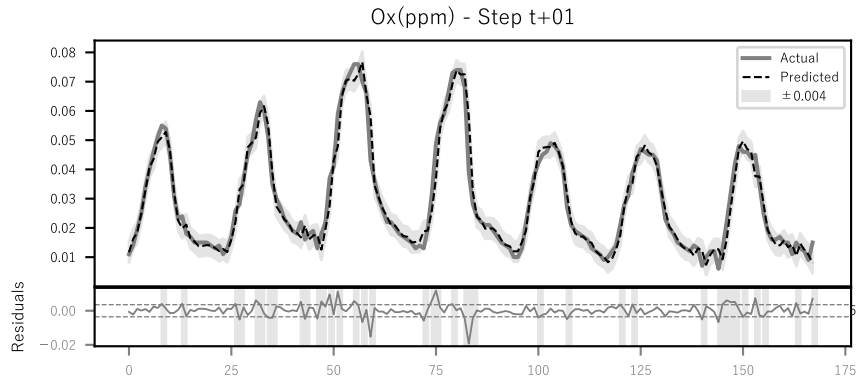
西条 - オキシダント予測の分析

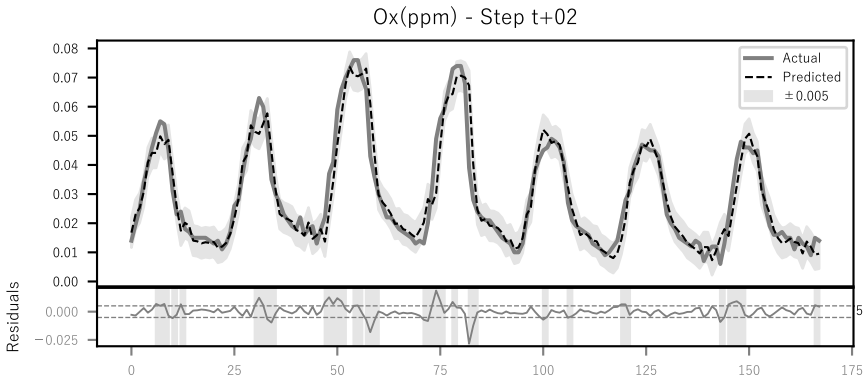
Model Parameters:
Prefecture code: 38
Station code: 38206050
Station name: 西条
Target item: Ox(ppm)
Number of data points in the train set: 13685
Number of data points in the test set: 5866
Forecast horizon (hours): 24
Model: XGBoost
Objective: reg:squarederror
Booster: None
Number of estimators: 400
Learning rate: 0.04
Elapsed time: 1 min 17 sec
Number of used features: 141

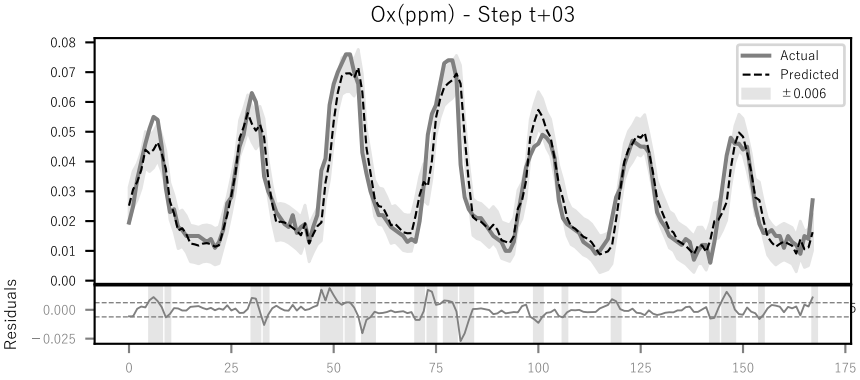
Features:
Ox(ppm), NO(ppm), NO2(ppm), U, V
Ox(ppm)_lag1, Ox(ppm)_lag2, Ox(ppm)_lag3, Ox(ppm)_lag4, Ox(ppm)_lag5
Ox(ppm)_lag6, Ox(ppm)_lag7, Ox(ppm)_lag8, Ox(ppm)_lag9, Ox(ppm)_lag10
Ox(ppm)_lag11, Ox(ppm)_lag12, Ox(ppm)_lag13, Ox(ppm)_lag14, Ox(ppm)_lag15
Ox(ppm)_lag16, Ox(ppm)_lag17, Ox(ppm)_lag18, Ox(ppm)_lag19, Ox(ppm)_lag20
Ox(ppm)_lag21, Ox(ppm)_lag22, Ox(ppm)_lag23, NO(ppm)_lag1, NO(ppm)_lag2
NO(ppm)_lag3, NO(ppm)_lag4, NO(ppm)_lag5, NO(ppm)_lag6, NO(ppm)_lag7
NO(ppm)_lag8, NO(ppm)_lag9, NO(ppm)_lag10, NO(ppm)_lag11, NO(ppm)_lag12
NO(ppm)_lag13, NO(ppm)_lag14, NO(ppm)_lag15, NO(ppm)_lag16, NO(ppm)_lag17
NO(ppm)_lag18, NO(ppm)_lag19, NO(ppm)_lag20, NO(ppm)_lag21, NO(ppm)_lag22
NO(ppm)_lag23, NO2(ppm)_lag1, NO2(ppm)_lag2, NO2(ppm)_lag3, NO2(ppm)_lag4
NO2(ppm)_lag5, NO2(ppm)_lag6, NO2(ppm)_lag7, NO2(ppm)_lag8, NO2(ppm)_lag9
NO2(ppm)_lag10, NO2(ppm)_lag11, NO2(ppm)_lag12, NO2(ppm)_lag13, NO2(ppm)_lag14
NO2(ppm)_lag15, NO2(ppm)_lag16, NO2(ppm)_lag17, NO2(ppm)_lag18, NO2(ppm)_lag19
NO2(ppm)_lag20, NO2(ppm)_lag21, NO2(ppm)_lag22, NO2(ppm)_lag23, U_lag1
U_lag2, U_lag3, U_lag4, U_lag5, U_lag6
U_lag7, U_lag8, U_lag9, U_lag10, U_lag11
U_lag12, U_lag13, U_lag14, U_lag15, U_lag16
U_lag17, U_lag18, U_lag19, U_lag20, U_lag21
U_lag22, U_lag23, V_lag1, V_lag2, V_lag3
V_lag4, V_lag5, V_lag6, V_lag7, V_lag8
V_lag9, V_lag10, V_lag11, V_lag12, V_lag13
V_lag14, V_lag15, V_lag16, V_lag17, V_lag18
V_lag19, V_lag20, V_lag21, V_lag22, V_lag23
Ox(ppm)_roll_mean_3, Ox(ppm)_roll_std_6, NO(ppm)_roll_mean_3, NO(ppm)_roll_std_6, NO2(ppm)_roll_mean_3
NO2(ppm)_roll_std_6, U_roll_mean_3, U_roll_std_6, V_roll_mean_3, V_roll_std_6
Ox(ppm)_diff_1, Ox(ppm)_diff_2, Ox(ppm)_diff_3, NO(ppm)_diff_3, NO2(ppm)_diff_3
U_diff_3, V_diff_3, hour_sin, hour_cos, dayofweek
is_weekend

