Aerosol Detection and Characterization in the near UV
Sensitivity Analysis and Applications

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TOMS V8 Residue Definition

$$r_\lambda = -100\,[\log(\frac{I_\lambda}{I_{331}})_{meas} - \log(\frac{I_\lambda(R_{sfc})}{I_{331}(R_{sfc})})_{calc}]$$

R_{sfc} is a ***Lambert Equivalent effective surface reflectvity*** value such that

$$(I_{331})_{meas} = (I_{331})_{calc}$$

R_{sfc} is assumed ***wavelength independent***

Thus, the residue definition reduces to:

$$r_\lambda = -100\,\log[\frac{(I_\lambda)_{meas}}{(I_\lambda(R_{sfc})_{calc}}]$$

Calculation of Effective Surface Reflectivity

$$R_{sfc} = \frac{I_{331_{meas}} - I_{331_{Ray}}}{T_{331_{Ray}} + S_{331_{Ray}} (I_{331_{meas}} - I_{331_{Ray}})}$$

Residues are calculated at all the TOMS wavelengths.
Residues at $\lambda < 331$ nm are positive
Residue at 331 nm is zero by definition
Residues at $\lambda > 331$ nm are negative

The TOMS V8 Aerosol Index is the negative value of the 360 nm residue

$$AI = -r_{360}$$

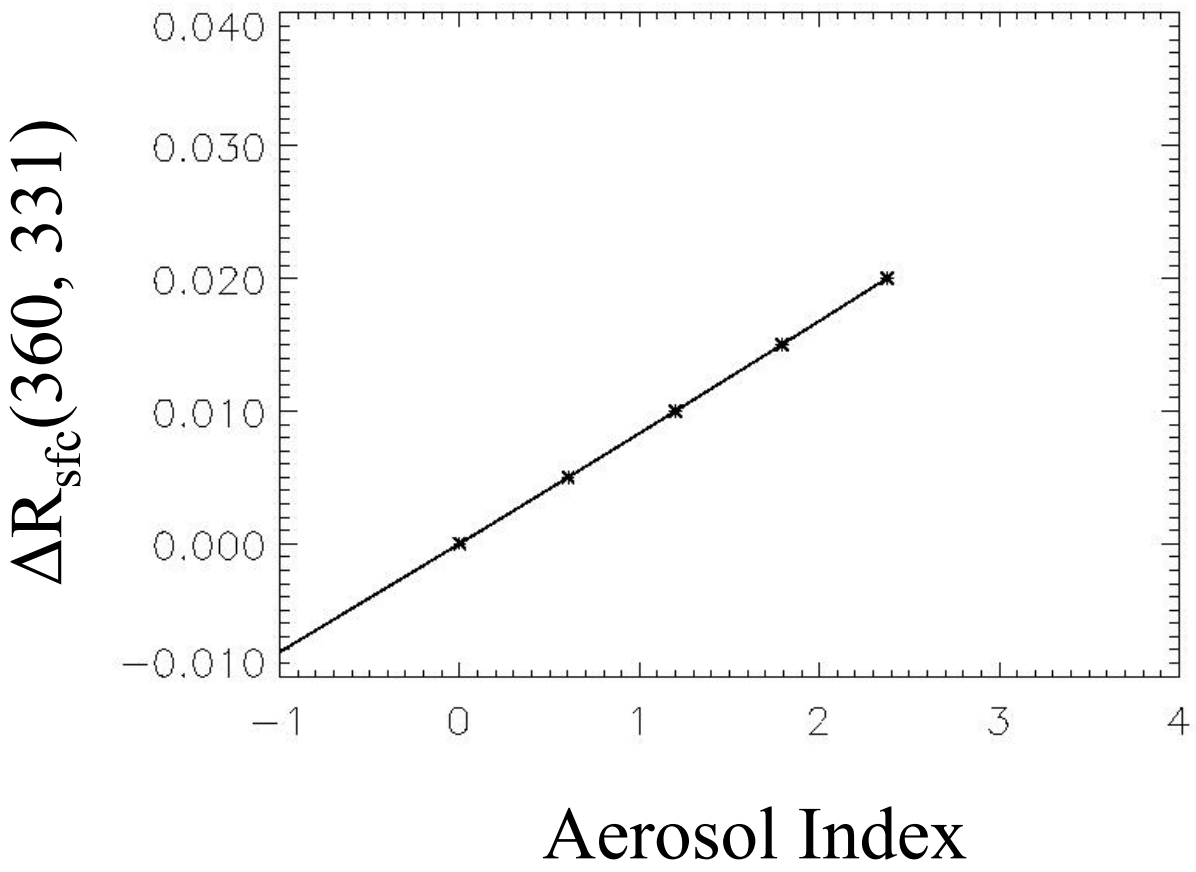
Geophysical Sources of residue

Aerosols
~*UV-absorbing*
~*Non-absorbing*

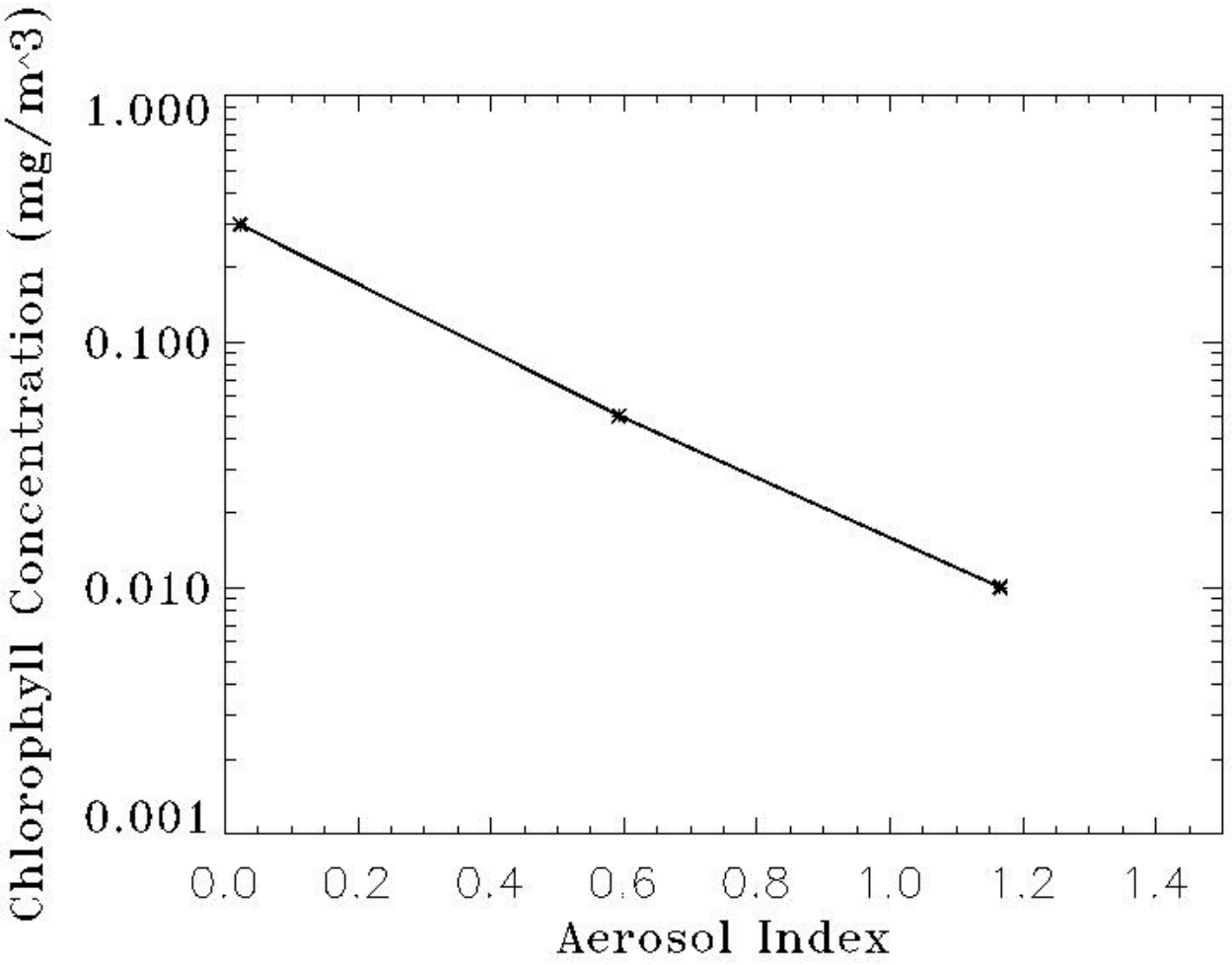
Surface Absorption Effects
~*Land*
~*Ocean*

