

# LASE Observations of aerosols and water vapor during NAMMA

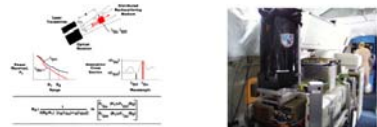
Ed Browell, Syed Ismail, Richard Ferrare, Susan Kooi, Tony Notari, Carolyn Butler, Sharon Burton, Bruce Anderson, Gao Chen

NASA Langley Research Center

Hampton, VA 23681



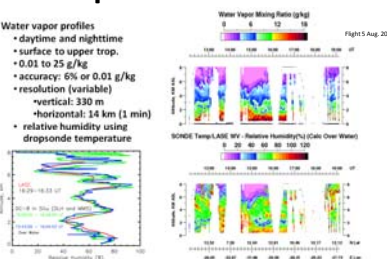
## LASE System



- Airborne Water Vapor DIAL
- Laser
  - 5 Hz doubled-pulsed Ti:sapphire
  - 100 mJ at  $\lambda_{ex}$  and  $\lambda_{off}$
- Wavelengths
  - 815 nm ( $\lambda_{off} - \lambda_{ex} = 40-70$  nm)
  - Two separate line pairs
- NASA ER-2, P-3, DC-8 aircraft
- Simultaneous nadir, zenith operations
- Real-time data analysis and display

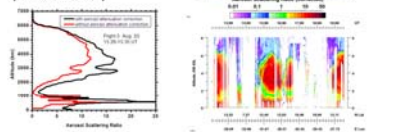
## Water Vapor Measurements

- Water vapor profiles
  - daytime and nighttime
  - surface to upper trop.
  - 0.01 to 25 g/kg
  - accuracy: 6% or 0.01 g/kg
  - resolution (variable)
    - vertical: 330 m
    - horizontal: 1.6 km (1 min)
  - relative humidity using dropsonde temperature

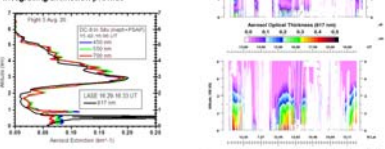


## Aerosol Measurements

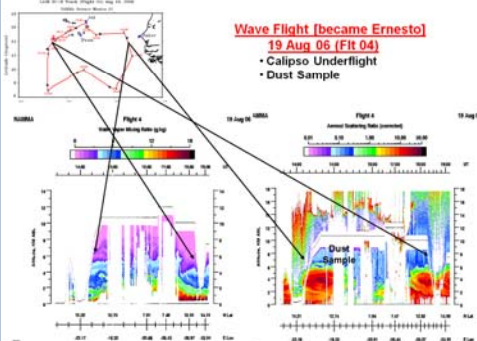
- Aerosol/cloud profiles
  - daytime and nighttime
  - 0.03 to 25 km
  - resolution (variable)
    - vertical: 30 m
    - horizontal: 200 m
  - Recently derived and applied correction for aerosol attenuation (to be archived also)



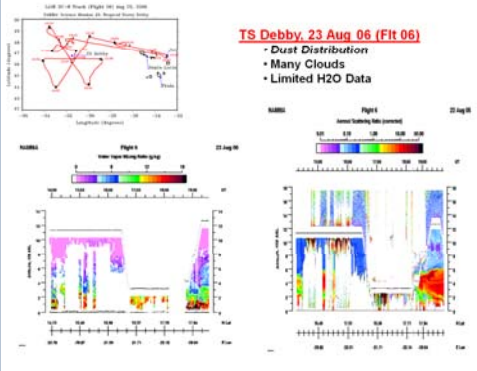
- Aerosol extinction
  - requires extinction/backscatter ratio  $S_a$  ("lidar ratio")
  - $S_a = 36$  sr at 837 nm) derived using LASE measurements above and below elevated dust layer to estimate transmission through layer
- Aerosol optical thickness (AOT) derived by integrating extinction profiles



