

Validation Campaigns in Extremadura. GT.6

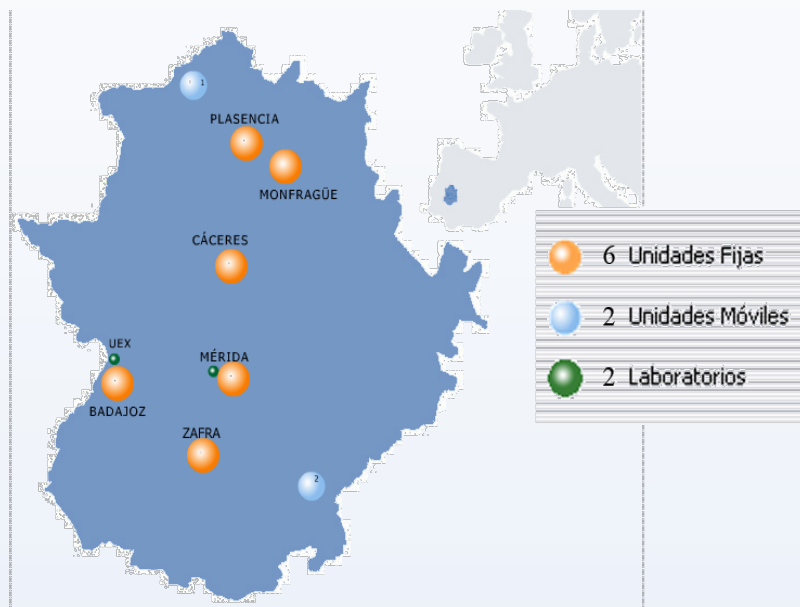
Jaime Gómez. University of Extremadura.

Outline

- Introduction
- Validation Campaign
- Calibration Techniques
- Results
- Conclusions



Introduction

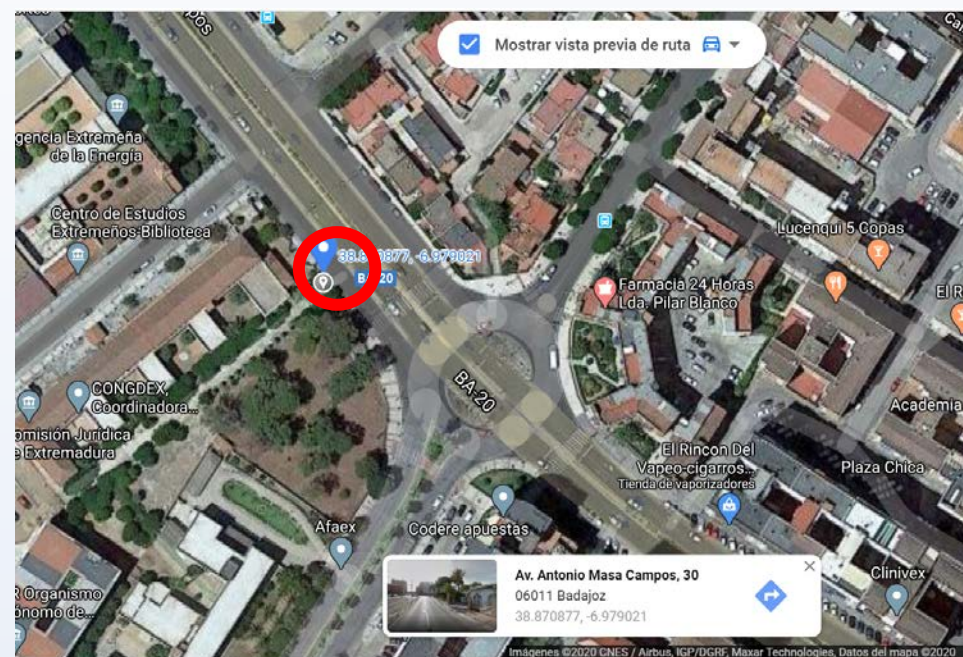


Validation Campaign:

Badajoz (12/03/2021-17/05/2021)

