



AIR QUALITY STATION TESTS & RESULTS

Co-location studies



Key concepts



R² (coefficient of determination)

The coefficient of determination (R^2) measures a comparison between an air quality device and another taken as a reference. The closer to 1, the better the device imitates the performance of the reference device.

MAE ($\mu\text{g}/\text{m}^3$) (Mean Absolute Error)

The mean absolute error (MAE) measures the average magnitude of errors between predicted and real values. MAE is used as an accuracy measuring method. The closer to 0, the better.

$\mu\text{g}/\text{m}^3$ (micrograms per cubic meter)

Co-location studies



- **Terrasa (Spain)** ⇒ pp. 3-12
- **Zaragoza- Jaime Ferrán St. (Spain)** ⇒ pp. 13-24
- **Zaragoza- Roger de Flor St. (Spain)** ⇒ pp. 25-36

Colocation study details



Location: Terrassa (Spain)

Libelium devices installed: AQS1, AQS2

Dates of train and validation: 1 month (2021-10-07 to 2021-11-04)

Dates of colocation study: 6 months (2021-11-05 to 2022-04-29)

Pollutants: NO, NO₂, O₃

Sampling: 15 minutes average value VS Reference Station data

Concentration units: µg/m³

Ambient conditions



Temperature max:

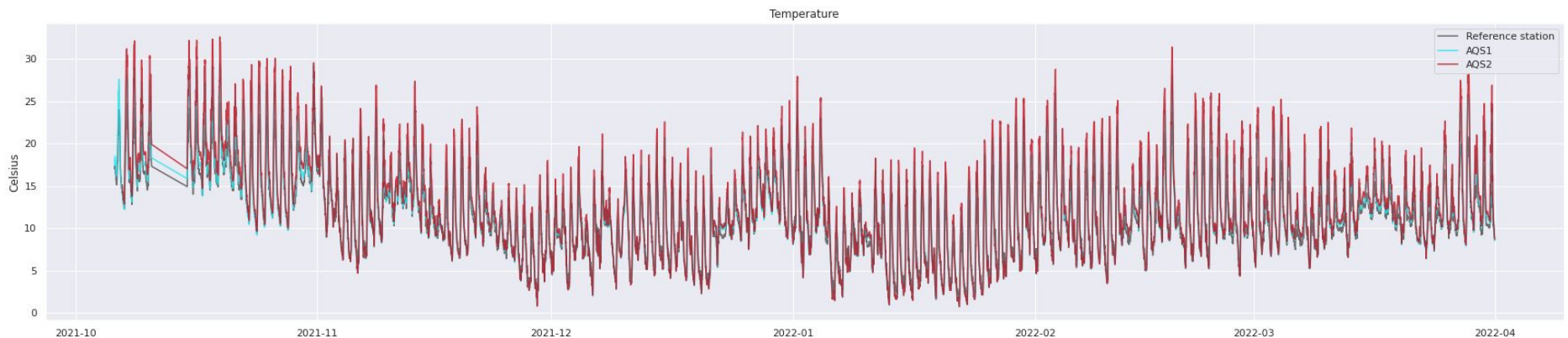
Train: 25° Celsius

Test: 23.7° Celsius

Temperature min:

Train: 9° Celsius

Test: 1.5° Celsius



Ambient conditions



Humidity max:

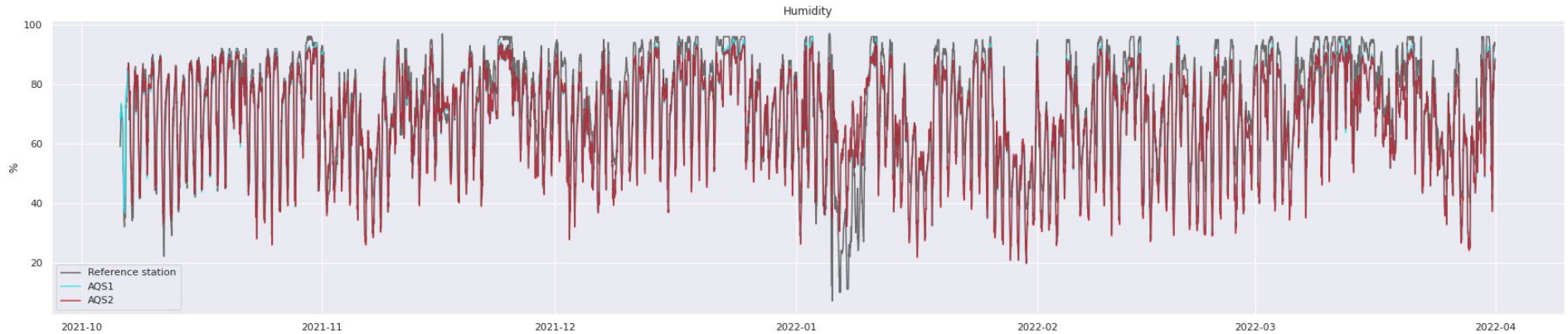
Train 96.0 %

Test: 97.0 %

Humidity min:

Train 22.0 %

Test: 7.0 %



Pollutants



NO (Nitrogen monoxide)

NO₂ (Nitrogen Dioxide)

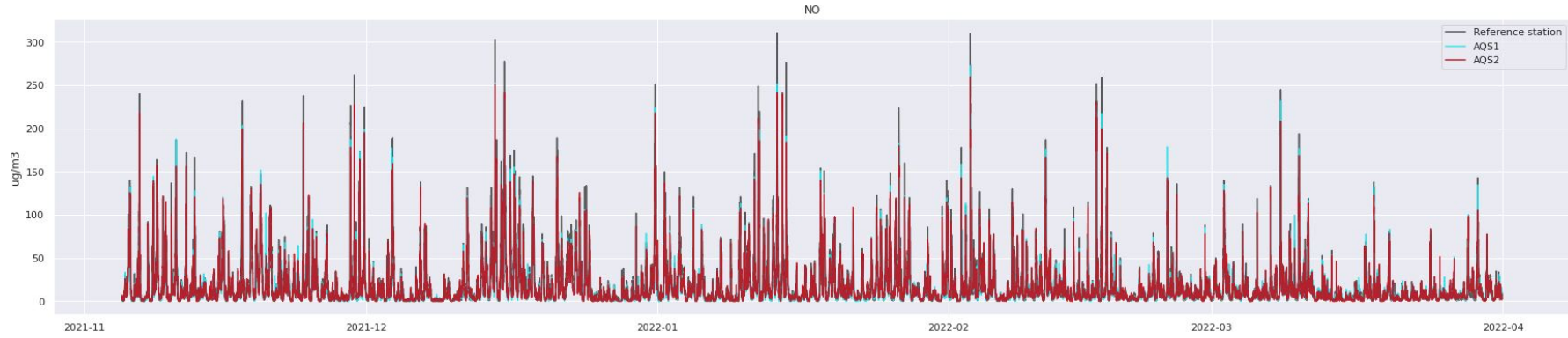
O₃ (Ozone)



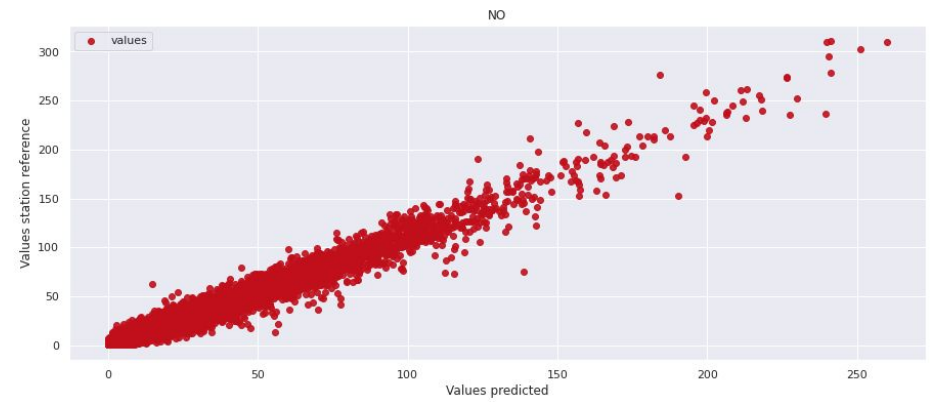
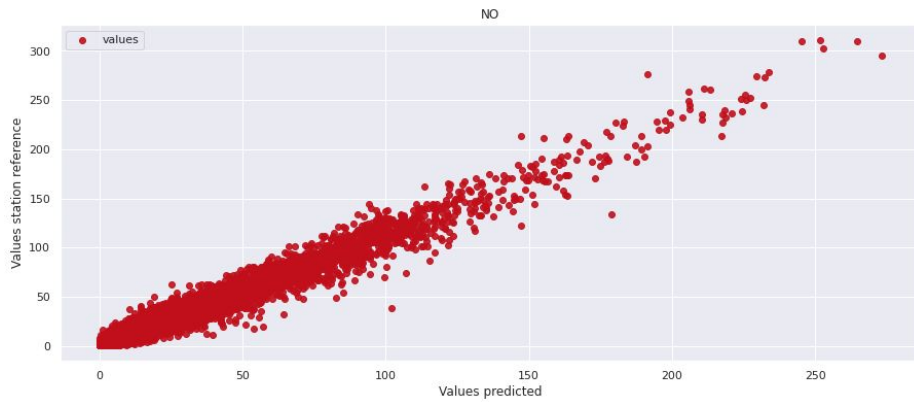
NO

