Recent Update on MODIS C6 and VIIRS Deep Blue Aerosol Products

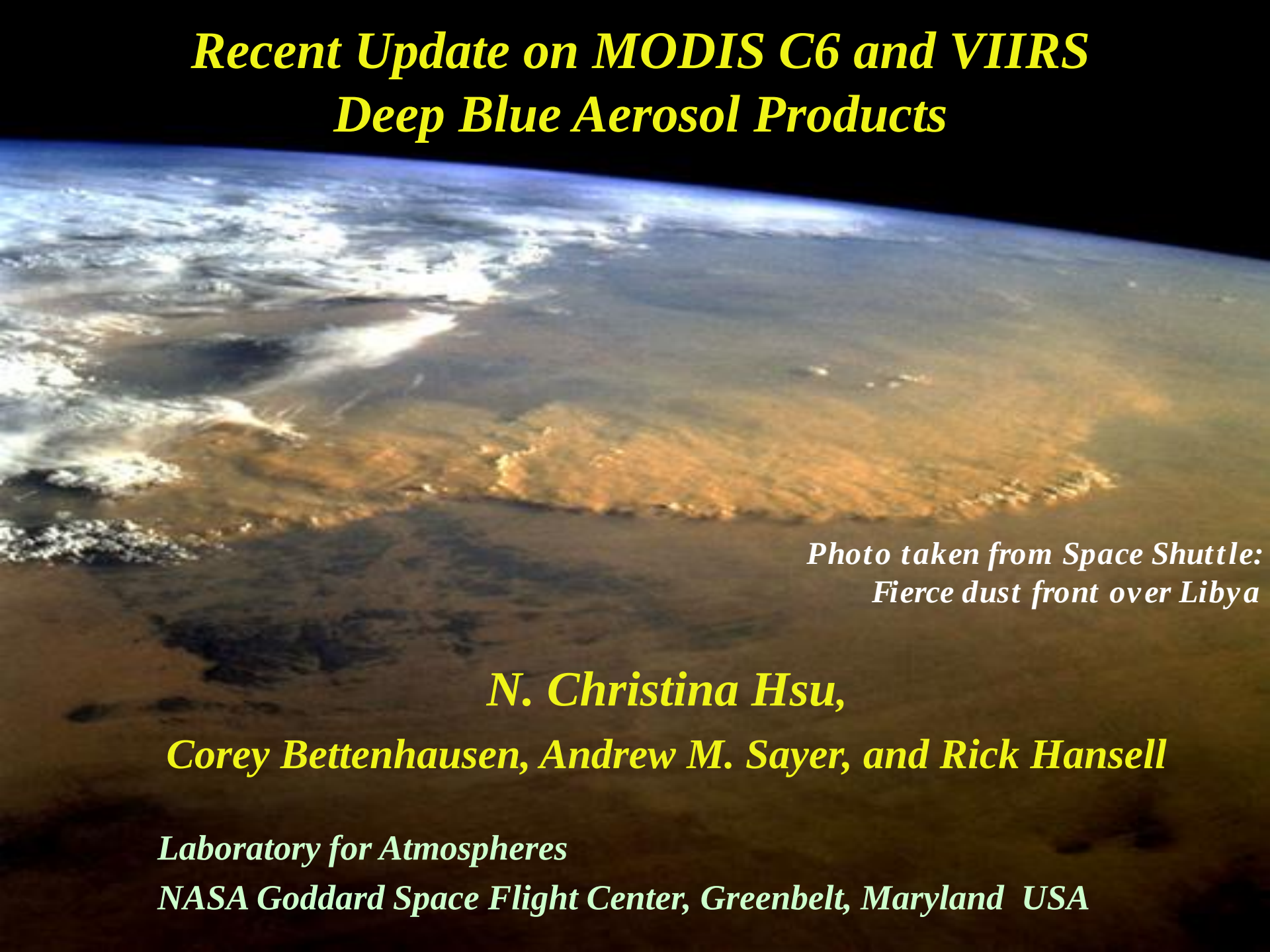

Photo taken from Space Shuttle: Fierce dust front over Libya

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Laboratory for Atmospheres

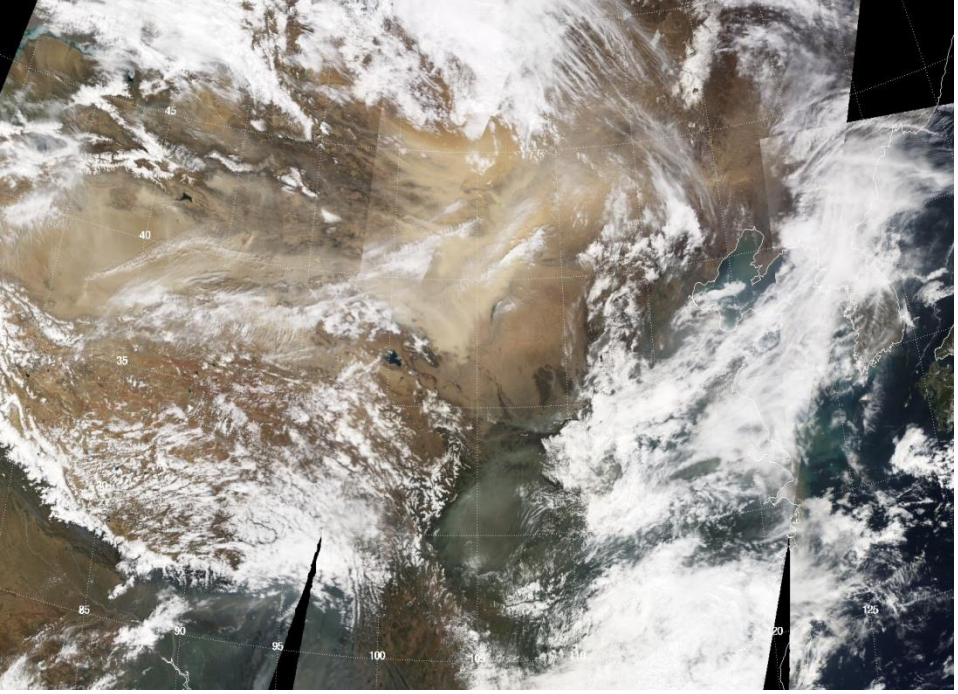
NASA Goddard Space Flight Center, Greenbelt, Maryland USA

