SDA / SDA+ / UCA : overview / update and some recent science results

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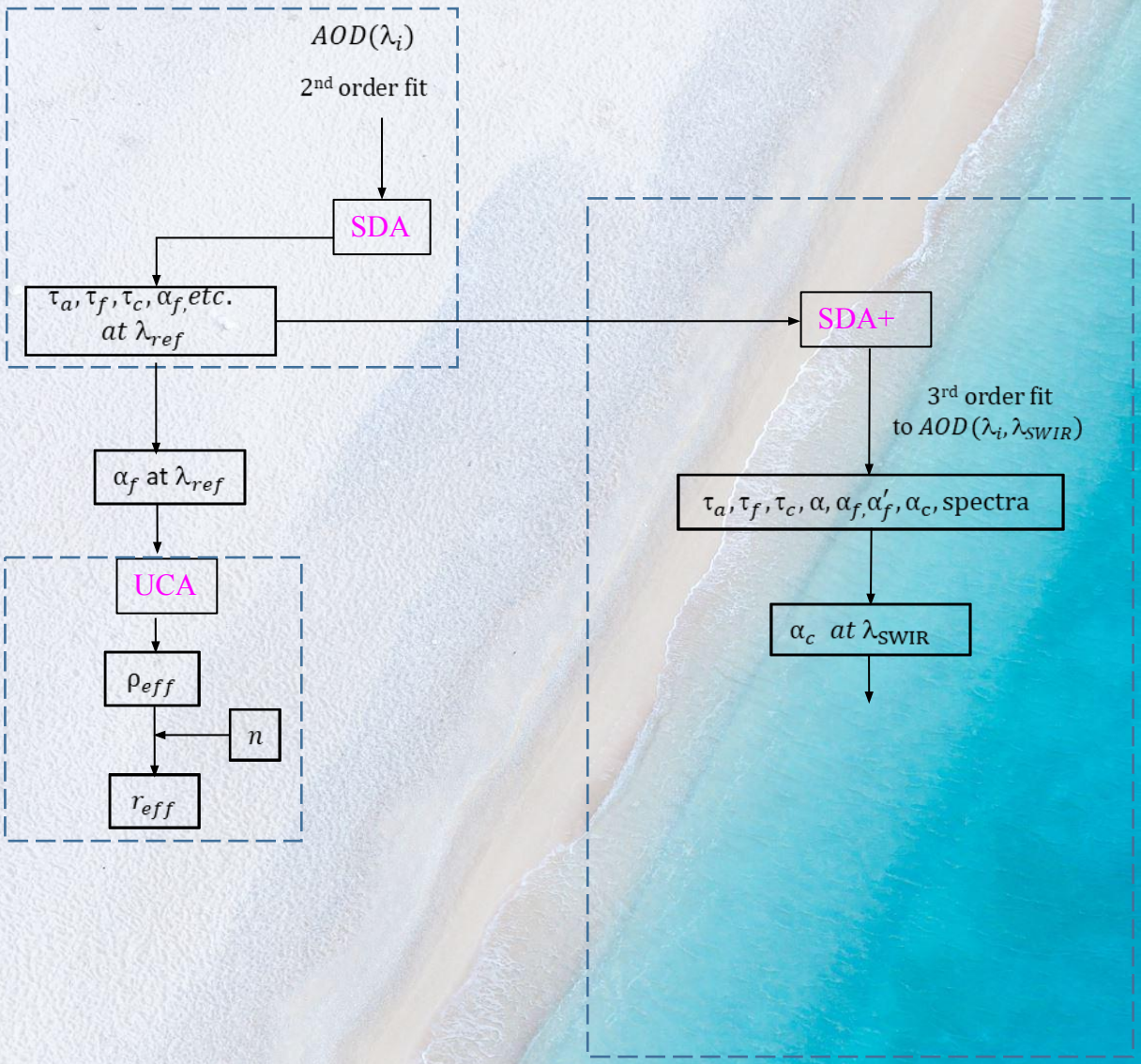
SDA, SDA+ and UCA

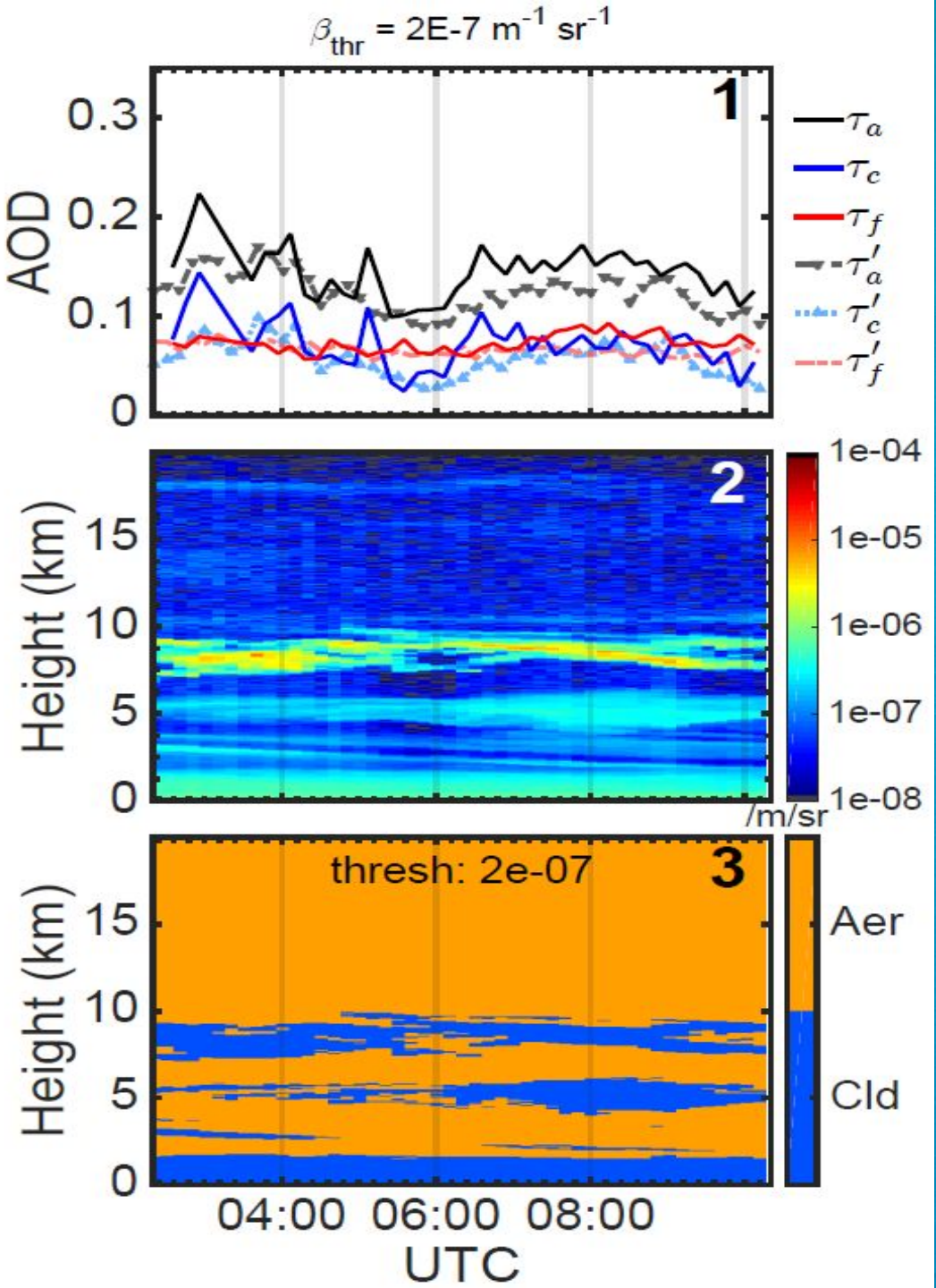
(SDA = Spectral Deconvolution Algorithm, UCA = Universal Curvature Algorithm)



* SWIR = Short Wave IR (1640 nm channel)

