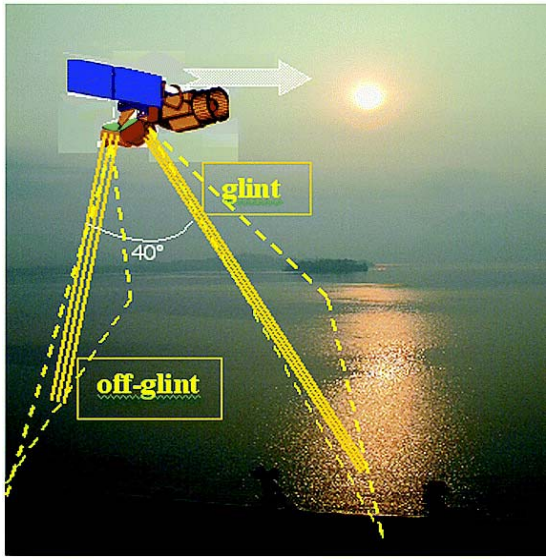
Measuring Aerosol Absorption from Space

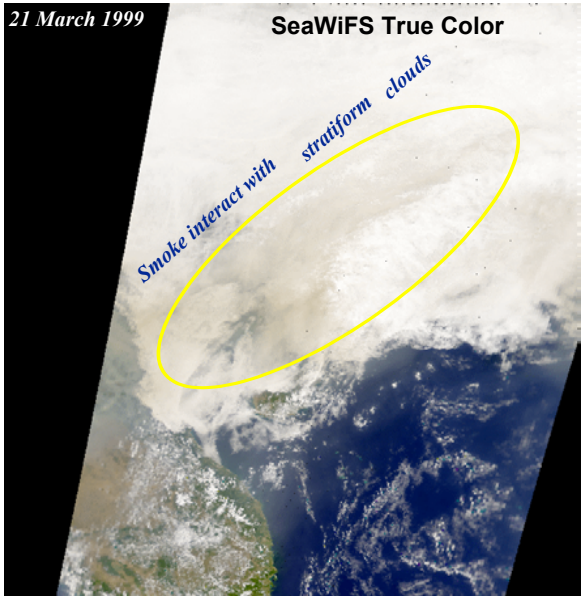
$$I_{aer} \approx \frac{\omega_0 P(\Theta)\pi F_0}{4\pi} \frac{\mu_0}{\mu_0+\mu}[1-e^{-\tau(1/\mu+1/\mu_0)}] + [I_0+I_s][e^{-(1-w_0)\tau(1/\mu+1/\mu_0)}-1] + ...$$

Sensitivity to aerosol absorption

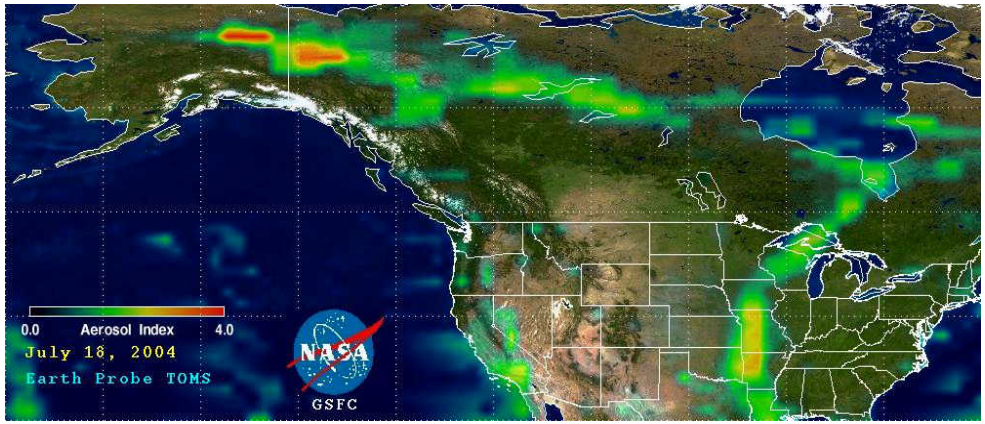


Illumination by sunglint (Kaufman, et al, GRL, 2002)

Aerosol absorption can be detected from space when the the absorbing layer is 'illuminated' using a natural source.