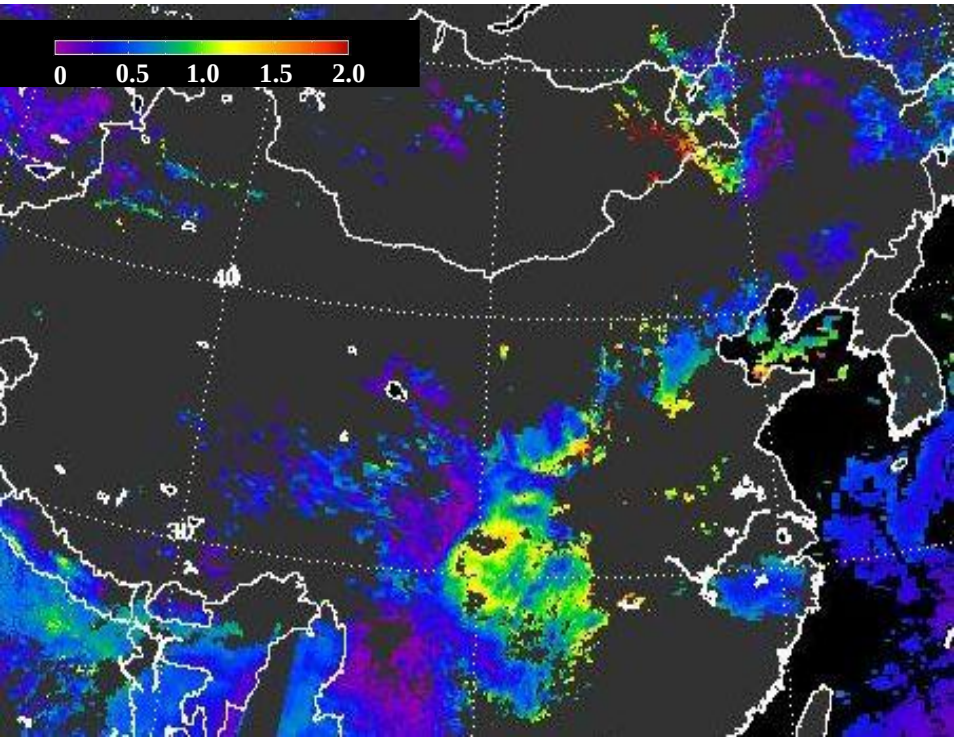
6 April 2001

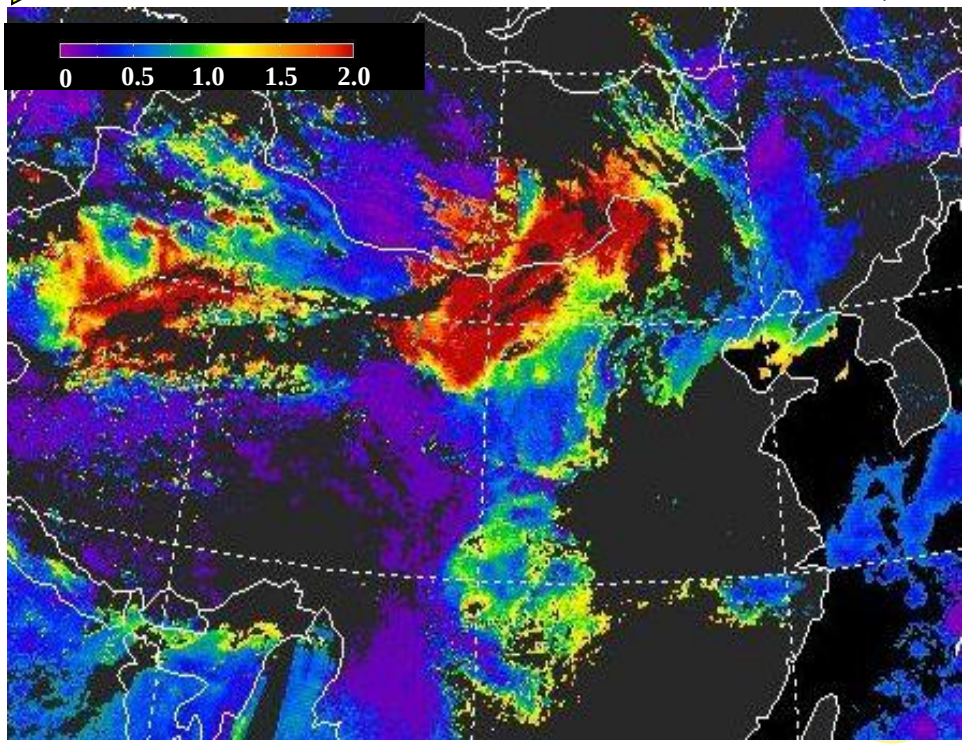
MODIS *Red*-*Green*-*Blue* with Rayleigh scattering removed

