



Canadian Wildfires Polluted New Jersey in Early June 2023

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ABSTRACT

In early June 2023, New Jersey experienced a historical pollution event. In this project, I utilized satellite images and ground observations to investigate this pollution event and its link to the Canadian wildfires.

The VIIRS images detected widespread wildfire hot spots in Quebec, Canada and large-scale smoke plumes spreading the Canadian wildfire pollution across the northeastern US (including NJ) during this event. Further meteorological data analysis shows that a cyclone, positioned over Nova Scotia, Canada, generated a counterclockwise wind flow, carrying the pollutants from Canada into New Jersey.

This project demonstrates VIIRS's ability to pinpoint wildfire locations and monitor the wildfire pollution plumes, providing scientific guidance to potentially mitigate the health risks posed by wildfire pollution on human beings. Additionally, this study emphasizes how meteorological wind patterns can transport wildfire pollutants across borders, underscoring the importance of a global approach to combating wildfire pollution.

RESEARCH QUESTION/BACKGROUND

Between June 6th and June 8th, 2023, New Jersey experienced a historical pollution event, attributed to the Canadian wildfires. The New Jersey Department of Environmental Protection has declared an Air Quality Action Day for Particulate Matter¹ for Wednesday, June 7. Using VIIRS satellite images and ground observations, I attempted to investigate the following research questions:

- What was the severity of the pollution level in New Jersey in June 2023?
- Where were the locations of wildfires in Canada?
- How did the smoke plumes appear in satellite images?
- What is the connection between the Canadian wildfires and the pollution in New Jersey?

RESEARCH with supporting VIIRS Satellite Images

- The Suomi NPP's I-Band Fire Radiative Power images detect the widespread wildfire hot spots in Quebec, Canada, commencing on 3 June, and reaching the peak on 6 June 2023.

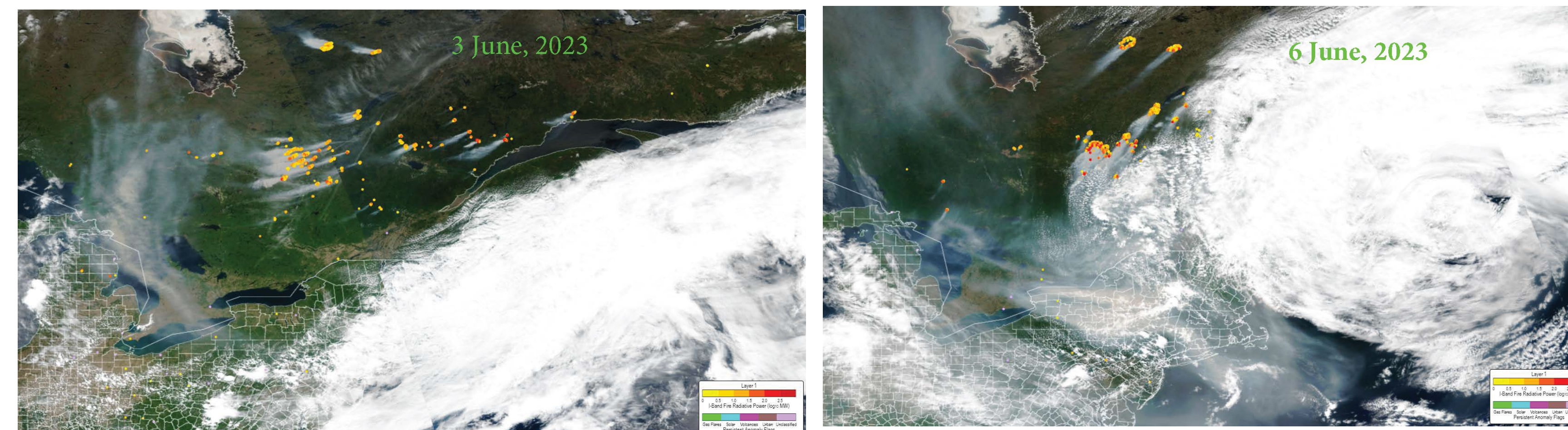


Image source: JSTAR Mapper, Suomi NPP, Land, I-Band Fire Radiative Power

- The Sentinel 5P Aerosol Index images depict a large-scale smoke plume spreading the Canadian wildfire pollution across the northeastern US during 6-7 June 2023.

