



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

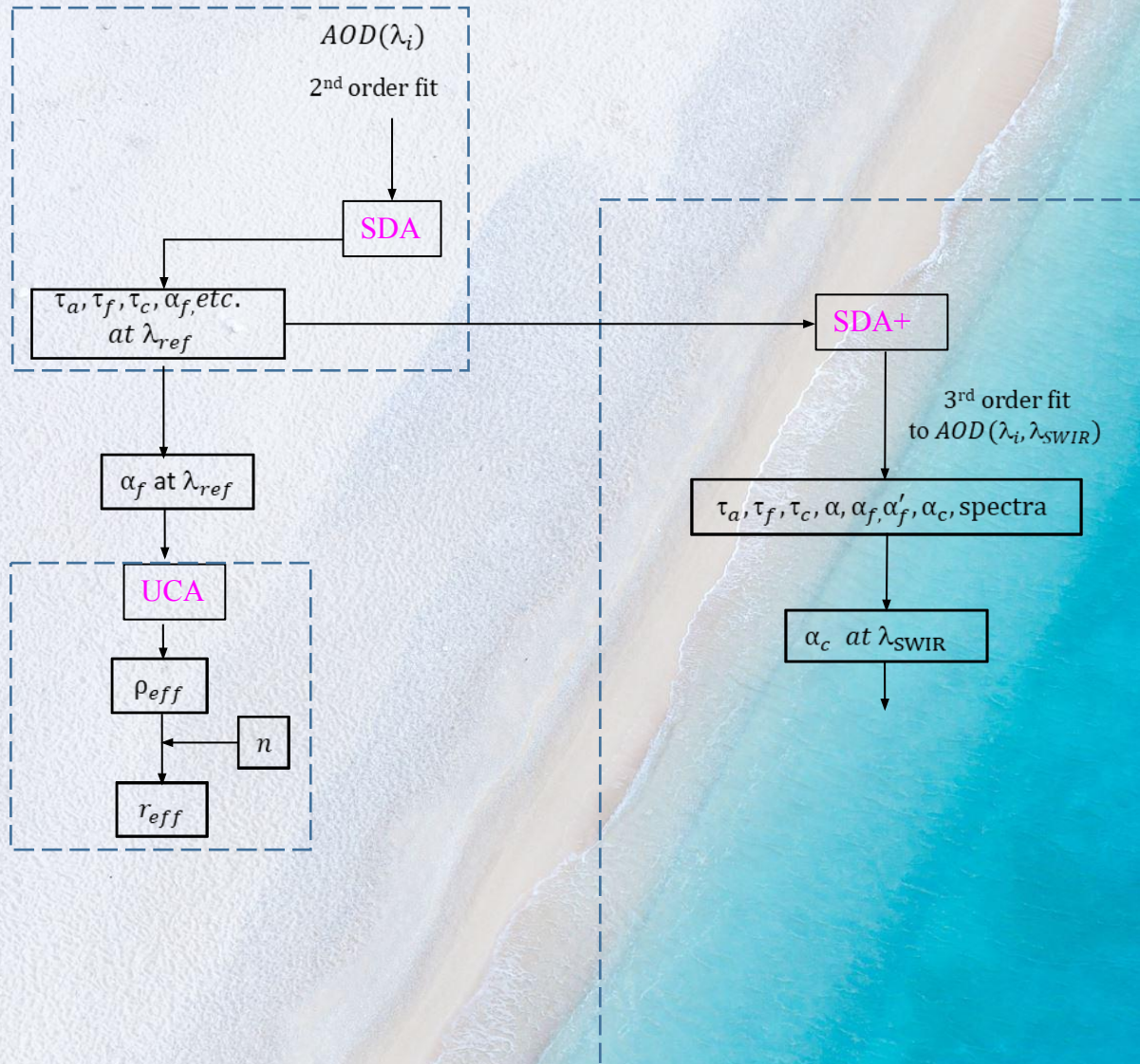
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SDA, SDA+ and UCA

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



* SWIR = Short Wave IR (1640 nm channel)

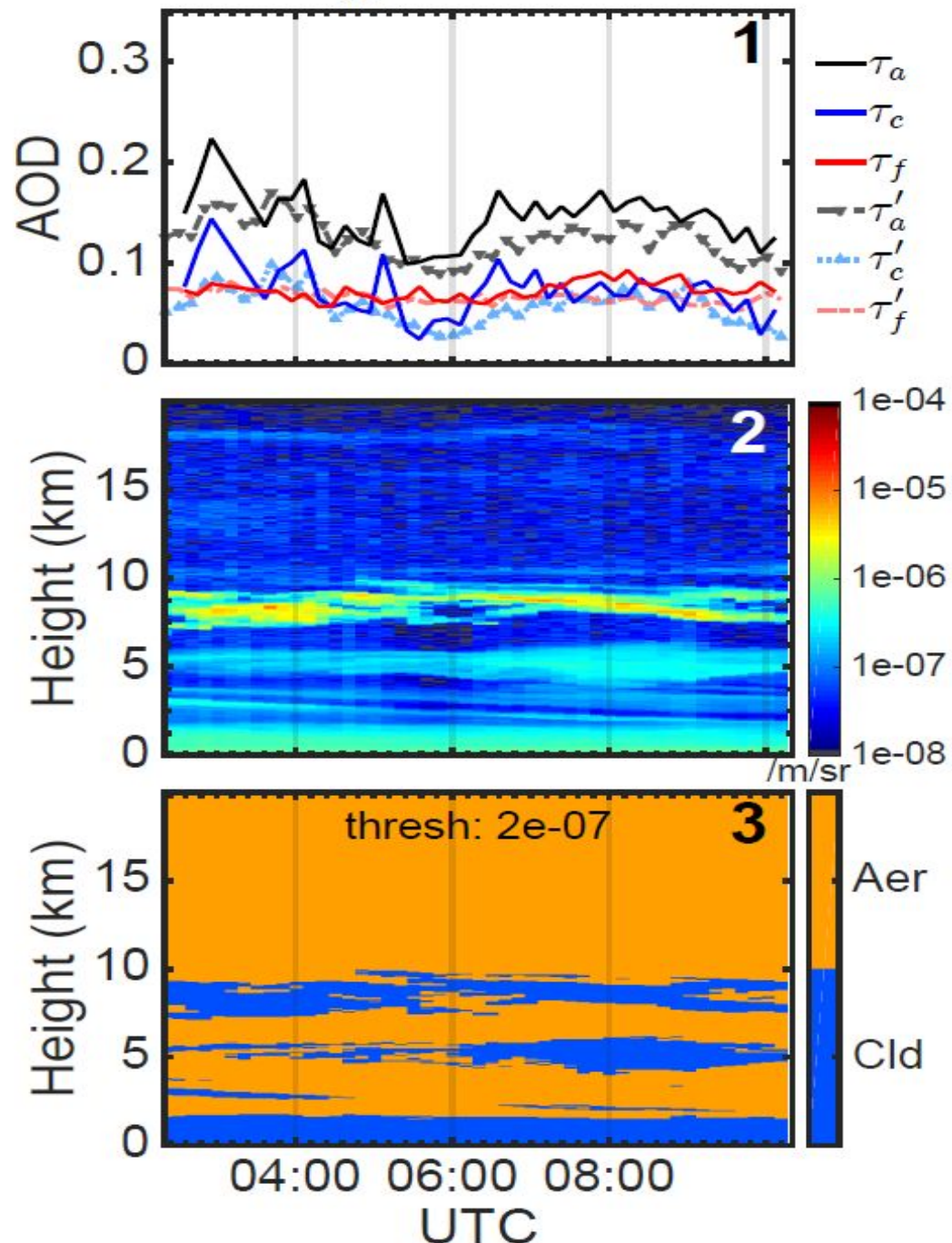
An aerial photograph of a tropical beach. The left side of the image shows a wide expanse of white sand. A narrow strip of golden-brown sand separates the white sand from the turquoise water. The water is clear and vibrant, with gentle waves lapping at the shore. The overall scene is bright and serene.