Nitrogen Monoxide

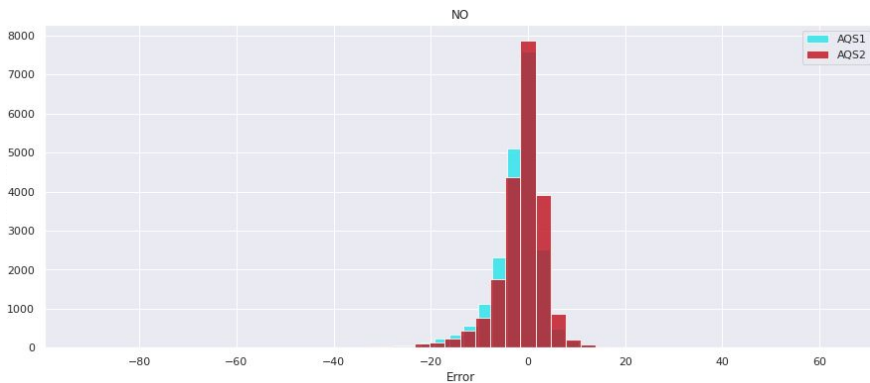
Prediction Graph



Scatter plot



Error histogram



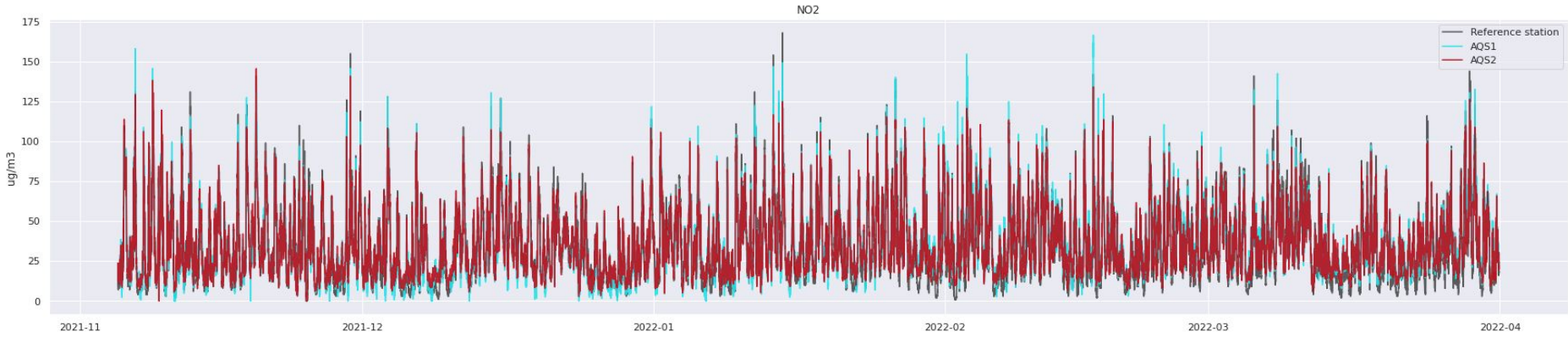
Metrics

Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.96	3.31	7.52
AQS2	0.96	3.36	7.38

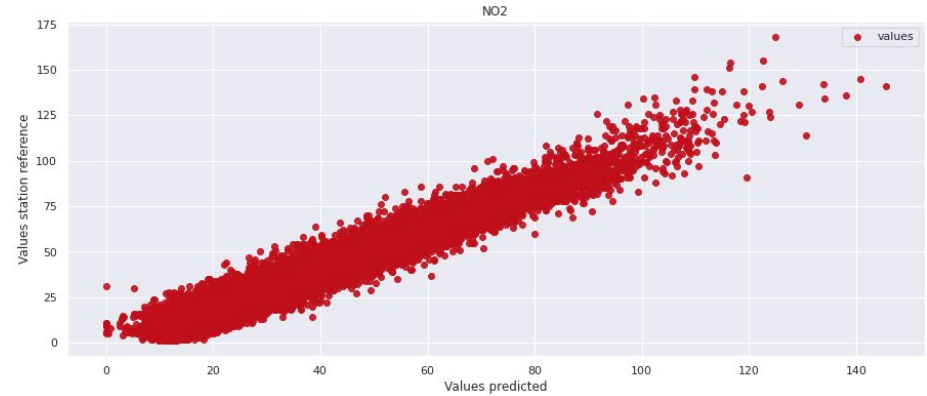
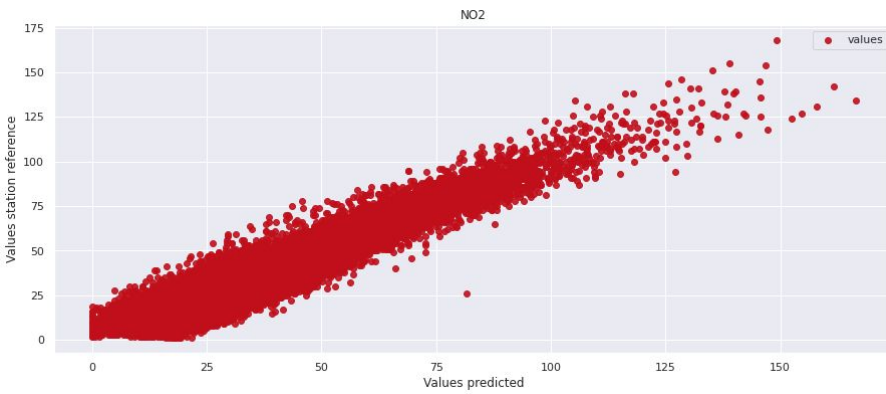


**Nitrogen
Dioxide**

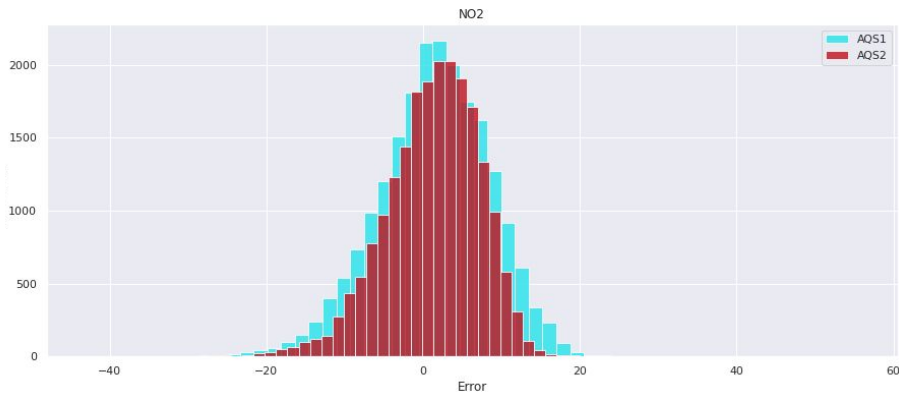
Prediction Graph



Scatter plot



Error histogram



Metrics

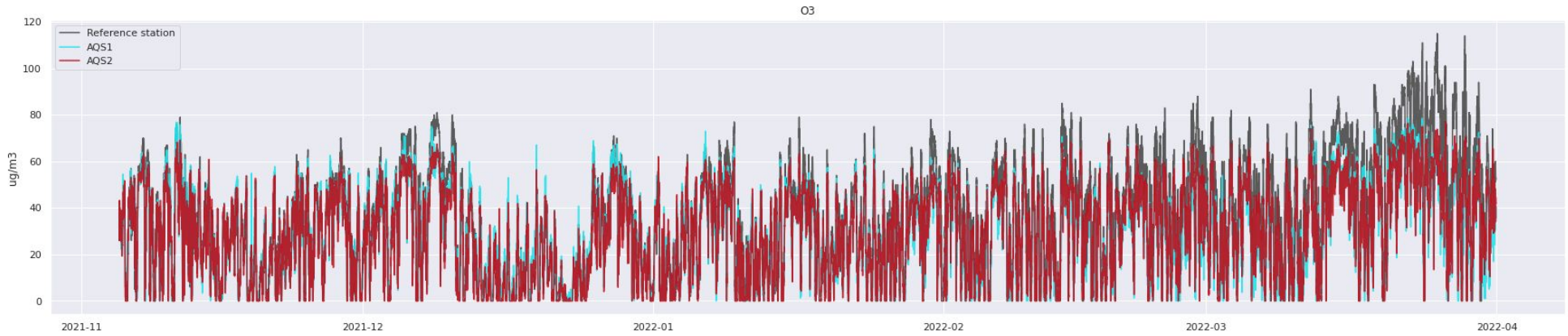
Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.90	5.63	11.66
AQS2	0.94	4.39	8.96

