# NOAA AQM Evaluation

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Air Quality Planning Branch

DEPARTMENT OF ENERGY & ENVIRONMENT

GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

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# PART 1: WHEN THE MODEL MISSED THE MARK

# Investigating Discrepancies

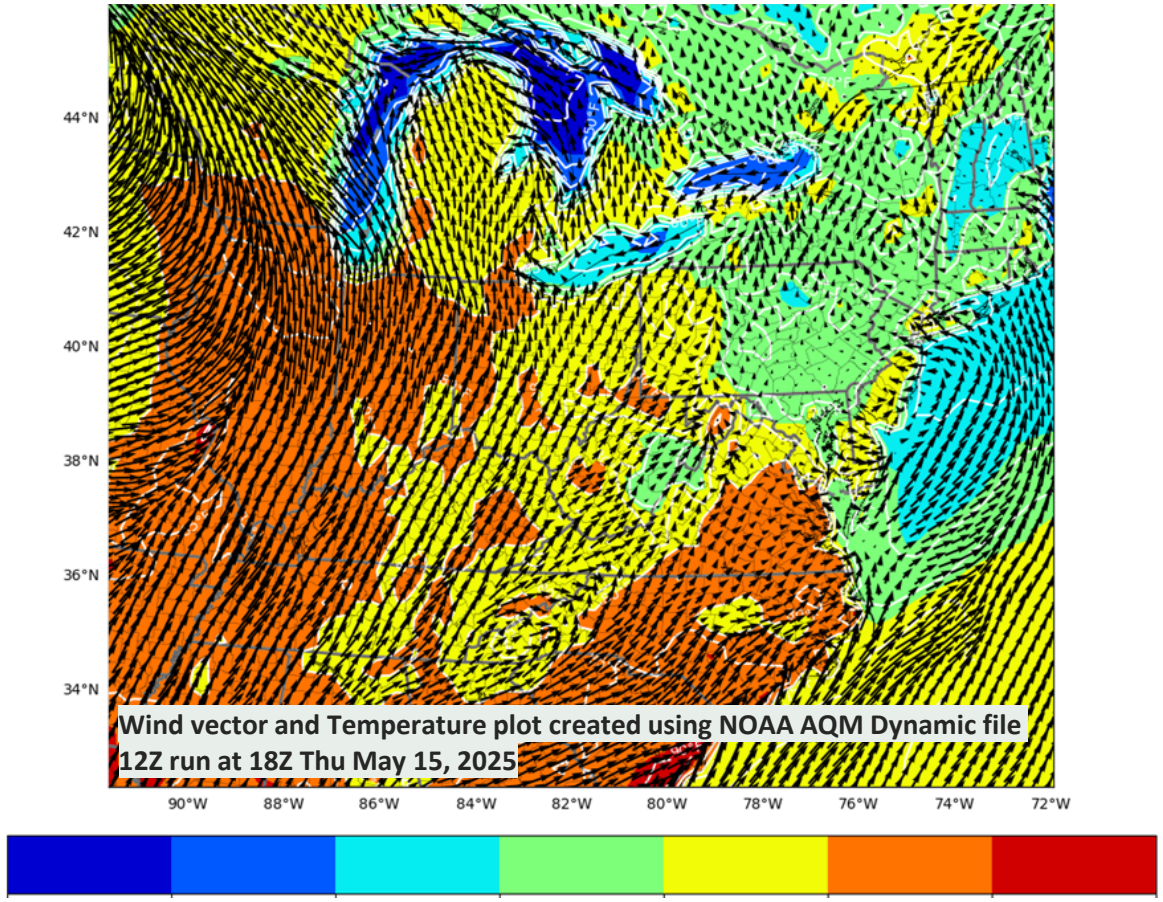
**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at our McMillan site using NOAA AQM 12Z model run.**

| Forecast Run Date | Forecast Lead Time | AQM MD8AO ppb for May 15th | McMillan MD8AO ppb | Model Bias |
|---|---|---|---|---|
| May 13th (12z) | Day 2 Operational | 65.55 | 53 | 12.55 |
| | Day 2 Bias Corrected | 68.47 | | 15.47 |
| May 14th (12z) | Day 1 Operational | 68.33 | | 15.33 |
| | Day 1 Bias Corrected | 71.88 | | 18.88 |

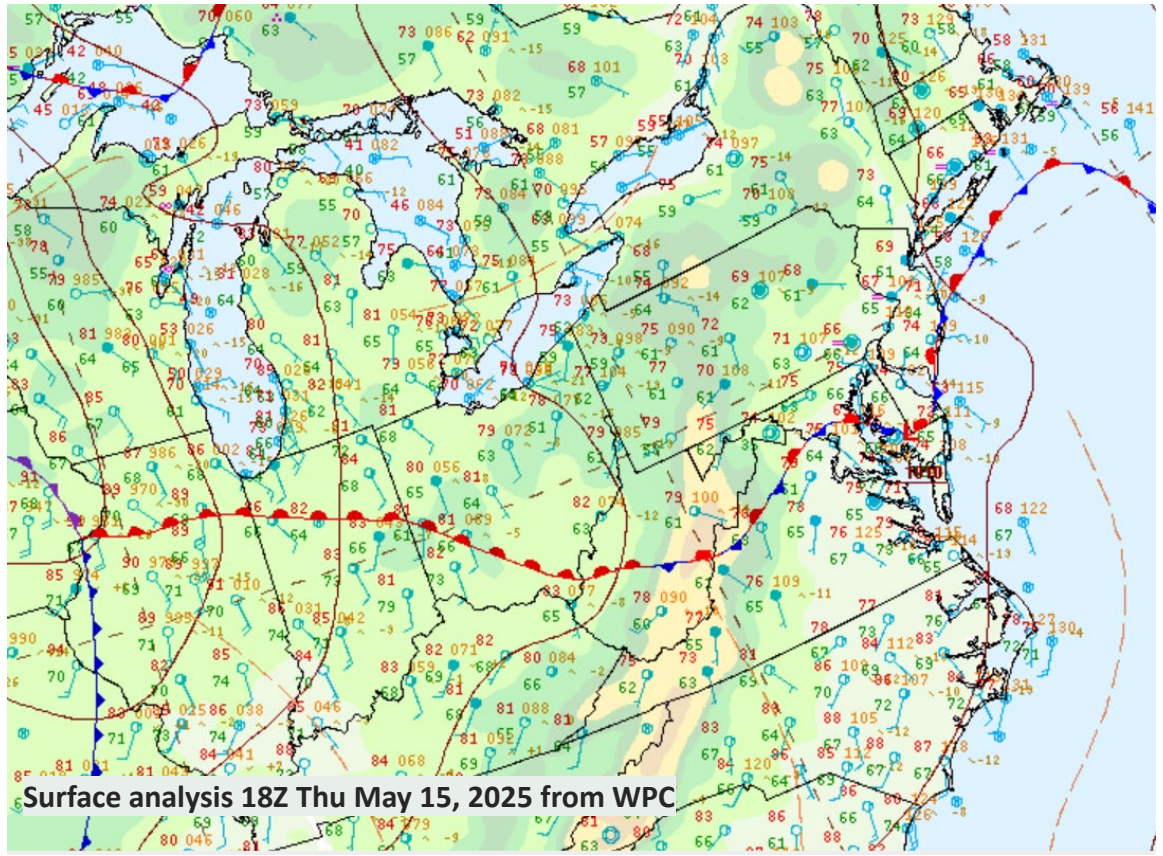
**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at Maryland's Lake Montebello site using NOAA AQM 12Z model run.**

| Forecast Run Date | Forecast Lead Time | AQM MD8AO ppb for May 15th | Lake Montebello MD8AO ppb | Model Bias |
|---|---|---|---|---|
| May 13th (12z) | Day 2 Operational | 65.35 | 49 | 16.35 |
| | Day 2 Bias Corrected | 68.85 | | 19.85 |
| May 14th (12z) | Day 1 Operational | 60.6 | | 11.6 |
| | Day 1 Bias Corrected | 65.32 | | 16.32 |

# Investigating Discrepancies: Meteorological Conditions




Wind vector and Temperature plot created using NOAA AQM Dynamic file 12Z run at 18Z Thu May 15, 2025