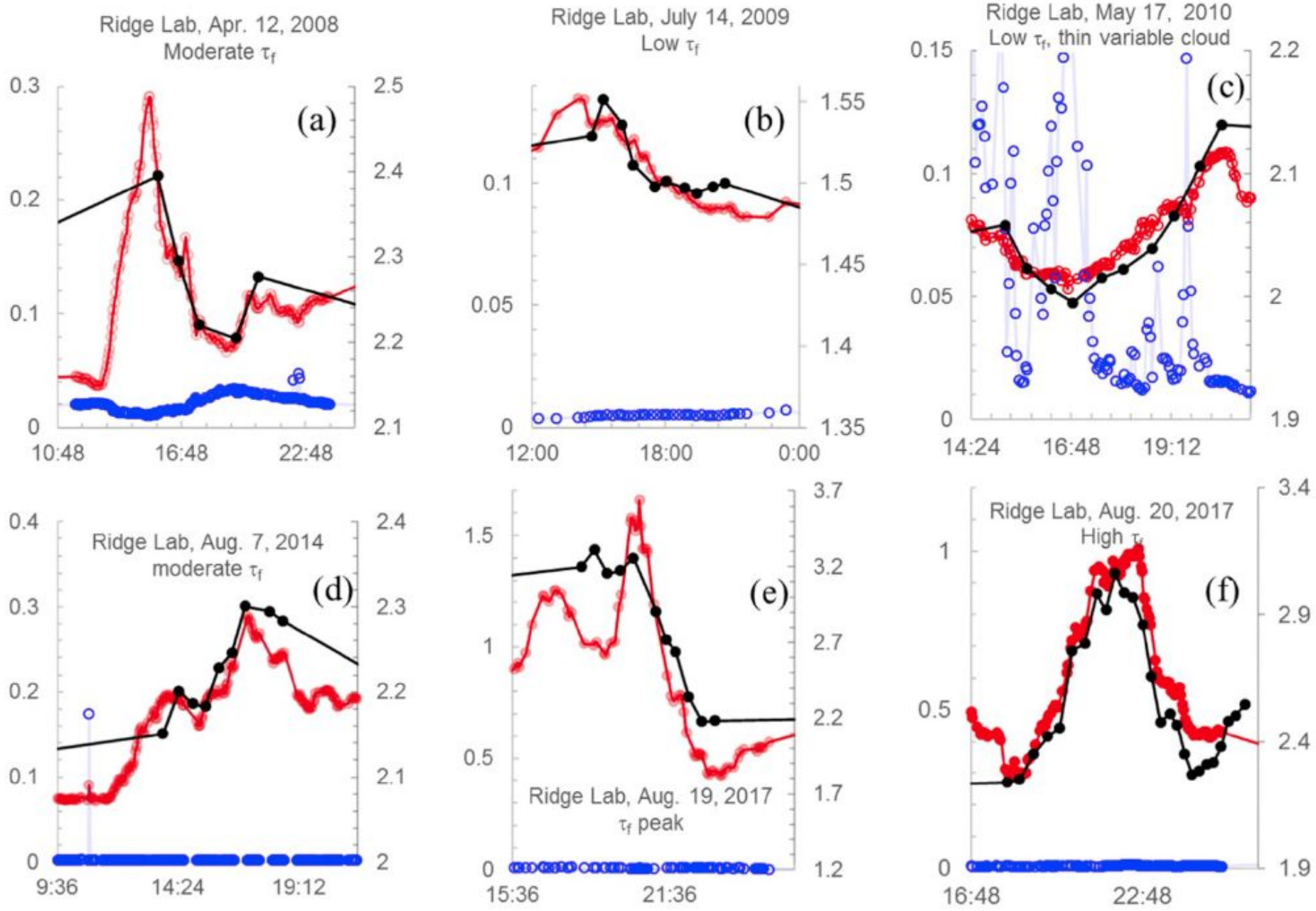
SDA / UCA analyses

Starphotometer vs lidar
(SDA verification / validation)

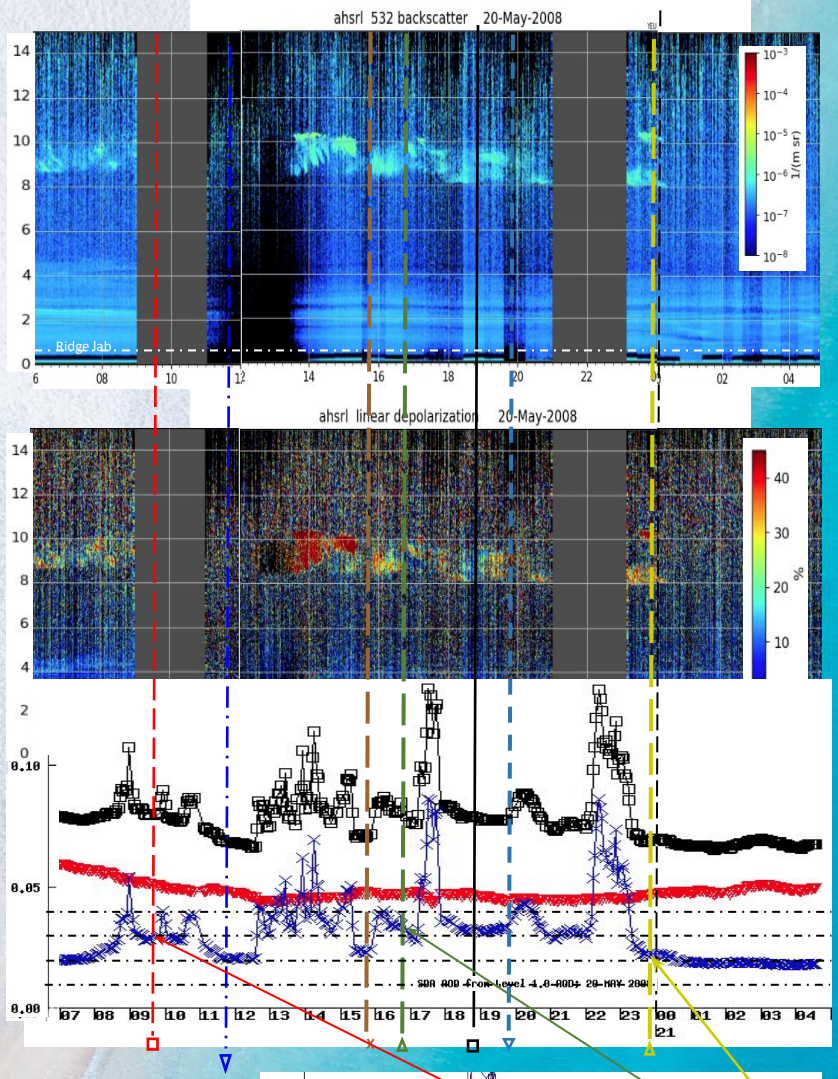


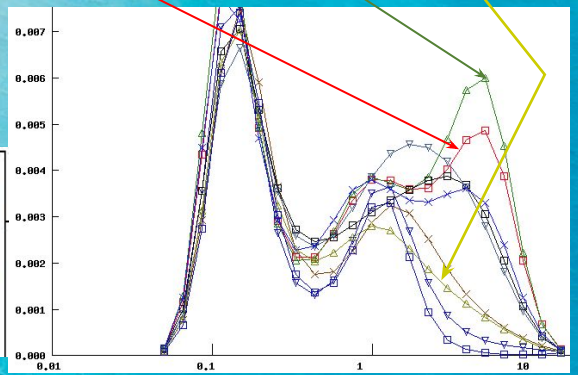
Baibakov et al. (2015)

SDA vs Carbon Monoxide (SDA verification / validation)