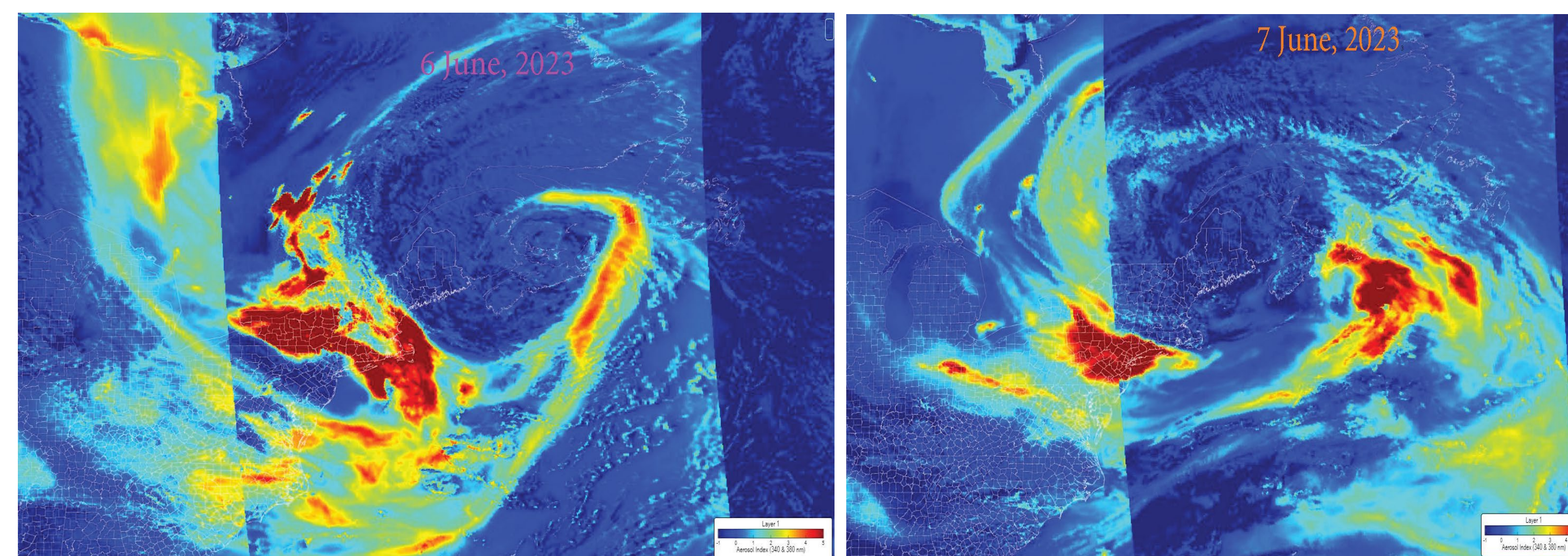


Image source: Sentinel 5P, TROPOMI products, Aerosol Index

- A cyclone, positioned over Nova Scotia, Canada, generates a counterclockwise wind flow, carrying the plumes from the Canadian wildfires into New Jersey, USA.