Surface analysis 18Z Thu May 15, 2025 from WPC

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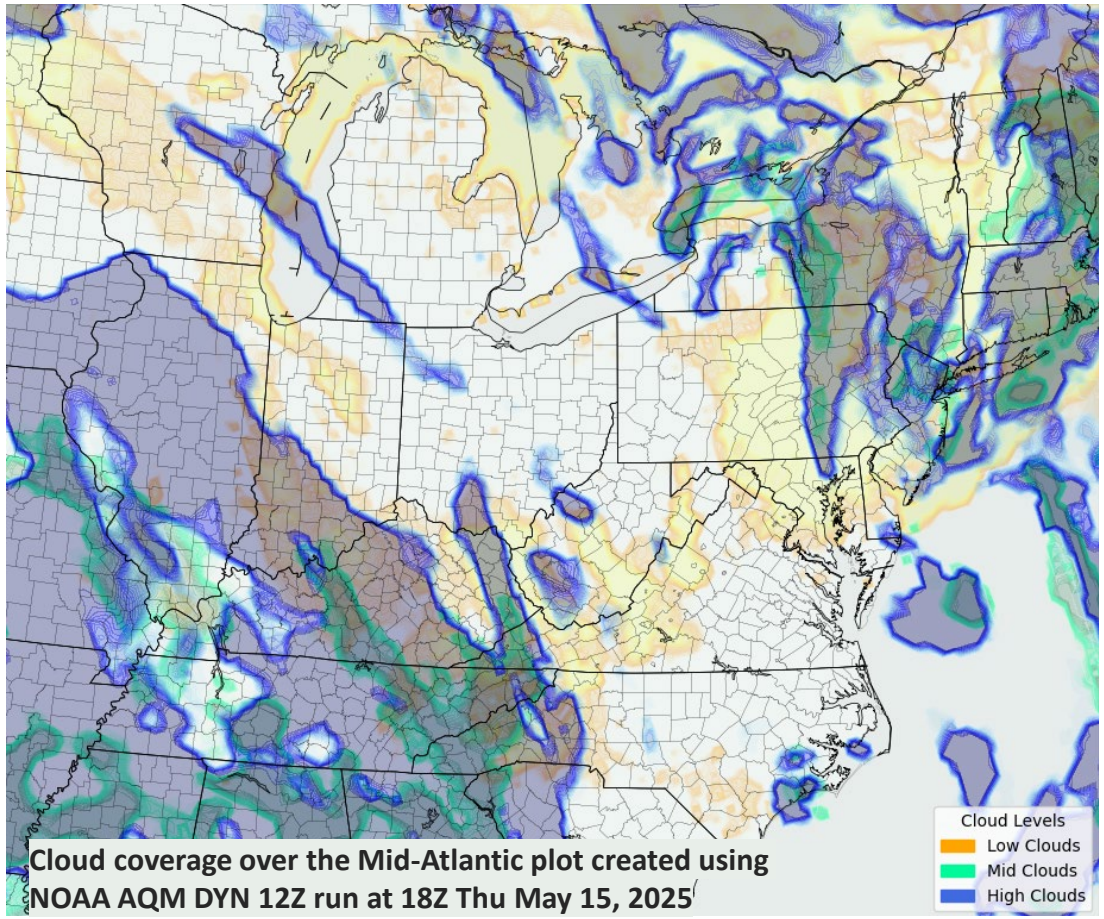
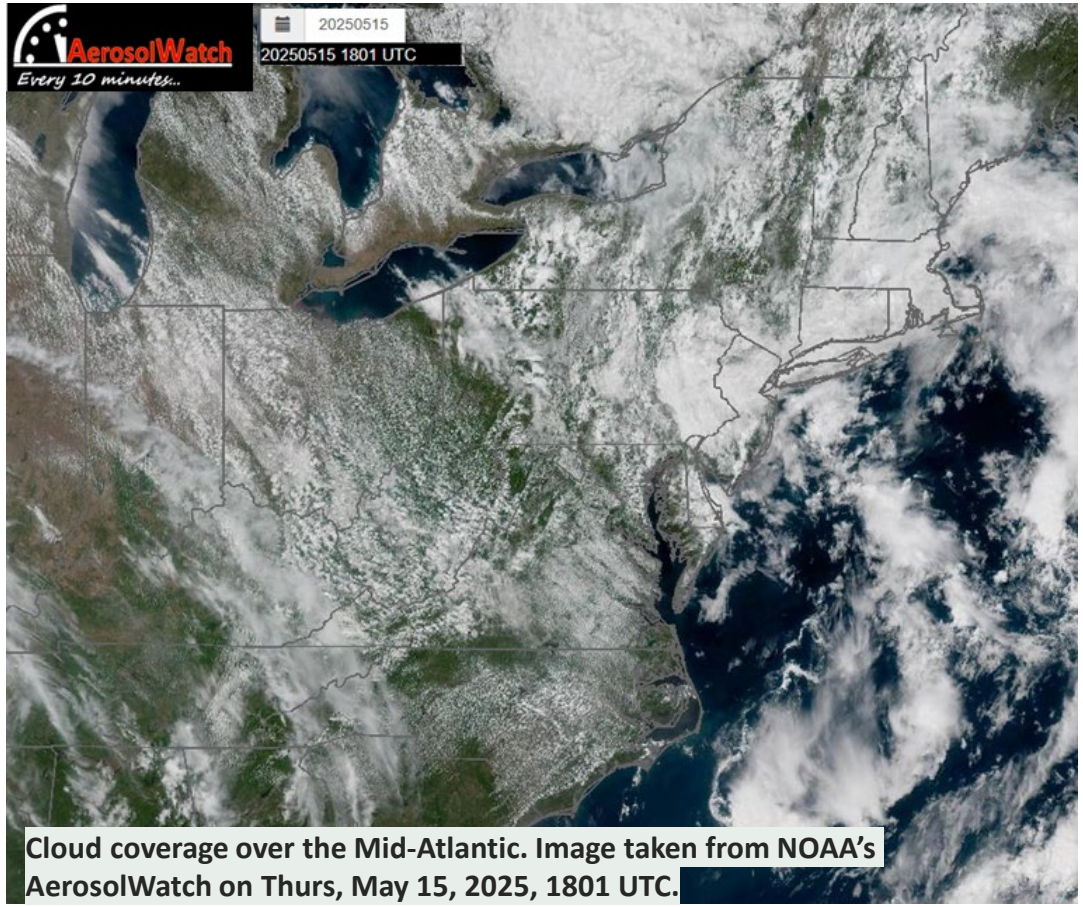
# Modeled vs. Observed Cloud Cover




Cloud coverage over the Mid-Atlantic plot created using NOAA AQM DYN 12Z run at 18Z Thu May 15, 2025




Cloud coverage over the Mid-Atlantic. Image taken from NOAA's AerosolWatch on Thurs, May 15, 2025, 1801 UTC.

