

“Potential Aerosol Absorption Measurements by MODIS and its Effects on the Aerosol Radiative Forcing”

J. Vanderlei Martins, (UMBC), Lorraine Remer, (NASA GSFC)
Hong-Bin Yu, (UMBC), and Charles Ichoku, (UMCP)

Absorption measurements from space requires bright and well known surface/background properties.

MODIS:

Ocean: Sunlint

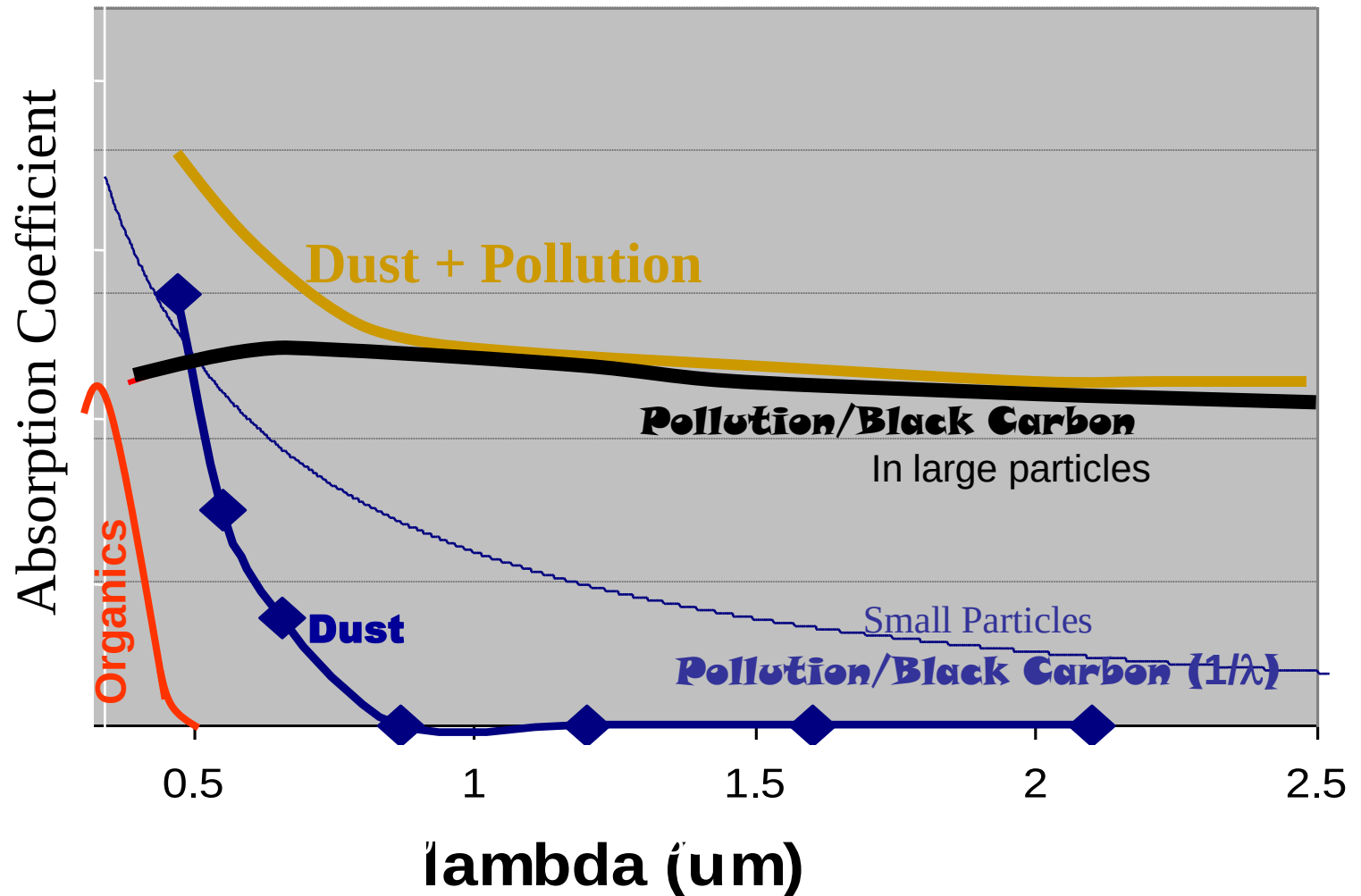
- Characterization of the surface BRF (2.1 μ m)
- Accurate Aerosol Scattering Properties (Glory Mission)

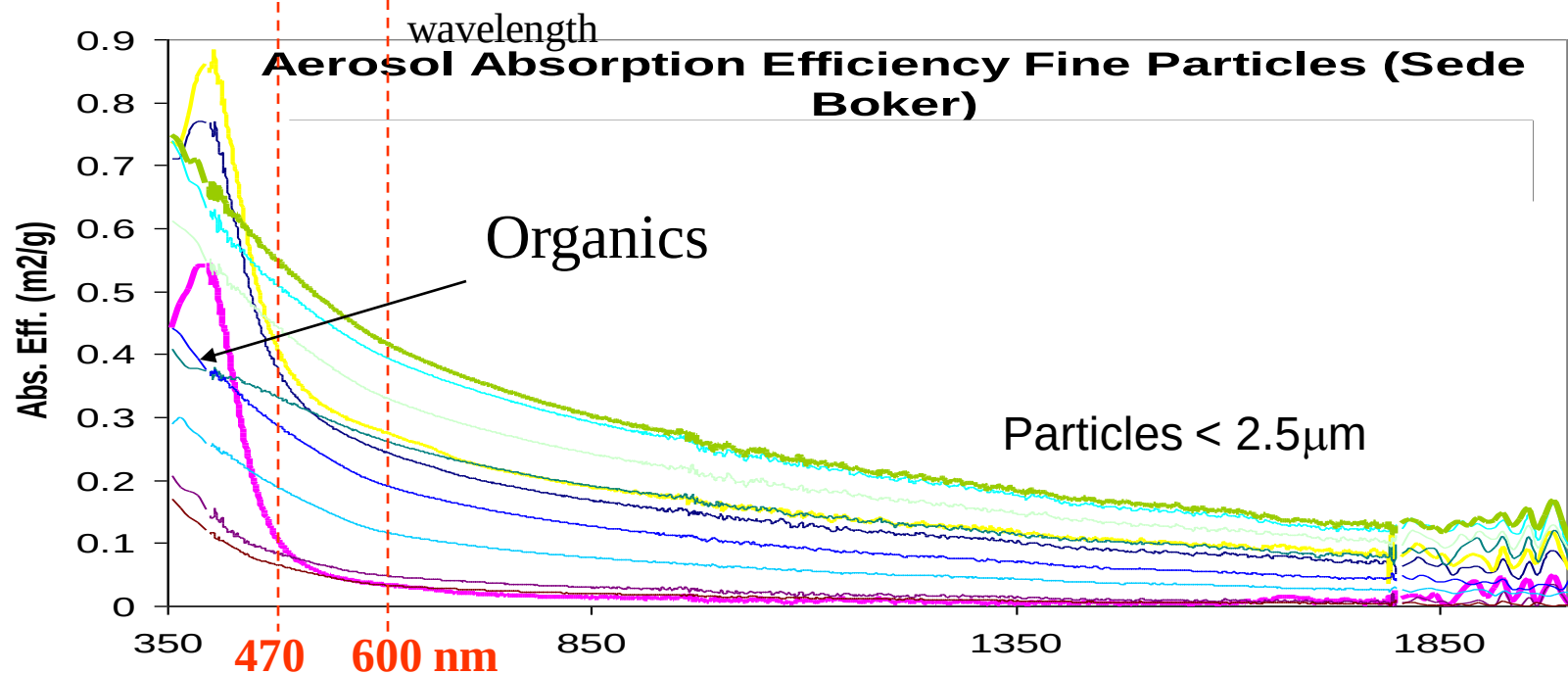
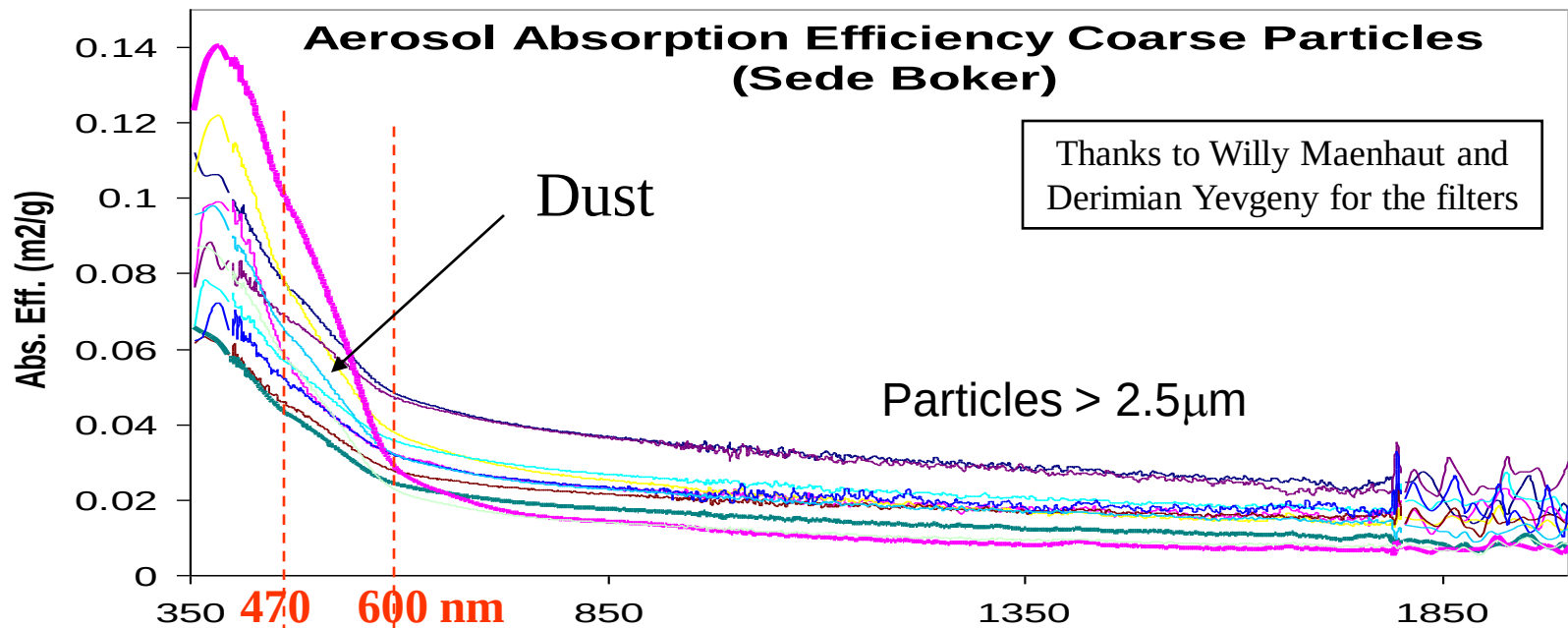
Land:

- Deep Blue (short wavelengths)
- **Critical Reflectance (broad spectral range)**

Great opportunity from MODIS Broad Spectral Range:

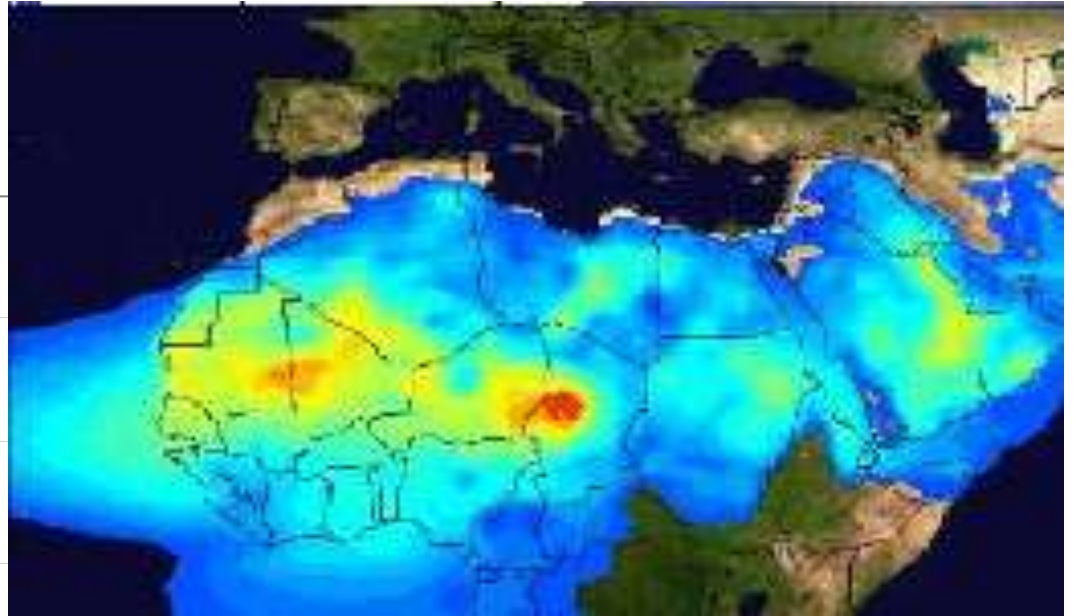
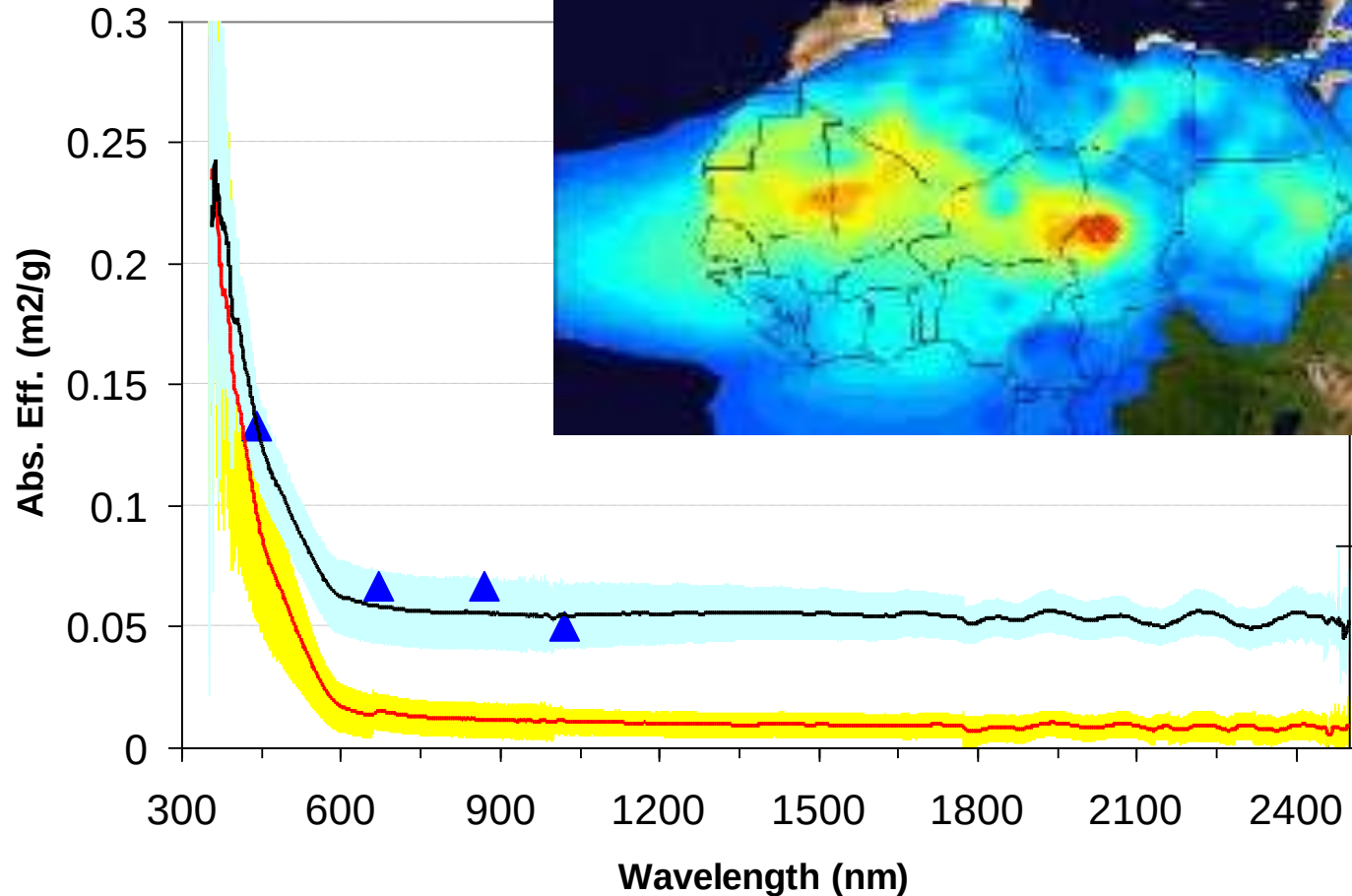
Aerosol Composition: Size X Refractive indices X Mixture



