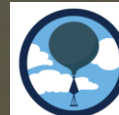


PM Studies in the El Paso-Juarez Airshed

Rosa M. Fitzgerald

Nakul Karle, William R. Stockwell, Ricardo Sakai, Duanjun Lu, Laura Fierce
Joscelyne Guzman, Fatema Tuz Zohora, Suzan Aranda



NCAS-M | NOAA COOPERATIVE SCIENCE
CENTER IN ATMOSPHERIC
SCIENCES AND METEOROLOGY



We have studied PM using:

- **Time series distribution, seasonal variations.**
- **Meteorology, i.e., PBL impacts.**
- **CAMs simulations.**
- **PSAT analysis.**
- **First principles model calculations for a regular and aged carbon aerosol particle.**

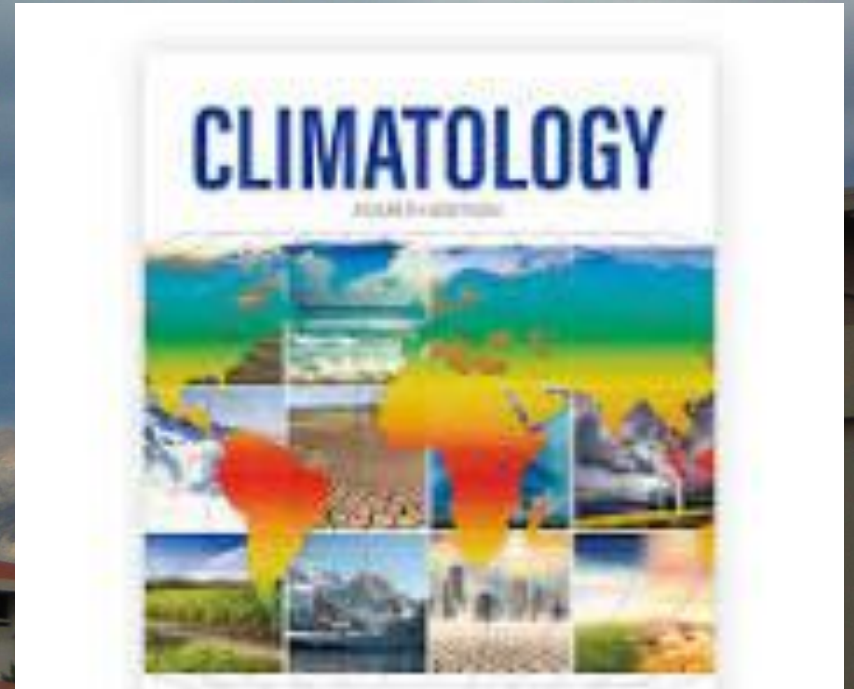


EPA Characterizes PM by its aerodynamic diameter.

PM2.5: Diameter $\leq 2.5 \mu\text{m}$, 2 categories: Primary and Secondary.

