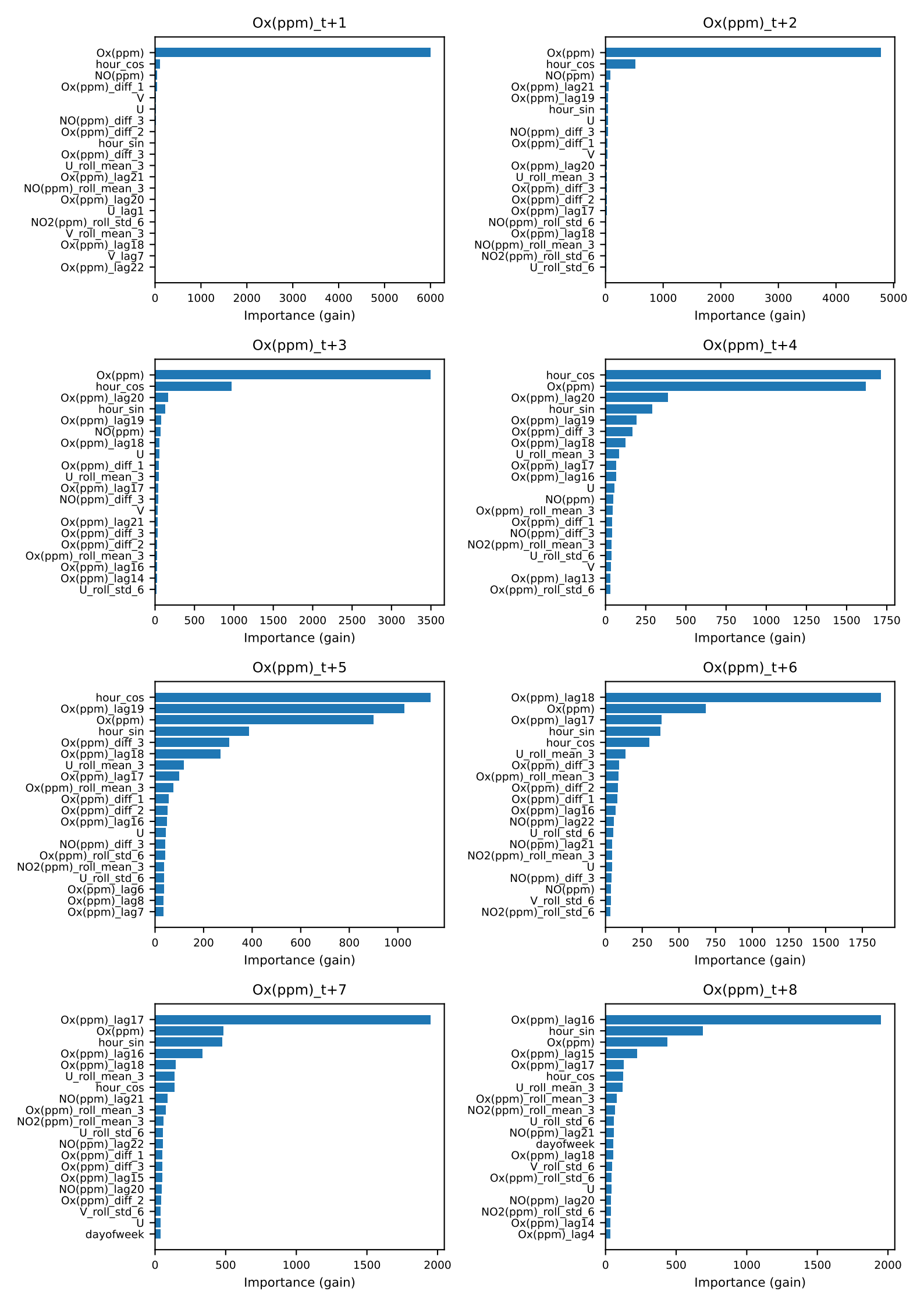
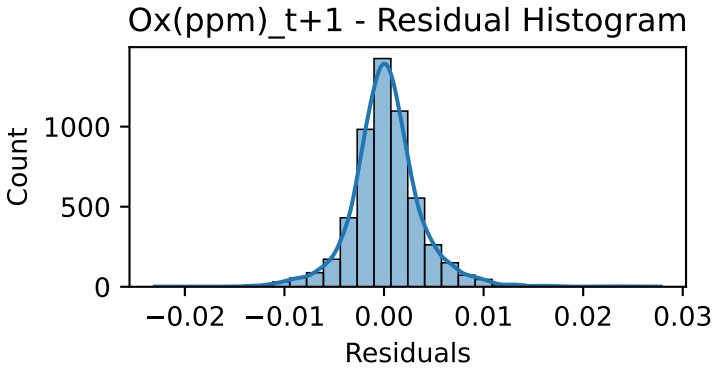
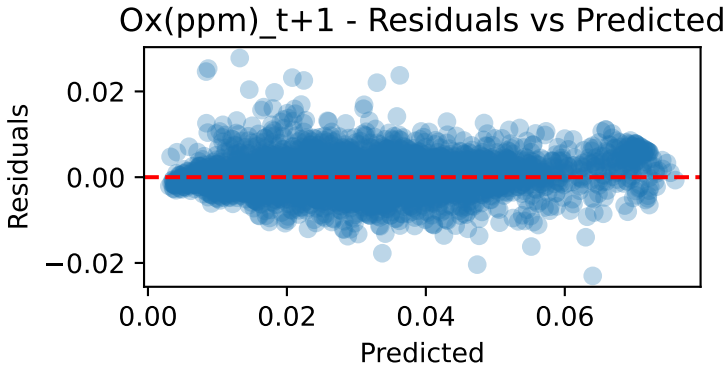
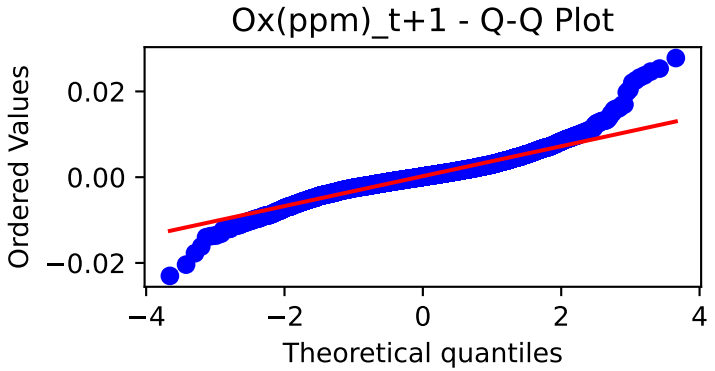
Model Parameters:
data_dir: ..\data\Ehime\
prefecture_code: 38
station_code: 38205010
target_item: Ox(ppm)
forecast_horizon: 8
features: ['Ox(ppm)', 'NO(ppm)', 'NO2(ppm)', 'U', 'V', 'Ox(ppm)_lag1', 'Ox(ppm)_lag2', 'Ox(ppm)_lag3', '
objective: regression
boosting_type: gbdt
n_estimators: 400
learning_rate: 0.04
max_depth: -1

