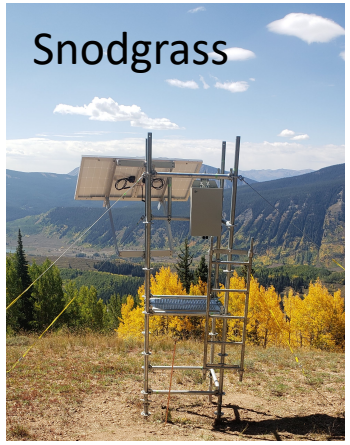
The Spatiotemporal Variability of Aerosol in the East River Watershed as seen by SAIL-Net
&
An Introduction to the Analysis of Spring Dust Events

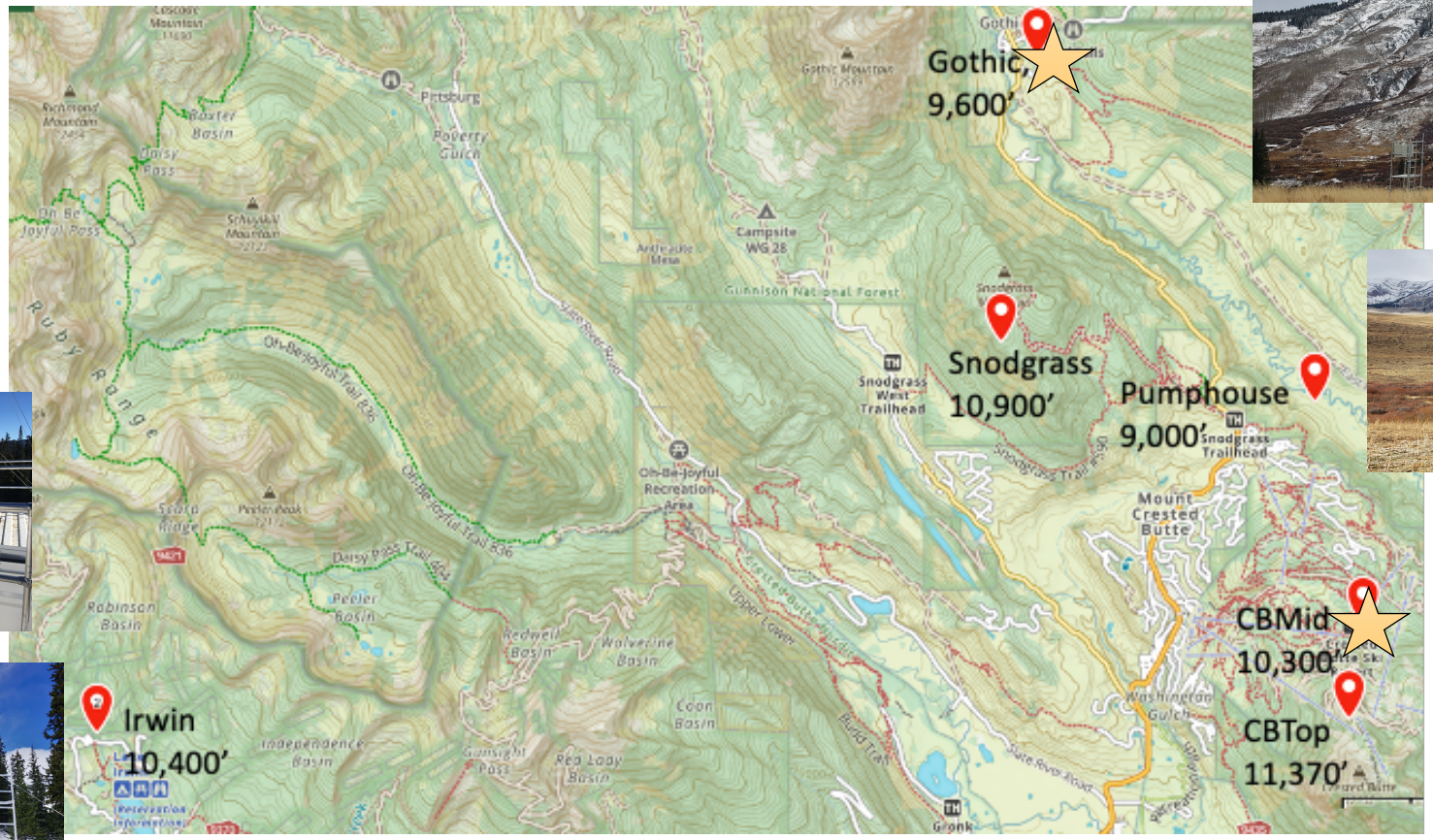
S3 Workshop November 2, 2023

Leah Gibson, Ethan Emerson, Nick Good, Anna Hodshire, Ezra Levin, Gavin McMeeking, Kate Patterson, Bryan Rainwater, Tom Ramin, Ben Swanson (Handix Scientific), *Adeyemi Adebiyi, 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.

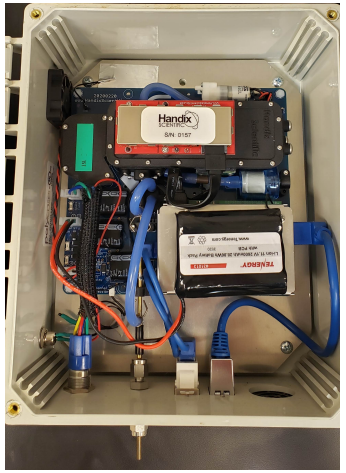




Instrumentation

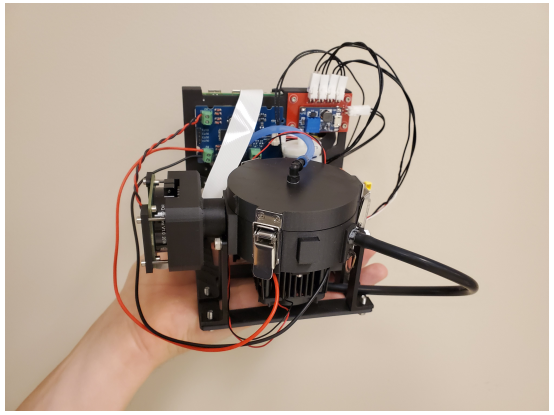
Aerosol size distribution: POPS

- **P**ortable **O**ptical **P**article **S**pectrometer (developed by Gao, et al. at NOAA)
- Measures size range of 140 nm – 3 um, 1 sec resolution



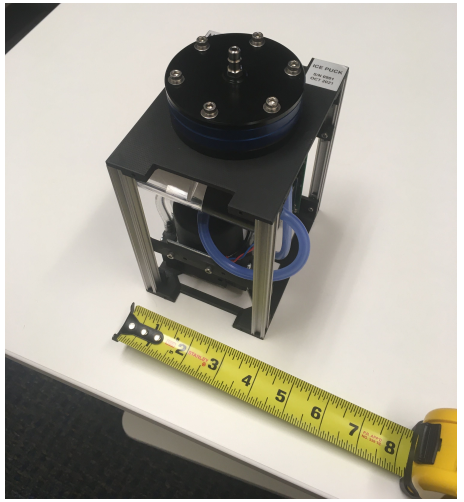
Cloud Condensation Nuclei: CloudPuck

- 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



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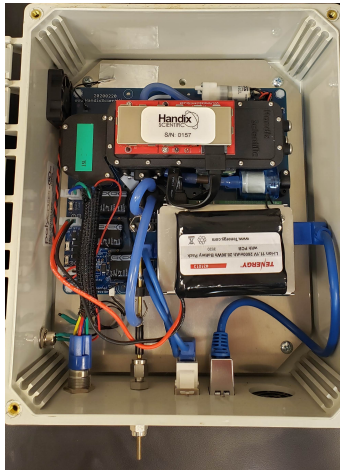

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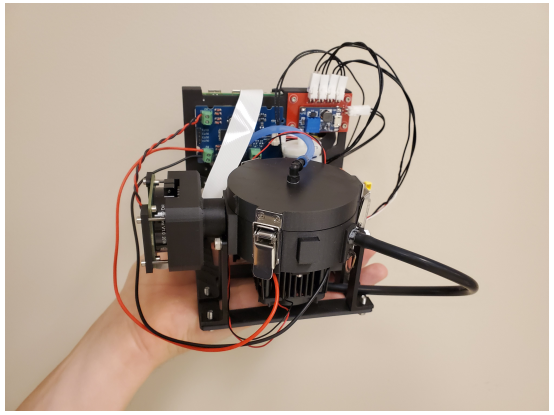