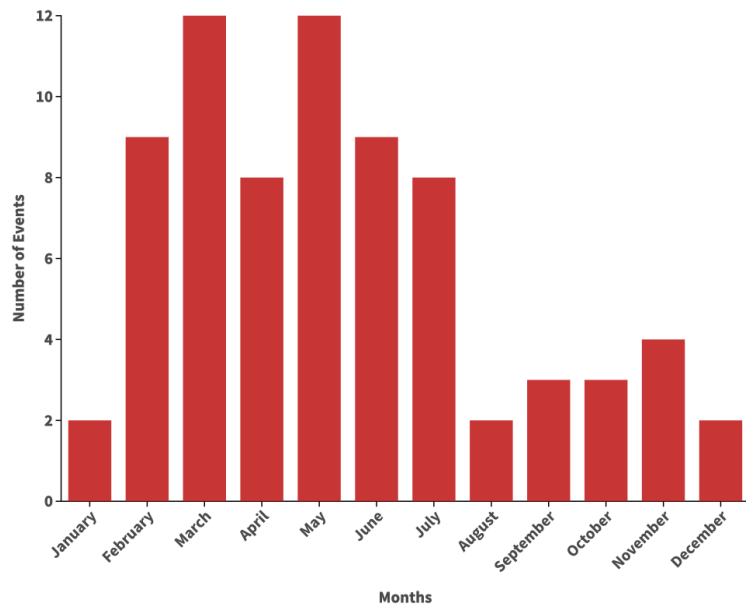
PM10: Diameter $\leq 10 \mu\text{m}$

Air Pollution



PM10

Monthly Distribution of high PM10 Events in El Paso, TX from 2016-2022

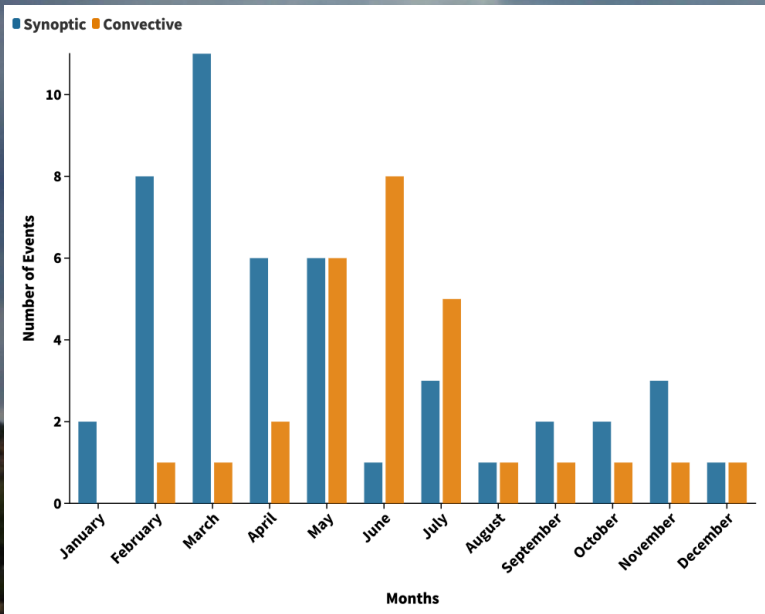


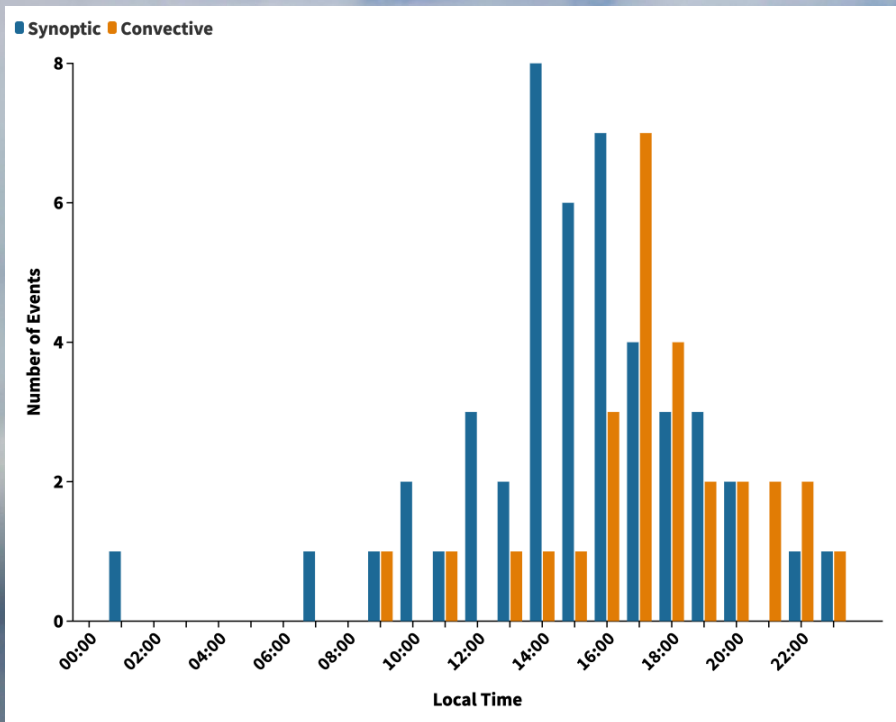
The graph shows the monthly distribution for synoptic and convective cases.

- We divided those events into **synoptic and convective cases**.

Synoptic cases were accompanied by a cold front, they happen during late winter and the spring months.

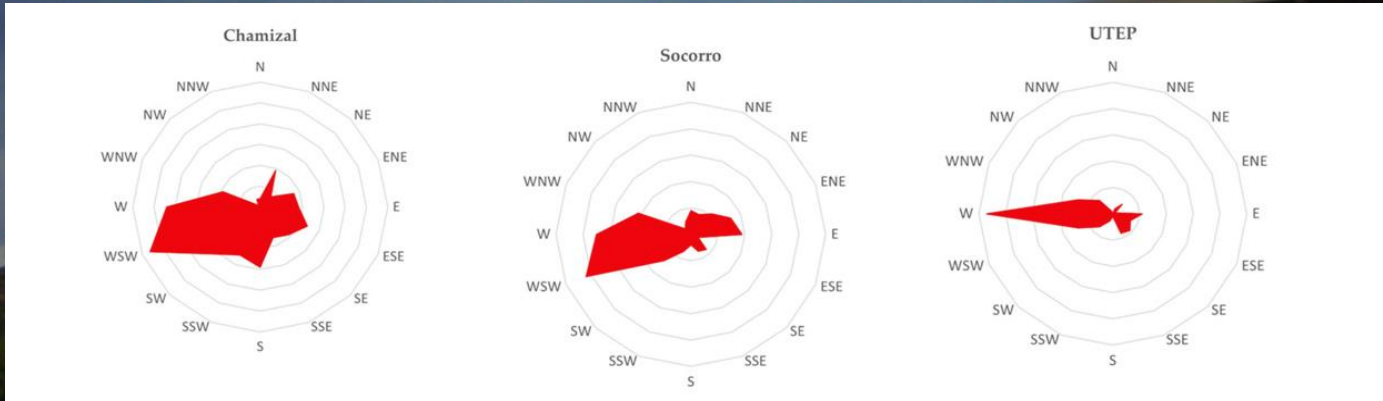
Convective cases happen in summer months, originating from thunderstorms, microbursts.





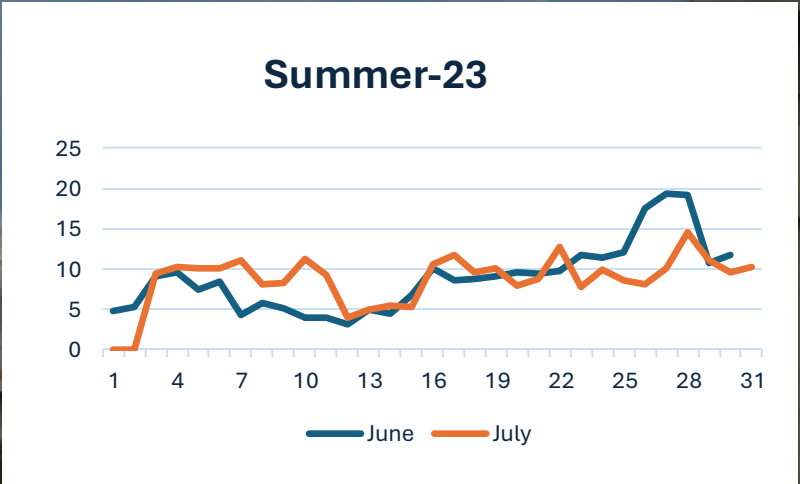
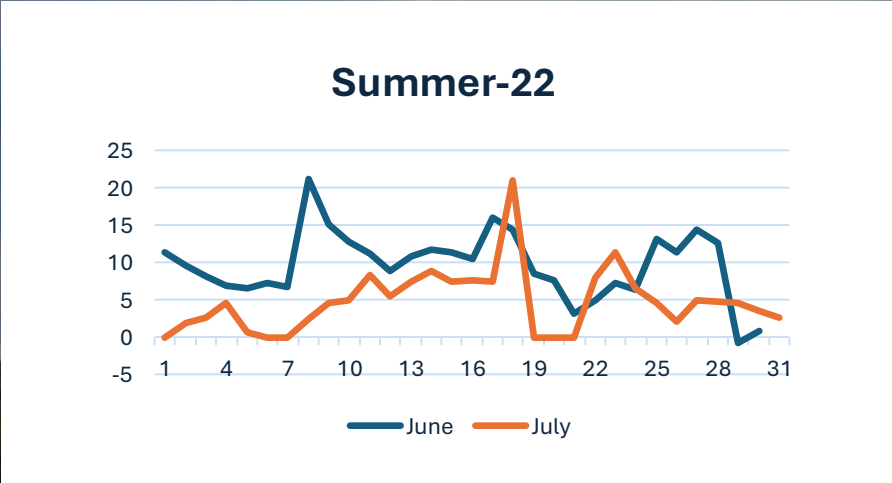
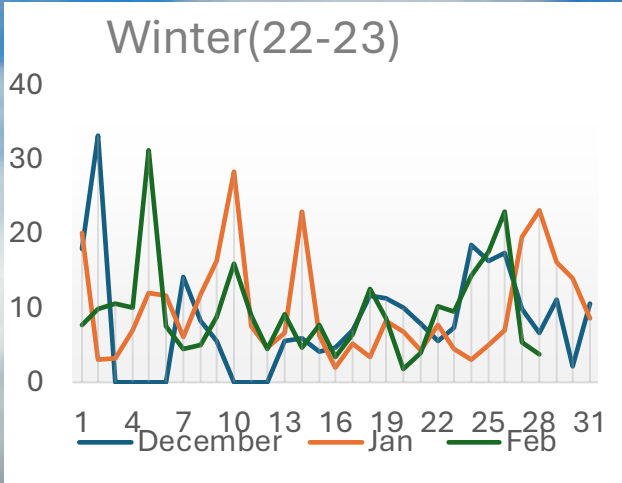
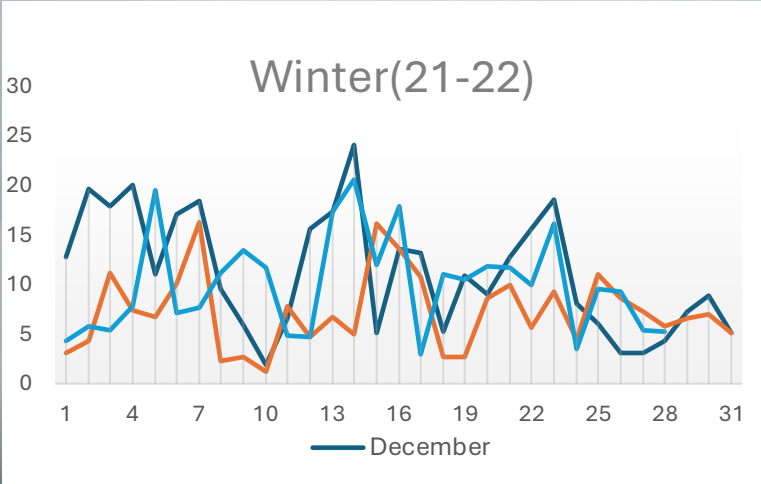
PM10

