Aerosol Lifecycle IOP at BNL

A. J. Sedlacek, L. Kleinmen, Y. -N. Lee, G. Senum, S. R. Springston, J. Wang

Oct. 12, 2010

BROOKHAVEN NATIONAL LABORATORY

a passion for discovery

Office of Science

U.S. DEPARTMENT OF ENERGY

Aerosol Lifecycle IOP: background

MAOS represents a new measurement standard for AOS platforms

- 19 instruments vs “core” 7 instruments
- Inclusion of research grade instruments (new AOS paradigm)
- Two 20-ft SeaTainers
- Platform is geared towards IOP-based deployments

See Stephen Springston for more details regarding the new generation AOS platforms

Aerosol Lifecycle IOP: background

MAOS is composed of two 20' SeaTainers (MAOS-A & MAOS-C)

ACSM	Ozone
CCN-200	PSAP
CPC (> 10 nm)	PASS-3
CPC (> 2.5 nm)	PILS
CO	PTRMS
f(RH)	SMPS
HTDMA	SO_2
MET station	SODAR
Neph	SP2
NO, NO_2, NO_y	UHSAS

All items in red represent core AOS instrument suite (AMF-I, AMF-II, & TWP)

Aerosol Lifecycle IOP: Infrastructure Motivation

- Conduct a 'shake out' of the MAOS platform prior to the GVAX campaign
- Develop & test new measurement strategy(ies)
  - Many of the instruments new to ACRF are operator intensive (PILS-IC-WSOC & PTR-ToF-MS)
  - Some instruments generate huge data sets (PTR-ToF-MS & SP2)
- Instrument Intercomparisons
  - PSAP, CPC, Nephelometer, CCN (3 units)
  - HR-AMS against ACSM
- Training of Indian Post-Docs in preparation for 2012 GVAX campaign

Aerosol Lifecycle IOP: Science Motivation

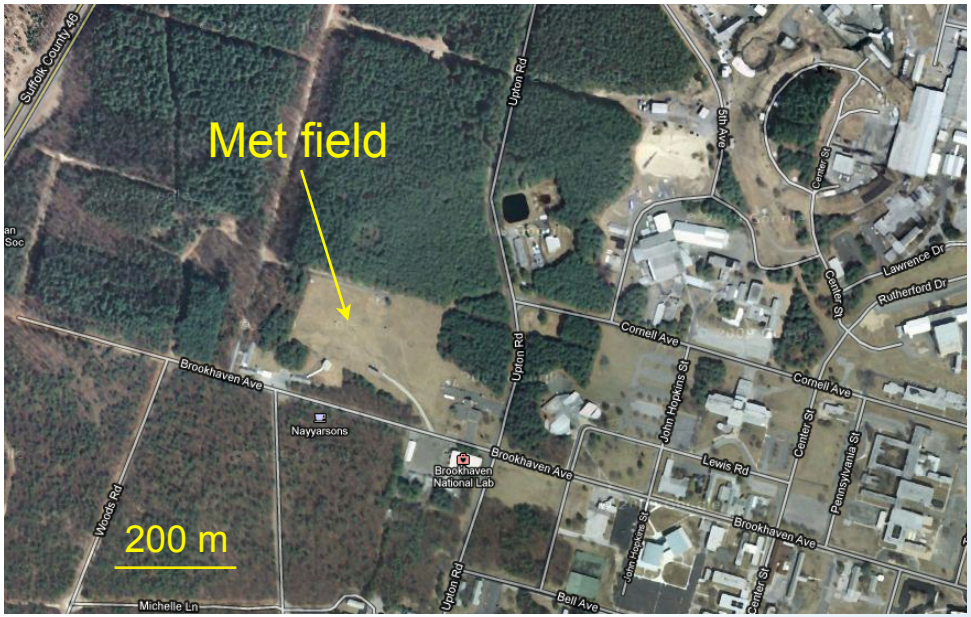
Opportunity to conduct intensive aerosol observations in a region that offers biogenic, marine and urban emissions.

- Urban emission dominated air from the west and southwest
- Biogenic emission dominated air from the north and northeast
- Atmospheric transport time of hours to days
- Absent strong synoptic forcing, a sea breeze develops in the afternoon
- Haze events (pollution alerts) can be expected
- Good chance of catching an intense but distant biomass burning event

Examples of previous northeast corridor studies:

- 1998-2002: Northeast Oxidant and Particle Study (NE-OPS)
- 2000: North American Research Strategy for Tropospheric Ozone (NARSTO)
- 1999/2000: Maryland Aerosol Research and CHaracterization (MARCH-Atlantic)
- 1998: Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX)