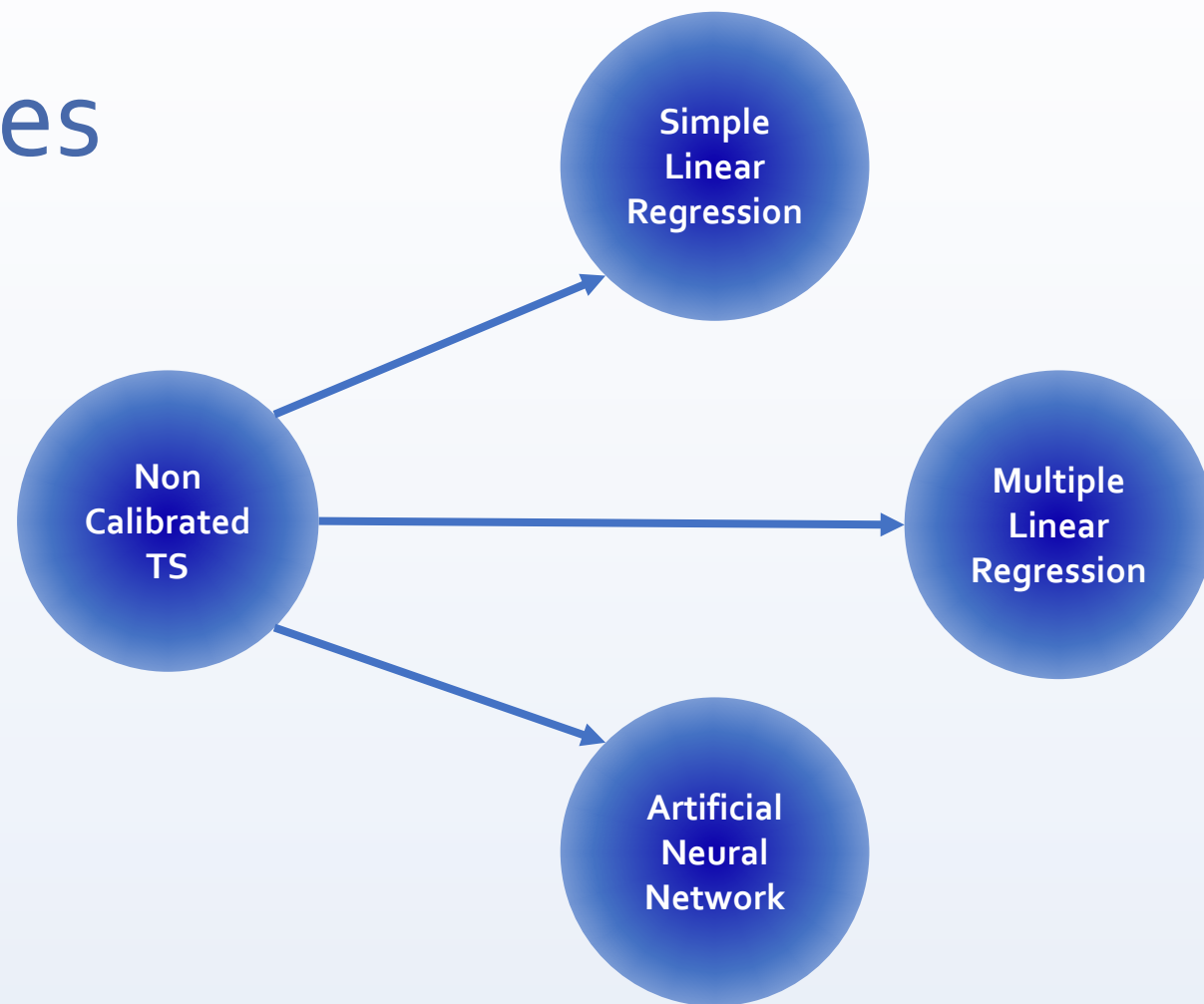


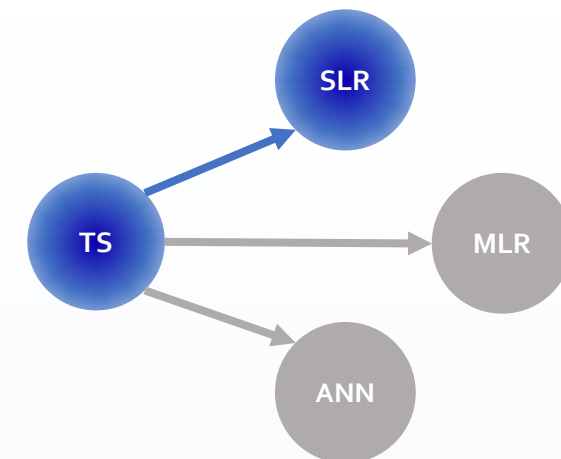
Traffic Hotspot



Calibration Techniques

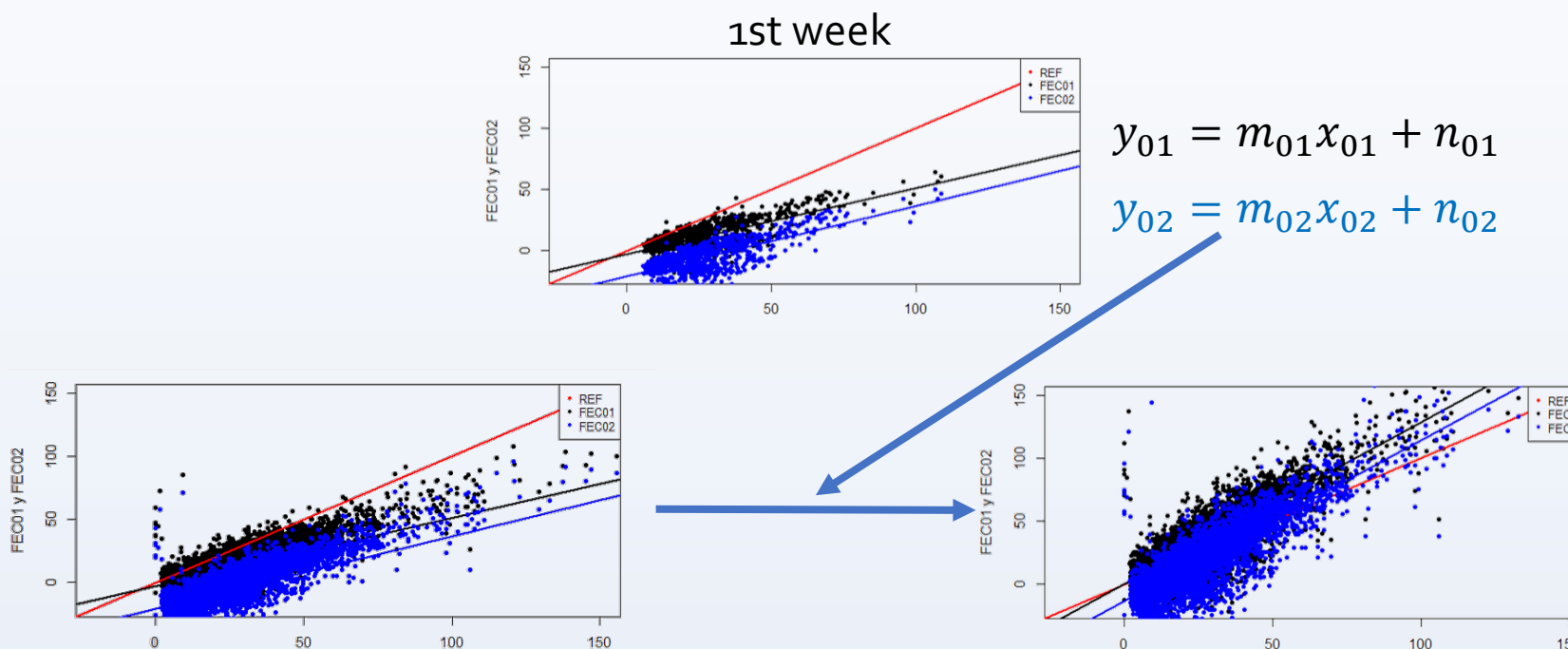
- Non calibrated time series
- Simple linear regression
- Multiple linear regression
- Artificial Neural Network





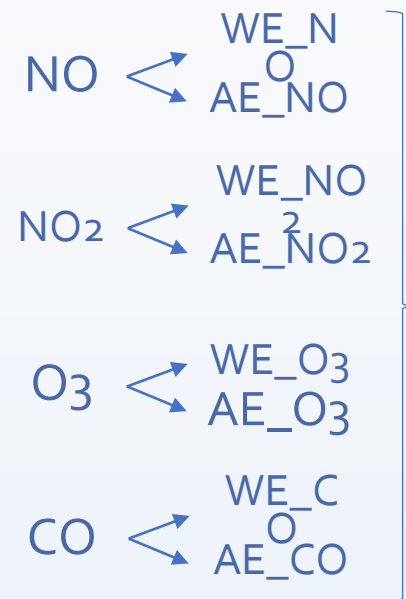
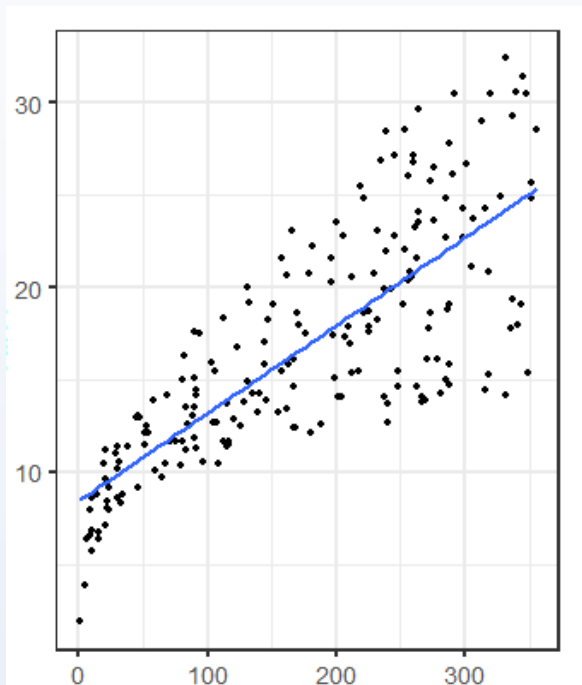
Calibration Techniques

- Simple linear regression



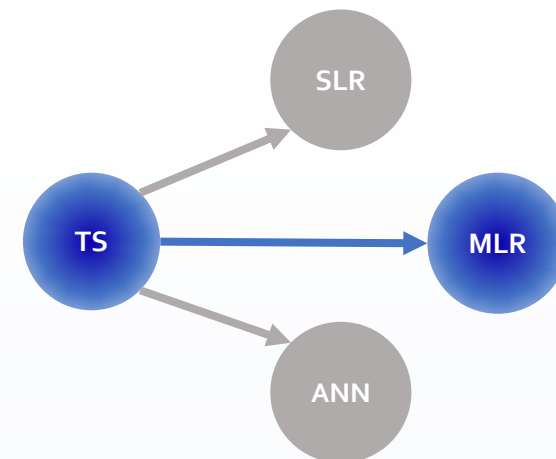
Calibration Techniques

- Multiple linear regression



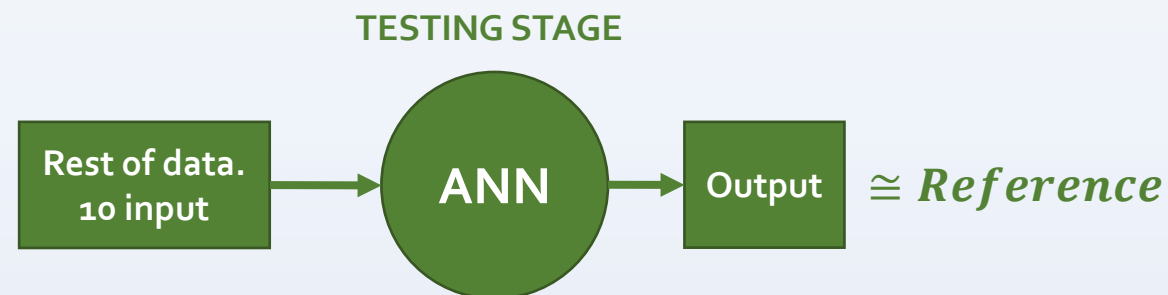
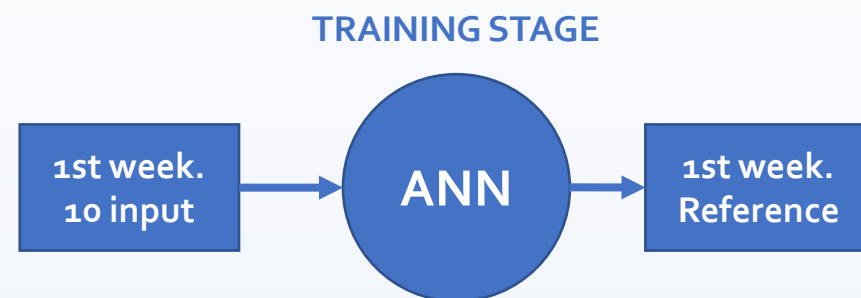
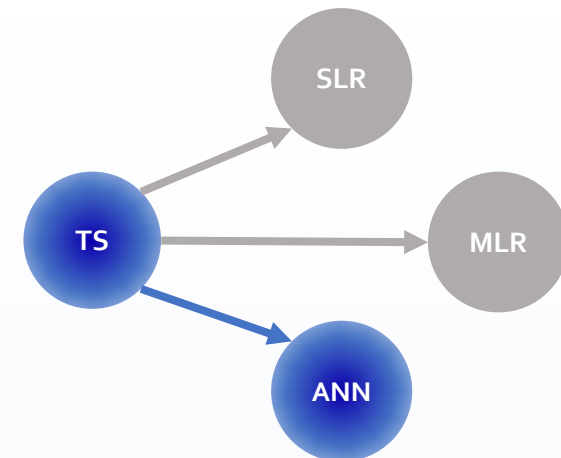
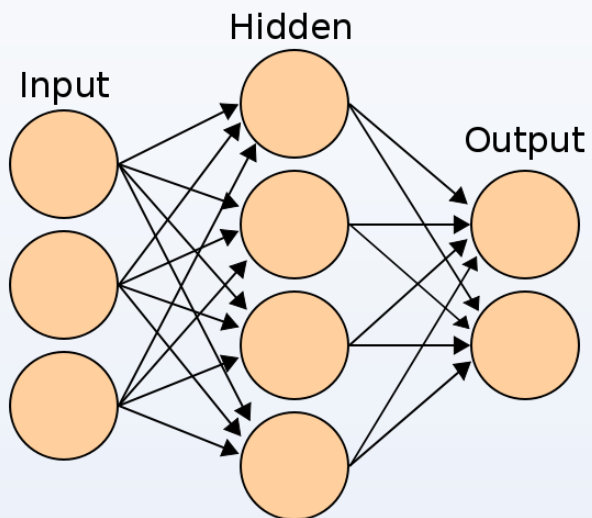
8 sensor values + Temperature
+ Relative Humidity

$$[Pollutant] = \alpha_1 + \alpha_2 WE_{NO} + \alpha_3 AE_{NO} + \dots + \alpha_{10} T + \alpha_{11} RH$$



