



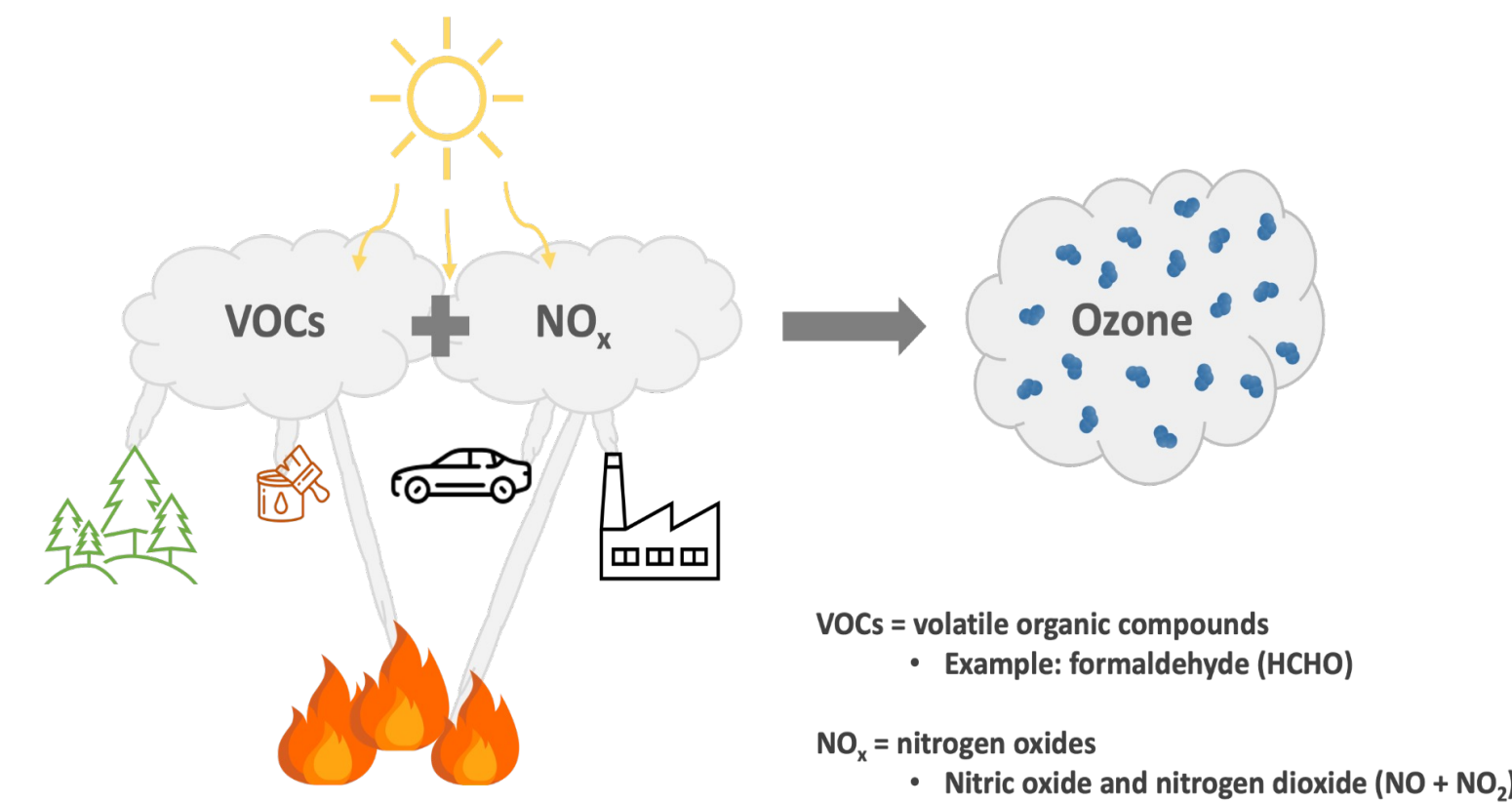
# Examining the Influence of Meteorology on High O<sub>3</sub> and PM<sub>2.5</sub> Events at Chiwaukee Prairie, WI in June 2022