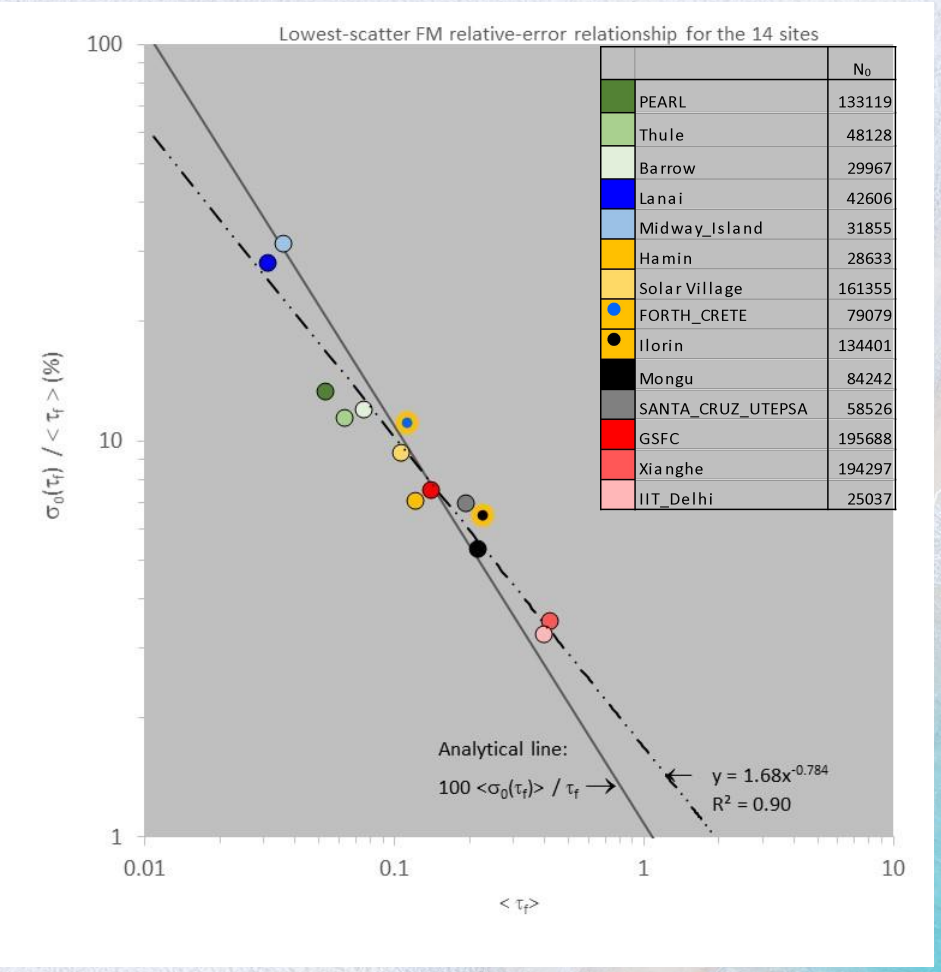


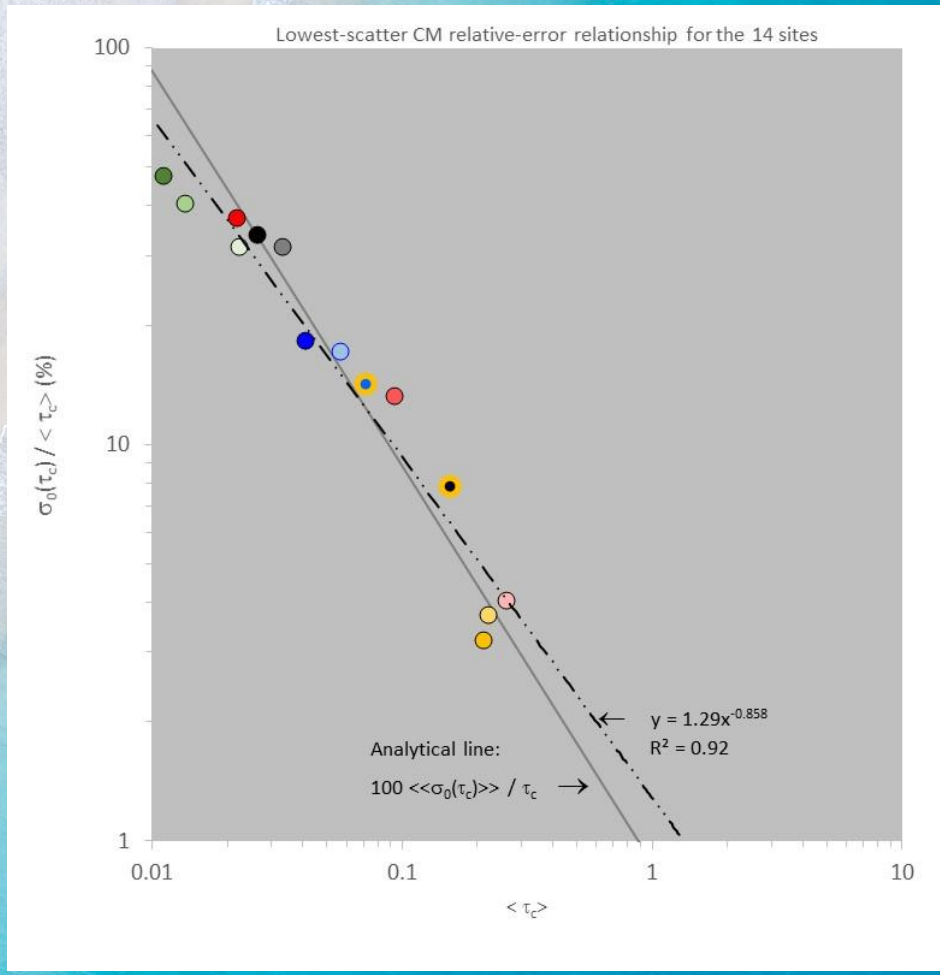
SDA versus AERONET
(τ_c / τ_f verification / validation)





Impact of random errors in AOD (SDA u243 error simulations)





$r_{eff,f}$ vs $\mathbf{r_{eff,f}}$ (SDA/UC vs AERONET inversion)

A word about the Van de Hulst parameter:

$$\rho_{eff,f} = 2\,\frac{2\pi r_{eff,f}}{\lambda}\,|(n-ik)-1|$$

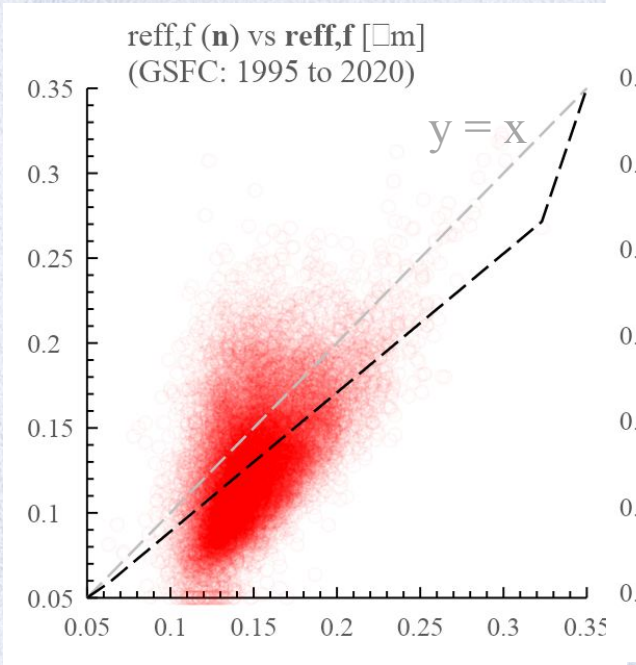
$$|(n-ik)-1| \cong n-1$$

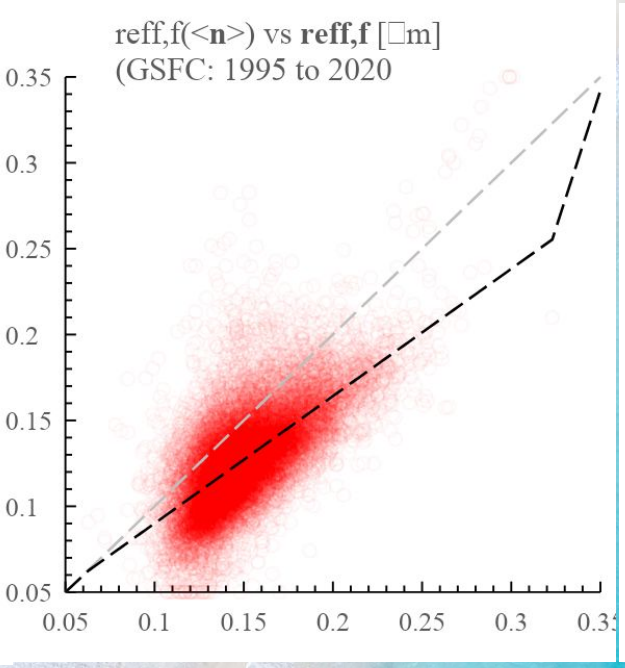
$$r_{eff,f} = \frac{\lambda}{4\pi}\frac{\rho_{eff,f}}{(\boldsymbol{n}-1)}$$

