Network of Atmospheric Composition and Aerosol Sensors

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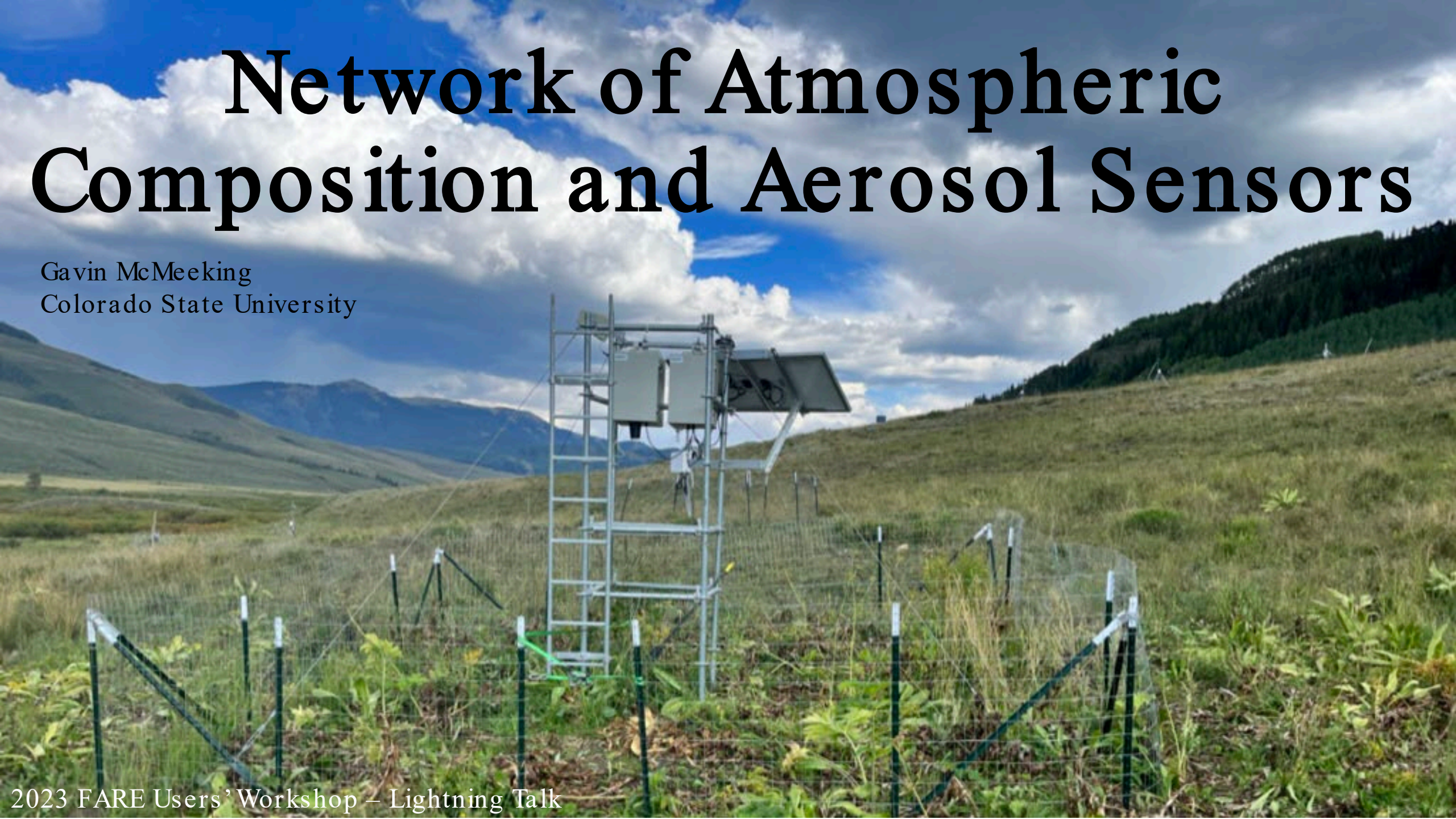