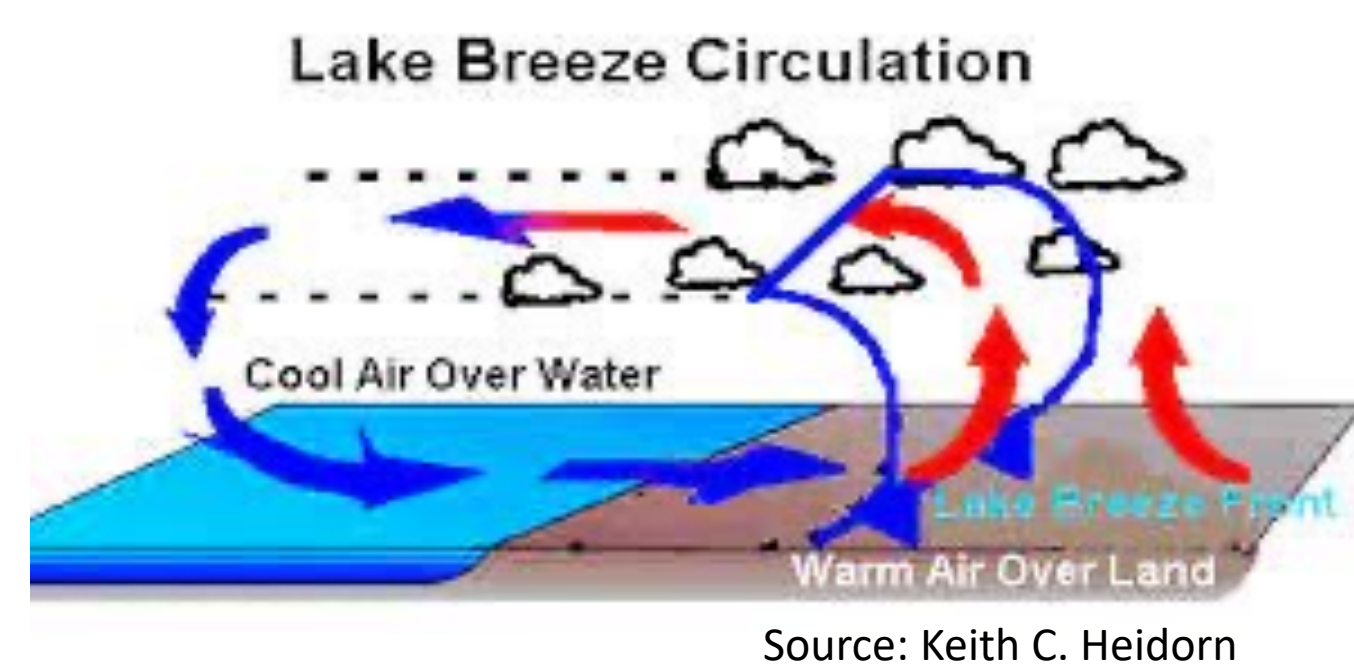
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## I. Background

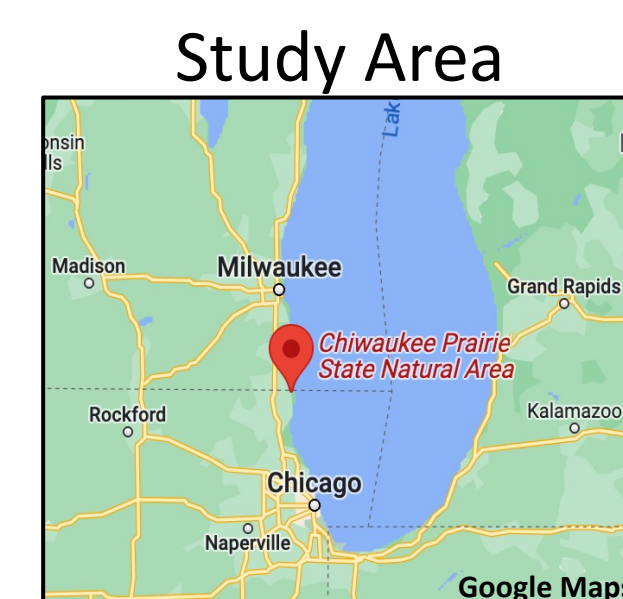


Poor air quality has a direct impact on human health, such as causing respiratory illnesses and shortness of breath. In June 2022, Chiwaukee Prairie, WI, experienced bad air quality due to abnormally high amounts of ozone (O<sub>3</sub>) and fine particulate matter (PM<sub>2.5</sub>). Chiwaukee Prairie is located north of Chicago, IL, along the Lake Michigan shoreline. The combination of Chicago's heavily populated and polluted city and transport associated with Lake Michigan's lake breeze often makes the pollution levels high at Chiwaukee Prairie. We conducted this study to investigate the relationship between synoptic and mesoscale meteorology and elevated amounts of O<sub>3</sub> and PM<sub>2.5</sub> in Chiwaukee Prairie.



