Tips to Improve Model Results

2019 Midwest Environmental Compliance Conference

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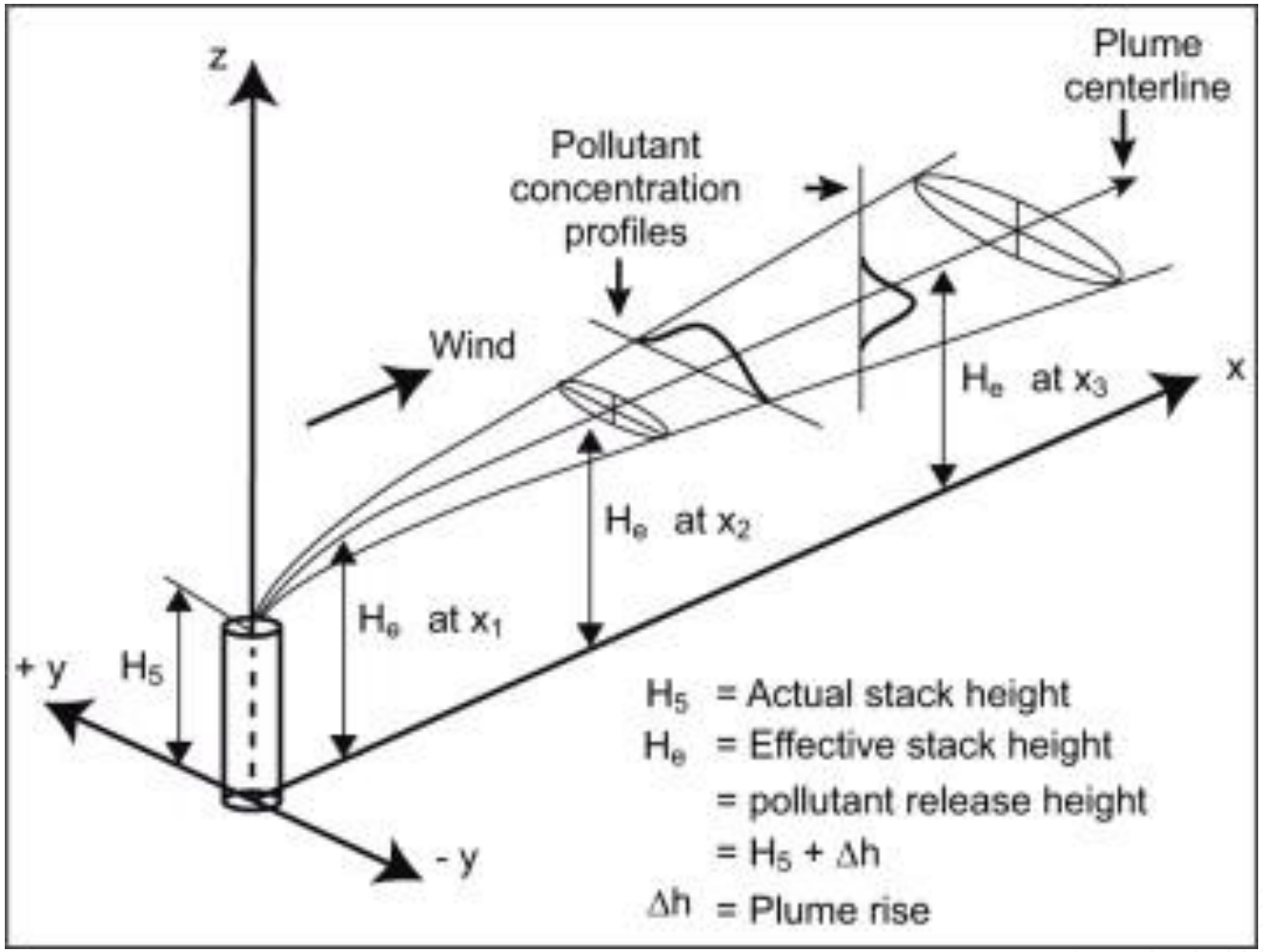
What is AERMOD?



- AERMOD Steady-State Dispersion Model
  - EPA's preferred near-field dispersion model
  - Applicable to a wide range of regulatory modeling studies in all types of terrain

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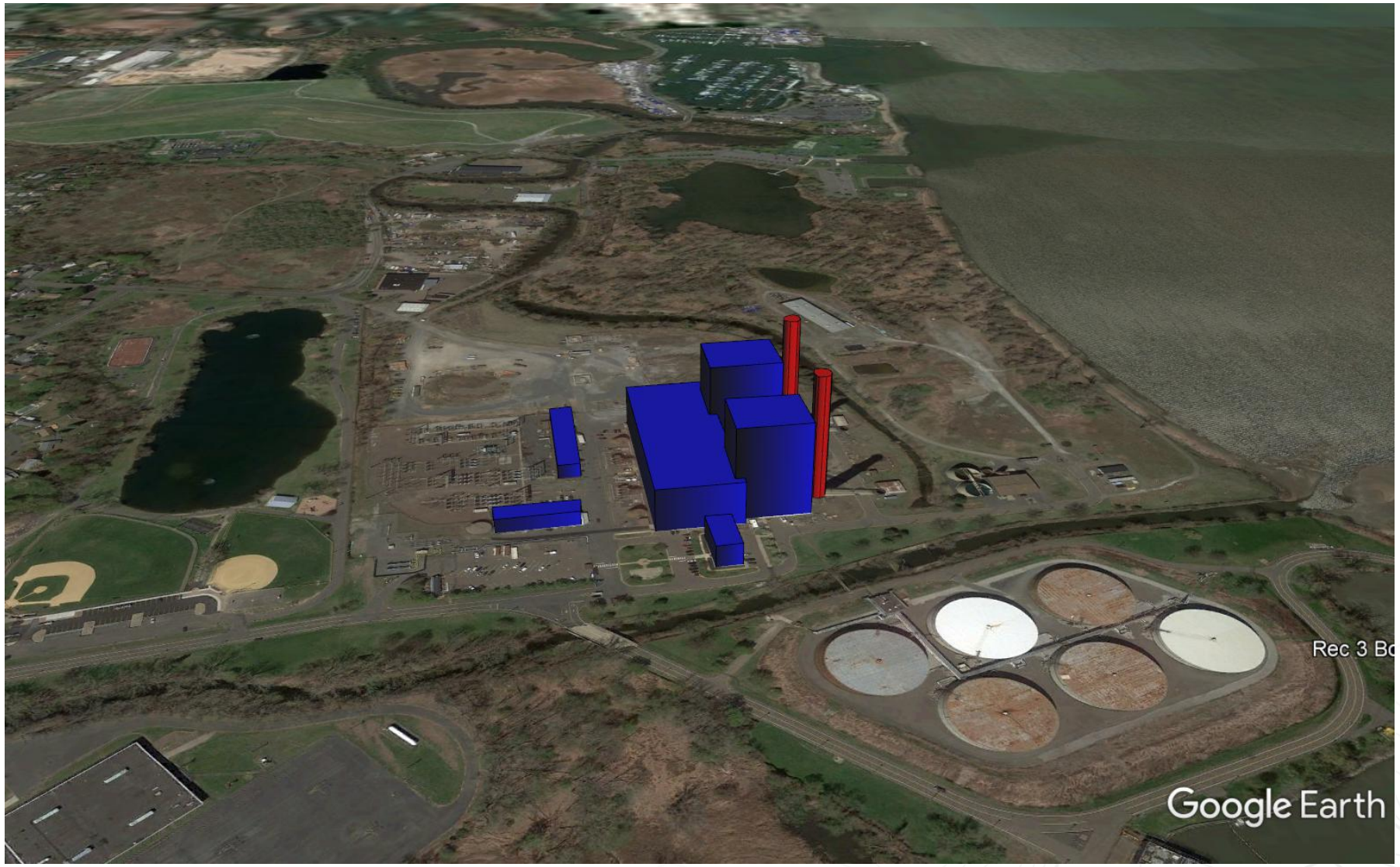
Is AERMOD Conservative?