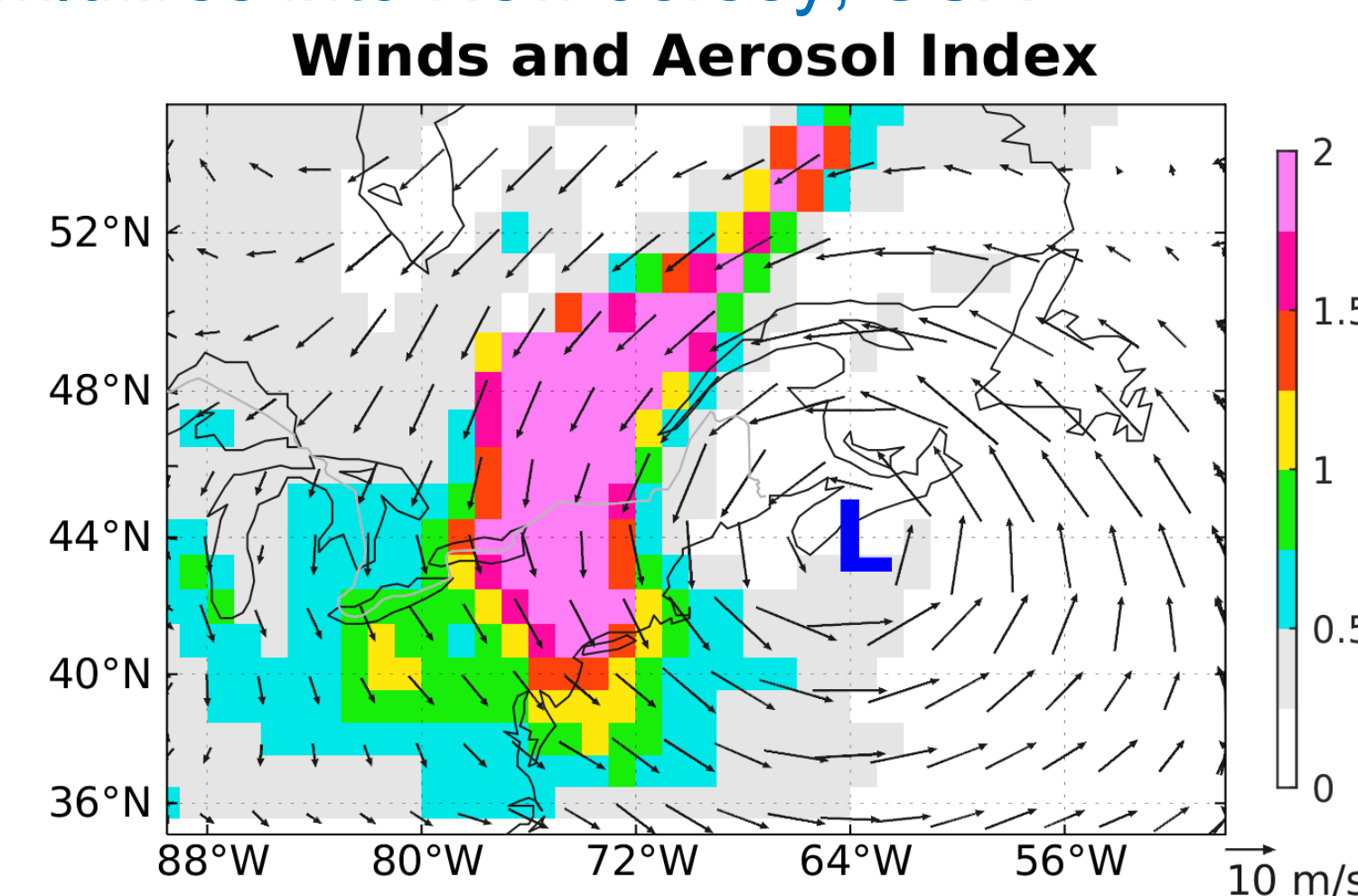


Image source: 850-hPa wind (vectors) and sea level pressure (contours) data from the ERA5 reanalysis², aerosol index from the MERRA2³ reanalysis

- On June 7th, 2023, the Trenton NJ ground station recorded a PM2.5 level exceeding 150 micrograms per cubic meter, indicating a very unhealthy air quality.

