CENTRE NATIONAL
DE LA RECHERCHE
SCIENTIFIQUE

MULTI-COMPONENT AEROSOL TRANSPORT AND RADIATIVE EFFECTS IN LMDZ-GCM

Part II

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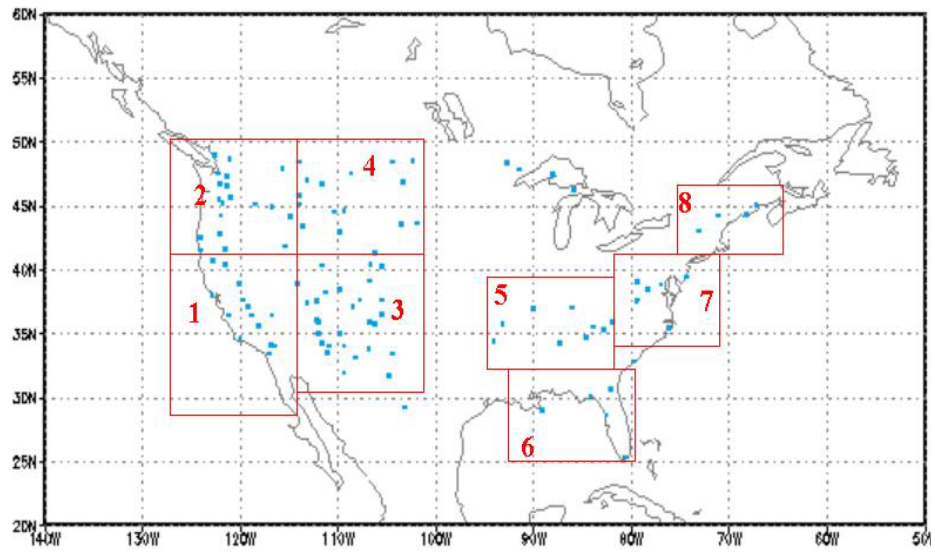
LOA, CNRS / USTL, Villeneuve d'Ascq, France

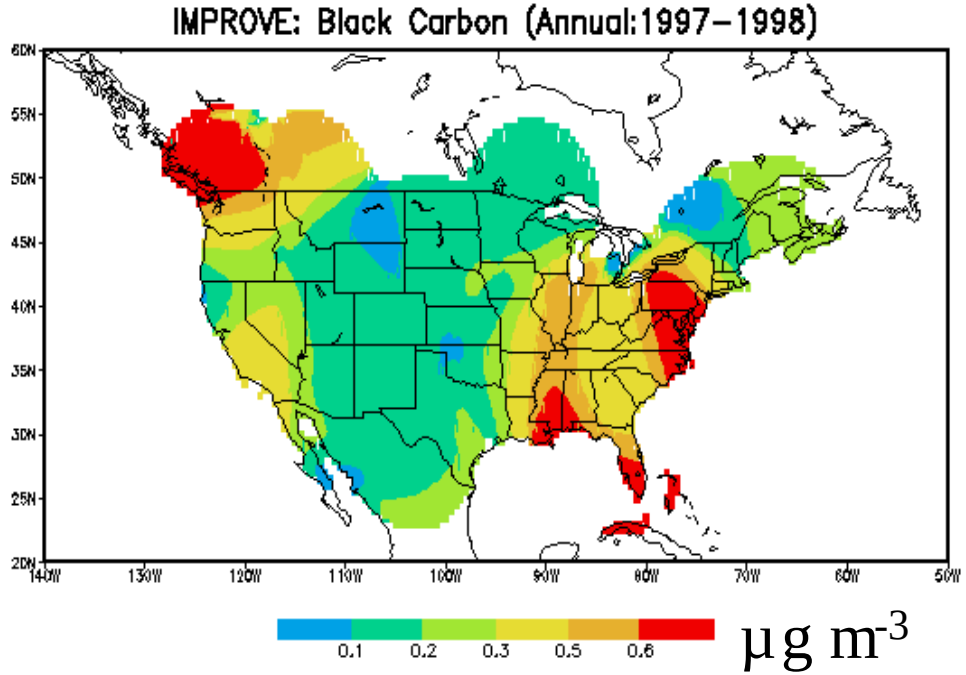
MODEL VALIDATION- CARBON

IMPROVE Network

About 148 stations



After interpolation



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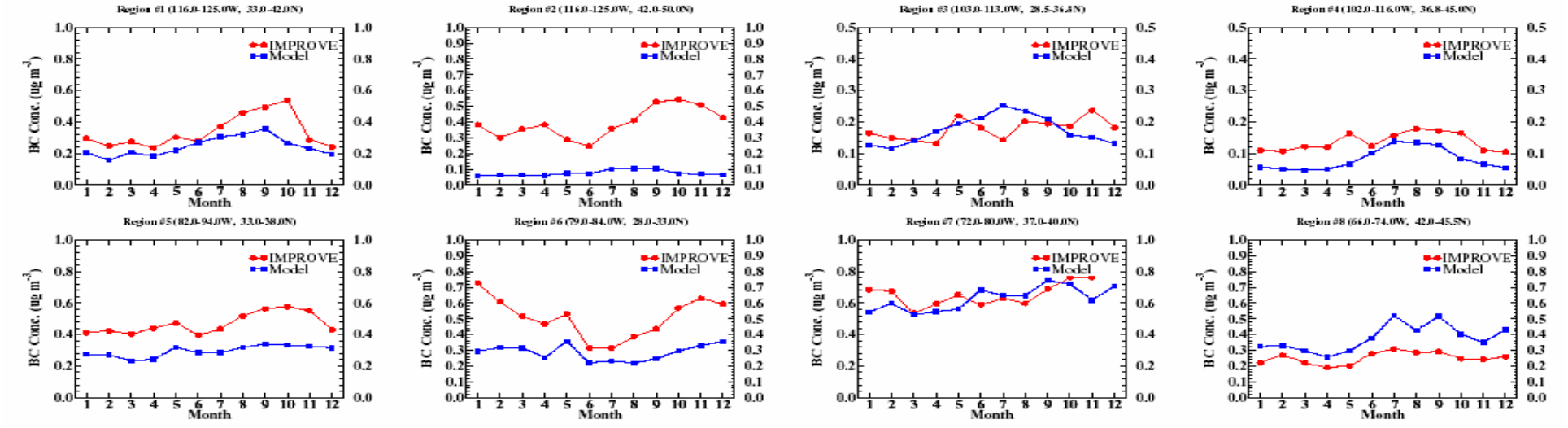
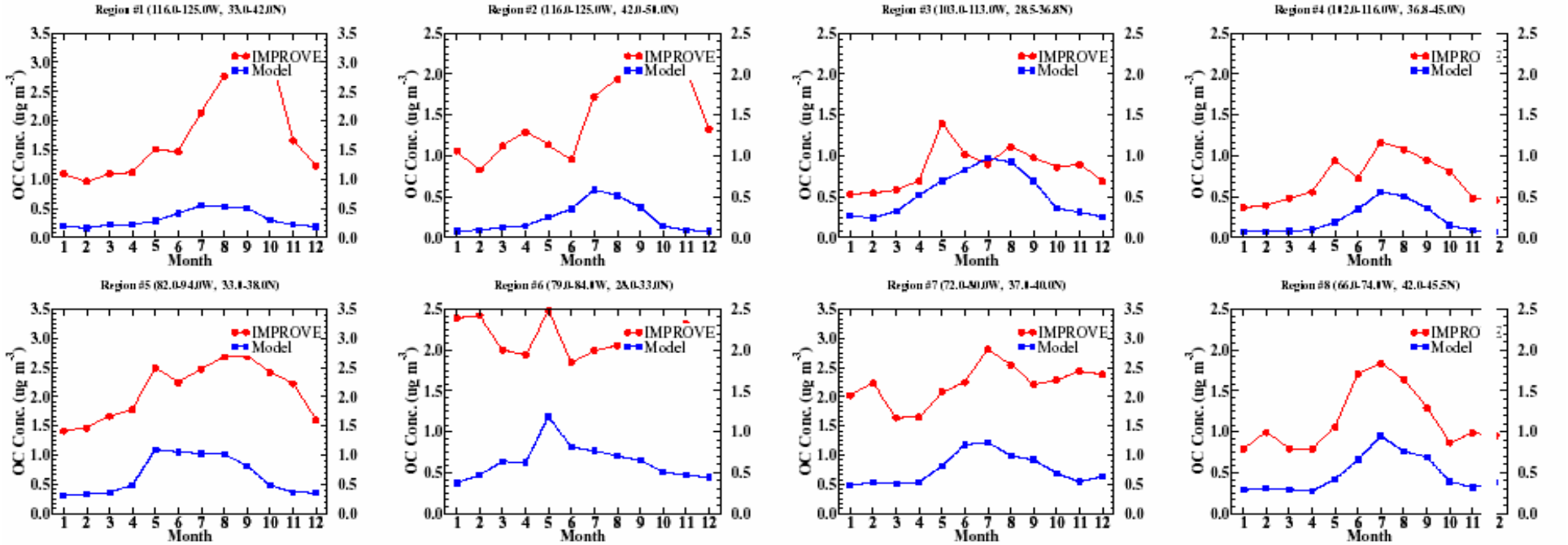
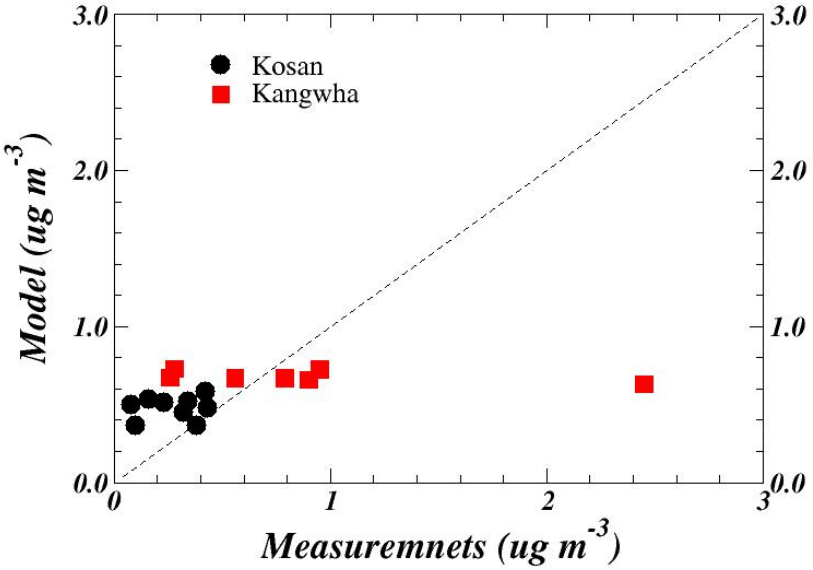




