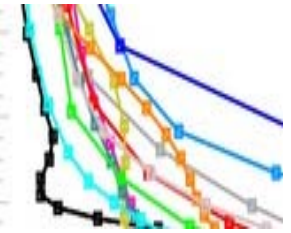

Evaluating the vertical profile of aerosol extinction with CALIOP observations

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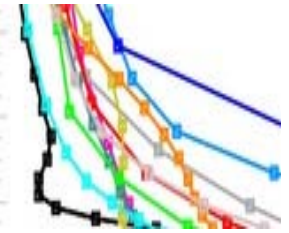
[2]Norwegian Meteorological Institute

Submitted to JGR August 2011

Application of the CALIOP Layer Product to evaluate the vertical distribution of aerosols estimated by global models: Part 1. AeroCom phase I results

Brigitte Koffi[1], Michael Schulz[2,1], Francois-Marie Bréon[1], Jan Griesfeller[2,1], Yves Balkanski[1], Susanne Bauer[3], Terje Berntsen[4,5], Mian Chin[6], William D. Collins[7], Frank Dentener[8], Thomas Diehl[6,9], Richard Easter[10], Steven Ghan[10], Paul Ginoux[11], Sunling Gong[12], Larry W. Horowitz[11], Trond Iversen[2,13], Alf Kirkevåg[2], Dorothy Koch[14], Maarten Krol[15,16], Gunnar Myhre[5], Philip Stier[17], Toshihiko Takemura[18], David Winker[19]