## II. Research Question

- How did synoptic and mesoscale meteorology influence bad air quality in Chiwaukee Prairie, WI, on June 14 and 15, 2022?



## III. Dataset Sources

- WI DNR EOM: Wisconsin Department of Natural Resources Enhanced Ozone Monitoring program
- NARR: North American Regional Reanalysis
- GOES-16: Geostationary Operational Environmental Satellites-16

\*All datasets were processed using Python

## IV. Results

### June 14, 2022 – High Ozone (O<sub>3</sub>)

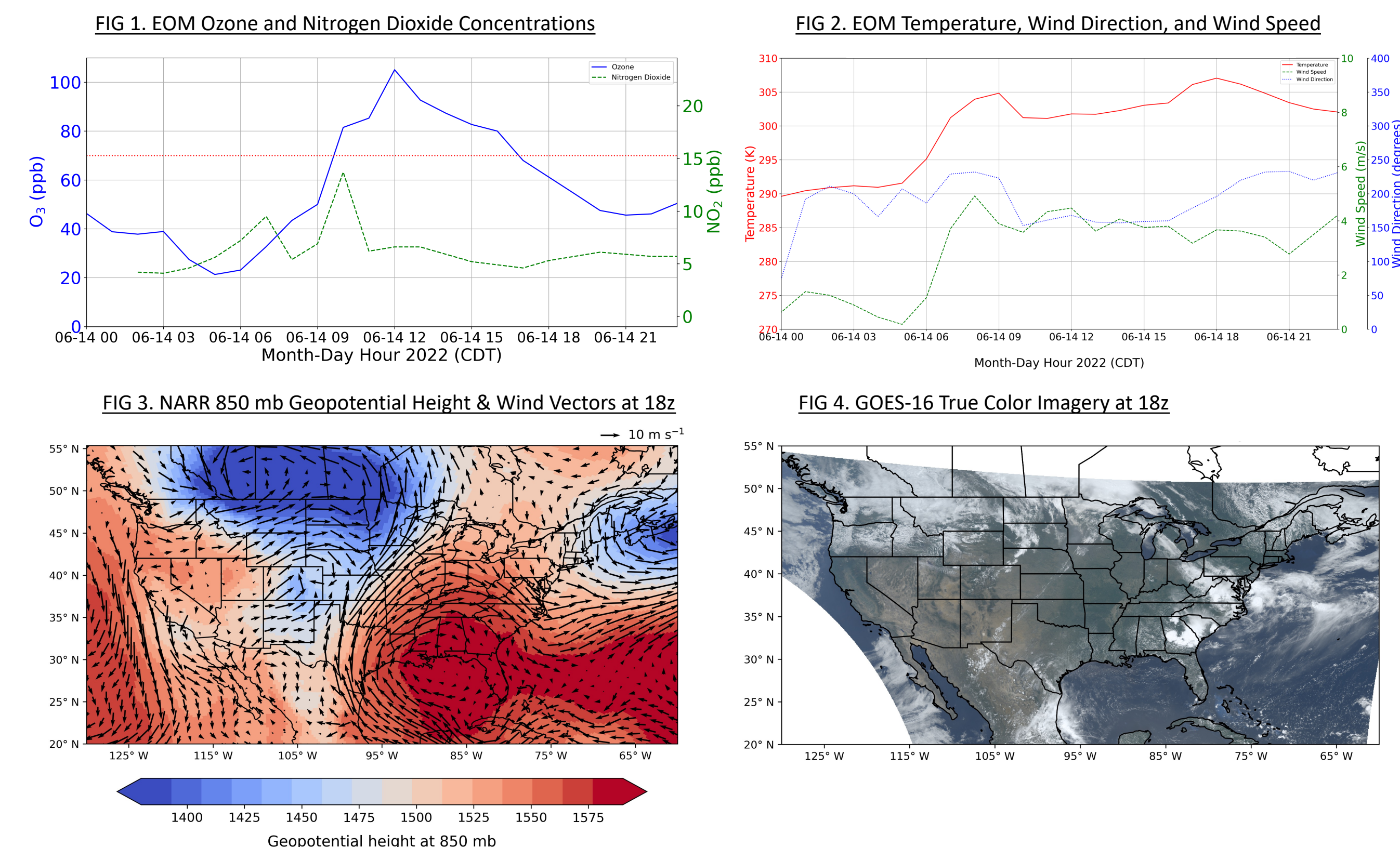


FIG 1. As O<sub>3</sub> concentrations increase (peak at 12pm CDT), NO<sub>2</sub> levels decrease. FIG 2. Mesoscale meteorological variables show evidence of a lake breeze that is coincident with increases in O<sub>3</sub> levels. FIG 3. The high-pressure system across the SE U.S. creates southwesterly synoptic winds near Chiwaukee Prairie at 18z (1pm CDT). FIG 4. GOES-16 true color image shows clear skies over Chiwaukee Prairie.