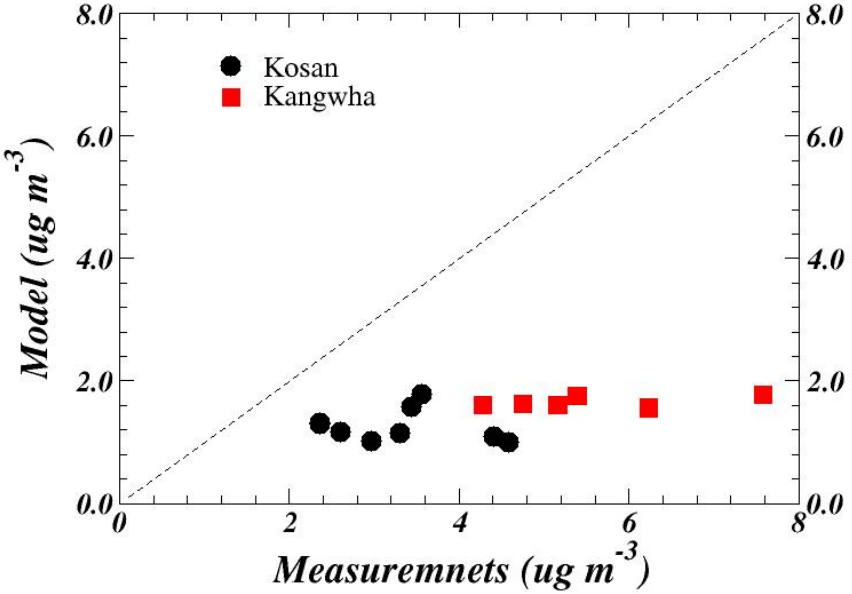
MODEL VALIDATION- CARBON

ASIA

BC



OC



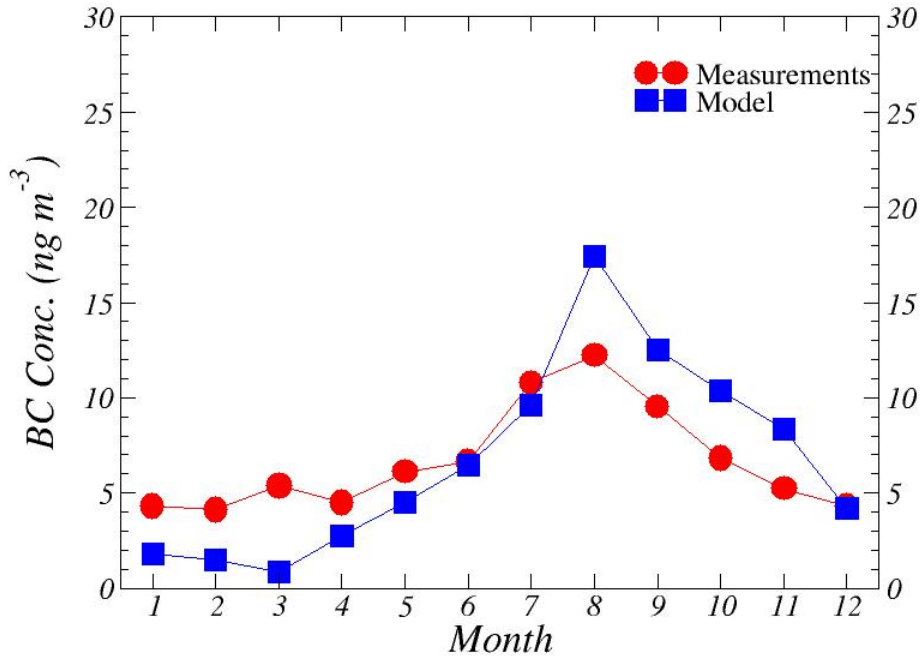
Kosan (33.3°N, 126.2°E)

Kanghwa (37.8°N, 126.5°E)

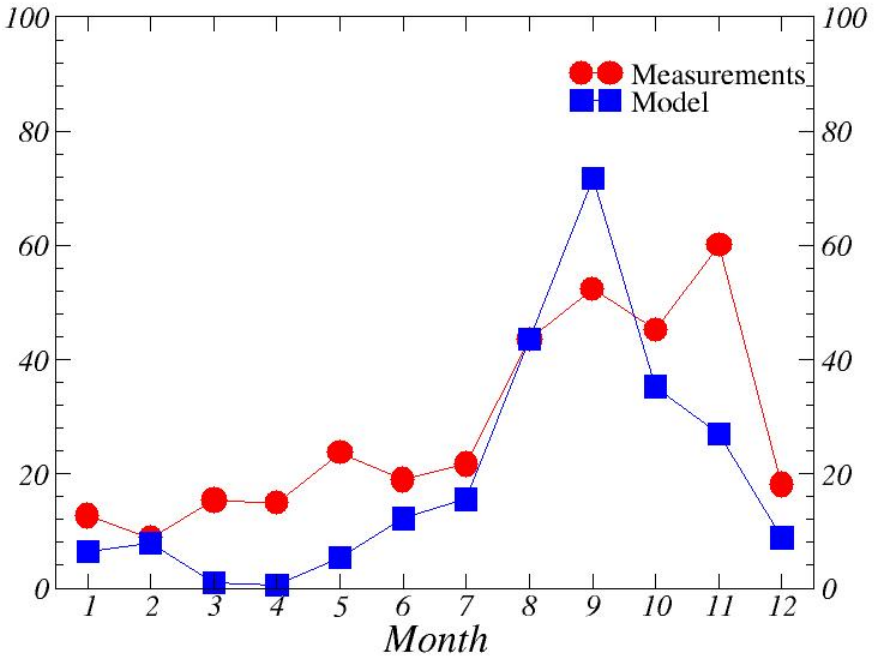
MODEL VALIDATION- CARBON

"AFRICA"

Amsterdam Island (38°S, 77°E)



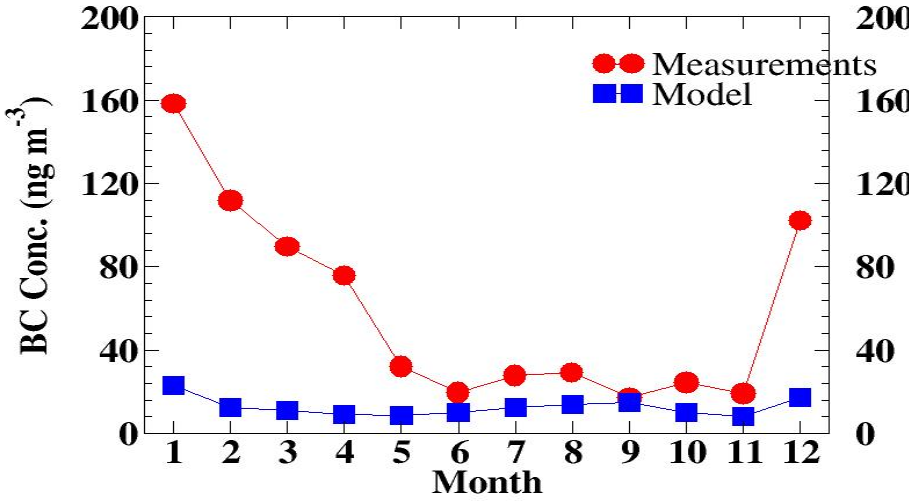
Point Textor (12°S, 55°E)