SDA / UCA analyses

Starphotometer vs lidar (SDA verification / validation)

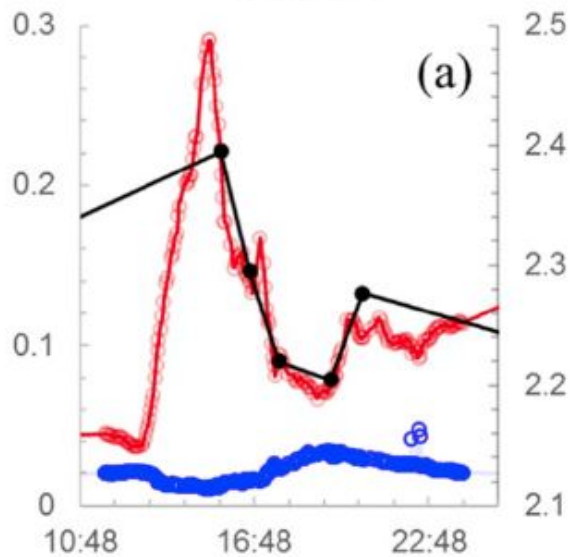


$$\beta_{\text{thr}} = 2\text{E-}7 \text{ m}^{-1} \text{ sr}^{-1}$$

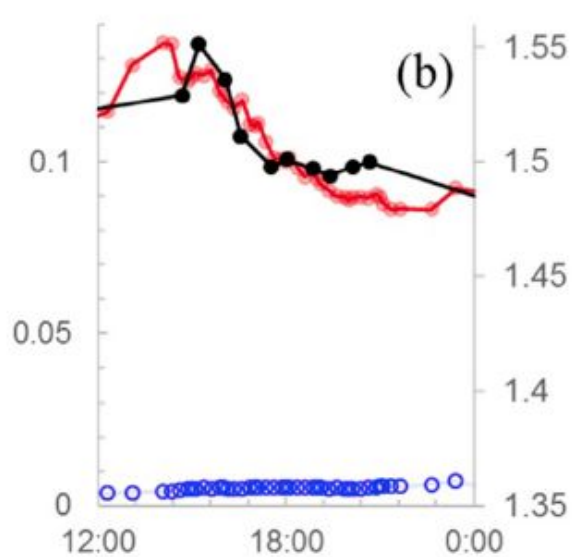


SDA vs Carbon Monoxide (SDA verification / validation)

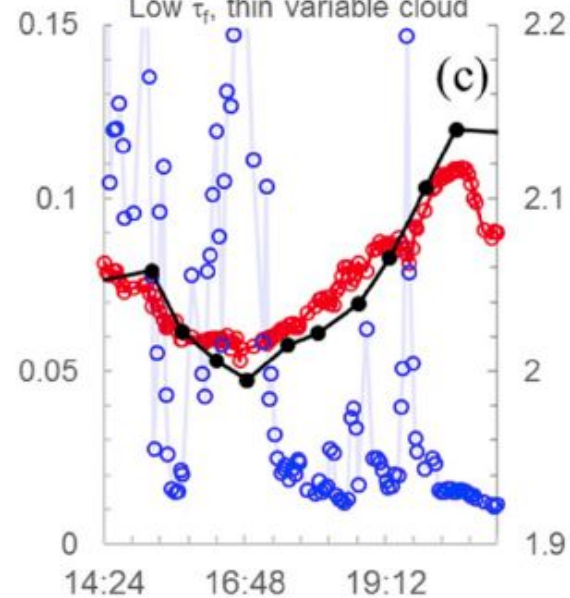
Ridge Lab, Apr. 12, 2008
Moderate τ_f



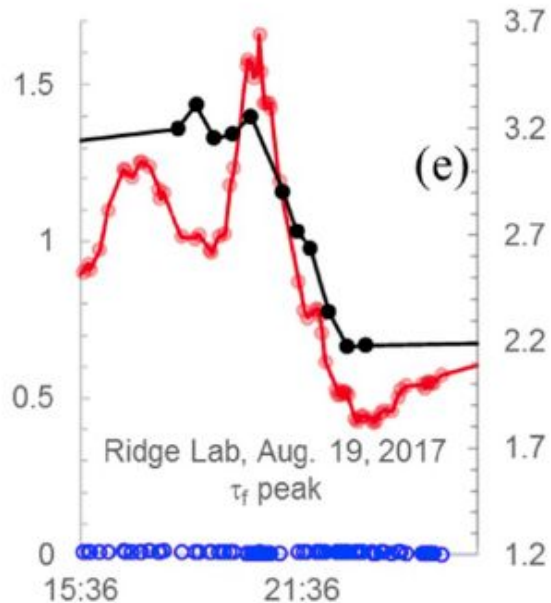
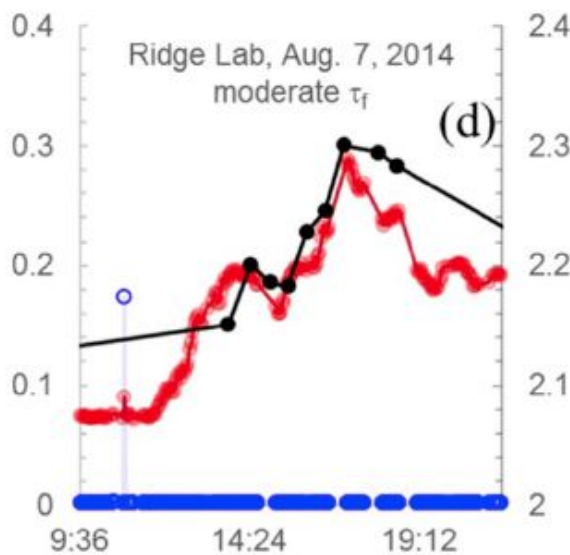
Ridge Lab, July 14, 2009
Low τ_f



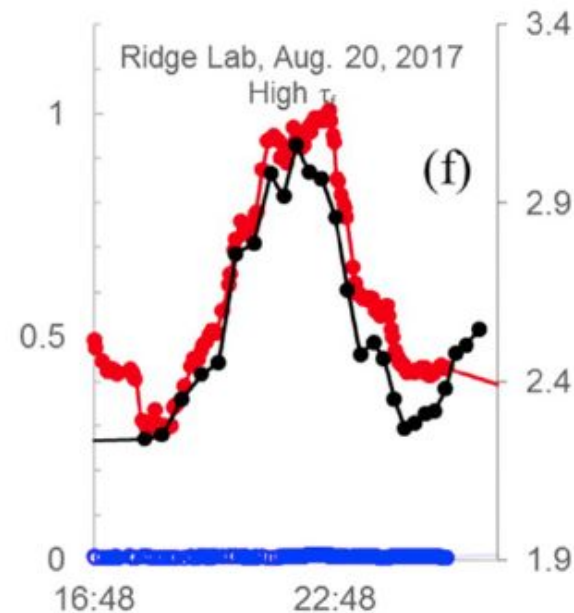
Ridge Lab, May 17, 2010
Low τ_f , thin variable cloud



Ridge Lab, Aug. 7, 2014
moderate τ_f

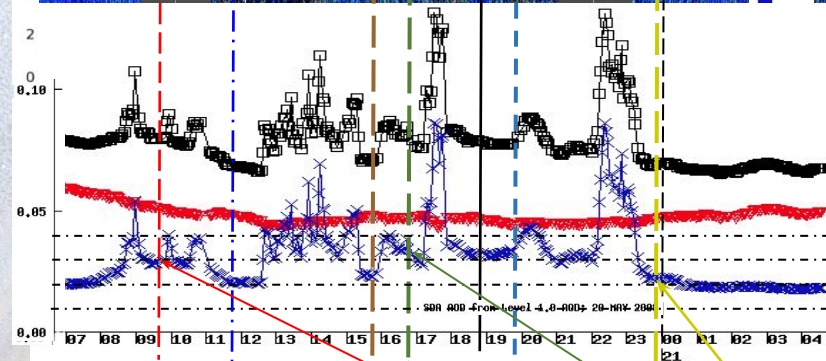
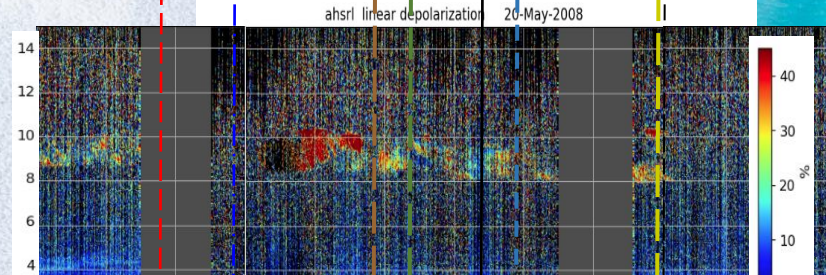
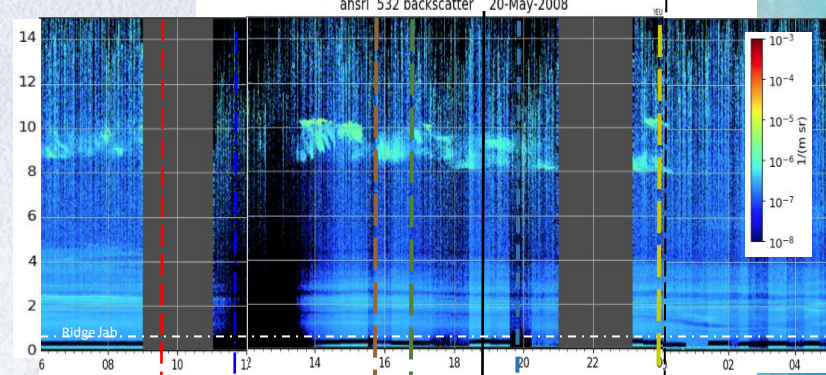


