UC DAVIS 2023 NETWORK UPDATE

IMPROVE Fall Steering Committee Meeting

2023 October 17

Nicole Hyslop, Xiaolu Zhang, Yongjing Zhao, Marcus Langston and the whole team

UCDAVIS
AIR QUALITY RESEARCH CENTER

RHR Completeness Failures in 2023

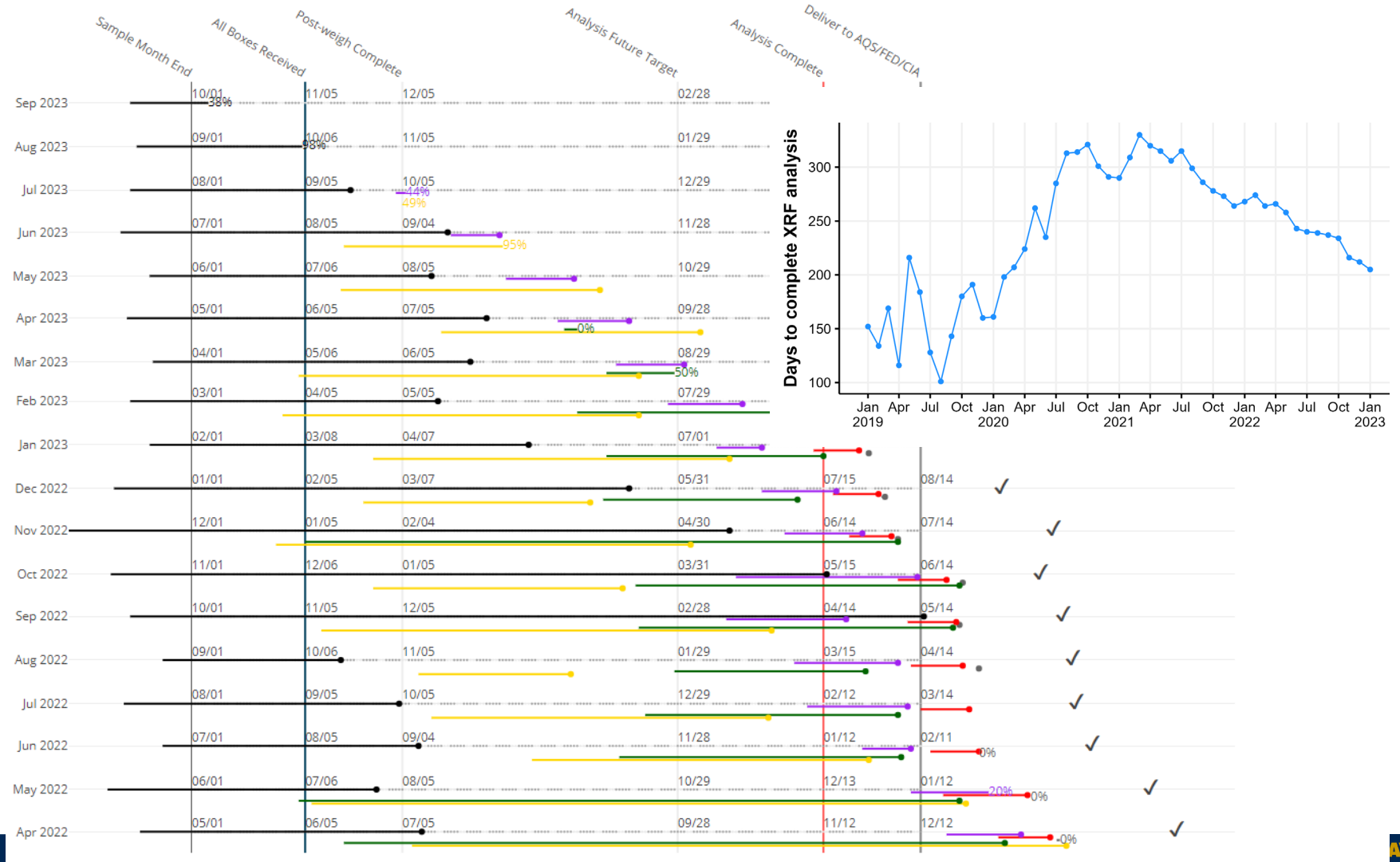
1. Agua Tibia, CA (AGTI1): late and no sample changes
2. Fort Peck, MT (FOPE1): late sample changes
3. Gates of the Mountains, MT (GAMO1): inaccessible
4. Hoover Wilderness, CA (HOOV1): inaccessible due to snow
5. Kaiser Wilderness, CA (KAIS1): limited access
6. Nebraska National Forest, NE (NEBR1): fire damage
7. San Rafael, CA (RAFA1): no operator
8. San Gabriel, CA (SAGA): no operator
9. UL Bend, MT (ULBE): no operator
10. Joshua Tree, CA (JOSH1): vandalism
11. Three Sisters Wilderness (THSI1): inaccessible due to fire

Who can identify the 2023 decommissioned sites?

2023 Site Updates

- Field Maintenance season ongoing with trips to
  - Great Smokeys Mtn. region this month and
  - Florida/Hawaii next month
- More shelters than usual were rebuilt
  - MAKA2
  - PORE1
  - STIL1
  - NEBR1
  - BRID1
- Several more shelters need to be relocated/rebuilt
  - GAMO1, NEBR1, WHPA1, RAFA1, BLIS1/2, BOWA1

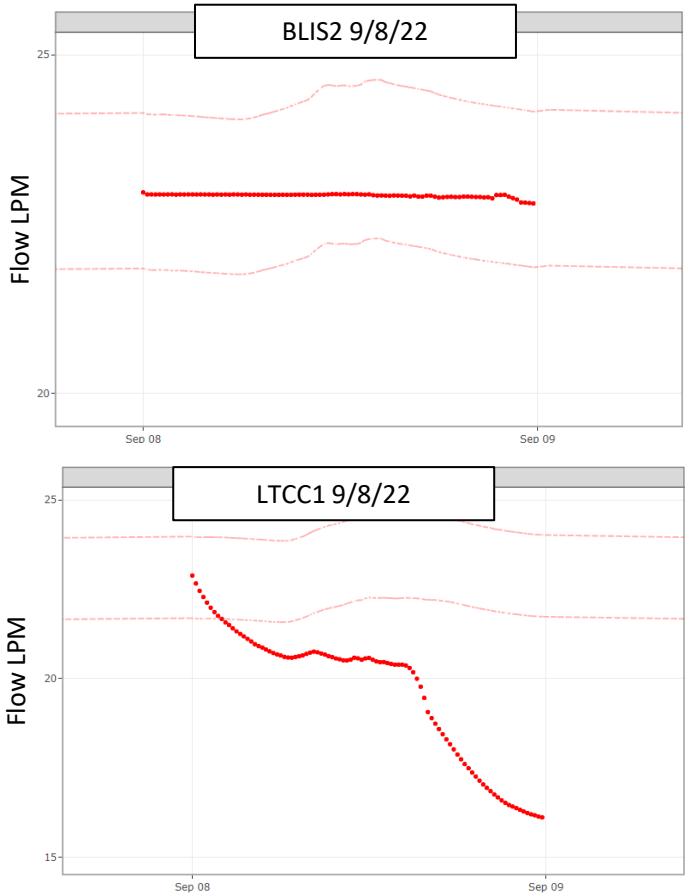
Data Delivery



Active Flow Control – Deployment Update 2023

- Requires new hardware, including variable speed pumps, electronic boards and software
- 9 Sites are running active flow control
  - FRES1, BLIS1, HOOV1, PHOE5, DINO1, CRMO1, LAVO1, PITT1,and PORE1
  - LTCC1 will be installed later this fall