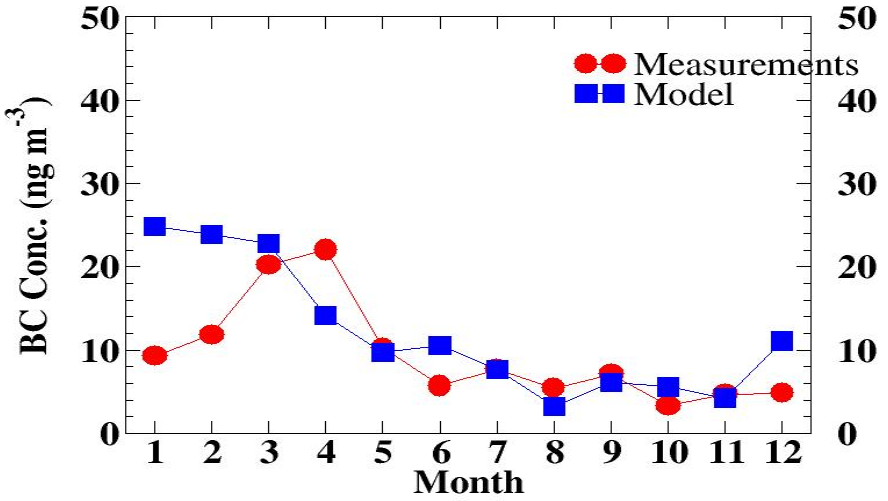
MODEL VALIDATION- CARBON

REMOTE STATIONS

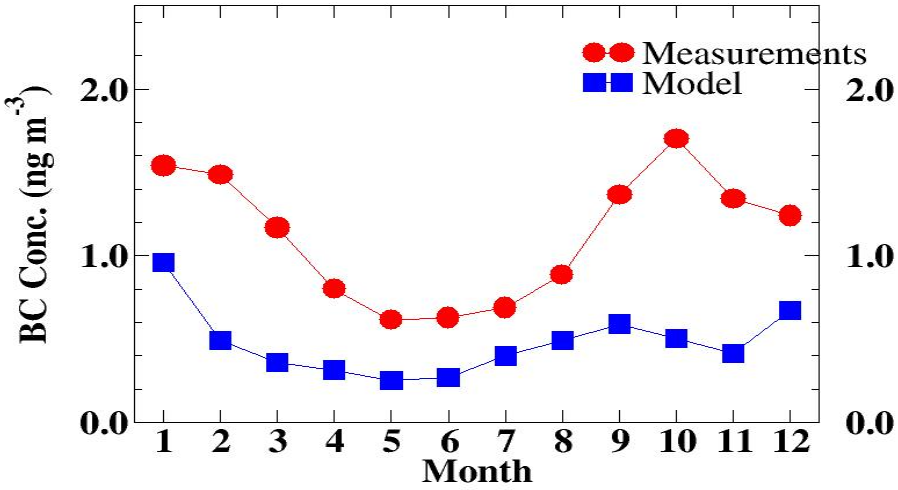
Barrow, Alaska (71.3N, 156.6W)



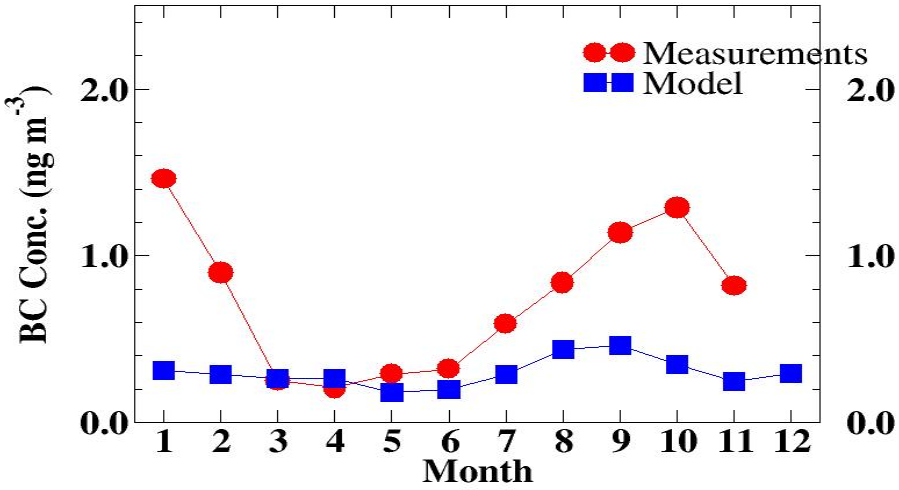
Mauna Loa (19.5N, 155.6W)



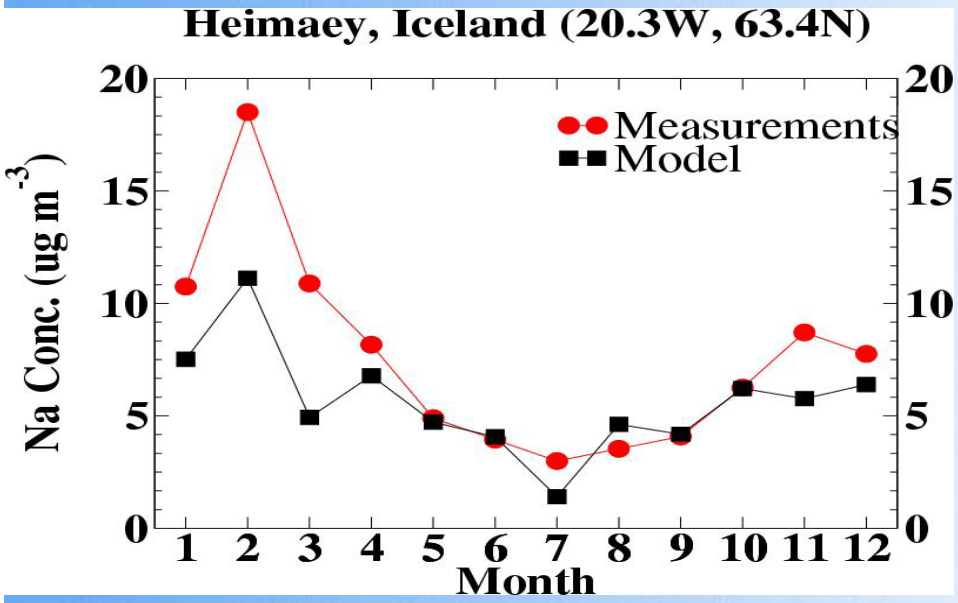
Halley Antarcitica (75.6S, 26.26E)

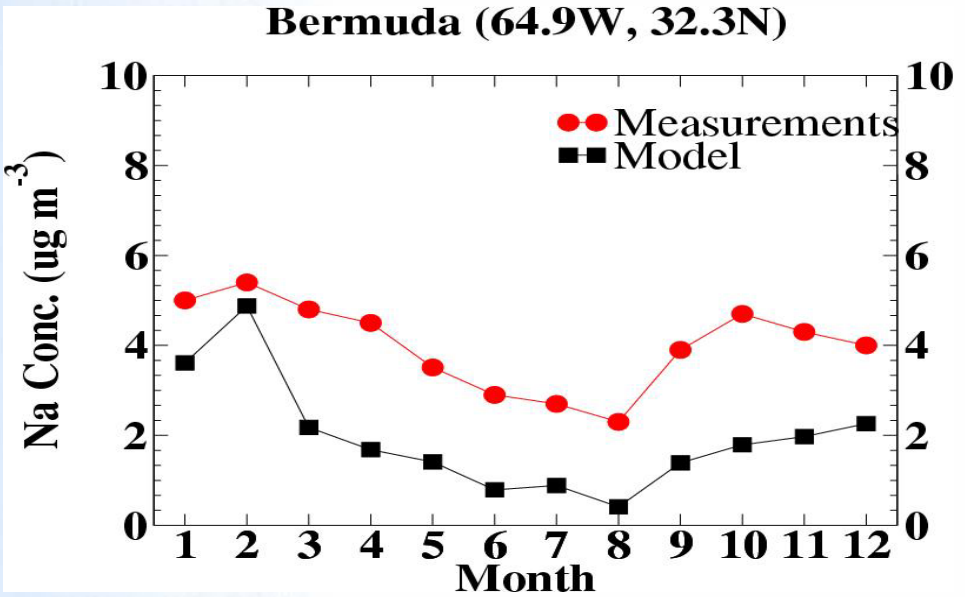


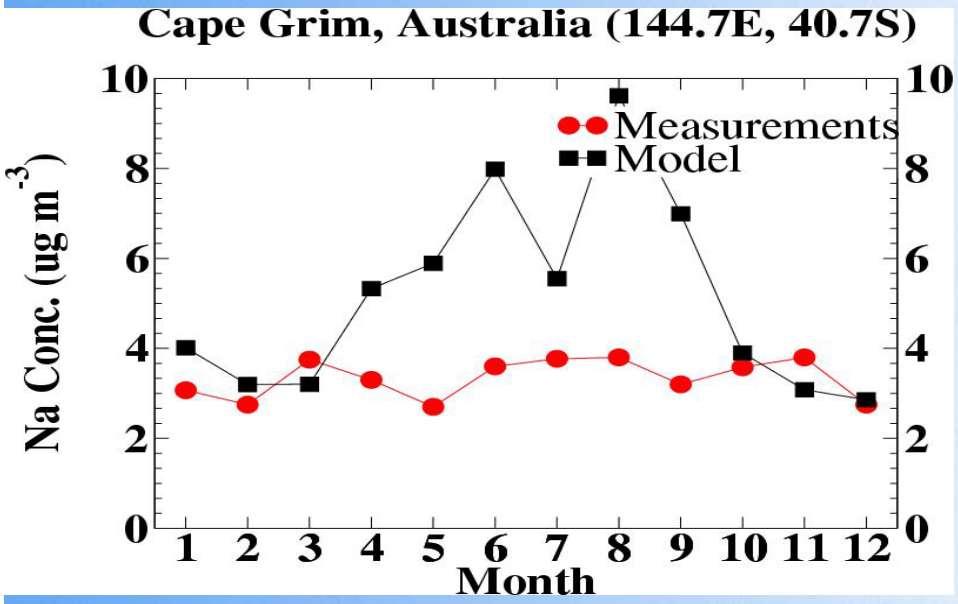
South Pole (89.0S, 102.0E)