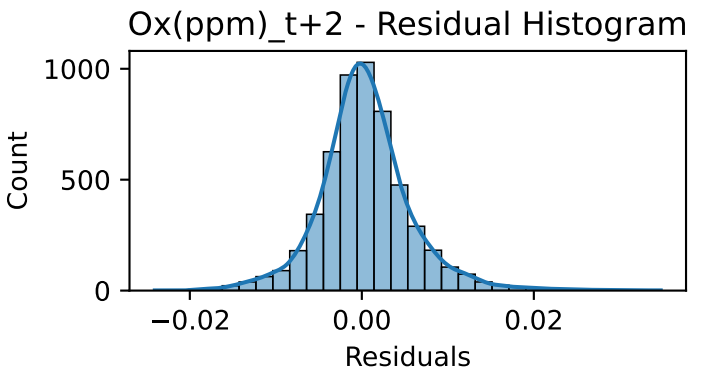
Metrics per Forecast Step:
Ox(ppm)_t+1 - R²: 0.9420, MAE: 0.0025, RMSE: 0.0036
Ox(ppm)_t+2 - R²: 0.8676, MAE: 0.0039, RMSE: 0.0054
Ox(ppm)_t+3 - R²: 0.8004, MAE: 0.0049, RMSE: 0.0067
Ox(ppm)_t+4 - R²: 0.7540, MAE: 0.0055, RMSE: 0.0074
Ox(ppm)_t+5 - R²: 0.7085, MAE: 0.0060, RMSE: 0.0081
Ox(ppm)_t+6 - R²: 0.6647, MAE: 0.0065, RMSE: 0.0087
Ox(ppm)_t+7 - R²: 0.6279, MAE: 0.0068, RMSE: 0.0091
Ox(ppm)_t+8 - R²: 0.5981, MAE: 0.0071, RMSE: 0.0095

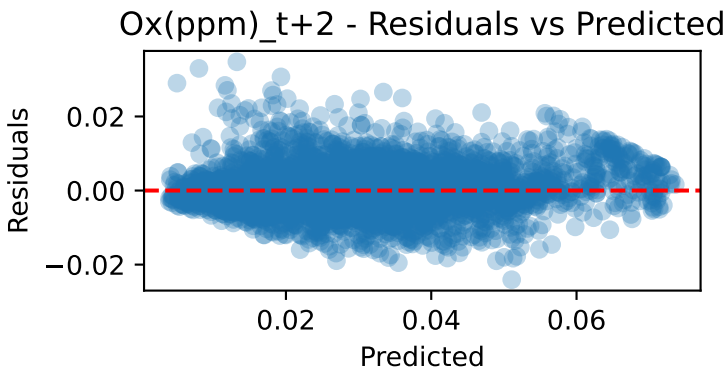

Ox(ppm)_t+1
Ox(ppm)
hour_cos
NO(ppm)
Ox(ppm)_diff_1
V
U
NO(ppm)_diff_3
Ox(ppm)_diff_2
hour_sin
Ox(ppm)_diff_3
U_roll_mean_3
Ox(ppm)_lag21
NO(ppm)_roll_mean_3
Ox(ppm)_lag20
U_lag1
NO2(ppm)_roll_std_6
V_roll_mean_3
Ox(ppm)_lag18
V_lag7
Ox(ppm)_lag22
0 1000 2000 3000 4000 5000 6000
Importance (gain)
Ox(ppm)_t+2
Ox(ppm)
hour_cos
NO(ppm)
Ox(ppm)_lag21
Ox(ppm)_lag19
hour_sin
U
NO(ppm)_diff_3
Ox(ppm)_diff_1
V
Ox(ppm)_lag20
U_roll_mean_3
Ox(ppm)_diff_3
Ox(ppm)_diff_2
Ox(ppm)_lag17
NO(ppm)_roll_std_6
Ox(ppm)_lag18
NO(ppm)_roll_mean_3
NO2(ppm)_roll_std_6
U_roll_std_6
0 1000 2000 3000 4000 5000
Importance (gain)
Ox(ppm)_t+3
Ox(ppm)
hour_cos
Ox(ppm)_lag20
hour_sin
Ox(ppm)_lag19
NO(ppm)
Ox(ppm)_lag18
U
Ox(ppm)_diff_1
U_roll_mean_3
Ox(ppm)_lag17
NO(ppm)_diff_3
V
Ox(ppm)_lag21
Ox(ppm)_diff_3
Ox(ppm)_diff_2
Ox(ppm)_roll_mean_3
Ox(ppm)_lag16
Ox(ppm)_lag14
U_roll_std_6
0 500 1000 1500 2000 2500 3000 3500
Importance (gain)
Ox(ppm)_t+4
hour_cos
Ox(ppm)
Ox(ppm)_lag20
hour_sin
Ox(ppm)_lag19
Ox(ppm)_diff_3
Ox(ppm)_lag18
U_roll_mean_3
Ox(ppm)_lag17
Ox(ppm)_lag16
U
NO(ppm)
Ox(ppm)_roll_mean_3
Ox(ppm)_diff_1
NO(ppm)_diff_3
NO2(ppm)_roll_mean_3
U_roll_std_6
V
Ox(ppm)_lag13
Ox(ppm)_roll_std_6
0 250 500 750 1000 1250 1500 1750
Importance (gain)
Ox(ppm)_t+5
hour_cos
Ox(ppm)_lag19
Ox(ppm)
hour_sin
Ox(ppm)_diff_3
Ox(ppm)_lag18
U_roll_mean_3
Ox(ppm)_lag17
Ox(ppm)_roll_mean_3
Ox(ppm)_diff_1
Ox(ppm)_diff_2
Ox(ppm)_lag16
U
NO(ppm)_diff_3
Ox(ppm)_roll_std_6
NO2(ppm)_roll_mean_3
U_roll_std_6
Ox(ppm)_lag6
Ox(ppm)_lag8
Ox(ppm)_lag7
0 200 400 600 800 1000
Importance (gain)
Ox(ppm)_t+6
Ox(ppm)_lag18
Ox(ppm)
Ox(ppm)_lag17
hour_sin
hour_cos
U_roll_mean_3
Ox(ppm)_diff_3
Ox(ppm)_roll_mean_3
Ox(ppm)_diff_2
Ox(ppm)_diff_1
Ox(ppm)_lag16
NO(ppm)_lag22
U_roll_std_6
NO(ppm)_lag21
NO2(ppm)_roll_mean_3
U
NO(ppm)_diff_3
NO(ppm)
V_roll_std_6
NO2(ppm)_roll_std_6
0 250 500 750 1000 1250 1500 1750
Importance (gain)
Ox(ppm)_t+7
Ox(ppm)_lag17
Ox(ppm)
hour_sin
Ox(ppm)_lag16
Ox(ppm)_lag18
U_roll_mean_3
hour_cos
NO(ppm)_lag21
Ox(ppm)_roll_mean_3
NO2(ppm)_roll_mean_3
U_roll_std_6
NO(ppm)_lag22
Ox(ppm)_diff_1
Ox(ppm)_diff_3
Ox(ppm)_lag15
NO(ppm)_lag20
Ox(ppm)_diff_2
V_roll_std_6
U
dayofweek
0 500 1000 1500 2000
Importance (gain)
Ox(ppm)_t+8
Ox(ppm)_lag16
hour_sin
Ox(ppm)
Ox(ppm)_lag15
Ox(ppm)_lag17
hour_cos
U_roll_mean_3
Ox(ppm)_roll_mean_3
NO2(ppm)_roll_mean_3
U_roll_std_6
NO(ppm)_lag21
dayofweek
Ox(ppm)_lag18
V_roll_std_6
Ox(ppm)_roll_std_6
U
NO(ppm)_lag20
NO2(ppm)_roll_std_6
Ox(ppm)_lag14
Ox(ppm)_lag4
0 500 1000 1500 2000
Importance (gain)