### June 15, 2022 – High Fine Particulate Matter (PM<sub>2.5</sub>)

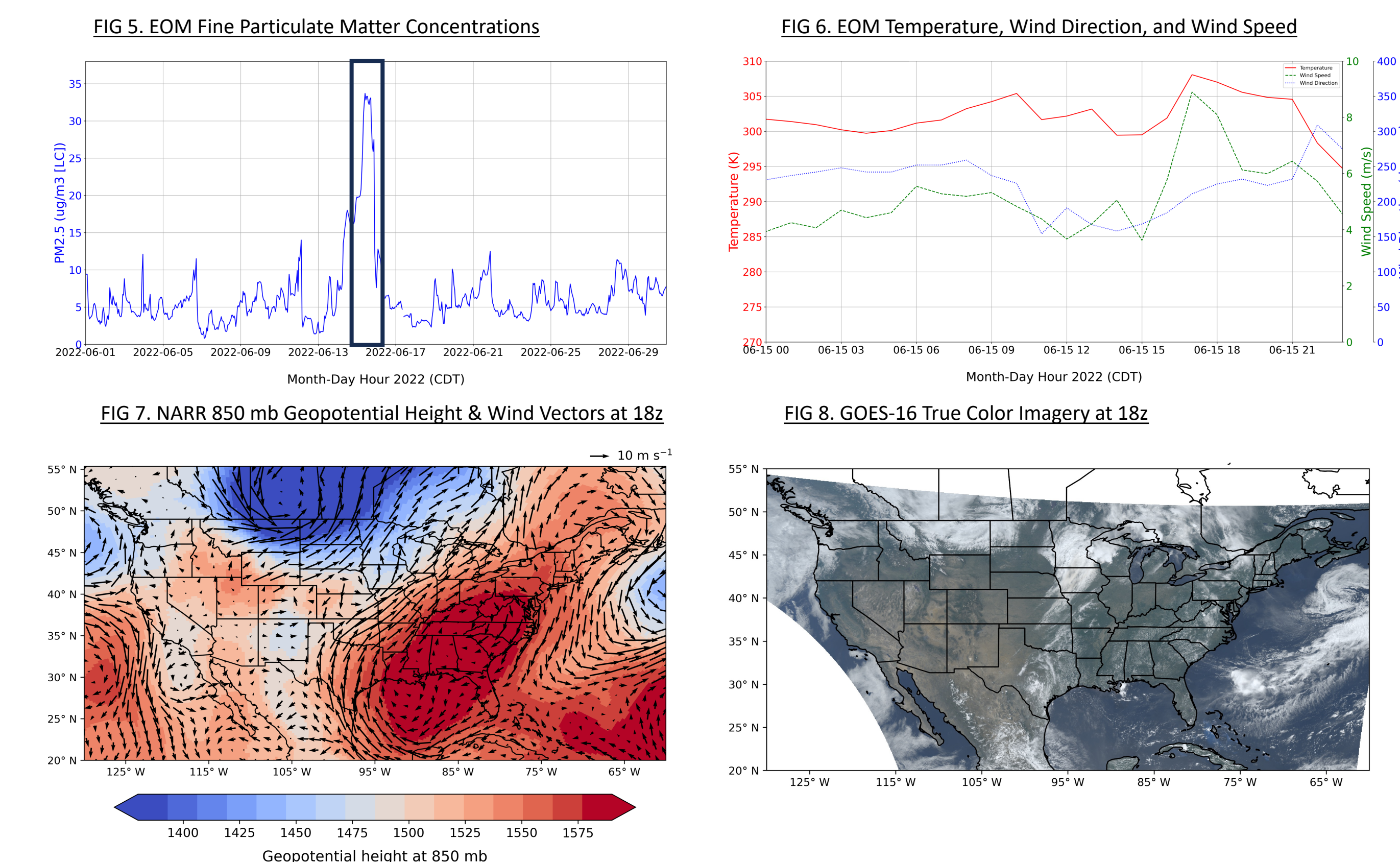


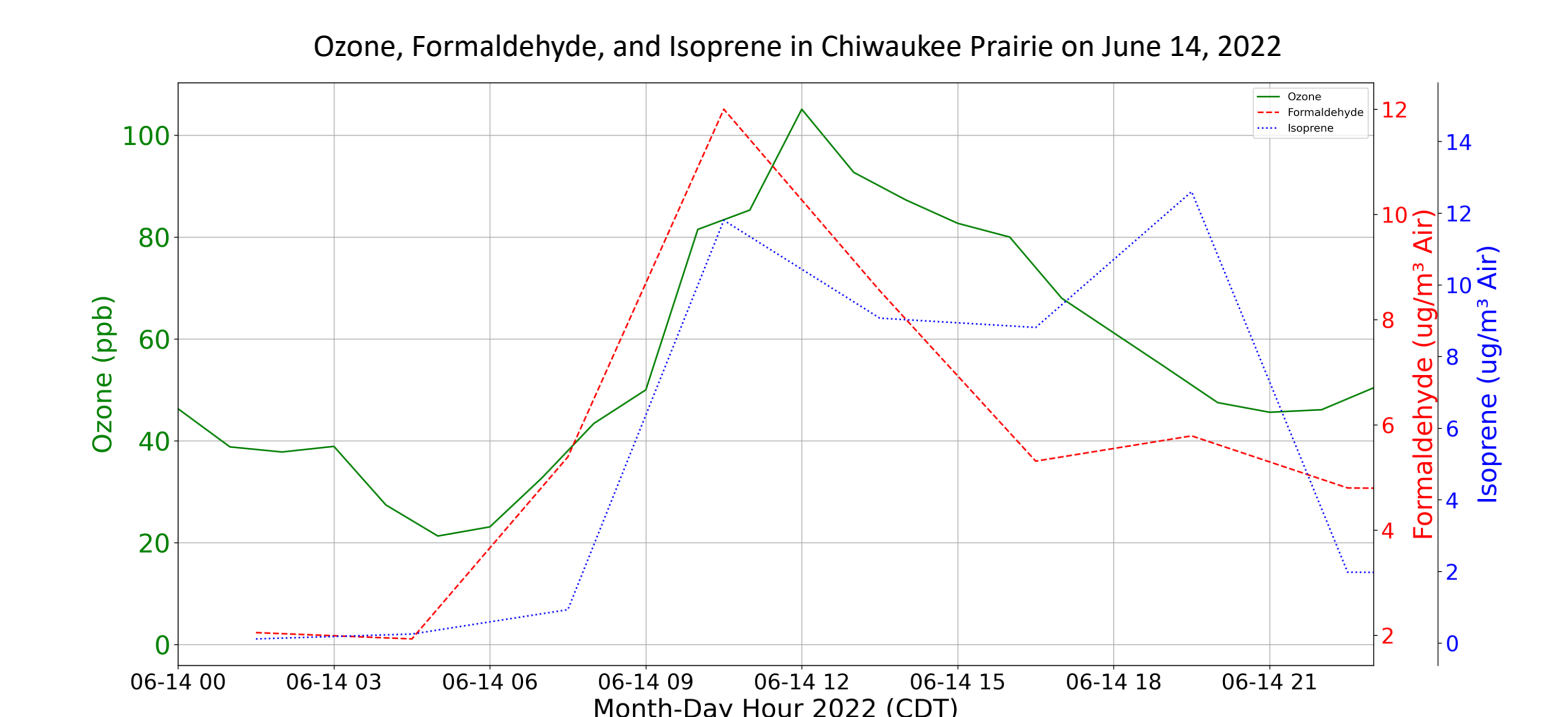
FIG 5. Time series of PM<sub>2.5</sub> values showing that June 15 has a significantly higher amount than the rest of the month. FIG 6. There was a lake breeze, but PM<sub>2.5</sub> levels were already high preceding the lake breeze. FIG 7. There was still southeasterly synoptic flow, but there was an approaching low-pressure system from the northwest. FIG 8. GOES-16 true color image shows mostly clear skies over Chiwaukee Prairie and clouds to the west associated with the encroaching low.

