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THE 2004 AEROSOL AND OCEAN SCIENCE EXPEDITION (AEROSE): A UNIQUE DATASET FOR INFRARED SATELLITE VALIDATION

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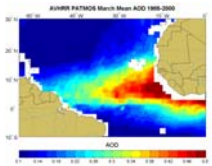
Introduction

- The **Aerosol and Ocean Science Expedition (AEROSE)** was a NOAA-led, multi-institutional research cruise conducted onboard the **NOAA Ship *Ronald H. Brown (RHB)*** in the tropical North Atlantic Ocean from 29 Feb to 26 Mar 04.
- The cruise track was based upon AVHRR PATMOS (Jacobowitz et al. 2003) aerosol climatology. Leg 1 was to maximize encounters with dust events, whereas Leg 2 was provide non-dust samples.
- Marine observations were acquired with a compliment of *in situ* and remote sensing sensors under dust and non-dust conditions.
- Aerosols are a source of error in most IR satellite derived products (e.g., SST; Nalli and Stowe 2002), including advanced instruments such as Aqua AIRS.



Objectives

To provide complementary visible and infrared (IR) measurements and analysis that can support the validation of radiometric data and derived products from advanced satellite instruments, including the NASA Aqua Atmospheric Infrared Sounder (AIRS), the NOAA Advanced Very High Resolution Radiometer (AVHRR/3), and the NASA Terra/Aqua Moderate Resolution Imaging Spectroradiometer (MODIS).

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Shipboard Data

- Marine Atmospheric Emitted Radiance Interferometer (M-AERI)
  - Ship-based FTS designed to sample atmospheric and surface IR emissions (Minnett et al. 2001)
  - Algorithms derive skin SST (<0.1 K), emissivity and BL profiles
- Calibrated InfraRed In situ Measurement System (CIRIMS)
  - Reduced complexity & cost; autonomous (Jessup et al. 2002)
  - Designed solely for providing accurate radiometric SST ground truth
- Vaisala RS80/90 RAOBs
  - ~3-Hourly throughout cruise, including AIRS overpasses
- Microtops handheld sunphotometer
  - Surface based measurements of aerosol optical depth (AOD)
- Oceanographic/meteorological surface data from ship

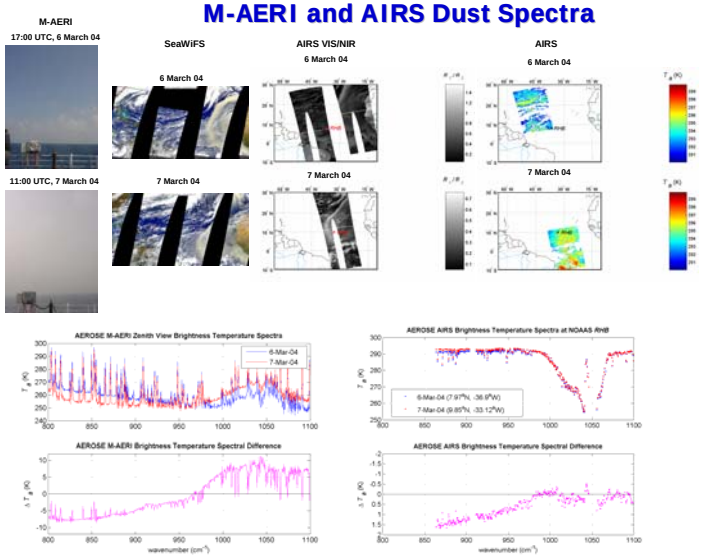
UW/APL CIRIMS

UM/RSMAS M-AERI

HU/NCAS Microtops Sunphotometers

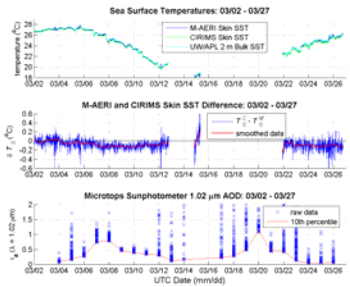
M-AERI and CIRIMS

M-AERI and AIRS Dust Spectra

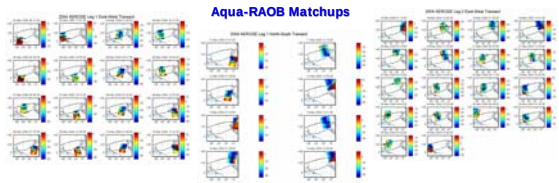


Validation Datasets

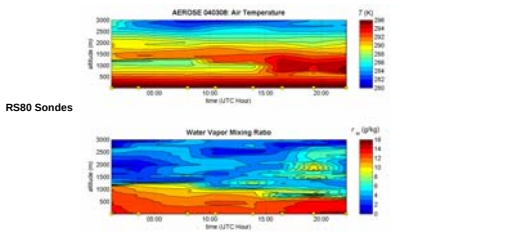
Radiometric Skin SST and AOD



Aqua-RAOB Matchups



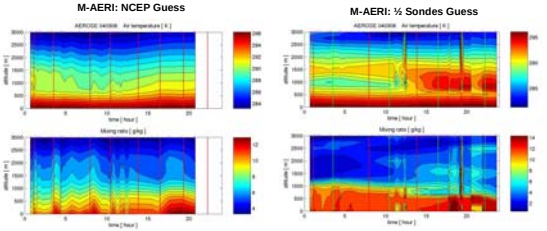
Lower Tropospheric Profile Evolution



RS80 Sondes

M-AERI: NCEP Guess

M-AERI: ½ Sondes Guess



Summary

- Aerosols are known to be a source of systematic error in standard IR satellite retrieval algorithms
- Data collected during AEROSE will facilitate satellite Cal/Val efforts and allow empirical studies of dust aerosol radiometric properties

Future Work

- Analyses of 2004 AEROSE dataset for satellite IR validation
  - AIRS/M-AERI profile retrievals
  - SST retrievals (e.g., AIRS, AVHRR)
  - Aerosol retrievals (e.g., AIRS, MODIS, AVHRR)
  - Radiative transfer models (e.g., UMBC)
- Conduct additional oceanographic research expeditions (AEROSE II is being sought for July 2005 to include ozonesondes and LIDAR)

Acknowledgements

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- Personnel supporting 3-hourly, 24-7 sonde operations throughout the mission
  - **R. Armstrong** and **Y. Detrés** (University of Puerto Rico, Mayagüez)
  - Students **L. Roldán, M. Strachan** and **F. Mensah** (Howard University); and **A. Lozada Rosado**. **V. Morales-Iriarry** and **A. Sánchez**.
- **F. Mensah** painstakingly conducted handheld sunphotometer AOD measurements under rough sea conditions.
- **Jonathan Shannahoff** (*RHB* Chief Survey Tech) for providing general instruction and guidance on conducting sonde operations.
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The views, opinions, and findings contained in this report are those of the authors and should not be construed as an official National Oceanic and Atmospheric Administration or U.S. Government position, policy, or decision.

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