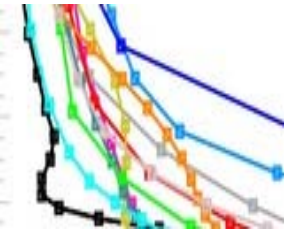
Overview

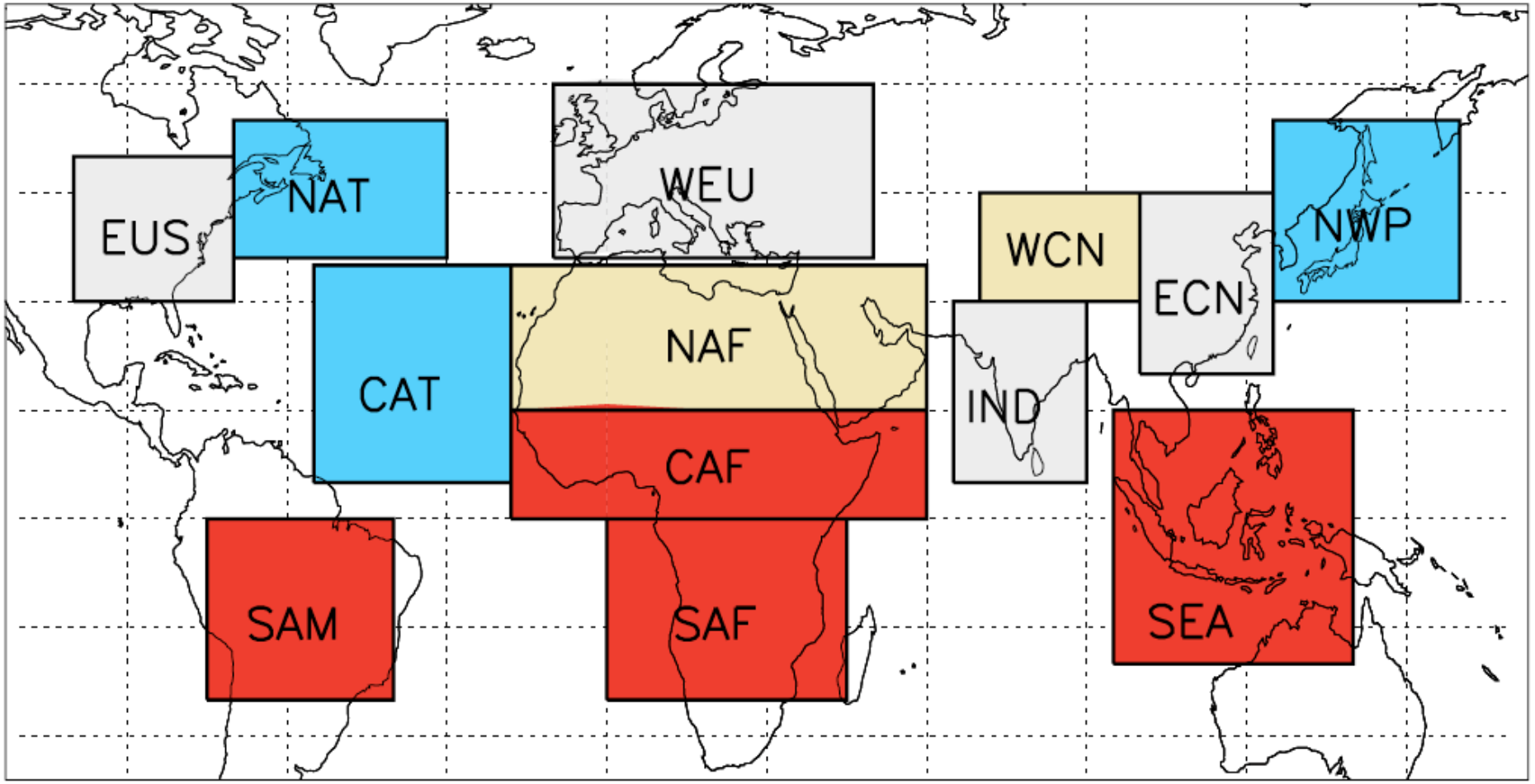


Exploiting new CALIOP version 3 (!) observations for AeroCom
Extinction layer product data 2007-2009
Part I AeroCom A & B models
Deriving regional mean extinction profiles from CALIOP
- Regions as Yu et al. 2010
- Cloudy volumes omitted, aerosol free set to zero
- Cloud aerosol discrimination
- Interpolation layer to 100m segments of individual profiles
- Expansion of lowest value to surface

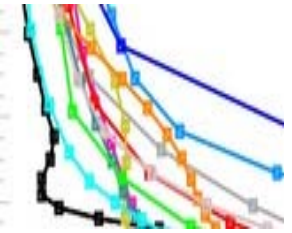
Model profiles interpolated to 100 m segments
Normalization of extinction to unit AOD
Averaging of MODIS for the same regions
Calculation of extinction weighted characteristic height of aerosol