Active Flow Control – Deployment Update 2023



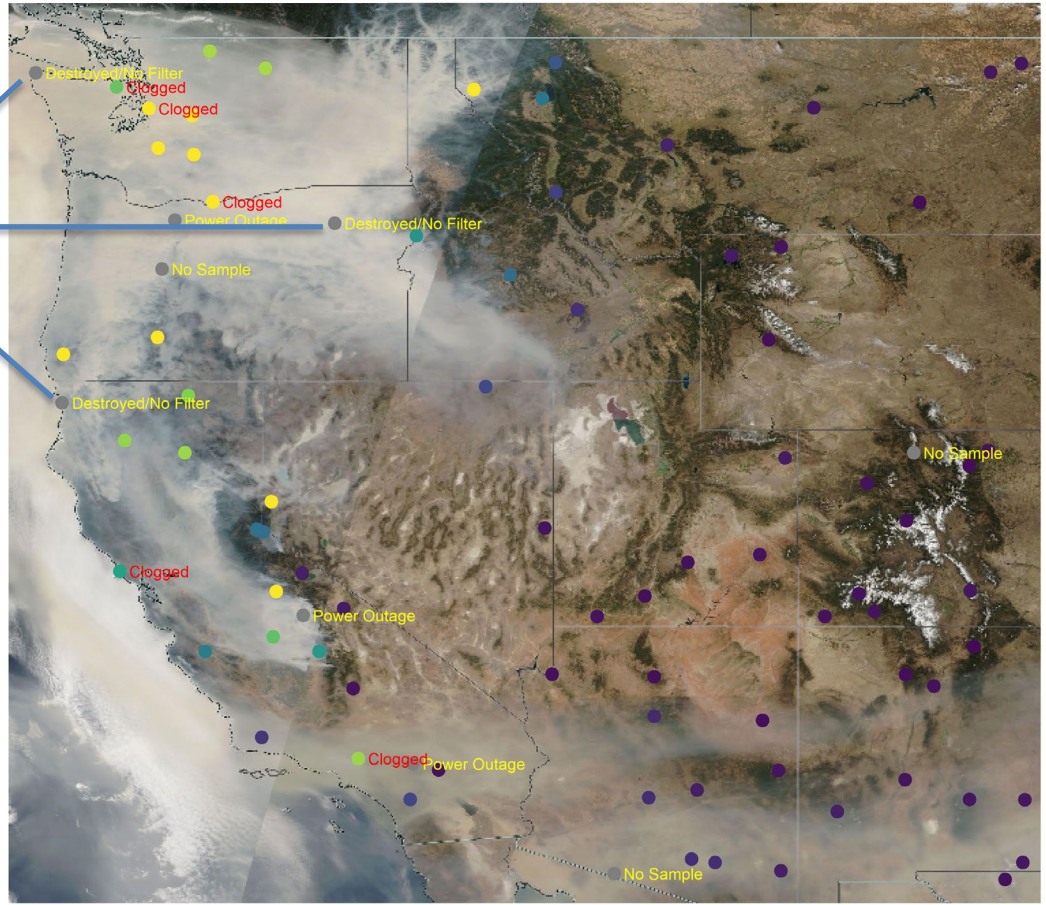
- Graph shows nearby sites LTCC1 and BLIS2 on a medium/heavy filter loading day
  - The flow control site (BLIS2) maintains a constant flow rate
- Filter clogging is delayed but inevitable with heavy loadings even with active flow control

Sample Clogging/Sticking

- MAKA – filter stuck (43 µg/m^3 OC)
- STAR – filter stuck (200 µg/m^3 OC)
- REDW – filter stuck (76 µg/m^3 OC)

- 27 filters in September 2020 invalidated because of holes
- 45 filter invalidated because of clogged flow

September 12, 2020



Scale is capped at 100, actual values may be higher

Clogging Protocol

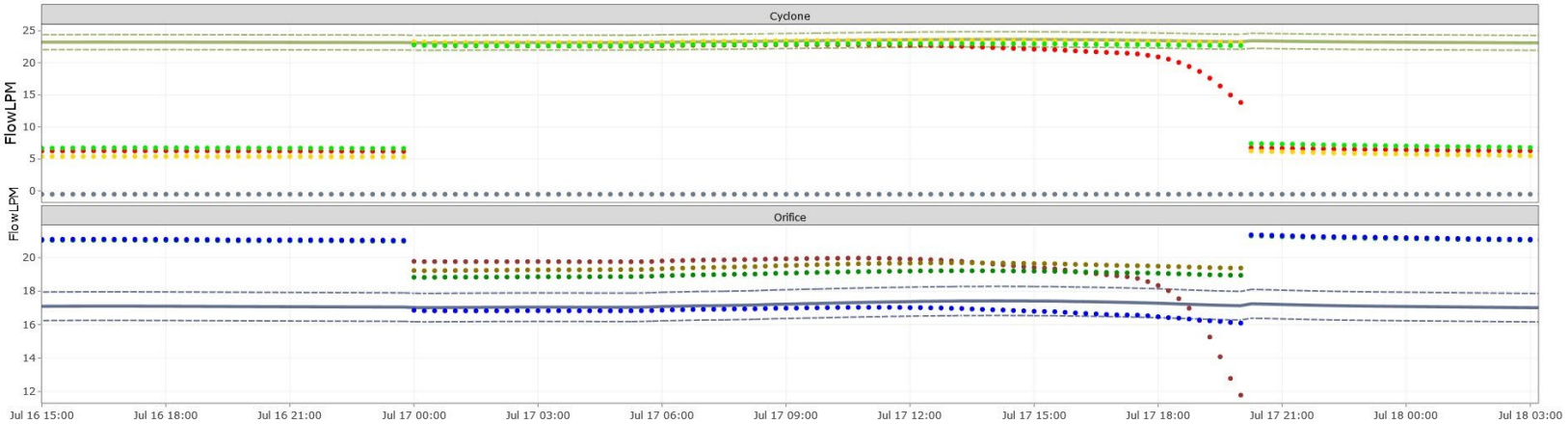
If the flow rate falls below 15 LPM for more than 15 minutes

- If ≥18 hours into sample
  - Shut off all modules
  - Data are still valid for RHR
- Else
  - Shut off the clogged module
  - Shut off the companion module for PM coarse calculation (i.e., shut off PM_{10} PTFE if $PM_{2.5}$ PTFE clogs)
  - Data are invalid for RHR but will be delivered with an accurate concentration and a qualifier flag indicating a short sample time

Status: Deployed at several sites and will be deployed networkwide by end of 2023

LOND1 – passive flow control

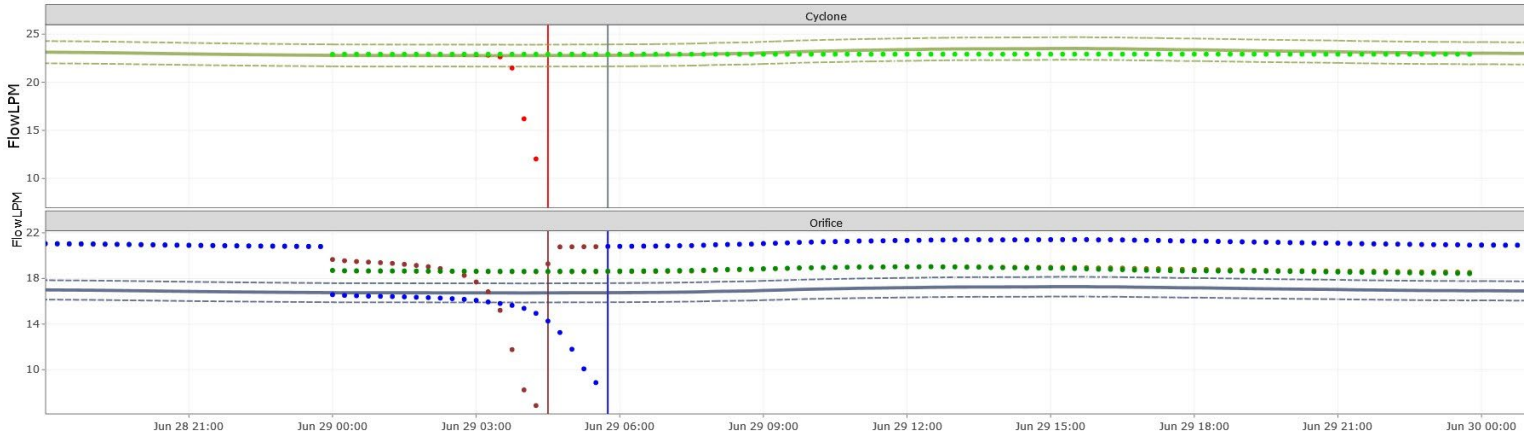
July 17, all modules stopped because 1A was clogged and sampling interval was more than 18 hours. All valid samples preserved for RHR.



