




Photo by Connor Scalbom

A white graphic design on a blue background, consisting of three white circles connected by white curved lines, resembling a stylized network or orbital path.

The Spatiotemporal Variability of Aerosol in the East River Watershed as seen by SAIL-Net & An Introduction to the Analysis of Spring Dust Events

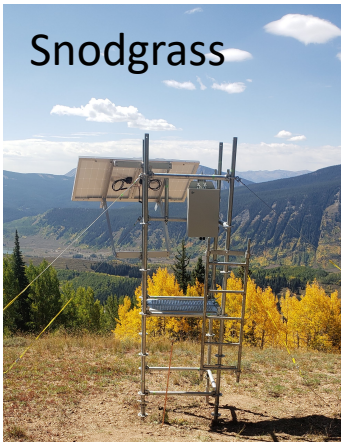
S3 Workshop November 2, 2023

Leah Gibson, Ethan Emerson, Nick Good, Anna Hodshire, Ezra Levin, Gavin McMeeking, Kate Patterson, Bryan Rainwater, Tom Ramin, Ben Swanson (Handix Scientific), *Adeyemi Adebisi*, *Allison Aiken*, *Dan Feldman*, *Laura Riihimaki*, *Erica Woodburn*



Supporting SAIL with SAIL-Net

SAIL-Net added six aerosol microphysics sites to the East River Watershed to study aerosol variability.



Snodgrass



Gothic



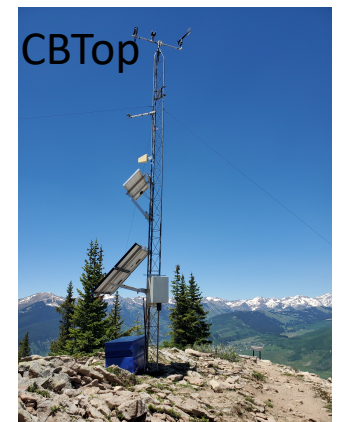
Pumphouse



CBMid (AOS)



Irwin



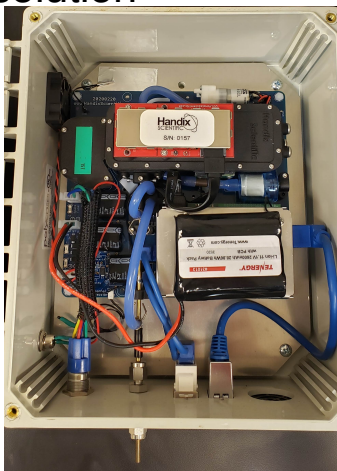
CBTop



Instrumentation

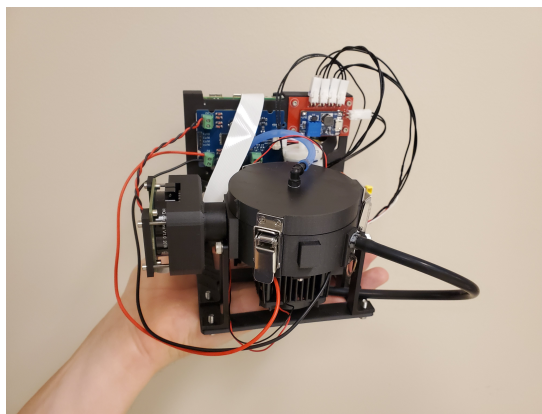
Aerosol size distribution: POPS

- **Portable Optical Particle Spectrometer** (developed by Gao, et al. at NOAA)
- Measures size range of 140 nm – 3 μm , 1 sec resolution



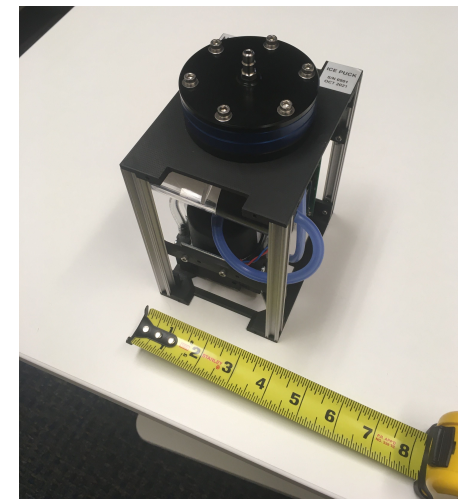
Cloud Condensation Nuclei: CloudPuck

- Static diffusion chamber design with approx. 5 minute resolution
- Collaboration with DU Huffman group



Ice Nucleating Particles: TMAC (formerly IcePuck)

- Sequential filter sampler based on Creamen et al., 2018
- 48 hours time resolution, 8 filter spots

