Modeling PM2.5 and SO2 Interactions and Public Responses in Hawaii (2015-2025)

Izack Takazawa

Data Science with a concentration in Health Information and Analytics,

Chaminade University of Honolulu

Overview

Hawaii's unique volcanic air pollution (vog) stems from continuous volcanic activity directly impacting communities across our state.

Vog Composition:

- PM2.5 (particles <2.5 micrometers)
- SO2 (sulfur dioxide)
- Prolonged exposure causes respiratory and cardiovascular health effects

Research Questions:

- How have PM2.5 and SO2 levels changed across Hawaii from 2015-2025?
- How does public perception of air quality align with the measured data?

Methods

Data Collection:

- EPA Air Quality System Data
  - Met One BAM-1020 with VSCC (PM2.5 & SO2)
- 10 years of monitoring 1-Hour Samples (2015-2025)
- Reddit data scraping for public perception
- Filtering keywords and symptoms

Analysis Tools:

- TACC Stampede 3 supercomputer
- Jupyter Notebook (Python 3.12)
- Geospatial analysis
- Time series modeling
- Sentiment analysis

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Spatial Distribution Patterns

Figure 1.

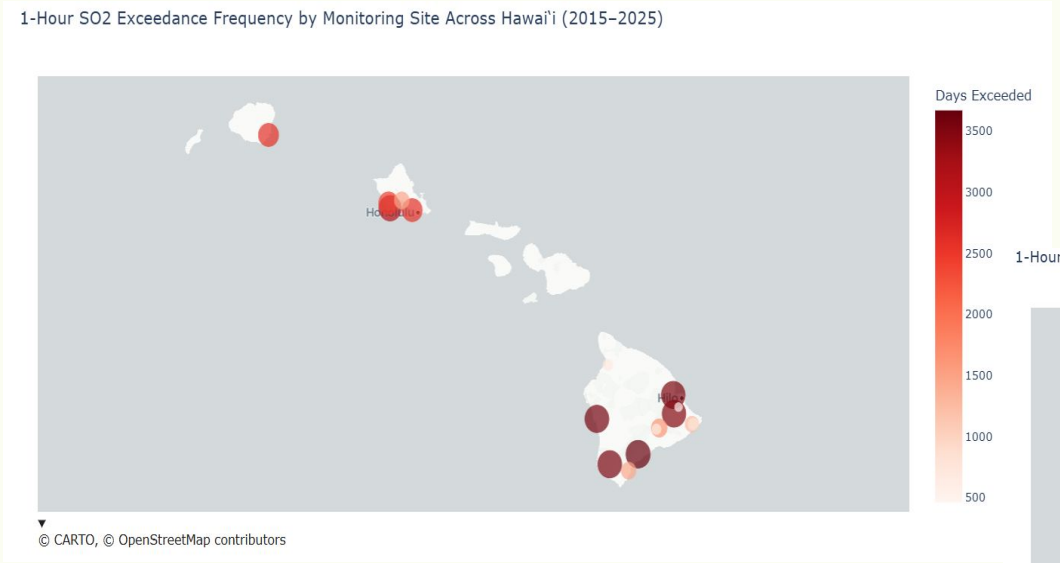

Figure 2.

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Figure 3.

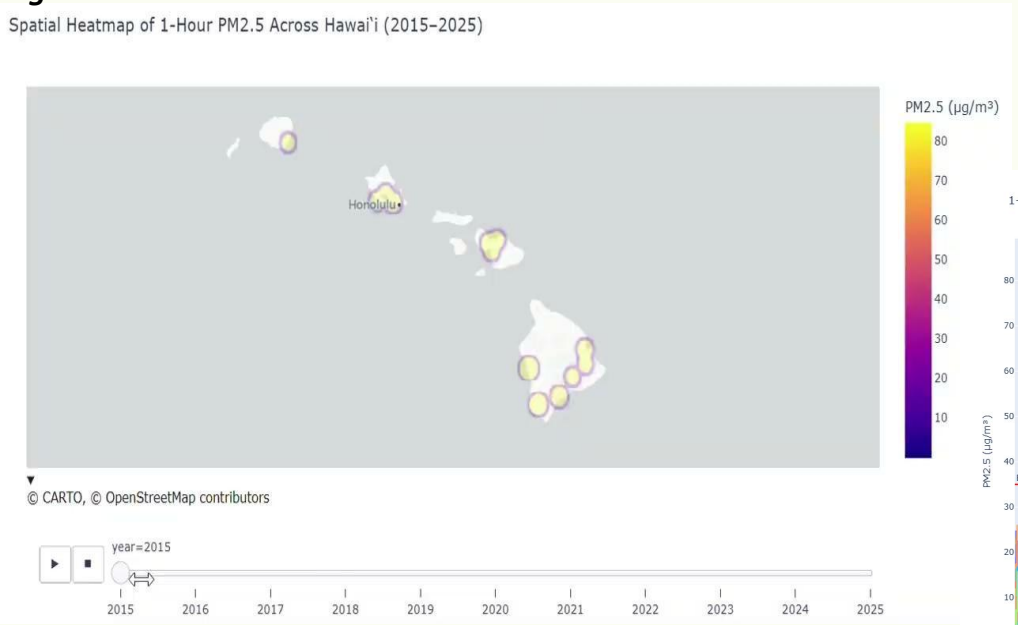
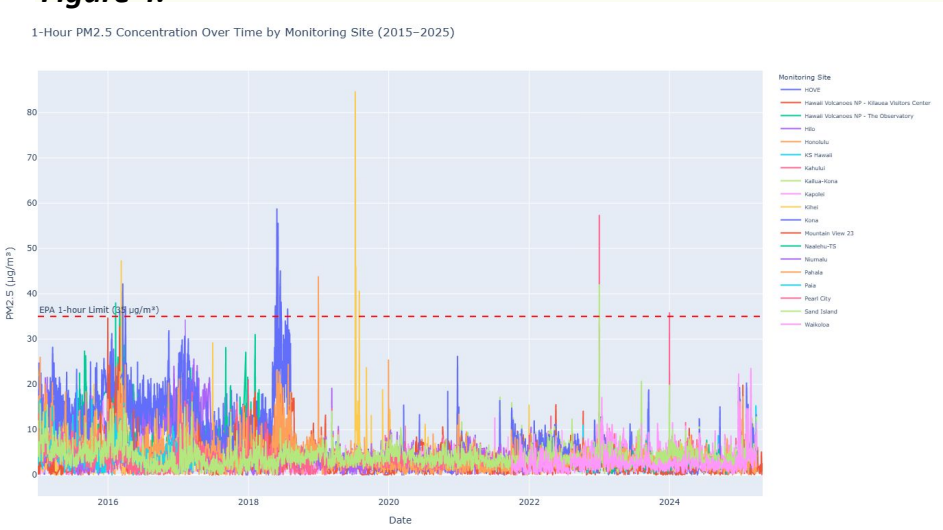