Current* MODIS *retrievals:
Aerosol Optical Thickness

New* MODIS *Deep Blue:
Aerosol Optical Thickness



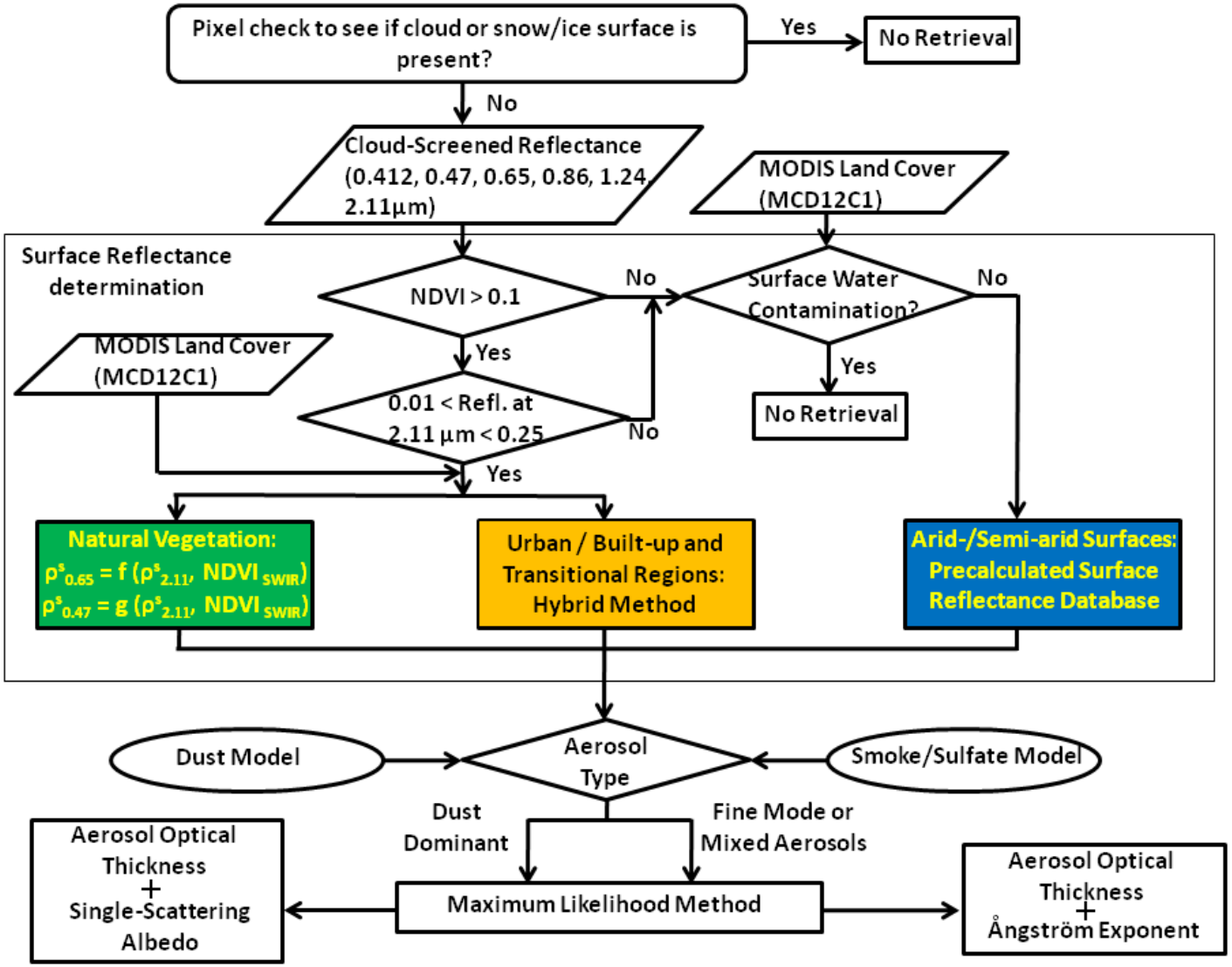




Recent Progress on Deep Blue Aerosol Algorithm in MODIS C6

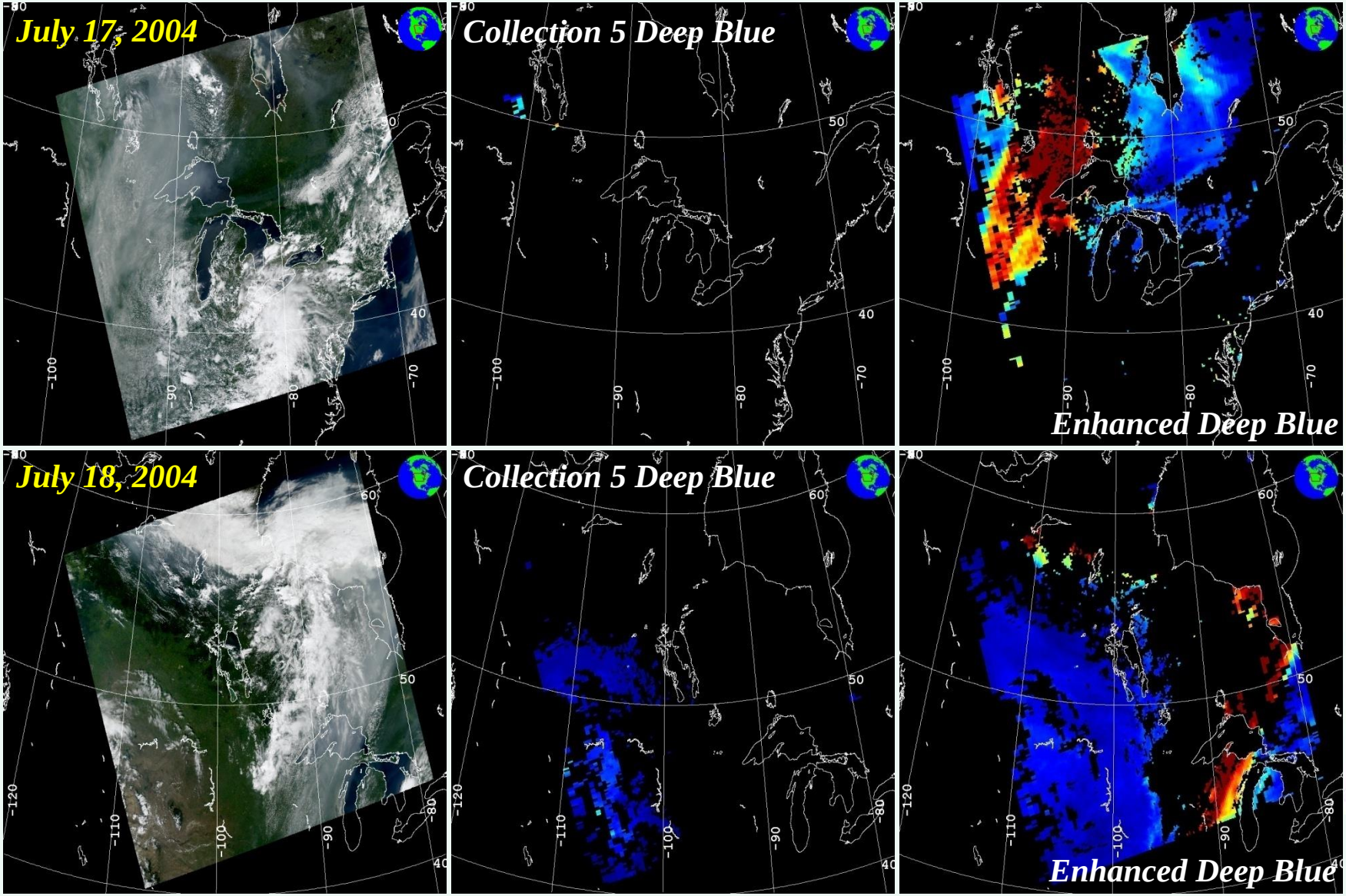
- Expand coverage from arid and semi-arid regions into vegetated (SeaWiFS, MODIS C6, and VIIRS) areas as well as oceans (SeaWiFS and VIIRS only)
- Move away from the static surface reflectance data bases
  - implemented dynamic surface reflectance determination into Deep Blue algorithm;
  - include changes in vegetation using NDVI.
- Improve cloud screening scheme, particularly for the presence of thin cirrus under moist deprived regions
- Better identify strongly absorbing mineral dust by using both visible and IR channels simultaneously

Flowchart of MODIS C6 Deep Blue Algorithm

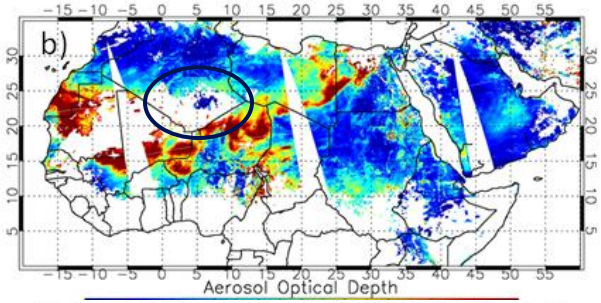


Reference: *Hsu, N. C., M.-J. Jeong, C. Bettenhausen, A. M. Sayer, et al., Enhanced Deep Blue Aerosol Retrieval Algorithm: The Second Generation, J. Geophys. Res. , 118, doi:10.1002/jgrd.50712, 2013.*

Expanding Spatial Coverage of Deep Blue Aerosol Retrieval into Entire Land Surfaces including Vegetated Areas