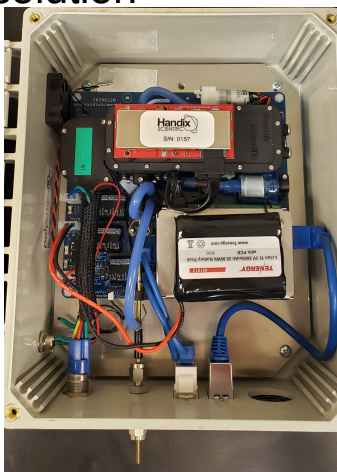




Instrumentation

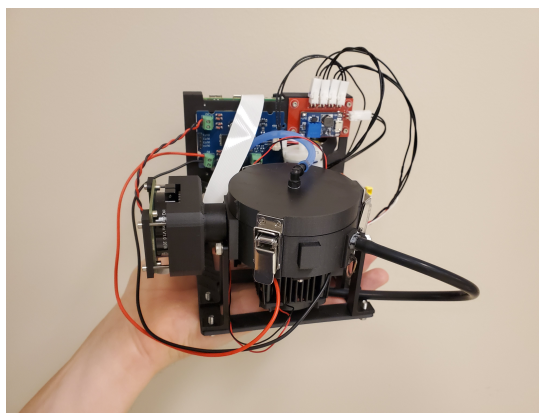
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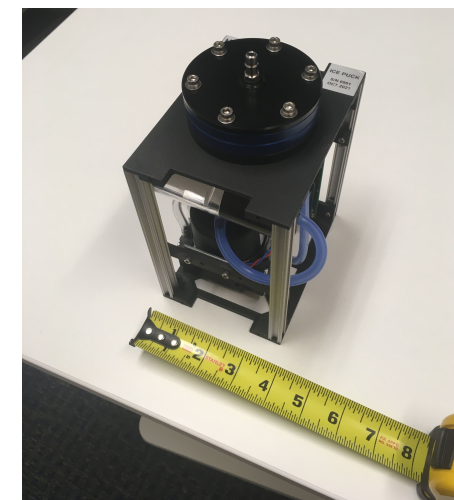
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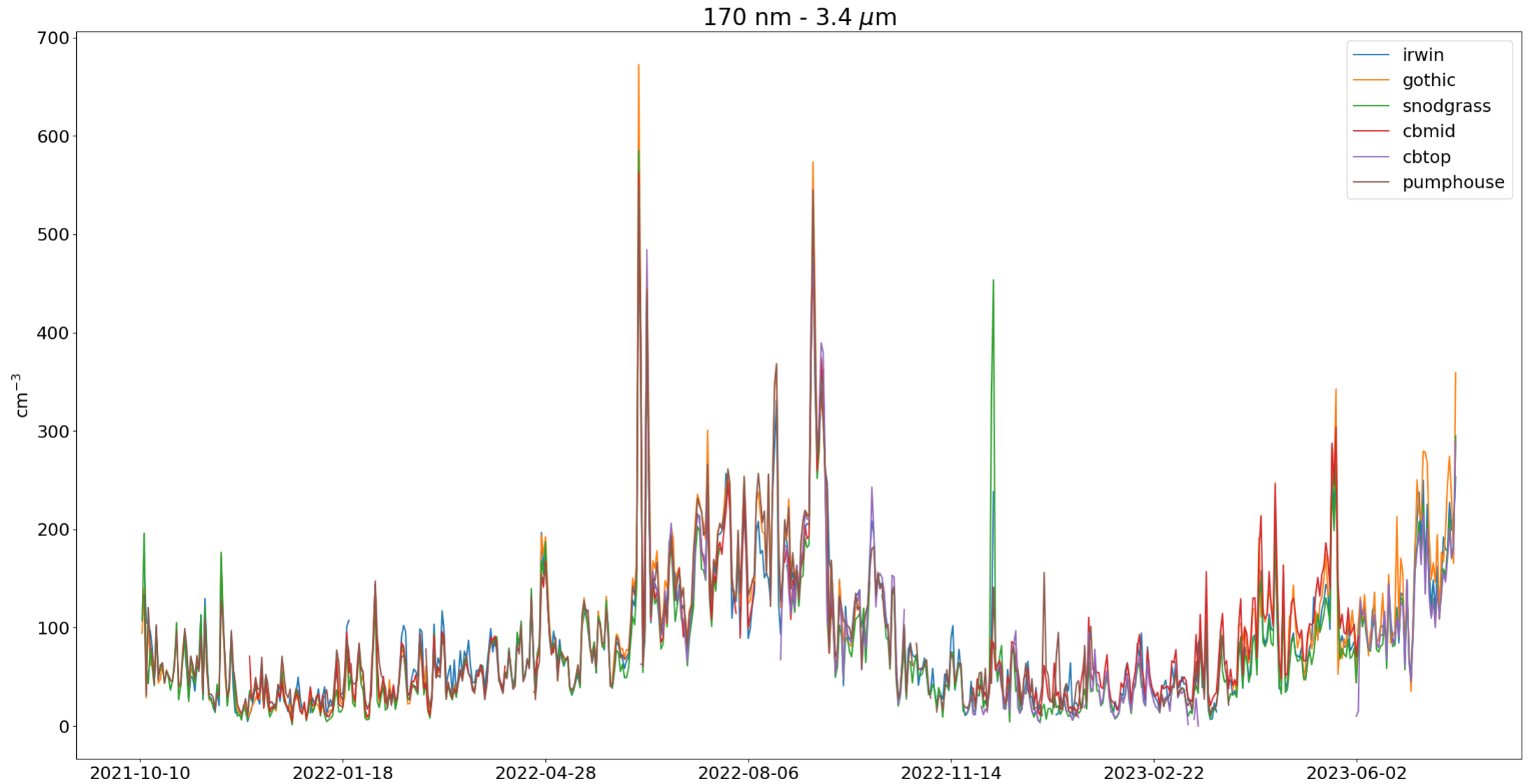
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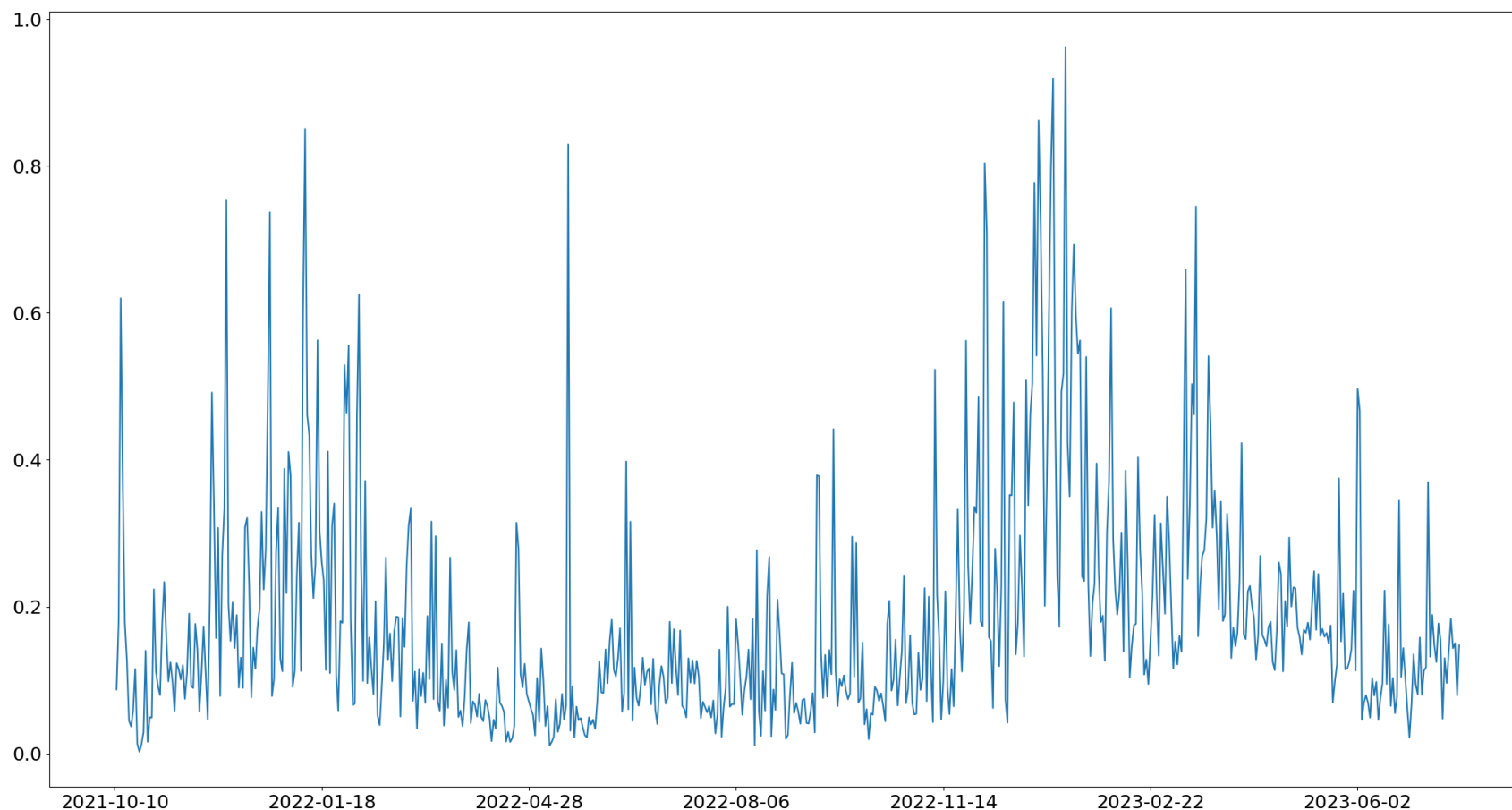
Timeseries from the POPS





Seasonal Variability

There is more variability between the sites in the winter than in the summer, as seen by plotting the coefficient of variation over time.

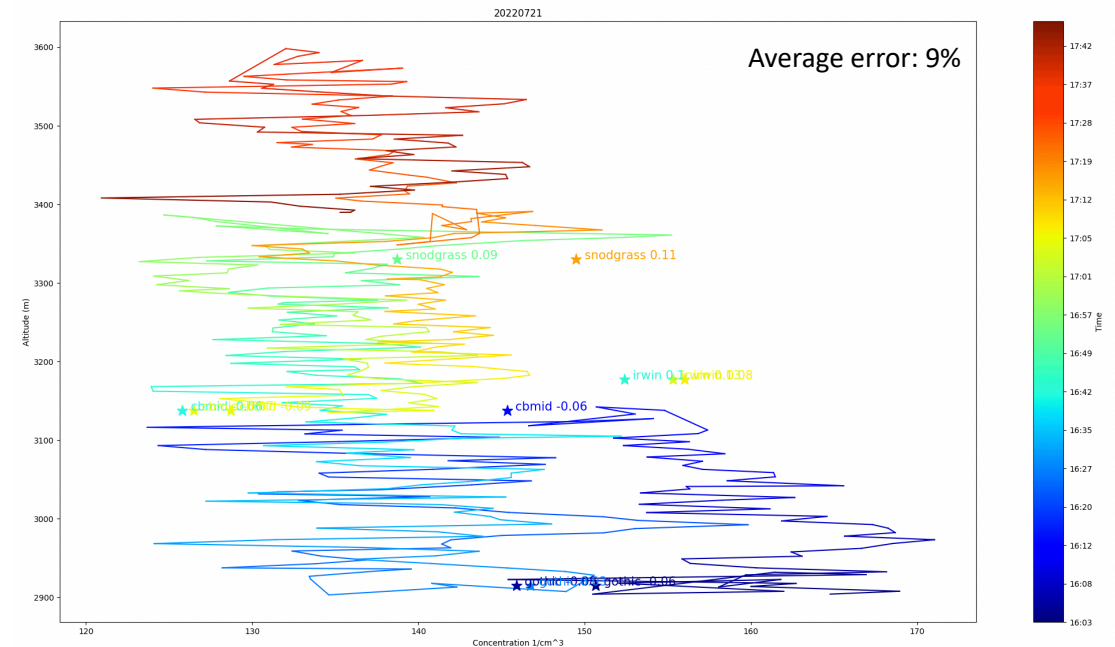
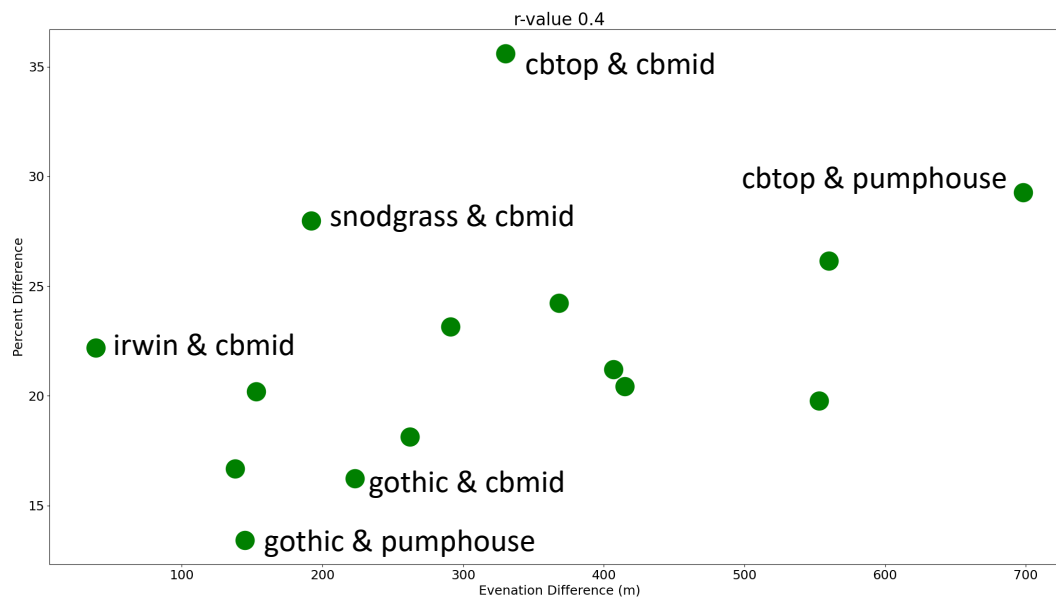




