Validation of MODIS-Aqua Deep Blue Aerosol Products over Bright Surfaces

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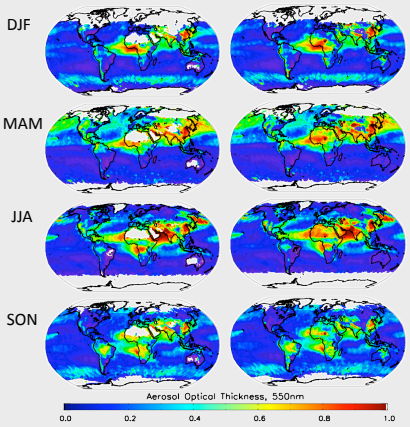
Background

About Deep Blue

Because of the difficulty in separating the signals of aerosols from those of highly reflective surfaces, aerosol retrievals over bright surfaces, such as deserts, have been limited. The MODIS Deep Blue aerosol retrieval algorithm uses the blue channels, where the surface contribution is relatively low, to retrieve aerosol properties over such regions (Hsu et al., 2004; 2006).

The Deep Blue Advantage

Deep Blue fills in data gaps left by the Dark Target-Land aerosol retrieval, which does not operate over bright surfaces. Below are seasonal average aerosol optical thickness (AOT) maps for 2008 from MYD04_L2 Aerosol Product without Deep Blue (left column) and with Deep Blue (right column).



Collection 5.1

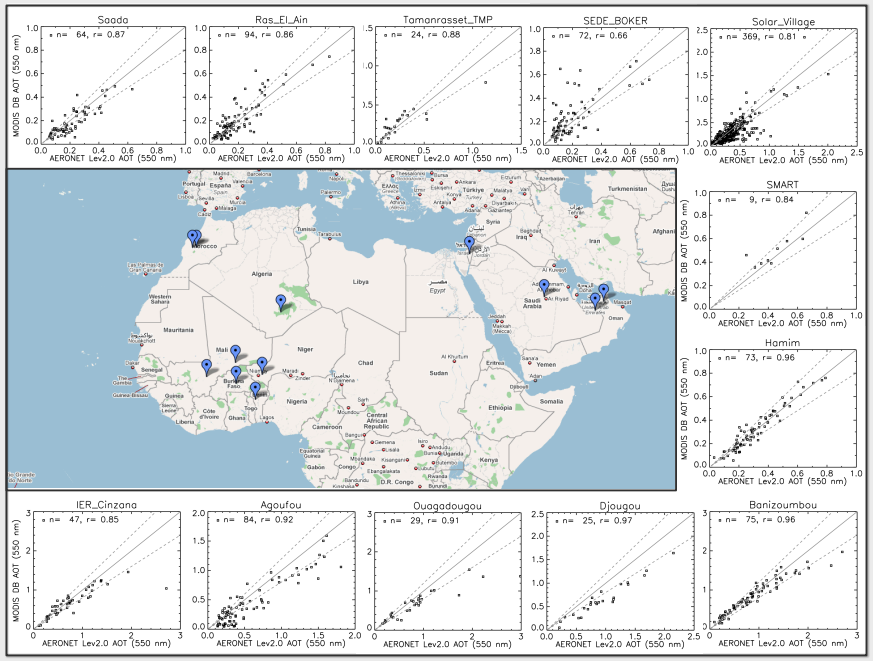
Major updates to the Deep Blue algorithm were included in the MODIS-Aqua reprocessing (Collection 5.1), which finished earlier this year. The Collection 5.1 MODIS-Terra reprocessing is set to begin soon. Deep Blue datasets will be available in MODIS-Terra products from the start of the mission (Feb 2000) to Dec 2007.

Validation by Site

Validation Methodology

MODIS-Aqua Deep Blue AOT retrievals are validated against the global AERONET sun photometer network. The MODIS Atmosphere Parameters Subset Statistics (MAPSS) collocation tool (Ichoku et al., 2002) is used to create data pairs; collocated AERONET-MODIS pairs are composed of the AERONET value nearest to overpass time (within 5 minutes) and the value of the MODIS pixel containing the AERONET site. AERONET data are constrained to Level 2.0 (Quality Assured). MODIS-Aqua Deep Blue data are constrained to QA=3.

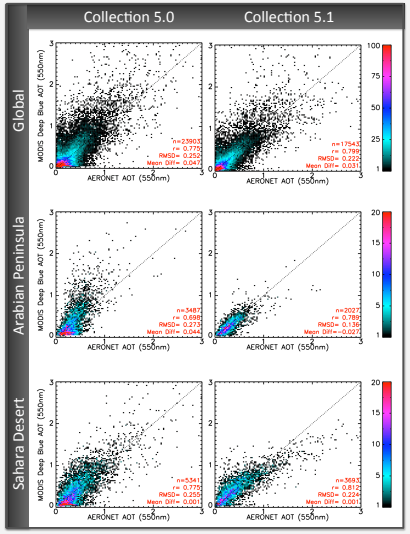
The map at right pinpoints AERONET sites around the globe where collocated Deep Blue retrievals exist. Thus far, site-specific validation efforts are concentrated in the Sahara Desert and the Arabian Peninsula, two important aerosol source regions. The entire MODIS-Aqua dataset is used, from July 2002 to December 2008.



Validation by Region

Density Plots

The improved agreement of Collection 5.1 versus Collection 5.0 is shown in the density plots below. Again, the MAPSS tool is used to collocated MODIS-Aqua and AERONET data. Comparisons are separated by region, with global (top), Arabian Peninsula (middle) and Sahara Desert (bottom) results shown.



Summary

The MODIS Deep Blue aerosol retrieval algorithm is an important addition to the MODIS aerosol Product, as it fills in data gaps over bright surfaces, such as deserts. Recent updates to the algorithm, termed “Collection 5.1”, yield improved AOT agreement compared to AERONET values as seen by global and local comparisons over six years of MODIS-Aqua data.

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Ichoku, C., D. A. Chu, S. Mattoo, Y. J. Kaufman, L. A. Remer, D. Tanré, I. Slutsker, and B. N. Holben (2002), A spatio-temporal approach for global validation and analysis of MODIS aerosol products. *Geophys. Res. Lett.*, 29(12):10.1029/2001GL013206.
Hsu, N. C., S.-C. Tsay, M. D. King, and J. R. Herman (2004). Aerosol properties over bright-reflecting source regions. *IEEE T. Geosci. Remote, 42(3)*, 557–569.
Hsu, N. C., S.-C. Tsay, M. D. King, and J. R. Herman (2006). Deep blue retrievals of asian aerosol properties during ace-asia. *IEEE T. Geosci. Remote, 44(11)*, 3180–3195.