Ridge Lab, Aug. 20, 2017
High τ_f

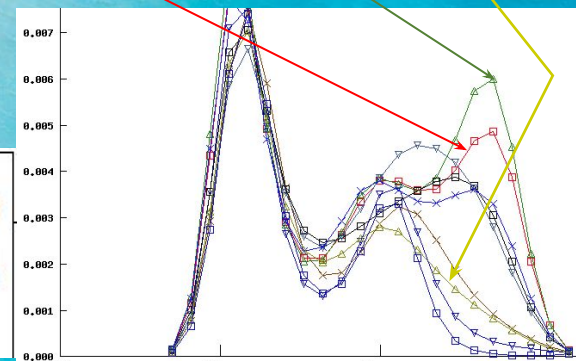


SDA versus AERONET

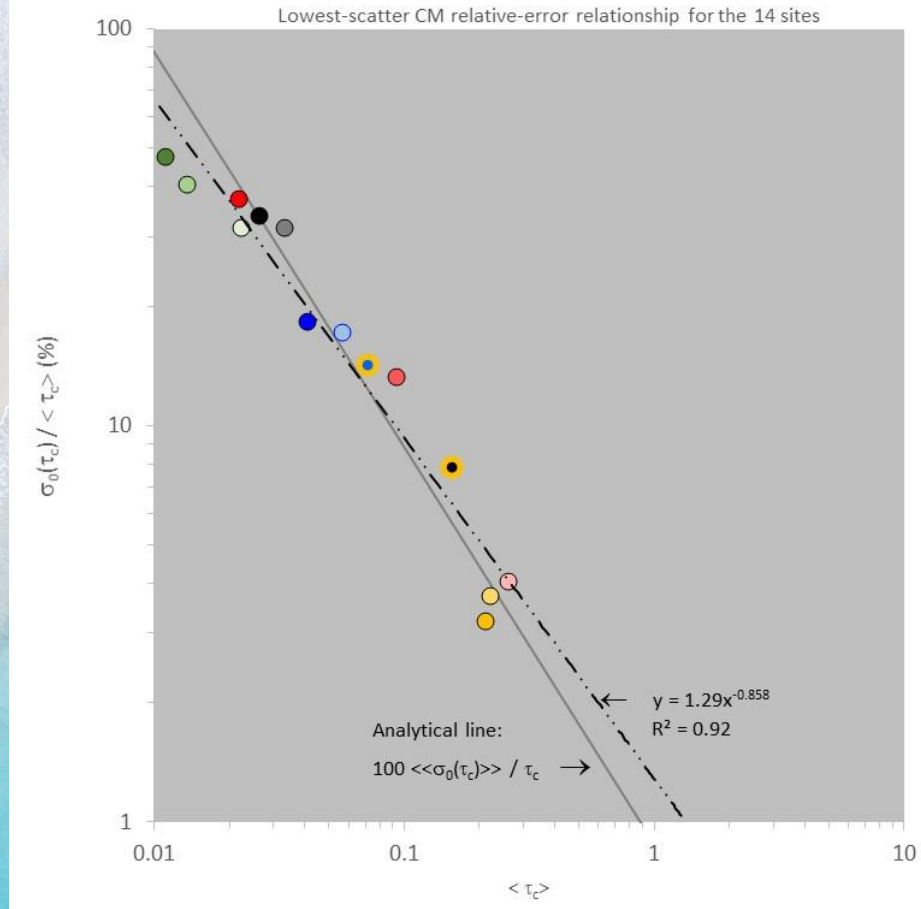
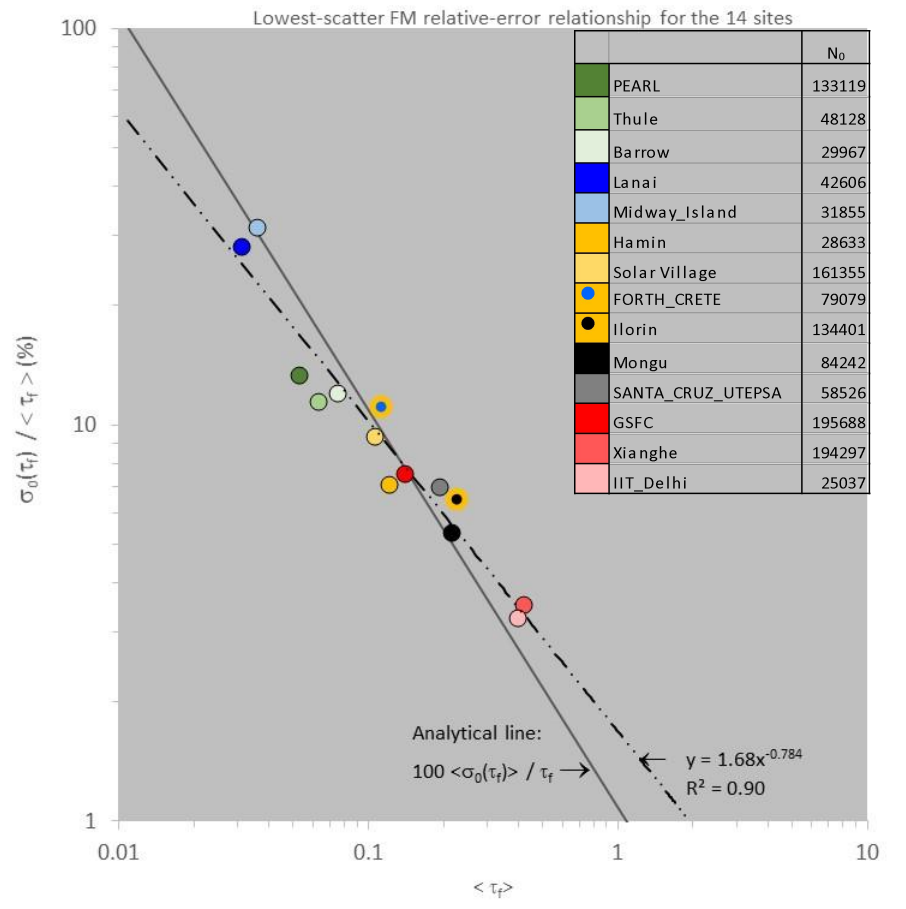
(τ_c / τ_f verification / validation)



- 09:34:54 [skyerr=6.4%;sz=75;t440=0.10]
- 11:39:59 [skyerr=9.3%;sz=70;t440=0.09]
- 15:45:57 [skyerr=12.4%;sz=61;t440=0.09]
- 16:45:54 [skyerr=9.2%;sz=60;t440=0.10]
- 18:45:55 [skyerr=10.6%;sz=60;t440=0.09]
- 19:45:56 [skyerr=11.9%;sz=61;t440=0.09]
- 20:45:57 [skyerr=8.0%;sz=63;t440=0.09]
- 23:49:23 [skyerr=6.5%;sz=70;t440=0.09]
- 01:55:21 [skyerr=5.4%;sz=75;t440=0.08]



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



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

A word about the Van de Hulst parameter:

