prova

February 10, 2023

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import matplotlib as mplt
import seaborn as sns
import arviz as az
import datetime
```

[2]:
```
import fit_arima
```

[3]:
```
import open_data
df_temp = open_data.open()
df = df_temp[0]
```

[4]:
```
ritorno = fit_arima.compute(2, 1, catene=4, samples_per_chain=2500, burnin=1000)
```

```
19:19:05 - cmdstanpy - INFO - CmdStan start processing
chain 1 |          | 00:00 Status
chain 2 |          | 00:00 Status
chain 3 |          | 00:00 Status
chain 4 |          | 00:00 Status


19:49:59 - cmdstanpy - INFO - CmdStan done processing.
19:49:59 - cmdstanpy - WARNING - Non-fatal error during sampling:
Exception: code_model_namespace::log_prob: H is not symmetric. H[1,2] = inf, but
H[2,1] = inf (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 91, column 2 to column 53)
        Exception: code_model_namespace::log_prob: H is not symmetric. H[1,2] =
inf, but H[2,1] = inf (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 91, column 2 to column 53)
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'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
```

```
line 91, column 2 to column 53)
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'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
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'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
```

```
line 91, column 2 to column 53)
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line 91, column 2 to column 53)
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inf, but H[2,1] = inf (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 91, column 2 to column 53)
Exception: normal_lpdf: Scale parameter is 0, but must be positive! (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 177, column 4 to column 34)
        Exception: normal_lpdf: Scale parameter is 0, but must be positive! (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 177, column 4 to column 34)
        Exception: normal_lpdf: Scale parameter is 0, but must be positive! (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 177, column 4 to column 34)
        Exception: code_model_namespace::log_prob: H is not symmetric. H[1,2] =
inf, but H[2,1] = inf (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 91, column 2 to column 53)
        Exception: normal_lpdf: Scale parameter is 0, but must be positive! (in
'/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/code.stan',
line 177, column 4 to column 34)
Consider re-running with show_console=True if the above output is unclear!
```

```
/home/br1/PythonProjects/PythonStats/ARIMA_last_computation/Spatial/fit_arima.py
:43: FutureWarning: Indexing with a float is deprecated, and will raise an
IndexError in pandas 2.0. You can manually convert to an integer key instead.
  y_missing_list.append({'Stazione':df.columns[v[i]],'Data':df.index[u[i]],'Samp
les':inference_data.posterior.w.values[:,:,i].reshape(catene*samples_per_chain)}
)
```

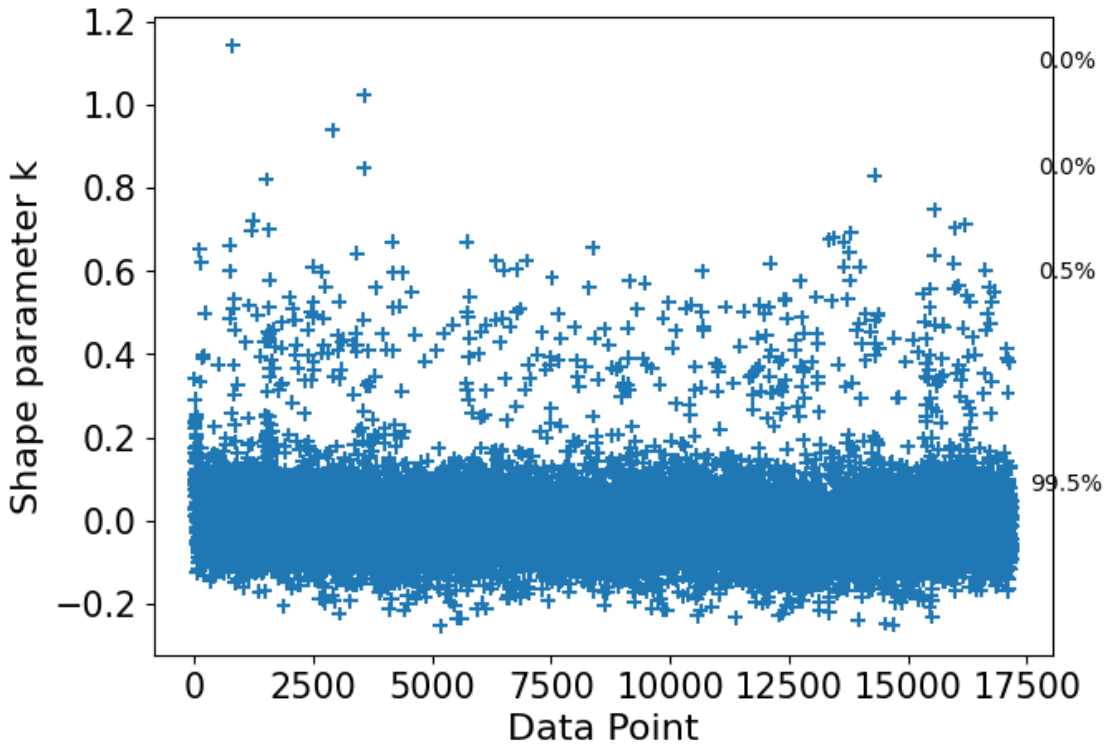
Tempo di computazione: 30:53

[5]:
```
res = az.loo(ritorno['inference_data'], var_name="log_lik", pointwise=True,␣
↪scale='deviance')
res
```

```
/home/br1/PythonProjects/PythonStats/.venv/lib/python3.10/site-
packages/arviz/stats/stats.py:803: UserWarning: Estimated shape parameter of
Pareto distribution is greater than 0.7 for one or more samples. You should
consider using a more robust model, this is because importance sampling is less
likely to work well if the marginal posterior and LOO posterior are very
different. This is more likely to happen with a non-robust model and highly
influential observations.
  warnings.warn(
```

[5]:
```
Computed from 10000 posterior samples and 17191 observations log-likelihood
matrix.

             Estimate       SE
deviance_loo -14505.76   309.72
p_loo          286.07        -

There has been a warning during the calculation. Please check the results.
------

Pareto k diagnostic values:
                         Count   Pct.
(-Inf, 0.5]   (good)     17102   99.5%
 (0.5, 0.7]   (ok)          79    0.5%
   (0.7, 1]   (bad)          8    0.0%
   (1, Inf)   (very bad)     2    0.0%
```

[6]:
```
aux_plt = az.plot_khat(res, show_bins=True, figsize=(7,5))
```

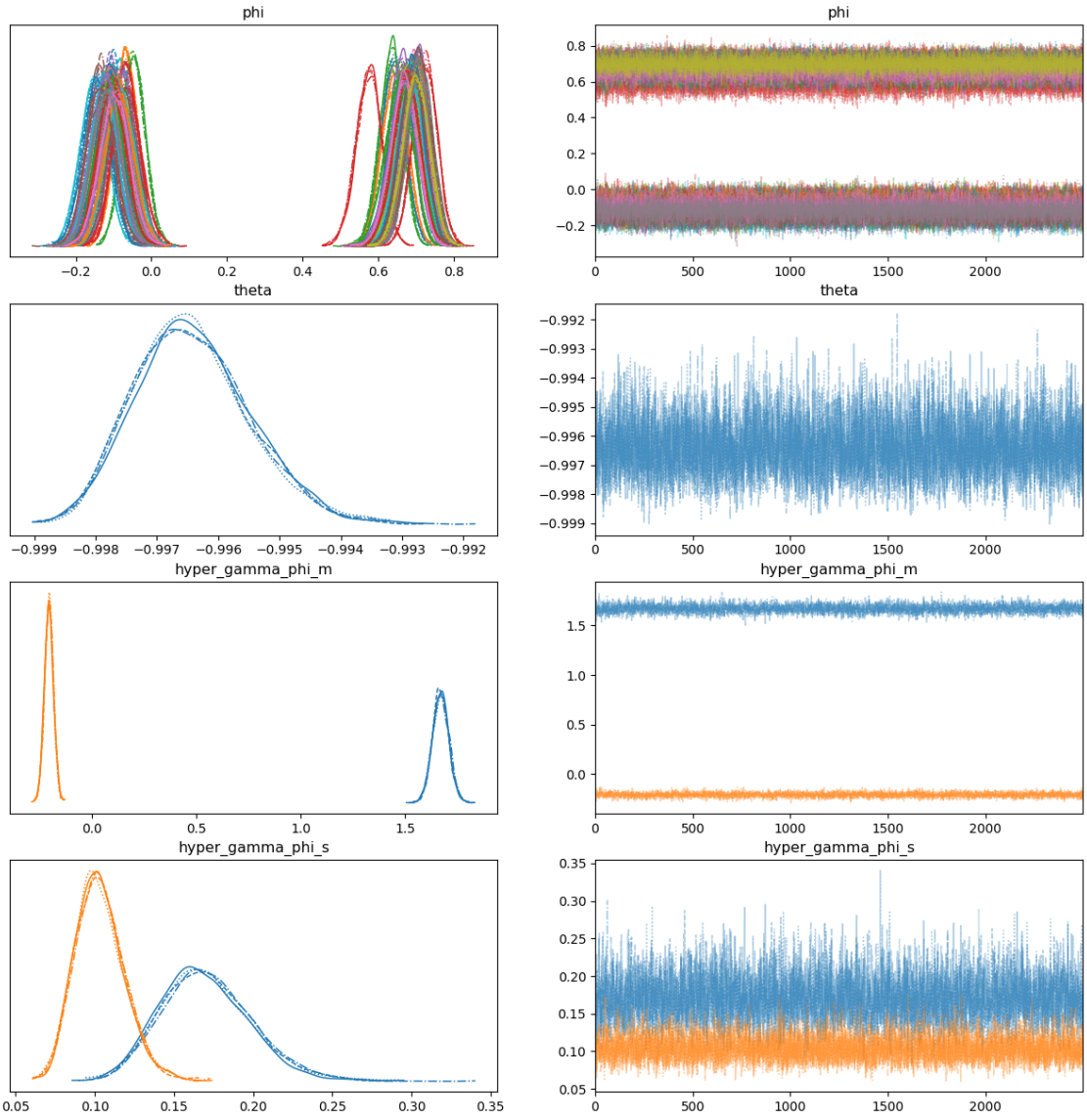


[7]:
```
res = az.waic(ritorno['inference_data'], var_name="log_lik", scale='deviance')
res
```

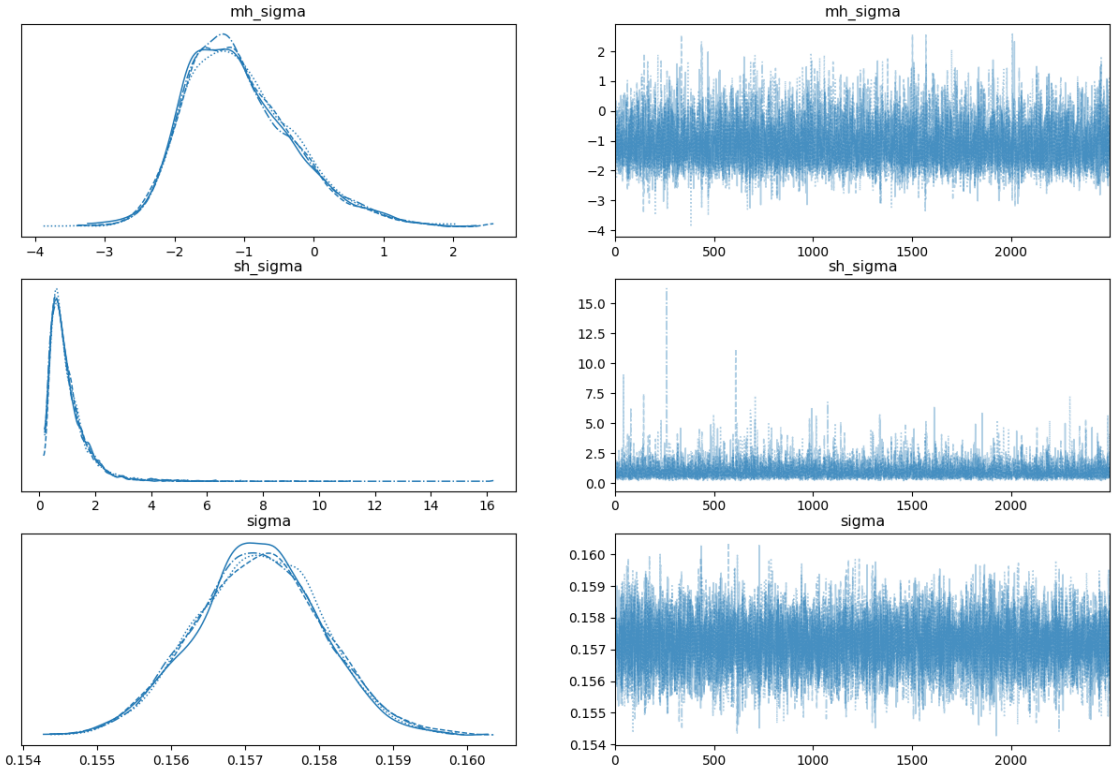
```
/home/br1/PythonProjects/PythonStats/.venv/lib/python3.10/site-
packages/arviz/stats/stats.py:1645: UserWarning: For one or more samples the
posterior variance of the log predictive densities exceeds 0.4. This could be
indication of WAIC starting to fail.
See http://arxiv.org/abs/1507.04544 for details
  warnings.warn(
```

[7]:
```
Computed from 10000 posterior samples and 17191 observations log-likelihood
matrix.

               Estimate       SE
deviance_waic -14530.08   309.40
p_waic          273.91        -

There has been a warning during the calculation. Please check the results.
```

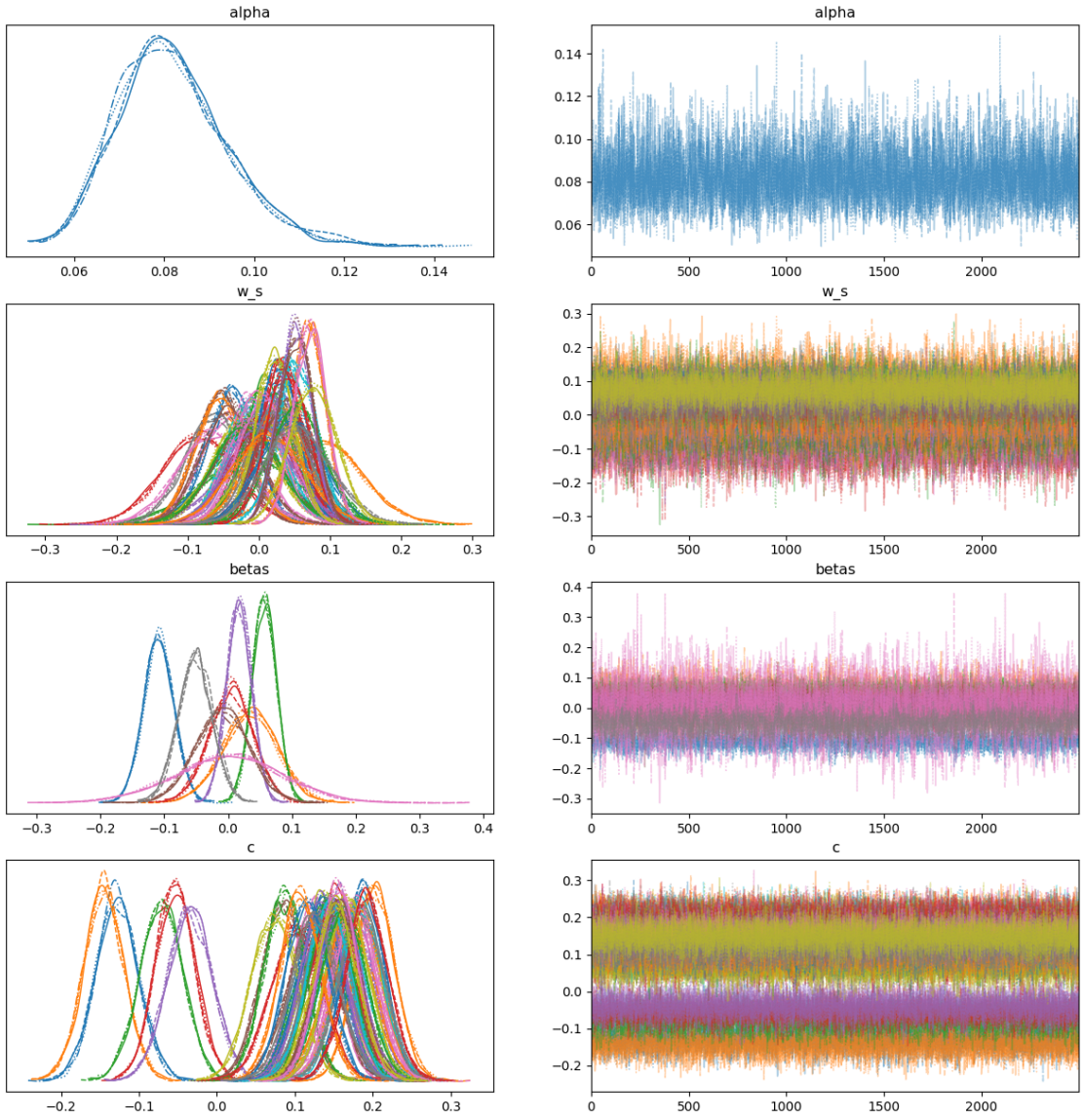
[8]:
```
plt_aux = az.plot_trace(ritorno['inference_data'],␣
 ↪var_names=['phi','theta','hyper_gamma_phi_m','hyper_gamma_phi_s'],␣
 ↪divergences=True, figsize=(15,15))
```



[9]:
```
plt_aux = az.plot_trace(ritorno['inference_data'],␣
↪var_names=['mh_sigma','sh_sigma','sigma'], divergences=True, figsize=(15,10))
```



[10]:
```
plt_aux = az.plot_trace(ritorno['inference_data'],␣
↪var_names=['alpha','w_s','betas','c'], divergences=True, figsize=(15,15))
```



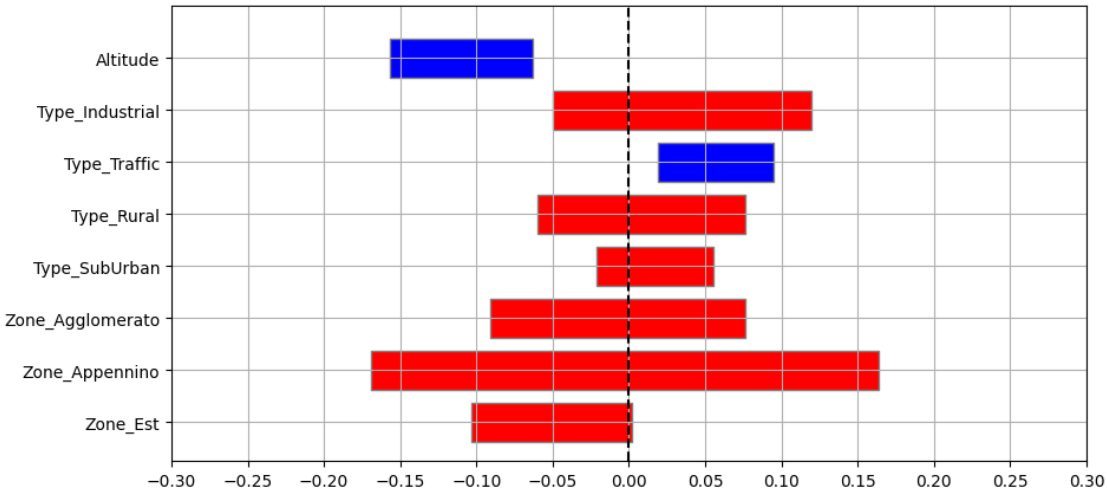
[11]:
```
df_risultati = az.summary(ritorno['inference_data'], var_names=['betas'],␣
↪hdi_prob=0.95)
df_risultati.loc[:,'Name'] = df_temp[1].columns
df_risultati.set_index('Name', inplace=True)
df_risultati
```

[11]:

Name	mean	sd	hdi_2.5%	hdi_97.5%	mcse_mean	mcse_sd	\
Altitude	-0.109	0.024	-0.157	-0.063	0.000	0.000	
Type_Industrial	0.034	0.043	-0.050	0.120	0.001	0.001	
Type_Traffic	0.057	0.019	0.019	0.095	0.000	0.000	
Type_Rural	0.005	0.035	-0.060	0.076	0.001	0.000	

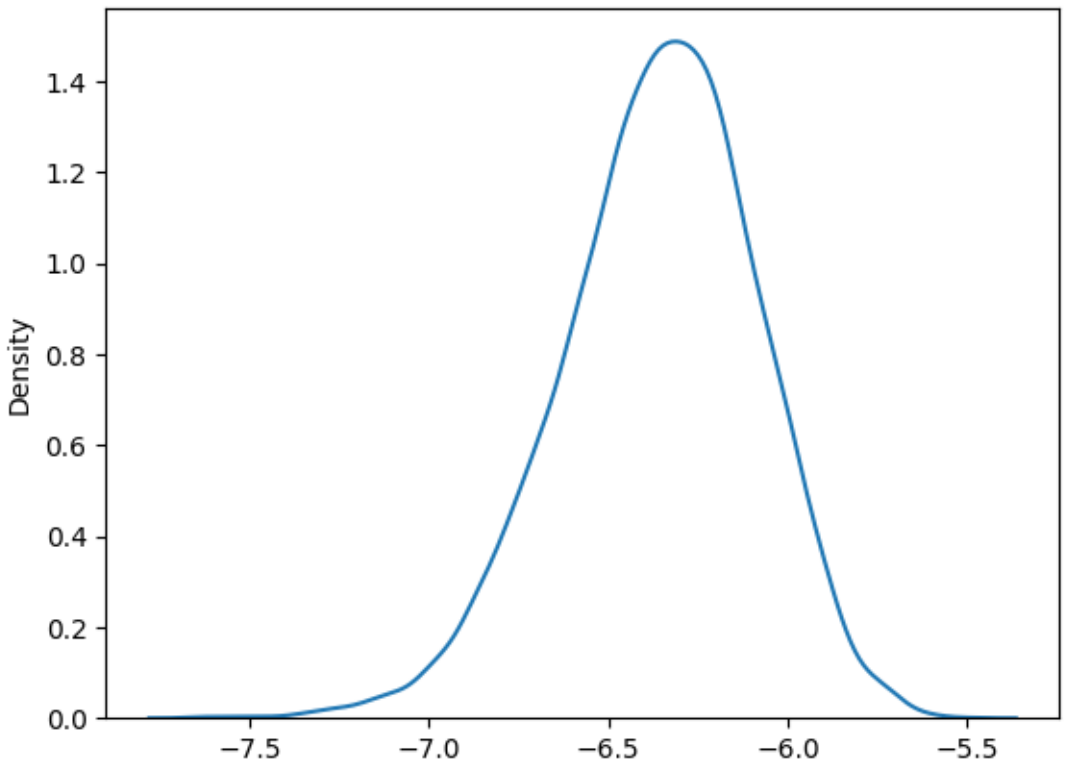
```
Type_SubUrban     0.017  0.020    -0.021      0.055      0.000    0.000
Zone_Agglomerato -0.009  0.042    -0.091      0.076      0.001    0.001
Zone_Appennino    0.000  0.085    -0.169      0.164      0.002    0.001
Zone_Est         -0.052  0.027    -0.103      0.002      0.001    0.000

                 ess_bulk  ess_tail  r_hat
Name
Altitude            2824.0    4341.0    1.0
Type_Industrial     3653.0    5676.0    1.0
Type_Traffic        3969.0    5911.0    1.0
Type_Rural          2960.0    4837.0    1.0
Type_SubUrban       4280.0    6165.0    1.0
Zone_Agglomerato    2587.0    4002.0    1.0
Zone_Appennino      3074.0    4660.0    1.0
Zone_Est            1677.0    3271.0    1.0
```

[12]:
```
import time
from matplotlib.patches import Rectangle

plt.figure(figsize=(10,5))
ax = plt.subplot(1,1,1)
plt.xlim(left = -0.3, right = 0.3)
pos_rows = np.arange(0,len(df_risultati.index))
plt.ylim(bottom=-0.75, top=pos_rows[-1]+1.0)
i = 1
for row in df_risultati.index:
    lci = df_risultati.loc[row, 'hdi_2.5%']
    rci = df_risultati.loc[row, 'hdi_97.5%']
    len_ci = rci - lci
    if lci*rci <= 0:
        col = 'red'
    else:
        col = 'blue'
    ax.add_patch(Rectangle((lci, pos_rows[-i] - 0.75/2), len_ci, 0.75,
             edgecolor = 'grey',
             facecolor = col,
             fill=True,
             lw=1))
    i += 1


