NASA/ONR PRIDE Campaign in Support of EOS/MODIS Research

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Code 913 SMART Group

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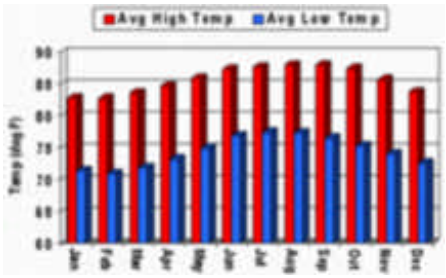
Code 913, MODIS Aerosol Retrieval Group

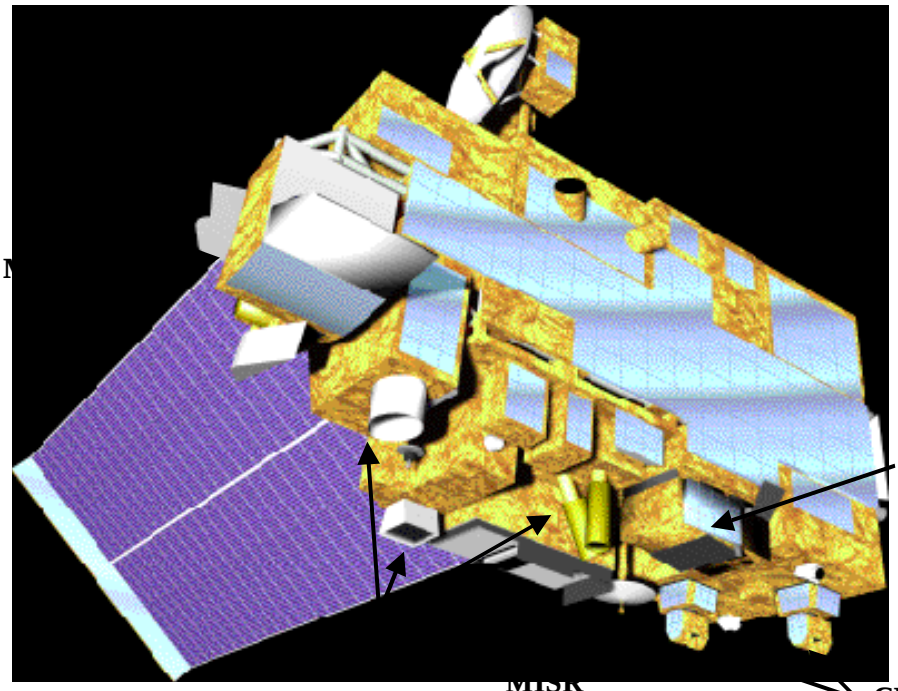
PRIDE: Puerto RIco Dust Experiment

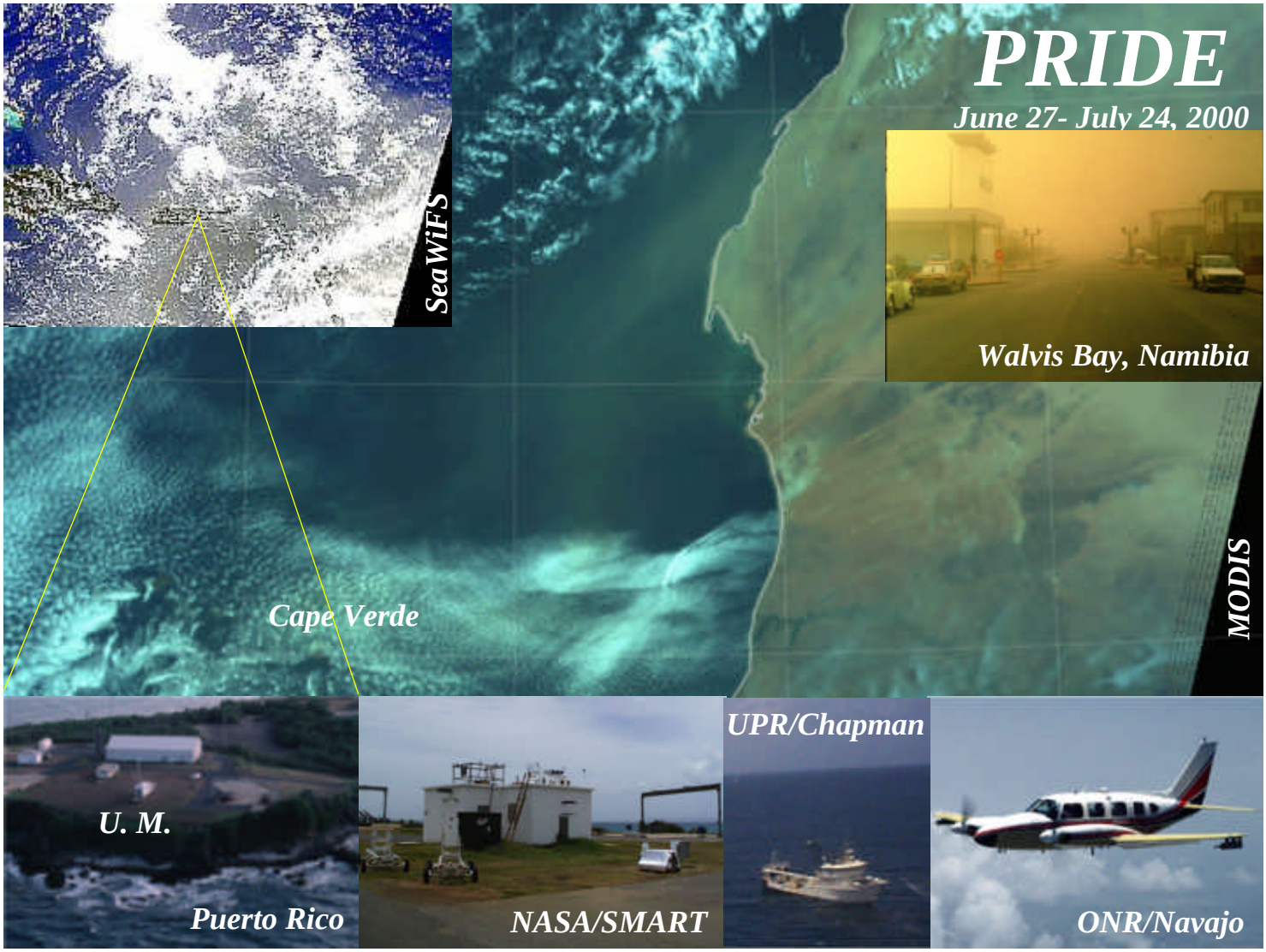
- 18° 20” N, 65° 40” W
- Participants:
  - -NASA 913/923
  - -NASA Ames & JPL
  - -U. Alabama - Huntsville
  - -U.C. Davis
  - -U. Miami
  - -U. Puerto Rico
  - -DoD/NPS, ONR, & SPAWAR



