



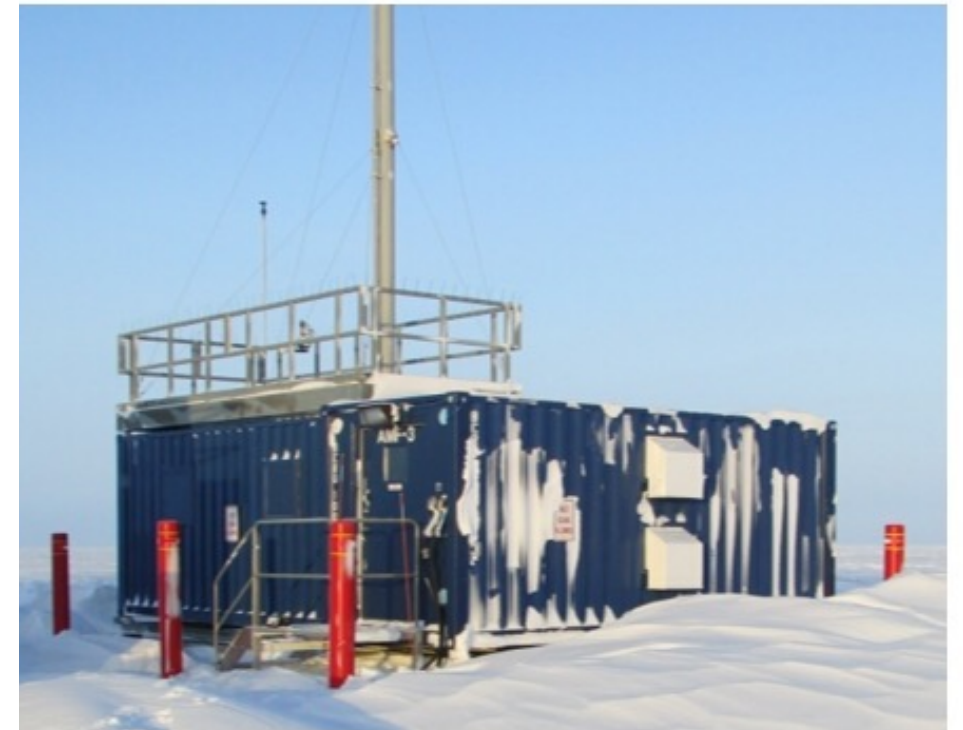
# Aerosol Observing Systems (AOS) Instrumentation

Olga Mayol-Bracero

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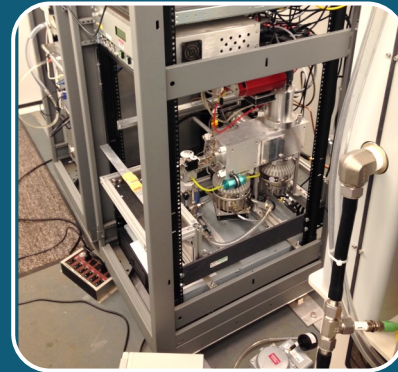
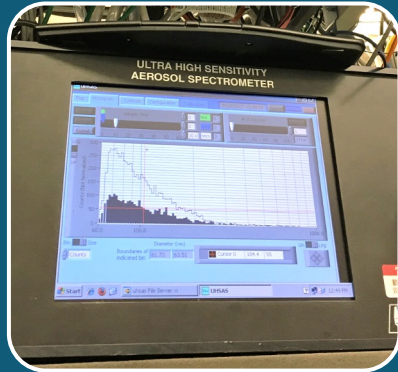




# Outline

- 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<sub>3</sub>
- SO<sub>2</sub>

**More than 75 instruments in 5 different locations**



# 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  $\mu\text{m}$ )
  - 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 (O<sub>3</sub>)
- Impactor and Met system (AOSMET)

In blue – ACTRiS obligatory  
aerosol in-situ variables



# 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 (SO<sub>2</sub>)
- 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

# 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 Nephys 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

	Sep 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Oct 2024	Nov 2024	Dec 2024
Site																
AMF1 (EPC)																
AMF2 (CAPE-K)*																
AMF3 (BNF)																
ENA																
SGP																
NSA																
Calibration Trip																
X - Every effort will be made to ensure all instruments are operating at a high quality																
Ideal periods for IOPs																

Calibration Schedule and IOPs

Theisen et al. [ARM FY2024 Aerosol Operations Plan. 2023. 10.2172/2008425](#)