plt.axvline(0, 0, pos_rows[-1]+0.75, linestyle='--', color='black')
plt.grid(axis='both')
plt.yticks(ticks=np.flip(pos_rows), labels=df_risultati.index.to_list())
plt.xticks(ticks=np.linspace(-0.3,0.3,13))
plt.show()
```



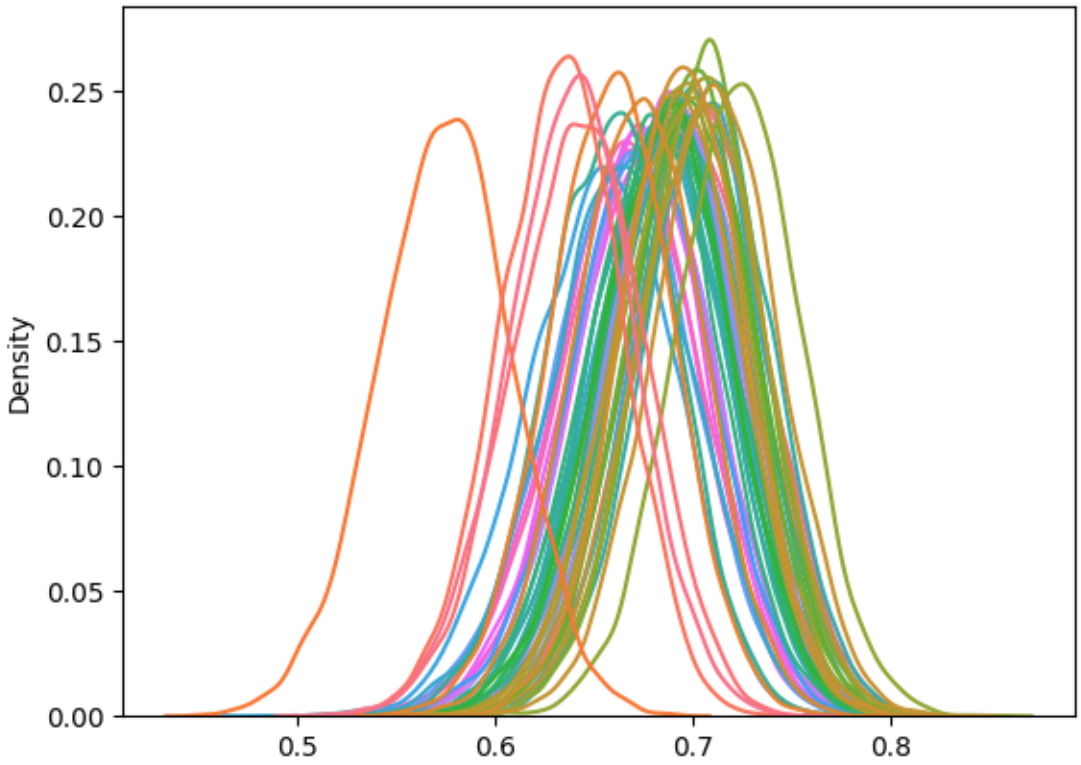
[13]:
```
aux_shape = ritorno['inference_data'].posterior.gamma_th.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.gamma_th.values.
 ↪reshape((aux_shape[0]*aux_shape[1])), legend=False)
```

[13]: <AxesSubplot: ylabel='Density'>



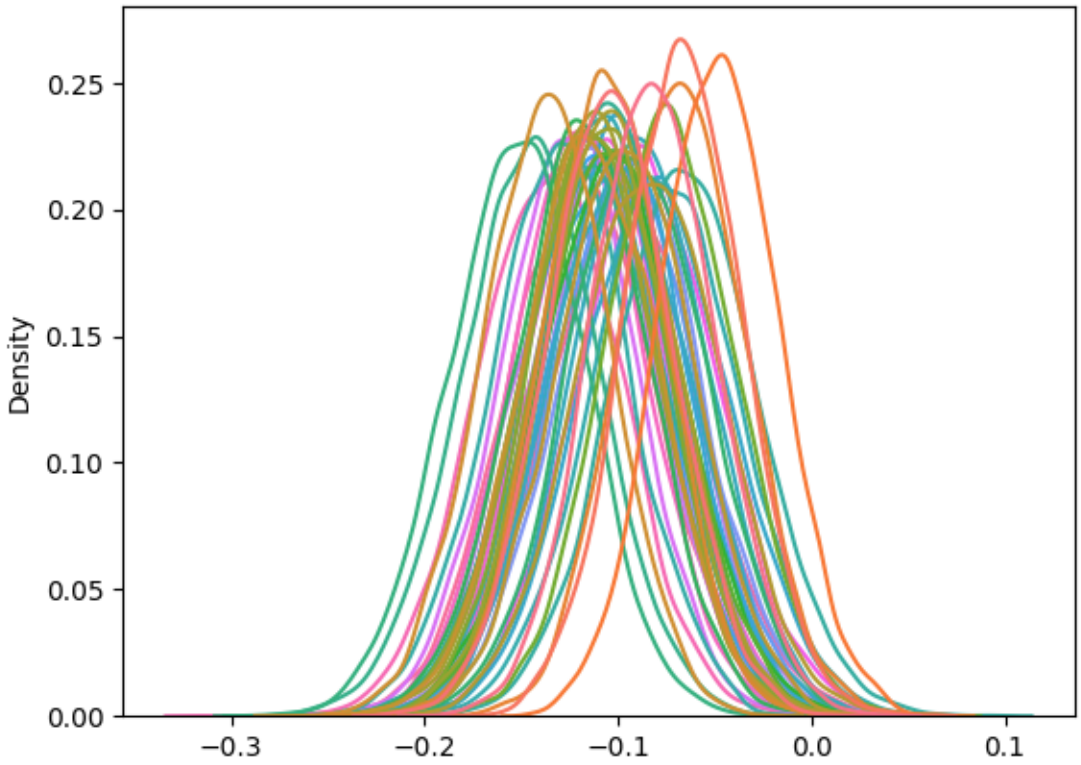
[14]:
```
aux_shape = ritorno['inference_data'].posterior.phi.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.phi.values.
 ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2],aux_shape[3]))[:,0,:],␣
 ↪legend=False)
```

[14]: <AxesSubplot: ylabel='Density'>



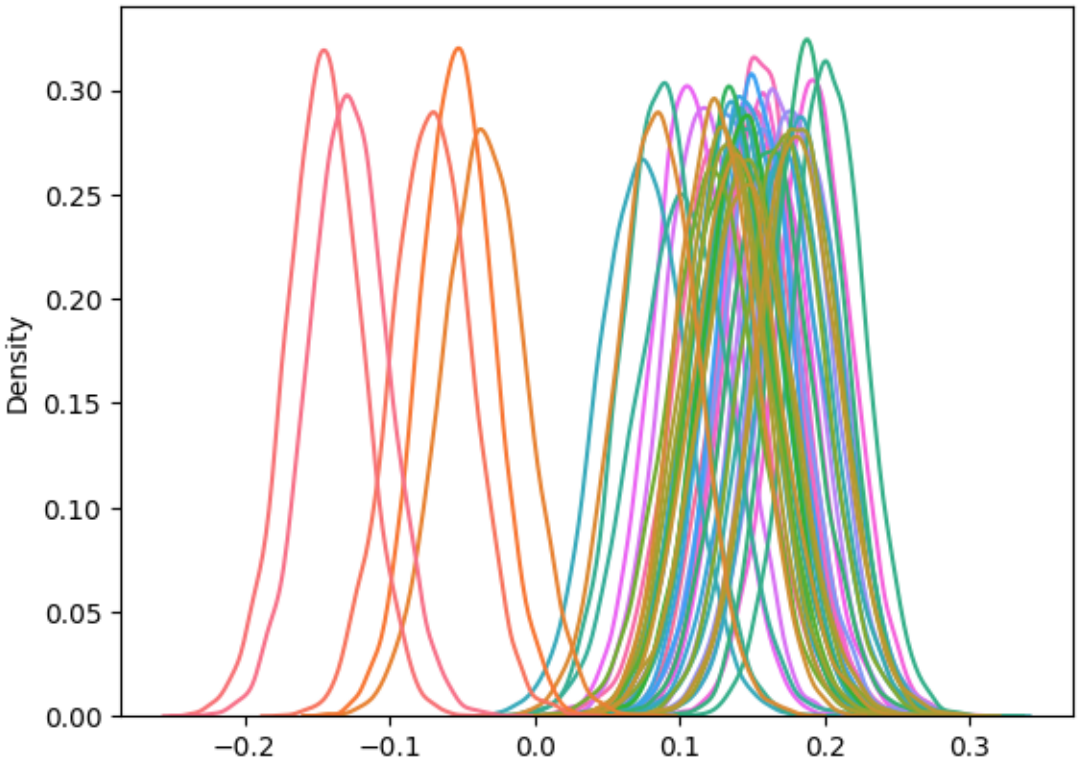
[15]:
```
aux_shape = ritorno['inference_data'].posterior.phi.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.phi.values.
 ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2],aux_shape[3]))[:,1,:],␣
 ↪legend=False)
```

[15]: <AxesSubplot: ylabel='Density'>



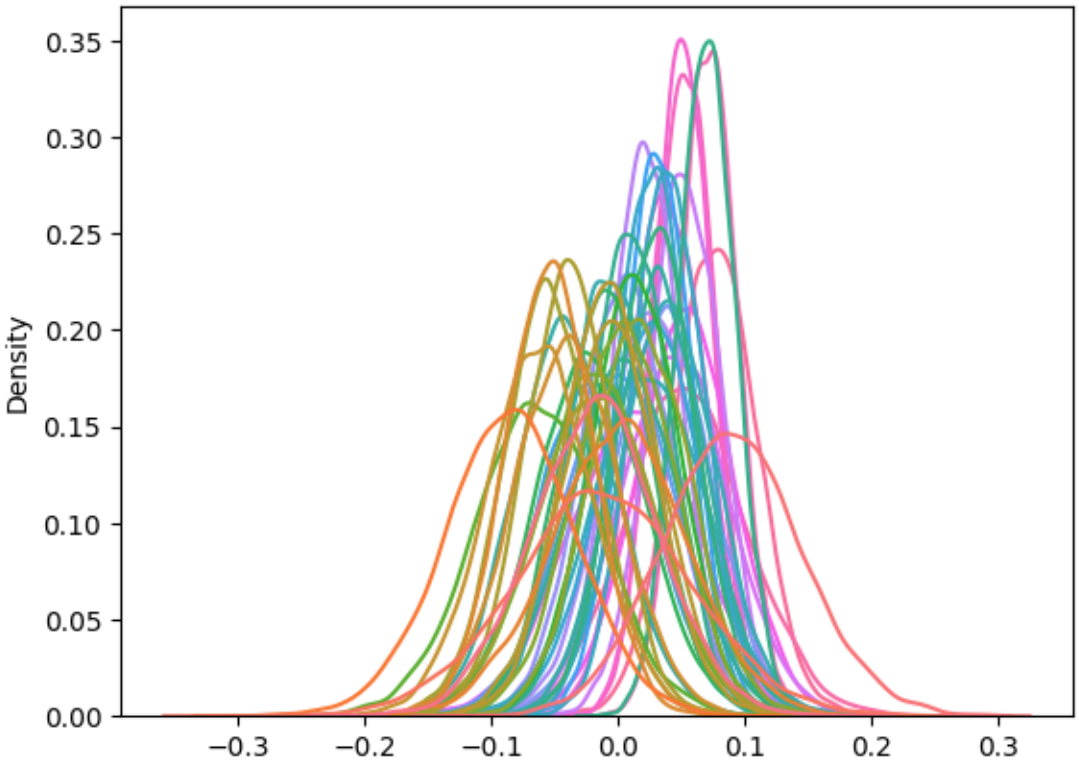
[16]:
```
aux_shape = ritorno['inference_data'].posterior.c.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.c.values.
  ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), legend=False)
```

[16]: <AxesSubplot: ylabel='Density'>



[17]:
```
aux_shape = ritorno['inference_data'].posterior.w_s.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.w_s.values.
  ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), legend=False)
```

[17]: <AxesSubplot: ylabel='Density'>



[18]:
```
pd.set_option('display.max_columns', 500)
spatial_results = pd.DataFrame(ritorno['inference_data'].posterior.w_s.values.
 ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), columns=df.columns).
 ↪describe()
spatial_results.loc['abs_dist_from_mean',:] = (spatial_results.loc['mean',:] -␣
 ↪spatial_results.loc['mean',:].mean()).abs()
spatial_results.sort_values('abs_dist_from_mean', axis=1, ascending=False)
#spatial_results.sort_values('mean', axis=1, ascending=True)
```

[18]:

	SAVIGNANO DI RIGO	FEBBIO	SAN LAZZARO	\
count	10000.000000	10000.000000	10000.000000	
mean	-0.085256	0.090438	-0.062758	
std	0.051762	0.055739	0.049765	
min	-0.309093	-0.135869	-0.253992	
25%	-0.119403	0.053220	-0.096185	
50%	-0.084646	0.090060	-0.063155	
75%	-0.050487	0.127243	-0.029049	
max	0.102594	0.298936	0.165372	
abs_dist_from_mean	0.095740	0.079953	0.073242	

	GIARDINI MARGHERITA	TIMAVO	VERUCCHIO	\
count	10000.000000	10000.000000	10000.000000	

mean	-0.061179	0.076898	-0.053923
std	0.042939	0.033002	0.034507
min	-0.221576	-0.042387	-0.189186
25%	-0.089413	0.054831	-0.077194
50%	-0.061281	0.076965	-0.053597
75%	-0.032911	0.098891	-0.030684
max	0.115708	0.215842	0.072680
abs_dist_from_mean	0.071663	0.066413	0.064407

	DE AMICIS	SAN FRANCESCO	PARCO EDILCARANI \
count	10000.000000	10000.000000	10000.000000
mean	-0.052873	0.071998	0.070562
std	0.037416	0.023190	0.023108
min	-0.187342	-0.025468	-0.021174
25%	-0.077647	0.056553	0.054947
50%	-0.053857	0.072025	0.070457
75%	-0.028119	0.087371	0.086013
max	0.094285	0.167773	0.167688
abs_dist_from_mean	0.063358	0.061514	0.060077

	PORTA SAN FELICE	BADIA	MARECCHIA \
count	10000.000000	10000.000000	10000.000000
mean	-0.041013	-0.040519	-0.038737
std	0.040829	0.042277	0.034955
min	-0.192243	-0.215443	-0.189844
25%	-0.068006	-0.068975	-0.062057
50%	-0.041920	-0.039870	-0.038581
75%	-0.014506	-0.012262	-0.015286
max	0.120248	0.120611	0.102320
abs_dist_from_mean	0.051497	0.051004	0.049221

	GERBIDO	S. LAZZARO	FLAMINIA	CITTADELLA \
count	10000.000000	10000.000000	10000.000000	10000.000000
mean	0.054784	0.053523	0.053274	0.052707
std	0.048296	0.029146	0.039477	0.023562
min	-0.134987	-0.067991	-0.094413	-0.037197
25%	0.022907	0.034590	0.027280	0.036487
50%	0.053786	0.053200	0.053426	0.052847
75%	0.085848	0.073183	0.079130	0.068753
max	0.243535	0.167565	0.222594	0.148065
abs_dist_from_mean	0.044299	0.043038	0.042789	0.042222

	MONTEBELLO	S. ROCCO	GAVELLO	GIARDINI \
count	10000.000000	10000.000000	10000.000000	10000.000000
mean	0.050866	0.045335	-0.021751	0.040508
std	0.022951	0.043360	0.044059	0.029765
min	-0.035863	-0.121586	-0.178745	-0.073786

25%	0.035271	0.016050	-0.051094	0.020624
50%	0.050907	0.045476	-0.022111	0.039874
75%	0.066533	0.073896	0.007522	0.060310
max	0.149088	0.201958	0.144614	0.161492
abs_dist_from_mean	0.040381	0.034850	0.032235	0.030024

	VILLA FULVIA	PARCO FERRARI	BOGOLESE	CASTELLUCCIO	\
count	10000.000000	10000.000000	10000.000000	10000.000000	
mean	0.040244	0.039730	-0.017955	-0.017825	
std	0.037940	0.028551	0.047166	0.050742	
min	-0.103088	-0.063503	-0.196239	-0.218721	
25%	0.014793	0.020512	-0.049480	-0.051669	
50%	0.040155	0.039523	-0.018115	-0.016908	
75%	0.065790	0.059056	0.013192	0.015319	
max	0.204090	0.154262	0.174424	0.193343	
abs_dist_from_mean	0.029760	0.029245	0.028439	0.028310	

	VIA CHIARINI	SAN PIETRO CAPOFIUME	CENO	\
count	10000.000000	10000.000000	10000.000000	
mean	-0.016629	-0.016504	0.035443	
std	0.048690	0.046231	0.039652	
min	-0.191980	-0.199127	-0.117411	
25%	-0.048952	-0.046874	0.008916	
50%	-0.016550	-0.016663	0.035715	
75%	0.015587	0.014069	0.061773	
max	0.185884	0.165559	0.188650	
abs_dist_from_mean	0.027114	0.026988	0.024958	

	CORTE BRUGNATELLA	CAORLE	SARAGAT	\
count	10000.000000	10000.000000	10000.000000	
mean	-0.012049	0.032690	0.031248	
std	0.070760	0.036443	0.028046	
min	-0.324665	-0.129863	-0.083385	
25%	-0.058026	0.008447	0.012758	
50%	-0.012643	0.032620	0.031273	
75%	0.034642	0.057308	0.049997	
max	0.276698	0.174019	0.150209	
abs_dist_from_mean	0.022534	0.022205	0.020764	

	CASTELLARANO	ROMA	PARCO RESISTENZA	\
count	10000.000000	10000.000000	10000.000000	
mean	0.030368	-0.008426	-0.006673	
std	0.032298	0.037453	0.036953	
min	-0.102233	-0.156523	-0.160536	
25%	0.008886	-0.033314	-0.031388	
50%	0.030545	-0.008668	-0.007165	
75%	0.051642	0.016310	0.017691	

max	0.160934	0.134898	0.139732
abs_dist_from_mean	0.019883	0.018910	0.017158

	ISONZO	PARCO MONTECUCCO	ZALAMELLA
count	10000.000000	10000.000000	10000.000000
mean	0.027101	0.027051	-0.005933
std	0.038356	0.028451	0.035537
min	-0.113564	-0.090765	-0.149914
25%	0.001434	0.008256	-0.029419
50%	0.027031	0.027409	-0.006039
75%	0.052828	0.045996	0.017505
max	0.193360	0.142520	0.120277
abs_dist_from_mean	0.016617	0.016566	0.016418

	CENTO	GHERARDI	PARCO BERTOZZI
count	10000.000000	10000.000000	10000.000000
mean	0.026307	0.025133	-0.004131
std	0.040778	0.045294	0.039785
min	-0.114222	-0.172926	-0.149918
25%	-0.000646	-0.005079	-0.030394
50%	0.026891	0.024891	-0.003780
75%	0.053041	0.055647	0.022526
max	0.228669	0.194470	0.149282
abs_dist_from_mean	0.015822	0.014648	0.014615

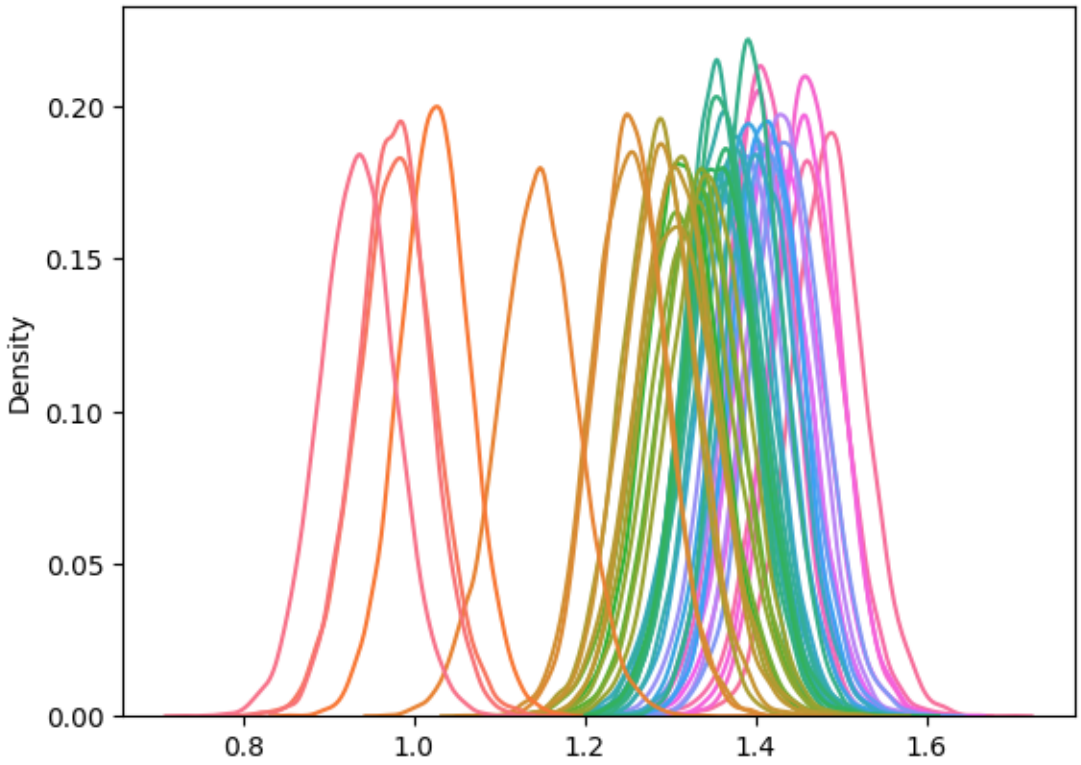
	GIORDANI-FARNESE	SAN LEO	FRANCHINI-ANGELONI
count	10000.000000	10000.000000	10000.000000
mean	0.022656	0.001161	0.018290
std	0.027519	0.054816	0.039529
min	-0.088844	-0.266741	-0.151628
25%	0.004174	-0.035007	-0.008409
50%	0.022482	0.002032	0.017774
75%	0.040723	0.037446	0.044922
max	0.138671	0.201900	0.175004
abs_dist_from_mean	0.012171	0.009324	0.007805

	PARADIGNA	BESENZONE	SAVIGNANO	REMESINA
count	10000.000000	10000.000000	10000.000000	10000.000000
mean	0.003424	0.005366	0.005968	0.007031
std	0.046281	0.044585	0.040233	0.035686
min	-0.181537	-0.158826	-0.171157	-0.141326
25%	-0.027614	-0.024037	-0.020613	-0.016780
50%	0.002775	0.005101	0.005946	0.006835
75%	0.034028	0.035143	0.032989	0.030902
max	0.174818	0.181195	0.166302	0.136351
abs_dist_from_mean	0.007061	0.005118	0.004517	0.003453

	LUGAGNANO	MALCANTONE	DELTA CERVIA
count	10000.000000	10000.000000	10000.000000
mean	0.013551	0.013139	0.011090
std	0.035428	0.051514	0.032409
min	-0.127480	-0.230634	-0.114607
25%	-0.009960	-0.021241	-0.010387
50%	0.013815	0.013437	0.010992
75%	0.037425	0.047316	0.032539
max	0.148329	0.231007	0.133852
abs_dist_from_mean	0.003067	0.002654	0.000605

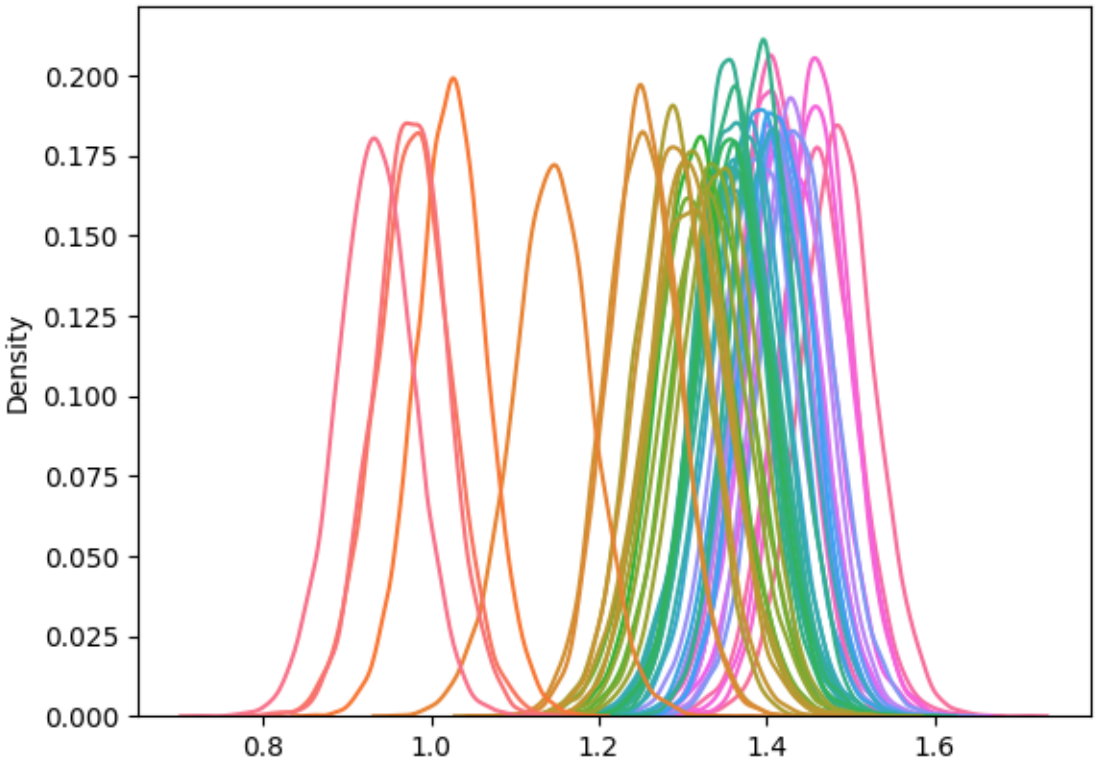
[19]:
```
aux_shape = ritorno['inference_data'].posterior.annual_mean.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.annual_mean.values.
  ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), legend=False)
```

[19]: <AxesSubplot: ylabel='Density'>



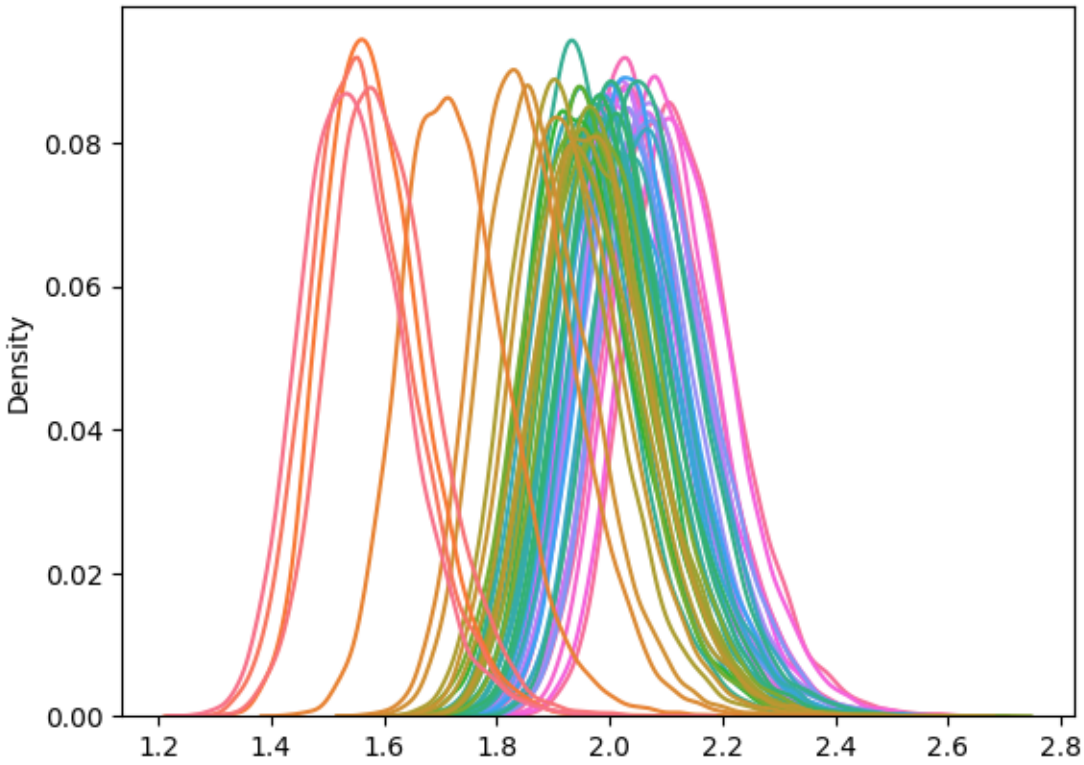
[20]:
```
aux_shape = ritorno['inference_data'].posterior.annual_median.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.annual_median.values.
  ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), legend=False)
```

[20]: <AxesSubplot: ylabel='Density'>

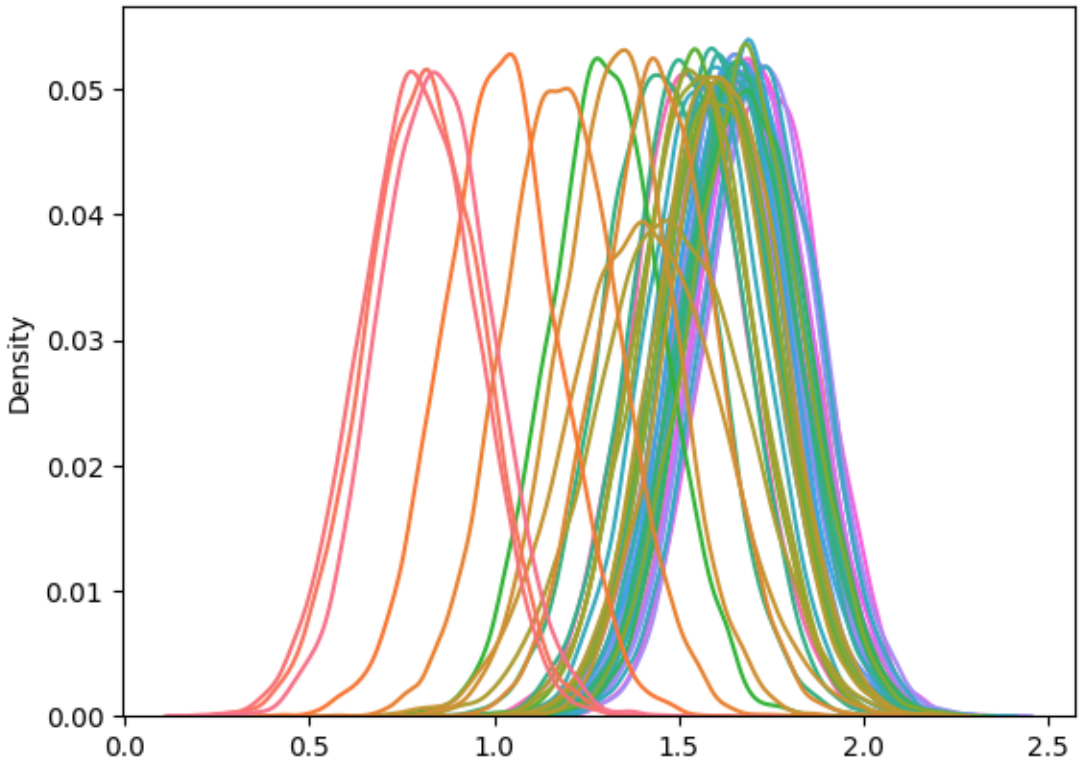


[21]:
```
aux_shape = ritorno['inference_data'].posterior.annual_max.values.shape
sns.kdeplot(ritorno['inference_data'].posterior.annual_max.values.
  ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), legend=False)
```

[21]:
```
<AxesSubplot: ylabel='Density'>
```

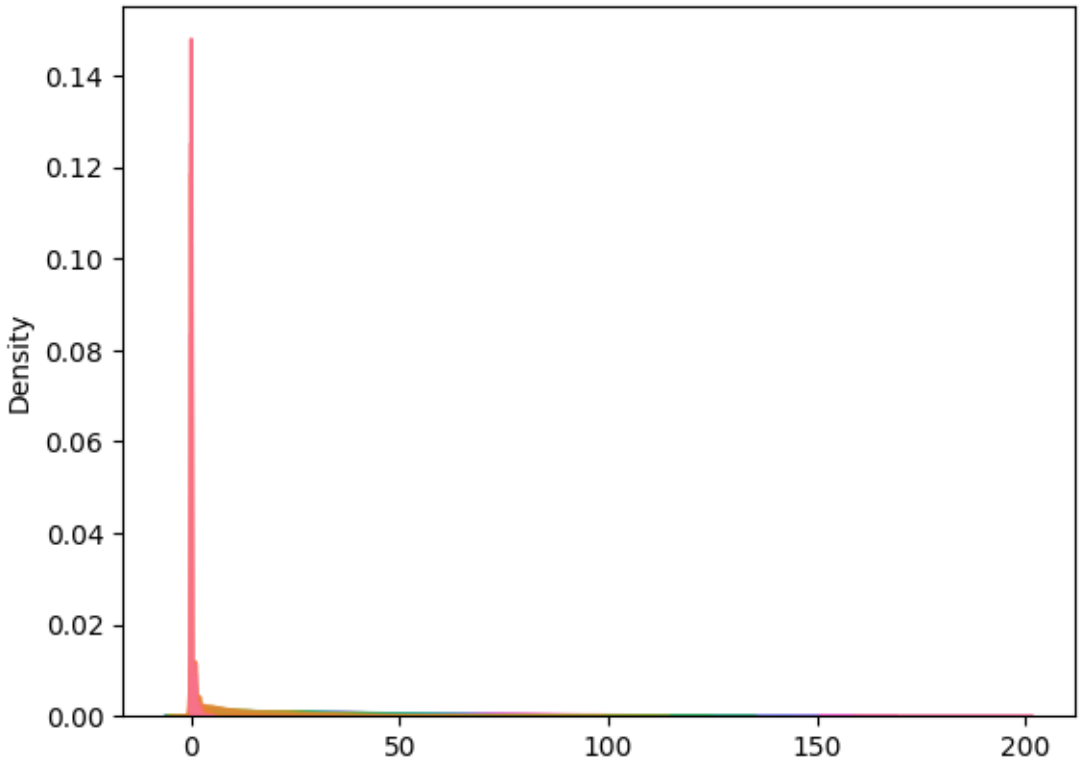


[22]:
```
valori_31_dic = []
for dizionario in ritorno['missing']:
    if dizionario['Data'] == '2018-12-31':
        valori_31_dic.append(dizionario['Samples'])