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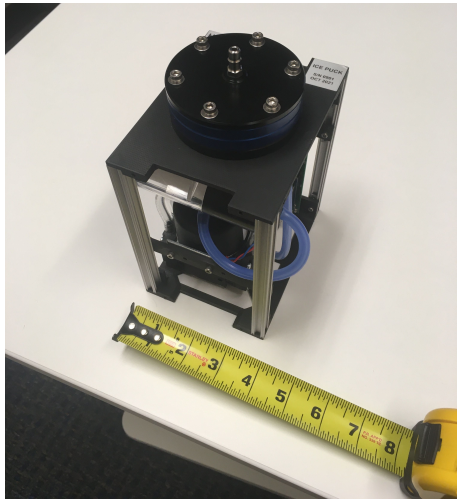
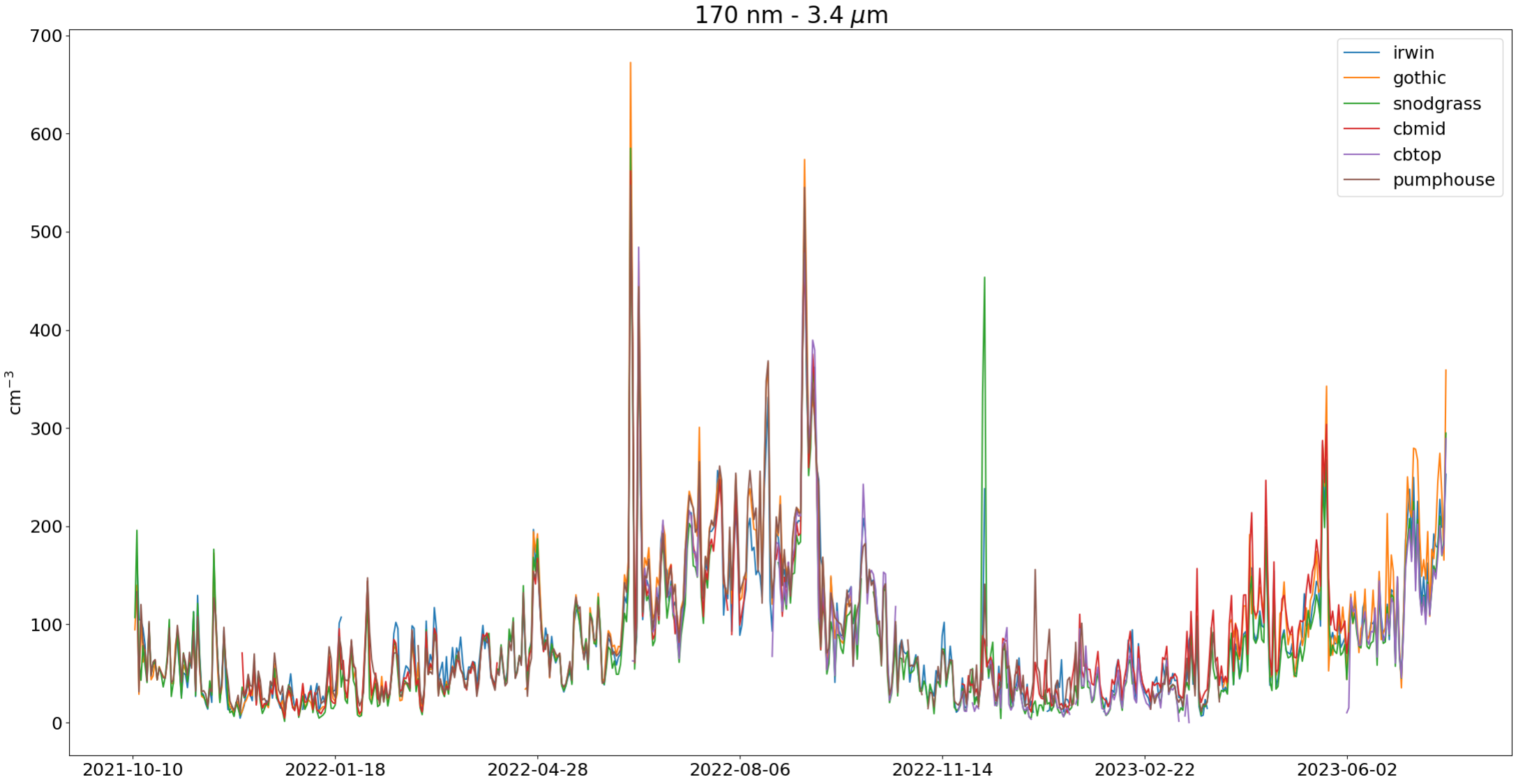
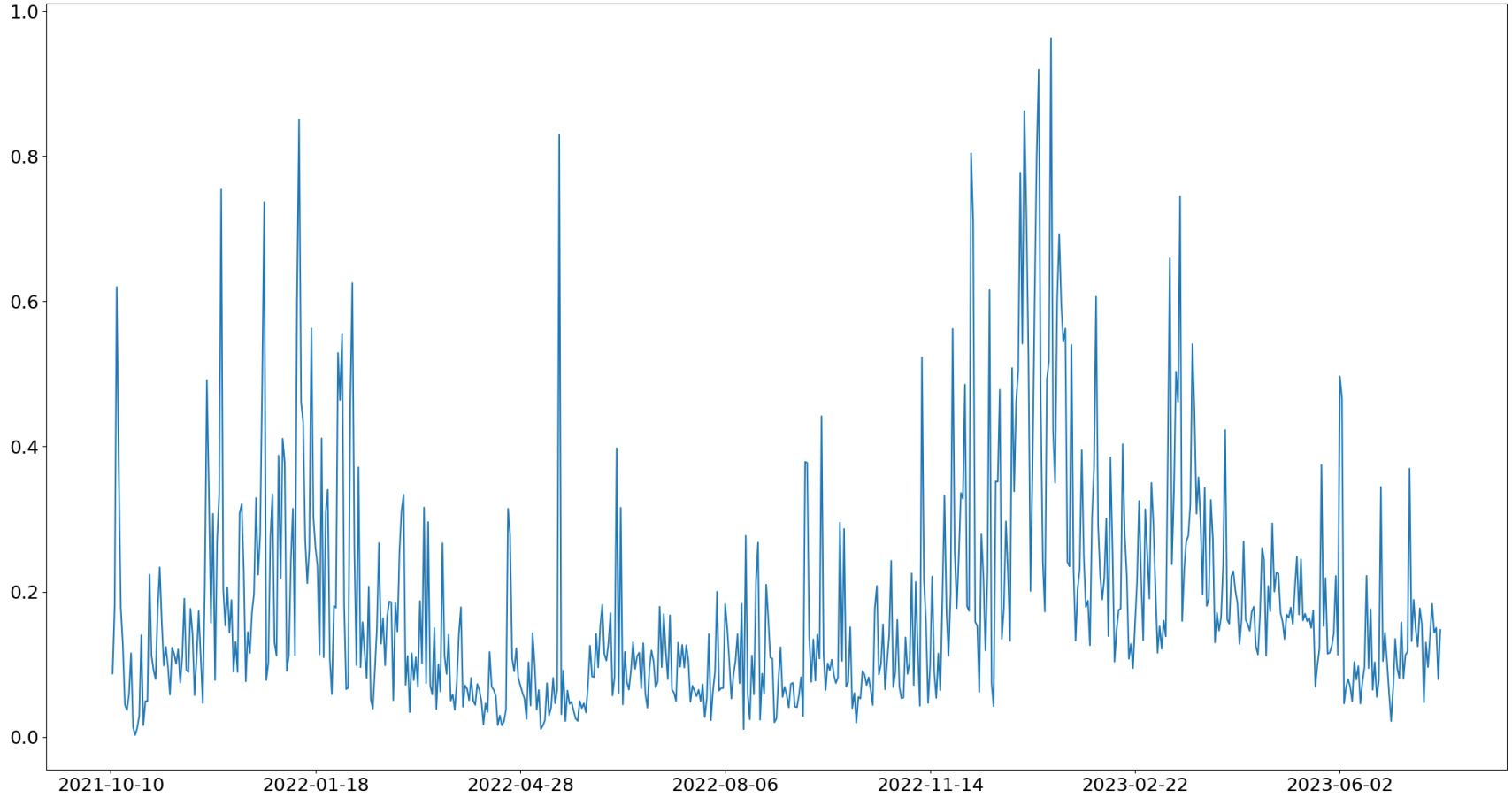