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

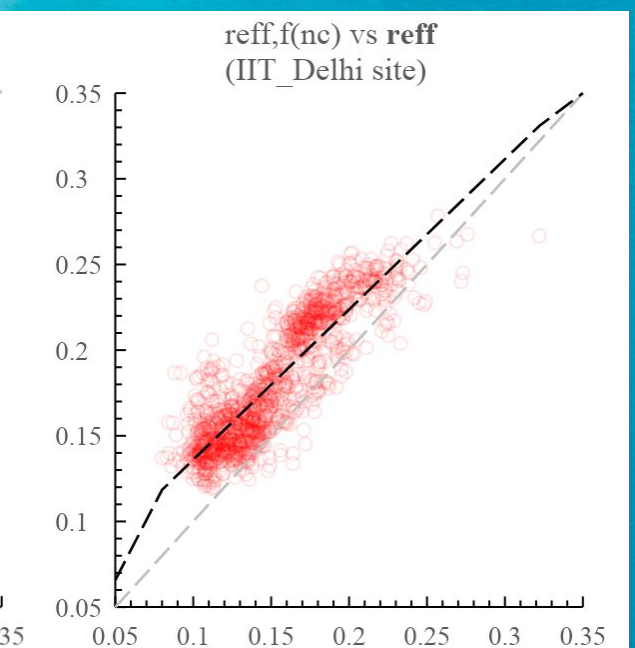
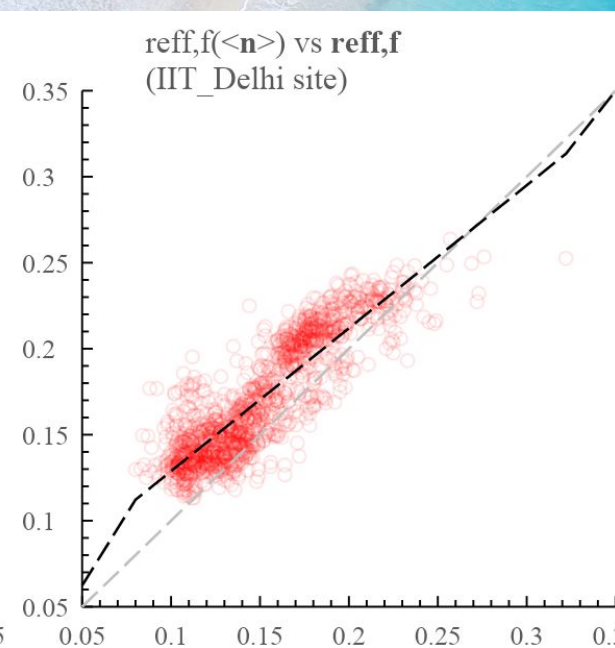
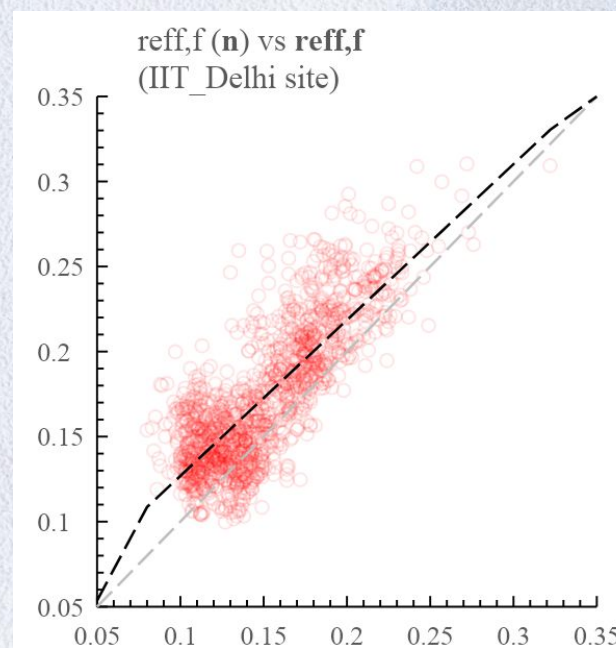
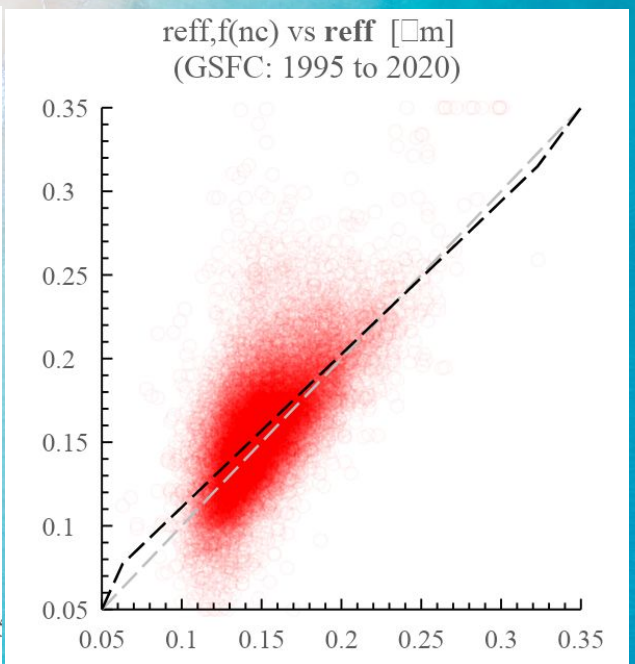
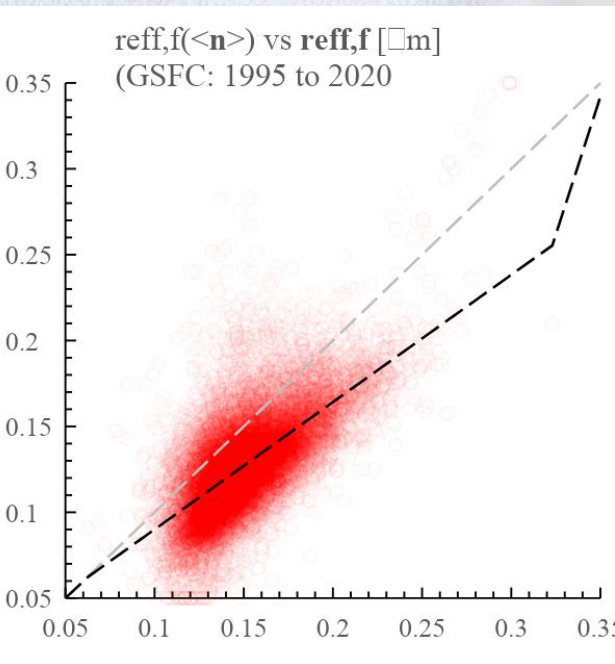
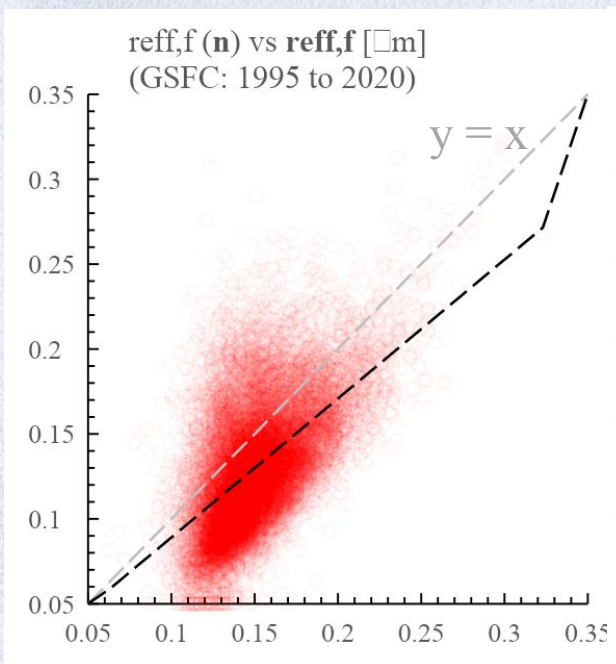
$$|(n - ik) - 1| \cong n - 1$$