Pollutants

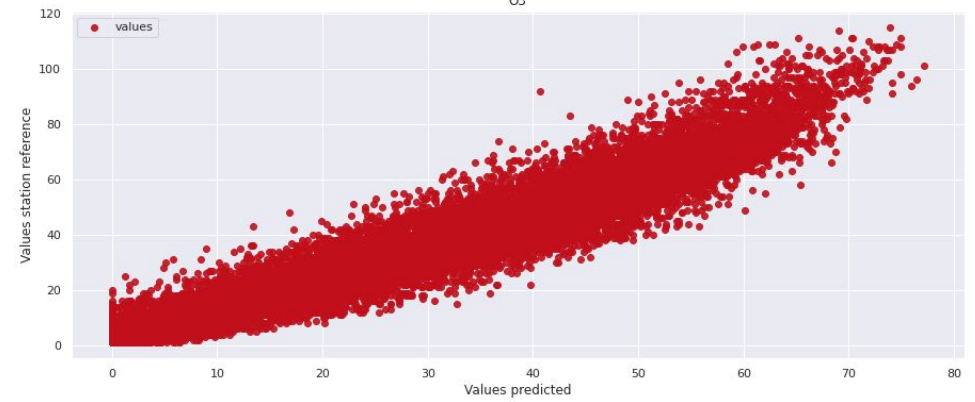
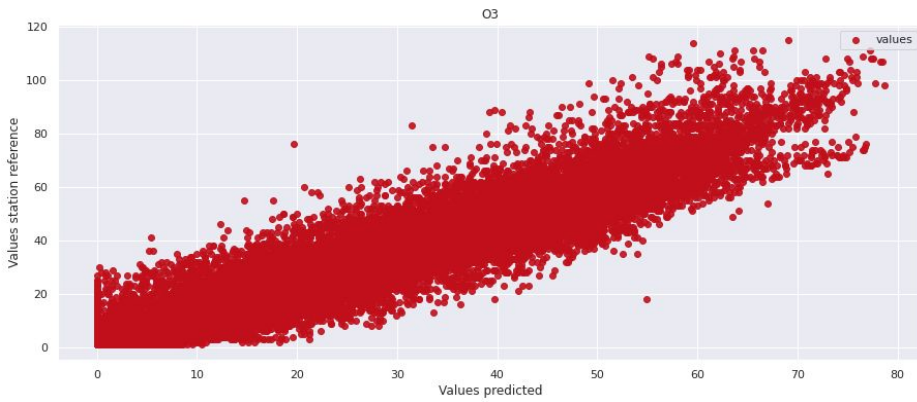


Ozone

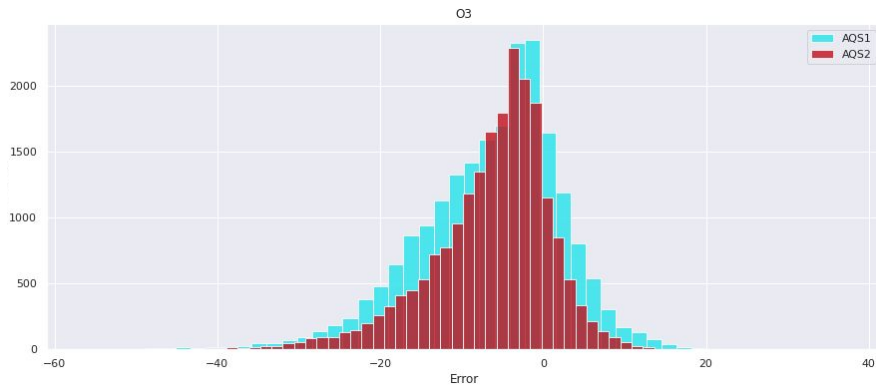
Prediction Graph



Scatter plot



Error histogram



Metrics

Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.87	6.40	13.63
AQS2	0.92	4.93	10.79

Colocation study details



Location: Zaragoza- Jaime Ferrán St. (Spain)

Libelium devices installed: AQS1, AQS2

Dates of train and validation: 1 month (2021-10-07 to 2021-11-04)

Dates of colocation study: 6 months (from 2021-11-05 to 2022-04-29)

Pollutants: CO, NO, NO₂, O₃

Sampling: 15 minutes average value VS Reference Station data

Concentration units: µg/m³

Ambient conditions



Temperature max:

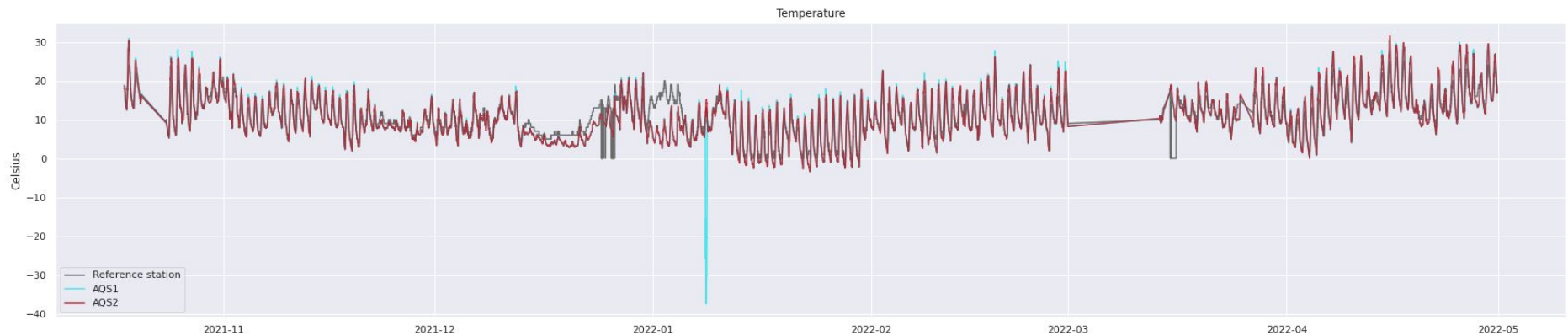
Train: 24.0° Celsius

Test: 26.0° Celsius

Temperature min:

Train: 6.0° Celsius

Test: -2.0° Celsius



Ambient conditions



Humidity max:

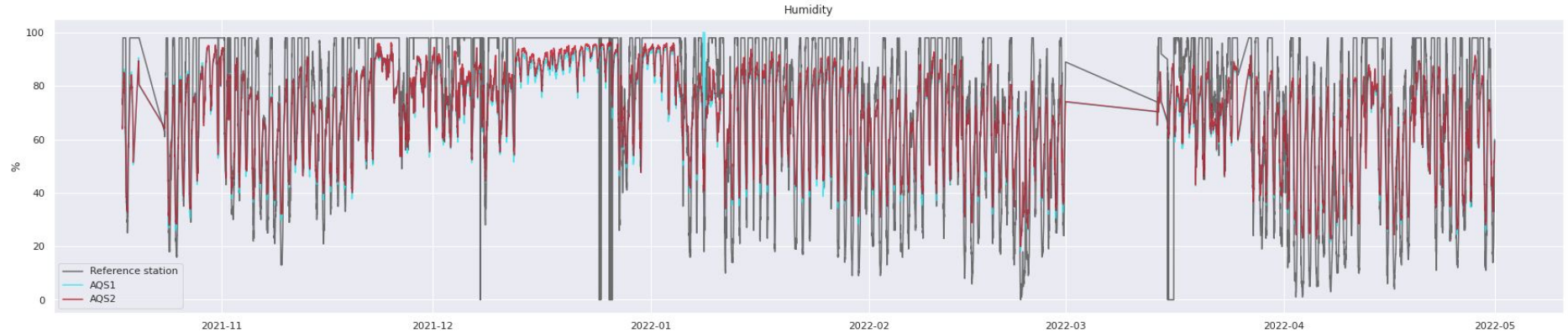
Train: 98.0%

Test: 98.0%

Humidity min:

Train: 16.0 %

Test: 0.0 %



Pollutants



CO (Carbon Monoxide)

NO (Nitrogen monoxide)

NO₂ (Nitrogen Dioxide)

