Enhancing Environmental Monitoring Through Advanced Air Quality Assurance of Ambient Pollutants

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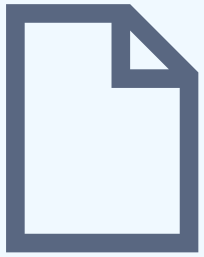
Environmental Measurement Symposium - Garden Grove, CA

August 5th - 9th

Background

- Growing number of pollution sources now subject to rules:
  - BAAQMD Rule 12-15
  - SCAQMD Rule 1180
  - SJVAQMD Rule 4460
  - Colorado House Bill 21-1189
- Real-time data validity becomes critical

Enhancing Air Quality Assurance with AI/ML



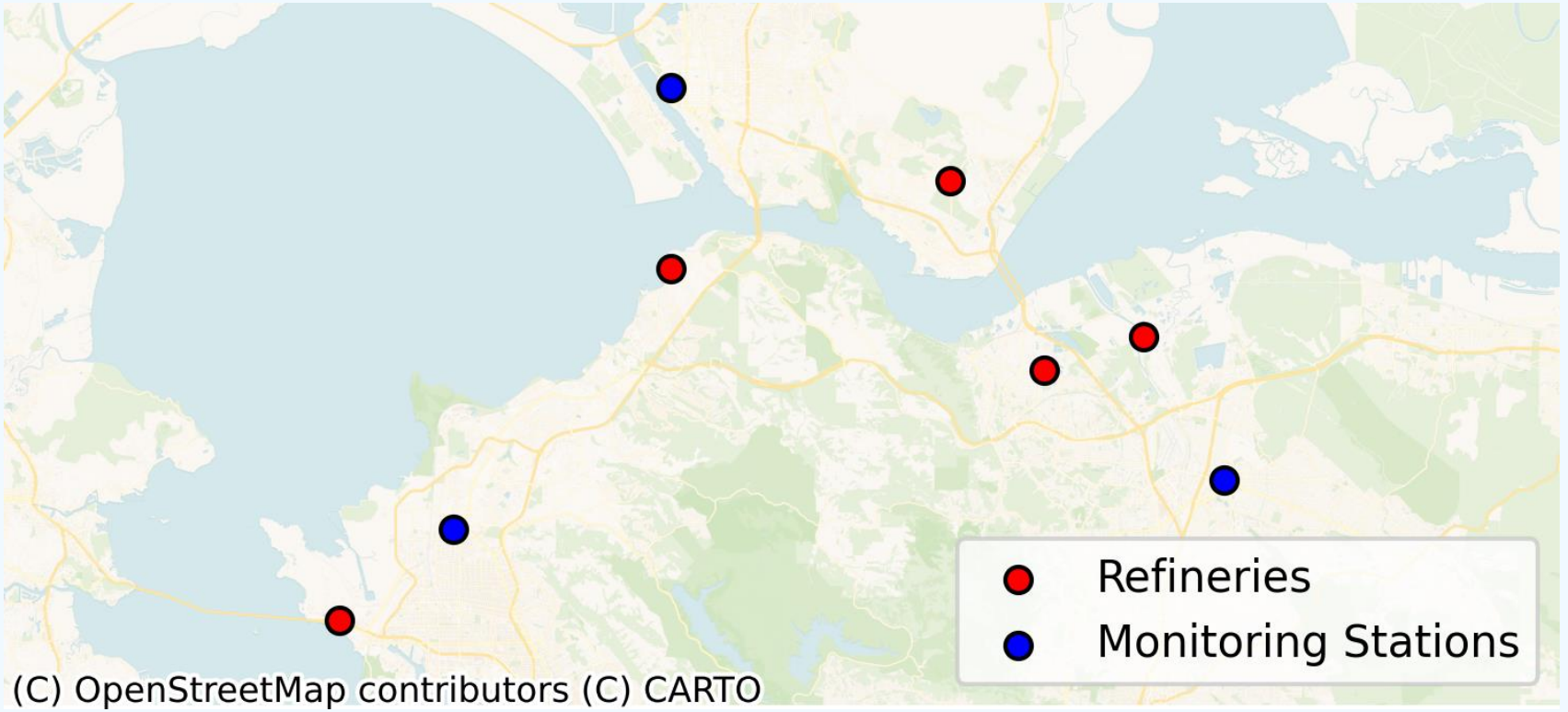
Cross-referencing with trusted external data sources