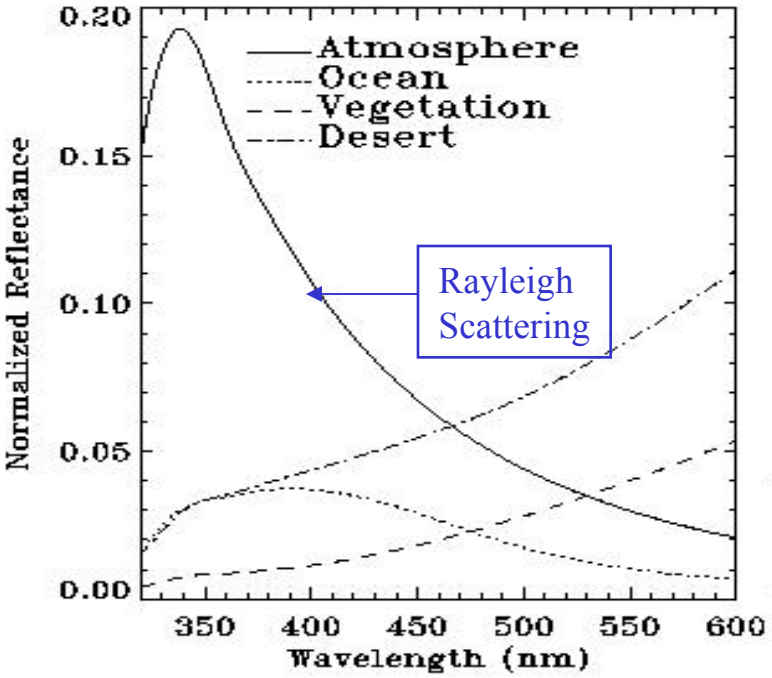
Illumination by clouds (Figure by N.C. Hsu, UMBC)



Illumination by Rayleigh Scattering (Torres et al., JGR, 2004)

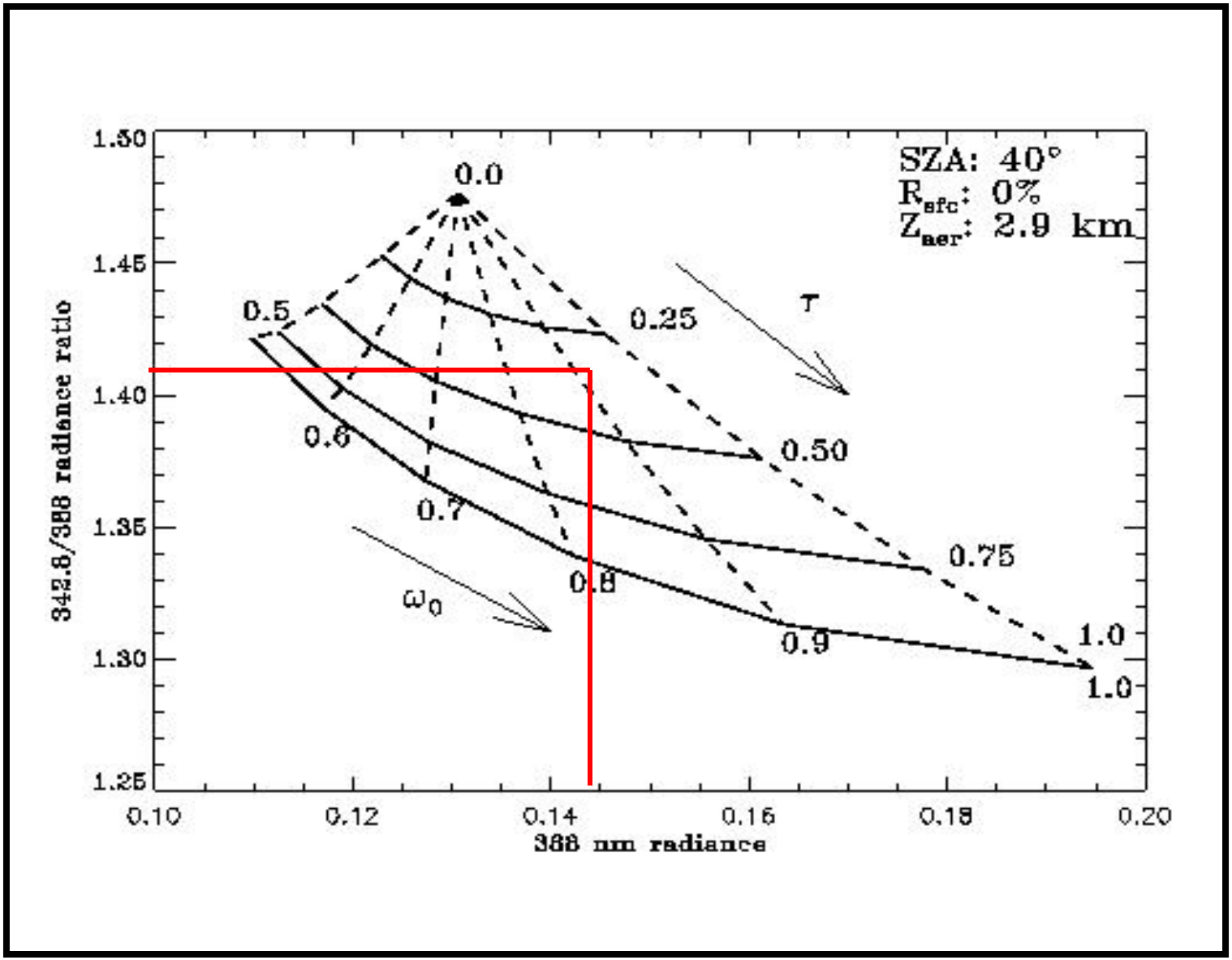
Measuring Aerosol Absorption from Space using near UV observations

