Studies of Emissions and Composition, Clouds and Climate Coupling by Regional Surveys (SEAC\textsuperscript{4}RS):

Surface Network Information
April 2013
http://espo.nasa.gov/missions/seac4rs/
• AERONET is pretty well set up for the west, but the Southeast US is a bit sparse. Hence, a mission network is being deployed with sites generally associated with IMPROVE or SEARCH. SEARCH sites are also a focus of SOAS/SENEX. First sites are going in this week.

• LIDAR observations are rare, but DISCOVR-AQ will deploy their ozone lidar, and there is the Newchurch ozone lidar in Huntsville, AL. We may be able to get an HSRL into the SEUS.

• Whereas SE Asia had few opportunities for collateral ground data, in CONUS we are swimming in it. Keep in mind the 1 day in 3 particle chemistry calendar.

• Tag team: Anne Thompson, Gary Morris and Rennie Selkirk are coordinating regional balloon operations. SEACIONS sonde network connects to other ground sites (eg lidar) and DISCOVER-AQ in Houston. Balloon team is ready to help.
Swimming in Surface Data
http://www.epa.gov/airdata/ad_maps.html.
National Air Chemistry Networks

- IMPROVE (aerosol chem)
- NCOR (aerosol and gas)
- NATTS (air toxics, VOCs)
SouthEastern Aerosol Research And CHaracterization Study

Centreville, AL (CTR) 6/92-Present

Pensacola, FL (OLF) 6/92-Present

Yorkville, GA (YRK) 6/92-Present
SEARCH Objectives

- Develop O$_3$, PM and Hg Climatologies
  - O$_3$ 18+ years
  - PM 12+ years
  - Hg 8+ years
- Understand Composition and its Variability
  - Year to Year, Season to Season (1999-2011)
  - Rural vs. Urban
  - Coastal vs. Inland
- Long-Term Trends
- Provide Data to Health Researchers
- Test and Improve Methods
- Collaborate with States and Others
Discrete Particles and Gases (24-hour filter/denuder)
- PM$_{2.5}$ and PM$_{\text{coarse}}$ Mass
- PM$_{2.5}$ and PM$_{\text{coarse}}$ Anions (7), Cations (5), Trace Elements (12), water-soluble Metals (15-25)
- PM$_{2.5}$ OC/EC and thermal fractions
- NH$_3$

Continuous Particles (5-min to 1-hr)
- PM$_{2.5}$ Mass (TEOM)
- TC and Optical EC (Sunset)
- BC and dry $B_{\text{abs}}$ (Magee Sci. aeth)
- Ammonium/Nitrate (ARA)
- Sulfate (ARA)
- Wet and dry $B_{\text{scat}}$ (Optec NGN-2a, Radiance Research M903)

Trace Gases (5-min)
- O$_3$, NO, NO$_2$, NOy, HNO$_3$, SO$_2$, CO, NH$_3$

Meteorology
- WS/WD (10m)
- T (10m and 2m)
- RH (10m and 2m)
- BP, SR, precipitation
• Ceilometers at CTR and BHM (particle layers, cloud layers and boundary layer depth)
• Acid Gases at YRK (HCl, HF, etc.)
• $\Sigma$PAN/$\Sigma$AN analyzer (CTR only)
• Wet Deposition at CTR and GA Station (NADP-NTN)
• Began operating in spring of 1988 with 20 monitoring sites
• Today has over 160 sites most with 10 or more years of data.
**IMPROVE Aerosol Monitor**

- **A:** PM2.5 Gravimetric mass, elements (Na-PB - XRF, H – PESA), coefficient of absorption – HIPS
- **B:** PM2.5 Ions (SO₄, NO₃, Cl ion chromatography)
- **C:** PM2.5 Carbon (organic and elemental – Thermal Optical Reflectance (TOR))
- **D:** PM10 gravimetric mass
• Began operation in 2000 and approximately 200 sites are in operation today
Chemical Speciation Network (CSN) vs IMPROVE

- CSN and IMPROVE use similar sampling and analysis techniques for mass, elements, ions and organic and elemental carbon. These methods have been shown to be near equivalent except for soil elements.

