Initial Validation of the AIRPACT 3-day Forecast

NW-AIRQUEST Meeting
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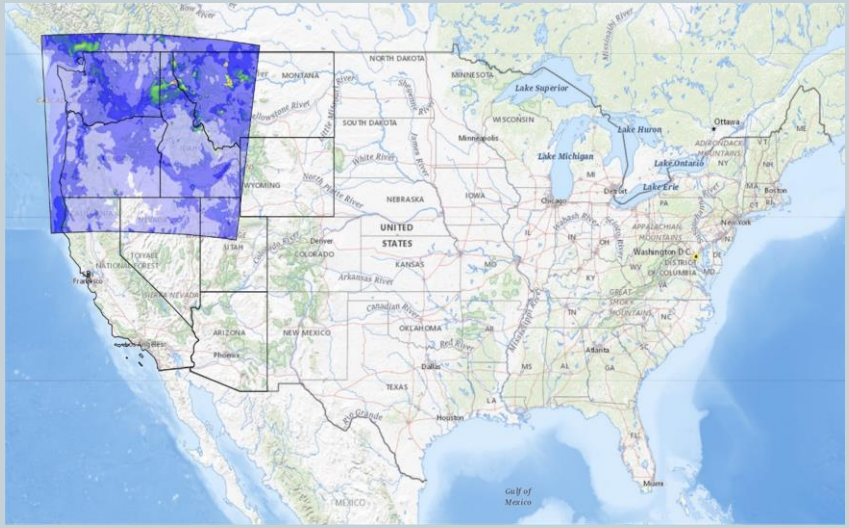
from LAR/CEE/WSU

Introduction

- AIRPACT5 provides a 48-hour (2-day) forecast
- From 17 November 2023 the results of Day3 are available
- Validation of AIRPACT5 for Day1, Day2 and Day3
- Special focus of validation for Day3

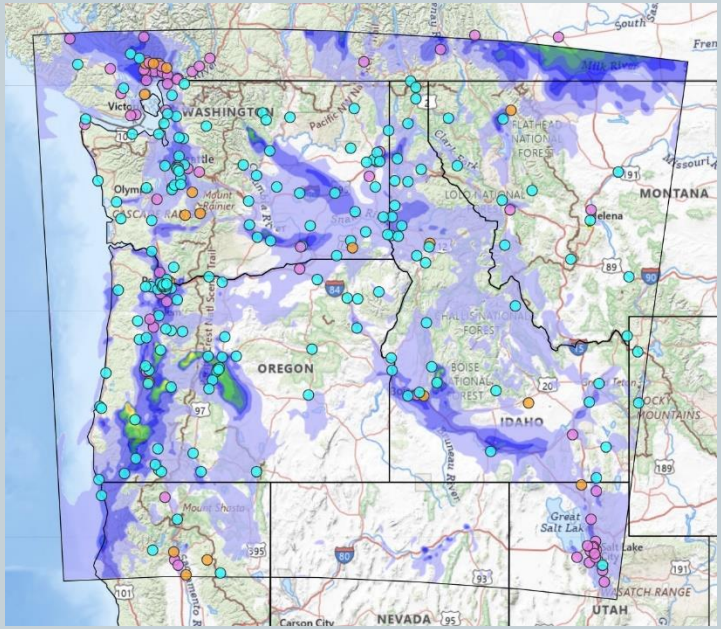


Introduction

- Pollutants: O3 and PM2.5 (Hourly)

	Number of Airnow Stations		
Pollutant	Total	Without Canada	Categorized
O3	61	32	27
PM2.5	231	200	150

- Total in AIRPACT domain
- Categorized: Urban, Suburban and Rural
- There is not categorized station for Canada
- The same with EPA station
- O3: Urban=6, Suburban=12, Rural=9
- PM2.5: Urban=39, Suburban=51, Rural=60