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

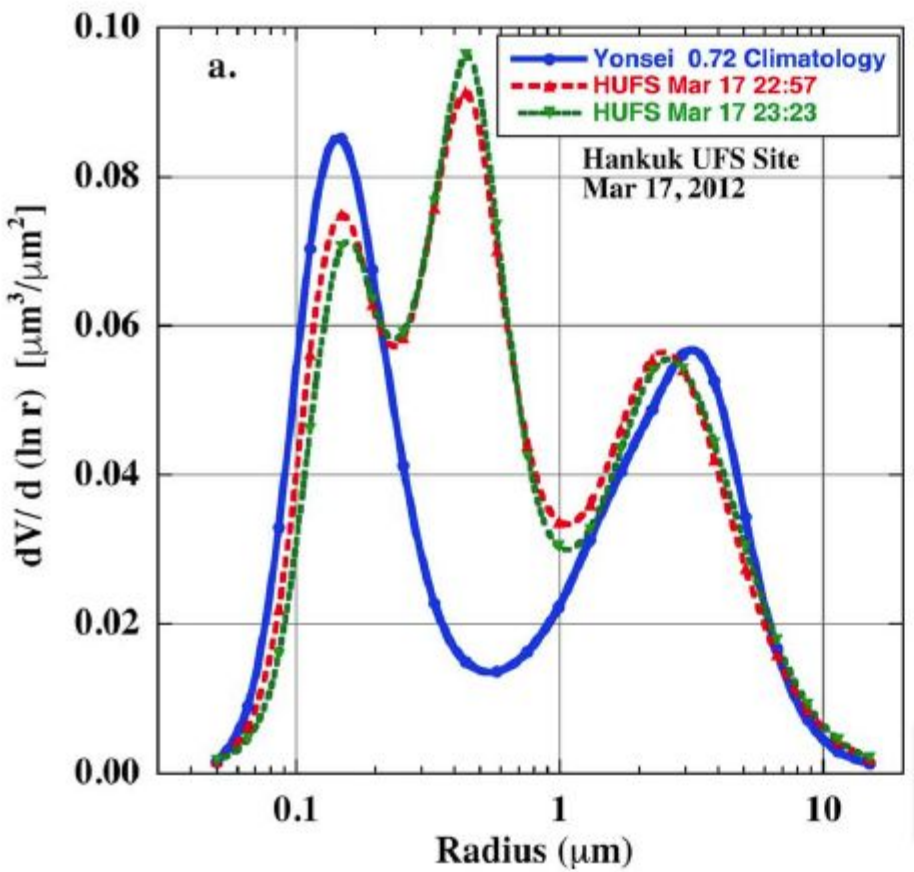
From the SDA/UCA (from α_f and α_f')

From AERONET inversion or a climatology

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



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

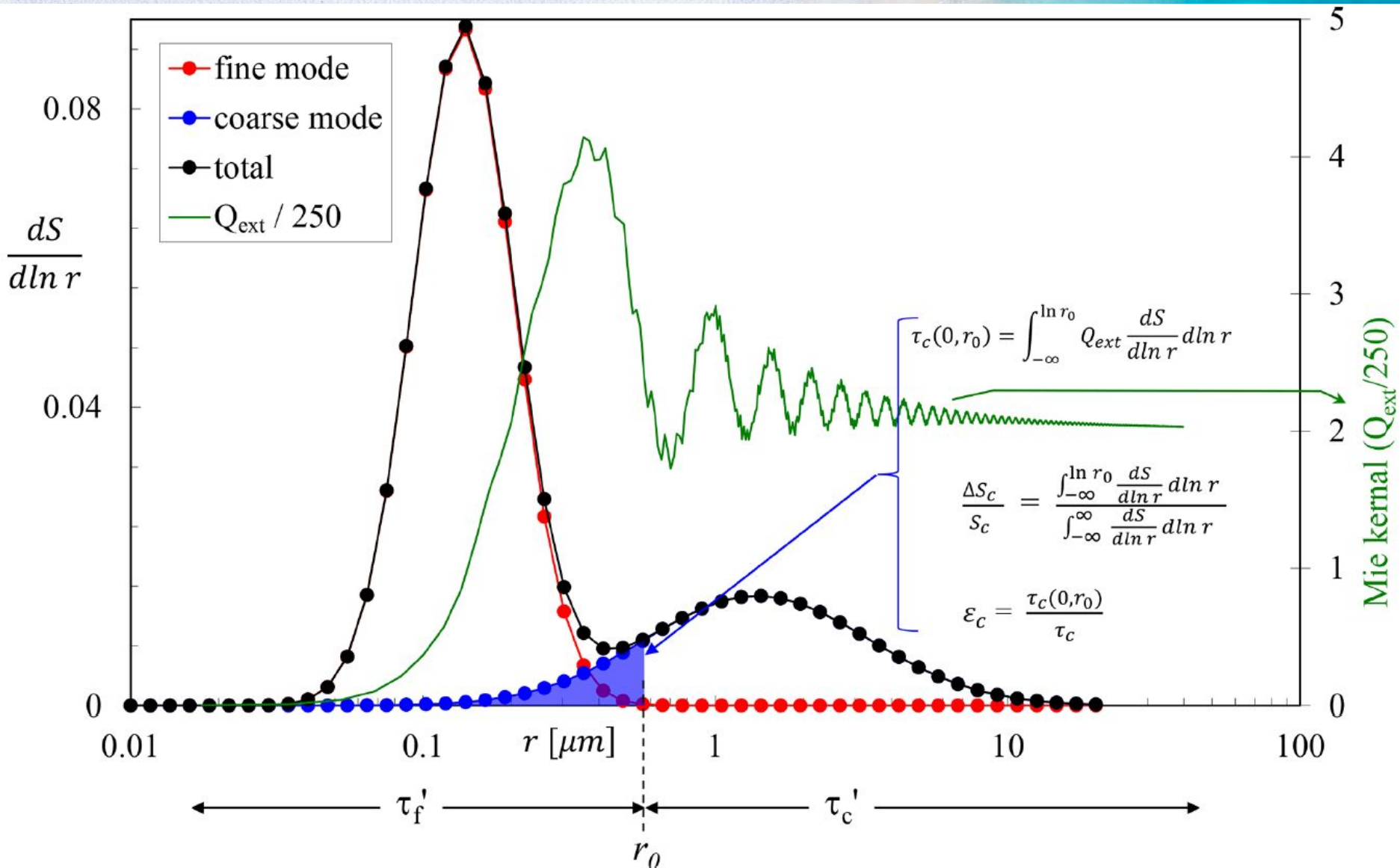


An aerial photograph of a coastline. The left side shows a wide, light-colored sandy beach. The right side shows the ocean with varying shades of turquoise and blue. The text is centered over the boundary between the beach and the water.

SMF vs FMF

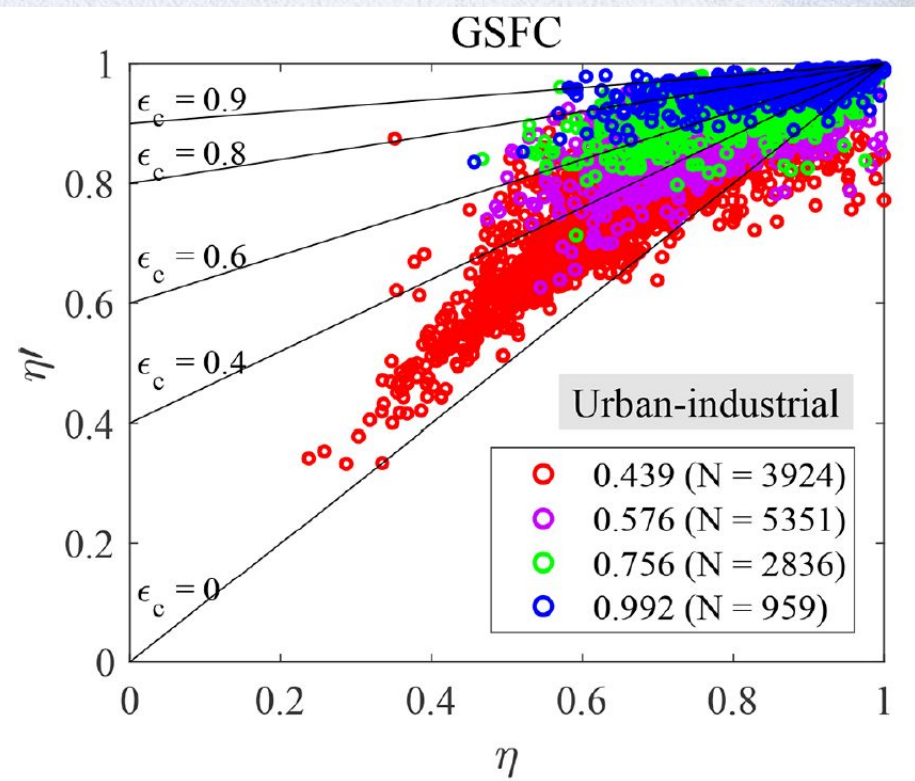
(Submicron fraction vs fine mode fraction)