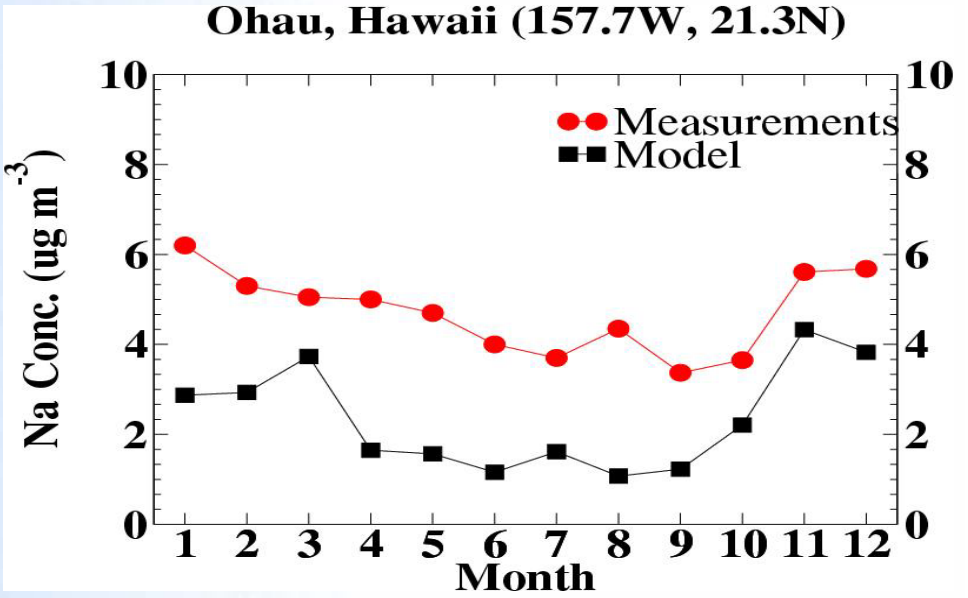


MODEL VALIDATION- SEA SALT

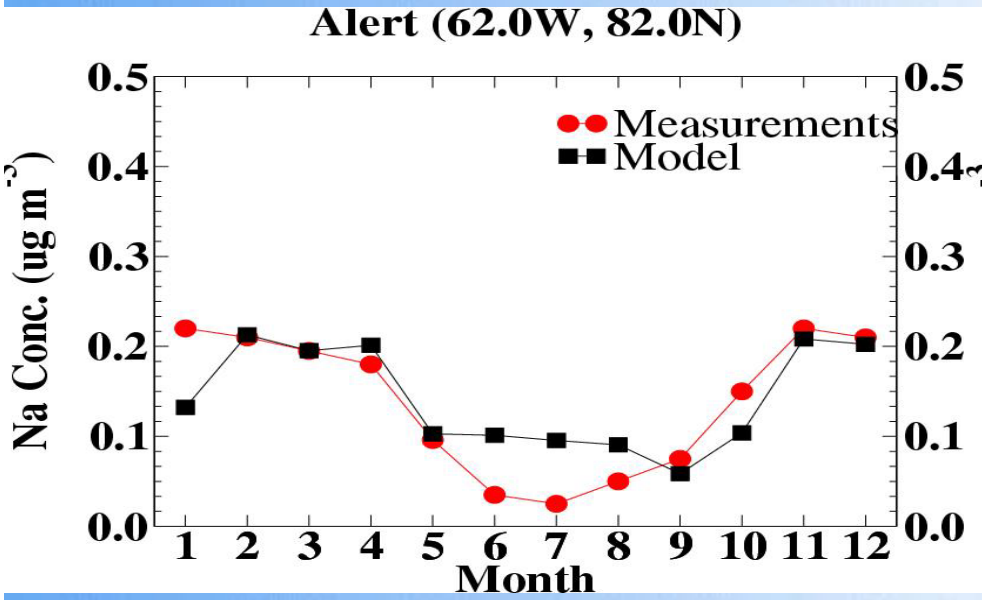


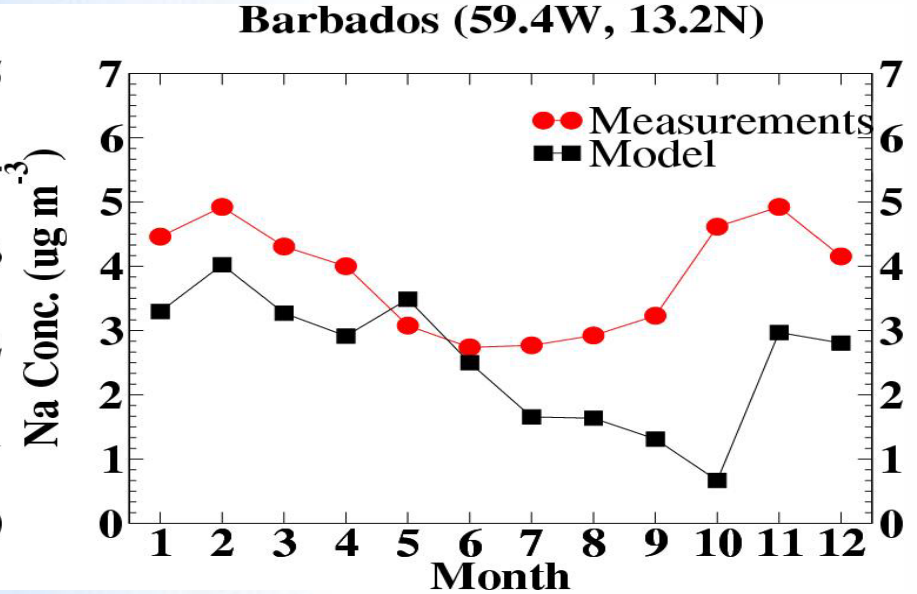


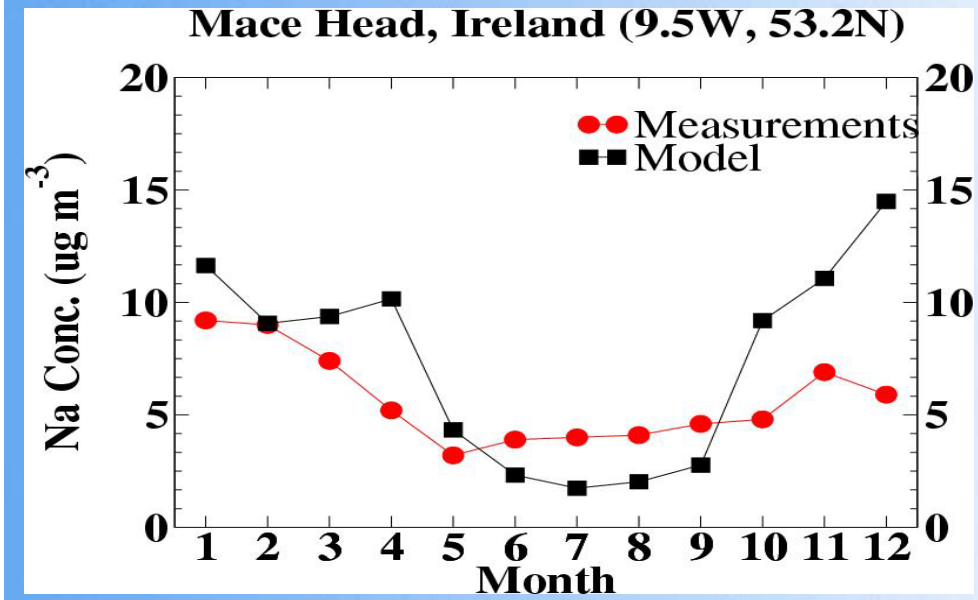


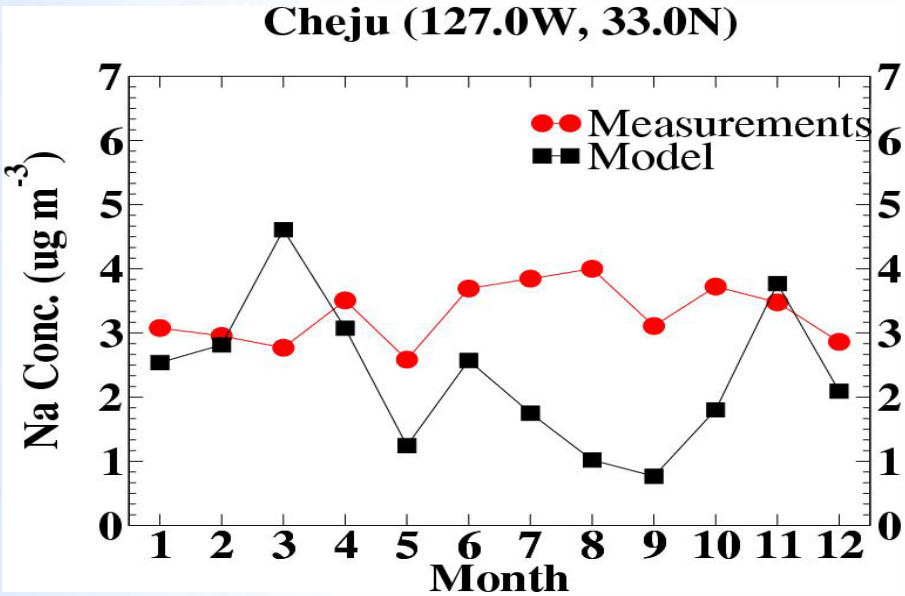


MODEL VALIDATION- SEA SALT

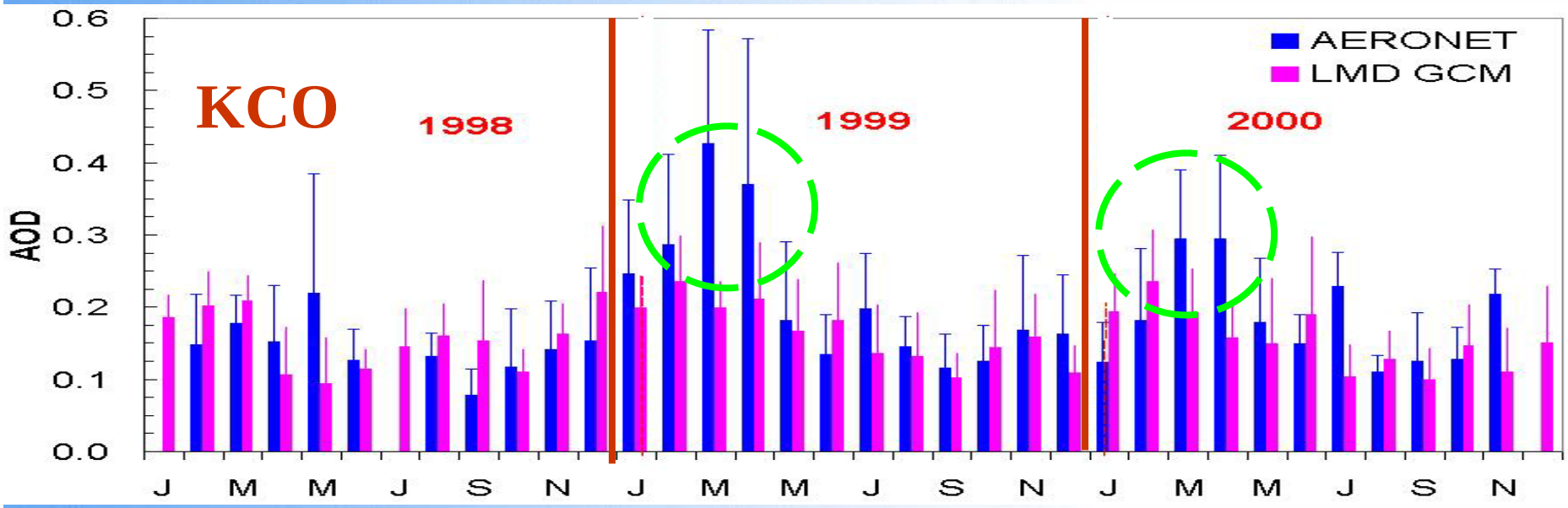


