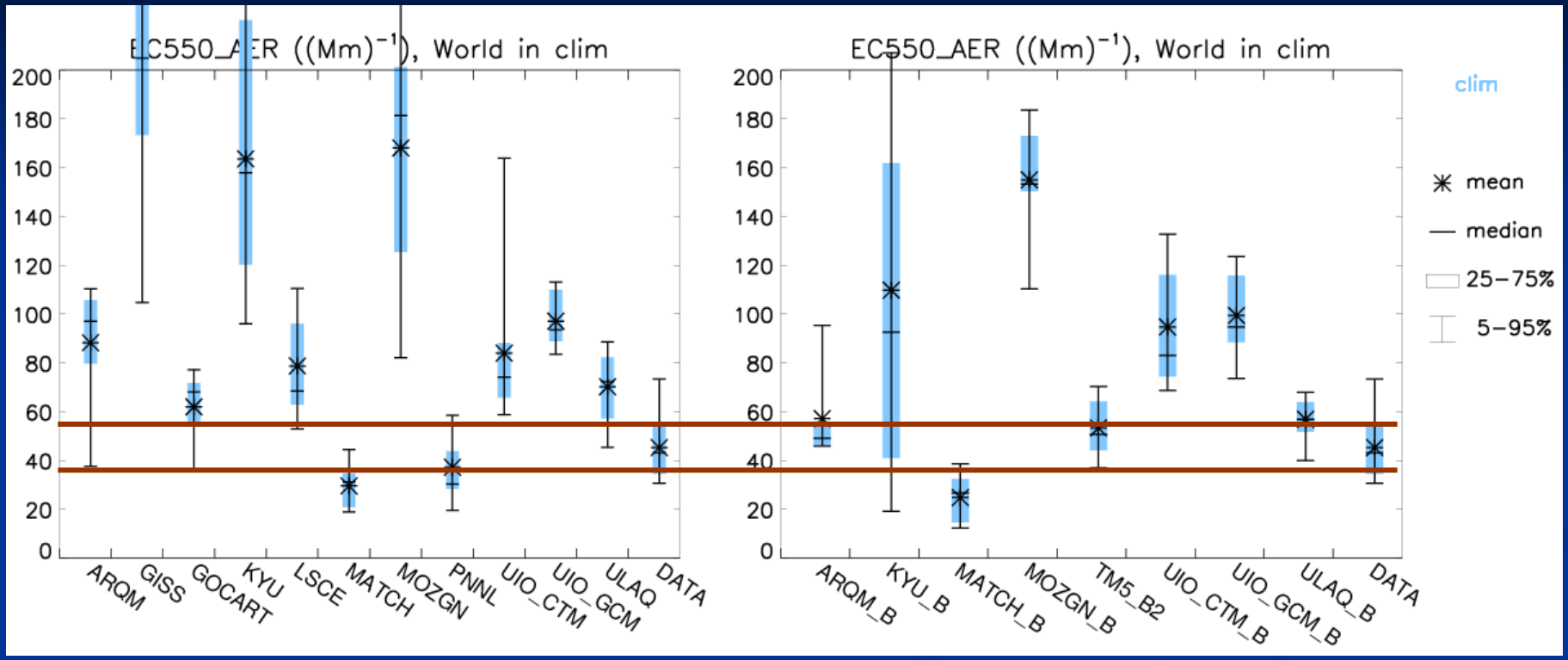
Caracterisation of the models

Experiment B

	Low EC values in PBL	Large EC values in PBL
Aberystwyth	MATCH, UIO_CTM, ULAQ	GISS, KYU, MOZGN, UIO_GCM GISS_B
Hamburg	MATCH, UIO_CTM, ULAQ	GISS, KYU, MOZGN, UIO_GCM GISS_B, MOZGN_B
Lecce	GOCART, LSCE, MATCH, PNNL, UIO_CTM, ULAQ, ARQM, GISS	KYU, MOZGN KYU_B
SGP	GOCART, LSCE, MATCH, UIO_CTM, ULAQ, UMI, ARQM, GISS	

EC550 at ground level

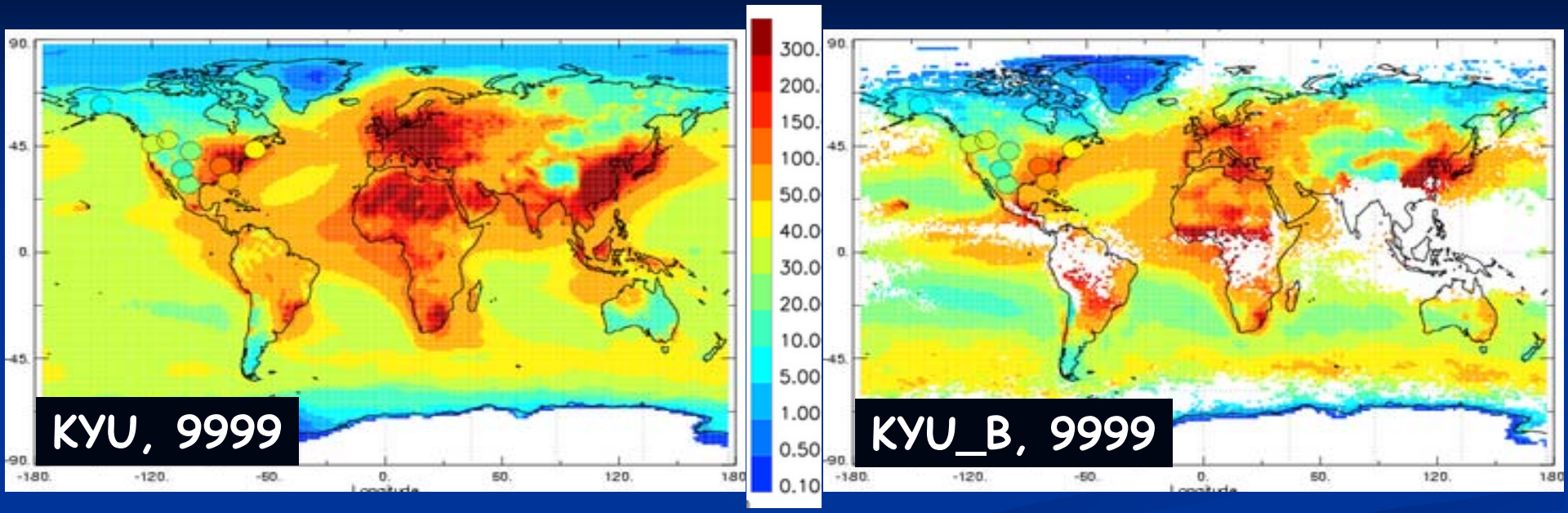
Experiment B



Surface EC values decrease betwen expA and expB
=> coherent with change in EC profiles observed