Terra: The EOS Flagship and Winner of "Y2K Best of What's New" (Popular Science)

Launched December 18, 1999




PRIDE
June 27- July 24, 2000
SeaWiFS
Walvis Bay, Namibia
Cape Verde
MODIS
U. M.
Puerto Rico
NASA/SMART
UPR/Chapman
ONR/Navajo

SMART: Surface Measurements for Atmospheric Radiative Transfer

http://particle.gsfc.nasa.gov/smart

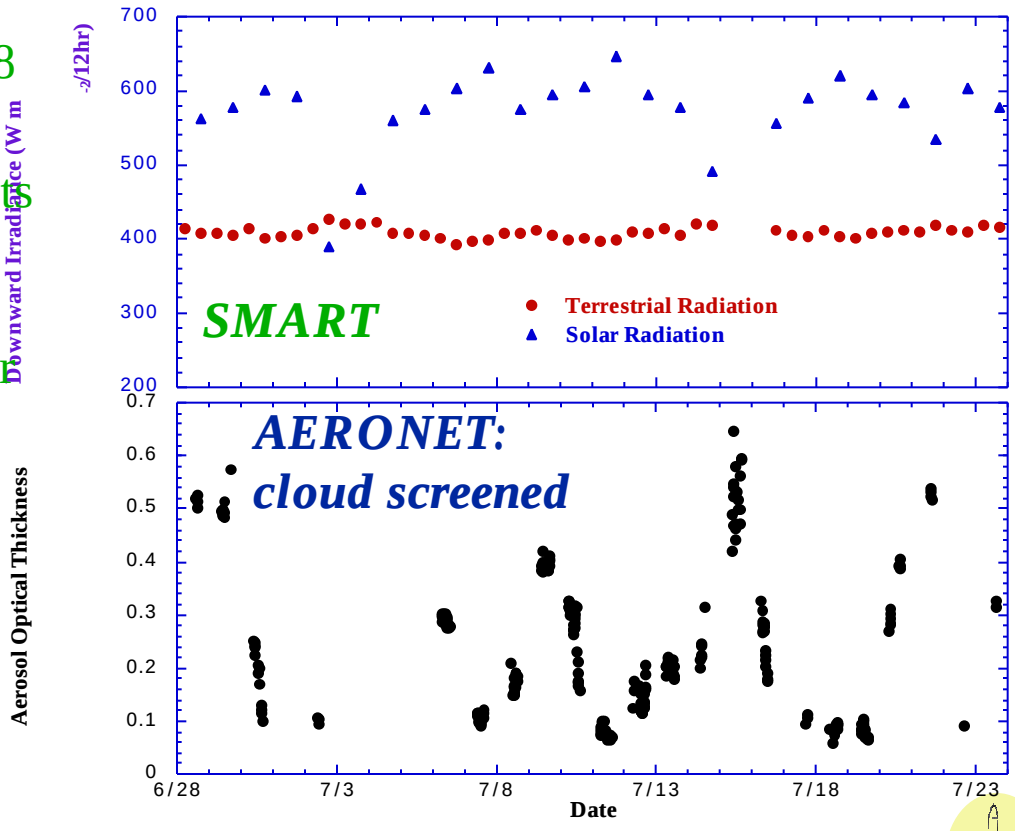
Objectives

Bringing experimentalists, remote sensing, and modelers together….