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

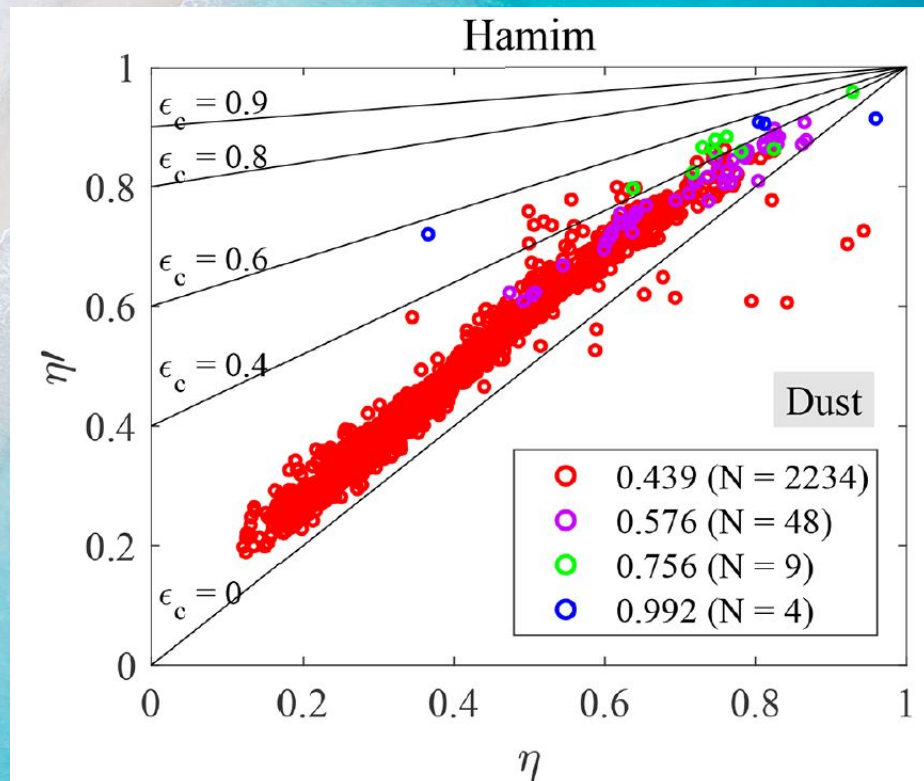


Sub-micron fraction (SMF) vs fine mode fraction (FMF) (SDA versus AERONET inversion analysis)

Fine mode dominated



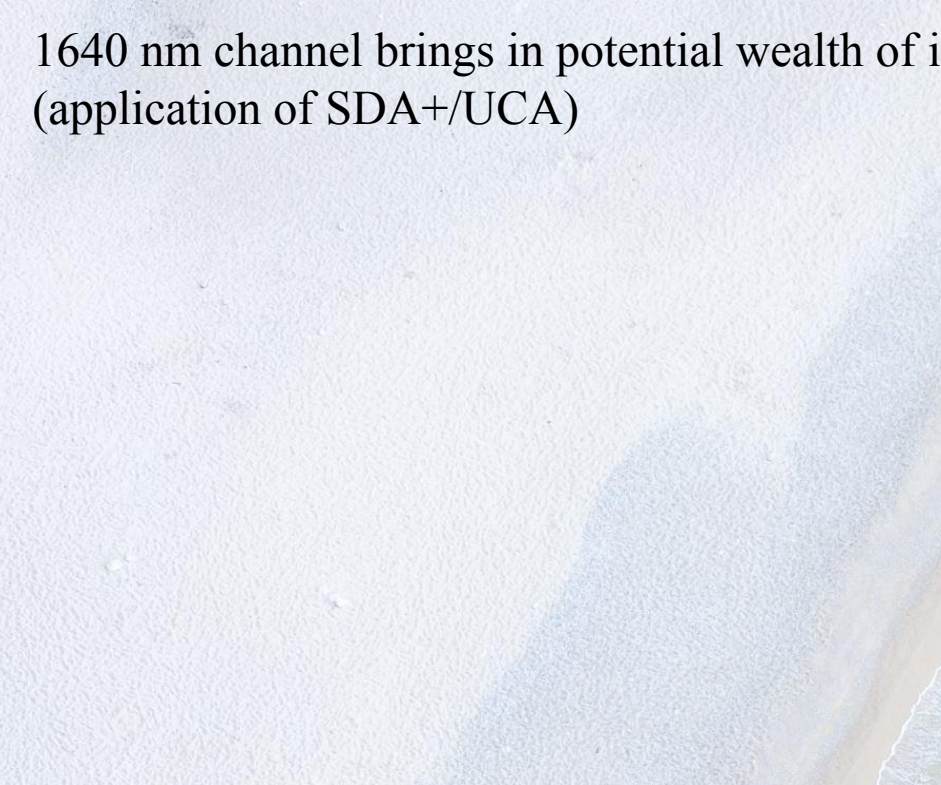
Coarse mode dominated



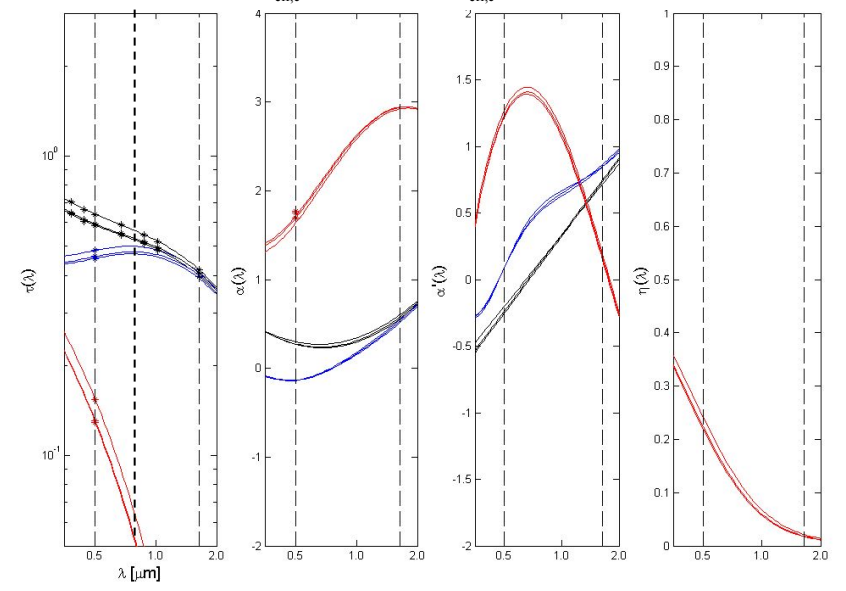
An aerial photograph of a tropical beach. The left side shows a wide expanse of white sand. A narrow strip of beach separates the sand from the turquoise water on the right. The water is clear and vibrant, with some darker blue patches further out. The overall scene is bright and serene.