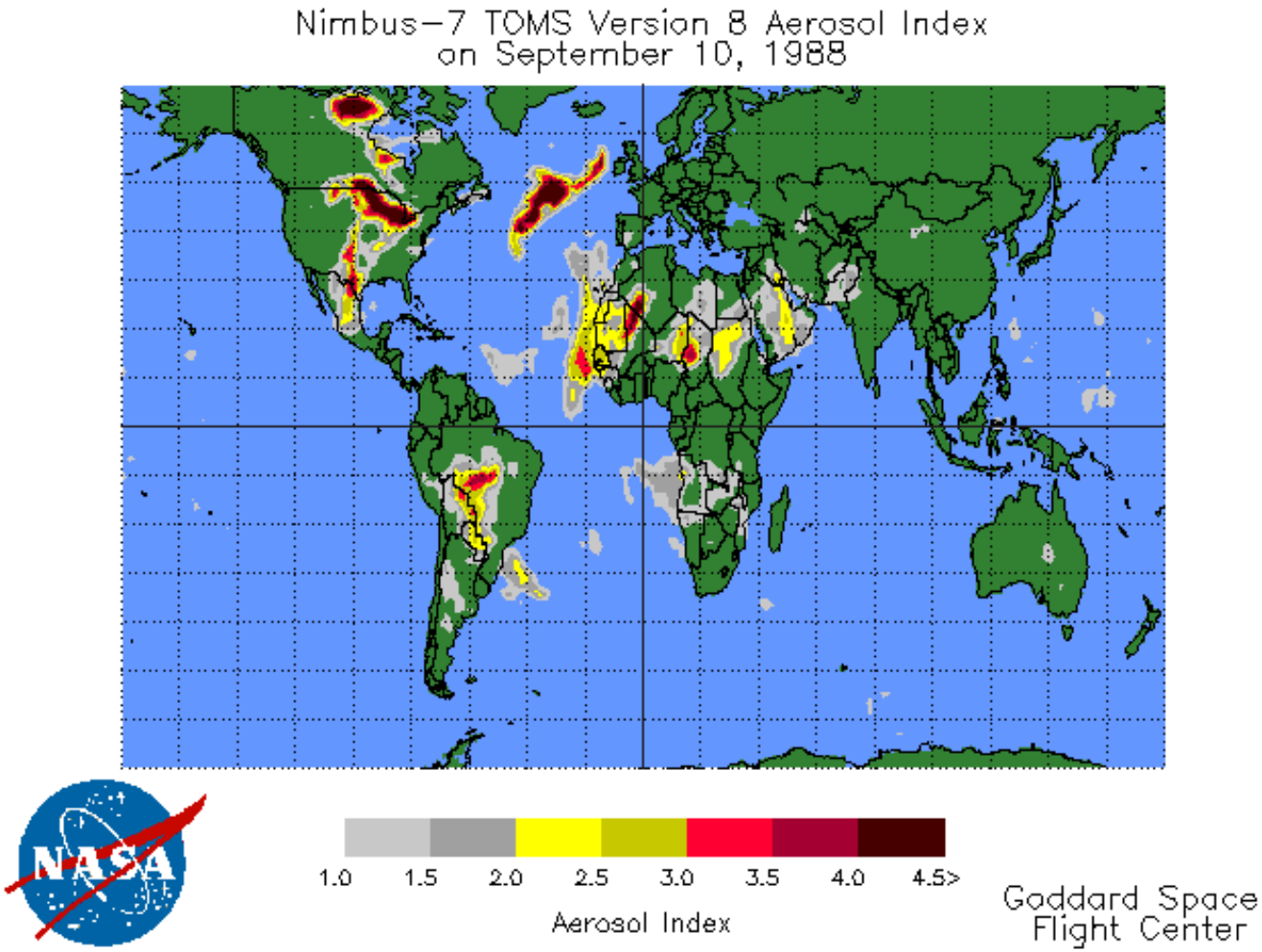
Sunglint

Spectral Dependence of Surface Albedo



