
Something in the Air:

Wildfires and their impact on air quality

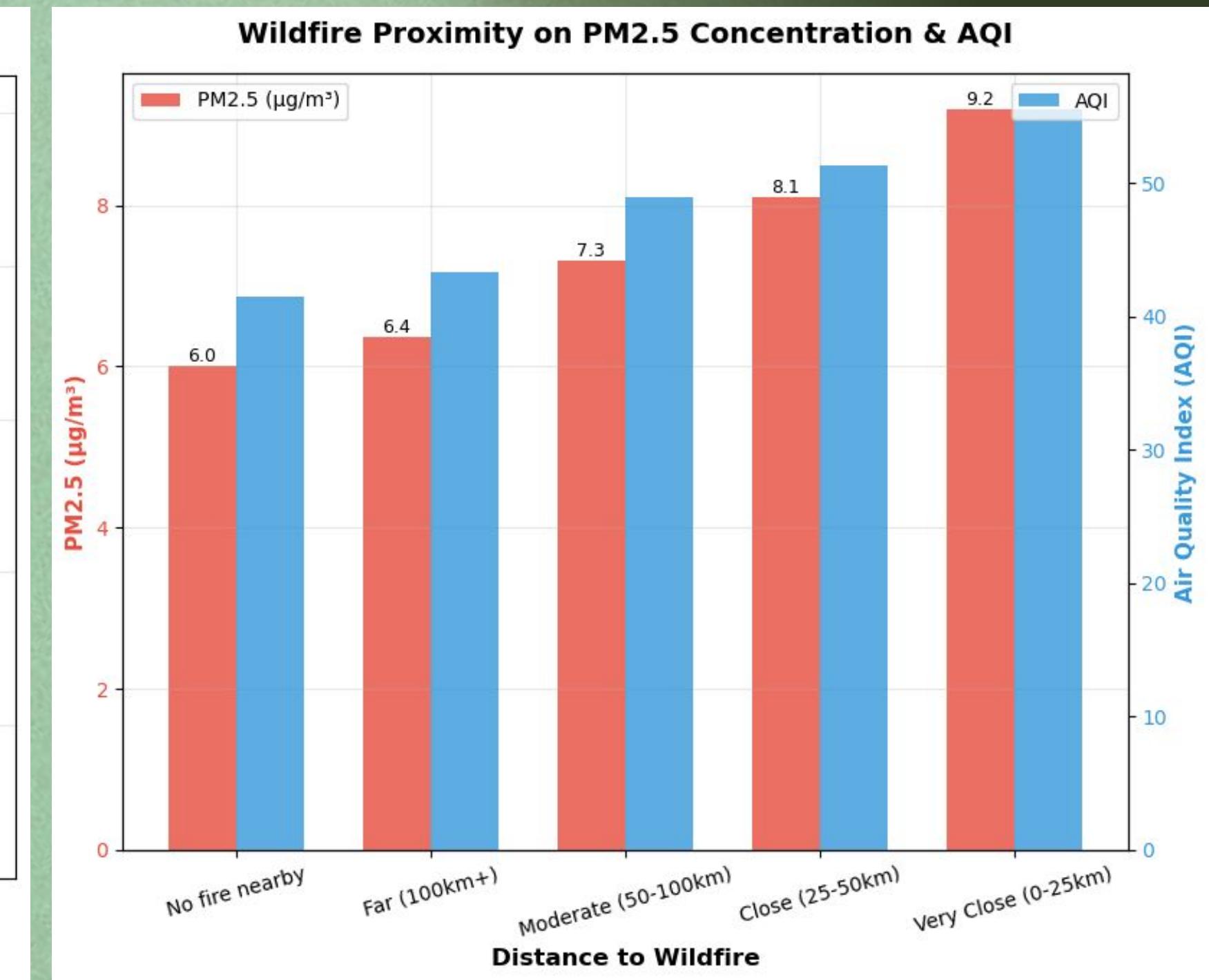
