Aerosol Properties from OMI Measurements: Potential of the Multi-wavelength Algorithm

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OMI

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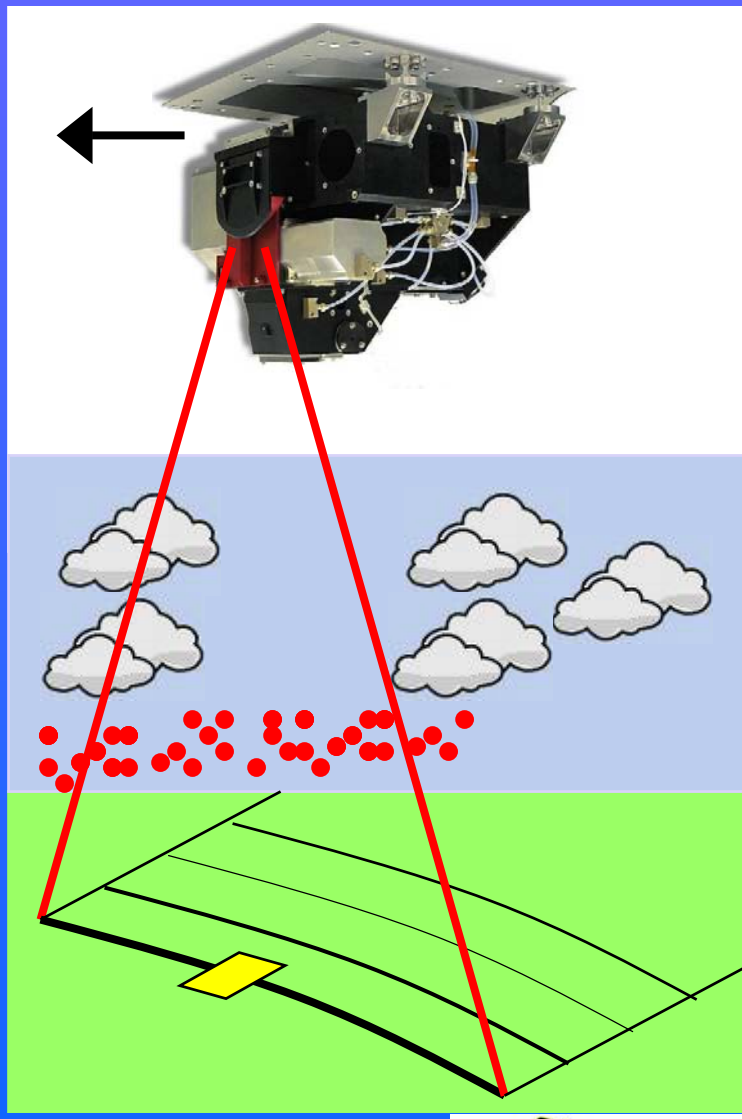
EOS AURA
Chemistry & Climate

Overview

- Ozone Monitoring Instrument
- Aerosol Retrieval Multi-wavelength Algorithm
  - Retrieval Strategy
  - Constraints
- Data Quality
- Transport Models
- Conclusions

Ozone Monitoring Instrument

- UV-VIS imaging spectrometer sensitive to:
  - AOT & aerosol type
  - UV-absorbing aerosols
  - aerosols above clouds (UV-aerosol index)
  - aerosol layer height
- Small pixel size 13 km x 24 km at nadir
  - ~20% cloudfree pixels
- Daily global coverage