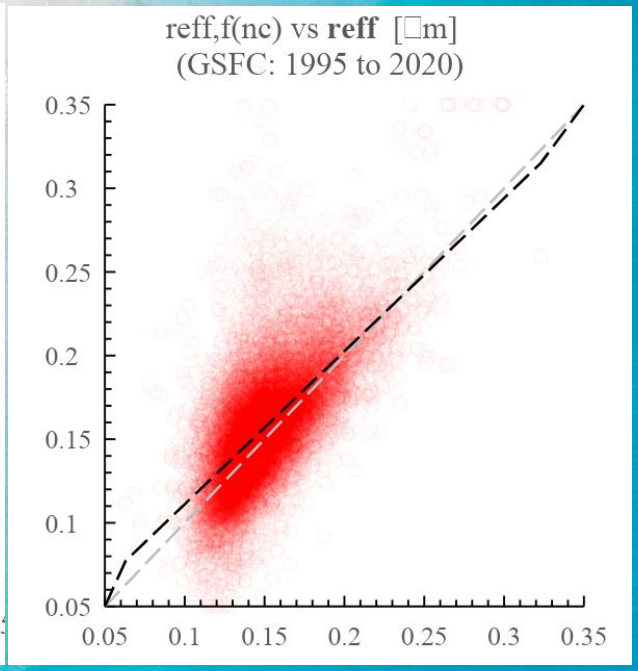
From the SDA/UCA (from α_f and α_f')

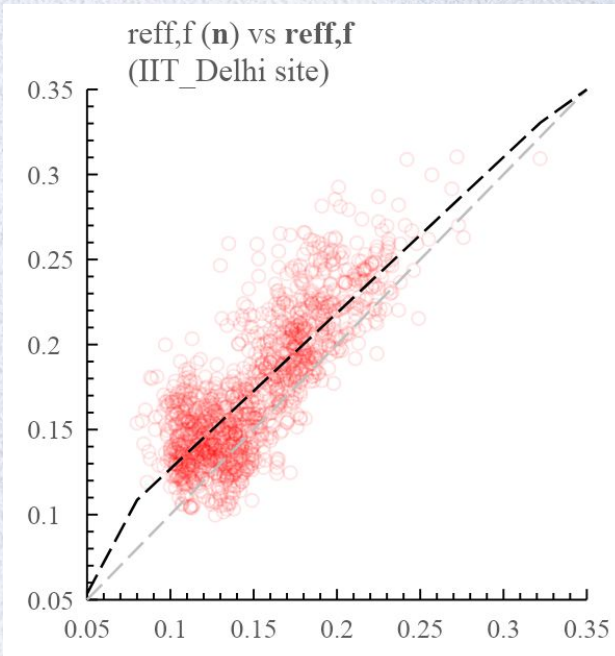
From AERONET inversion or a climatology

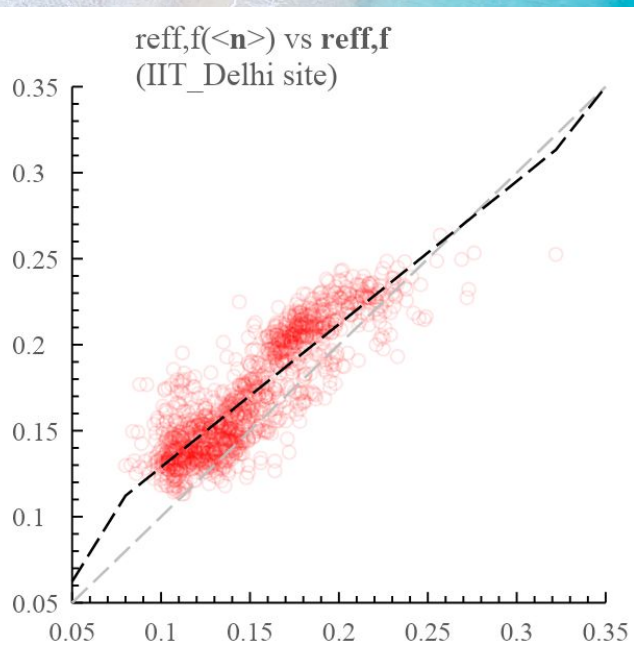
$r_{eff,f}$ vs $\mathbf{r_{eff,f}}$ (SDA/UCA vs AERONET inversion validate / verification)