Calibration Techniques

- Artificial Neural Network

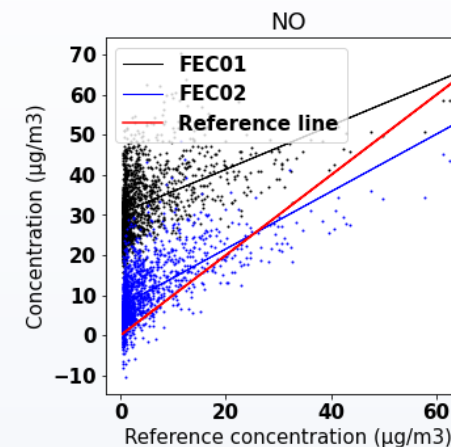
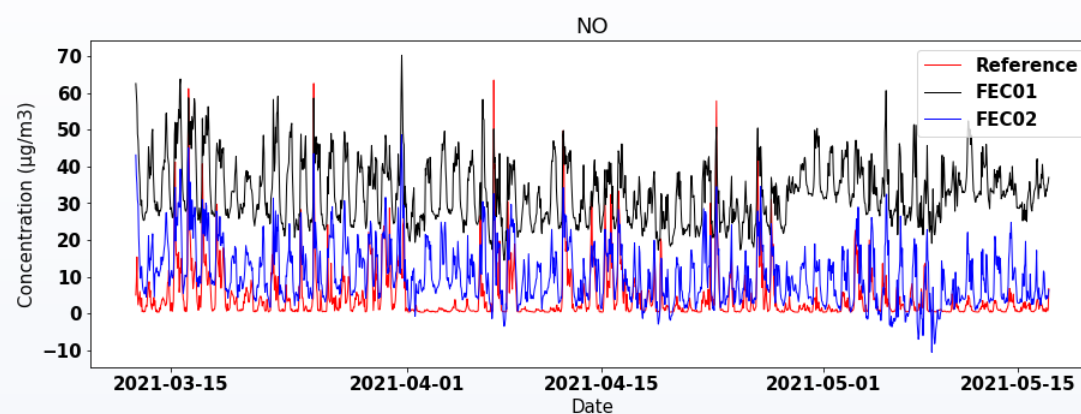


Results

- Gaseous Pollutants
- Particulate Matter

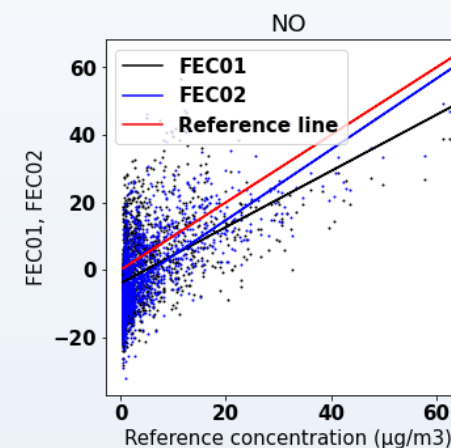
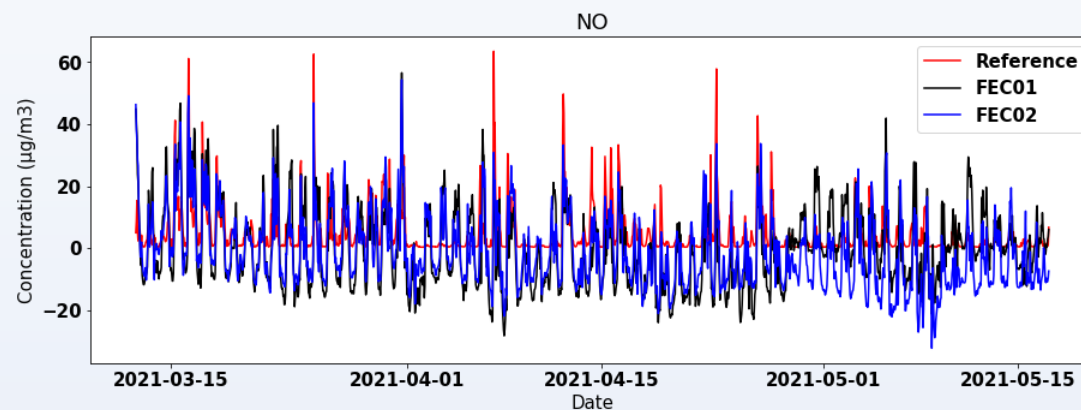
Gaseous Pollutants: NO

Non-calibrated
time serie



R^2	
FEC05	FEC06
0.22	0.41

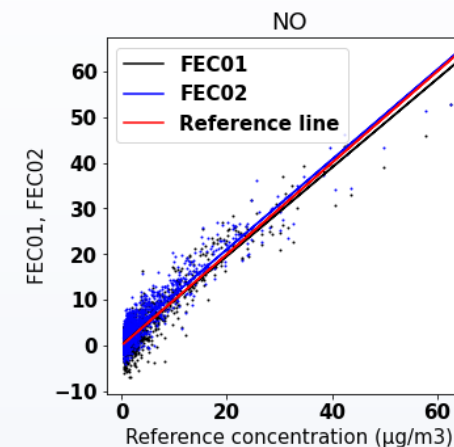
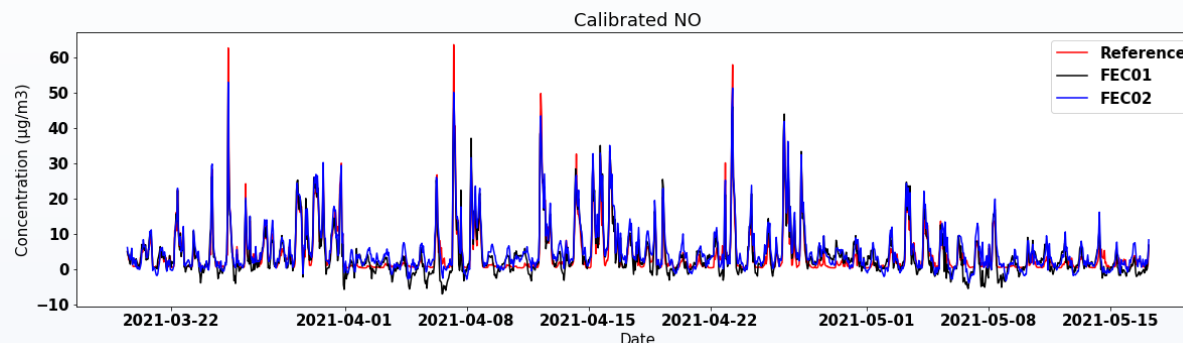
Simple Linear
Regression



R^2	
FEC05	FEC06
0.22	0.41

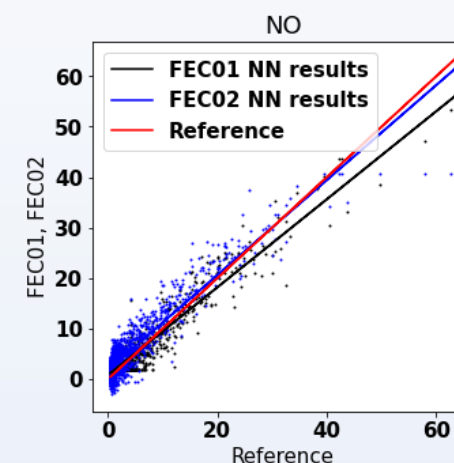
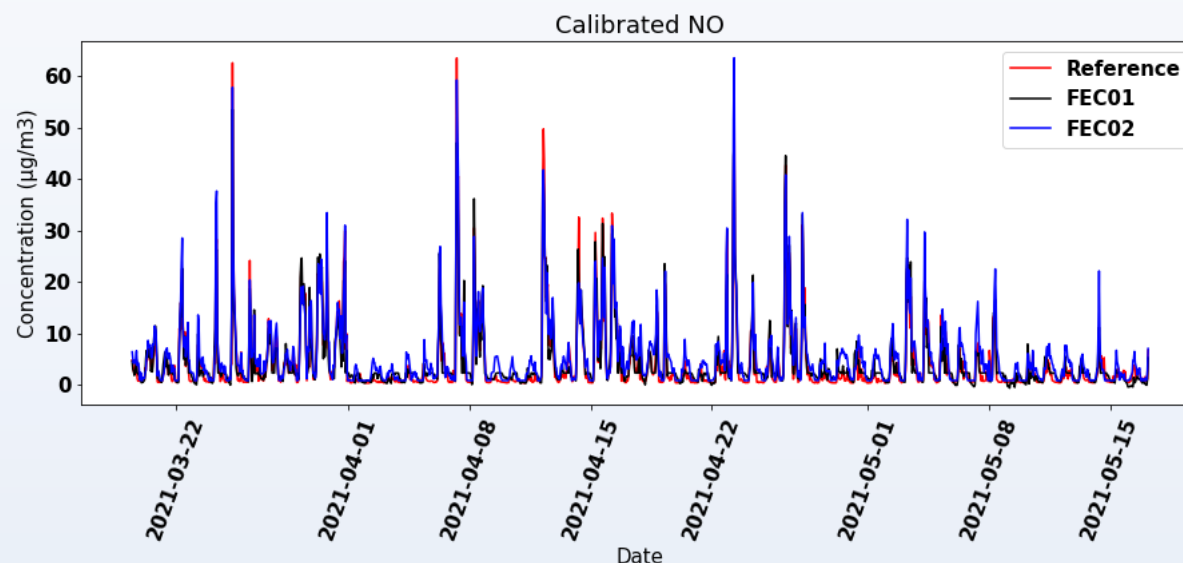
Gaseous Pollutants: NO