- ***What do you really need to know about dust to model it correctly?***
- ***How well can we model dust transport?***
- ***How do true variabilities in meteorology, physics and chemistry stack up to instrumentation and retrieval uncertainties?***

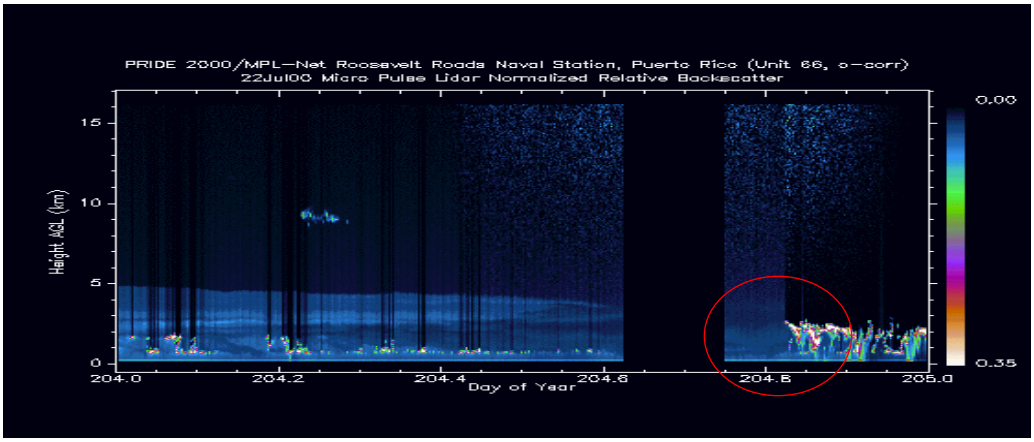
PRIDE: Mission Summary

- Average τ ~0.28
- 6 Dust events
- 21 Navajo Flights
- 6 LAP Flights
- 5 Days of R/V
- 4 Weeks data for SMART