EC550 at ground level

Experiment B



OD = LOAD * MEC

EC = CONC * MEC

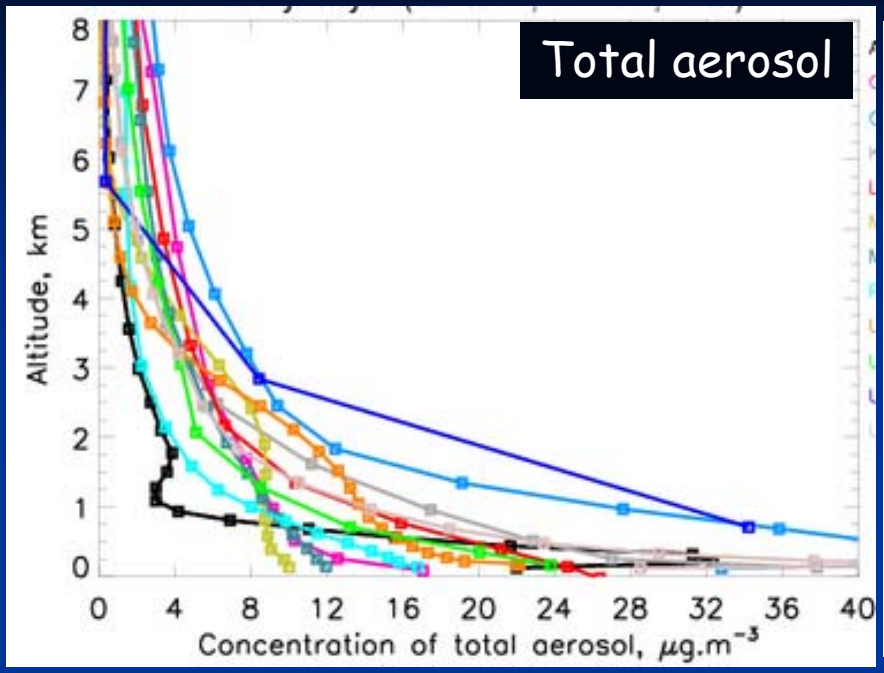
= f(RH)

See Friday presentation

Could we link the models comportement regarding concentration with the EC profiles ?

Concentration : Aberystwyth (marine)

Experiment A



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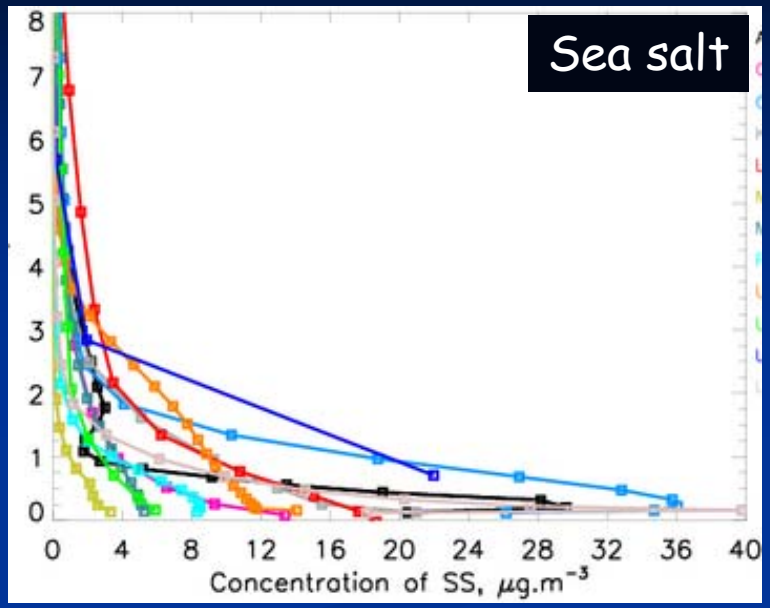
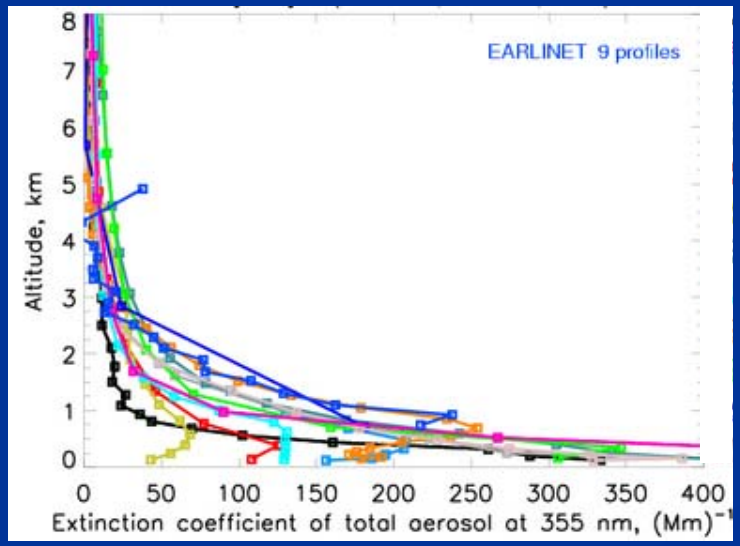