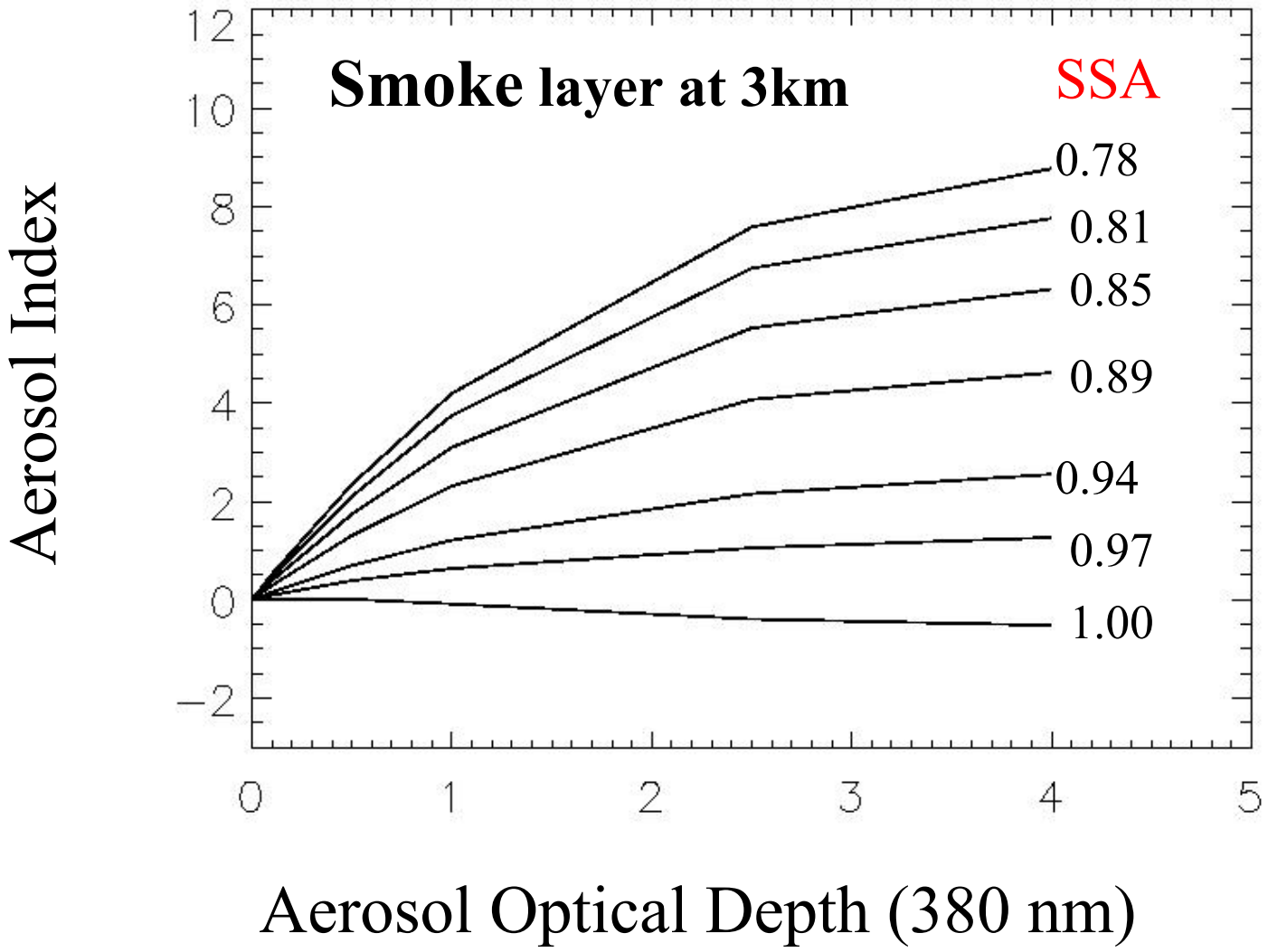
Pure water Absorption Effects



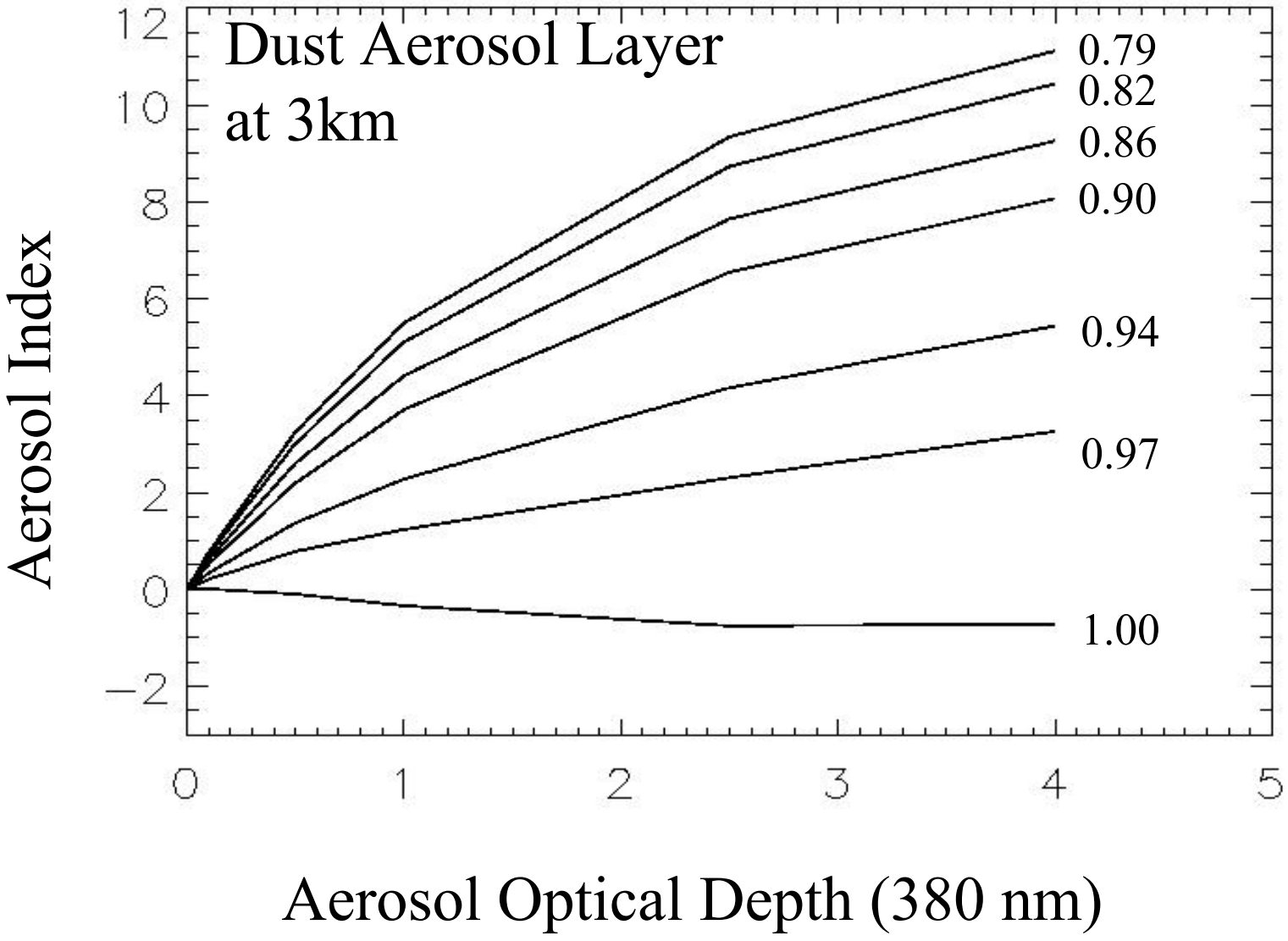


