



Network Update: Laboratory & Field

IMPROVE Steering Committee Meeting
October 16, 2018 | Fort Collins, Colorado

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UCDAVIS
AIR QUALITY RESEARCH CENTER



Total = 156 Sites

New Sites
Toolik Field Station, AK
Nov 2018

Sites Offline
Barrier Lake (BALA), Apr 2017
Sierra Ancha (SIAN), Aug 2017
Virgin Islands (VIIS), Aug 2017

* Inserts not to scale

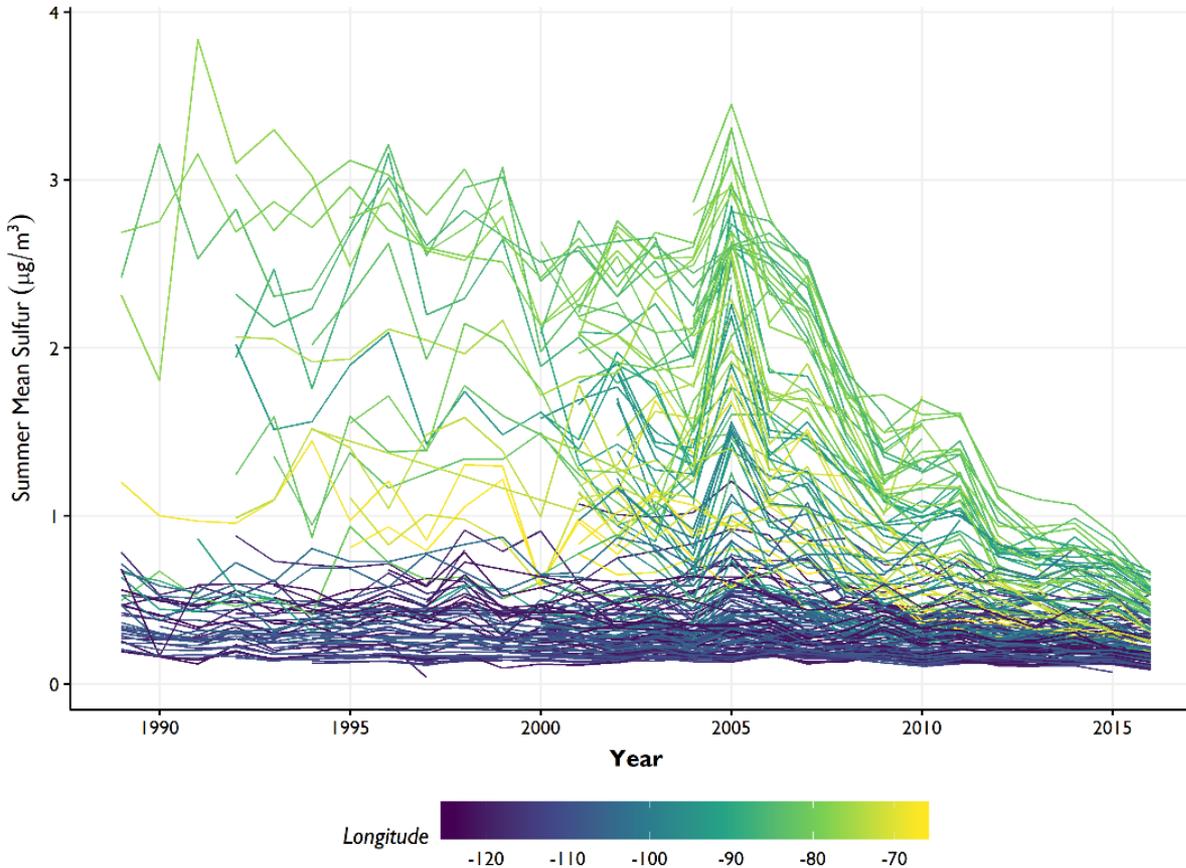
Effective 9/25/2018

Analysis and Delivery Status

All 2017 data has been delivered to AQS and FED.