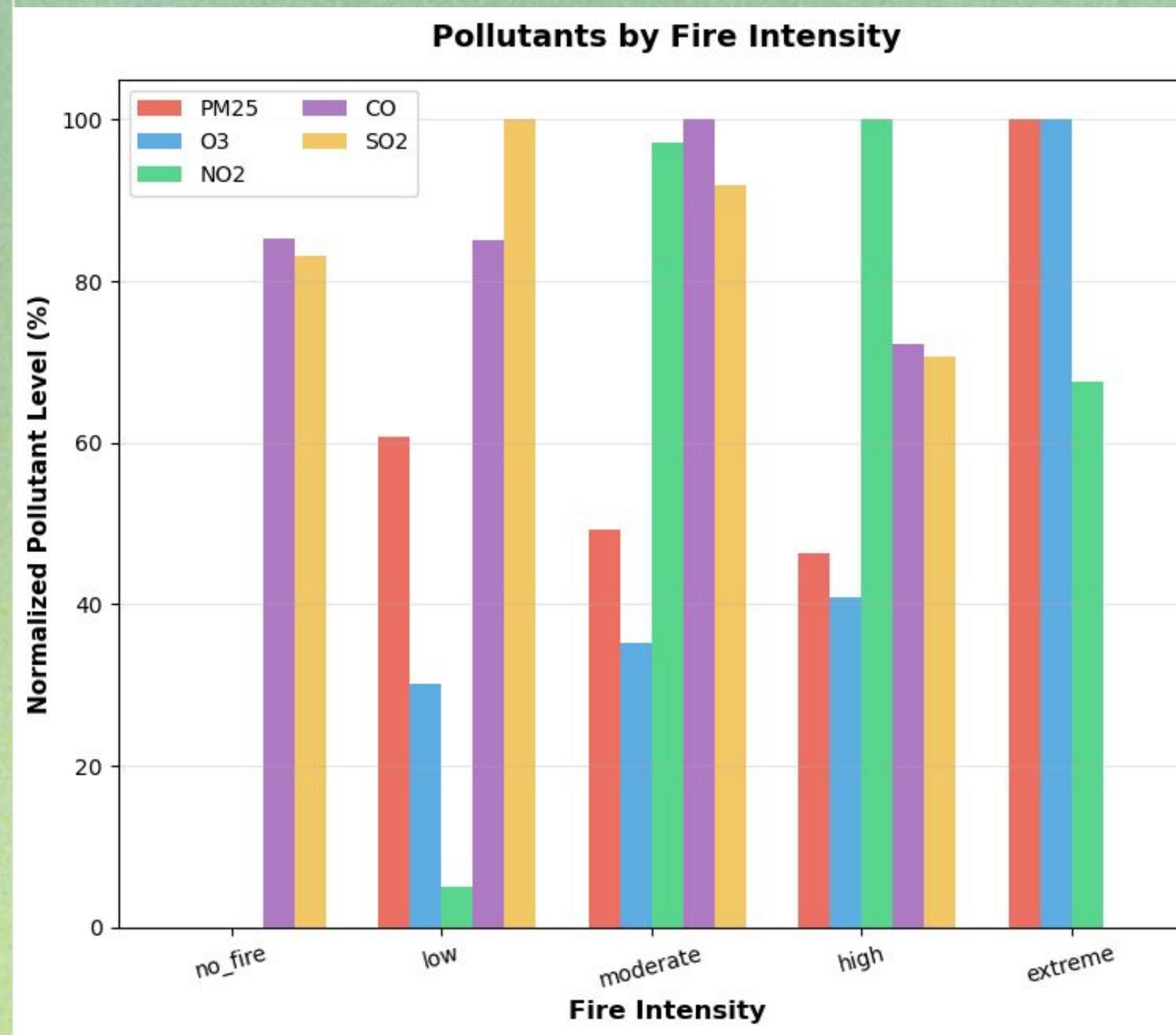
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Group 15 - December 12, 2025