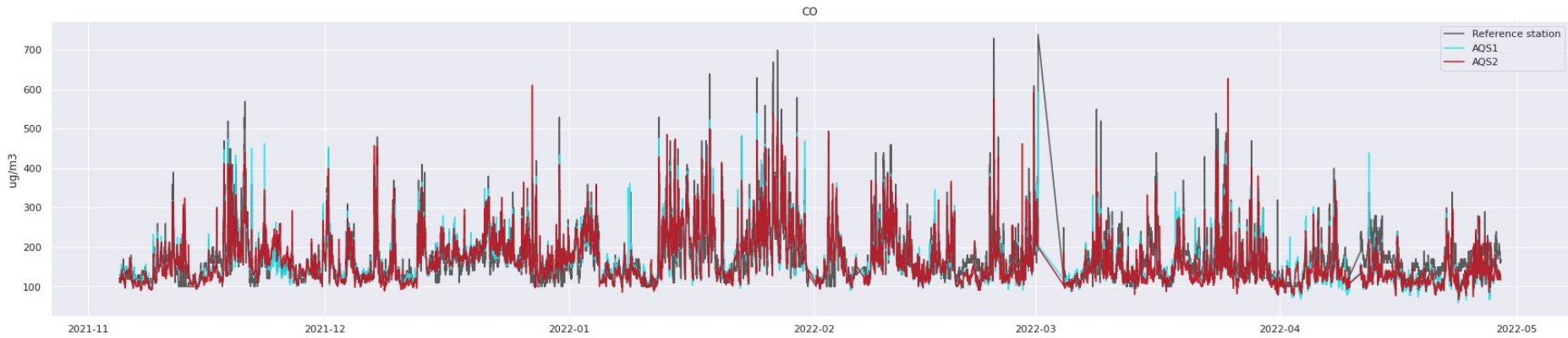
O₃ (Ozone)



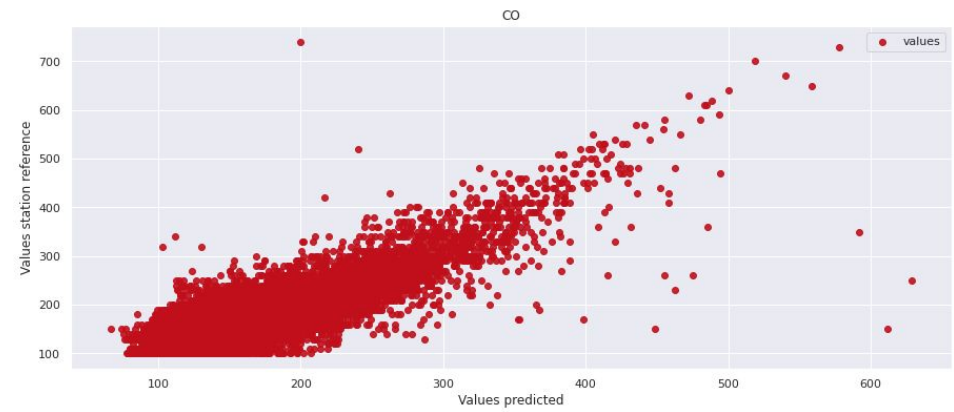
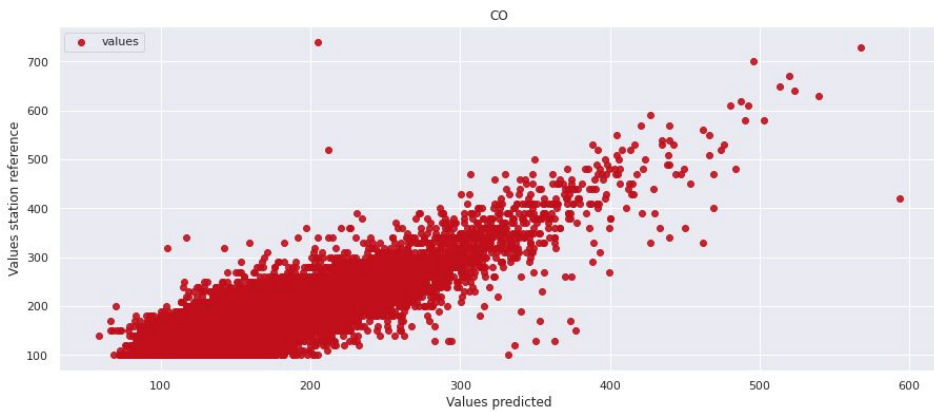
CO

**Carbon
Monoxide**

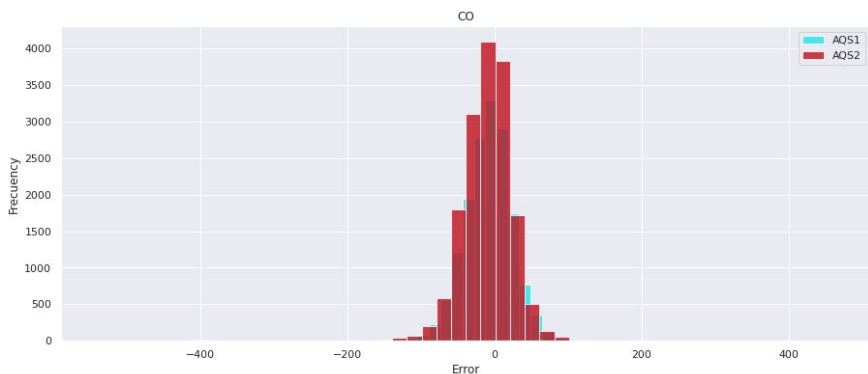
Prediction Graph



Scatter plot



Error histogram



Metrics

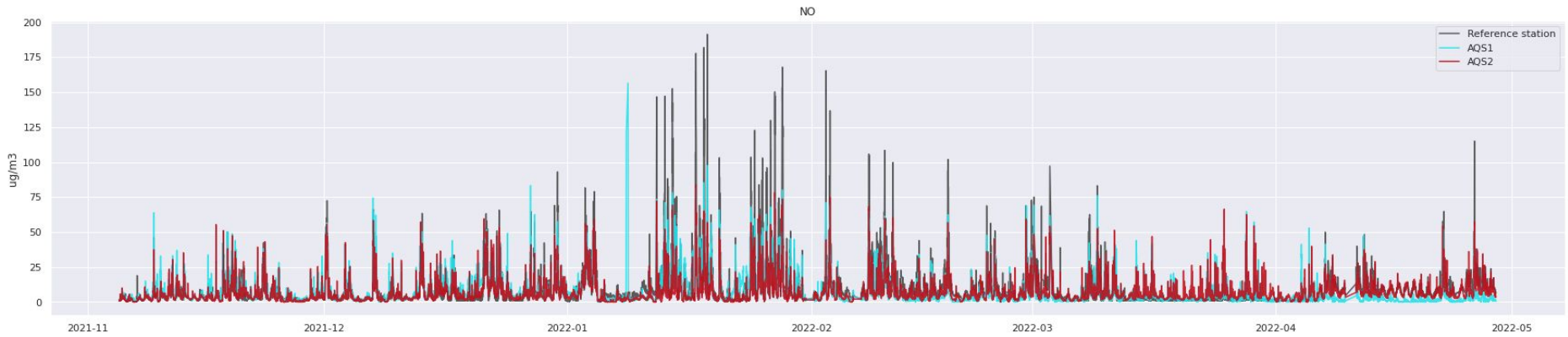
Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.70	24.97	51.43
AQS2	0.70	24.59	49.12



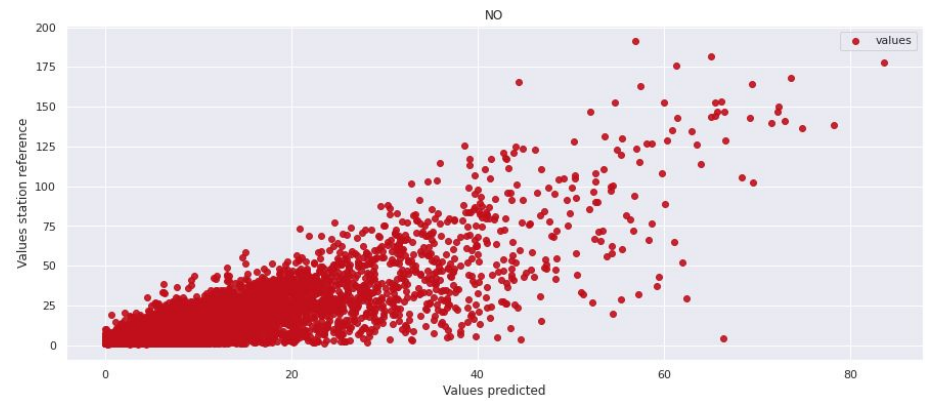
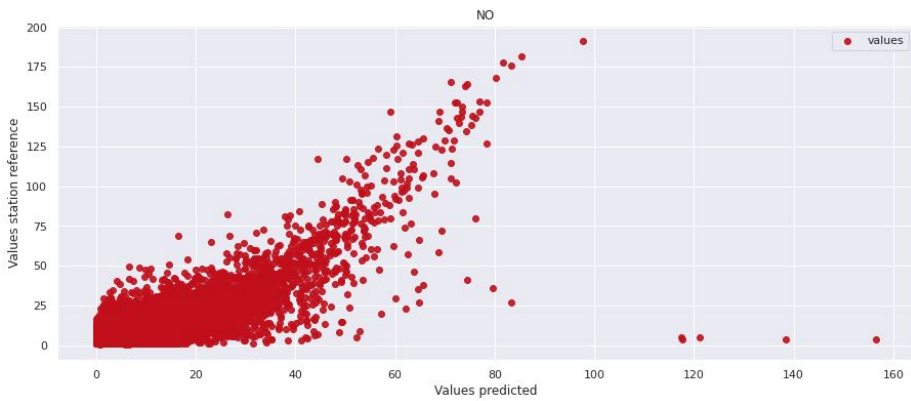
NO