2018	Ions	Carbon	Elements	Validation	Delivery (AQS & FED)
January	✓	✓	✓	🕒	✗
February	✓	✗	✓	✗	✗
March	✓	✗	✓	✗	✗
April	✓	✗	✓	✗	✗
May	✓	✗	✓	✗	✗
June	✓	✗	✓	✗	✗
July	✗	✗	✗	✗	✗
August	✗	✗	✗	✗	✗
September	✗	✗	✗	✗	✗

Documentation: Semiannual Quality Assurance Report



Most recent QA Report delivered on October 12, which explores 2017 data.

Please check out the QA Reports online at CIRA or UCD websites. We welcome your feedback!

Documentation: Data Advisories

- 1** Calibration Bias in Reported Vanadium Concentrations
Released: February 2018
Period Impacted: January 2011 through October 2017
- 2** Possible Over-Correction of Chloride Concentration for Nylon Filter Contamination
Released: Update to previous advisory
Period Impacted: January 2008 through February 2011
- 3** Changes to Flow Rate Calculation and Implementation of Universal Flow Constant
Released: Coming Soon
Period Impacted: 2018 onward

Regional Haze Rule (RHR) Completeness Criteria

Can't exceed...

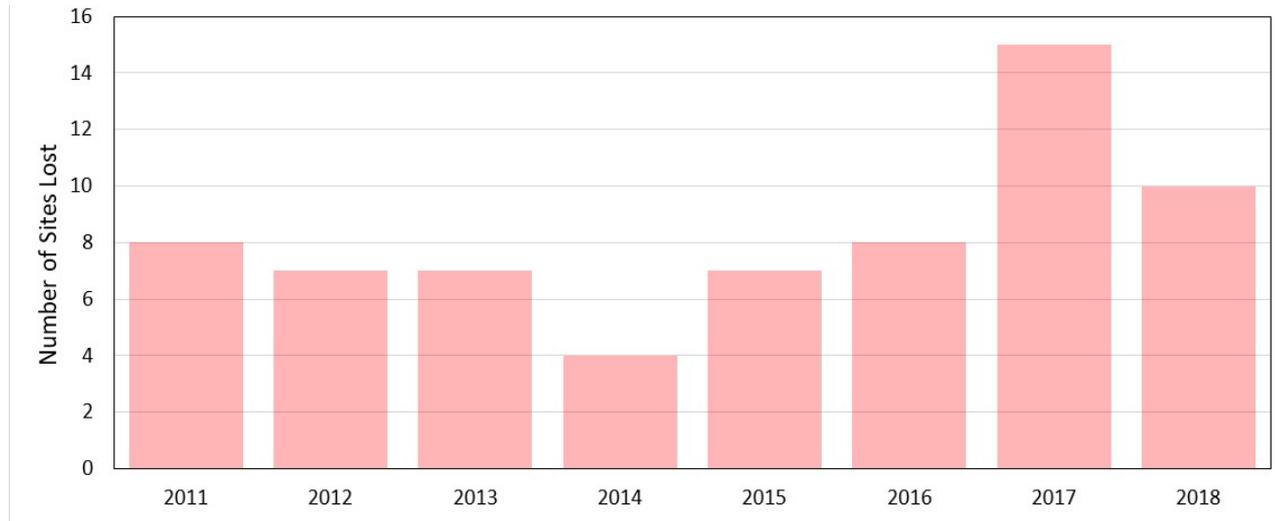
10 samples lost in a row

15 samples lost per calendar quarter (> **50% recovery per quarter**)

30 samples lost per year (> **75% recovery per year**)

UCD Sample Handling Lab sends notices to at-risk sites with a breakdown of how many samples have been invalidated and a RHR reminder.

Site Status



2011-2017: Final number of losses after completion of full validation.

2018: Number of losses year-to-date.

Sites Not Meeting RHR Criteria: Missed Samples



Agua Tibia, CA (AGTI)

- Late sample changes compounded by pump and controller (old version) failures.
- Over 30 samples lost over first, second, and third quarters.
- Site also lost during 2017.