res_plot = sns.kdeplot(valori_31_dic, legend=False)
```



[23]:
```
aux_shape = ritorno['inference_data'].posterior.annual_days_over_threshold.
 ↪values.shape
sns.kdeplot(ritorno['inference_data'].posterior.annual_days_over_threshold.
 ↪values.reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), legend=False)
```

[23]:
```
<AxesSubplot: ylabel='Density'>
```



[24]:
```
pd.set_option('display.max_columns', 500)
aux_results = pd.DataFrame(ritorno['inference_data'].posterior.
 ↪annual_days_over_threshold.values.
 ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), columns=df.columns).
 ↪describe()
aux_results.sort_values('mean', axis=1, ascending=True)
```

[24]:

	CASTELLUCCIO	CORTE BRUGNATELLA	SAVIGNANO DI RIGO	FEBBIO	\
count	10000.000000	10000.000000	10000.000000	10000.000000	
mean	0.079200	0.099200	0.120000	0.194200	
std	0.321151	0.367387	0.386024	0.522603	
min	0.000000	0.000000	0.000000	0.000000	
25%	0.000000	0.000000	0.000000	0.000000	
50%	0.000000	0.000000	0.000000	0.000000	
75%	0.000000	0.000000	0.000000	0.000000	
max	5.000000	5.000000	4.000000	5.000000	

	SAN LEO	VERUCCHIO	BADIA	MARECCHIA	\
count	10000.000000	10000.000000	10000.000000	10000.000000	
mean	1.398200	6.631200	8.290600	12.368900	
std	1.836402	4.707972	5.507412	6.993848	
min	0.000000	0.000000	0.000000	0.000000	

```
25%        0.000000      3.000000      4.000000      7.000000
50%        1.000000      6.000000      7.000000     11.000000
75%        2.000000      9.000000     11.000000     16.000000
max       34.000000     43.000000     62.000000     62.000000

       GIARDINI MARGHERITA  SAN PIETRO CAPOFIUME     LUGAGNANO  \
count         10000.000000          10000.000000  10000.000000
mean             14.114200             16.876800     17.462300
std               7.885999              9.869993      9.257988
min               0.000000              0.000000      0.000000
25%               8.000000             10.000000     11.000000
50%              13.000000             15.000000     16.000000
75%              18.000000             22.000000     22.000000
max              61.000000             88.000000     67.000000

       PARCO BERTOZZI  DELTA CERVIA  PARCO RESISTENZA     DE AMICIS  \
count    10000.000000  10000.000000      10000.000000  10000.000000
mean        17.986600     18.407600         19.957500     20.599600
std         10.143555      8.938873          9.866794     10.115578
min          0.000000      0.000000          1.000000      0.000000
25%         11.000000     12.000000         13.000000     13.000000
50%         16.000000     17.000000         19.000000     19.000000
75%         23.000000     23.000000         25.000000     26.000000
max         78.000000     81.000000         94.000000     84.000000

           GHERARDI  SAN LAZZARO  FRANCHINI-ANGELONI  VIA CHIARINI  \
count  10000.000000  10000.00000        10000.000000  10000.000000
mean      20.773700     20.83930           21.235700     22.824100
std       11.104072     10.68403           11.078051     11.198272
min        0.000000      0.00000            0.000000      0.000000
25%       13.000000     13.00000           13.000000     15.000000
50%       19.000000     19.00000           20.000000     21.000000
75%       27.000000     27.00000           27.000000     29.000000
max      103.000000    106.00000          102.000000    109.000000

          BESENZONE       GAVELLO     SAVIGNANO        CAORLE  \
count  10000.000000  10000.000000  10000.000000  10000.000000
mean      24.003100     24.516700     24.520100     25.722900
std       12.023591     11.510881     11.441708     12.266498
min        0.000000      0.000000      0.000000      0.000000
25%       15.000000     16.000000     16.000000     17.000000
50%       22.000000     23.000000     23.000000     24.000000
75%       31.000000     31.000000     31.000000     32.000000
max       96.000000    118.000000     86.000000    119.000000

       PORTA SAN FELICE  VILLA FULVIA  PARCO MONTECUCCO  CASTELLARANO  \
count      10000.000000  10000.000000      10000.000000   10000.00000
```

mean	26.417800	27.040900	28.467500	29.25990
std	11.355384	12.139562	12.605024	11.63496
min	1.000000	1.000000	1.000000	1.00000
25%	18.000000	18.000000	19.000000	21.00000
50%	25.000000	25.000000	27.000000	28.00000
75%	33.000000	34.000000	36.000000	36.00000
max	93.000000	96.000000	102.000000	95.00000

	ROMA	CENTO	BOGOLESE	ZALAMELLA	MALCANTONE	\
count	10000.000000	10000.000000	10000.000000	10000.00000	10000.00000	
mean	29.280500	30.479100	32.877700	33.37780	36.01070	
std	12.934858	13.595722	13.294421	13.63159	14.66728	
min	1.000000	1.000000	2.000000	1.00000	2.00000	
25%	20.000000	21.000000	23.000000	24.00000	25.00000	
50%	27.000000	29.000000	31.000000	32.00000	34.00000	
75%	36.000000	38.000000	41.000000	41.00000	44.00000	
max	129.000000	114.000000	111.000000	107.00000	142.00000	

	S. LAZZARO	SAN FRANCESCO	S. ROCCO	CITTADELLA	REMESINA	\
count	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	
mean	37.437000	37.448500	37.503500	37.523700	37.595600	
std	14.503726	13.027944	14.430648	13.326762	14.564116	
min	3.000000	5.000000	2.000000	4.000000	2.000000	
25%	27.000000	28.000000	27.000000	28.000000	27.000000	
50%	36.000000	36.000000	36.000000	36.000000	36.000000	
75%	46.000000	45.000000	46.000000	46.000000	46.000000	
max	113.000000	124.000000	102.000000	111.000000	112.000000	

	PARADIGNA	SARAGAT	PARCO EDILCARANI	PARCO FERRARI	\
count	10000.00000	10000.00000	10000.000000	10000.000000	
mean	37.89760	39.28930	41.232000	42.321300	
std	14.99654	14.29132	13.525334	15.185438	
min	1.00000	3.00000	6.000000	4.000000	
25%	27.00000	29.00000	32.000000	32.000000	
50%	36.00000	38.00000	40.000000	41.000000	
75%	47.00000	48.00000	50.000000	52.000000	
max	127.00000	115.00000	114.000000	118.000000	

	ISONZO	GIORDANI-FARNESE	FLAMINIA	CENO	\
count	10000.000000	10000.000000	10000.000000	10000.000000	
mean	43.172900	47.321100	48.425500	49.438700	
std	15.451009	16.022736	17.191917	16.964829	
min	4.000000	5.000000	6.000000	5.000000	
25%	32.000000	36.000000	36.000000	37.000000	
50%	42.000000	46.000000	47.000000	48.000000	
75%	52.000000	57.000000	59.000000	60.000000	
max	136.000000	133.000000	135.000000	142.000000	

	GERBIDO	MONTEBELLO	GIARDINI	TIMAVO
count	10000.000000	10000.000000	10000.000000	10000.000000
mean	53.588700	55.750100	60.511900	66.443100
std	18.713069	16.823363	17.912815	20.057577
min	6.000000	5.000000	7.000000	13.000000
25%	40.000000	44.000000	48.000000	52.000000
50%	52.000000	55.000000	59.000000	65.000000
75%	65.000000	66.000000	72.000000	79.000000
max	160.000000	135.000000	150.000000	192.000000

[25]:
```
pd.set_option('display.max_columns', 500)
aux_results = pd.DataFrame(ritorno['inference_data'].posterior.
 ↪is_over_daily_limit.values.
 ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), columns=df.columns).
 ↪describe()
aux_results.sort_values('mean', axis=1, ascending=True)
```

[25]:

	CASTELLUCCIO	FEBBIO	CORTE BRUGNATELLA	SAVIGNANO DI RIGO	SAN LEO	\
count	10000.0	10000.0	10000.0	10000.0	10000.0	
mean	0.0	0.0	0.0	0.0	0.0	
std	0.0	0.0	0.0	0.0	0.0	
min	0.0	0.0	0.0	0.0	0.0	
25%	0.0	0.0	0.0	0.0	0.0	
50%	0.0	0.0	0.0	0.0	0.0	
75%	0.0	0.0	0.0	0.0	0.0	
max	0.0	0.0	0.0	0.0	0.0	

	VERUCCHIO	BADIA	MARECCHIA	GIARDINI MARGHERITA	\
count	10000.000000	10000.000000	10000.000000	10000.000000	
mean	0.000600	0.000900	0.006500	0.014600	
std	0.024489	0.029988	0.080364	0.119951	
min	0.000000	0.000000	0.000000	0.000000	
25%	0.000000	0.000000	0.000000	0.000000	
50%	0.000000	0.000000	0.000000	0.000000	
75%	0.000000	0.000000	0.000000	0.000000	
max	1.000000	1.000000	1.000000	1.000000	

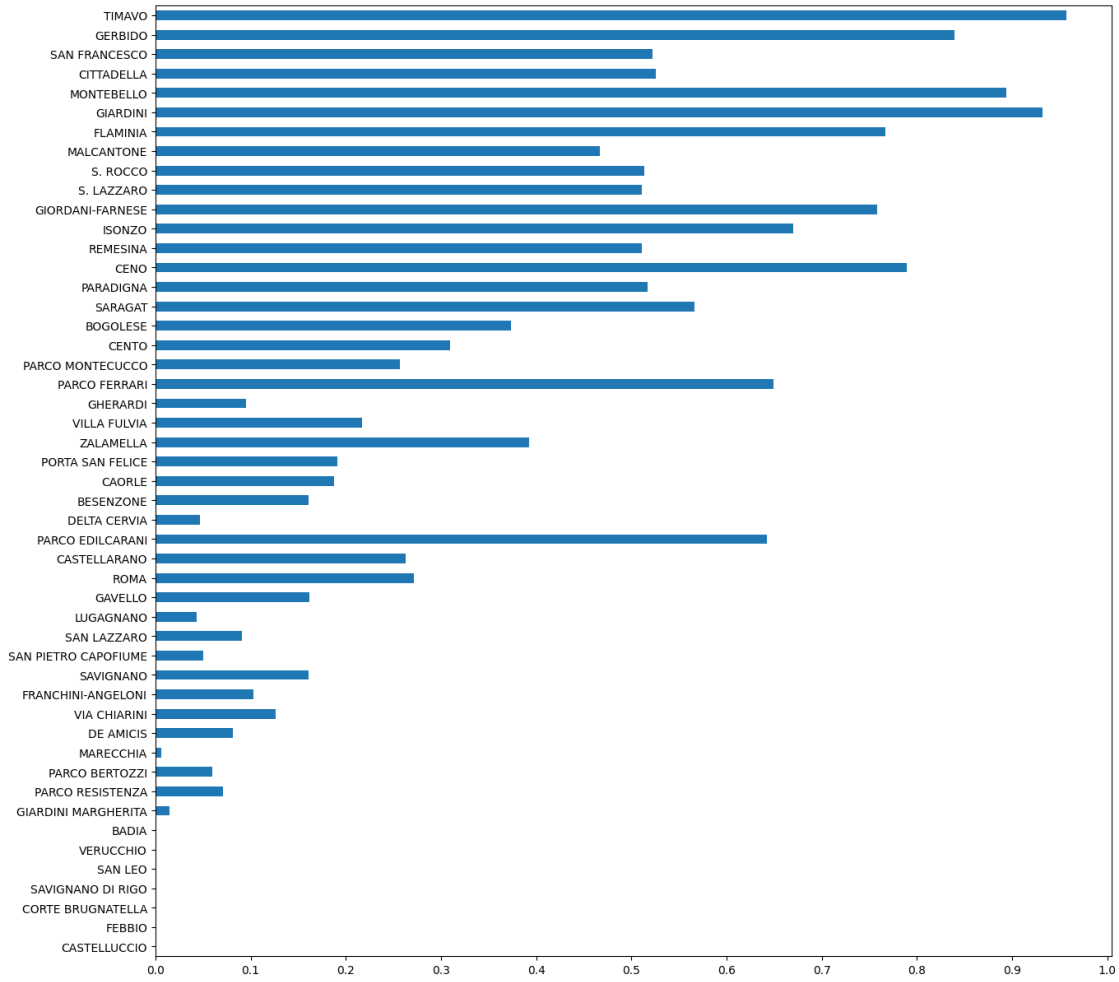
	LUGAGNANO	DELTA CERVIA	SAN PIETRO CAPOFIUME	PARCO BERTOZZI	\
count	10000.000000	10000.000000	10000.000000	10000.000000	
mean	0.043700	0.046800	0.049900	0.060100	
std	0.204437	0.211221	0.217749	0.237684	
min	0.000000	0.000000	0.000000	0.000000	
25%	0.000000	0.000000	0.000000	0.000000	
50%	0.000000	0.000000	0.000000	0.000000	
75%	0.000000	0.000000	0.000000	0.000000	
max	1.000000	1.000000	1.000000	1.000000	

```
       PARCO RESISTENZA     DE AMICIS  SAN LAZZARO      GHERARDI  \
count      10000.000000  10000.000000  10000.00000  10000.000000
mean           0.071300      0.081200      0.09130      0.095600
std            0.257338      0.273156      0.28805      0.294057
min            0.000000      0.000000      0.00000      0.000000
25%            0.000000      0.000000      0.00000      0.000000
50%            0.000000      0.000000      0.00000      0.000000
75%            0.000000      0.000000      0.00000      0.000000
max            1.000000      1.000000      1.00000      1.000000

       FRANCHINI-ANGELONI  VIA CHIARINI    BESENZONE     SAVIGNANO  \
count        10000.000000  10000.000000  10000.00000  10000.000000
mean             0.103400      0.126300      0.16060      0.160700
std              0.304496      0.332204      0.36718      0.367272
min              0.000000      0.000000      0.00000      0.000000
25%              0.000000      0.000000      0.00000      0.000000
50%              0.000000      0.000000      0.00000      0.000000
75%              0.000000      0.000000      0.00000      0.000000
max              1.000000      1.000000      1.00000      1.000000

           GAVELLO        CAORLE  PORTA SAN FELICE  VILLA FULVIA  \
count  10000.00000  10000.000000      10000.000000  10000.000000
mean       0.16150      0.187300          0.191400      0.217300
std        0.36801      0.390172          0.393423      0.412429
min        0.00000      0.000000          0.000000      0.000000
25%        0.00000      0.000000          0.000000      0.000000
50%        0.00000      0.000000          0.000000      0.000000
75%        0.00000      0.000000          0.000000      0.000000
max        1.00000      1.000000          1.000000      1.000000

       PARCO MONTECUCCO  CASTELLARANO          ROMA         CENTO  \
count      10000.000000  10000.000000  10000.000000  10000.000000
mean           0.256700      0.262800      0.271600      0.309200
std            0.436834      0.440177      0.444807      0.462187
min            0.000000      0.000000      0.000000      0.000000
25%            0.000000      0.000000      0.000000      0.000000
50%            0.000000      0.000000      0.000000      0.000000
75%            1.000000      1.000000      1.000000      1.000000
max            1.000000      1.000000      1.000000      1.000000

           BOGOLESE     ZALAMELLA    MALCANTONE    S. LAZZARO     REMESINA  \
count  10000.000000  10000.000000  10000.000000  10000.000000  10000.00000
mean       0.373200      0.392100      0.467000      0.510500      0.51070
std        0.483679      0.488243      0.498935      0.499915      0.49991
min        0.000000      0.000000      0.000000      0.000000      0.00000
25%        0.000000      0.000000      0.000000      0.000000      0.00000
```

```
50%        0.000000      0.000000      0.000000      1.000000      1.00000
75%        1.000000      1.000000      1.000000      1.000000      1.00000
max        1.000000      1.000000      1.000000      1.000000      1.00000

           S. ROCCO     PARADIGNA  SAN FRANCESCO    CITTADELLA       SARAGAT  \
count  10000.000000  10000.000000   10000.000000  10000.000000  10000.000000
mean       0.513100      0.517100       0.522200      0.525600      0.566600
std        0.499853      0.499732       0.499532      0.499369      0.495569
min        0.000000      0.000000       0.000000      0.000000      0.000000
25%        0.000000      0.000000       0.000000      0.000000      0.000000
50%        1.000000      1.000000       1.000000      1.000000      1.000000
75%        1.000000      1.000000       1.000000      1.000000      1.000000
max        1.000000      1.000000       1.000000      1.000000      1.000000

       PARCO EDILCARANI  PARCO FERRARI        ISONZO  GIORDANI-FARNESE  \
count      10000.000000    10000.00000  10000.000000      10000.000000
mean           0.641900        0.64950      0.670000          0.757900
std            0.479466        0.47715      0.470236          0.428376
min            0.000000        0.00000      0.000000          0.000000
25%            0.000000        0.00000      0.000000          1.000000
50%            1.000000        1.00000      1.000000          1.000000
75%            1.000000        1.00000      1.000000          1.000000
max            1.000000        1.00000      1.000000          1.000000

          FLAMINIA         CENO       GERBIDO    MONTEBELLO      GIARDINI  \
count  10000.00000  10000.00000  10000.000000  10000.000000  10000.000000
mean       0.76680      0.78890      0.839000      0.893700      0.932200
std        0.42289      0.40811      0.367549      0.308237      0.251415
min        0.00000      0.00000      0.000000      0.000000      0.000000
25%        1.00000      1.00000      1.000000      1.000000      1.000000
50%        1.00000      1.00000      1.000000      1.000000      1.000000
75%        1.00000      1.00000      1.000000      1.000000      1.000000
max        1.00000      1.00000      1.000000      1.000000      1.000000