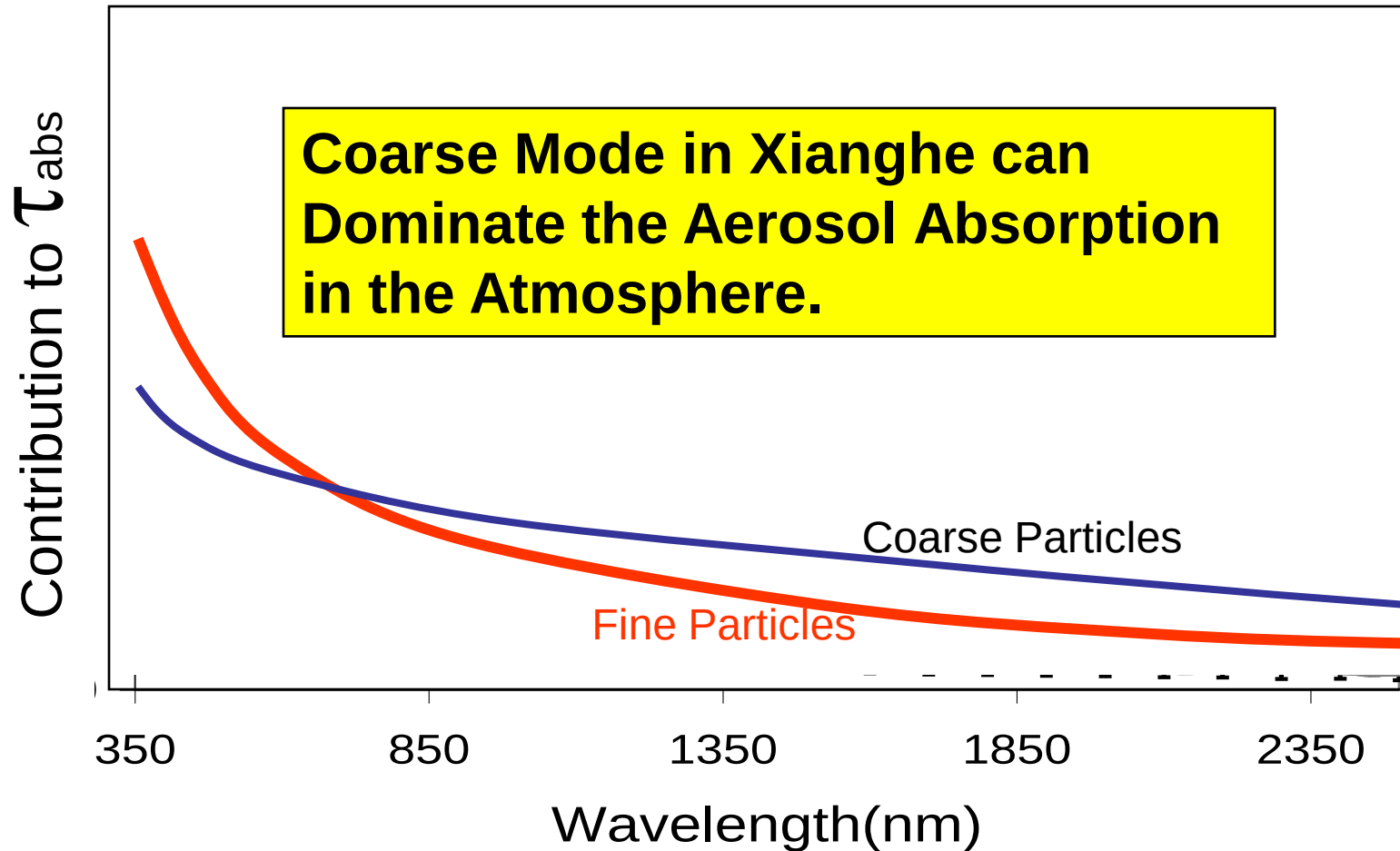


Dust absorption Efficiency in the Bodele Depression

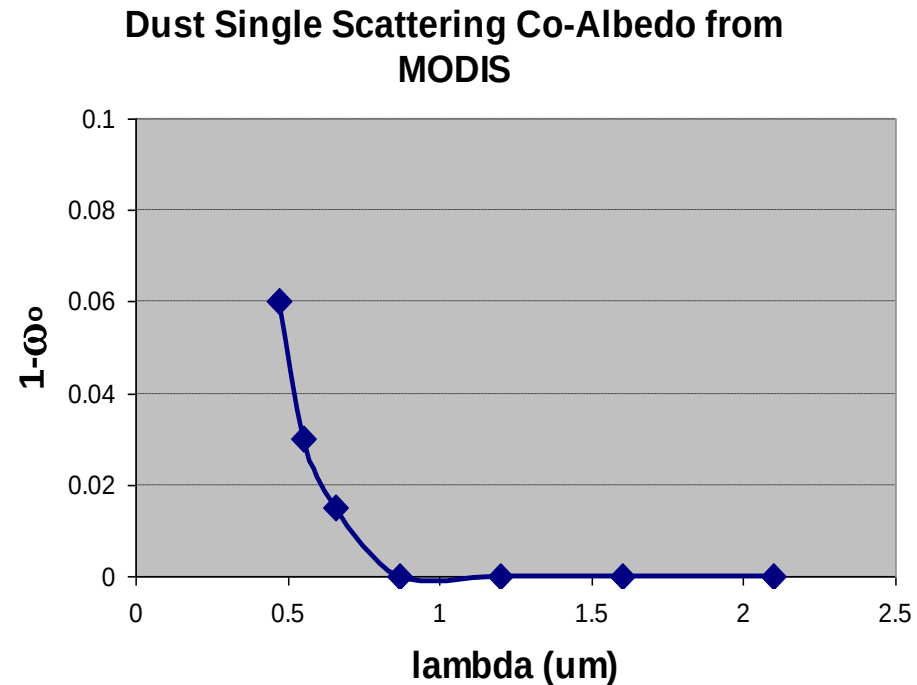
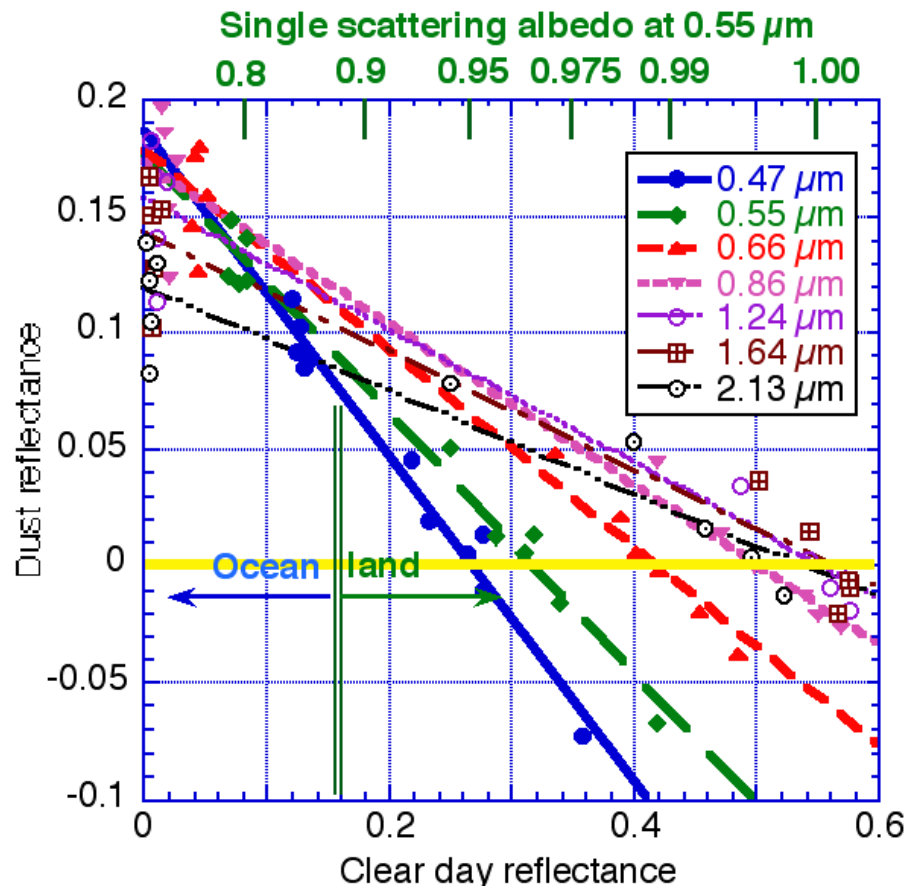
BODEX Experiment:
Samples collected by
Martin Todd and collaborators