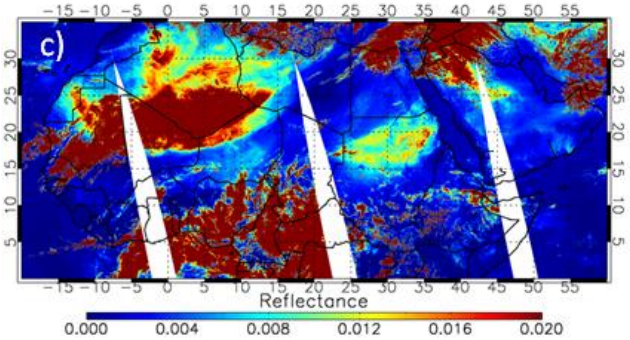


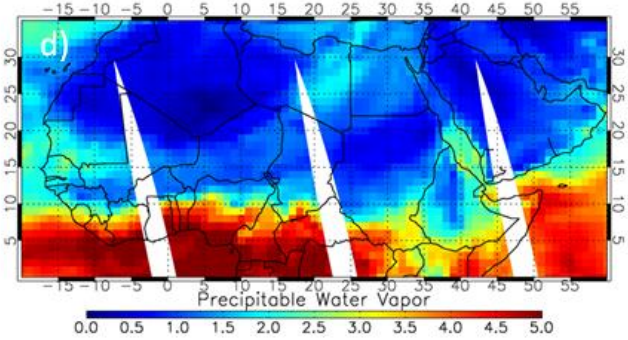
MODIS RGB image over Sahara on March 7, 2006



MODIS C5 Deep Blue AOT

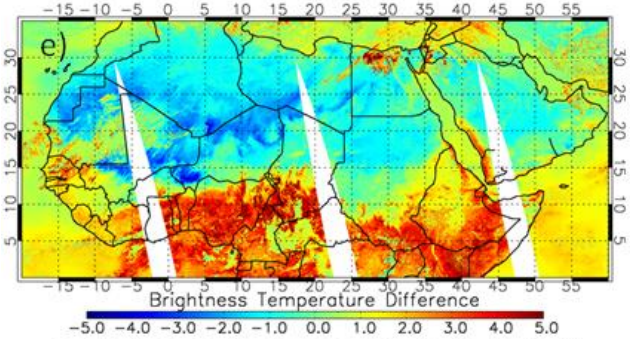
TOA Reflectance at 1.38 μm

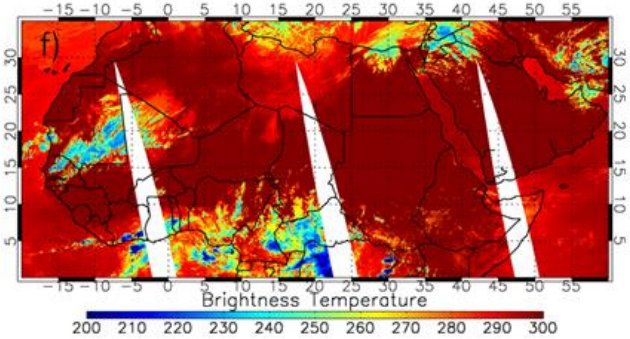




Precipitable water vapor

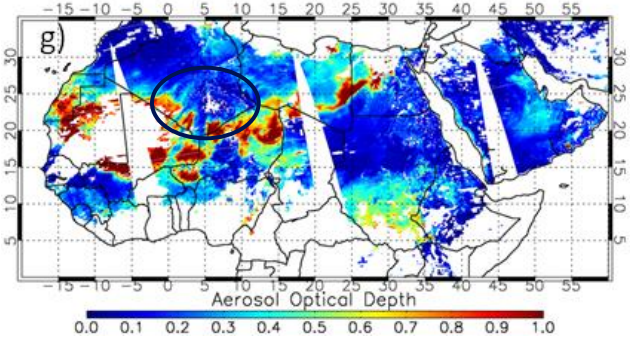
BTD11-12





Brightness temperature at 11 μm

MODIS C6 Deep Blue AOT

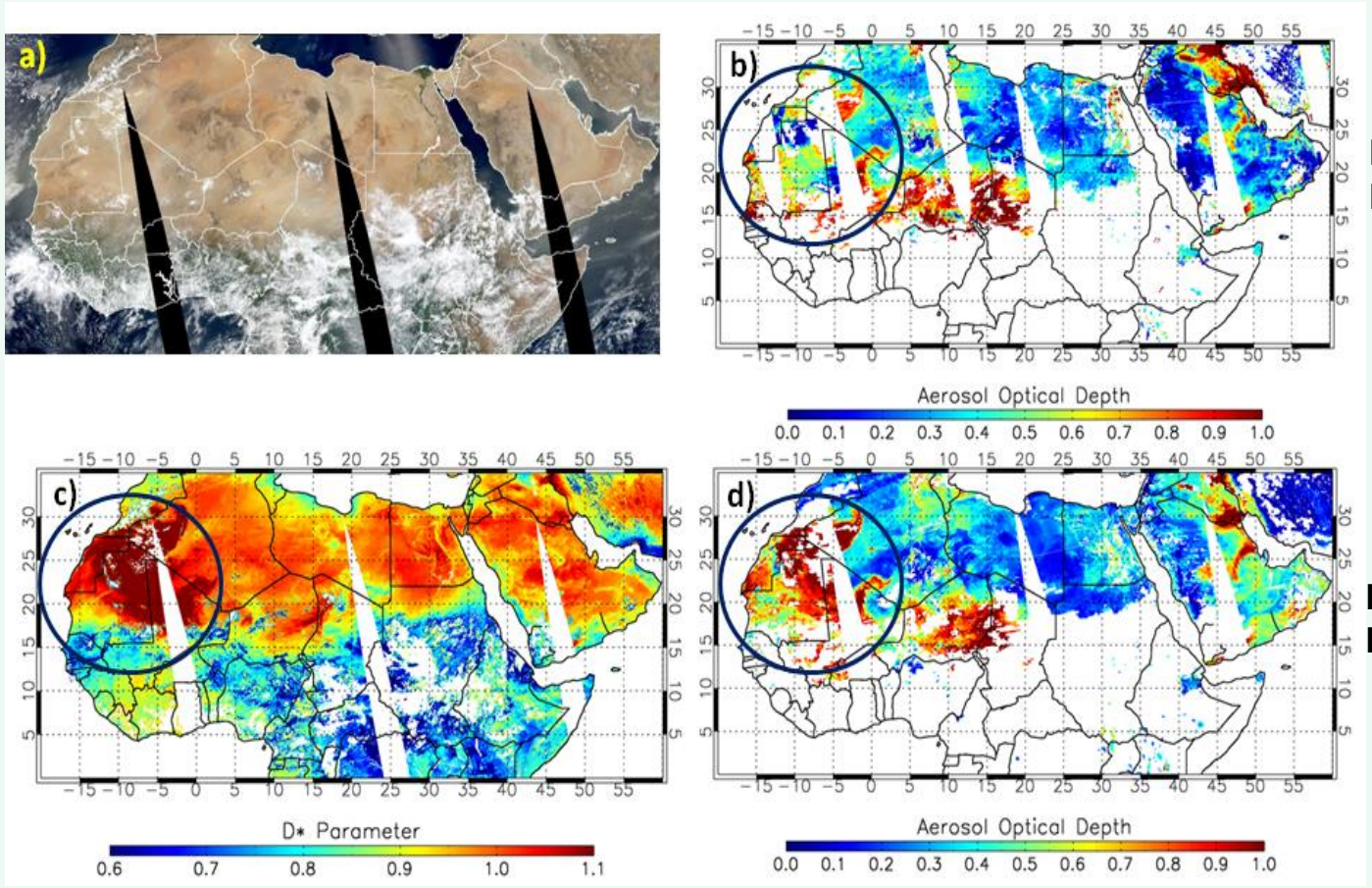


Improving Thin Cirrus Over-Screening over Moist Deprived Regions

Identifying Strongly Absorbing Dust using Brightness Temperature Differences from Thermal Infrared Channels