- Use a real world test case to determine

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Test Case Source Summary

- Use data from the Bowline Dataset
  - Coal-fired power plant in New York
  - Hourly SO2 CEMS and ambient monitoring data at 2 locations for a full year
  - On-site hourly wind and temperature data available
- Used by EPA for their AERMOD Validation Study

Parameter	Value
SO_2 Emission Rate	1100-3600 lb/hr (each stack) 10,500 ton/year (total)
Stack Height	285 ft (both stacks)
Exhaust Temperature	180-314 ^oF (225 ^oF average)
Stack Exit Velocity	1500-5900 fpm (2600 fpm average)
Stack Diameter	18.8 ft (both stacks)

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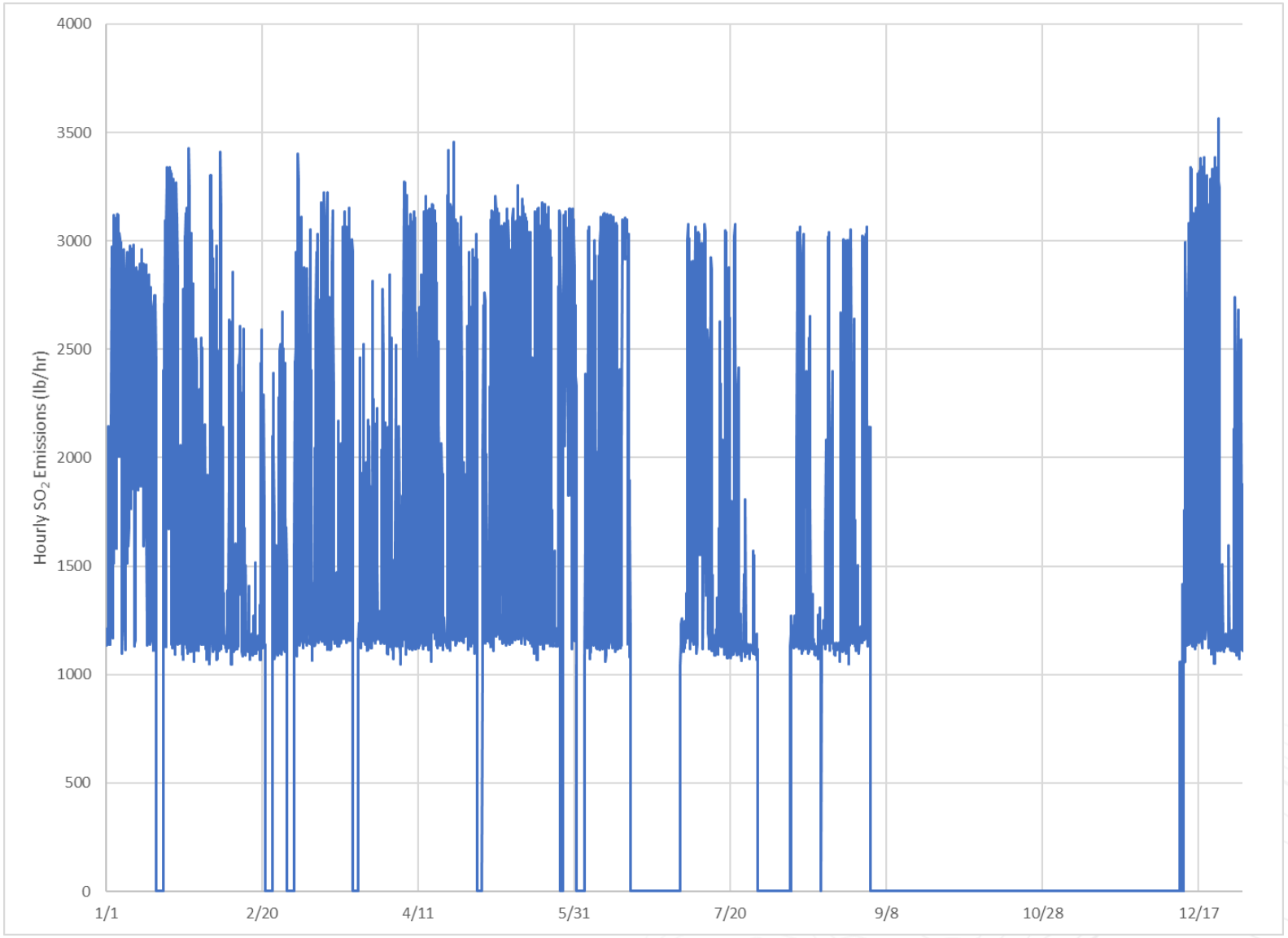
Source SO_2 Emissions



SO_2 Emissions (lb/hr)

Parameter	Stack 1	Stack 2
Minimum	0	0
Maximum	3566	3423
Average	1127	1278
St. Deviation	1077	949