Figure 4.



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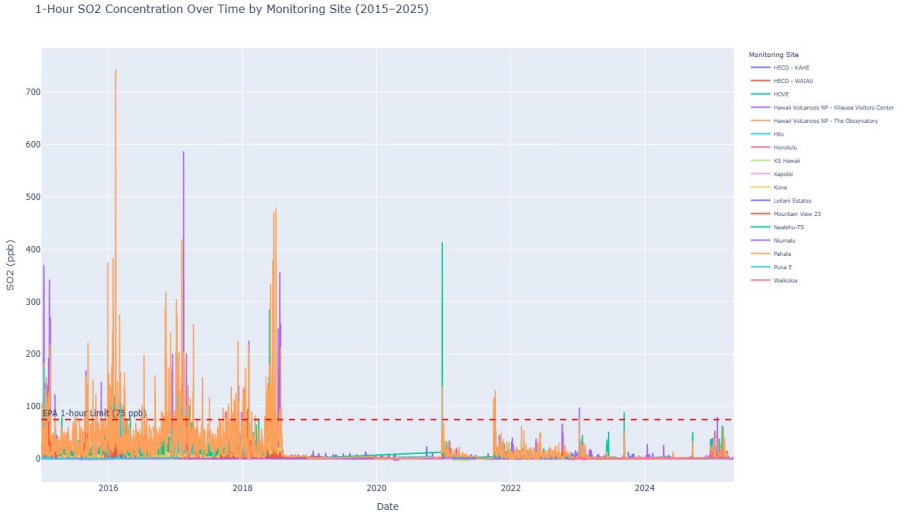
Spatial Distribution Patterns

Figure 5.

Figure 6.