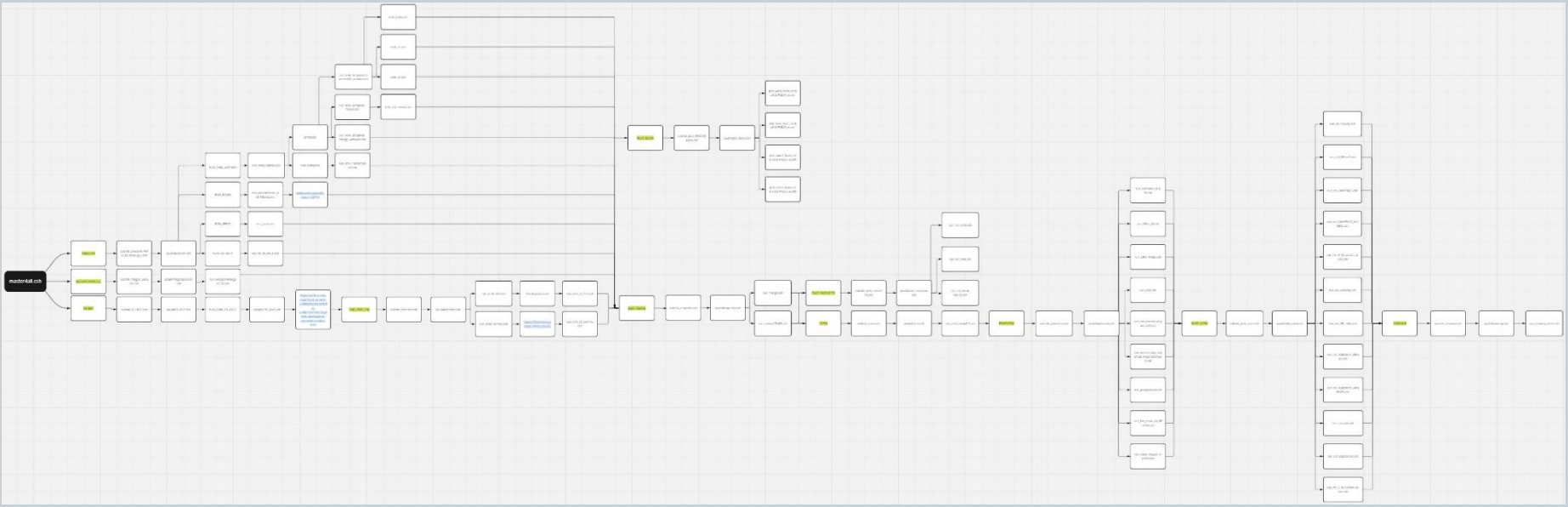


Day3 Model Configuration

- 9 main scripts for DAY3 on Aeolus Cluster:

- Megan, precctm, fireemis, mrgemis, plot_noncctm, cctm, postcctm, plot_cctm, Cleanup

- 7 scripts for WRF/Mcip of Day3 on UW Rainier Cluster



Day3 Model Configuration

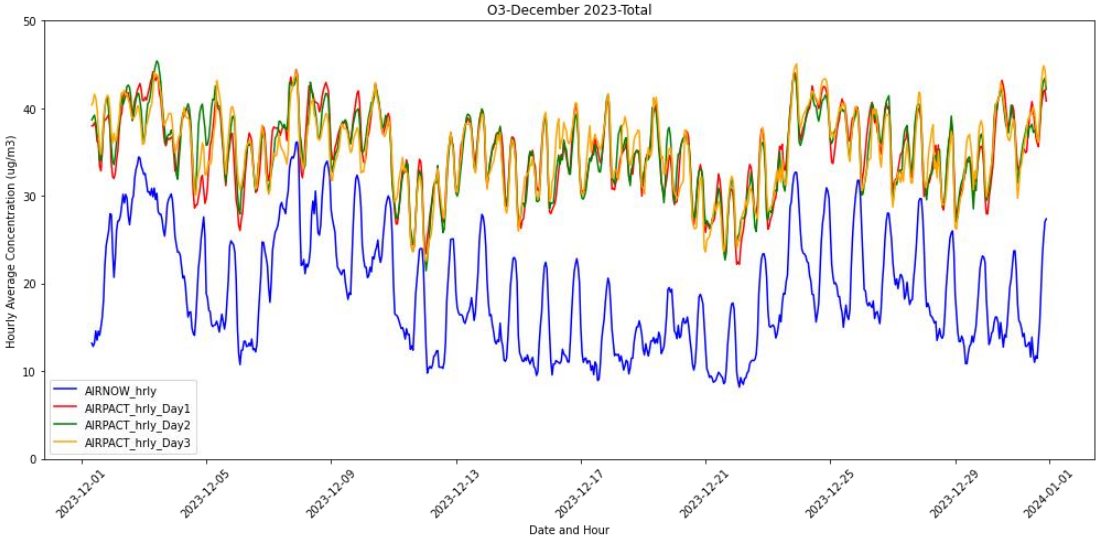
- Day3 Timing:

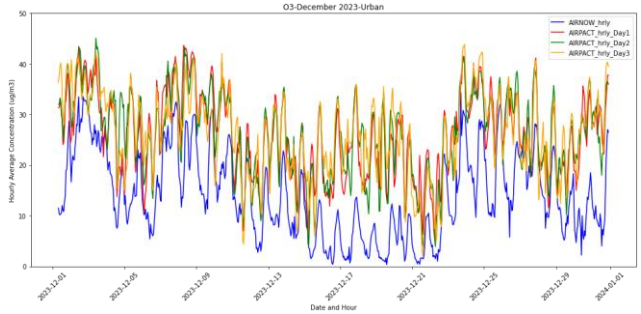
	Day1	Day2	Day3
Start Time	10:30 PM	11:59 PM	4:00 AM
End Time	Around 4:00 AM	Around 6:00 AM	Around 9:00 AM

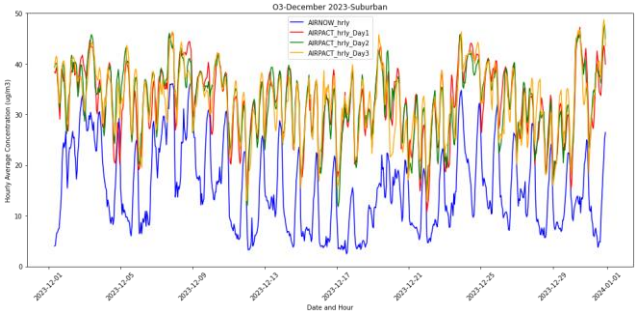
- Day1, Day2 and Day3 forecasts were compared with measured data for December 2023 in categorized stations
- Ongoing task: January 2024 to May 2024

