Aerosol Observing Systems (AOS) Instrumentation

Olga Mayol-Bracero

AMSG Workshop

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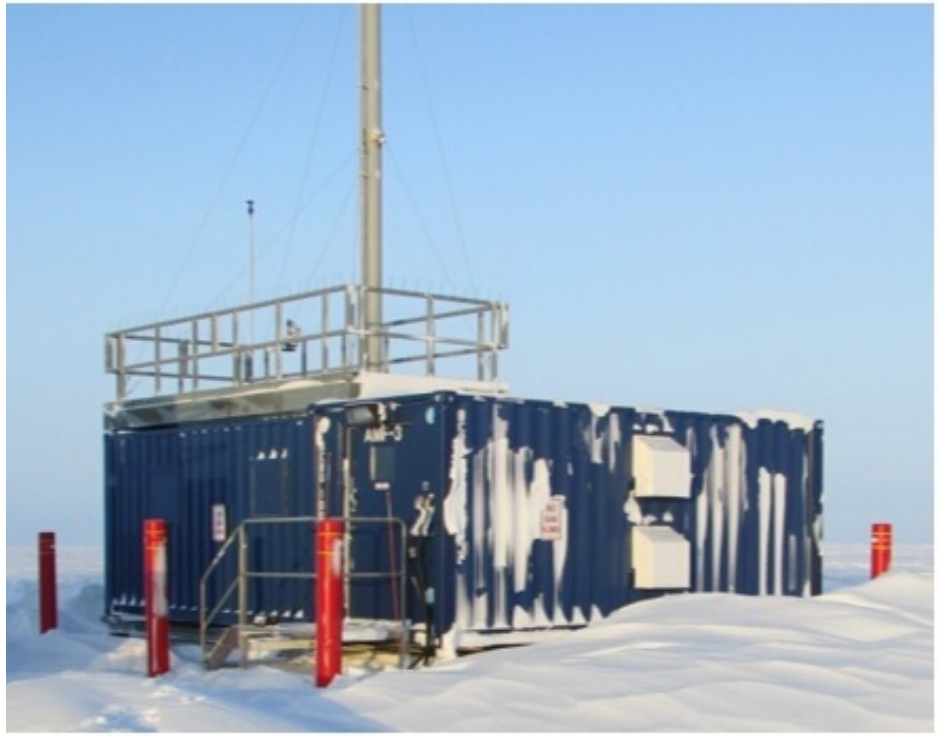
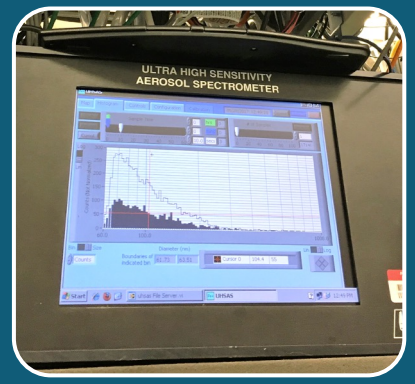
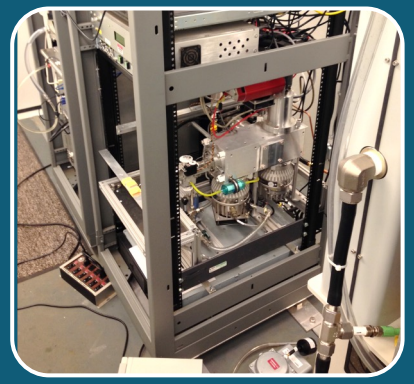


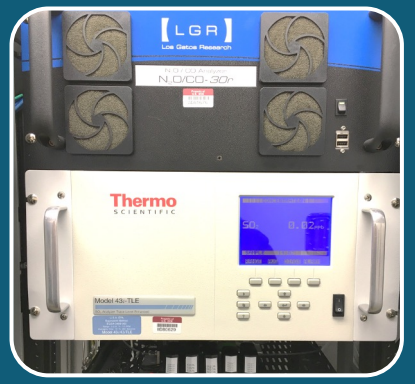
Outline

- Measurements
- Standard AOS
- Additional Instrumentation
- Instruments and Deployments
- ARM's Plans for Removing/ Adding Instruments