            TIMAVO
count  10000.000000
mean       0.956900
std        0.203092
min        0.000000
25%        1.000000
50%        1.000000
75%        1.000000
max        1.000000
```

[26]:
```
aux_results.loc['mean',:].plot(kind='barh', figsize=(15,15), xticks=np.
 ↪linspace(0,1,11))
#res = plt.xticks(rotation = 30)
```

[26]: <AxesSubplot: >



[27]:
```
pd.set_option('display.max_columns', 500)
aux_results = pd.DataFrame(ritorno['inference_data'].posterior.
 ↪is_over_annual_limit.values.
 ↪reshape((aux_shape[0]*aux_shape[1],aux_shape[2])), columns=df.columns).
 ↪describe()
aux_results.sort_values('mean', axis=1, ascending=True)
```

[27]:

	CASTELLUCCIO	DELTA CERVIA	BESENZONE	PORTA SAN FELICE	ZALAMELLA	\
count	10000.0	10000.0	10000.0	10000.0	10000.0	
mean	0.0	0.0	0.0	0.0	0.0	
std	0.0	0.0	0.0	0.0	0.0	
min	0.0	0.0	0.0	0.0	0.0	
25%	0.0	0.0	0.0	0.0	0.0	
50%	0.0	0.0	0.0	0.0	0.0	
75%	0.0	0.0	0.0	0.0	0.0	

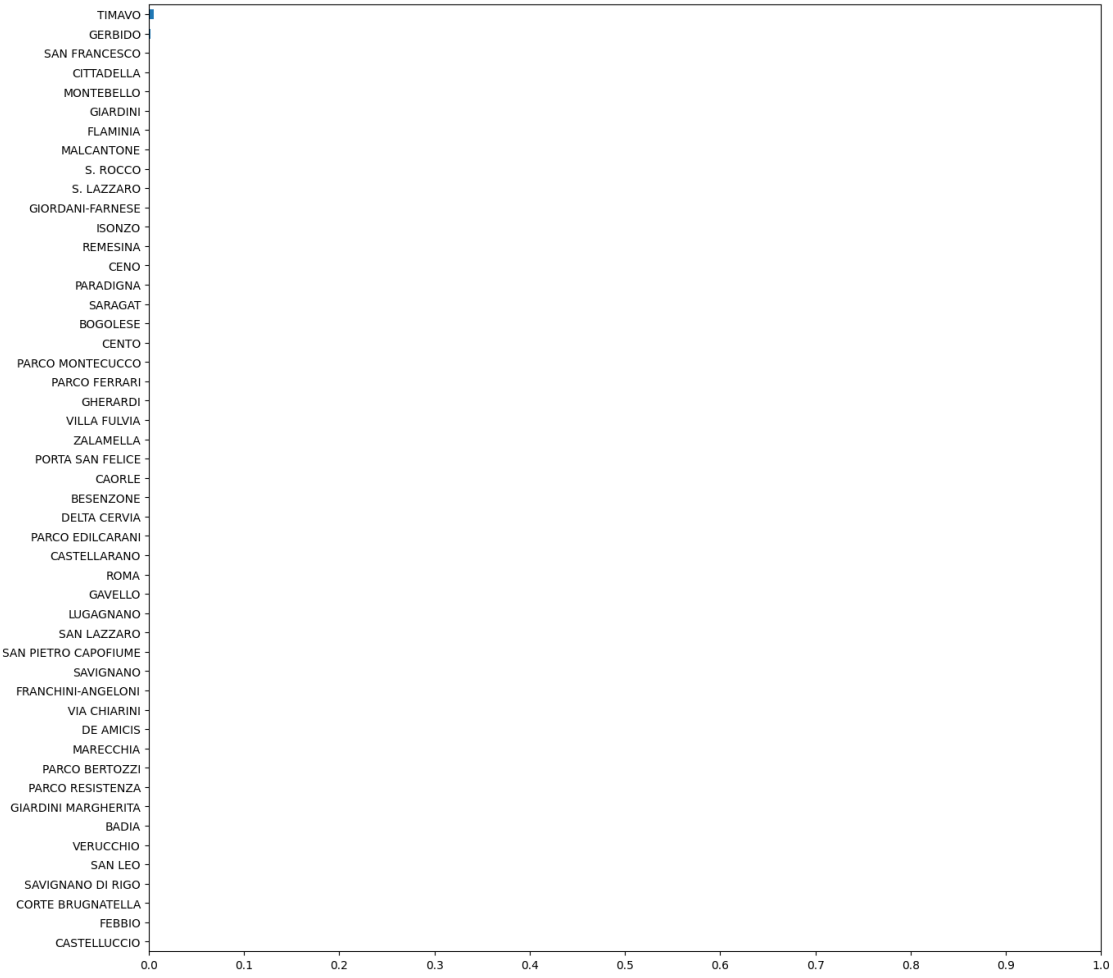
```
max            0.0           0.0        0.0               0.0        0.0

       VILLA FULVIA  GHERARDI  PARCO FERRARI  PARCO EDILCARANI  \
count       10000.0   10000.0        10000.0           10000.0
mean            0.0       0.0            0.0               0.0
std             0.0       0.0            0.0               0.0
min             0.0       0.0            0.0               0.0
25%             0.0       0.0            0.0               0.0
50%             0.0       0.0            0.0               0.0
75%             0.0       0.0            0.0               0.0
max             0.0       0.0            0.0               0.0

       PARCO MONTECUCCO  BOGOLESE  SARAGAT  REMESINA  S. LAZZARO  S. ROCCO  \
count           10000.0   10000.0  10000.0   10000.0     10000.0   10000.0
mean                0.0       0.0      0.0       0.0         0.0       0.0
std                 0.0       0.0      0.0       0.0         0.0       0.0
min                 0.0       0.0      0.0       0.0         0.0       0.0
25%                 0.0       0.0      0.0       0.0         0.0       0.0
50%                 0.0       0.0      0.0       0.0         0.0       0.0
75%                 0.0       0.0      0.0       0.0         0.0       0.0
max                 0.0       0.0      0.0       0.0         0.0       0.0

       CITTADELLA  SAN FRANCESCO    CENTO  CASTELLARANO   CAORLE  GAVELLO  \
count     10000.0        10000.0  10000.0       10000.0  10000.0  10000.0
mean          0.0            0.0      0.0           0.0      0.0      0.0
std           0.0            0.0      0.0           0.0      0.0      0.0
min           0.0            0.0      0.0           0.0      0.0      0.0
25%           0.0            0.0      0.0           0.0      0.0      0.0
50%           0.0            0.0      0.0           0.0      0.0      0.0
75%           0.0            0.0      0.0           0.0      0.0      0.0
max           0.0            0.0      0.0           0.0      0.0      0.0

       VERUCCHIO  CORTE BRUGNATELLA     ROMA    BADIA  GIARDINI MARGHERITA  \
count    10000.0            10000.0  10000.0  10000.0              10000.0
mean         0.0                0.0      0.0      0.0                  0.0
std          0.0                0.0      0.0      0.0                  0.0
min          0.0                0.0      0.0      0.0                  0.0
25%          0.0                0.0      0.0      0.0                  0.0
50%          0.0                0.0      0.0      0.0                  0.0
75%          0.0                0.0      0.0      0.0                  0.0
max          0.0                0.0      0.0      0.0                  0.0

       PARCO RESISTENZA  PARCO BERTOZZI  SAVIGNANO DI RIGO  MARECCHIA  \
count           10000.0         10000.0            10000.0    10000.0
mean                0.0             0.0                0.0        0.0
std                 0.0             0.0                0.0        0.0
min                 0.0             0.0                0.0        0.0
```

```
25%                0.0             0.0                0.0        0.0
50%                0.0             0.0                0.0        0.0
75%                0.0             0.0                0.0        0.0
max                0.0             0.0                0.0        0.0

       VIA CHIARINI  FRANCHINI-ANGELONI  SAVIGNANO   FEBBIO  \
count       10000.0             10000.0    10000.0  10000.0
mean            0.0                 0.0        0.0      0.0
std             0.0                 0.0        0.0      0.0
min             0.0                 0.0        0.0      0.0
25%             0.0                 0.0        0.0      0.0
50%             0.0                 0.0        0.0      0.0
75%             0.0                 0.0        0.0      0.0
max             0.0                 0.0        0.0      0.0

       SAN PIETRO CAPOFIUME  SAN LAZZARO  LUGAGNANO  DE AMICIS  SAN LEO  \
count                10000.0      10000.0    10000.0    10000.0  10000.0
mean                     0.0          0.0        0.0        0.0      0.0
std                      0.0          0.0        0.0        0.0      0.0
min                      0.0          0.0        0.0        0.0      0.0
25%                      0.0          0.0        0.0        0.0      0.0
50%                      0.0          0.0        0.0        0.0      0.0
75%                      0.0          0.0        0.0        0.0      0.0
max                      0.0          0.0        0.0        0.0      0.0

       MALCANTONE   PARADIGNA      ISONZO  GIORDANI-FARNESE      FLAMINIA  \
count  10000.0000  10000.0000  10000.0000        10000.0000  10000.000000
mean       0.0001      0.0001      0.0001            0.0001      0.000200
std        0.0100      0.0100      0.0100            0.0100      0.014141
min        0.0000      0.0000      0.0000            0.0000      0.000000
25%        0.0000      0.0000      0.0000            0.0000      0.000000
50%        0.0000      0.0000      0.0000            0.0000      0.000000
75%        0.0000      0.0000      0.0000            0.0000      0.000000
max        1.0000      1.0000      1.0000            1.0000      1.000000

         MONTEBELLO          CENO      GIARDINI      GERBIDO        TIMAVO
count  10000.000000  10000.000000  10000.000000  10000.00000  10000.000000
mean       0.000200      0.000300      0.000900      0.00180      0.005600
std        0.014141      0.017319      0.029988      0.04239      0.074627
min        0.000000      0.000000      0.000000      0.00000      0.000000
25%        0.000000      0.000000      0.000000      0.00000      0.000000
50%        0.000000      0.000000      0.000000      0.00000      0.000000
75%        0.000000      0.000000      0.000000      0.00000      0.000000
max        1.000000      1.000000      1.000000      1.00000      1.000000
```

[28]:
```
aux_results.loc['mean',:].plot(kind='barh', figsize=(15,15), xticks=np.
 ↪linspace(0,1,11))
```

```
#res = plt.xticks(rotation = 30)
```

[28]: <AxesSubplot: >



[29]:
```
y_post_pred = ritorno['inference_data'].posterior.y_post_pred.to_numpy()
y_post_pred = y_post_pred.reshape(y_post_pred.shape[0]*y_post_pred.shape[1],␣
 ↪y_post_pred.shape[2], y_post_pred.shape[3])
y_post_pred.shape
```

[29]: (10000, 365, 49)

[30]:
```
import ipywidgets as widgets
from ipywidgets import HBox, VBox
from IPython.display import display
```

[31]:
```
@widgets.interact(stazione = df.columns)
def f(stazione):
    col_map = sns.light_palette((20, 75, 70), input='husl', as_cmap=True)

    plt.figure(figsize=(14,8))
    ax = plt.subplot(1,1,1)

    idx_stazione = df.columns.to_list().index(stazione)

    """
    sns.lineplot(np.transpose(y_post_pred[0:50,:,idx_stazione]))
    """

    lower_lim = np.zeros(len(df.index))
    upper_lim = np.zeros(len(df.index))
    for i in range(len(df.index)):
        lower_lim[i] = np.percentile(y_post_pred[:,i,idx_stazione],2.5)
        upper_lim[i] = np.percentile(y_post_pred[:,i,idx_stazione],97.5)


#    sns.lineplot(lower_lim)
#    sns.lineplot(upper_lim)

    for i in range(len(df.index)):
        ax.add_patch(mplt.patches.
 ↪Rectangle((i,lower_lim[i]),1,upper_lim[i]-lower_lim[i], fill=True,␣
 ↪color=col_map(180)))

    sns.lineplot(df[stazione])
    sns.lineplot(np.mean(y_post_pred[:,:,idx_stazione], axis=0))


    index = 0
    for line in ax.get_lines():
        if index == 0:
            col_map = sns.dark_palette((230,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(155))
        else:
            col_map = sns.dark_palette((10,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(175))
        index += 1

    plt.ylim(bottom=0,top=2.5)

    primo_giorno = datetime.date(2018,1,1)
    date_da_segnare = []
    date_da_segnare_posizioni = []
```

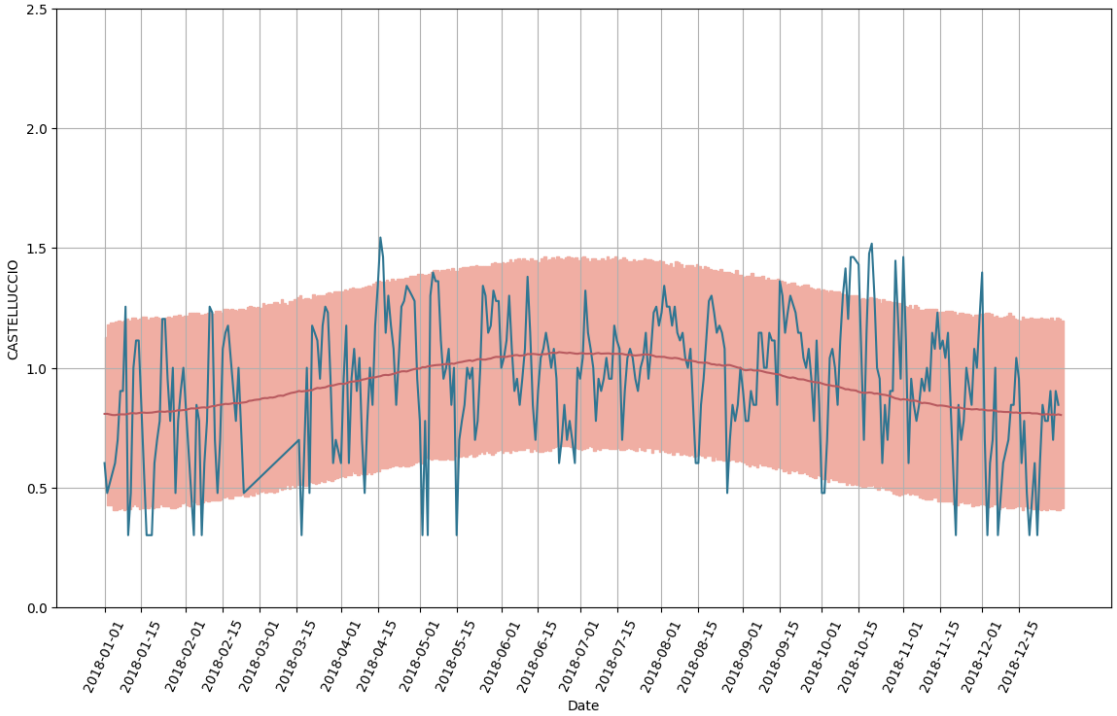
```
    for i in range(12):
        date_da_segnare.append(datetime.date(2018,i+1,1))
        date_da_segnare_posizioni.append((date_da_segnare[2*i] - primo_giorno).
↪days)
        date_da_segnare.append(datetime.date(2018,i+1,15))
        date_da_segnare_posizioni.append((date_da_segnare[2*i+1] -␣
↪primo_giorno).days)
        date_da_segnare[2*i] = date_da_segnare[2*i].isoformat()
        date_da_segnare[2*i+1] = date_da_segnare[2*i+1].isoformat()

    plt.xticks(date_da_segnare_posizioni,date_da_segnare,rotation=65)
    plt.tick_params(
        axis='x',          # changes apply to the x-axis
        which='both',      # both major and minor ticks are affected
        bottom=True,      # ticks along the bottom edge are off
        top=False,         # ticks along the top edge are off
        labelbottom=True)
    plt.grid()

    """
    ax.get_legend().remove()
    col_vals = np.linspace(1,255,num=len(df.columns))
    index = 0
    for line in ax.get_lines():
        if(index == len(ax.get_lines()) - 1):
            col_map = sns.dark_palette((230,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(175))
            continue
        if(index == len(ax.get_lines()) - 2):
            col_map = sns.dark_palette((120,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(175))
            index += 1
            continue

        #line.set_c(col_map(int(np.round(col_vals[index]))))
        line.set_c(col_map(220))
        line.set_alpha(0.3)
        index += 1
    """



    plt.show()
```

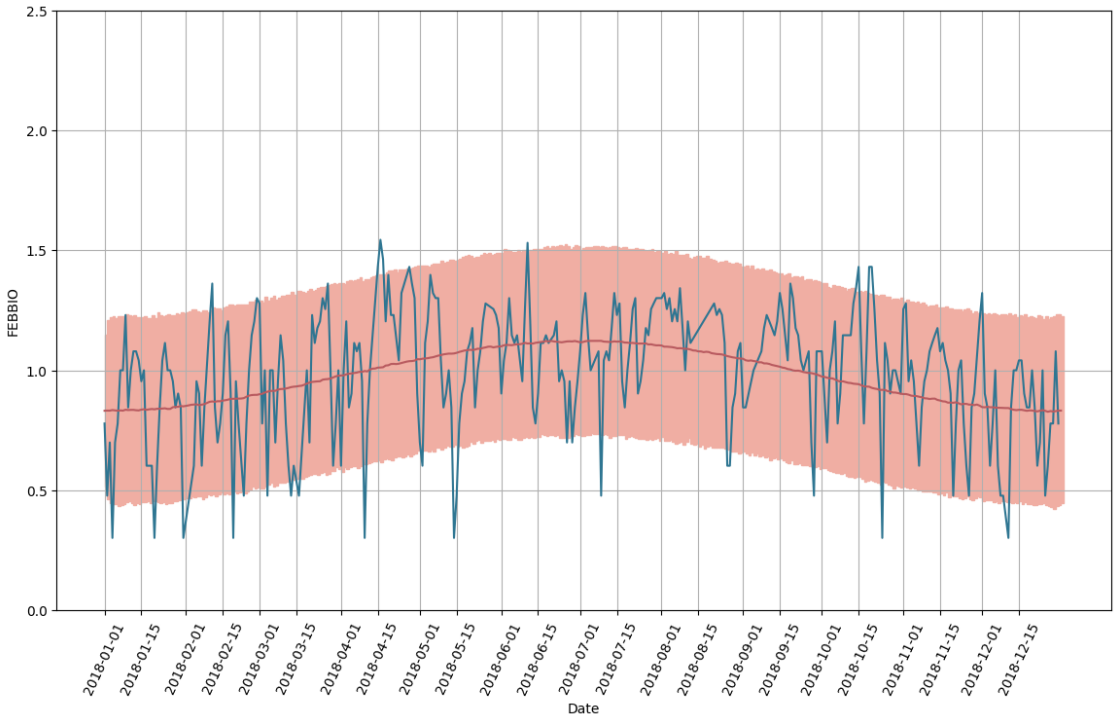
```
interactive(children=(Dropdown(description='stazione', options=('CASTELLUCCIO',␣
↪'FEBBIO', 'CORTE BRUGNATELLA',…
```

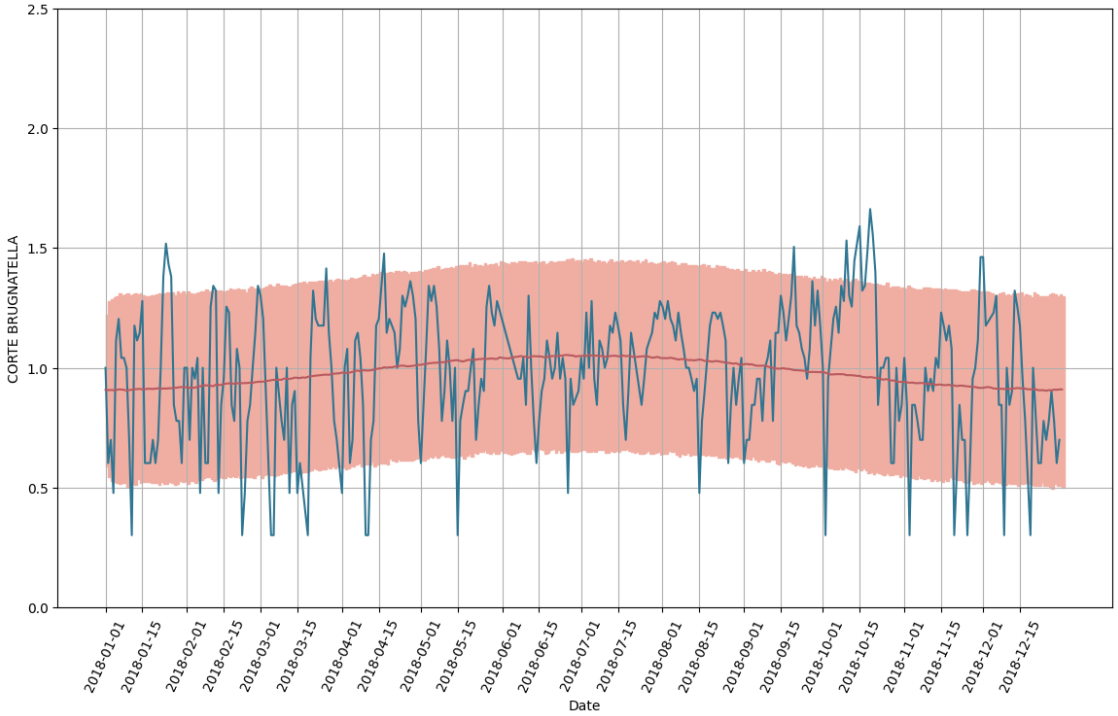
[32]:
```
def f(stazione):
    col_map = sns.light_palette((20, 75, 70), input='husl', as_cmap=True)

    plt.figure(figsize=(14,8))
    ax = plt.subplot(1,1,1)

    idx_stazione = df.columns.to_list().index(stazione)

    """
    sns.lineplot(np.transpose(y_post_pred[0:50,:,idx_stazione]))
    """

    lower_lim = np.zeros(len(df.index))
    upper_lim = np.zeros(len(df.index))
    for i in range(len(df.index)):
        lower_lim[i] = np.percentile(y_post_pred[:,i,idx_stazione],2.5)
        upper_lim[i] = np.percentile(y_post_pred[:,i,idx_stazione],97.5)


#    sns.lineplot(lower_lim)
#    sns.lineplot(upper_lim)

    for i in range(len(df.index)):
        ax.add_patch(mplt.patches.
 ↪Rectangle((i,lower_lim[i]),1,upper_lim[i]-lower_lim[i], fill=True,␣
 ↪color=col_map(180)))

    sns.lineplot(df[stazione])
    sns.lineplot(np.mean(y_post_pred[:,:,idx_stazione], axis=0))


    index = 0
    for line in ax.get_lines():
        if index == 0:
            col_map = sns.dark_palette((230,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(155))
        else:
            col_map = sns.dark_palette((10,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(175))
        index += 1

    plt.ylim(bottom=0,top=2.5)

    primo_giorno = datetime.date(2018,1,1)
    date_da_segnare = []
    date_da_segnare_posizioni = []
```

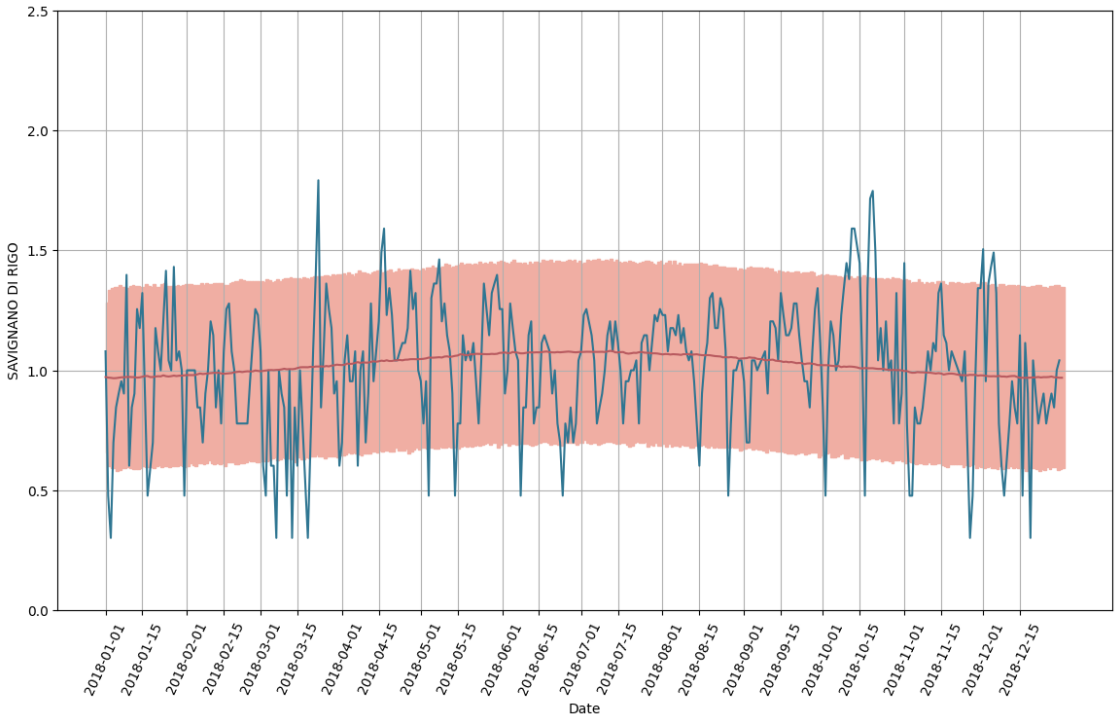
```
    for i in range(12):
        date_da_segnare.append(datetime.date(2018,i+1,1))
        date_da_segnare_posizioni.append((date_da_segnare[2*i] - primo_giorno).
↪days)
        date_da_segnare.append(datetime.date(2018,i+1,15))
        date_da_segnare_posizioni.append((date_da_segnare[2*i+1] -␣
↪primo_giorno).days)
        date_da_segnare[2*i] = date_da_segnare[2*i].isoformat()
        date_da_segnare[2*i+1] = date_da_segnare[2*i+1].isoformat()

    plt.xticks(date_da_segnare_posizioni,date_da_segnare,rotation=65)
    plt.tick_params(
        axis='x',          # changes apply to the x-axis
        which='both',      # both major and minor ticks are affected
        bottom=True,      # ticks along the bottom edge are off
        top=False,         # ticks along the top edge are off
        labelbottom=True)
    plt.grid()