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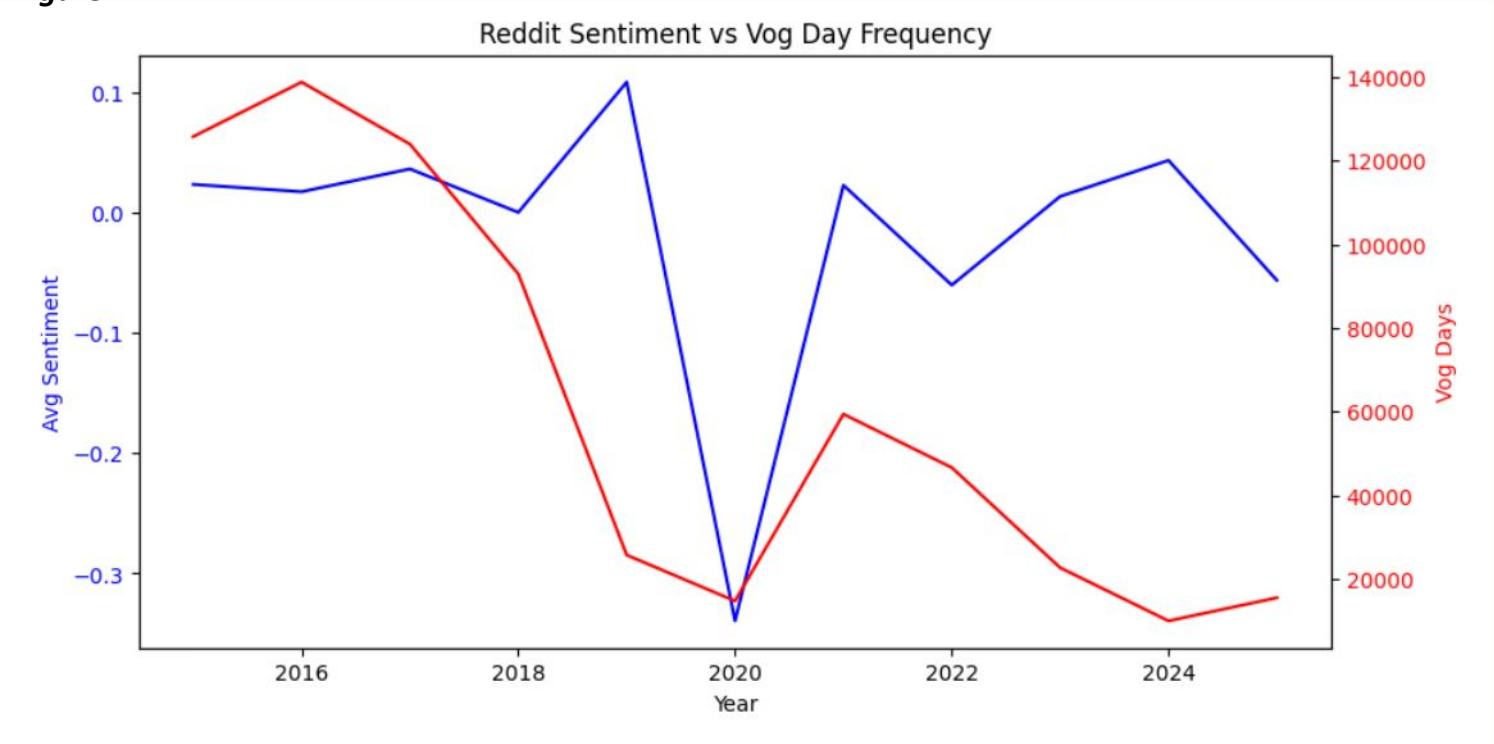
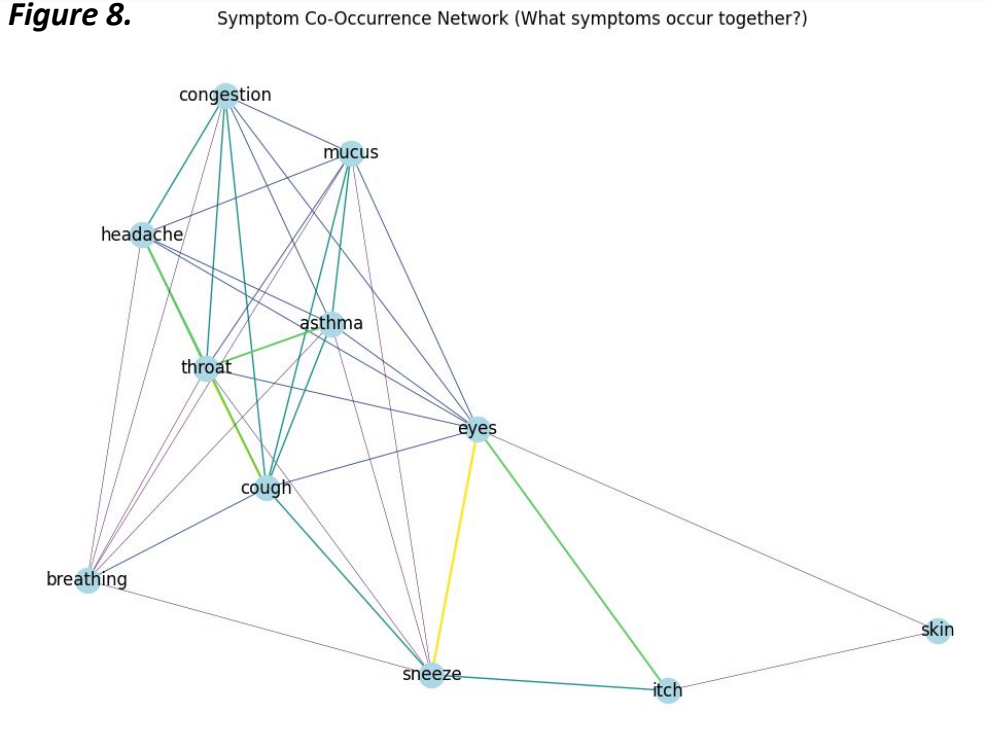
Public Perception v.s. Measured Data

Figure 7.



Public Perception v.s. Measured Data

Figure 8.



Conclusion

Key Takeaways:

R1: The air quality is affected by volcanic activity

R2: Public perception of the vog aligns with the measured data as the number of vog days decrease the more happy people feel

- Vog exposure is inevitable for Hawaii residents, yet healthcare access remains critically limited

Future Work:

- Advocate for increased healthcare infrastructure and respiratory services within the most affected communities
- Currently developing accessible public health resources for particulate exposure across Hawaii