Timeseries from the POPS



Seasonal Variability

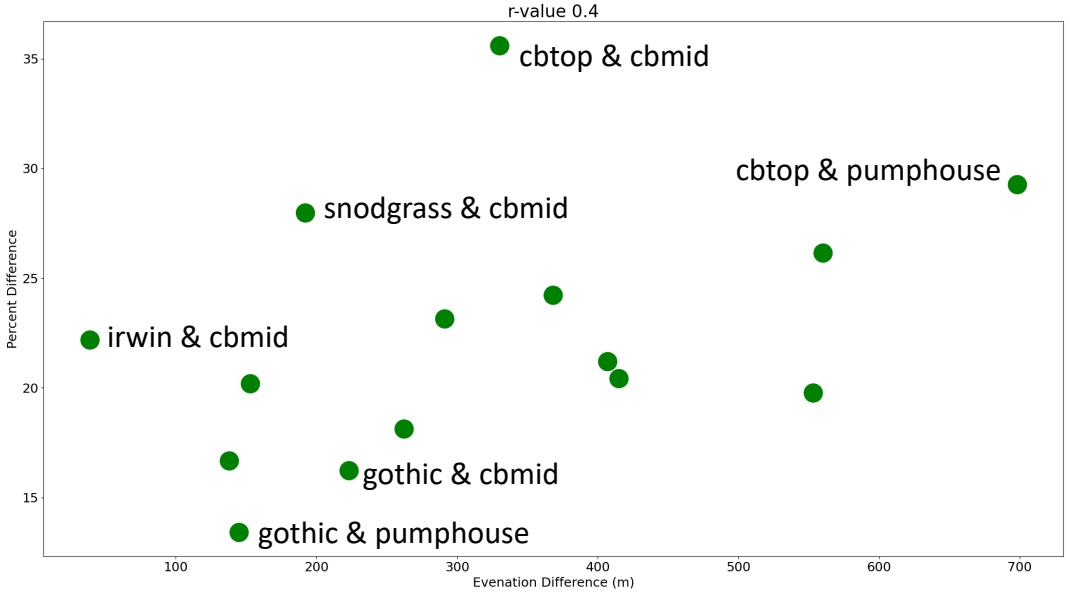
There is more variability between the sites in the winter than in the summer, as seen by plotting the coefficient of variation over time.

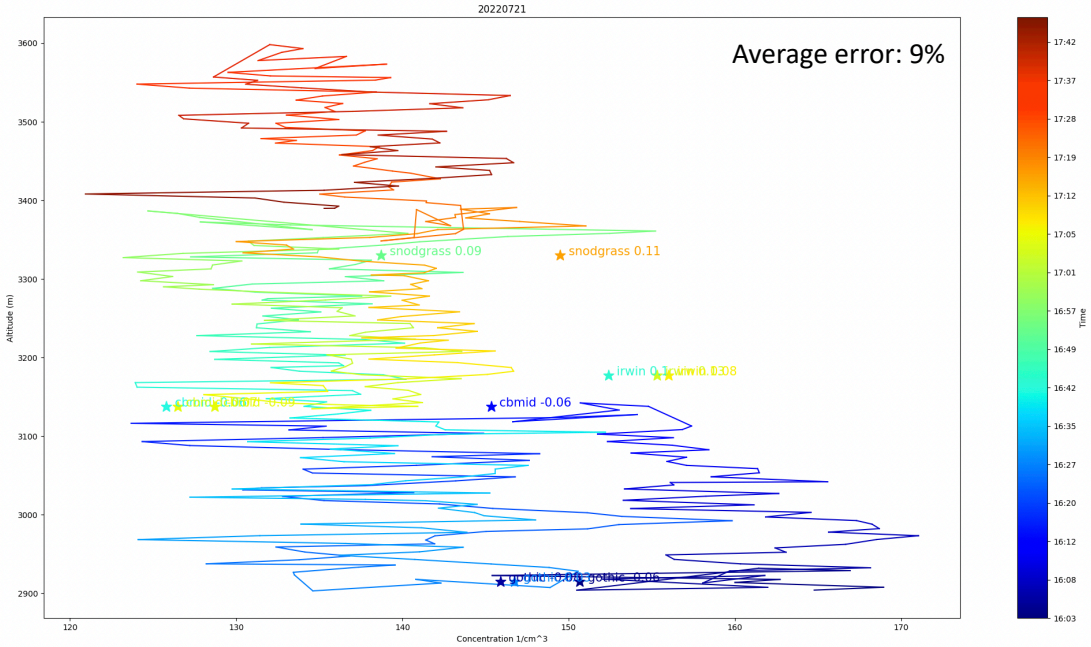


The Role of Elevation

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.



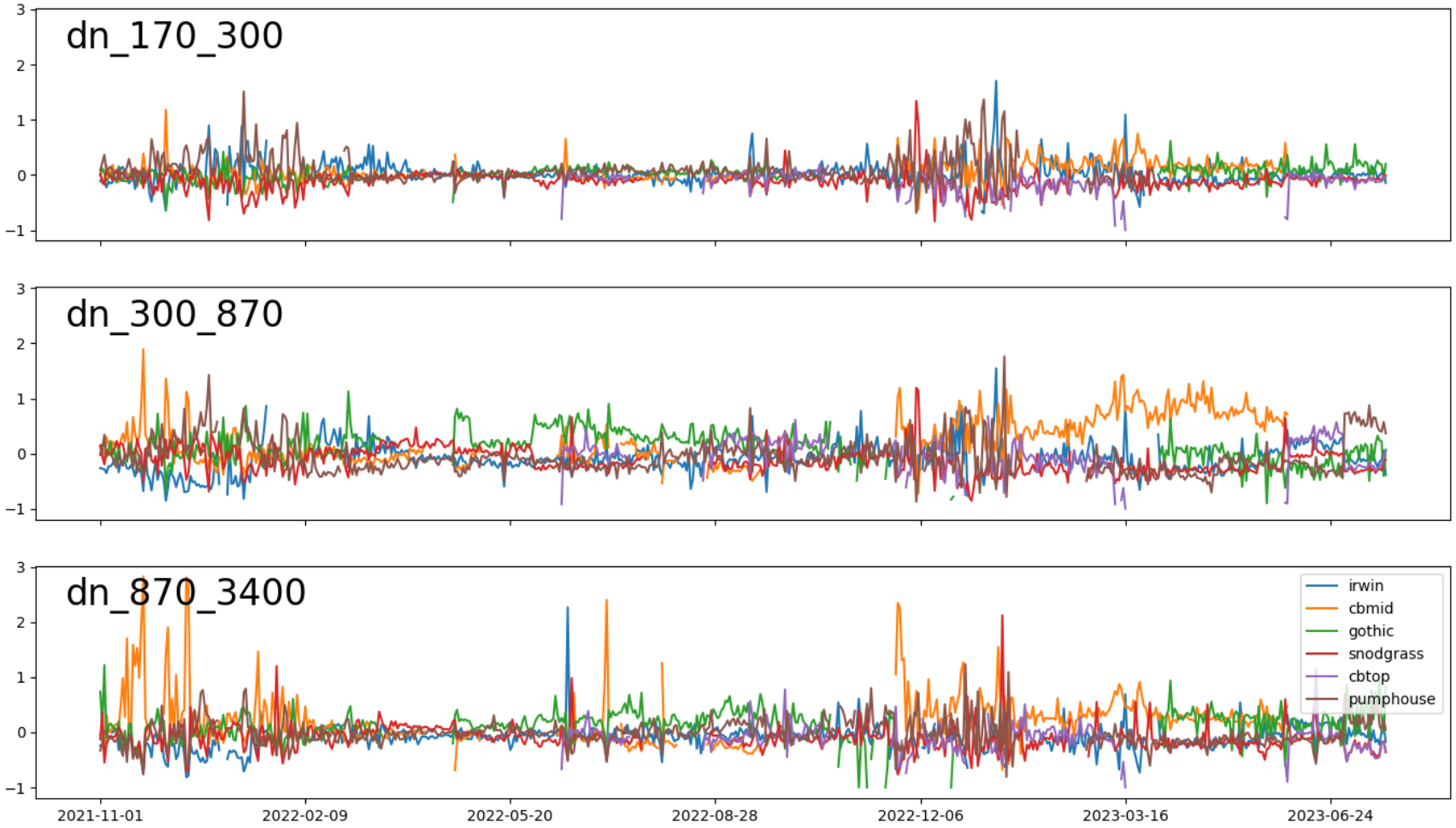


Representation Error

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:

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



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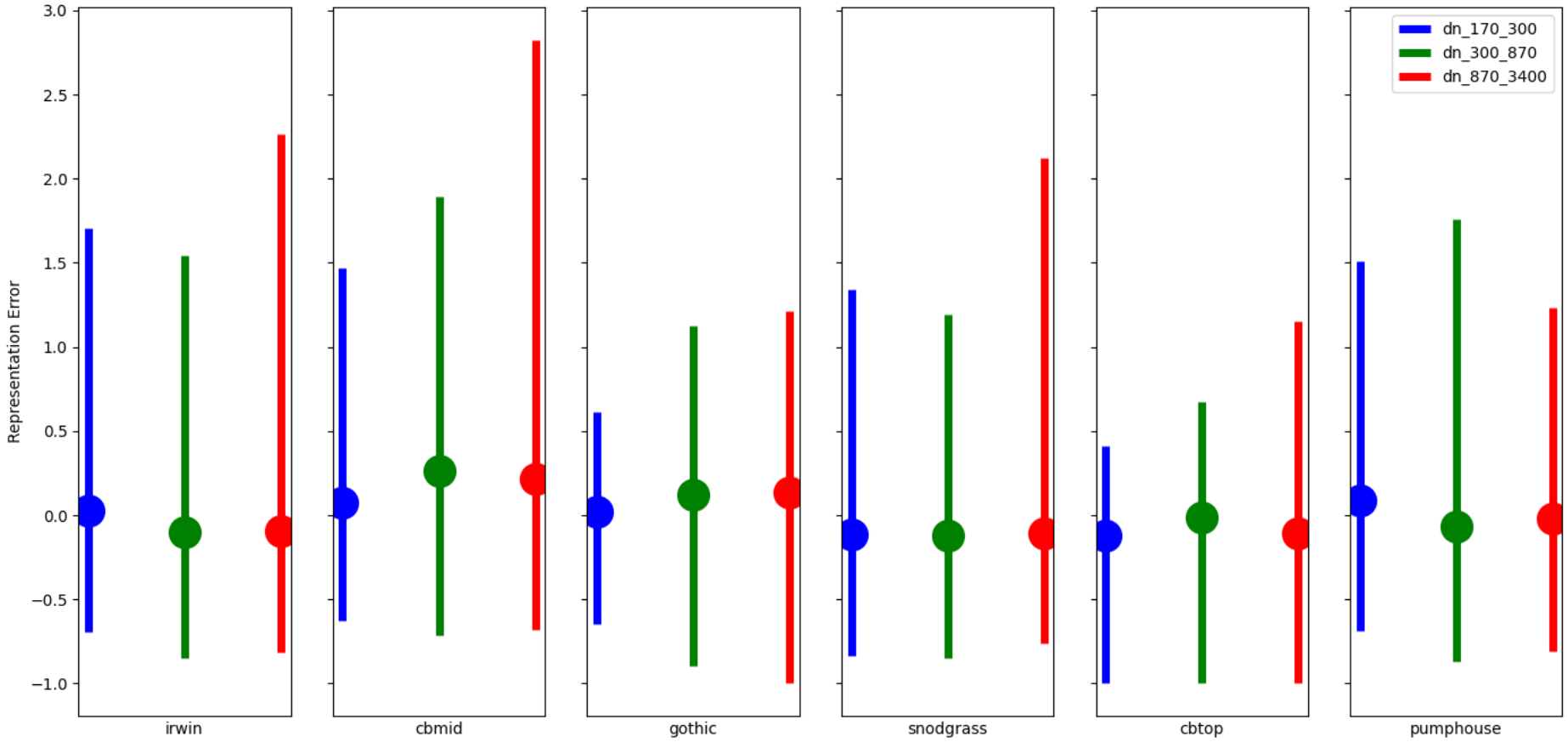
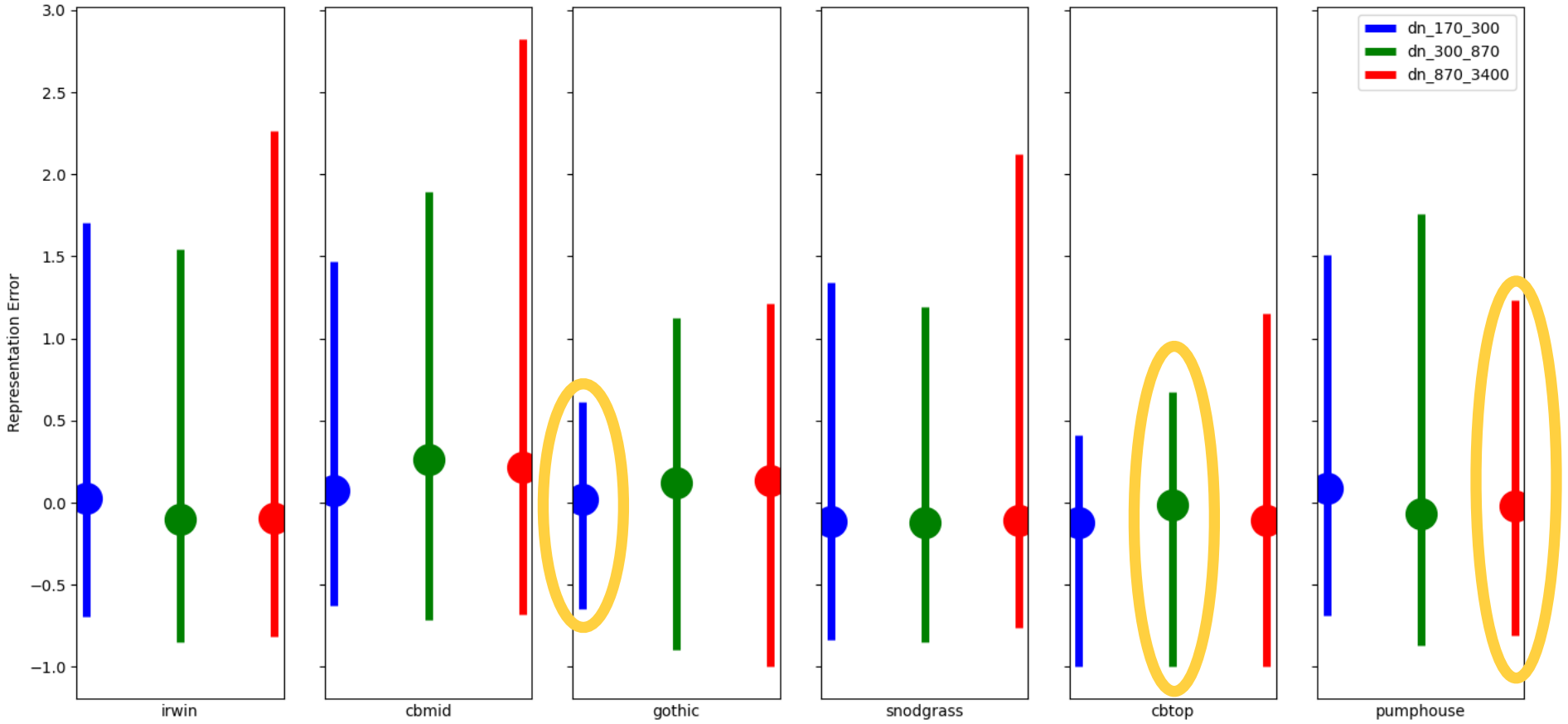
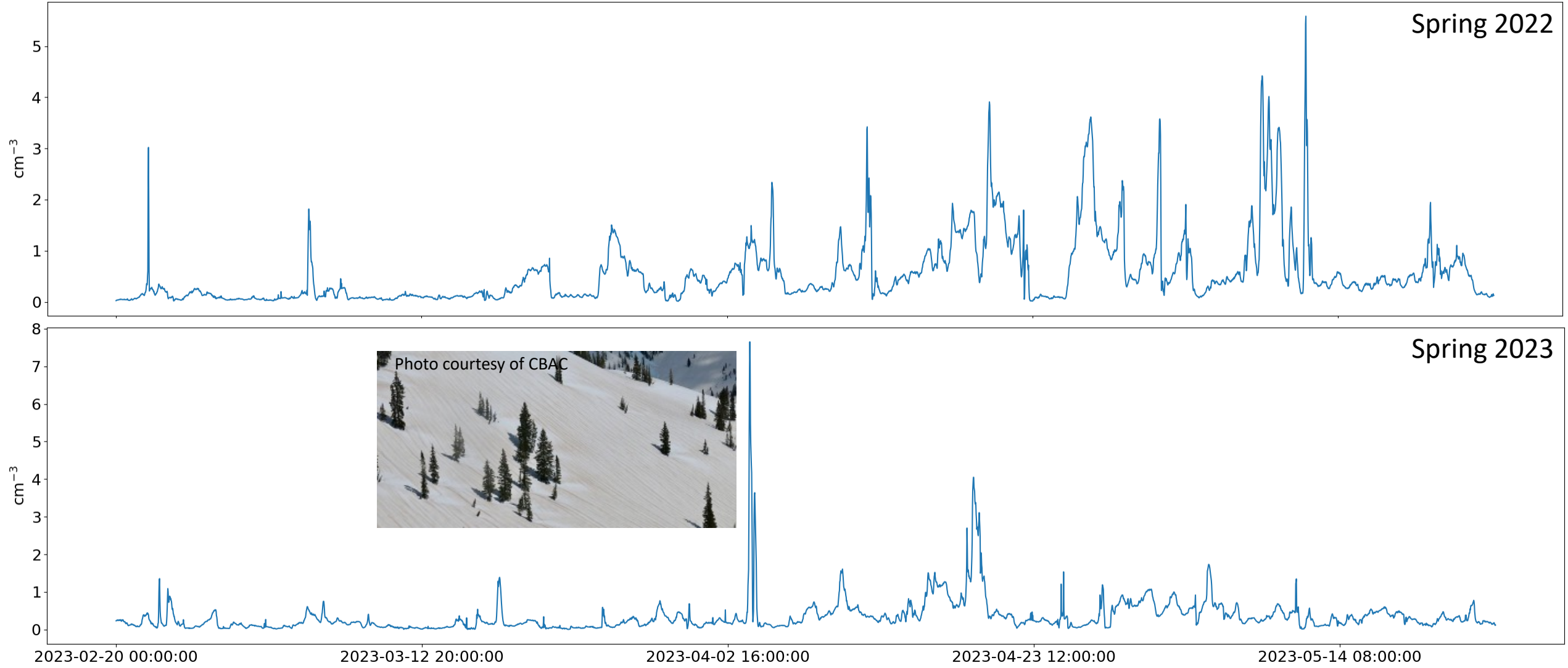