EGBE1 - passive flow control
July 26, only 1A module stopped because sampling interval was less than 18 hours

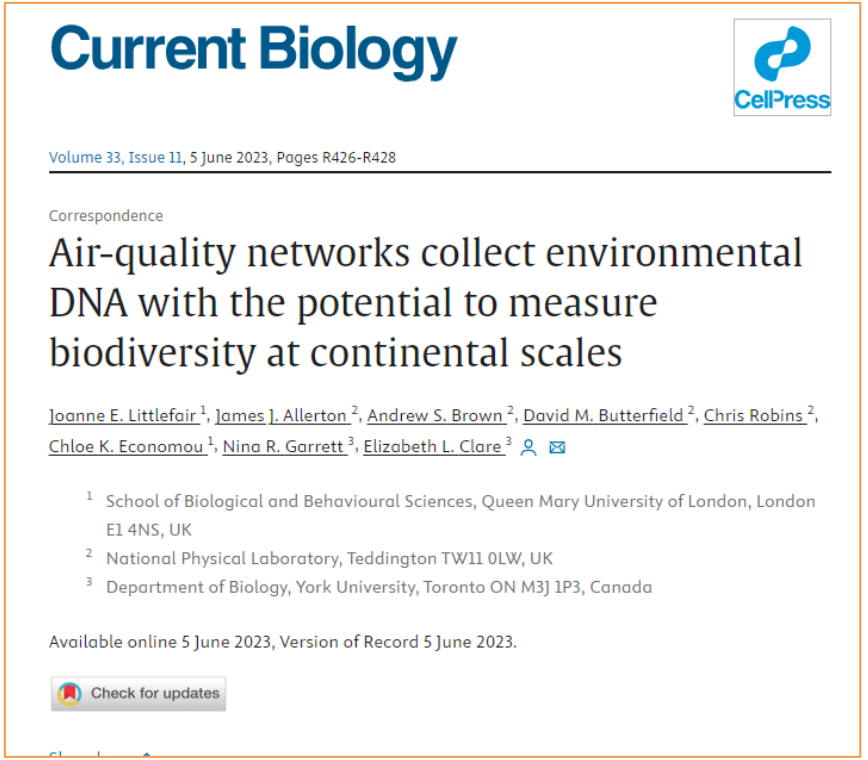
PITT1- active flow control

June 29, 1A module stopped early and 4D stopped later, 2B and 3C sampled all day



Archived Filter Requests

- More interest this year than ever before
- Last week provided 5 PM_{10} samples from 1995 to a group at UCD interested in studying biologicals from natural disasters
    - If the method works, they'll be writing a proposal to analyze many archived samples



Current Biology

CellPress

Volume 33, Issue 11, 5 June 2023, Pages R426-R428

Correspondence

Air-quality networks collect environmental DNA with the potential to measure biodiversity at continental scales

Joanne E. Littlefair [1], James J. Allerton [2], Andrew S. Brown [2], David M. Butterfield [2], Chris Robins [2], Chloe K. Economou [1], Nina R. Garrett [3], Elizabeth L. Clare [3]

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[2] National Physical Laboratory, Teddington TW11 0LW, UK

[3] Department of Biology, York University, Toronto ON M3J 1P3, Canada

Available online 5 June 2023, Version of Record 5 June 2023.

Check for updates

QUALITY ASSURANCE ACTIVITIES

New Balance QC Review Page

Daily Balance QC Review

2023-10-14 13:29:38

Instrument

LUNA

Date Range

2023-09-30 to 2023-10-14

* ND = No Data

Download plotted data

Download all metal weight of the specified date range

Daily Check Status

Approve

Last Check
Initials: WLR
Date: Fri 13 Oct 2023 08:16:53 AM PDT
Comment: All Clear

Metal Reference

50mg	MTL50A OK	MTL50B ND	MTL50C ND	MTL50D ND
100mg	MTL100A OK	MTL100B ND	MTL100C ND	MTL100D ND
200mg	MTL200A OK	MTL200B ND	MTL200C ND	MTL200D ND

Environment

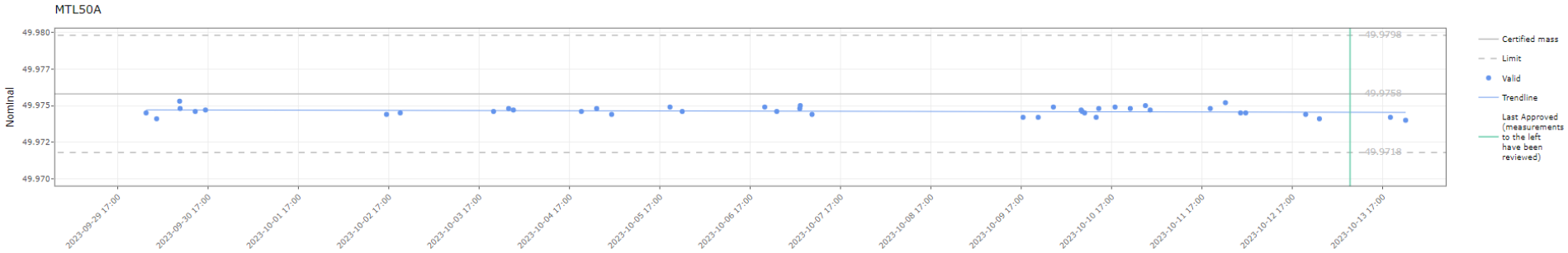
Include measurement from filters

Temp OK

RH OK

Criteria lines only

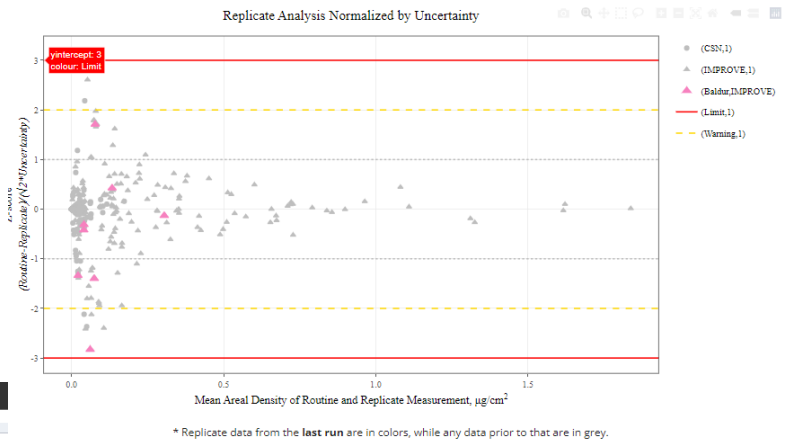
Squish out of bounds values into range



Reference Weight Certification Dates

Label	MTL100A	MTL100B	MTL100C	MTL100D	MTL200A	MTL200B	MTL200C	MTL200D	MTL400A	MTL400B	MTL400C	MTL50A	MTL50B	MTL50C	MTL50D
LastDateCertified	2023-08-03	2023-08-29	2023-01-09	2023-07-11	2023-08-03	2023-08-29	2023-01-09	2023-07-11	2023-07-11	2023-08-03	2023-08-03	2023-08-03	2023-08-29	2023-07-11	2023-08-29
ExpirationDate	2024-08-03	2024-08-29	2024-01-09	2024-07-11	2024-08-03	2024-08-29	2024-01-09	2024-07-11	2024-07-11	2024-08-03	2024-08-03	2024-08-03	2024-08-29	2024-07-11	2024-08-29

Replicates Added to XRF QC Pages



* Replicate data from the **last run** are in colors, while any data prior to that are in grey.

XRF Daily Operations | QC Summary | Weekly Replicates | Replicates Thumbnails

Daily QC Checks

	Blanks	ME
Odin	OK	OK
Froya	OK	OK
Thor	OK	OK
Nanna	OK	OK
Baldur	OK	OK

Weekly QC Checks

Analyzer	Replicate	ME
Odin	Na	OK
Froya	Mg, Na, P	OK
Thor	P	OK
Nanna	As, Na	OK
Baldur	Mg, Na	OK

Daily Check Status

Approved

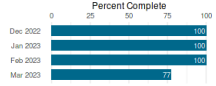
Last Check
Initials: LK
Date: Sat 14 Oct 2023 06:51:38 AM PDT
Comment: QC passes for all instruments.

Last Analysis

Odin	Froya	Thor	Nanna	Baldur
39 min	17 min	42 min	14 min	40 min

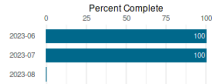
IMPROVE Network

Month	Analyzed	Total
Dec 2022	1608	1608
Jan 2023	1439	1439
Feb 2023	1371	1371
Mar 2023	1208	1564



CSN Network

Batch	Analyzed	Total
2023-06	973	973
2023-07	1187	1187
2023-08	0	1240



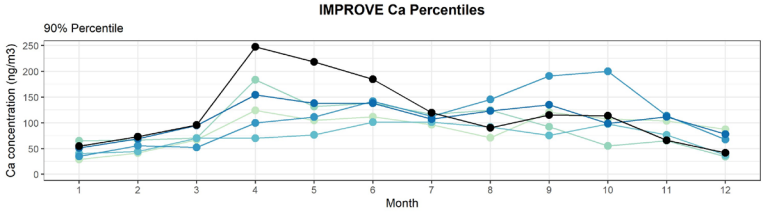
Misused Applications (last 2 weeks)

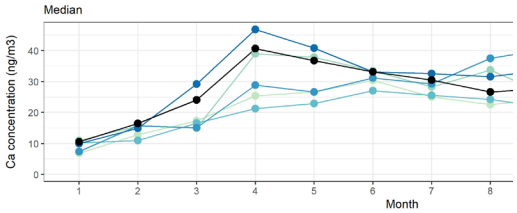
No misused applications.

