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National Laboratory



U.S. DEPARTMENT OF  
**ENERGY**

# Development of ARM mini-AOS for Distributed Sensing Network

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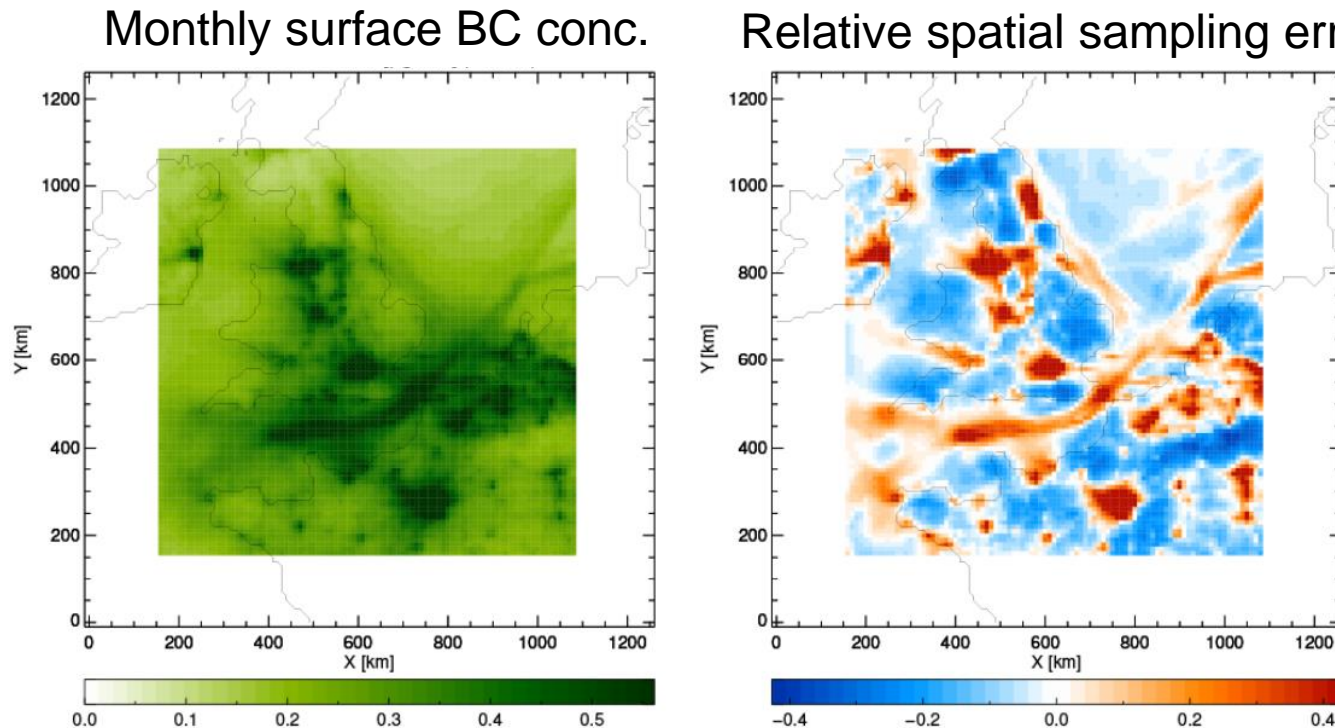
ARM AMSG, 2024/07/10



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# Motivation: Capturing Aerosol Spatial Heterogeneity and its Drivers

Spatially-distributed aerosol measurements are needed to resolve land-atmosphere controls on aerosol-climate impacts.



Representativeness errors  
(spatial and temporal)

Sub-grid variability → aerosol  
process controls

Model-Observation bias



# Approach: A Tiered Network of AOS and Miniaturized AOS

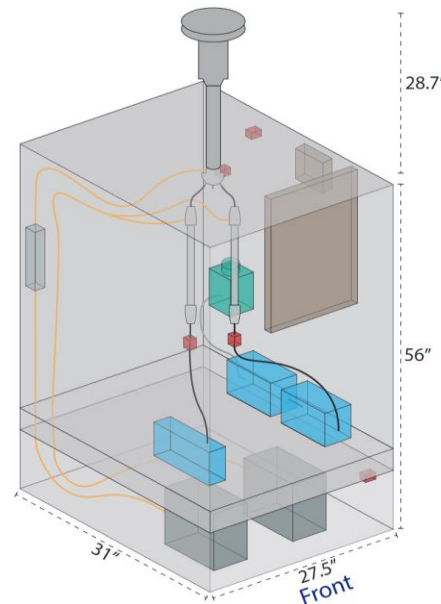
## Tier 1: AOS

- Large footprint: 6 m x 3 m x 3 m
- Highest quality instrumentation
- 10-20 instruments
- Process studies