The Role of Elevation

On average, aerosol concentrations are more similar across similar elevations than at geographically proximal sites.

There is also surprisingly good agreement between SAIL-Net site concentrations and TBS flight data in warmer weather.



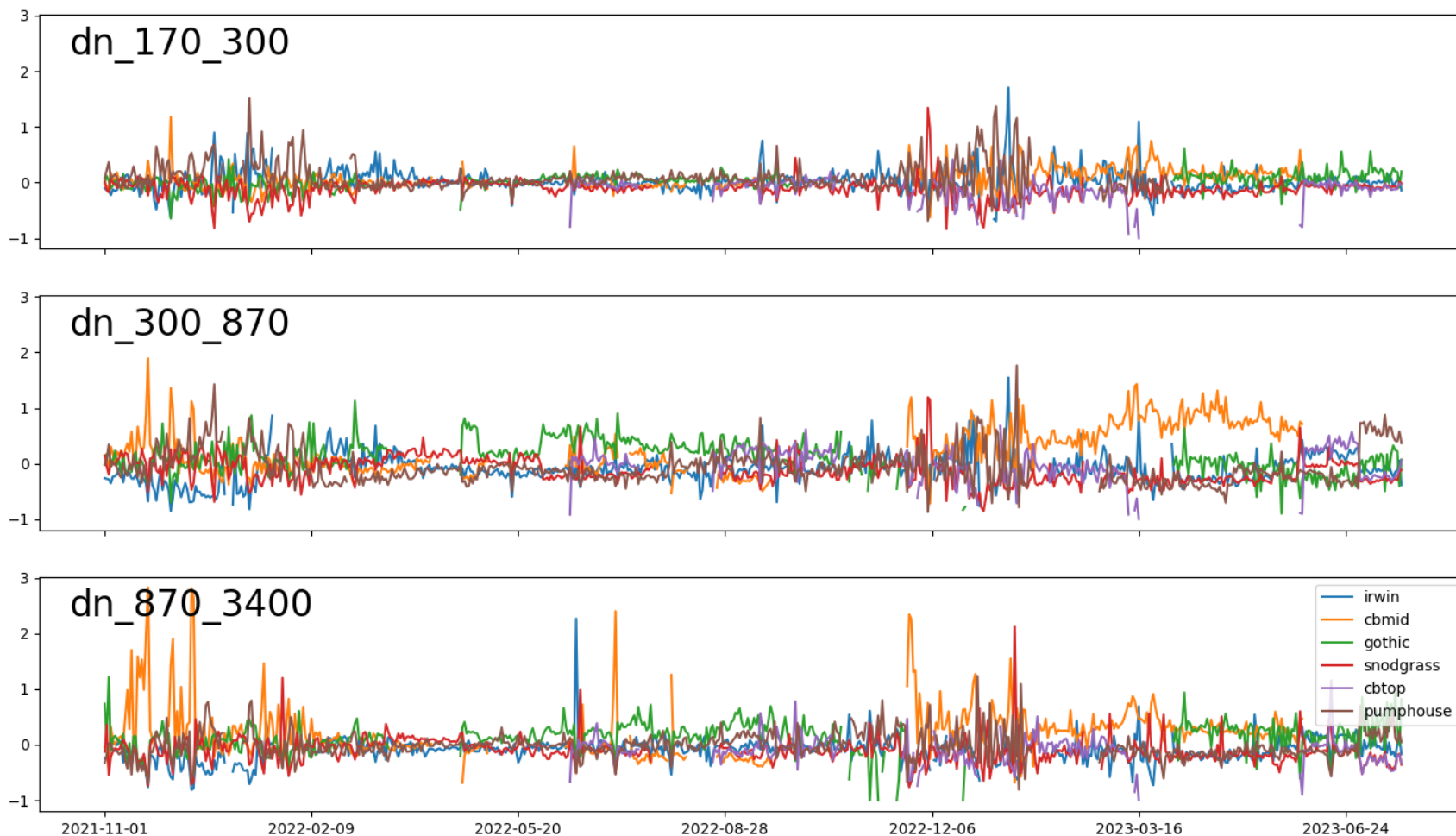


Representation Error

Overall, the representation error is also higher in the winters.

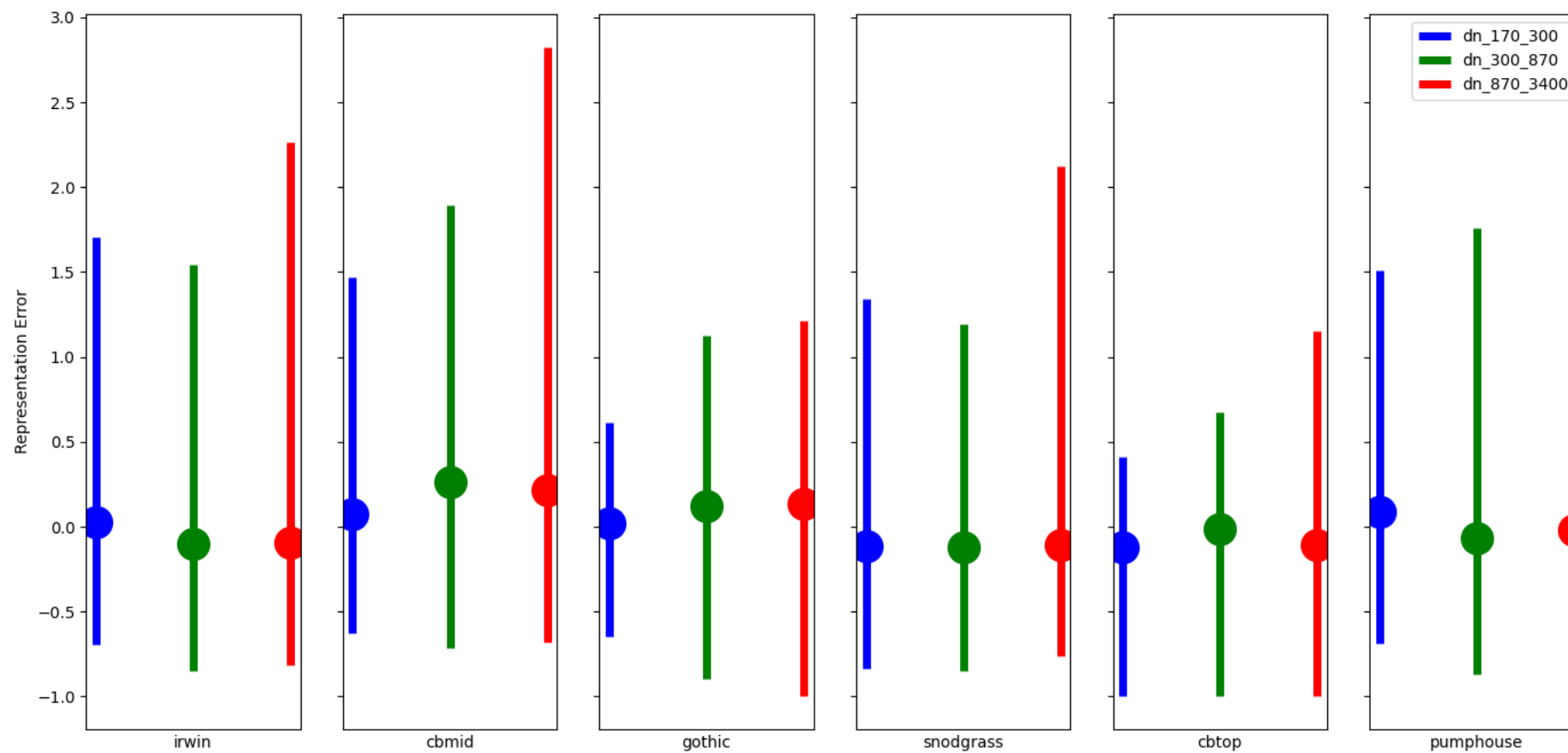
The representation error e_s for a site observation O_s is the normalized difference between O_s and the network mean N :