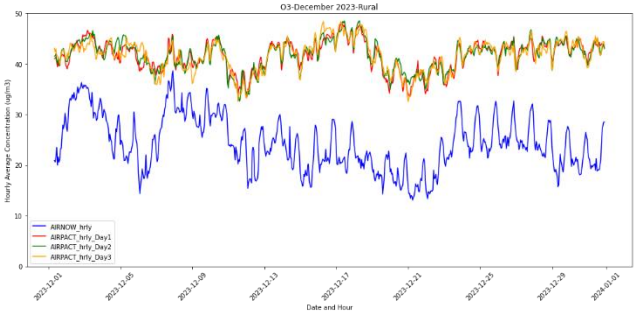
Results

Hourly average plot of each day for categorized stations

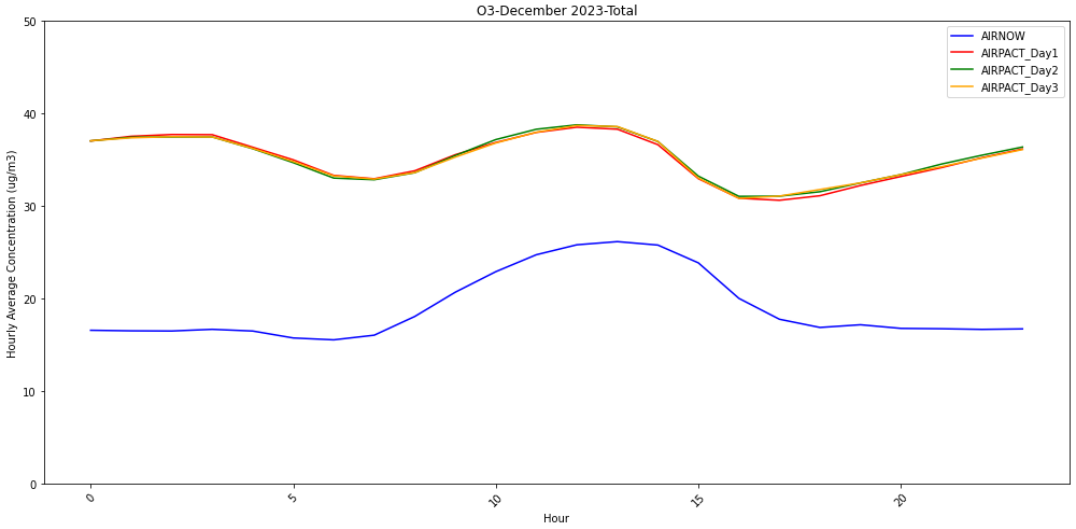


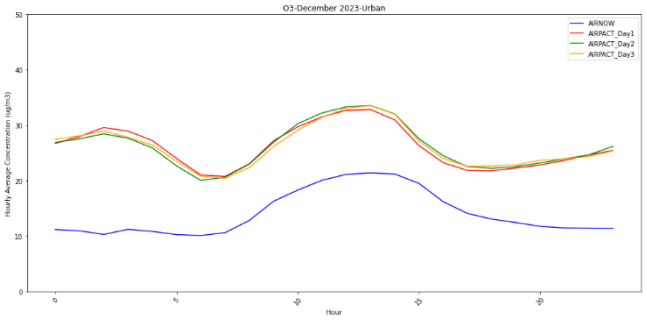


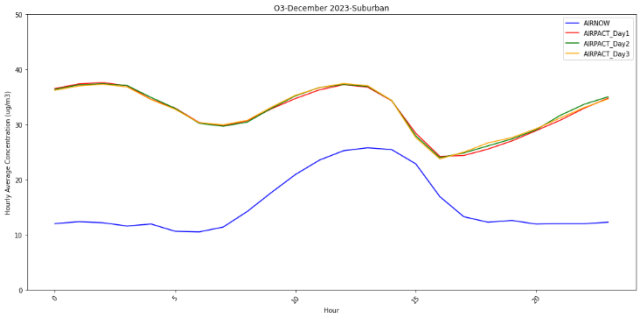


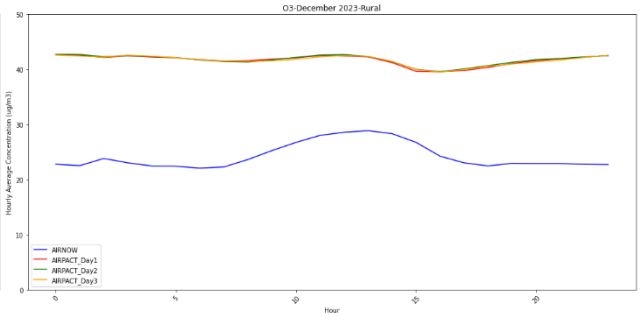


Hourly average plot of diurnal cycle (for categorized stations)