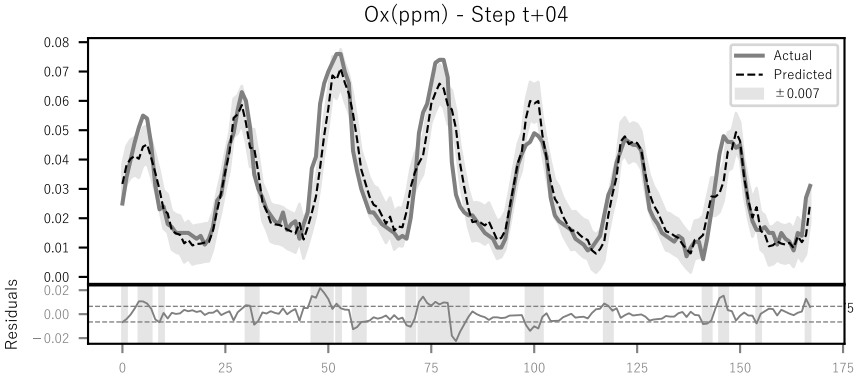
Metrics per Forecast Step:
Ox(ppm)_t+01 - R^2: 0.9407, MAE: 0.0027, RMSE: 0.0038
Ox(ppm)_t+02 - R^2: 0.8703, MAE: 0.0041, RMSE: 0.0057
Ox(ppm)_t+03 - R^2: 0.8183, MAE: 0.0049, RMSE: 0.0067
Ox(ppm)_t+04 - R^2: 0.7680, MAE: 0.0056, RMSE: 0.0076
Ox(ppm)_t+05 - R^2: 0.7174, MAE: 0.0062, RMSE: 0.0084
Ox(ppm)_t+06 - R^2: 0.6697, MAE: 0.0067, RMSE: 0.0091
Ox(ppm)_t+07 - R^2: 0.6384, MAE: 0.0070, RMSE: 0.0095
Ox(ppm)_t+08 - R^2: 0.6049, MAE: 0.0073, RMSE: 0.0099
Ox(ppm)_t+09 - R^2: 0.5805, MAE: 0.0076, RMSE: 0.0102
Ox(ppm)_t+10 - R^2: 0.5503, MAE: 0.0078, RMSE: 0.0106
Ox(ppm)_t+11 - R^2: 0.5478, MAE: 0.0079, RMSE: 0.0106
Ox(ppm)_t+12 - R^2: 0.5239, MAE: 0.0081, RMSE: 0.0109
Ox(ppm)_t+13 - R^2: 0.5056, MAE: 0.0082, RMSE: 0.0111
Ox(ppm)_t+14 - R^2: 0.4971, MAE: 0.0083, RMSE: 0.0112
Ox(ppm)_t+15 - R^2: 0.4869, MAE: 0.0084, RMSE: 0.0113
Ox(ppm)_t+16 - R^2: 0.4800, MAE: 0.0085, RMSE: 0.0114
Ox(ppm)_t+17 - R^2: 0.4635, MAE: 0.0086, RMSE: 0.0116
Ox(ppm)_t+18 - R^2: 0.4547, MAE: 0.0087, RMSE: 0.0117
Ox(ppm)_t+19 - R^2: 0.4434, MAE: 0.0088, RMSE: 0.0118
Ox(ppm)_t+20 - R^2: 0.4423, MAE: 0.0088, RMSE: 0.0118
Ox(ppm)_t+21 - R^2: 0.4371, MAE: 0.0088, RMSE: 0.0118
Ox(ppm)_t+22 - R^2: 0.4305, MAE: 0.0088, RMSE: 0.0119
Ox(ppm)_t+23 - R^2: 0.4396, MAE: 0.0088, RMSE: 0.0118
Ox(ppm)_t+24 - R^2: 0.4361, MAE: 0.0089, RMSE: 0.0119

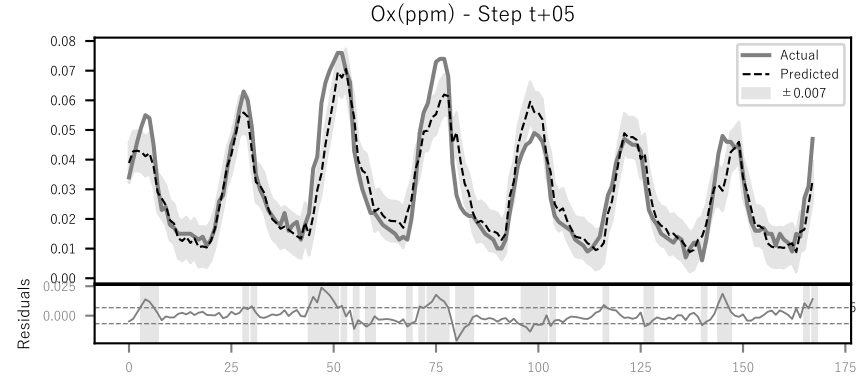
Comparison between actual and predicted values
with ± Standard Deviation Bands