$$e_s = \frac{O_s - N}{N}$$





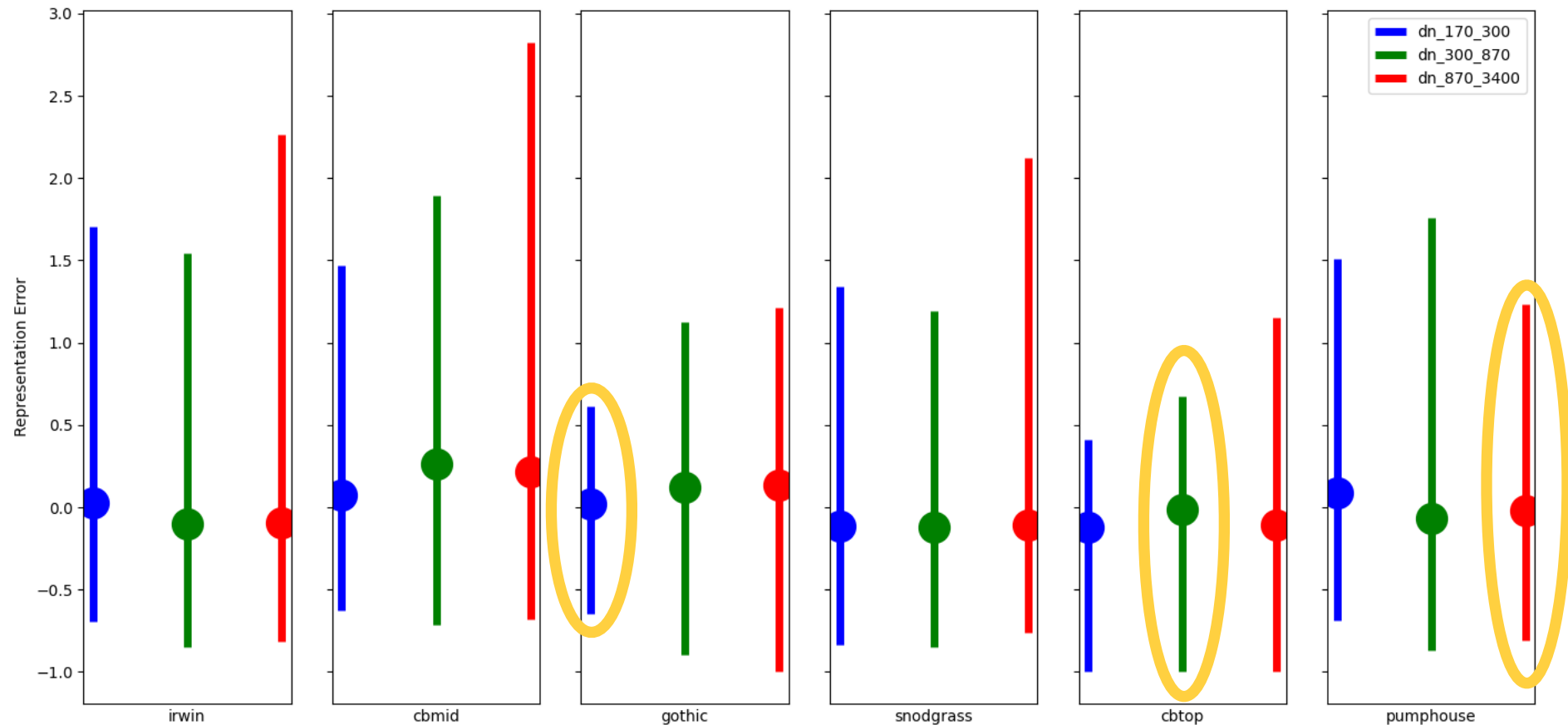
Representation Error





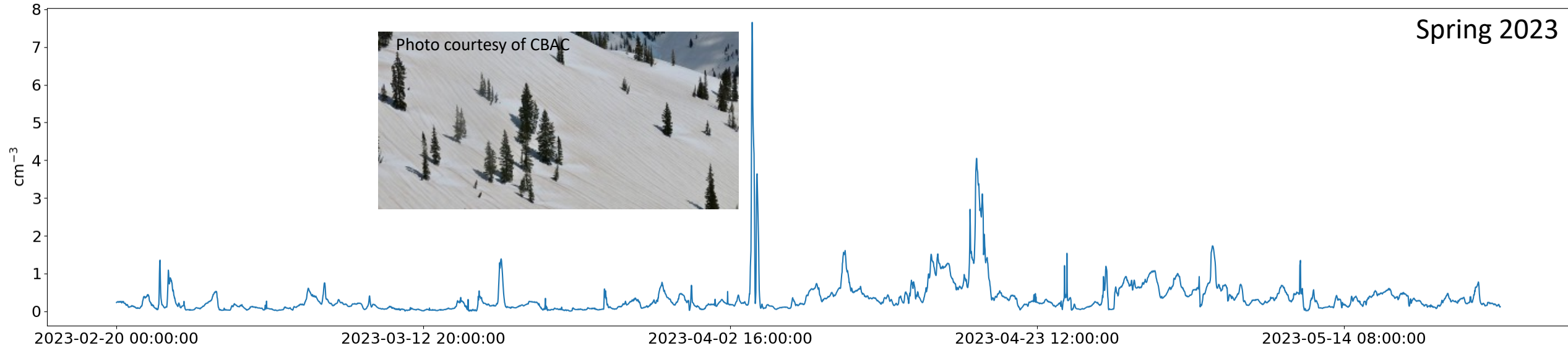
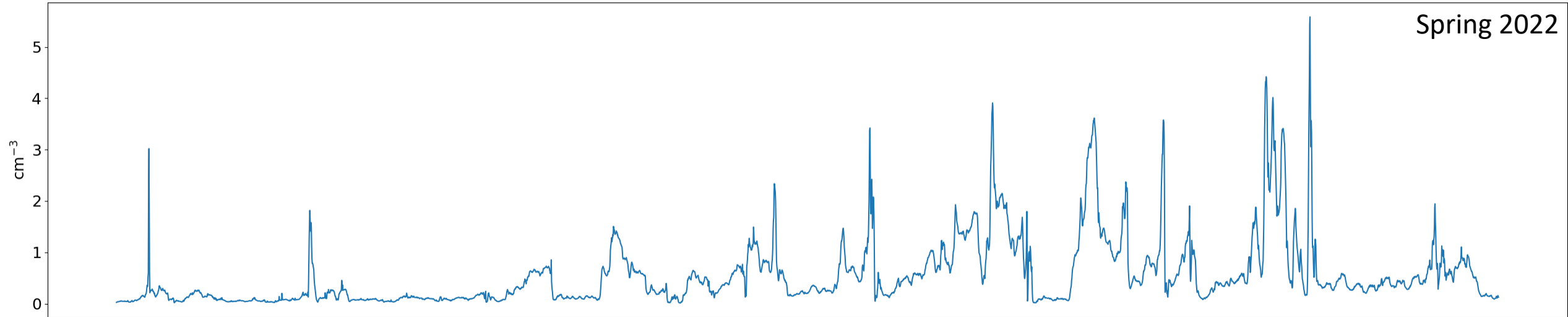
Representation Error

The most representative site is not consistent over different aerosol sizes.