Aerosol absorption can be quantified when the illuminating source can be accurately characterized.



The interaction of the large near UV Rayleigh scattering component and aerosol absorption provides the signal to measure aerosol absorption over land and water surfaces.

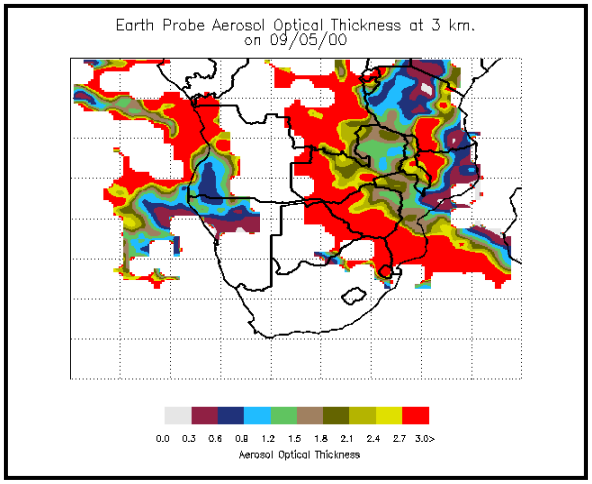
Near UV retrieval scheme



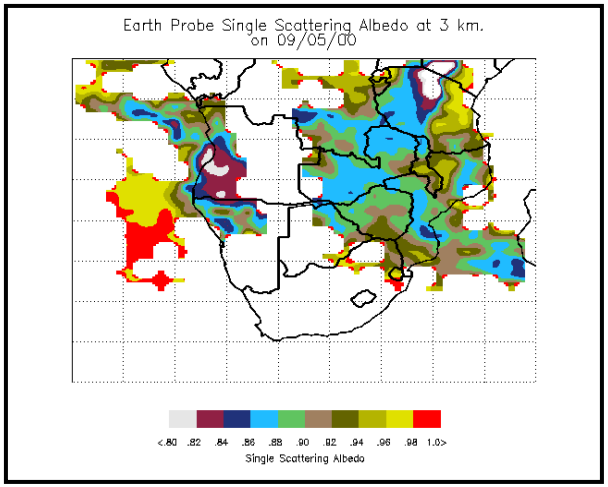
TOMS – Aeronet comparison during SAFARI2000

Sept., 5 2000

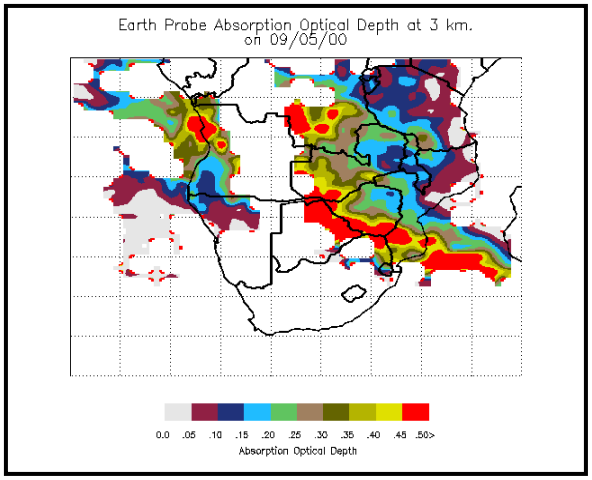
Optical depth (380 nm)

