Optical Depth Comparison of an Elastic Lidar and MODIS

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Outline

• Project Goals
• Elastic Lidar Facility (ELF)
• Comparing MODIS and ELF Optical Depths
  – Bad Agreement
  – Good Agreement
• Conclusions/Future Work

Motivation/Goals

• Paul Menzel and Steve Ackerman interested in comparison of MODIS and lidar optical depth products
  – Determine the minimum optical depth that MODIS is capable of resolving
  – Resolve any large discrepancies in the optical depth comparison

Elastic Lidar Facility (ELF)
ABOVE 2003 Experiment

- Chesapeake Lighthouse
  - 14 miles off the VA shore
  - More than 70 overpasses
  - Uniform ocean surface
- Cloud detection for AIRS overpasses on the Aqua satellite

*http://physics.umbc.edu/~mcmillan/ABOVE/

Comparing the Data

- Convert ELF temporal data to MODIS spatial data
- Integration over the columns

Optical Depth Comparison

June 6, 2003

Poor Agreement: June 6, 2003
Cirrus Clouds

*http://eosdb.ssec.wisc.edu/modisdirect

Integrating Below the Cirrus

Conclusions/Future Work

- Comparison showed generally good agreement
  - More data is needed for minimum optical depth validation
- Test ELF algorithm against Klett method
\[ \beta^{+1}_A = \beta^{-1}_A \left( \frac{\frac{2}{\beta} \sigma_0(z)}{K \beta^{+1}_A} \right) \]

\[ \alpha_s = S_A \beta_s \]

\[ \tau_A = \int_0^z \alpha_s dz \]

**Equation 1**

*P*\(_0\)\(_i\): Power

\(K\): system constant

\(\beta_s\): Aerosol backscatter coefficient

\(\alpha_s\): Rayleigh backscatter coefficient

\(\nu_s\): Aerosol extinction coefficient

\(\nu_r\): Rayleigh extinction coefficient

**Equation 2**

\(S_A\) is a constant value that depends on the properties of the aerosols that are measured.

**Equation 3**

We assume most of the contribution to optical depth lies in the 0.05 to 15.33 km range, which is the limits of ELF’s ability to detect.