Data & Variables

- **Sources:** NASA satellite fire detections, EPA air quality monitoring, and Open-Meteo API weather data
- **Dataset:** 20K observations from 75 monitoring sites across 40 states, each row corresponding to a daily observation
- ***Target variable:*** PM2.5 concentration ($\mu\text{g}/\text{m}^3$), i.e., fine particulate matter
- ***Air quality measurements:*** CO, O₃, NO₂, SO₂, AQI
- ***Fire features:*** dist to nearest fire, intensity, brightness, fire counts within 50-100 km radius
- ***Weather conditions:*** temperature, humidity, wind speed, precipitation, evapotranspiration, weather description
- ***Temporal factors:*** season, month, day of week, wildfire season



Exploratory Data Visualizations



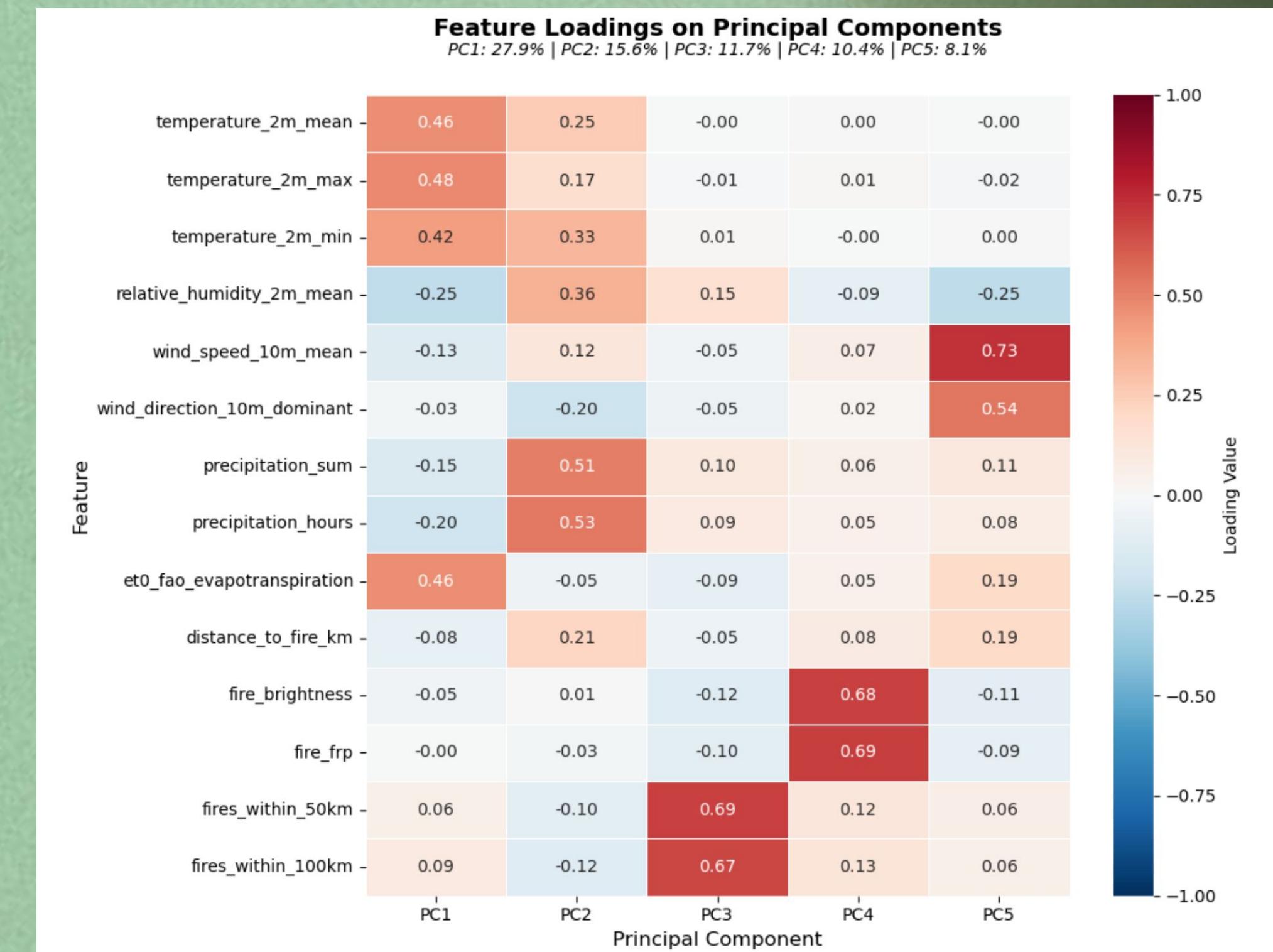
Research Questions:

How does fire proximity affect PM2.5?

