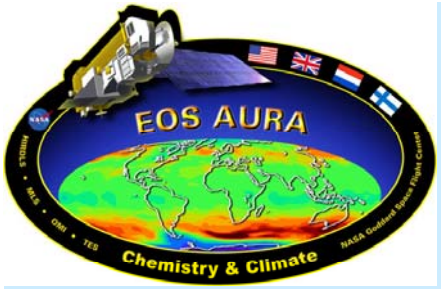


ESA Atmospheric Science Conference

Aerosol Products from the Aura-OMI sensor

Omar Torres
University of Maryland Baltimore County
NASA Goddard Space Flight Center

8-12 may 2006
ESA ESRIN
Frascati, Italy

Ozone Monitoring Instrument (OMI)

-One of four sensors on the Eos-AURA satellite
-Launch date: July 15, 2004
-Developed by the Netherlands Space Agency (NIVR) and the Finnish Meteorological Institute (FNMI)
-1:30 pm Equator Crossing Time
-2600 km across track swath (Daily Global Coverage)
-Hyper-spectral Sensor (270-500 nm)
-Spatial Resolution 13x24 km^2

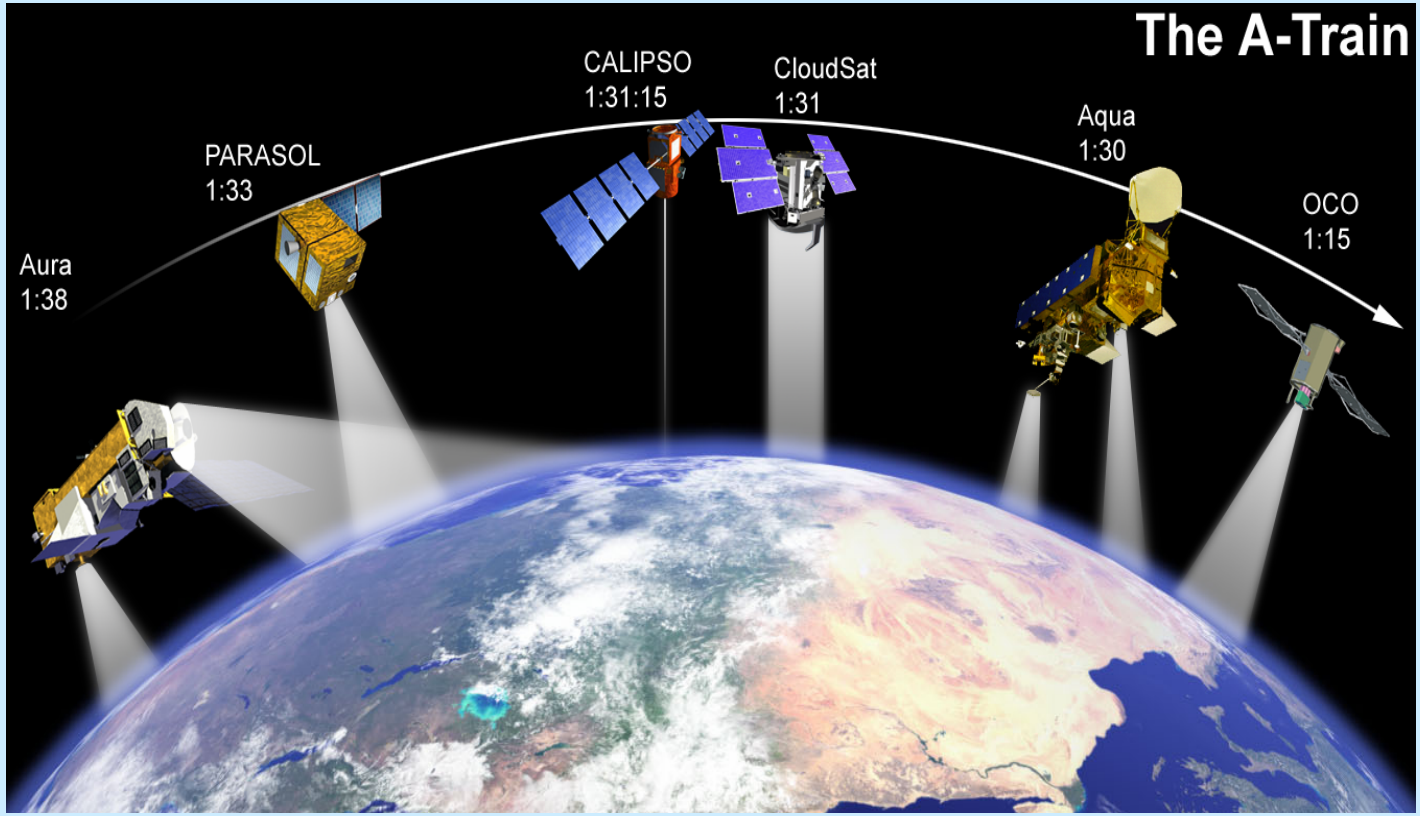
Aerosol Data Products

-Absorbing Aerosol Index
-Aerosol Extinction Optical Depth (342,**388**,500), τ_{ext}
-Aerosol Absorption Optical Depth (342,**388**,500), τ_{abs}

$$\tau_{abs} = \tau_{ext}(1.0 - \omega_0)$$

-Aerosol Extinction Optical Depth (multi-wavelength algorithm)

OMI-Aura is part of the A-train

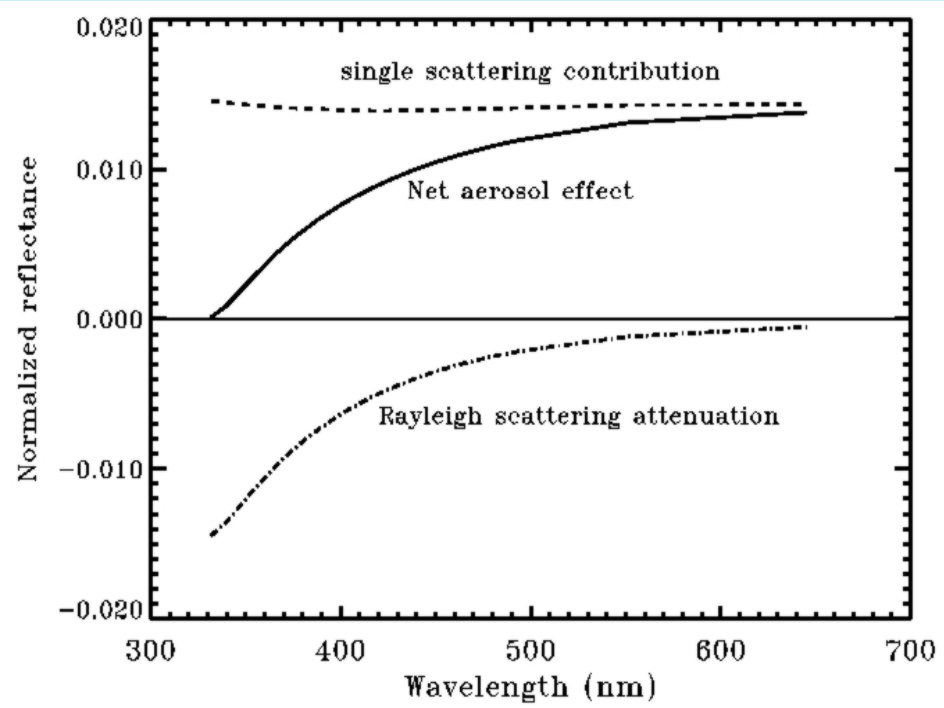


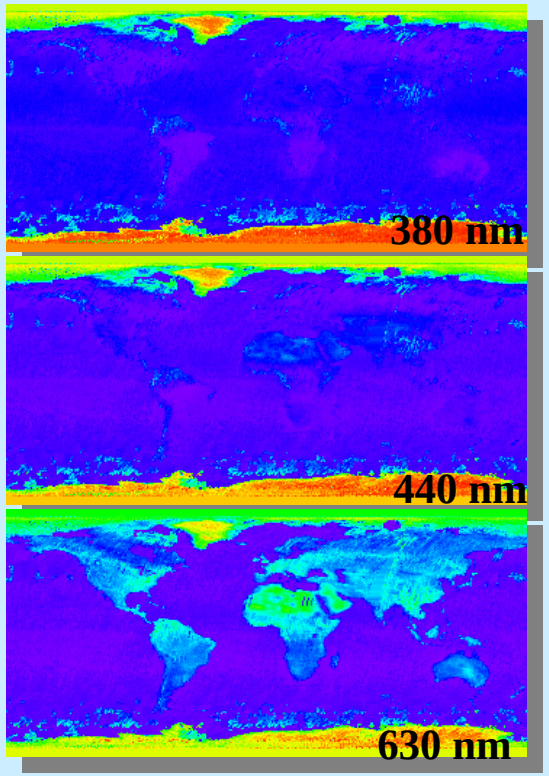
CALIPSO lidar profiles will provide aerosol vertical distribution information.

Physical Basis of OMI Near UV aerosol products

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

Sensitivity to aerosol absorption





Near UV measurements have large sensitivity to aerosol absorption.
Retrieval capability over all terrestrial surfaces.