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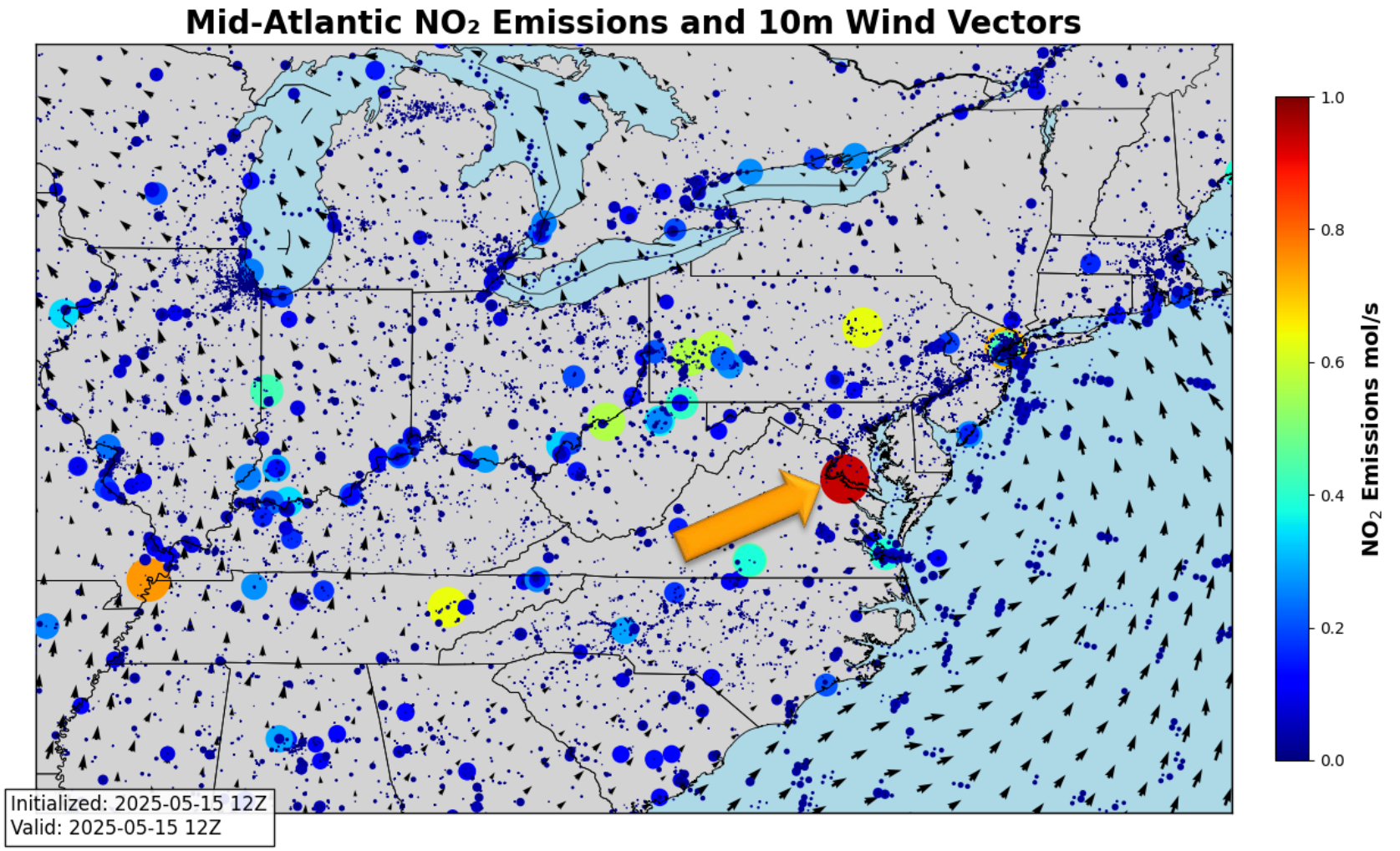
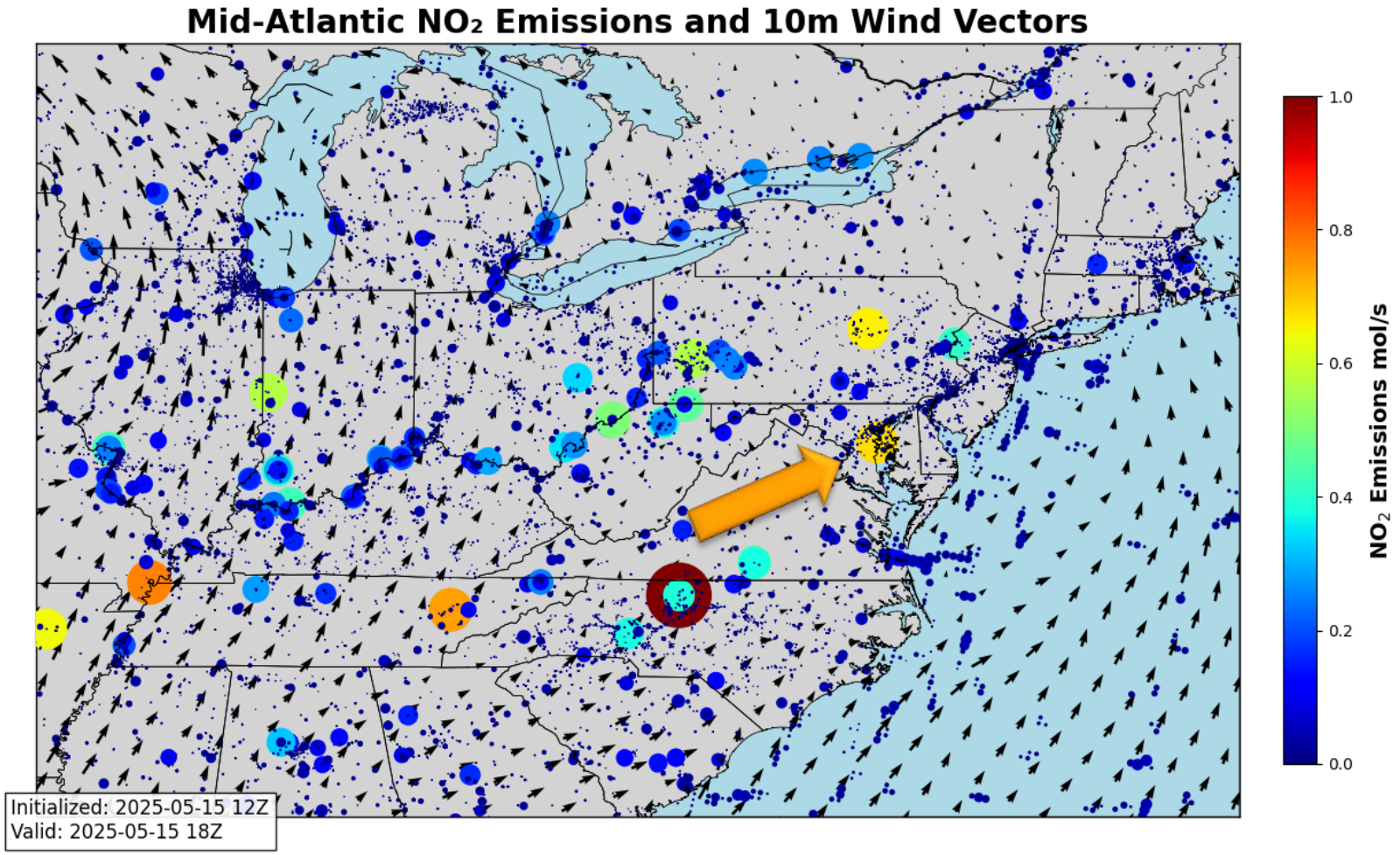
# Investigating Discrepancies: NO2 Point Source



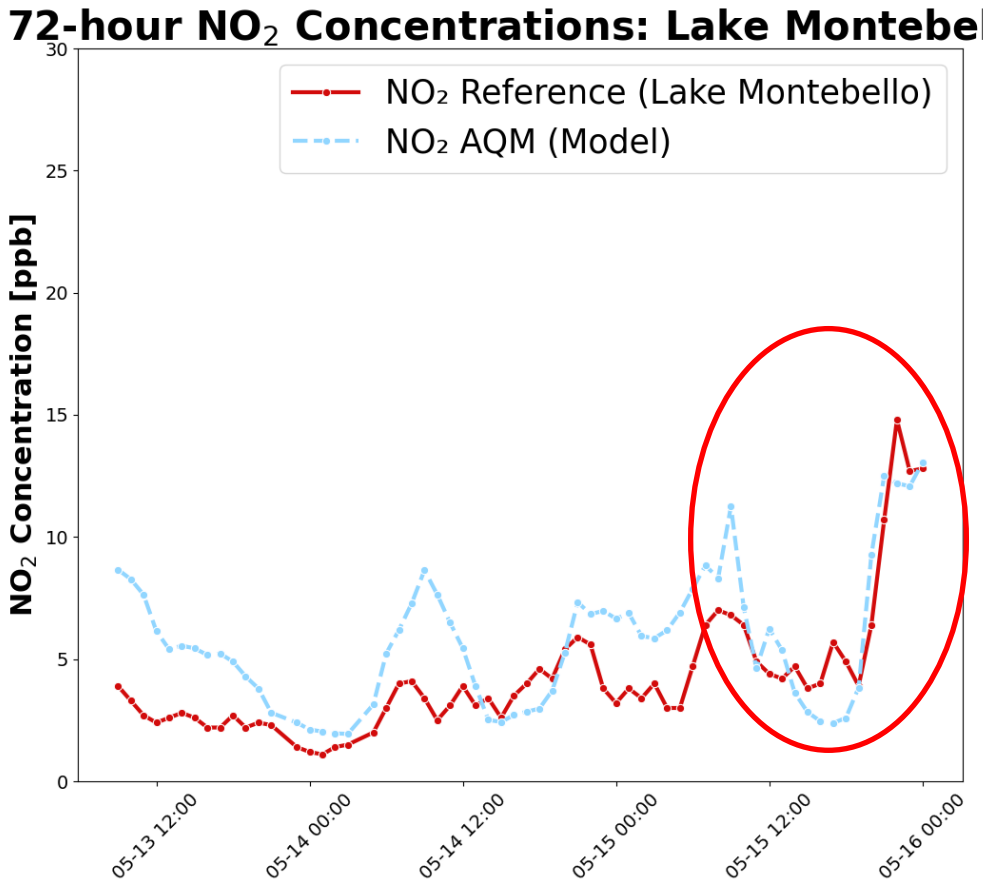

- Wind data sourced from NOAA AQM physics files; input $NO_2$ emissions for the AQM.
- Stagnant air mass observed over the DC area at 12Z, with weak 10-meter winds, indicating limited atmospheric dispersion.

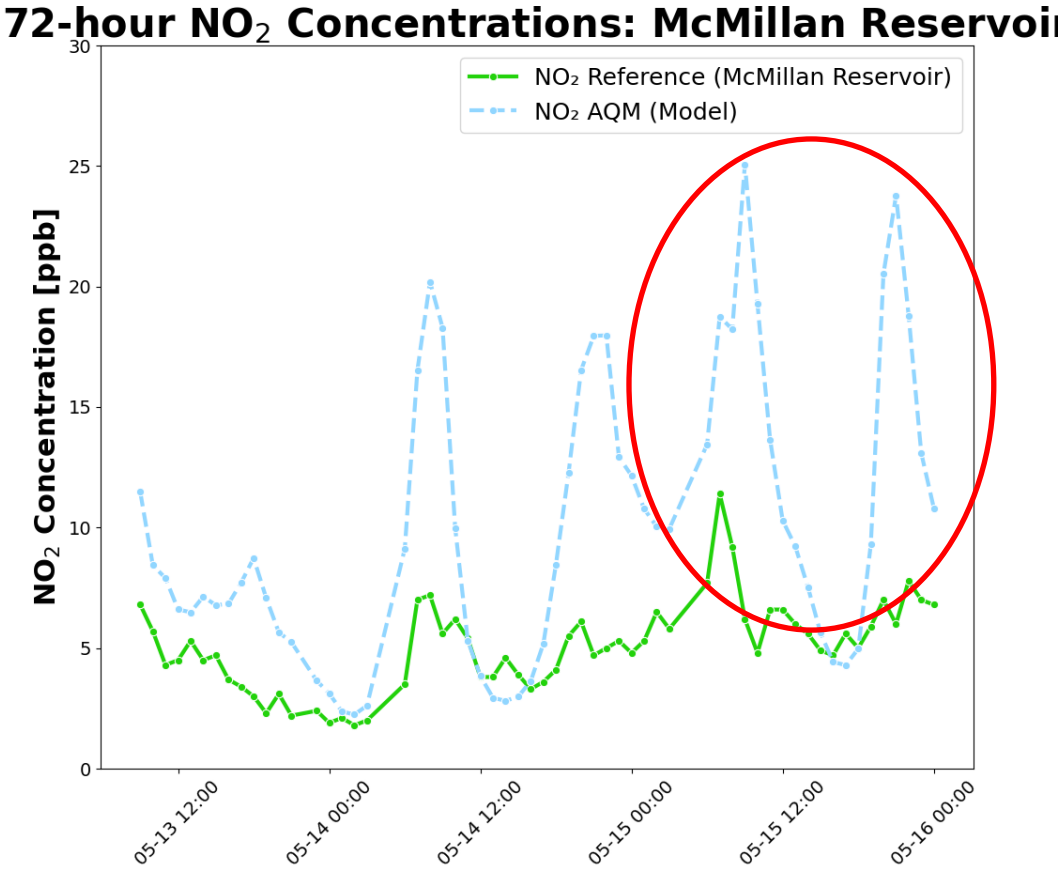
# Afternoon Evolution: Shrinking NO2 Plume-18z snapshot




- By 18Z, $NO_2$ emissions have diminished, while modeled ozone levels increase, indicating photochemical activity.
- Mobile and area sources are not included in this figure, so total precursor availability may be underestimated.