Baengnyeong Island, South Korea (BYIS)

- Controller (old version) issue and delayed operator response.
- First and second quarter, 41 consecutive samples lost.
- Site also lost during 2017.

Sites Not Meeting RHR Criteria: Missed Samples



Hoover, CA (HOOV)

- Combination of pump issues and difficulty with site communication.
- First quarter, 11 consecutive samples lost.



Hawaii Volcano, HI (HAVO)

- Site staffing issues, building repairs, and poor weather; was not serviced for six weeks.
- First quarter, 14 consecutive samples lost.

Sites Not Meeting RHR Criteria: Equipment Problem



Egbert, Ontario (EGBE)

- Solenoid and pump malfunctions.
- Second quarter, 13 consecutive samples lost.



Gates of the Mountains, MT (GAMO)

- Sample stack inserted incorrectly by site operator.
- Over 30 samples lost over first, second, and third quarters.
- Site also lost during 2011 and 2012.

Sites Not Meeting RHR Criteria: Equipment Problem



Grand Canyon, AZ (GRCA)

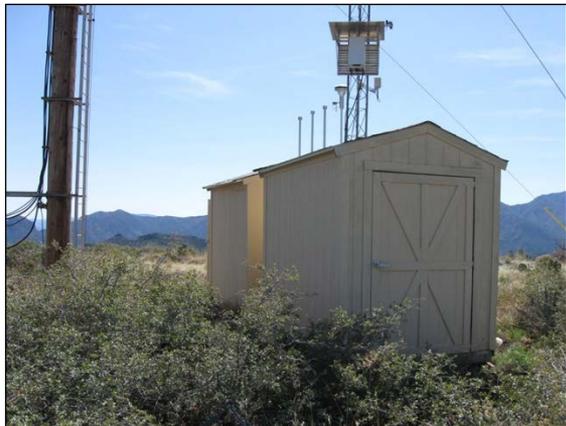
- Controller (old version) and solenoid complications with lengthy troubleshooting.
- Over 30 samples lost over first, second, and third quarters.
- Site also lost during 2017.



Sawtooth, ID (SAWT)

- Multiple pump failures and replacements.
- Third quarter, over 10 consecutive samples lost.
- Site also lost during 2013 and 2017.