OMI Aerosol Index

Aerosol detection capability with the AI was discovered in 1995 when the 'residue' concept was introduced in the TOMS Total Ozone Algorithm

$$r_\lambda = 100\,[\log(\frac{I_\lambda}{I_{\lambda_0}})_{obs} - \log(\frac{I_\lambda(R_{\lambda_0})}{I_{\lambda_0}(R_{\lambda_0})})_{calc}]$$

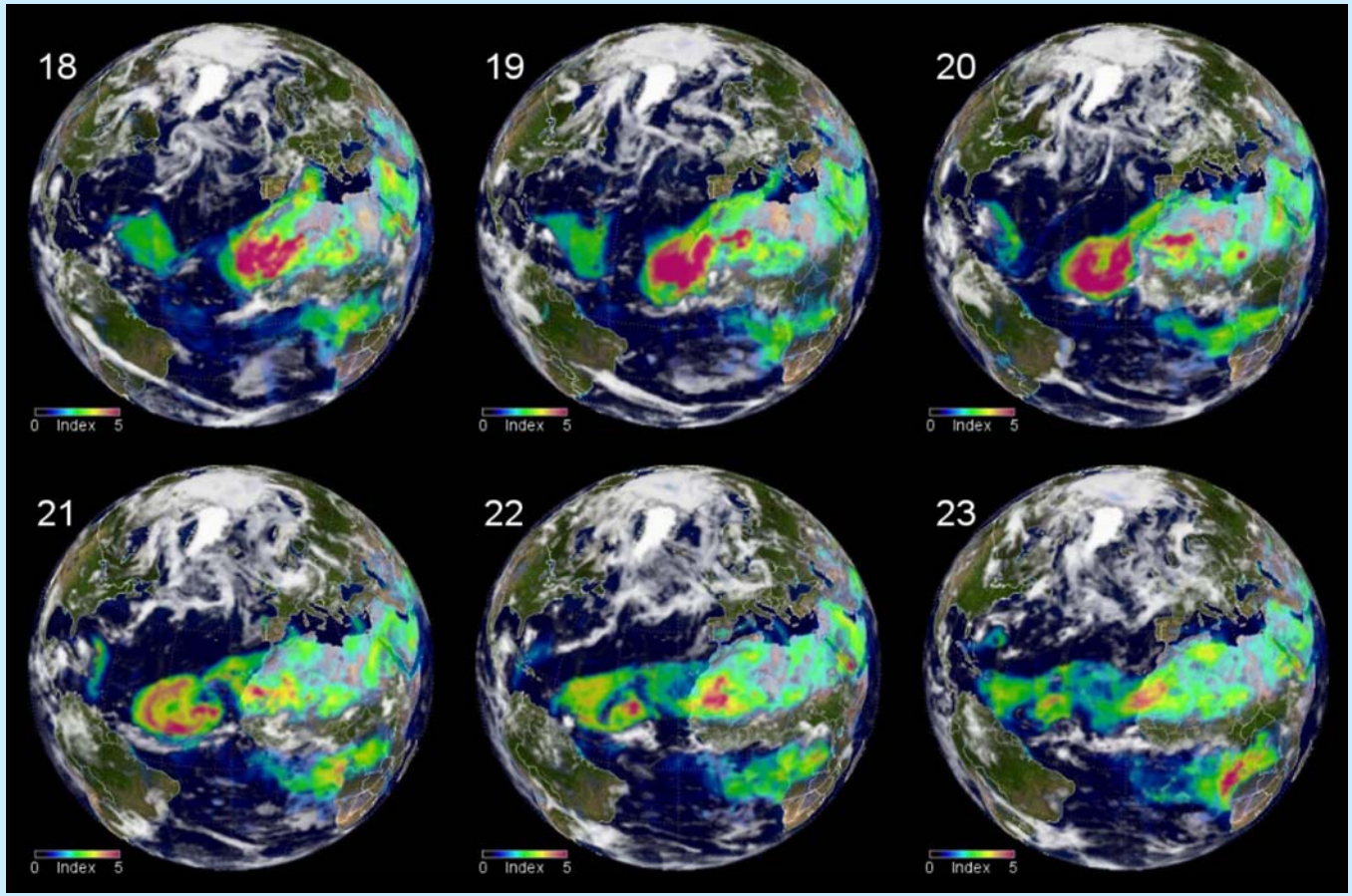
R_{λ_0} is the ***Lambert Equivalent Reflectivity*** of a hypothetical surface such that

$$[I_{\lambda_0}]_{obs} = [I_{\lambda_0}(R_{\lambda_0})]_{calc}$$

The near UV index is calculated using $\lambda = 342.5$ and $\lambda_0 = 388.0$

A visible index is calculated using $\lambda = 388.0$ and $\lambda_0 = 471.0$

OMI Near UV Aerosol Index



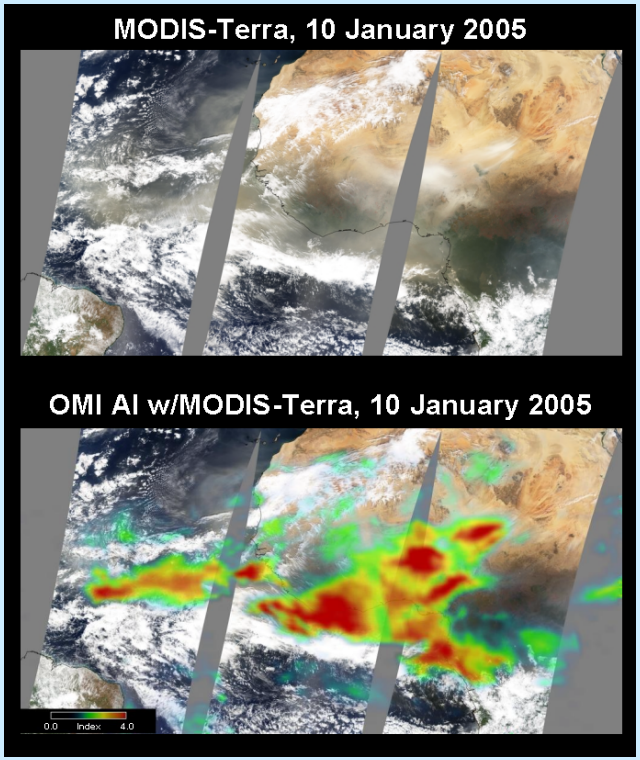
July 2005 Saharan dust storm as seen by OMI

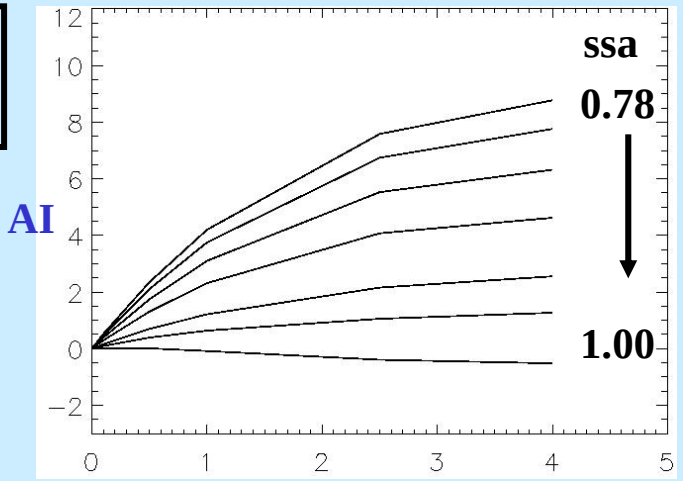
Aerosol Index Properties

Clearly separates between absorbing (smoke, desert dust) and non-absorbing aerosols.

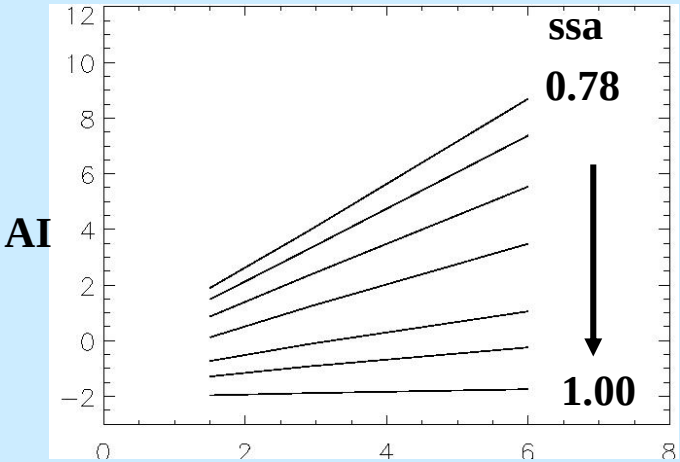
-AI magnitude depends on aerosol height, aerosol optical depth and optical properties.