## V. Conclusions

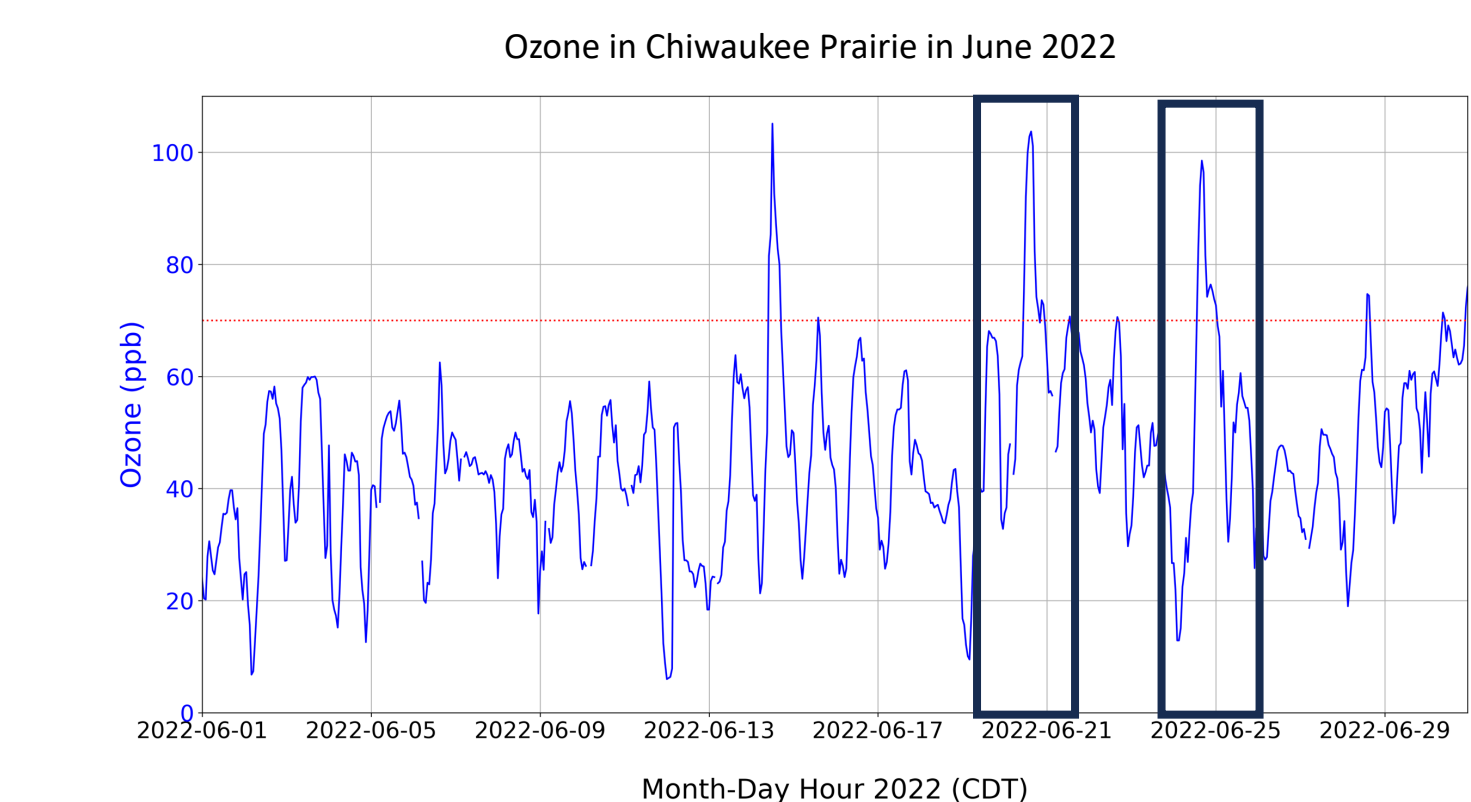
- Air pollution can be transported on different scales:
  - High O<sub>3</sub> event on June 14, 2022, was driven by **mesoscale lake breeze** pollution transport.
  - Significant increase in O<sub>3</sub> levels occurred at the same time as the arrival of the lake breeze.
- High PM<sub>2.5</sub> event on June 15, 2022, was driven by **synoptic-scale** pollution transport.
  - Even though there was a lake breeze present, PM<sub>2.5</sub> were already high beforehand

## VI. Future Work

- Identify which VOC is the main contributor to ozone formation:



- Compare meteorological conditions to other ozone exceedance days (June 20 and 24, 2022):



## VII. Acknowledgements

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