Sites Not Meeting RHR Criteria: Fire Restrictions



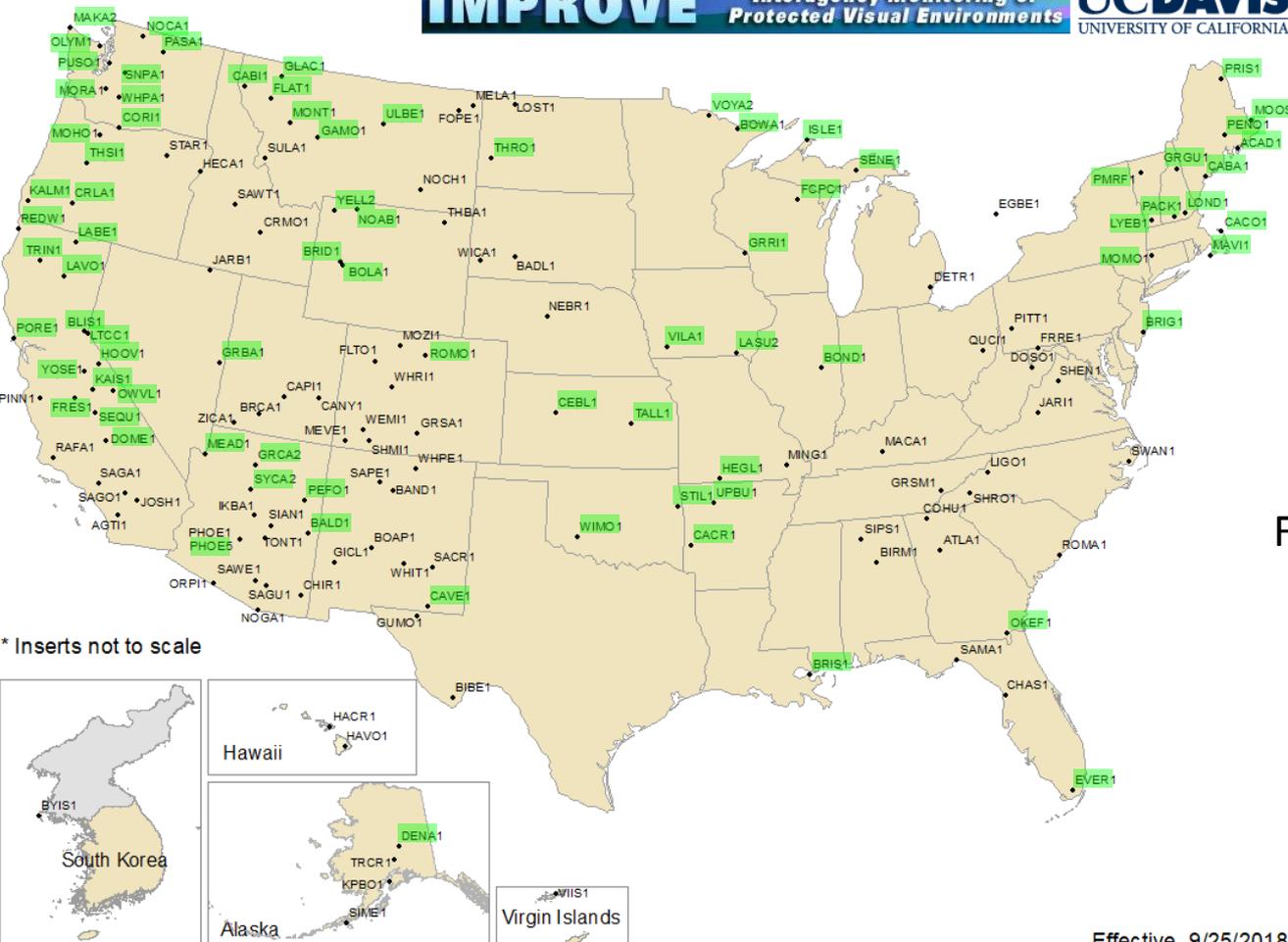
Ike's Backbone, AZ (IKBA)

- Site access restricted in response to fire warnings.
- Second quarter, 12 consecutive samples lost.



Wheeler Peak, NM (WHPE)

- Site access restricted in response to fire warnings.
- No samples collected from late May to early October.



New Controller

Daily data downloads.

Faster problem identification and troubleshooting.

Deployed at over 1/2 of the IMPROVE network sites.

* Inserts not to scale



Effective 9/25/2018

New Controller: Real-time Interface

Internet access at most IMPROVE network sites with new controllers.

The screenshot displays the IMPROVE Management Site interface. At the top, there is a navigation bar with tabs for Home, XRF, Analysis Data, Operations, and Admin, along with a Log in link. Below this is a secondary menu with options like Alerts, Status, Exceptions, Pumps, Zeroes, Filter Readings, and Import. The main content area is titled "Network Summary" and features a grid of site status cards. Each card shows a site ID and a status indicator (a circle with a number). The sites are arranged in rows, with the first row containing 16 sites, the second row 16 sites, the third row 16 sites, the fourth row 16 sites, the fifth row 16 sites, and a final row with one site (YOSE1). The BRIS1 site is highlighted in red, indicating it needs attention. Other sites like BALD1, DOME1, EVER1, and FLAT1 are highlighted in grey, indicating an internet problem. A color key at the bottom explains the status indicators: Good (green), Offline site (white), Missed check in (light grey), Internet problem (dark grey), Warning (yellow), Needs attention (red), and Info (blue). Buttons for "Show readings" and "Show all sites" are located in the top right corner.