2023 FARE Users' Workshop – Lightning Talk

Example 1: POPSnet-SGP

Location: Southern Great Plains, DOE ARM Facilities

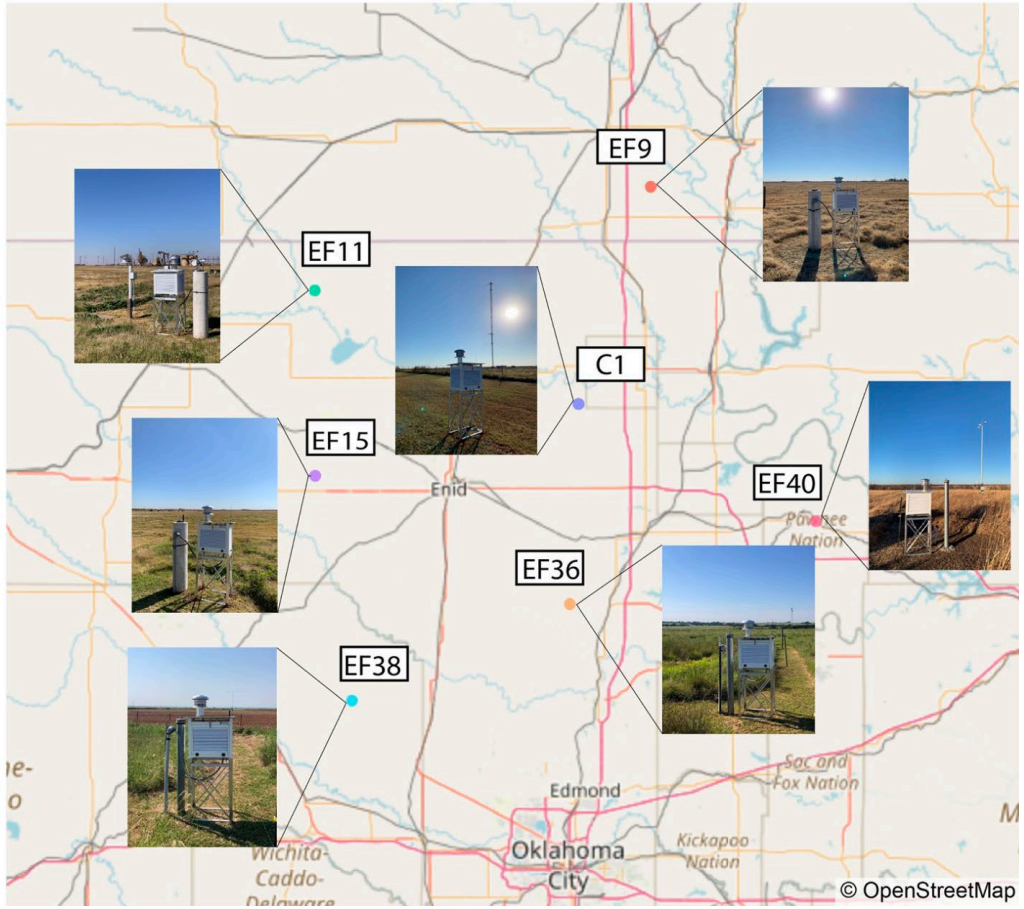
Duration: Sep 2019 - Aug 2021

Partners: NOAA CSL, CIRES, University of Leeds, Yale University, Brookhaven National Laboratory

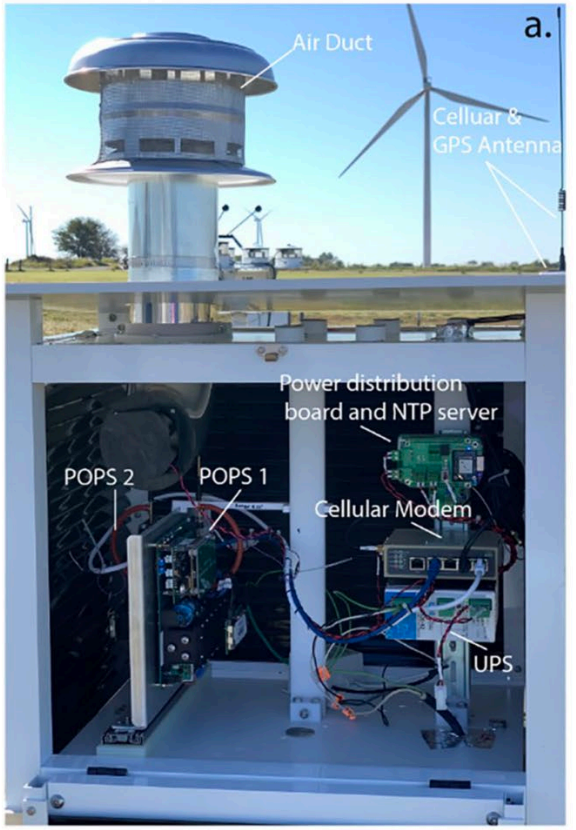
Instrumentation: POPS for aerosol size (0.14 - 2.5 μm) searchPM for PM1, PM2.5, PM10, T/RH, CO