- Prior to 2010, CSN used thermal optical transmission (TOT) vs thermal optical reflectance (TOR) for IMPROVE and different temperature profiles.
  - The TOT method produced smaller EC and greater OC concentrations compared to IMPROVE TOR

- The IMPROVE TOR method was phased into the CSN program starting in 2007 and completed in 2009
Data and Information Distribution Visualization and Analysis Websites
http://vista.cira.colostate.edu/IMPROVE

Interagency Monitoring of Protected Visual Environments

Our national Parks and Wilderness Areas possess many stunning vistas and scenery. Unfortunately, these scenes are diminished by uniform haze causing discoloration and loss of texture and visual range. Layered hazes and plume rise also detract from the scene. Recognizing the importance of visual air quality, Congress included legislation in the 1977 Clean Air Act to prevent future and remedy existing visibility impairment in Class I areas. To aid the implementation of this legislation, the IMPROVE program was initiated in 1995. This program implemented an extensive long term monitoring program to establish the current visibility conditions, track changes in visibility and determine causes of impairment in the National Parks and Wilderness Areas.

The purpose of this website is to provide access to the IMPROVE and educational material on the science of visibility and regulations. The Overview section which summarizes the IMPROVE network and vision.

Federal Land Manager Database (FED)

This website provides access to an extensive database of environmental data and an integrated suite of online tools and resources to help Federal Land Managers assess and analyze the air quality and visibility in Federally-protected lands such as National Parks, National Forests, and Wilderness Areas.

AQRV Summaries
Vote graphical summaries and reports of the status and trends of air-quality-related values (AQRVs) and other metrics that have been chosen by Federal Land Managers (FLMs) for assessing air quality in protected federal areas.

Webcams and Photographs
See live video from webcams at select rural and urban sites, and examine sequences of photographs from selected monitoring sites that demonstrate the range of visual conditions at each site over time.

Data Visualization and Exploration
Use a variety of interactive tools and applications to visualize, explore, filter, and download raw and aggregated air quality data and relevant metadata from the integrated database in a variety of customizable formats.

Metadata and Reference
Find and explore detailed metadata about datasets, monitoring sites, parameters, sampling and analysis protocols, processing methods, data flags, and other aspects of the air quality data in the integrated database.

Featured Substance
Barium

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Website: http://vista.cira.colostate.edu/IMPROVE
**Base package**
- PM$_{2.5}$, PM$_{10}$
- CO, NO$_x$, SO$_2$, O$_3$
- Basic Met
- Wind profiler

**SAS package (Jun-Jul 15)**
- AIM, AMSs
- VOCs, PAN, Aldahydes, H$^+$
- PM$_{2.5}$ OC/BC, ions and C14
- PASS, SMPS, SP2,
- Basic Met
- Wind profiler
RAOBS & NEXRAD

COMPLETED WSR-88D INSTALLATIONS WITHIN THE CONTIGUOUS U.S.
Important POCs
Thanks to all of our partners!

- Traffic cop: Jeffrey Reid (jeffrey.reid@nrlmry.navy.mil)
- AERONET: Brent Holben (brent.n.holben@nasa.gov) http://aeronet.gsfc.nasa.gov/
- IMPROVE: Bret Schichtel (Bret.Schichtel@colostate.edu) http://vista.cira.colostate.edu/IMPROVE
- RTP Site: John Offenberg (Offenberg.John@epa.gov)
- SEARCH: Eric Edgerton (eedgerton@atmospheric-research.com) for SEARCH and SEARCH data and Brad Gingrey (bgingrey@atmospheric-research.com) for contact and logistics and http://www.atmospheric-research.com/studies/SEARCH/
- SEACIONS: Anne Thompson (amt16@psu.edu) http://croc.gsfc.nasa.gov/seacions
SEACIONS UPDATE: Reconfiguring a Strategic Sonde Network for US Campaign

POINTS OF CONTACT:
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H Selkirk, USRA @ NASA/GSFC
Henry.b.selkirk@nasa.gov