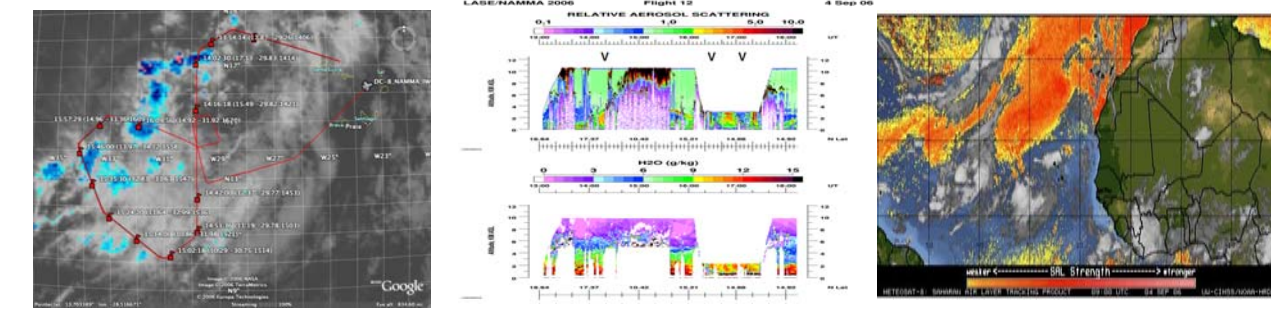
## Flight 4 Aug. 19 CALIPSO/SAL



## Flight 6 Aug. 23 TS Debby



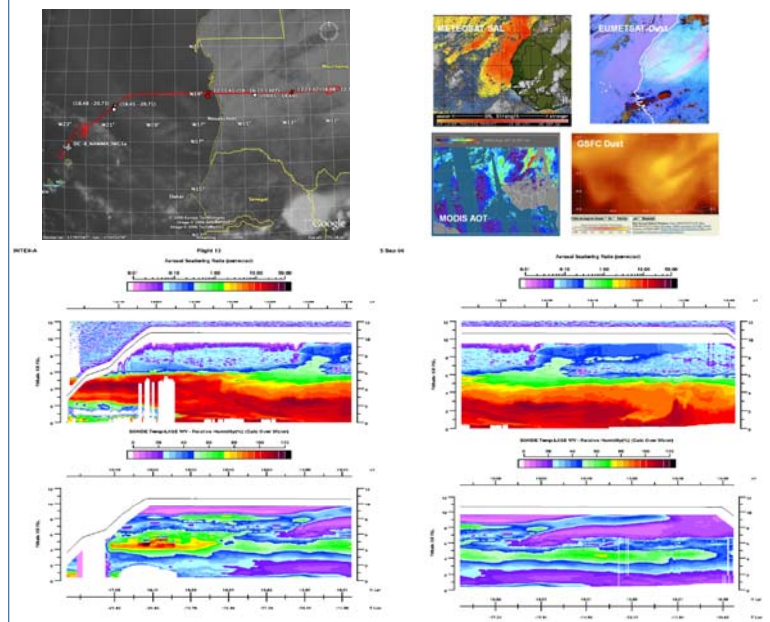
## Flight 12 Sep. 4 Easterly Wave Day 2



## Summary

- LASE archived data include water vapor and aerosol profiles
- LASE images provide information on water vapor, aerosol, cloud distributions
- We have initiated retrievals of RH using dropsonde temperature profiles
- We have initiated retrievals of aerosol extinction and optical thickness profiles
- LASE measurements were made in SAL clear, convective, AEW, and TS development regions
  - SAL layers were observed from surface to 6 km
  - SAL aerosol optical thickness (817 nm) ranged from 0.05 to 0.5
  - Convection often was suppressed when SAL present
  - TS development was sometimes inhibited due to the presence of SAL
  - SAL regions were generally associated with dry air, however, SAL regions with high moisture (RH~100%) with imbedded clouds were observed
    - Moistening of SAL layers in convective regions was observed
- LASE water vapor data are being used in data assimilation and hurricane forecast and precipitation studies at FSU
- Initial comparisons between LASE and dropsonde water vapor measurements show very good agreement in the absence of clouds
- LASE data from NAMMA will be useful for satellite (e.g. AIRS, CALIPSO, MODIS) validation studies
- LASE data from NAMMA will be useful for studying convection, humidification of dust, and growth of aerosols

## Flight 13 Sep. 5 SAL/Dust



For addition information , see <http://asd-www.larc.nasa.gov/lidar/namma/namma.html>

We thank NASA Headquarters Science Mission Directorate (SMD) and Dr. Ramesh Kakar for their support of LASE during NAMMA.