SDA+ / UCA analyses

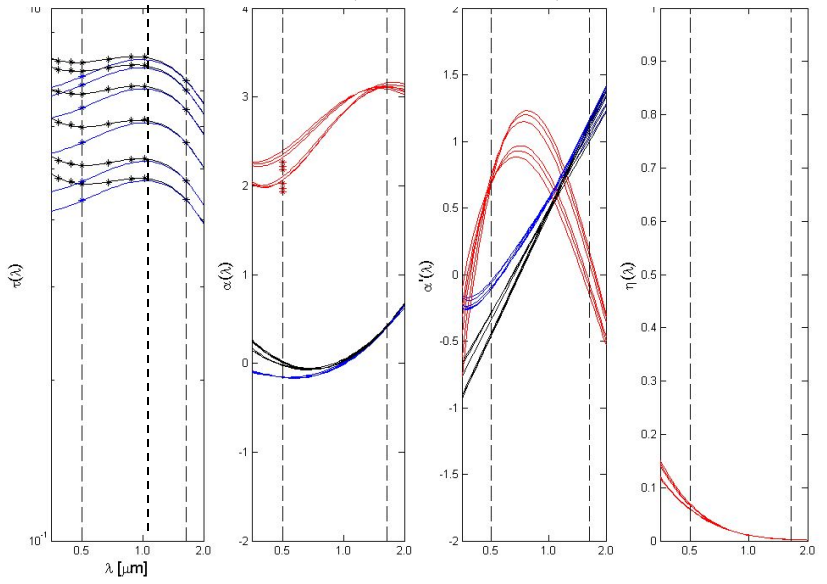
1640 nm channel brings in potential wealth of information (application of SDA+/UCA)



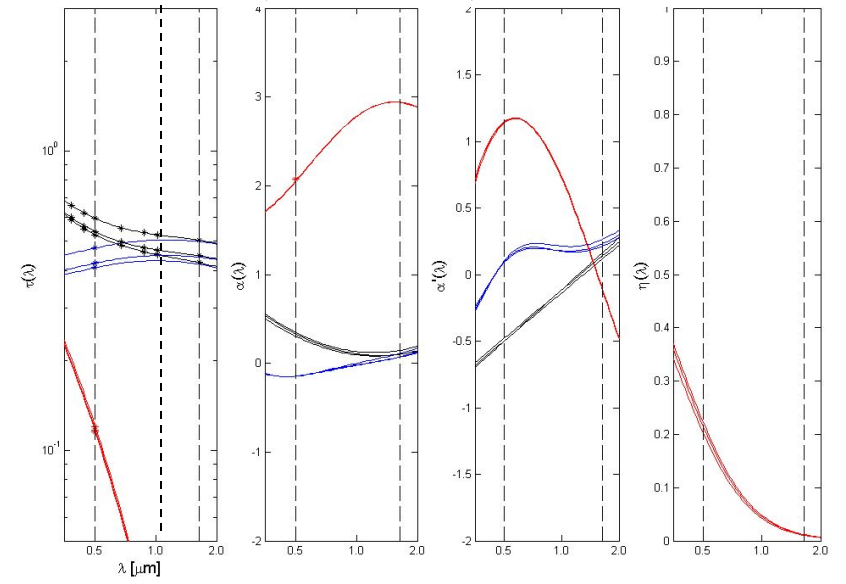
SMART, 238.2 to 239 ($r_{\text{eff,c}}(\text{SDA+}) = 0.8 \mu\text{m}$, $r_{\text{eff,c}}(\text{AERONET}) = 1.66 \mu\text{m}$)



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



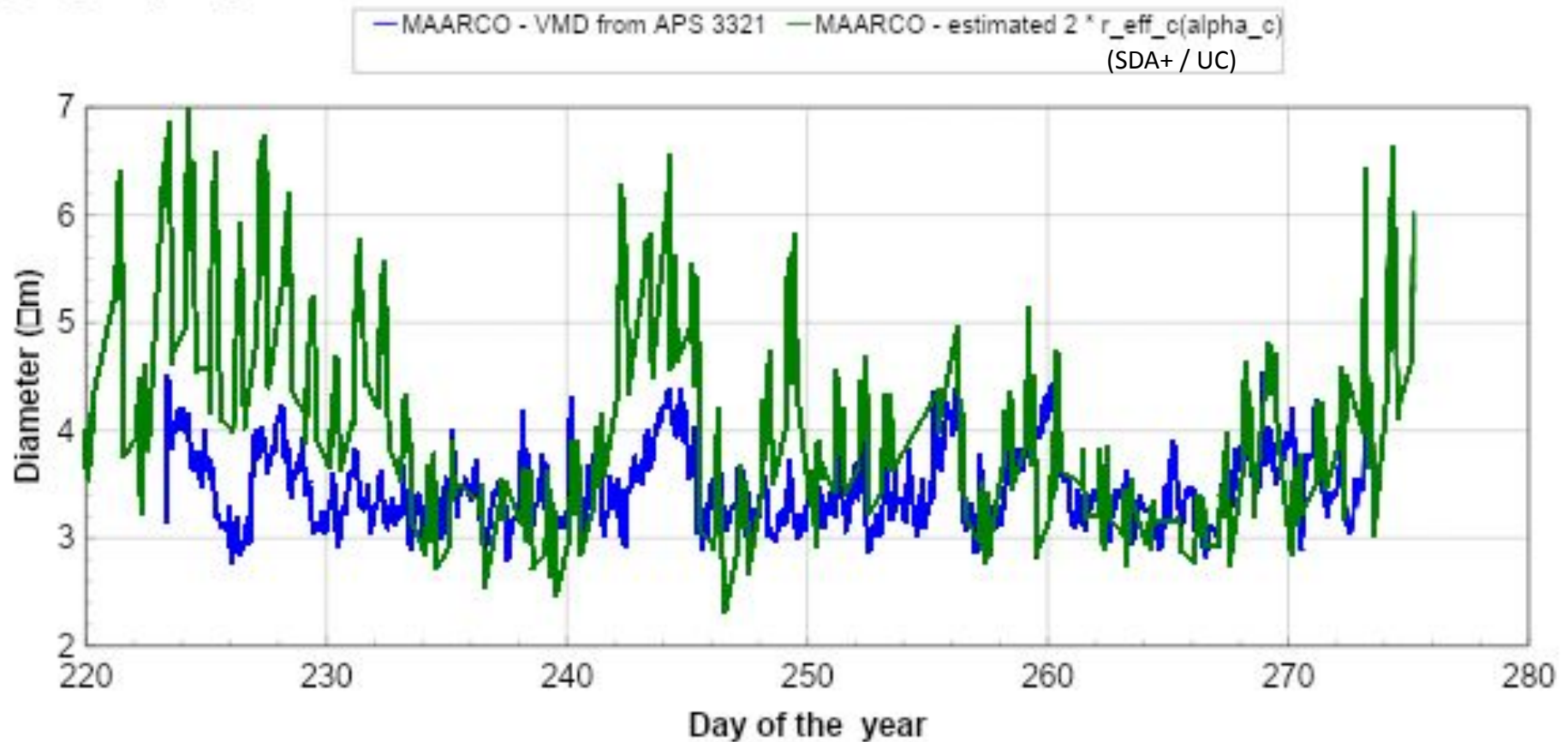
SMART, 224 to 225 ($r_{\text{eff,c}}(\text{SDA+}) = 2.05 \mu\text{m}$, $r_{\text{eff,c}}(\text{AERONET}) = 2.4 \mu\text{m}$)