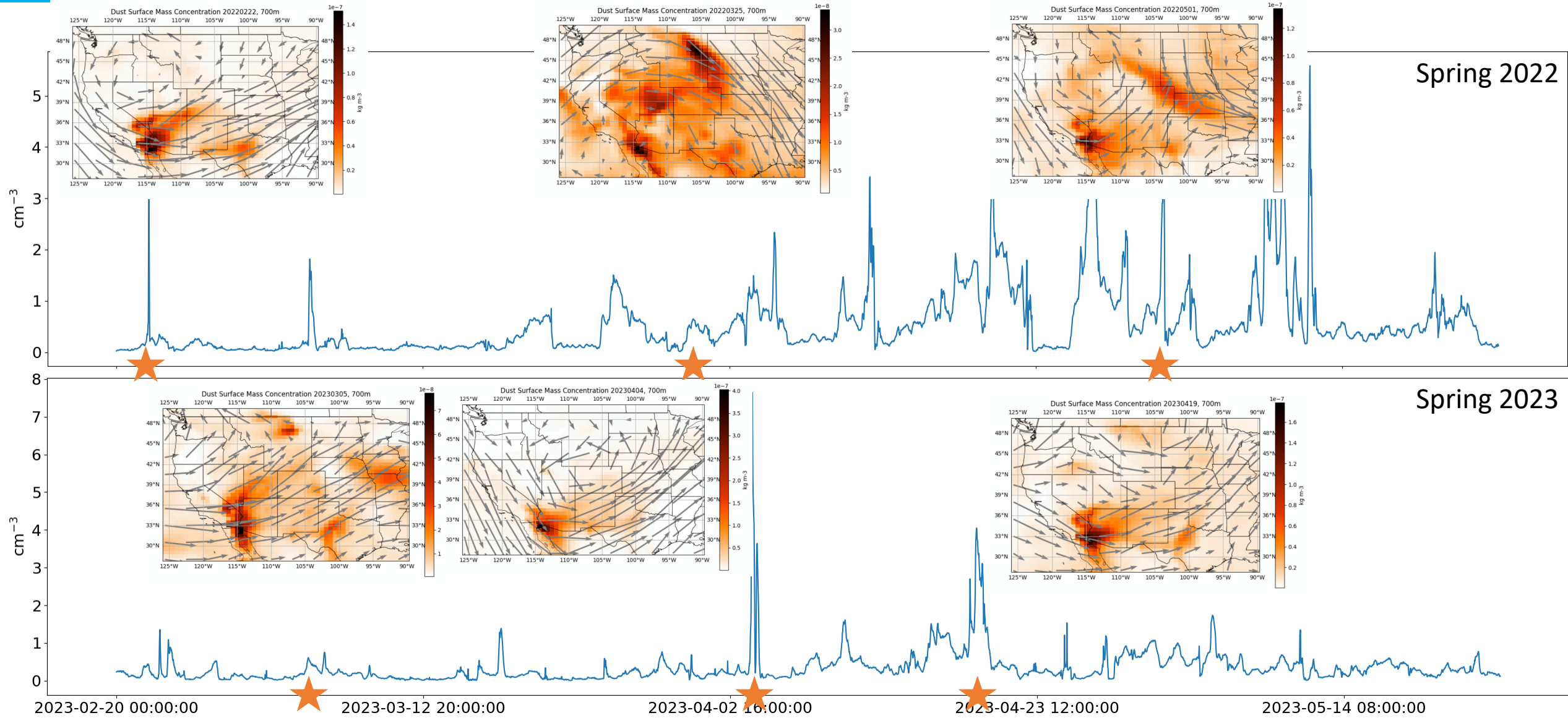


Spring Dust Analysis



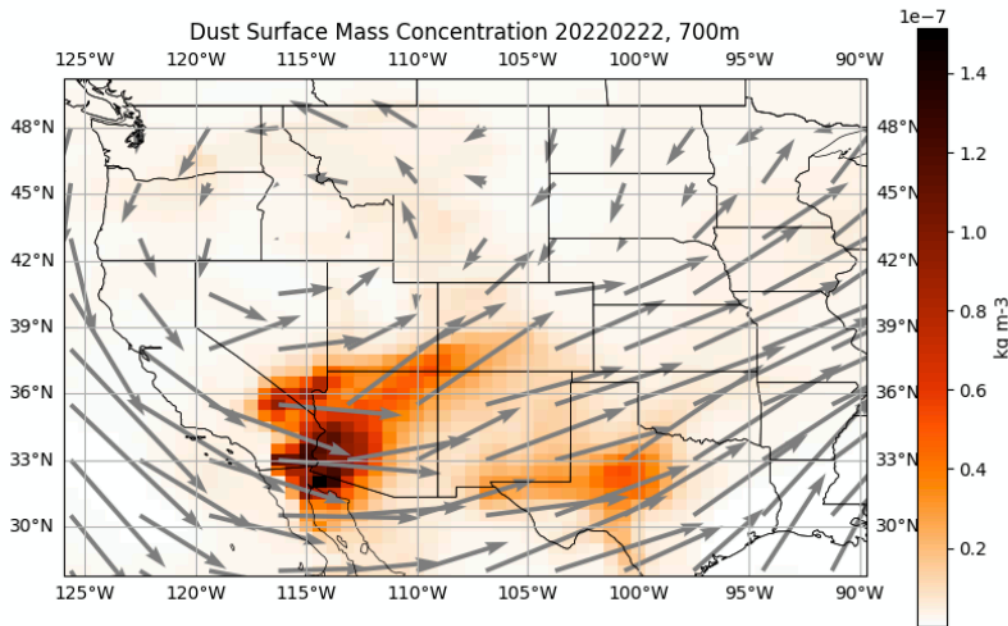


Spring Dust Analysis

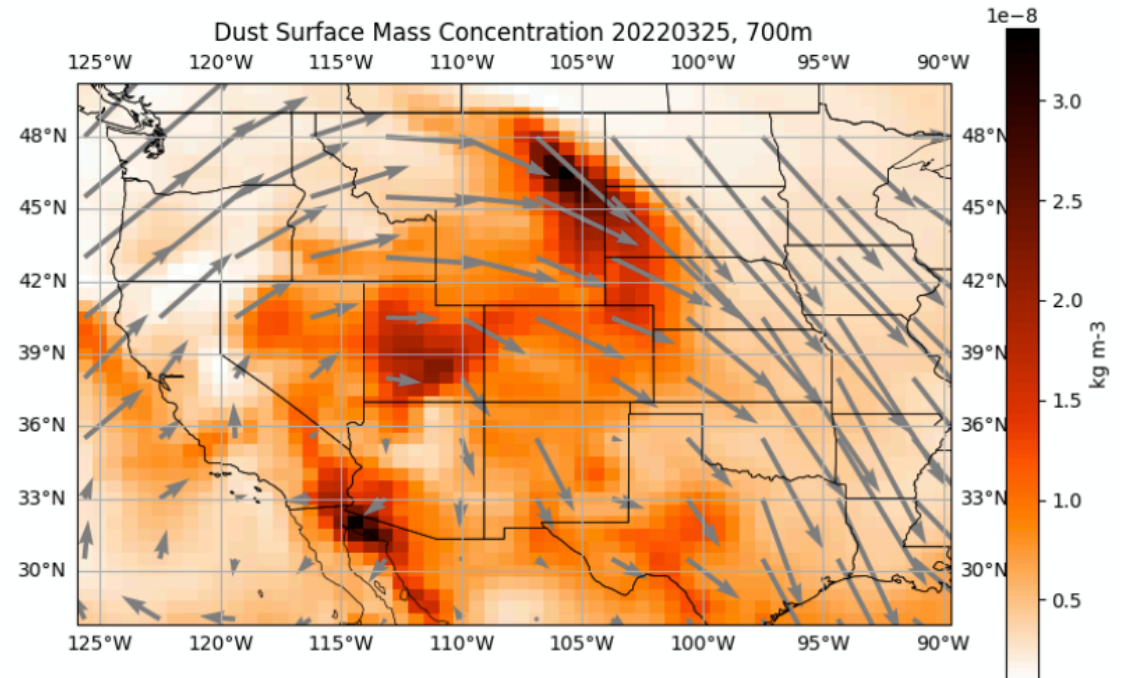


Predominant Transport Paths

Southwestern US



West/Northwestern US



See Laura Riihimaki's talk tomorrow 8:40-8:50 for dust's affect on albedo!