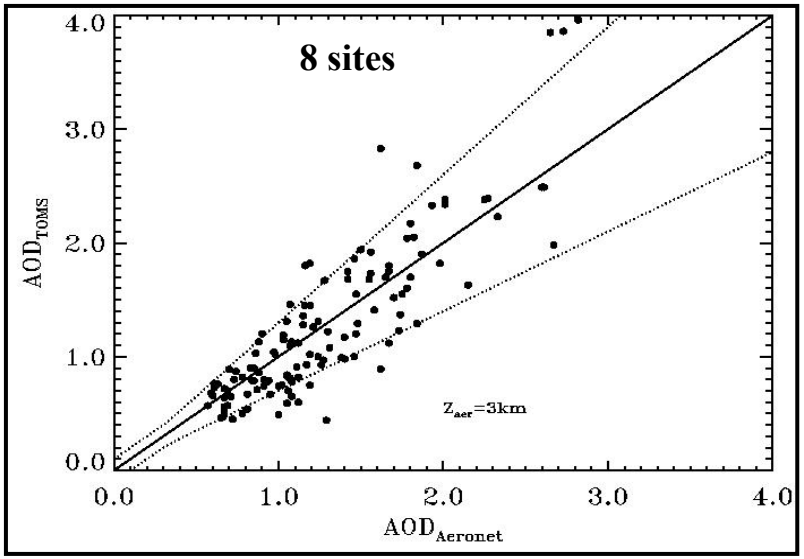


Single scattering albedo

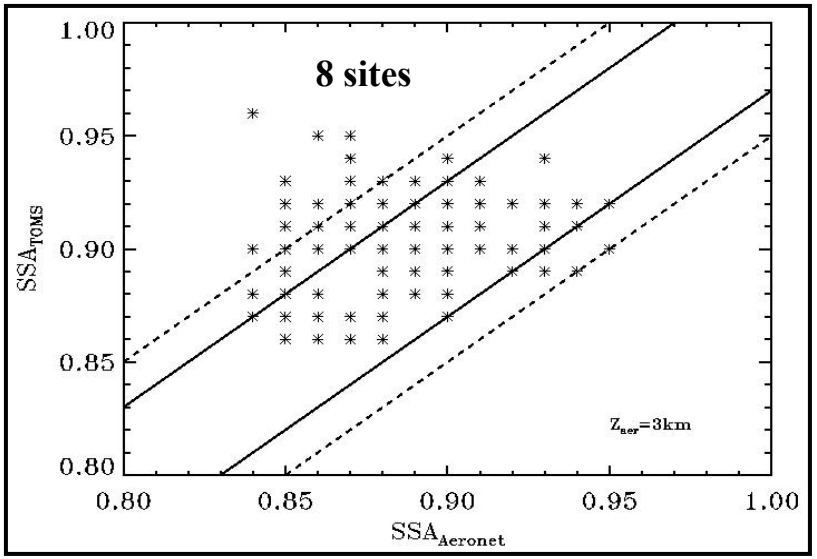


Absorption optical depth





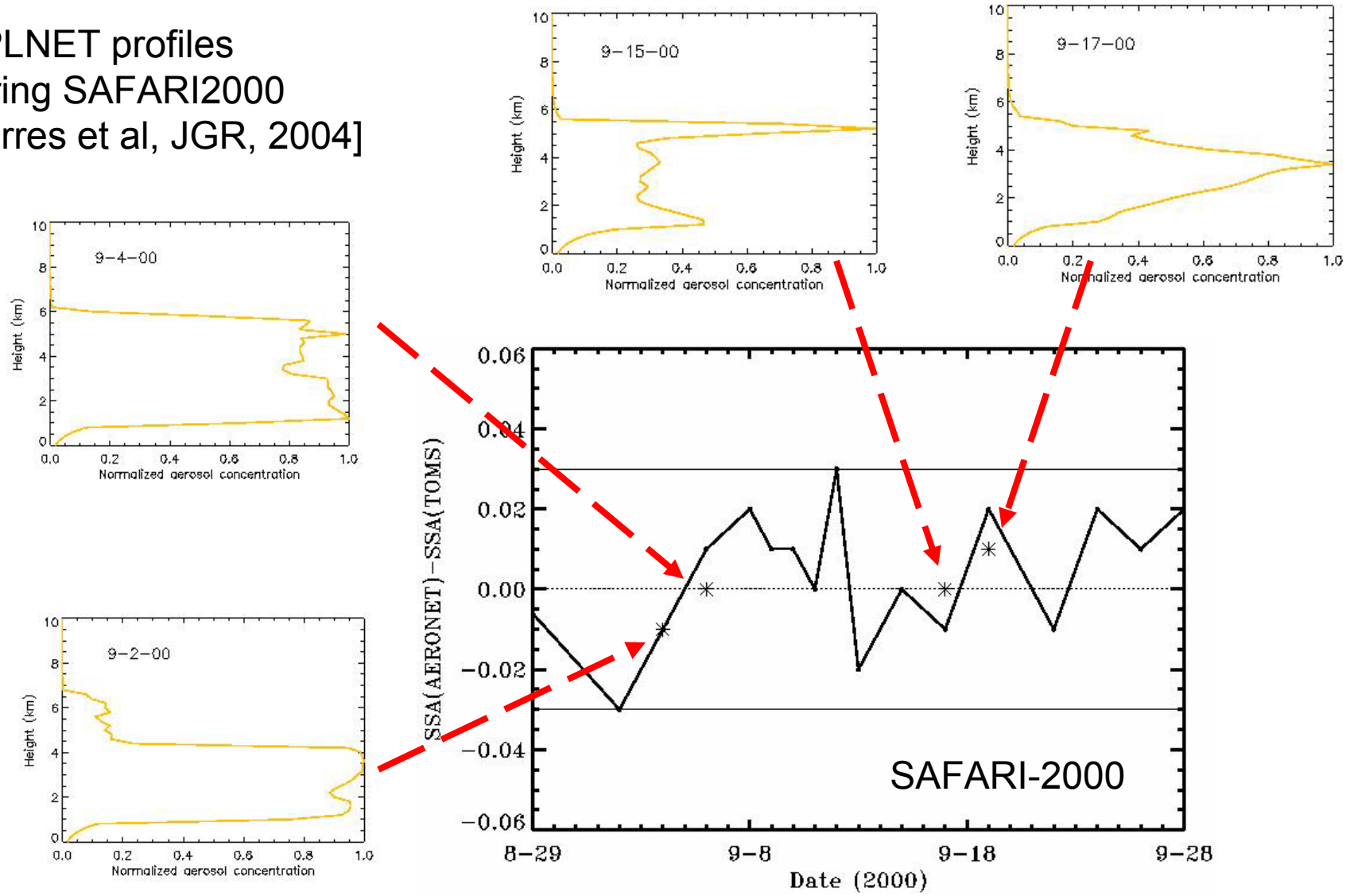
82% of points are within expected accuracy limits (0.1 or 30%)



63% within +/- 0.03
87% within +/- 0.05

Aerosol Vertical Distribution

MPLNET profiles
during SAFARI2000
[Torres et al, JGR, 2004]