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SO_2 Monitor Locations

Parameter	North Monitor
Maximum	514
Average	53
St. Deviation	83

Parameter	South Monitor
Maximum	824
Average	57
St. Deviation	99

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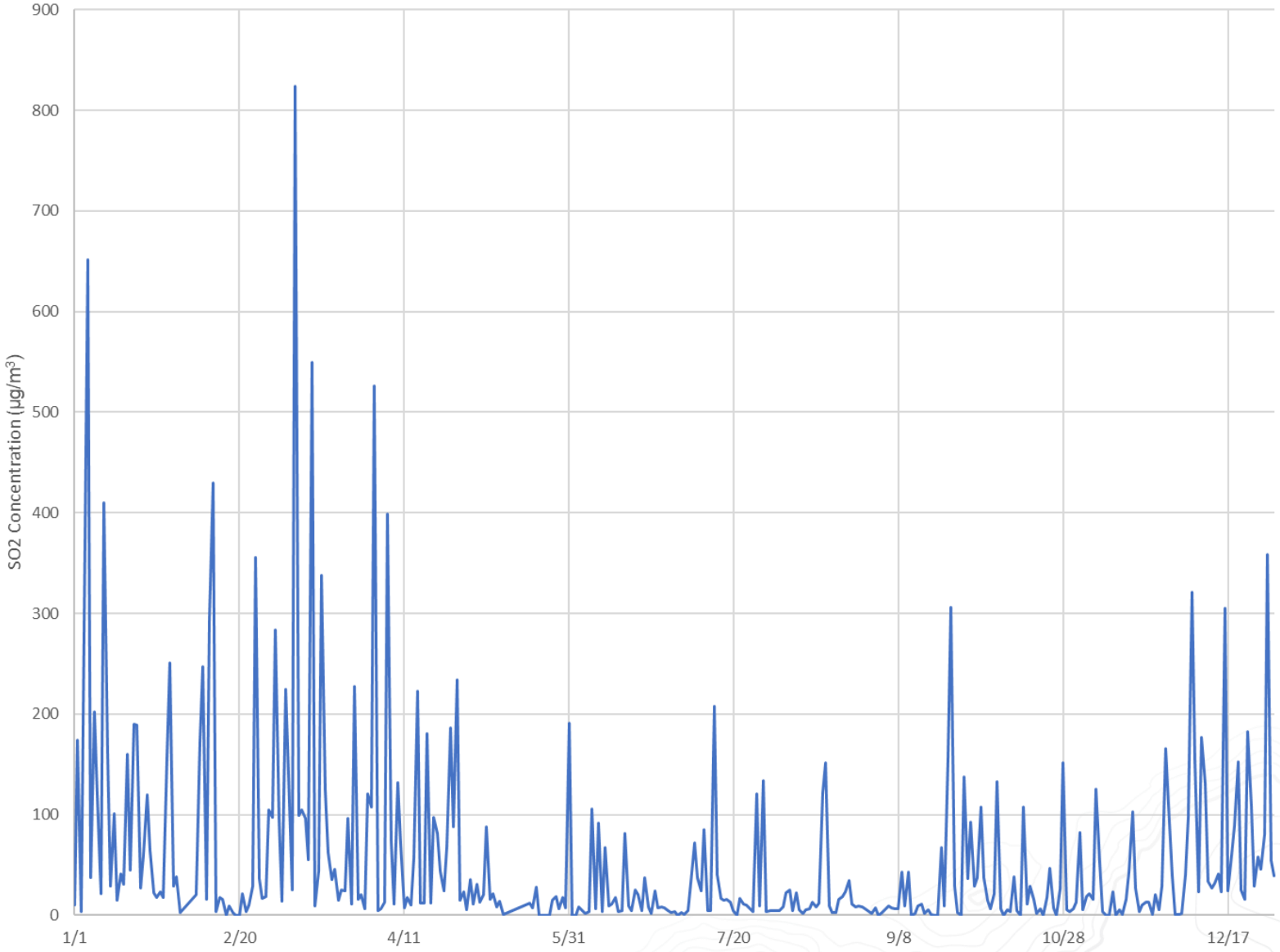
Monitor Time Series (South Monitor)



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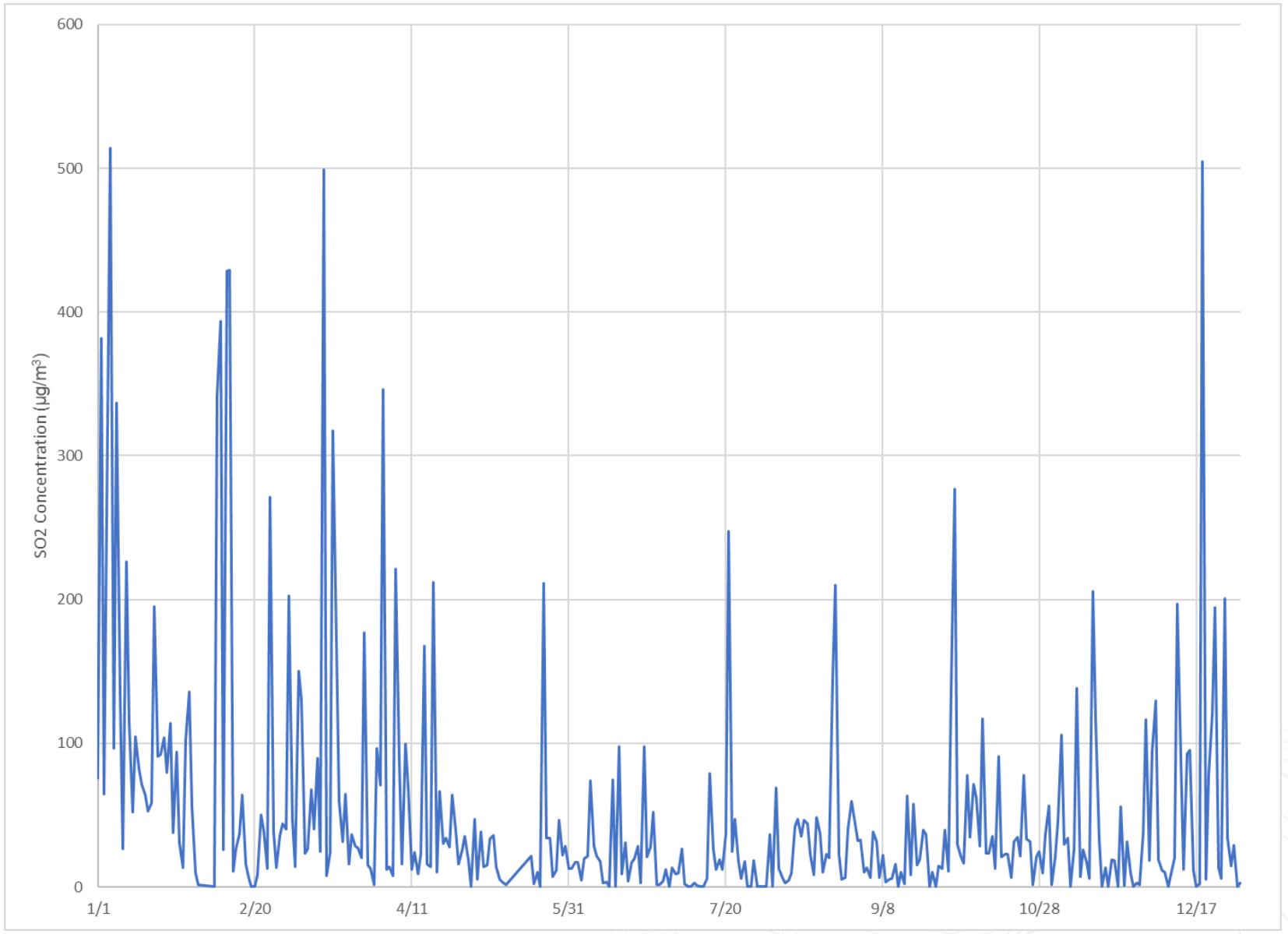
Monitor Time Series (North Monitor)