- High PM10 events tend to happen more between the 2pm to 5pm local time.

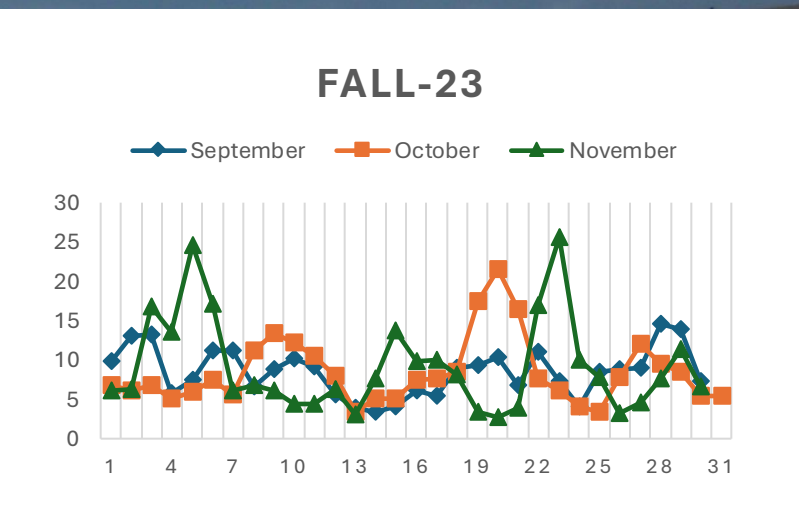
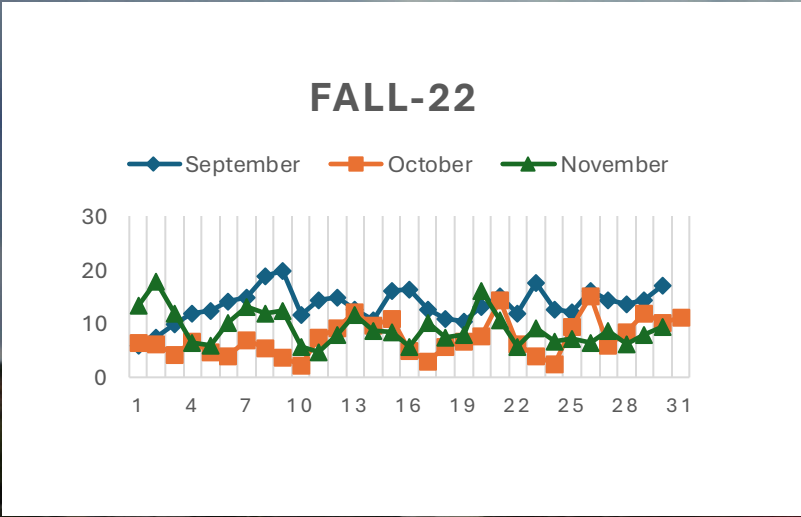
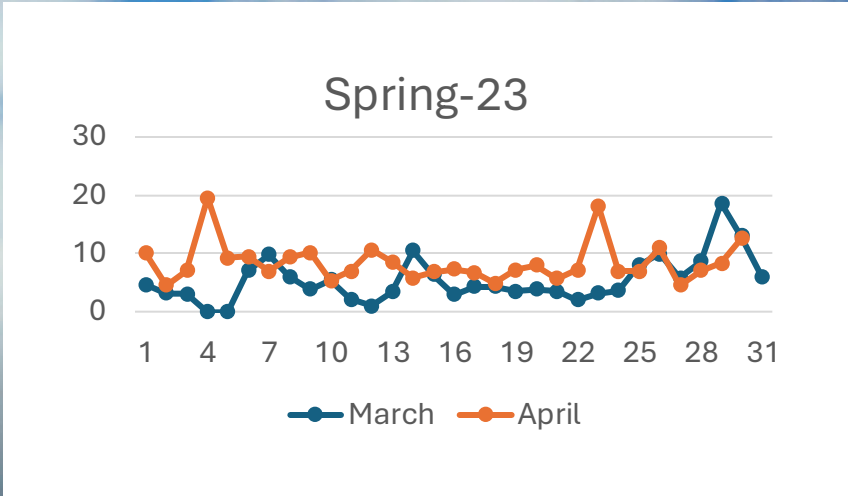
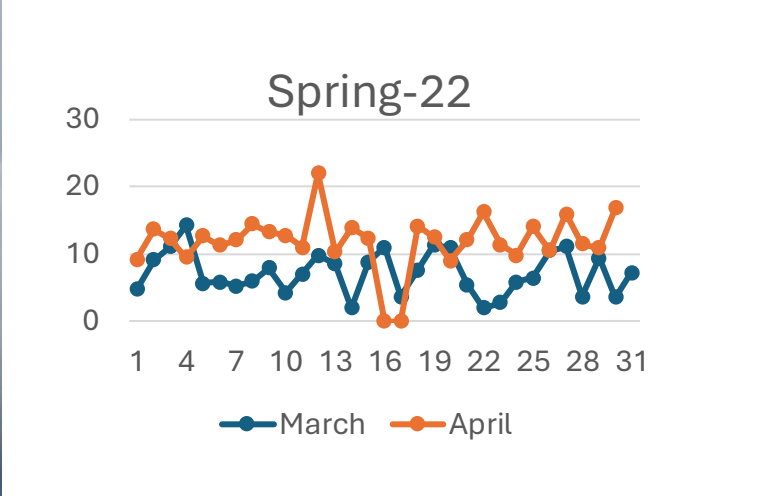


We came across 683 possible dust events across all 3 CAMS.