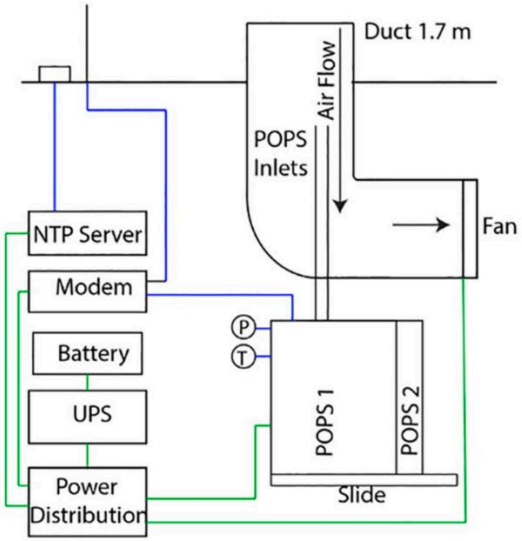
Objective: Assess statistical representativeness of single-point surface microphysical measurements within a global model grid cell.

Significance: Address 'representation error' to improve climate model accuracy by filling gaps in long-term, spatially dense aerosol measurements.



Asher et al., JGR, 2021





Example 2: SAIL-NET

Location: East River Watershed, Colorado

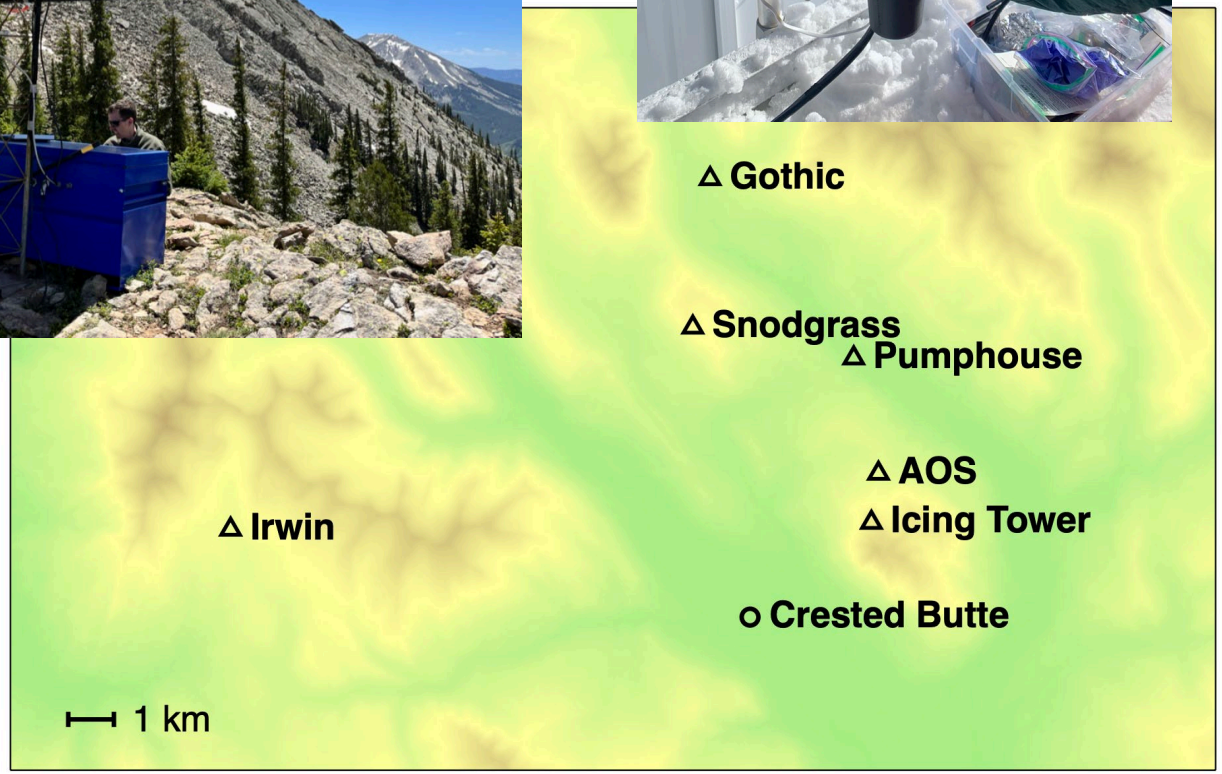
Duration: Sep 2021 - June 2023

Partners: Handix Scientific, Colorado State University

Instrumentation: POPS for aerosol size (0.14 - 2.5 μm), sequential filter sampler for INP, prototype CCN counter

Objective: Assess statistical representativeness of single-point surface microphysical measurements in complex terrain.

