A33B-03 AGU

The MODIS-Aqua Deep Blue Aerosol Products: An Update to Collection 5.1 and Validation

M.-J. Jeong[1,2], N.C. Hsu[2], C. Salustro[3], S.-C. Tsay[2], Q. Ji[2,4], R.A. Hansell[2,4]

[1]Goddard Earth Sciences and Technology Center, University of Maryland Baltimore County, Baltimore, MD.

[2]Goddard Space Flight Center, National Aeronautics and Space Administration, Greenbelt, MD.

[3]Science Systems and Applications, Inc. Lanham, MD.

[4]Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD

Email: Myeong-Jae.Jeong-1@nasa.gov

Introduction

The MODIS Deep Blue algorithm utilizes the blue channels of the MODIS sensor to retrieve aerosol properties, particularly but not limited to, over bright surfaces. Recent updates to the algorithm, here referred to as 'Collection 5.1', have led to improved agreement with collocated AERONET observations.

SUMMARY OF CHANGES IN COLLECTION 5.1

Collection 5.1 includes several updates, most significantly:

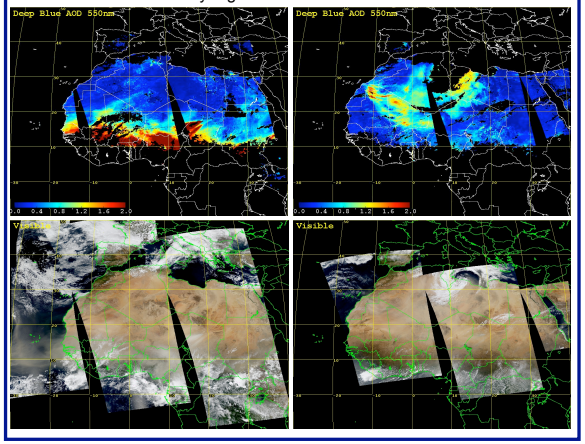
(1) parameterization of BRDF effects on surface reflectance over deserts
(2) improvement of the cloud screening procedures
(3) improvement on the classification of QA/QC flags

AVAILABILITY

Deep Blue Collection 5.1 will be incorporated in the upcoming MODIS-Aqua reprocessing, set to begin in June. Deep Blue will be included for the first time in the MODIS-Terra reprocessing later this summer.

Examples: Airborne Saharan Dust

Retrievals of Deep Blue Aerosol Optical Thickness (AOT) [top row] and their corresponding true-color images (bottom row) illustrate how Deep Blue captures aerosol properties over the bright surface of the Sahara. On 10 March 2006, the result of a large dust outbreak event is clearly visible over the ocean (bottom left), and Deep Blue maps the plume over land (top left). On 9 March 2007, several dust storms across the Northwest Africa are present, forming an arch shape (top and bottom right). Note that no retrieval is made in cloudy regions.



Summary

Updates in physics (surface BRDF effect and cloud screening) and quality control procedures are made to the MODIS Deep Blue aerosol retrieval algorithm. Better agreements with the AERONET are achieved based on the updated physics. An updated version (Collection 5.1) of the operational MODIS Deep Blue aerosol products will be publicly available soon (http://ladsweb.nascom.nasa.gov/).

Validation

METHODOLOGY

Deep Blue AOT is compared to AERONET sun photometer data using the MODIS Atmosphere Parameters Subset Statistics (MAPSS) collocation tool (Ichoku et al., 2002). For this study, the average of all AERONET (level 2.0, quality assured) observations within +/-30 minutes of MODIS-Aqua overpass is combined with the MODIS value for the pixel containing the AERONET site to form a collocated pair.