Aerosols from Xianghe China

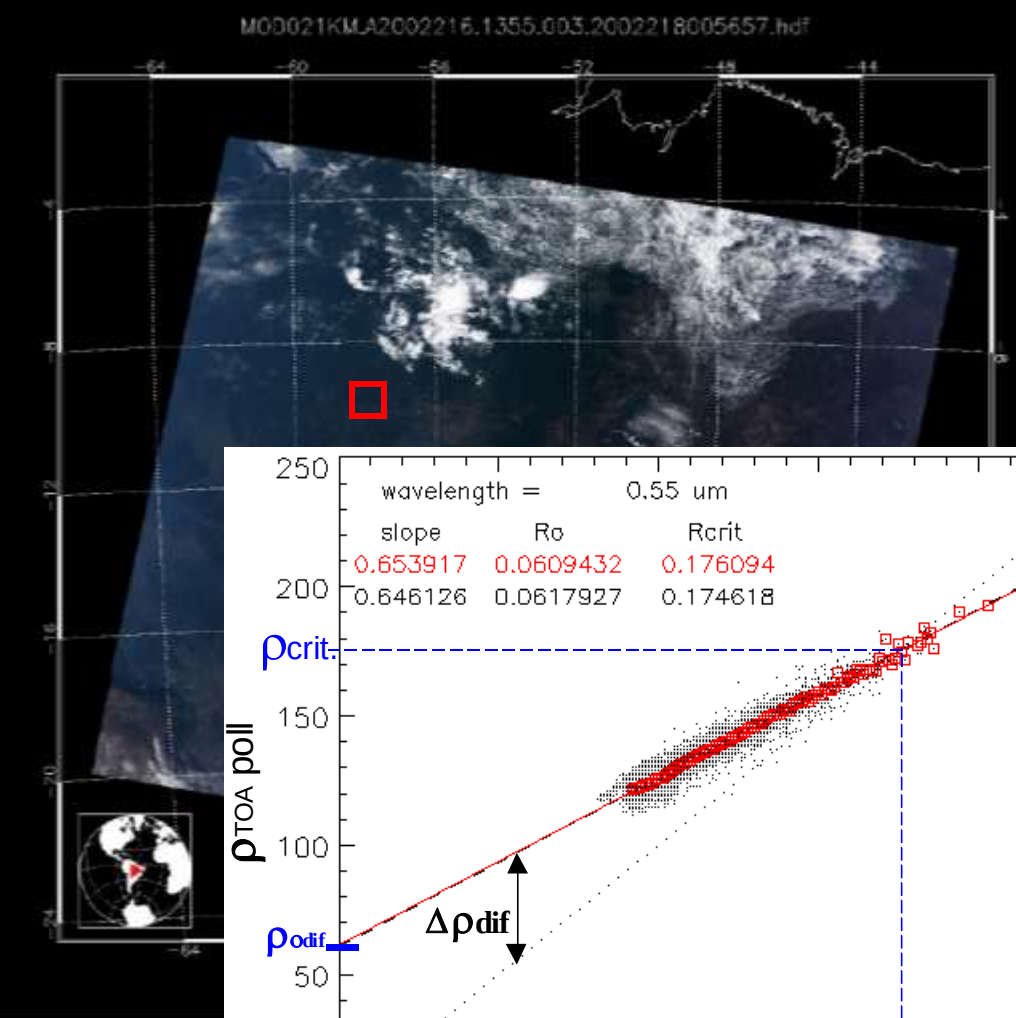


Remote Sensing of Aerosol Absorption

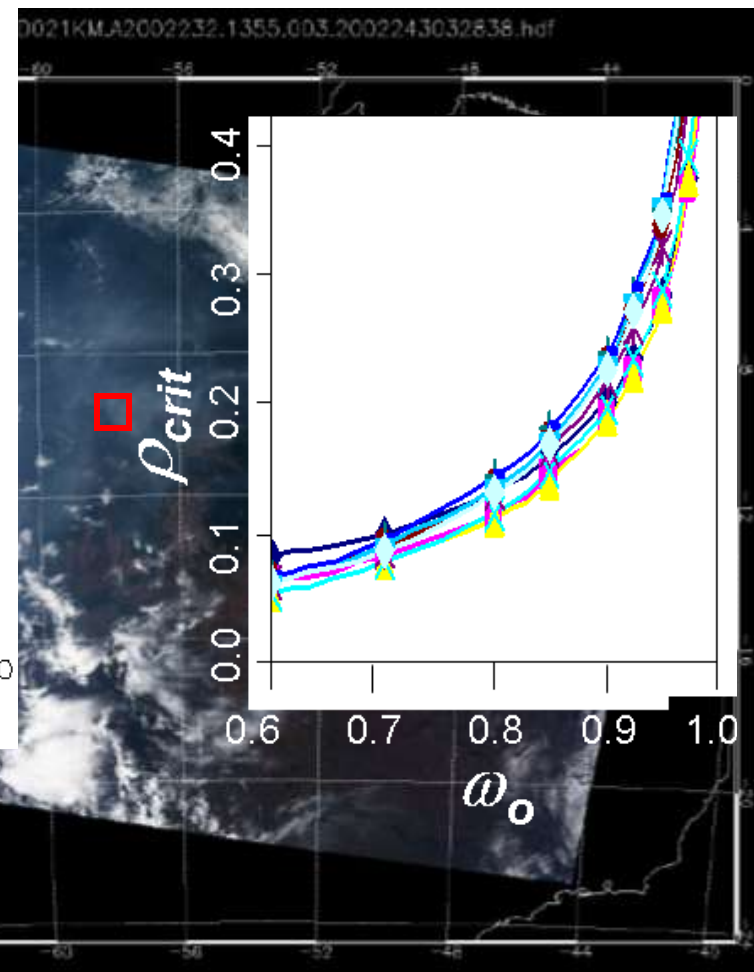
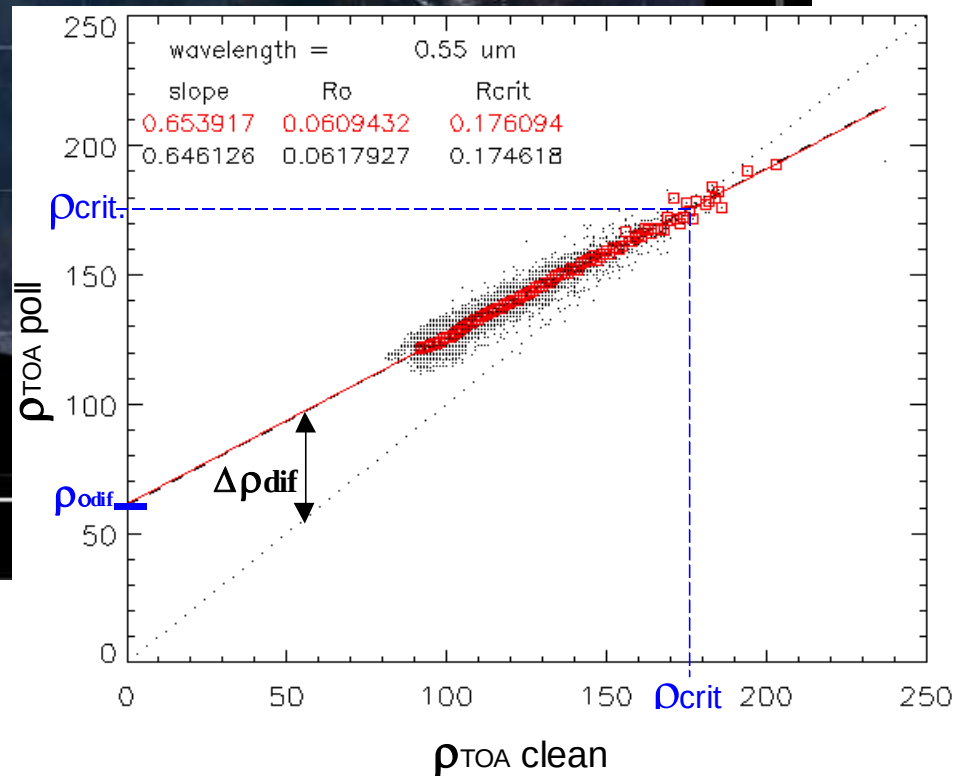


Derivation of the single scattering albedo of dust from MODIS spectral measurements. The spectral single scattering albedo is 0.94 in the blue (0.47 μm), 0.97 in the green (0.55 μm), 0.985 in the red (0.66 μm) and 1.00 for longer wavelengths.