# May Case Study: NO2 72-Hour Total Concentrations

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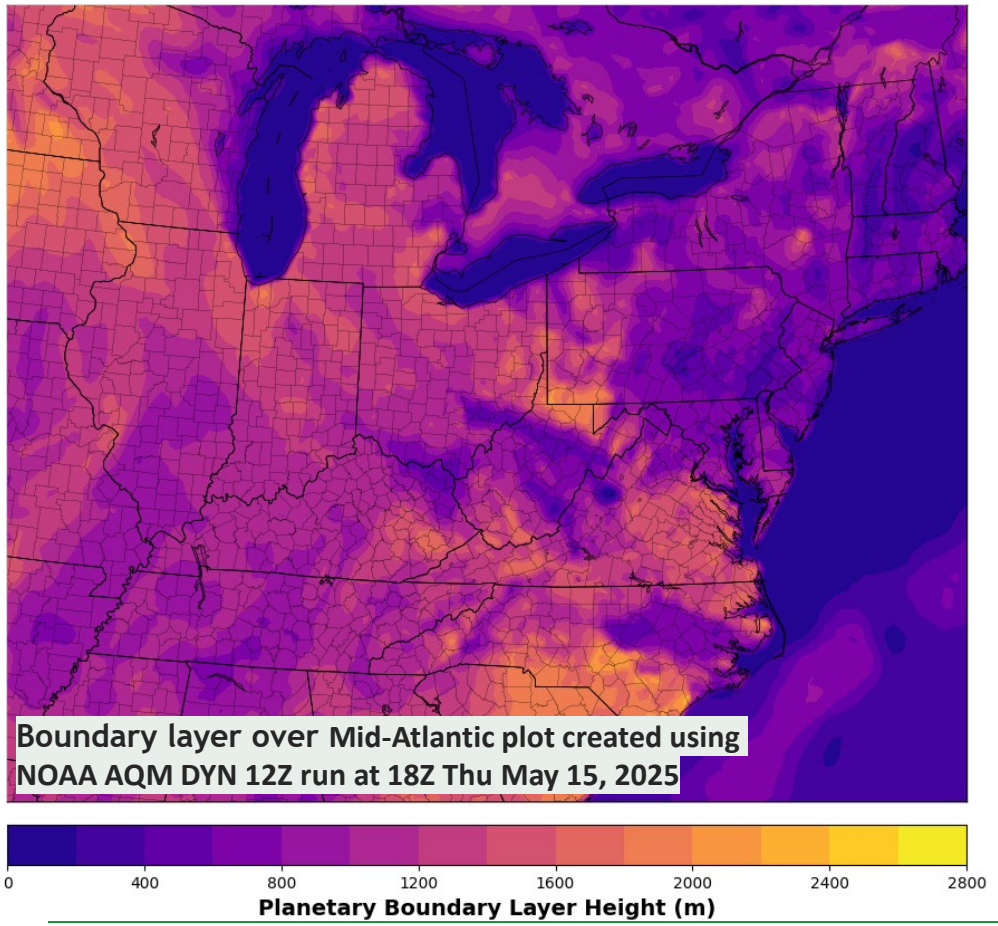
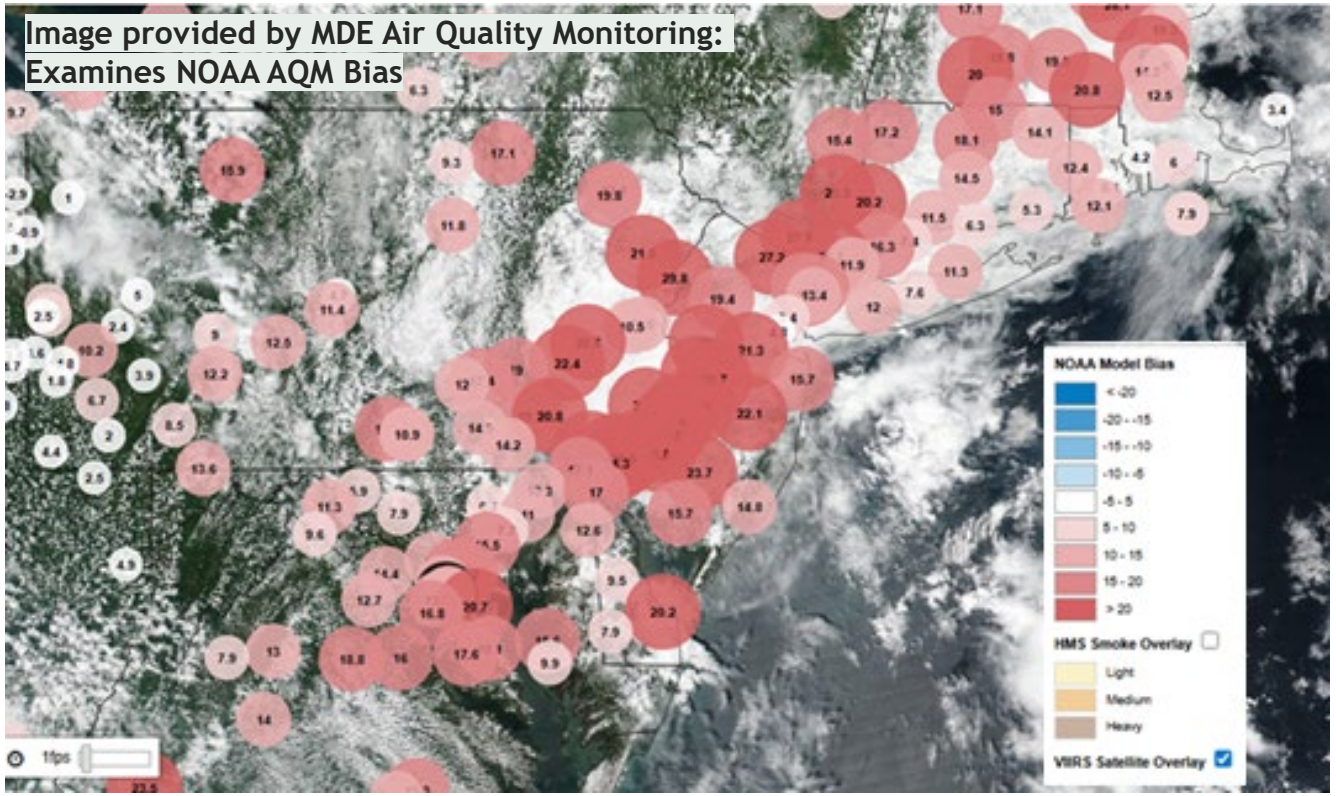
# Very Shallow Boundary Layer

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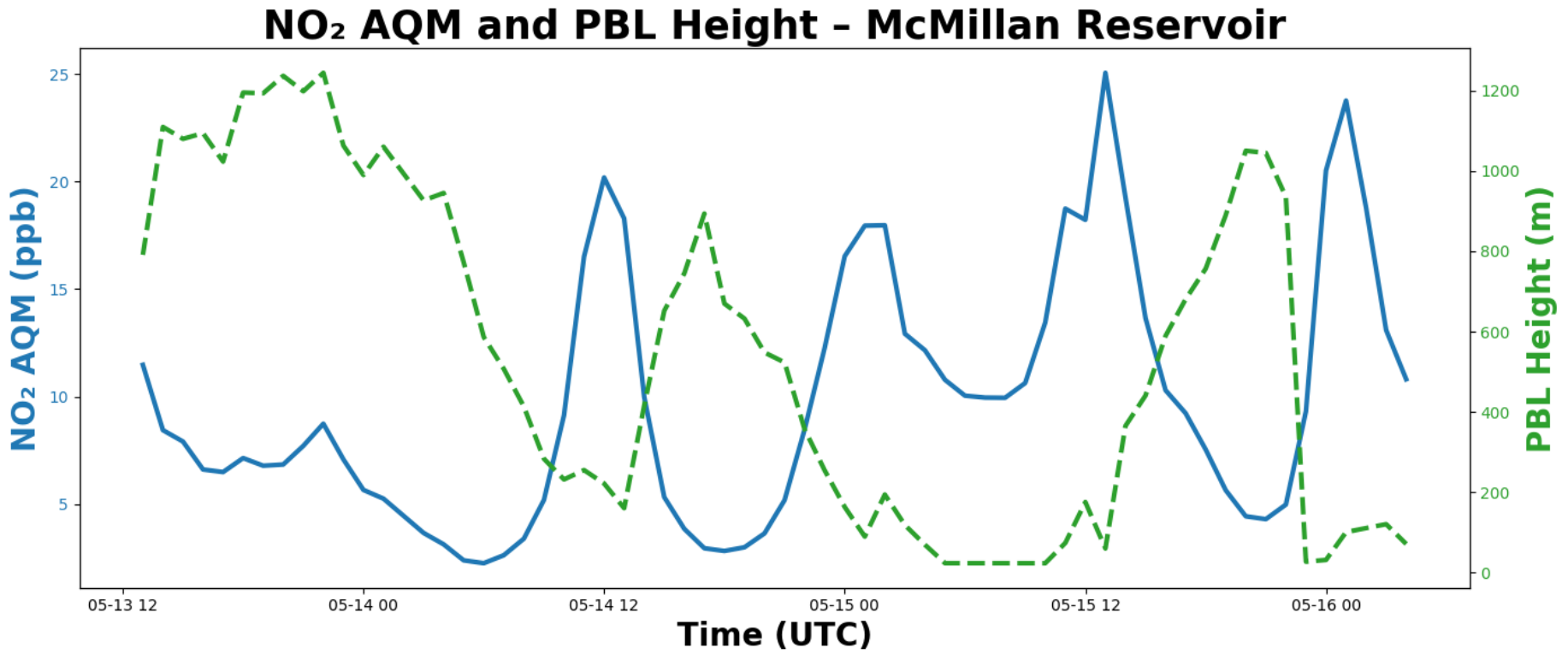