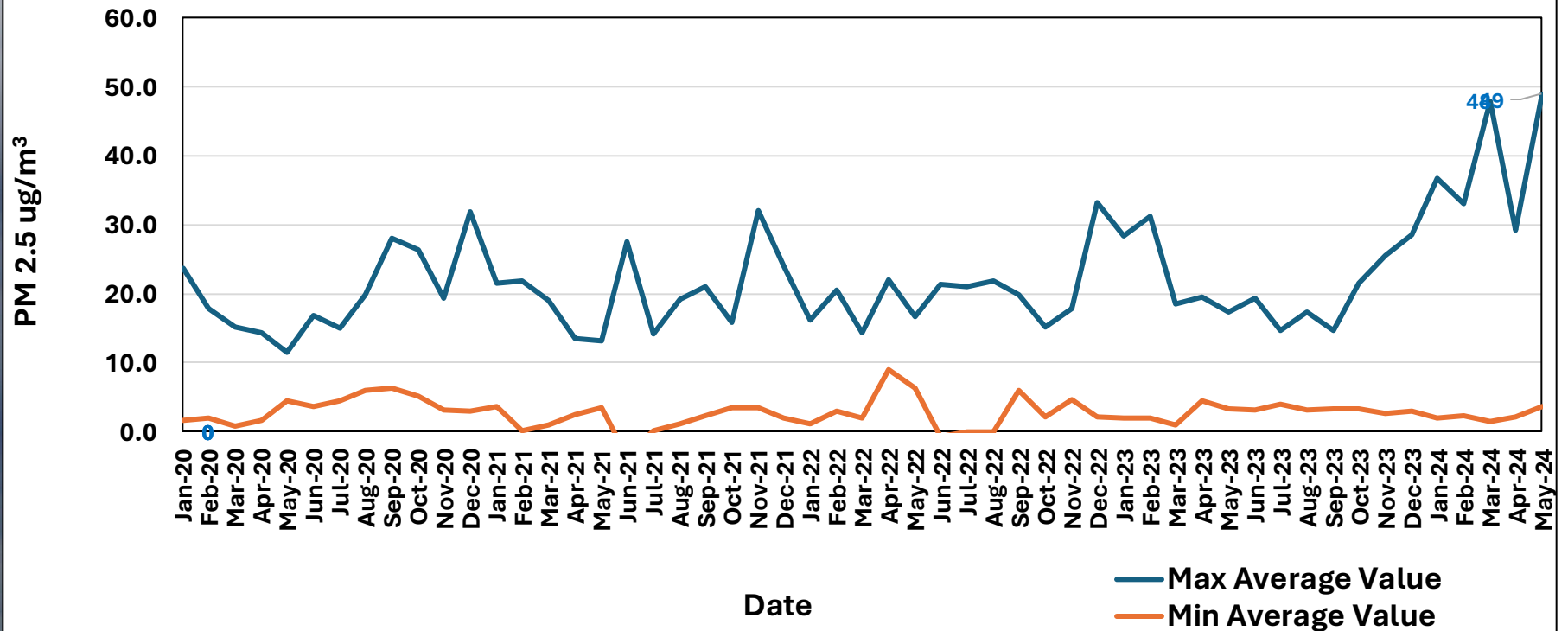
PM2.5



PM2.5

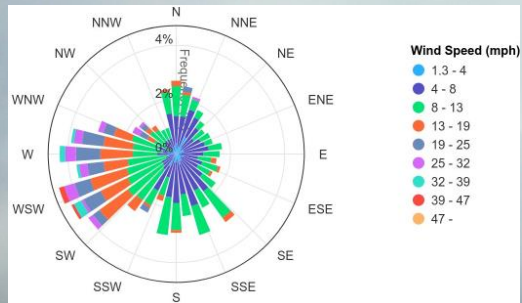


Monthly PM 2.5 values from 2020 through 2024

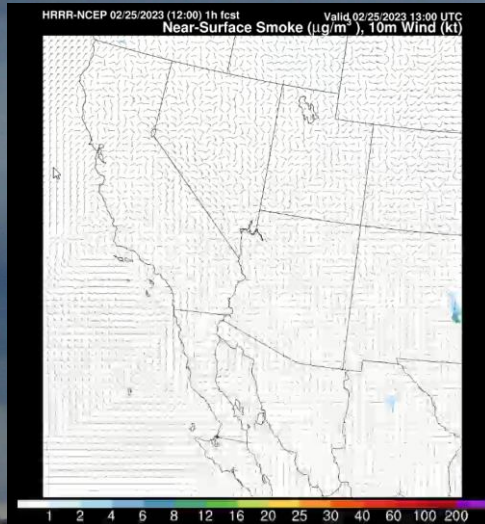
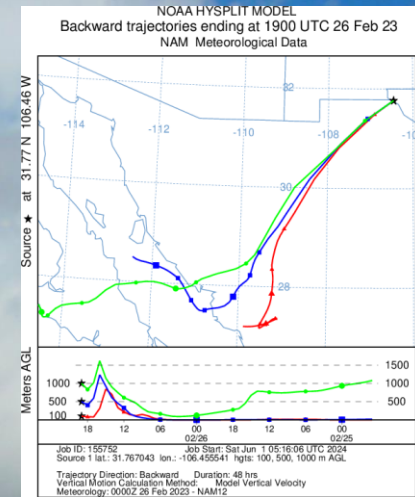
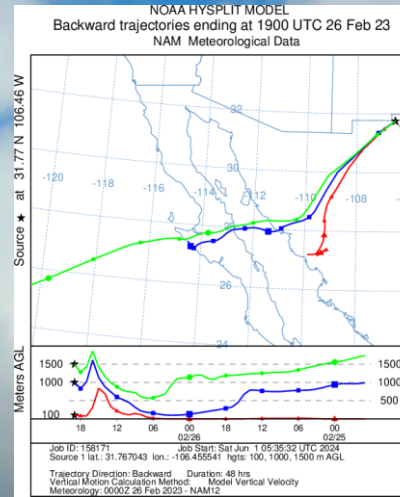