Aerosol Lifecycle IOP Site



Surface: Precipitation

2 meters: Temp, RH, Pres

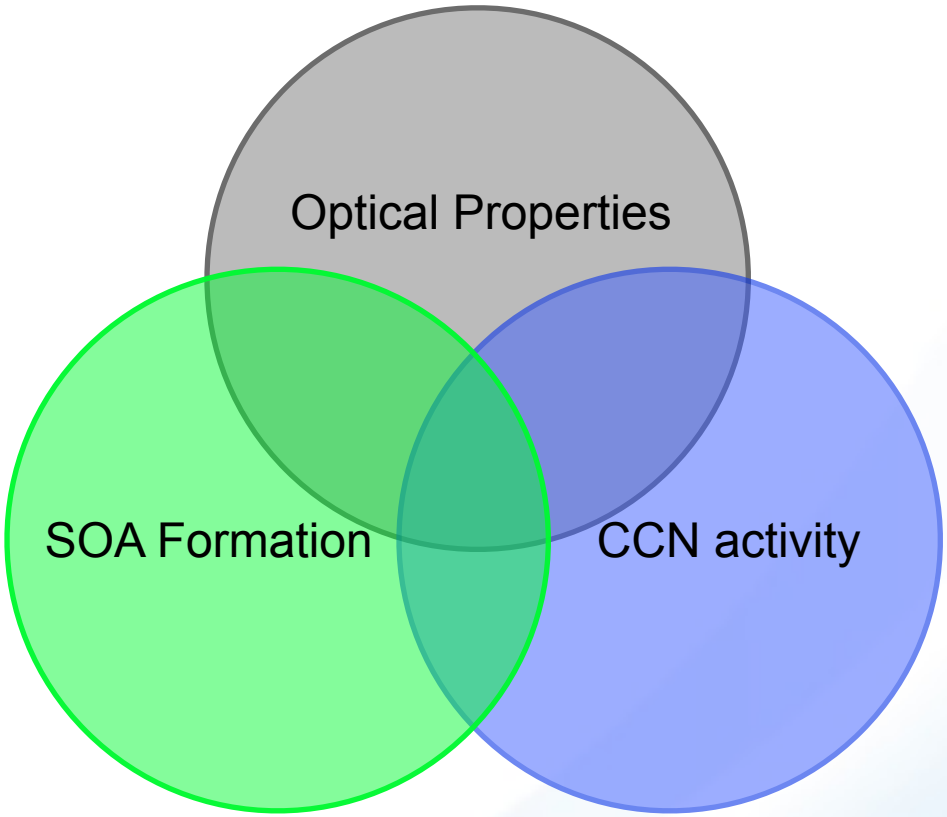
10 meters: Temp, Wind Spd, Wind Dir

85 meters: Temp, Wind Spd, Wind Dir

Anticipate measurements of T, WS, & WD at 50 meters next year

Aerosol Lifecycle IOP Site

Three foci of scientific inquiry are envisioned



A key component of these three focus areas is that aerosol properties will be determined as function of atmospheric processing and chemical conditions or source type.

Characterization of Secondary Organic Aerosol Formation (Lee)

- Is there agreement between different SOA proxies: Δorg (over POA), OOA (PMF), and WSOC (PILS)?
- Does SOA formation rate depend on emission source types (anthropogenic vs natural)?
- Are there synergistic effects in SOA formation due to fast reacting biogenic organics?
- Is it possible to link SOA formation to cloud processing?
- Is it possible to identify highly oxygenated compounds (e.g., SVOC) that are responsible for SOA formation?

Cloud activation properties of aerosol particles (Wang)

- Examine the influences of size distribution, chemical composition, and mixing state on aerosol CCN spectrum.
- Derive particle hygroscopicity (κ) from size-resolved measurements of CCN activation spectra.
- Derive/constrain the hygroscopicities of major organics classes (e.g. HOA, OOA, etc) by combining size-resolved CCN and composition measurements.
- Examine the CCN properties of organic species as functions of O:C ratios and photochemical age.

Aerosol Light Absorption (Sedlacek)

- How does the aerosol mass absorption coefficient (absorption per unit mass of BC) vary with atmospheric processing?
- Constrain BC coating thickness estimates utilizing UHSAS, CPC and SP2 and composition with AMS.
- Utilizing the above data, evaluate how well observations agree with a shell-core model?
- Using NO_x - NO_y as a proxy for age, examine correlation between BC CCN activity with age (degree of processing).
- Examine degree of processing-induced morphology changes in BC (using BNL nanoscience TEM/SEM facilities).

Aerosol Lifecycle IOP Site

IOP dates: July 15, 2011- September 15, 2011

Collaborations, thus far...

Dr. Qi Zhang (U. Davis): *High-Resolution Time-of-Flight AMS (HR-ToF-AMS)*:

- ACSM intercomparison
- SOA science: size resolved aerosol chemical composition and unambiguous elemental composition of organic mass fragments

Summary

Interested parties should contact either:

Art Sedlacek sedlacek@bnl.gov
Larry Kleinman kleinman@bnl.gov