AOS Measurements and Instruments







Number concentration and size (3 nm – 20 µm)

- CPC
- SMPS
- UHSAS
- APS
- OPC

Hygroscopicity

- CCN
- HT-DMA

Chemical composition

- ACSM
- SP2

Optical properties

- Aethalometer
- CAPS
- Nephelometer
- PSAP

Trace gases

- CO
- O_3
- SO_2

More than 75 instruments in 5 different locations

Uin et al. 2019

Standard AOS Instruments - part of every deployment

- Particle number concentration
  - Condensation particle counter (CPC, CPCf, down to 10 nm)
- Particle number size distribution
  - Aerodynamic particle sizer (APS, 0.5 – 20 μm)
  - Scanning mobility particle sizer (SMPS, 10-500 nm)
  - Ultra-high sensitivity aerosol spectrometer (UHSAS, 60 – 1000 nm)
- Hygroscopicity
  - Cloud condensation nuclei counter (CCN)
- Optical (scattering and absorption)
  - Nephelometer (NEPH), particle soot absorption photometer (PSAP)
- Trace Gases
  - Ozone (O3)
- Impactor and Met system (AOSMET)

In blue – ACTRiS obligatory aerosol in-situ variables

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Theisen et al. ARM FY2024 Aerosol Operations Plan. 2023. 10.2172/2008425.

Additional AOS Instruments

- Particle Number Concentration
  - Ultra-fine condensation particle counter (CPCU/CPCUF, down to 2.5 nm)
- Particle Size Distribution
  - Nano scanning mobility particle sizer (NANOSMPS, 2-60 nm)
  - Wide-range scanning mobility particle sizer (WIDESMPS, 10-800 nm)
  - Hygroscopicity
  - Humidified-tandem differential mobility analyzer (HT-DMA)
- Optical
  - Aethalometer (AETH)
  - Cavity-attenuated phase shift monitor (CAPS)
- Trace Gases
  - Carbon monoxide (CO)
  - Sulfur Dioxide (SO2)
- Chemical Composition
  - Aerosol chemical speciation monitor (ACSM, ACSM-TOF)
  - Single particle soot photometer (SP2)
  - Proton transfer reaction mass spectrometer (PTR-MS)
- Filters for ice nucleation particles (INS/INP) – not part of the AOS

May be deployed full-time at certain sites or just during IOPs (by PI request)

Observatories and AOS instruments

Campaign/Site	CoURAGE	CAPE-k	BNF	ENA	SGP	NSA	IOP
INSTRUMENT	AOS01	AOS02	AOS03	AOS06	AOS07		
Standard AOS							
ACSM/ACSM-TOF							
Aethalometer							
CAPS							
CO							
CPCuf							
HT-DMA							
n-SMPS							
SO2							
SP2/SP2-XR	IOP	IOP	XR			XR	
INS/INP		IOP					
NOx							IOP
PTR-MS							IOP
GHGs (CO2, CH4)							IOP

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DEPLOYED
ADDITIONS IN FY24
REMOVALS