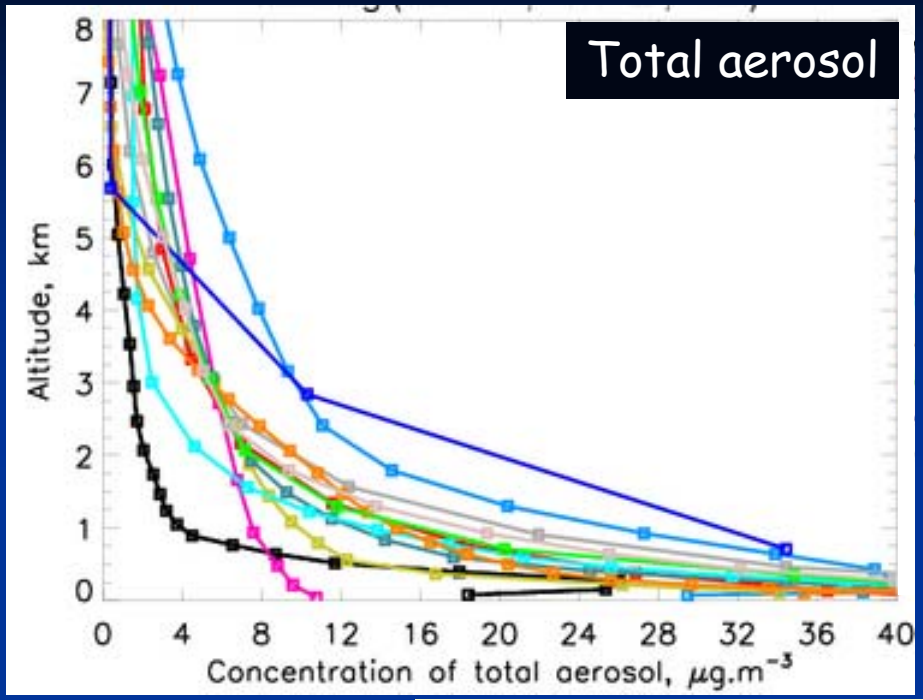
Sea-salt = dominant species

Models with largest concentration : GOCART, KYU, ULAQ, UMI

Models with largest EC values : GISS, KYU, MOZGN, UIO_GCM, UMI

Concentration : Hamburg (continental)

Experiment A



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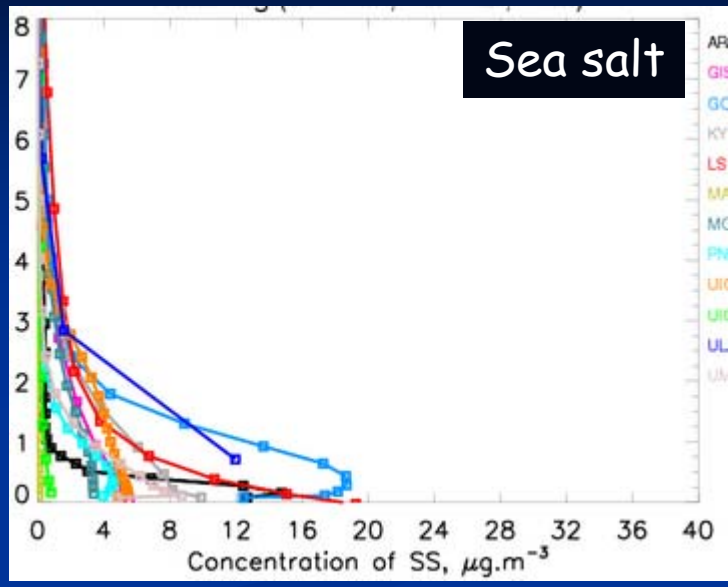
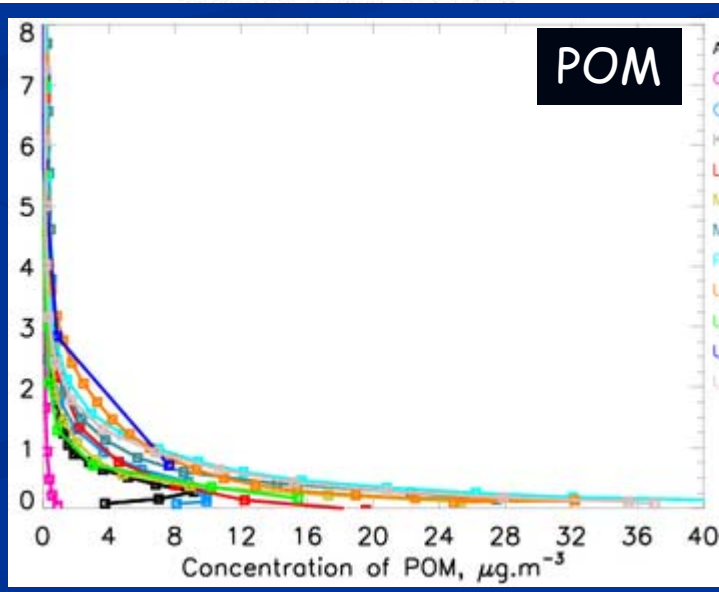


Dominant species = POM and SS

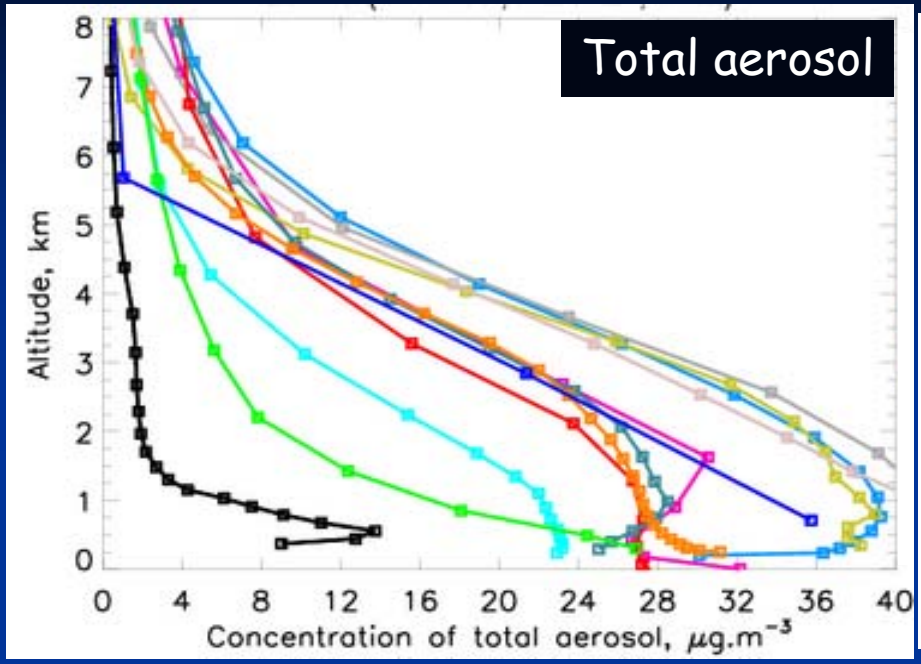


Very large concentration for all models except GISS, MATCH

Large values of EC : GISS, KYU, MOZGN, UIO_GCM, UMI, LSCE, PNNL

Concentration : Lecce (dusty)