## Intermediate Tier: “mini-AOS”

- Small footprint: 1 m x 1 m x 2 m
- Miniaturized instrumentation
- 4-5 instruments
- Budgets, spatio-temporal scaling



In development for AMF3 BNF

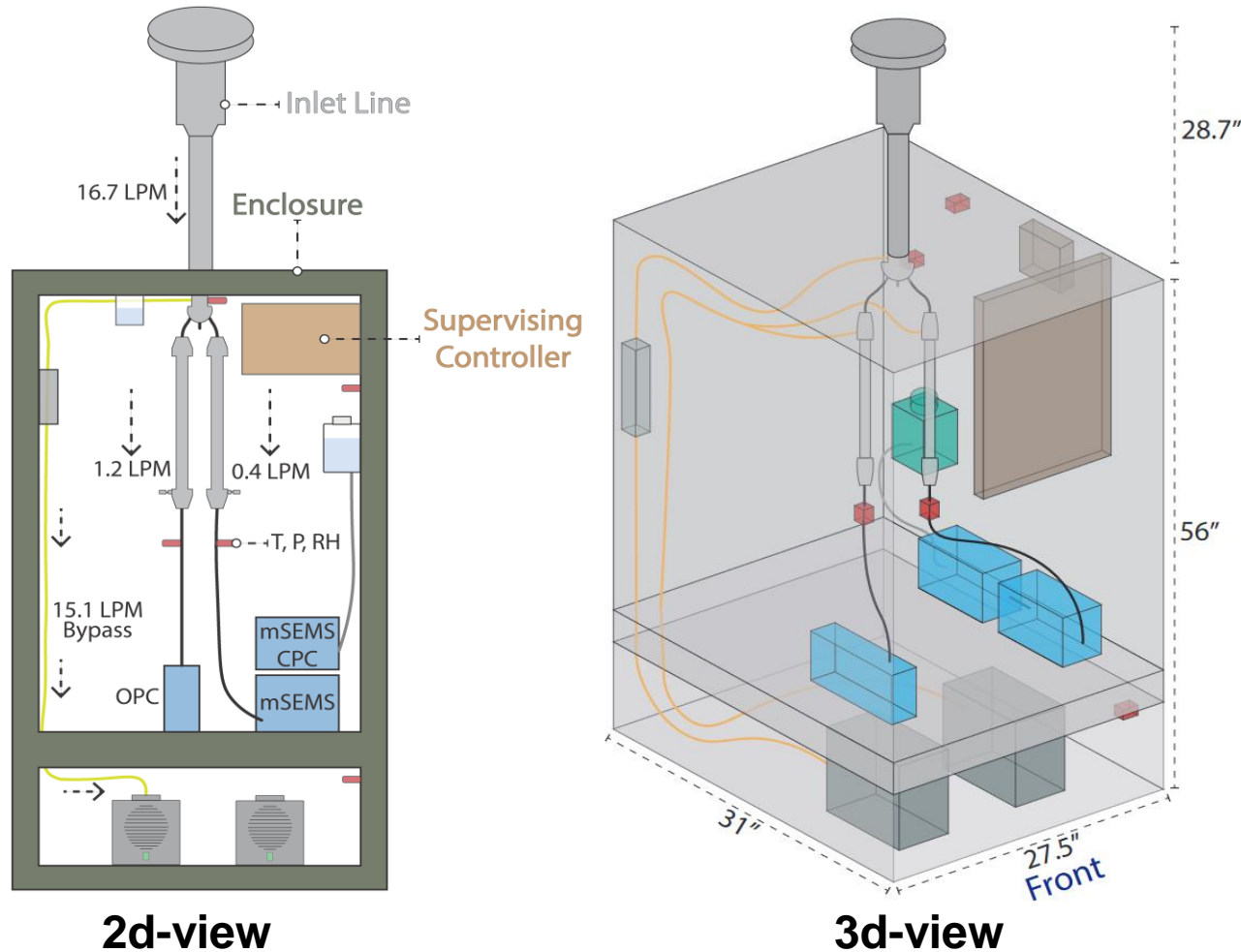
## Baseline Tier: “micro-AOS”

- Very small footprint: 0.5 m x 0.5 m x 1 m
- Lower-complexity instrumentation
- 1-2 instruments
- Spatio-temporal scaling



SGP POPsNET

# Challenge in distributed network: mini-AOS development and its measurement uncertainty?



## Target Species

- **AMF3 BNF:** Aerosol microphysical & optical properties
- **Future meaningful expansion:** Filter-based, columnar-based, hygroscopic, trace gas

## Network calibration type and burden?

- Measurement uncertainty bounds for each unit:
  - Instrument to system level
- Establishing system-level bias
  - Within mini-AOS and with AOS