Predicting expected values based on historical trends

Detecting anomalies and outliers

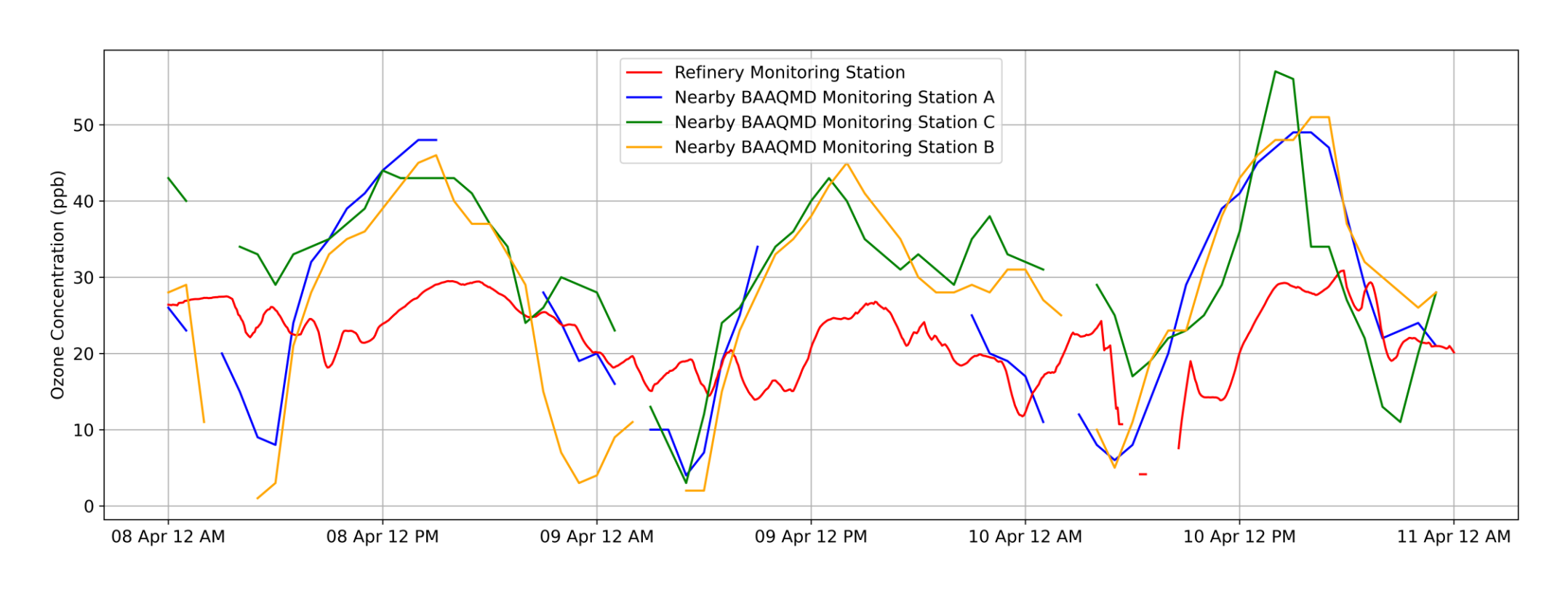
Case Study

BAAQMD Rule 12-15 requires local refineries to report fence-line data to communities in real time