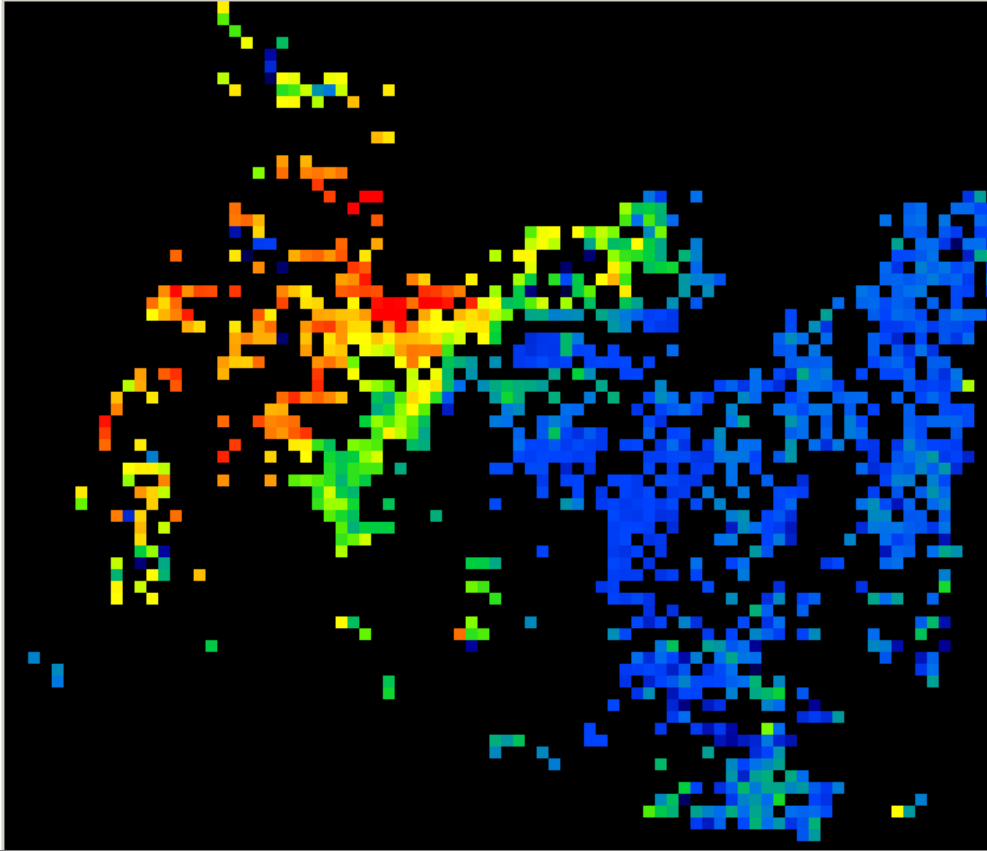
MOD021KMA2002216.1355.003.2002218005657.hdf