Nitrogen Monoxide

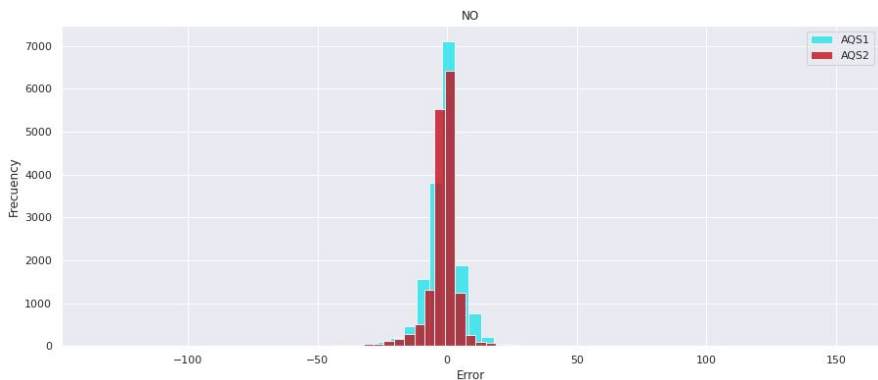
Prediction Graph



Scatter plot



Error histogram



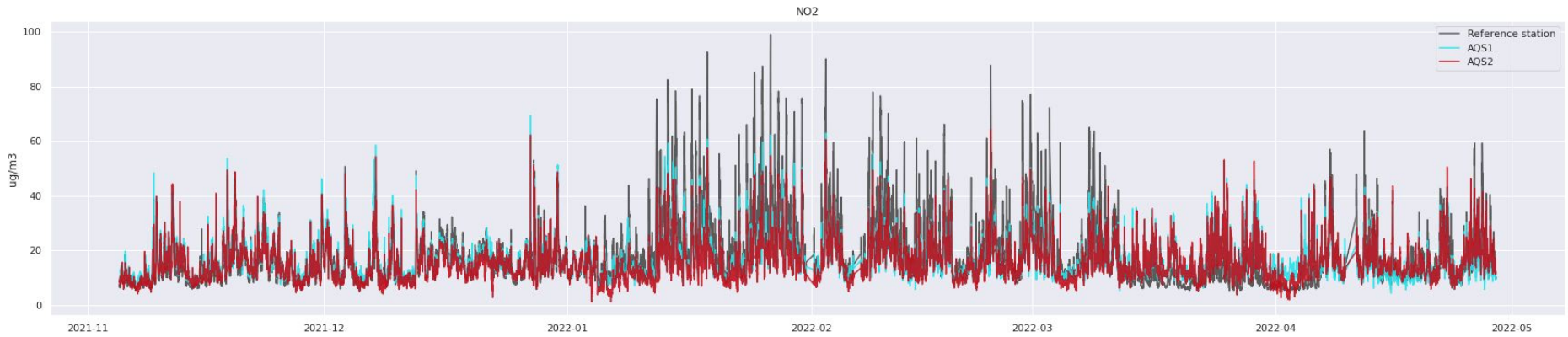
Metrics

Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.63	5.08	11.18
AQS2	0.71	4.12	9.11

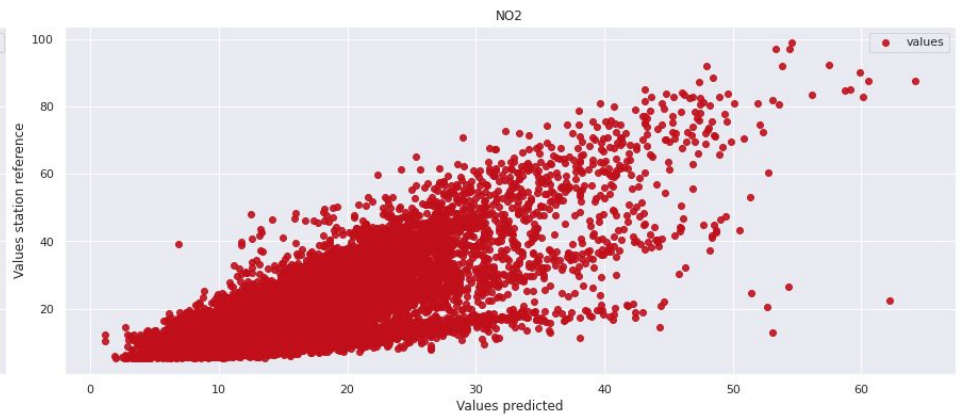
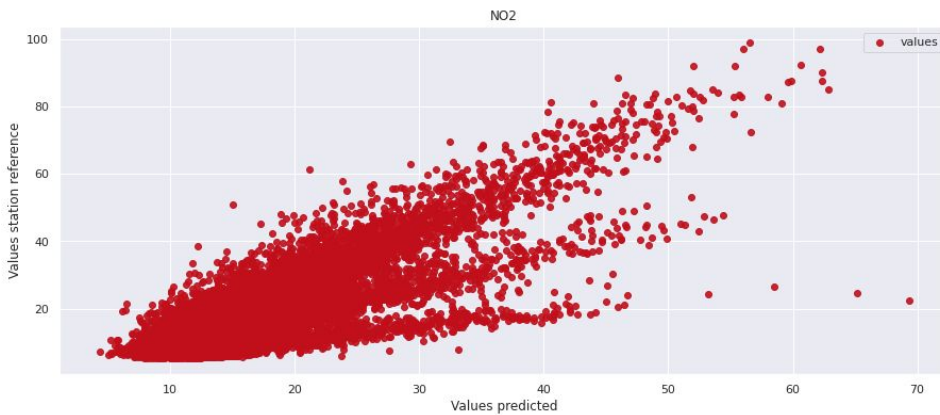


**Nitrogen
Dioxide**

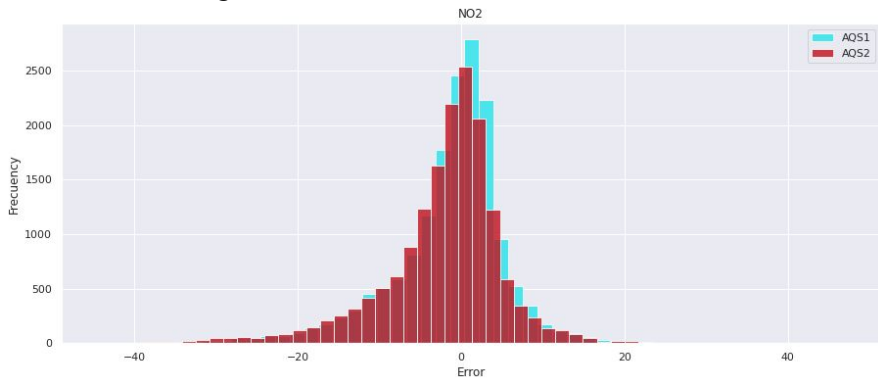
Prediction Graph



Scatter plot



Error histogram



Metrics

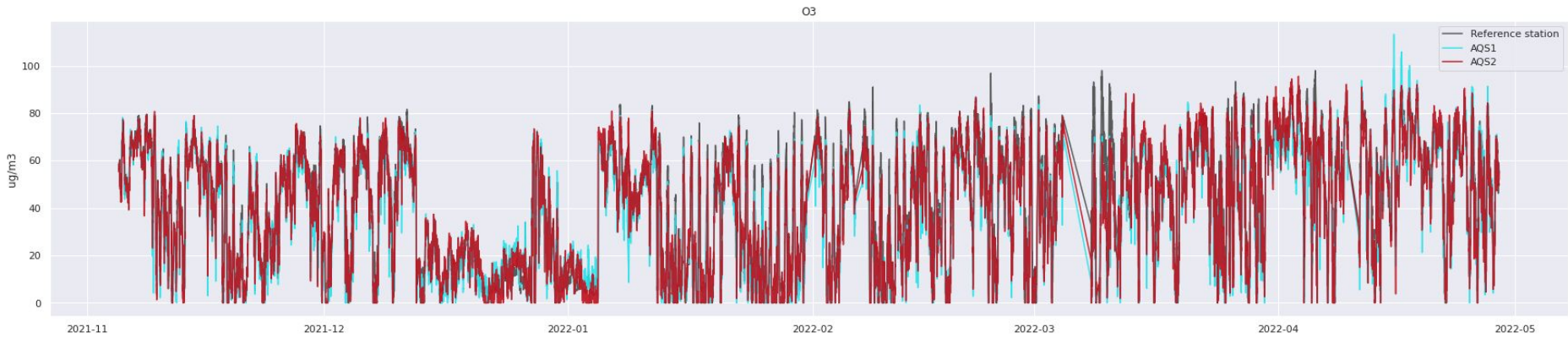
Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.67	4.70	10.70
AQS2	0.62	5.11	11.47