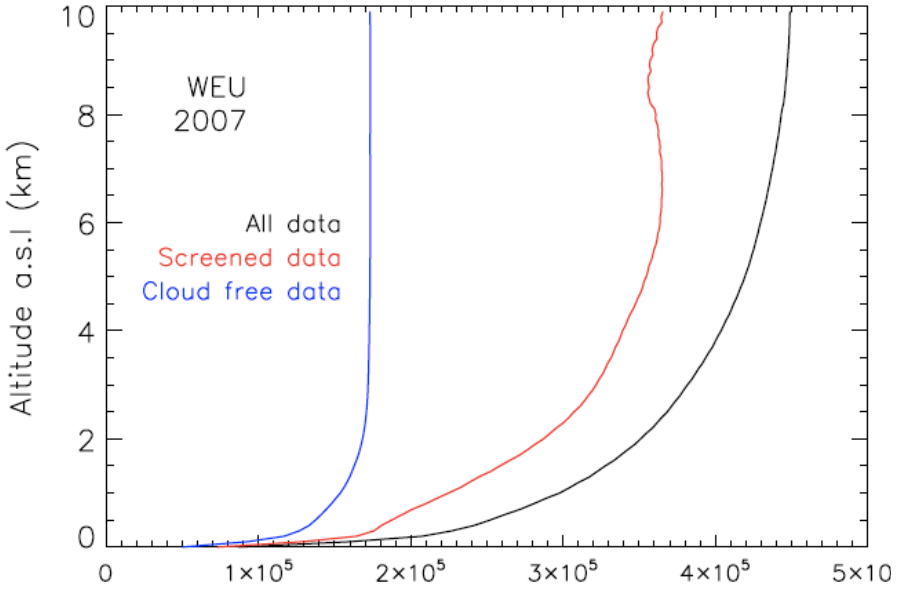
Regions

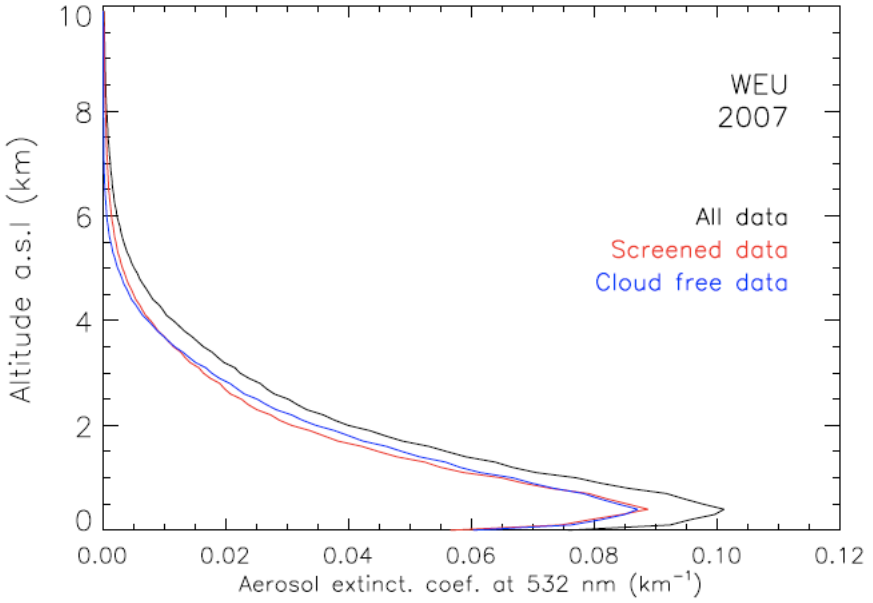




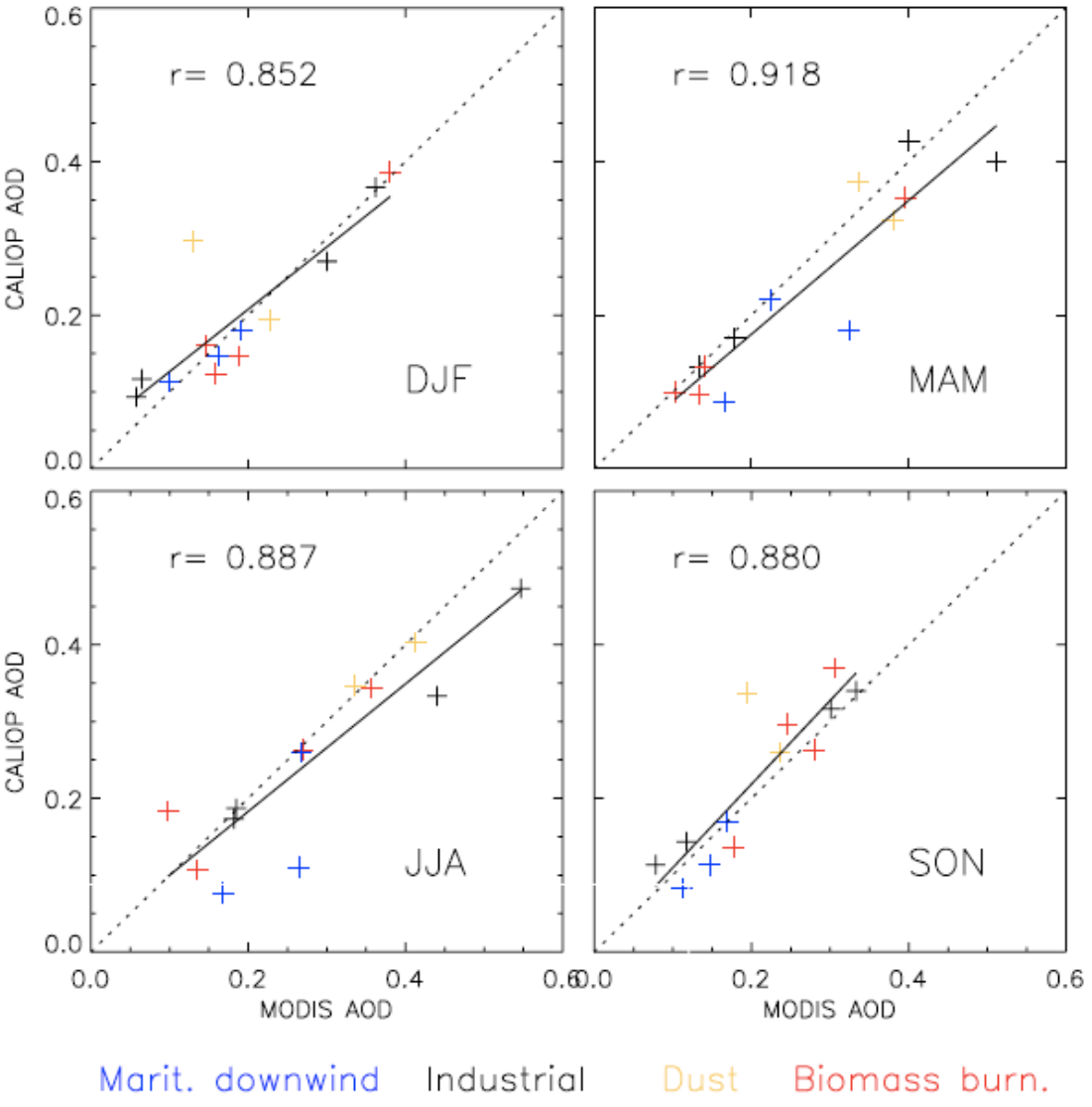
Caliop profile example Western Europe 2007