MODIS RGB image over Sahara on July 9, 2007

D* values

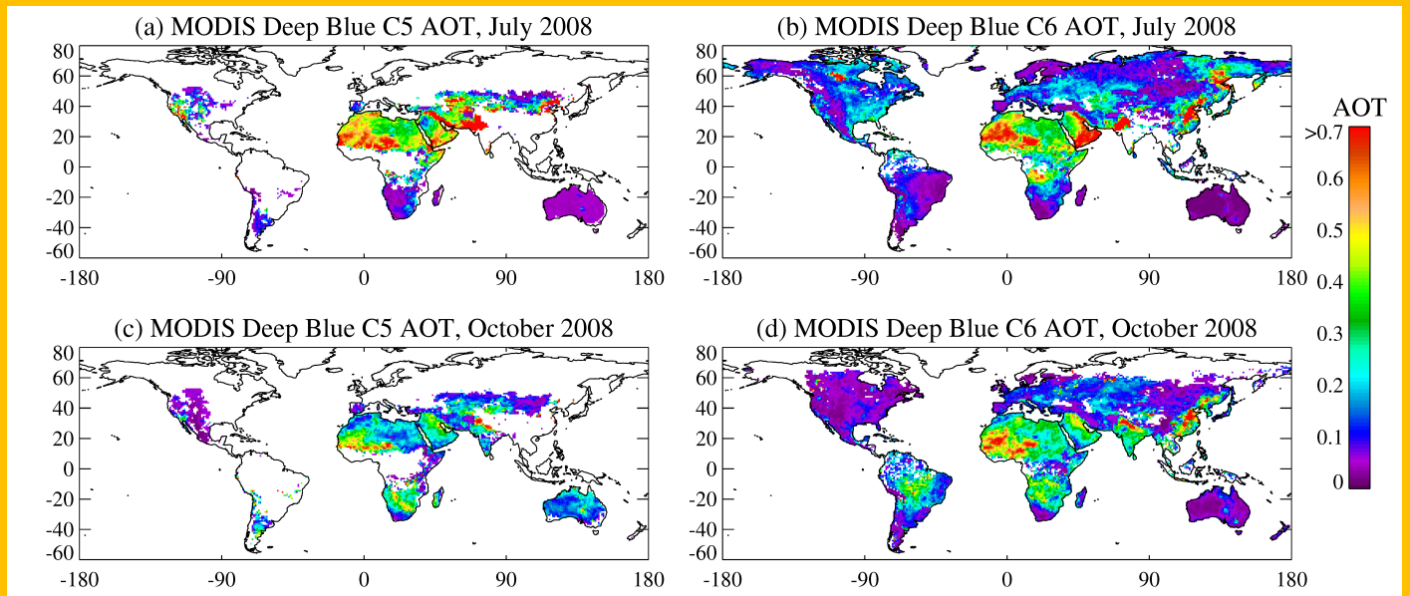


MODIS C5 Deep Blue AOT

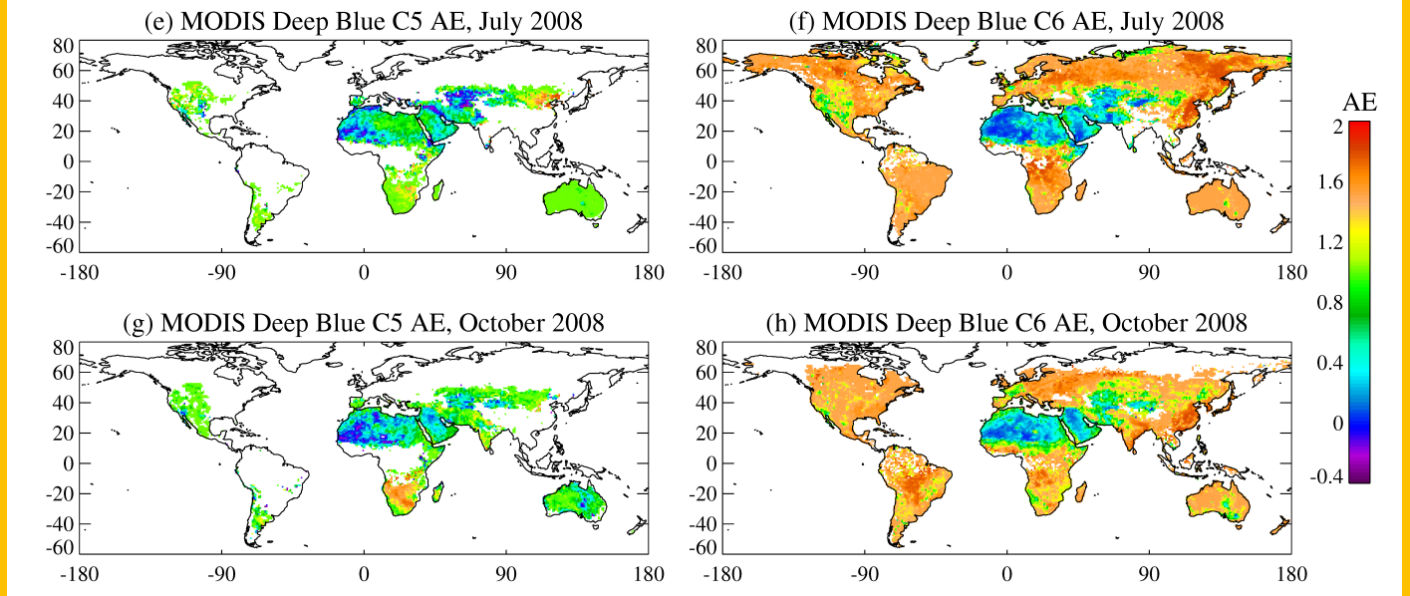
MODIS C6 Deep Blue AOT

When D* >1.1, a Heavy Dust Flag will be triggered and then different retrieval path will be performed in the Deep Blue algorithm, where D* = *exp*{[(BTD11-12) + 0.05] / [(BTD8-11) – 10.0)]}.