Multiple Linear
Regression



R^2	
FEC05	FEC06
0.85	0.88

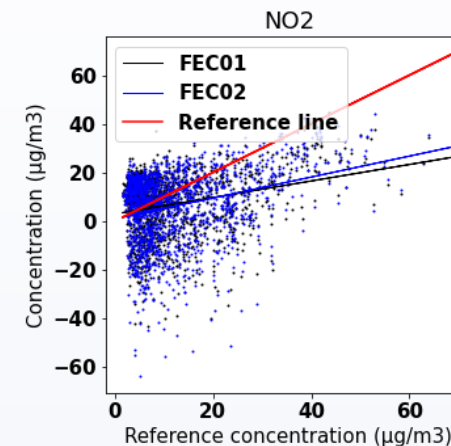
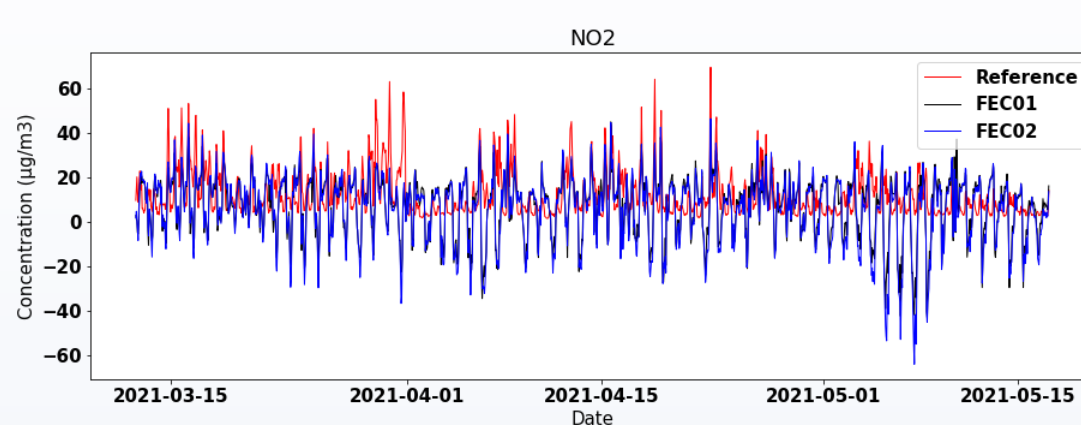
Artificial Neural
Network



R^2	
FEC05	FEC06
0.92	0.89

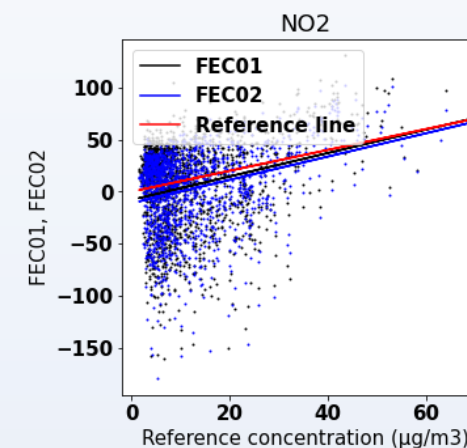
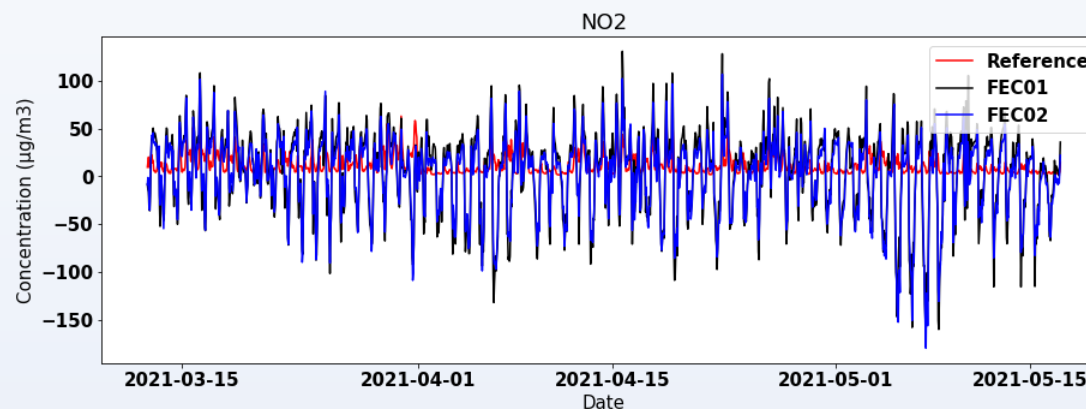
Gaseous Pollutants: NO₂

Non-calibrated
time serie



R ²	
FEC05	FEC06
0.07	0.09

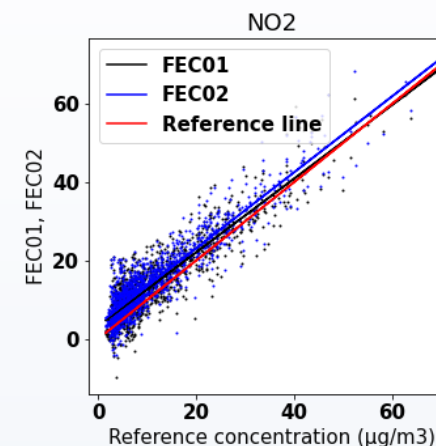
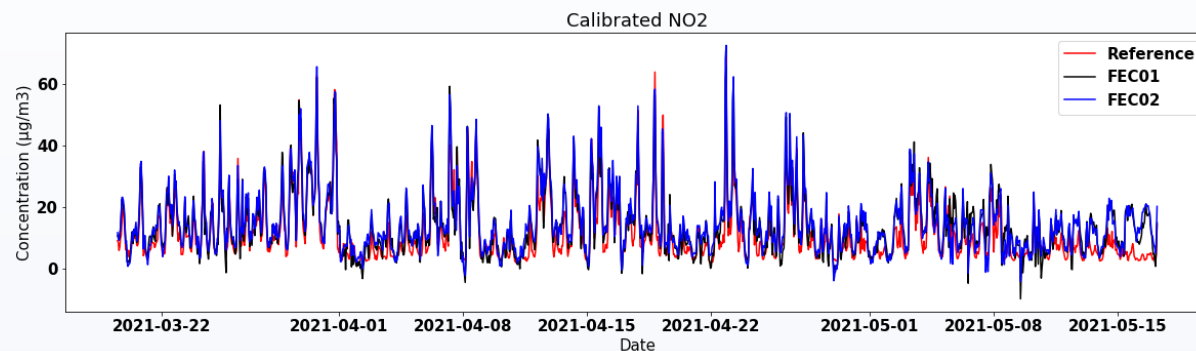
Simple Linear
Regression