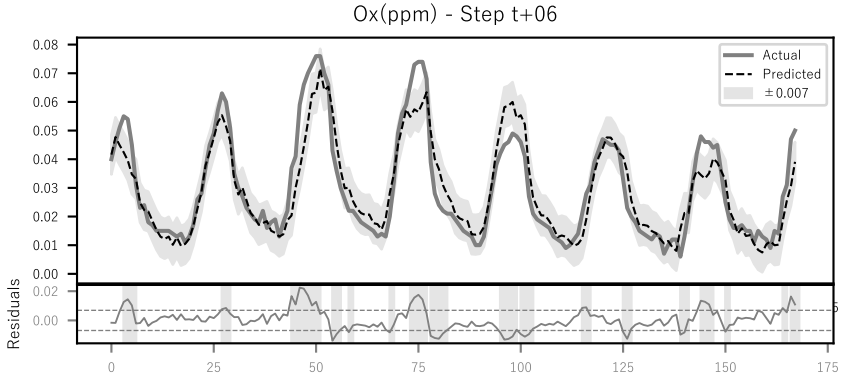




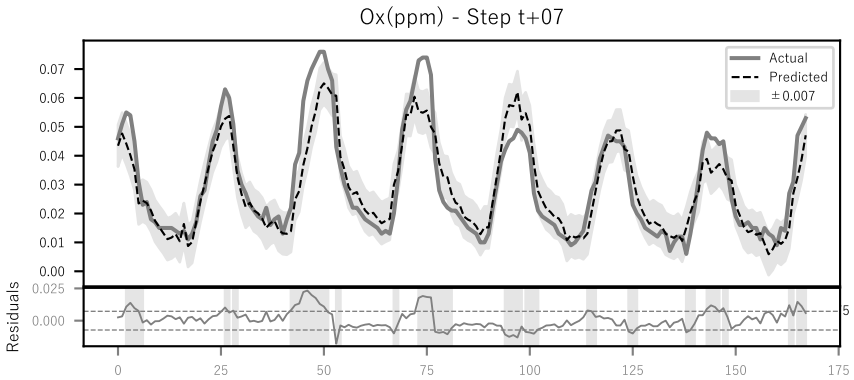


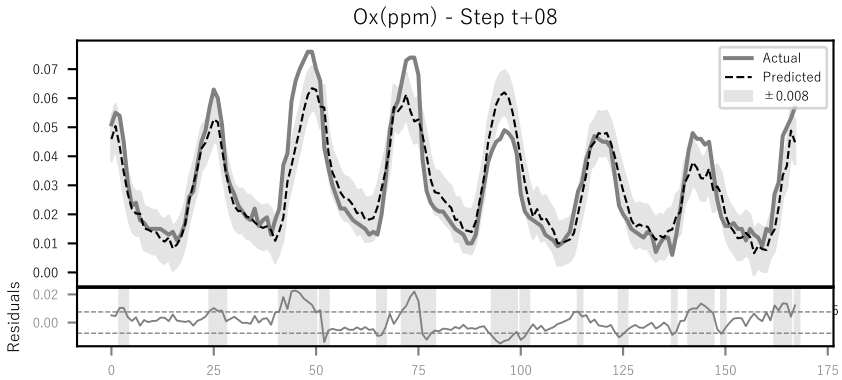


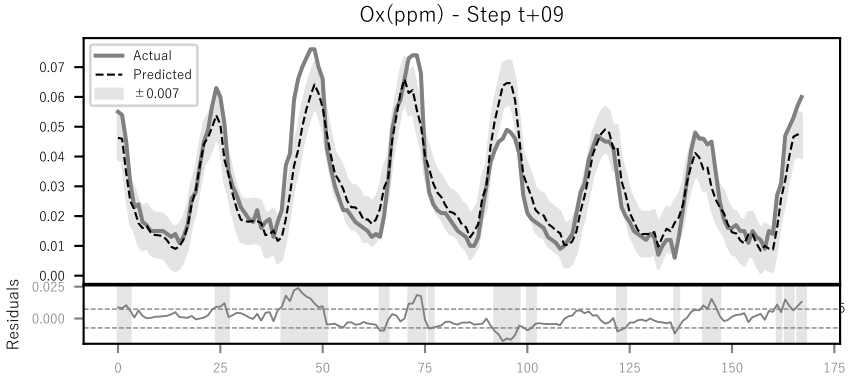


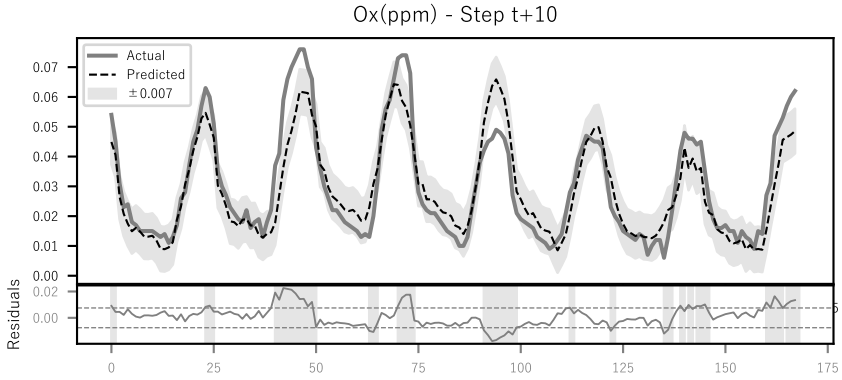


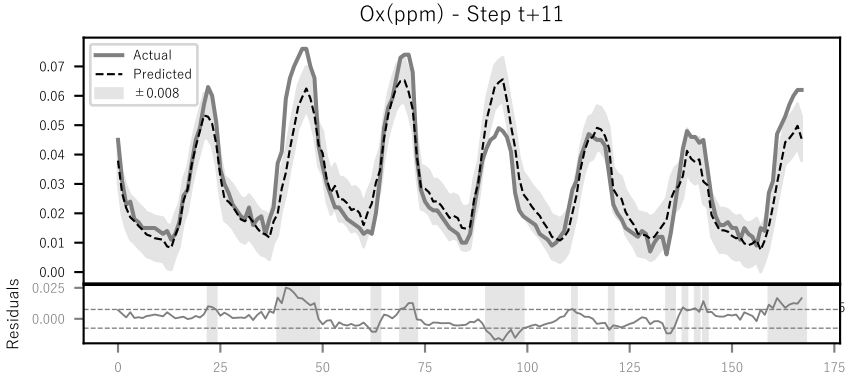
Comparison between actual and predicted values
with ± Standard Deviation Bands