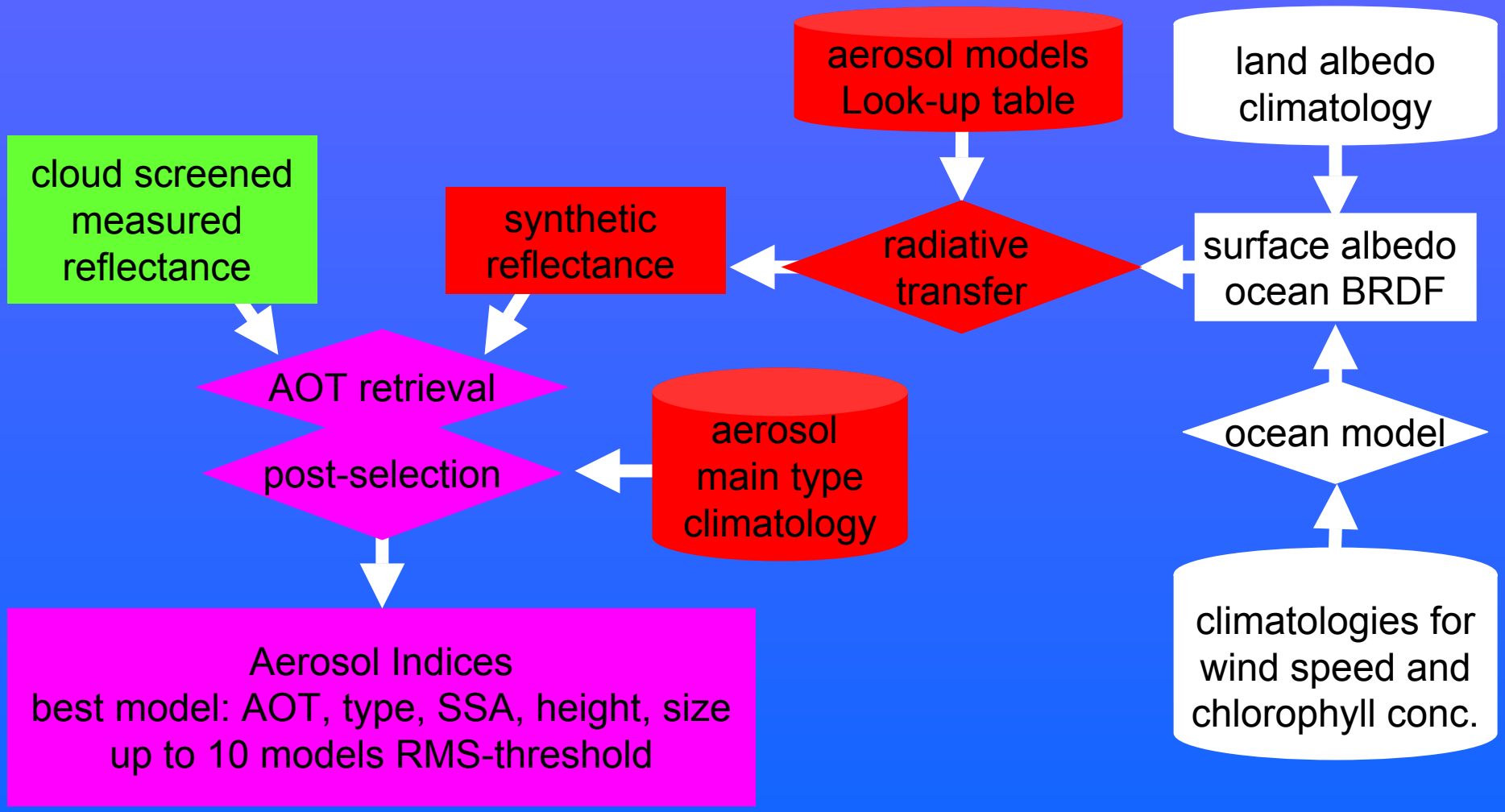
OMI Aerosol algorithms

- **Multi-wavelength algorithm (OMAERO product)**
  - 14 wavelength bands, 1 nm broad
  - Aerosol Optical Thickness (AOT)
  - best fitting aerosol model (out of 50 models)
    - main type: Biomass Burning / **non-spherical** Desert Dust / Weakly Absorbing / Volcanic
    - refractive index → Single-Scattering Albedo (SSA)
    - height
    - size distribution
  - Aerosol Indices (AI): UV, vis