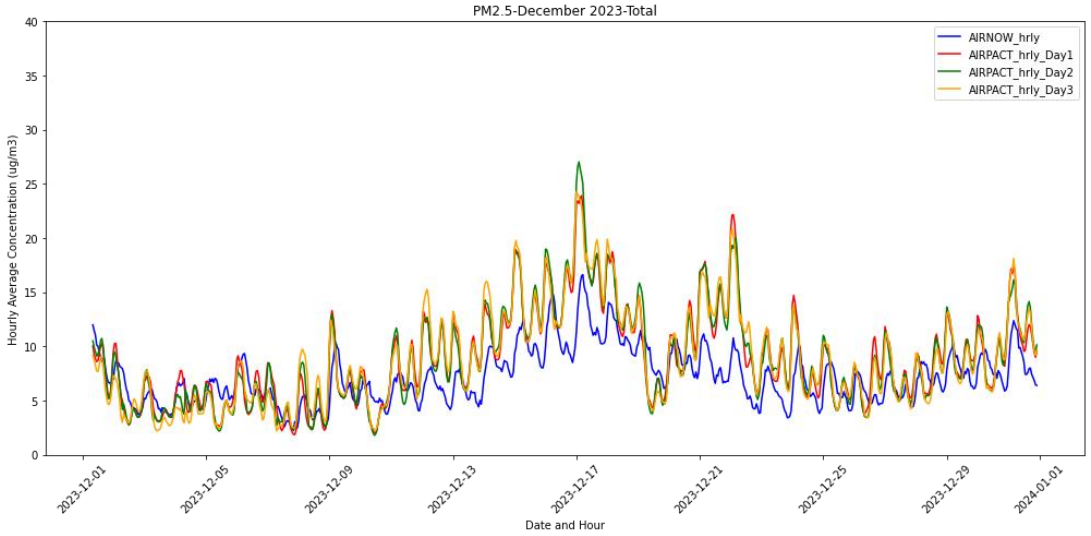


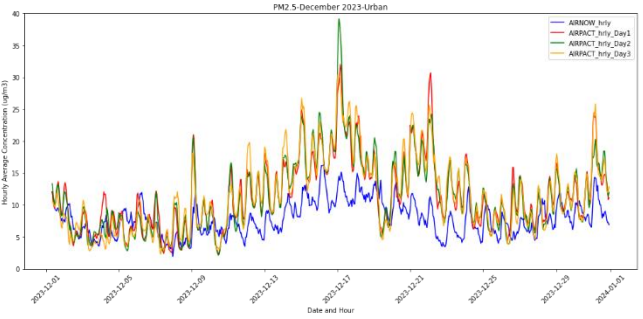


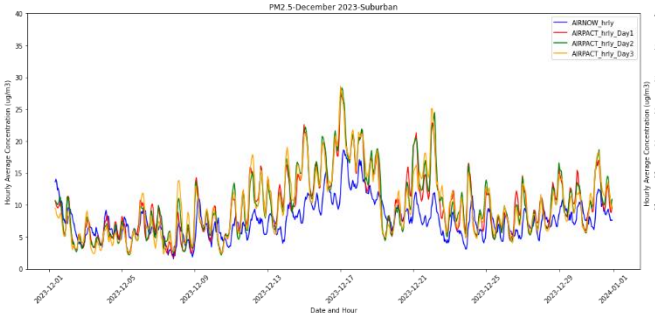


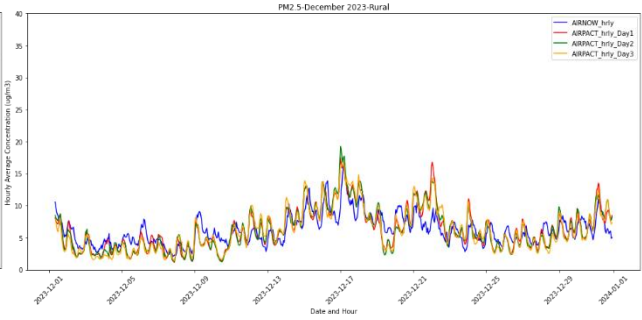


Hourly average plot of each day for categorized stations









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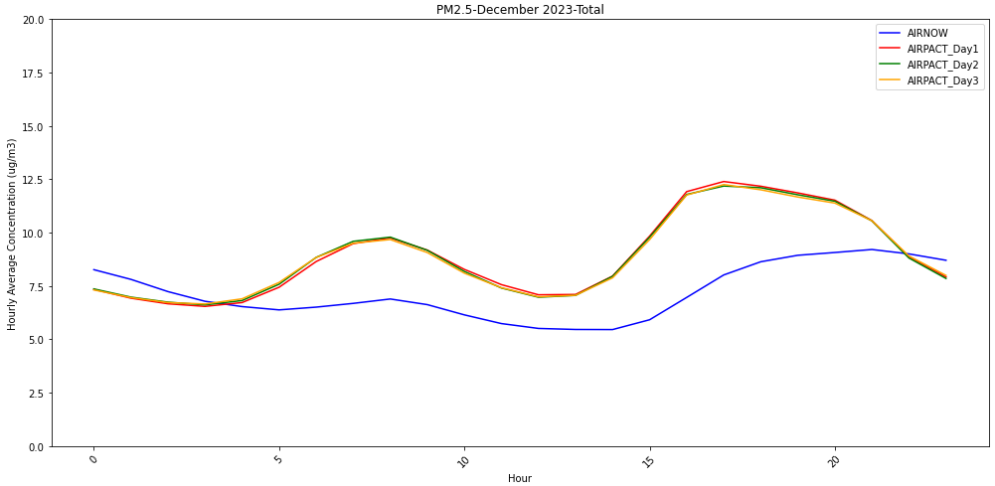
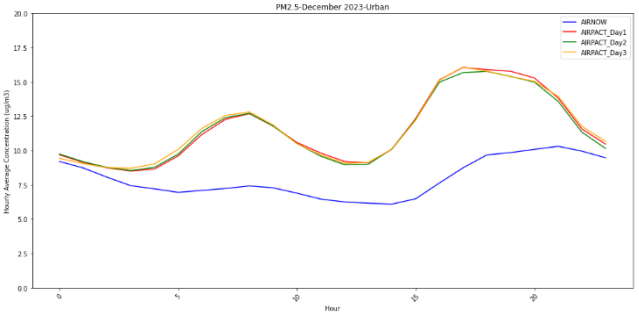
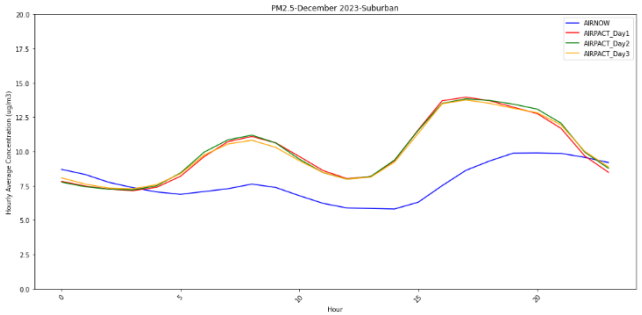
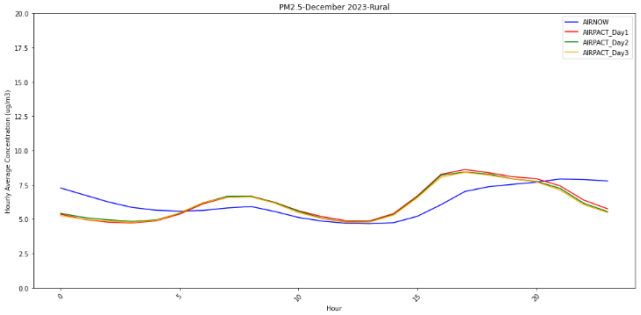
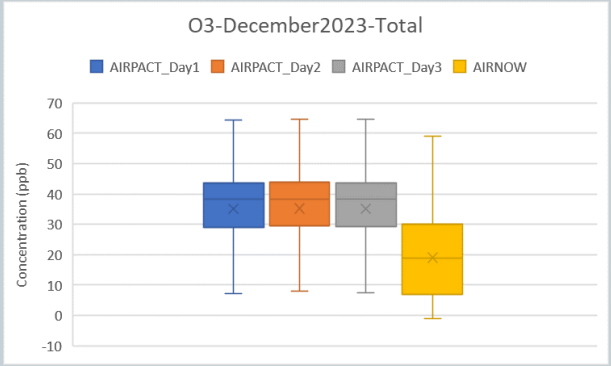