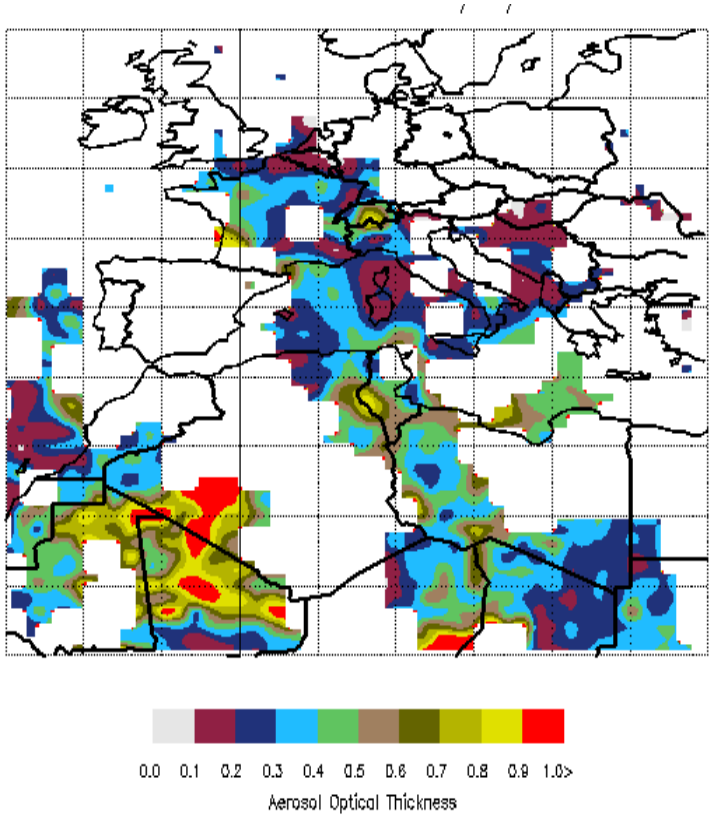


CALIPSO (Spring-05) will provide information on aerosol layer height

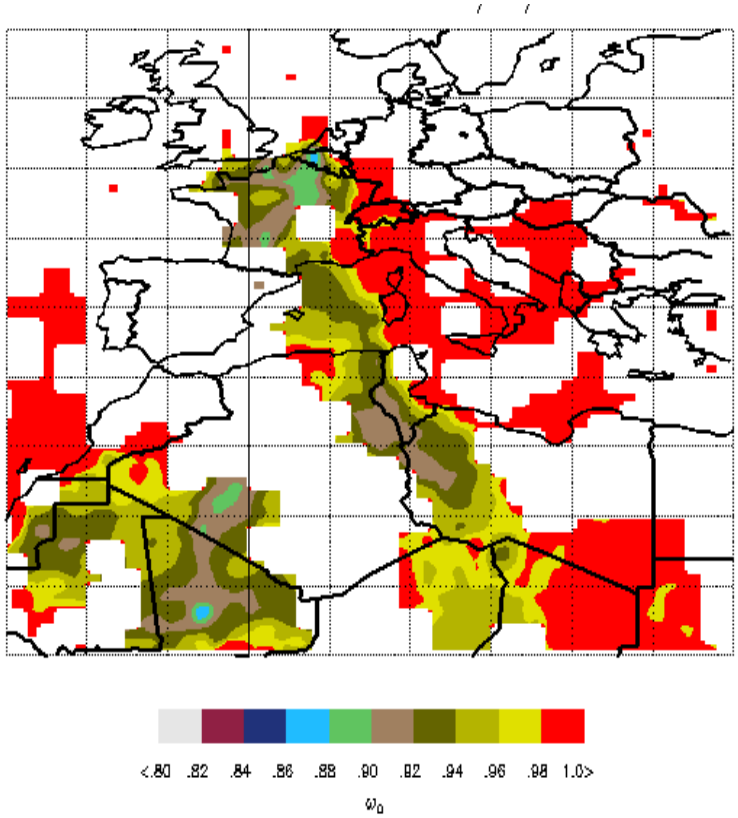
Application to TOMS Observations (2)