Experiment A



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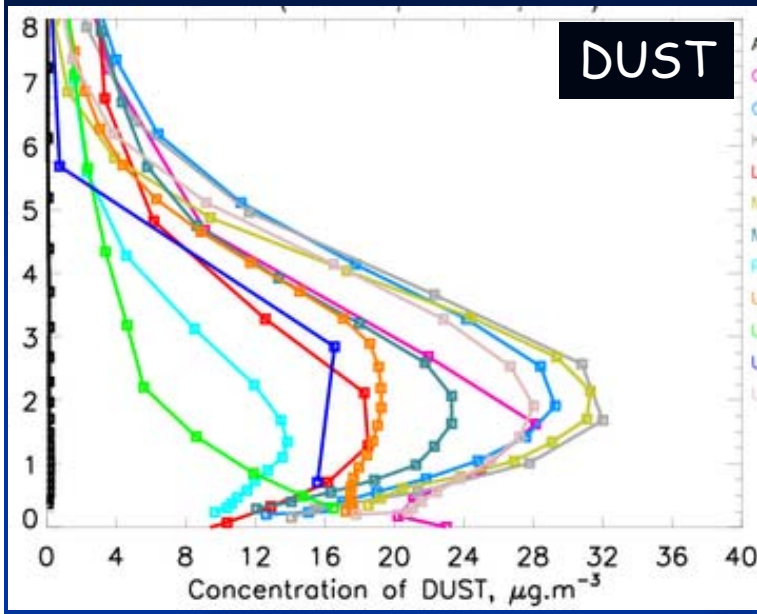
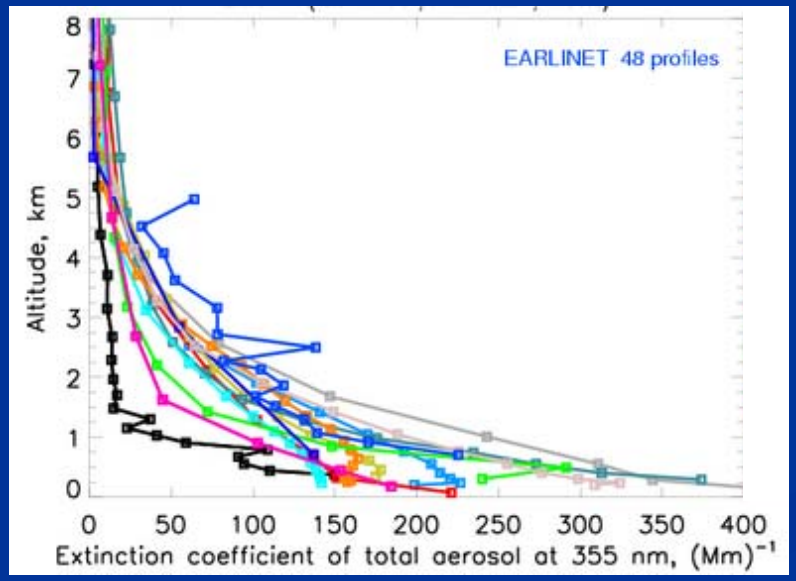


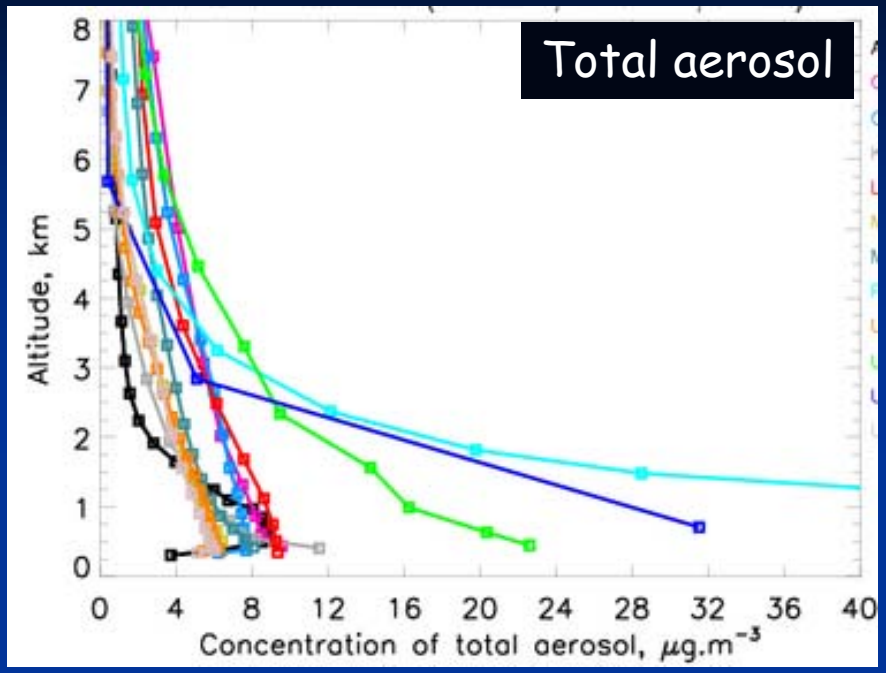


Larger concentration for KYU and UMI

Larger EC values for KYU and MOZGN

Concentration : SGP (remote)