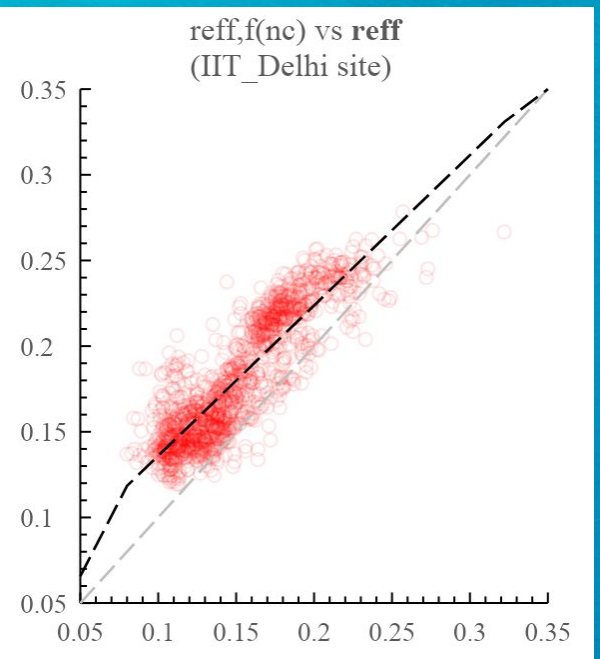




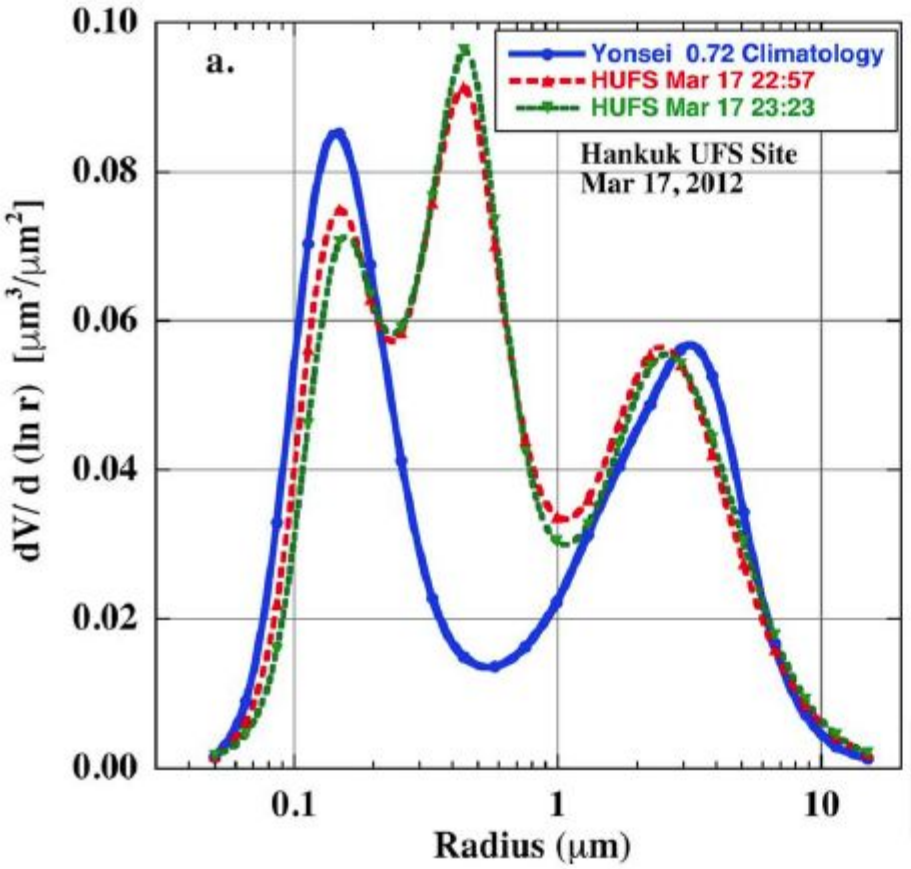


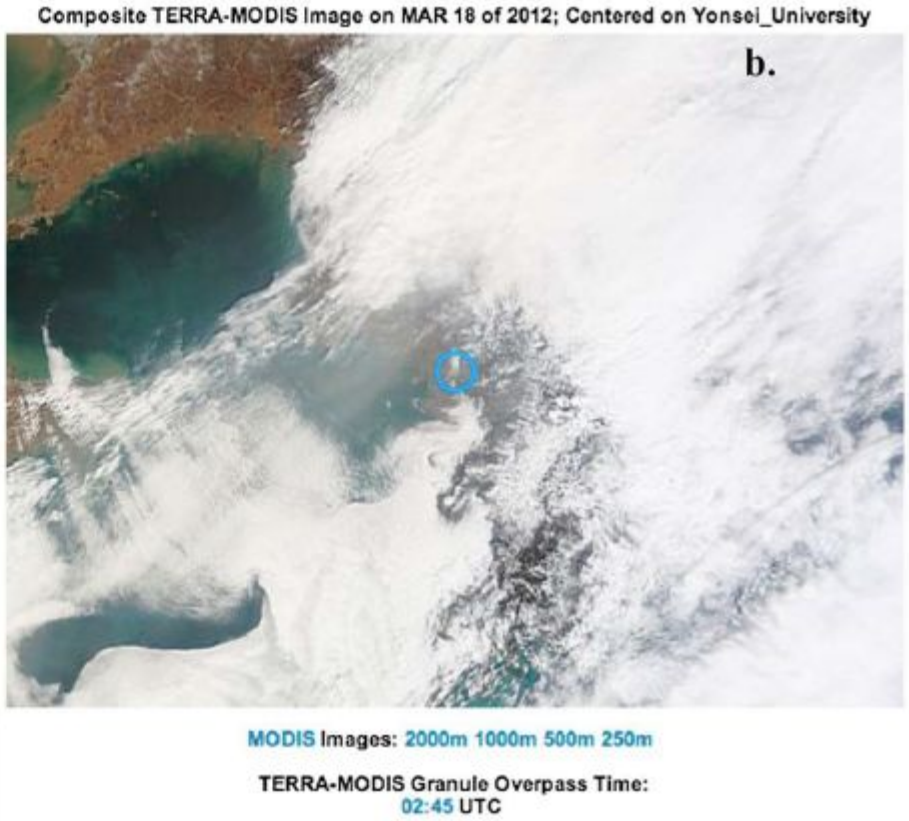






Need for rapid $r_{eff,f}$ measurements? (SDA/UCA application)



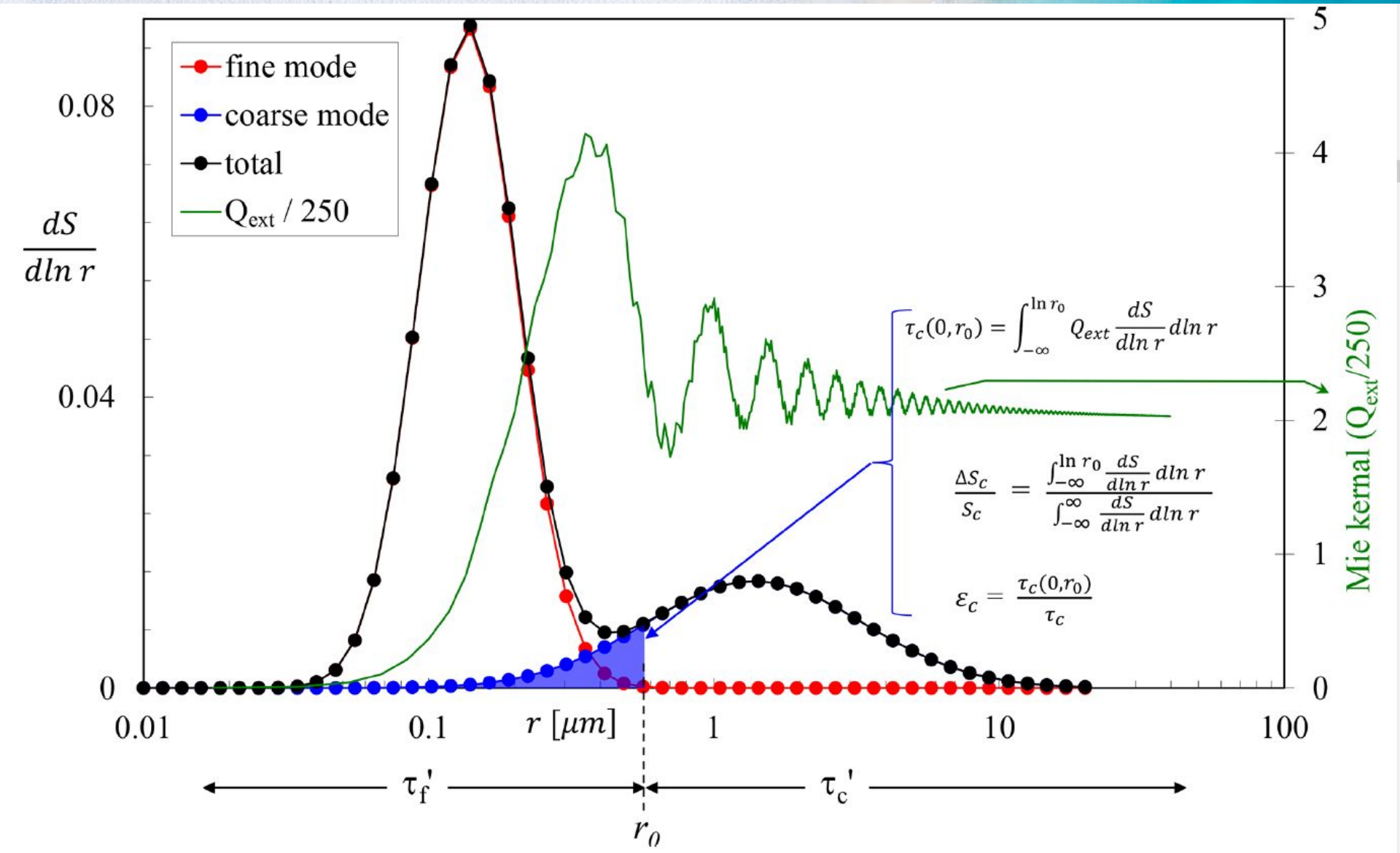


Eck et al. (2018)

SMF vs FMF

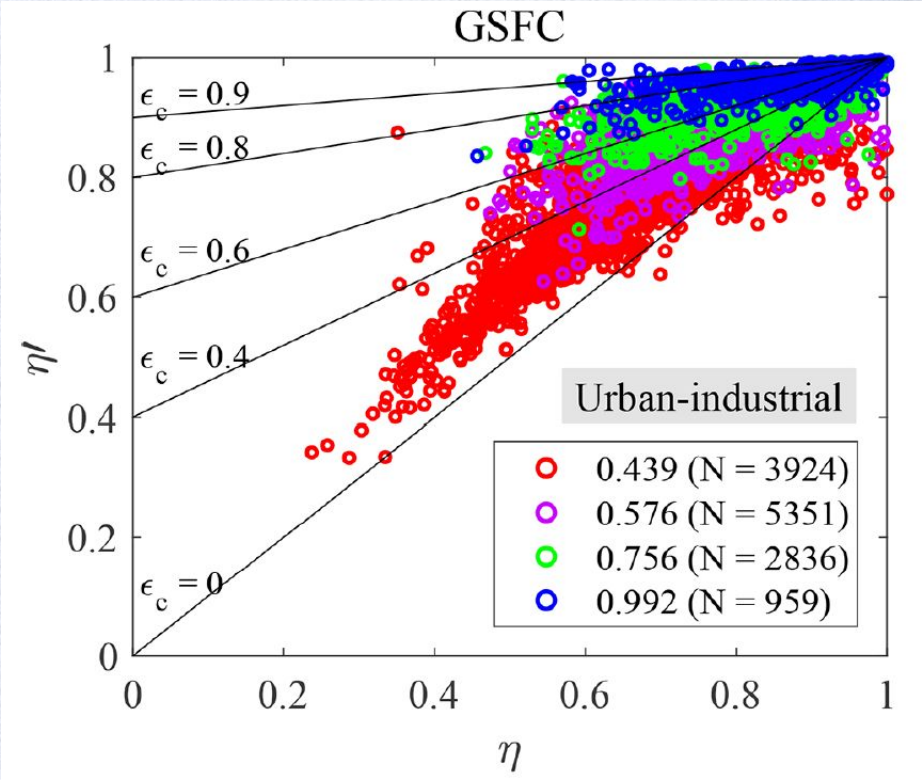
(Submicron fraction vs fine mode fraction)