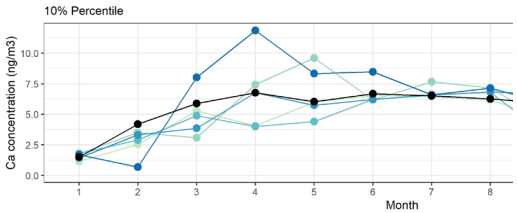
Instrument Stats

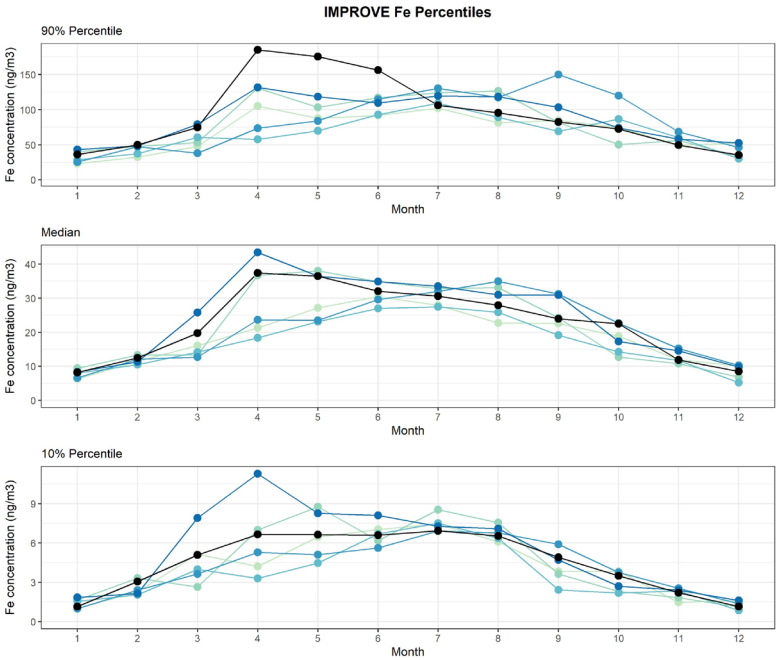
	Odin	Froya	Thor	Nanna	Baldur	All
Network	IMPROVE	IMPROVE	IMPROVE	IMPROVE	IMPROVE	
Samples in last 12 hours	15	16	15	16	15	**77**
Samples per day	27	24	29	26	28	**134**
Monday	23	13	23	17	22	**98**
Tuesday	25	23	32	31	32	**143**
Wednesday	31	30	31	31	31	**154**
Thursday	32	32	32	31	31	**158**
Friday	32	32	32	32	32	**160**
Saturday	17	18	17	18	17	**87**
Sunday	18	17	24	17	18	**94**
Weekly Total	**178**	**165**	**191**	**177**	**183**	**894**