R ²	
FEC05	FEC06
0.07	0.09

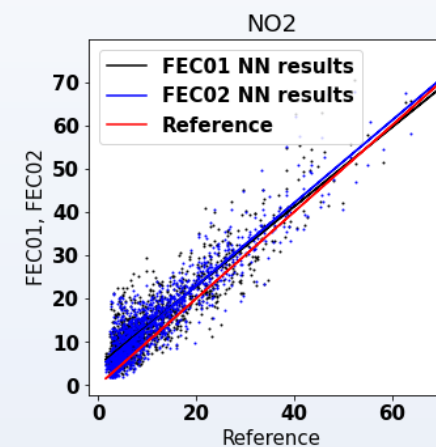
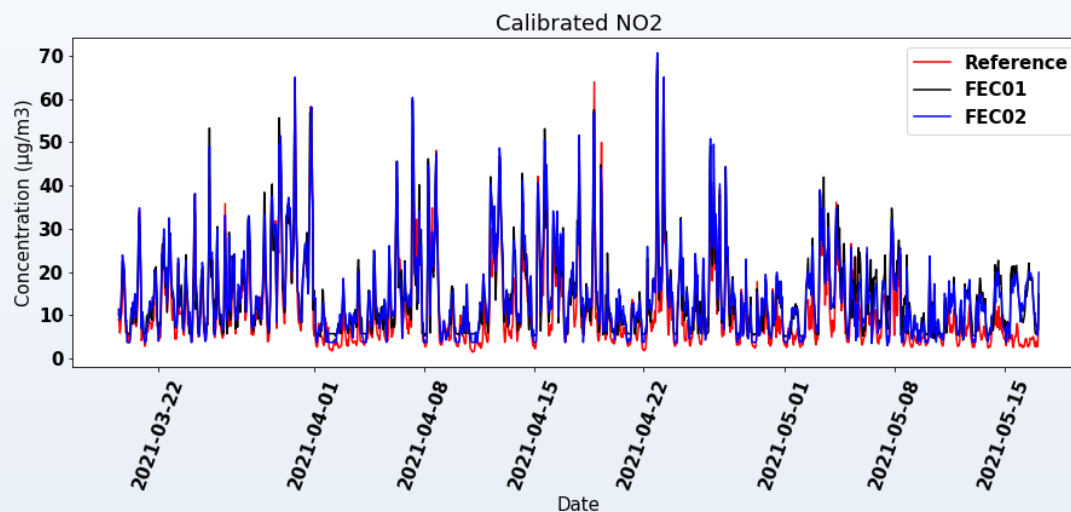
Gaseous Pollutants: NO₂

Multiple Linear
Regression



R^2	
FEC05	FEC06
0.81	0.85

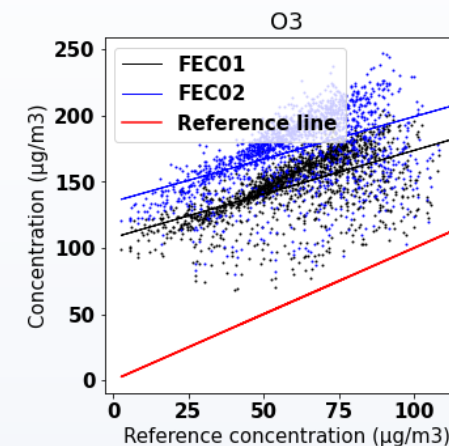
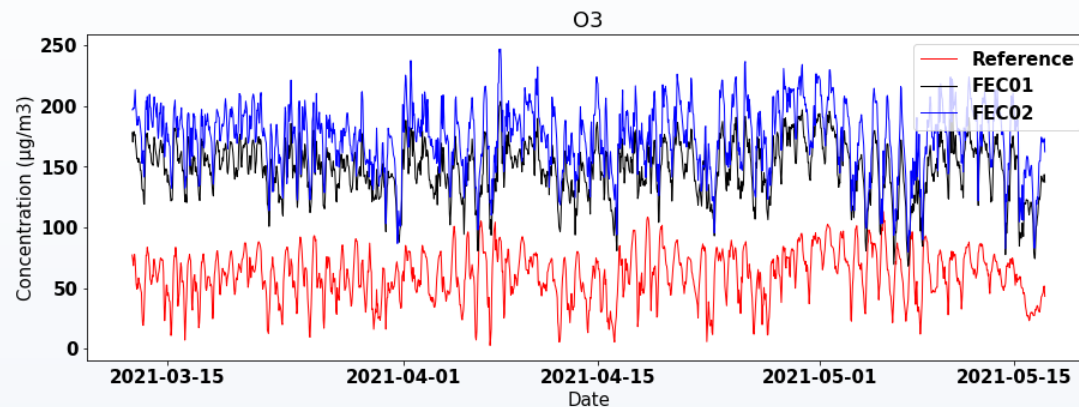
Artificial Neural
Network



R^2	
FEC05	FEC06
0.83	0.86

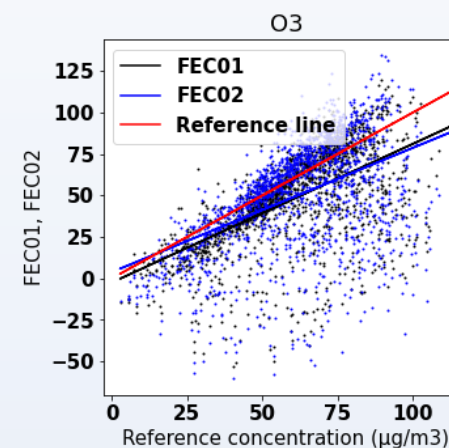
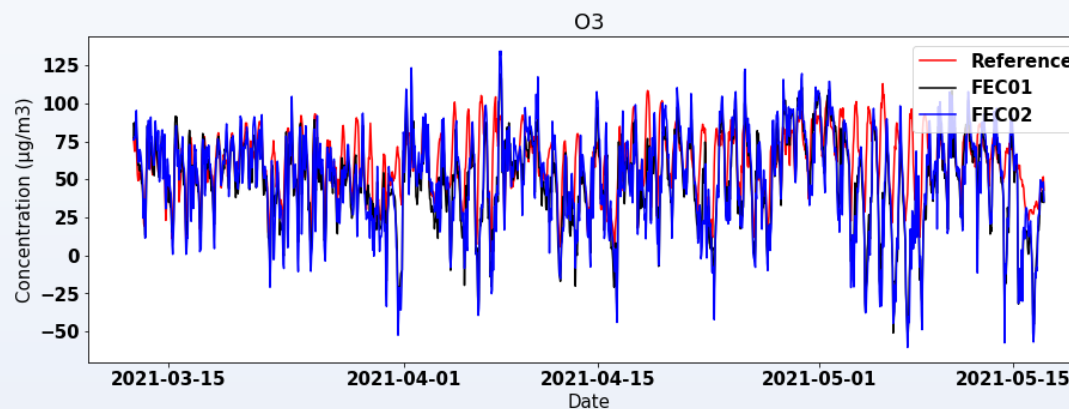
Gaseous Pollutants: O₃

Non-calibrated
time serie



R ²	
FEC05	FEC06
0.34	0.21

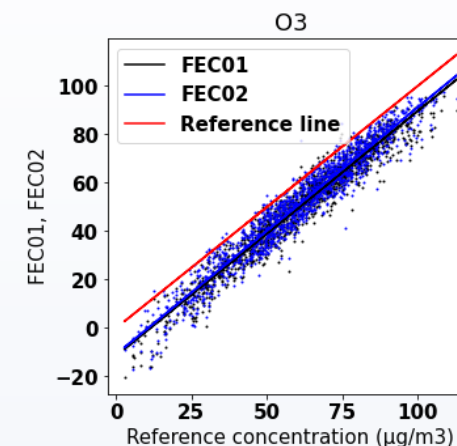
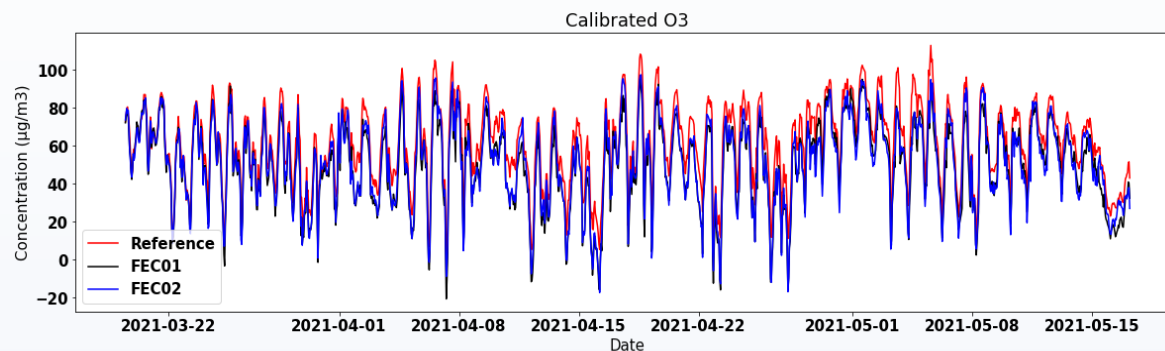
Simple Linear
Regression