Using CASTNET Data as a Proxy for Dust

EPA United States Environmental Protection Agency

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Gothic (GTH161) [Contact Us](#)

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Site Photos

Site Information

Site ID: GTH161
 Site name: Gothic
 County: Gunnison
 State abbreviation: CO
 AQS ID: 080519991
 Latitude, decimal degrees: 38.95627
 Longitude, decimal degrees: -106.98587
 Elevation, m: 2915
 Operating agency: EPA
 Start date: 05/13/1989

Graphical Results

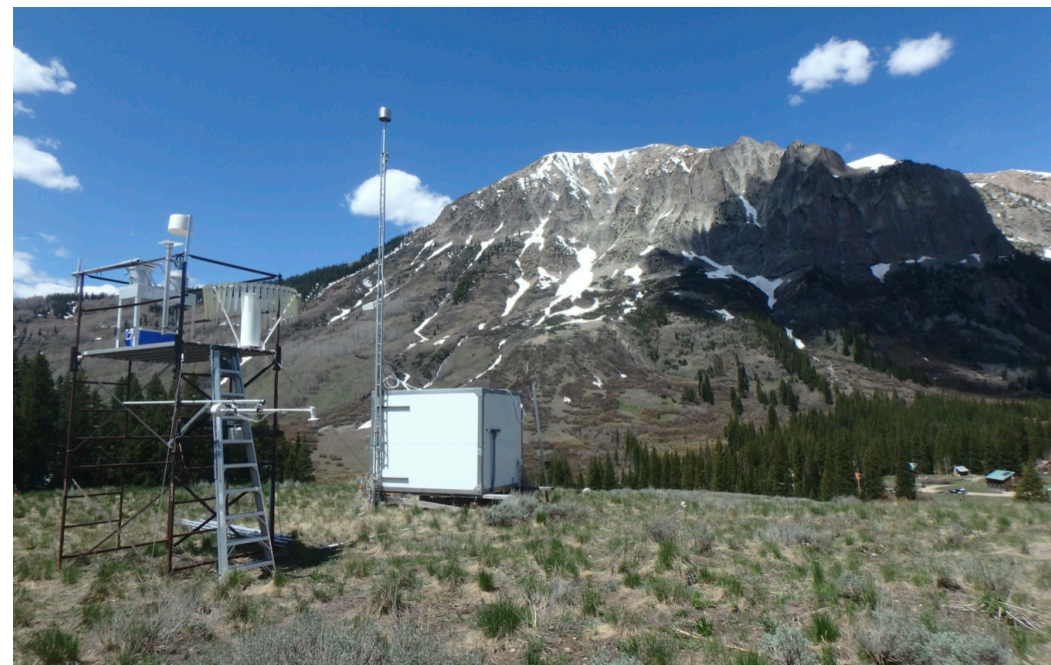
Composition of total nitrogen deposition by species

Trends in total nitrogen deposition

Trends in wet and dry nitrogen deposition

Composition of total sulfur deposition by species

Trends in total sulfur deposition

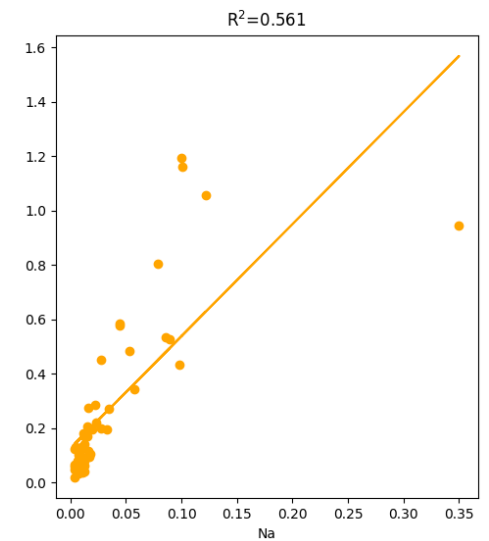
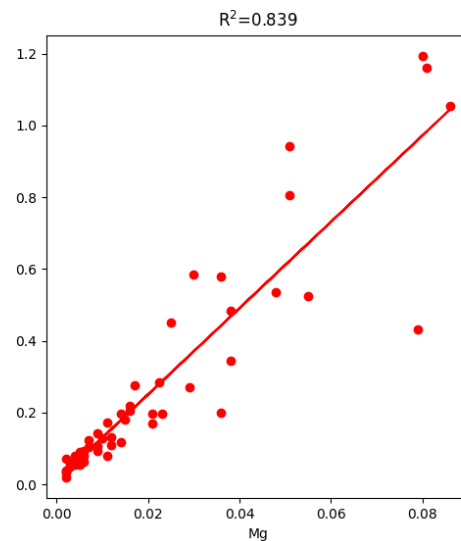
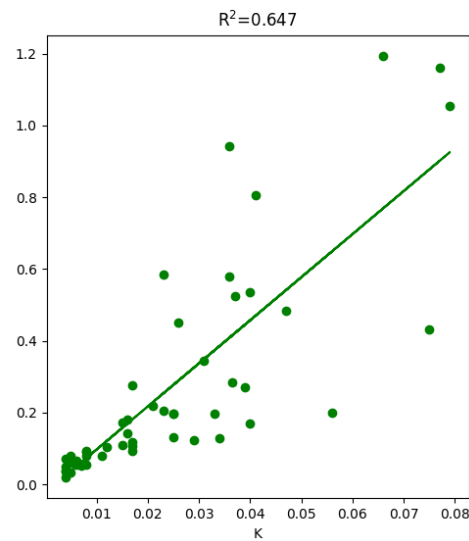
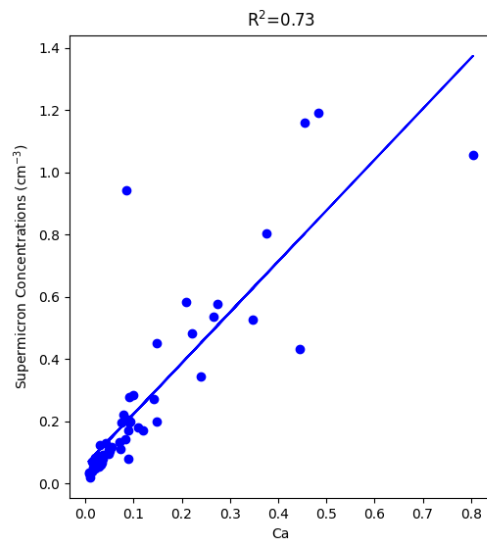
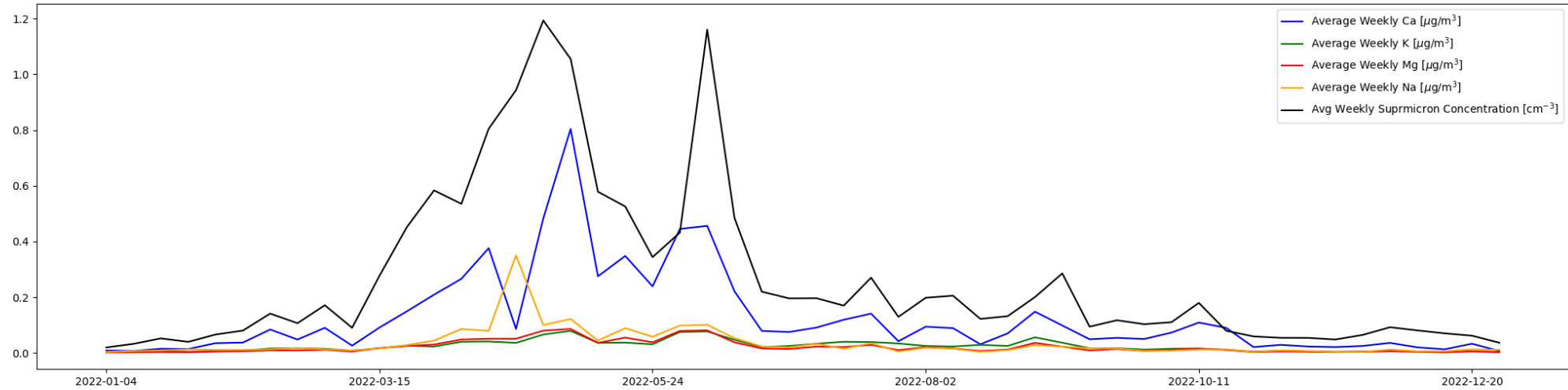