Saharan dust outbreak over Europe

October 12-2001



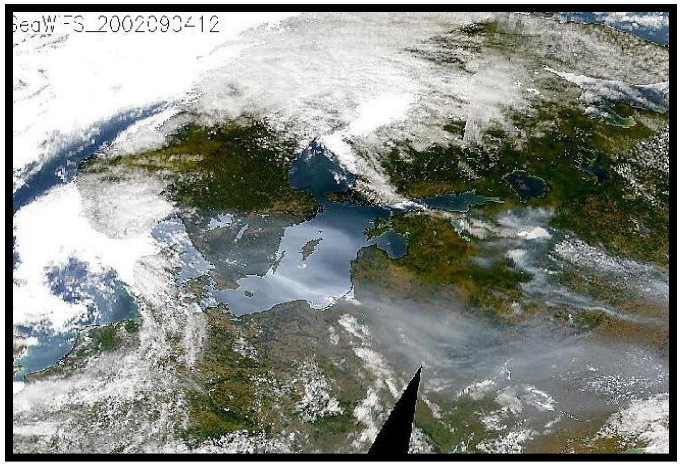
Optical Depth

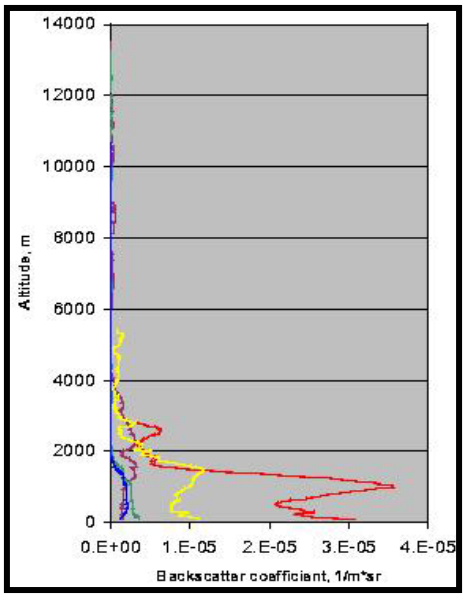


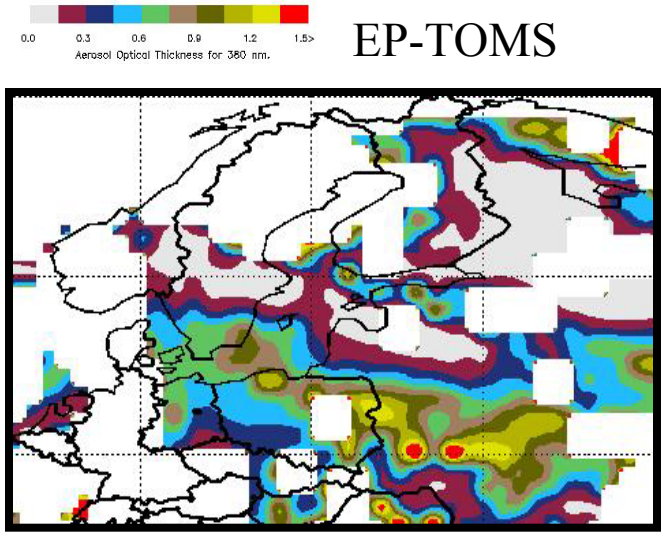
Single Scattering Albedo

Peat Fires in Eastern Europe (Sept 4, 2002)