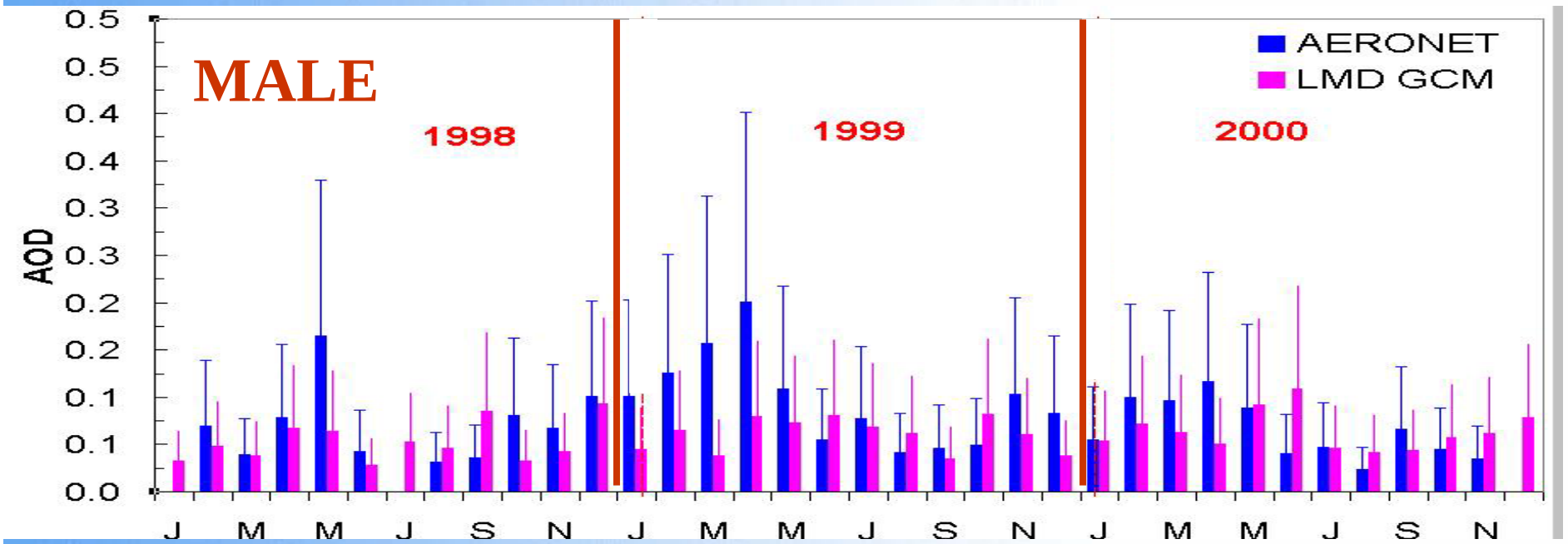




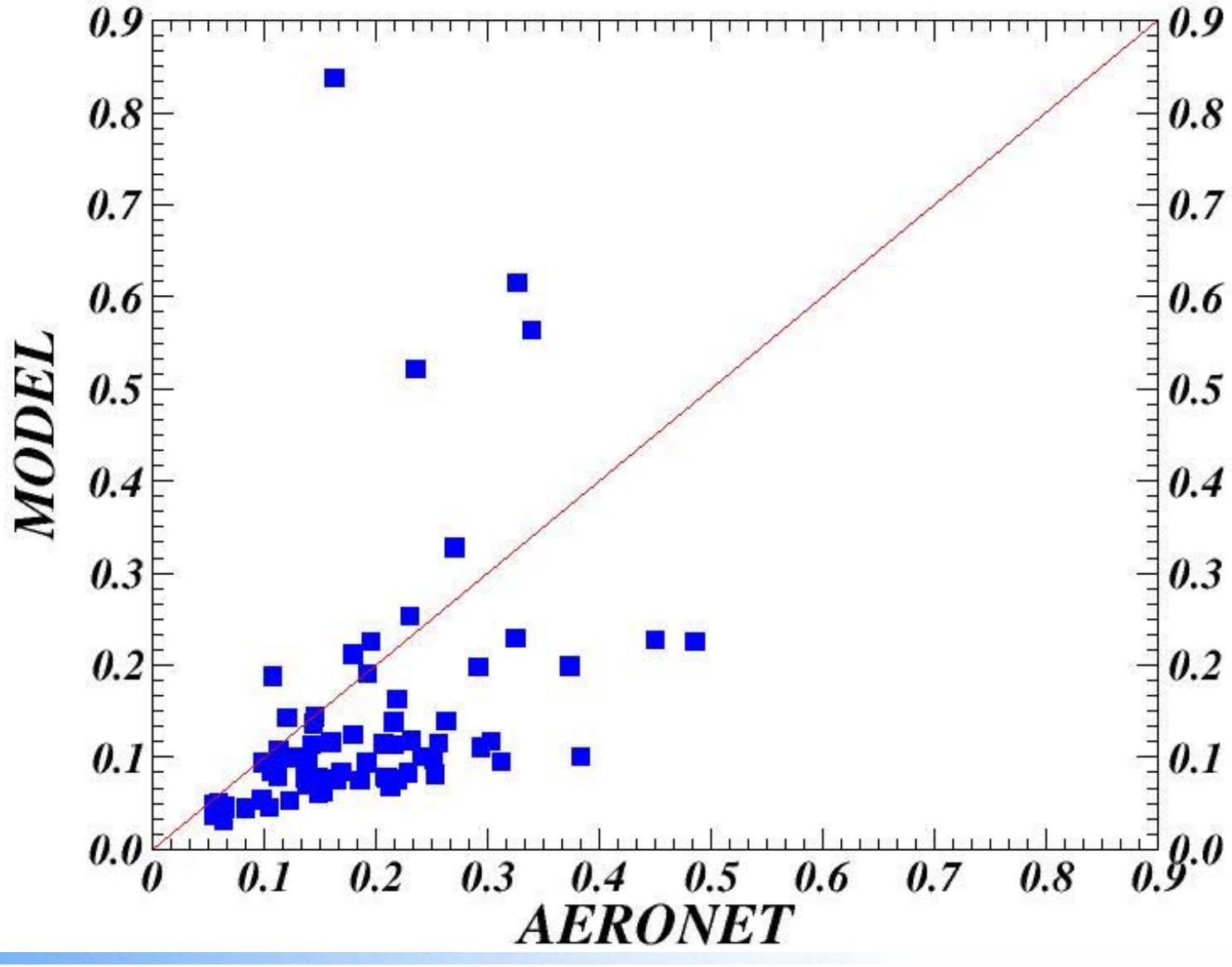


MULTIYEAR AOD: INDIAN OCEAN





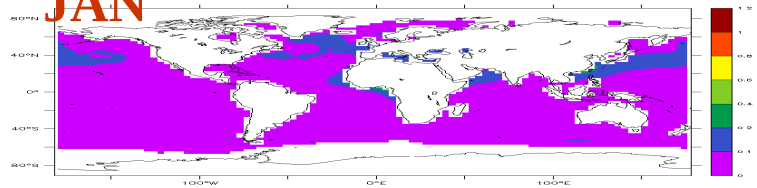
MODEL VALIDATION- AOD



MODEL

POLDER

JAN



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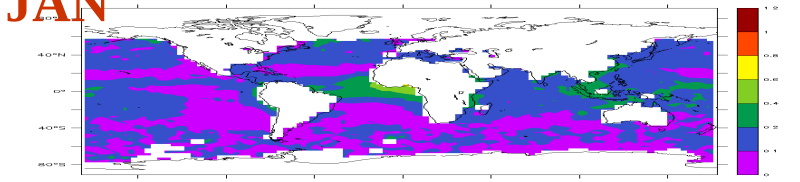