Parameter	North Monitor
Maximum	514
Average	53
St. Deviation	83

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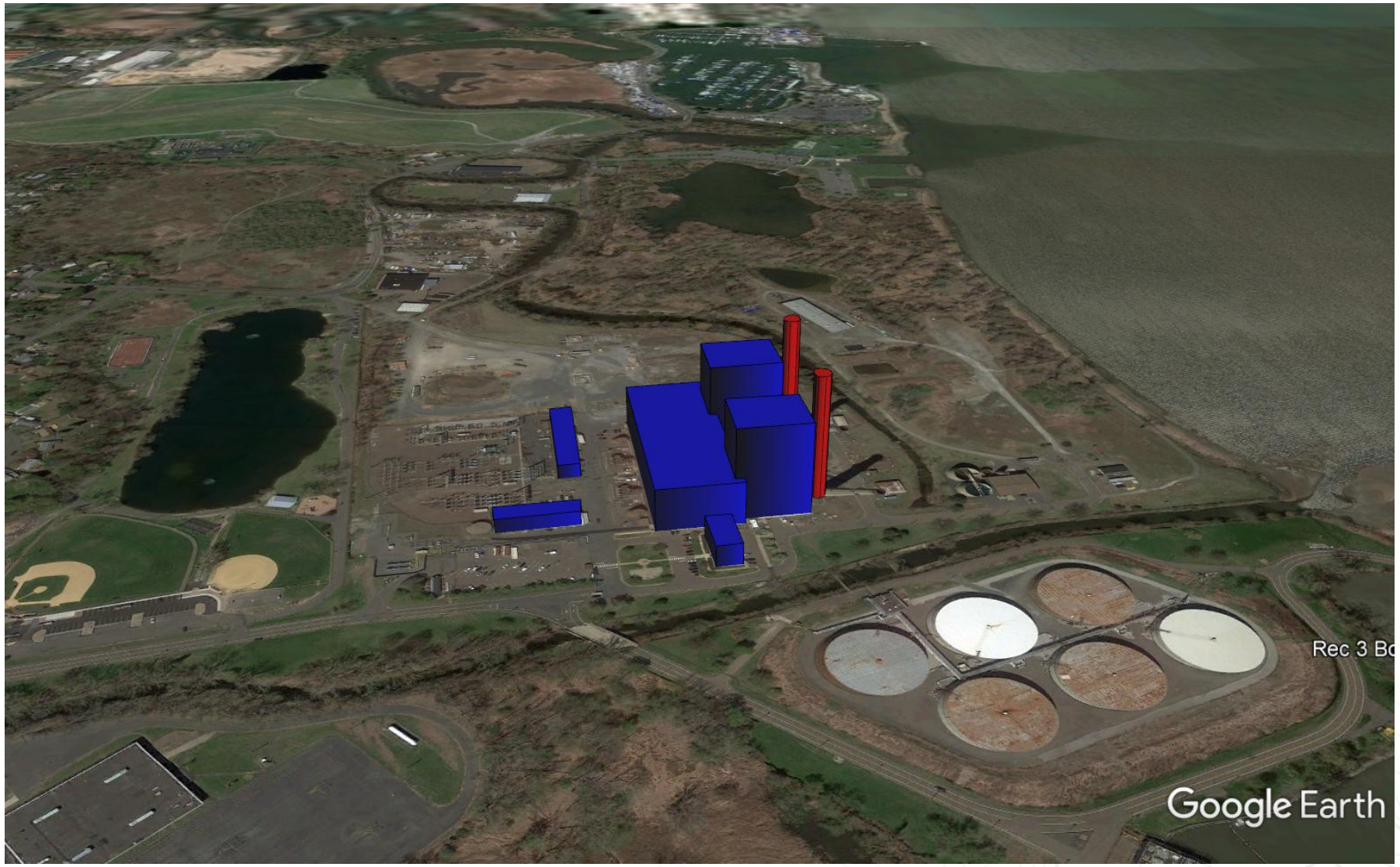
First Step – Actual Value Model



- Use actual emissions and met data
- Compare model results to monitor data

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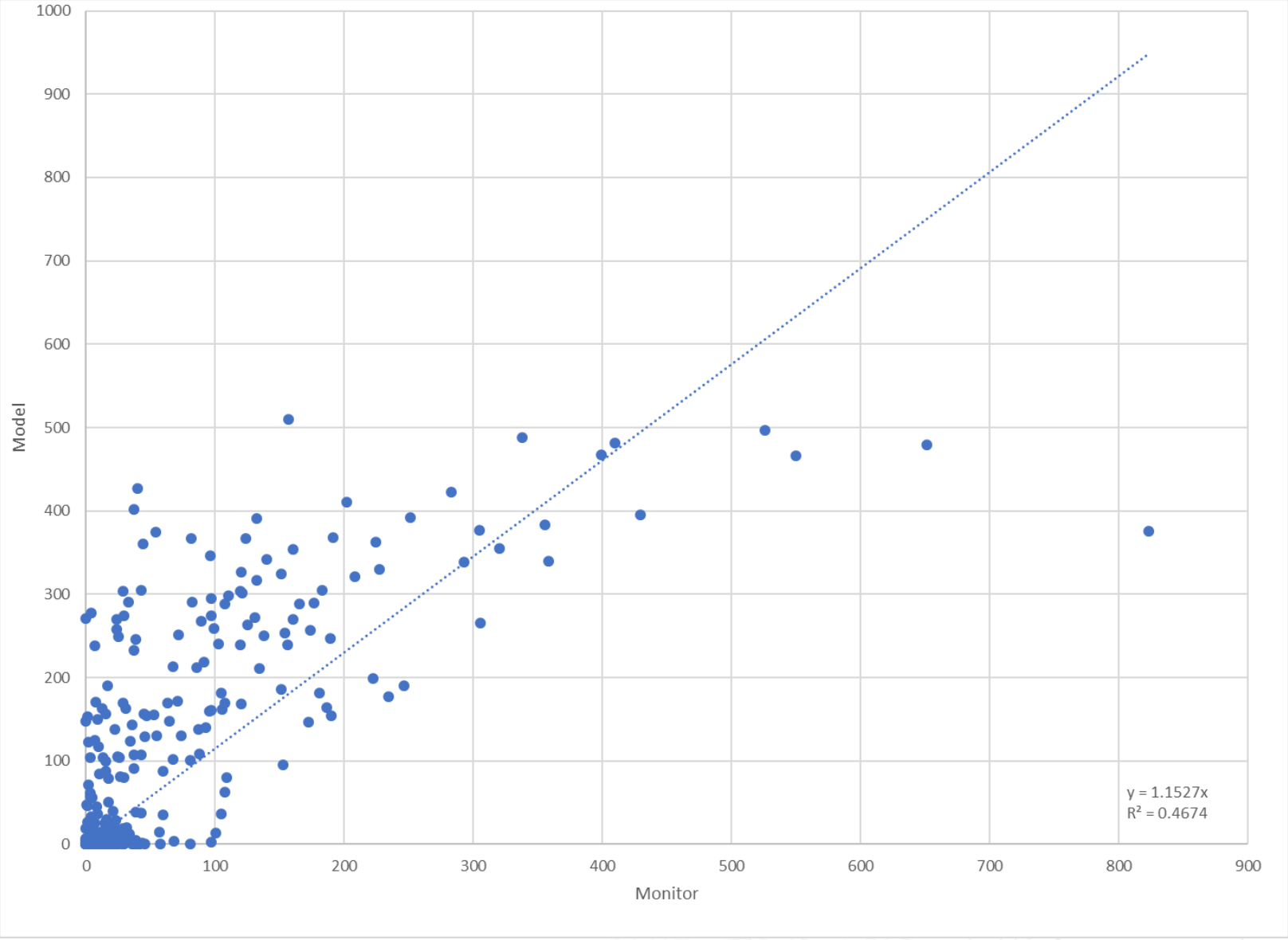
Model/Monitor Paired Correlation (South Monitor)