Filter Pack Concentrations - Weekly | Meteorological - Hourly | Ozone - Hourly | Ozone QC results - Daily | Trace Gas - Hourly | Trace Gas QC results - Daily | Total Deposition - Annual | Help

Site ID	Q	Week	Q	Year	Q	DATEON	DATEOFF	Ca	Q	Cl	Q	HNO ₃	Q	K	Q	Mg	Q	Na	Q	NH ₃	Q	NO _x	Q	SO ₂	Q	SO _x	Q	TNO _x	Q
GTH161		1		2022		1/04/2022	1/11/2022	0.009		0.015		0.0		0.004		0.002		0.004		0.02		0.026		0.071		0.048		0.096	
GTH161		2		2022		1/11/2022	1/18/2022	0.007		0.013		0.1		0.005		0.002		0.007		0.047		0.023		0.1		0.091		0.155	
GTH161		3		2022		1/18/2022	1/25/2022	0.015		0.013		0.1		0.007		0.003		0.009		0.052		0.036		0.083		0.101		0.201	
GTH161		4		2022		1/25/2022	2/01/2022	0.014		0.014		0.1		0.004		0.002		0.013		0.047		0.036		0.09		0.1		0.163	
GTH161		5		2022		2/01/2022	2/08/2022	0.035		0.014		0.		0.006		0.005		0.011		0.06		0.067		0.112		0.127		0.215	
GTH161		6		2022		2/08/2022	2/15/2022	0.037		0.013		0.1		0.008		0.006		0.011		0.06		0.045		0.086		0.148		0.144	
GTH161		7		2022		2/15/2022	2/22/2022	0.084		0.013		0.1		0.016		0.009		0.013		0.072		0.131		0.109		0.171		0.258	
GTH161		8		2022		2/22/2022	3/01/2022	0.048		0.013		0.1		0.017		0.009		0.018		0.077		0.082		0.088		0.204		0.185	
GTH161		9		2022		3/01/2022	3/08/2022	0.09		0.013		0.1		0.015		0.011		0.013		0.094		0.11		0.057		0.227		0.219	
GTH161		10		2022		3/08/2022	3/15/2022	0.026		0.013		0.1		0.008		0.005		0.009		0.069		0.043		0.082		0.166		0.16	
GTH161		11		2022		3/15/2022	3/22/2022	0.091		0.013		0.1		0.017		0.017		0.016		0.105		0.072		0.074		0.286		0.326	
GTH161		12		2022		3/22/2022	3/29/2022	0.149		0.013		0.		0.026		0.025		0.028		0.073		0.164		0.093		0.25		0.282	
GTH161		13		2022		3/29/2022	4/05/2022	0.209		0.02		0.1		0.023		0.03		0.044		0.114		0.223		0.091		0.396		0.321	
GTH161		14		2022		4/05/2022	4/12/2022	0.266		0.051		0.0		0.04		0.048		0.085		0.085		0.192		0.098		0.334		0.265	
GTH161		15		2022		4/12/2022	4/19/2022	0.376		0.038		0.1		0.041		0.051		0.079		0.153		0.346		0.06		0.521		0.448	
GTH161		16		2022		4/19/2022	4/26/2022	0.086		0.377		0.0		0.036		0.051		0.35		0.115		0.423		0.055		0.473		0.493	

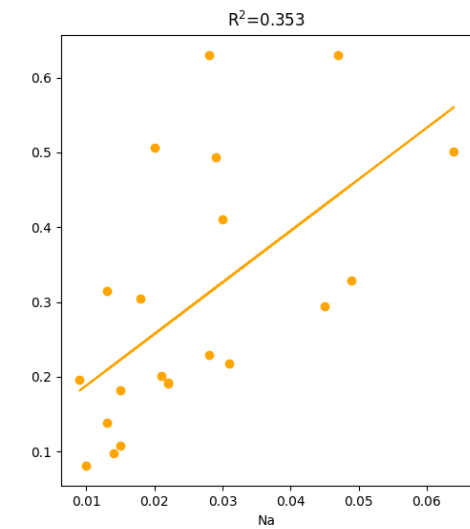
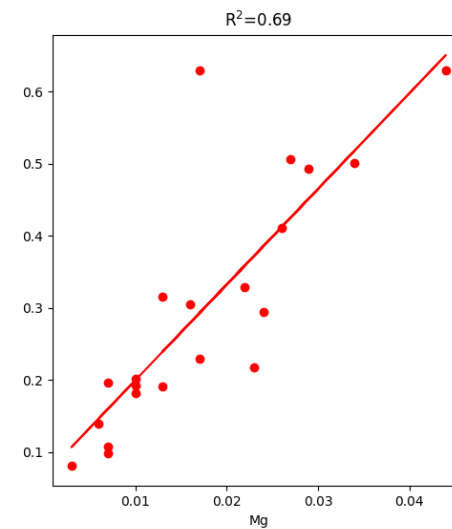
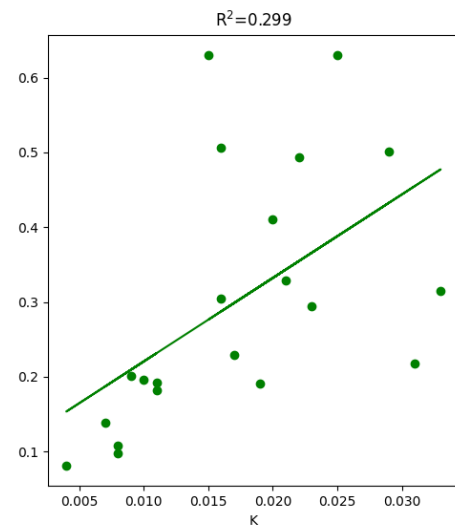
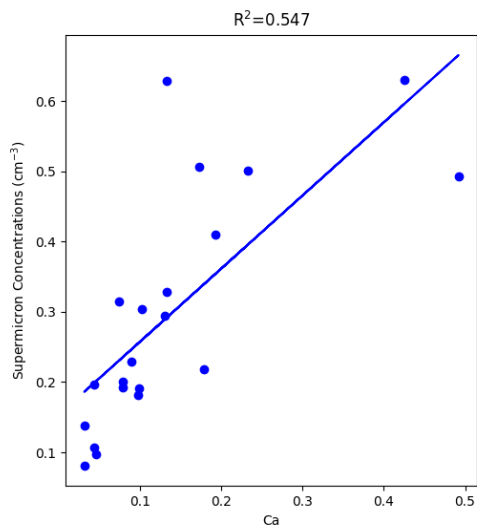
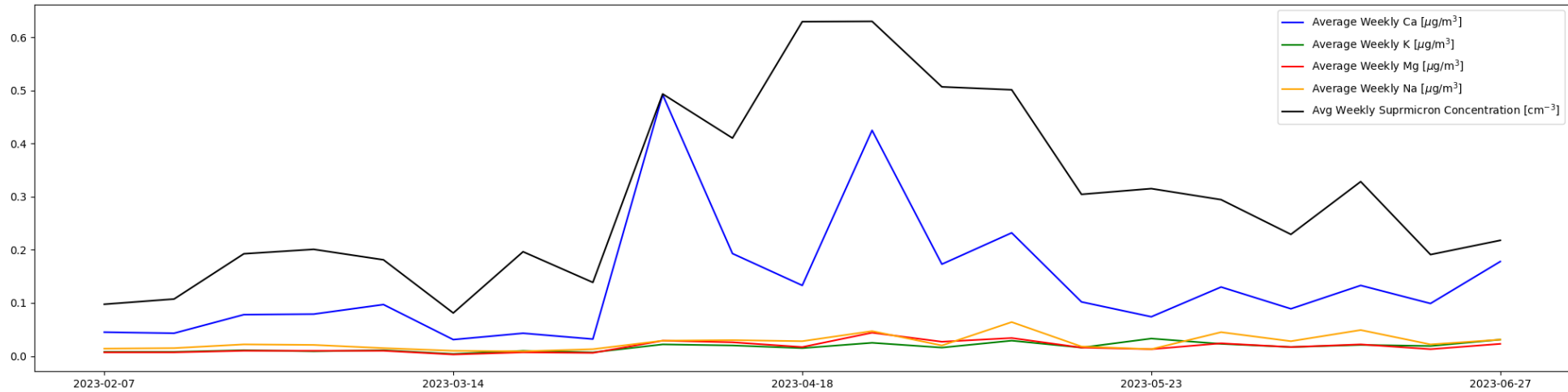