Pollutants

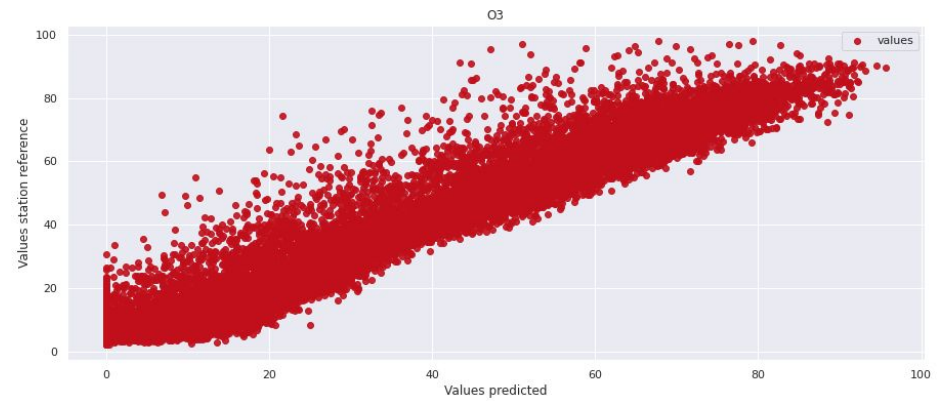
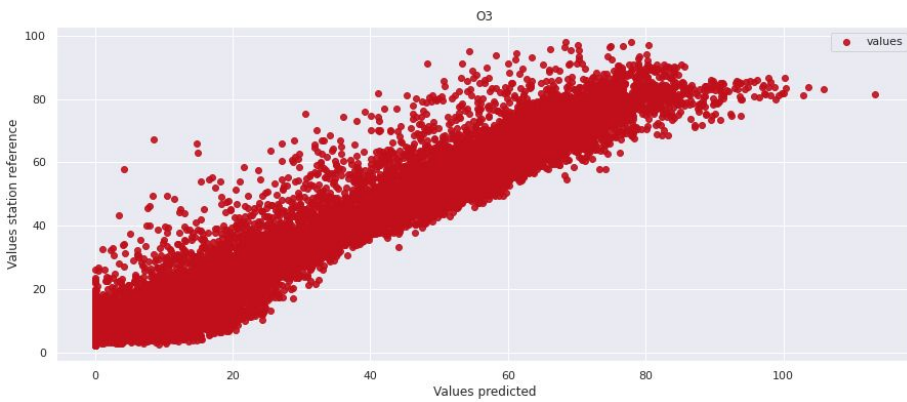


Ozone

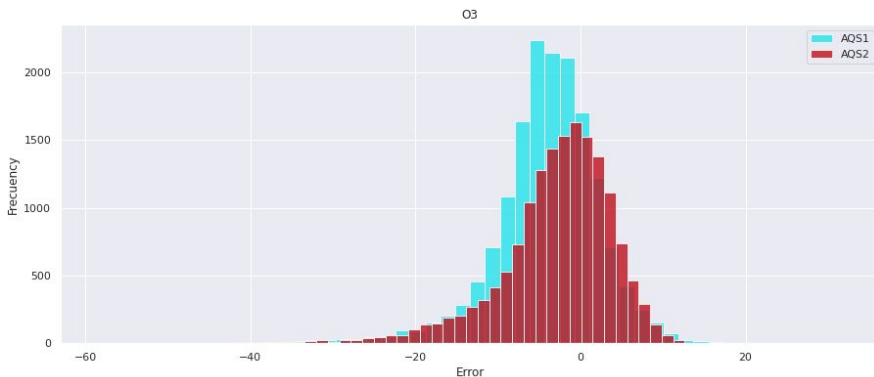
Prediction Graph



Scatter plot



Error histogram



Metrics

Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.93	4.59	9.97
AQS2	0.92	5.01	10.57

Colocation study details



Location: Zaragoza- Roger de Flor St. (Spain)

Libelium devices installed: AQS2

Dates of train and validation: 1 month (2021-12-14 to 2022-01-11)

Dates of colocation study: 4 months (2022-01-12 to 2022-04-27)

Pollutants: CO, NO, NO₂, O₃

Sampling: 15 minutes average value VS Reference Station data

Concentration units: µg/m³

Ambient conditions



Temperature max:

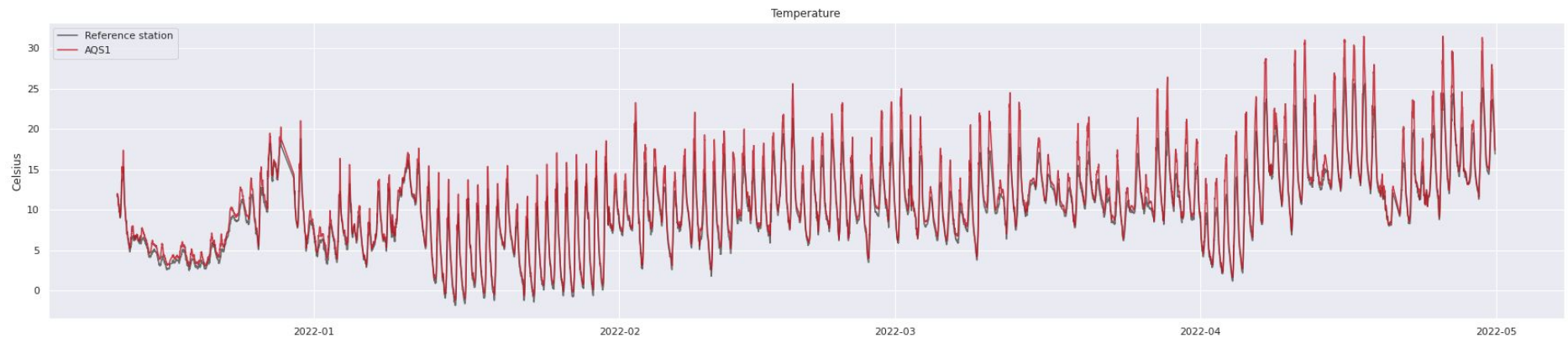
Train: 18.8° Celsius

Test: 26.3° Celsius

Temperature min:

Train: 2.5° Celsius

Test: -1.8° Celsius



Ambient conditions



Humidity max:

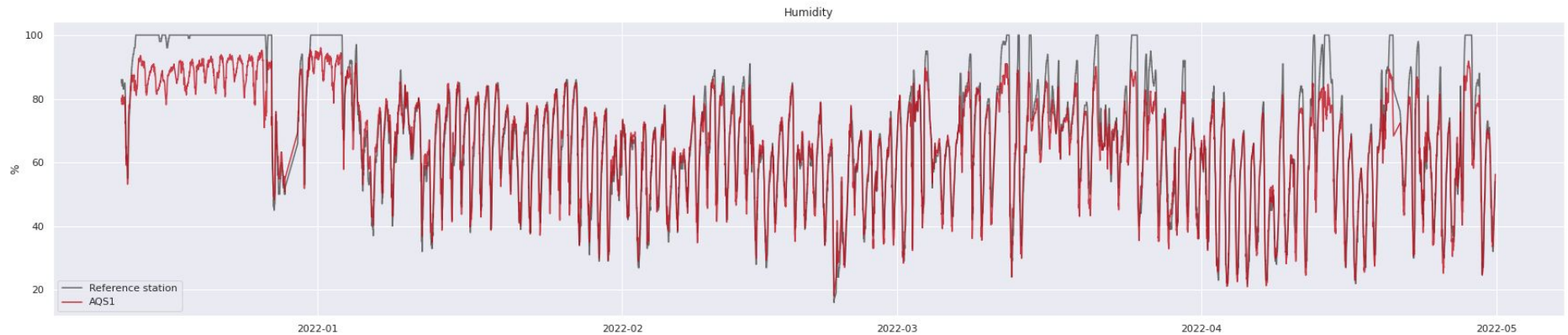
Train: 100.0%

Test: 100.0%

Humidity min:

Train: 37.0%

Test: 16.0%



Pollutants



CO (Carbon Monoxide)

NO (Nitrogen monoxide)

NO₂ (Nitrogen Dioxide)