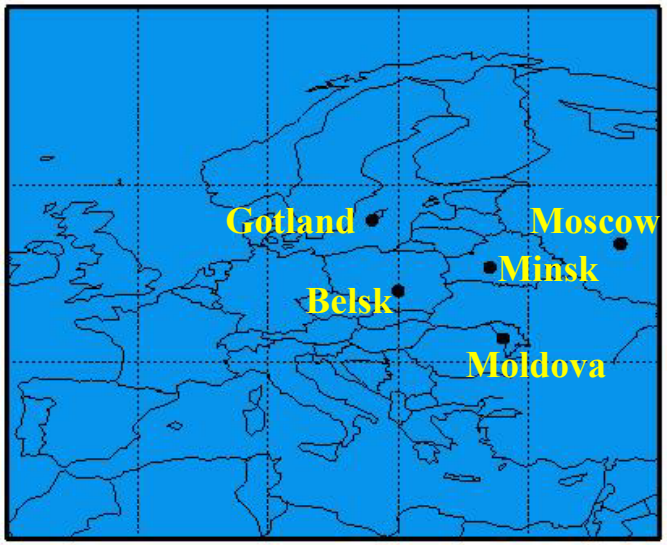
SeaWIFS RGB



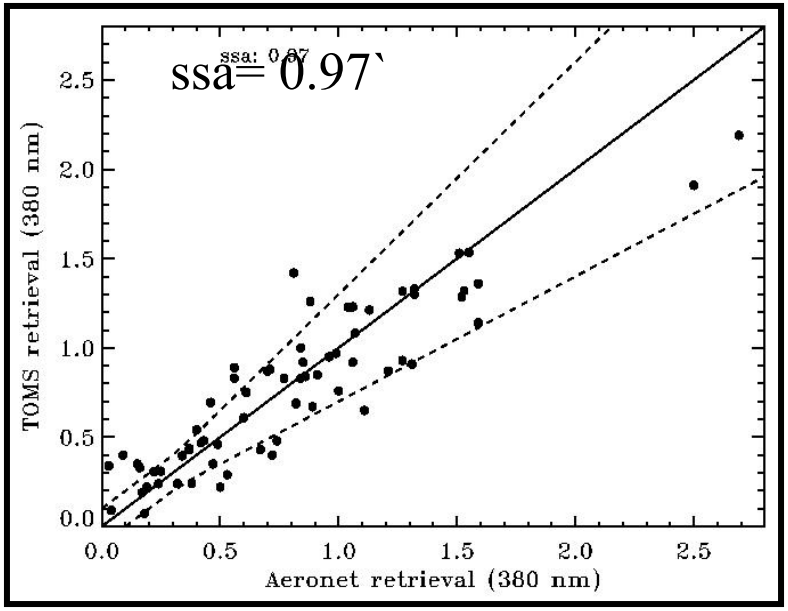




EP-TOMS



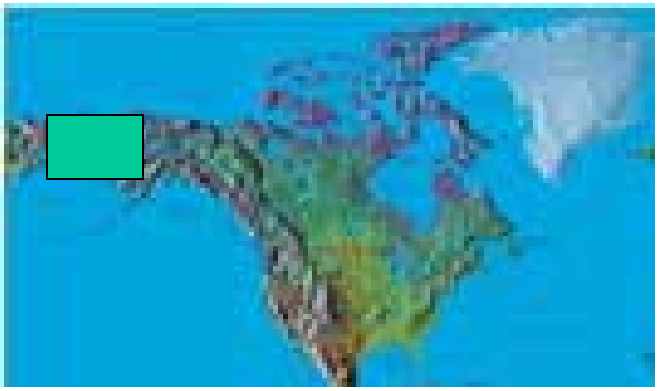
AERONET sites



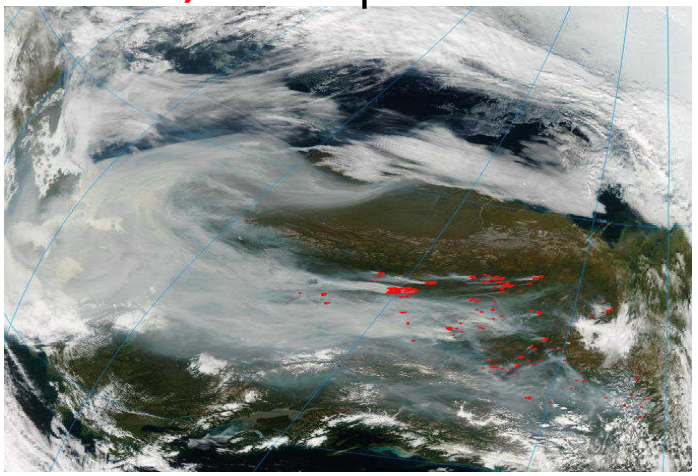
TOMS-AERONET AOT comparison