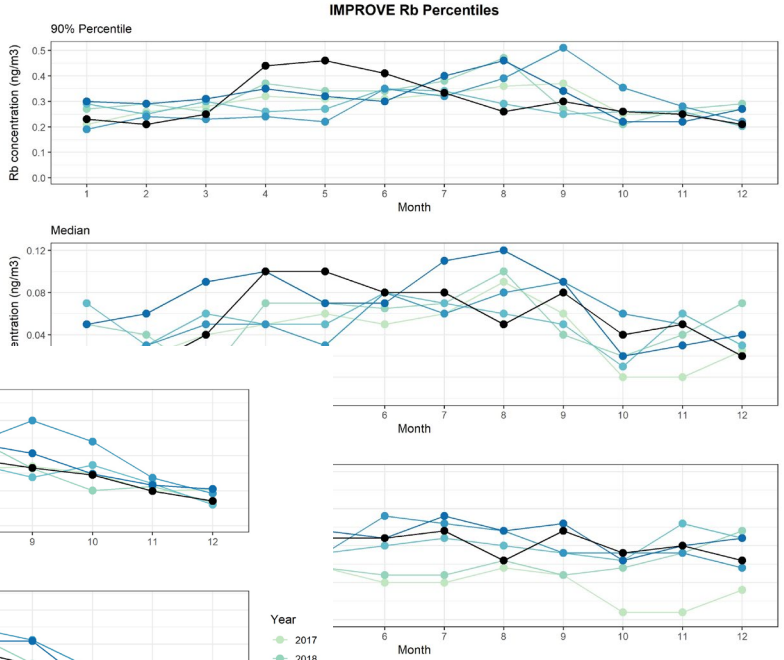
Early Onset in Spring Dust

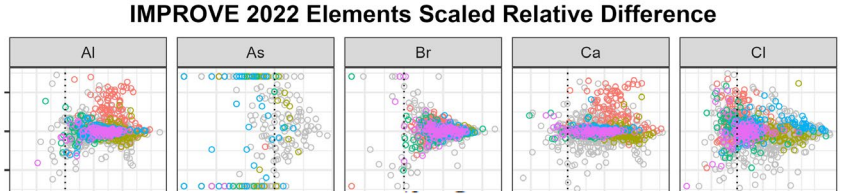




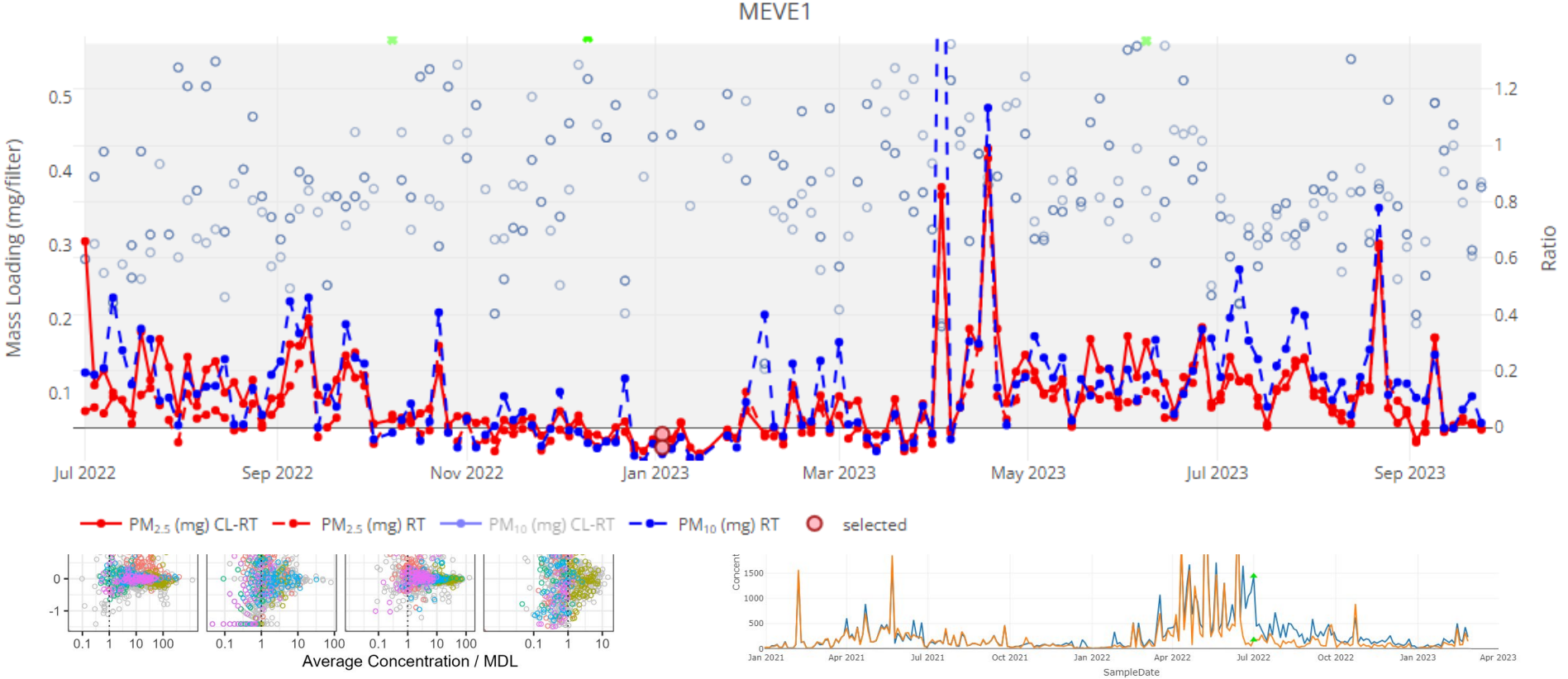




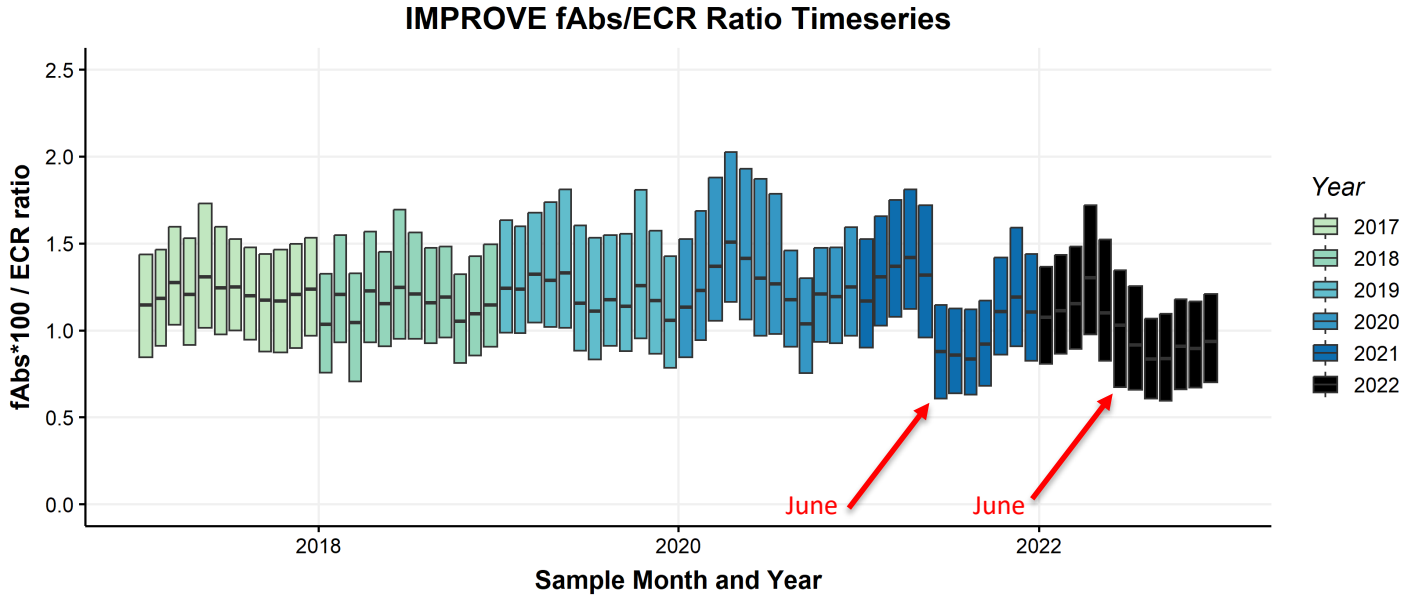




- Mesa Verde A-module collocated agreement

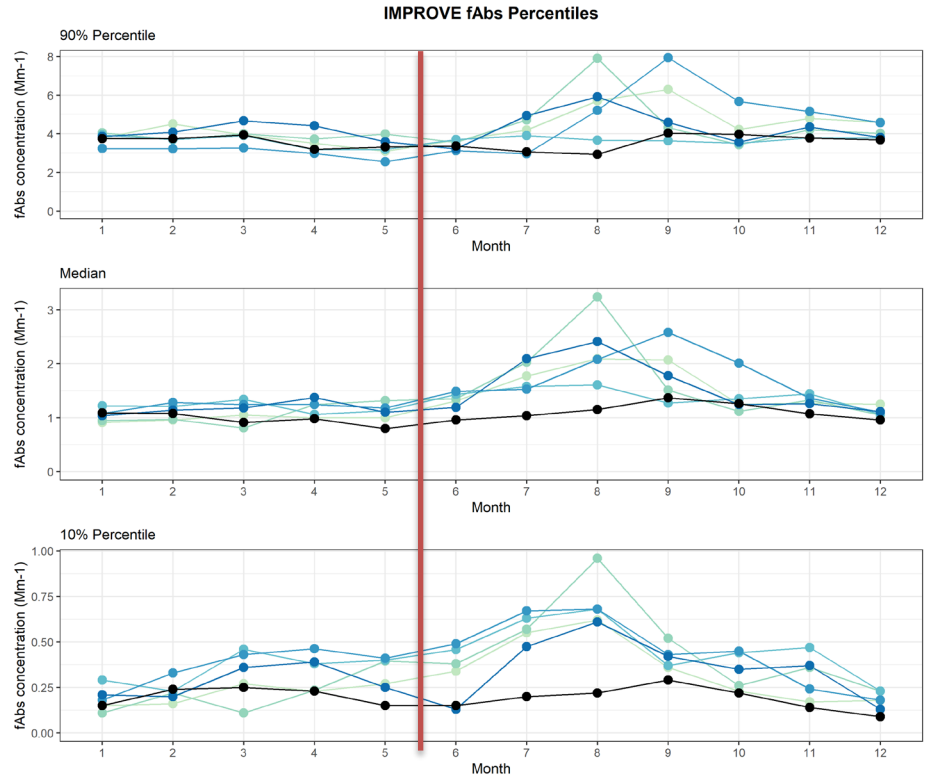


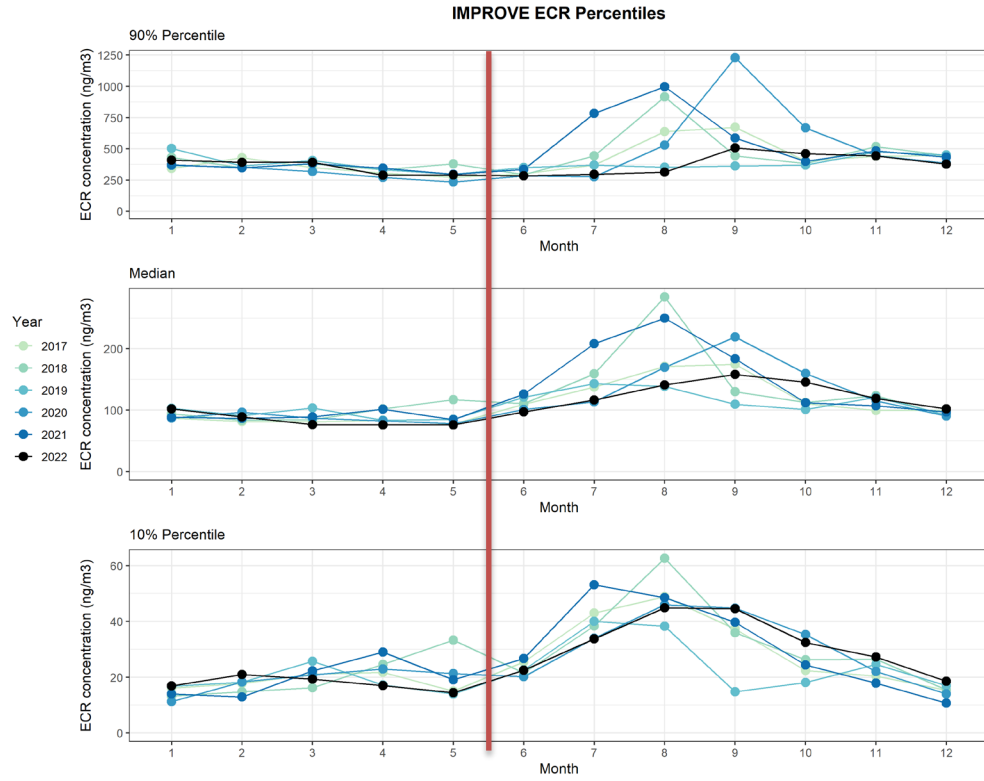
Cross-Module Ratios



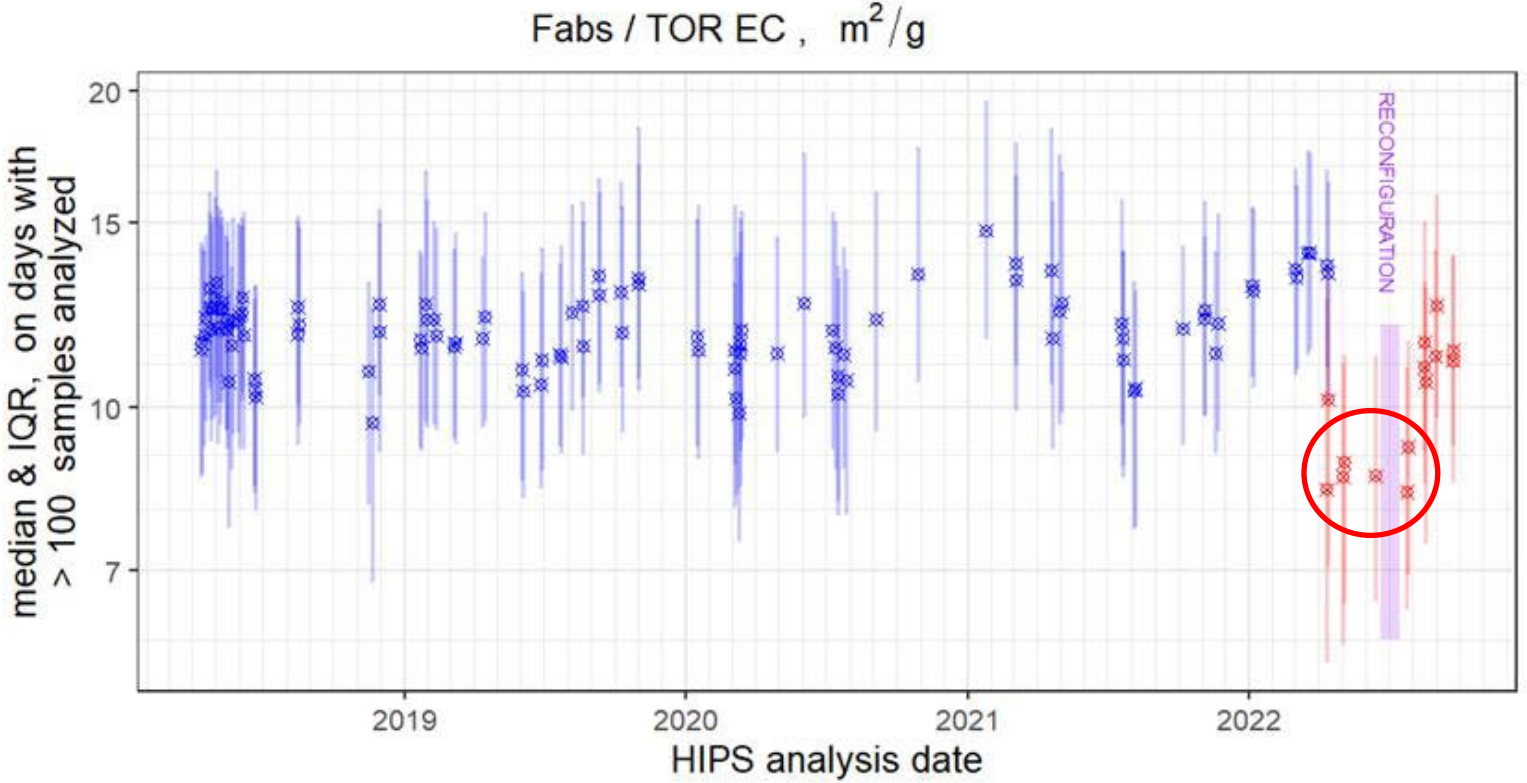
- Filter manufacturer changed (Pall to MTL) around June 2021
- Hybrid Integrating Plate and Sphere (HIPS) Instrument used to measure filter absorption (f_{Abs}) was modified prior to analysis of August 2021