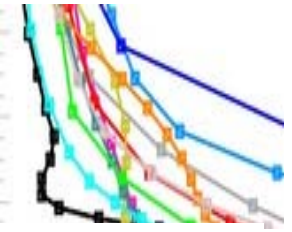


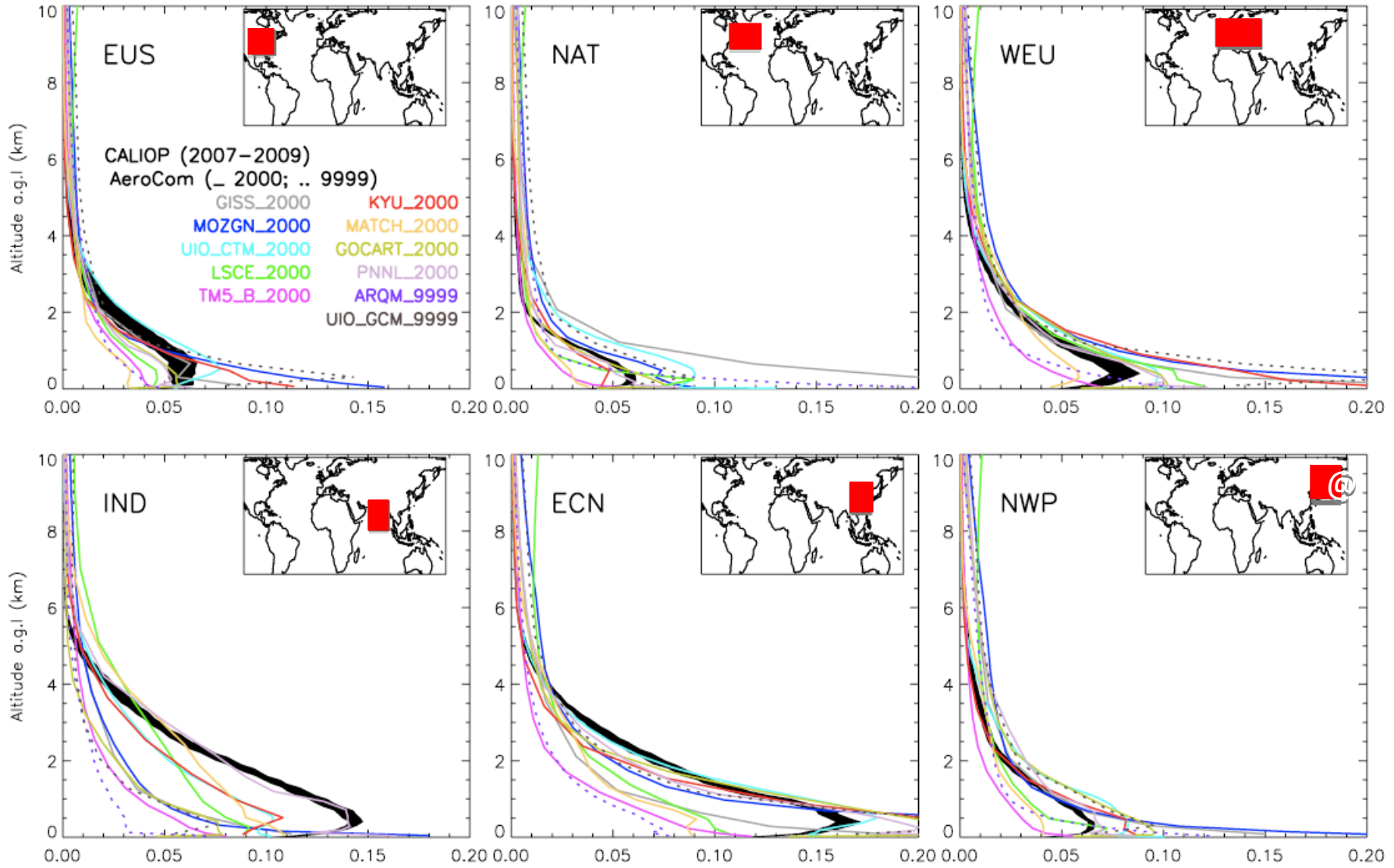


Comparison of AOD in all regions against MODIS



Mean profiles CALIOP Against model profiles





CALIOP vs MODELS