PRIDE: Spatial Distribution

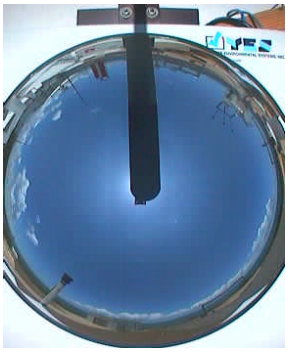
Lidar



July 22

Whole Sky Imager

12:30



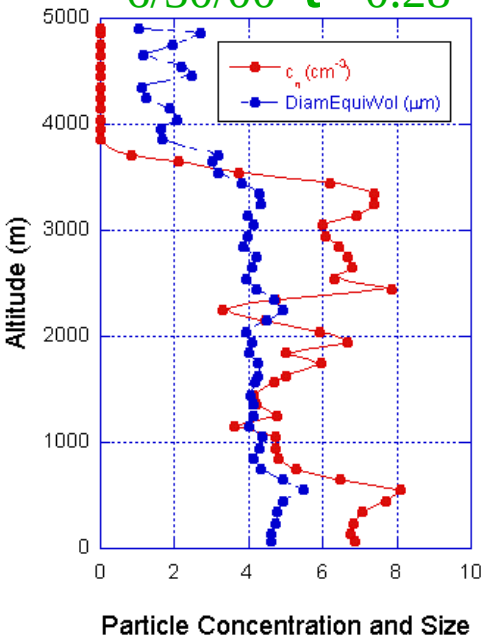
15:50

16:30

PRIDE: Vertical Profiles

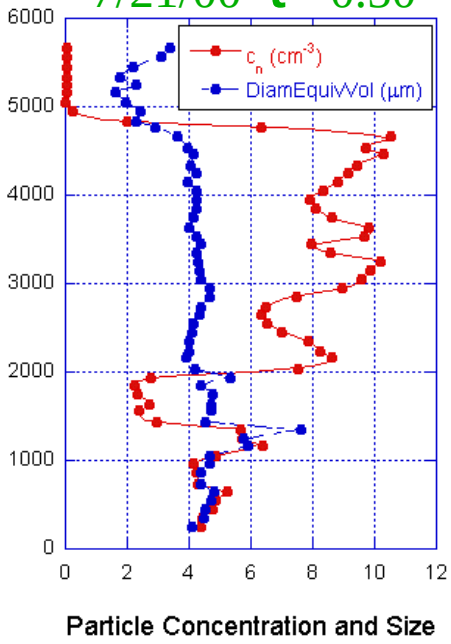
Uniform Transport

6/30/00 τ ~0.28



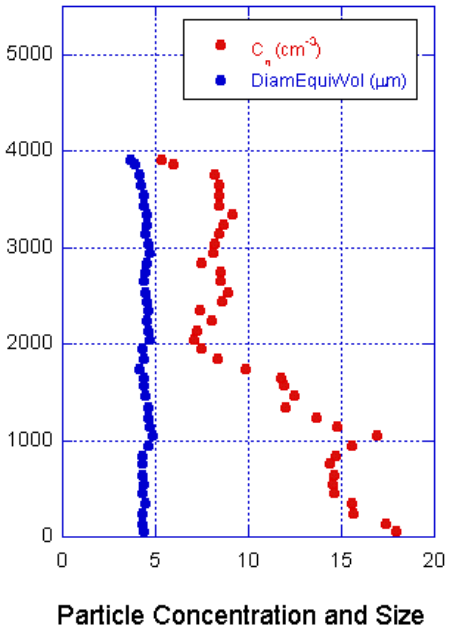