- High Monitor-South
- Paired Correlation
- Units in µg/m^3

Parameter	Monitor	Model
Maximum	824	509
Average	57	96
St. Deviation	99	132

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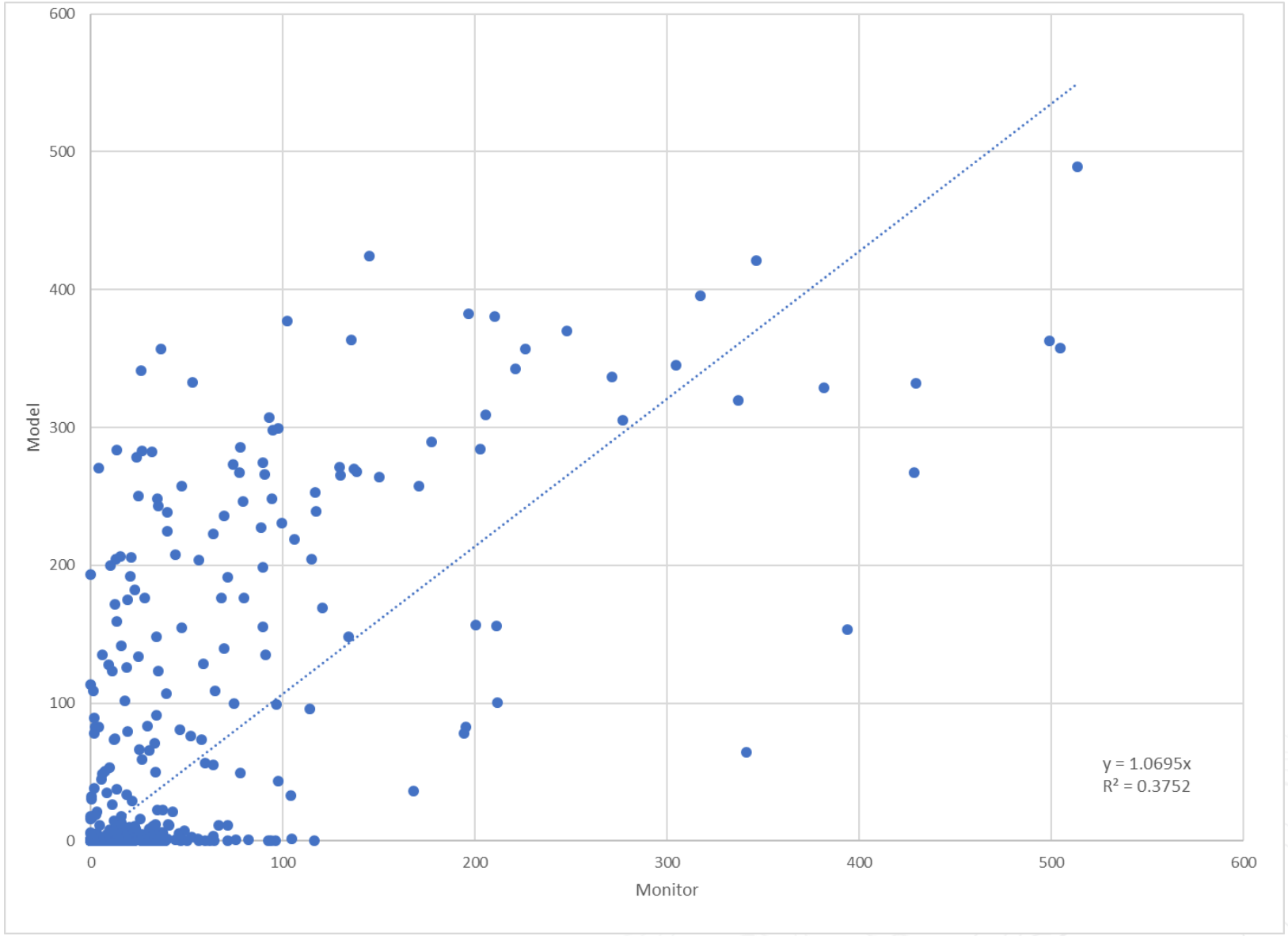
Model/Monitor Paired Correlation (North Monitor)



- North Monitor
- Paired Correlation
- Units in µg/m^3

Parameter	Monitor	Model
Maximum	514	489
Average	53	78
St. Deviation	83	115

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Is AERMOD Conservative?