    """
    ax.get_legend().remove()
    col_vals = np.linspace(1,255,num=len(df.columns))
    index = 0
    for line in ax.get_lines():
        if(index == len(ax.get_lines()) - 1):
            col_map = sns.dark_palette((230,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(175))
            continue
        if(index == len(ax.get_lines()) - 2):
            col_map = sns.dark_palette((120,90,65), input='husl', as_cmap=True)
            line.set_c(col_map(175))
            index += 1
            continue

        #line.set_c(col_map(int(np.round(col_vals[index]))))
        line.set_c(col_map(220))
        line.set_alpha(0.3)
        index += 1
    """



    plt.show()
```

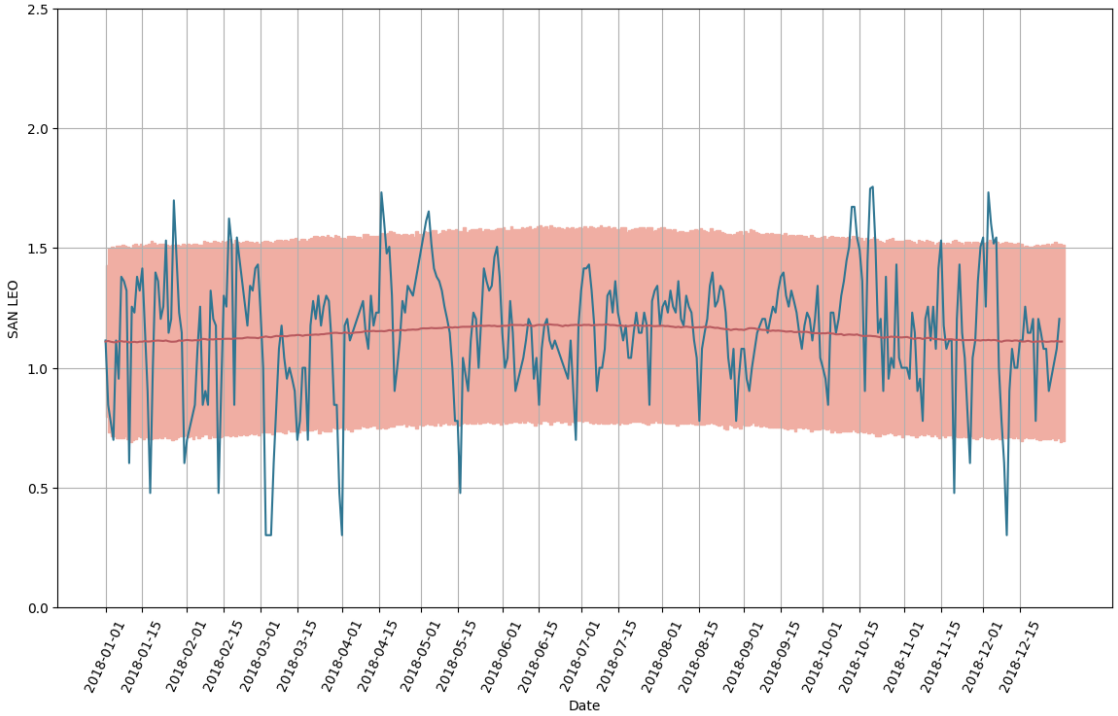
[33]:
```
for stazione in df.columns:
    f(stazione)
```

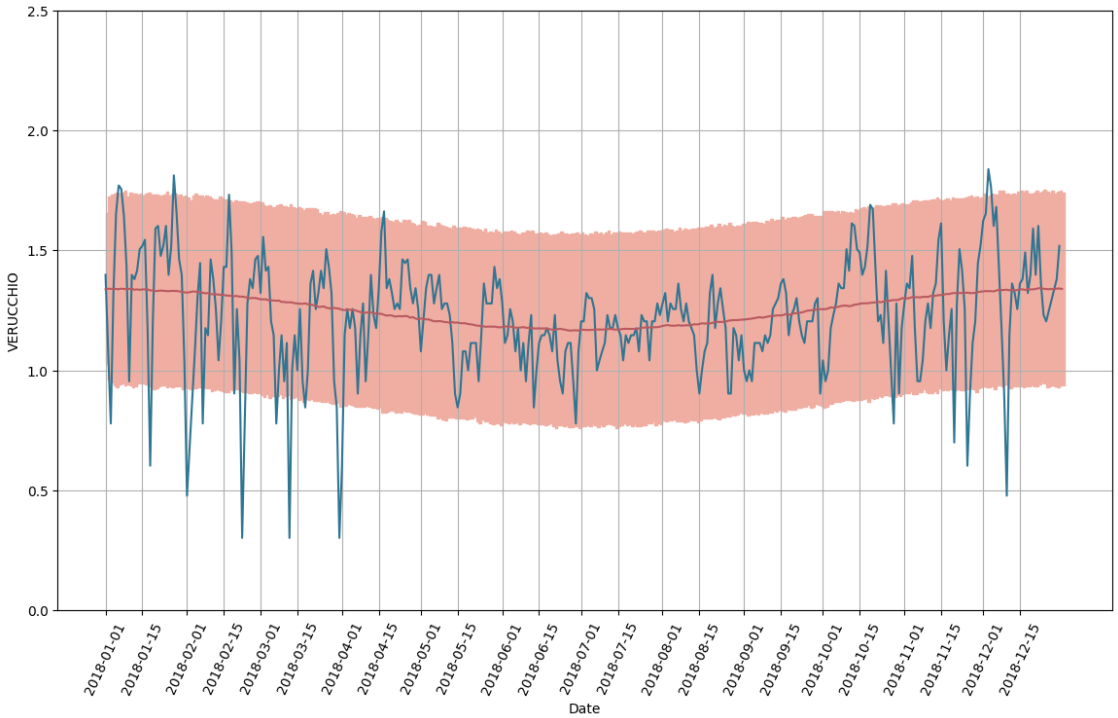

CASTELLUCCIO
2.5
2.0
1.5
1.0
0.5
0.0
2018-01-01
2018-01-15
2018-02-01
2018-02-15
2018-03-01
2018-03-15
2018-04-01
2018-04-15
2018-05-01
2018-05-15
2018-06-01
2018-06-15
2018-07-01
2018-07-15
2018-08-01
2018-08-15
2018-09-01
2018-09-15
2018-10-01
2018-10-15
2018-11-01
2018-11-15
2018-12-01
2018-12-15
Date

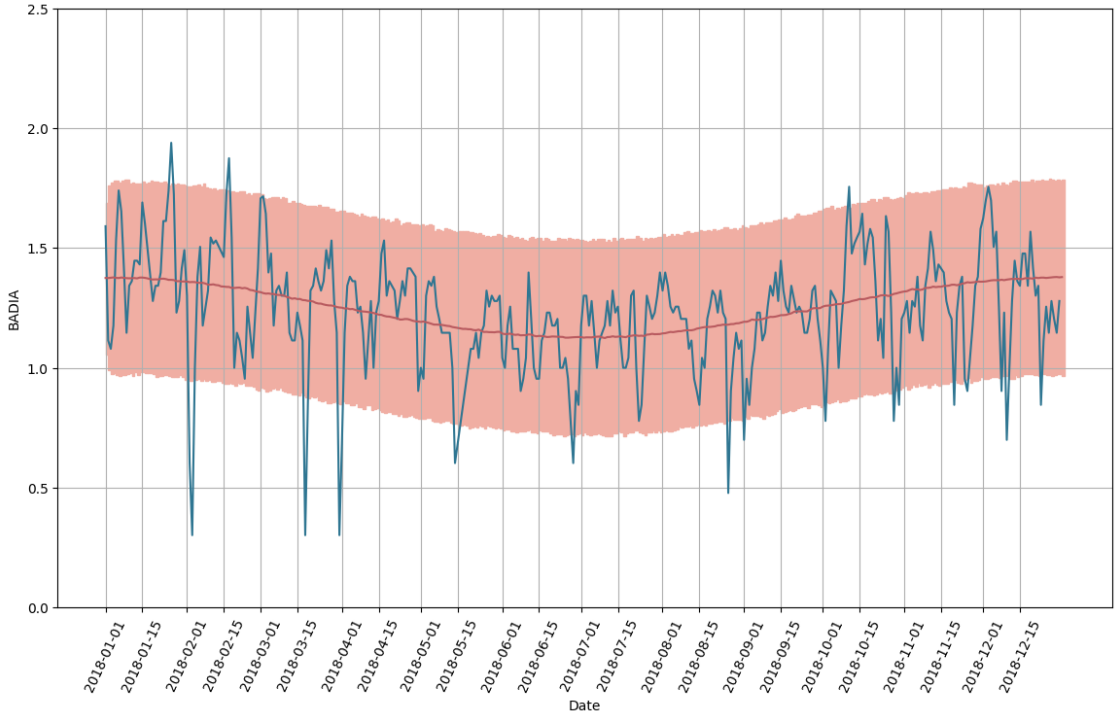

FEBBIO
2.5
2.0
1.5
1.0
0.5
0.0
2018-01-01
2018-01-15
2018-02-01
2018-02-15
2018-03-01
2018-03-15
2018-04-01
2018-04-15
2018-05-01
2018-05-15
2018-06-01
2018-06-15
2018-07-01
2018-07-15
2018-08-01
2018-08-15
2018-09-01
2018-09-15
2018-10-01
2018-10-15
2018-11-01
2018-11-15
2018-12-01
2018-12-15
Date


CORTE BRUGNATELLA
2.5
2.0
1.5
1.0
0.5
0.0
2018-01-01
2018-01-15
2018-02-01
2018-02-15
2018-03-01
2018-03-15
2018-04-01
2018-04-15