Detects absorbing aerosols over all terrestrial surfaces including ice and snow, and above cloud decks





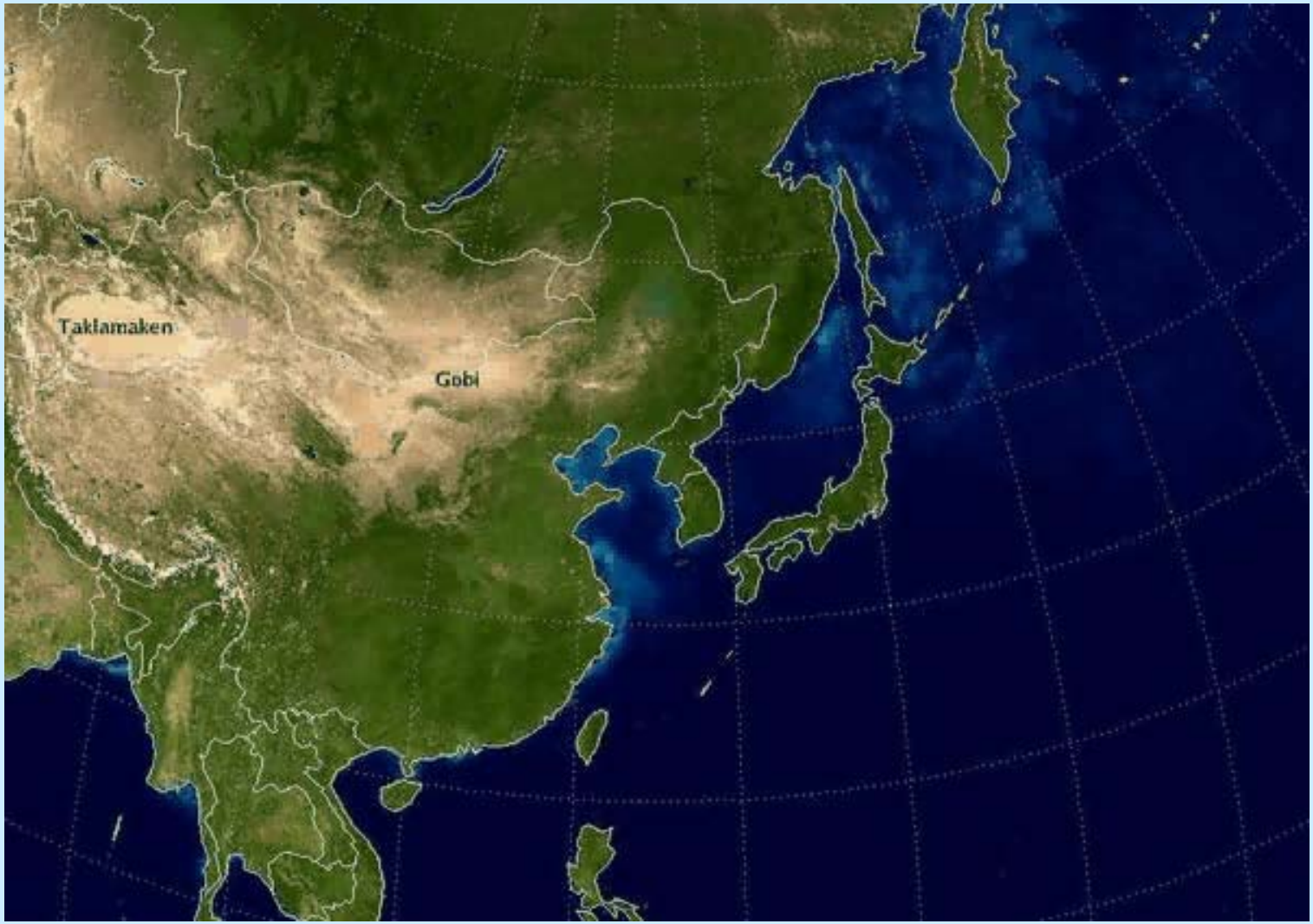
Aerosol Opt. Depth



Aerosol Layer Height (km)

Insensitive to clouds

2006 Asian outflow of UV-absorbing aerosols as seen by OMI



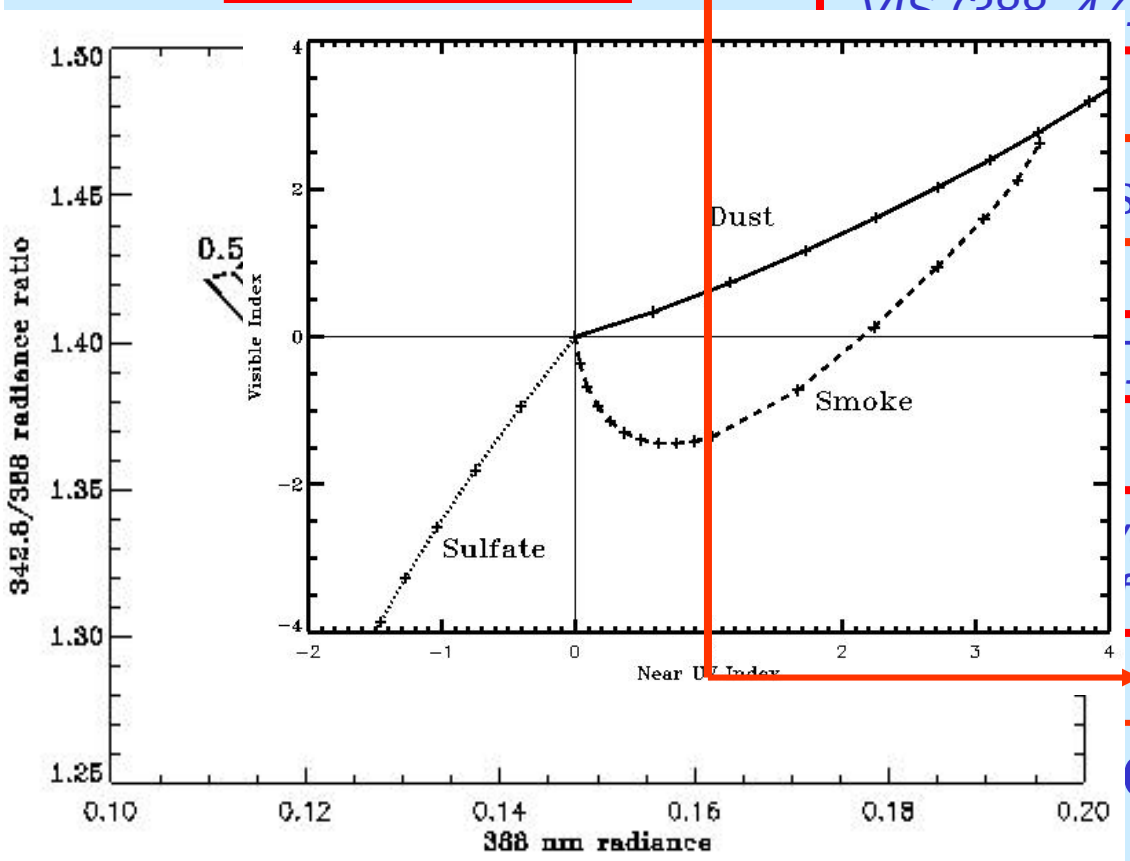
Courtesy of Colin Seftor, SSAI

OMI Near-UV Algorithm

Input: Observed radiances at 342.5, 388. and 471 nm

Aerosol Indices Calculation
-UV (342.5, 388 nm)
-VIS (388, 471)

-Surface Albedo



screening

Type selection

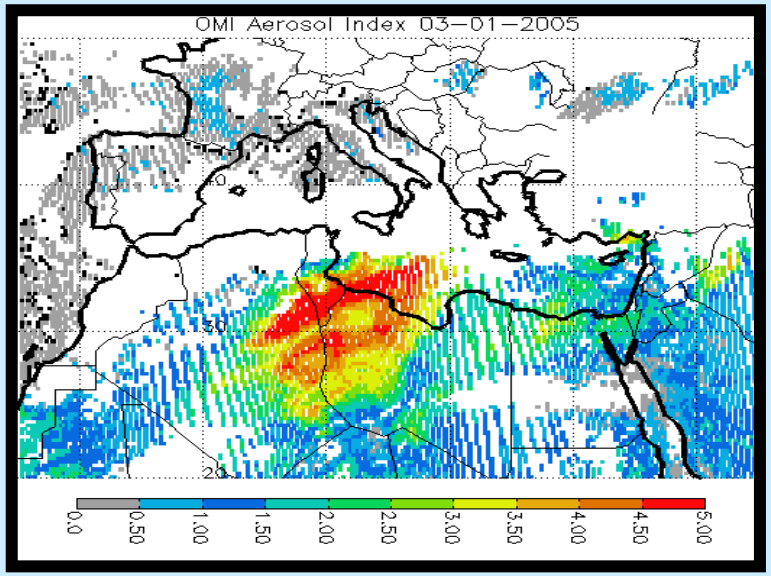
Layer height
(If aerosol type)