- Regulatory analysis is conservative – not necessarily AERMOD
- Assume all occur at the same time
  - Peak emission rate
  - Worst-case meteorology
  - Maximum impact from nearby sources
- Must consider all ambient locations

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What Can You Do? Set Realistic Emission Limits

C = Q/u * …

C = Pollutant Concentration

Q = Pollutant Emission Rate

u = Wind Speed

Pollutant concentration proportional to the emission rate

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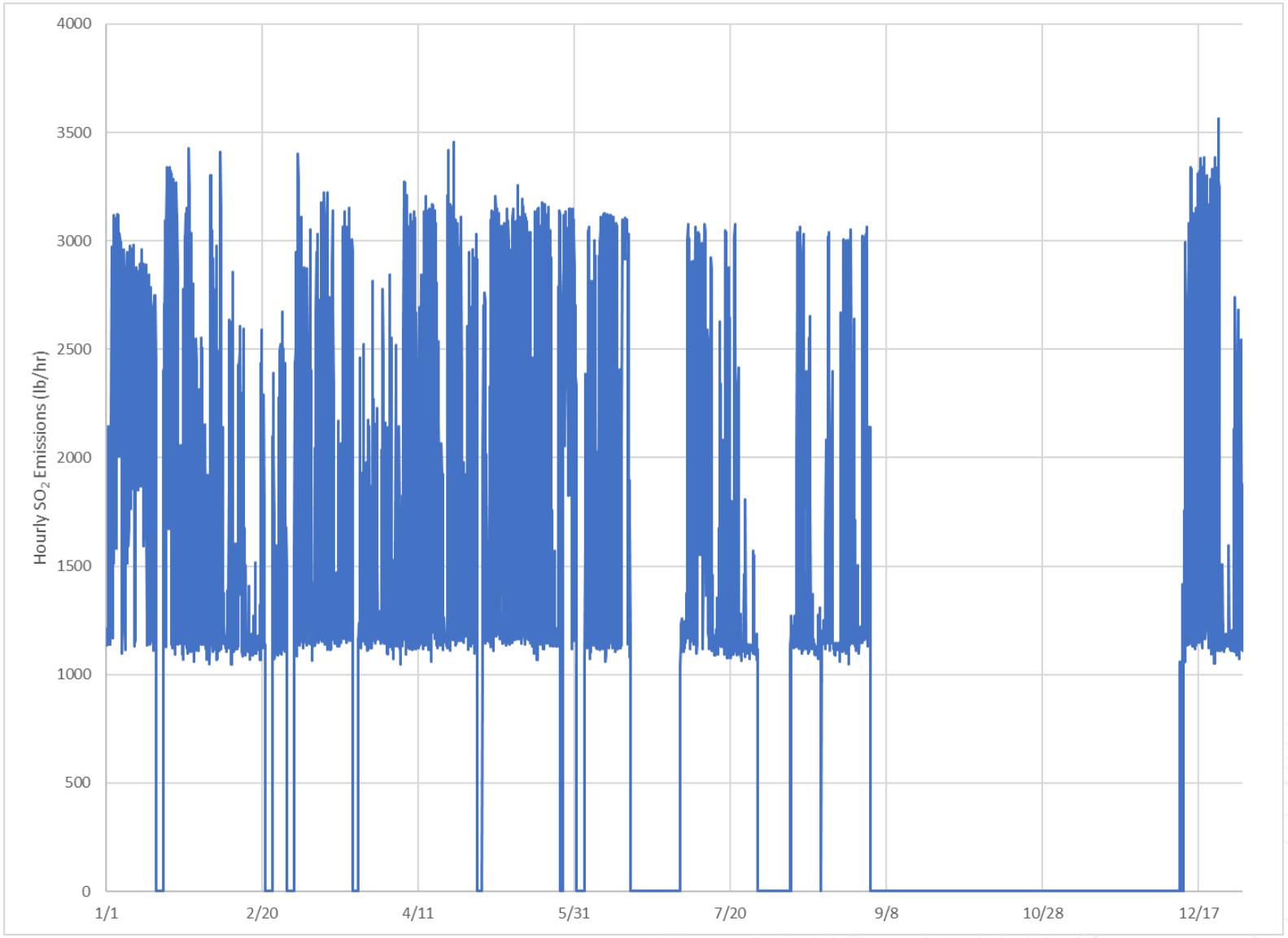
What Can You Do? Set Realistic Emission Limits



Tip: Use a Monte-Carlo simulation to estimate the probability of achieving continuous compliance

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What Can You Do? Use Onsite Wind Measurements

C = Q/u * …

C = Pollutant Concentration

Q = Pollutant Emission Rate

u = Wind Speed

Pollutant concentration inversely proportional to wind speed

Measure as close to the release height as practical

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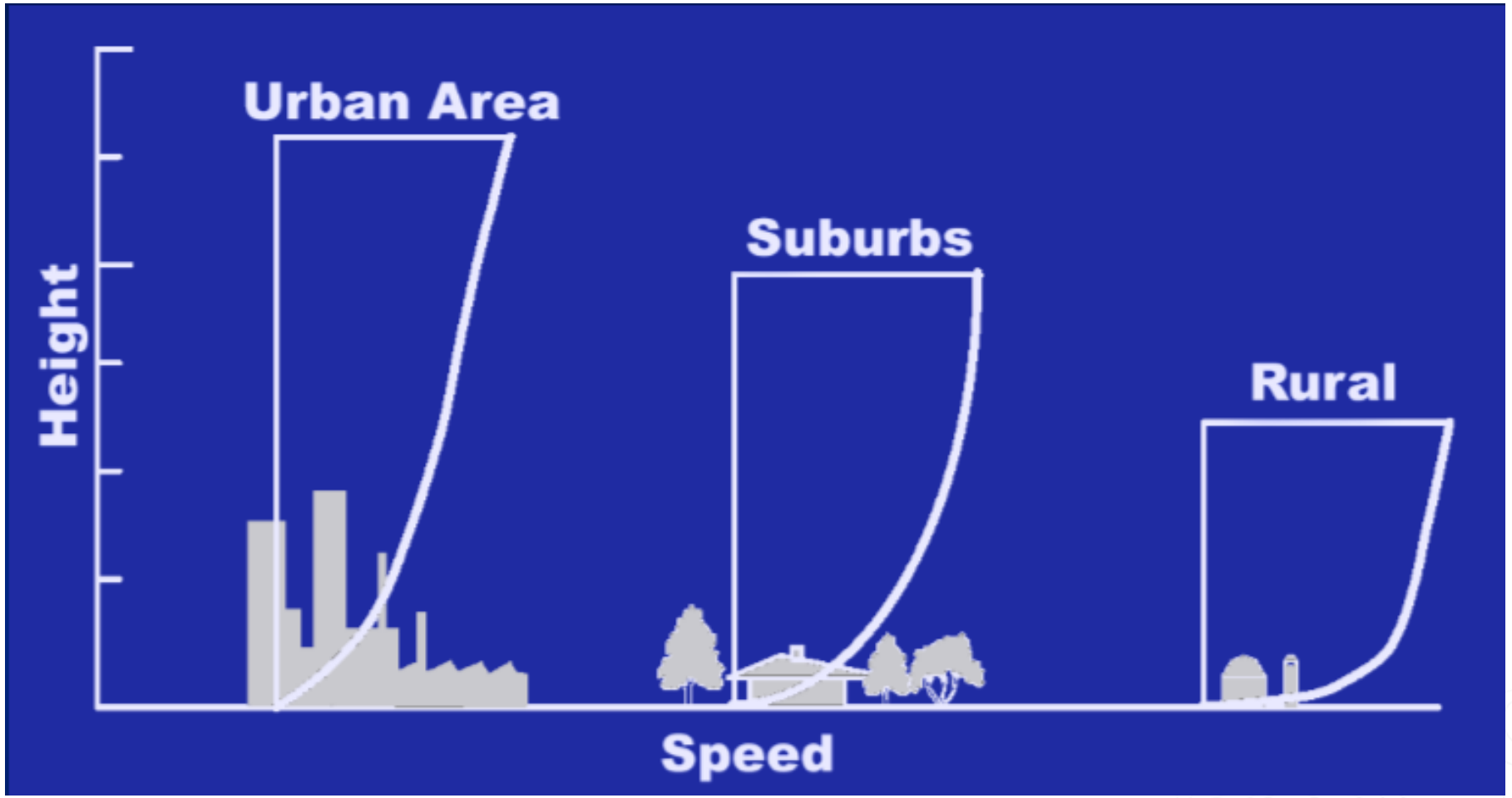
What Can You Do? Verify Surface Roughness Length