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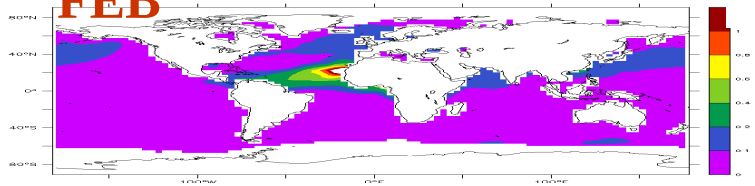

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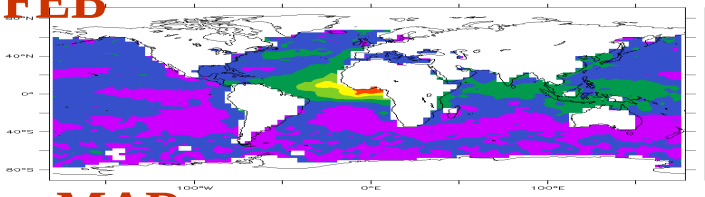
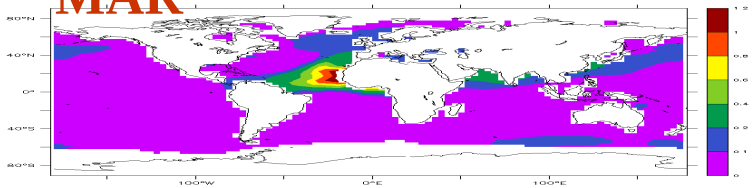


1.2
0.8
0.4
0.1

MAR



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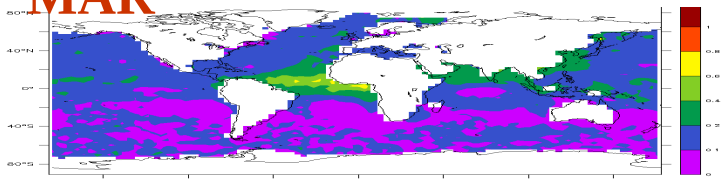

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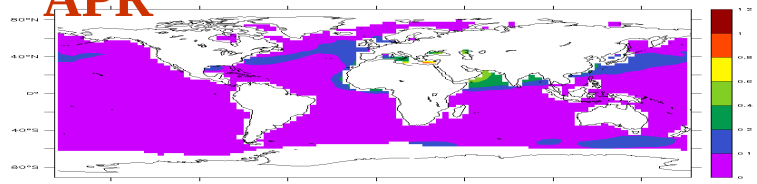

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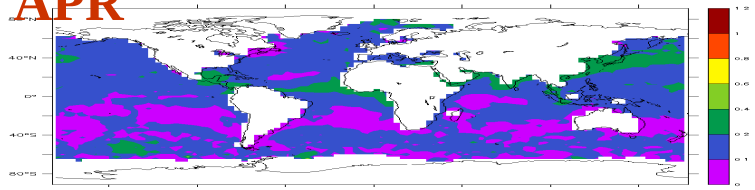

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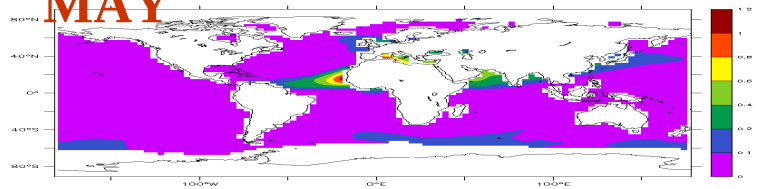

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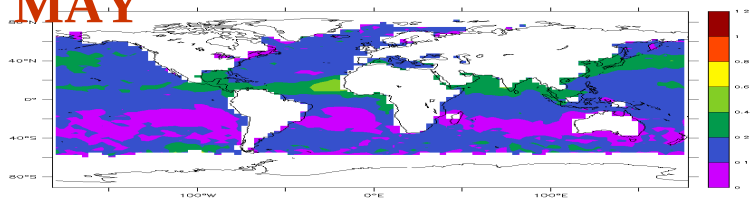

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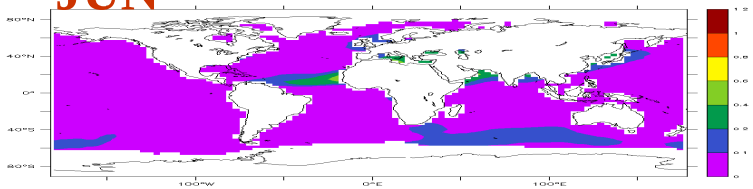

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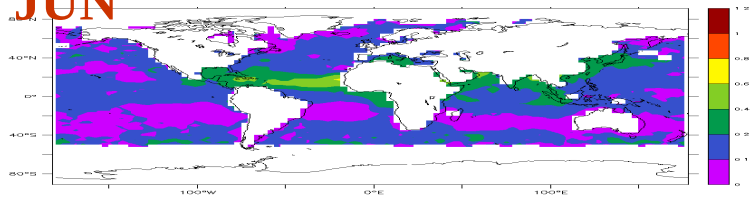
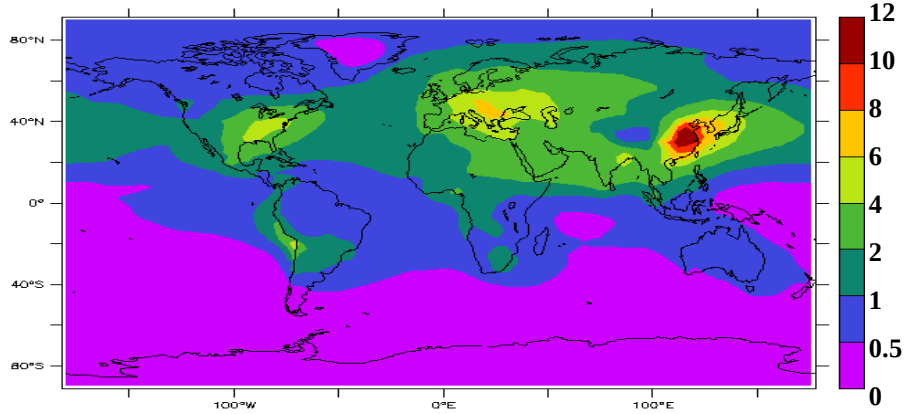
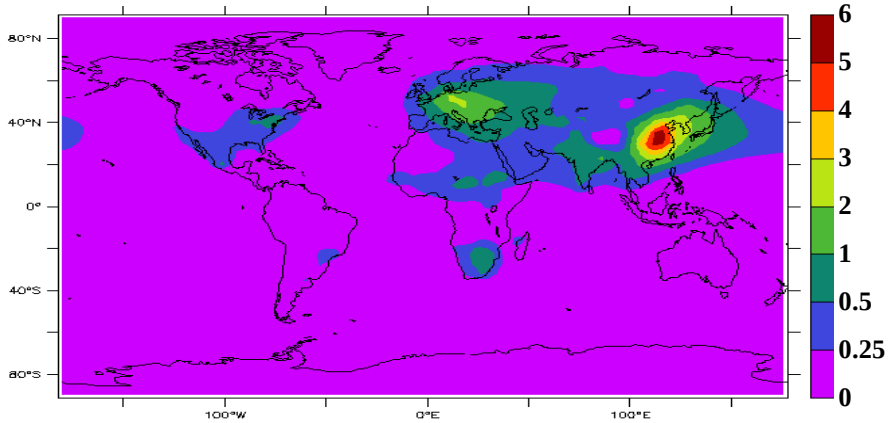


AEROSOL BURDENS (mg m^{-2})