Representation Error

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



Spring Dust Analysis



Dust Surface Mass Data come from MERRA-2

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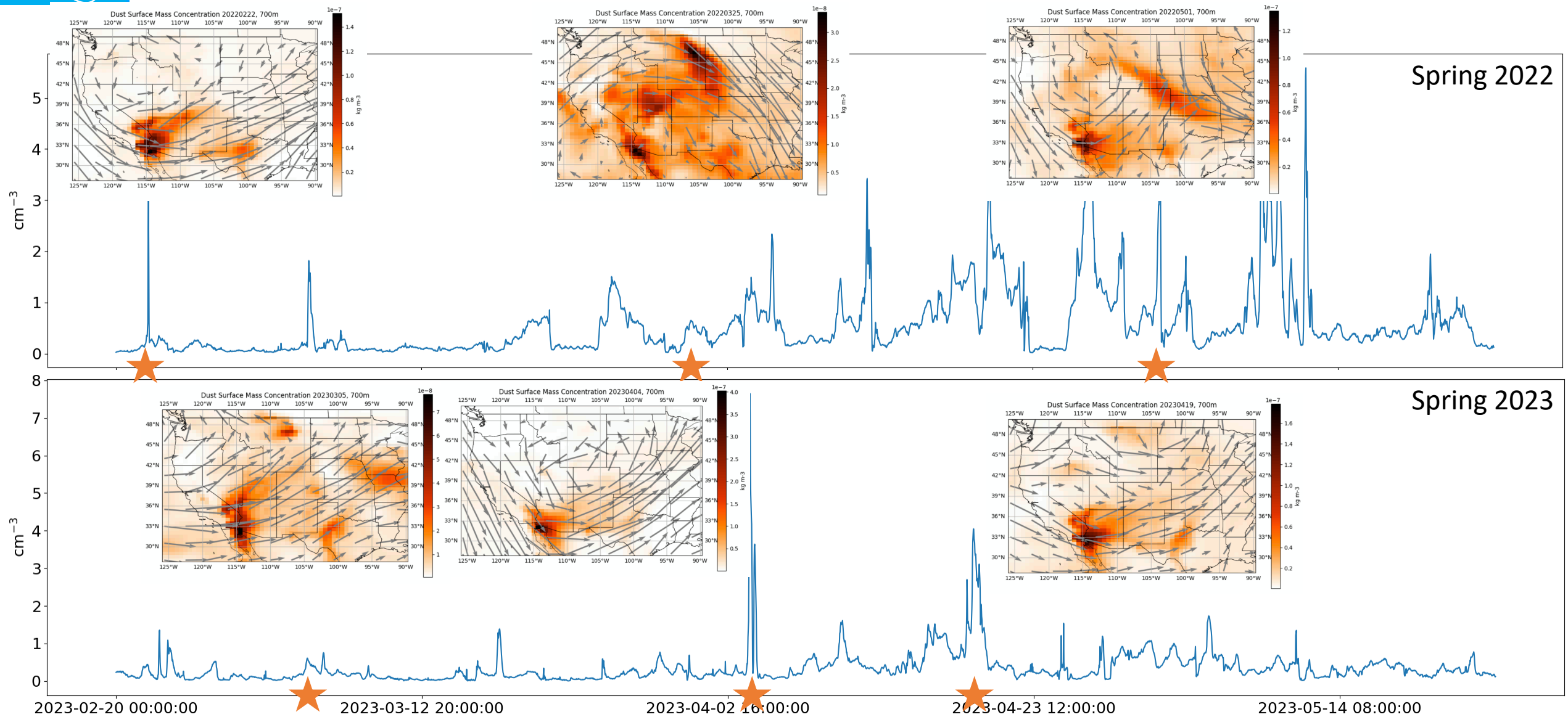