Experiment A



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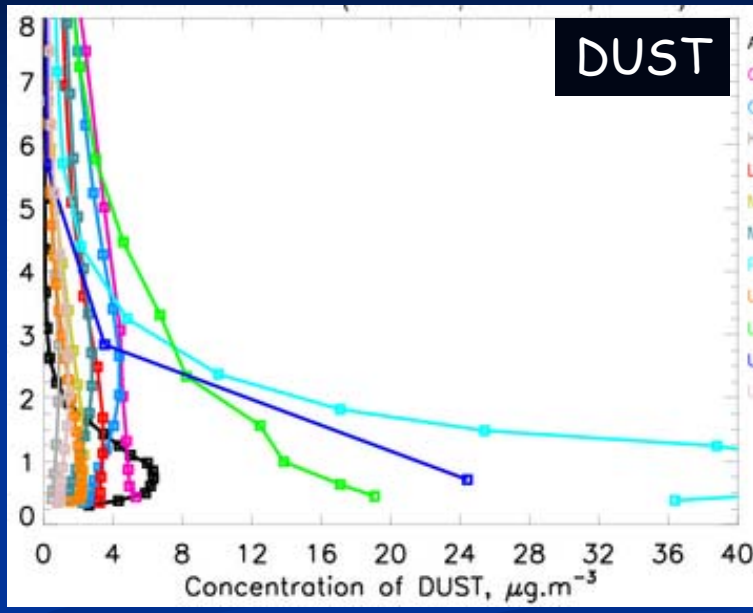
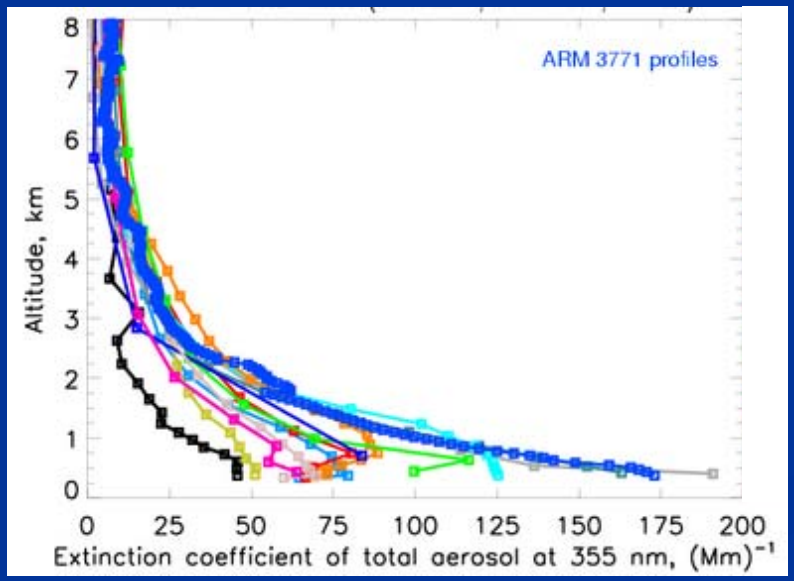
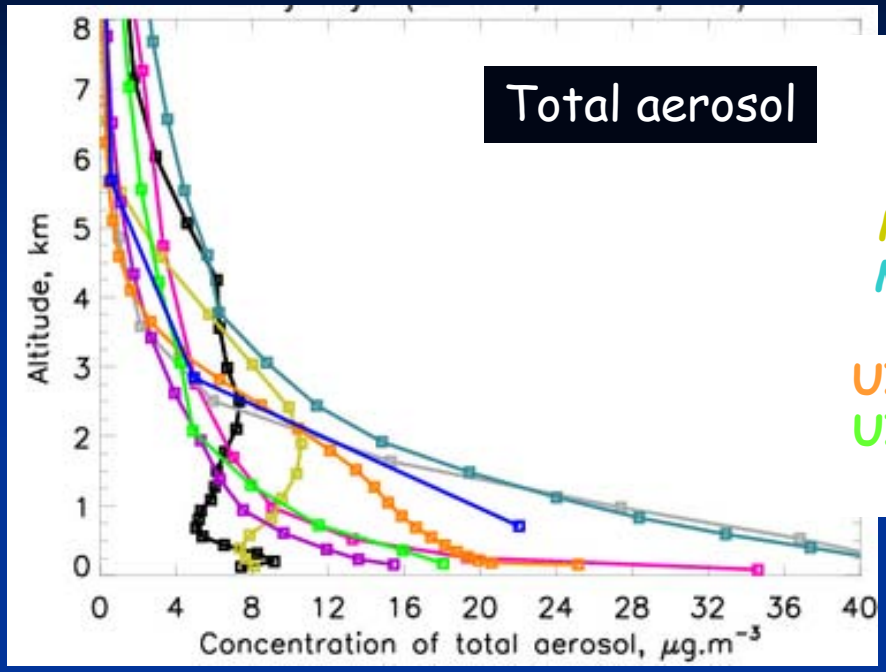




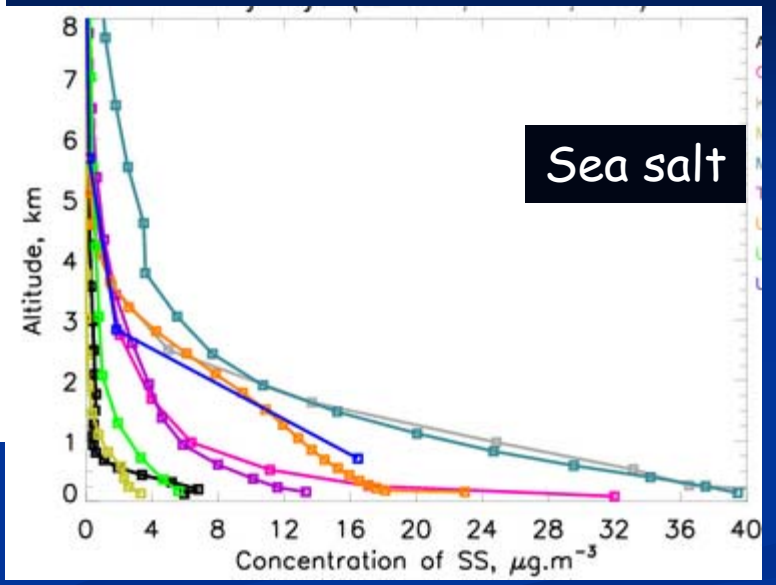
All models give dust as the dominant species except KYU (BCPOM)

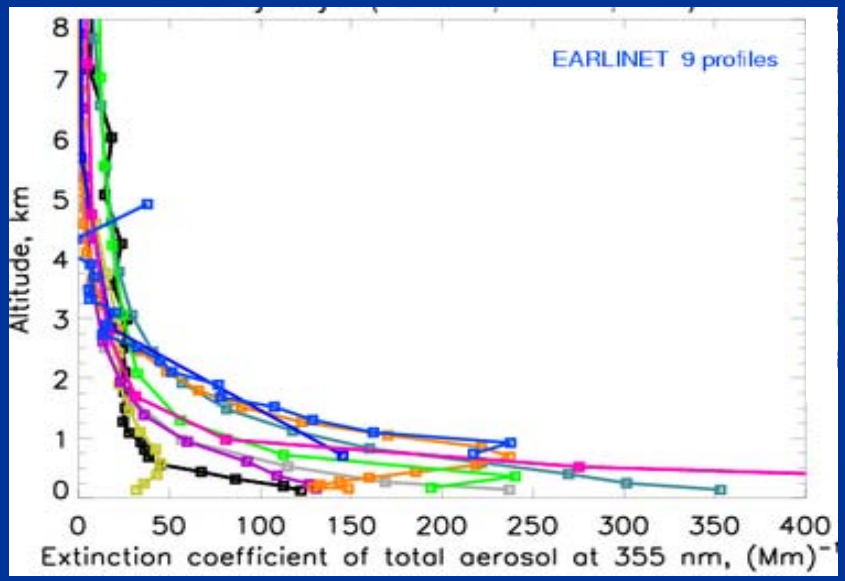
Concentration : Aberystwyth (marine)