Do weather conditions moderate these fire impacts?

Which predictors impact PM_{2.5} most?

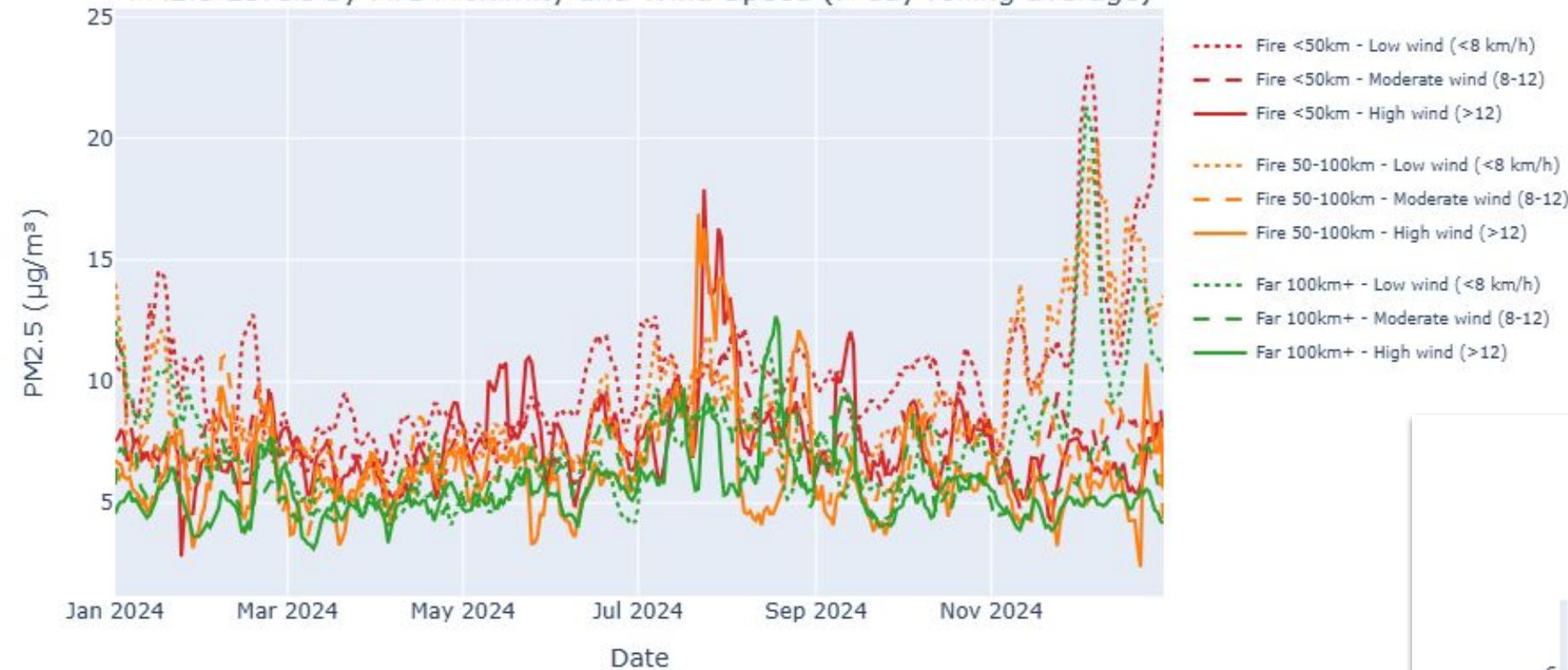
- First 3 PCAs only capture **55.1% of variability**
- **Natural groupings**
 - PC1 ~ temperature
 - PC2 ~ rain
 - PC3 ~ fire