A threshold-value of 1.0 removes most of non-aerosol related AI signal

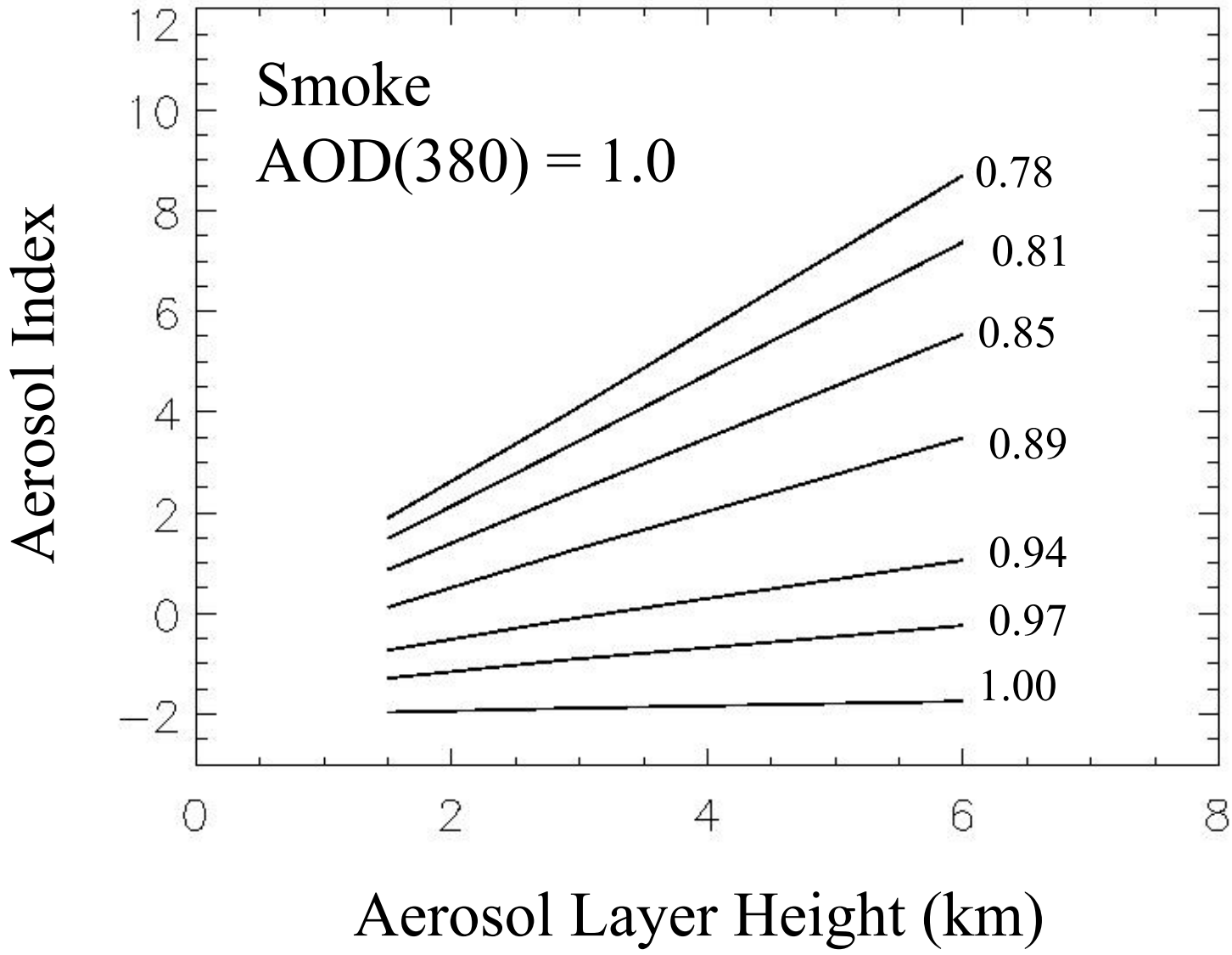
Sensitivity to Optical Depth and Single Scattering Albedo (1)