2018-05-01
2018-05-15
2018-06-01
2018-06-15
2018-07-01
2018-07-15
2018-08-01
2018-08-15
2018-09-01
2018-09-15
2018-10-01
2018-10-15
2018-11-01
2018-11-15
2018-12-01
2018-12-15
Date


SAVIGNANO DI RIGO
2.5
2.0
1.5
1.0
0.5
0.0
2018-01-01
2018-01-15
2018-02-01
2018-02-15
2018-03-01
2018-03-15
2018-04-01
2018-04-15
2018-05-01
2018-05-15
2018-06-01
2018-06-15
2018-07-01
2018-07-15
2018-08-01
2018-08-15
2018-09-01
2018-09-15
2018-10-01
2018-10-15
2018-11-01
2018-11-15
2018-12-01
2018-12-15
Date


SAN LEO
Date
2.5
2.0
1.5
1.0
0.5
0.0
2018-01-01
2018-01-15
2018-02-01
2018-02-15
2018-03-01
2018-03-15
2018-04-01
2018-04-15
2018-05-01
2018-05-15
2018-06-01
2018-06-15
2018-07-01
2018-07-15
2018-08-01
2018-08-15
2018-09-01
2018-09-15
2018-10-01
2018-10-15
2018-11-01
2018-11-15
2018-12-01
2018-12-15


VERUCCHIO
Date
2.5
2.0
1.5
1.0
0.5
0.0
2018-01-01
2018-01-15
2018-02-01
2018-02-15
2018-03-01
2018-03-15
2018-04-01
2018-04-15
2018-05-01
2018-05-15
2018-06-01
2018-06-15
2018-07-01
2018-07-15
2018-08-01
2018-08-15
2018-09-01
2018-09-15
2018-10-01
2018-10-15
2018-11-01
2018-11-15
2018-12-01
2018-12-15


BADIA
Date
2.5
2.0
1.5
1.0
0.5
0.0
2018-01-01
2018-01-15
2018-02-01
2018-02-15
2018-03-01
2018-03-15
2018-04-01
2018-04-15
2018-05-01
2018-05-15
2018-06-01
2018-06-15
2018-07-01
2018-07-15
2018-08-01
2018-08-15
2018-09-01
2018-09-15
2018-10-01
2018-10-15
2018-11-01
2018-11-15
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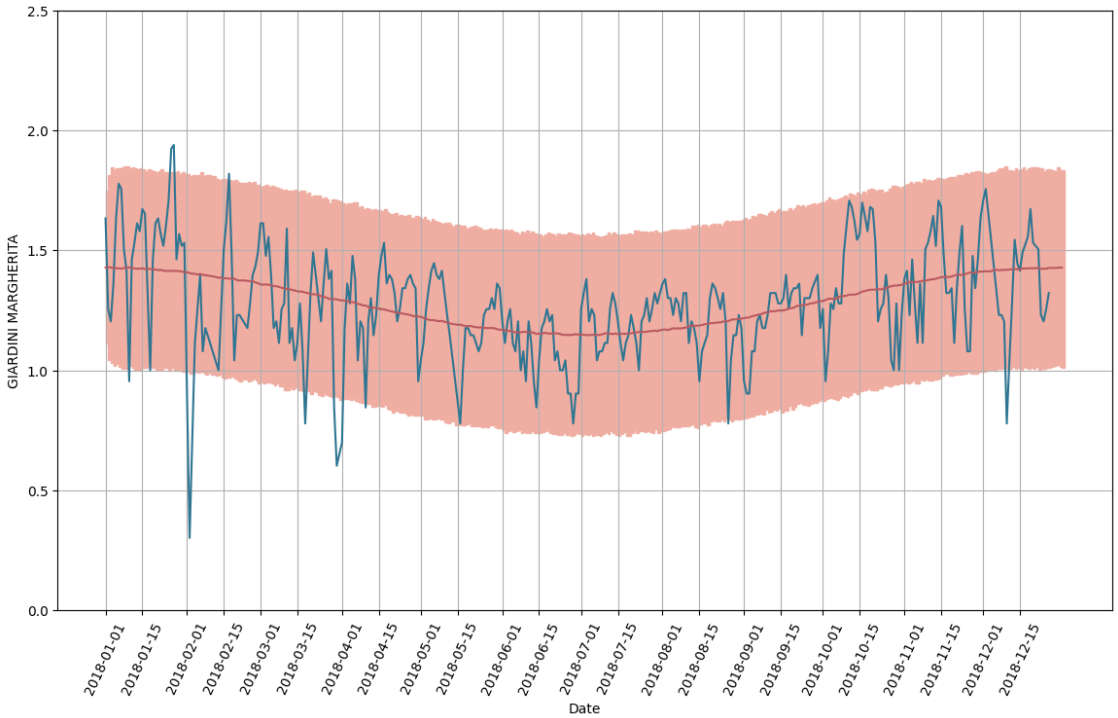
2018-12-15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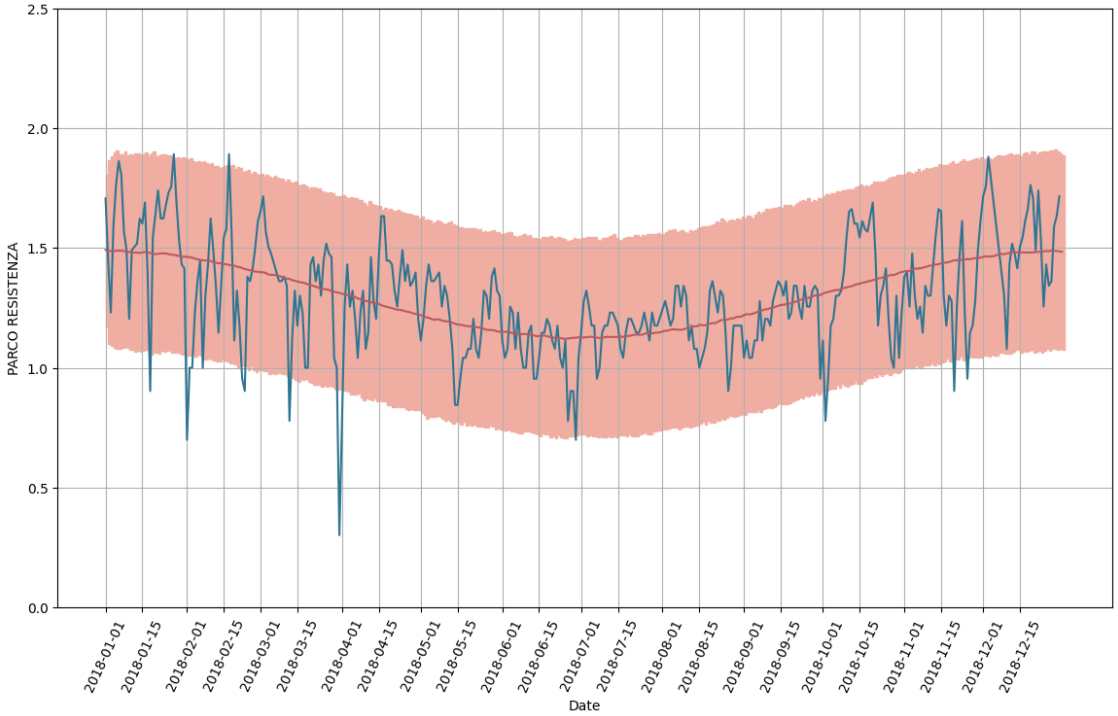