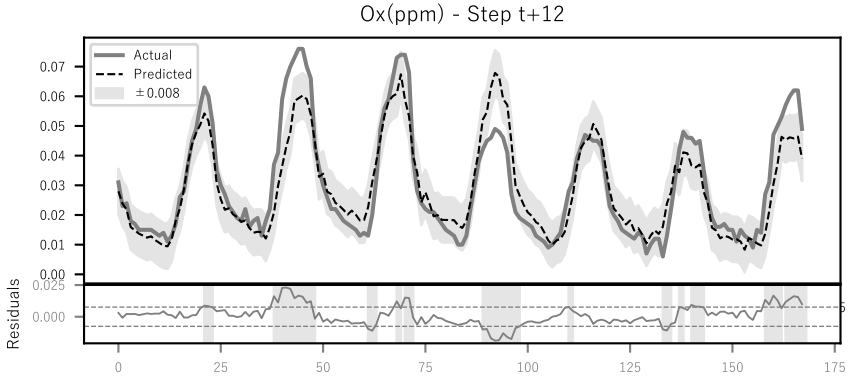




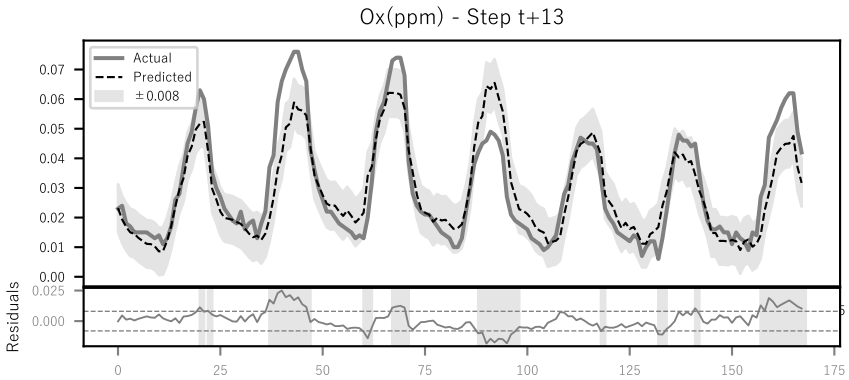


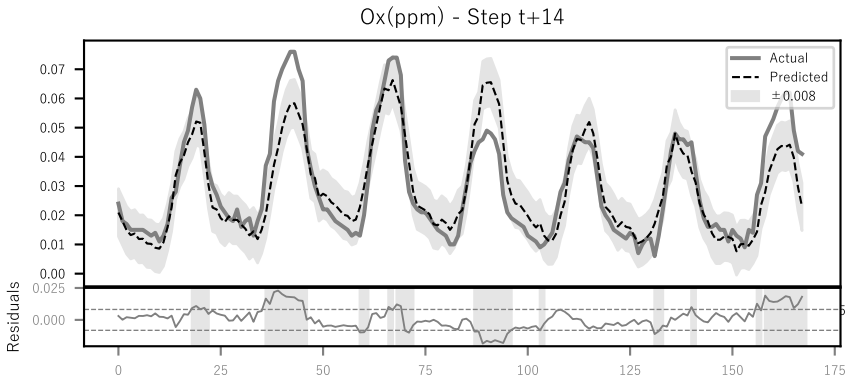


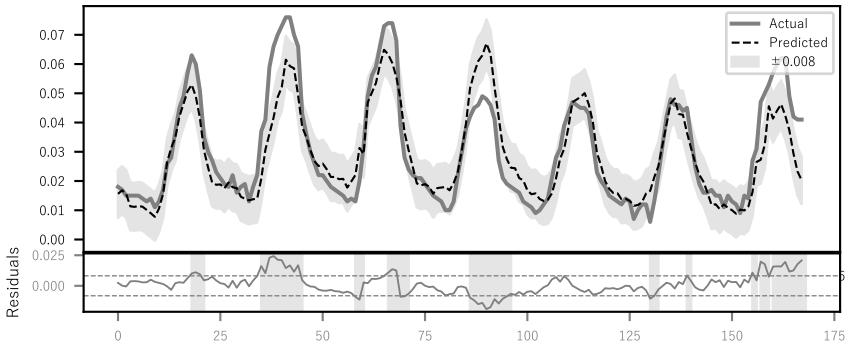


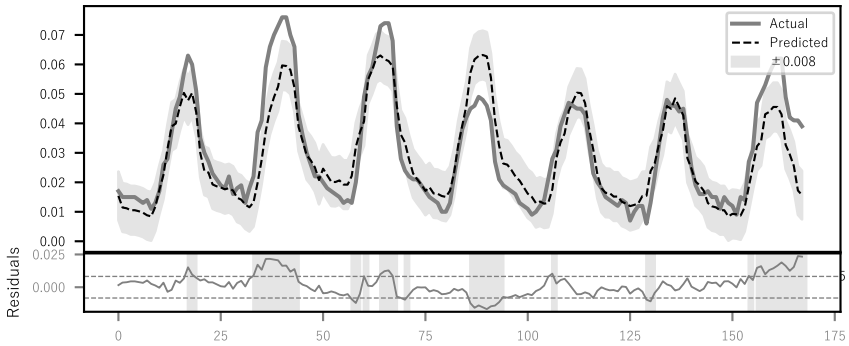


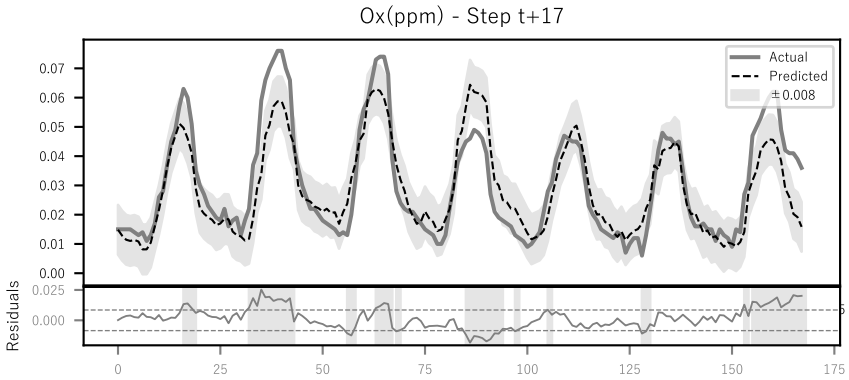
Comparison between actual and predicted values
with ± Standard Deviation Bands