Classic Dust Layer

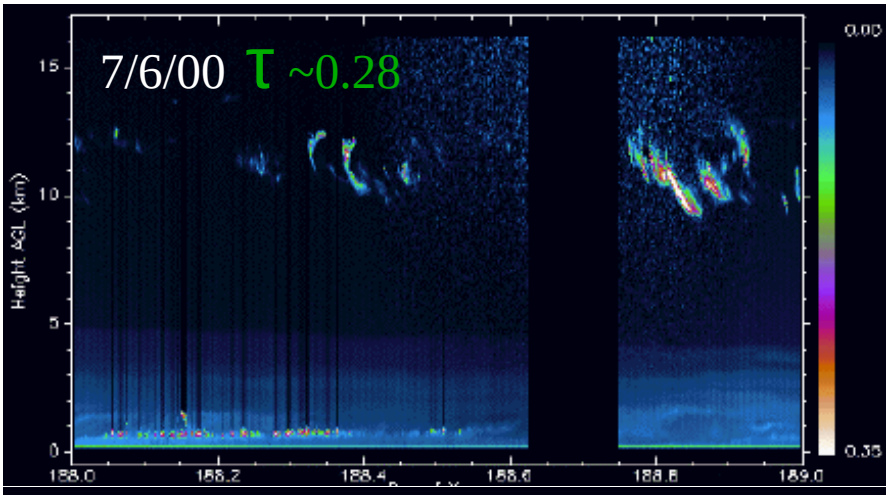
7/21/00 τ ~0.50



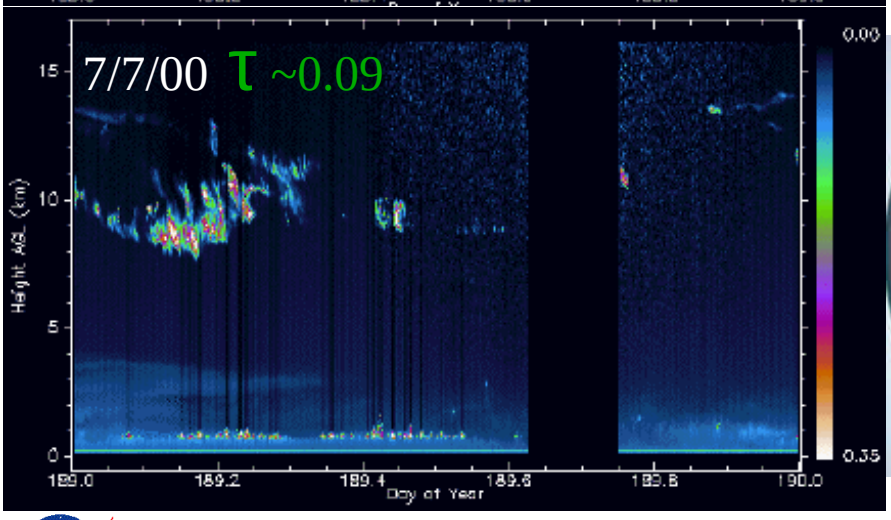
Non-Classic Dust Layer

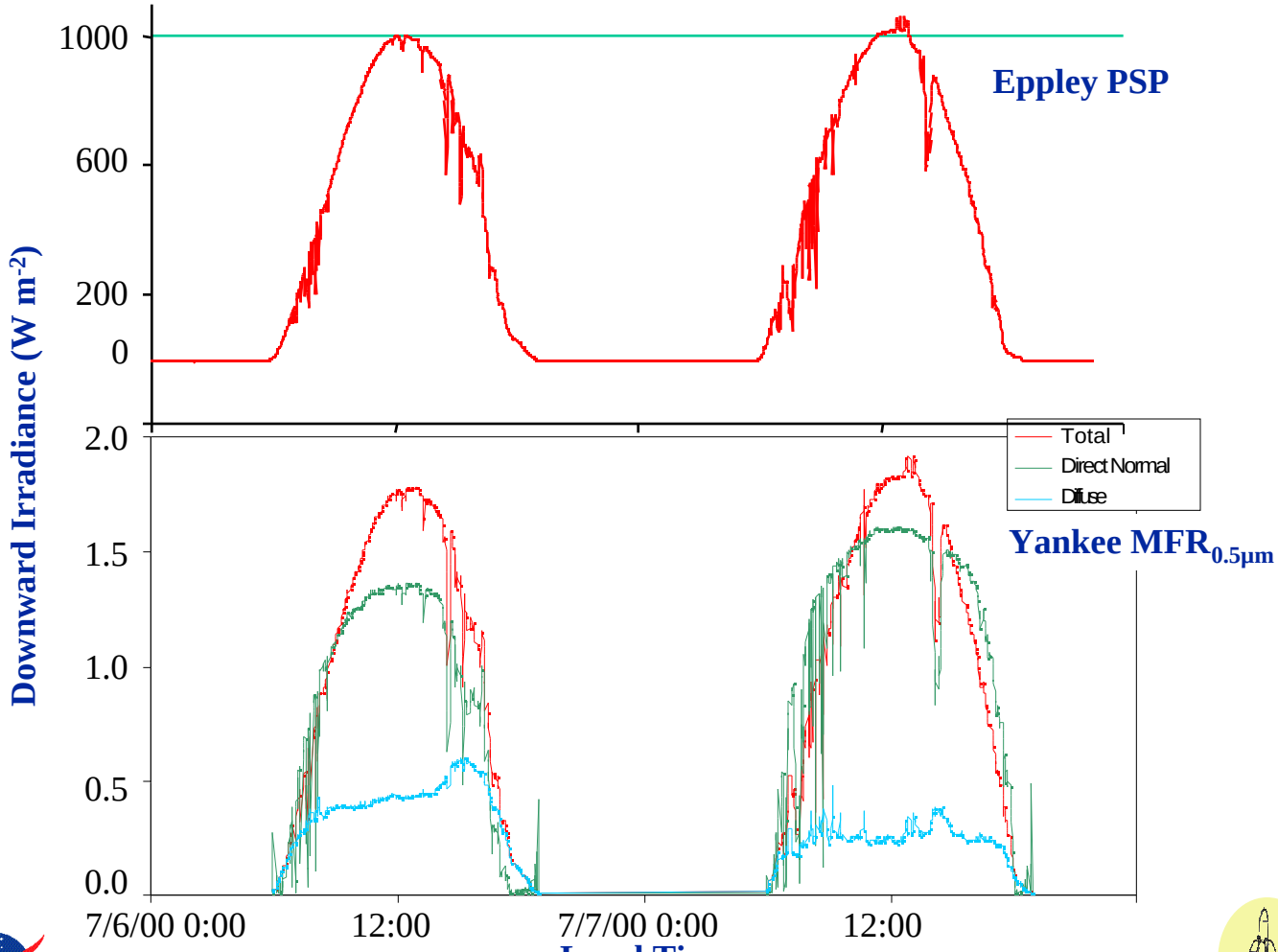
6/28/00 τ ~0.50




7/6/00 τ ~0.28
Height AGL (km)
0
5
10
15
188.0
188.2
188.4
188.6
188.8
189.0
0.00
0.35