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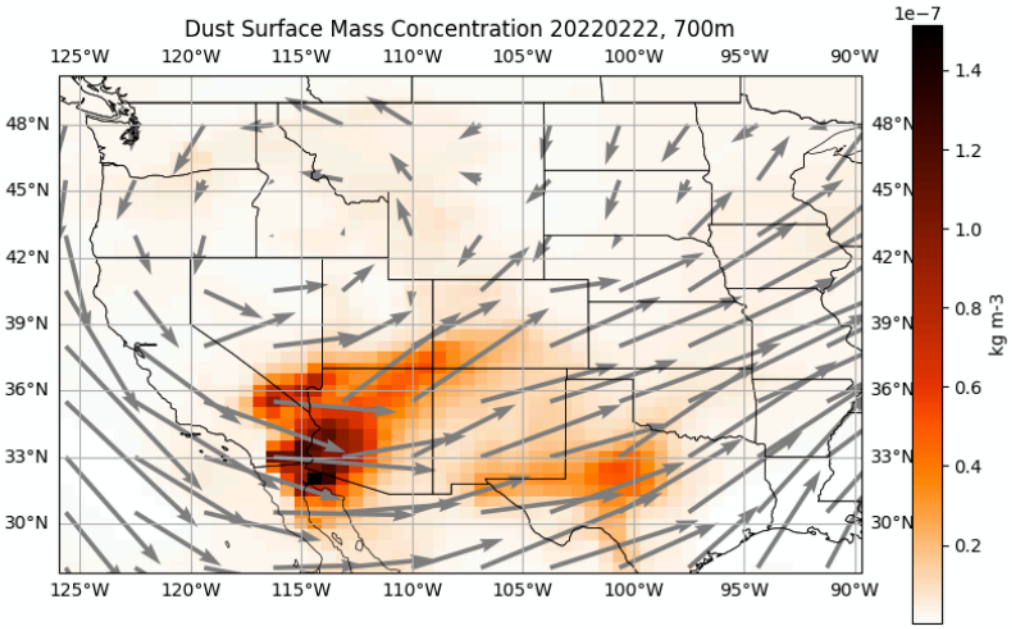
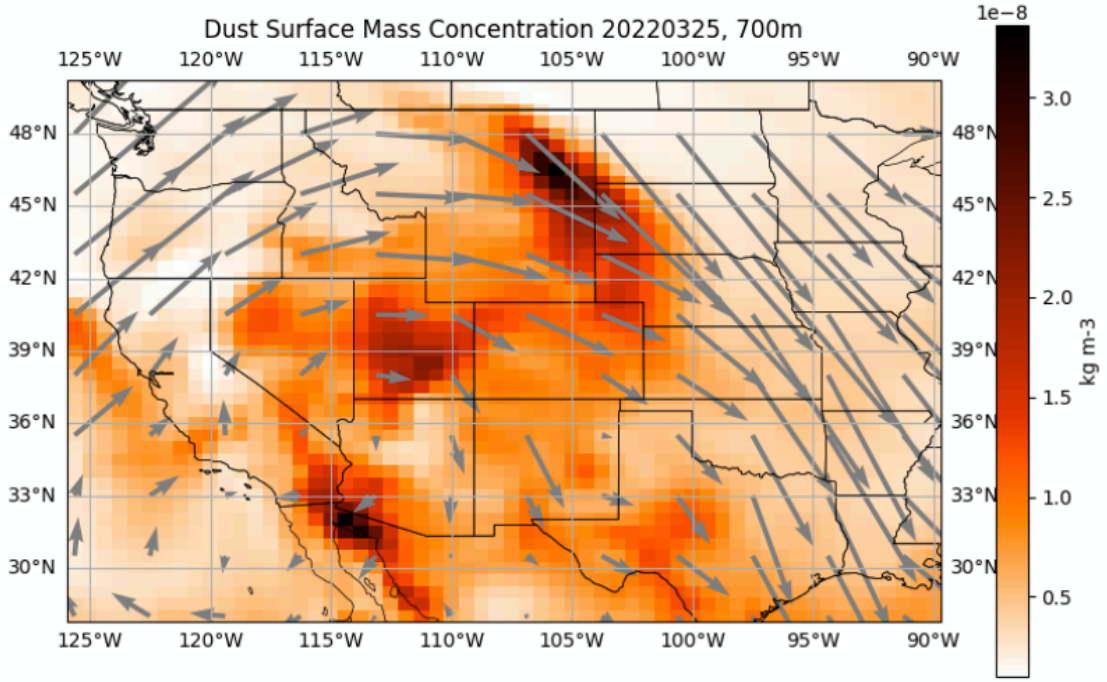
Predominant Transport Paths

Southwestern US

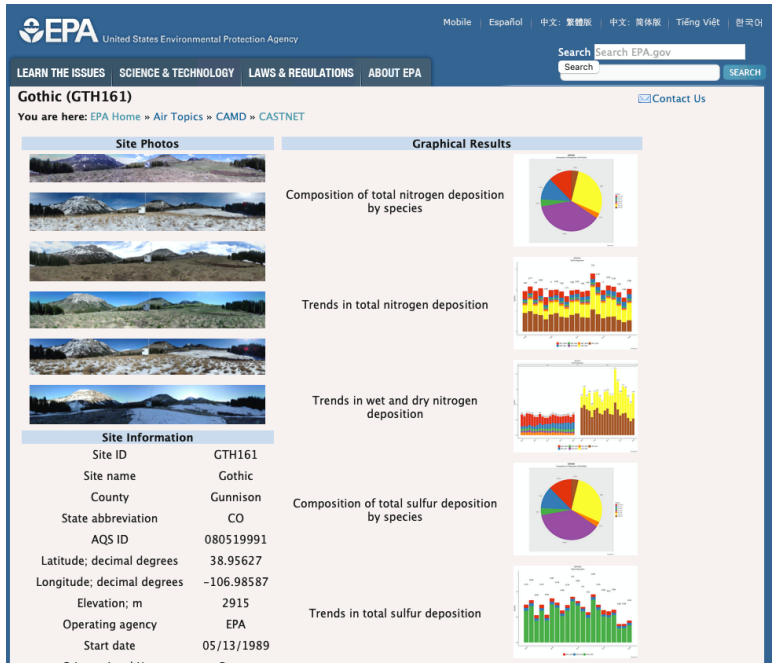


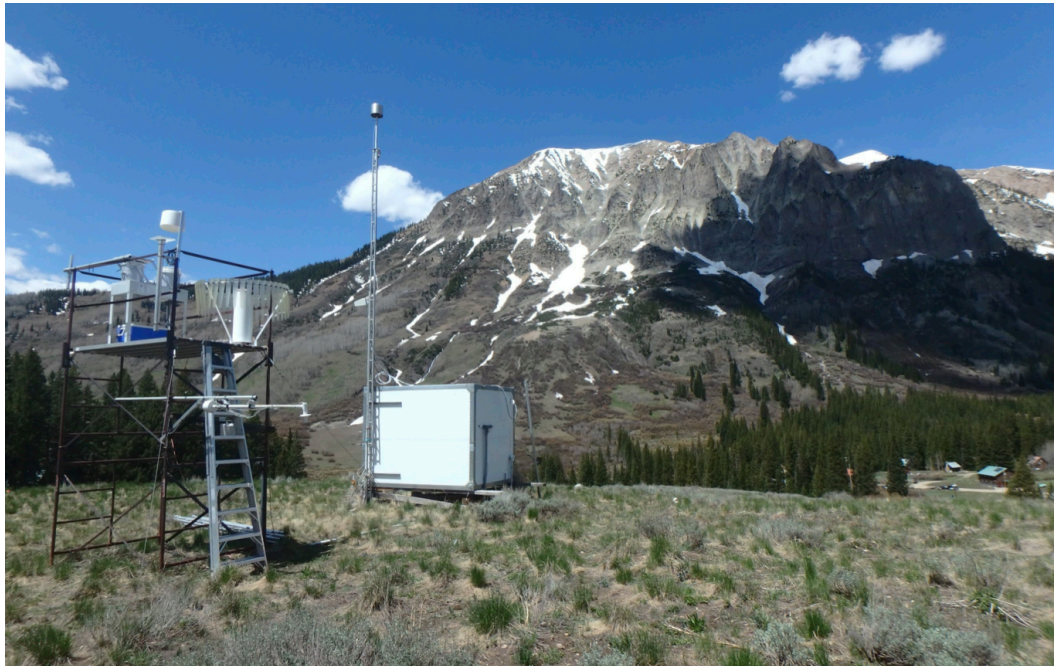
West/Northwestern US



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

Using CASTNET Data as a Proxy for Dust





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	Week	Year	DATEON	DATEOFF	Ca	Cl	HNO_3	K	Mg	Na	NH_4	NO_3	SO_2	SO_4	TNO_3
GTH161	1	2022	1/04/2022	1/11/20	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	1/18/20	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	1/25/20	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	2/01/20	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	2/08/20	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	2/15/20	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	2/22/20	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	3/01/20	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	3/08/20	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	3/15/20	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	3/22/20	0.091	0.013	0.1	0.017	0.017	0.016	0.105	0.172	0.074	0.286	0.326
GTH161	12	2022	3/22/2022	3/29/20	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	4/05/20	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	4/12/20	0.266	0.051	0.0	0.04	0.048	0.086	0.085	0.192	0.098	0.334	0.265
GTH161	15	2022	4/12/2022	4/19/20	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	4/26/20	0.086	0.377	0.0	0.036	0.051	0.35	0.115	0.423	0.055	0.473	0.493