Experiment B



ARQM_B
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
UIO_GCM_B
ULAQ_B



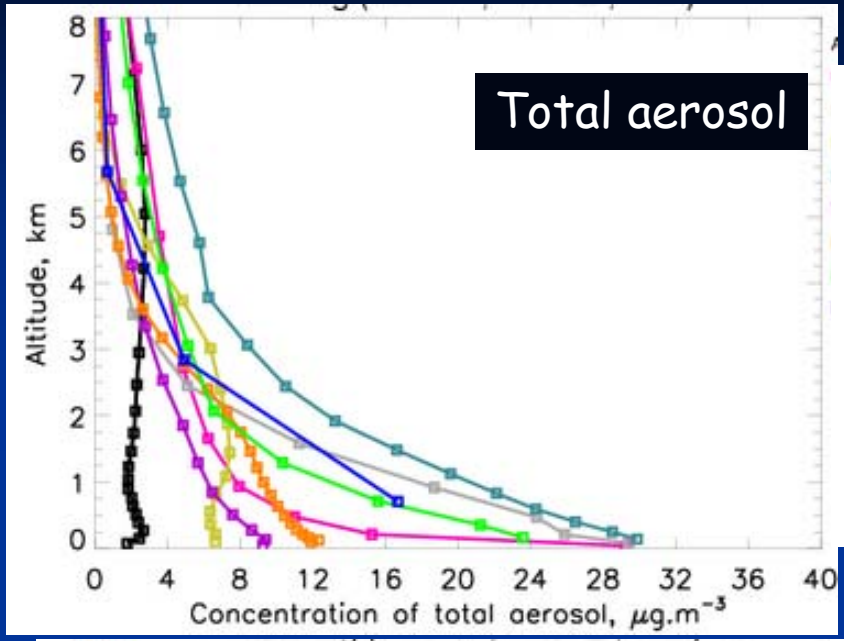


Large concentration for KYU_B and MOZGN_B

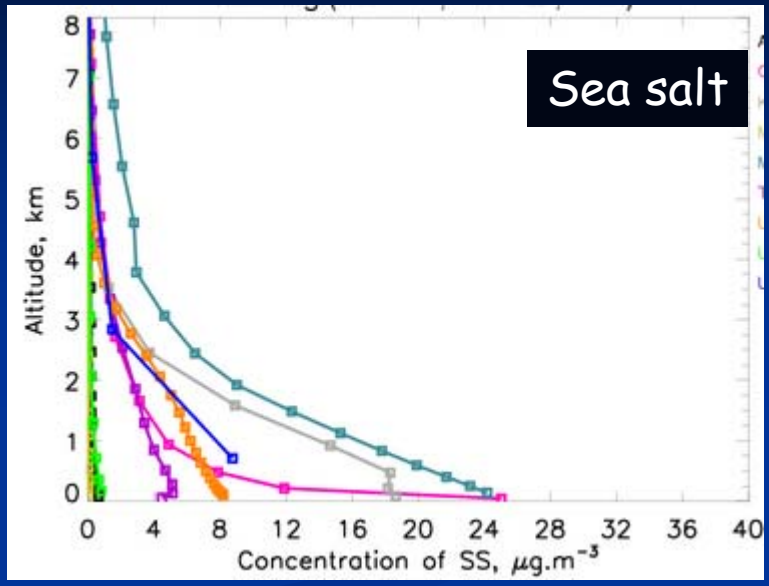
Large EC values for GISS_B and MOZGN_B

Concentration : Hamburg (continental)