Comparisons of Monthly AOT at 550 nm and Angstrom Exponent for July and October 2008 (MODIS Aqua C5 vs. C6)



AOT

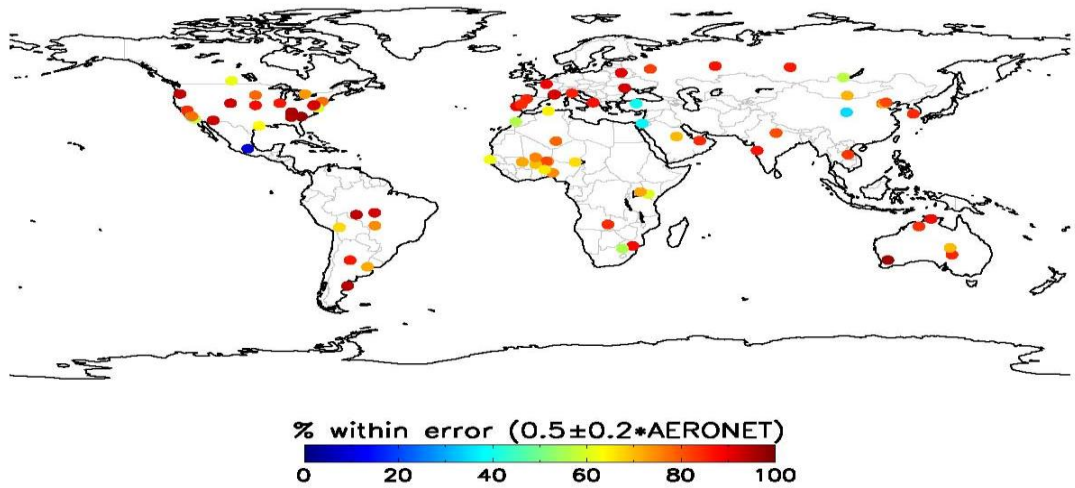


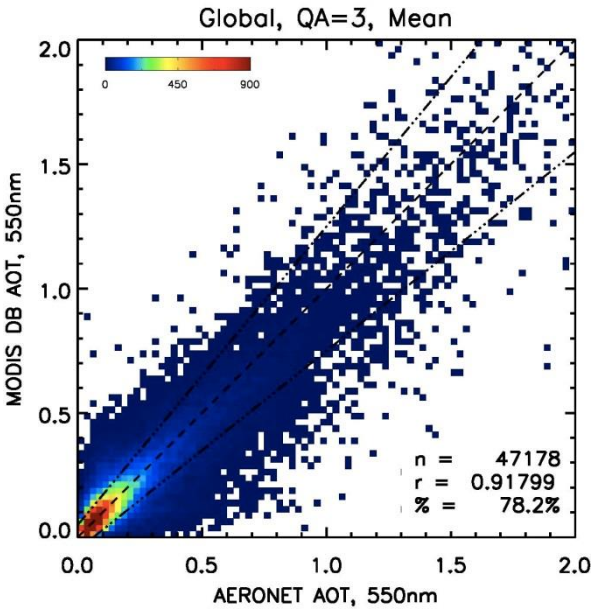
AE

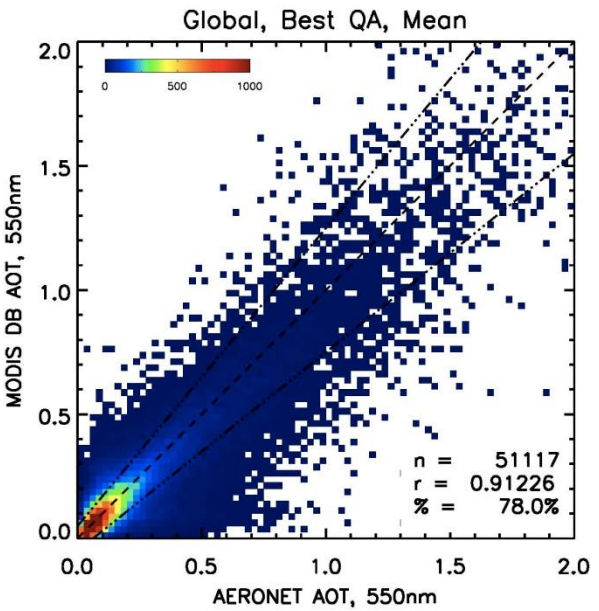
Only data with better QA (2 or 3) flag are included in the analysis