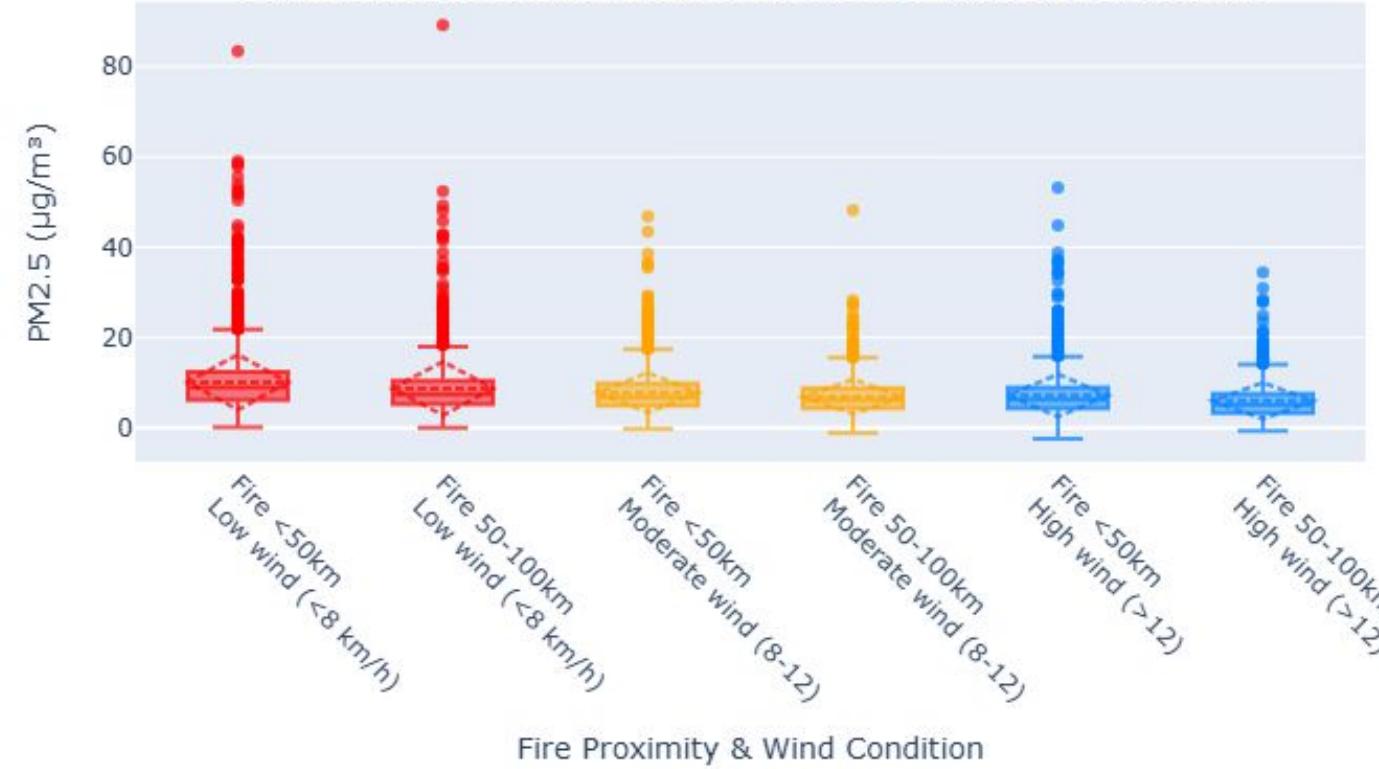
Time Series Analysis

How Wind Speed Moderates Wildfire Impacts on Air Quality

Higher wind speeds (solid lines) reduce PM2.5 levels during fire events by dispersing smoke
PM2.5 Levels by Fire Proximity and Wind Speed (7-day rolling average)