Optical Depth
Optical Depth

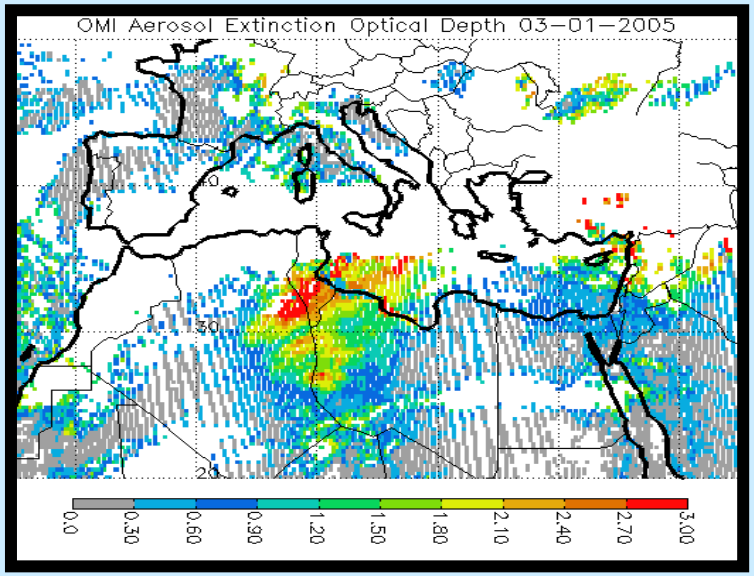
Best retrievals
-Ref < 0.15
-AI_{nuv} > 1.0

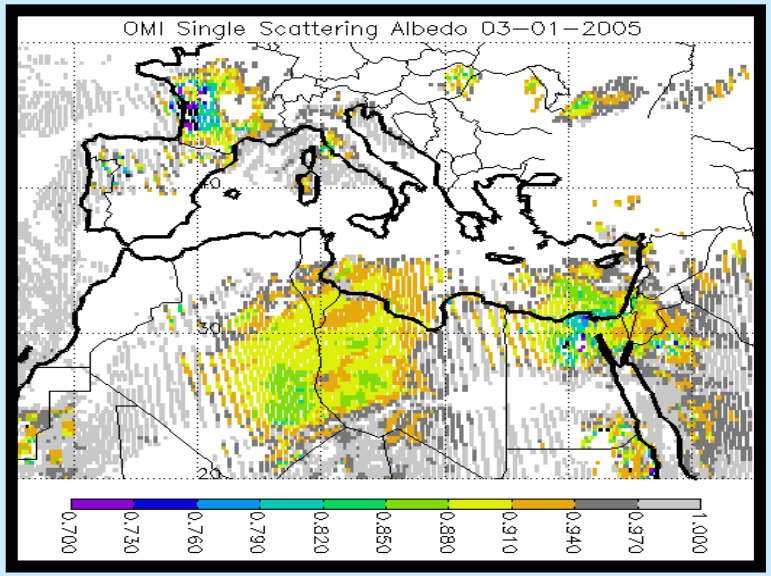
Sample OMI Aerosol Retrievals

AI

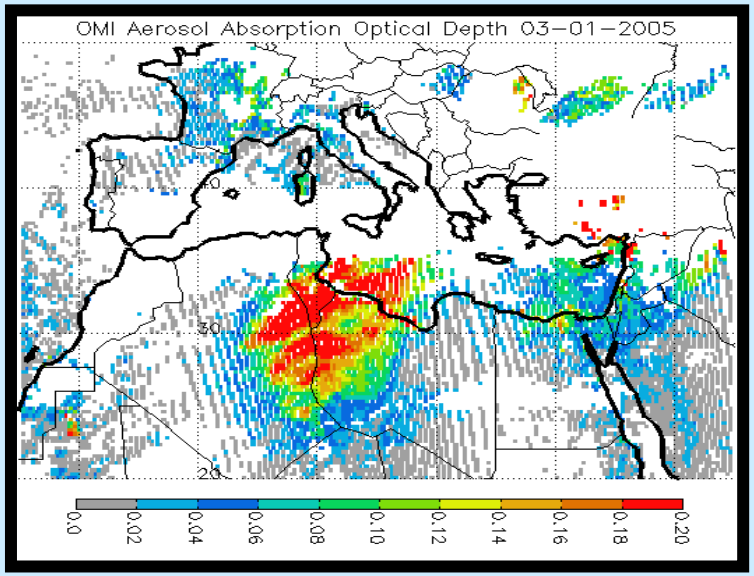


AOD





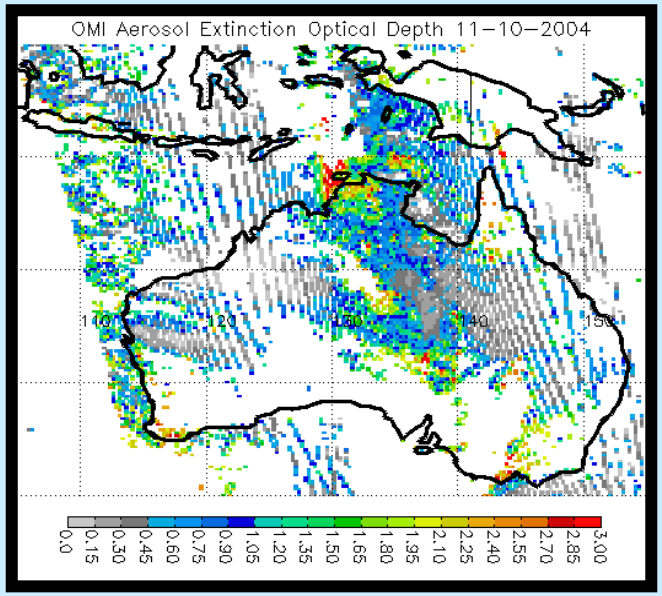
SSA



Absorption Optical Depth

03-01-2005

Biomass Burning Aerosols over Australia on November 10 2004



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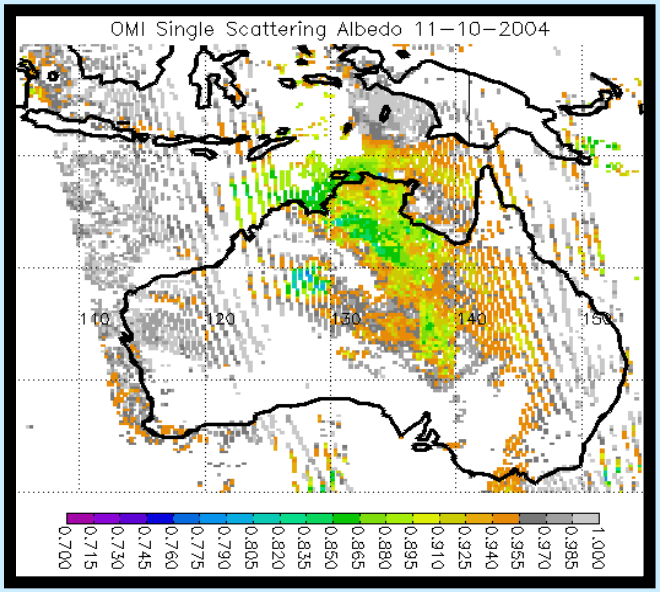