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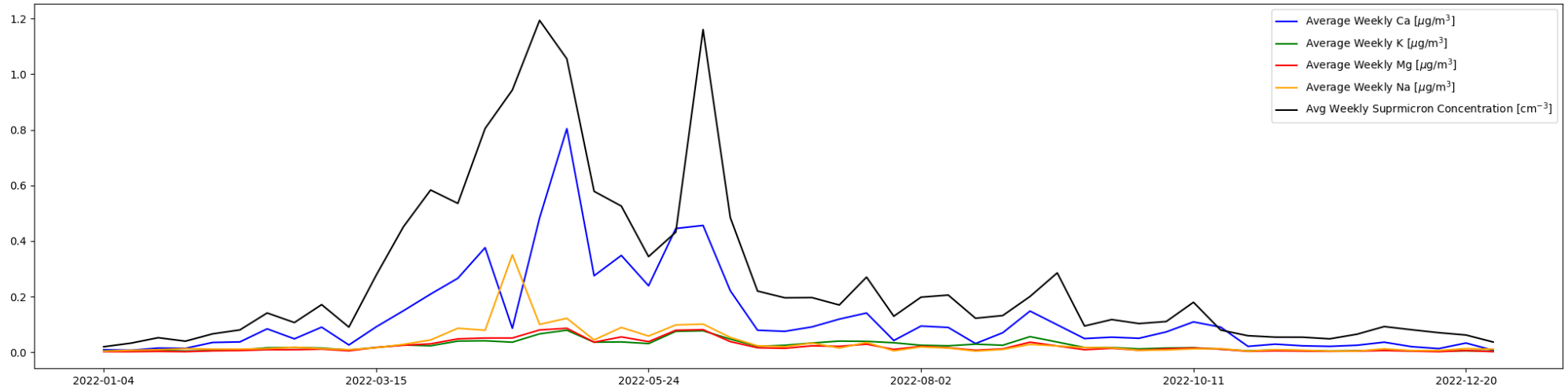

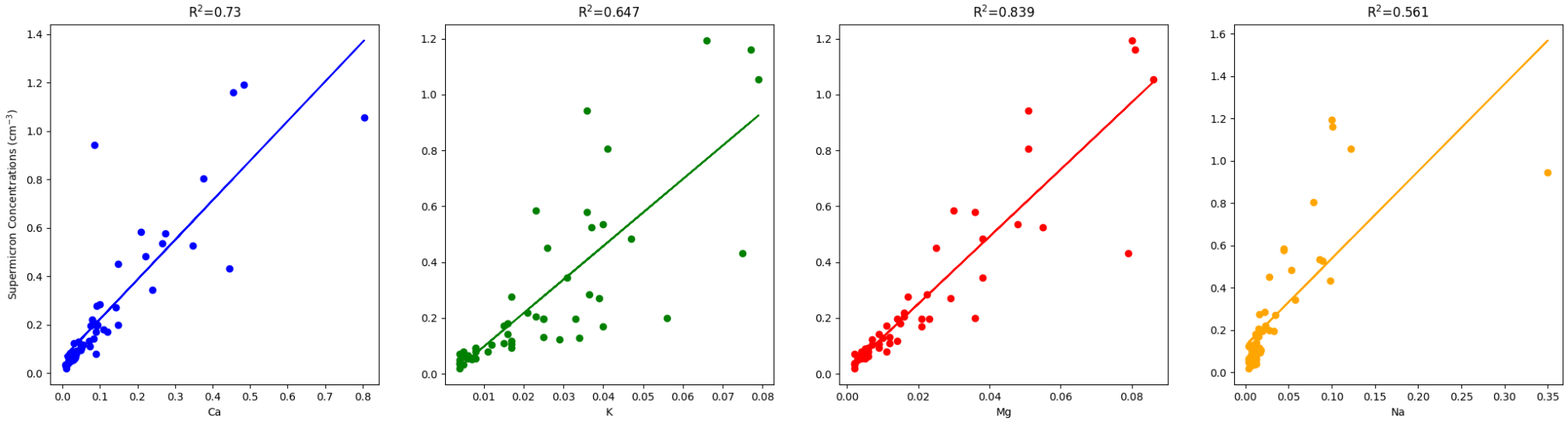

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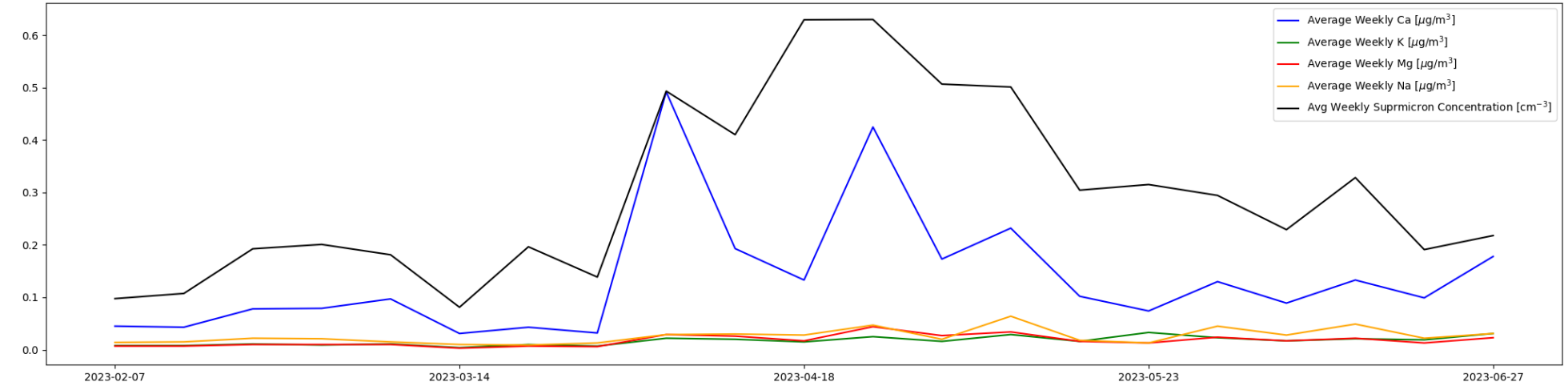
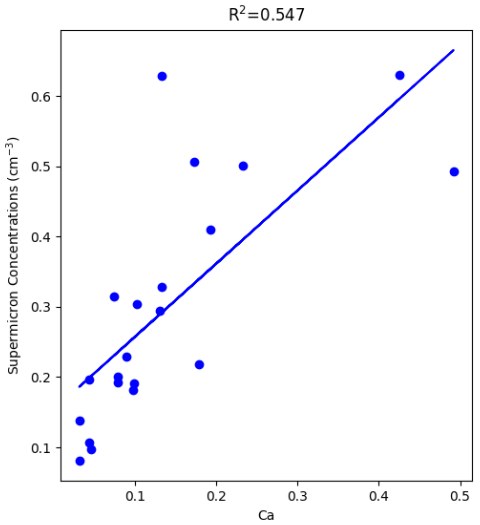
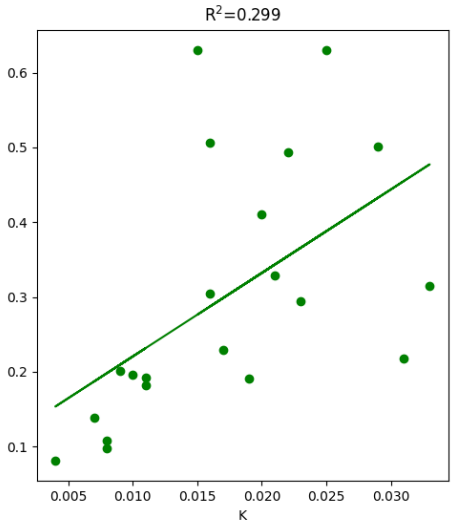
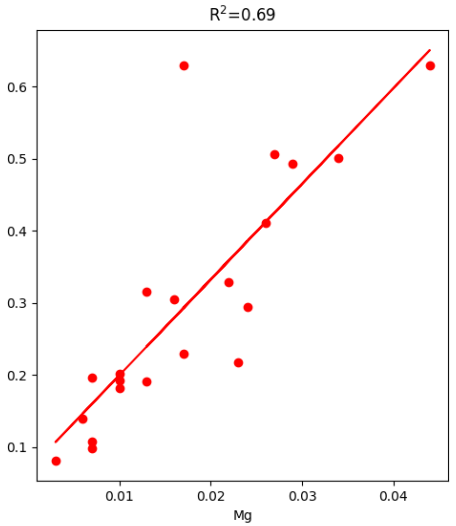
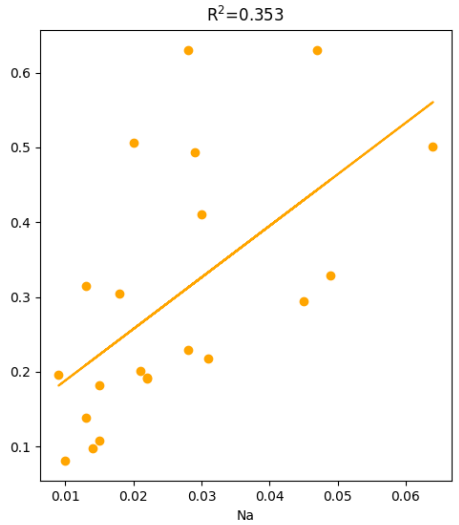