Improve Management Site Home XRF Analysis Data Operations Admin Log in

Home Alerts Status Exceptions Pumps Zeroes Filter Readings Import

Network Summary

Show readings
Show all sites

ACAD1 0	BALD1 0	BLIS1 0	BOLA1 0	BOND1 0	BOWA1 0	BRID1 0	BRIG1 0	BRIS1 0	CABA1 0	CABI1 0	CACO1 0	CACR1 0	CAVE1 0	CEBL1 0	CORI1 0
CRLA1 0	DENA1 0	DOME1 0	EVER1 0	FCPC1 0	FLAT1 0	FRES1 0	GAMO1 0	GLAC1 0	GRBA1 0	GRCA2 0	GRGU1 0	GRR11 0	HEGL1 0	HOOV1 0	ISLE1 0
KAIS1 0	KALM1 0	LABEL1 0	LASU2 0	LAVO1 0	LOND1 0	LTCC1 0	LYEB1 0	MAKA2 0	MAVI1 0	MEAD1 0	MOHO1 0	MOMO1 0	MONT1 0	MOOS1 0	MORA1 0
NOAB1 0	NOCA1 0	OKEF1 0	OLYM1 0	OWVL1 0	PACK1 0	PASA1 0	PEFO1 0	PENO1 0	PHOE5 0	PMRF1 0	PORE1 0	PRIS1 0	PUSO1 0	REDW1 0	ROMO1 0
SENE1 0	SEQU1 0	SNPA1 0	STIL1 0	SYCA2 0	TALL1 0	THRO1 0	THSI1 0	TRIN1 0	ULBE1 0	UPBU1 0	VILA1 0	VOYA2 0	WHPA1 0	WIMO1 0	YELL2 0
YOSE1 0															

Color key:
Good Offline site Missed check in Internet problem Warning Needs attention Info

New Controller: Success Stories



Quick identification of pump failure cases.

Greater confidence in flow rate measurements, and ability to rapidly identify flow rate changes.

Remote login to fix configuration issues and run diagnostics.

Faster identification of power outages.

User-friendly touchscreen with better filter change instructions.

Ability to see if filter changes are done correctly and on-time.

Improvement to Flow Rate Calculation

Flow monitored using pressure transducers.

Flow equations and constants determined from multipoint calibration.

Old Controller

Analogue pressure transducers.

Noisy pressure measurements
prone to drifting.

Flow constants determined
separately for each site.

New Controller

Digital pressure transducers.

More stable and reliable pressure
measurements.

Universal flow constants
determined for entire network.