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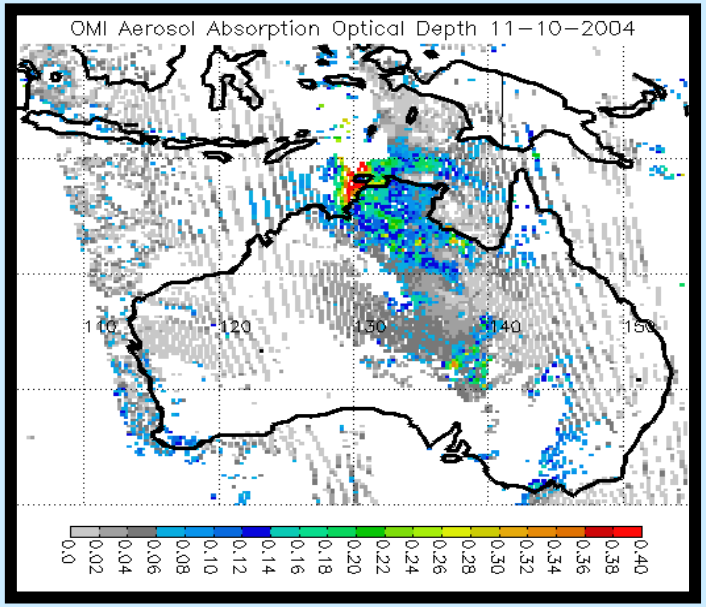
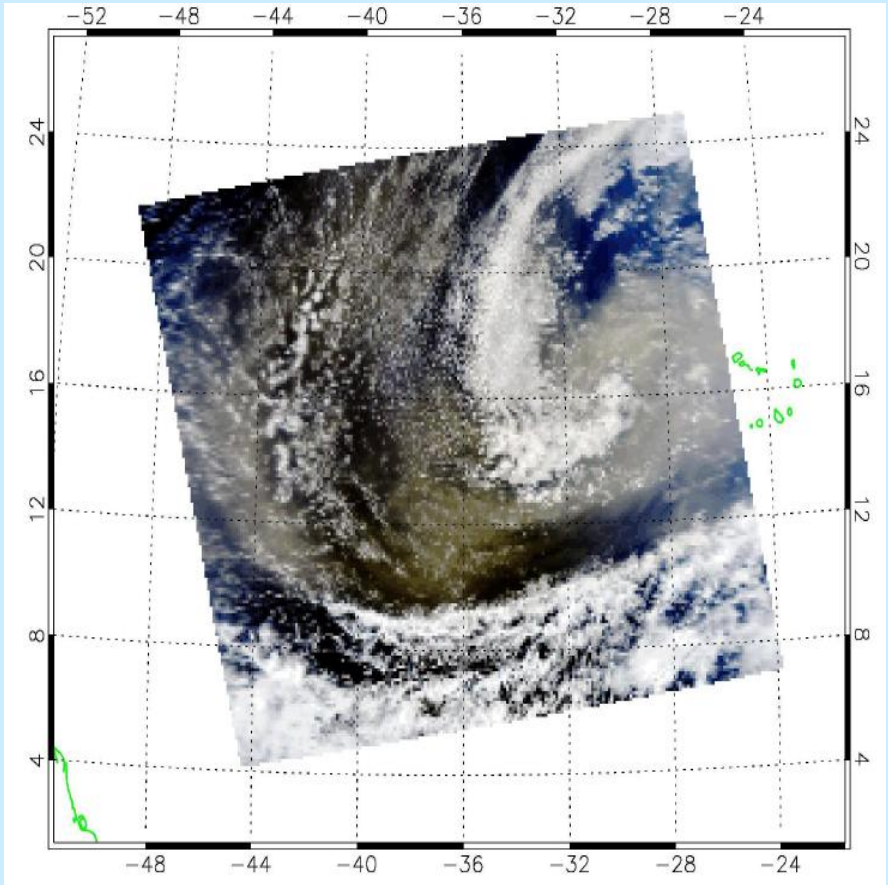
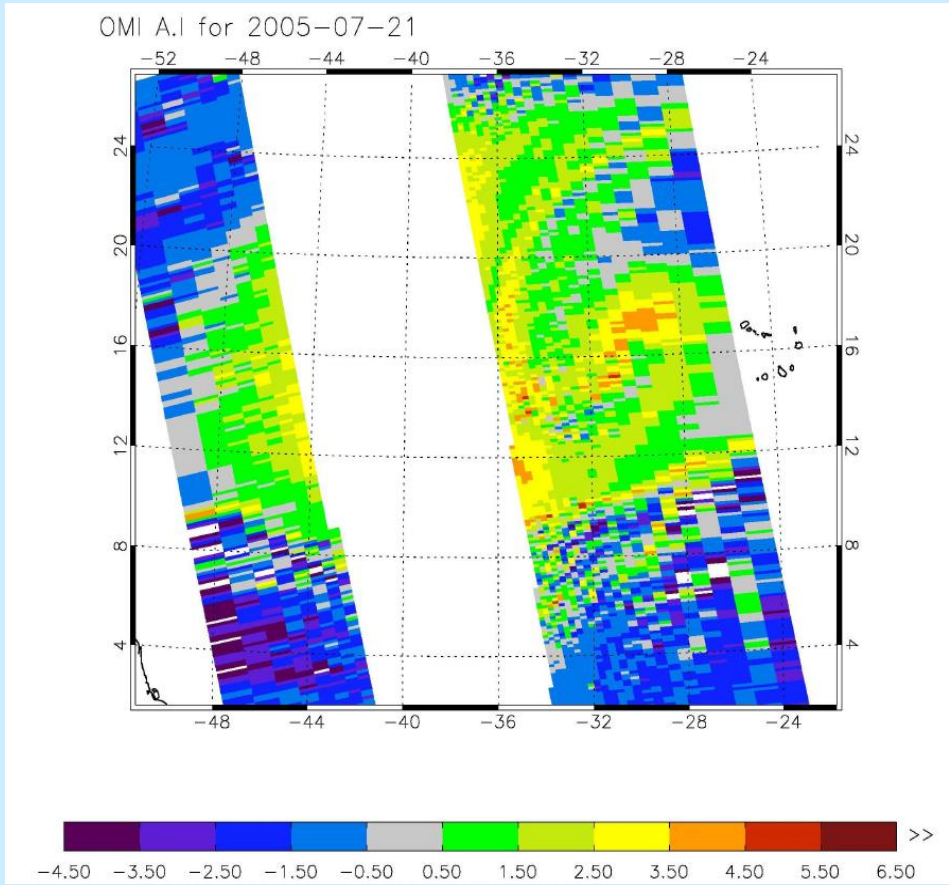


Absorption Optical Depth

Aerosol Observation on July 21 2005

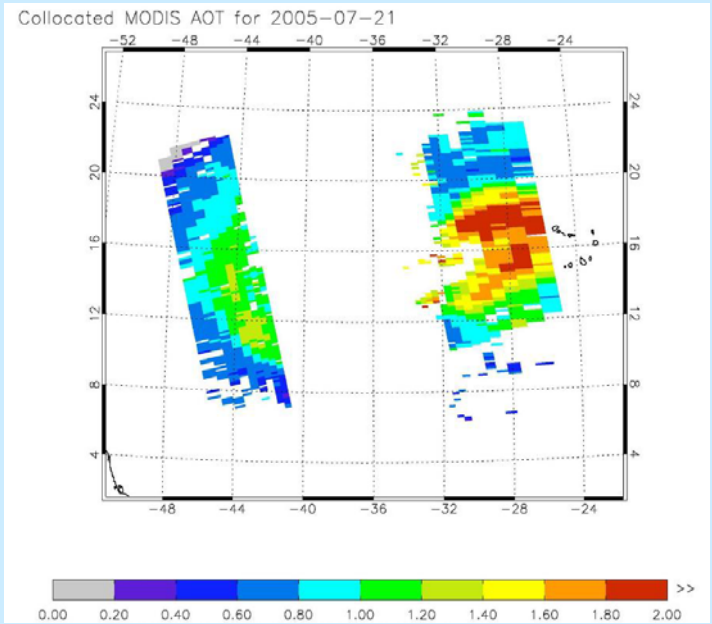




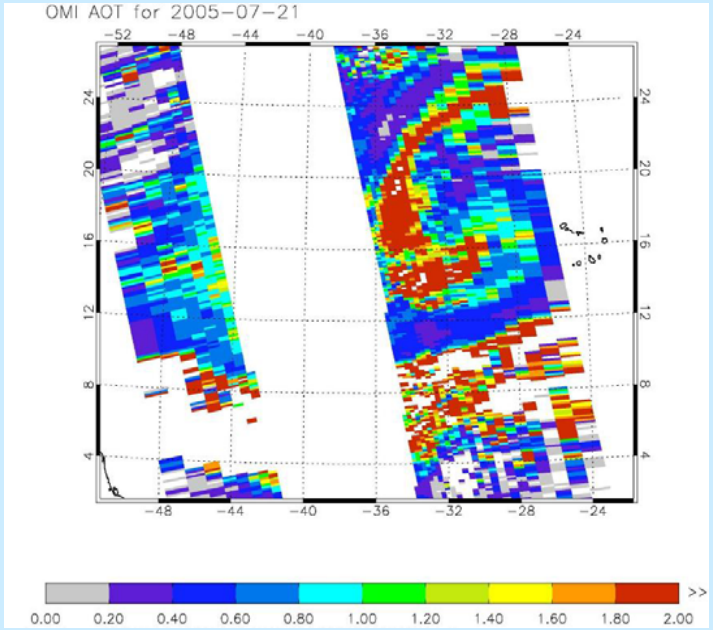
MODIS RGB Image

OMI Near UV Aerosol Index

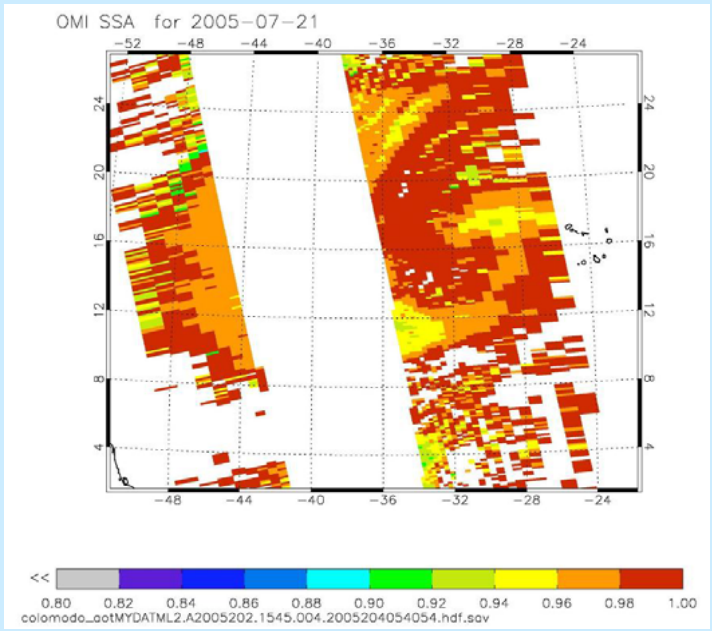
MODIS AOT(550 nm)