Tip: Check the vectors used to define surface roughness length for worst-case wind directions

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What Can You Do? Verify Surface Roughness Length

12, 30-degree sectors commonly used

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What Can You Do? Verify Surface Roughness Length

Better to use sectors customized to the project

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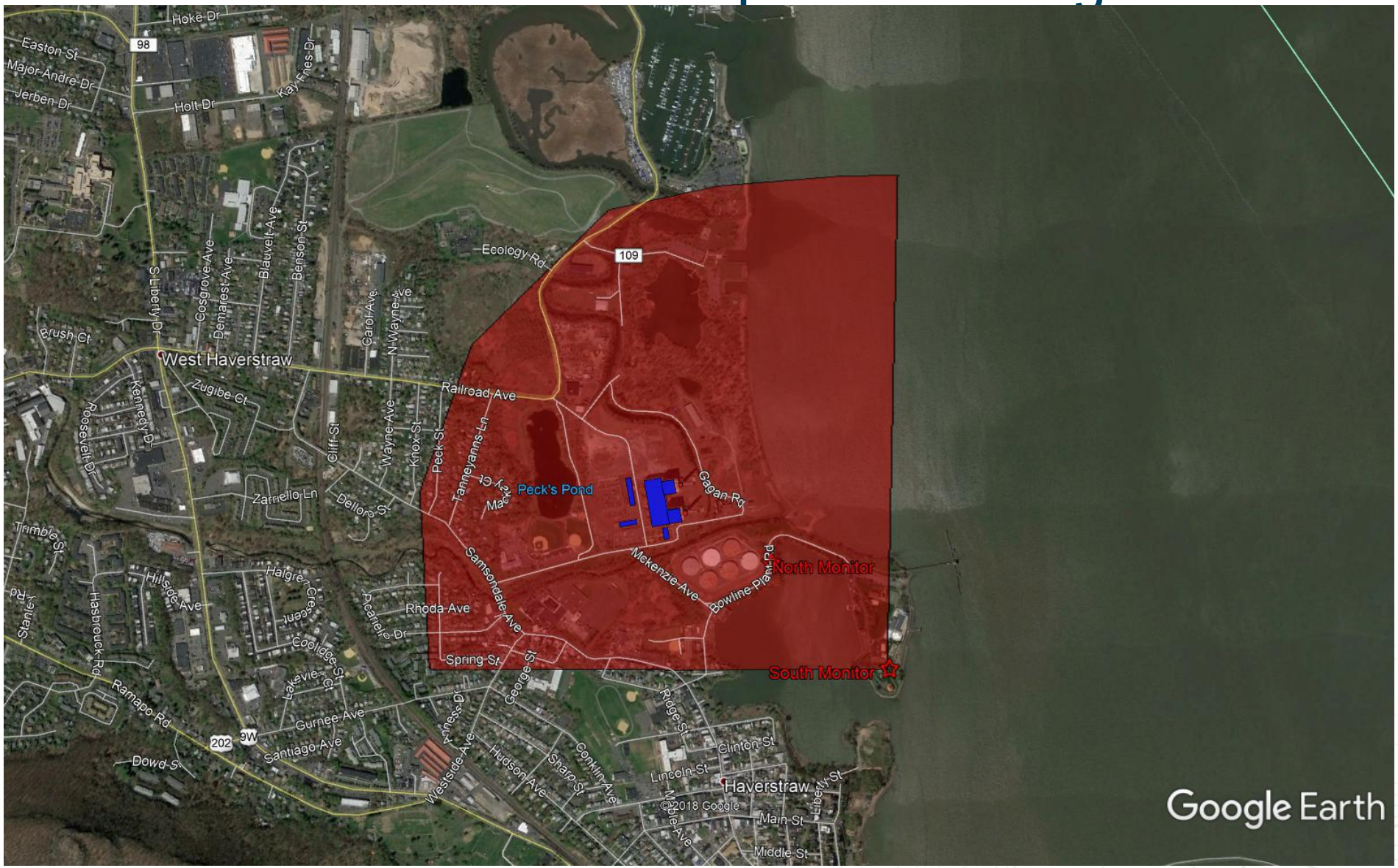
What Can You Do? Site Specific Background Data