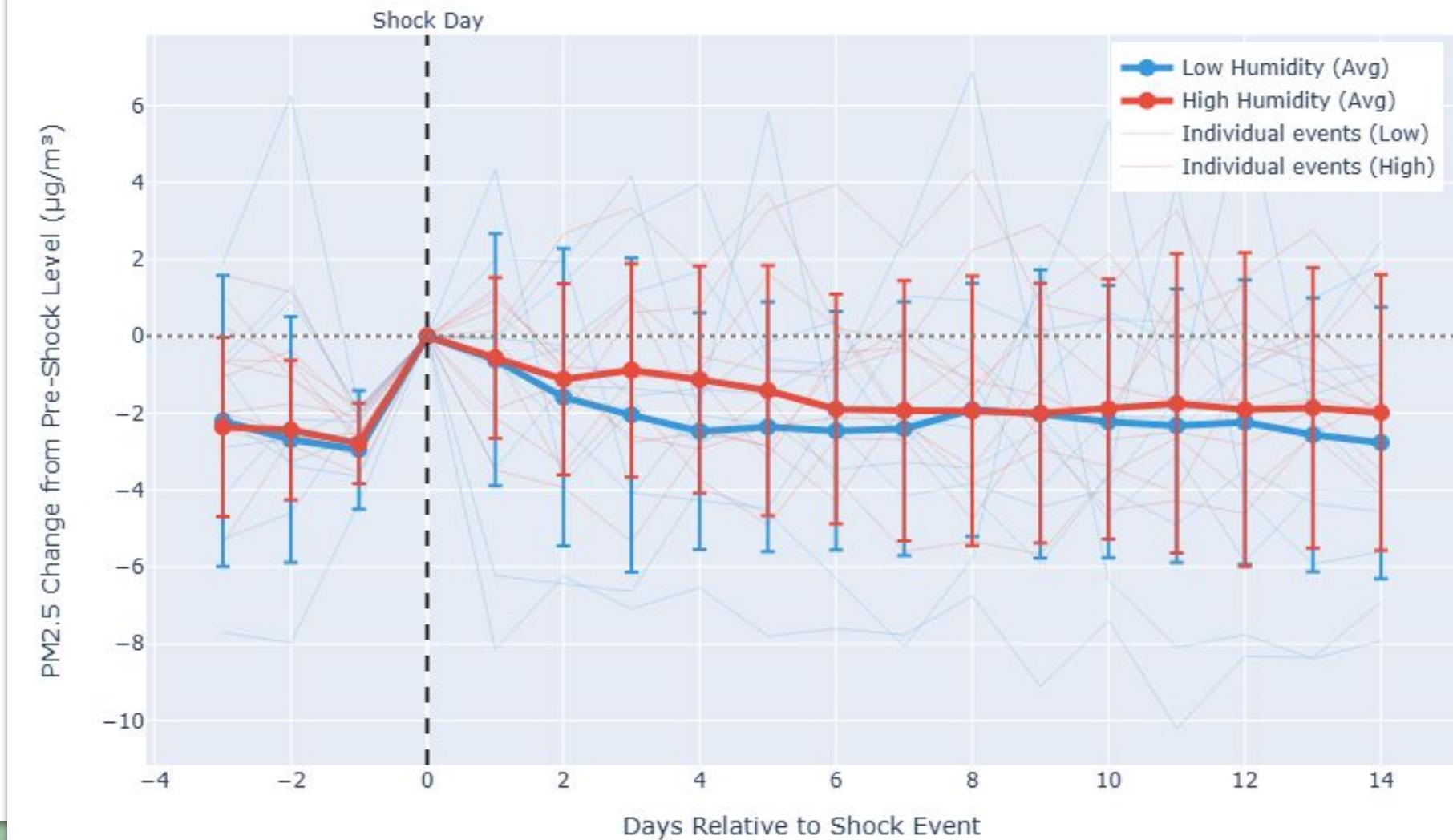
Wind Speed Moderation Effect on Fire-Air Quality Relationship



High wind speeds

Low humidity

PM2.5 Response to Shock Events: Evidence of Slower Dissipation



Conclusions for Stakeholders

- **Environment:** Encourage action by policymakers and individuals
 - **Public health:** Issue air quality warnings and mind humid conditions
 - **Policy Planning:** Anticipate air quality impacts in advance
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- **Prediction challenges despite multi-model approach**
 - **However, successful capture of trends and conditions**
 - **Actionable insights for protecting environmental and public health**