- New collimating/focusing lens was installed on the HIPS instrument and all samples back to June 2021 were reanalyzed

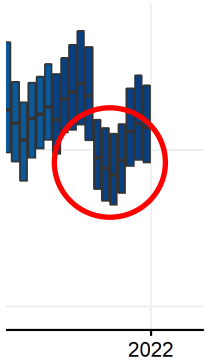
Network-wide Percentiles for the Individual Measurements





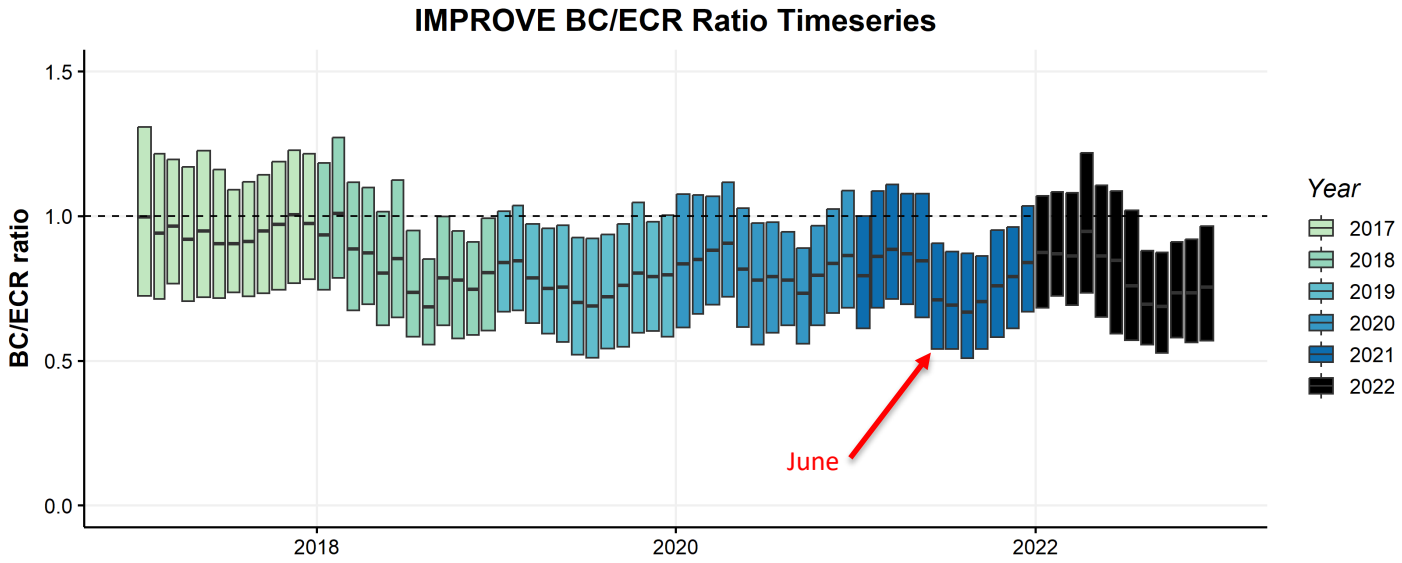
Values drop with the introduction of Lot 250 but remain stable after reconfiguration, then return to normal while still in Lot 250





Is this drop isolated to the HIPS instrument?

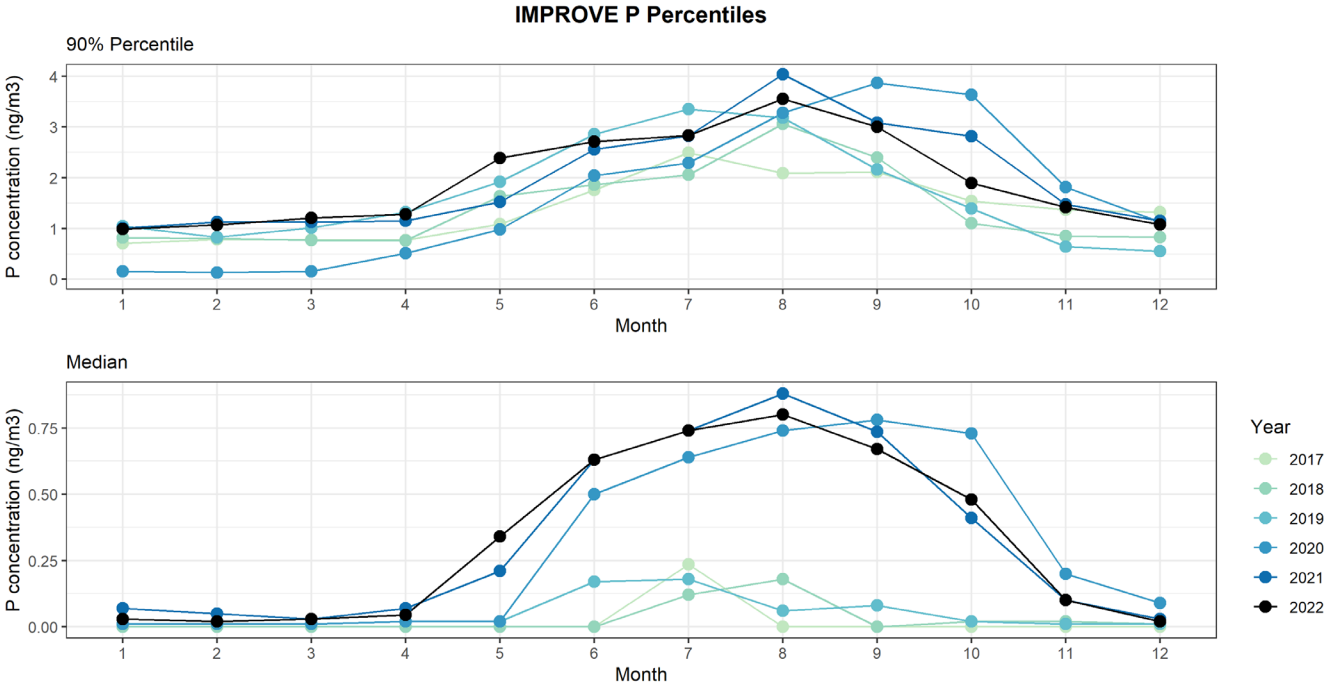
- No, ratios of light absorption (BC) to EC on the quartz filters also show a drop in June 2021



What the heck?