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# PART 2: WHEN THE MODEL SUCCEEDED

# July 9th -11th MD8AO Data DC/NOVA

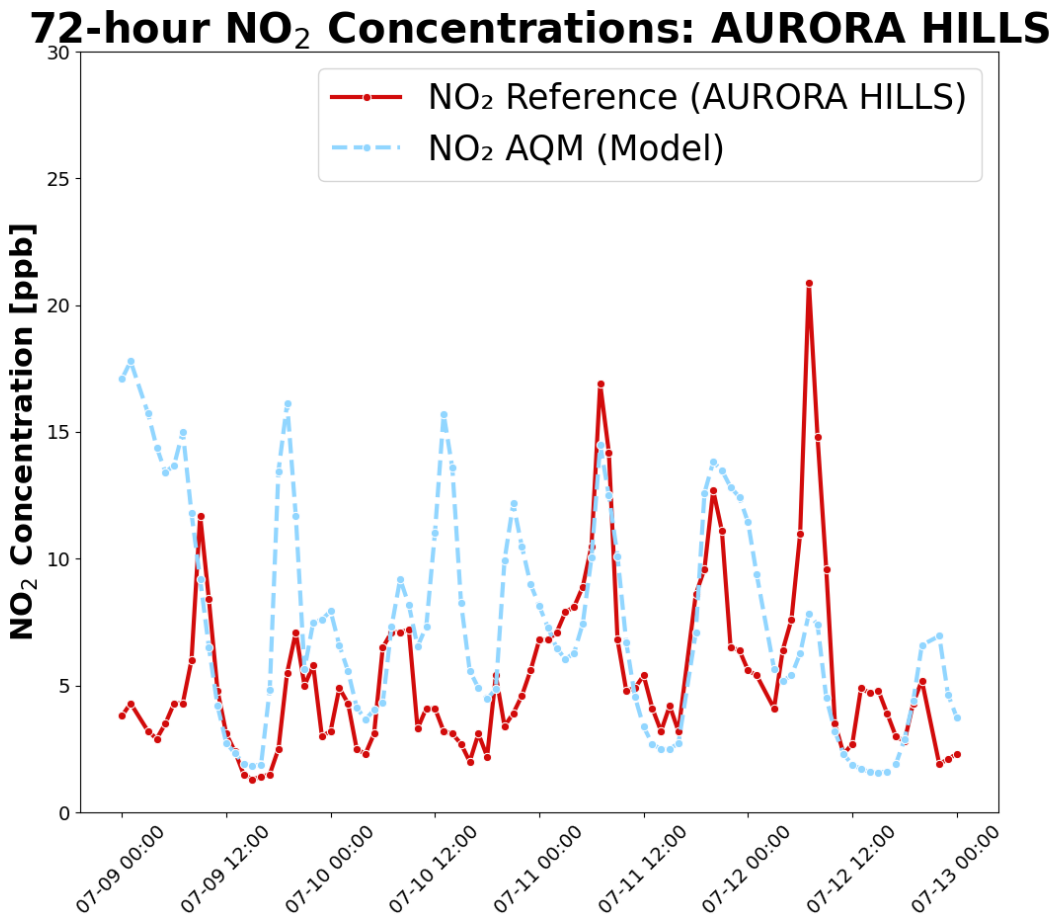
**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at our McMillan site using NOAA AQM 12Z model run.**

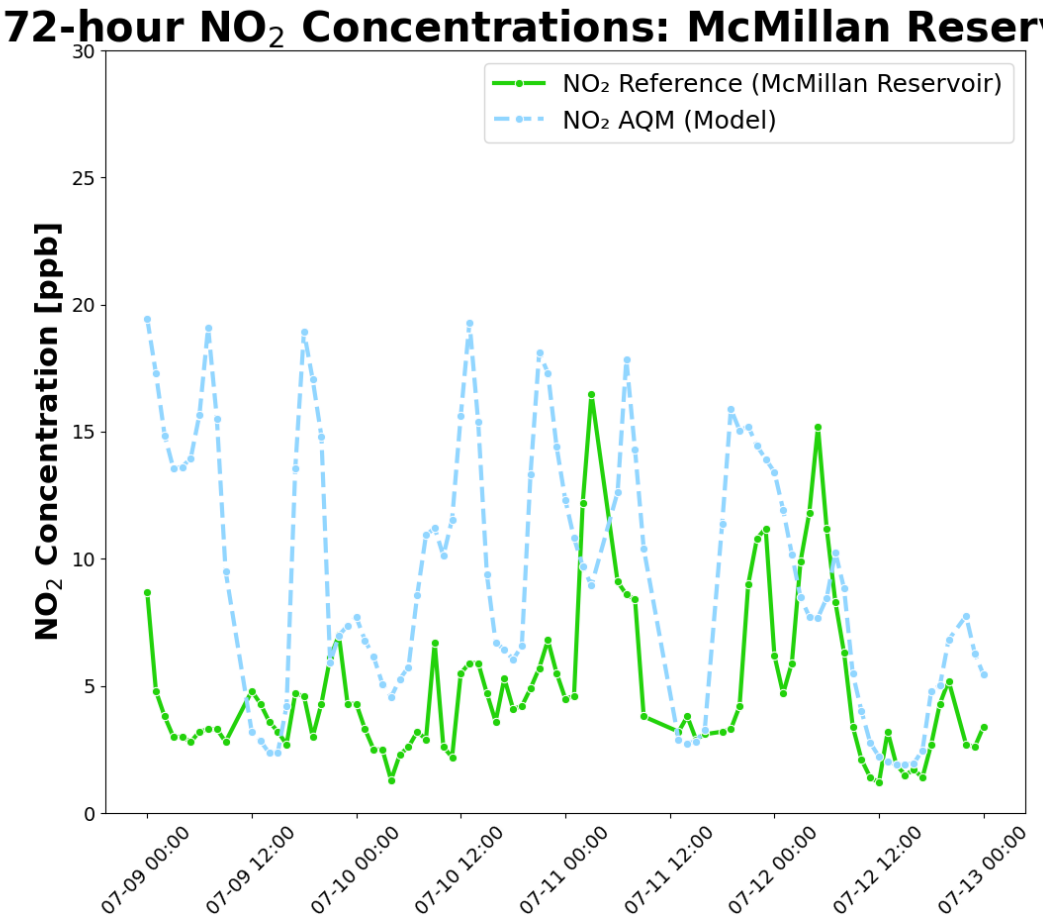
| Forecast Run Date | Forecast Lead Time | AQM MD8AO ppb for May 15th | McMillan MD8AO ppb | Model Bias |
|---|---|---|---|---|
| July 9th (12z) | Day 2 Operational | 72.36 | 68 | 4.36 |
| | Day 2 Bias Corrected | 55.98 | | -12.02 |
| July 10th (12z) | Day 1 Operational | 78.11 | | 10.11 |
| | Day 1 Bias Corrected | 63.86 | | -4.14 |

**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at and Virginia VEQ's Aurora Hills site using NOAA AQM 12Z model run.**