**Comparison of
10x10km boxes
between both images
for each wavelength**

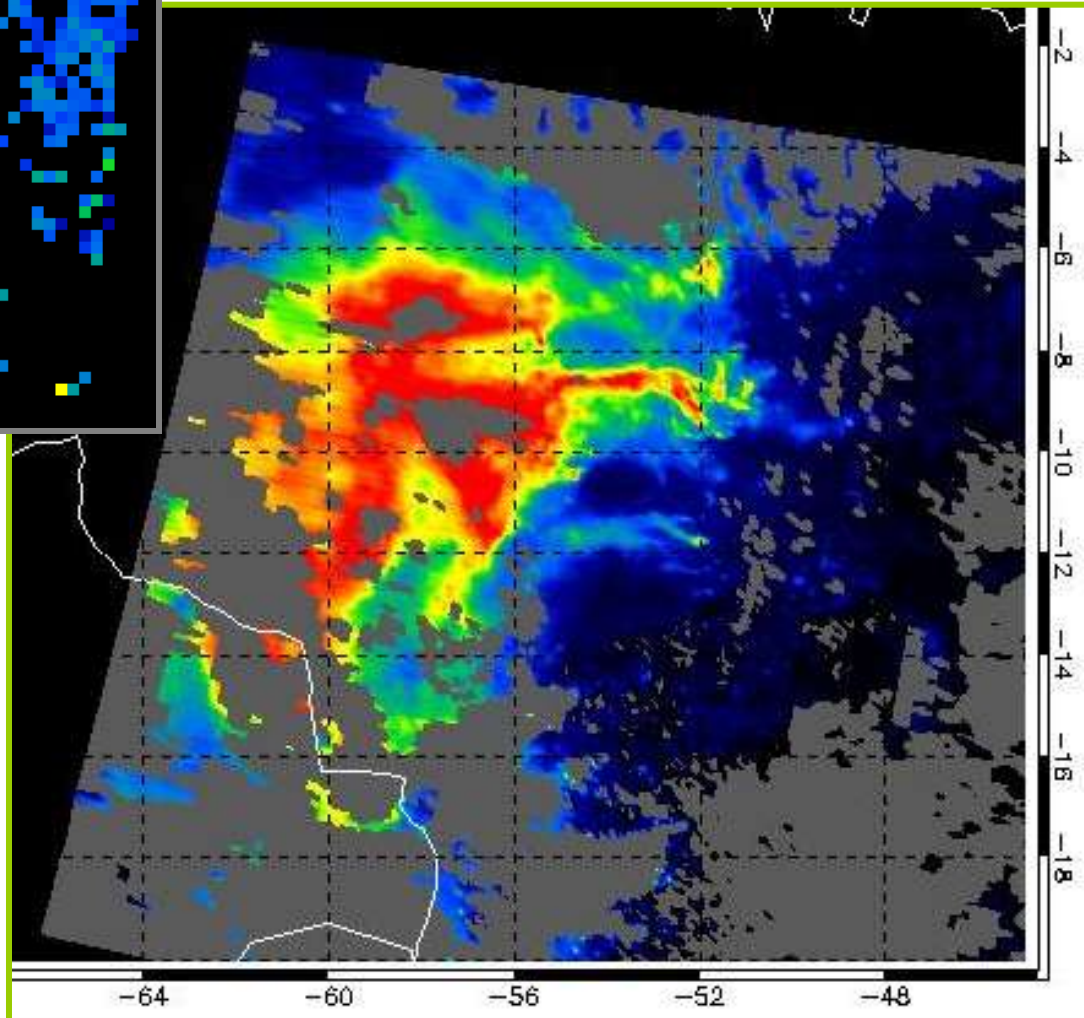


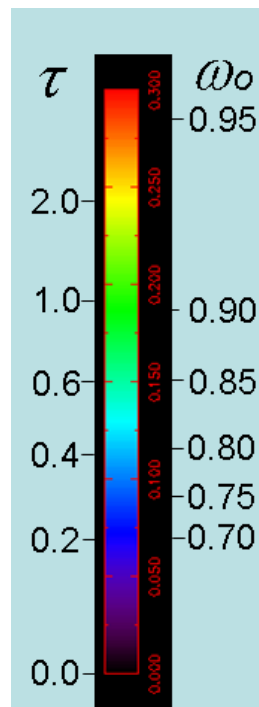
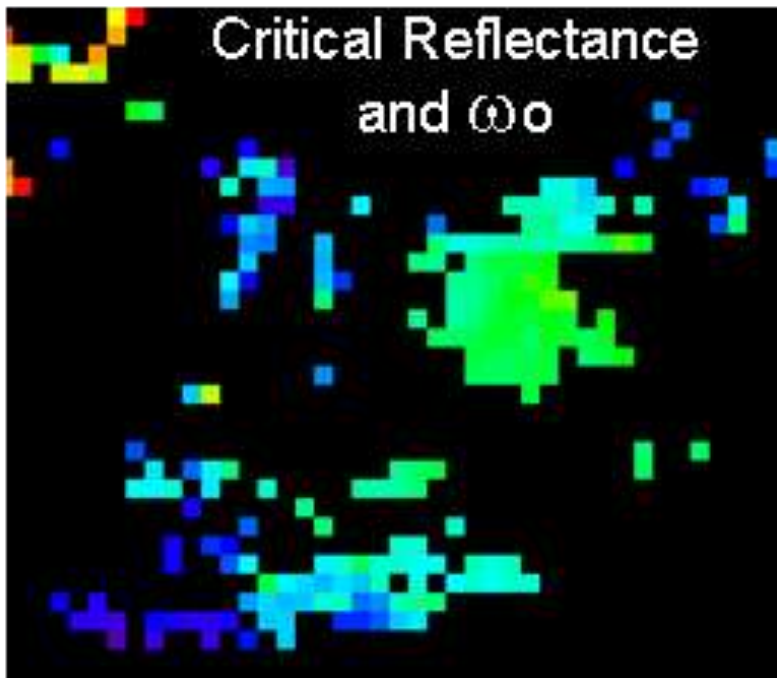
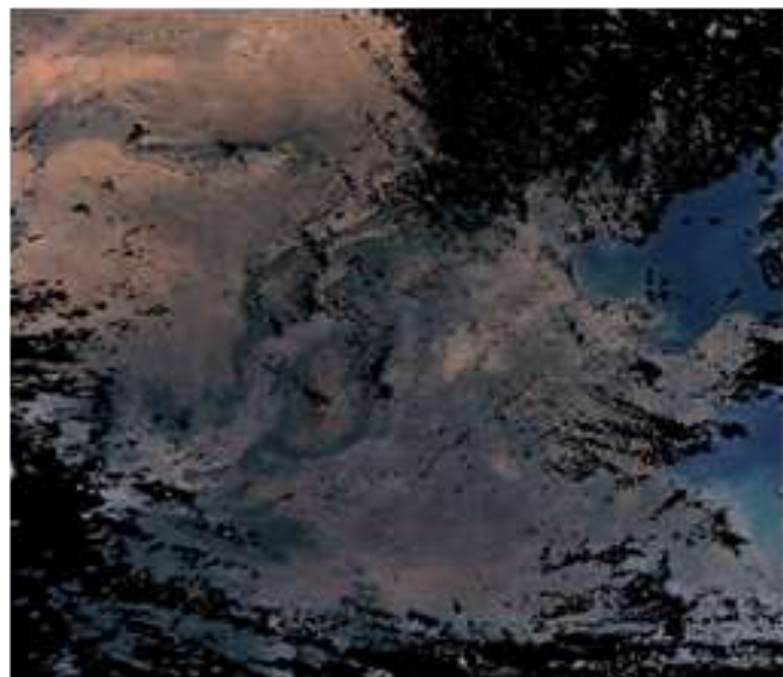
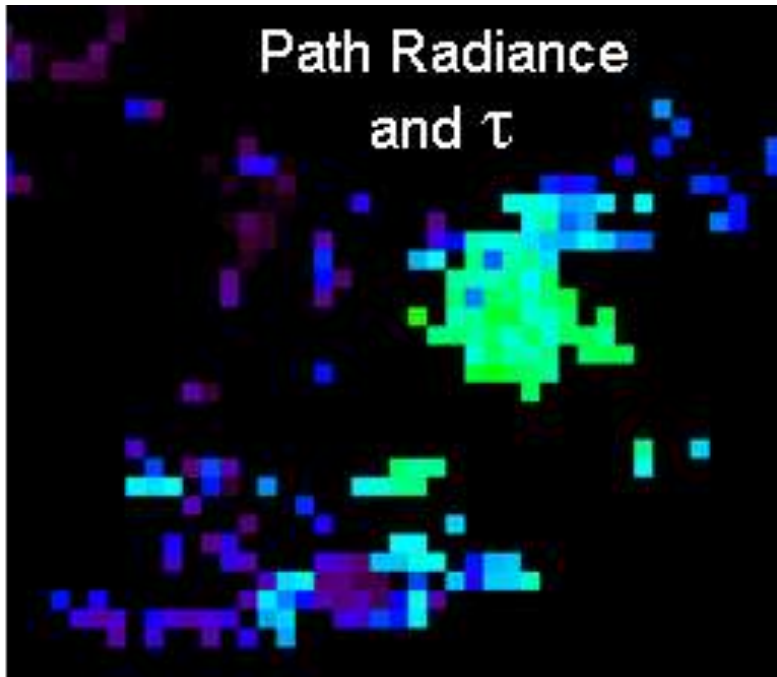
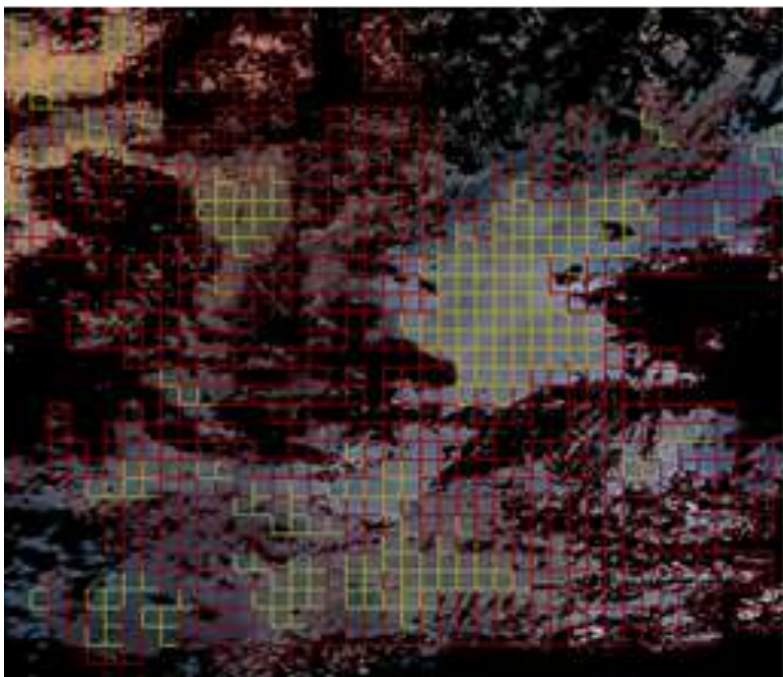
Operational Modis AOT Product (smoothed)