- Made some modifications to the HIPS instrument to improve precision and reanalyzed a year of filters back to June 2021
    - Jun-Dec 2021 f_{Abs} data will be redelivered soon (Oct 2023)
- Started collecting collocated Pall and MTL PTFE filters to check if the results are significantly different on the two manufacturers
    - After this experiment, suggest running collocated filters with backup (drain) disks to homogenize samples
- Plan to run experiments on both Pall and MTL PTFE filters
    - Analyze by HIPS
    - Install in sampler in chamber and pull clean air through filters for 24 hours
    - Analyze by HIPS to see if filter properties are the same

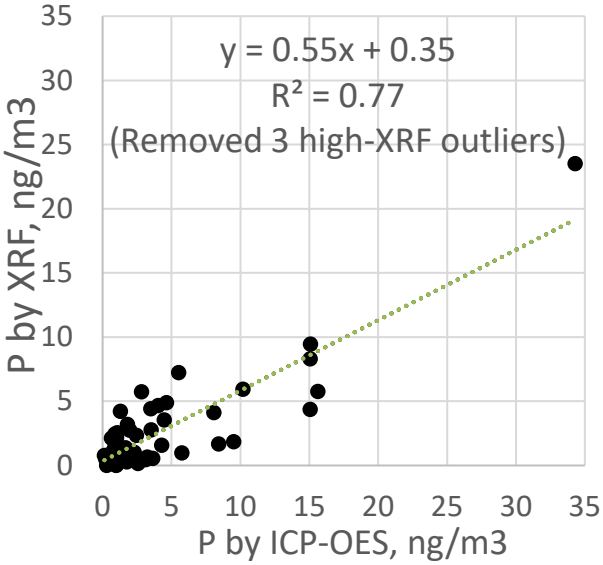
XRF Phosphorus Measurements

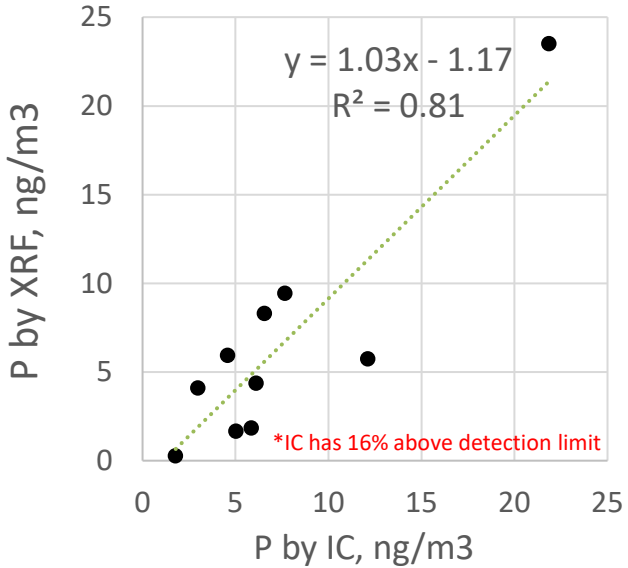


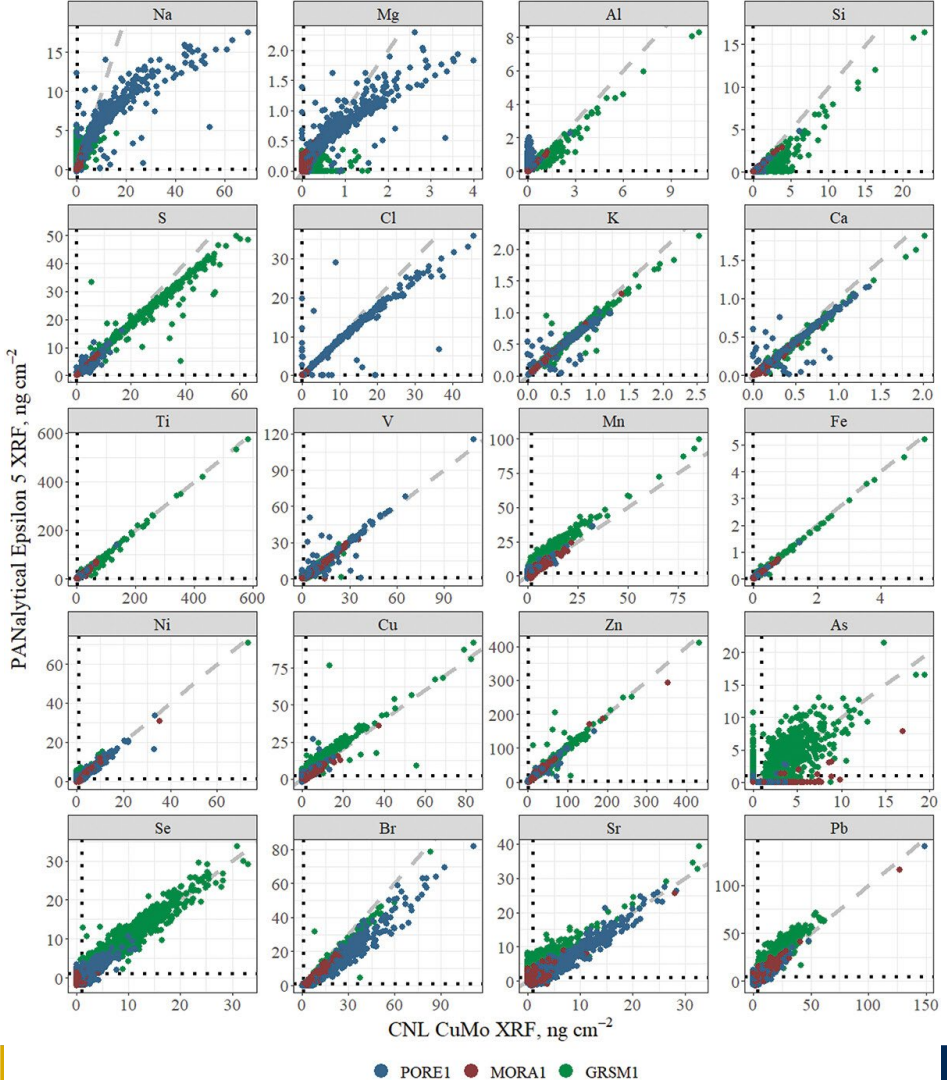
- Biologists interested in P deposition
- Elevated P median concentrations in recent years (2020 - 2022)
- Reliability/accuracy of XRF P measurements is unknown
- Sometimes high in fires, sometimes not

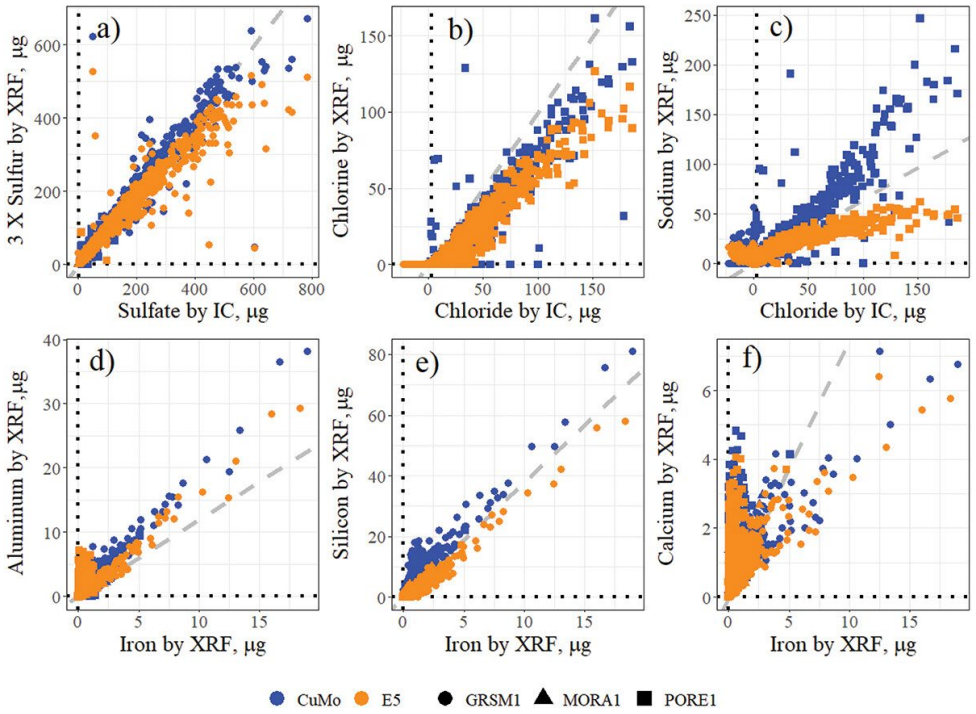
Phosphorus XRF-ICP(IC) Intercomparison

- Selected 63 IMPROVE samples in 2021 summer based on sites and PM, OC loadings
- RTI measured the paired Nylon filters with Colorimetric method, two IC methods, and ICP-OES
- XRF P compares reasonably well with ICP-OES and IC (carb/bi-carb)
- Will select ~100 more samples from Summer 2022 for comparison