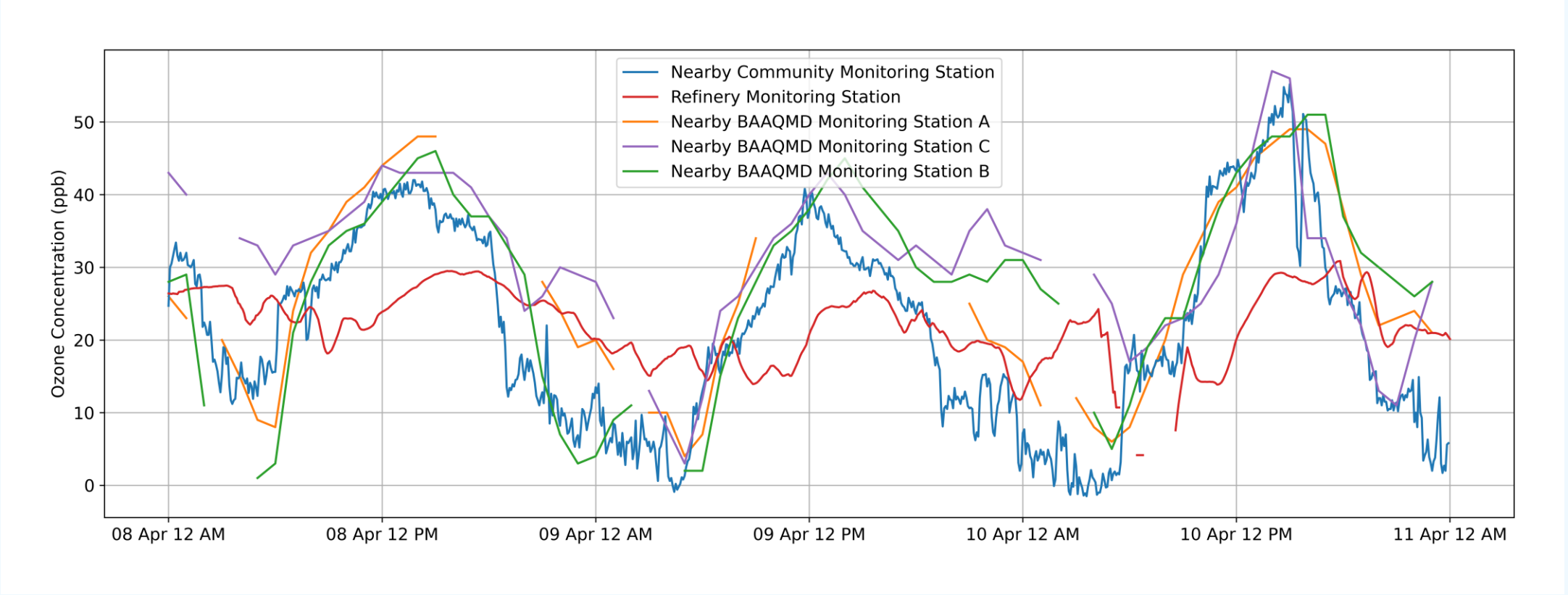
Case Study

Refinery ozone data doesn't correlate with nearby BAAQMD monitoring stations



Case Study

Community ozone data correlates with nearby BAAQMD monitoring stations



AI and Machine Learning

Artificial Intelligence: Systems that mimic human intelligence

Machine Learning: AI subset focused on learning from data

AI/ML can help streamline the data validation process in multiple ways:

Can analyze large datasets in real-time	Identify patterns and anomalies	Compare data across multiple sources

Proposed Solution

- Create easy to use AI based tool
- Trained on fence-line, point monitor, met, seasonal and infrastructure related data
- Validate whether real-time fence-line and point monitor data makes sense
    - Compares incoming data with short term forecasts

AI/ML Techniques

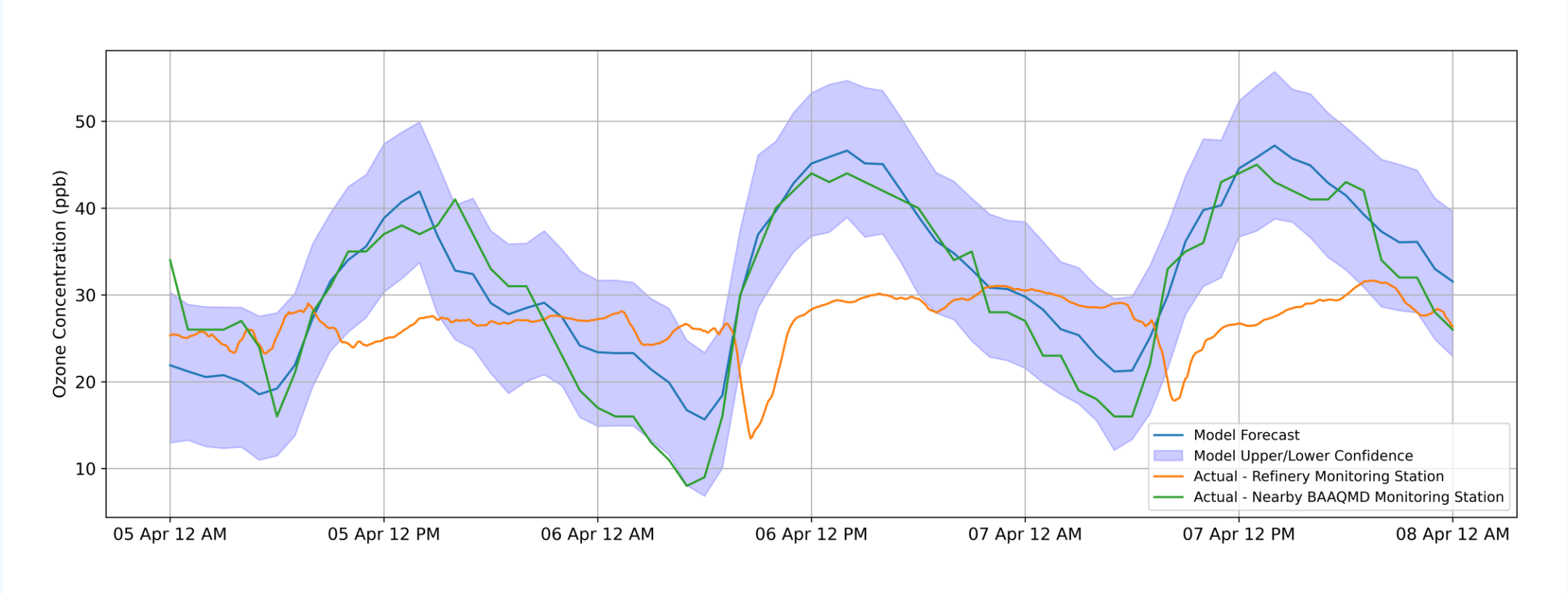
- Facebook's Prophet model:
  - Forecasting tool for time series data
  - Combines trends, seasonality, and holiday effects
- PyTorch:
  - General purpose ML library
  - Can be used with Long Short-Term Memory (LSTM) networks for time series analysis