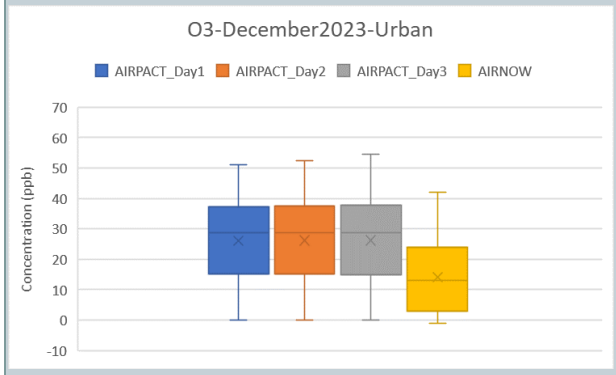


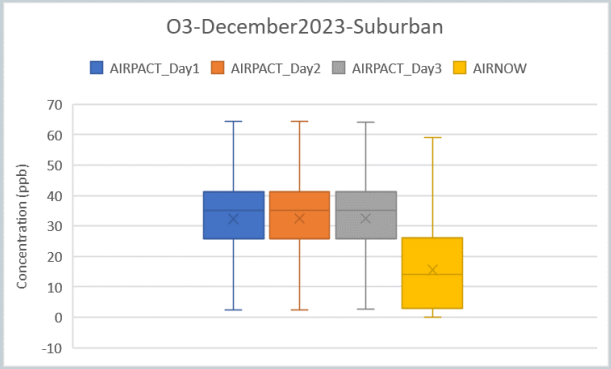


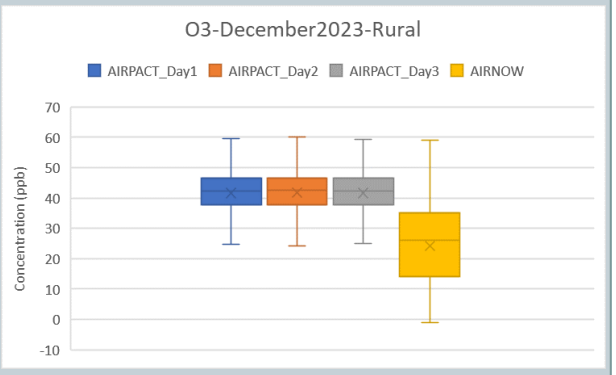


Box plot for categorized stations









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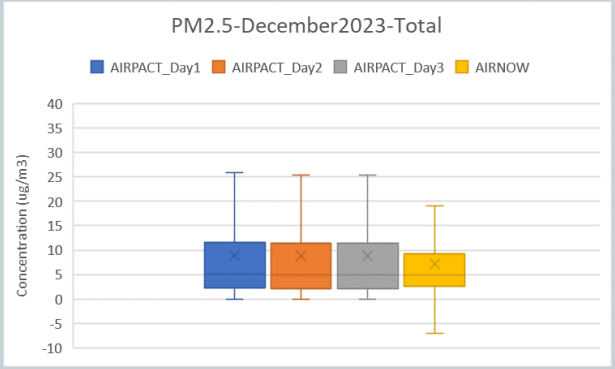
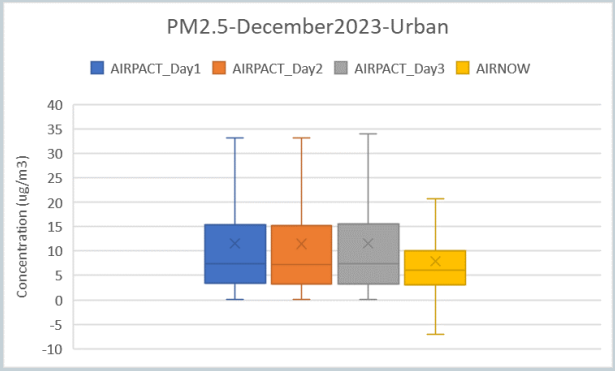
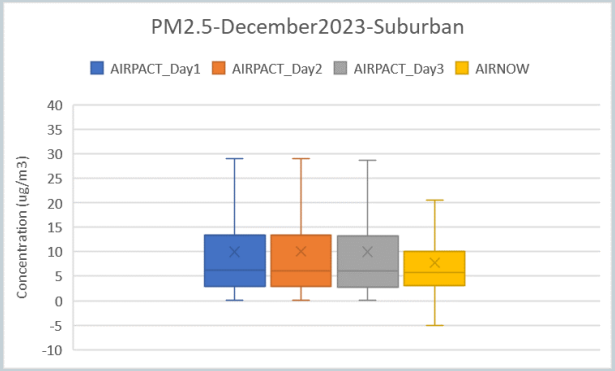
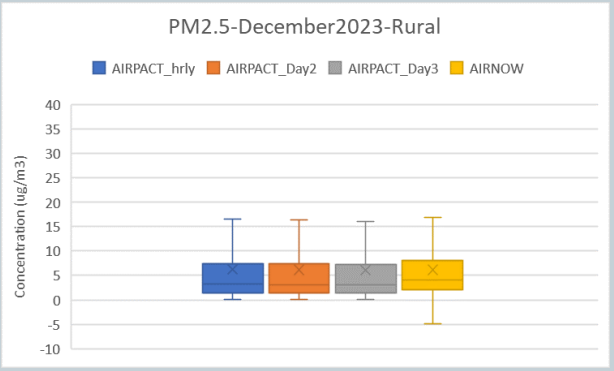
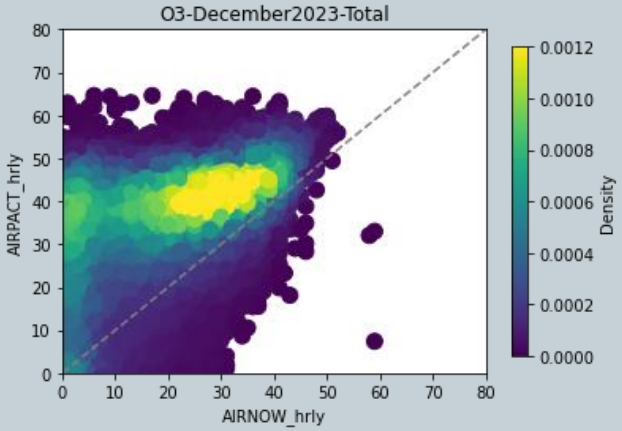