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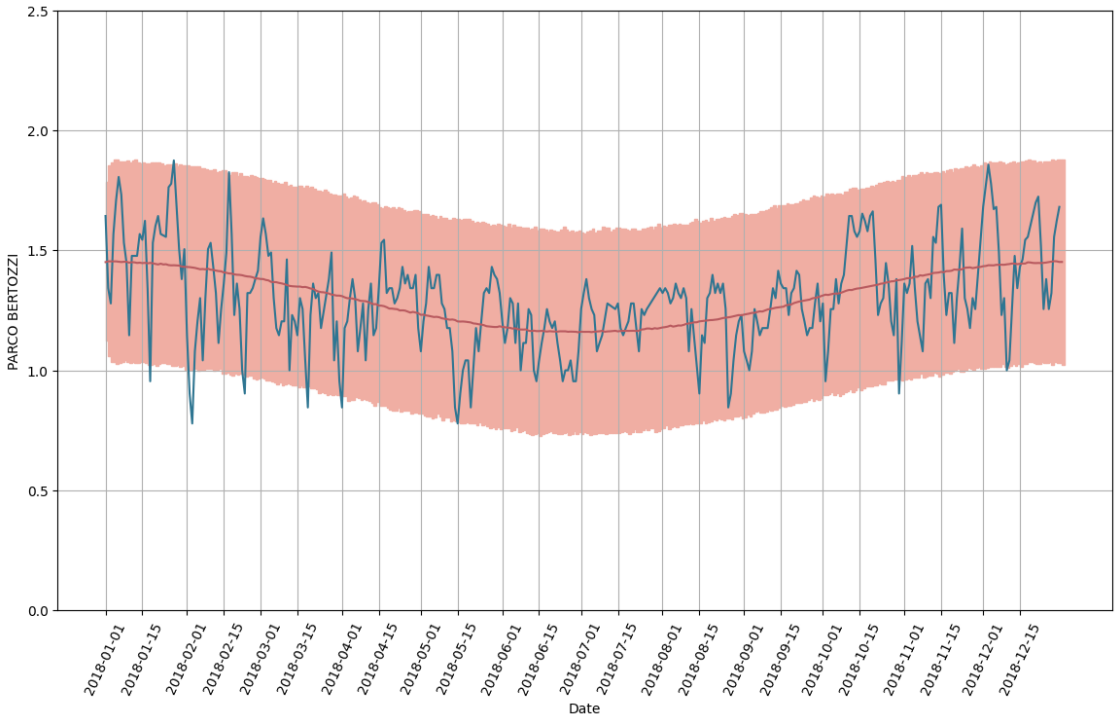
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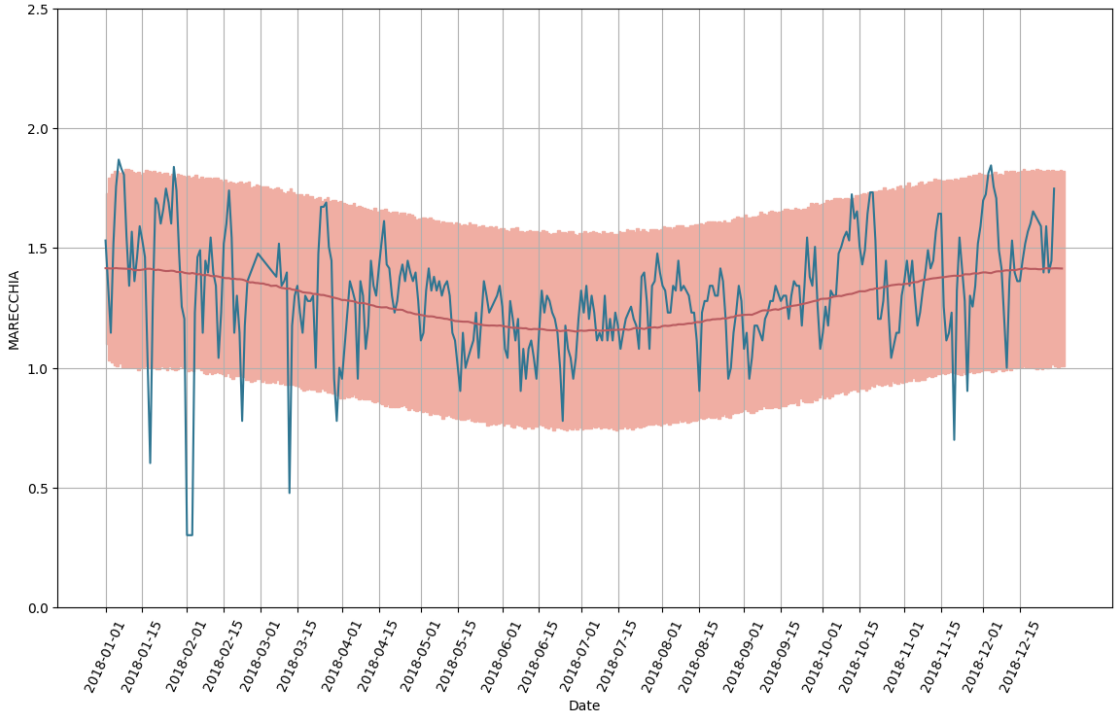
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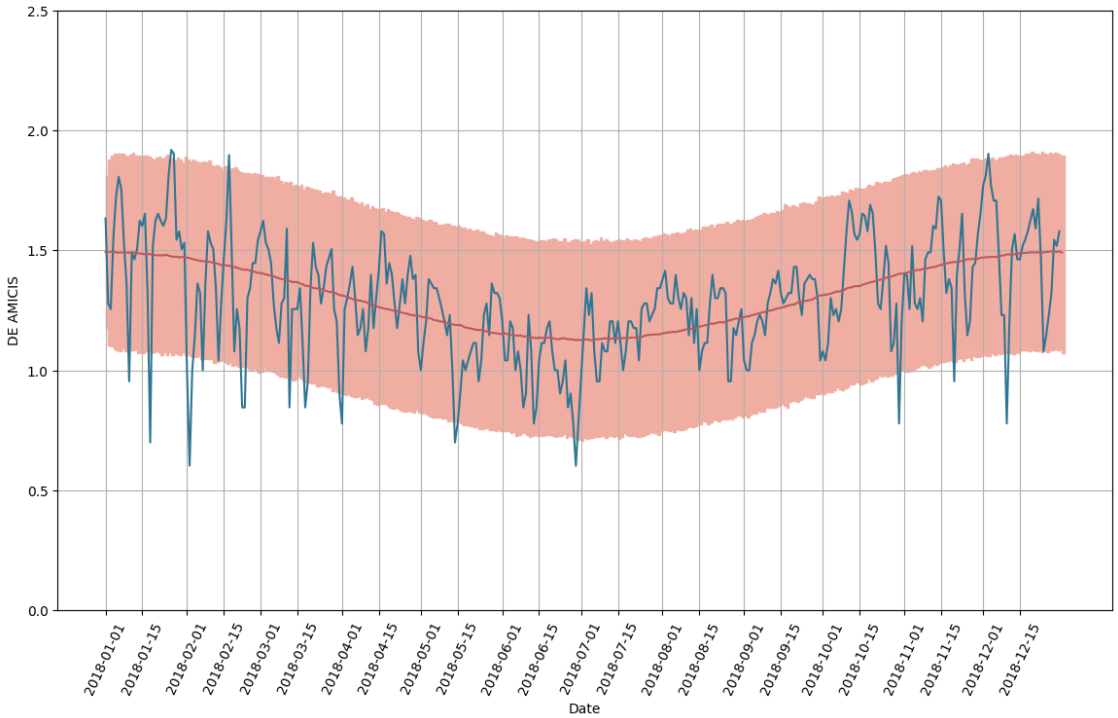
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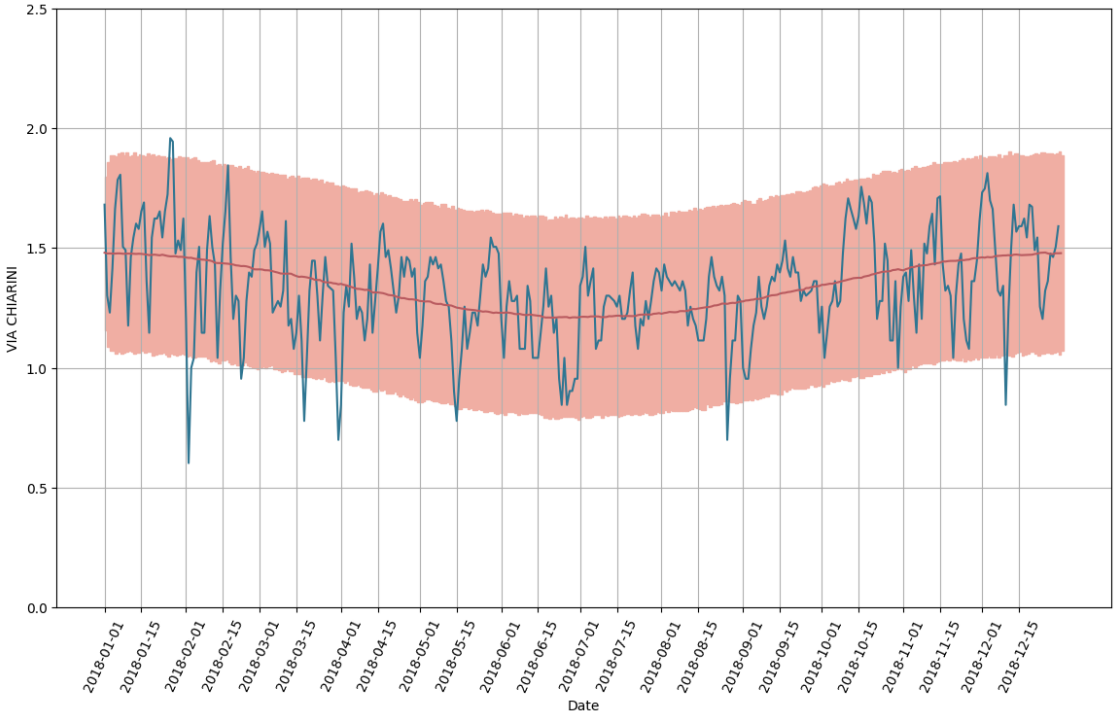
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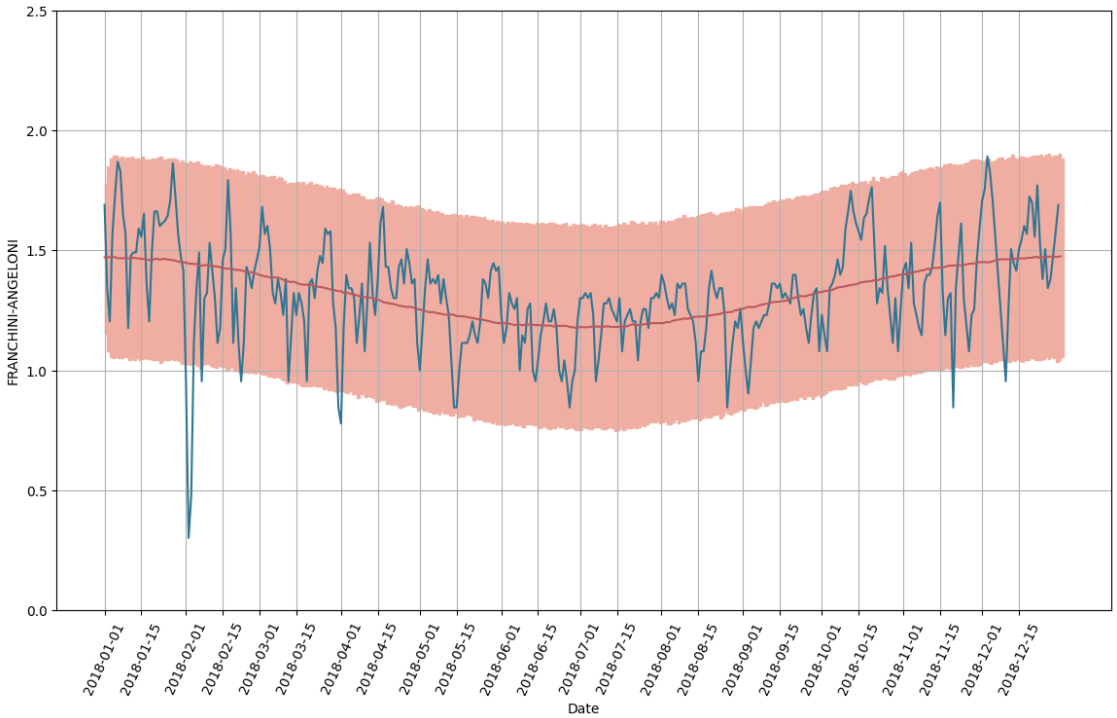
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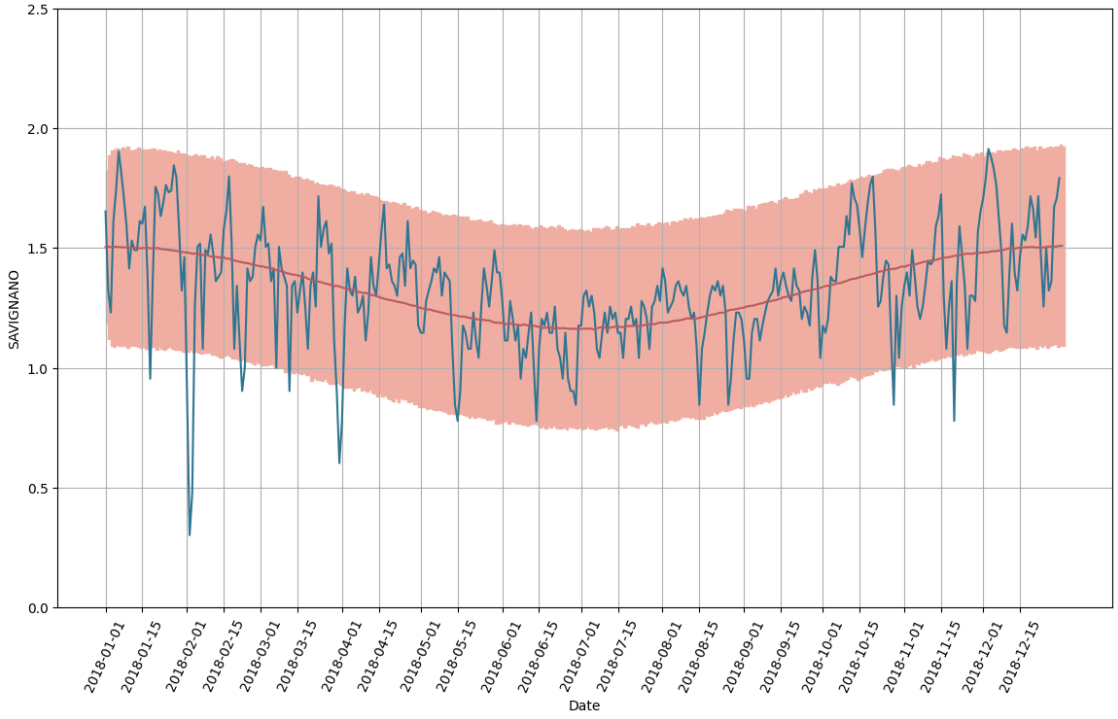
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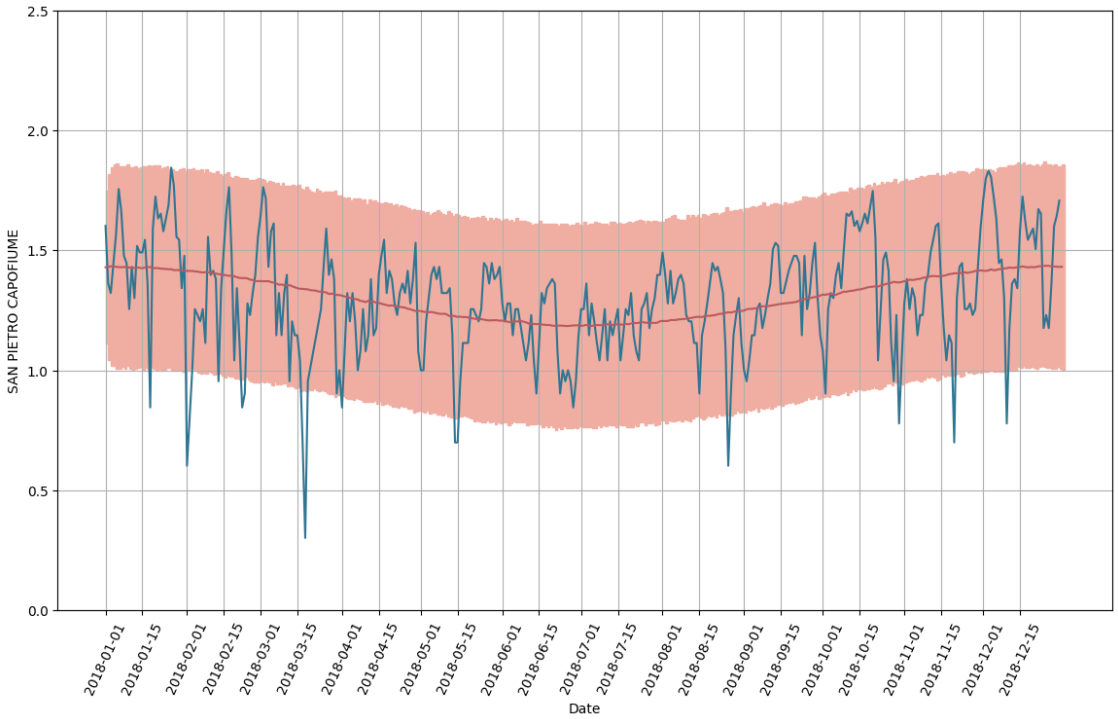
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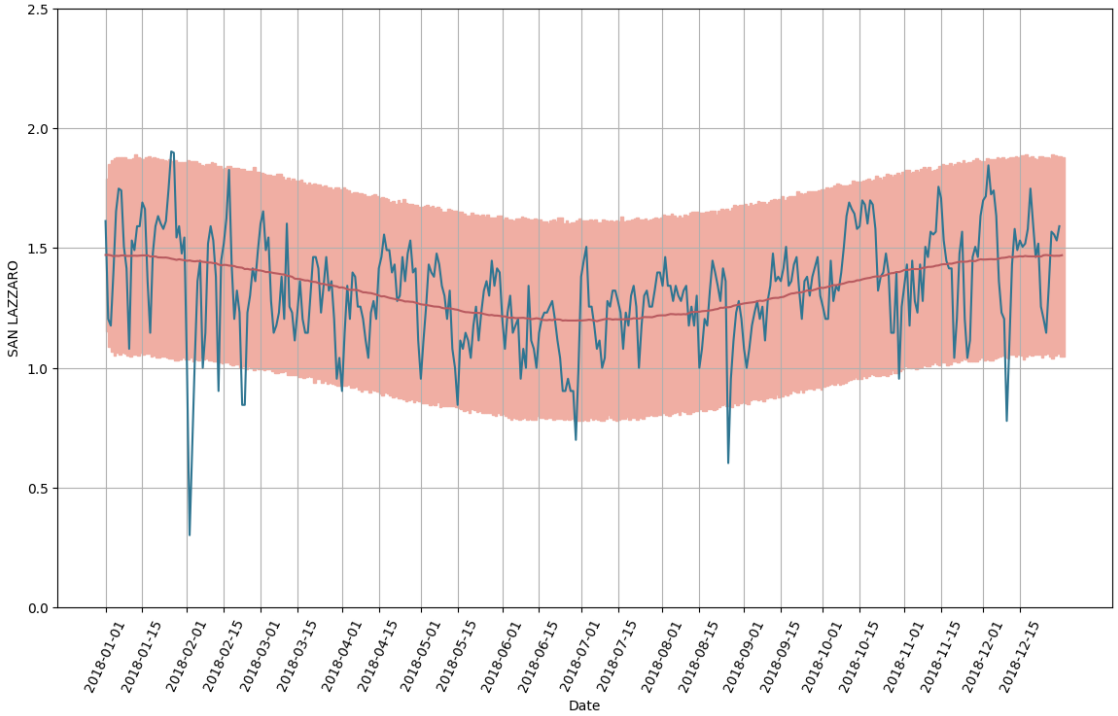
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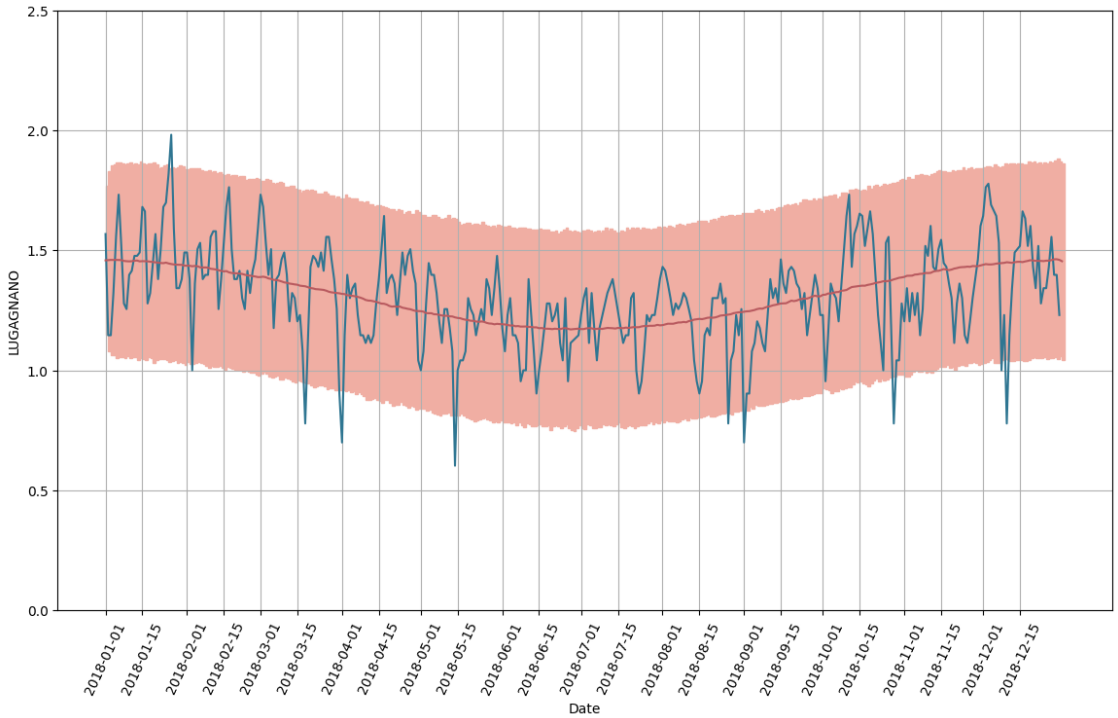
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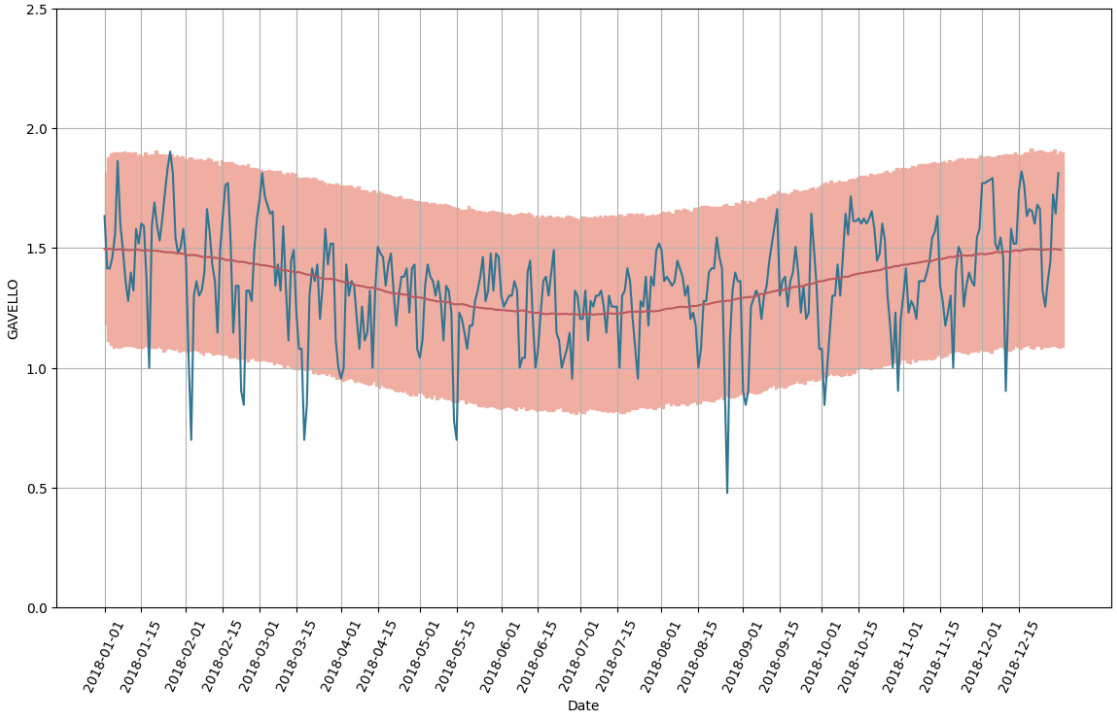
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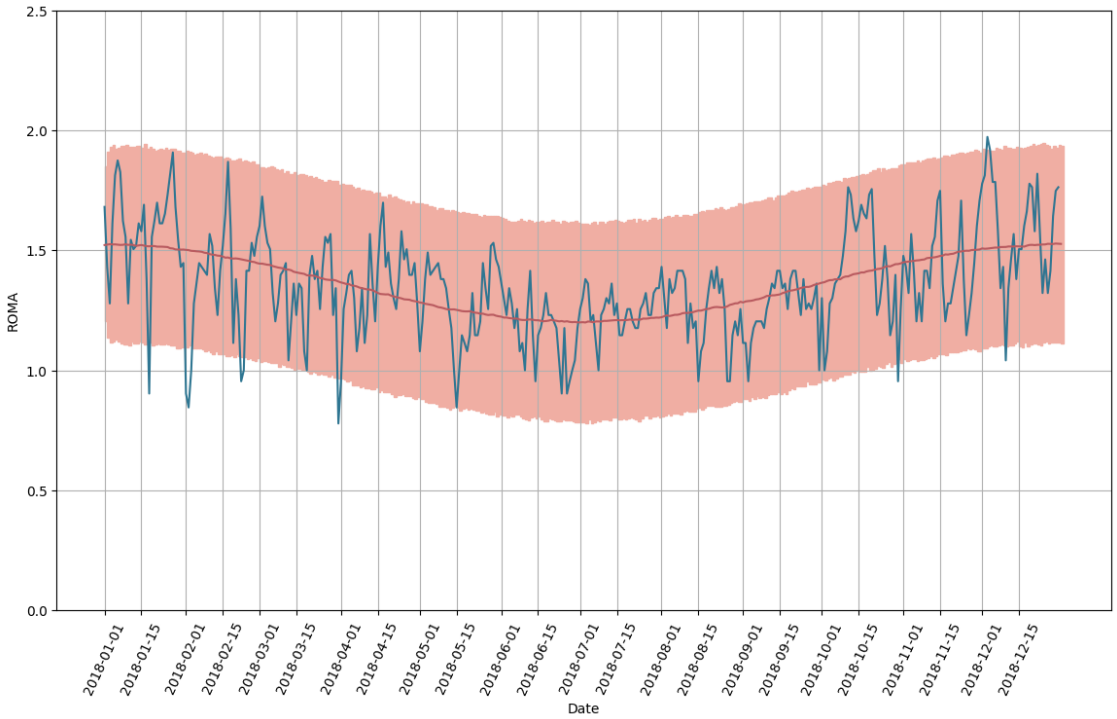
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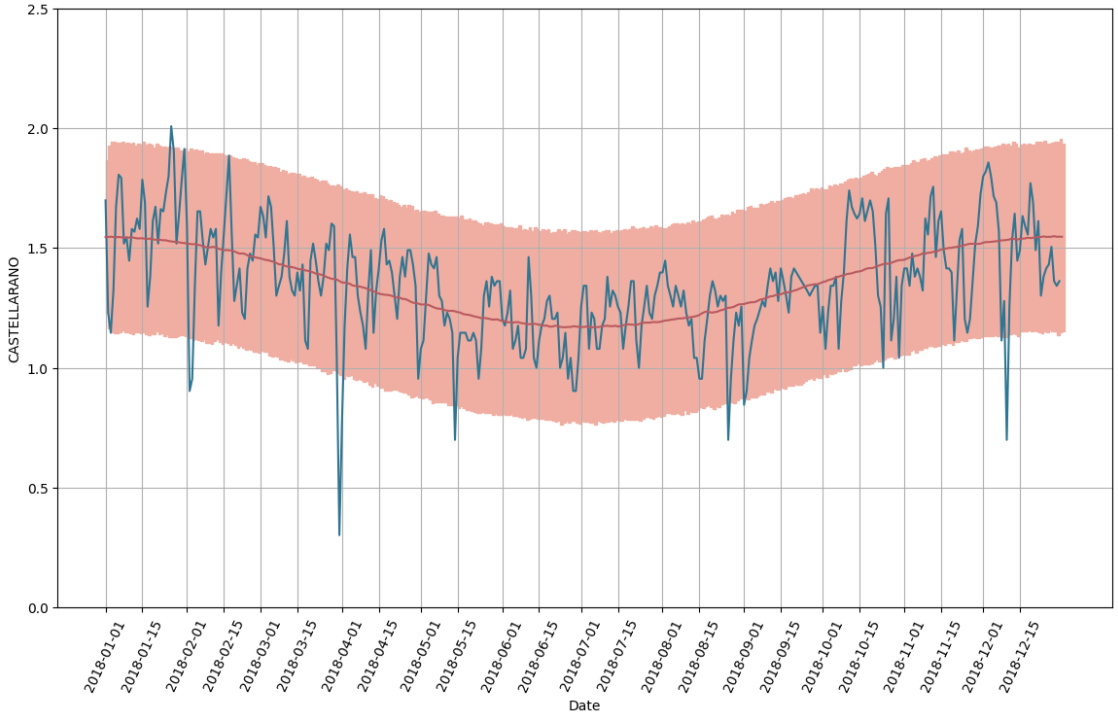
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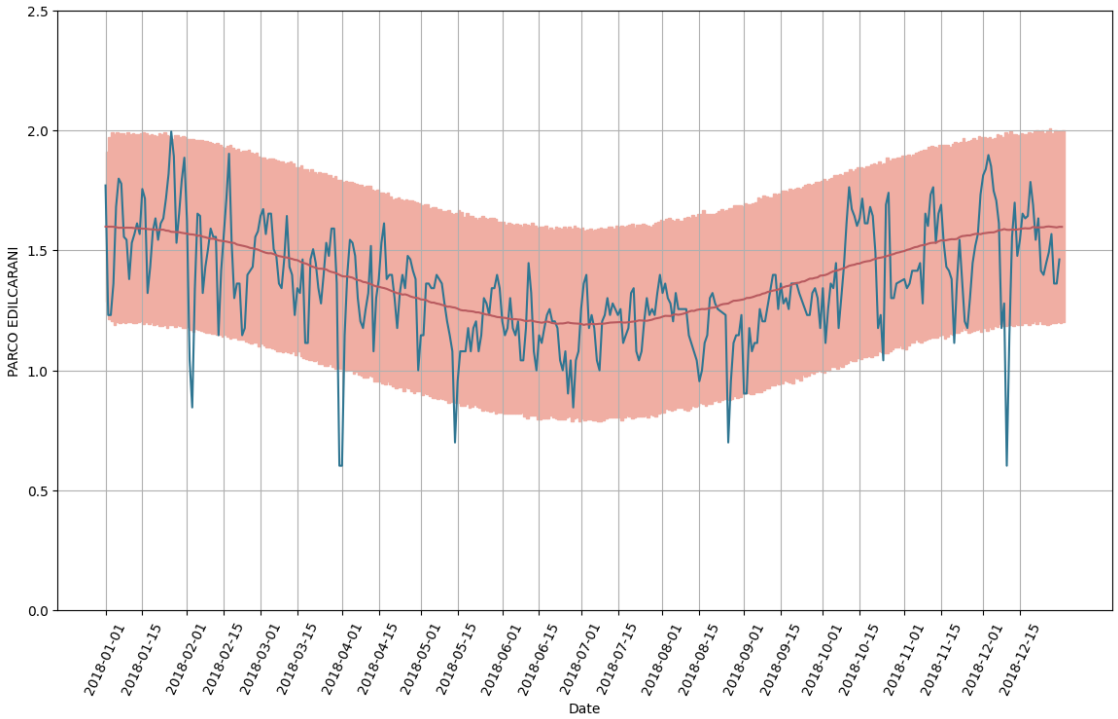
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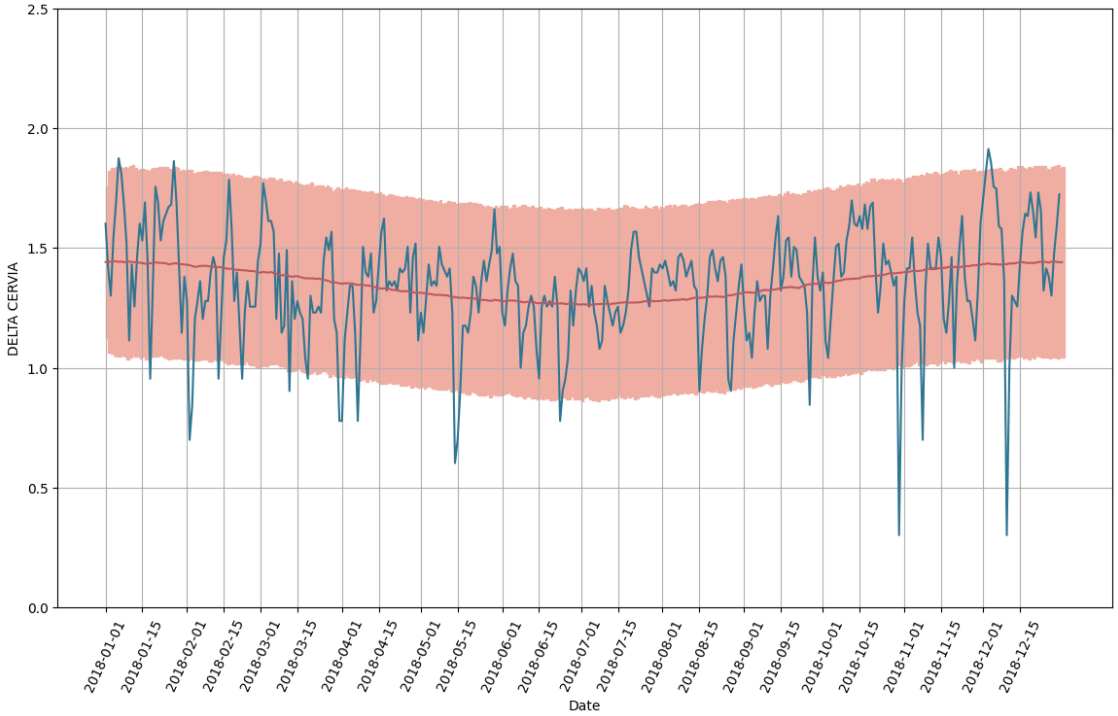
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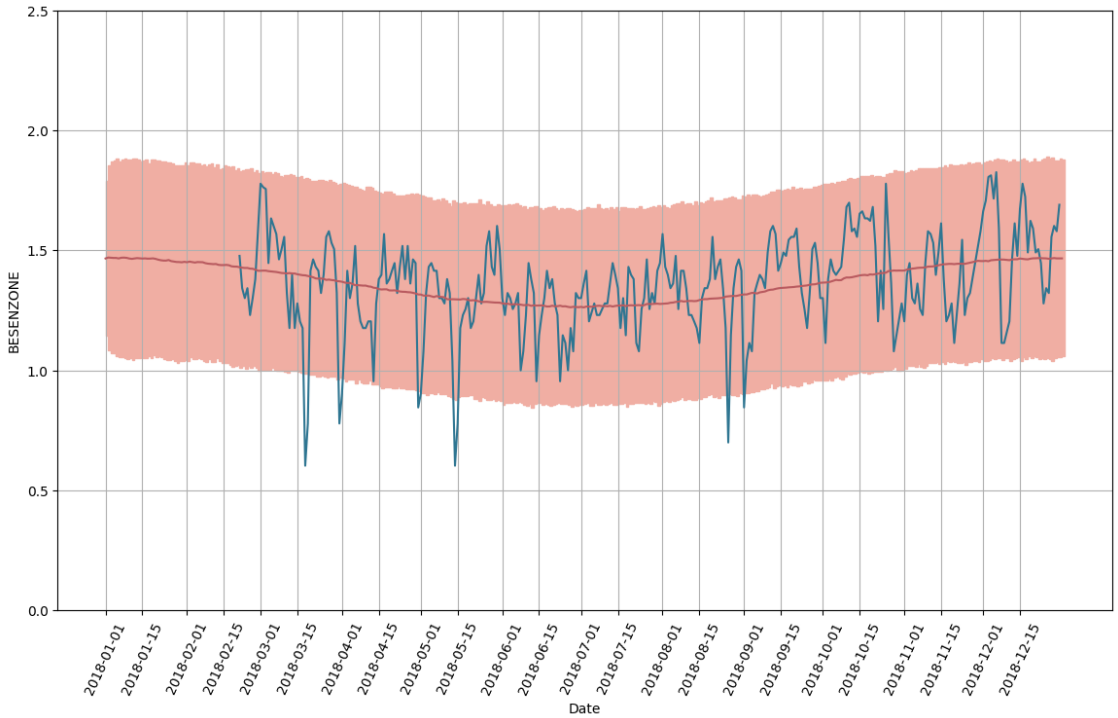
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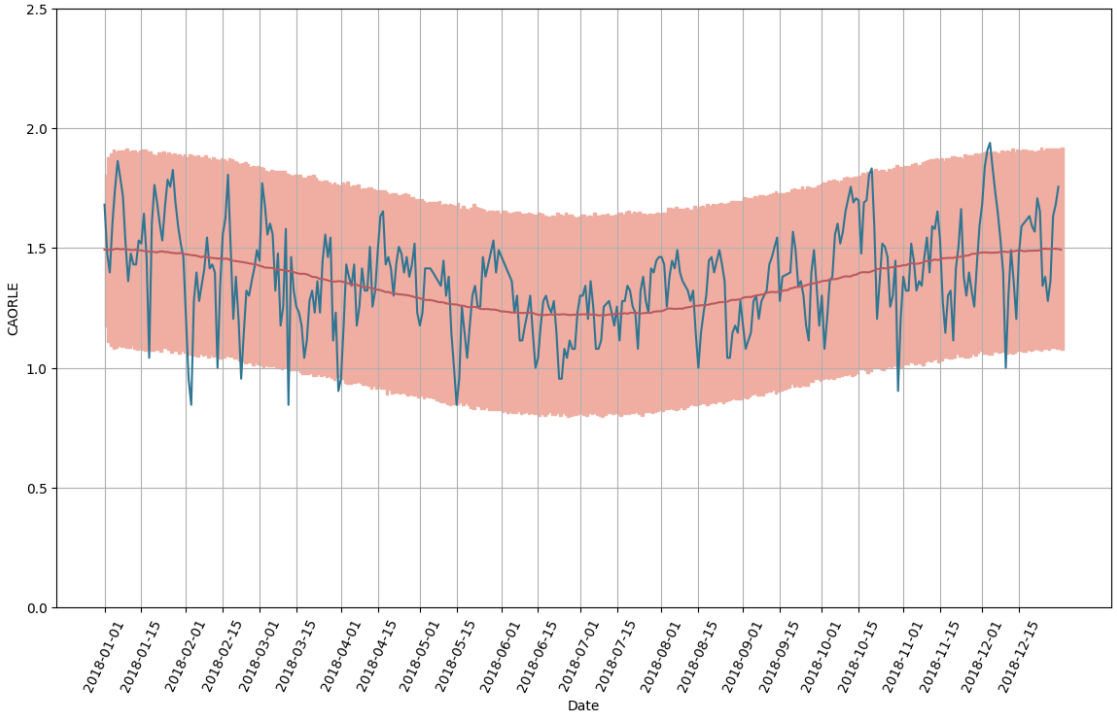
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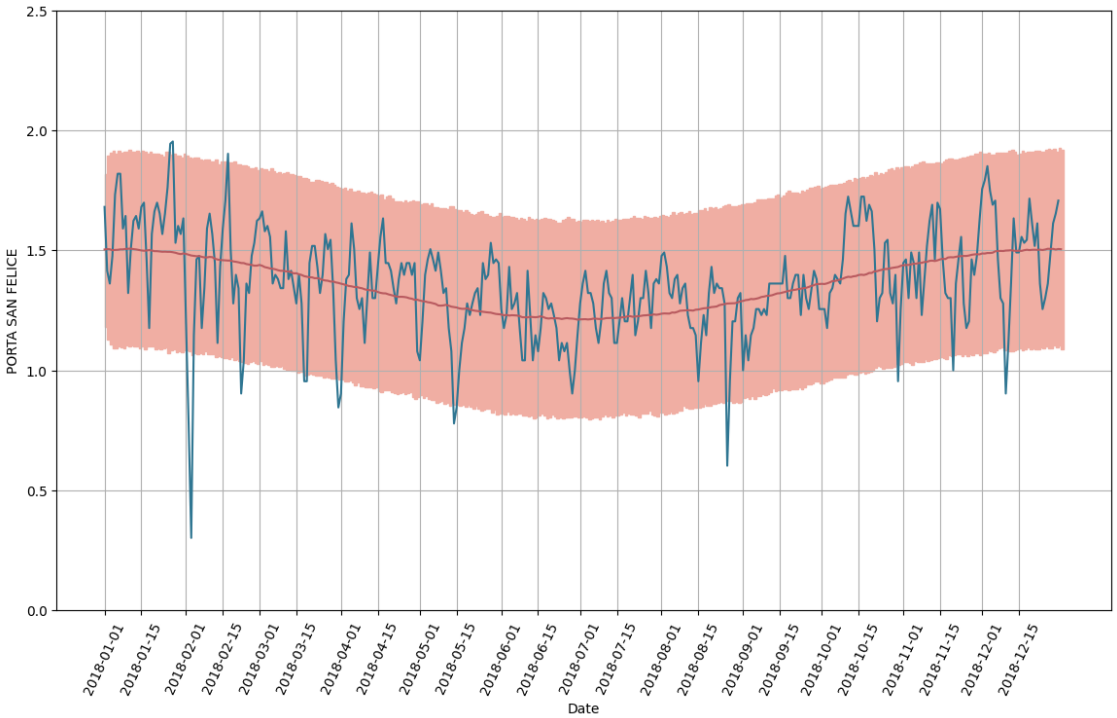