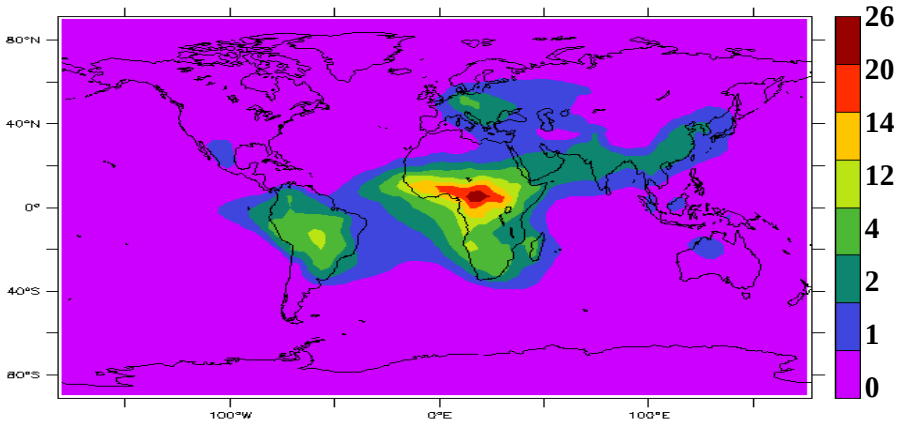
Sulfate



BC

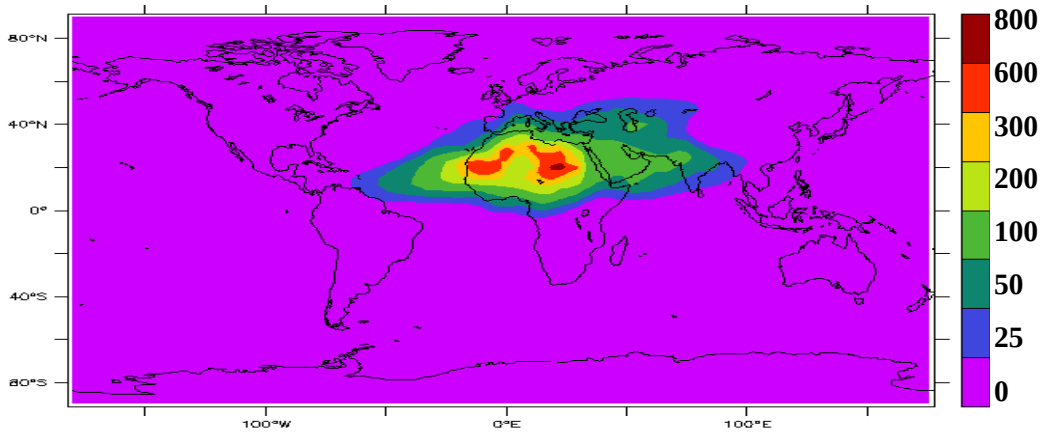


OM

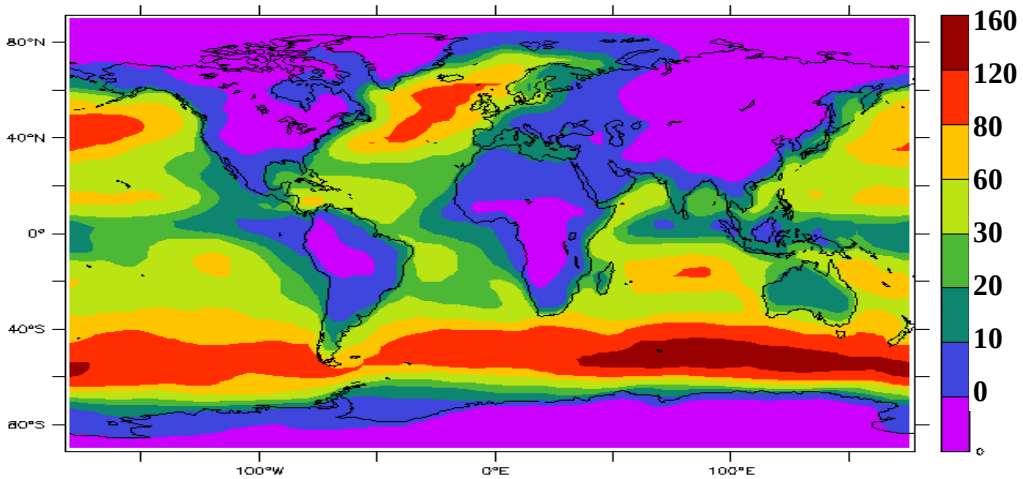


AEROSOL BURDENS

Dust



Sea Salt

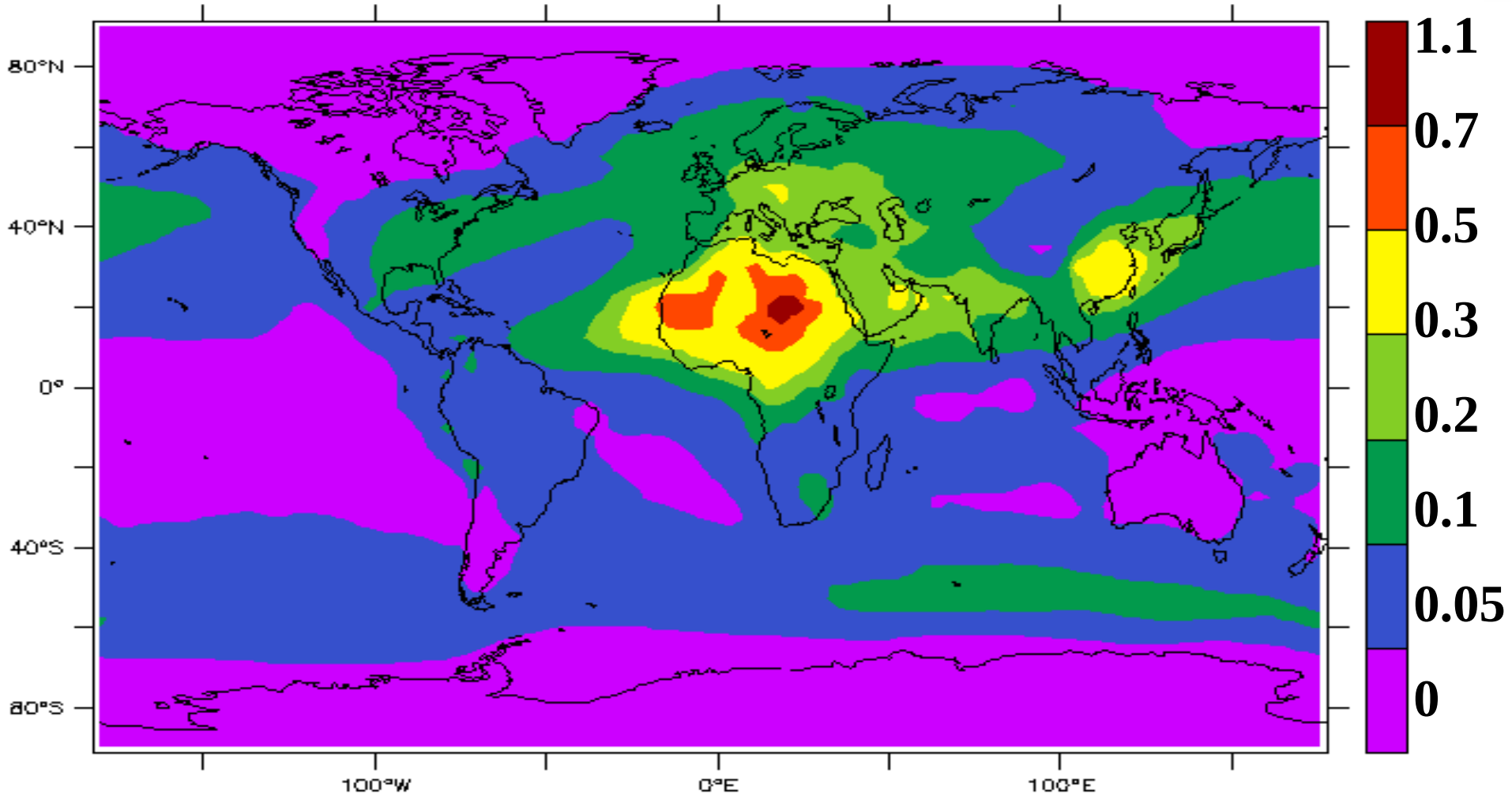


AEROSOL LIFETIMES

	Emissions (Tg yr^{-1})	Burden (Tg)	Lifetime (days)
Sulfate*	59.7	0.59	3.7
Black Carbon	11	0.23	7.4
Hydrophobic		***0.035***	***1.4***
Hydrophilic		***0.195***	***6.9***
Organic Carbon	69	1.53	7.5
Hydrophobic		***0.13***	***1.4***
Hydrophilic		***1.40***	***7.1***
Dust	762	9.75	4.7
Sea salt	6267	7.39	0.4

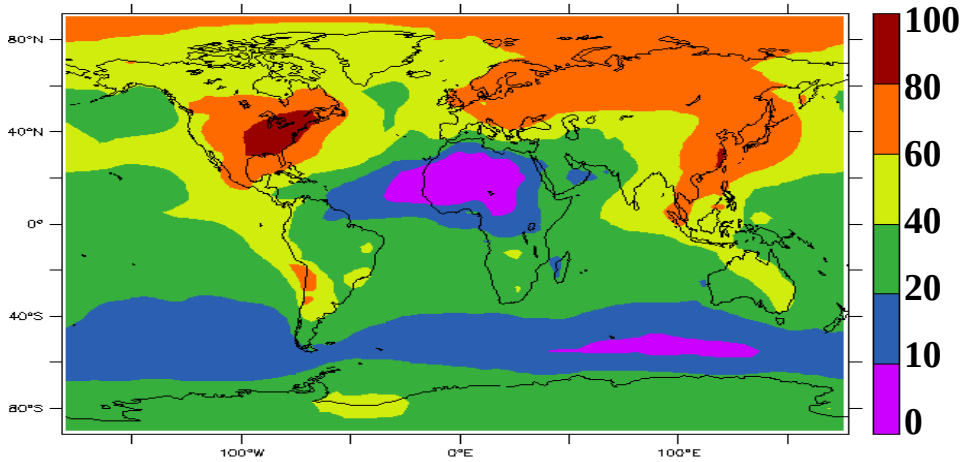
* *Sulfate emissions include direct emissions and production of sulfate in the atmosphere from gas and aqueous phase reactions in TgS*