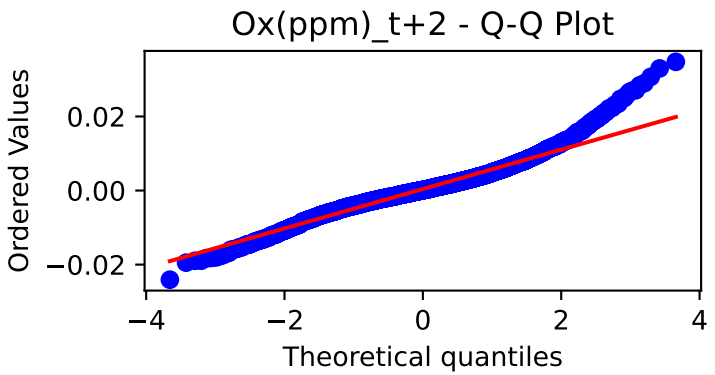

Ox(ppm)_t+1 - Residual Histogram
Count
Residuals

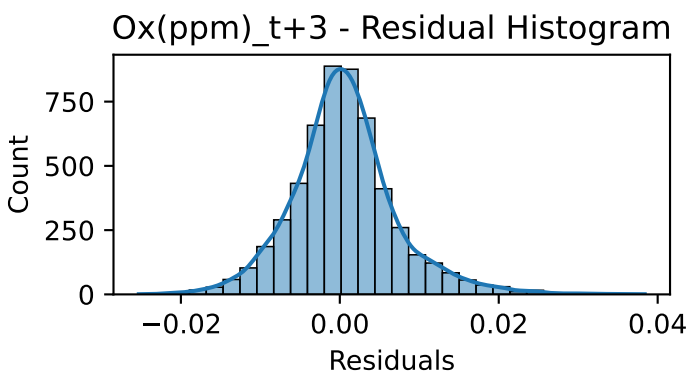

Ox(ppm)_t+1 - Residuals vs Predicted
Residuals
Predicted

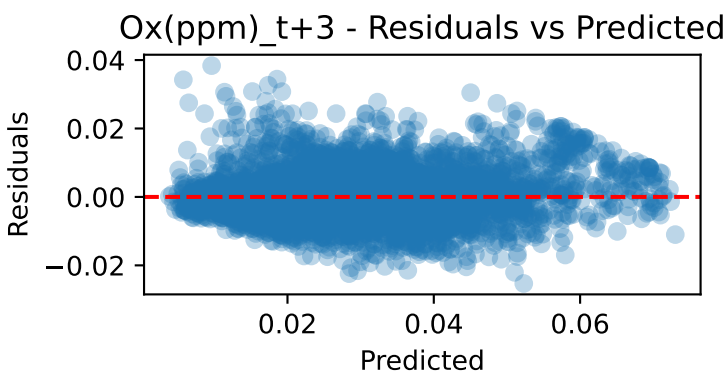

Ox(ppm)_t+1 - Q-Q Plot
Ordered Values
Theoretical quantiles

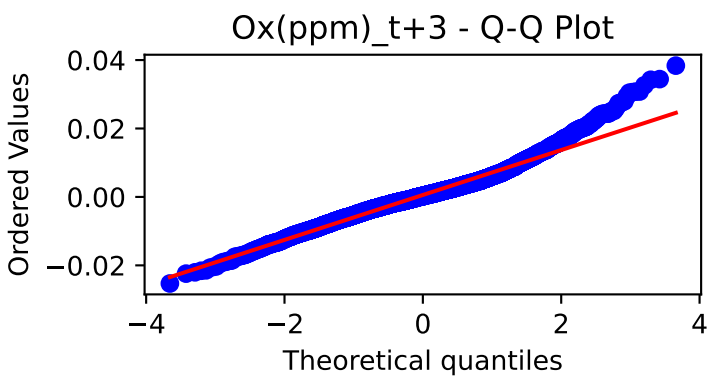

Ox(ppm)_t+2 - Residual Histogram
Count
Residuals

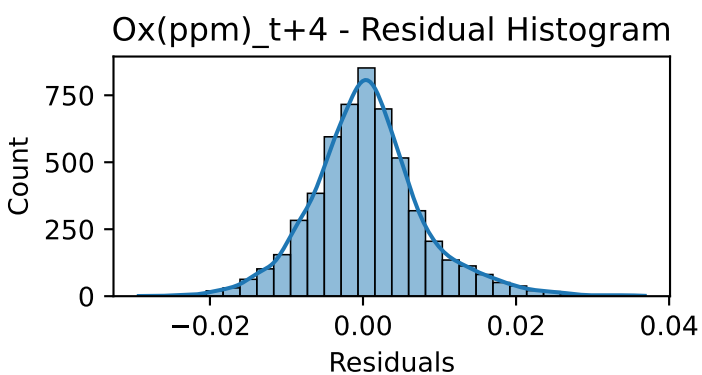

Ox(ppm)_t+2 - Residuals vs Predicted
Residuals
Predicted

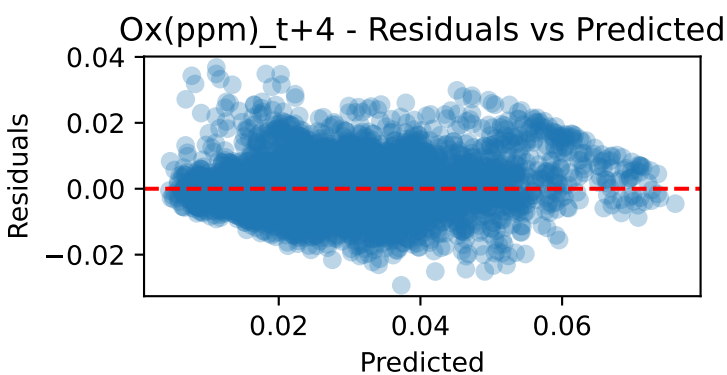

Ox(ppm)_t+2 - Q-Q Plot
Ordered Values
Theoretical quantiles

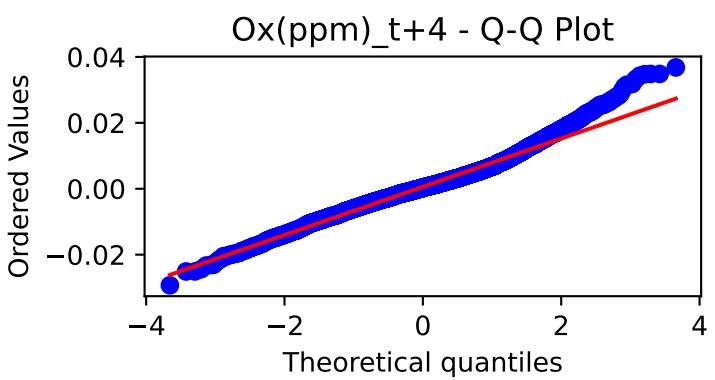