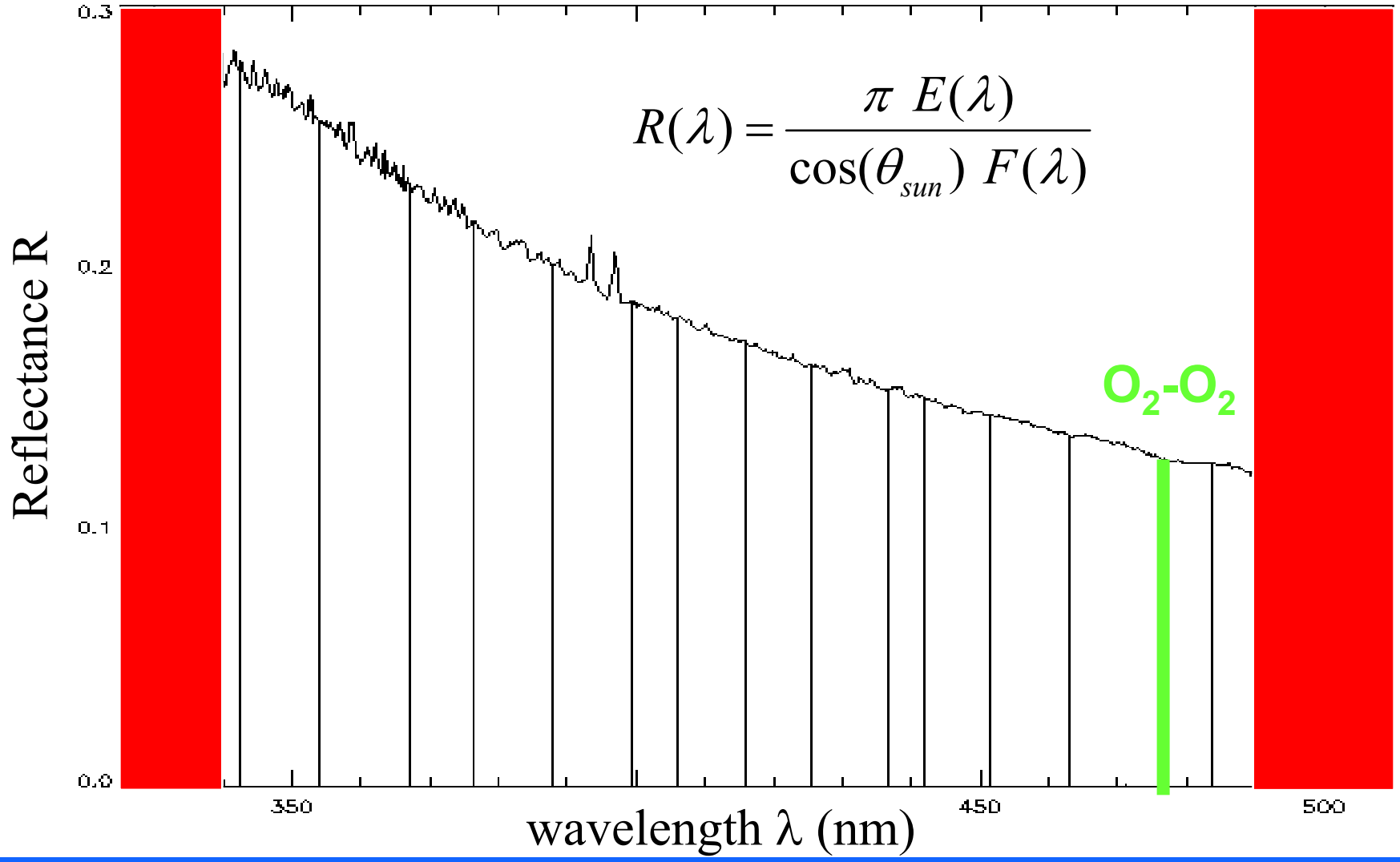
- Near-UV algorithm (OMAERUV product)
  - 2 wavelength bands in UV, TOMS heritage
  - AOT, AI, absorbing AOT