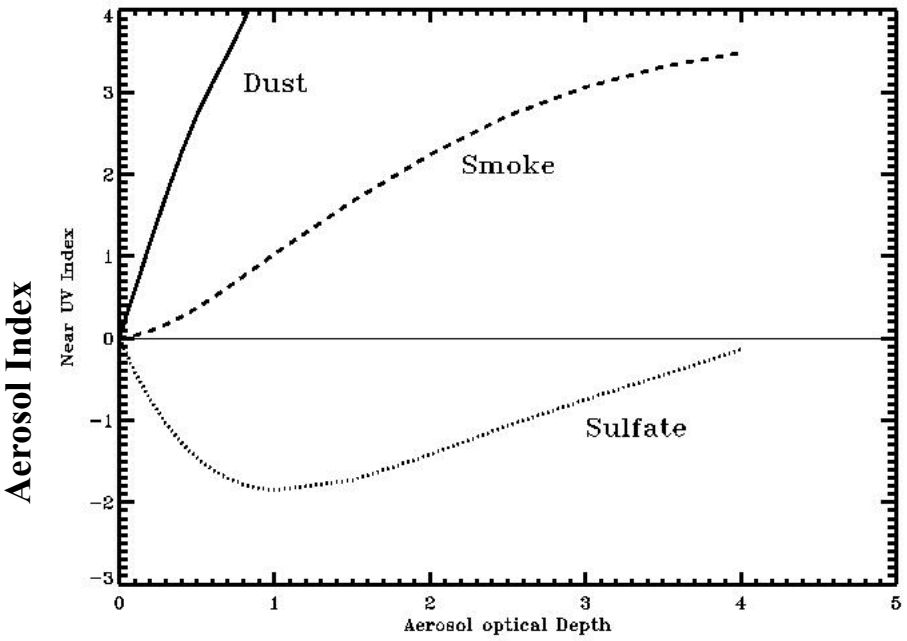
Sensitivity to Aerosol Optical Depth and Single Scattering Albedo (2)