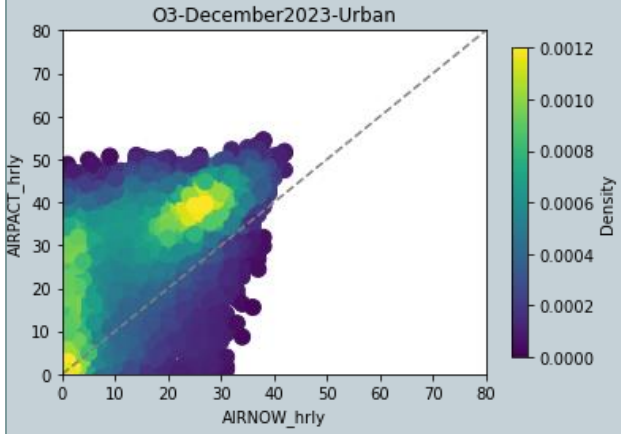


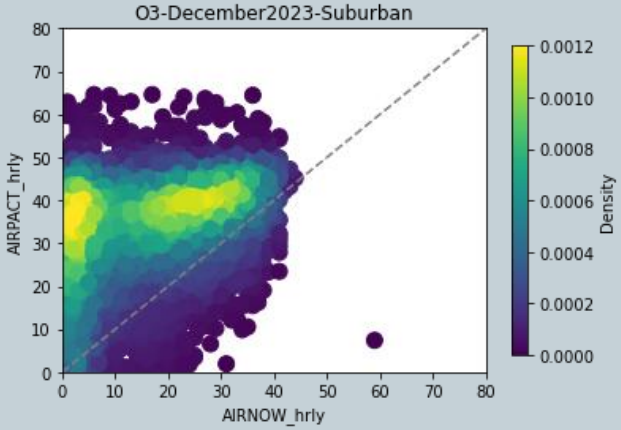


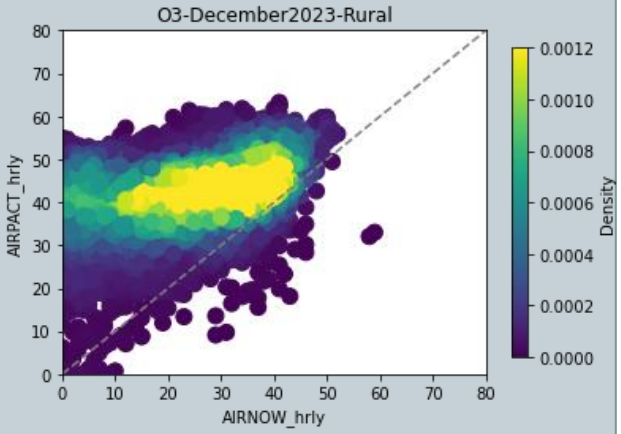


Density scatter plot of categorized stations for Day3









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