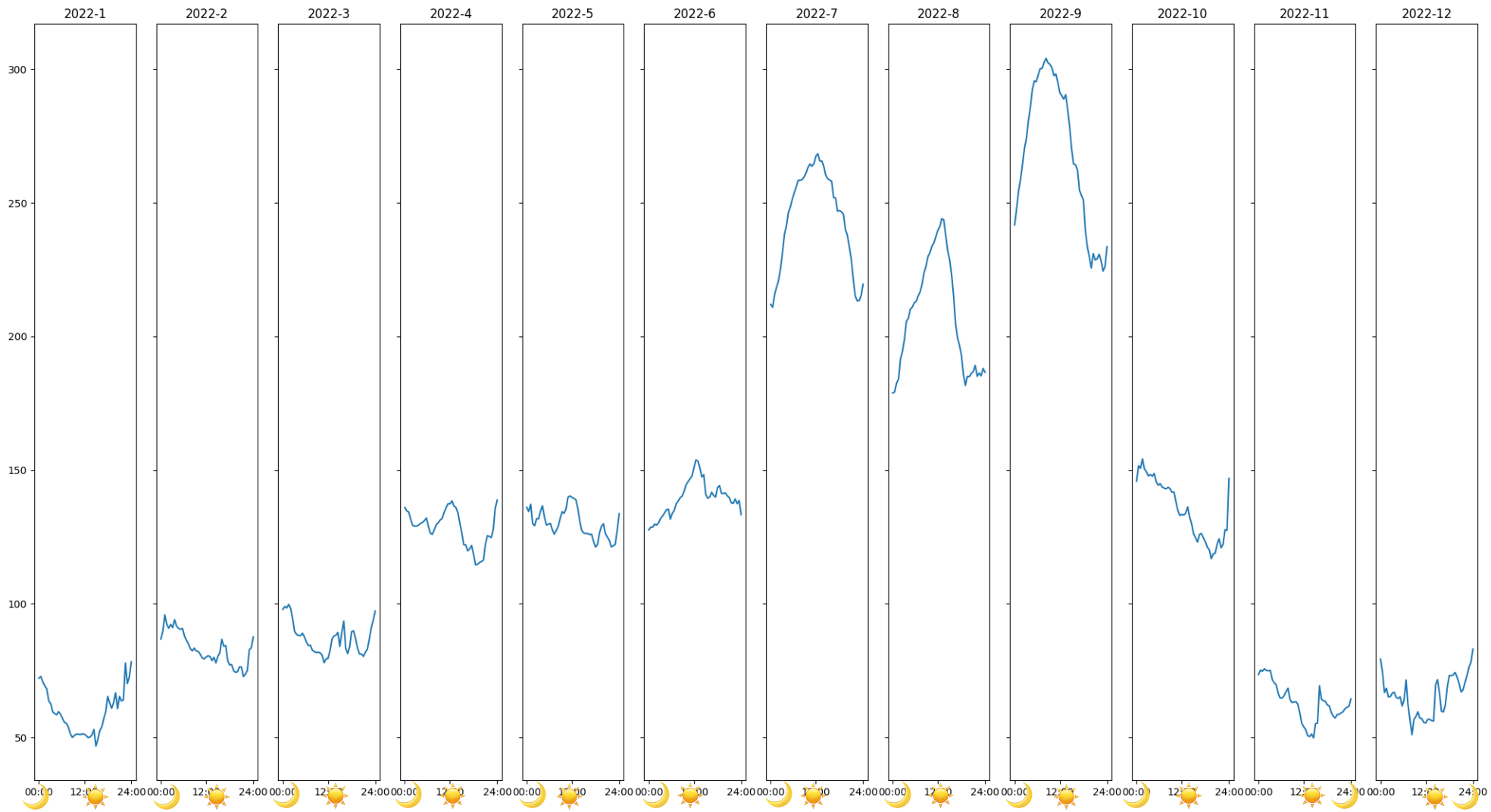




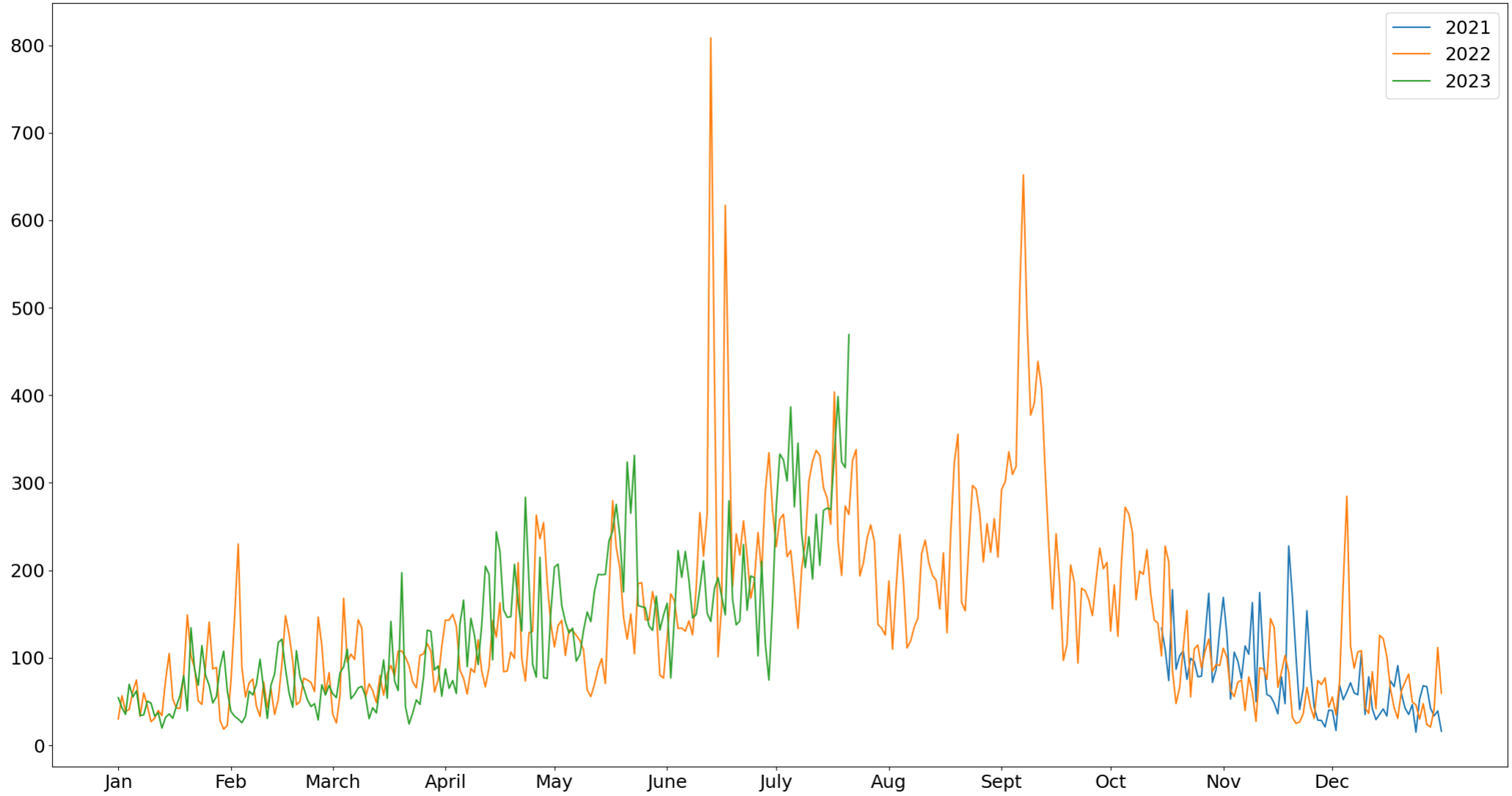
Questions & Discussion

- 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?

Seasonality and Diurnal Patterns



Differences Over the Years



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