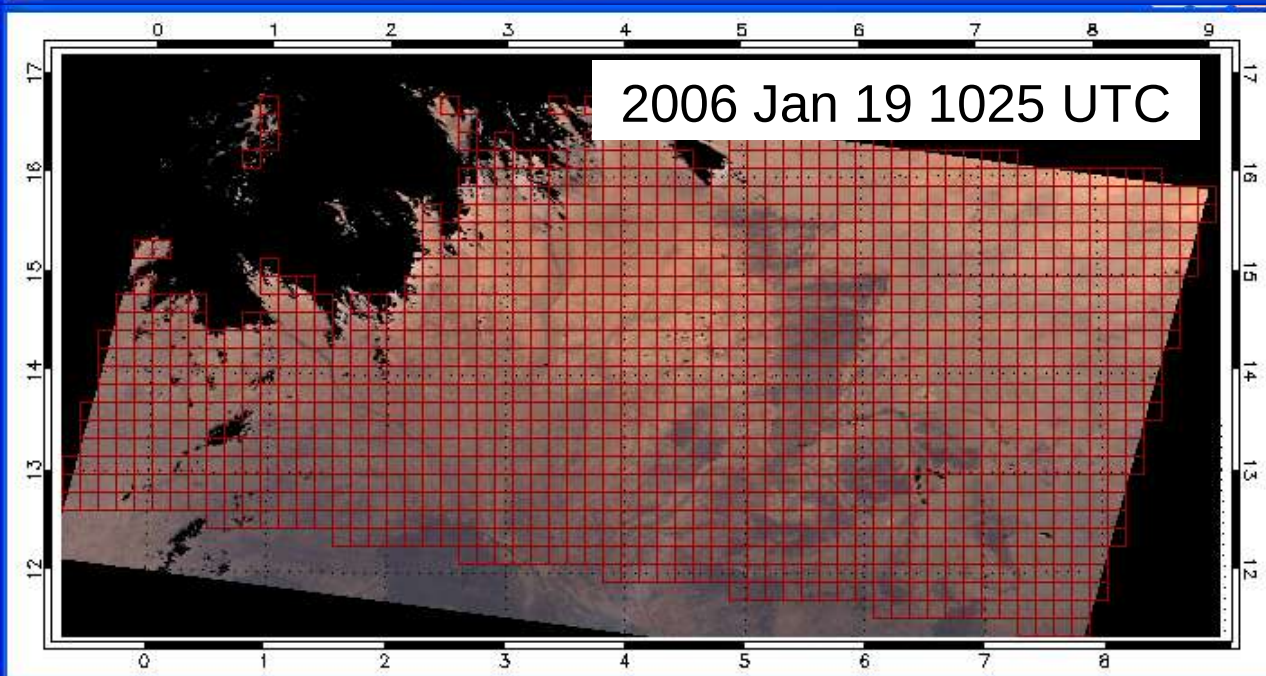
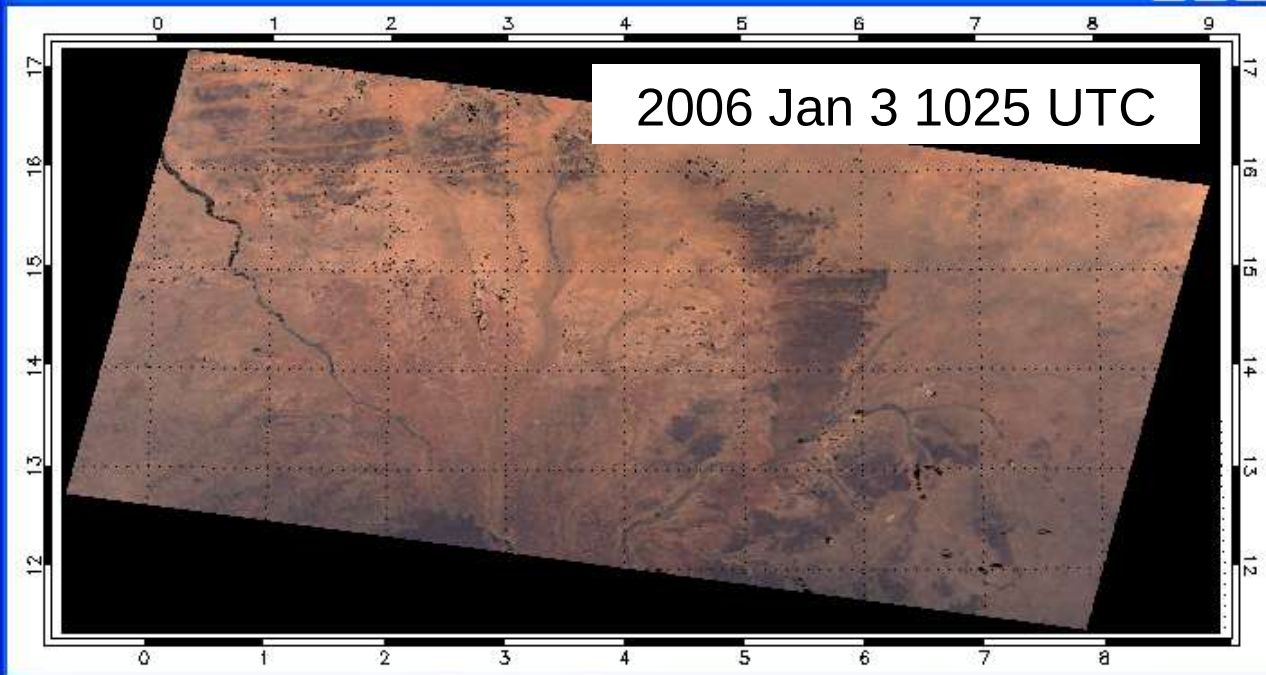


Path Radiance $0.66\mu\text{m}$
from the 2 days
comparison

(min=-0.05,max=0.15)







Critical Reflectance Estimates for 19 Jan 2006:

- Two estimates with day-16 (Jan 3) and day+16 (Feb 4)
- MODIS Terra Level 1B
- Rebinned to ~1.5 km res
- 10 x 10 pixel boxes
- Regressed polluted reflectances onto reflectances from cleaner day

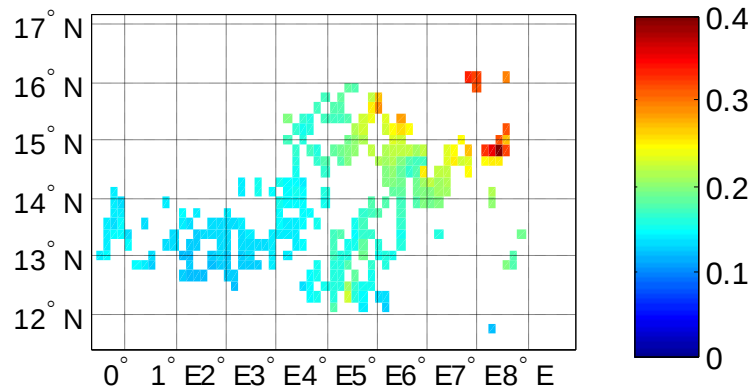
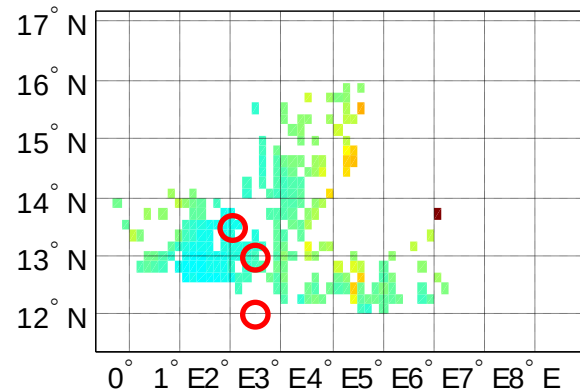
Assumptions:

- AOD invariant in box
- Background aerosol same on both days
- Surface invariant from day 1 to day 2

2006Jan3-19 Chan 4 Critical Reflectance

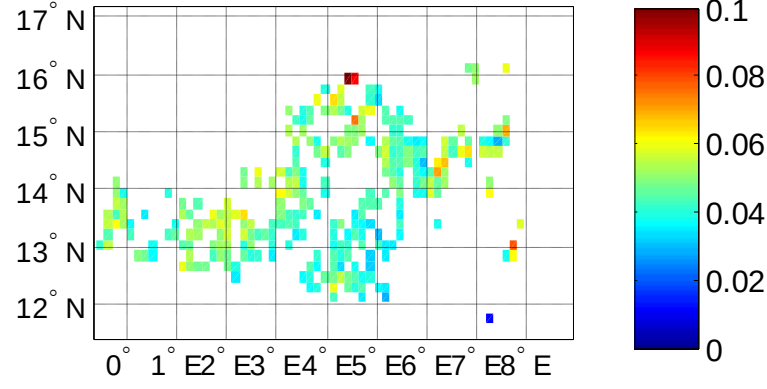
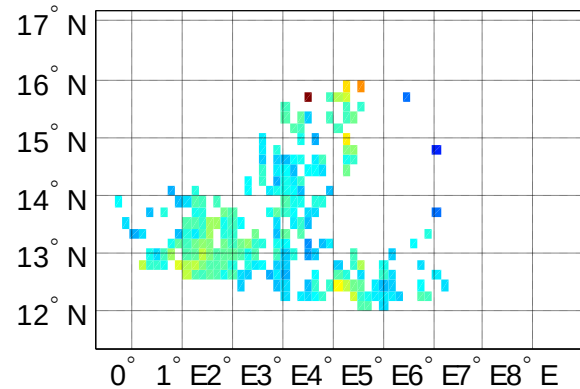
2006Jan19-Feb 4 Chan 4 Critical Reflectance

550 nm
(circles denote
flight profiles)



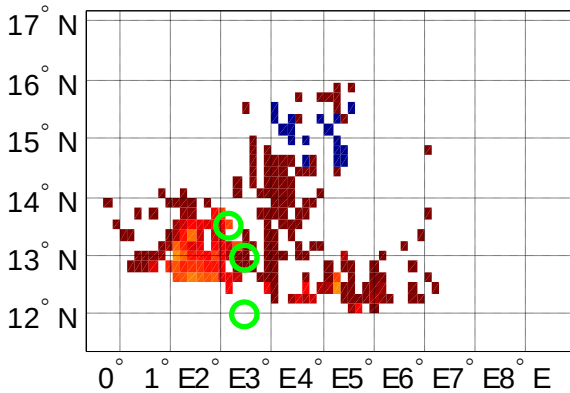
2006 Jan3-19 Chan 4 Path Radiance Dif

2006 Jan 19-Feb 4 Chan 4 Path Radiance Dif

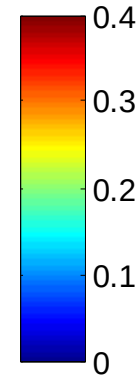
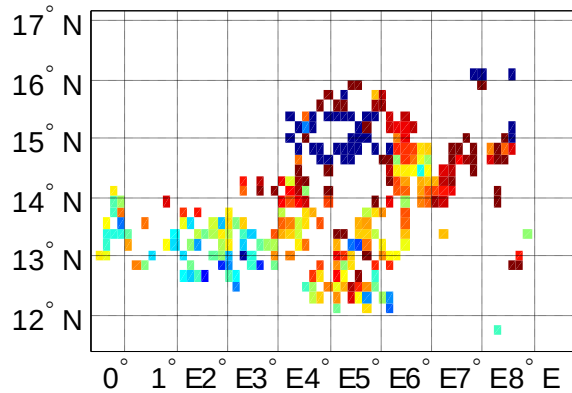