PM Sources

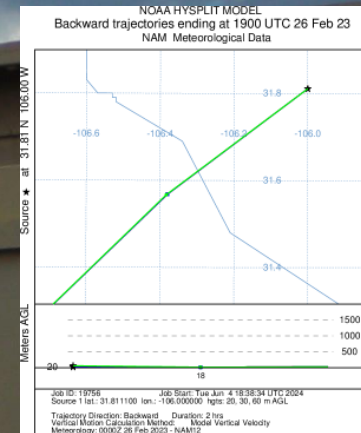
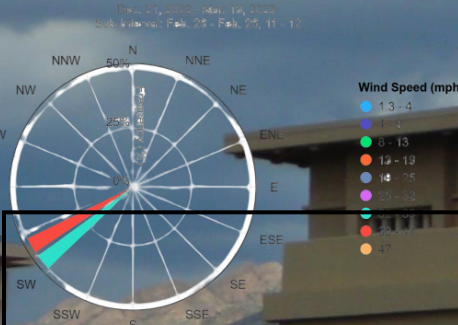
December 21, 2022 – March 19, 2023



Different heights: 100-500-1000 / 100-1000-1500



EL PASO INTL AP (TX) Wind Rose



Height
s:
20m
30m
60m

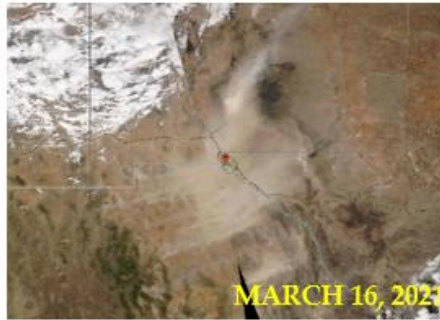
Dust Storms



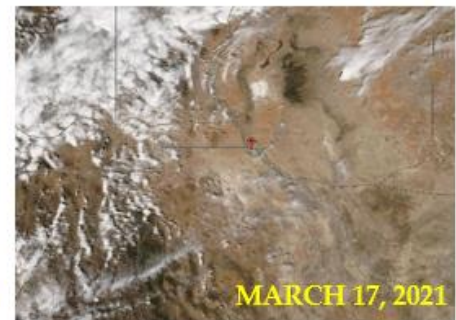
March 29, 2023



MARCH 15, 2021



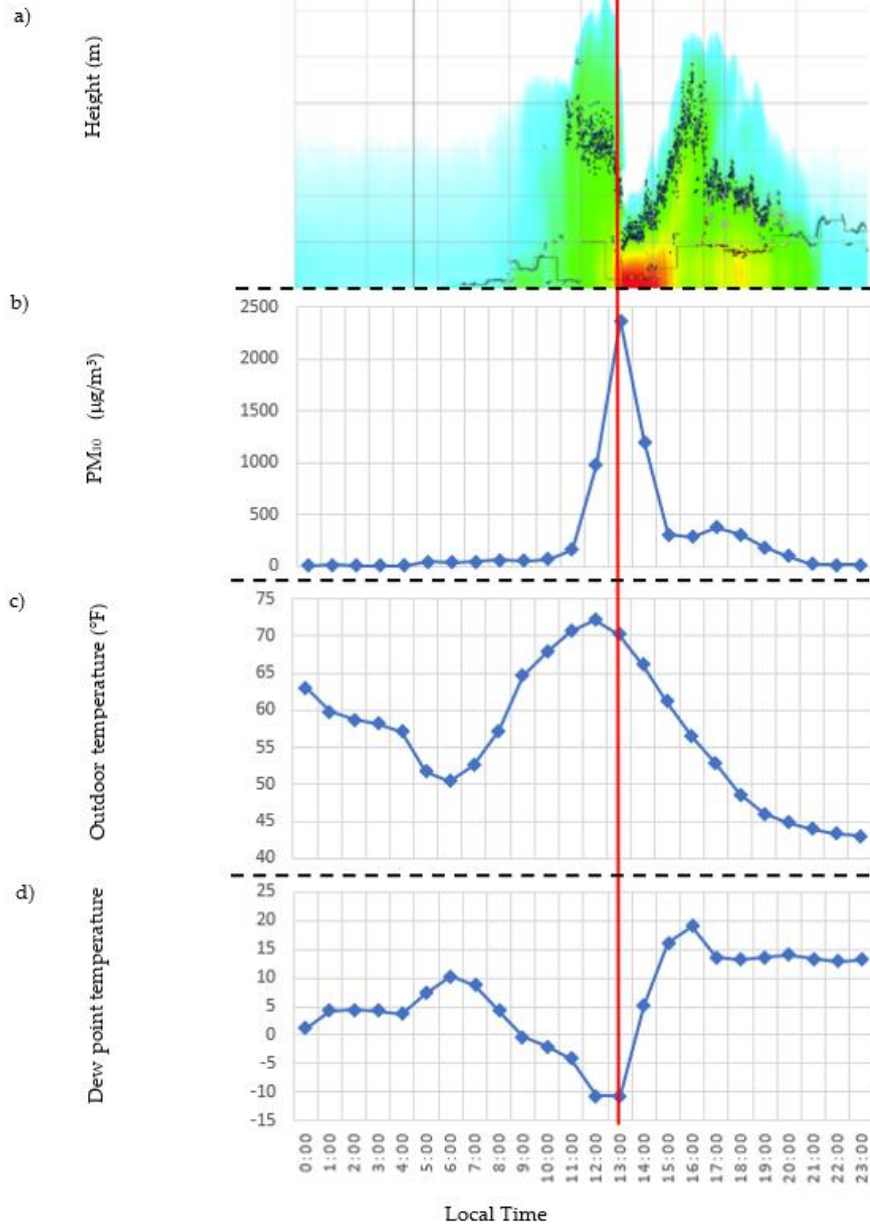
