MISR aerosol product status

MISR
Multi-angle Imaging SpectroRadiometer

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First AEROCOM model/satellite intercomparison meeting
Paris, France
June 2-3 2003
MISR observing concept

9 pushbroom cameras

9 view angles at Earth surface:
70.5° forward to 70.5° aftward

Multiple spectral bands at each angle:
446, 558, 672, 866 nm

14-bit digitization

On-board calibration system

Continuous pole-to-pole coverage
on orbit dayside

400-km swath

Contiguous zonal coverage:
9 days at equator
2 days at poles

275 m - 1.1 km sampling

7 minutes to observe each scene
at all 9 angles
Aerosol retrieval methodology over water
Applied to each 17.6-km area

MISR multi-angle imagery

Compositional models consisting of mixtures of prescribed particles

Surface glitter and whitecap model

Calculate model path radiance as function of optical depth

Minimize residuals between observations and modeled radiation field

Accept models and associated optical depths with residuals below a specified threshold
Aerosol retrieval methodology over land
Applied to each 17.6-km area

MISR multi-angle imagery

Subtract minimum reflectance to remove path radiance

Decompose residual angular shape into empirical orthogonal functions (EOFs)

Use these EOFs to construct the angular shape of the surface-leaving radiance of each pixel

Compute synthesized TOA radiation field and minimize difference with observations

Accept models and optical depths with residuals below a specified threshold

Compositional models consisting of mixtures of prescribed particles

Calculate model path radiance as function of optical depth
<table>
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<th></th>
<th>24 mixtures used in retrievals</th>
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<th>$\omega_0$</th>
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</table>
Scattering phase functions of component aerosols

Component particle type and effective radius of distribution (μm)

Phase function

Scattering angle (degrees)
Example MISR scattering angle coverage (March 21)
Recent algorithm enhancement
Northern Africa
P187, O13602, 9 July 2002

Left: 70°-forward browse image
Middle: HDRF pre-filter off
Right: HDRF pre-filter on
Northern Africa
P187, O13602, 9 July 2002
Blocks 66-78

70°-forward HDRF
Left: HDRF pre-filter off
Right: HDRF pre-filter on
Radiative effects

70° backward

TOA local albedo

Southern Mexico
2 May 2002

wavelength = 558 nm
solar zenith angle = 18°
MISR vs. AERONET optical depths
51 globally distributed sites, March 2002

Data plotted are matchups where MISR and AERONET had coincident retrievals
MISR directional hemispherical reflectance March 2002
Conclusions

Multi-angle remote sensing provides unique ways of retrieving aerosol properties over many surface types, including bright deserts which are major source regions

MISR data products and tools are publicly available through the NASA Langley Atmospheric Sciences Data Center
http://eosweb.larc.nasa.gov

For more information about MISR:
http://www-misr.jpl.nasa.gov