Multi-wavelength algorithm

Retrieval strategy



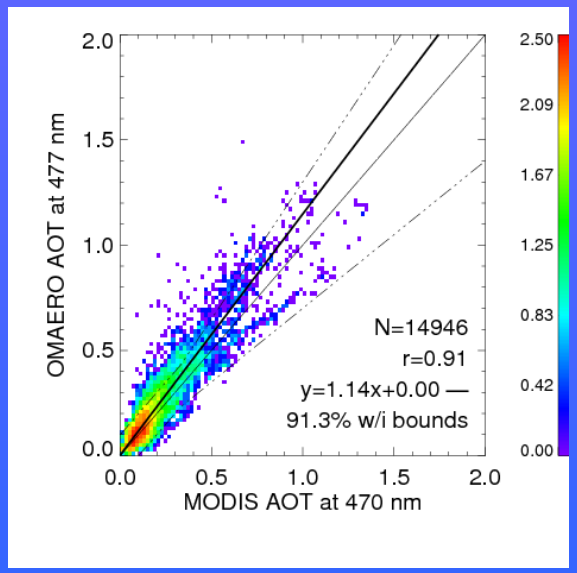
Wavelength bands used in multi-λ algorithm



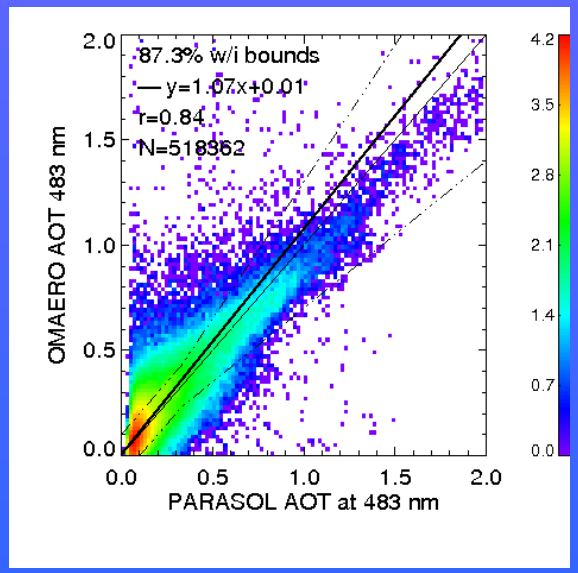
Constraining Aerosol Retrieval

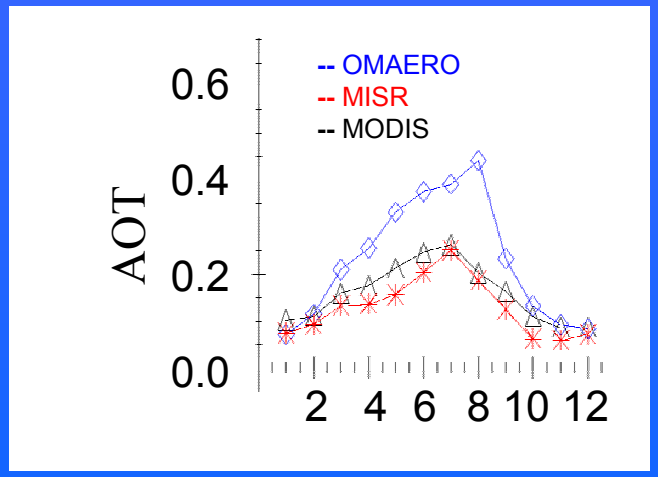
- Aerosol models
- Land surface albedo ρ
  - from global seasonal climatology
  - soon from OMI
  - error $\Delta\rho = 0.05$ → Δ AOT= 0.1 to 0.25
- Aerosol main type
  - climatology from atmospheric transport model
- Aerosol layer height (optional)
  - from CALIPSO → improved SSA

Data Quality



over ocean:
good agreement
with AOT from
MODIS (QA flag =3)
and POLDER





over land:
bias, trends agree with AOT
from MODIS & MISR

Data Quality

- AOT from AATS aircraft measurement (MILAGRO INTEX-B)
  - OMAERO tends to overestimate AOT
- AOT from Aeronet
  - good correlation with biomass burning cases in Amazonia
  - correlation diverse for stations in Europe [0 - 0.64]
- Discrepancies caused by
  - cloud contamination
  - land surface albedo
    → improvement expected with new climatology from OMI
  - correlated errors with height or SSA

Transport Models

- Assimilation of AOT
  - OMI + transport model (EUCAARI project)