Using CASTNET Data as a Proxy for Dust





Using CASTNET Data as a Proxy for Dust





Questions & Discussion

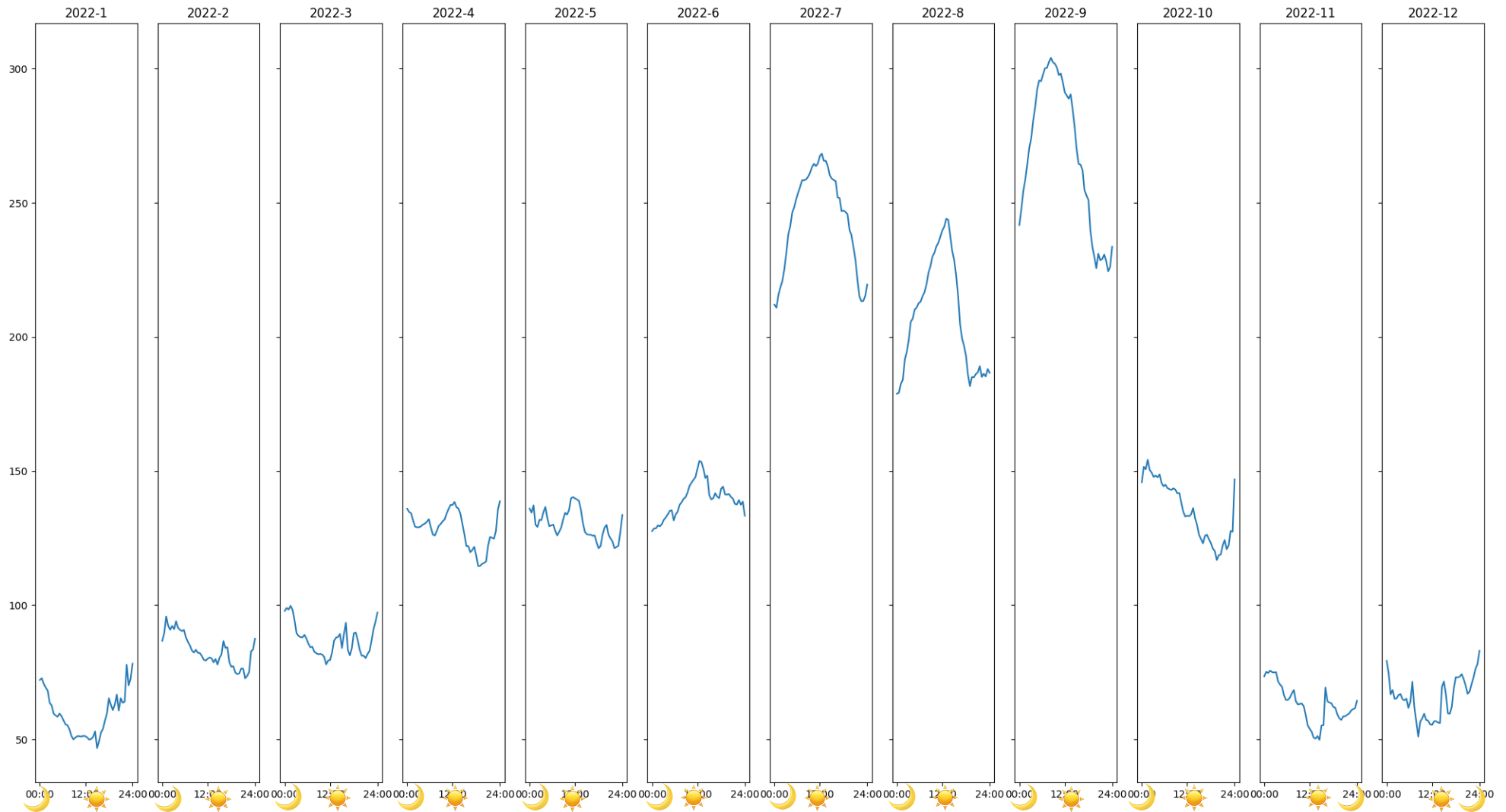
- Why might there be more variability in aerosol concentrations in the winter?
- Are there other folks working on analysis of the dust events in various capacities?



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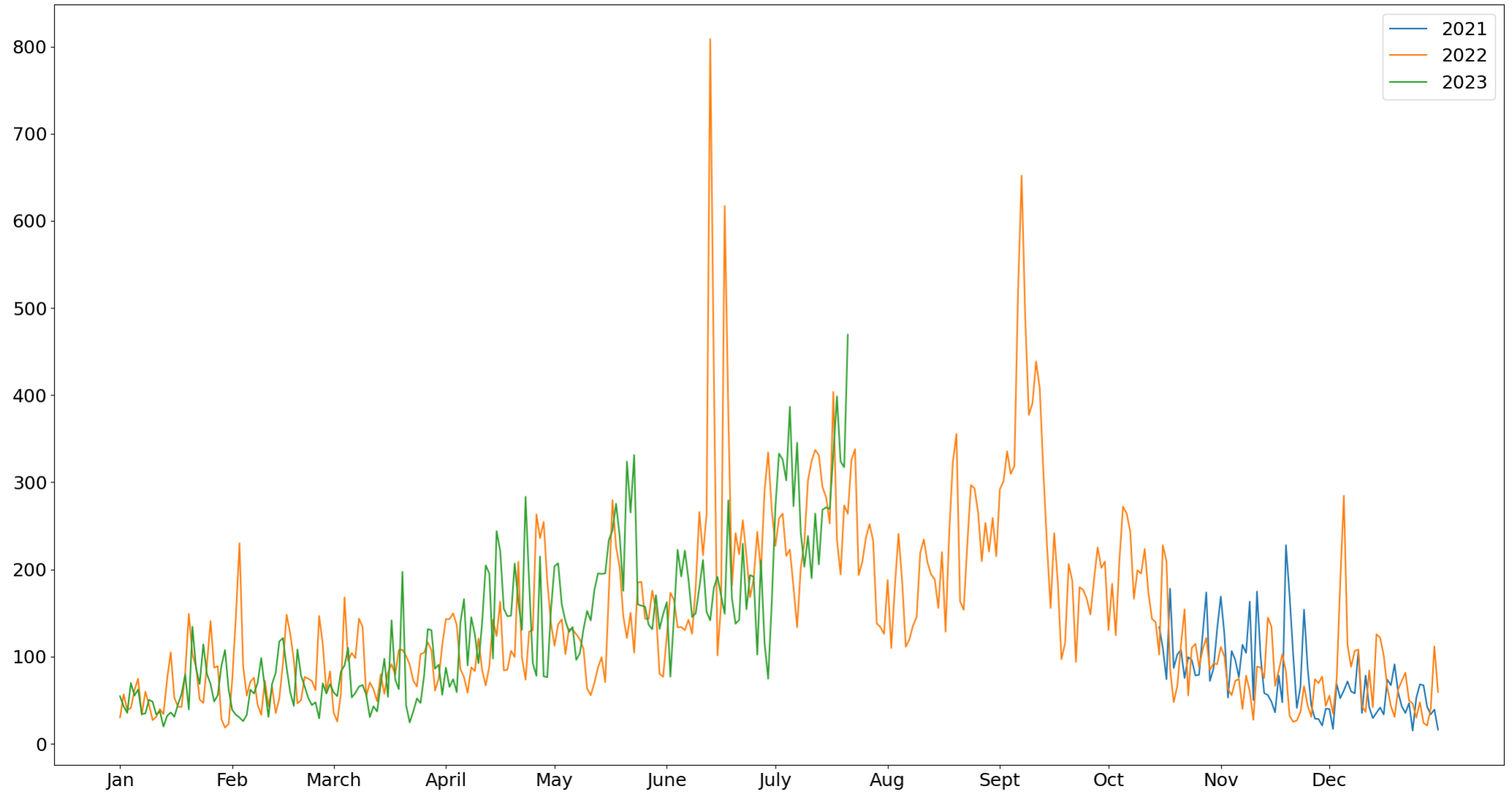


Seasonality and Diurnal Patterns





Differences Over the Years





Differences Over the Years