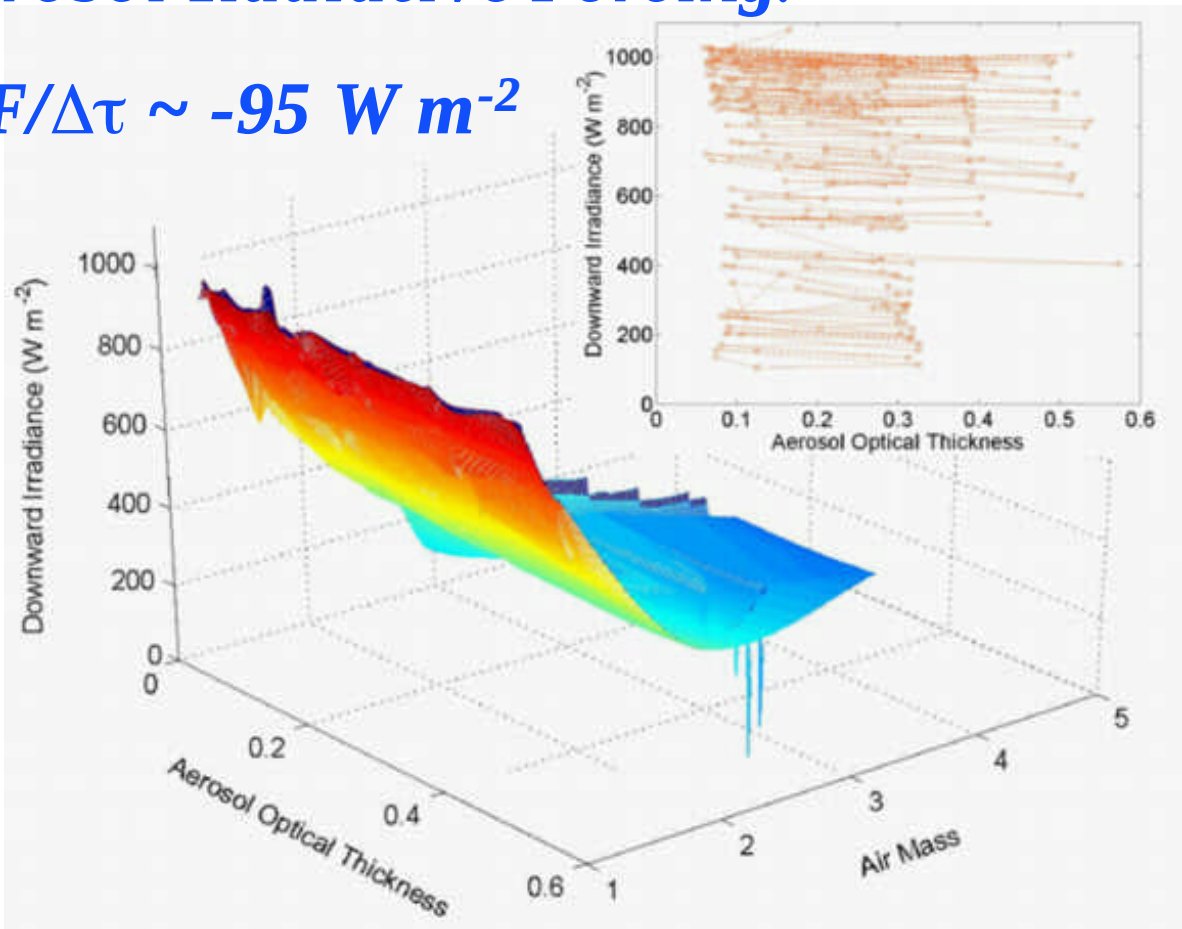
11:00 AM


7/7/00 τ ~0.09
Height AGL (km)
0
5
10
15
189.0
189.2
189.4
189.6
189.8
190.0
Day of Year
0.00
0.35


Downward Irradiance (W m-2)
1000
600
200
0
Eppley PSP
2.0
1.5
1.0
0.5
0.0
Total
Direct Normal
Diffuse
Yankee MFR0.5µm
7/6/00 0:00
12:00
7/7/00 0:00
12:00
Local Time

Aerosol Radiative Forcing:

$\Delta F/\Delta\tau \sim -95\ W\ m^{-2}$

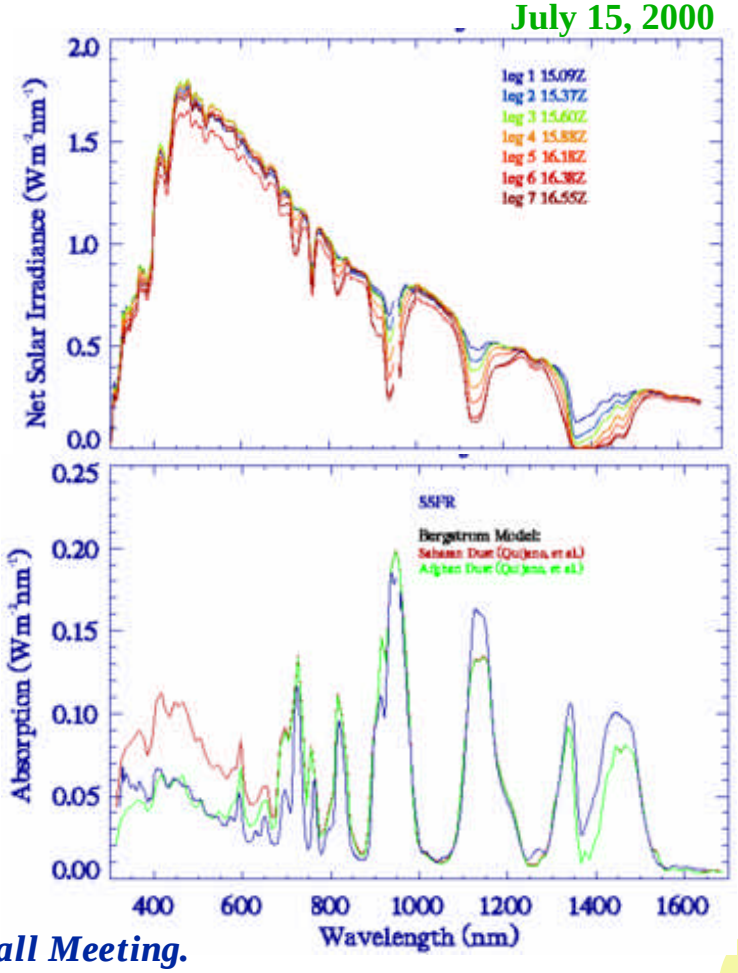


*PRIDE: SSFR Spectral Data**

- Average τ ~0.15
- 7 level legs in descent profile (3 in dust layers)
- 0.3-1.7 μm spectral range, with 8-12 nm resolution
- Assuming 0.3-0.7 μm for dust & λ > 0.7 μm for water vapor absorption:

$$\Delta F/\Delta\tau \sim -100\ W\,m^{-2}$$

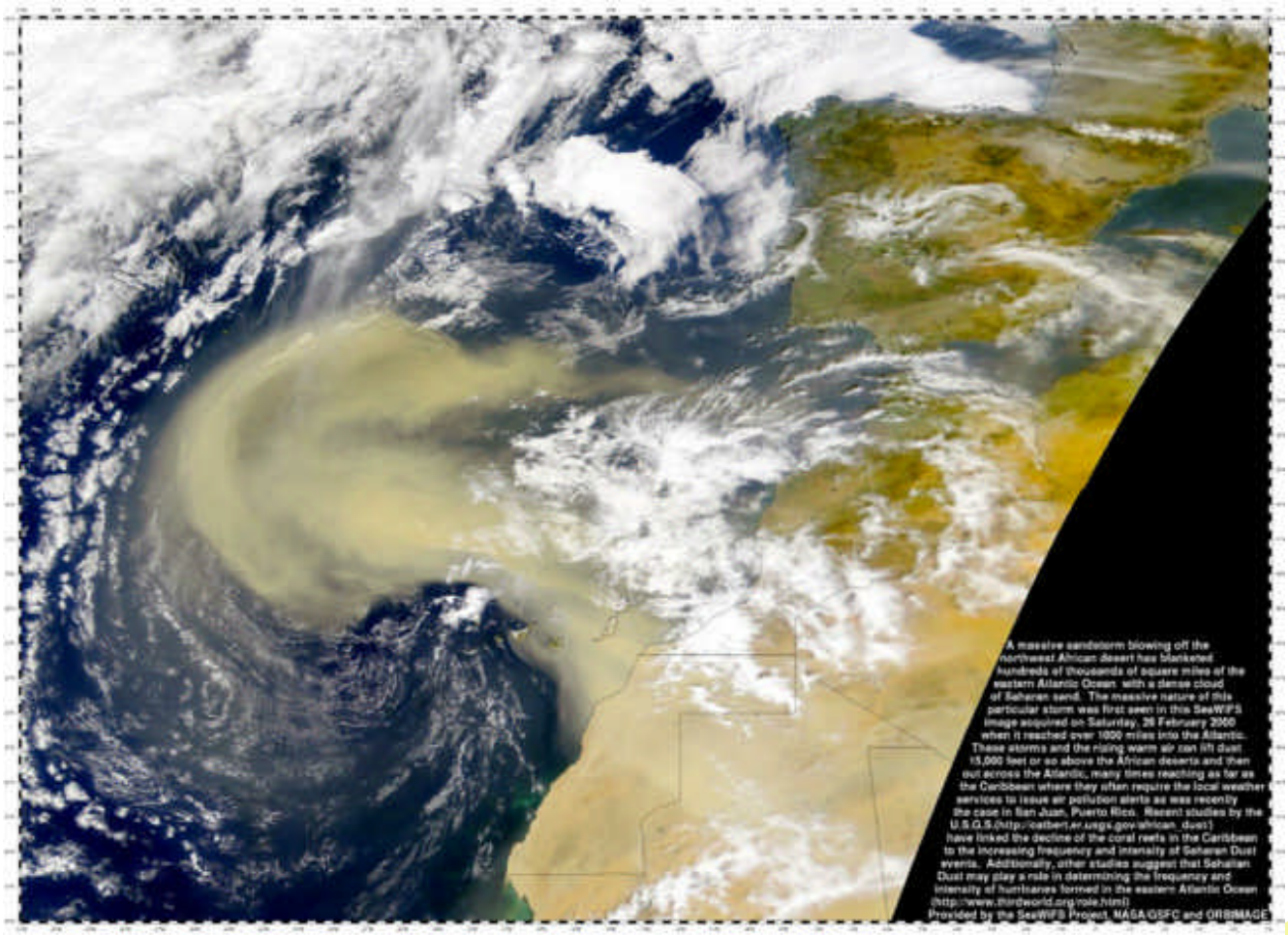
July 15, 2000

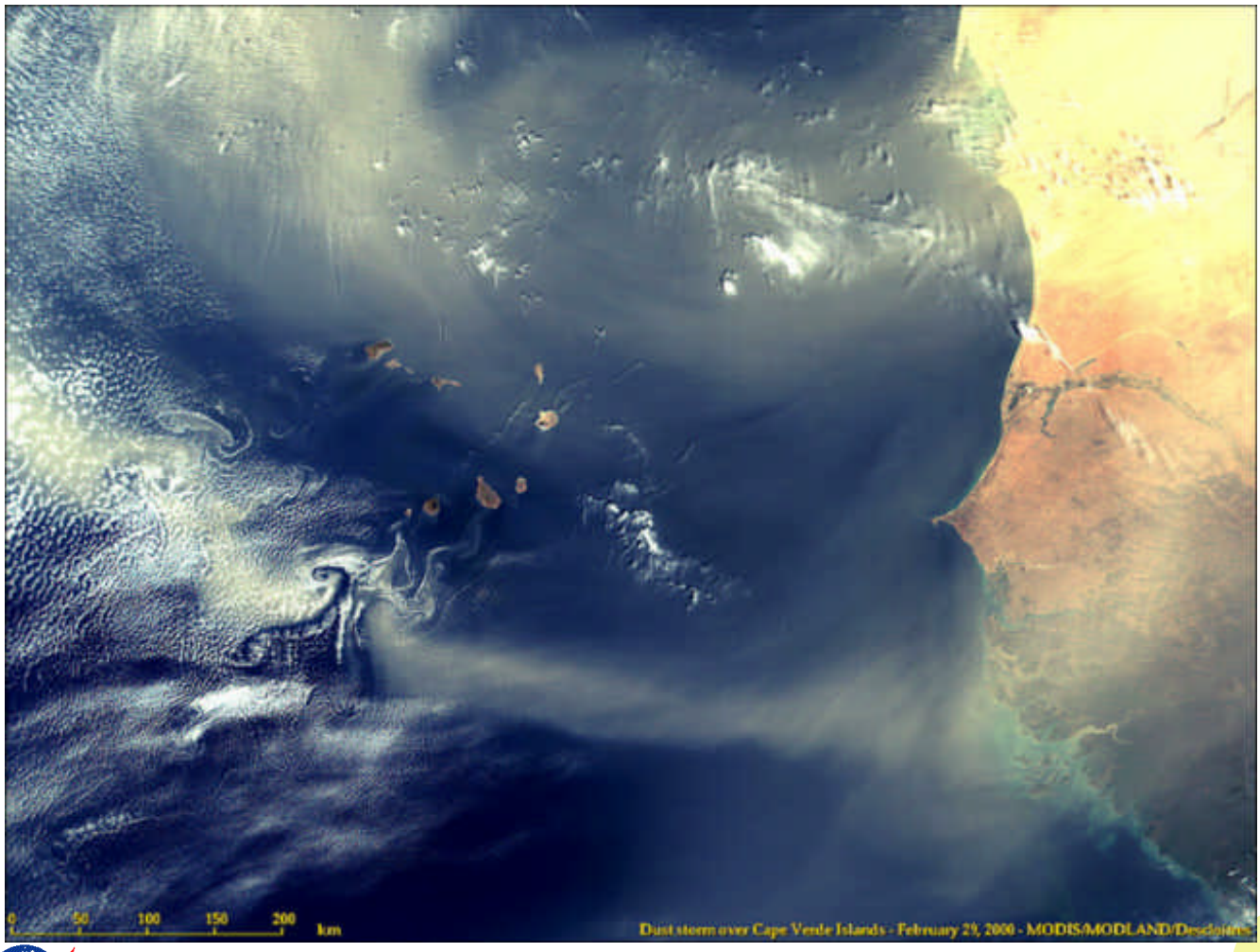


Pilewskie et al., 2000,* AGU *Fall Meeting.

Summary for SMART

- **Long range transport of Saharan dust across the Atlantic Ocean to the Caribbean may introduce aerosol radiative cooling, $\Delta F/\Delta\tau \sim -95\ Wm^{-2}$, at high sun.**
- **Use MFR to increase data volume, and analyze NIP/PSP for *Direct* and *Diffuse* partitioning.**


A massive sandstorm blowing off the northwest African desert has blanketed hundreds of thousands of square miles of the western Atlantic Ocean with a dense cloud of Saharan sand. The massive nature of this particular storm was first seen in this SeaWiFS image acquired on Saturday, 26 February 2000 when it reached over 1000 miles into the Atlantic. These storms and the rising warm air can lift dust 15,000 feet or so above the African deserts and then out across the Atlantic, many times reaching as far as the Caribbean where they often require the local weather services to issue air pollution alerts as was recently the case in San Juan, Puerto Rico. Recent studies by the U.S.G.S.(http://oceans.er.usgs.gov/african_dust) have linked the decline of the coral reefs in the Caribbean to the increasing frequency and intensity of Saharan Dust events. Additionally, other studies suggest that Saharan Dust may play a role in determining the frequency and intensity of hurricanes formed in the eastern Atlantic Ocean (http://www.thirdworld.org/role.html)
Provided by the SeaWiFS Project, NASA/GSFC and ORBIMAGE


0 50 100 150 200 km
Dust storm over Cape Verde Islands - February 29, 2000 - MODIS/MODLAND/Desdemona