PARTICULATE MATTER (PM$_{2.5}$) CONCENTRATION FORECASTING THROUGH AN ARTIFICIAL NEURAL NETWORK IN PORT CITY ENVIRONMENT

BÁRBARA A. MACIAS-HERNANDEZ

EDGAR TELLO-LEAL
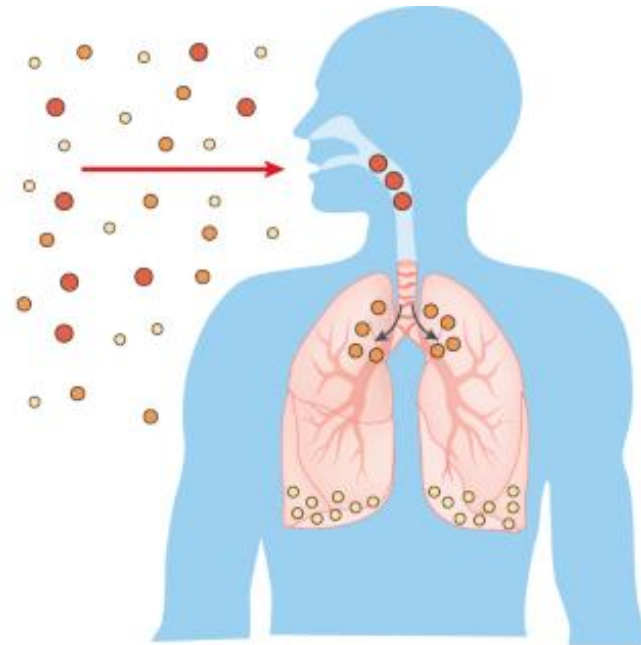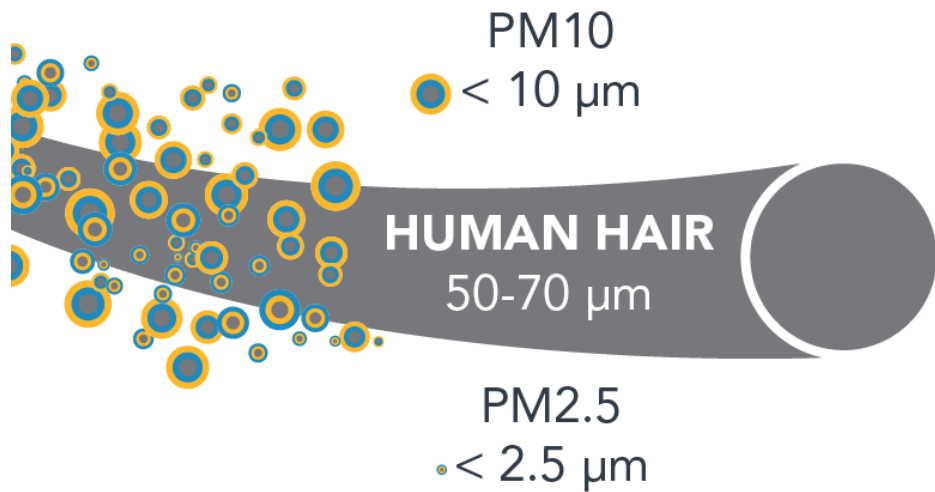
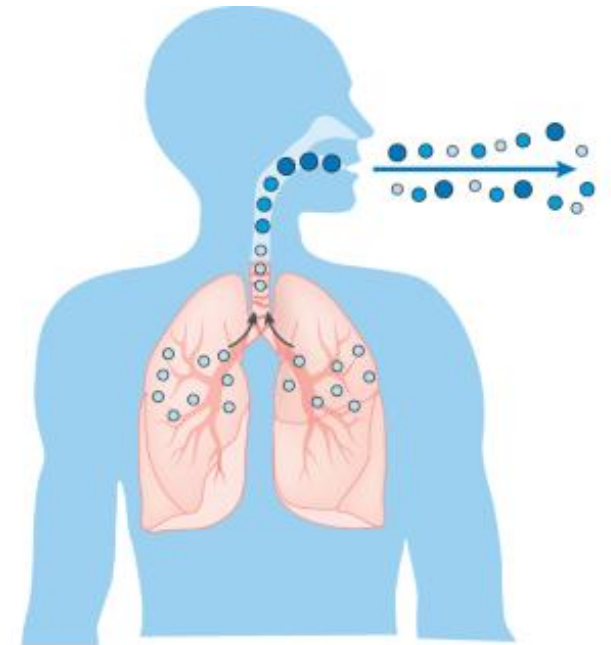ULISES M. RAMIREZ-ALCOCER