Ox(ppm)_t+3 - Residual Histogram
Count
Residuals

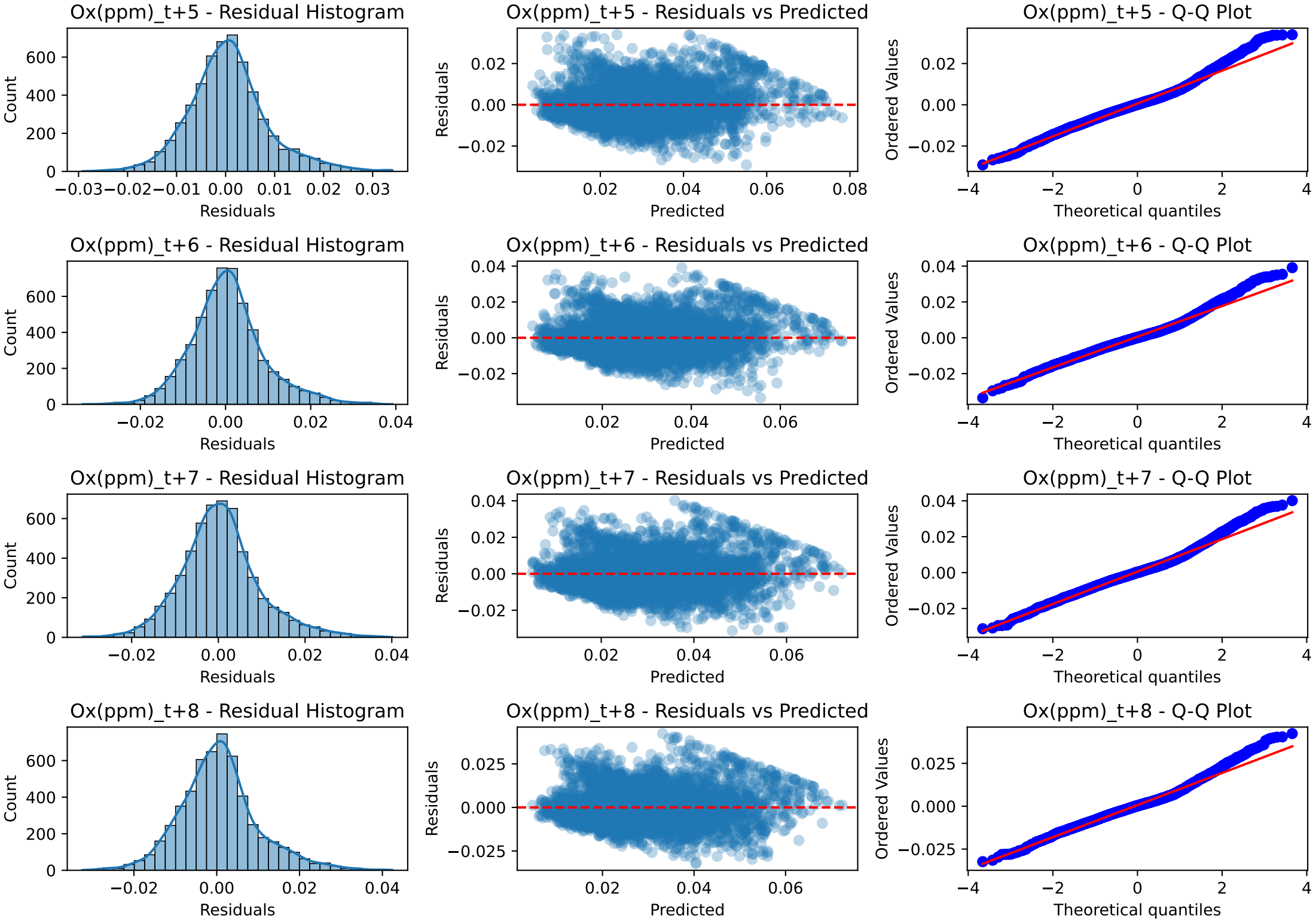

Ox(ppm)_t+3 - Residuals vs Predicted
Residuals
Predicted


Ox(ppm)_t+3 - Q-Q Plot
Ordered Values
Theoretical quantiles

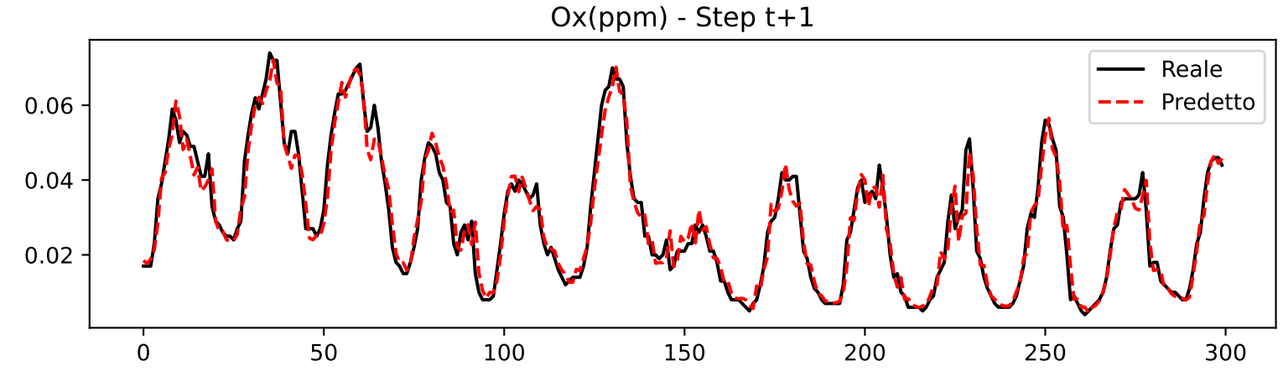

Ox(ppm)_t+4 - Residual Histogram
Count
Residuals

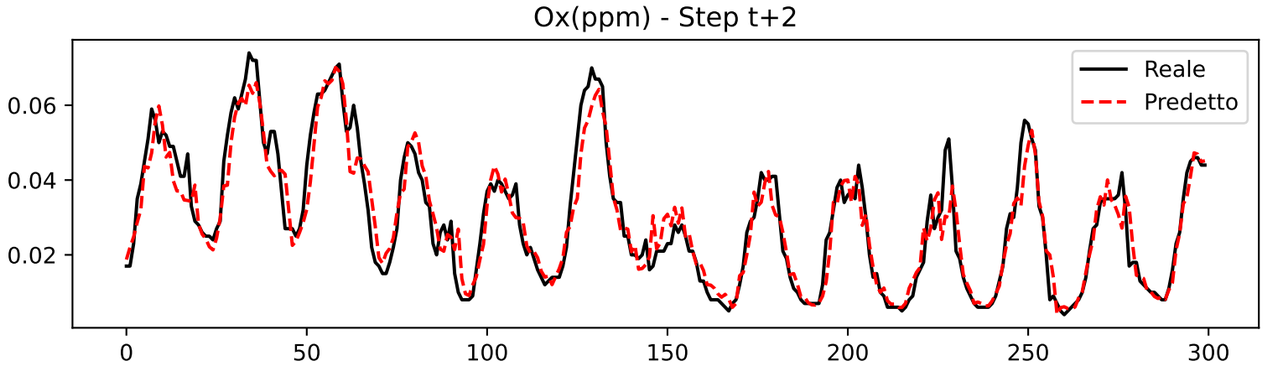

Ox(ppm)_t+4 - Residuals vs Predicted
Residuals
Predicted

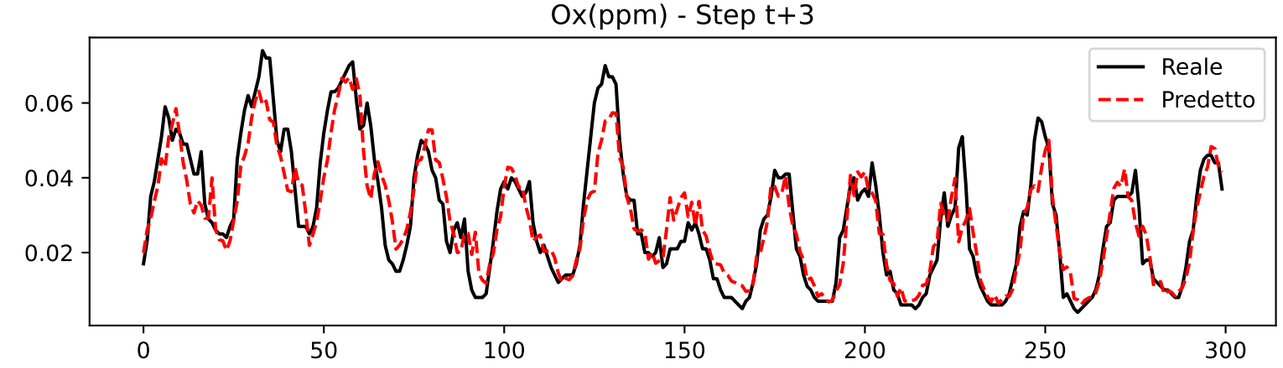

Ox(ppm)_t+4 - Q-Q Plot
Ordered Values
Theoretical quantiles

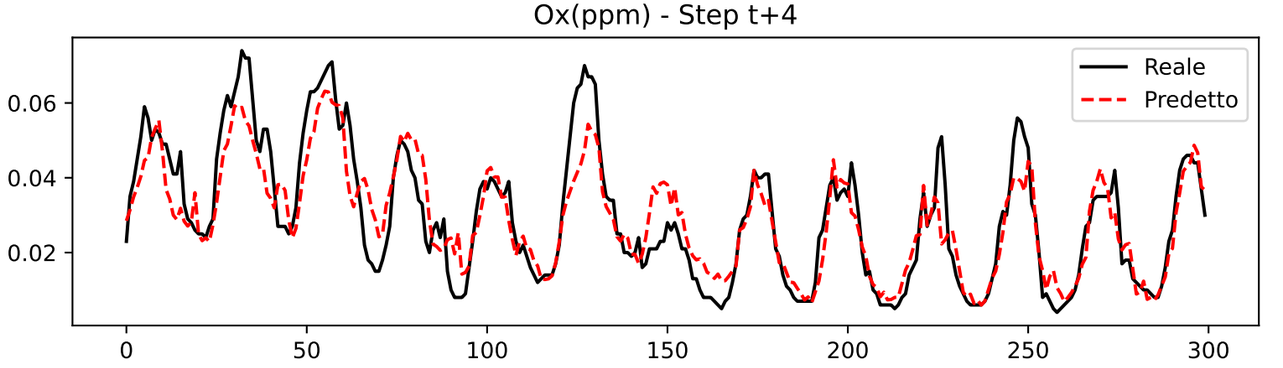

Ox(ppm)_t+5 - Residual Histogram
Count
Residuals
Ox(ppm)_t+5 - Residuals vs Predicted
Residuals
Predicted