ARM's Plans for Removing and/or Adding Instruments

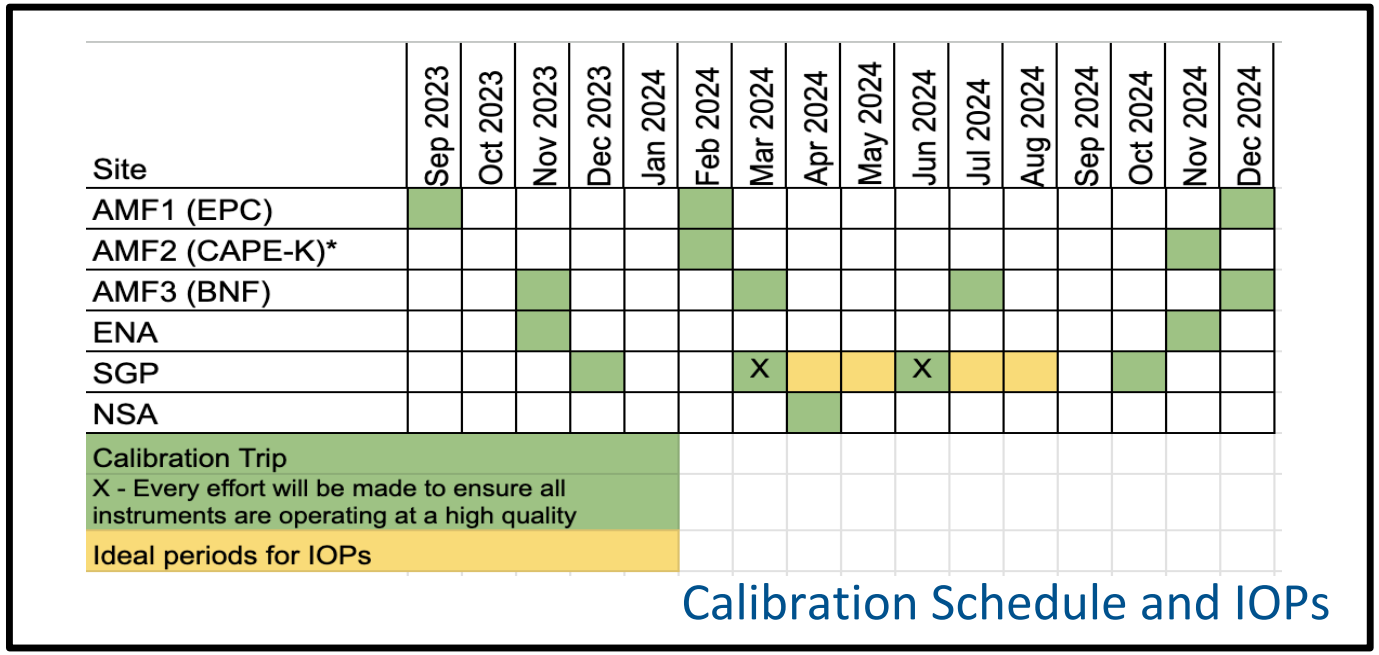
- Removed FY24
  - All five humidigraphs (fRH and wet neph)
  - Three HT-DMAs (AMF1, AMF2 and ENA). We'll operate AMF1 and AMF3 and determine plans for FY26 as part of the FY26 aerosol operations plan
  - One ACSM (ENA)

- Adding FY24, FY25
  - NSA: APS, ACSM, SP2-XR – starting in September
  - TSI Nephs will be replaced with the Aurora Neph, procuring one in FY24, rest in FY25.
  - NOx (ARM or ARM via guest instruments) - ARM will support NOx for CoURAGE (AMF1) and BNF (AMF3).

- In the "near" future
  - Replacement of the PSAPs
    - "*Filter Absorption Measurements In New Experiment for replacing ARM's PSAP absorbing aerosol measurements (AMICE)*" – Connor Flynn, Tim Onash, Art Sedlacek

IOP (Intensive Operational Period) Mode vs Normal Mode of Operation

- ARM IOPs aligned with calibration plan
- ARM will prioritize efforts to ensure that all instruments are operational, calibrated, and producing high-quality data during this period.
- This includes shifting known activities (repairs, upgrades, etc.) to either before or after this period and providing more frequent reviews of the data from the Data Quality Office and mentor
- Calibrations closely integrated with CAMS calibrations plans and staggered to spread the workload and equipment needs
- Flexibility to adjust to ARM's needs



Calibration Schedule and IOPs

Theisen et al. ARM FY2024 Aerosol Operations Plan. 2023. 10.2172/2008425