MARCH 16, 2021



MARCH 17, 2021

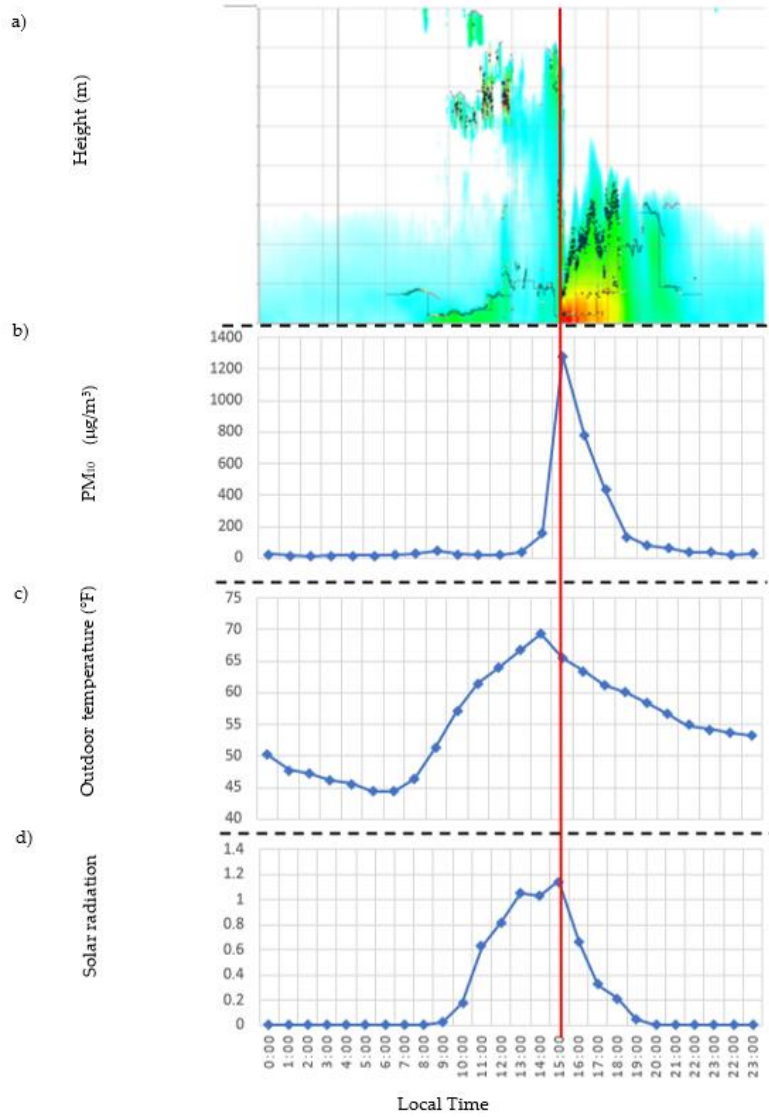
Dust Storm on March 16, 2023

PBL Impact



March 16, 2021 event at 12:00 local time, synoptic case.

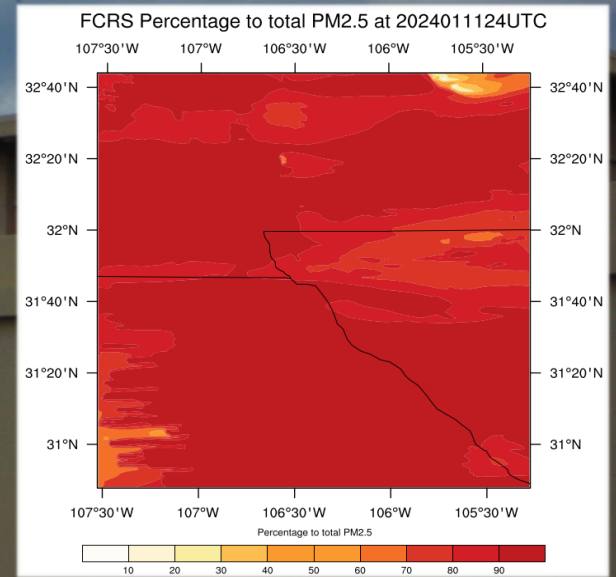
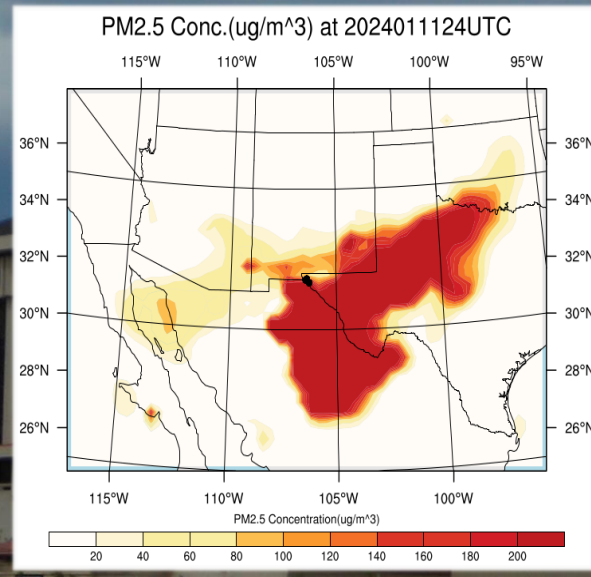
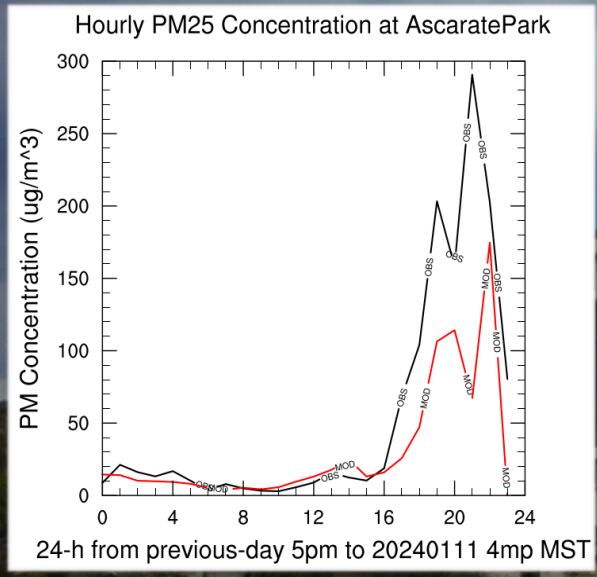
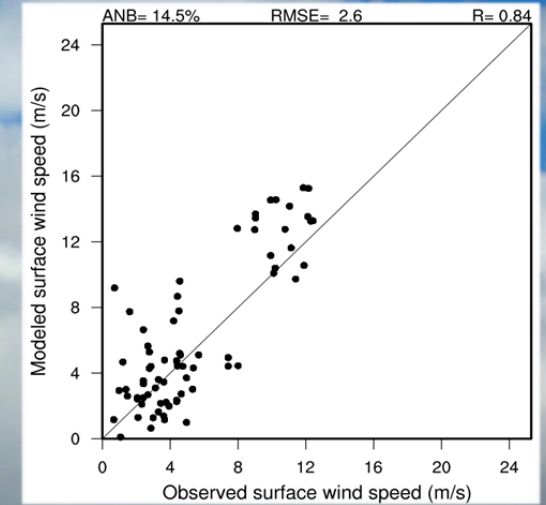
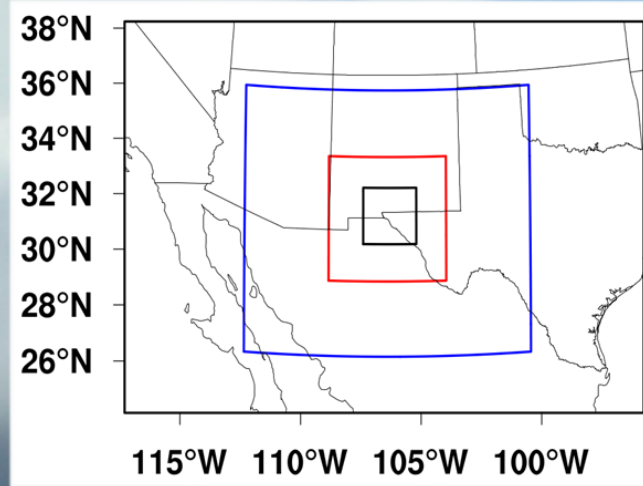
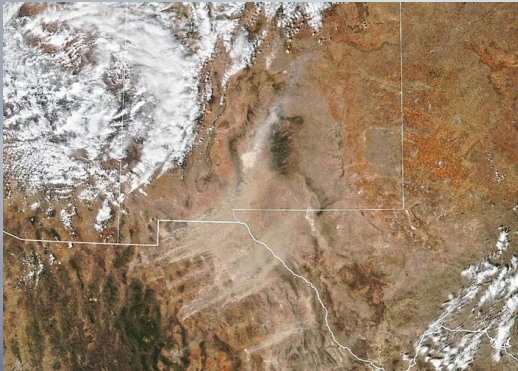