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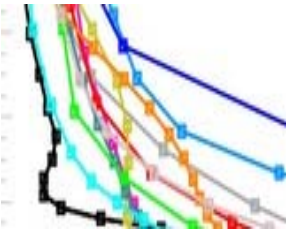
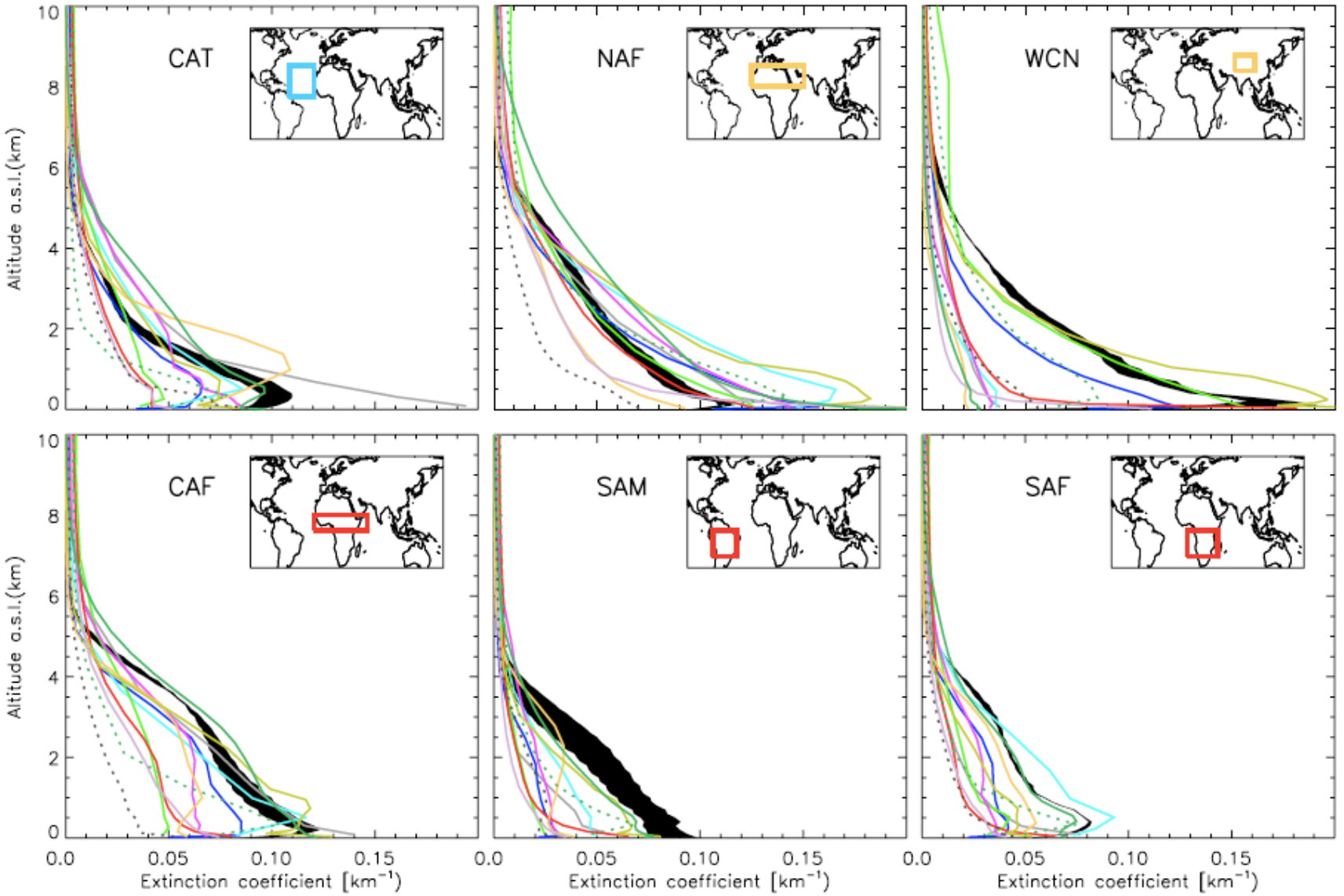
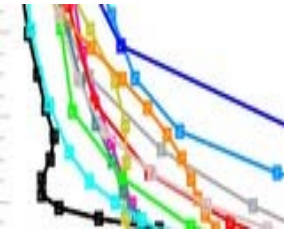
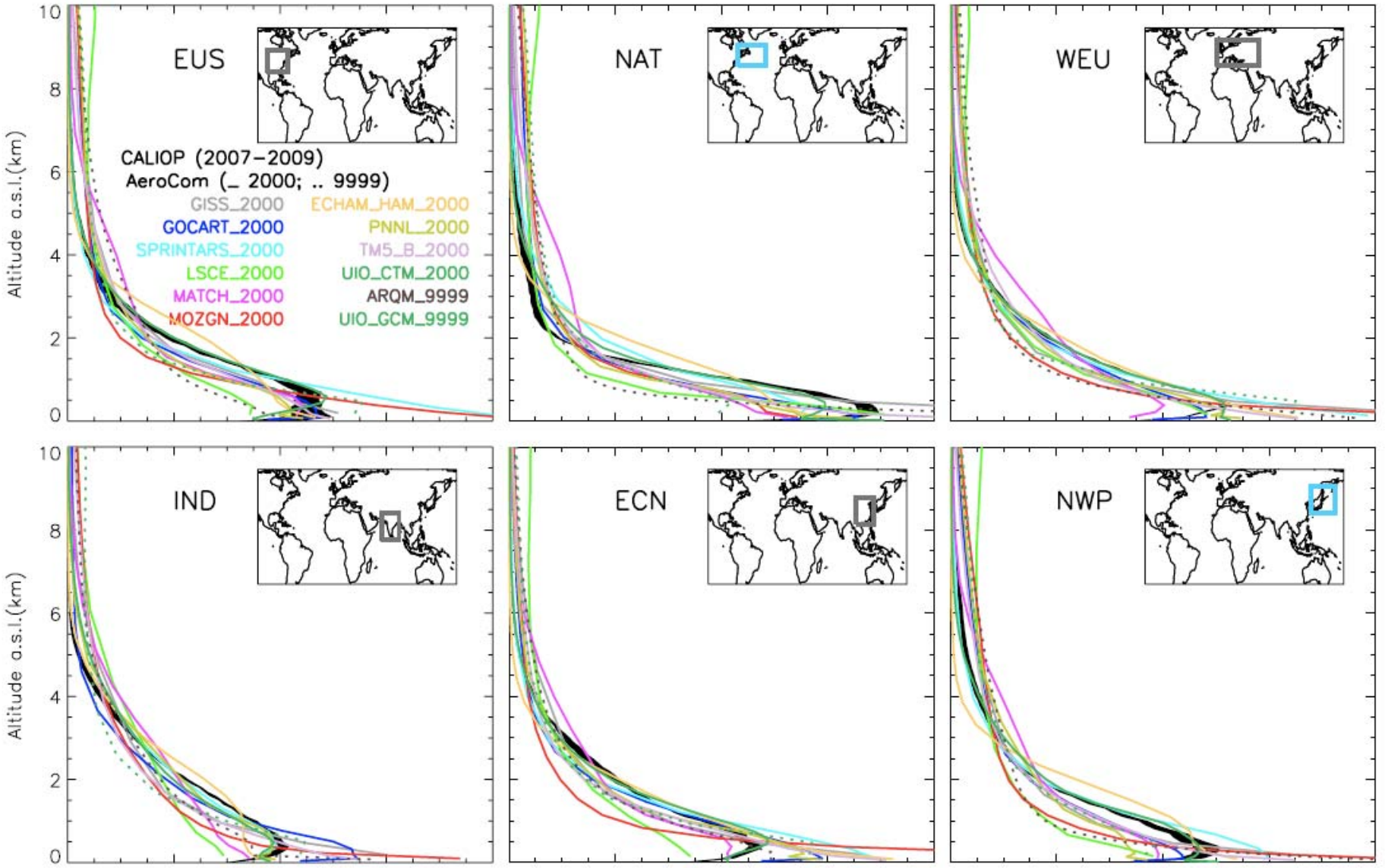
Mean profiles CALIOP
Against model profiles