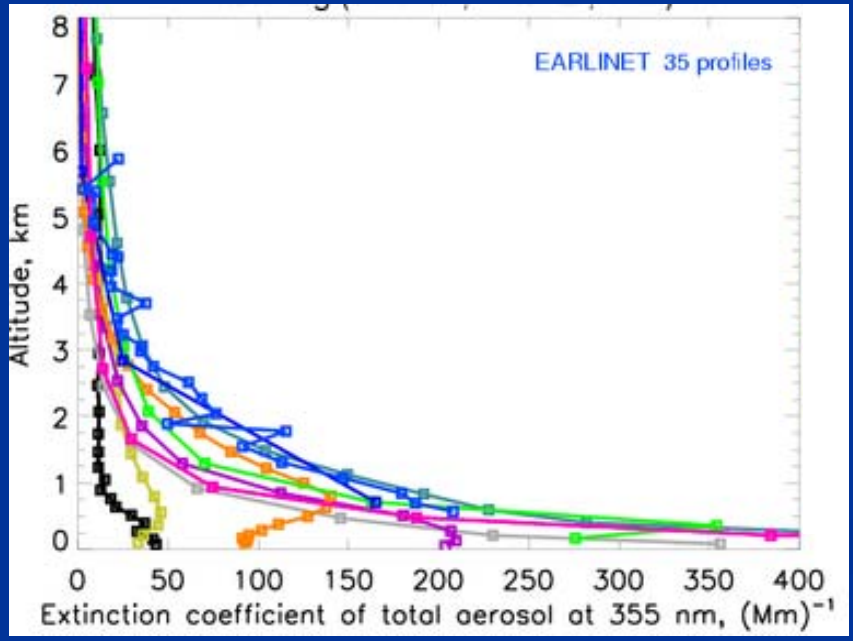
Experiment B



ARQM_B
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
UIO_GCM_B
ULAQ_B



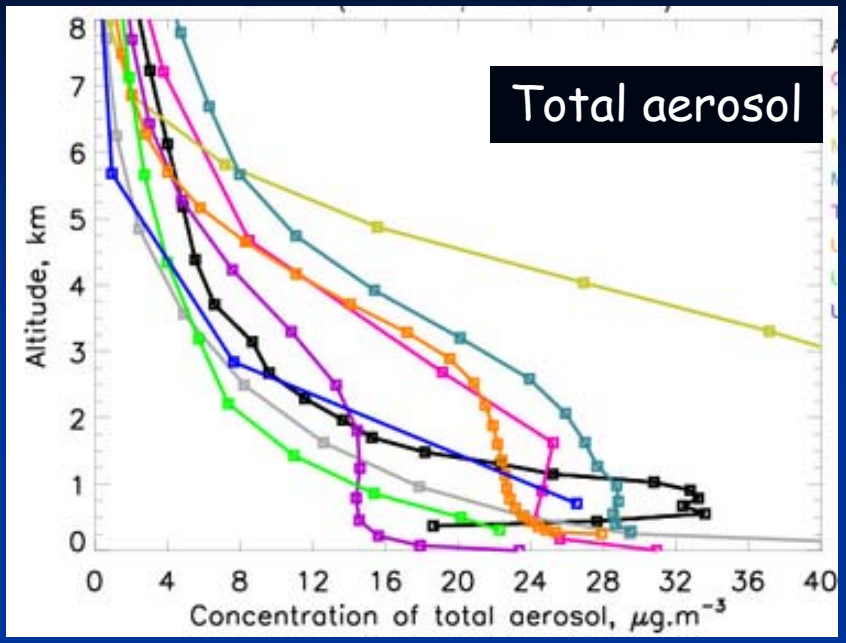
No more POM



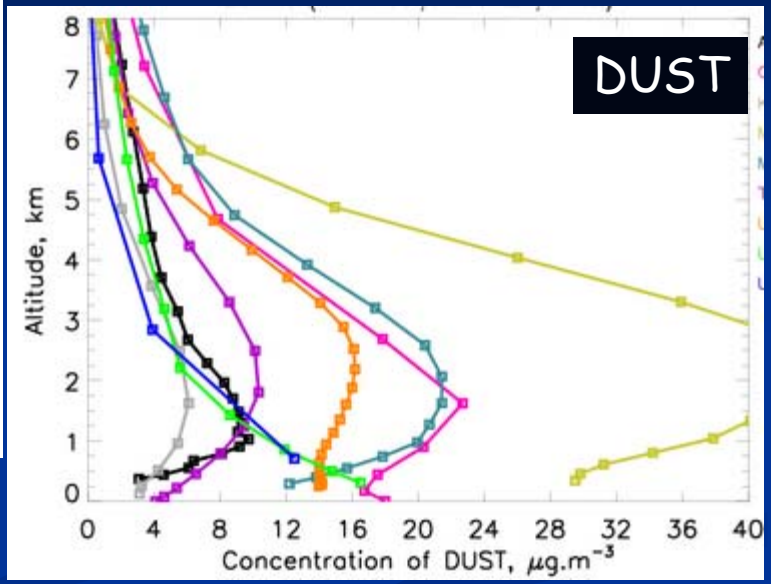
No more really large concentration as in expA but still large EC values for GISS_B and MOZGN_B

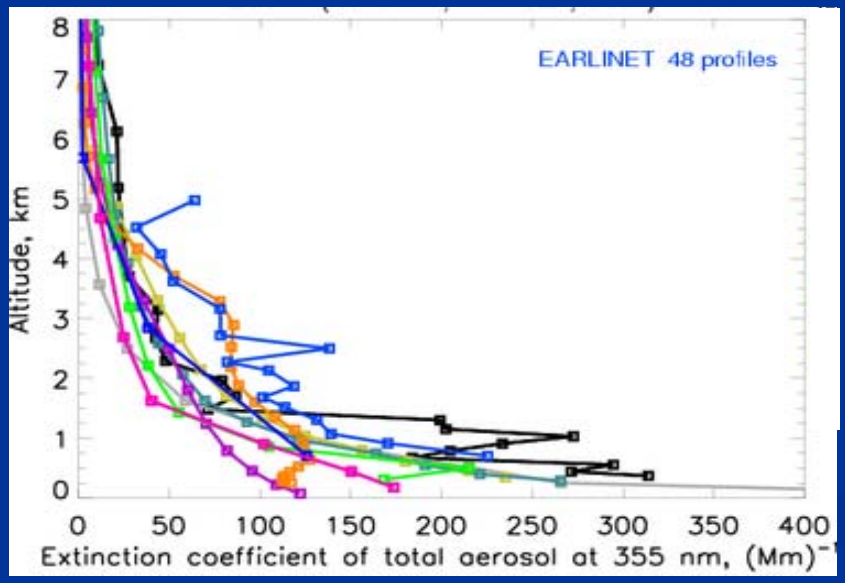
Concentration : Lecce (dusty)