Calculate site specific background concentrations using on-site monitor data

Wind towards monitor

23 µg/m^3

Wind away

2.4 µg/m^3

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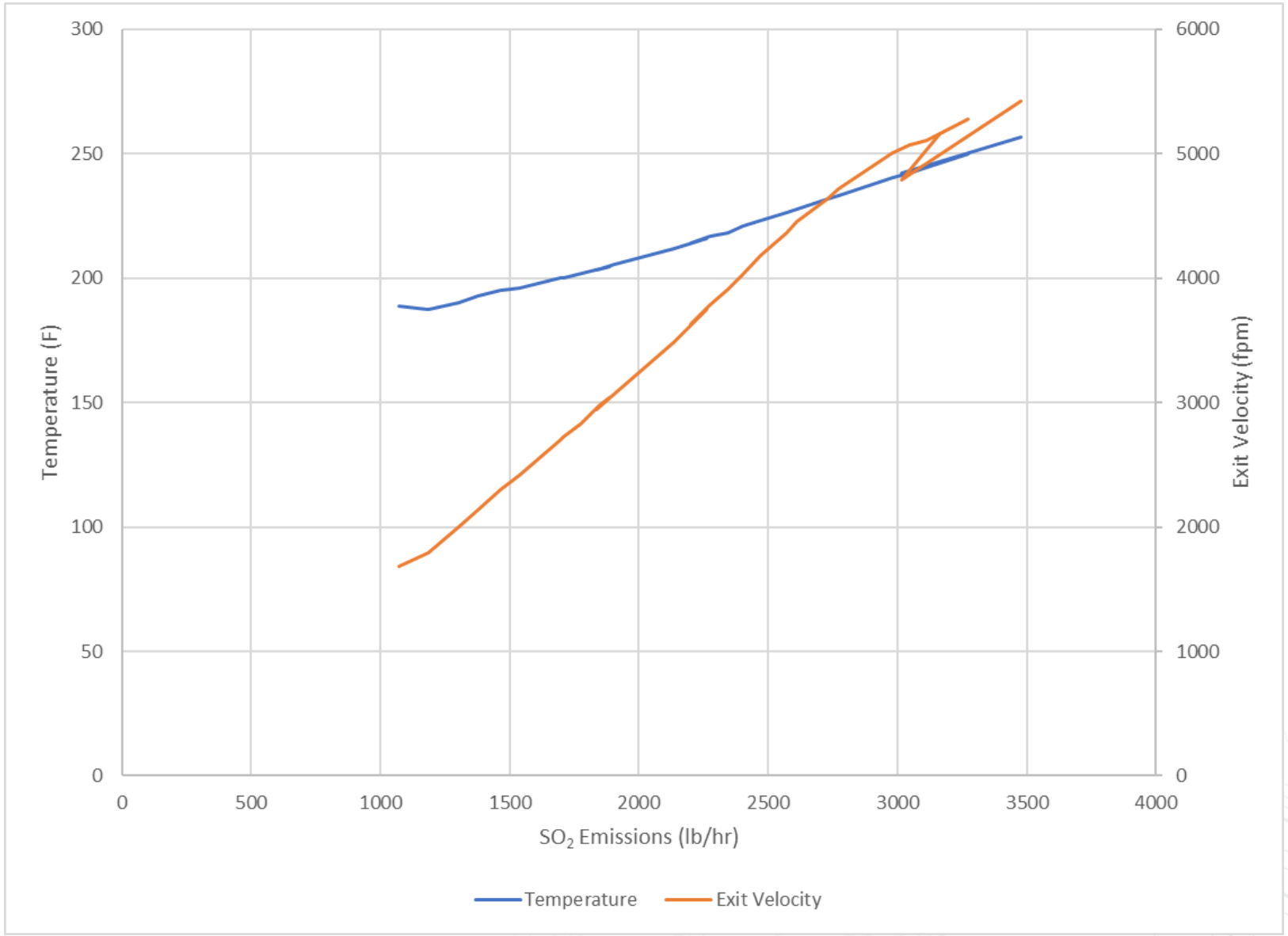
What Can You Do? Appropriate Stack Flow/Temps



Utilize stack flow/temperature data that corresponds to the emissions modeled

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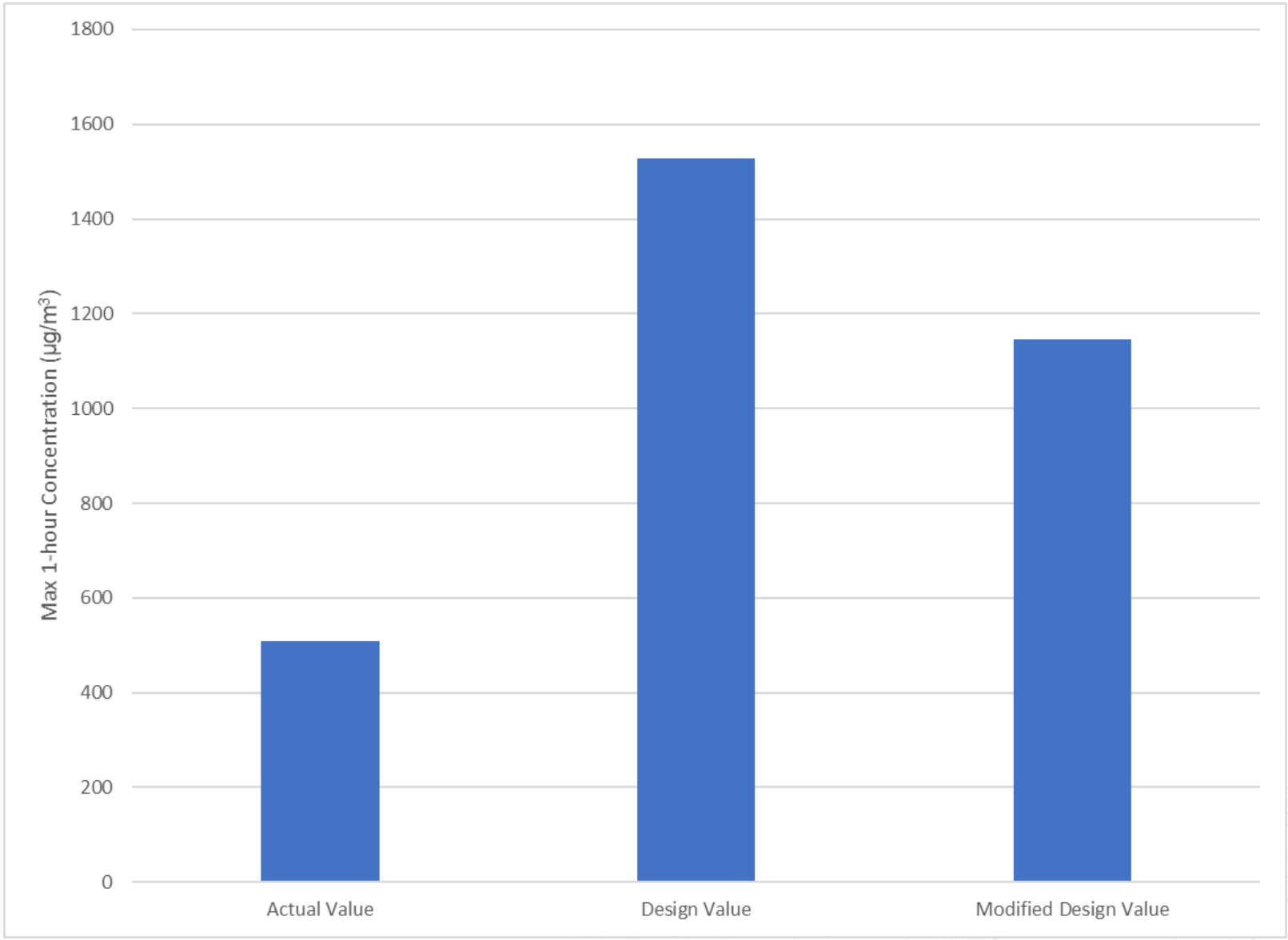
Test Case: Did the Modifications Improve Results?



Modified design value 25% less

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Conclusion

- Regulatory analyses very conservative
- AERMOD model gives realistic results when run using realistic parameters
- Refining these key inputs assures more representative results:
  - Emission rates
  - Wind measurements
  - Surface roughness length
  - Background concentrations
  - Stack flow and temperature data

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