- Same spatial patterns, but critical reflectance generally lower (more absorbing) using the day+16 pair
- Inverse relationship between path radiance and critical reflectance, generally (more biomass burning aerosol on Jan 19)
- Larger path radiance for second pair of days (Feb 4 cleaner than Jan 19)

2006Jan3-19 Chan 6 Critical Reflectance

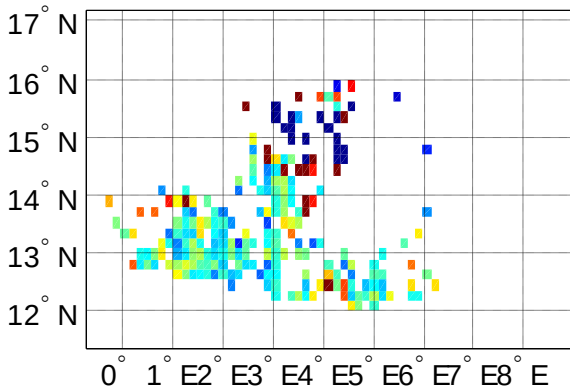


2006Jan19-Feb 4 Chan 6 Critical Reflectance

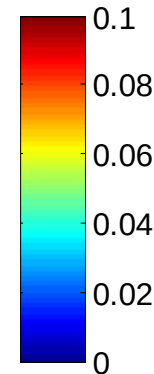
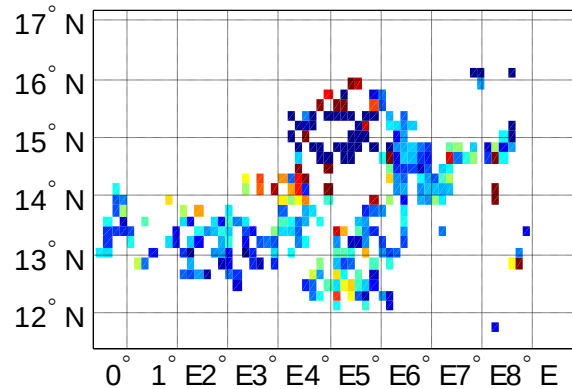


1.63 μm
(circles
denote flight
profiles)

2006 Jan3-19 Chan 6 Path Radiance Dif

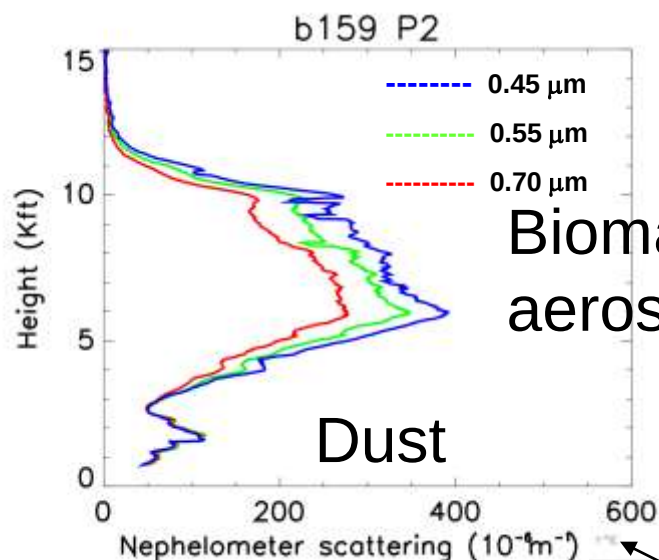


2006 Jan 19-Feb 4 Chan 6 Path Radiance Dif



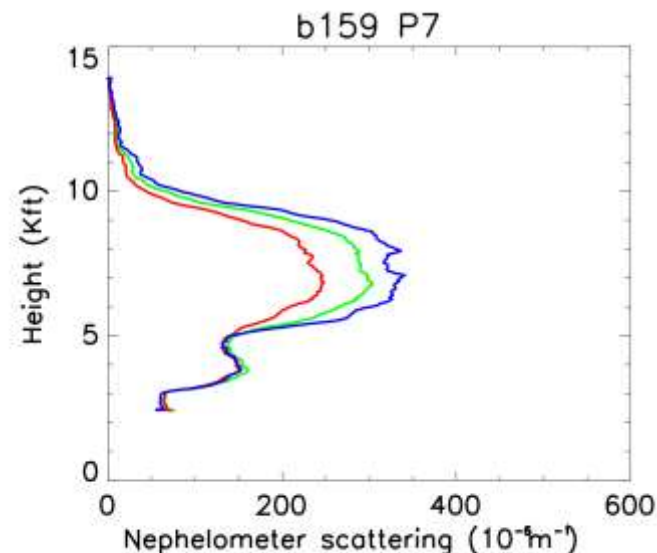
- Same spatial patterns in 1.6 μm for first pair of days, signal indicates presence of dust on 19 Jan, larger path radiances than second pair of days
- Lots of noise in second pair of days in critical reflectance and path radiance, dust concentration may be comparable between these two days

B159 Nephelometer profiles

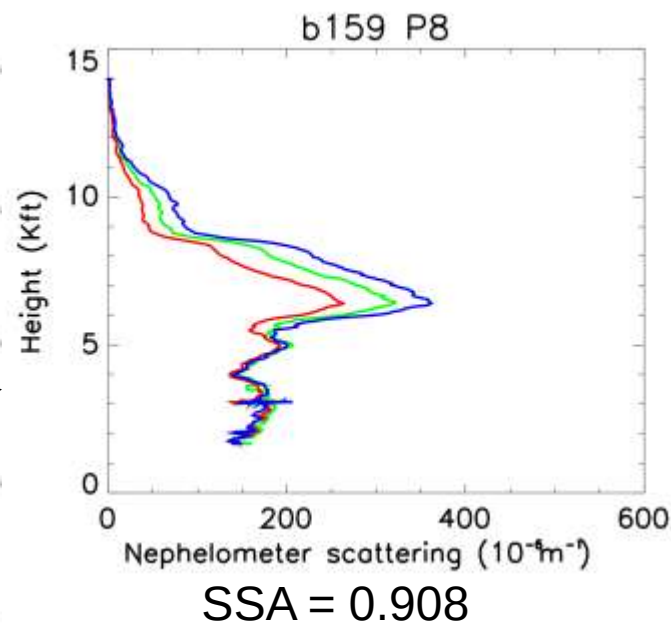
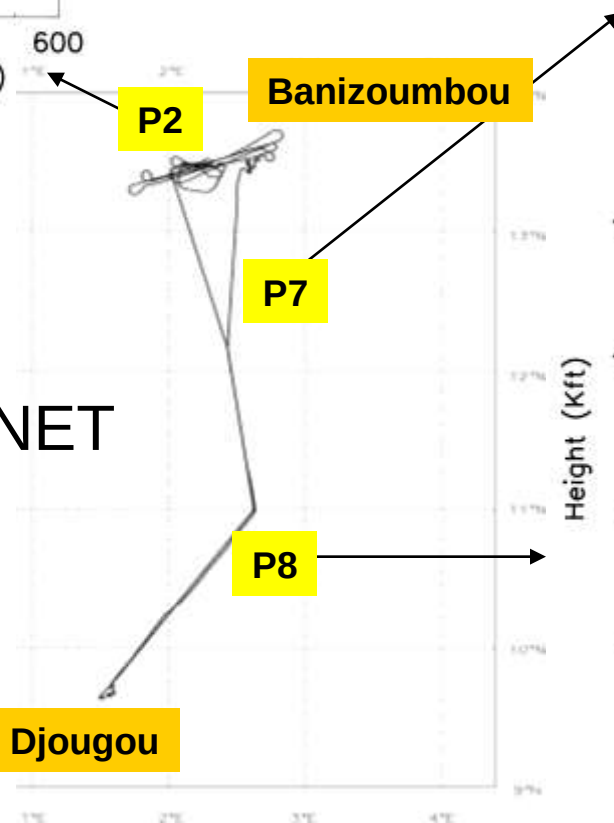


Biomass-burning
aerosol layer

Dust



Location of
Profiles & AERONET



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**MODIS Broad Spectral Range Provides Great
Opportunity for the Remote Sensing of Aerosol
“Composition” from Space and its Effects on the
Aerosol Forcing.**

Thank you!!!