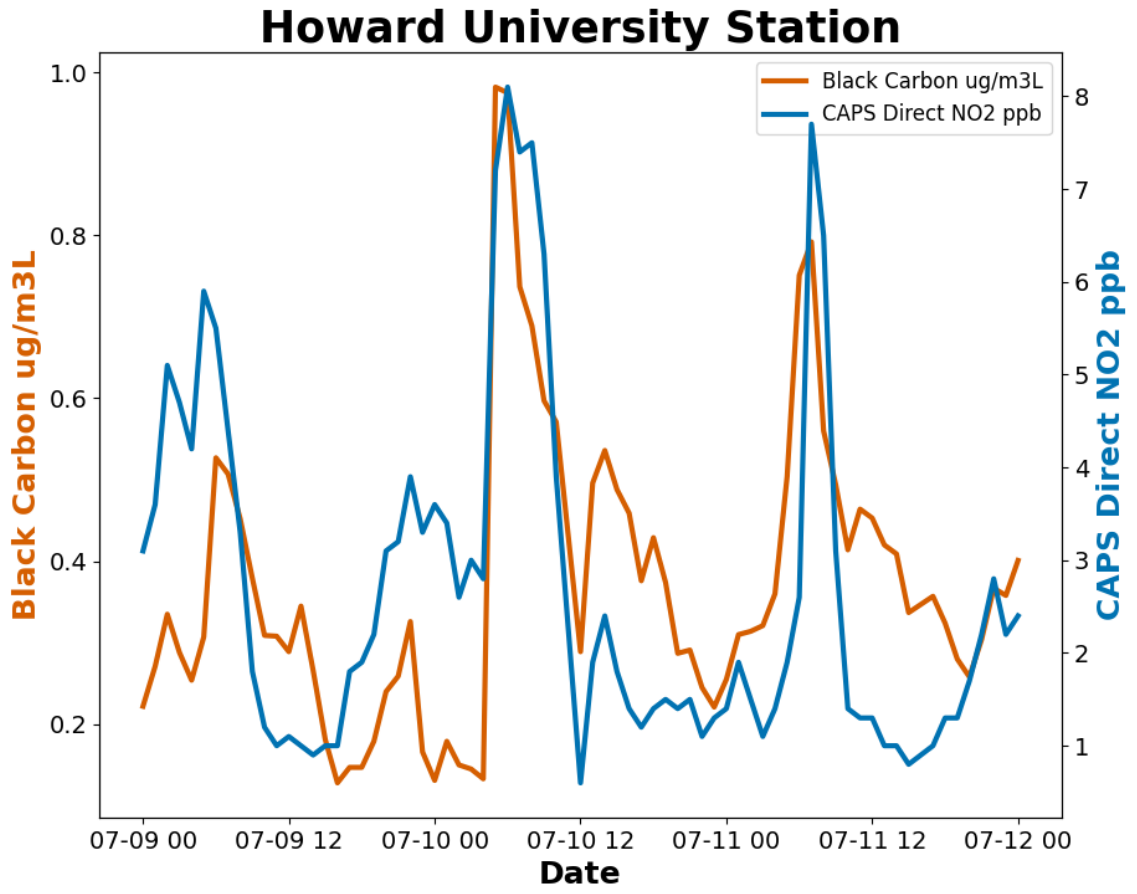
| Forecast Run Date | Forecast Lead Time | AQM MD8AO ppb for May 15th | McMillan MD8AO ppb | Model Bias |
|---|---|---|---|---|
| July 9th (12z) | Day 2 Operational | 53.16 | 71 | -17.84 |
| | Day 2 Bias Corrected | 68.47 | | -2.53 |
| July 10th (12z) | Day 1 Operational | 75.03 | | 4.03 |
| | Day 1 Bias Corrected | 61.21 | | -9.79 |

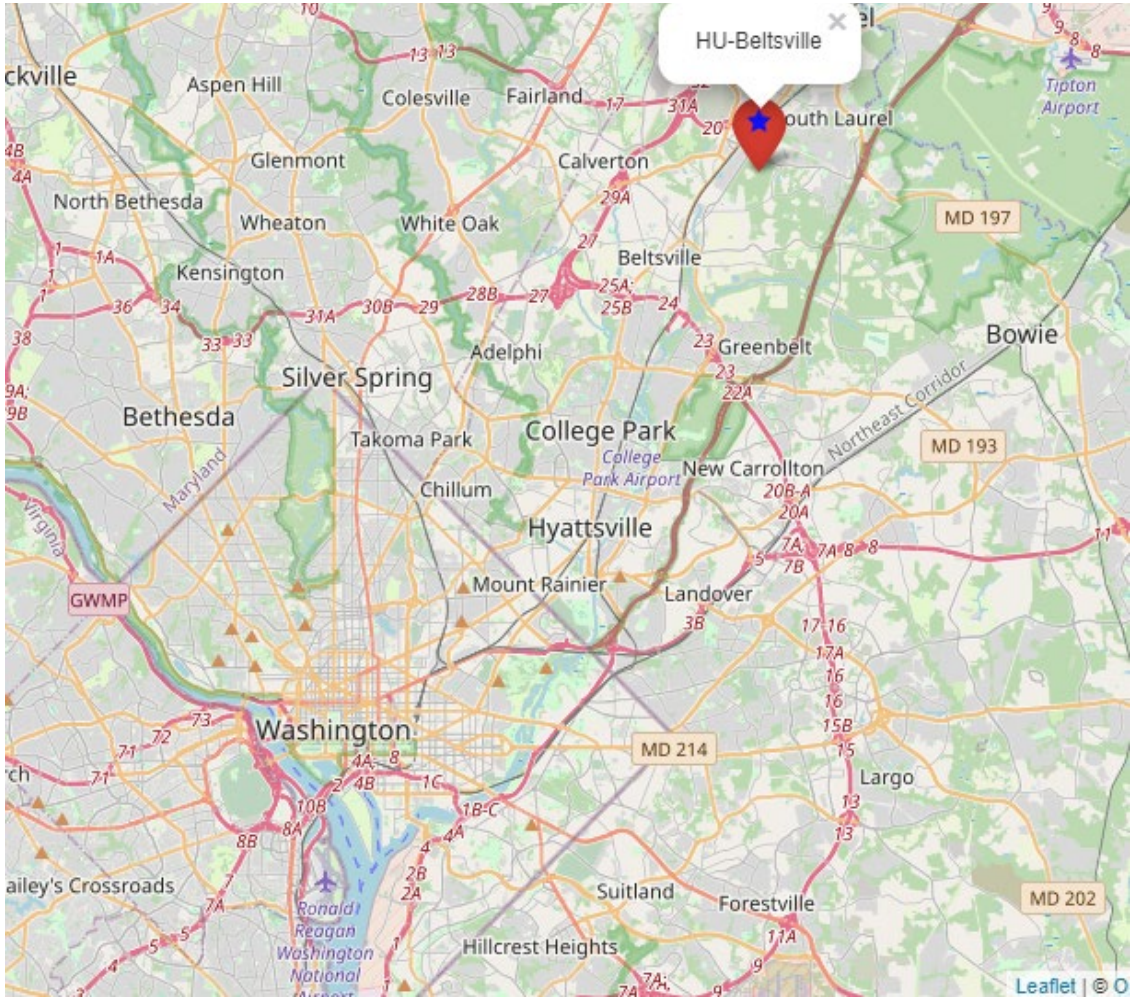
# July Case Study: NO2 72-Hour Total Concentrations



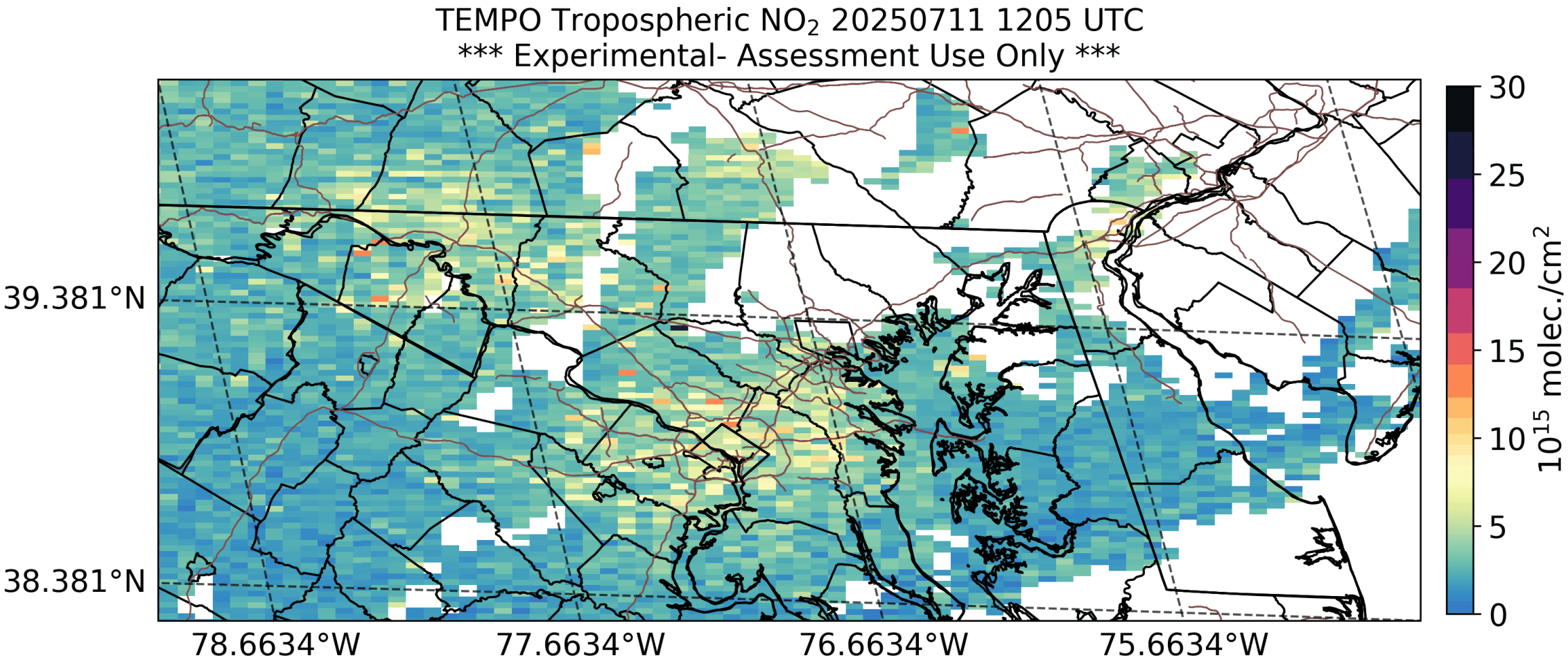



# Driving Factors - Onroad Emissions



# Driving Factors - The Morning Inversion



# Conclusions

- The model can sometimes predict USG levels of a pollutant and alarm in communities and agencies
- We have had to restructure alert processes because automated AirNow alerts were being used
- Those alerts override our forecasts, which are more likely to give better predictions, especially if conditions change for better or for worse