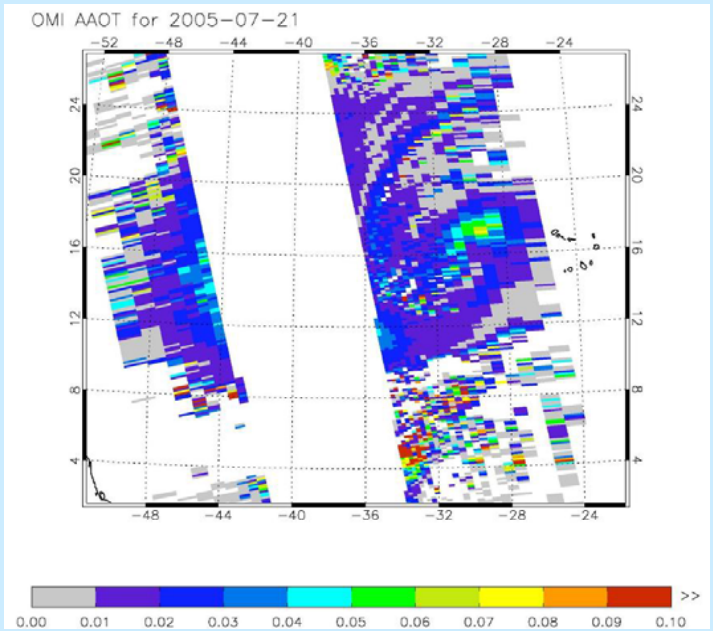


OMI AOT (500 nm)