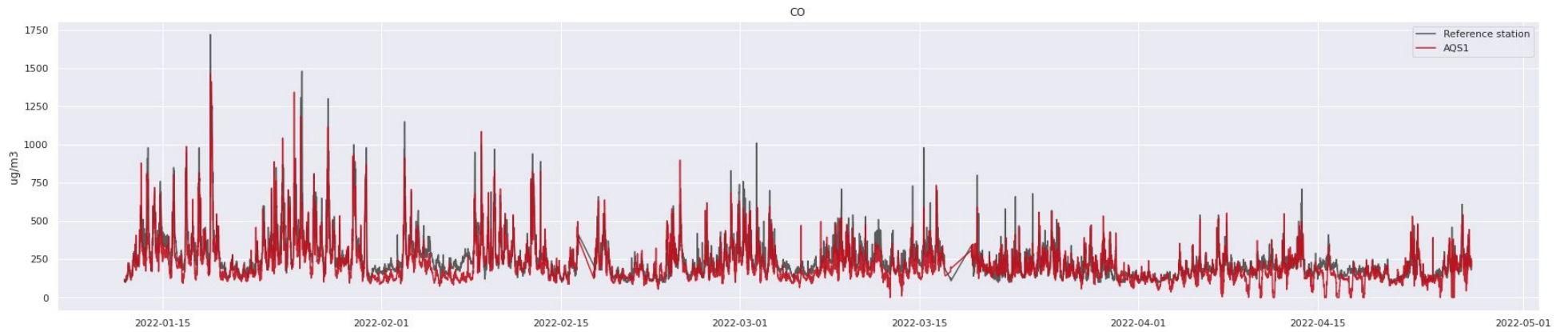
O₃ (Ozone)



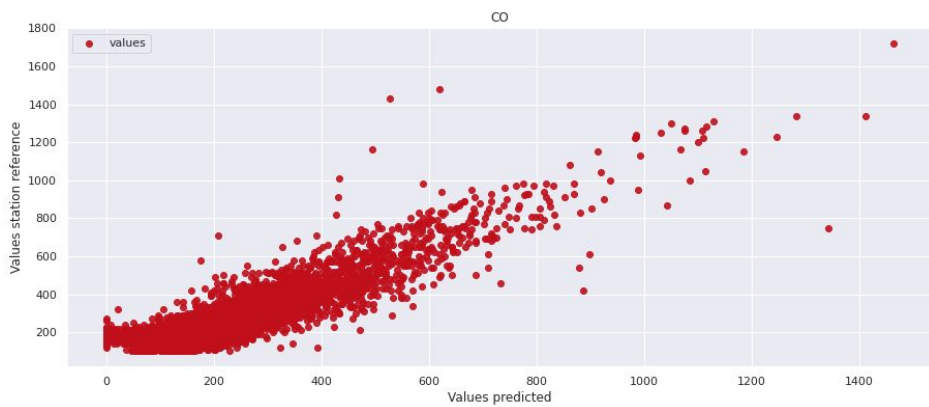
CO

**Carbon
Monoxide**

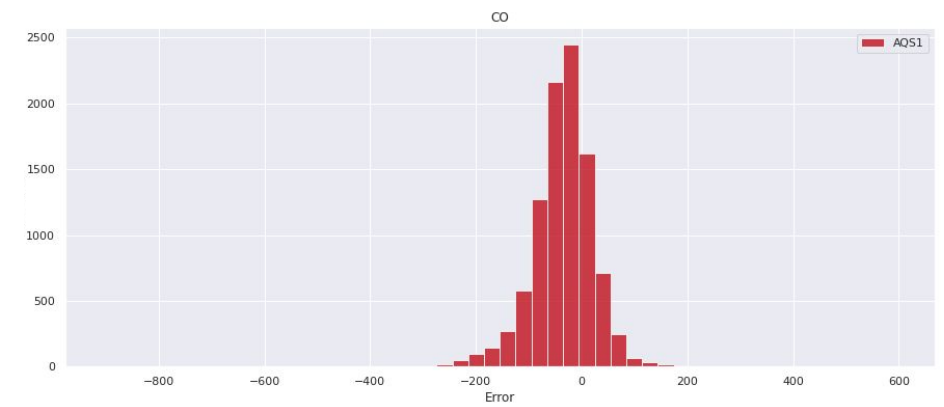
Prediction Graph



Scatter plot



Error histogram



Metrics

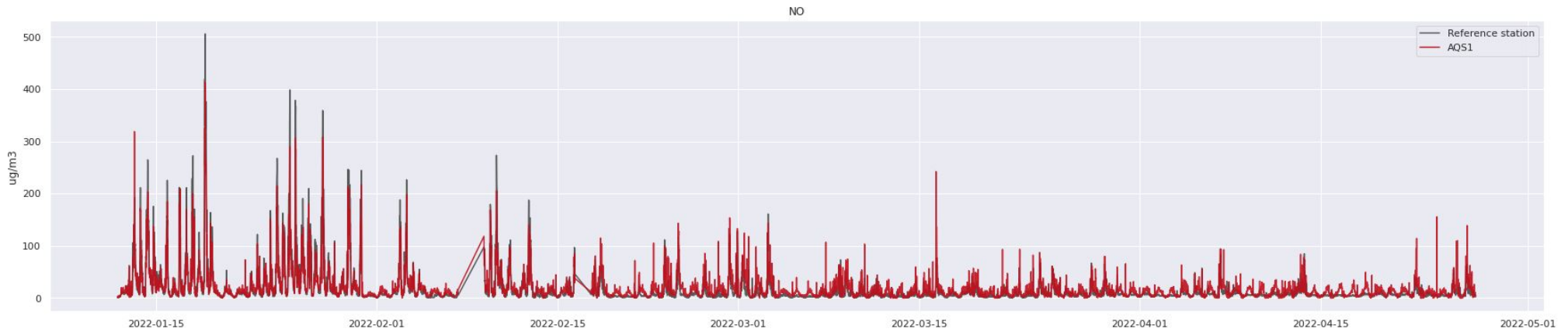
Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQSI	0.80	42.41	89.34