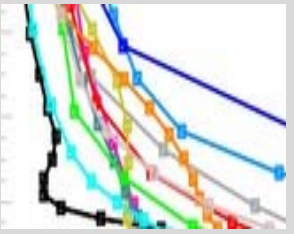


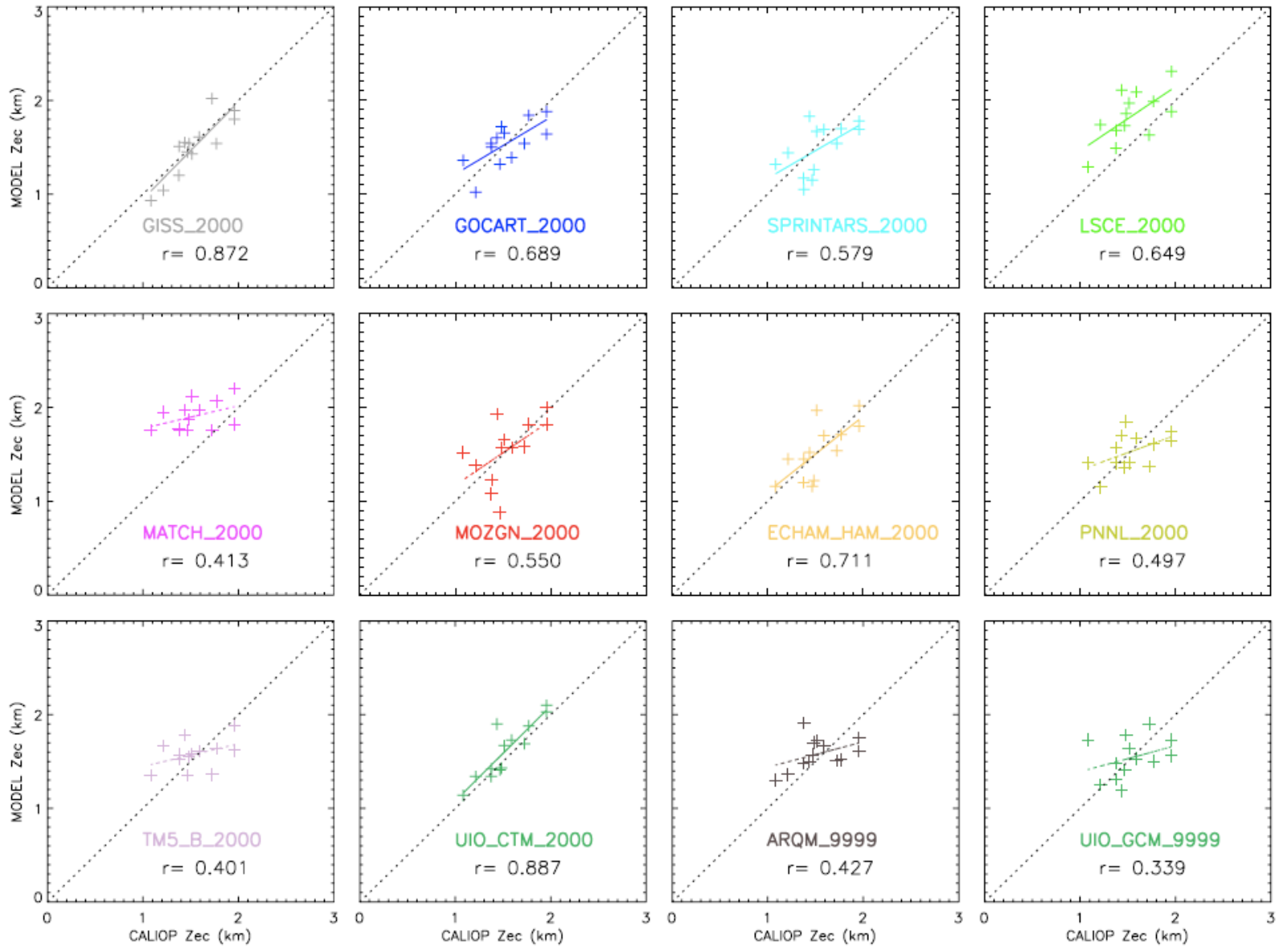
Normalized profiles CALIOP Against model profiles