Significance: Stay tuned!



Active Instrument Development Work

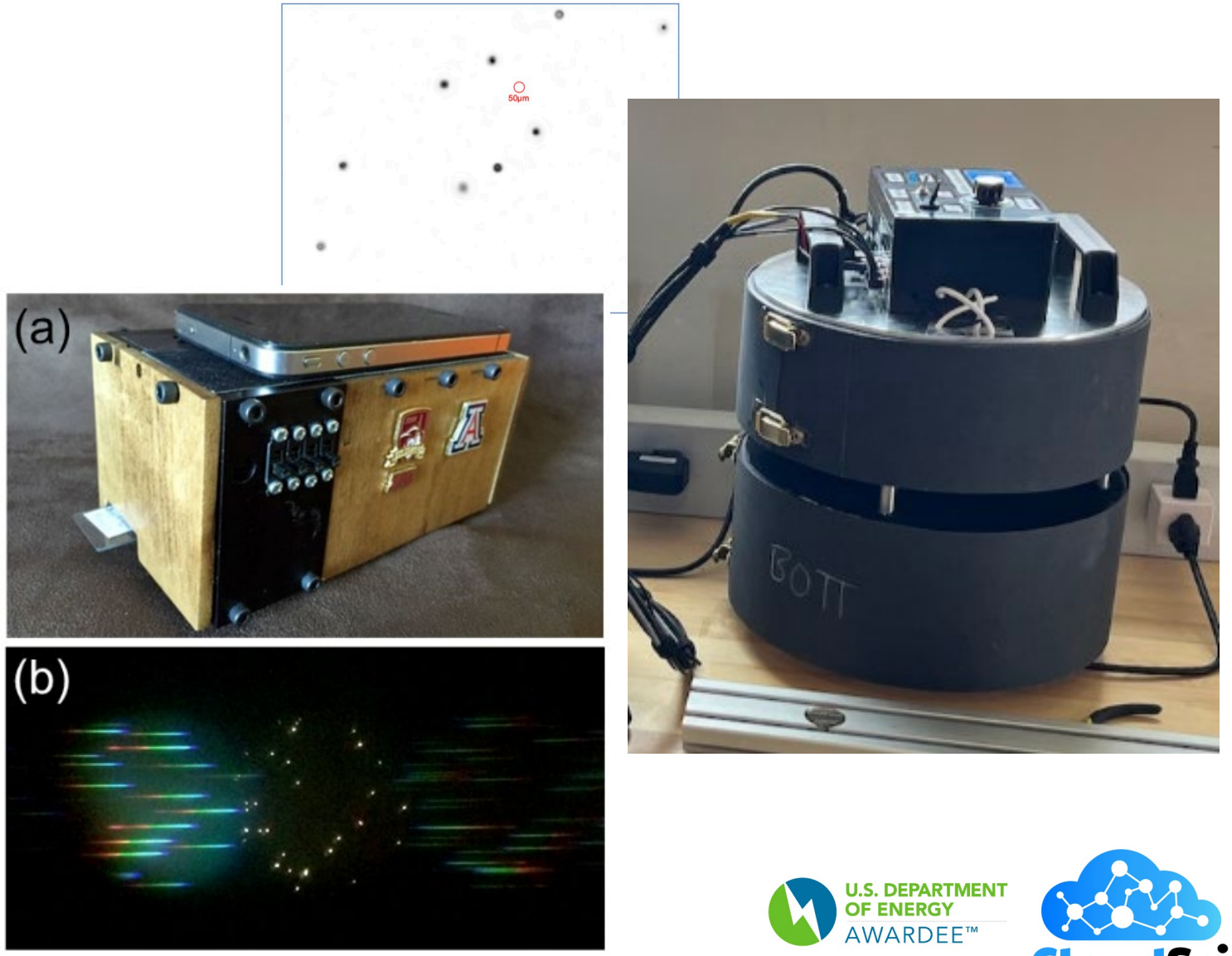
Several projects seeking to miniaturize and “cheapen” costs of research-grade instruments

Likely many “mid-cost” instruments available in next 2-5 years

Need feedback on properties that need to be measured

Work required to determine how best to deploy these sensors:

- how many?
- where?
- sampling frequency?
- how long?