R ²	
FEC05	FEC06
0.34	0.21

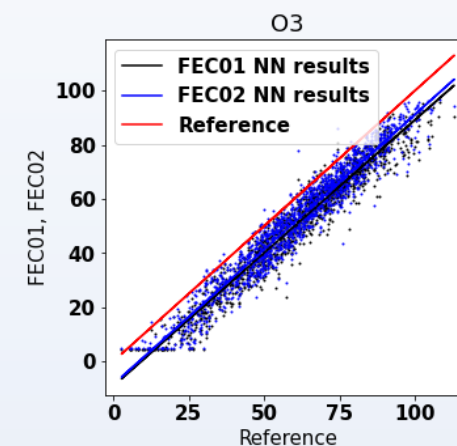
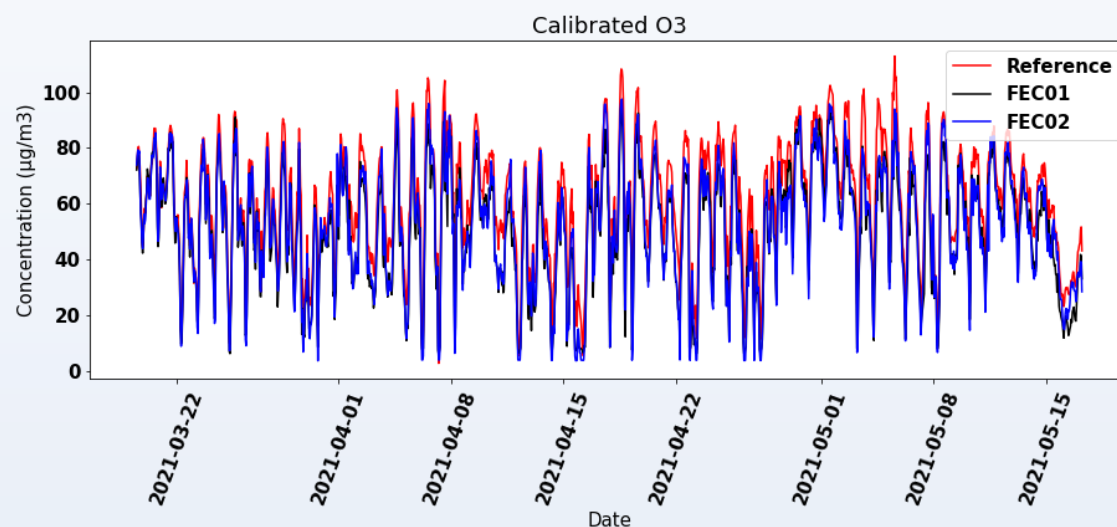
Gaseous Pollutants: O₃

Multiple Linear
Regression



R^2	
FEC05	FEC06
0.94	0.93

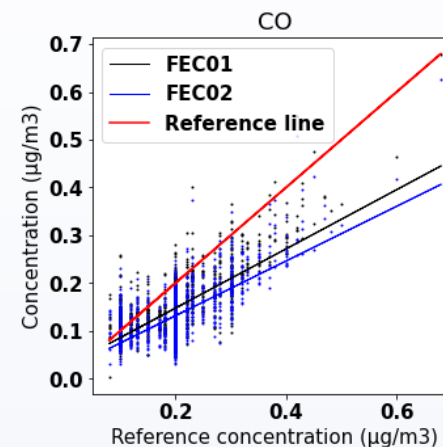
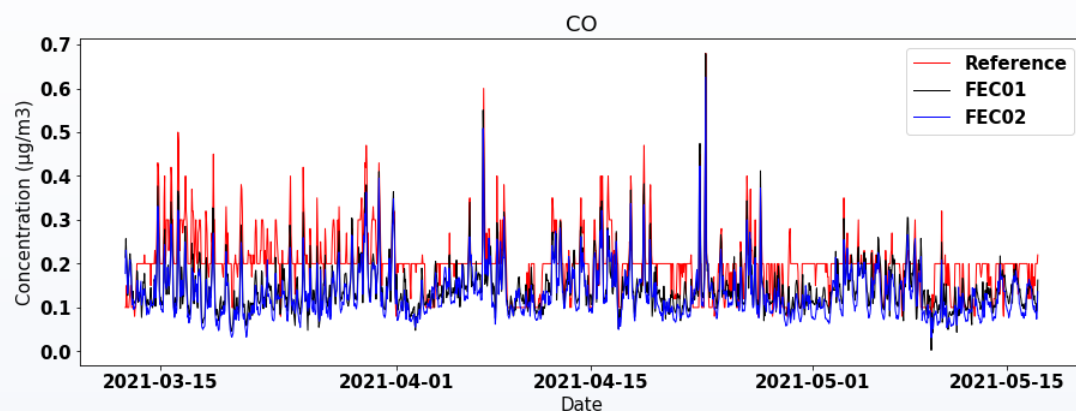
Artificial Neural
Network



R^2	
FEC05	FEC06
0.95	0.94

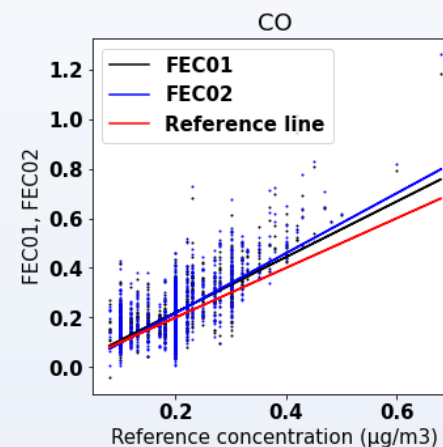
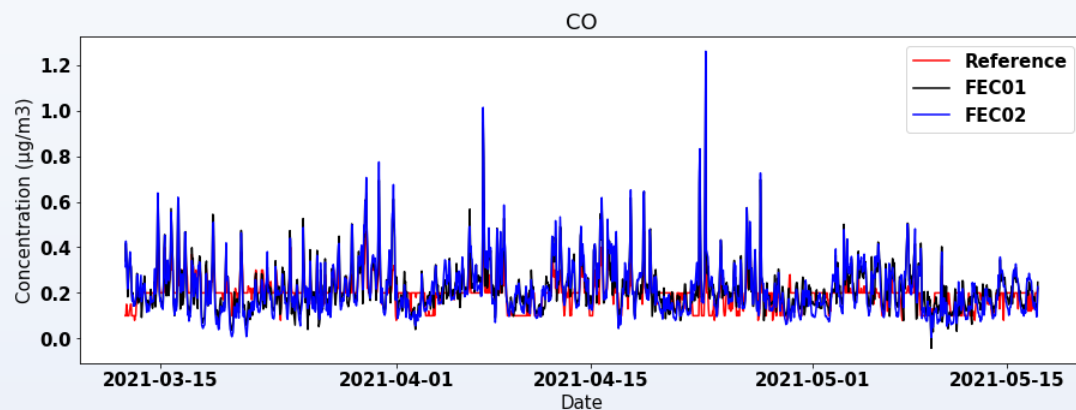
Gaseous Pollutants: CO

Non-calibrated
time serie



R^2	
FEC05	FEC06
0.47	0.45

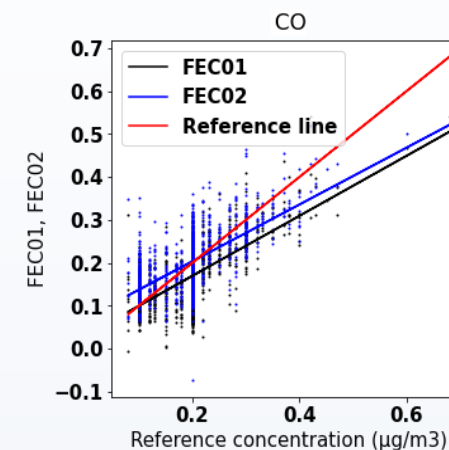
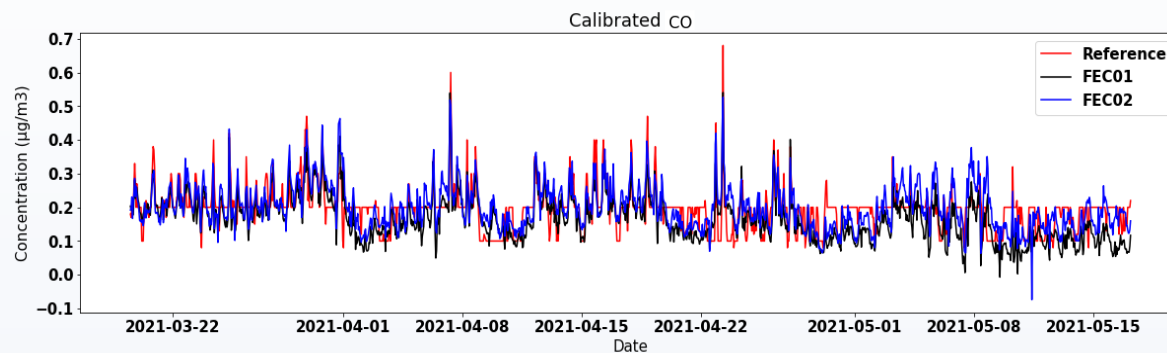
Simple Linear
Regression



R^2	
FEC05	FEC06
0.47	0.45

Gaseous Pollutants: CO

Multiple Linear
Regression

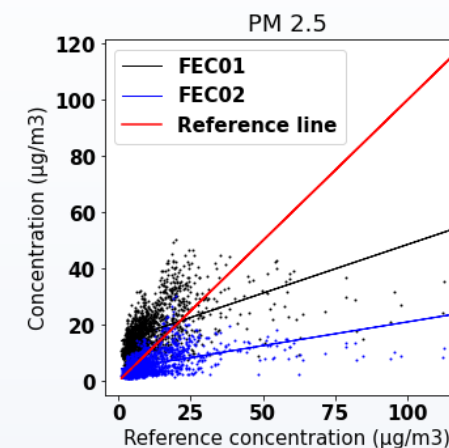
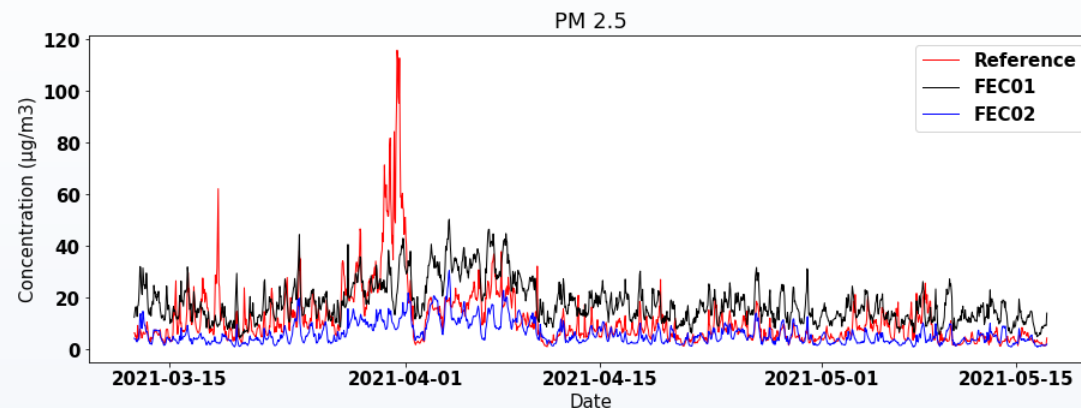