Implementation Process

- Data collection from refinery and BAAQMD sources
- Preliminary AI model trained on historical data
- Real-time analysis of incoming refinery data
  - Validate data
  - Flag discrepancies and suspect gaps in data

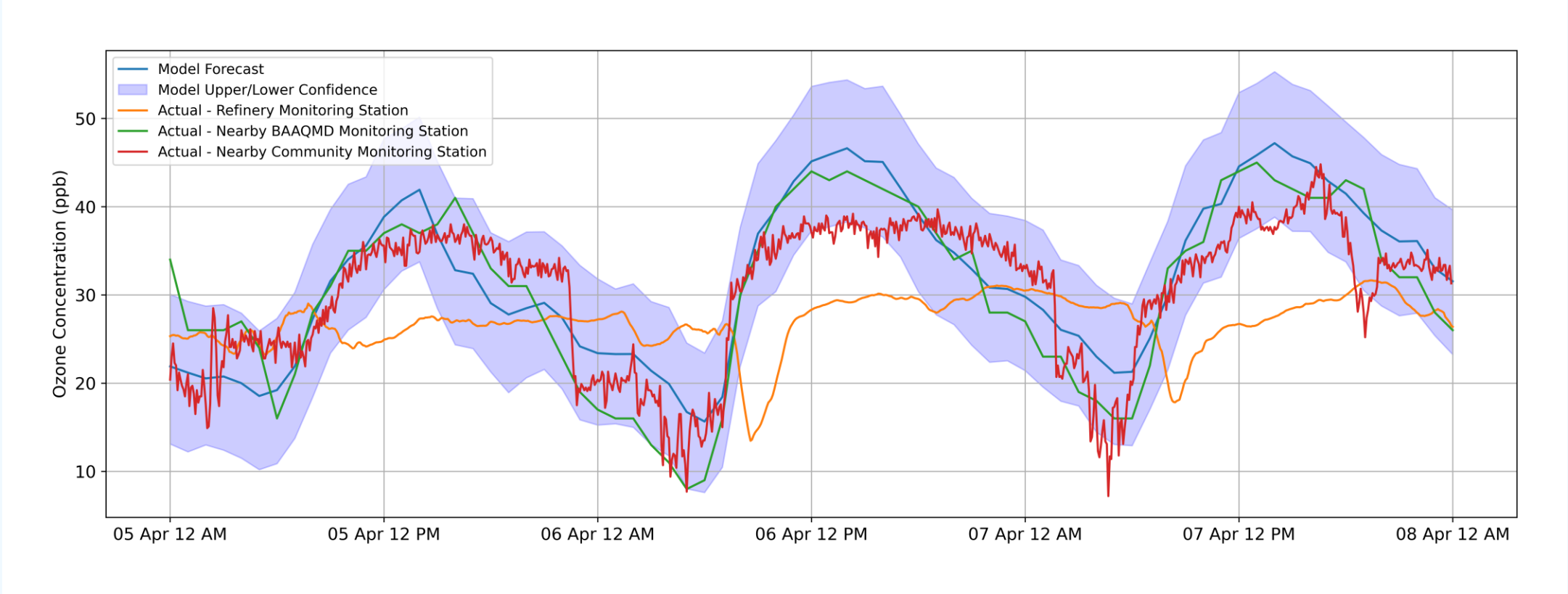
Preliminary Data Analysis Conclusions

BAAQMD ozone data correlates with forecast; refinery data does not



Preliminary Data Analysis Conclusions

Community ozone data correlates with forecast



Benefits

Increased transparency and real-time trust in reported data

Early detection of monitoring equipment issues

Improved public health protection through accurate reporting

Challenges

Variations in sensors and local air quality

Downtime gaps in training data

Future Expansions

- More parameters and systems
- Apply to many refineries and industrial facilities
- Develop public website
- Evaluate and improve models

Q & A

Thank you!

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