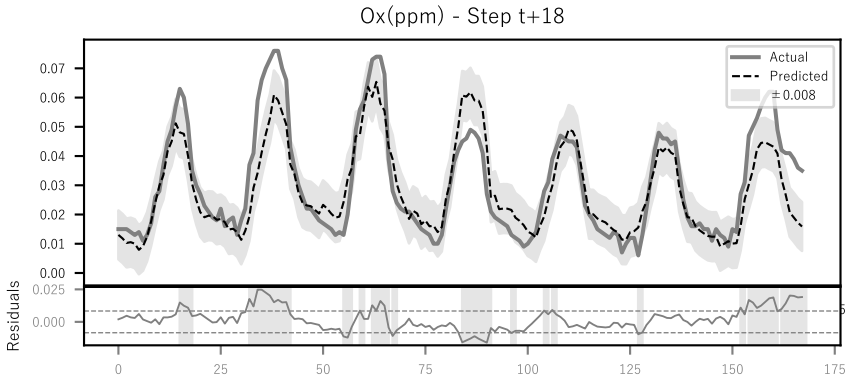




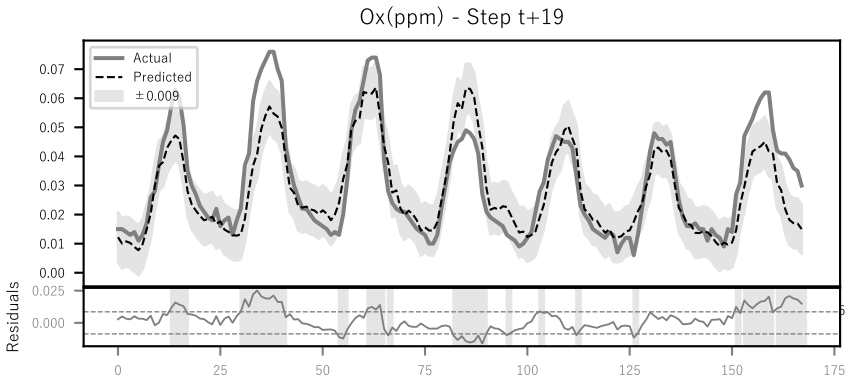


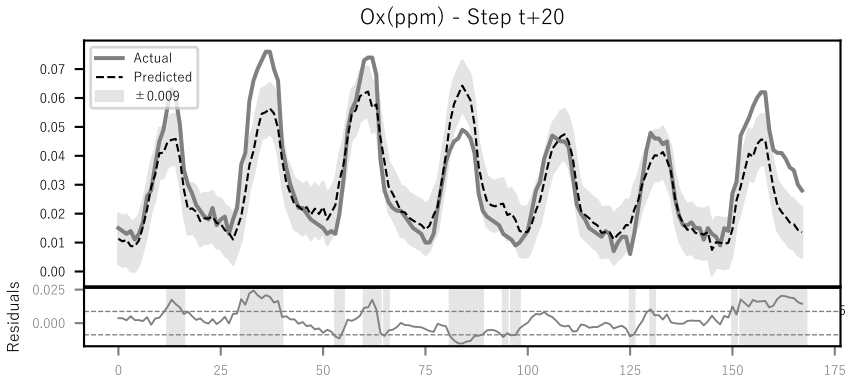


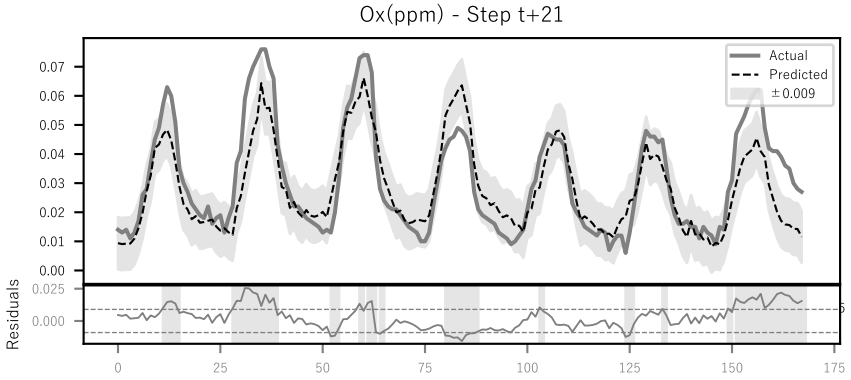


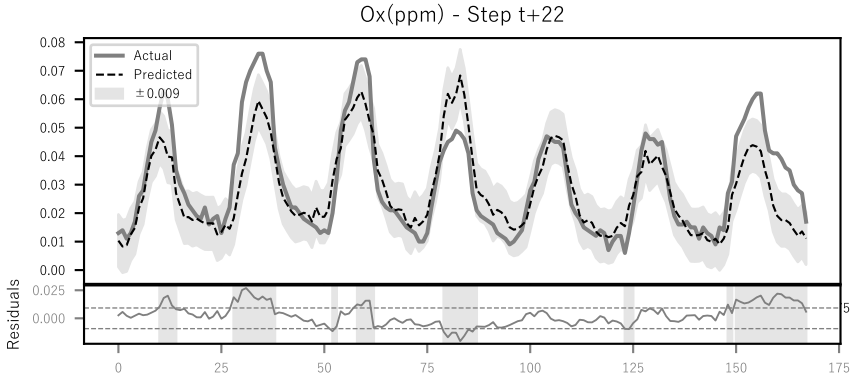


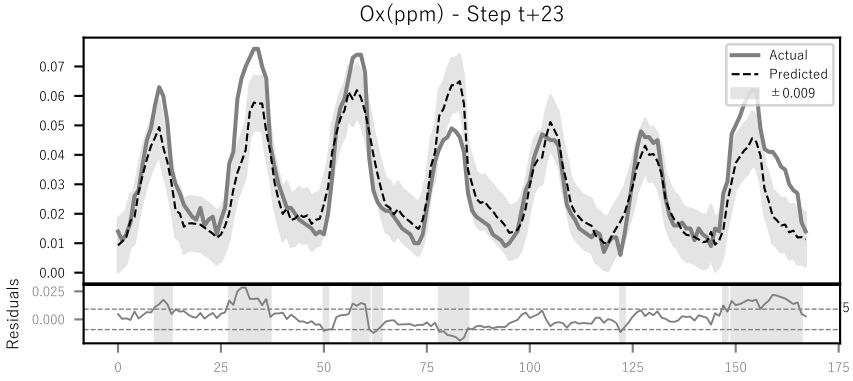
Comparison between actual and predicted values
with ± Standard Deviation Bands