Ox(ppm)_t+5 - Q-Q Plot
Ordered Values
Theoretical quantiles
Ox(ppm)_t+6 - Residual Histogram
Count
Residuals
Ox(ppm)_t+6 - Residuals vs Predicted
Residuals
Predicted
Ox(ppm)_t+6 - Q-Q Plot
Ordered Values
Theoretical quantiles
Ox(ppm)_t+7 - Residual Histogram
Count
Residuals
Ox(ppm)_t+7 - Residuals vs Predicted
Residuals
Predicted
Ox(ppm)_t+7 - Q-Q Plot
Ordered Values
Theoretical quantiles
Ox(ppm)_t+8 - Residual Histogram
Count
Residuals
Ox(ppm)_t+8 - Residuals vs Predicted
Residuals
Predicted
Ox(ppm)_t+8 - Q-Q Plot
Ordered Values
Theoretical quantiles

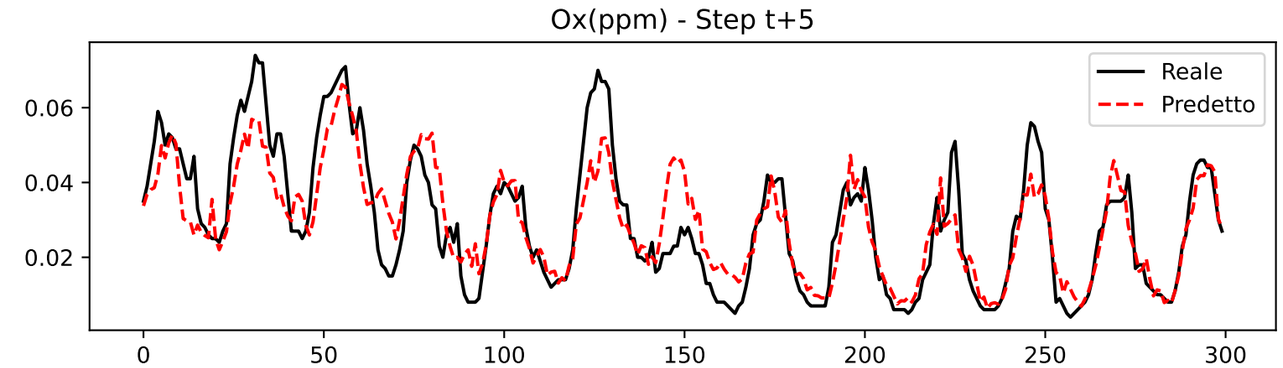
Comparison between actual and predicted values