JACIEL D. HERNANDEZ RESENDIZ

INTRODUCTION

PARTICULATE MATTER   PM$_{2.5}$

PM10
○ < 10 μm

HUMAN HAIR
50-70 μm

PM2.5
· < 2.5 μm

○ 0.1 μm particle deposited in the alveolar region
● 2.5 μm particle deposited in the lung
● 10 μm particle deposited in the mouth

○ 1 μm particle generated in the bronchioles
● 5 μm particle generated in the larynx
● 50 μm particle generated in the mouth

OBJETIVE

This study aims to analyze maritime traffic's effect on air quality through multiple regression analysis using recurrent neural networks (RNN), allowing to forecast the daily concentration of $PM_{2.5}$.

STUDY AREA
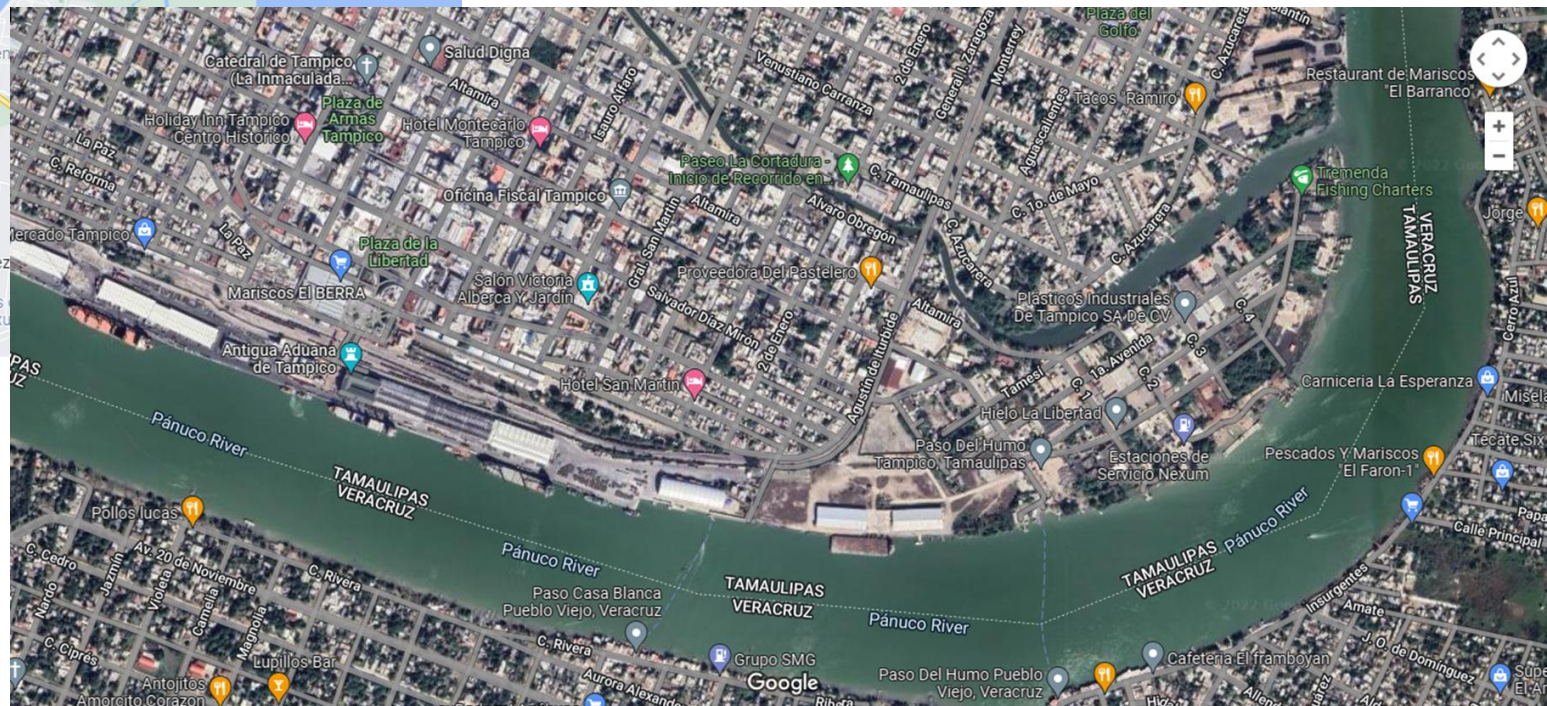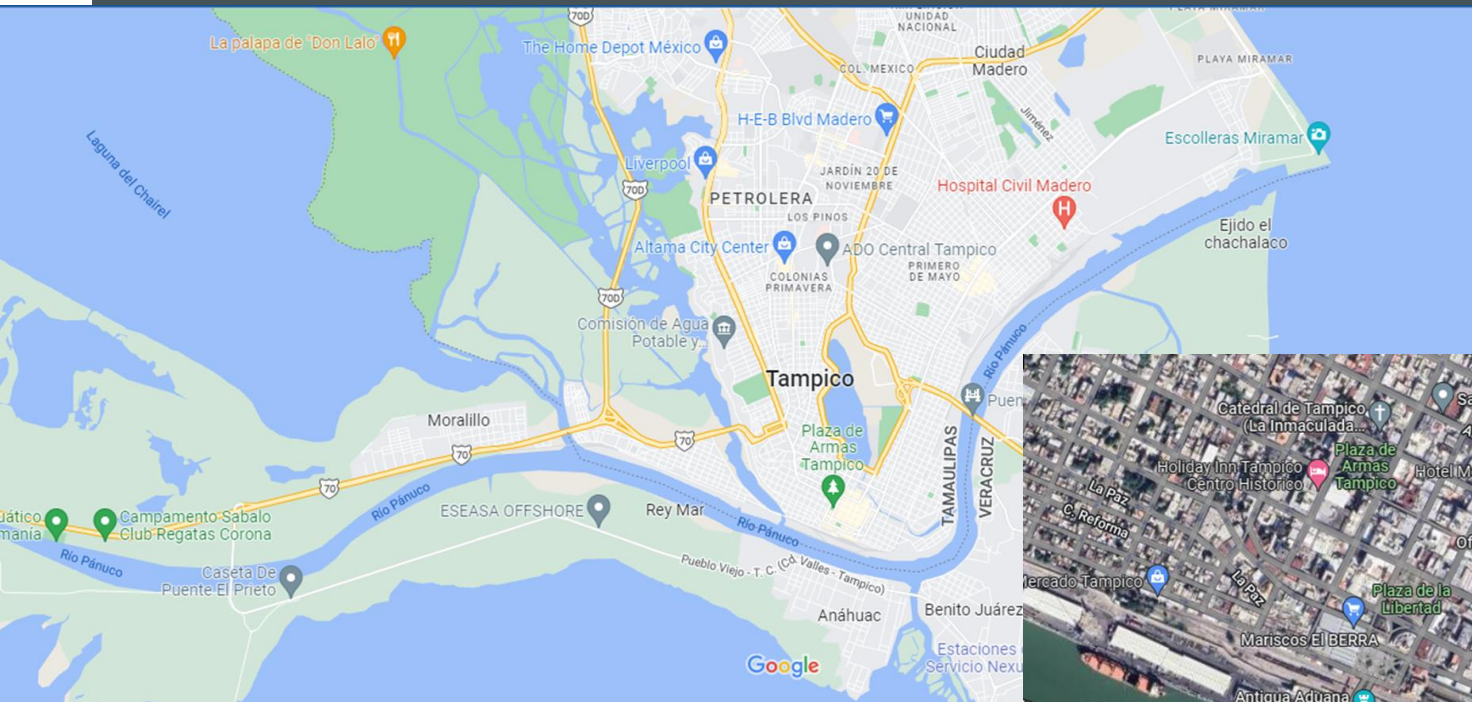
Descriptive Statistics Of Particulate Matter (PM_1, $PM_{2.5}$ And PM_{10}) Monitored For A Period Of 9 Months in Tampico Tamaulipas In $\mu g/m^3$