R^2	
FEC05	FEC06
0.42	0.38

Artificial Neural
Network

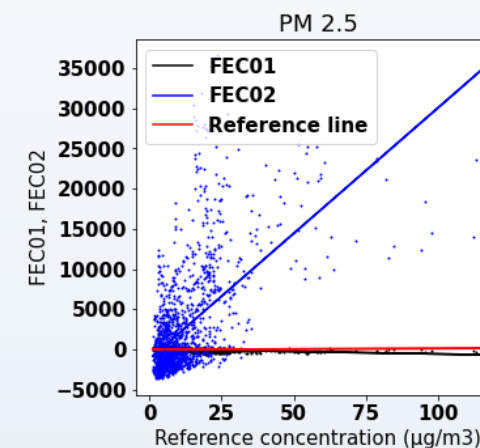
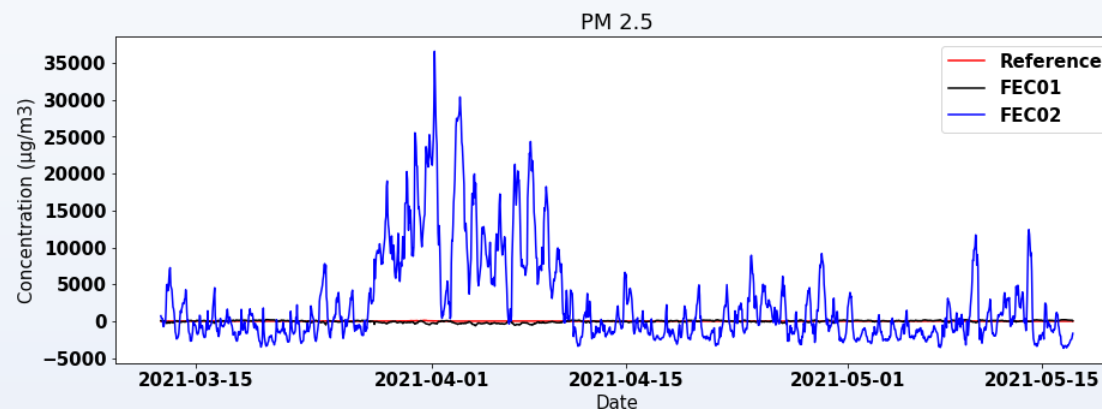
Particulate Matter: PM 2.5

Non-calibrated
time serie



R^2	
FEC05	FEC06
0.27	0.22

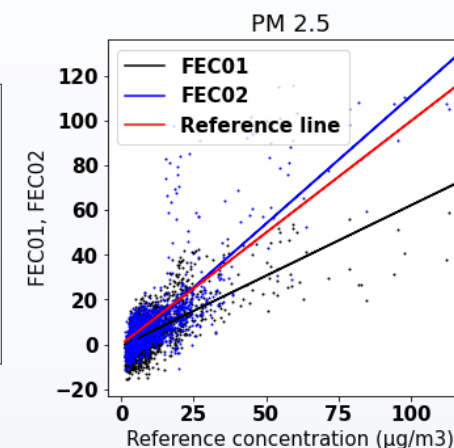
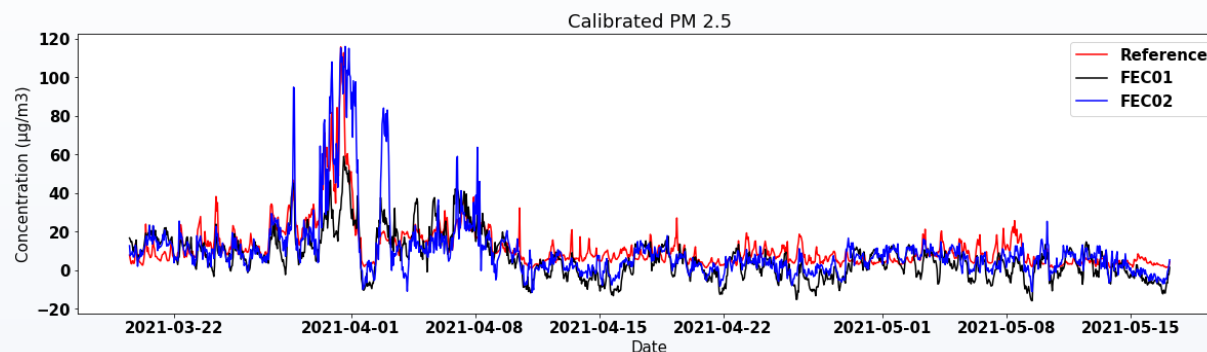
Simple Linear
Regression



R^2	
FEC05	FEC06
0.27	0.22

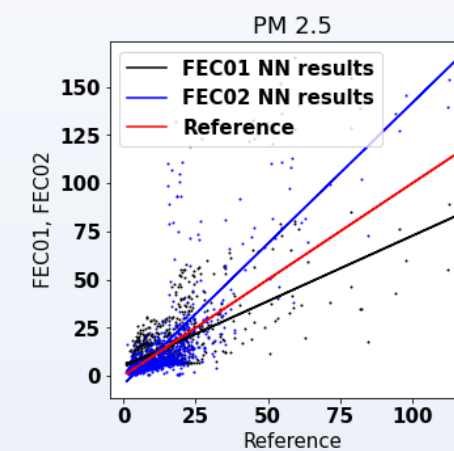
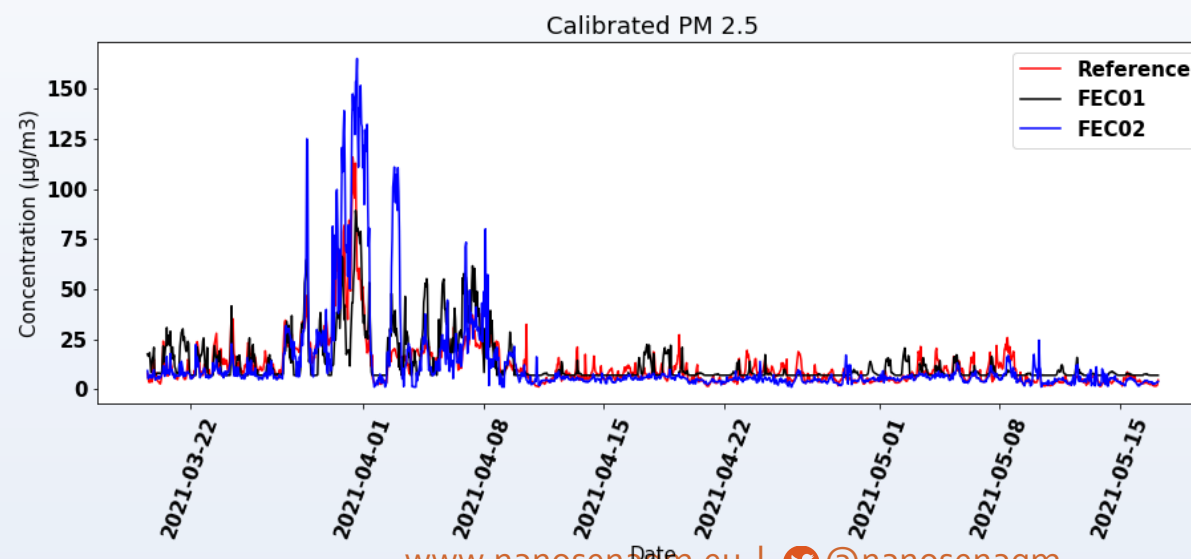
Particulate Matter: PM 2.5