February 22, 2023,
Convective case

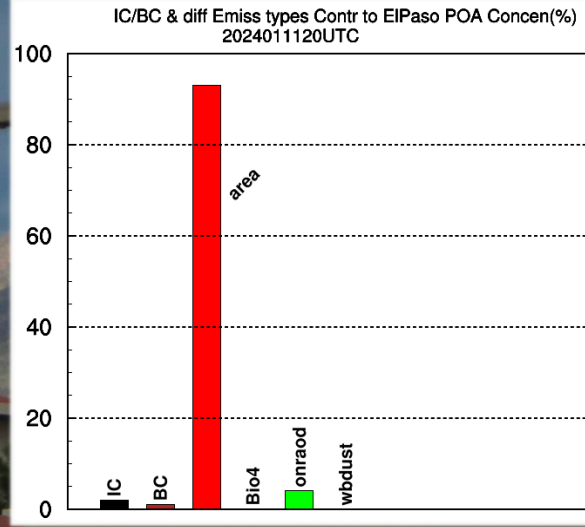
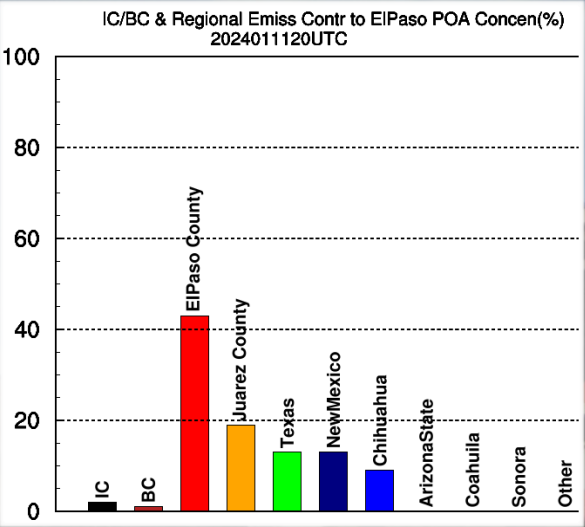
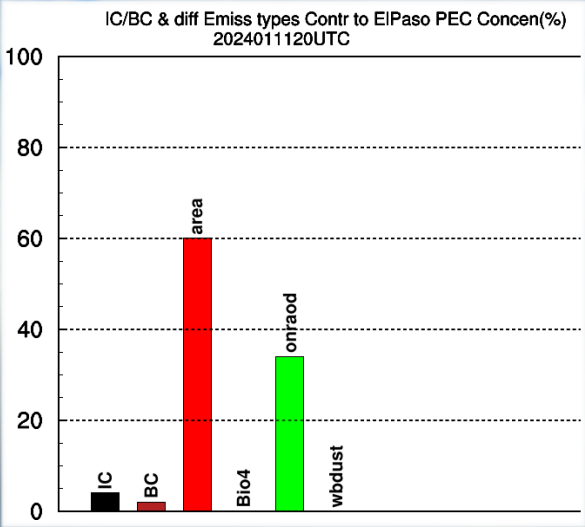
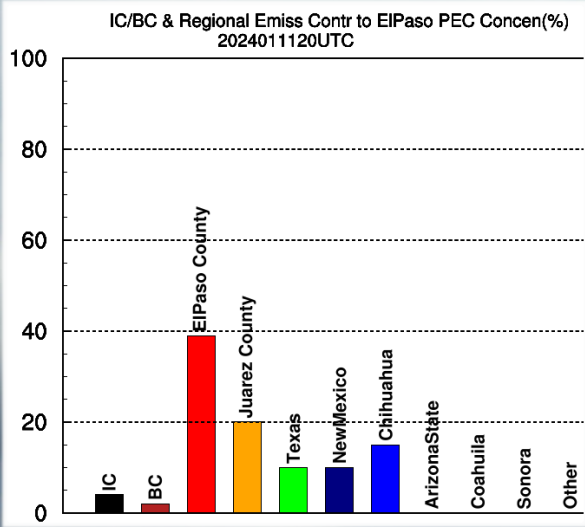
Published:
 Joscelyn Guzman-Gonzalez, Rosa M. Fitzgerald, Nakul N. Karle, Ricardo K. Sakai, William R. Stockwell, "Particulate Matter in the American Southwest: Detection and Analysis of Dust Storms Using Surface Measurements and Ground-Based LIDAR", *Atmosphere*, 15, January 2024, <https://doi.org/10.3390/atmos15010110>.