2021	PM_1 ($\mu g/m^3$)				$PM_{2.5}$ ($\mu g/m^3$)				PM_{10} ($\mu g/m^3$)			
	Median	IQR	Max	Min	Median	IQR	Max	Min	Median	IQR	Max	Min
May	12.65	10.5	29.44	5.91	17.18	15.3	42.53	7.36	19.77	16.7	51.43	8.71
June	9.4	4.95	26.98	1.91	12.01	6.83	39.66	2.5	15	8.21	48.39	3.47
July	9.77	5.63	22.15	2.57	12.74	8.84	31.91	3.13	14.12	10.8	37.46	3.93
August	10.58	4.03	26.83	3.52	13.59	6.15	39.7	4.27	15.25	6.71	48.06	5.1
September	10.39	10.4	23	2.14	13.41	14.5	35.39	2.71	14.94	15.2	41.43	3.51
October	10.79	8.41	31.16	3.4	13.39	13.1	46.44	4.63	14.95	15.1	56.94	6.08
November	8.485	5.7	26.35	2.91	11.22	8.22	37.68	3.34	13.14	9.75	44.49	3.87
December	**17.06**	8.65	34.6	4.57	**24.56**	14.1	51.97	5.93	**29.35**	18.1	63.36	7.7
January*	12.77	8.55	24.92	3.23	17.58	13.3	35.62	3.93	21.45	16.1	42.29	4.7