Multiple Linear
Regression



R^2	
FEC05	FEC06
0.45	0.64

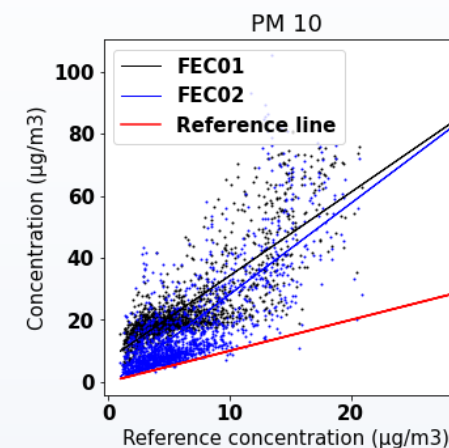
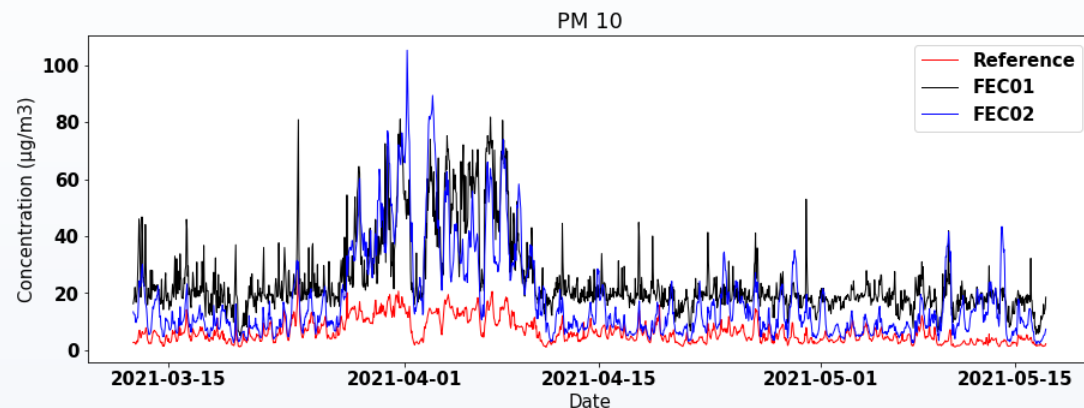
Artificial Neural
Network



R^2	
FEC05	FEC06
0.50	0.64

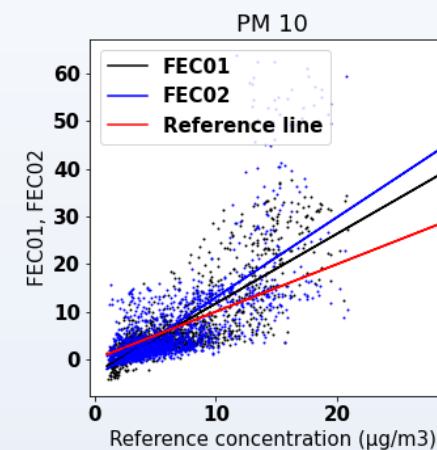
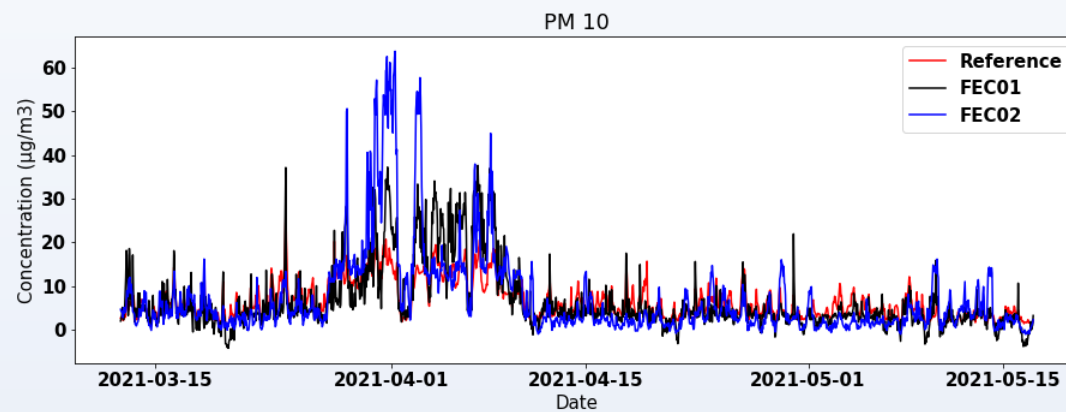
Particulate Matter: PM 10

Non-calibrated
time serie



R^2	
FEC05	FEC06
0.66	0.58

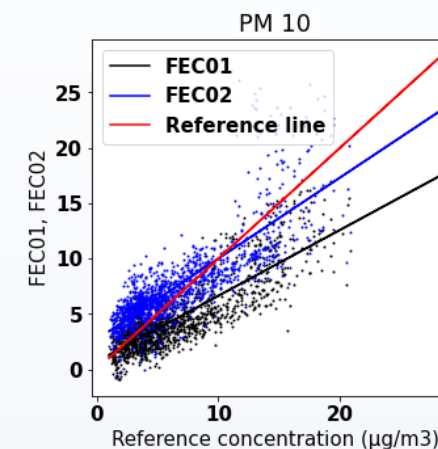
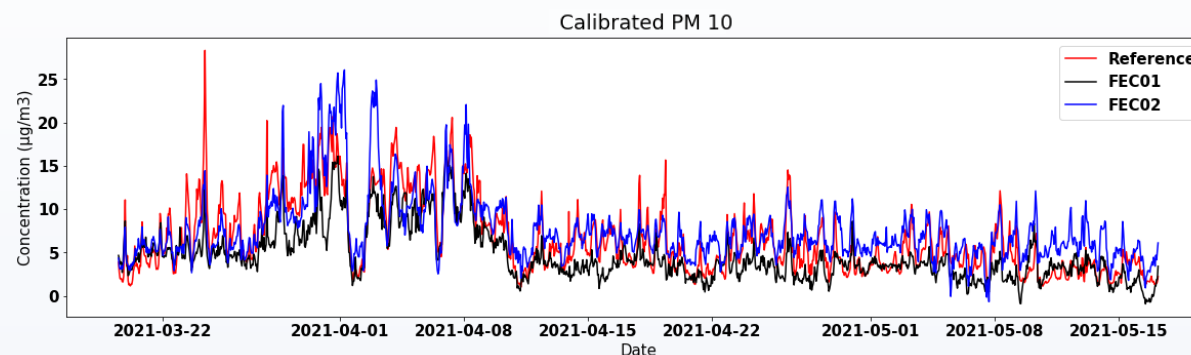
Simple Linear
Regression



R^2	
FEC05	FEC06
0.66	0.58

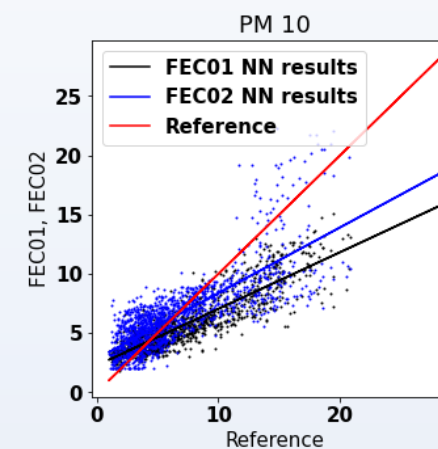
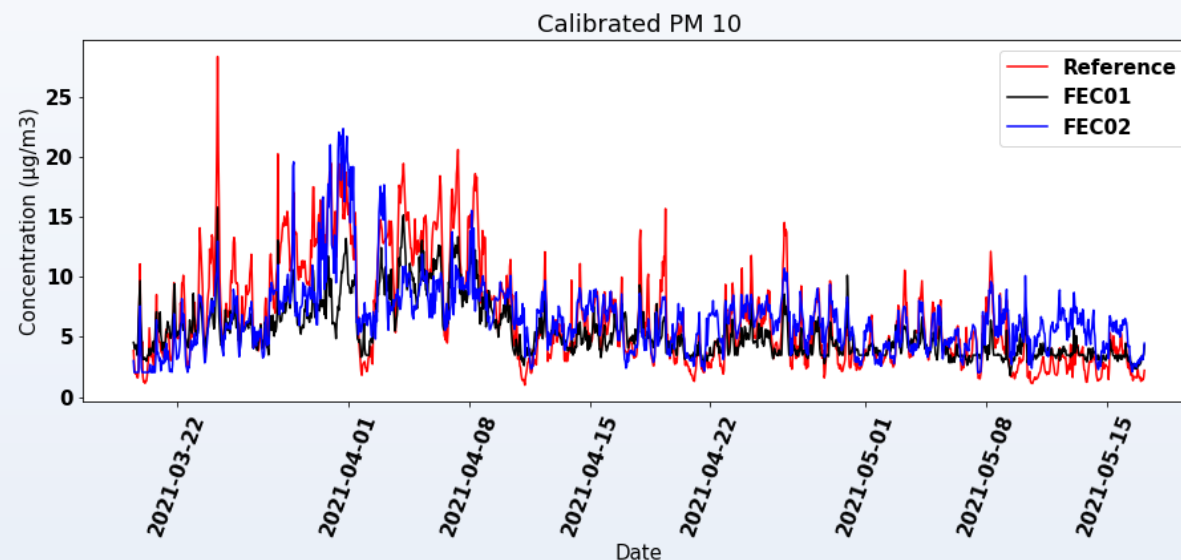
Particulate Matter: PM 10

Multiple Linear
Regression



R^2	
FEC05	FEC06
0.70	0.66

Artificial Neural
Network



R^2	
FEC05	FEC06
0.78	0.60

Conclusions

- The campaign in Badajoz has been carried out successfully. Sensors have worked properly.
- The calibration stage is key in the performance of the sensors. ANN achieved the better results.
- The calibration time period (1 week) plays a vital role. It has to be representative of the whole time serie.
- PMs sensors could be improve in further research.



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