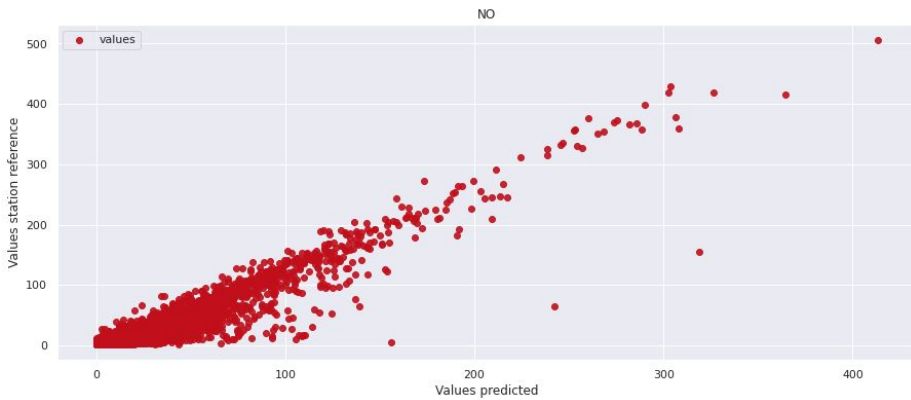
NO

Nitrogen Monoxide

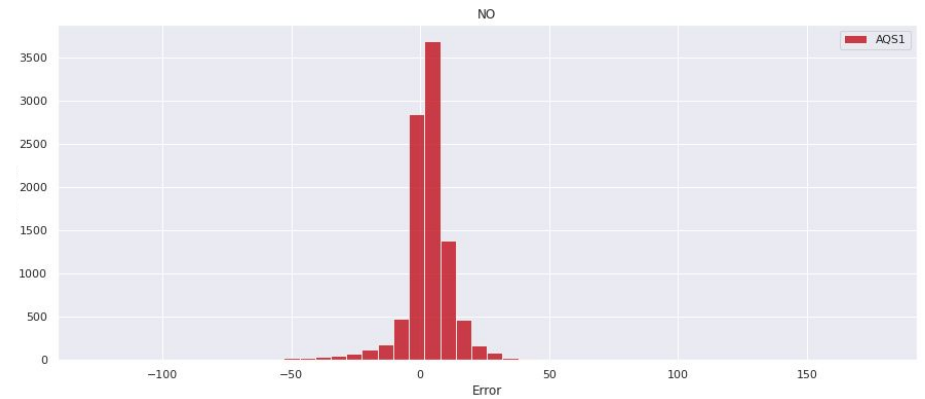
Prediction Graph



Scatter plot



Error histogram



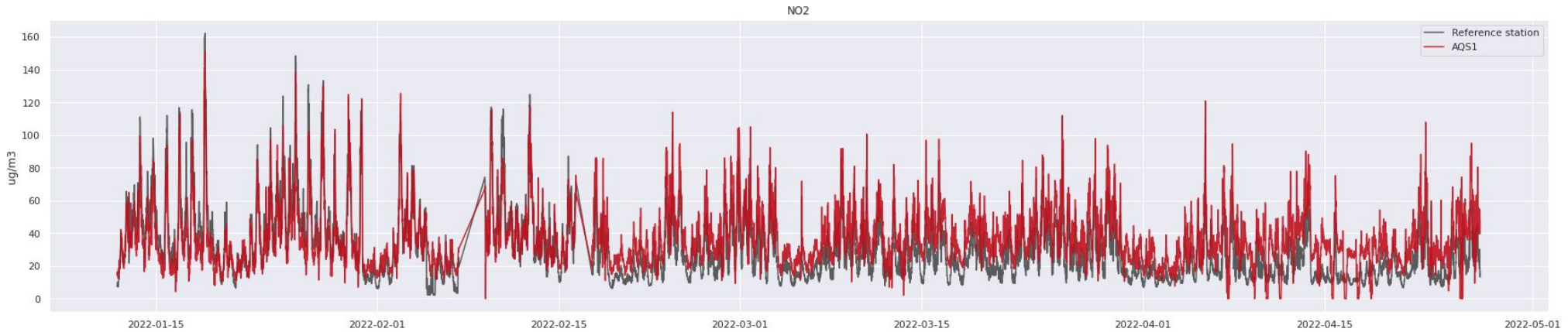
Metrics

Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.89	6.33	14.20

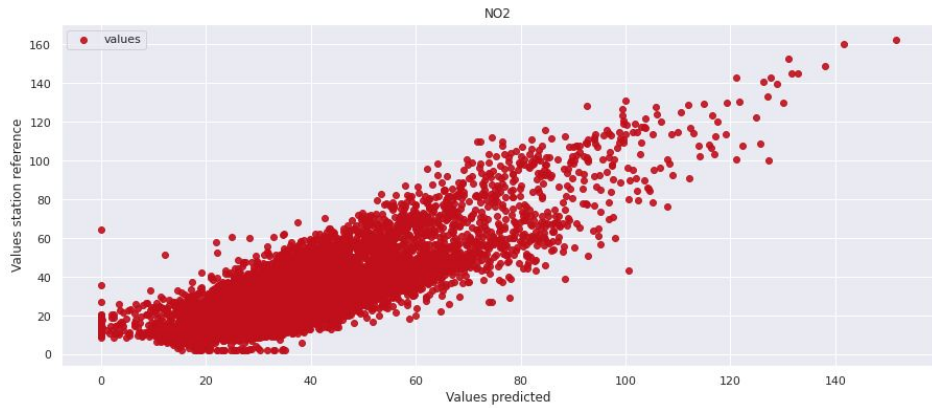


**Nitrogen
Dioxide**

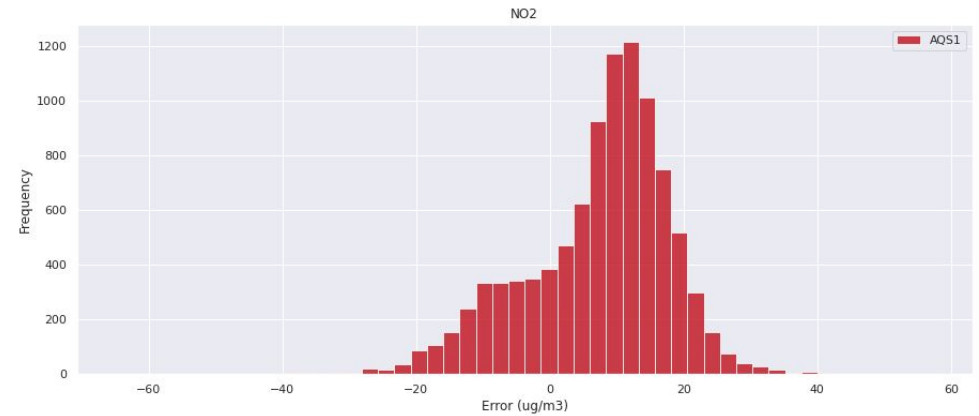
Prediction Graph



Scatter plot



Error histogram



Metrics

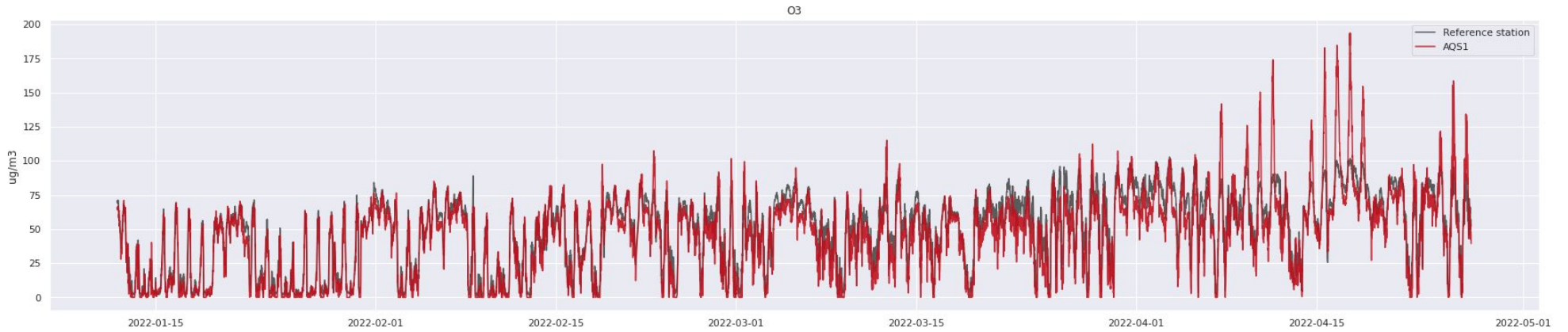
Device	R2	MAE ($\mu\text{g}/\text{m}^3$)	90% confidence ($\mu\text{g}/\text{m}^3$)
AQS1	0.71	7.91	16.31

Pollutants

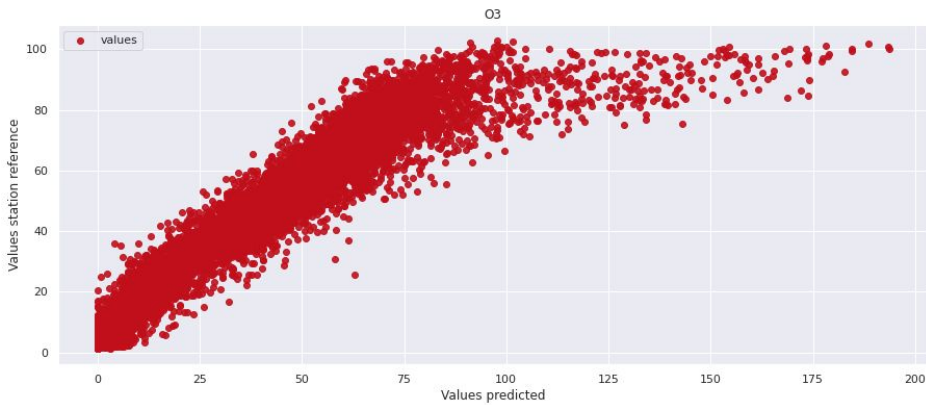


Ozone

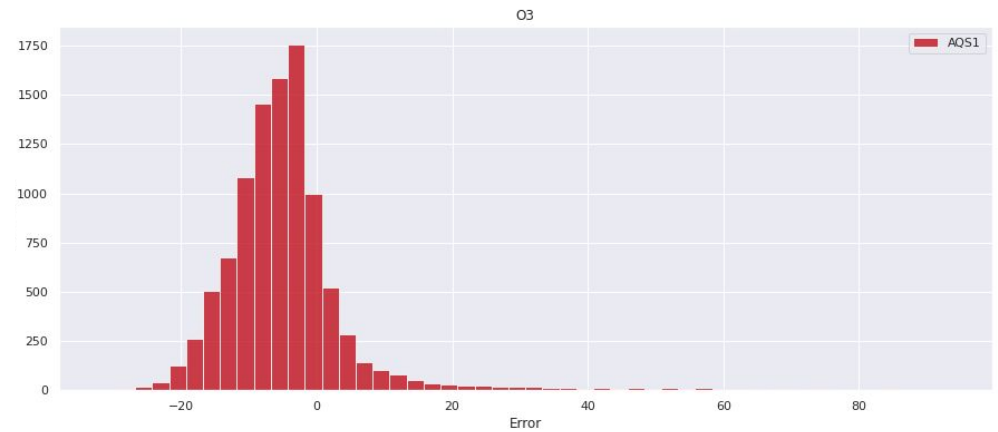
Prediction Graph



Scatter plot



Error histogram



Metrics

Device	R2	MAE (µg/m3)	90% confidence (µg/m3)
AQS1	0.87	7.03	12.17



libelium

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Beyond the challenge**

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