    European Integrated Project of Aerosol Cloud Climate Air Quality Interactions

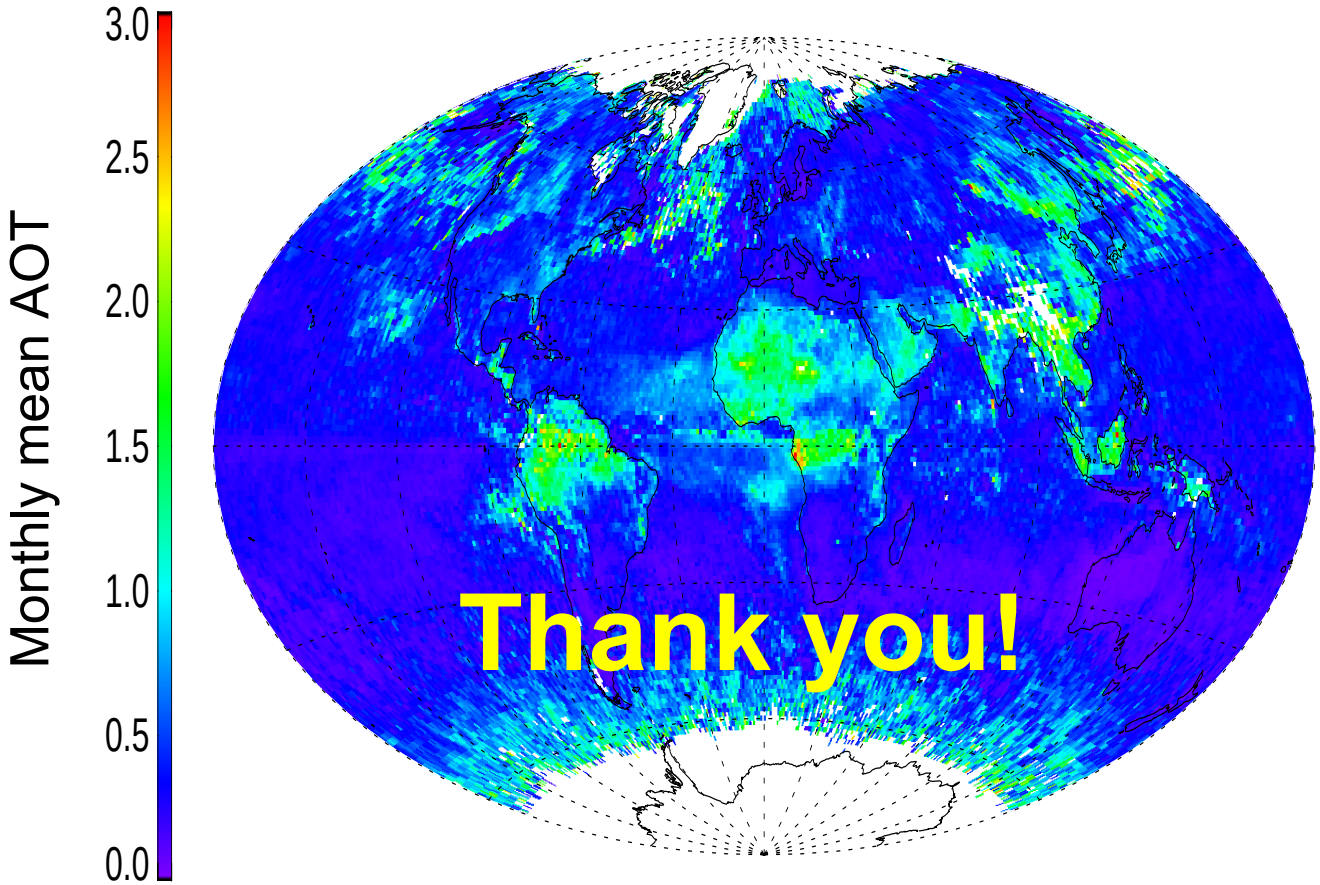
- Estimate particulate matter PM_{10} and $PM_{2.5}$
  - using meteo-scaled AOT + hygroscopic growth → PM
  - OMI + transport model

  → Air Quality near surface

Conclusion

- 3 years global aerosol data: AOT & type
- Validation: AOT over ocean good
  AOT over land promising
- Application to near-surface air quality
- Model applications envisaged

OMAERO data available: http://disc.gsfc.nasa.gov



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