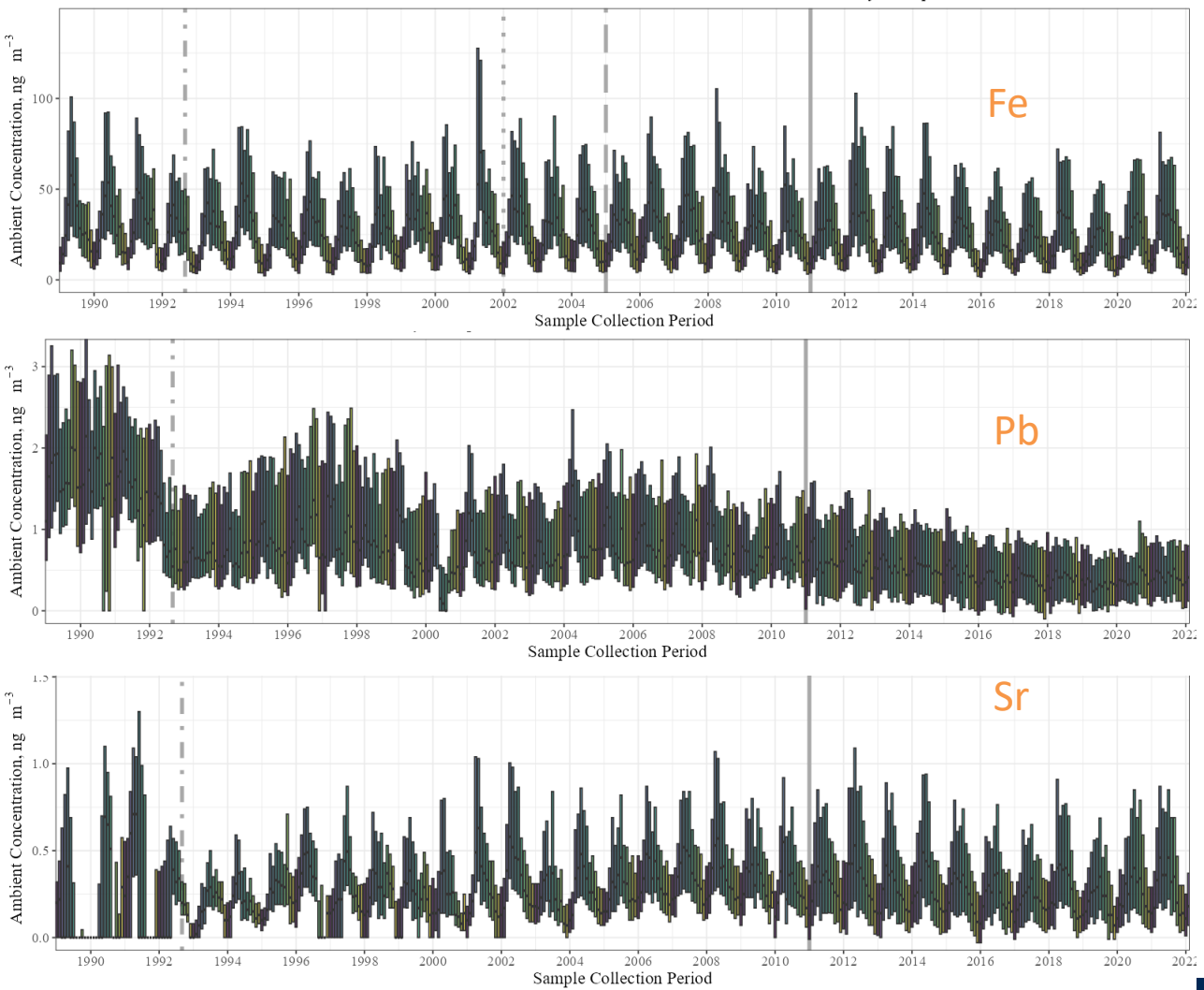




Nicholas Spada, Sinan Yatkin, Jason Giacomo, Krystyna Trzepla & Nicole P. Hyslop (2023) Evaluating IMPROVE $PM_{2.5}$ element measurements, Journal of the Air & Waste Management Association, DOI: 10.1080/10962247.2023.2262417

Element Long-term Trends

- Investigating stability of element measurements provide guidance to community on trends analyses



XRF Instrument Replacement

- Our 5 Panalytical Epsilon 5 XRF instruments are 8-13 years old
  - Currently used to analyze all CSN and IMPROVE samples
  - Manufacturer will end service in a few years
  - 3 new Bruker Puma XRF instruments purchased in 2022 to analyze CSN samples – still in development
  - Need long-term plan/investment for replacing XRF instruments

IMPROVE Annual Site Reports

*Select a site report from a location and year to view the PDF. Scroll down or click for the **map** of IMPROVE site locations.*

Site Name	2015 Report	2016 Report	2017 Report	2019 Report	2020 Report	2021 Report
Acadia National Park	ACAD1—15	ACAD1—16	ACAD1—17	ACAD1—19	ACAD1—20	ACAD1—21
Agua Tibia	AGTI1—15	AGTI1—16	AGTI1—17	AGTI1—19	AGTI1—20	AGT1—21
Atlanta				ATLA1—19	ATLA1—20	ATLA1—21
Badlands	BADL1—15	BADL1—16	BADL1—17	BADL1—19	BADL1—20	BADL1—21
Baengnyeong Island	BYIS1—15	BYIS1—16	BYIS1—17			
Bandelier	BAND1—15	BAND1—16	BAND1—17	BAND1—19	BAND1—20	BAND1—21
Barrier Lake	BALA1—15	BALA1—16	BALA1—17			

UC DAVIS
UNIVERSITY OF CALIFORNIA

IMPROVE
Interagency Monitoring of Protected Visual Environments

Glacier (GLAC1) 2021 Site Report

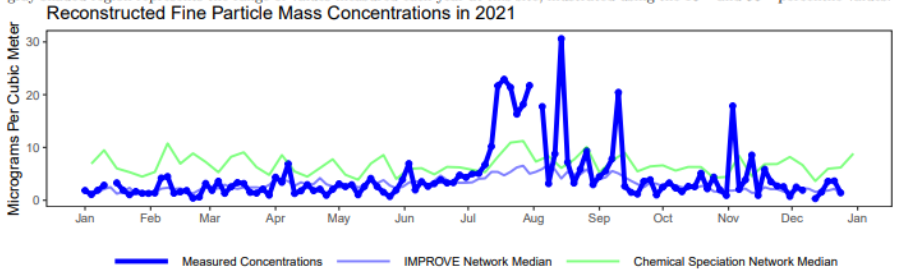
The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a long-term air pollution measurement program designed to document and track visibility in protected areas. IMPROVE samples and analyzes the haze particles that impair visibility so their sources can be identified and addressed.

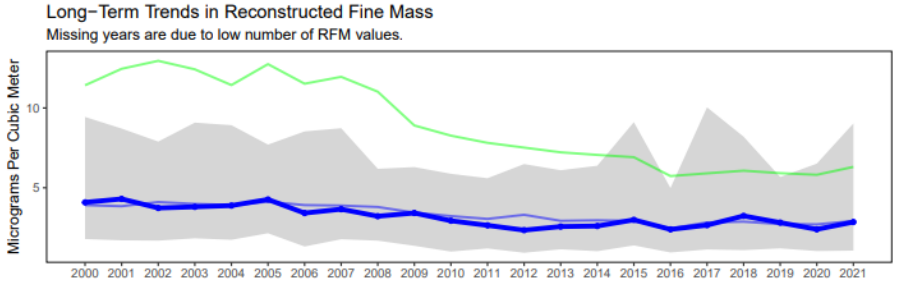
Percent of Samples Successfully Collected and Analyzed Per Year

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
99	98	98	98	95	93	94	94	97	100	98	95	84	98	94	86	96	96

Samples Successfully Collected and Analyzed in 2021 by Filter Type. PTFE: 128 (97.0%), Nylon: 125 (94.7%), Quartz: 118 (89.4%)

The plots below show temporal trends for site 30-029-8001 alongside network-wide CSN and IMPROVE median concentrations. The top plot shows the variability of the reconstructed fine mass (RFM) concentrations during 2021; RFM can only be calculated if all three filters collected on a sampling day are valid. The bottom plot illustrates the long-term trends of ambient concentrations; the gray shaded region represents the range of values measured each year at this site, illustrated using the 10th and 90th percentile values.





More Information


Any questions?