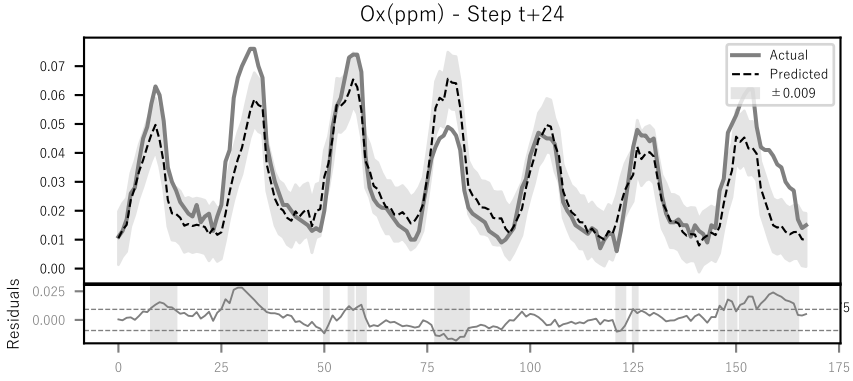


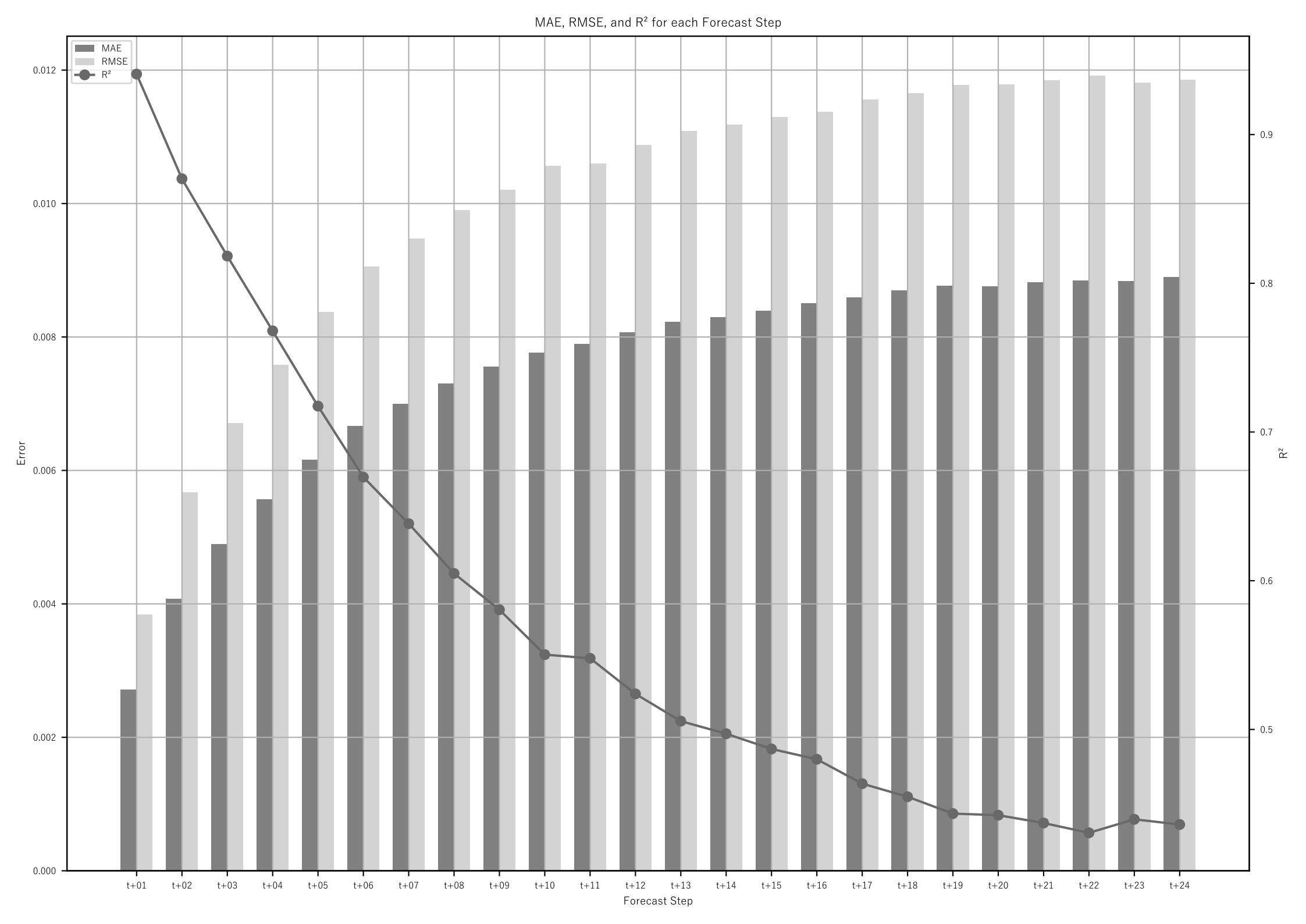


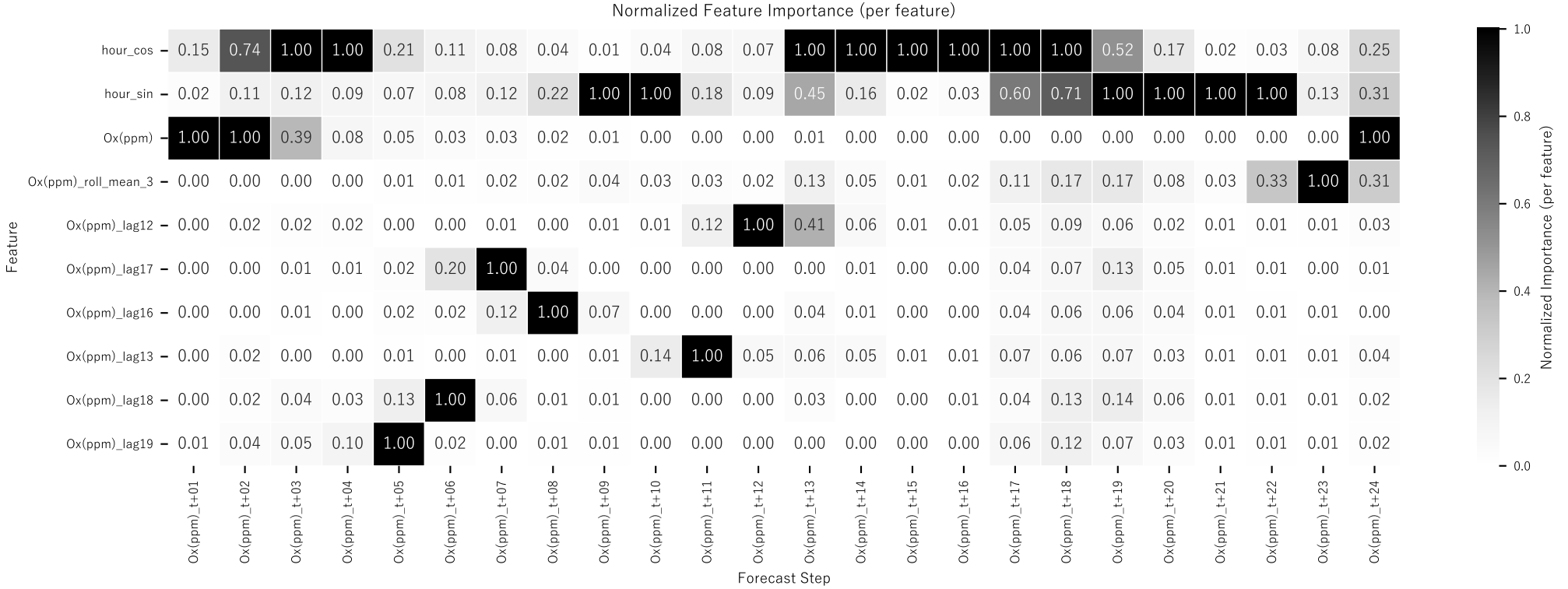


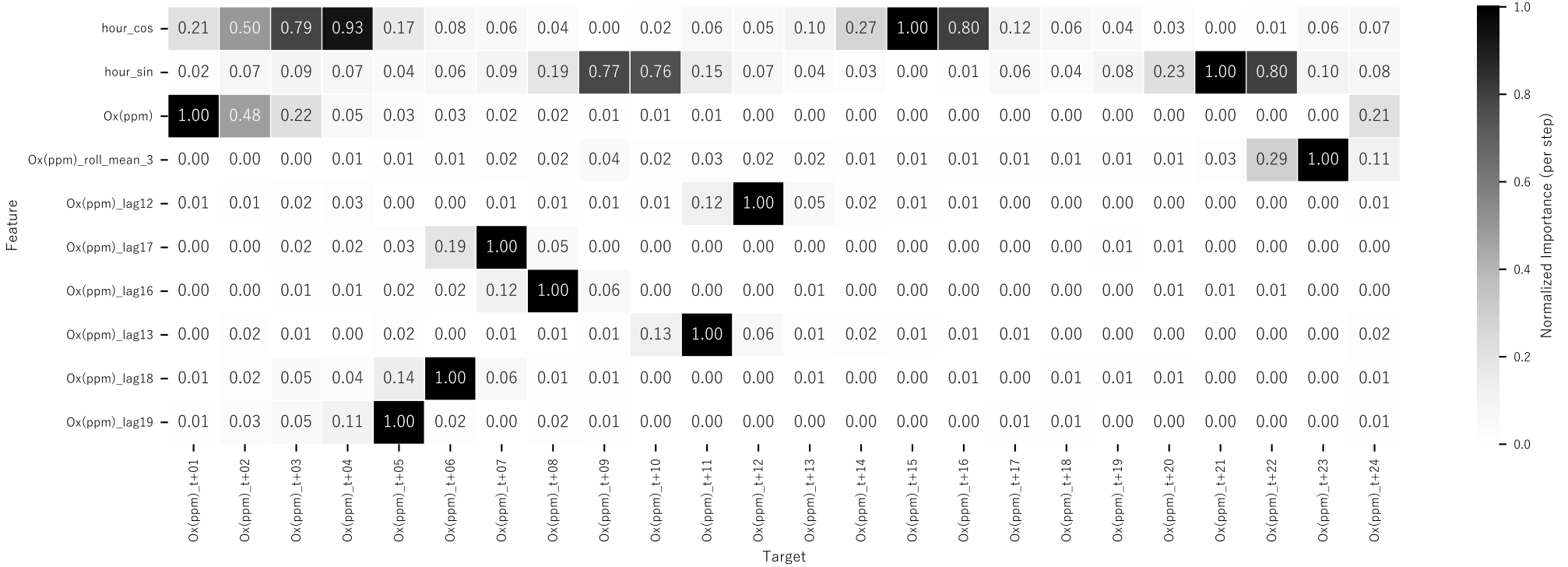







MAE, RMSE, and R² for each Forecast Step
MAE
RMSE
R²
Error
R²
Forecast Step
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.5
0.6
0.7
0.8
0.9
t+01
t+02
t+03
t+04
t+05
t+06
t+07
t+08
t+09
t+10
t+11
t+12
t+13
t+14
t+15
t+16
t+17
t+18
t+19
t+20
t+21
t+22
t+23
t+24