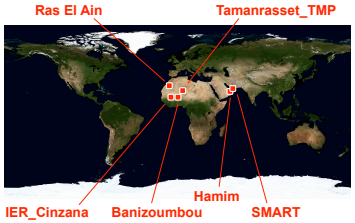
DATA

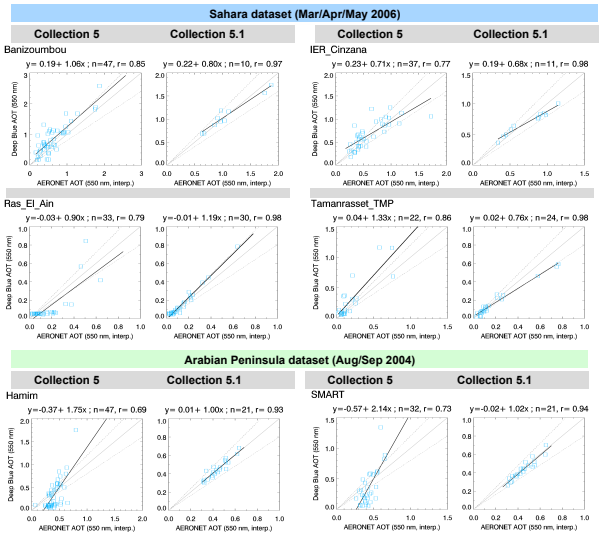
Results are shown for two validation datasets:

August-September 2004 covering the Arabian Peninsula

March-April-May 2006 covering the Sahara Desert

The map at right shows selected AERONET sites used for the scatter plots below.

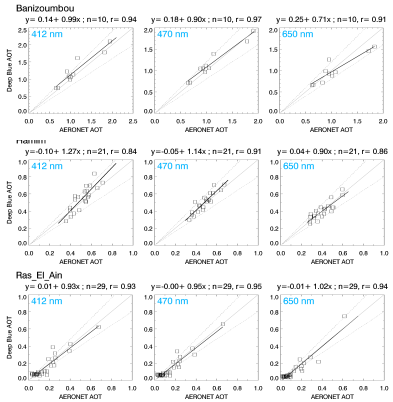




RESULTS BY SITE

Collocated AOT (550 nm) is plotted for Collection 5 (left column) and Collection 5.1 (right column) Deep Blue data for select AERONET sites. For Collection 5.1, only high quality data ("Very Good") is used. No QA filtering is implemented for Collection 5. Dashed grey lines are +/- 20%. The thick black line is represents the line of best fit. The corresponding equation, along with the number of collocated pairs (n) and Pearsons linear correlation coefficient (r) is given at the top of the plot. Note different scales.

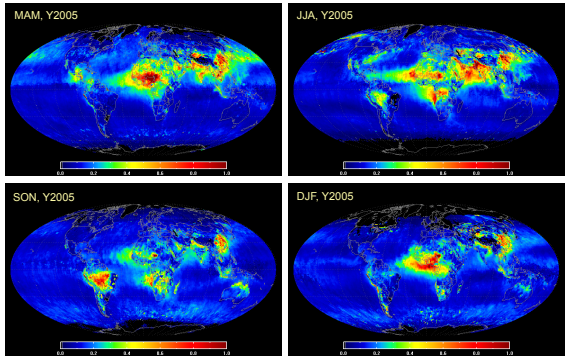
Comparison at Other Wavelengths



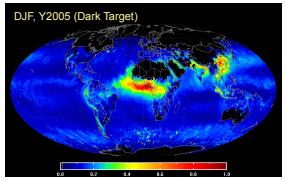
In addition to 550 nm, Deep Blue retrieves aerosol properties at 412, 470 and 650 nm. Early results for Collection 5.1 show consistent agreement across all wavelengths (left), indicating proper spectral dependence in models used for the retrievals.

The Deep Blue Advantage

Deep Blue is an important addition to the MODIS Level 2 Aerosol Products. Because the Dark Target Land and Ocean algorithms do not retrieve aerosol over bright surfaces, Deep Blue products fill in significant data gaps (below right). With Deep Blue, aerosol properties over important source regions, including the Sahara Desert, can be quantified.



Above, global maps of 2005 seasonal AOT averages are constructed by combining Dark Target (Land and Ocean; Remer et al., 2005) with Deep Blue retrievals.



Reference

Ichoku, C., D.A. Chu, S. Mattoo, Y.J. Kaufman et al. (2002), A spatio-temporal approach for global validation and analysis of MODIS aerosol products. *Geophys. Res. Lett.*, 29(12):10.1029/2001GL013206.

Remer, L.A., Y.J. Kaufman, S. Mattoo, J.V. Martins, C. Ichoku, R.C. Levy, and R.G. Kleidman (2005), The MODIS aerosol algorithm, products, and validation, *J. Atmos. Sci.*, 62(4), 947-973.