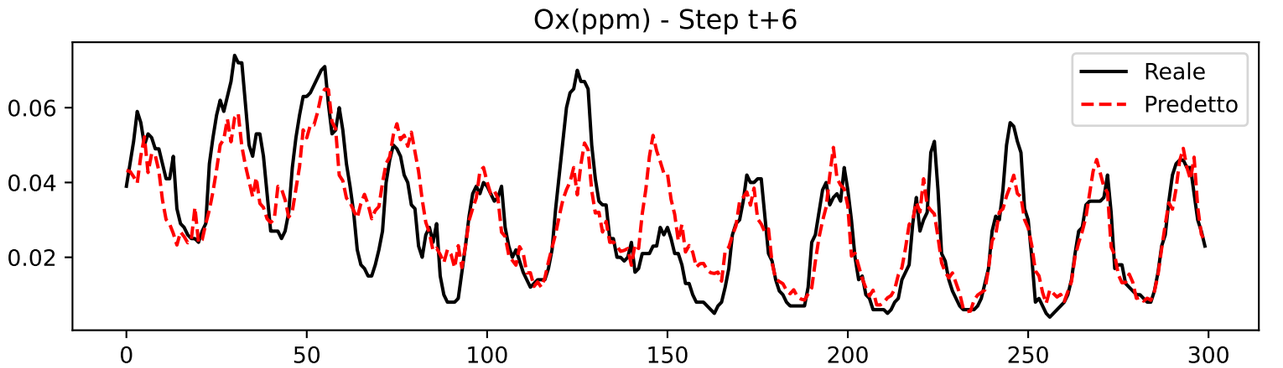


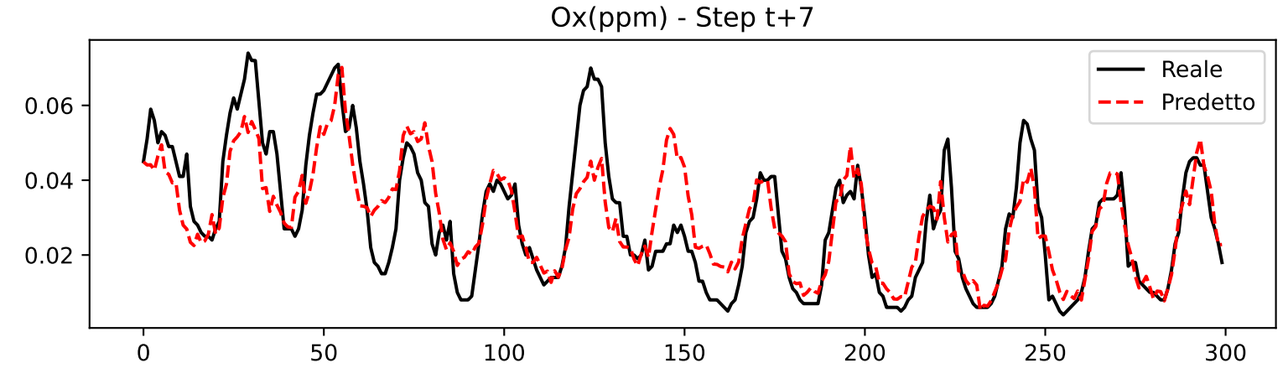


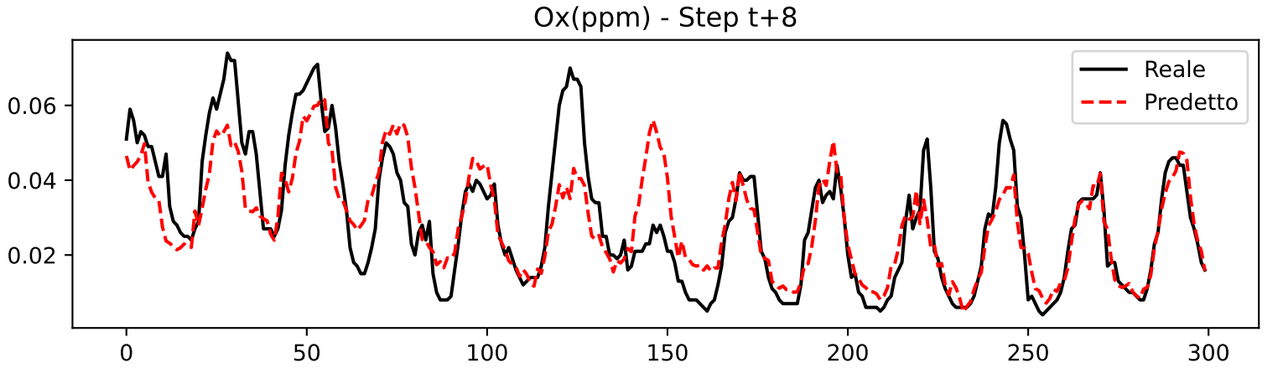


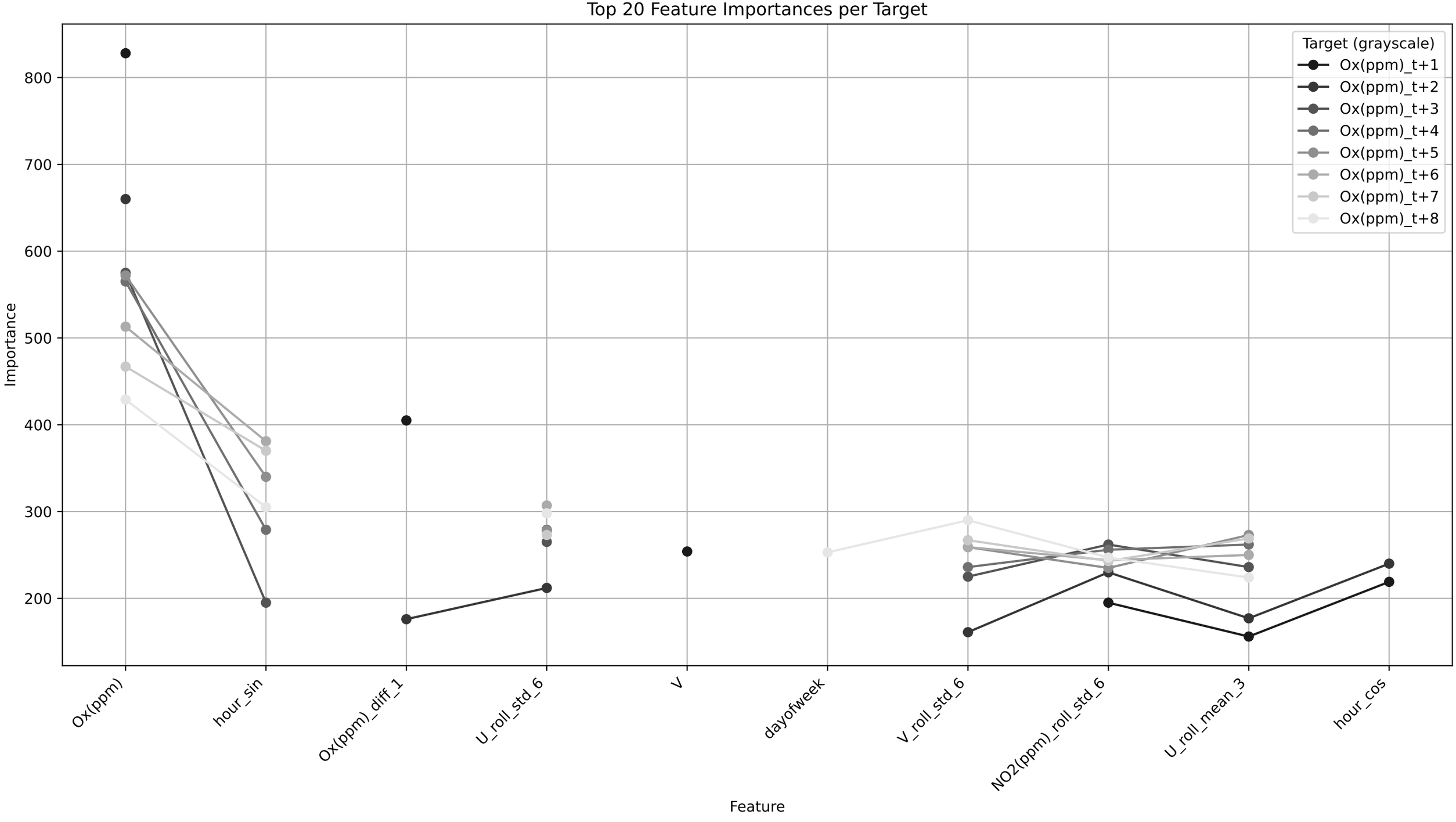


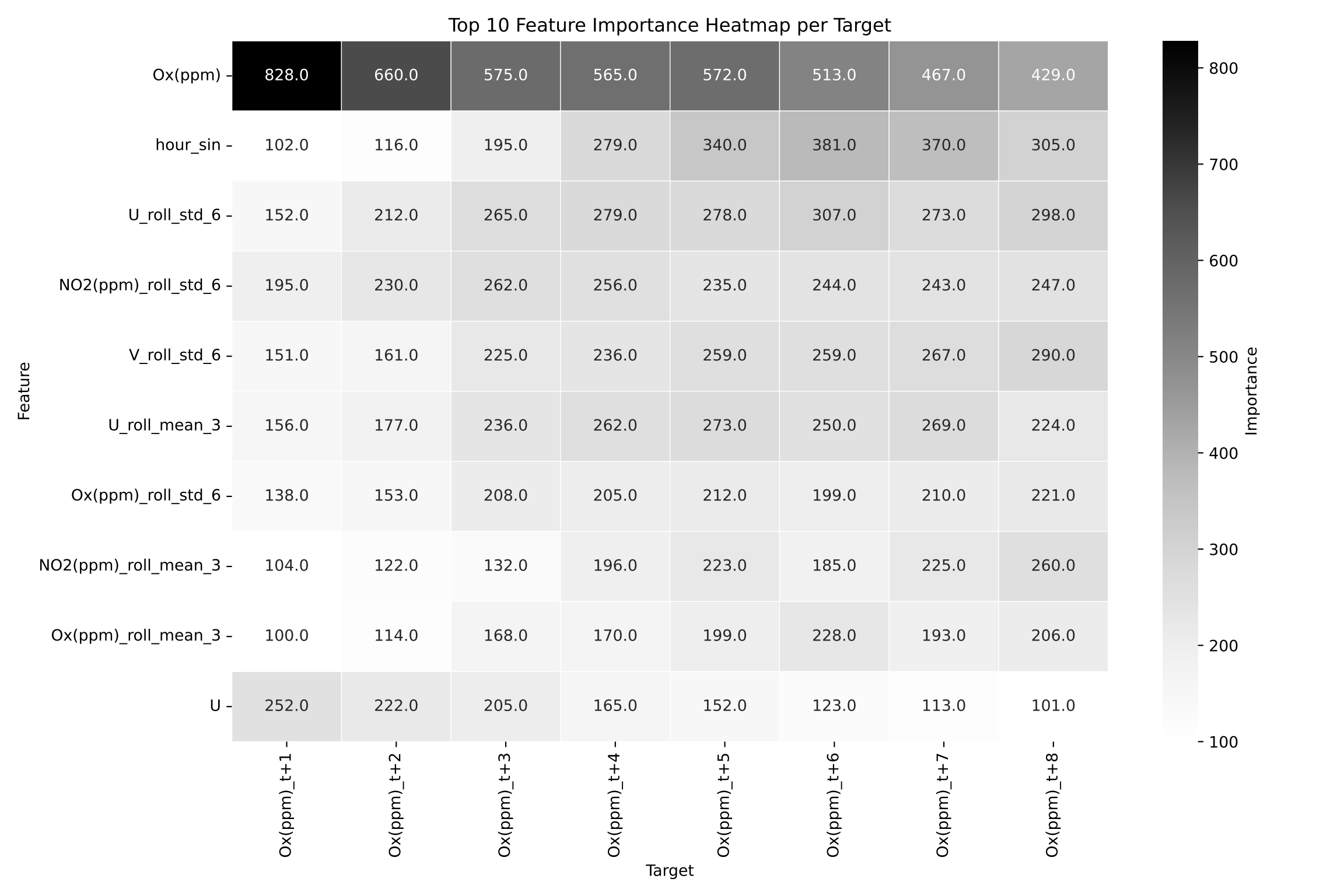


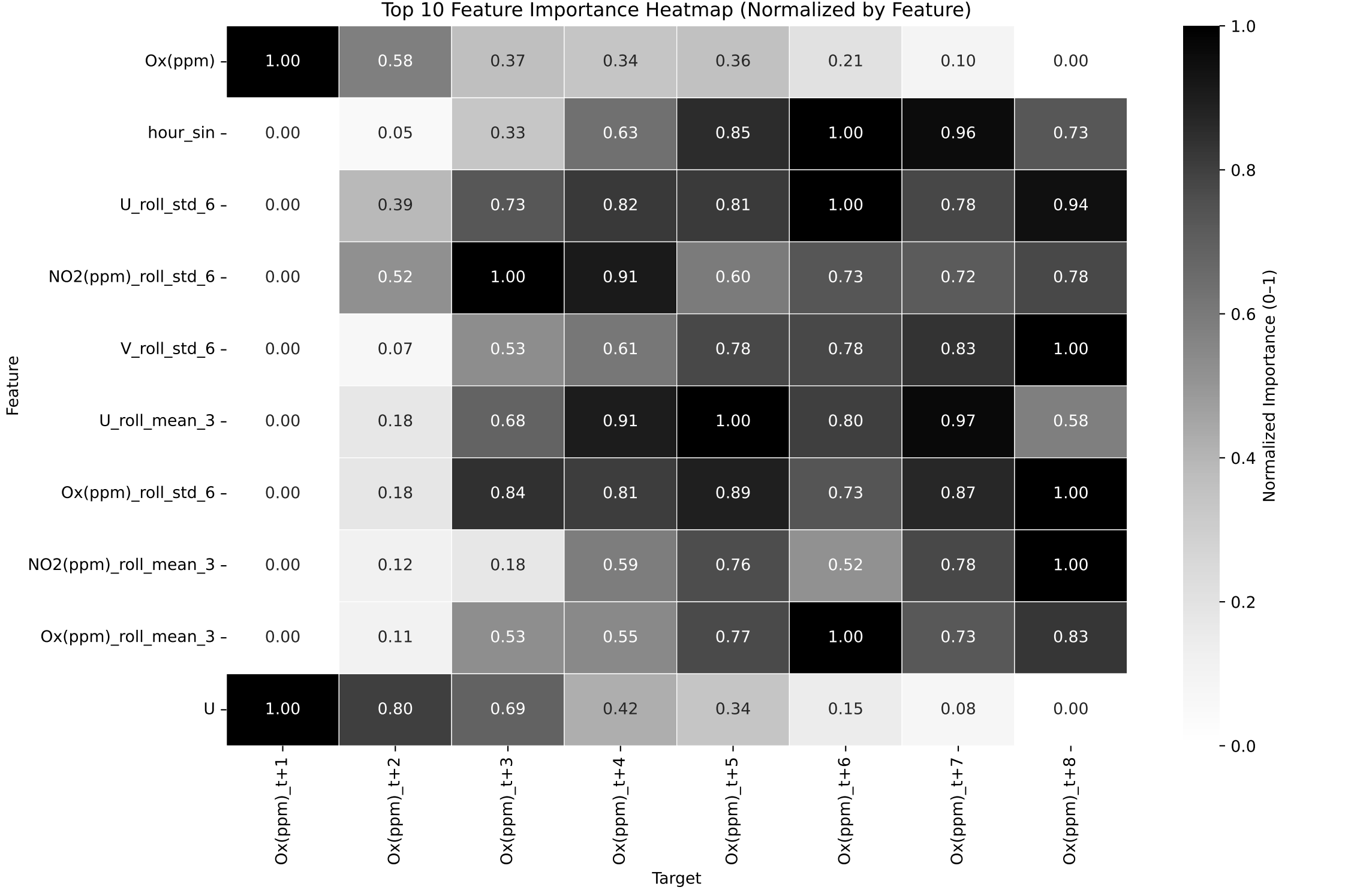


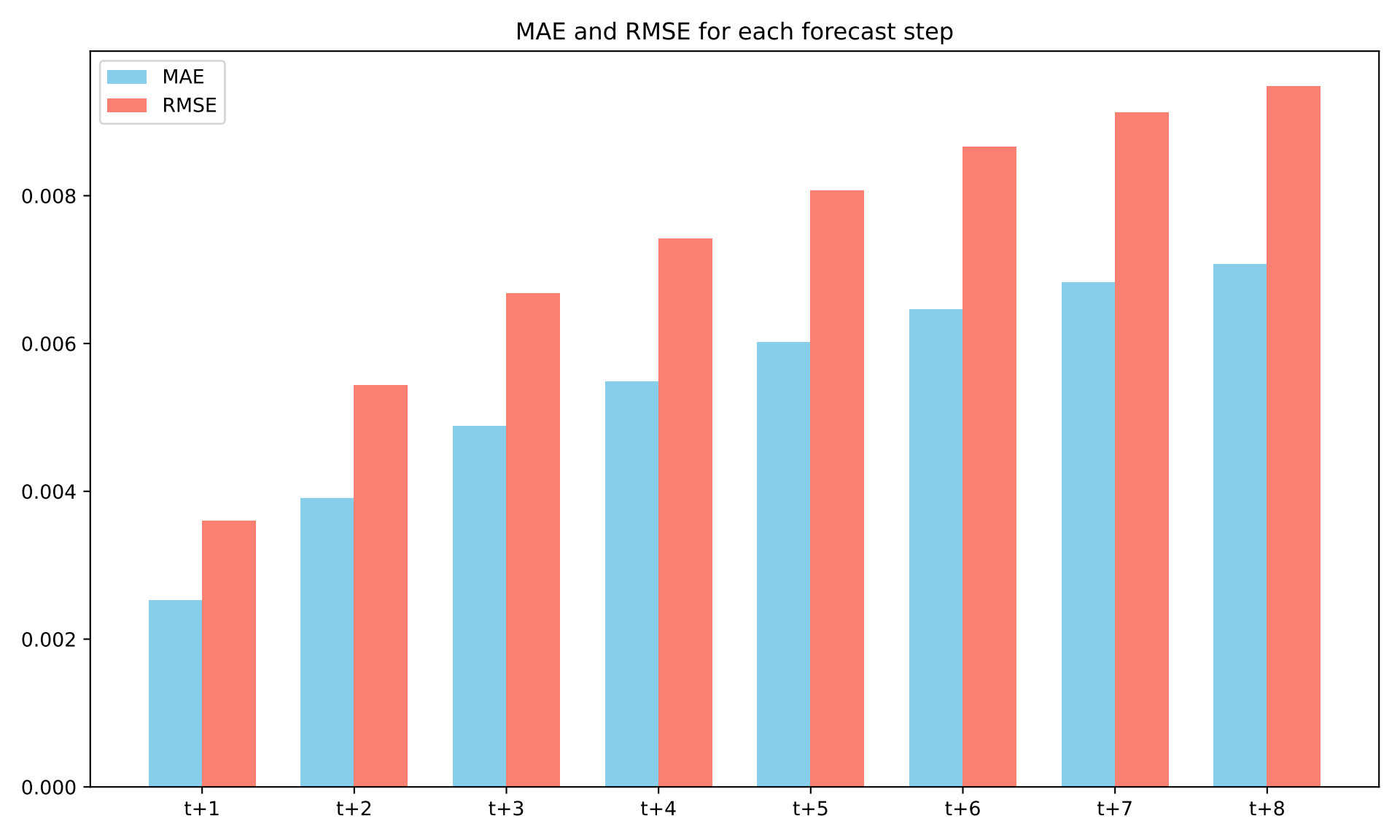





Top 20 Feature Importances per Target
Target (grayscale)
Ox(ppm)_t+1
Ox(ppm)_t+2
Ox(ppm)_t+3
Ox(ppm)_t+4
Ox(ppm)_t+5
Ox(ppm)_t+6
Ox(ppm)_t+7
Ox(ppm)_t+8
Importance
800
700
600
500
400
300
200
Ox(ppm)
hour_sin
Ox(ppm)_diff_1
U_roll_std_6
V
dayofweek
V_roll_std_6
NO2(ppm)_roll_std_6
U_roll_mean_3
hour_cos
Feature


Top 10 Feature Importance Heatmap per Target
Feature
Ox(ppm)
hour_sin
U_roll_std_6
NO2(ppm)_roll_std_6
V_roll_std_6
U_roll_mean_3
Ox(ppm)_roll_std_6