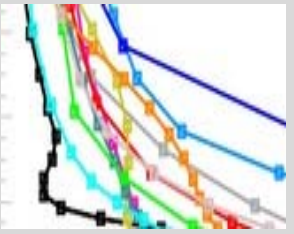


Characteristic Height of Aerosol Extinction [km] below 6 km Model vs CALIOP





Vertical distribution of aerosol particles
Advection of High Level Dust



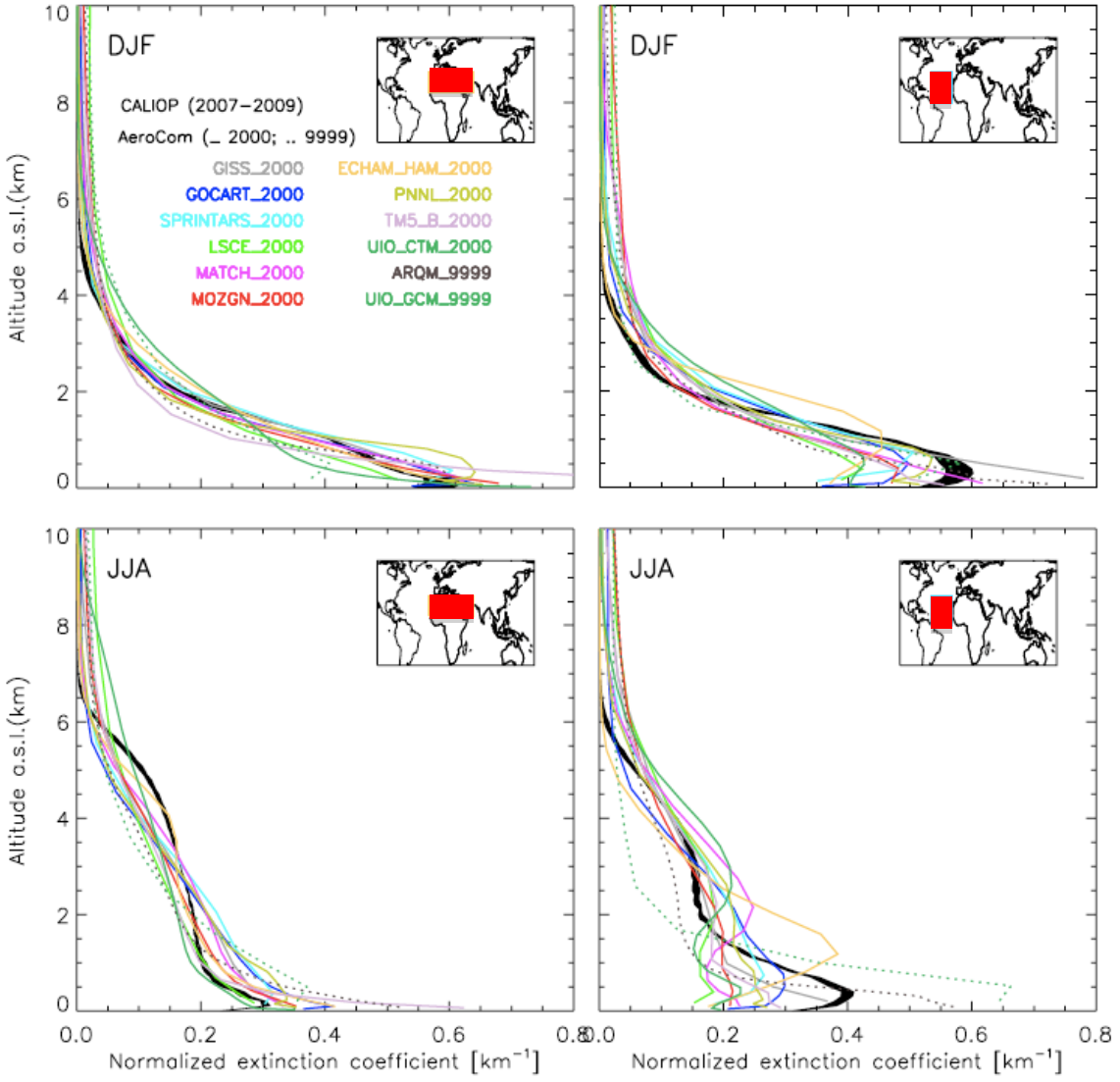
Normalized Aerosol Extinction CALIOP vs MODELS