Normalized Feature Importance (per feature)
Feature
hour_cos 0.15 0.74 1.00 1.00 0.21 0.11 0.08 0.04 0.01 0.04 0.08 0.07 1.00 1.00 1.00 1.00 1.00 1.00 0.52 0.17 0.02 0.03 0.08 0.25
hour_sin 0.02 0.11 0.12 0.09 0.07 0.08 0.12 0.22 1.00 1.00 0.18 0.09 0.45 0.16 0.02 0.03 0.60 0.71 1.00 1.00 1.00 1.00 0.13 0.31
Ox(ppm) 1.00 1.00 0.39 0.08 0.05 0.03 0.03 0.02 0.01 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00
Ox(ppm)_roll_mean_3 0.00 0.00 0.00 0.00 0.01 0.01 0.02 0.02 0.04 0.03 0.03 0.02 0.13 0.05 0.01 0.02 0.11 0.17 0.17 0.08 0.03 0.33 1.00 0.31
Ox(ppm)_lag12 0.00 0.02 0.02 0.02 0.00 0.00 0.01 0.00 0.01 0.01 0.12 1.00 0.41 0.06 0.01 0.01 0.05 0.09 0.06 0.02 0.01 0.01 0.01 0.03
Ox(ppm)_lag17 0.00 0.00 0.01 0.01 0.02 0.20 1.00 0.04 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.04 0.07 0.13 0.05 0.01 0.01 0.00 0.01
Ox(ppm)_lag16 0.00 0.00 0.01 0.00 0.02 0.02 0.12 1.00 0.07 0.00 0.00 0.00 0.04 0.01 0.00 0.00 0.04 0.06 0.06 0.04 0.01 0.01 0.01 0.00
Ox(ppm)_lag13 0.00 0.02 0.00 0.00 0.01 0.00 0.01 0.00 0.01 0.14 1.00 0.05 0.06 0.05 0.01 0.01 0.07 0.06 0.07 0.03 0.01 0.01 0.01 0.04
Ox(ppm)_lag18 0.00 0.02 0.04 0.03 0.13 1.00 0.06 0.01 0.01 0.00 0.00 0.00 0.03 0.00 0.00 0.01 0.04 0.13 0.14 0.06 0.01 0.01 0.01 0.02
Ox(ppm)_lag19 0.01 0.04 0.05 0.10 1.00 0.02 0.00 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.06 0.12 0.07 0.03 0.01 0.01 0.01 0.02
Ox(ppm)_t+01 Ox(ppm)_t+02 Ox(ppm)_t+03 Ox(ppm)_t+04 Ox(ppm)_t+05 Ox(ppm)_t+06 Ox(ppm)_t+07 Ox(ppm)_t+08 Ox(ppm)_t+09 Ox(ppm)_t+10 Ox(ppm)_t+11 Ox(ppm)_t+12 Ox(ppm)_t+13 Ox(ppm)_t+14 Ox(ppm)_t+15 Ox(ppm)_t+16 Ox(ppm)_t+17 Ox(ppm)_t+18 Ox(ppm)_t+19 Ox(ppm)_t+20 Ox(ppm)_t+21 Ox(ppm)_t+22 Ox(ppm)_t+23 Ox(ppm)_t+24
Forecast Step
Normalized Importance (per feature)
1.0
0.8
0.6
0.4
0.2
0.0


Normalized Feature Importance (per step)
Feature
hour_cos 0.21 0.50 0.79 0.93 0.17 0.08 0.06 0.04 0.00 0.02 0.06 0.05 0.10 0.27 1.00 0.80 0.12 0.06 0.04 0.03 0.00 0.01 0.06 0.07
hour_sin 0.02 0.07 0.09 0.07 0.04 0.06 0.09 0.19 0.77 0.76 0.15 0.07 0.04 0.03 0.00 0.01 0.06 0.04 0.08 0.23 1.00 0.80 0.10 0.08
Ox(ppm) 1.00 0.48 0.22 0.05 0.03 0.03 0.02 0.02 0.01 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.21
Ox(ppm)_roll_mean_3 0.00 0.00 0.00 0.01 0.01 0.01 0.02 0.02 0.04 0.02 0.03 0.02 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.03 0.29 1.00 0.11
Ox(ppm)_lag12 0.01 0.01 0.02 0.03 0.00 0.00 0.01 0.01 0.01 0.01 0.12 1.00 0.05 0.02 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01
Ox(ppm)_lag17 0.00 0.00 0.02 0.02 0.03 0.19 1.00 0.05 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00 0.00
Ox(ppm)_lag16 0.00 0.00 0.01 0.01 0.02 0.02 0.12 1.00 0.06 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.00 0.00
Ox(ppm)_lag13 0.00 0.02 0.01 0.00 0.02 0.00 0.01 0.01 0.01 0.13 1.00 0.06 0.01 0.02 0.01 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.02
Ox(ppm)_lag18 0.01 0.02 0.05 0.04 0.14 1.00 0.06 0.01 0.01 0.00 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.01 0.01 0.01 0.00 0.00 0.00 0.01
Ox(ppm)_lag19 0.01 0.03 0.05 0.11 1.00 0.02 0.00 0.02 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.01
Ox(ppm)_t+01 Ox(ppm)_t+02 Ox(ppm)_t+03 Ox(ppm)_t+04 Ox(ppm)_t+05 Ox(ppm)_t+06 Ox(ppm)_t+07 Ox(ppm)_t+08 Ox(ppm)_t+09 Ox(ppm)_t+10 Ox(ppm)_t+11 Ox(ppm)_t+12 Ox(ppm)_t+13 Ox(ppm)_t+14 Ox(ppm)_t+15 Ox(ppm)_t+16 Ox(ppm)_t+17 Ox(ppm)_t+18 Ox(ppm)_t+19 Ox(ppm)_t+20 Ox(ppm)_t+21 Ox(ppm)_t+22 Ox(ppm)_t+23 Ox(ppm)_t+24
Target
Normalized Importance (per step)
1.0
0.8
0.6
0.4
0.2
0.0