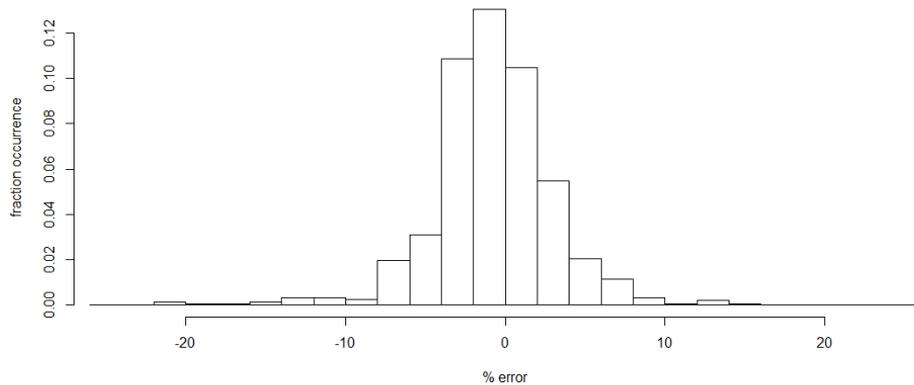
PM2.5 Module Flow Comparison

Histograms of PM2.5 Module % Error

Based on 70 Field Calibrations

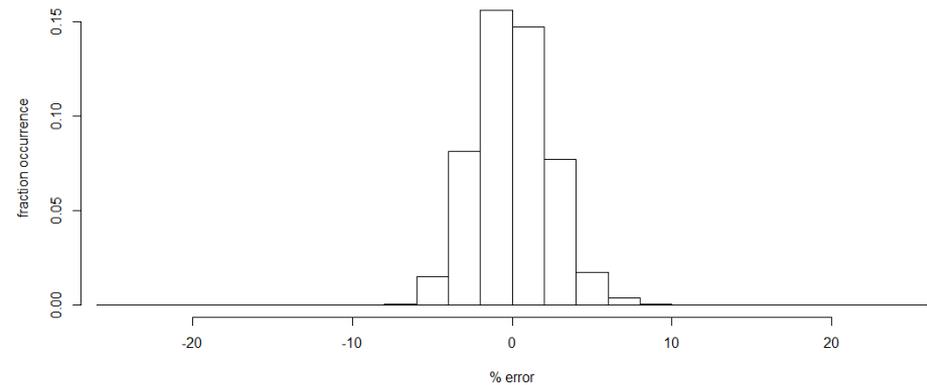
Old Method

Site Specific Constant vs. Flow Check Device at Maintenance



New Method

Universal Constant vs. Flow Check Device at Maintenance



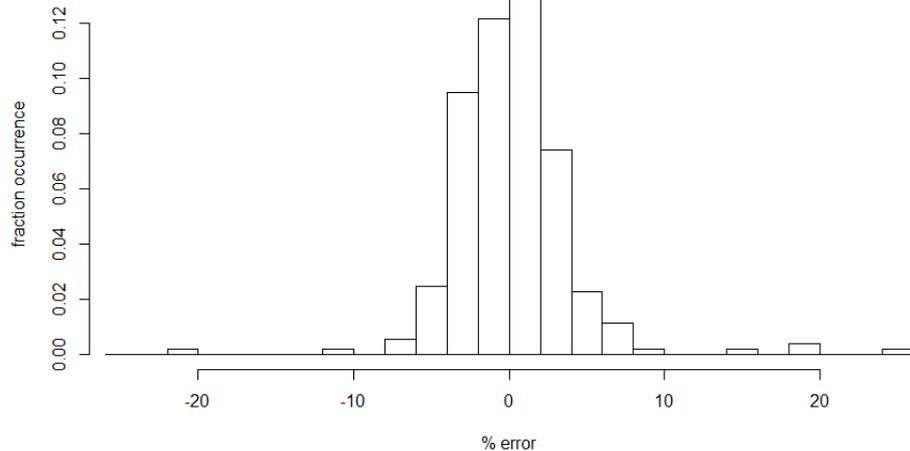
PM10 Module Flow Comparison

Histograms of PM10 Module % Error

Based on 70 Field Calibrations

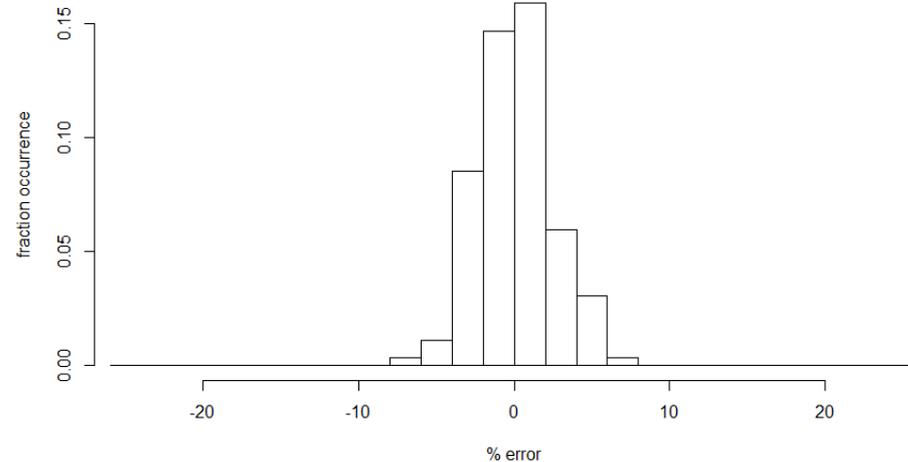
Old Method

Site Specific Constant vs. Flow Check Device at Maintenance



New Method

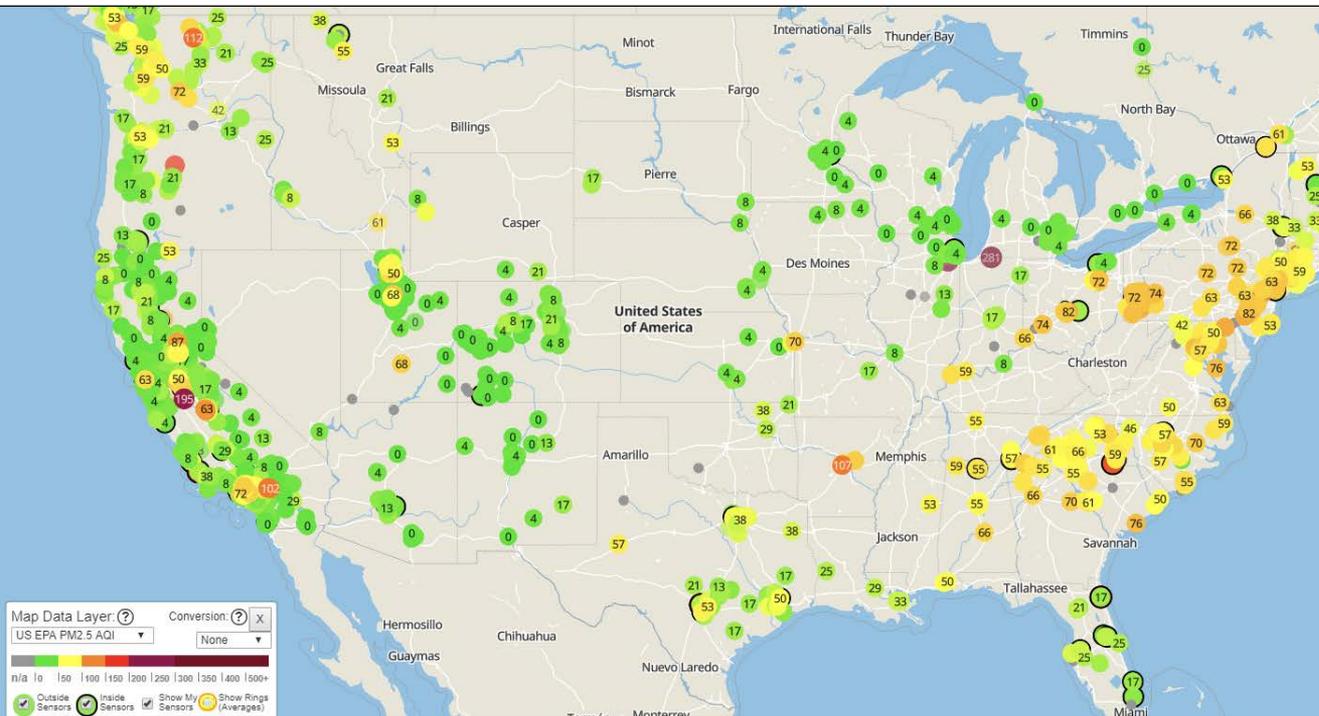
Universal Constant vs. Flow Check Device at Maintenance



Purple Air Sensors

Purple Air Sensors installed at six IMPROVE network sites:

MEAD1 (AZ), GRCA2 (AZ), BALD1 (AZ), FRES1 (CA), WIMO1 (OK), and HEGL1 (MO)



MTL Automated Weighing System



Operational starting October 5, 2018

Relative humidity set to 39% ($\pm 0.4\%$ with door closed)

Temperature set to 21.5 °C

Five hour equilibration time (operationally limited)

Long term testing is ongoing, where 5-10 % of filters will be weighed on old and new systems

MTL Automated Weighing System



Issue with aluminum contamination.