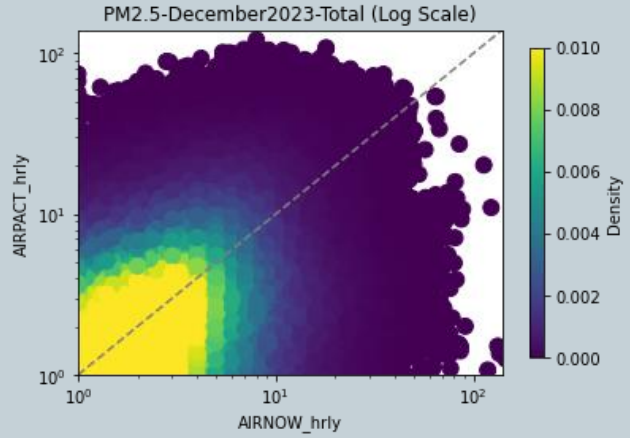
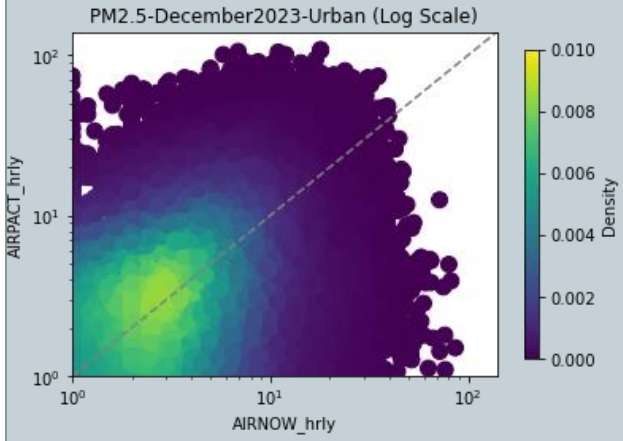
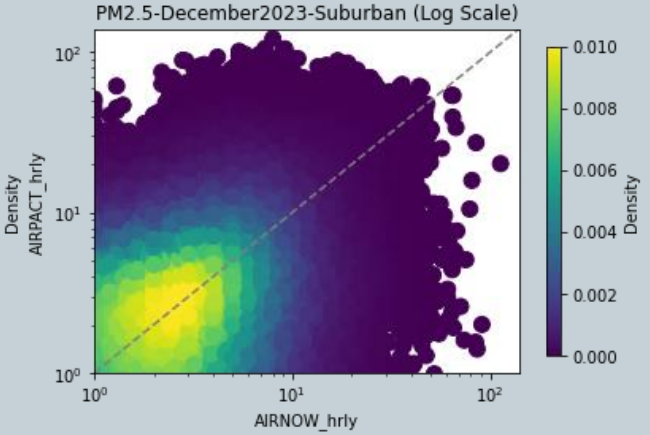
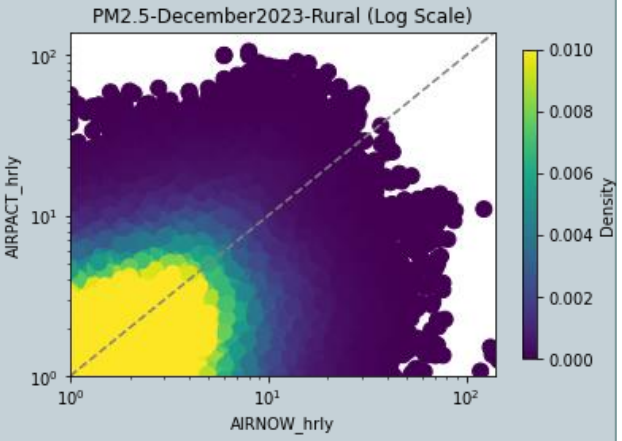
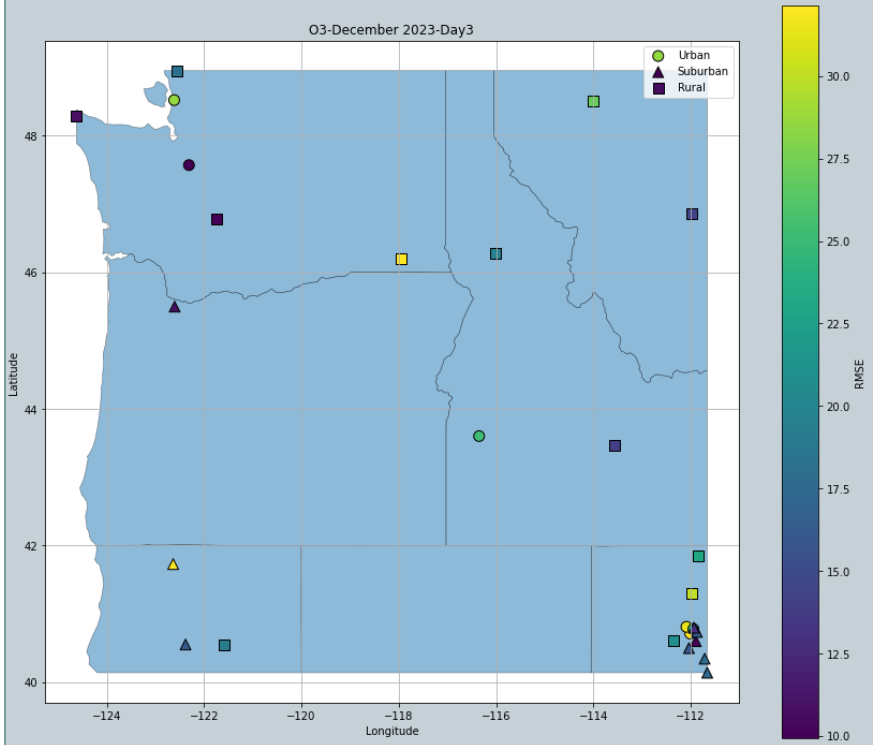