# Recommendations

- We recommend that NOAA think of all scenarios, especially with our changing climate conditions
- Specifically, NOAA should consider re-examining how the model monitors NO2 conditions and wind dispersion scenarios
- Then send an internal alert to monitor the situation BEFORE sending an automated alert
- Make documentation for the files more accessible

# Questions?

## Contact us: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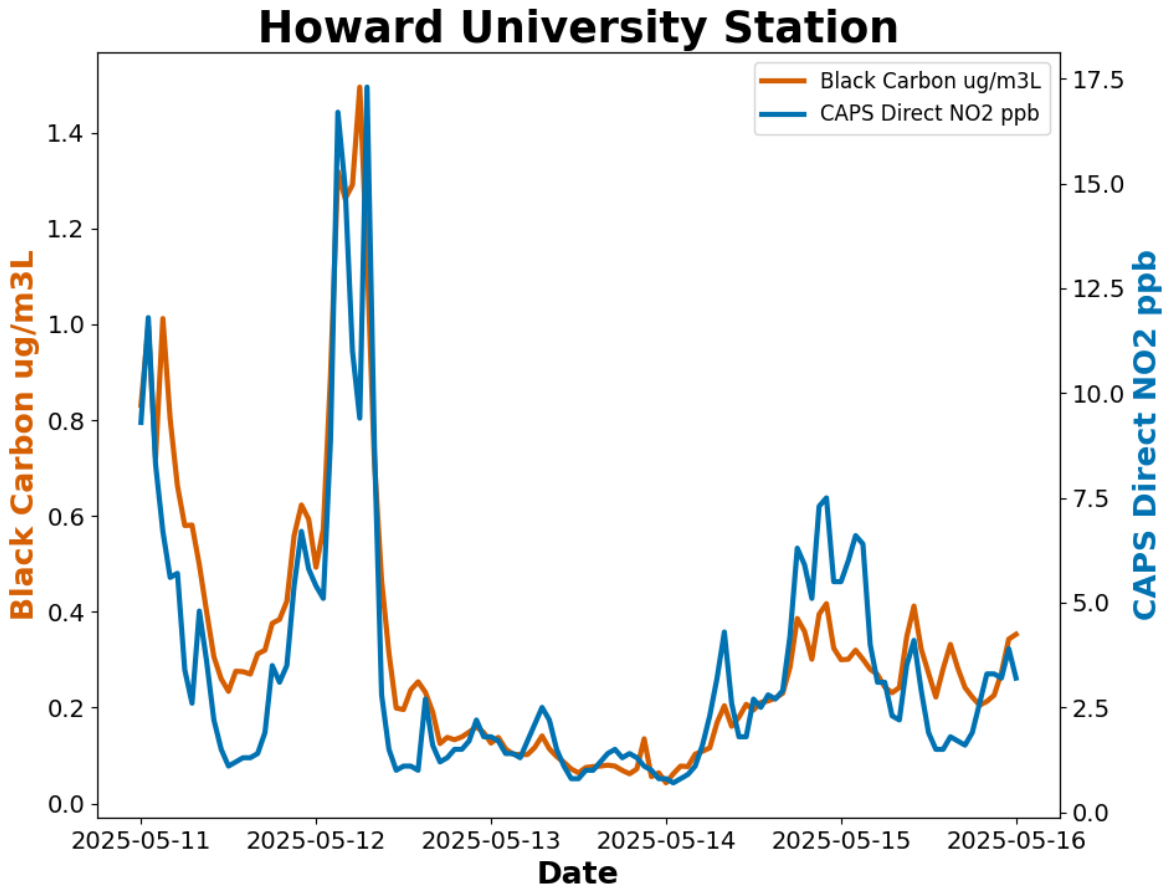
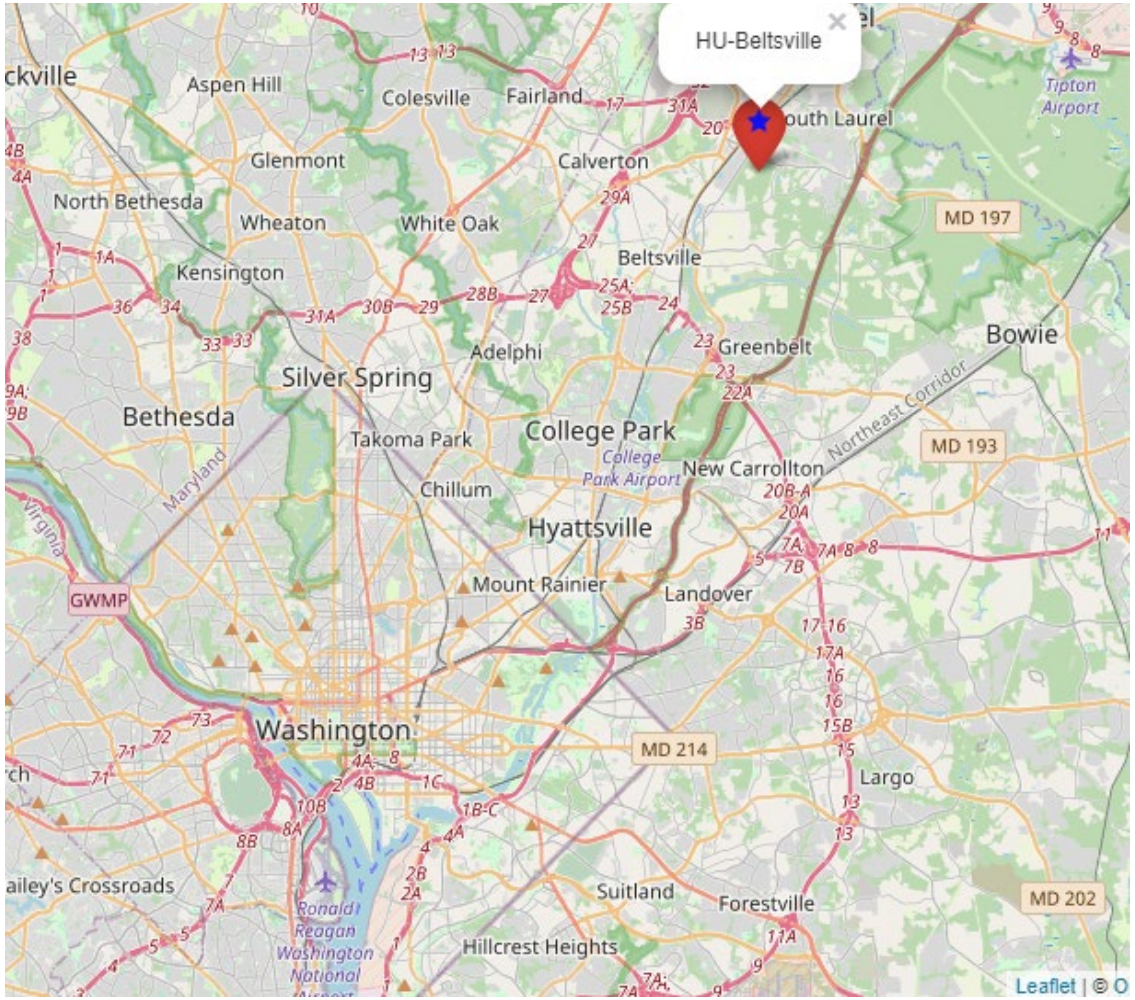
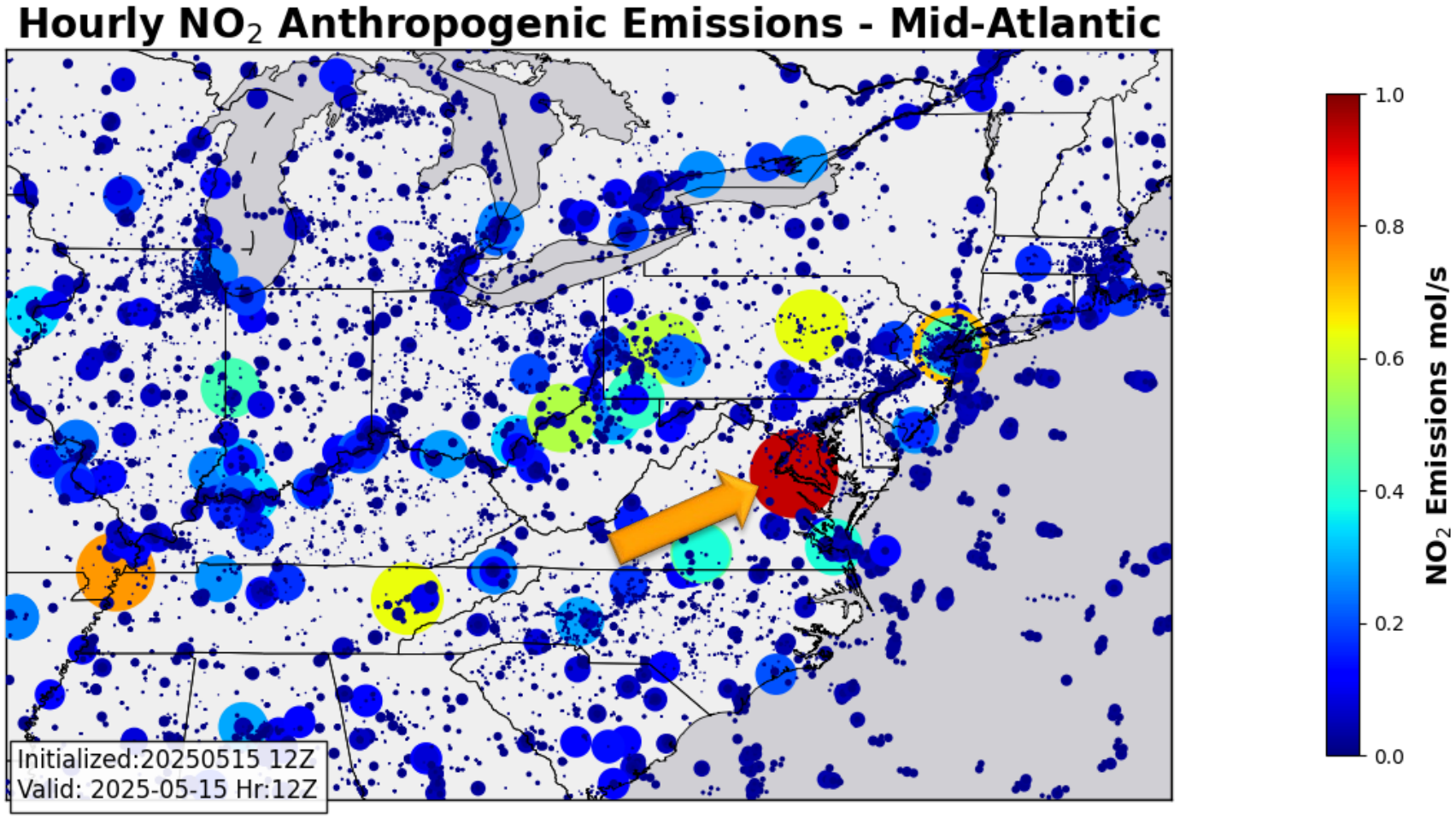
# Acknowledgements