MODIS C6 Deep Blue Aerosol Retrievals

Global Statistics of the Comparisons of MODIS with AERONET AOT

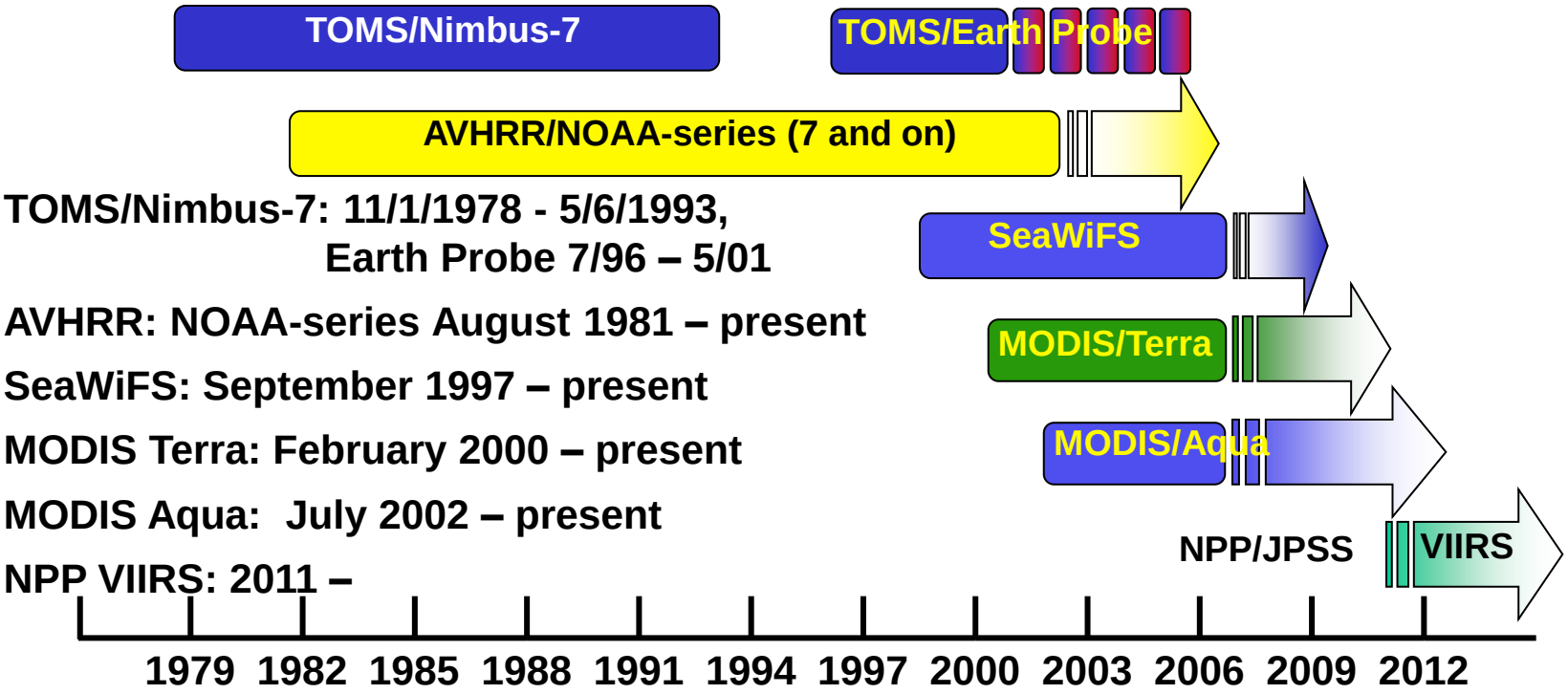






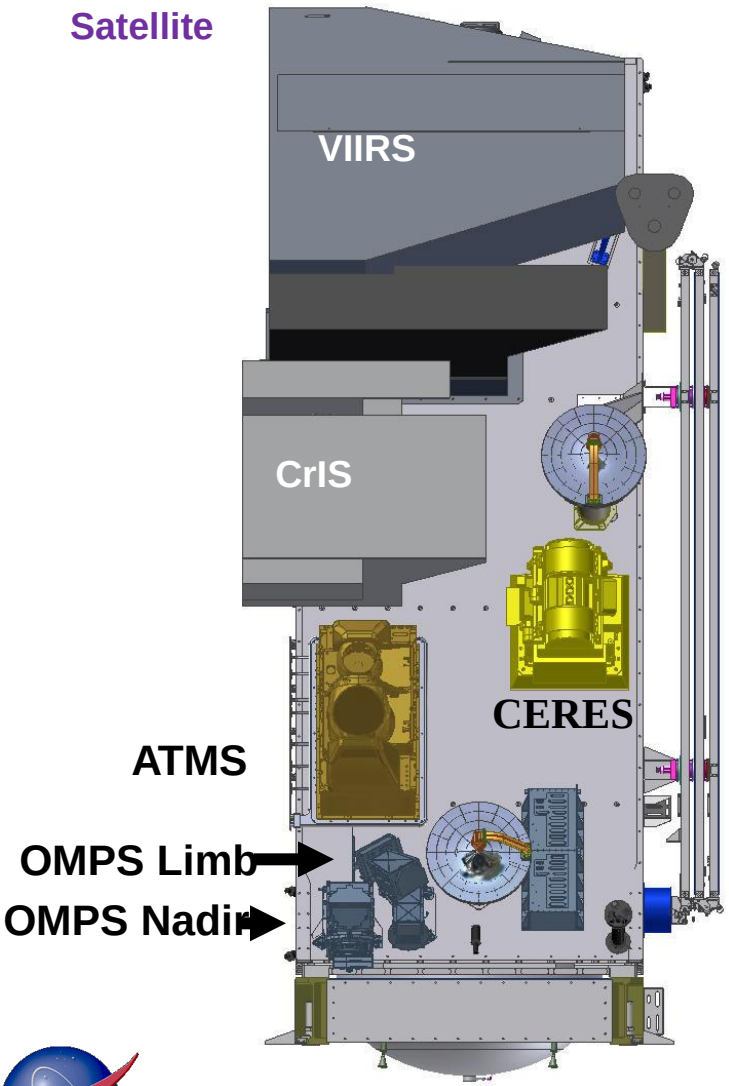
- Over land, the expected error is ±0.05±0.20*AOT.
- Among the land only data, 78.2% of the QA=3 data and 78.0% of the QA=2,3 fall into the expected error range.