NORTH AFRICA

CENTRAL ATLANTIC

winter

summer



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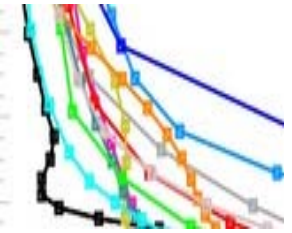
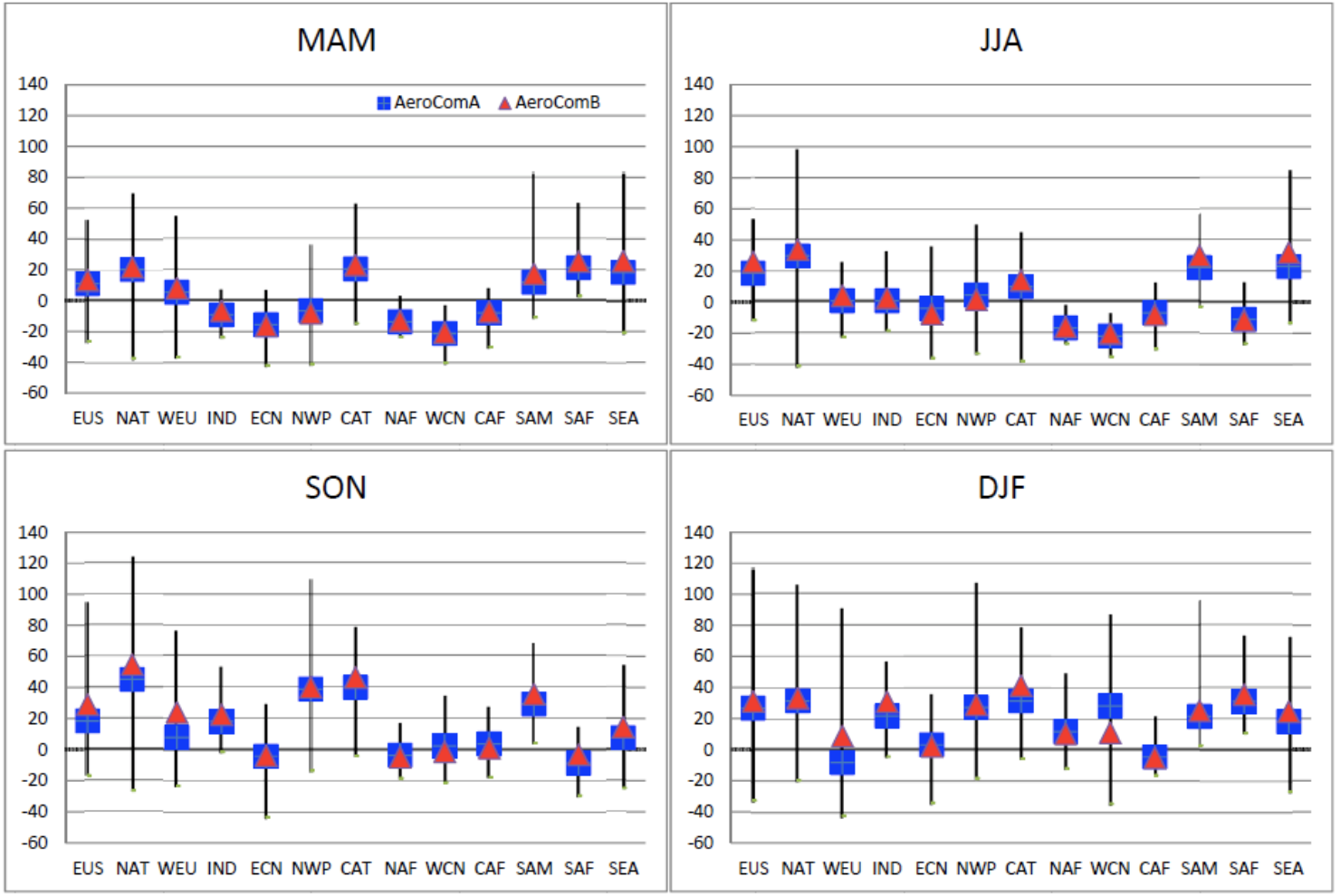
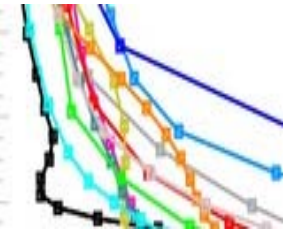
Characteristic Extinction Height BIAS in different regions & seasons AeroCom A versus B





Conclusions & Outlook



A robust set of Caliop extinction profiles was created, differing amazingly little in between years, being more smooth near ground using version 3.

Correlation with Modis suggests model extinction profiles can be evaluated quantitatively, eg underestimate over India in AeroCom A models

Overestimation of characteristic height in some regions by some models (profile below 6km better than upper tropospheric extinction)

Normalized profiles suggest eg differences in dust profile over Atlantic

Height is characteristic of a given model (no diff between A and B experiment)

How different is AeroCom phase II model
Which consequence for forcing of different profiles?
Which processes are responsible for diversity in profiles?