# Driving Factors - Onroad Emissions

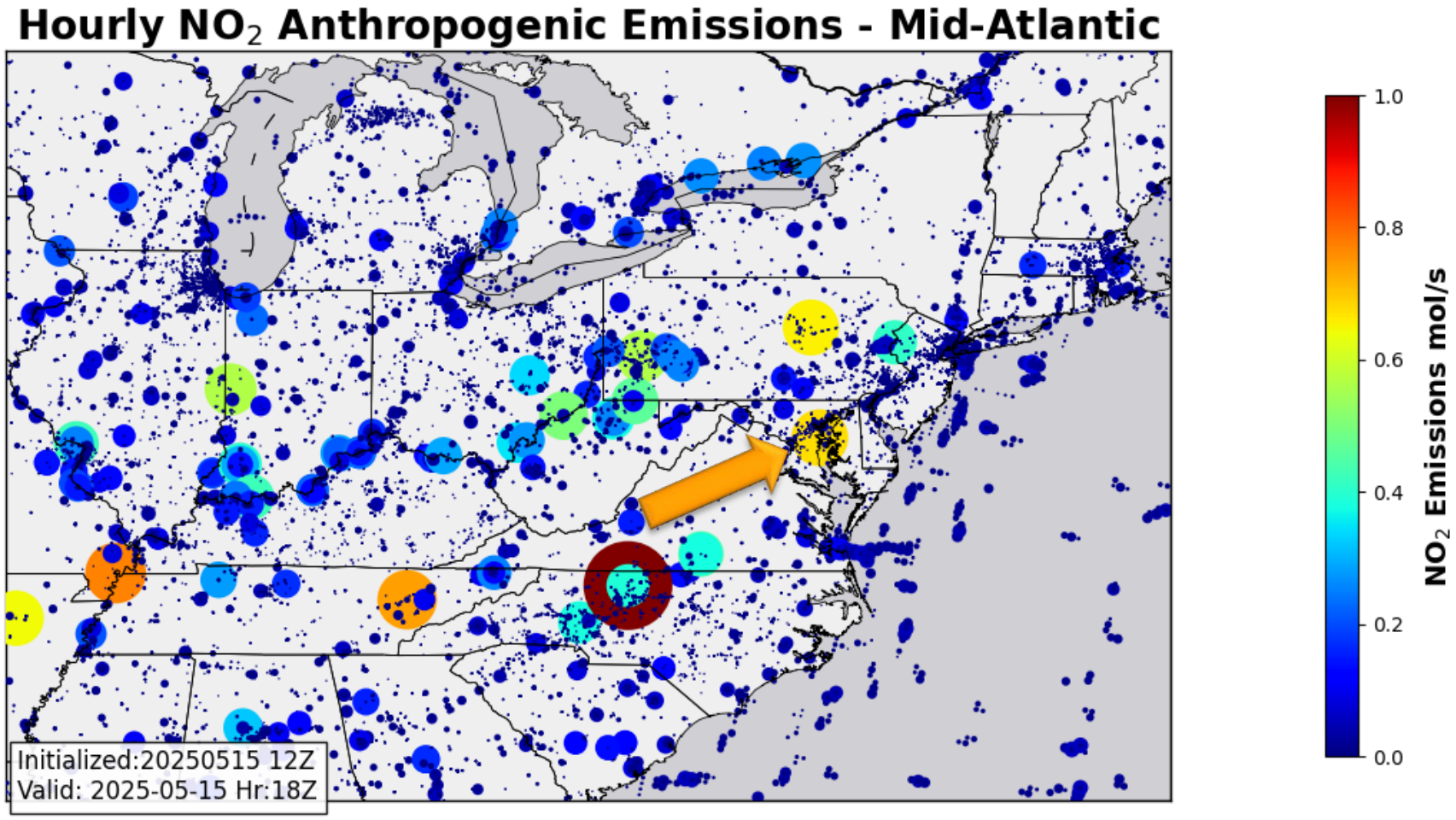


# Investigating Discrepancies: NO2 Point Source Plots



# Investigating Discrepancies: NO2 Point Source Plots



# July 10th -12th MD8AO Data DC/NOVA

**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at our McMillan and Virginia VEQ's Aurora Hills site using NOAA AQM 12Z model run.**

| Date | McMillan MD8O ppb | AQM @ McMillan MD8O ppb | Aurora Hills MD8O ppb | AQM @ Aurora Hills MD80 ppb | Reagan-Airport Temp High °F | AQM @ McMillan Temp High °F | AQM @ Aurora Hills Temp High °F |
|---|---|---|---|---|---|---|---|
| July 10th | 48 | 59.7 | 45 | 58.9 | 84 | 80.8 | 81.1 |
| July 11th | 68 | 79.0 | 71 | 80.2 | 91 | 88.6 | 88.6 |
| July 12th | 45 | 61.1 | 45 | 57.2 | 91 | 89.7 | 89.7 |

# July 10th -12th MD8AO Data Maryland

**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at MDE's Lake Montebello and Essex sites using NOAA AQM 12Z model run.**

| Date | Essex MD8O ppb | AQM @ Essex MD8O ppb | Lake Monte-bello MD8O ppb | AQM @ Lake Monte-bello MD8O ppb | BWI-Airport Temp High °F | AQM @ Lake Monte-bello Temp High °F | AQM @ Essex Temp High °F |
|---|---|---|---|---|---|---|---|
| July 10th | 56 | 61.6 | 55 | 59.4 | 80.6 | 82.5 | 80.4 |
| July 11th | 57 | 65.3 | 60 | 67 | 69.8 | 87.7 | 85.1 |
| July 12th | 41 | 57.9 | 45 | 65.3 | 69.8 | 85.8 | 84.9 |

# Investigating Discrepancies: Meteorological Conditions

**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at MDE's Lake Montebello and Essex sites using NOAA AQM 12Z model run.**

| Date | Essex MD8O ppb | AQM @ Essex MD8AO ppb | Lake Montebello MD8O ppb | AQM @ Lake Montebello MD8O ppb | BWI-Airport Temp High °F | AQM @ Essex Temp High °F | AQM @ Lake Monte-bello Temp High °F |
|---|---|---|---|---|---|---|---|
| May 12th | 56 | 52 | 56 | 53 | 80.6 | 72.3 | 74.4 |
| May 13th | 51 | 41 | 50 | 39 | 69.8 | 64.9 | 63.9 |
| May 14th | 44 | 47 | 43 | 47 | 69.8 | 71.4 | 70.4 |
| May 15th | 49 | 58 | 49 | 58 | 78.8 | 74.1 | 72.7 |

**Daily Maximum 8-Hour Average Ozone (MD8AO) concentrations at our McMillan site using NOAA AQM 12Z model run.**

| Date | McMillan MD8O ppb | AQM @ McMillan MD8O ppb | Reagan-Airport Temp High °F | AQM Temp High °F |
|---|---|---|---|---|
| May 12th | 52 | 49 | 78 | 75.9 |
| May 13th | 45 | 36 | 68 | 65.9 |
| May 14th | 39 | 51 | 75 | 73.9 |
| May 15th | 53 | 64 | 79 | 76.2 |