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

MODIS:

Ocean: Sunglint
- Characterization of the surface BRF (2.1um)
- 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
Aerosol Absorption Efficiency Coarse Particles (Sede Boker)

Dust

Particles > 2.5μm

Organics

Particles < 2.5μm

Thanks to Willy Maenhaut and Derimian Yevgeny for the filters
Dust absorption Efficiency in the Bodele Depression

BODEX Experiment:
Samples collected by Martin Todd and collaborators
Aerosols from Xianghe China

Coarse Mode in Xianghe can Dominate the Aerosol Absorption in the Atmosphere.
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.

Kaufman et al., GRL 2002
Comparison of 10x10km boxes between both images for each wavelength.
Operational Modis AOT Product (smoothed)

Path Radiance 0.66μm 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
• 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)
• Same spatial patterns in 1.6 um 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

Slides by Kelley C. Wells, CSU
B159 Nephelometer profiles

Location of Profiles & AERONET

Biomass-burning aerosol layer

Dust

SSA = 0.886

SSA = 0.890

SSA = 0.908

Slide courtesy of Ben Johnson
“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)


Thank you!!!