Sub-micron fraction (SMF) vs fine mode fraction (FMF)
(SDA versus AERONET-inversion analysis)

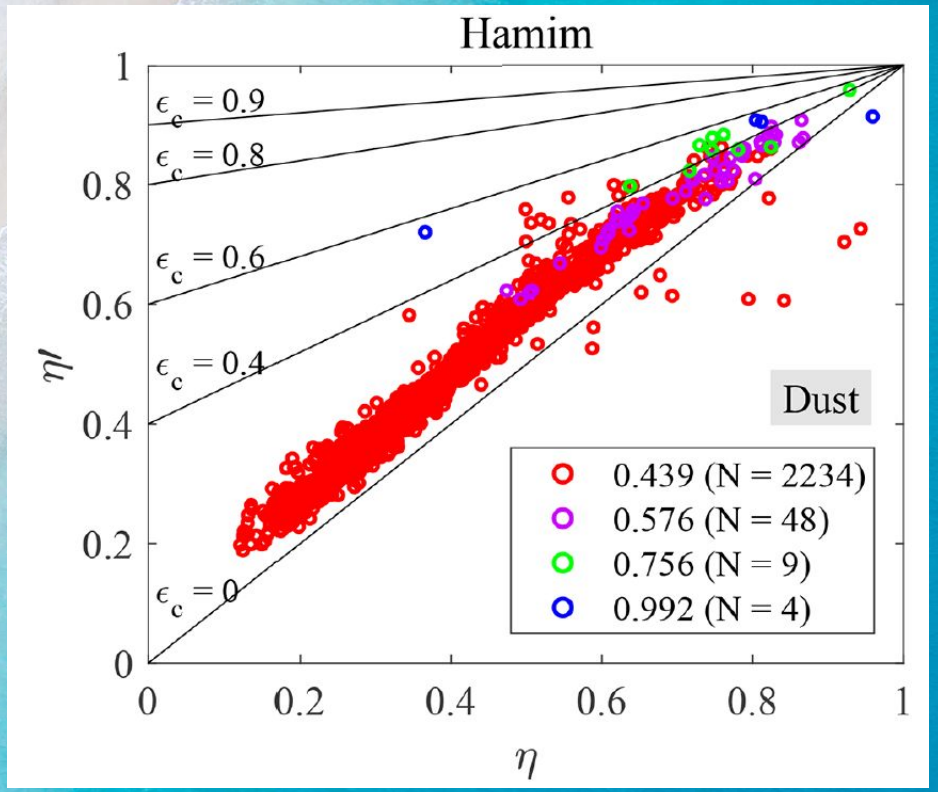


Sub-micron fraction (SMF) vs fine mode fraction (FMF)
(SDA versus AERONET inversion analysis)

Fine mode dominated



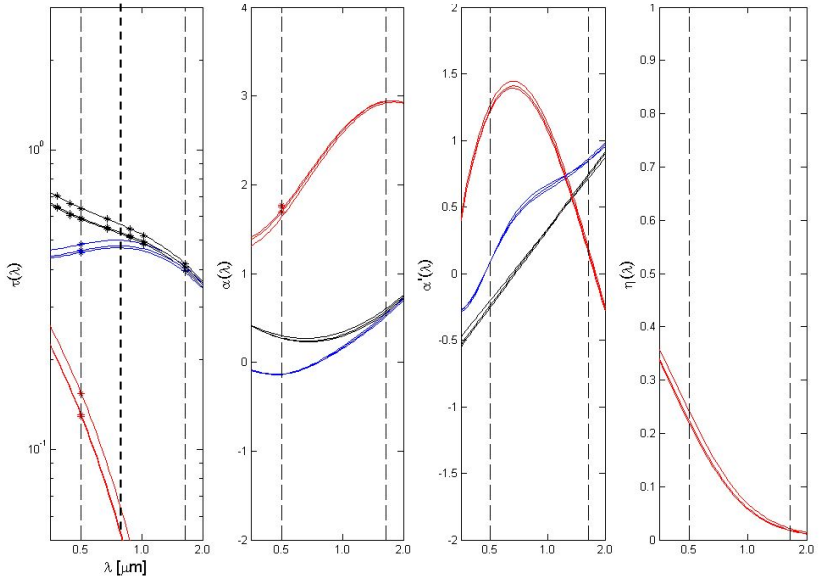
Coarse mode dominated



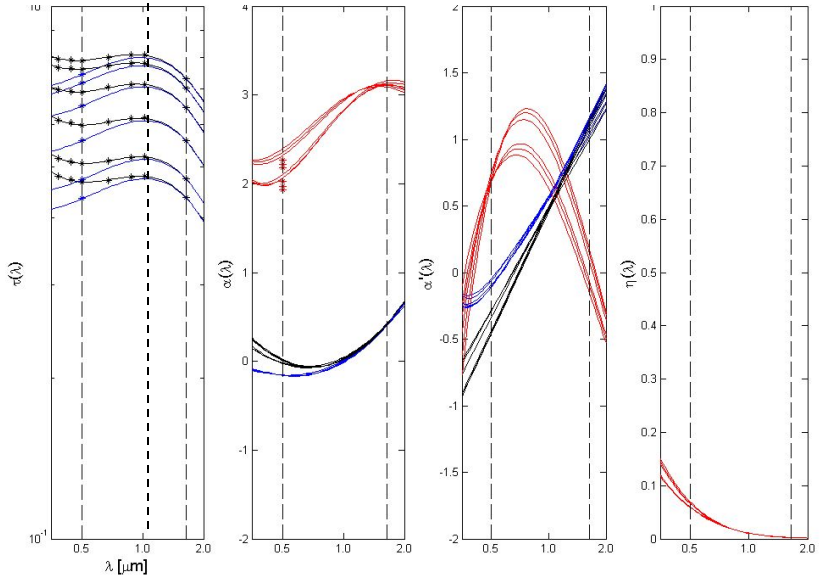
SDA+ / UCA analyses

1640 nm channel brings in potential wealth of information (application of SDA+/UCA)

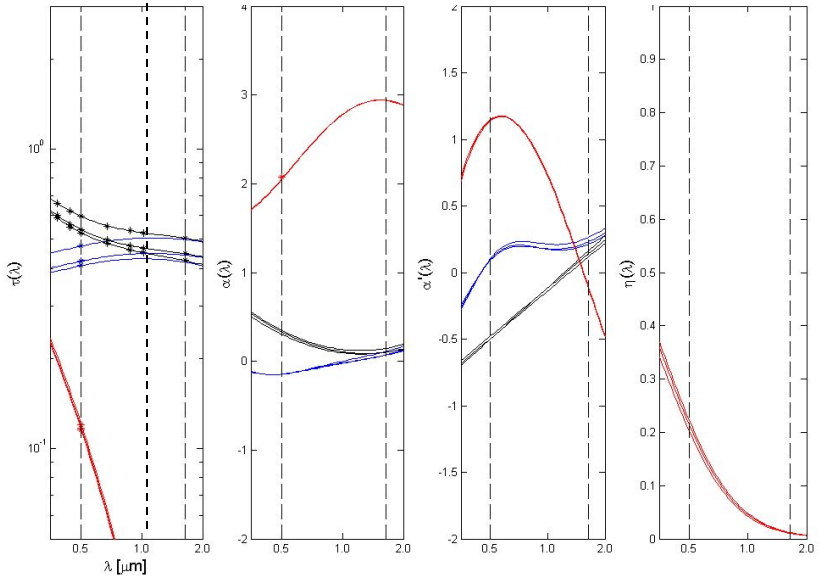
SMART, 238.2 to 239 ($r_{eff,c}$(SDA+) = 0.8 µm, $r_{eff,c}$(AERONET) = 1.66 µm)



Dhabi, 348 to 349 (Dec. 14, 2003 , $r_{eff,c}$(SDA+) = 1.3 µm), $r_{eff,c}$(AERONET) = 1.6 µm)