OMI Aerosol absorption retrievals (preliminary results)

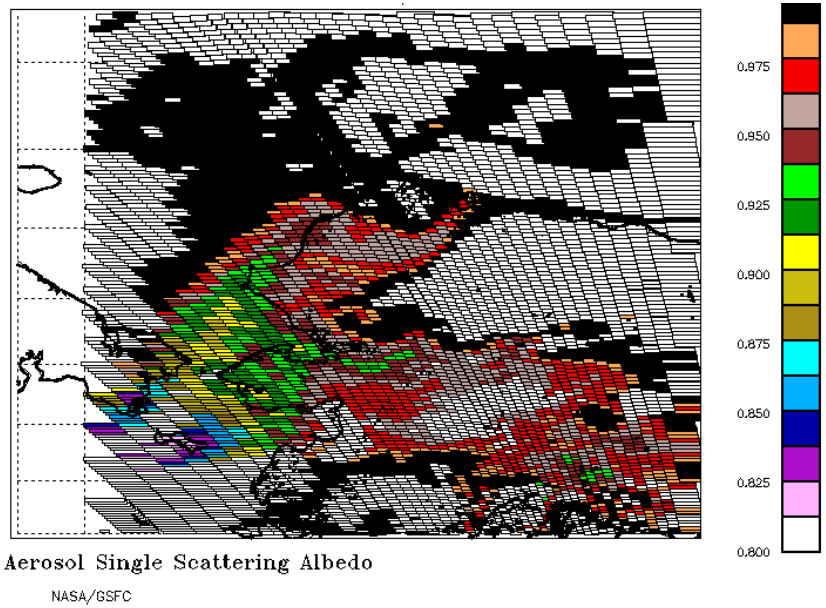
Aug-21-2004



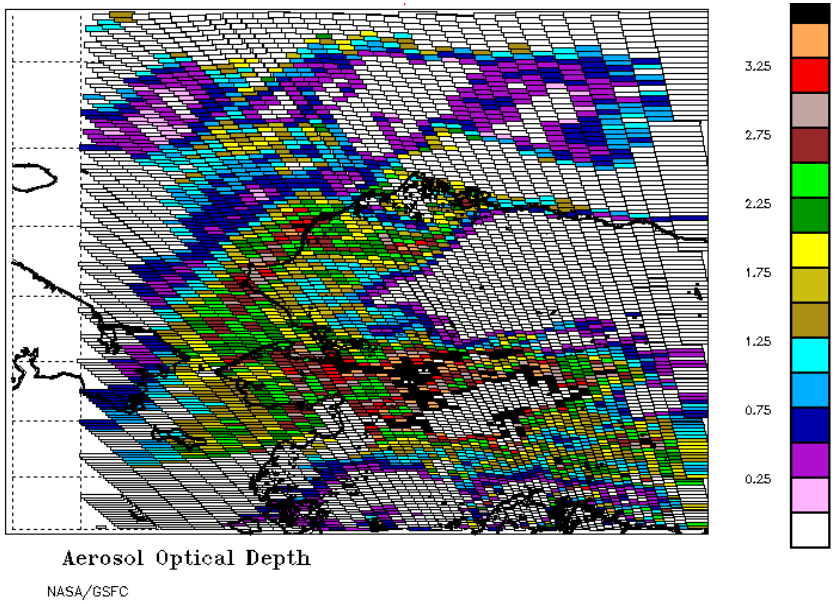
Aqua-MODIS



OMI retrieved parameters:



Single Scattering Albedo



Optical Depth