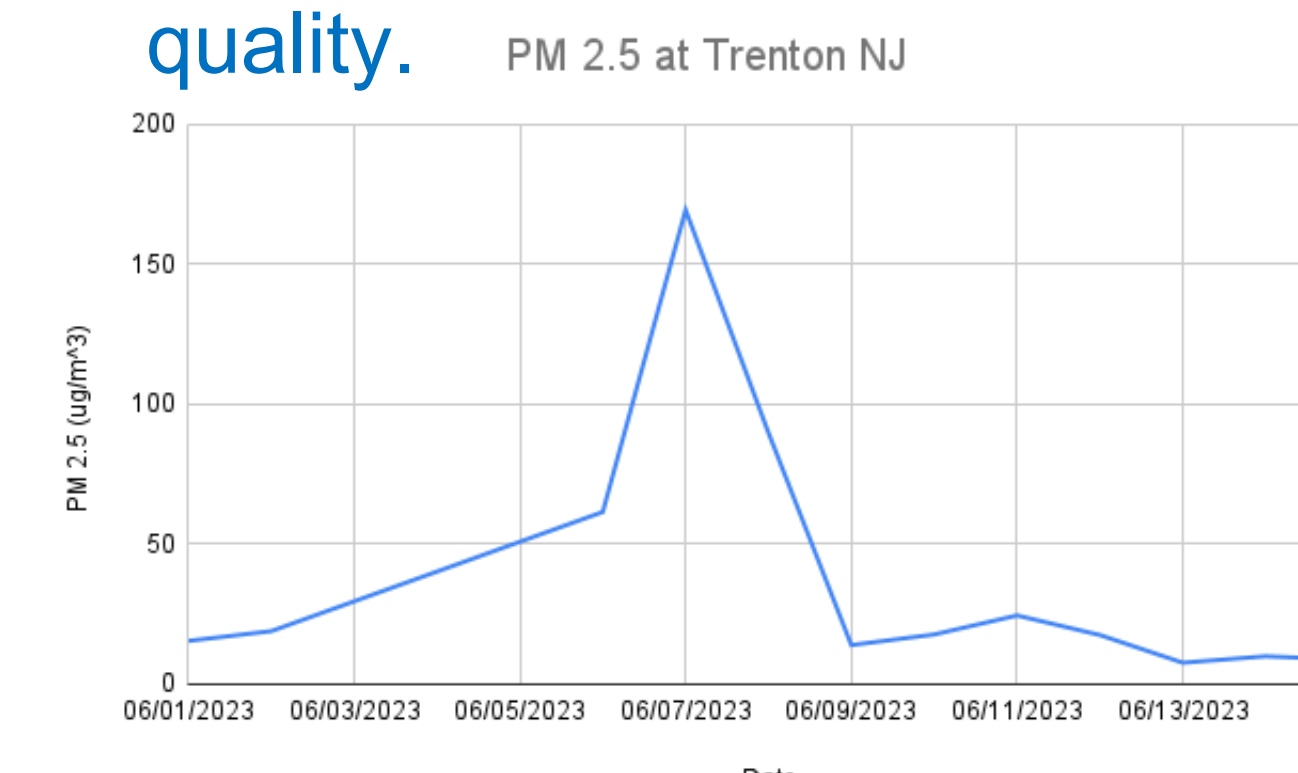


Image source: PM2.5 data from the US Environmental Protection Agency (EPA) website (<https://www.epa.gov/outdoor-air-quality-data/download-daily-data>)

RESULTS and CONCLUSIONS

This project conducted detection and attribution studies utilizing VIIRS satellite images and ground observations to investigate the historical pollution event in New Jersey and its link to the Canadian wildfires. The main findings are outlined below:

- Data from the ground station (Trenton, NJ) confirms that the PM2.5 level peaked at over 150 micrograms on June 7, 2023, signifying a very unhealthy air quality.
- The Suomi NPP's I-Band Fire Radiative Power images detected the widespread wildfire hot spots in Quebec, Canada, commencing on 3 June, and reaching peak on 6 June 2023.
- The Sentinel 5P Aerosol Index images depicted the large-scale smoke plume spreading the Canadian wildfire pollutants across the northeastern US during 6-7 June 2023.
- Further meteorological data analysis shows that a cyclone, positioned over Nova Scotia, Canada, generates a counterclockwise wind flow, carrying the plumes from the Canada into New Jersey.

This project demonstrates that VIIRS's ability to pinpoint wildfire locations and monitor the wildfire pollution plumes, providing scientific guidance to potentially mitigate the health risks posed by wildfire pollution on human beings. Additionally, this study emphasizes how meteorological wind patterns can transport wildfire pollutants across borders, underscoring the importance of a global approach to combating wildfire pollution.

References

1. Statement by Governor Murphy on Worsening Air Quality in New Jersey. (<https://www.nj.gov/governor/news/news/562023/20230607b.shtml>)
2. ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. (<https://www.ecmwf.int/en/forecasts/dataset/ecmwf-reanalysis-v5>)
3. MERRA2: Modern-Era Retrospective analysis for Research and Applications, Version 2 (<https://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/>)