Experiment B

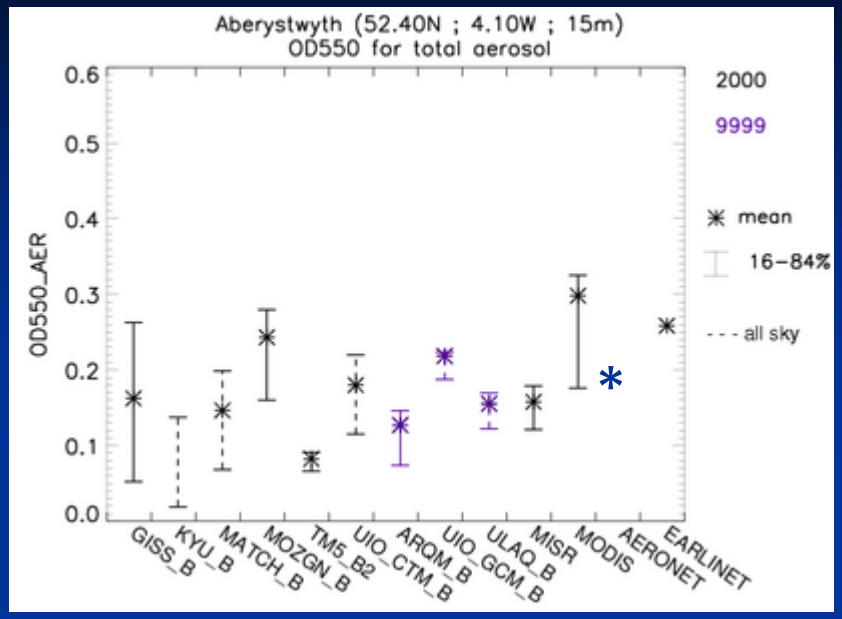


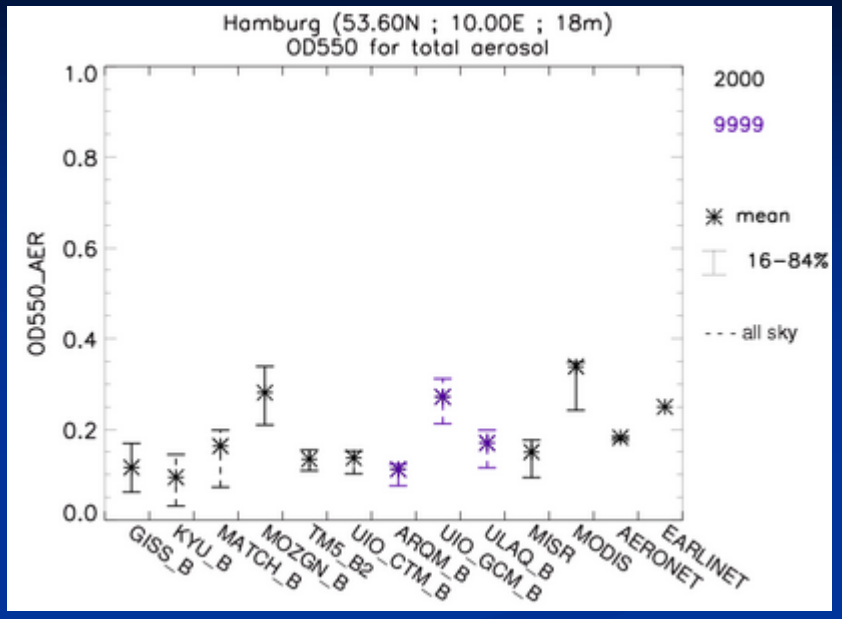
ARQM_B
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
UIO_GCM_B
ULAQ_B

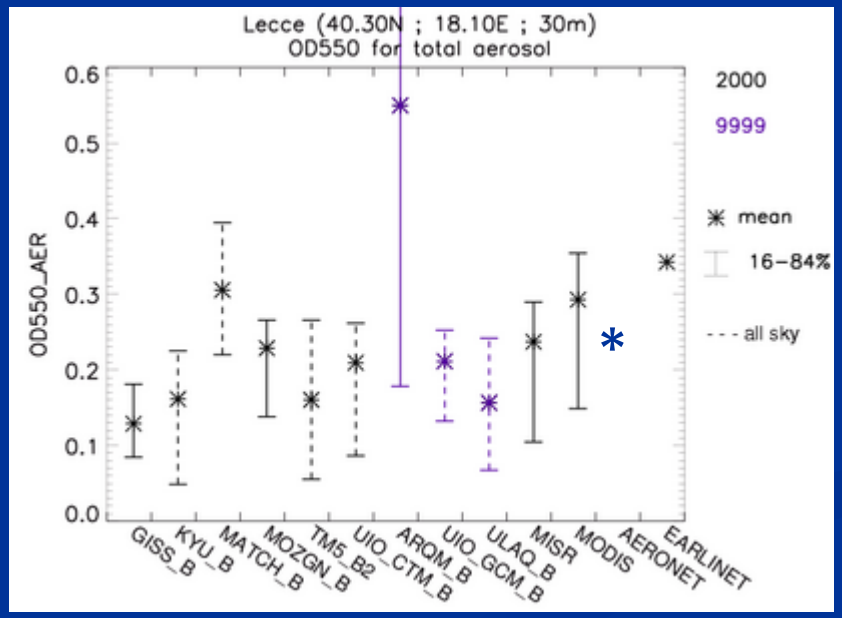


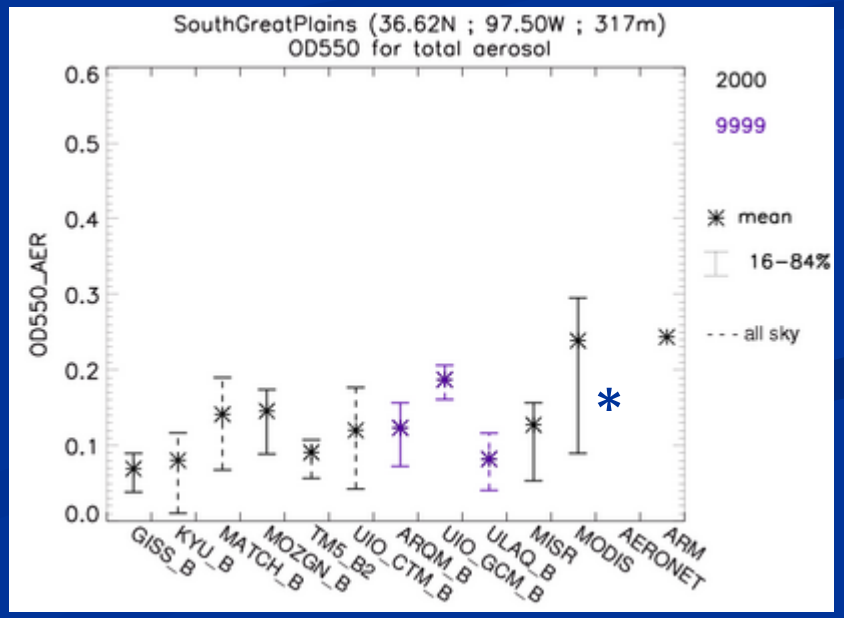


Large concentration for KYU_B and MATCH_B
For KYU_B : no more dust !!!!


Aberystwyth (52.40N ; 4.10W ; 15m)
OD550 for total aerosol
OD550_AER
2000
9999
mean
16–84%
all sky
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
AROM_B
UIO_GCM_B
ULAQ_B
MISR
MODIS
AERONET
EARLINET


Hamburg (53.60N ; 10.00E ; 18m)
OD550 for total aerosol
OD550_AER
2000
9999
mean
16–84%
all sky
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
AROM_B
UIO_GCM_B
ULAQ_B
MISR
MODIS
AERONET
EARLINET


Lecce (40.30N ; 18.10E ; 30m)
OD550 for total aerosol
OD550_AER
2000
9999
mean
16–84%
all sky
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
AROM_B
UIO_GCM_B
ULAQ_B
MISR
MODIS
AERONET
EARLINET


SouthGreatPlains (36.62N ; 97.50W ; 317m)
OD550 for total aerosol
OD550_AER
2000
9999
mean
16–84%
all sky
GISS_B
KYU_B
MATCH_B
MOZGN_B
TM5_B2
UIO_CTM_B
AROM_B
UIO_GCM_B
ULAQ_B
MISR
MODIS
AERONET
ARM