Huffman et al., AS&T, JGR, 2016

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Lessons Learned

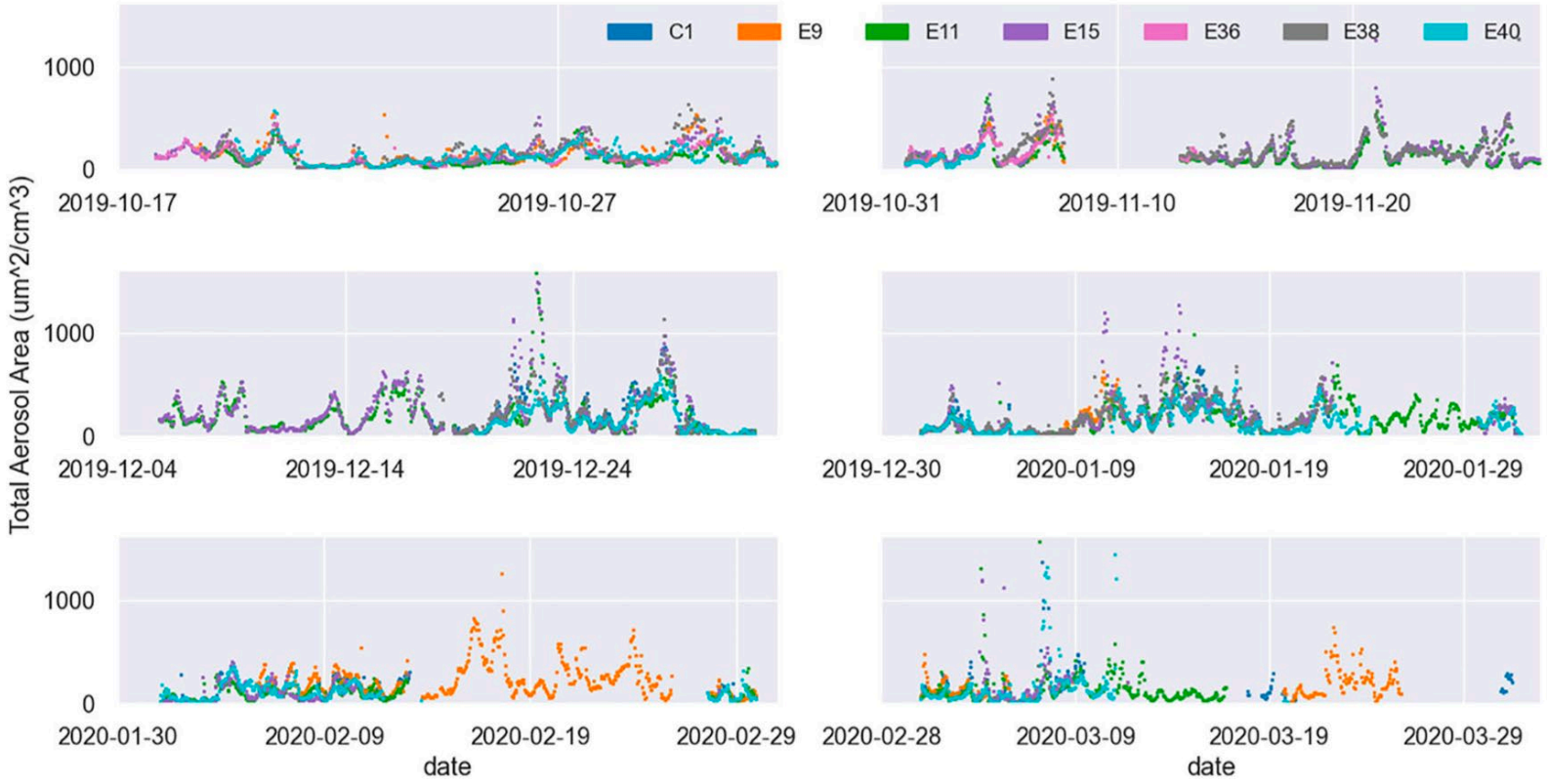
- Setting up, operating, and maintaining network of instruments is labor intensive.
- Calibration requirements (flow checks, sizing checks, etc.) can be a major challenge, especially for remote sites.
- General trend towards adding new measurement capabilities for more than “just” PM1, PM2.5, PM10
- The cost of infrastructure and continuous network support can’t be overlooked when planning networks.

Thank you!

Backup slides …

POPSnet-SGP Key Findings

- Measurement Representation Error: Reduced to ≤30% for N_140 with a 1-day averaging period.
- Error Reduction: 30%-45% decrease in representation error in N_140, A_140, and N_400 with increased averaging periods.
- Site Variability: >10% mean representation error between stations for N_140 and A_140 in a 30-min period.



Asher et al., JGR, 2021

Implications

- Future Monitoring: Validates the need for continued studies to confirm findings in other regions.

- Global Relevance: POPSNet-SGP useful for global models, may establish representation error prior for other remote regions.