The Aerosols and Ocean Science Expeditions (AEROSE) are a series of trans-Atlantic intensive atmospheric field campaigns conducted aboard the NOAA Ship Ronald H. Brown (RHB) (Morris et al., 2006).

- The AEROSE mission has contributed to the current data inventory from the following campaigns:
  - AEROSE-I (March 2004; 4 weeks)
  - PNE/CAMM-AEROSE-II (June-July 2006)
  - Leg 1 (4 weeks)
  - Leg 2 (4 weeks)
  - PNE/AEROSE-III (May 2007; 4 weeks)
  - RB-08-03 Interhemispheric Transit (April-May 2008; 3 weeks)
  - PNE/AEROSE-IV (July-August 2009; 4 weeks)
  - PNE/AEROSE-V (April-May 2010; 4 weeks)

As part of the NOAA/PNE mission, AEROSE has grown to become an unprecedented collection of in situ measurements of the Saharan air layer (SAL) and associated African dust and smoke outflows over the tropical Atlantic Ocean, including:
- Transport, microphysical evolution and regional impacts
- Regional atmospheric chemistry and marine meteorology

PNE/AEROSE Collaboration

- Howard University NOAA Center for Atmospheric Sciences (PH/NCAS)
- NOAA/NESDIS/STAR
- University of Miami/NOAA/CIMSS
- NOAA/ESRL/PSD (formerly NOAA/ETL)
- NOAA/CAT Atlantic Oceanographic and Meteorological Laboratory (AOML)
- NOAA Pacific Marine Environmental Laboratory (PME)

Synergism
- Low Cost – Low Risk
- Engages broader science community on specific problems
- All parties gain access to all data – AEROSE is a key component of the PNE cruises. NOAA’s allocation of ship time onboard the Ronald H. Brown for PNE/AEROSE cruises is fully optimized.

Dedicated Radiosonde Observations (RAOBs)

- Vaisala RS92 GPS rawinsondes [NSSL/NO in 2004; launched coinciding with LEO environmental satellite overpasses (viz. Aqua and MetOp)]
  - RS92 sondes measure
  - Pressure, temperature, humidity, PPS(u)
  - Wind speed and direction, u,v
  - GPS altitude, x,y
  - Typically ~4/day (~01:30, 09:30, 13:30, 21:30)
  - 2004, 2005–2010 not uploaded into CSS (i.e., not assimilated)

Other Shipboard Data

- Microparal Sunphotometer
  - Multi-channel raw data provides information on changes in total column aerosol
  - Since 2009, the AEROSE Team collaborated with the NASA/IFSC AERONET Marine Aerosol Network.

Marine Atmospheric Emitted Radiance Interferometer (M-AERI)

- Ship-based FTS systems designed to sample downwelling and upwelling calibrated IR spectra near the surface (Minnett et al., 2001).
- High accuracy calibration is achieved using 2 NIST-traceable blackbodies.
- Derived products:
  - High accuracy albedo SST derived from semi- opaque spectral region (~7.7 μm) [Smith et al. 1996]
  - Sea SST is a state parameter necessary for forward calculations.
  - Continuous retrievals of lower tropospheric profiles at horizontal time scales (e.g., Szczodrak et al. 2007)
  - Retrieval of ocean surface spectral emissivity (e.g., Hanafin and Minnett 2005; Nalli et al., 2008b).

Summary

- The PNE/AEROSE mission continues to compile a multidisciplinary set of ship-based, marine in situ correlative data measurements over the tropical Atlantic Ocean.

The cruise domains span a region of meteorological interest corresponding to current satellite observations, and tropospheric ozone/turbulence/aerosol chemistry and transport.

- There are numerous inter-disciplinary applications of PNE-AEROSE data.

- The cruise provides an object of interest to assist in the evaluation of available sounding missions; thus validation is desirable.

- Ocean-based correlative data has distinct advantages for satellite cal/val.

- AEROSE Research Data Set: [Nalli et al., 2010]

2010 Trans-Atlantic Cross-Sectional Analyses

- AEROSE Proxy Dataset
    - AEROSE 2010 has been selected for a pre-launch phase test of deployment of scientific validation campaigns of opportunity, and to be used as a field campaign proxy dataset to be developed by NOAA/MIT/LIAC.

- NOAA CrI/MSS edr proxy data will be derived from IASI matchup granules (see figures) that have been obtained from the NESDIS/STAR IASI Operational Product Processing System.

- The AEROSE domain is of scientific interest germane to the CrI/MSS mesoscale-synoptic observing mission.

- Saharan air layer (SAL) and distribution of tropical water vapor
- Dust and biomass burning aerosols
- Tropospheric ozone dynamics

- The figures below show trans-Atlantic RH and O3 cross-sections obtained from RAOB (top row) alongside those obtained from STAR IASI retrieval matchups (bottom row), revealing the ability of hyperspectral IR sounders for observing meteorological features of interest as a qualitative validation demonstration.

Acknowledgements

The Howard University NOAA Center for Atmospheric Sciences (NCAS), receiving institutions Educational Partnership Program supported by the NOAA Minority Serving Institutions Educational Partnership Program.

- The NOAA Oceanic and Atmospheric Research Office
- The NOAA GOES Algorithm Working Group (M. D. Goldston)
- The PIRATA Northeast Extension Project: R. Lumpkin and C. Schmit (NOAA/AOML)
- W. W. Wolf, T. King and P. Clemente-Collín (NOAA/NESDIS/STAR)
- T. Pagano (AP), and the AIRS Science Team
- M. Szyndrick and M. Izaguirre (UM/RSMAS); E. Roper (Scripps Inst.)
- The many students who participated in, and contributed to, the success of the campaigns, especially A. Flores, C. Steams, M. Oyella
- The officers and crew of the Ronald H. Brown

The views, opinions and findings contained in this report are those of the authors and should not be construed as an official NOAA or U.S. Government position, policy or decision.

Selected References


Corresponding Author:
Dr. N. R. Nalli, NOAA/NESDIS/STAR, Office 9-703, 1315 East-West Highway, Silver Spring, MD 20910, Phone: 301-415-4009
Email: nralli@noaa.gov