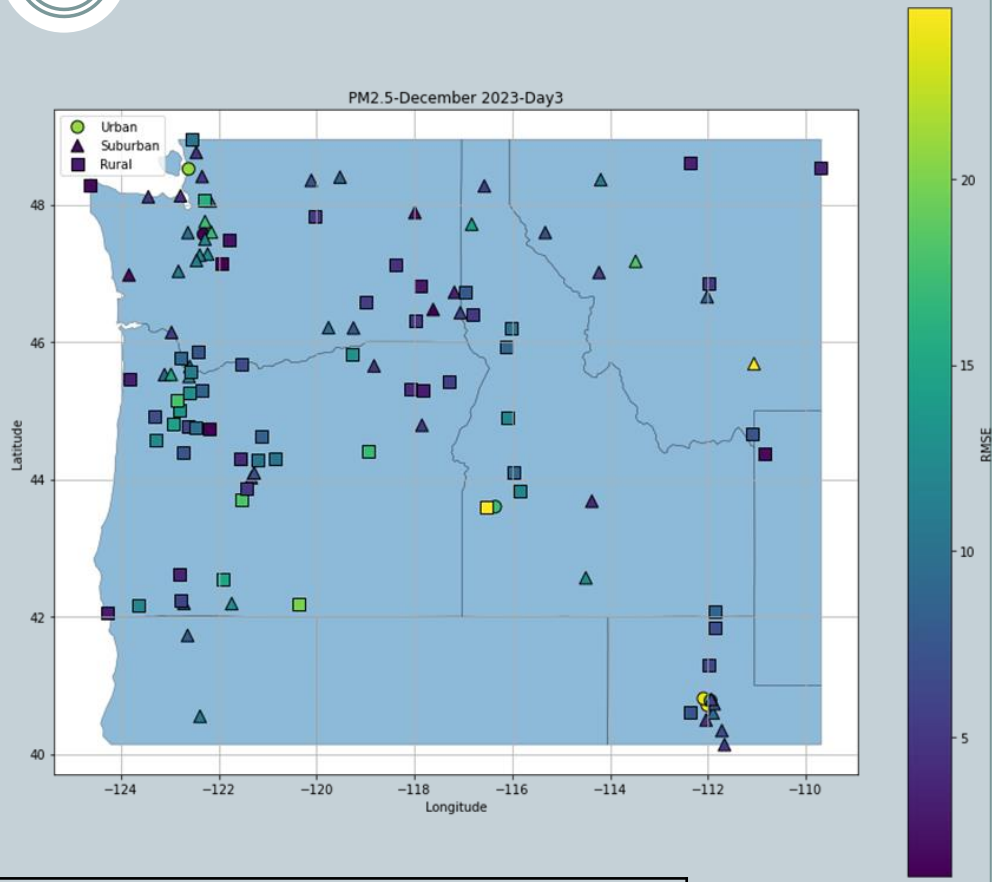






RMSE scatter plot of categorized stations for day3





RMSE – Day3					
O3			PM2.5		
Urban	Suburban	Rural	Urban	Suburban	Rural
17.67	21.71	21.09	13.41	11.63	9.76

Conclusion

- The simulation values for Day3 are close to Day1 and Day2.
- AIRPACT5 simulates PM2.5 better than O3.
- Modeled and measured O3 and PM2.5 values increase with decreasing and increasing population, respectively.
- Modeled and measured O3 and PM2.5 values are higher in rural and urban areas, respectively.
- Modeled and measured O3 and PM2.5 values are closer in urban and rural areas, respectively.
- RMSE for O3 and PM2.5 is lower in urban and rural areas, respectively.

Future Works

- Continue to track DAY1,2,3 performance for seasonal/annual cycle (December 2023 – December 2024).
- What causes the bias:

  - in rural areas for O3?

  - in urban areas for PM2.5?
- Calculating ME, MB, etc.
- Publishing a paper about this research.

Thank you!