NO2(ppm)_roll_mean_3
Ox(ppm)_roll_mean_3
U
828.0 660.0 575.0 565.0 572.0 513.0 467.0 429.0
102.0 116.0 195.0 279.0 340.0 381.0 370.0 305.0
152.0 212.0 265.0 279.0 278.0 307.0 273.0 298.0
195.0 230.0 262.0 256.0 235.0 244.0 243.0 247.0
151.0 161.0 225.0 236.0 259.0 259.0 267.0 290.0
156.0 177.0 236.0 262.0 273.0 250.0 269.0 224.0
138.0 153.0 208.0 205.0 212.0 199.0 210.0 221.0
104.0 122.0 132.0 196.0 223.0 185.0 225.0 260.0
100.0 114.0 168.0 170.0 199.0 228.0 193.0 206.0
252.0 222.0 205.0 165.0 152.0 123.0 113.0 101.0
Ox(ppm)_t+1
Ox(ppm)_t+2
Ox(ppm)_t+3
Ox(ppm)_t+4
Ox(ppm)_t+5
Ox(ppm)_t+6
Ox(ppm)_t+7
Ox(ppm)_t+8
Target
Importance
800
700
600
500
400
300
200
100


Top 10 Feature Importance Heatmap (Normalized by Feature)
Feature
Ox(ppm)
hour_sin
U_roll_std_6