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 $r_{\text{eff},c}$

(a) high frequency data



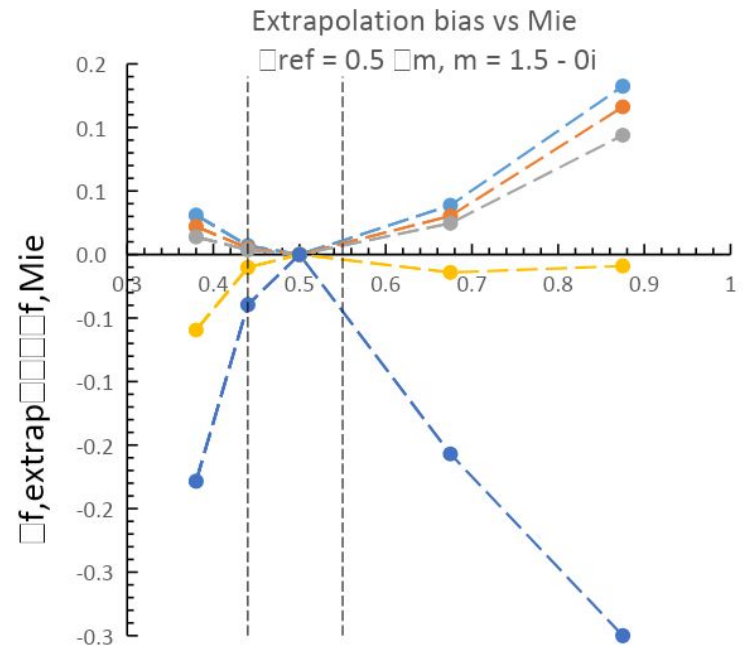
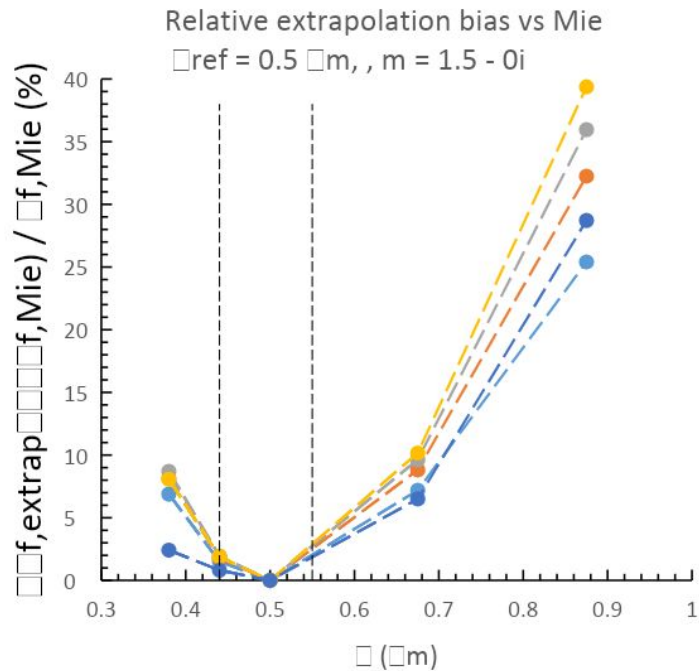
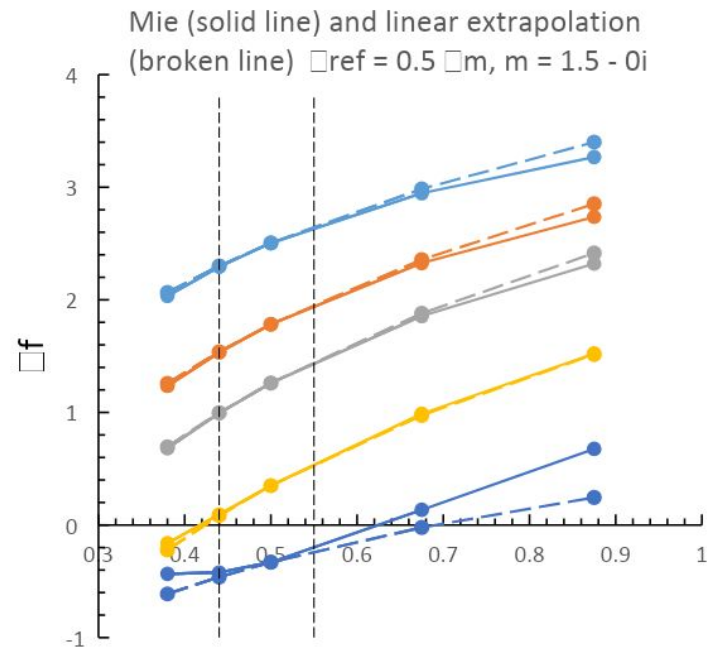
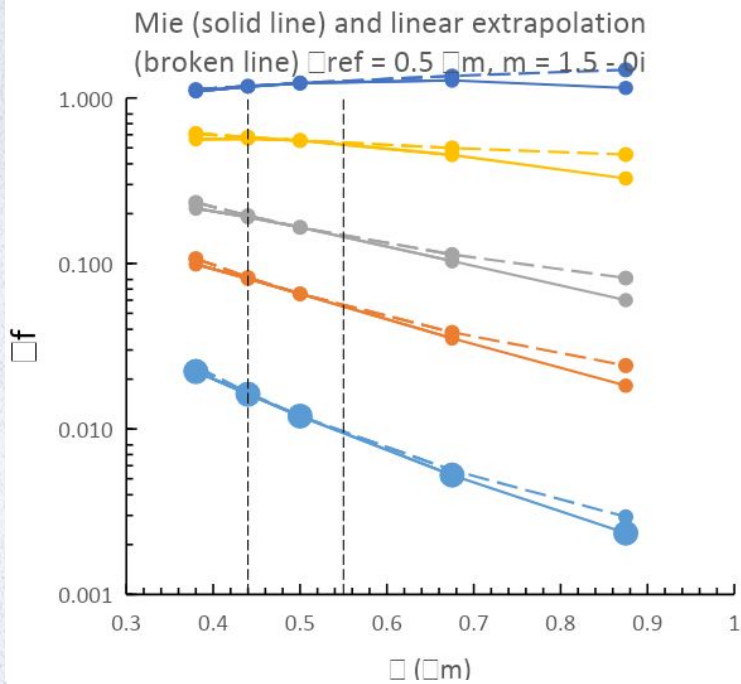
Thanks



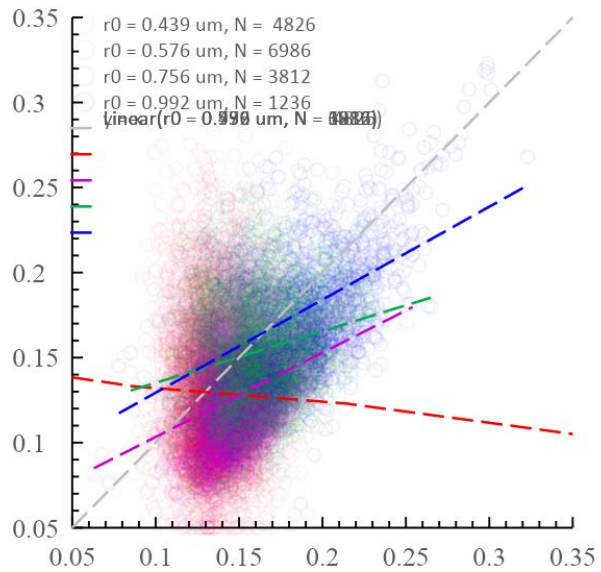
2009/08/20

An aerial photograph of a tropical beach. The left side shows a wide, light-colored sandy beach. The right side shows the ocean with clear, vibrant turquoise water. The text 'Extra slides' is centered over the image.

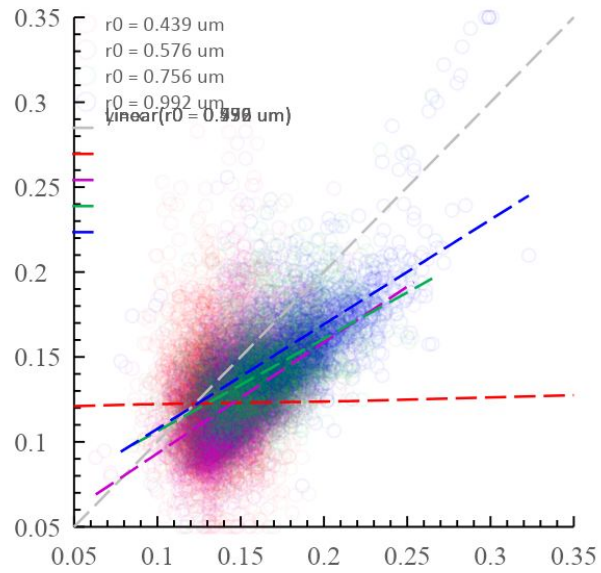
Extra slides



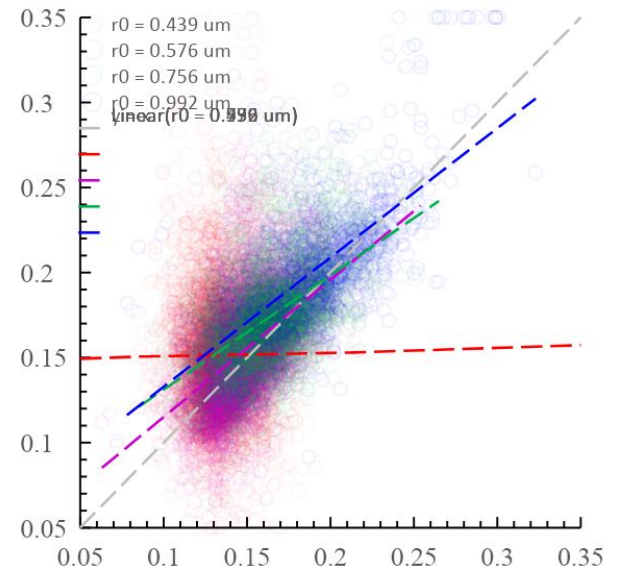
reff,f (n) vs reff,f [□m]
(GSFC: 1995 to 2020)



reff,f (<n>) vs reff,f [□m]
(GSFC: 1995 to 2020)



reff,f (nc) vs reff,f [□m]
(GSFC: 1995 to 2020)



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