Partners: B Johnson, S Oltmans, NOAA/GMD
A Panday, UVA
J Witte, SSAI @ NASA/GSFC

SEAC4RS STM, 29 April 13
(1) How does convective redistribution affect tropospheric & TTL ozone, \( \text{H}_2\text{O} \) in Asian anticyclone during Monsoon season (upper, middle)
(2) How do aerosols & ozone pollution sources (CO, NO\(_x\), VOC) from urban areas & biomass fires interact with convection during Asian Monsoon (lower)

Fly 2 aircraft (NASA DC-8, ER-2) over instrumented ground sites in August-September period

Updates at NASA-ESPO SEAC4RS Website: http://espo.nasa.gov/missions/seac4rs

NO\(_x\), VOCs, HO\(_x\) and aerosol precursors
Road Map

  - Summer IONS-04 & IONS06 w/ TEXAQS/GOMACCS/INTEX-B are models for 2013 SEACIONS
  - SEAC4RS-relevant science from 2006 (Houston/SE)

- Re-mapping SEACIONS to US: Options
  - Leverage existing sites, infrastructure
  - Houston – DISCOVER-AQ linkages (2-30 Sept 2013)
    - NATIVE daily sondes at Smith Point
    - Other TX soundings (G Morris)
INTEX-A: DC8 DIAL Ozone (E. Browell, LaRC) – Huntsville Sonde & RAQMS Model
Episodic pollution in BL

Up to 25/8, lightning & convection dominate; heavy stratospheric influence thereafter

- Wave analysis [Thompson et al., 2008]
- In 9-12 km layers, lightning dominant ozone source across SE US [Cooper et al., 2006; 2007]
SEACIONS Sampling Protocols

- Original “Asian” SEACIONS
  - Four sites with 40 daily ozonesonde launches
  - One site with 20 sondes
  - One site with 20 ozone only and 20 CFH-water-ozone combinations: at location of DC-8 & ER-2
  - *In principle, 6 sites possible for SEAC4RS*

- SEAC4RS Options Map follows. Following sites operating 5+ years:
  - Boulder NOAA Beltsville Howard
  - Huntsville UAH Wallops Is NASA
  - Houston UH & Valpo Trinidad Head NOAA

- Other “ready” sites: JPL/TMF, SGP/Salina, NMTech
Candidate Sites for US SEACIONS

**SW:** Smoke Pollution from Fires

**SE:** T-Storm Convection/Lightning & Pollution (Biogenic/Anthropogenic)
Houston Operation Linkage: DISCOVER-AQ

- Easy for PSU-USRA/NASA-VU to support CFH & sonde launches at Ellington. Also SEAC4RS, DISCOVER-AQ flight planning
- Sonde Training held in 5/12
- In September, PSU-VU supports DISCOVER-AQ daily ozonesondes at NATIVE. Can substitute for 15-20 ozone only SEAC4RS launches
- At NATIVE will have tethered balloon (Millersville), lidar (UAH)
- Contacts at UAH, NMTech, Boulder, Beltsville, St Louis available for SEACIONS!
TOPP Launch Sites

- Funded since 2004 w/ > 500 launches at Texas & Idabel sites
- Operating during Aug/Sept. 2013
- Planned sites for DISCOVER
- Past sites
- AQRQRP funding for 30 launches 2013
- TCEQ funding for ~5- launches 2013
- Project Website: physics.valpo.edu/ozone
- PI – Gary.Morris@valpo.edu

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Water vapor profiling in SEAC4RS:
the Mesoamerican Moist Pool
Rennie Selkirk, GESTAR/NASA GSFC
Anne Thompson, Penn State U (NASA GSFC)

Background:
• Pool of moist air in UTLS over Mesoamerica during NH summer
• Associated with upper-level anticyclone and NA Monsoon
• Significant input into WV tape recorder [Schoeberl et al., 2013]

Science Question:
What are the roles of deep convection, transport and microphysical processes in this Mesoamerican Moist Pool (MMP)?

Approach in SEAC4RS:
• Characterize water vapor and ozone structure and variability with CFH/ECC sondes
• Bracket the MMP with 20 launches each at San Jose (10°N) and Houston (30°N)
• Launches at Houston in concert with SEACIONS
• Opportunities for aircraft instrument inter-comparisons at Houston