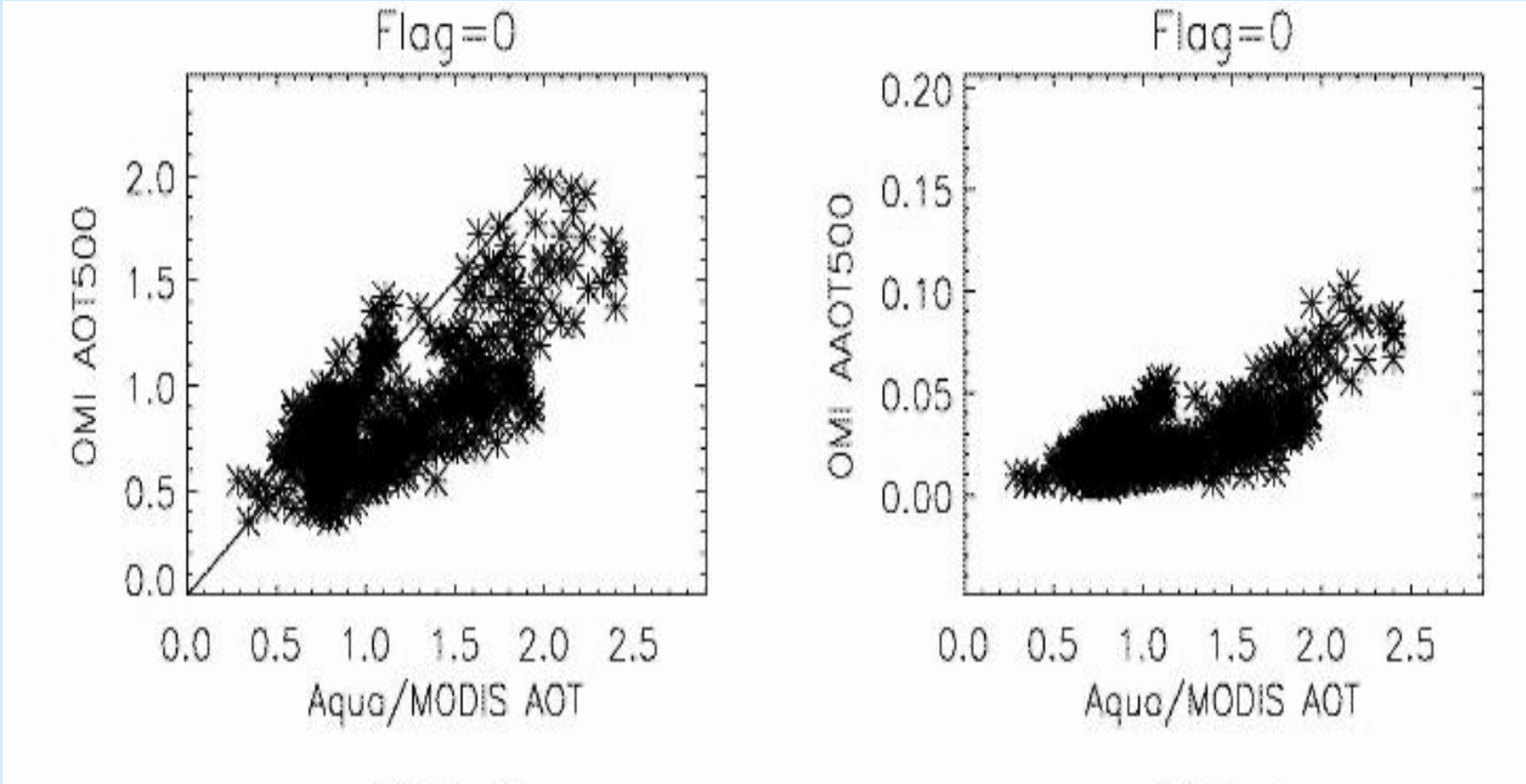
SSA



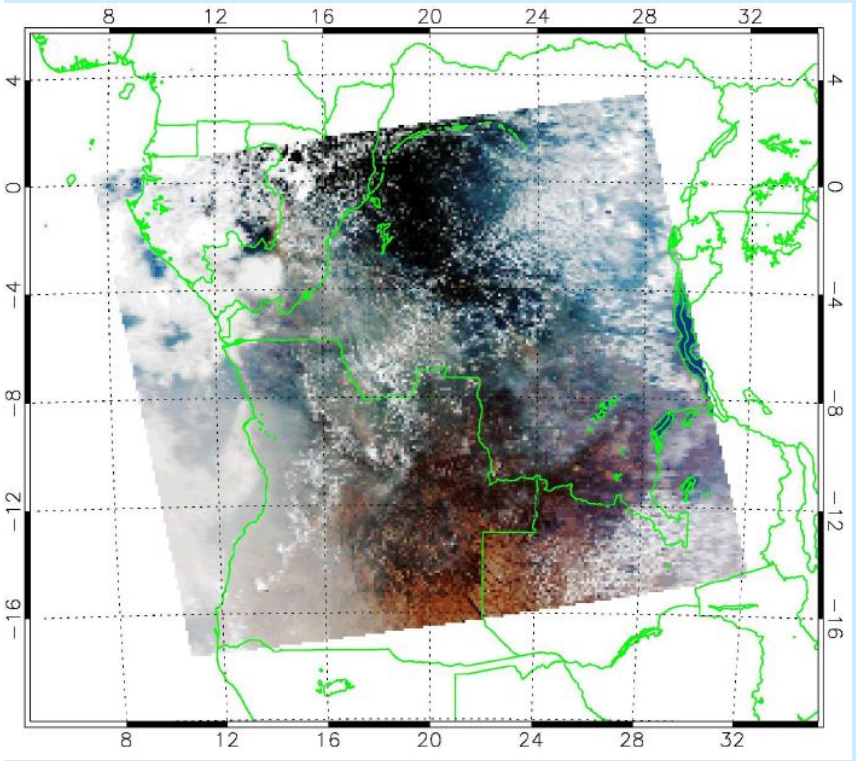


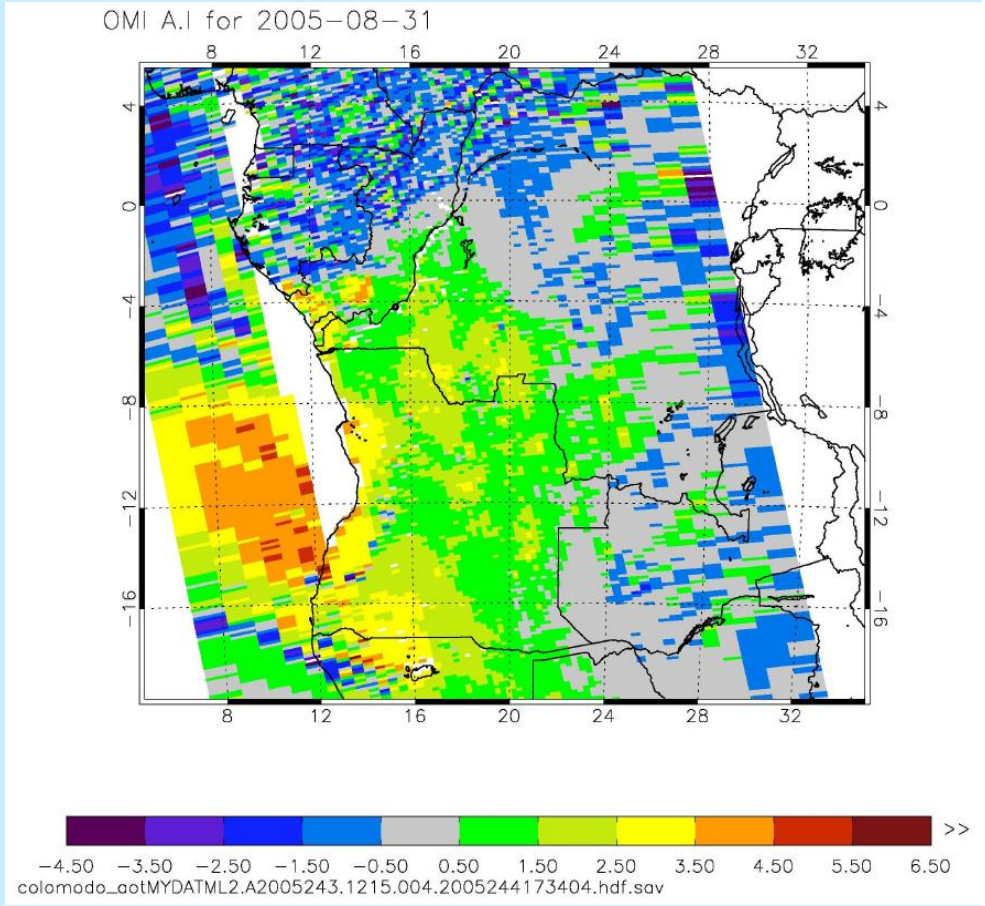
AAOT

MODIS-OMI Comparison on 07-21-2005



OMI smoke retrieval on August 31 2005

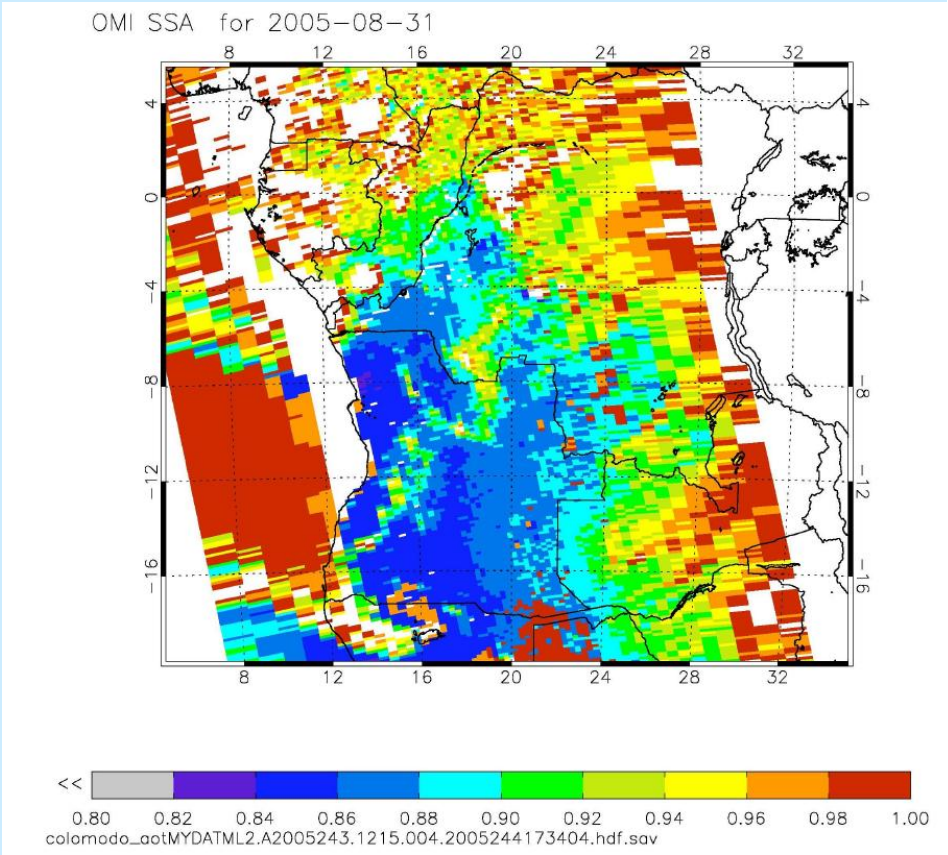


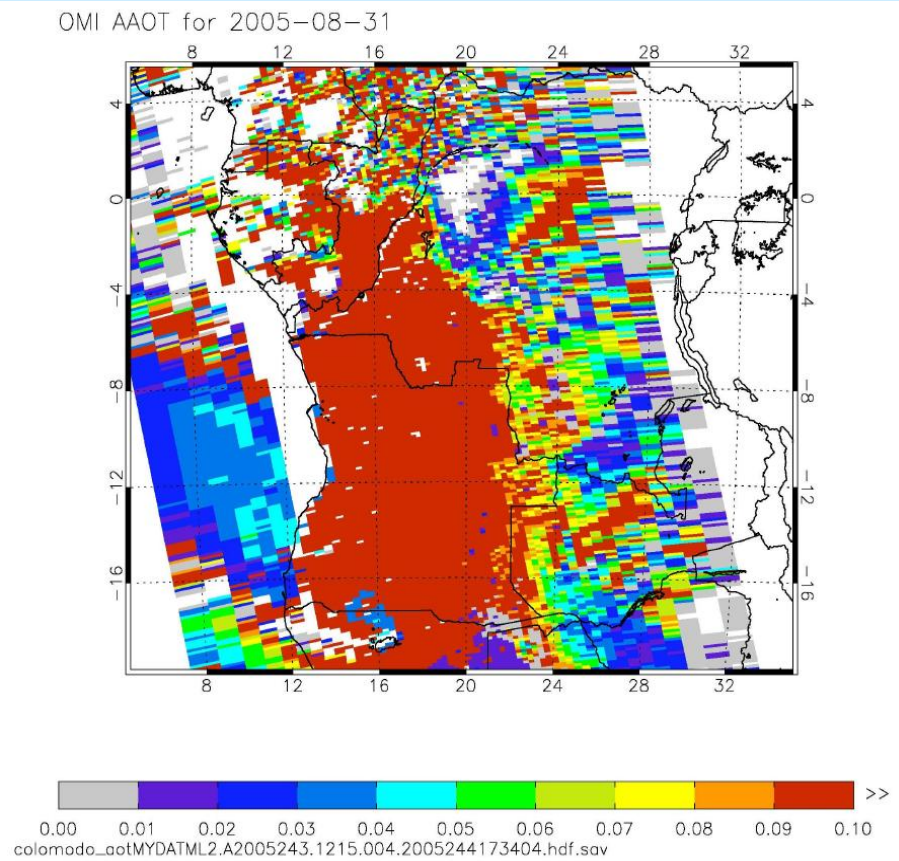


MODIS RGB

OMI Aerosol Index

August 31 2005

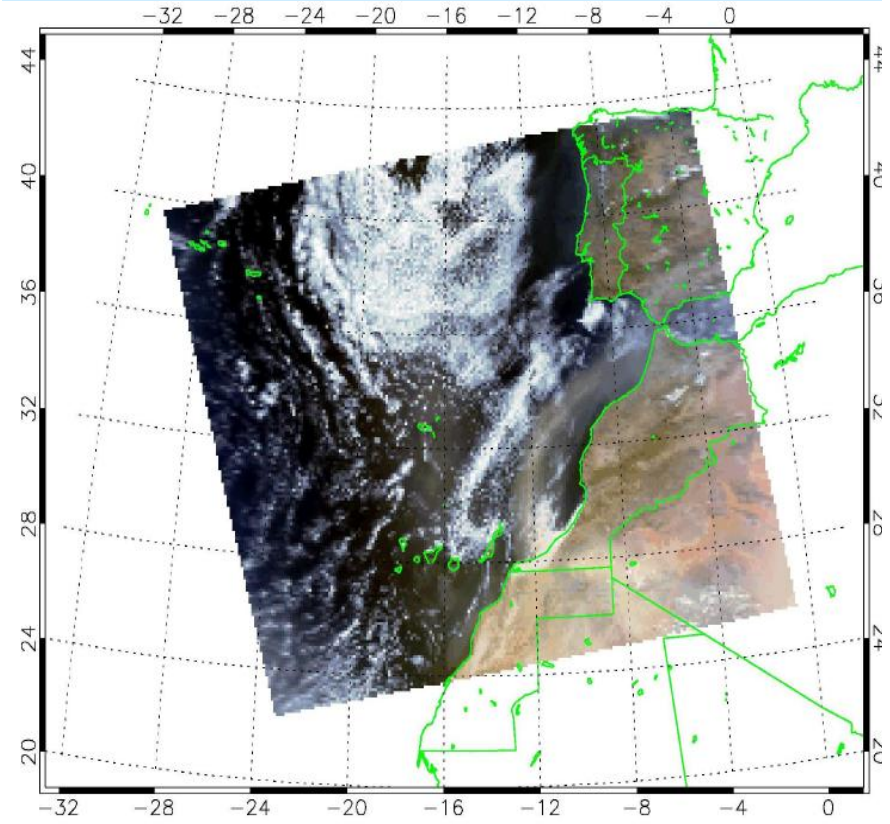




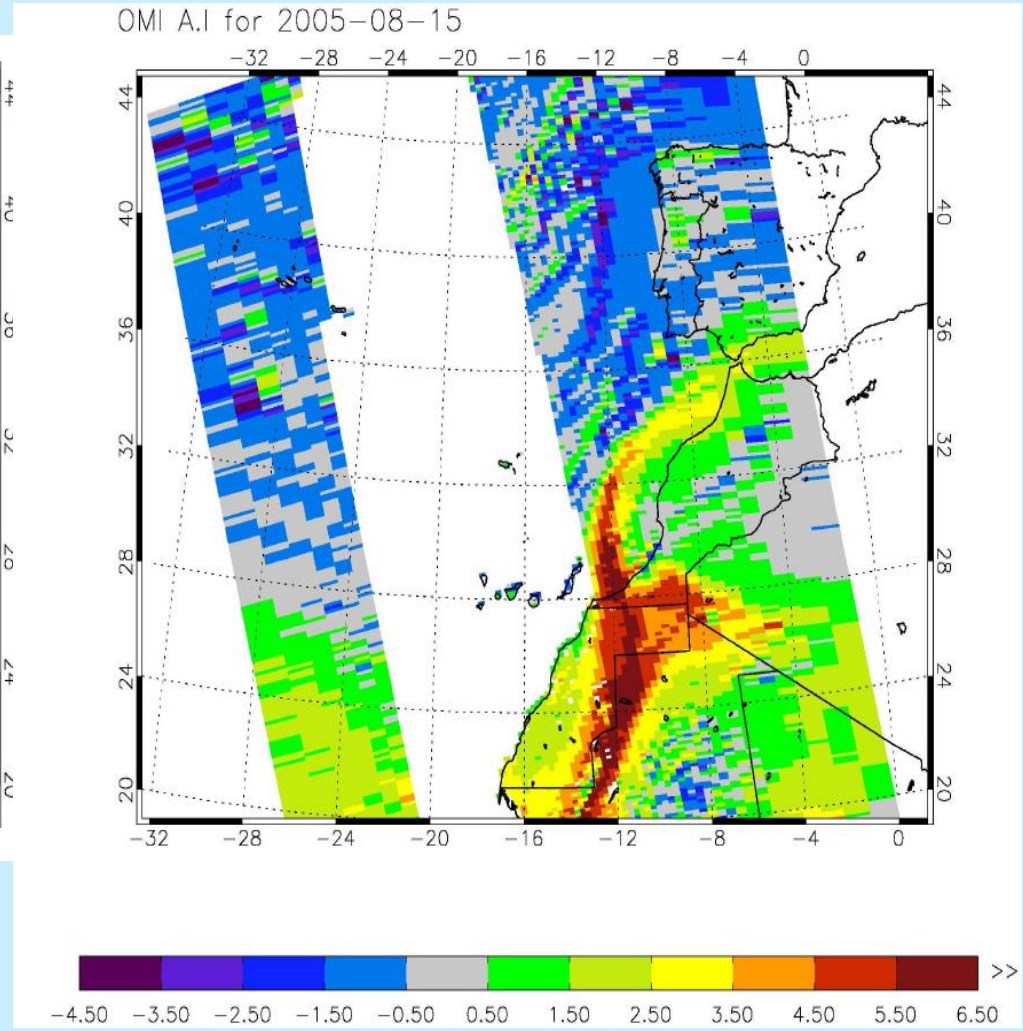
SSA

Absorption Optical Depth

August 15 2005

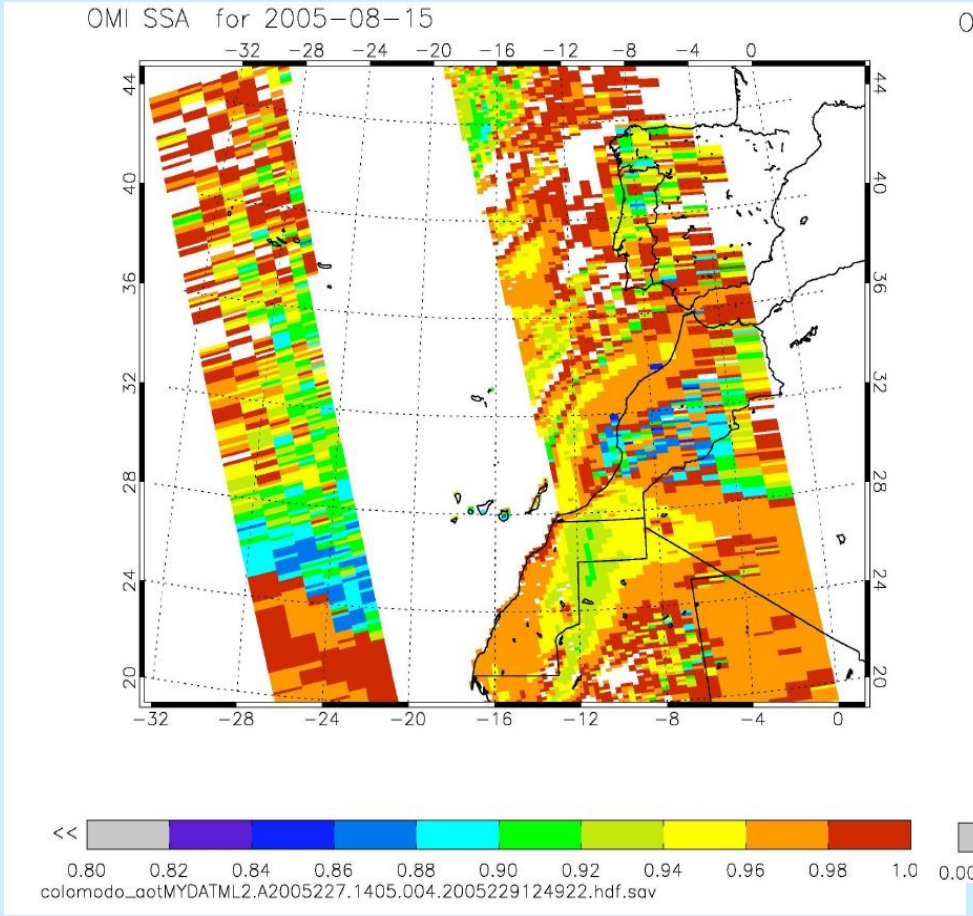


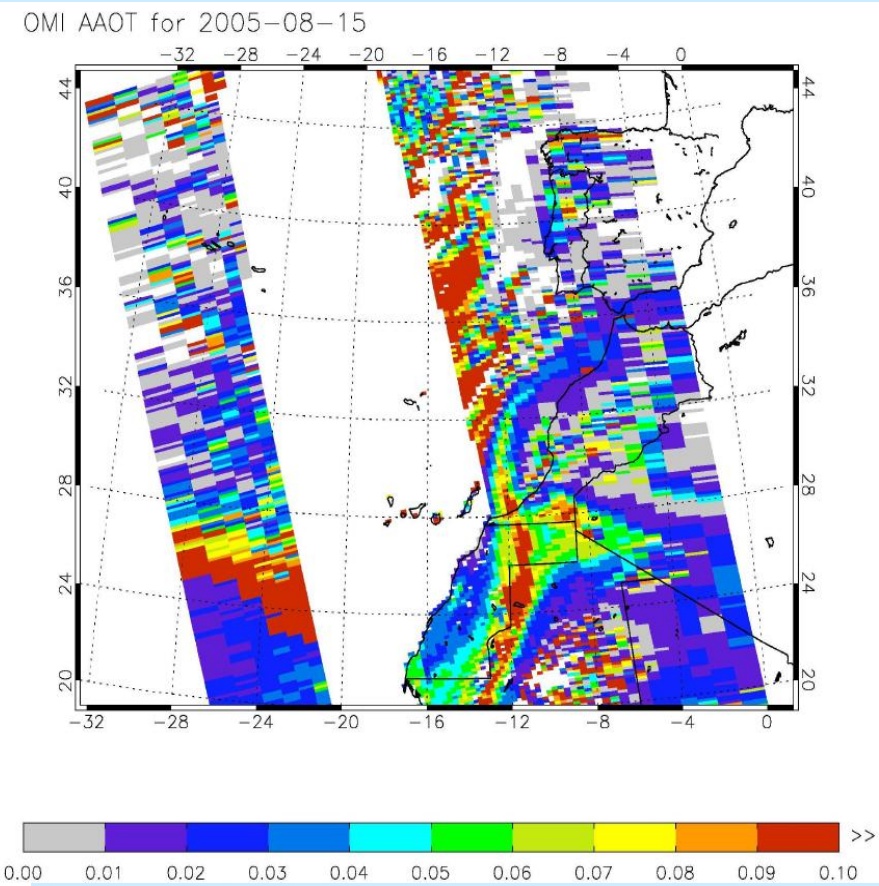
MODIS RGB



OMI Aerosol Index

August 15 2005





SSA

Absorption Optical Depth

Summary

OMI near UV observations are used to retrieve aerosol absorption optical depth. This is a unique OMI capability unavailable in other aerosol dedicated vis-near IR sensors.

The near-UV OMI approach works equally well over ocean and all land surfaces.

OMI improves TOMS capabilities for aerosol absorption observations:

- ***Better spatial resolution***
- ***Extended spectral coverage to the visible***

OMI observation sensor will extend the TOMS 20 year record on aerosol absorption.

-A-train allows the combined use of OMI data with observations from other Aerosol sensors (Calipso, MODIS, Parasol)