Descriptive Statistics Of gases (CO and O_3) Monitored For A Period Of 9 Months Tampico Tamaulipas In $\mu g/m^3$

	CO (ppm)				O_3 (ppm)			
	Median	IQR	Max	Min	Median	IQR	Max	Min
May	1.01	0.22	1.22	0.58	0.0200	0.0000	0.02	0.02
June	1.25	0.27	1.66	0.48	0.0200	0.0000	0.02	0.01
July	0.99	0.27	1.28	0.73	0.0200	0.0000	0.02	0.02
August	1.32	0.2	1.87	0.99	0.0200	0.0000	0.02	0.02
September	1.21	0.28	1.58	0.9	0.0200	0.0018	0.02	0.017
October	1.21	0.19	1.41	1.05	0.0234	0.0034	0.03	0.0148
November	**1.45**	0.16	1.68	1.13	0.0090	0.0021	0.02	0.0015
December	**1.45**	0.1	1.61	1.21	0.0068	0.0035	0.0095	0.0001
January	1.35	0.15	1.45	1.2	0.0100	0.0000	0.02	0.01

Correlation Matrix Or Air Pollutants, Meteorological Variables, And Daily Cargo Ship (CS) And Petrol Tankers (PT) Arrivals
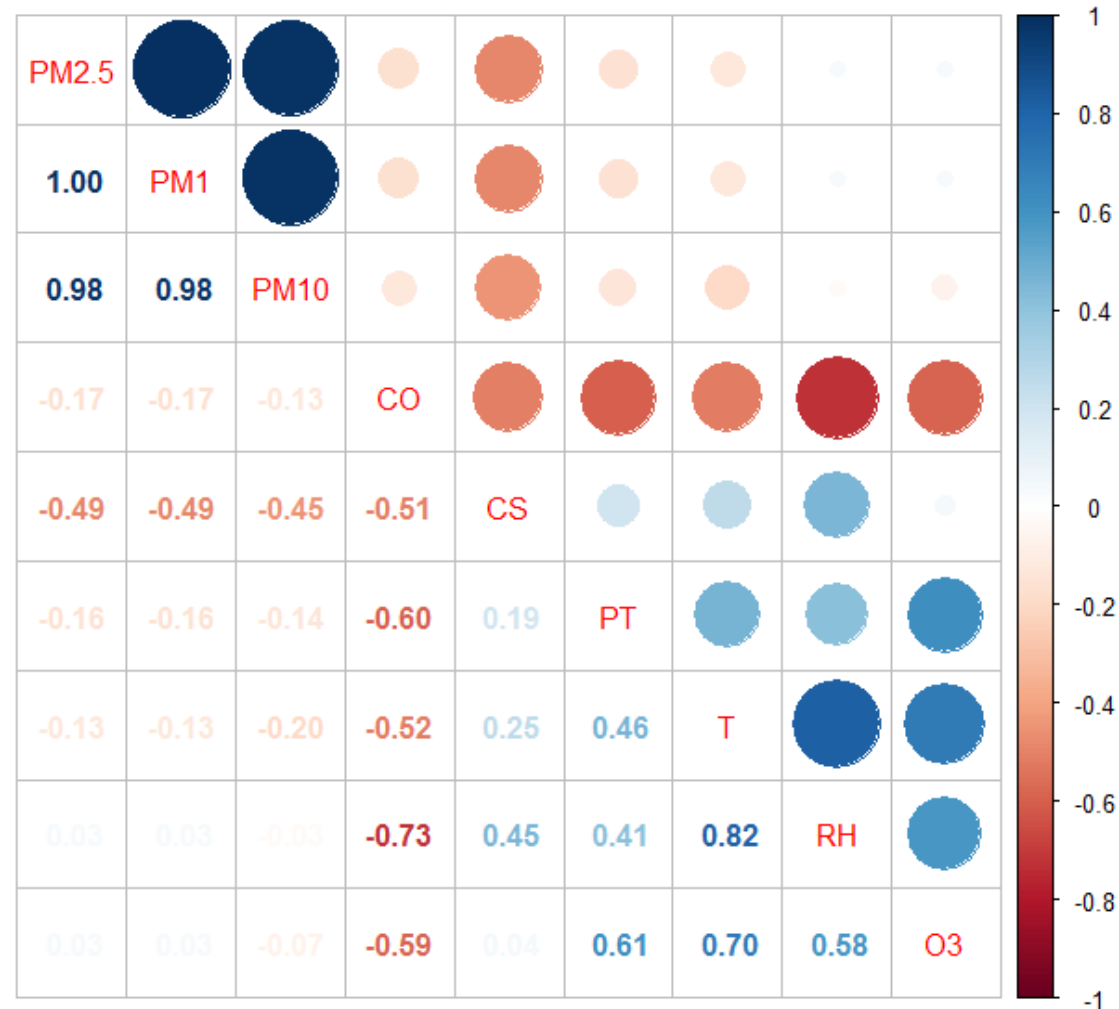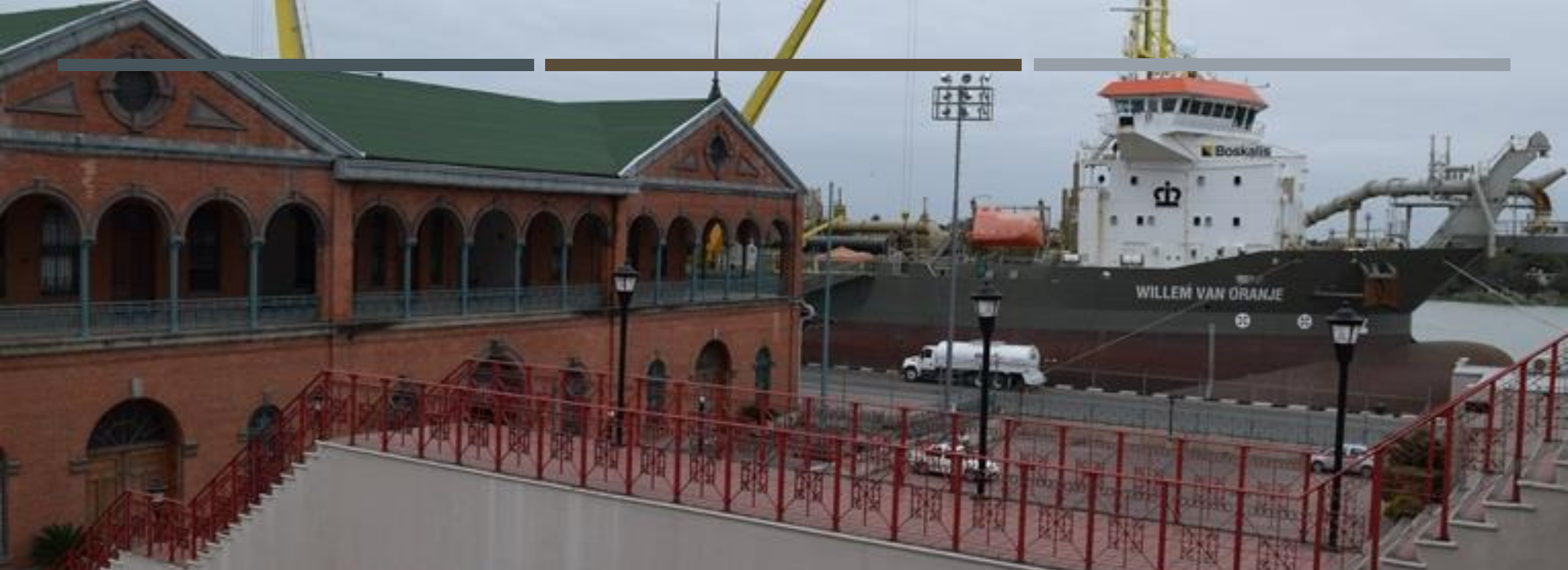
Prediction Accuracy Comparison Between Actual And Predicted Data (Blue Line: Original Values, Red Line: Predicted Values).

CONCLUSIONS

- Correlation coefficient analysis confirmed a very high relationship between the three types of particulate matter.
- CO air pullutnat presents a high negative association with relative humidity.
- Cargo ships show a moderate negative relationship with PM_1, $PM_{2.5}$, PM_{10}, and CO.
- The petroleum tankers have a moderately negative relationship with CO (r=-0.60).
- Linear regression analysis generated by the RNN prediction model obtains acceptable RMSE and MAE values.
- High MAPE metric, the daily prediction of $PM_{2.5}$ concentration should be considered with performance and accuracy moderate.

QUESTIONS