NO2(ppm)_roll_std_6
V_roll_std_6
U_roll_mean_3
Ox(ppm)_roll_std_6
NO2(ppm)_roll_mean_3
Ox(ppm)_roll_mean_3
U
1.00 0.58 0.37 0.34 0.36 0.21 0.10 0.00
0.00 0.05 0.33 0.63 0.85 1.00 0.96 0.73
0.00 0.39 0.73 0.82 0.81 1.00 0.78 0.94
0.00 0.52 1.00 0.91 0.60 0.73 0.72 0.78
0.00 0.07 0.53 0.61 0.78 0.78 0.83 1.00
0.00 0.18 0.68 0.91 1.00 0.80 0.97 0.58
0.00 0.18 0.84 0.81 0.89 0.73 0.87 1.00
0.00 0.12 0.18 0.59 0.76 0.52 0.78 1.00
0.00 0.11 0.53 0.55 0.77 1.00 0.73 0.83
1.00 0.80 0.69 0.42 0.34 0.15 0.08 0.00
Ox(ppm)_t+1
Ox(ppm)_t+2
Ox(ppm)_t+3
Ox(ppm)_t+4
Ox(ppm)_t+5
Ox(ppm)_t+6
Ox(ppm)_t+7
Ox(ppm)_t+8
Target
Normalized Importance (0–1)
1.0
0.8
0.6
0.4
0.2
0.0


MAE and RMSE for each forecast step
MAE
RMSE
0.000
0.002
0.004
0.006
0.008
t+1
t+2
t+3
t+4
t+5
t+6
t+7
t+8