Mitigate with regular cleaning and continued monitoring.

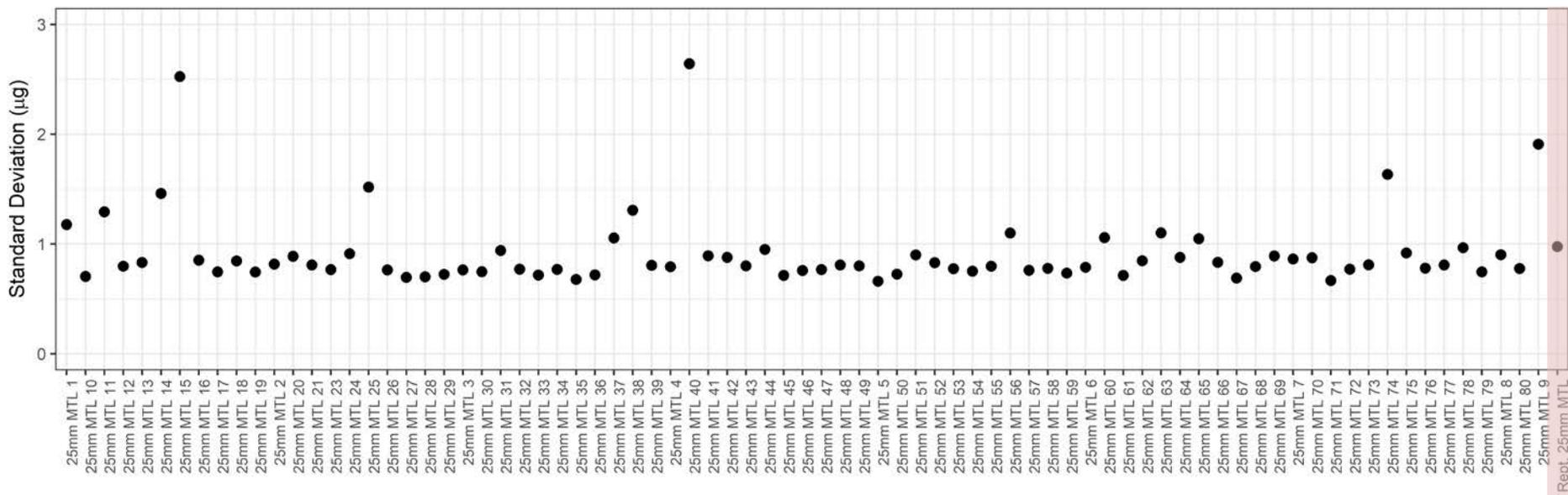


MTL Automated Weighing System

Average mass of MTL 25 mm filters is $96.11 \pm 1.74 \mu\text{g}$.

Reproducibility, filter weighed multiple times over a three week period.

Repeatability, filter weighed multiple times on the same day.



AGU Fall Meeting Session

A12E: Ground-Based Atmospheric Monitoring Networks I

A13I: Ground-Based Atmospheric Monitoring Networks II Posters

Ground-based networks for monitoring of atmospheric chemical composition and meteorology improve our understanding of local, regional, and continental scale atmospheric events and long-term trends, and inform decisions critical to air quality, climate change, weather forecasting, and human health. Monitoring networks serve an important role within the research community, providing a backbone of data to support modeling, satellite data product validation, and short-term measurement campaigns. Ongoing collaboration, communication, and promotion of monitoring network developments and data products is necessary in order to fully leverage the benefit from such networks. This session explores how U.S. and international ground-based atmospheric monitoring networks can be utilized to,

- (1) promote cross-network and -discipline engagement;
- (2) develop and test new technologies and sensors;
- (3) expand quality assurance methods and techniques; and
- (4) support modelling and satellite data products.

Thank you.