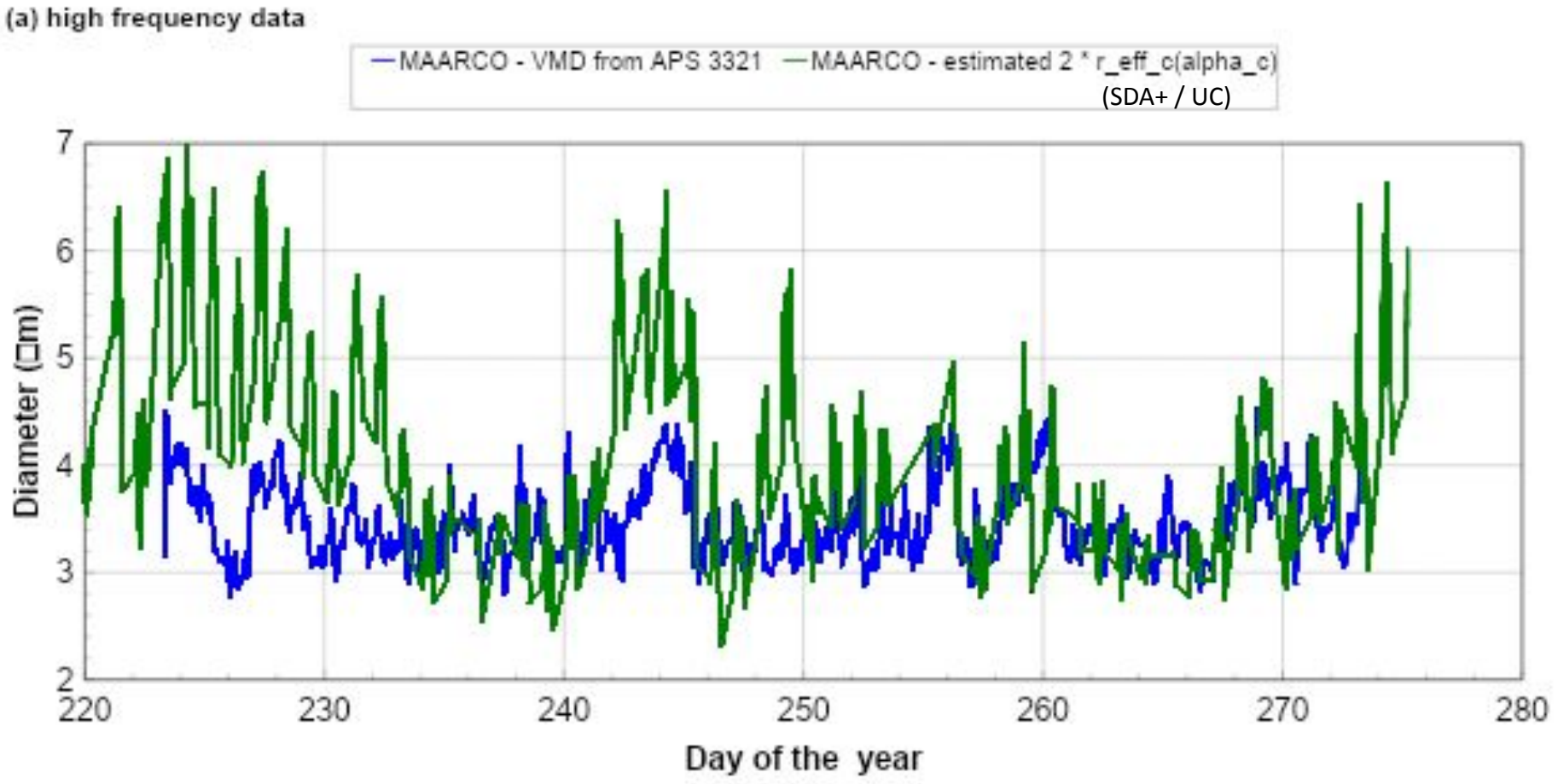


SMART, 224 to 225 ($r_{eff,c}$(SDA+) = 2.05 µm, $r_{eff,c}$(AERONET) = 2.4 µm



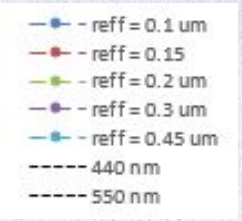
Correlation between effective radius of SDA+/UCA APS surface measurements (verification / validation of SDA+/UCA)

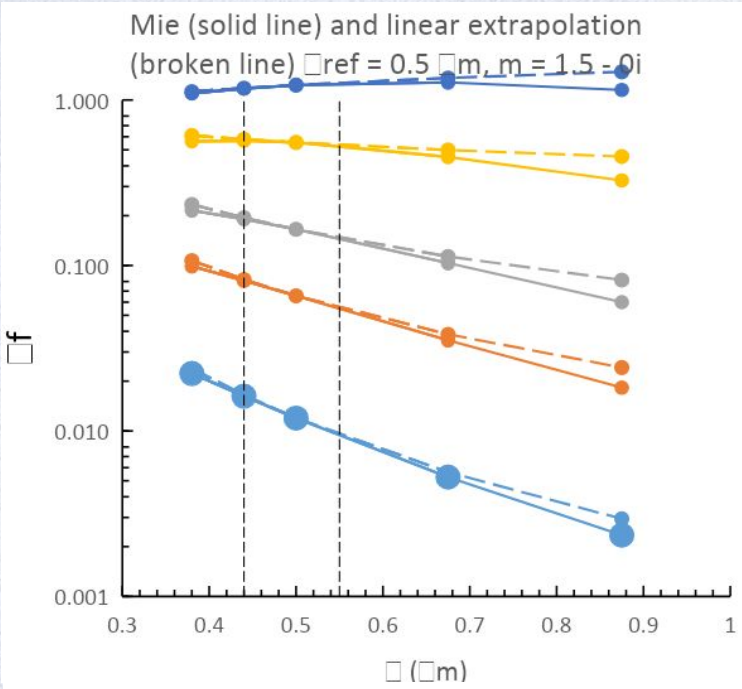
- High frequency extraction of τ_c at 1640 nm (or any other desired wavelength) and $r_{eff,c}$