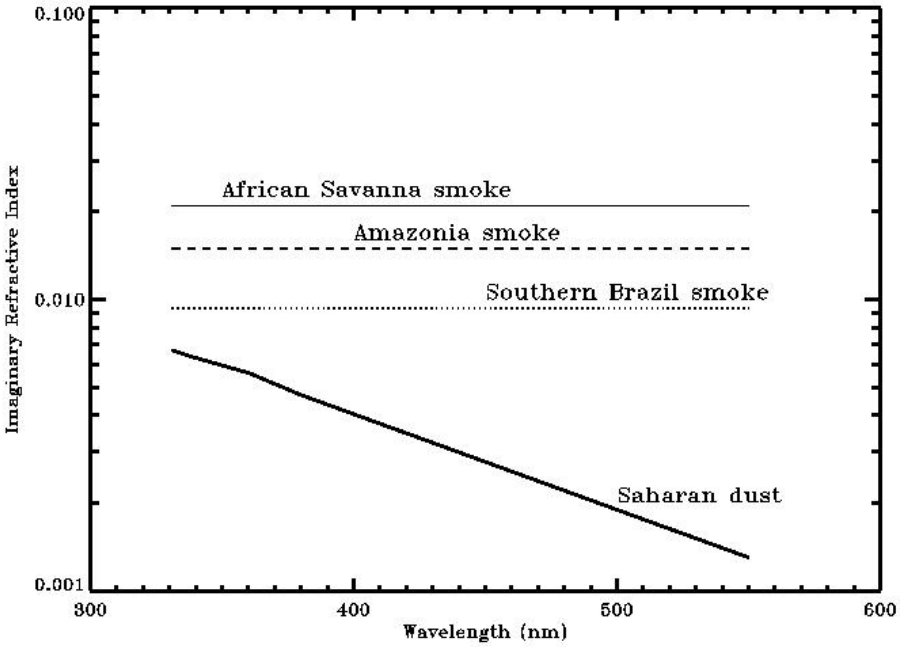


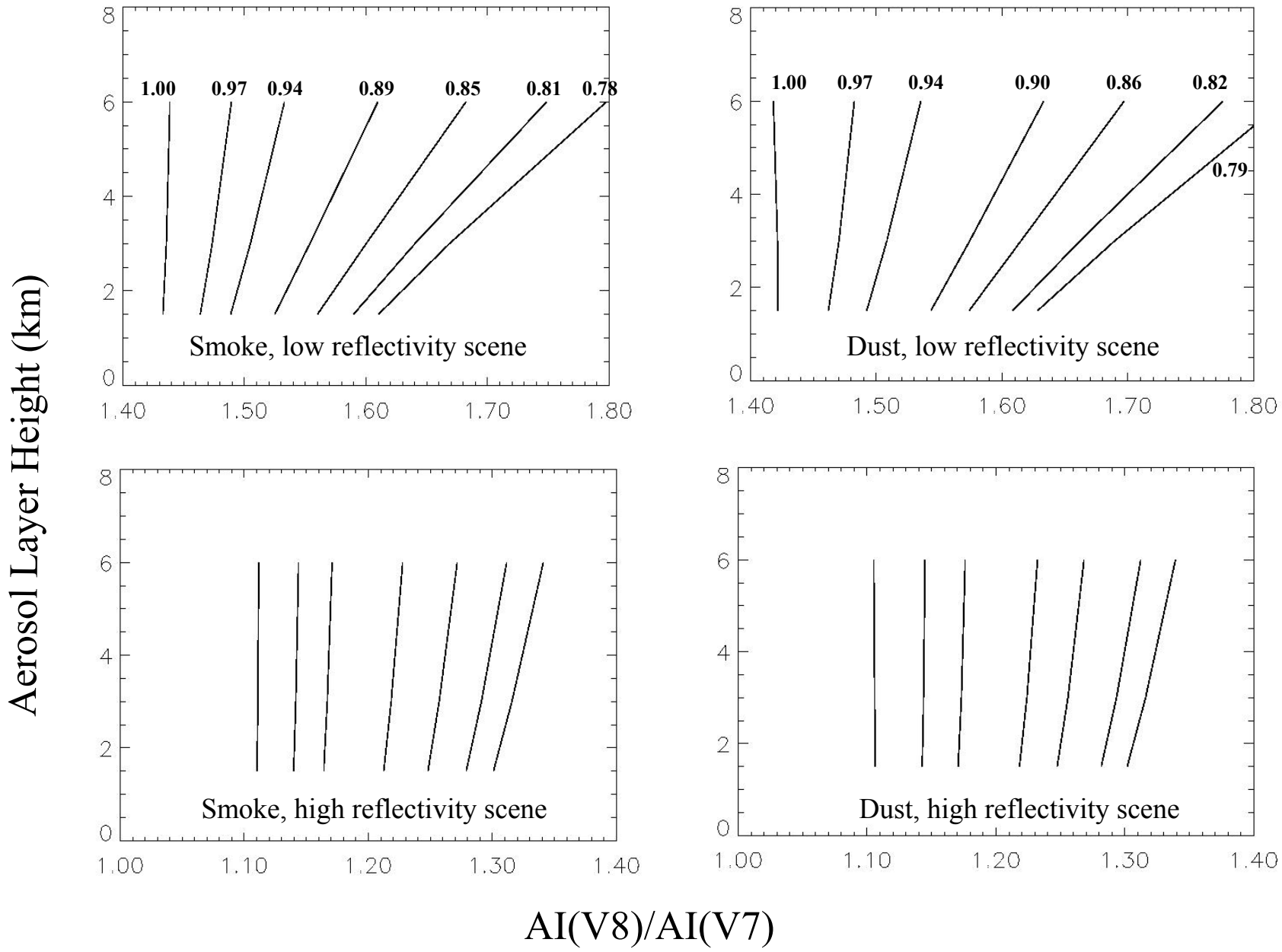
Sensitivity to Aerosol Layer Height



Spectral Dependence of Aerosol Absorption






Aerosol Layer Height (km)
AI(V8)/AI(V7)
1.00
0.97
0.94
0.89
0.85
0.81
0.78
Smoke, low reflectivity scene
1.00
0.97
0.94
0.90
0.86
0.82
0.79
Dust, low reflectivity scene
Smoke, high reflectivity scene
Dust, high reflectivity scene