Aerosol Data Record Time Series



VIIRS – Medium resolution Visible& Infra-red Imager

NPP
Satellite



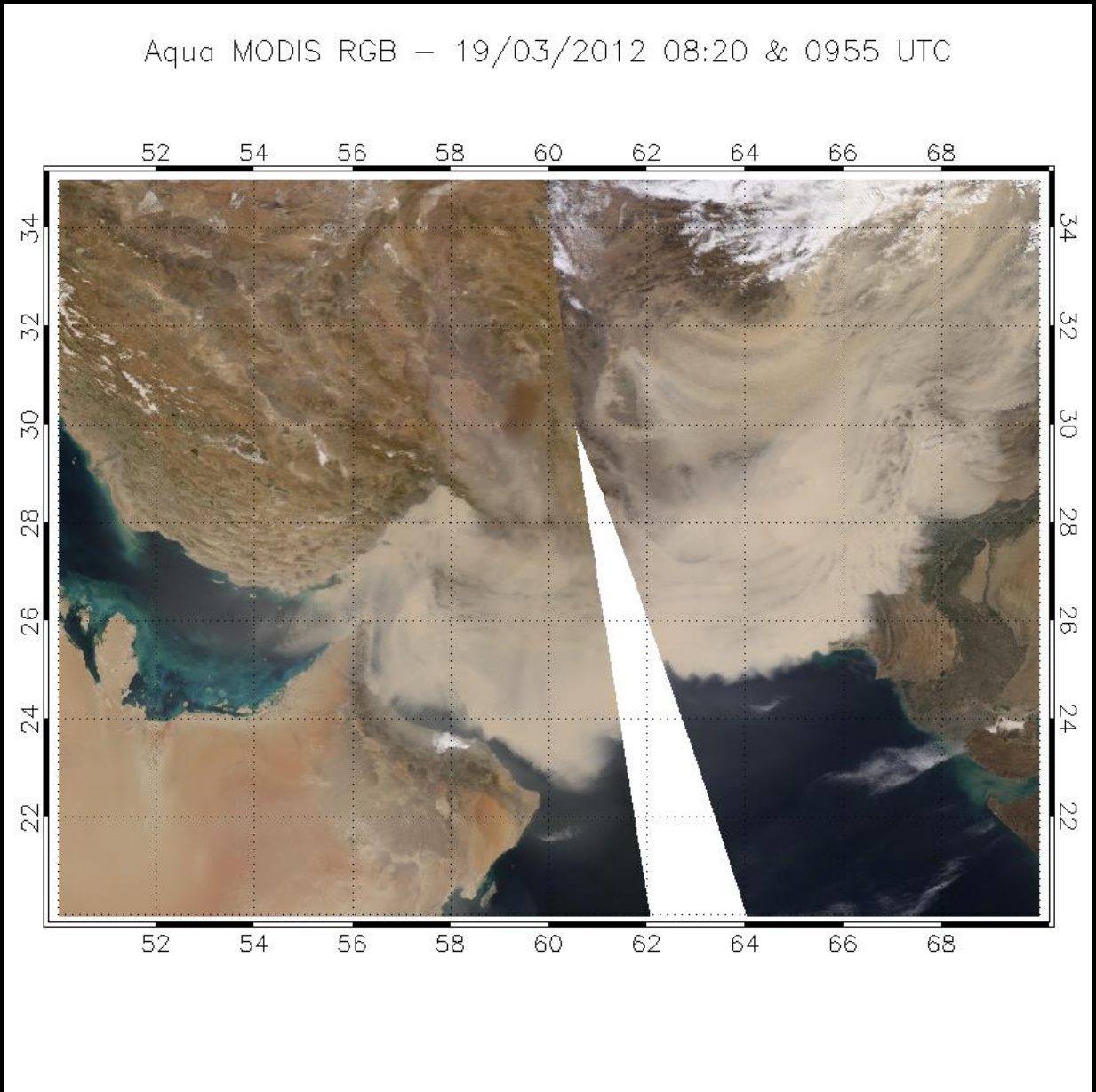
VIIRS 24 EDRs

Land, Ocean, Atmosphere, Snow

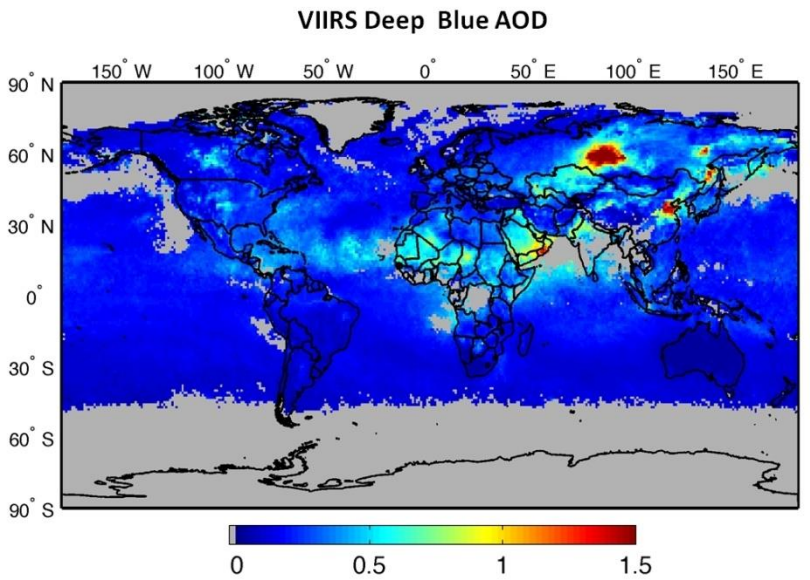
Name of Product	Group	Type
Imagery *	Imagery	EDR
Precipitable Water	Atmosphere	EDR
Suspended Matter	Atmosphere	EDR
Aerosol Optical Thickness	Aerosol	EDR
Aerosol Particle Size	Aerosol	EDR
Cloud Base Height	Cloud	EDR
Cloud Cover/Layers	Cloud	EDR
Cloud Effective Particle Size	Cloud	EDR
Cloud Optical Thickness/Transmittance	Cloud	EDR
Cloud Top Height	Cloud	EDR
Cloud Top Pressure	Cloud	EDR
Cloud Top Temperature	Cloud	EDR
Active Fires	Land	Application
Albedo (Surface)	Land	EDR
Land Surface Temperature	Land	EDR
Soil Moisture	Land	EDR
Surface Type	Land	EDR
Vegetation Index	Land	EDR
Sea Surface Temperature *	Ocean	EDR
Ocean Color and Chlorophyll	Ocean	EDR
Net Heat Flux	Ocean	EDR
Sea Ice Characterization	Snow and Ice	EDR
Ice Surface Temperature	Snow and Ice	EDR
Snow Cover and Depth	Snow and Ice	EDR

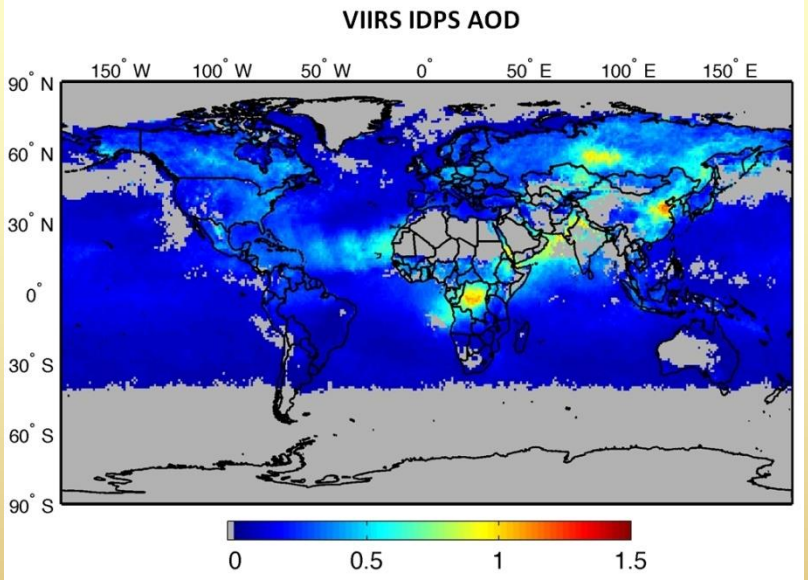
* Product has a Key Performance attribute

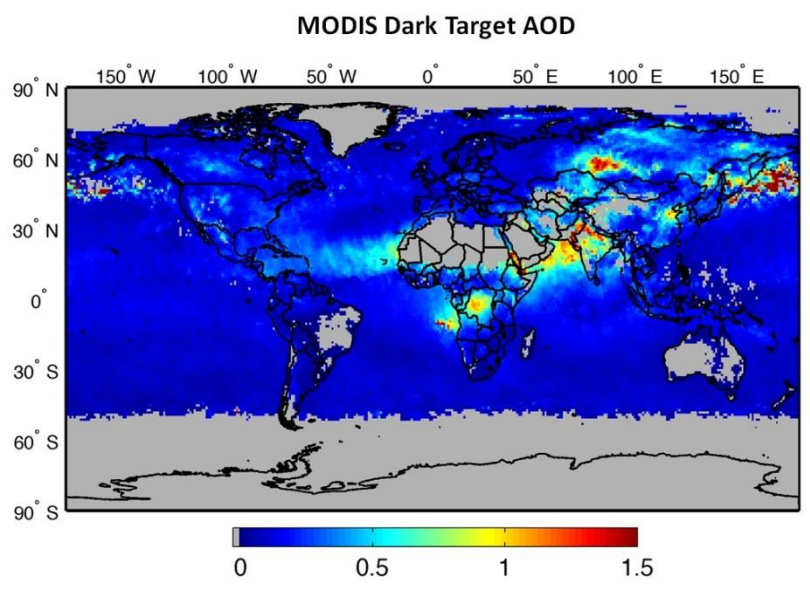
Progression of Dust Storm over Southwest Asia: 3 overpass from Terra, NPP, to Aqua



Comparisons of Monthly Mean of VIIRS Deep Blue AOD with VIIRS IDPS and MODIS DT for July 2012







- **VIIRS DB retrieves aerosols over desert and semi-desert regions, which are entirely missing in both VIIRS IDPS and MODIS DT products.**
- **VIIRS IDPS are biased high over most of land compared to VIIRS DB and MODIS DT, particularly at high latitudes in NH.**

Summary

- **Based upon the comparisons with AERONET AOD global observations, the expected error for SeaWiFS is 0.03±15% over ocean and 0.05±20% over land. Similar performance is expected for both MODIS C6 and VIIRS Deep Blue product.**
- **The testing and implementation of MODIS C6 codes has been completed. MODAPS will start the full reprocessing for C6 Atmospheric Products by the end of September 2013. MODIS Aqua will be reprocessed first and is expected to be finished in ~ two months.**
- **With the support of the Atmosphere PEATE, the implementation and testing of the Deep Blue algorithm have been successfully complete for VIIRS. The aerosol products are currently being generated at the PEATE and under initial evaluation phase.**