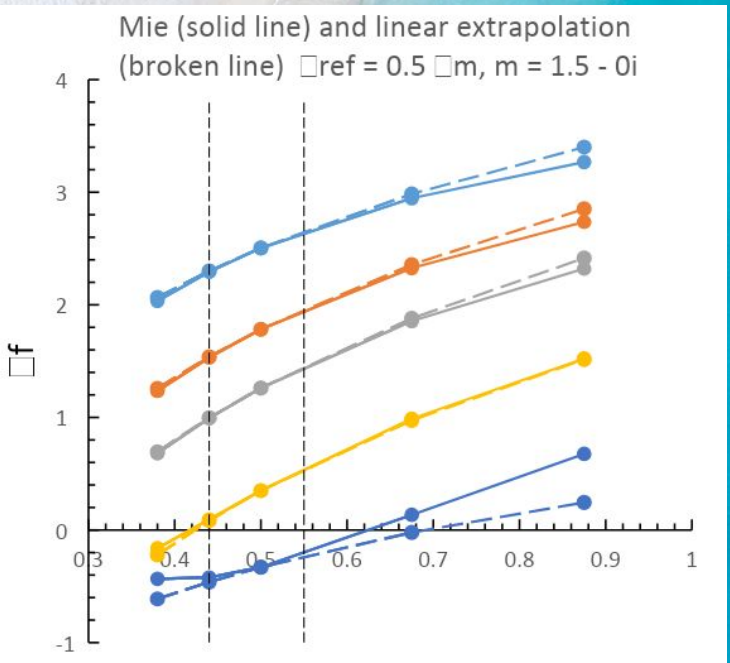


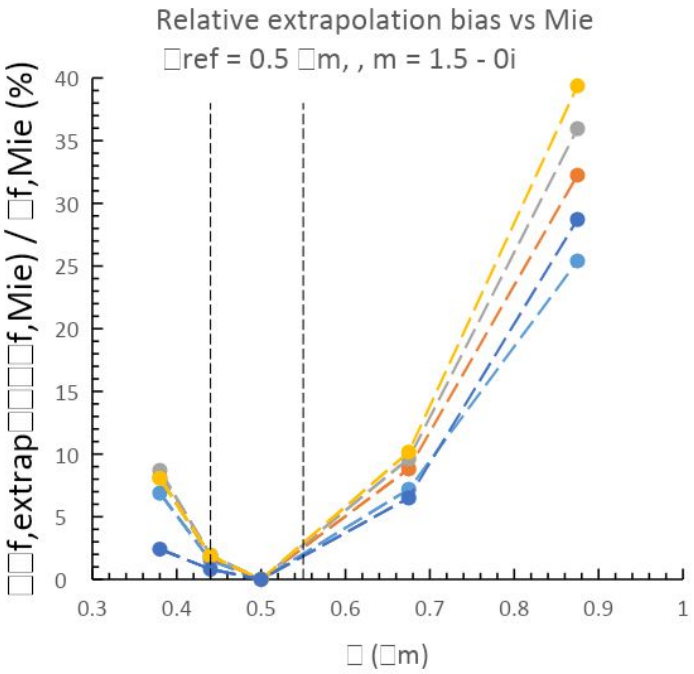

Thanks
2009/08/20

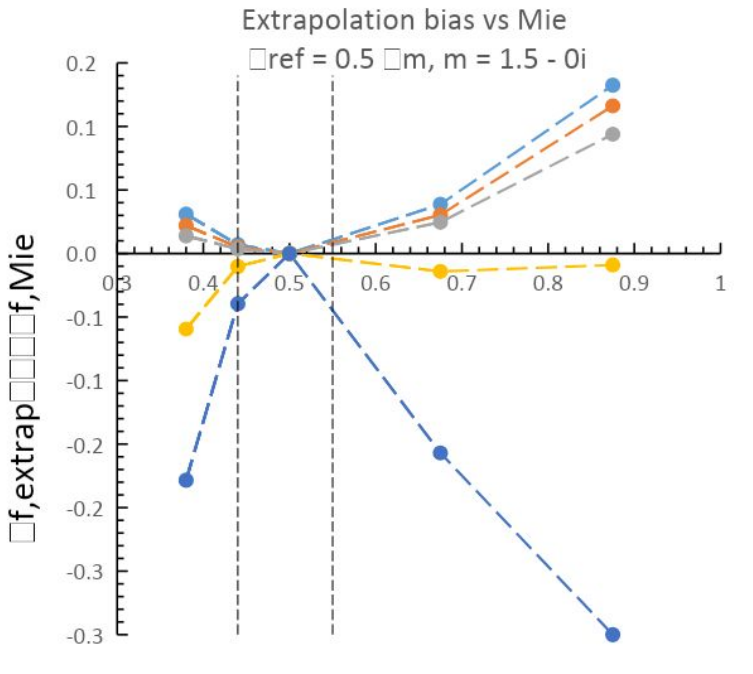
Extra slides

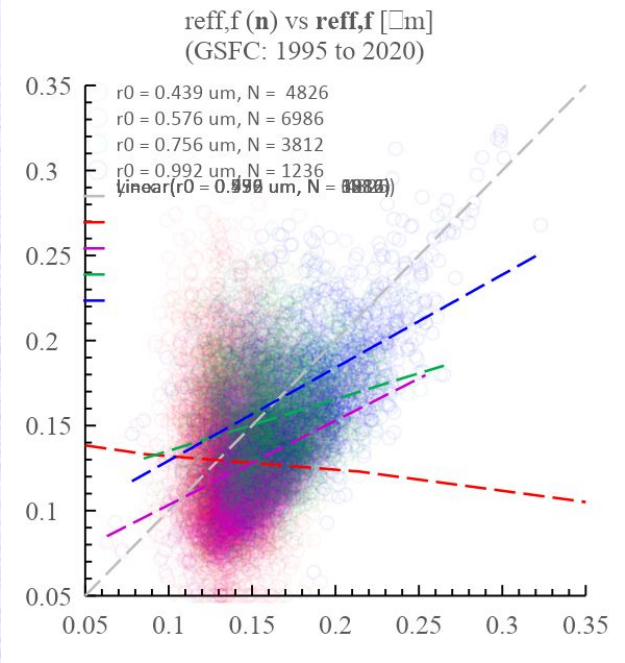

reff = 0.1 um
reff = 0.15
reff = 0.2 um
reff = 0.3 um
reff = 0.45 um
440 nm
550 nm

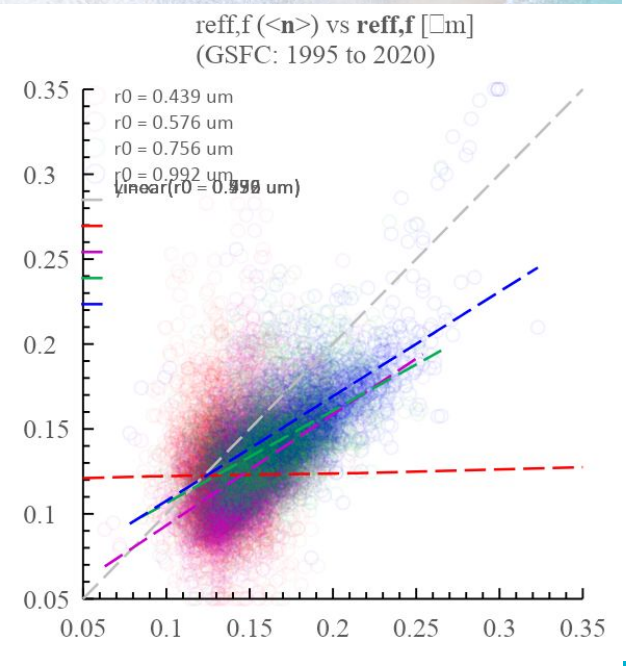

Mie (solid line) and linear extrapolation
(broken line) □ref = 0.5 □m, m = 1.5 - 0i
1.000
0.100
0.010
0.001
□f
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
□ (□m)

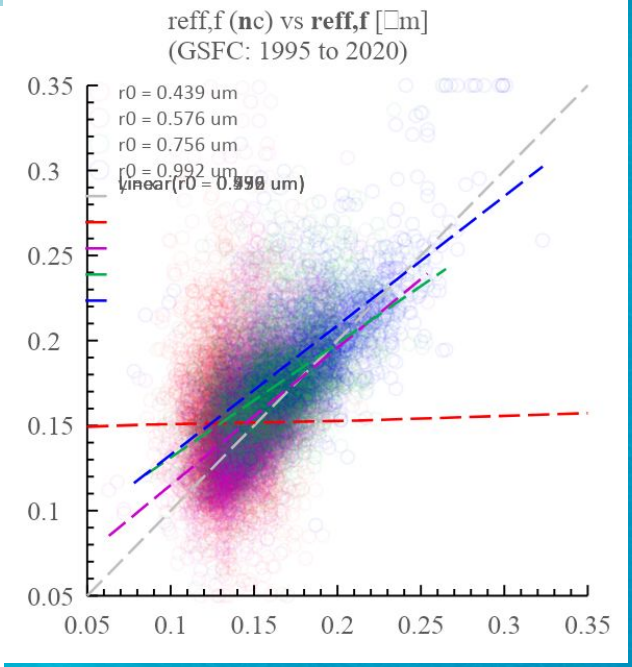

Mie (solid line) and linear extrapolation
(broken line) □ref = 0.5 □m, m = 1.5 - 0i
4
3
2
1
0
-1
□f
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Relative extrapolation bias vs Mie
□ref = 0.5 □m, , m = 1.5 - 0i
40
35
30
25
20
15
10
5
0
□□f,extrap□□□□f,Mie) / □f,Mie (%)
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
□ (□m)


Extrapolation bias vs Mie
□ref = 0.5 □m, m = 1.5 - 0i
0.2
0.1
0.1
0.0
-0.1
-0.1
-0.2
-0.2
-0.3
-0.3
□f,extrap□□□□f,Mie
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


reff,f (**n**) vs **reff,f** [□m]
(GSFC: 1995 to 2020)
r0 = 0.439 um, N = 4826
r0 = 0.576 um, N = 6986
r0 = 0.756 um, N = 3812
r0 = 0.992 um, N = 1236
Linear(r0 = 0.992 um, N = 1236)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0.05 0.1 0.15 0.2 0.25 0.3 0.35


reff,f (<**n**>) vs **reff,f** [□m]
(GSFC: 1995 to 2020)
r0 = 0.439 um
r0 = 0.576 um
r0 = 0.756 um
r0 = 0.992 um
Linear(r0 = 0.992 um)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0.05 0.1 0.15 0.2 0.25 0.3 0.35


reff,f (**nc**) vs **reff,f** [□m]
(GSFC: 1995 to 2020)
r0 = 0.439 um
r0 = 0.576 um
r0 = 0.756 um
r0 = 0.992 um
Linear(r0 = 0.992 um)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0.05 0.1 0.15 0.2 0.25 0.3 0.35

Fine mode retrievals vs particle volume concentration (SDA / UCA analysis)