CAMx Simulations, January 11, 2024

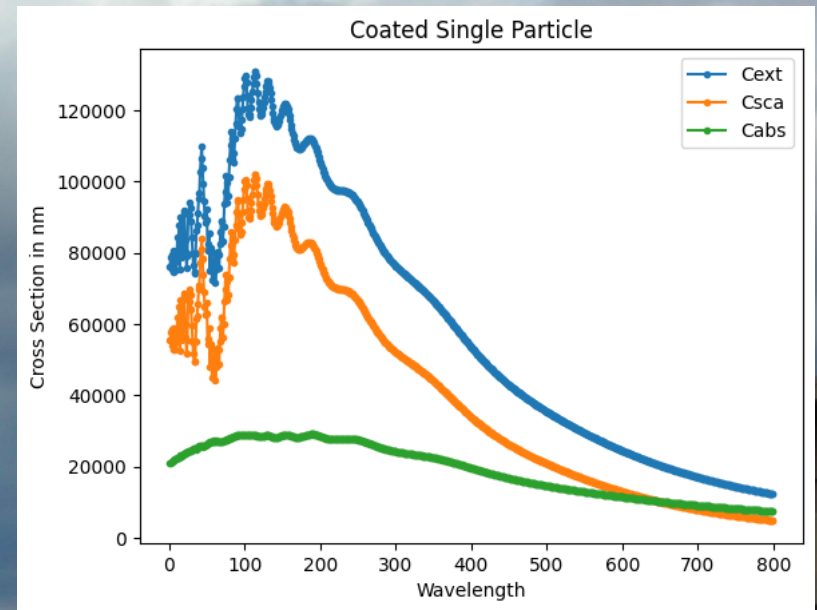
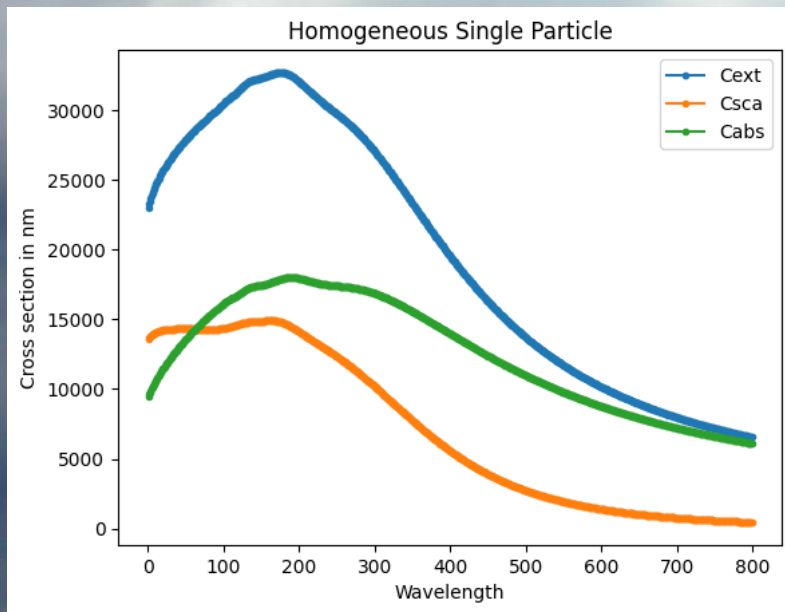


fine crustal PM2.5

PSAT

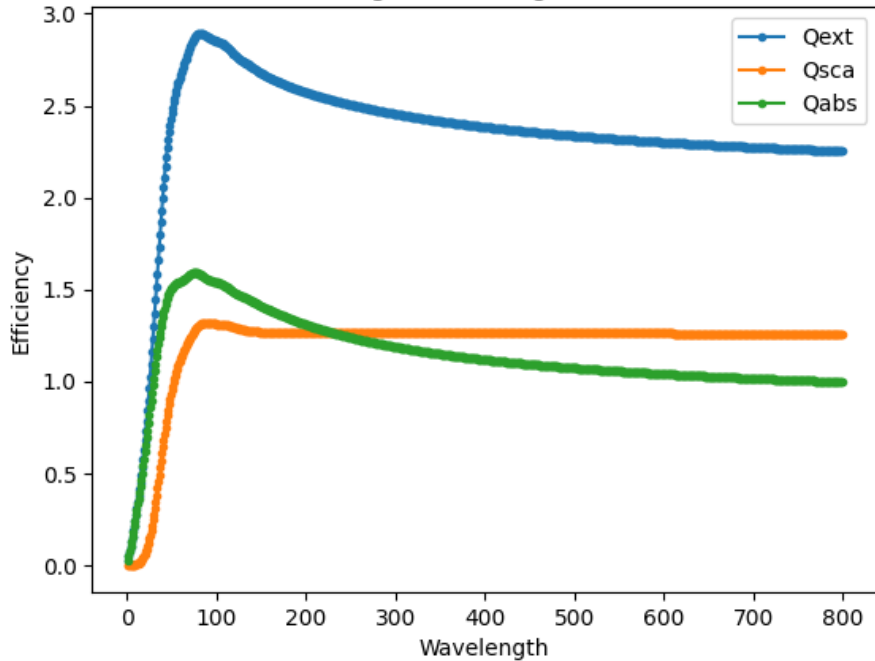


Model Results for a Carbon particle Cross Section without and with a Shell

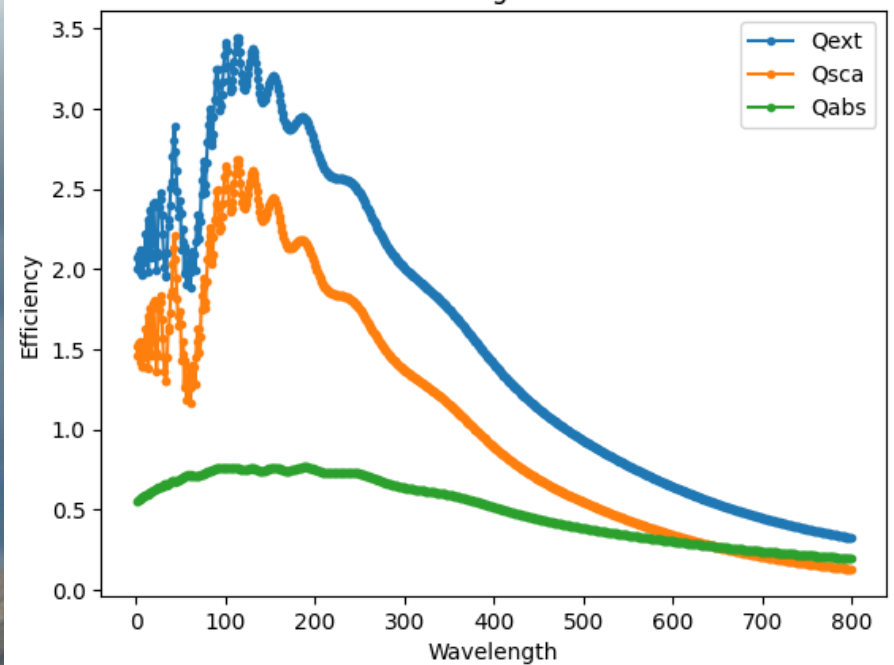


Model Results for a Carbon particle Efficiency without and with a Shell

Homogeneous Single Particle



Coated Single Particle



Conclusions

- First Comprehensive Study Analyzed the intricate relationship between PM and the PBL Heights.
- Identification of Dust Events as Synoptic and Convective Occurrences.
- The collapse of the PBL during a Dust Storm (the passage of a Cold Front for the Synoptic Case and the Diminished Solar radiation because of high PM concentrations for the Convective Case).
- The PM_{2.5} Analysis is in progress...
- Successfully implemented PSAT to Detect Sources of PM_{2.5} in our region.
- Modeling from first principles light inter-action with a carbon aerosol particle with and without a shell will allow us to obtain optical signatures to detect regular carbon particles vs aged carbon particles in the atmosphere for future analysis.



THANK YOU