AEROSOL OPTICAL DEPTH @ 550nm

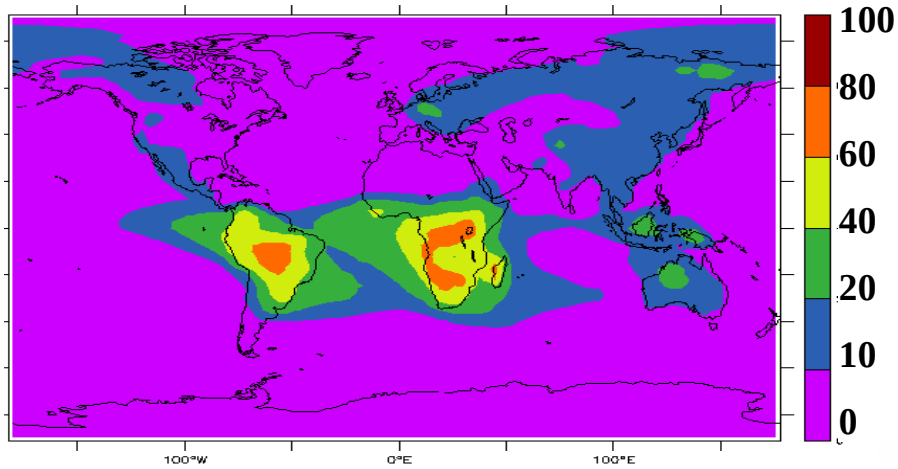


RELATIVE CONTRIBUTION

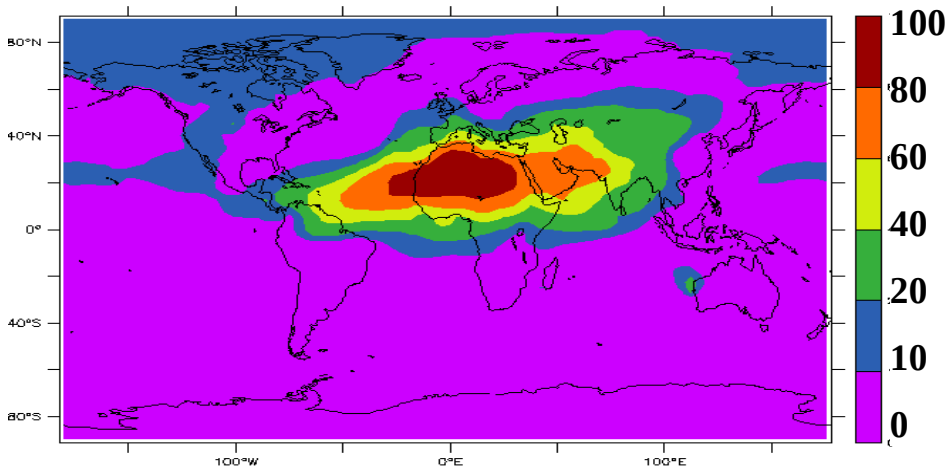
Sulfate (%)



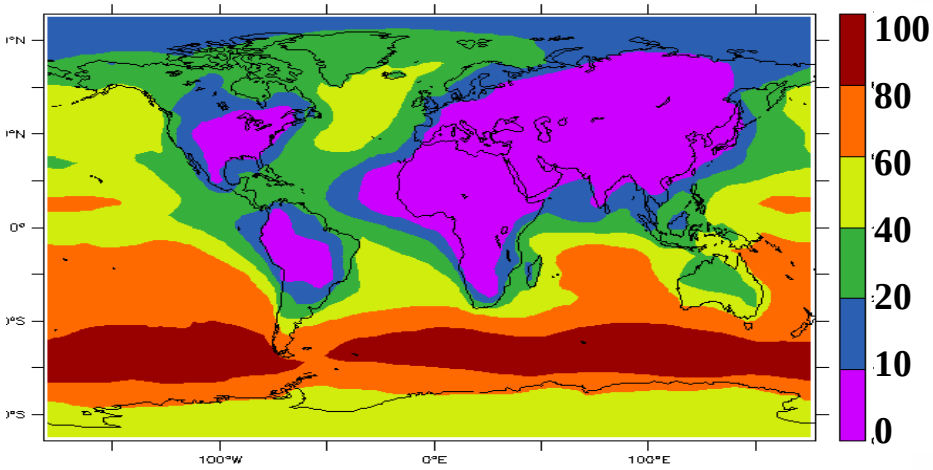
BC+OM (%)



Dust (%)

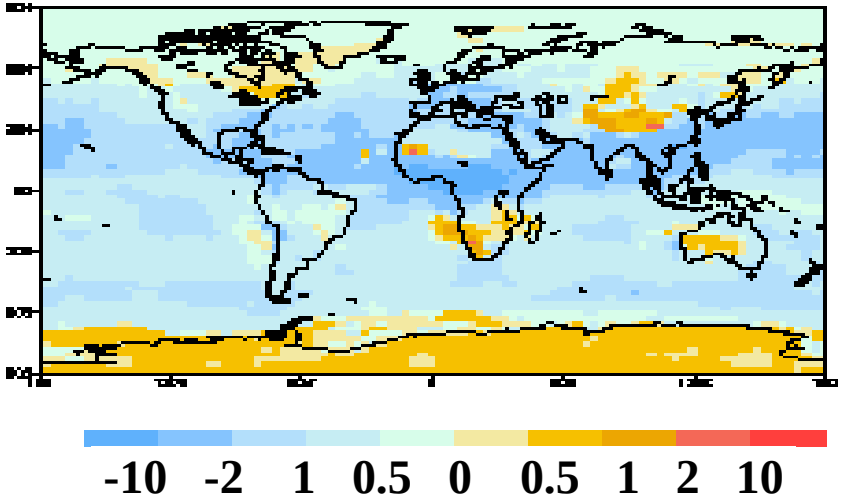


Sea salt (%)

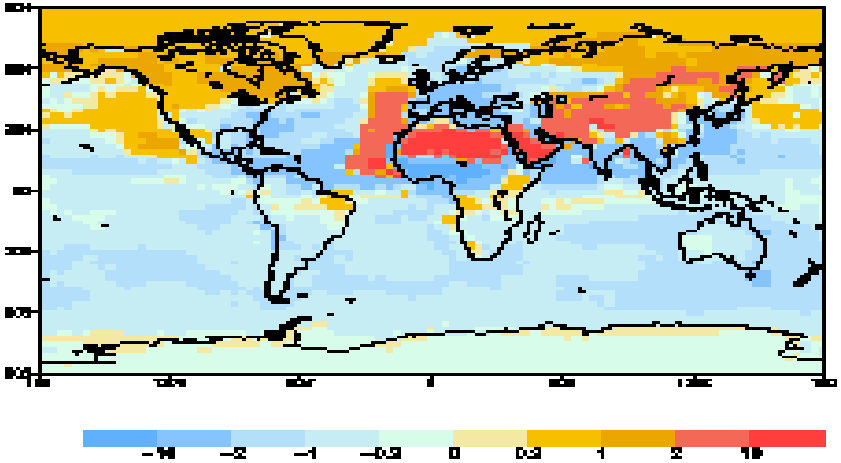


ALL SKY FORCING (Wm^{-2})

DJF



MAM



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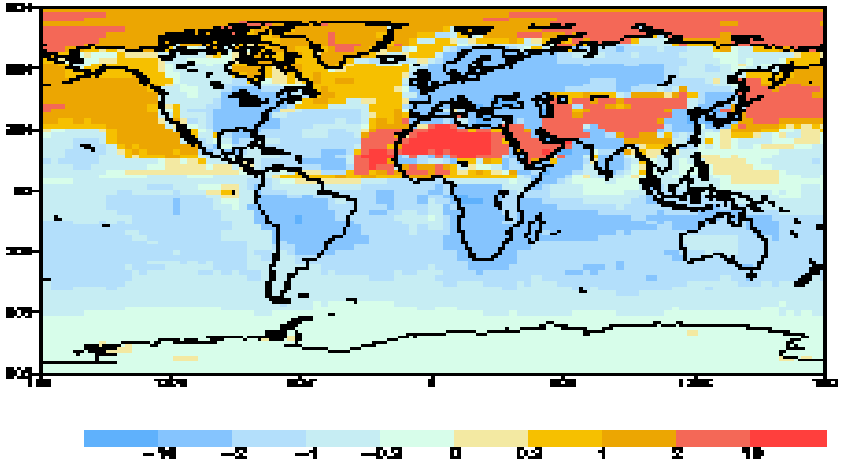

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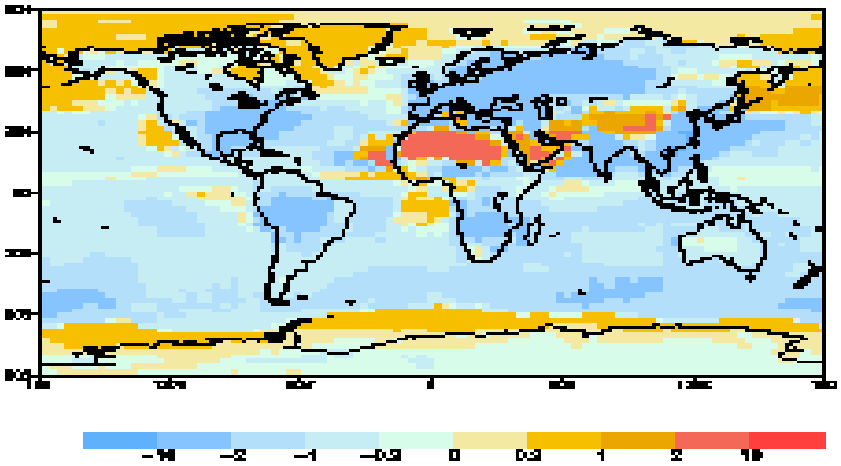

SUMMARY

Multi-component aerosol transport and direct radiative forcing estimates are carried out in LMDZT GCM.

To improve the open biomass burning emissions seasonality, satellite observed fire counts are used to estimate the inter-annual seasonal aerosol emissions.

Model performance has been validated for sulfate, carbonaceous, and sea salt aerosol atmospheric cycling.

Model predicted AODs at 550 nm reasonably compare well with AERONET measured values over different locations. Major features and gradients in monthly mean AODs (865 nm) compare well with POLDER values. However, over the remote locations the model estimates are at lower end of the POLDER retrievals, due to a probable under estimation of sea-salt contribution.

SUMMARY

The globally averaged AOD at 550 nm is 0.095, with a relative contributions of sulfate, BC, OM, dust, and sea salt are 34%, 1%, 11%, 27% and 28%, respectively.

The whole-sky aerosol direct radiative perturbation at top of the atmosphere from all aerosol species ranges from –12 W m^{-2} to +12 W m^{-2} with a wide regional differences and seasonal variability (subject to further work).