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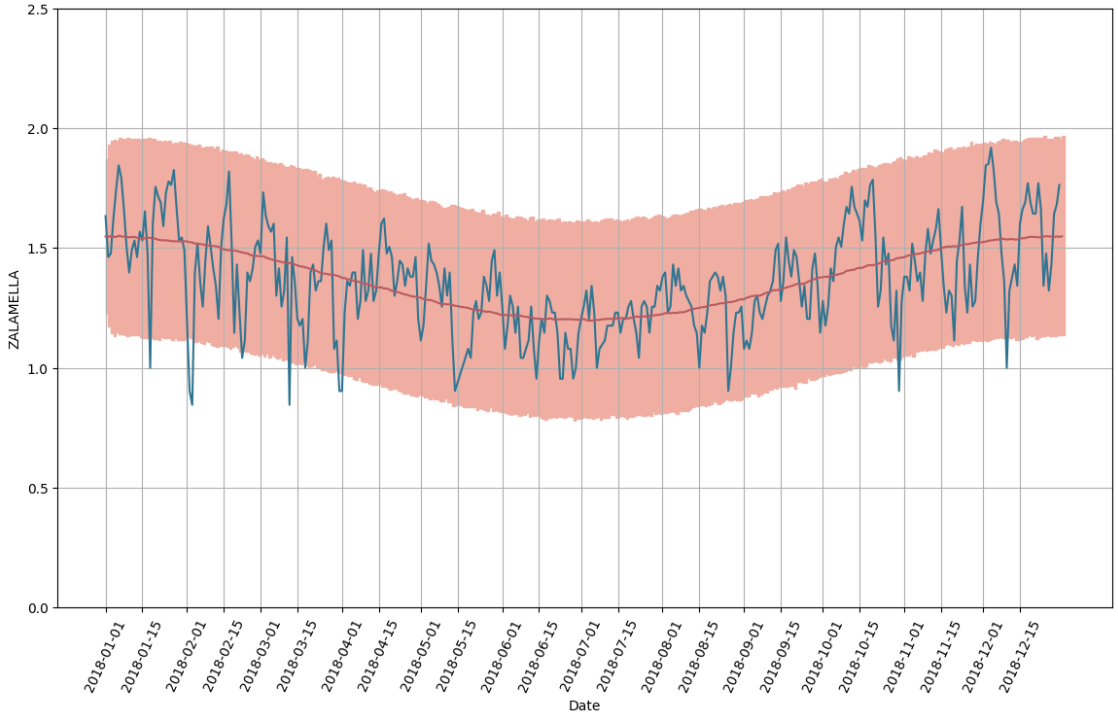
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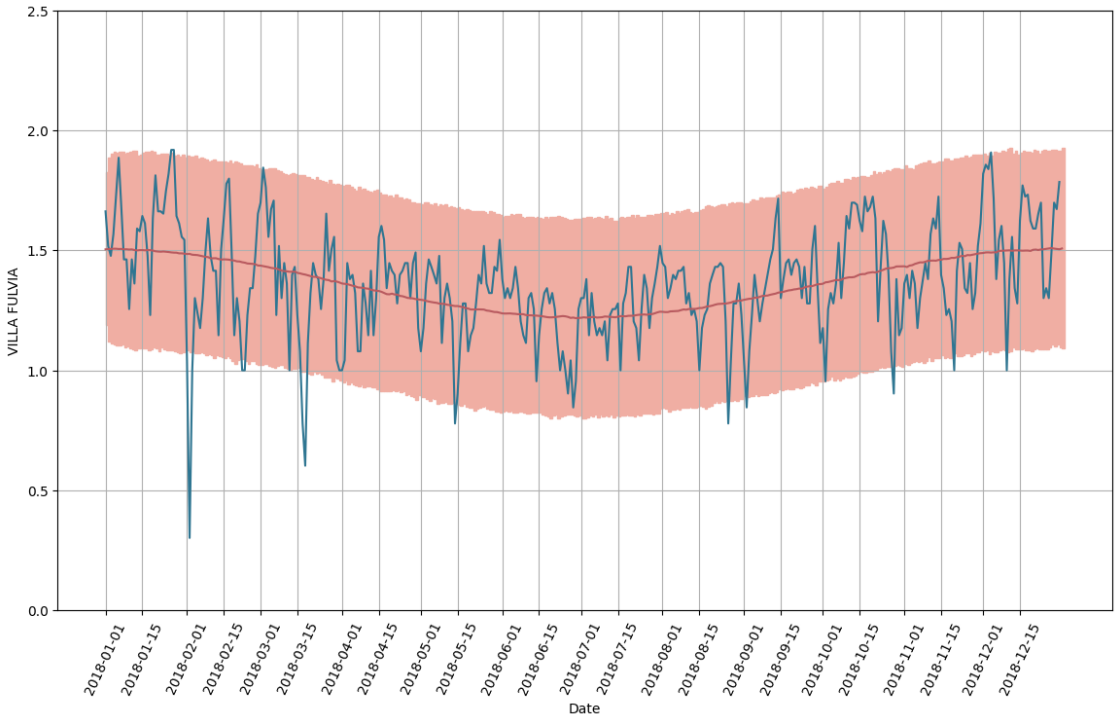
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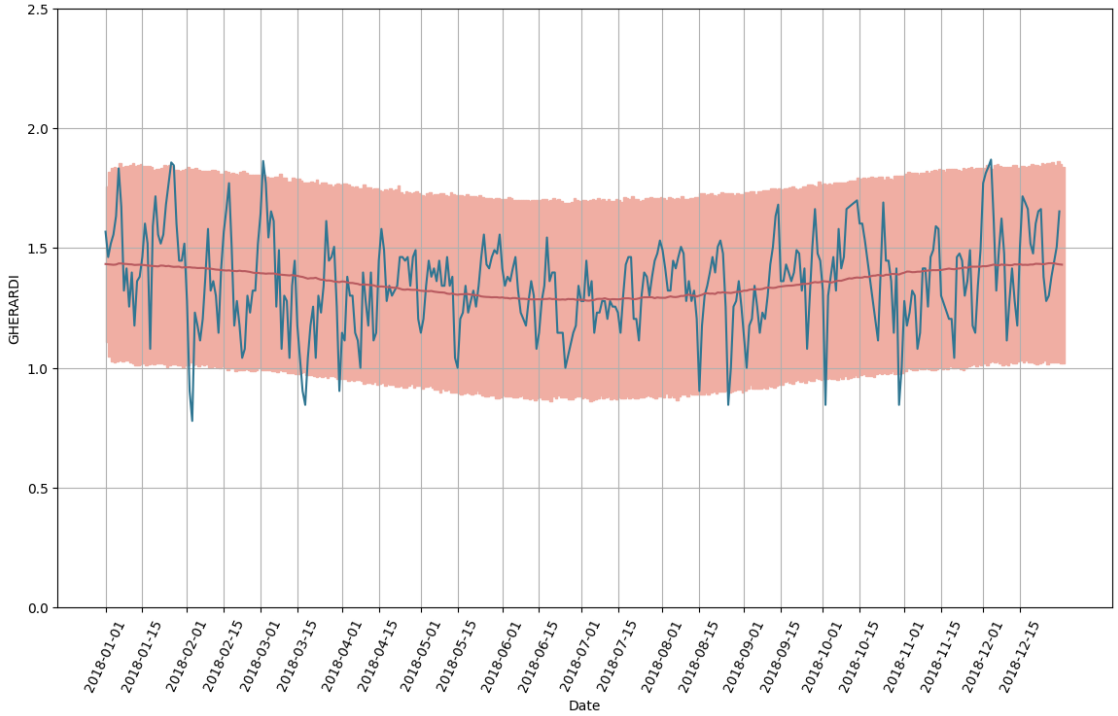
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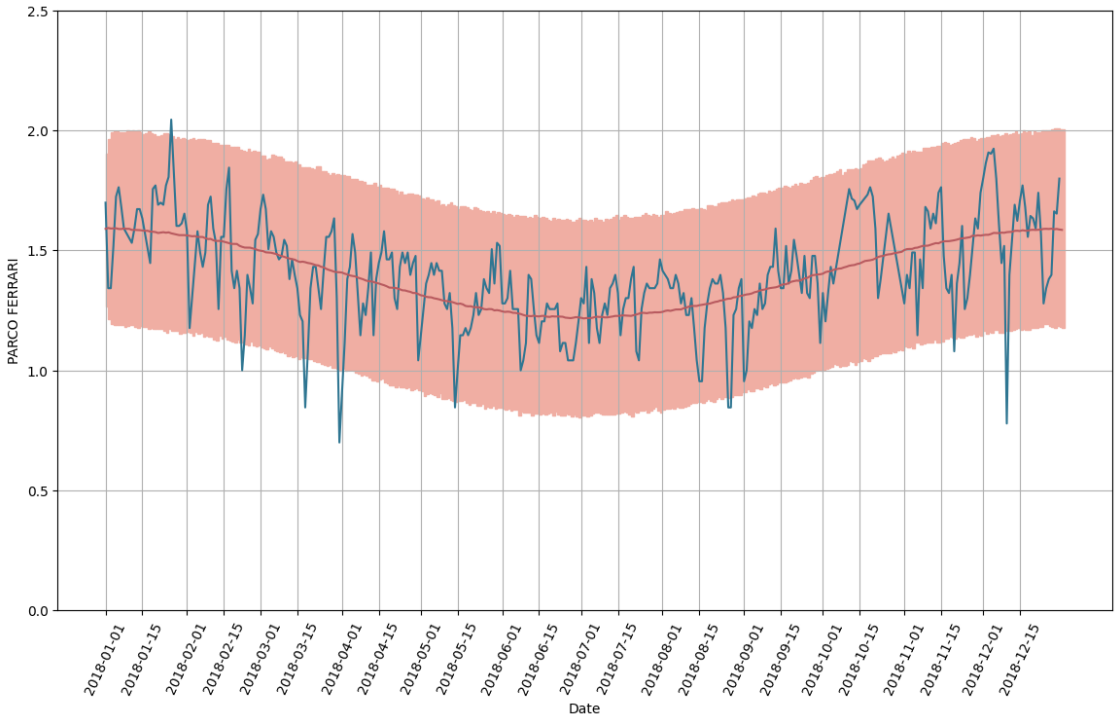
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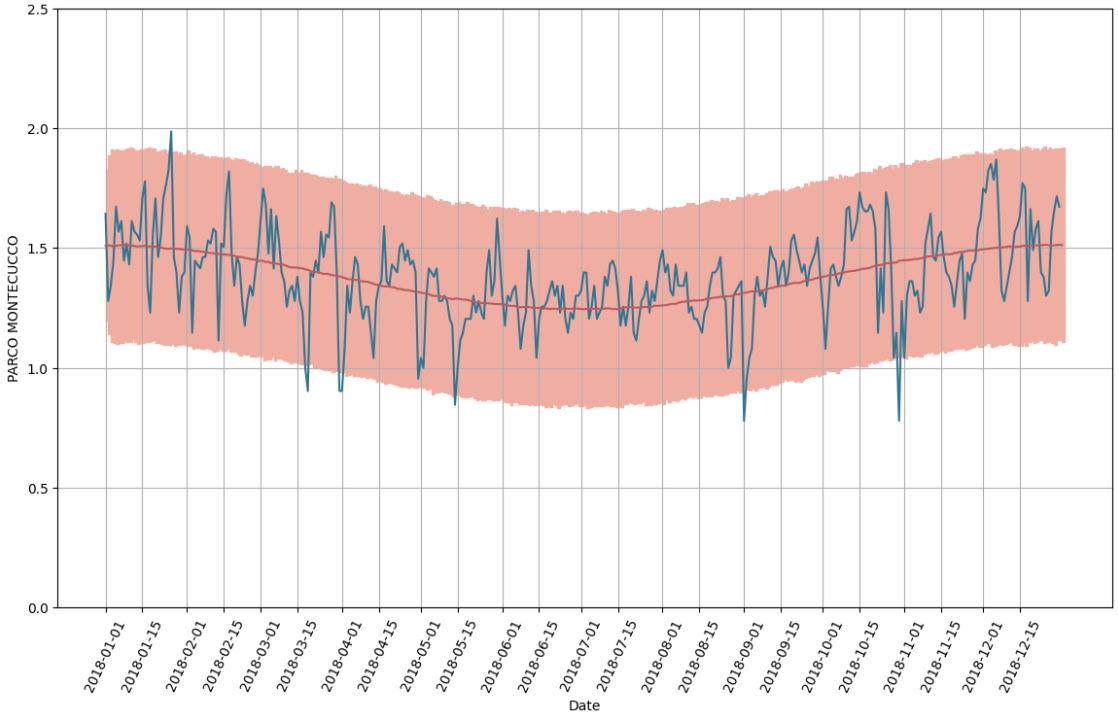
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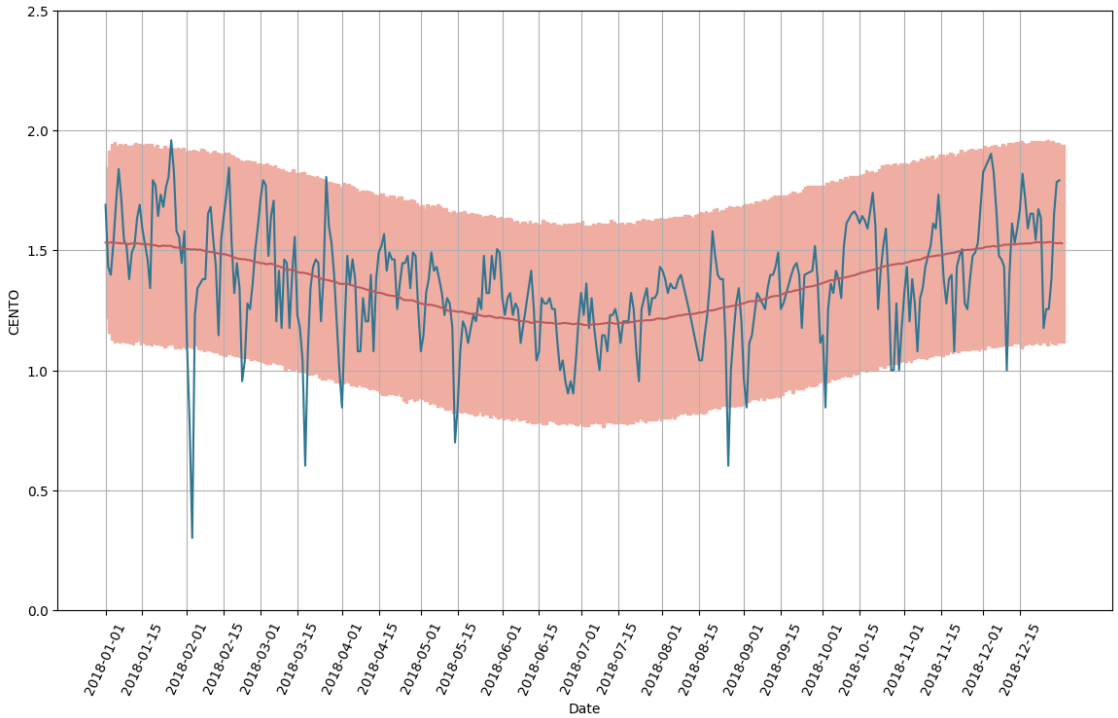
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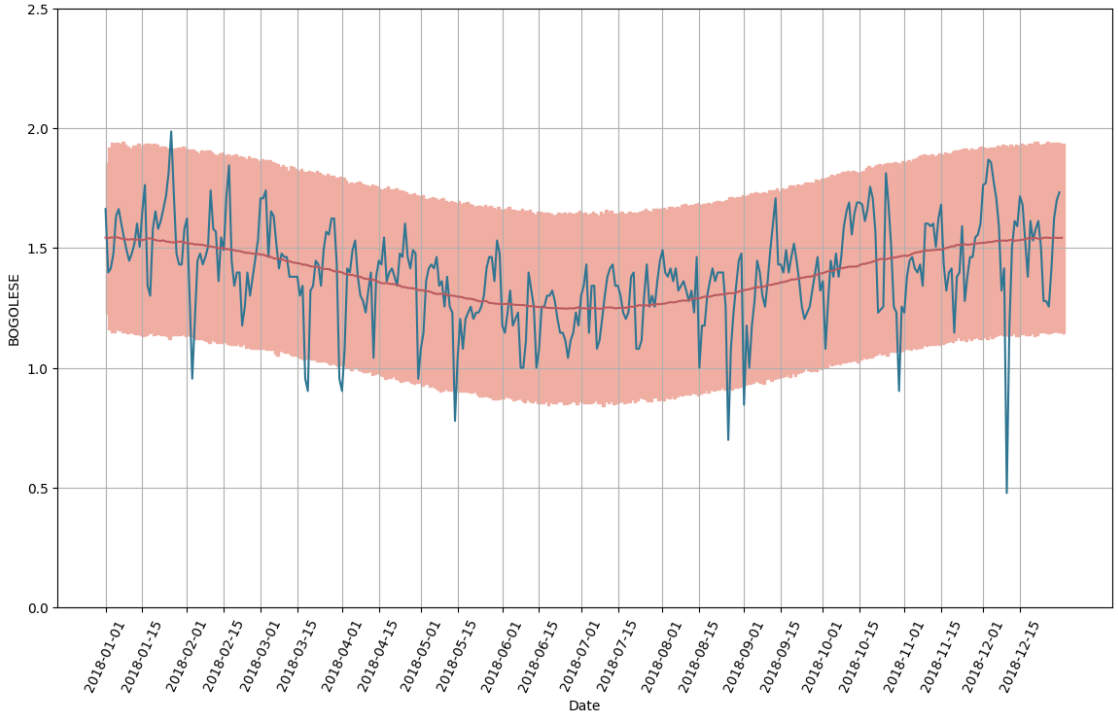
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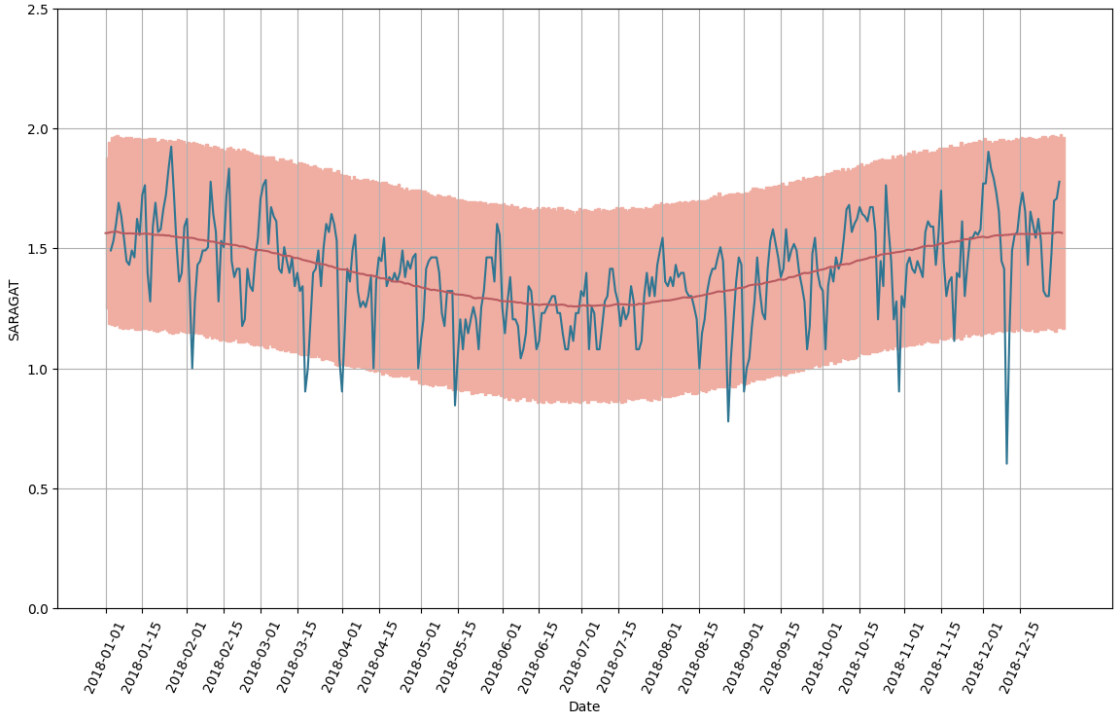
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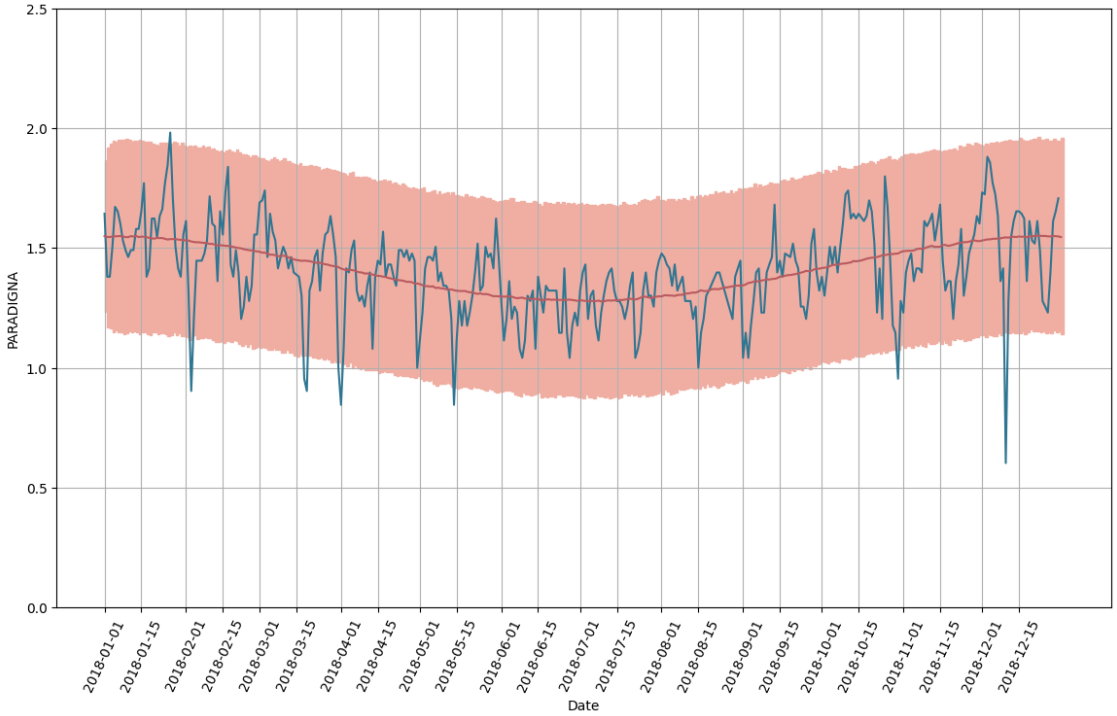
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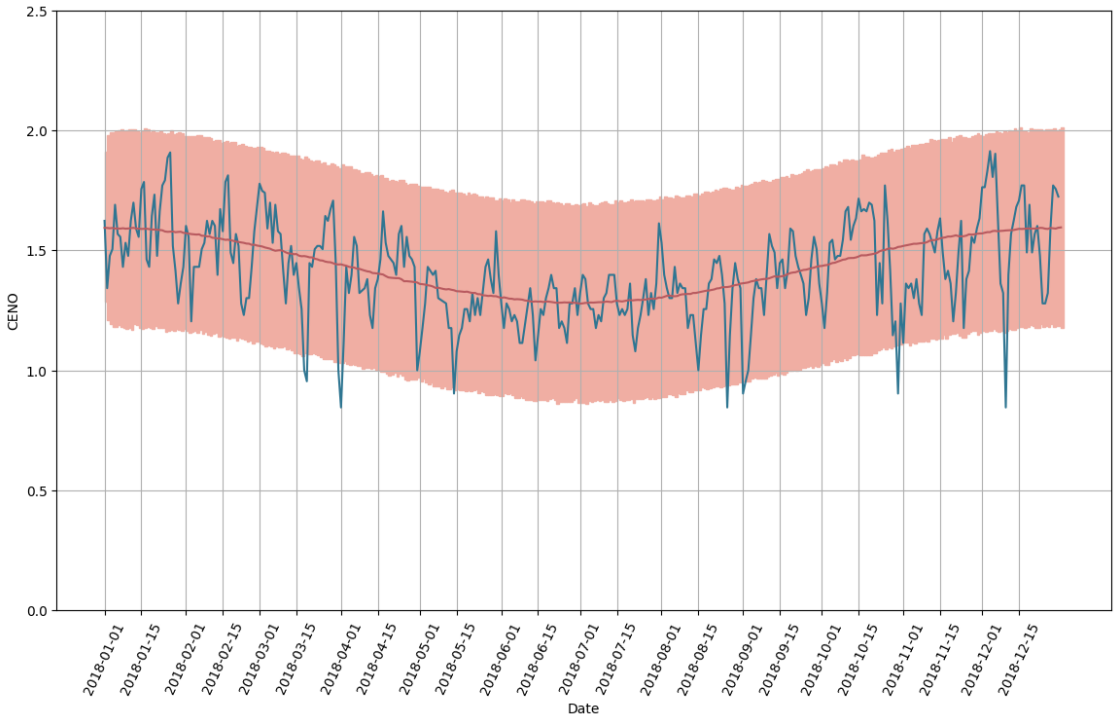
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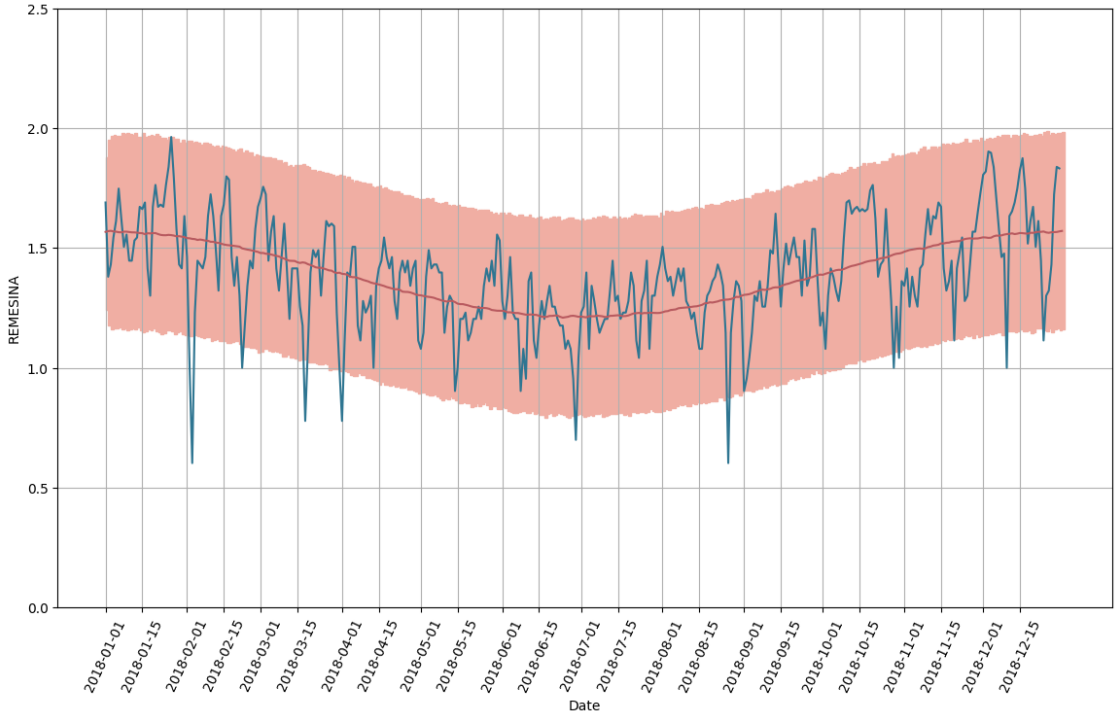
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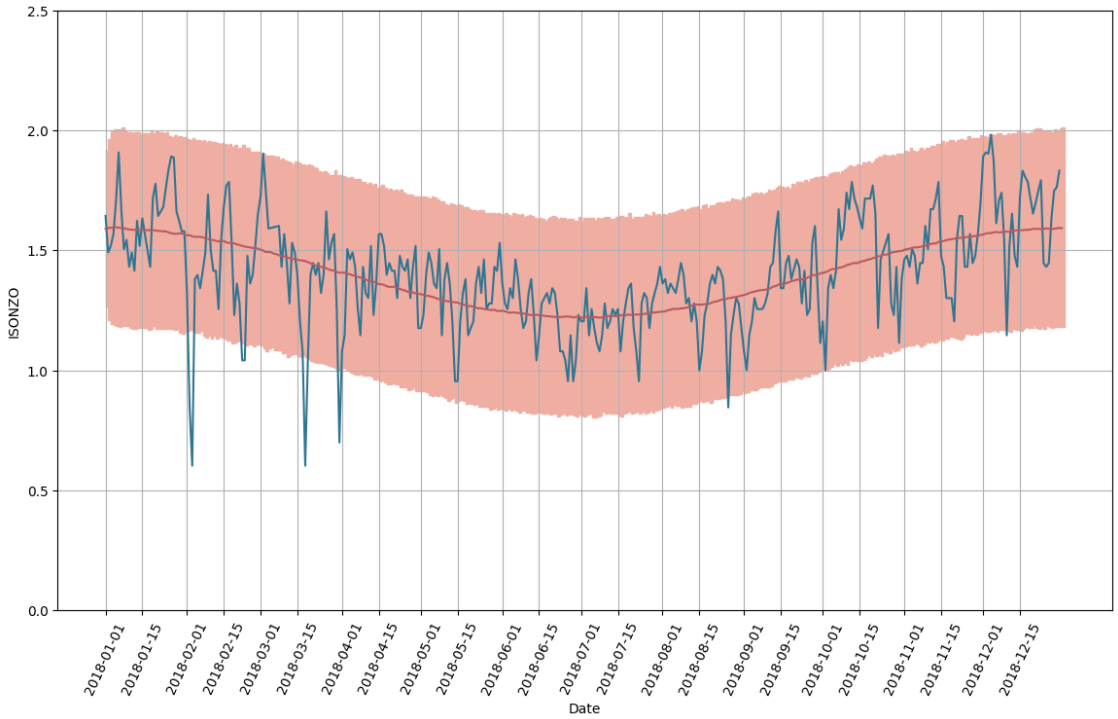
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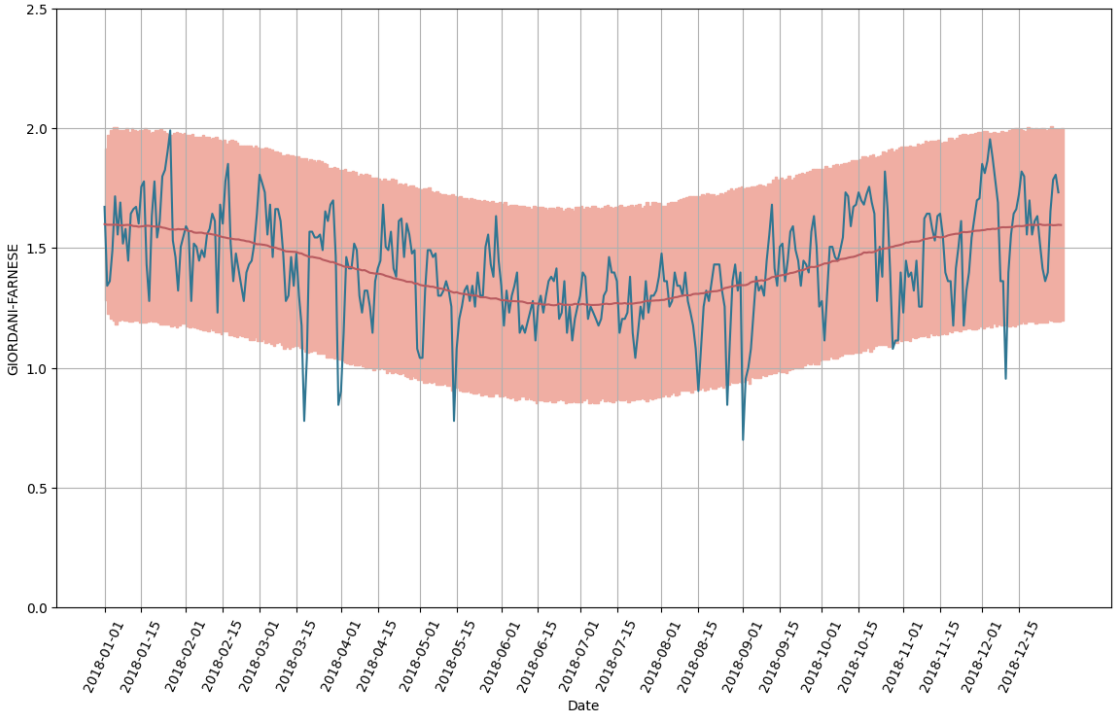
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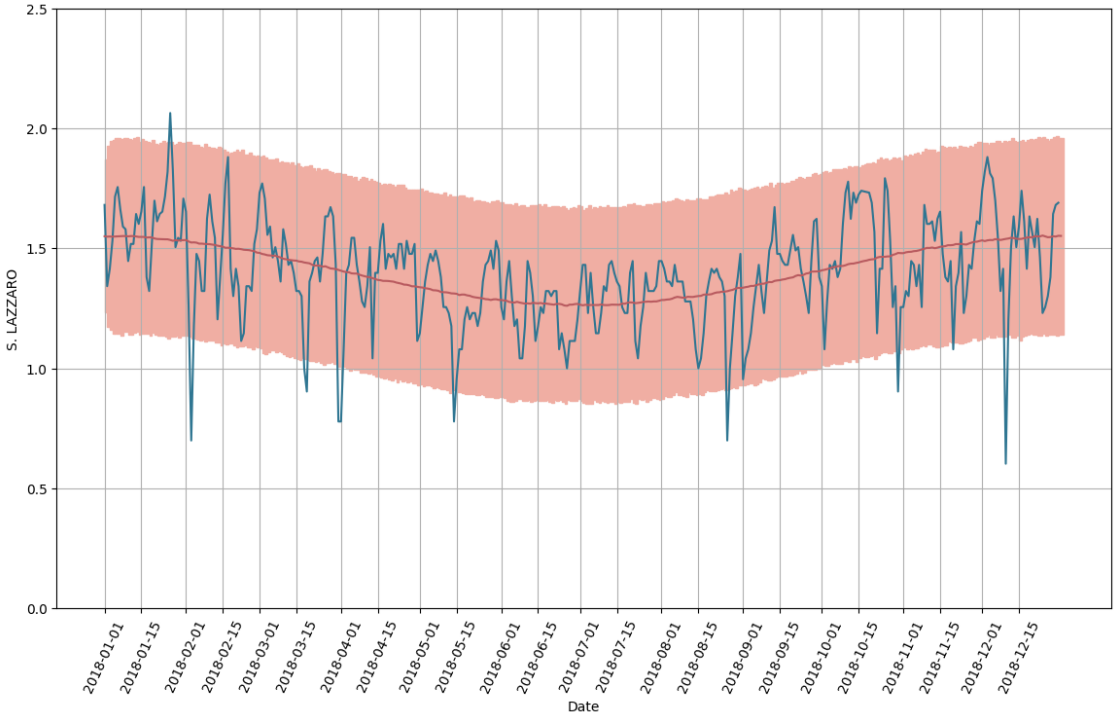
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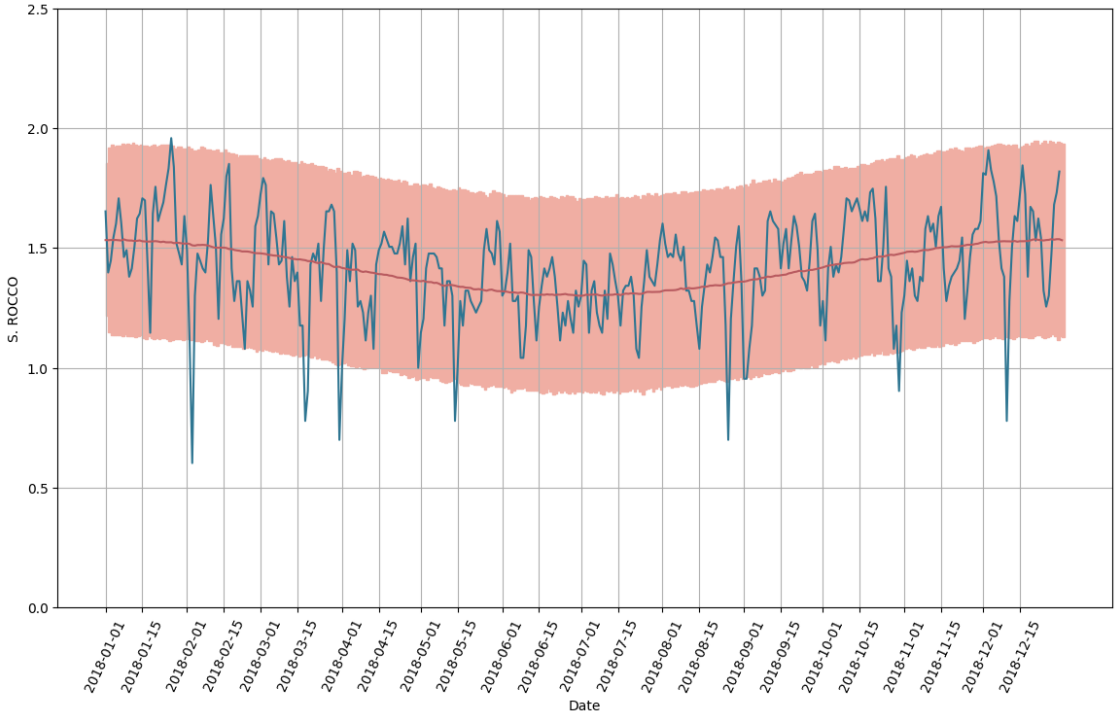
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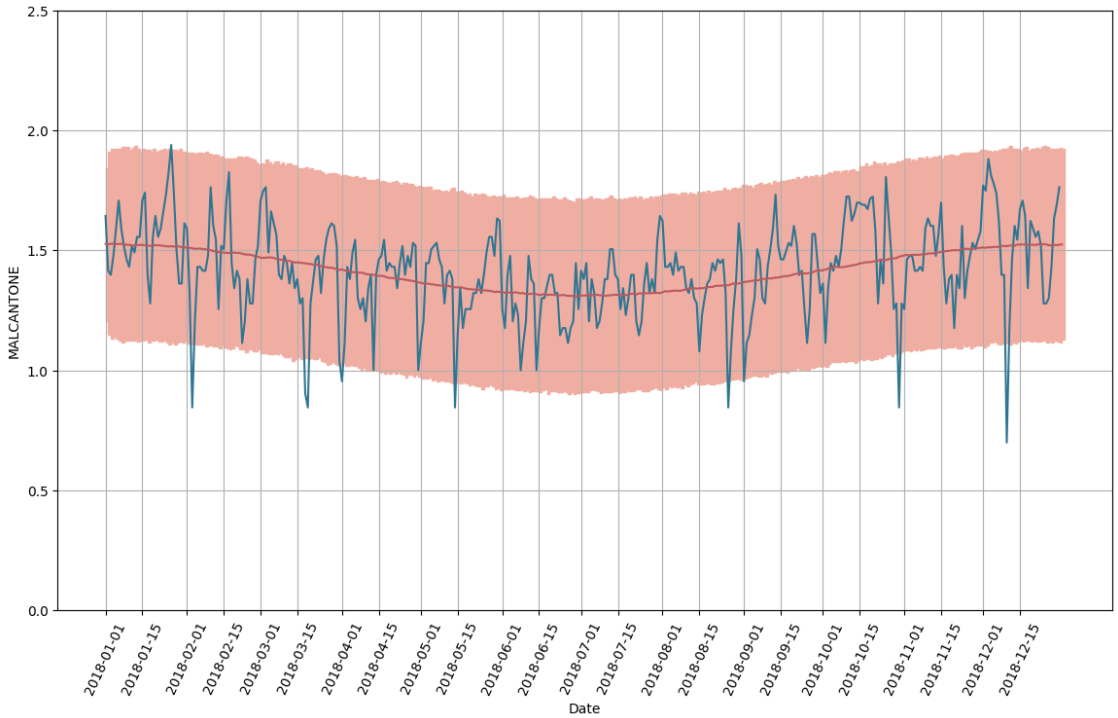
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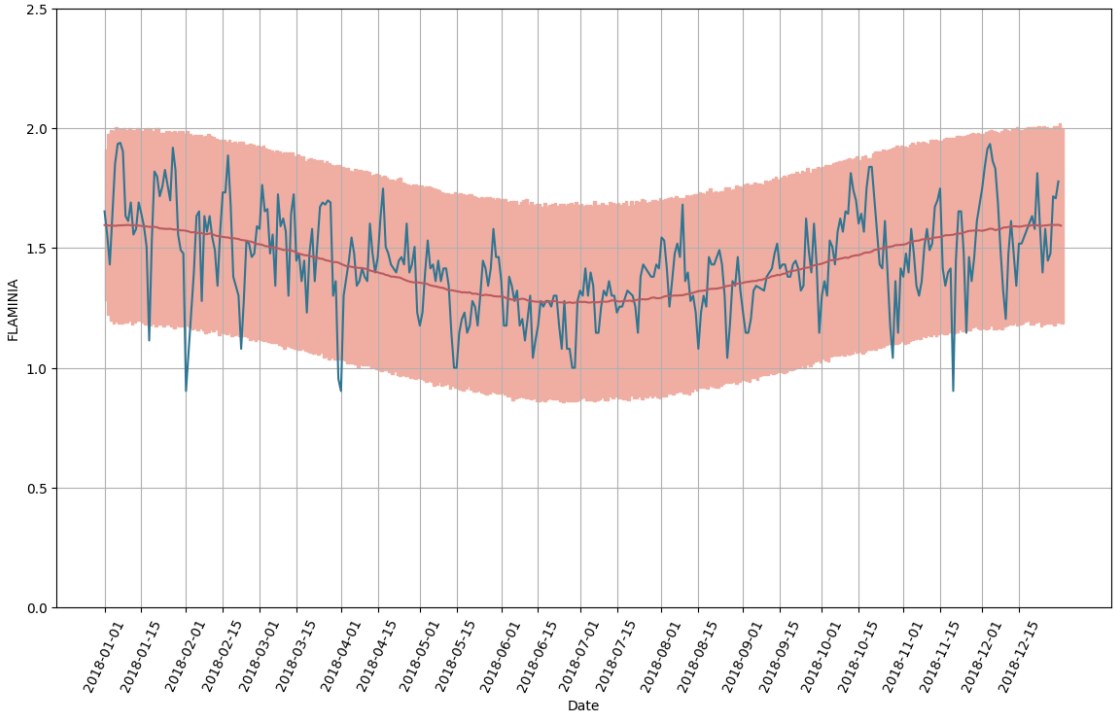
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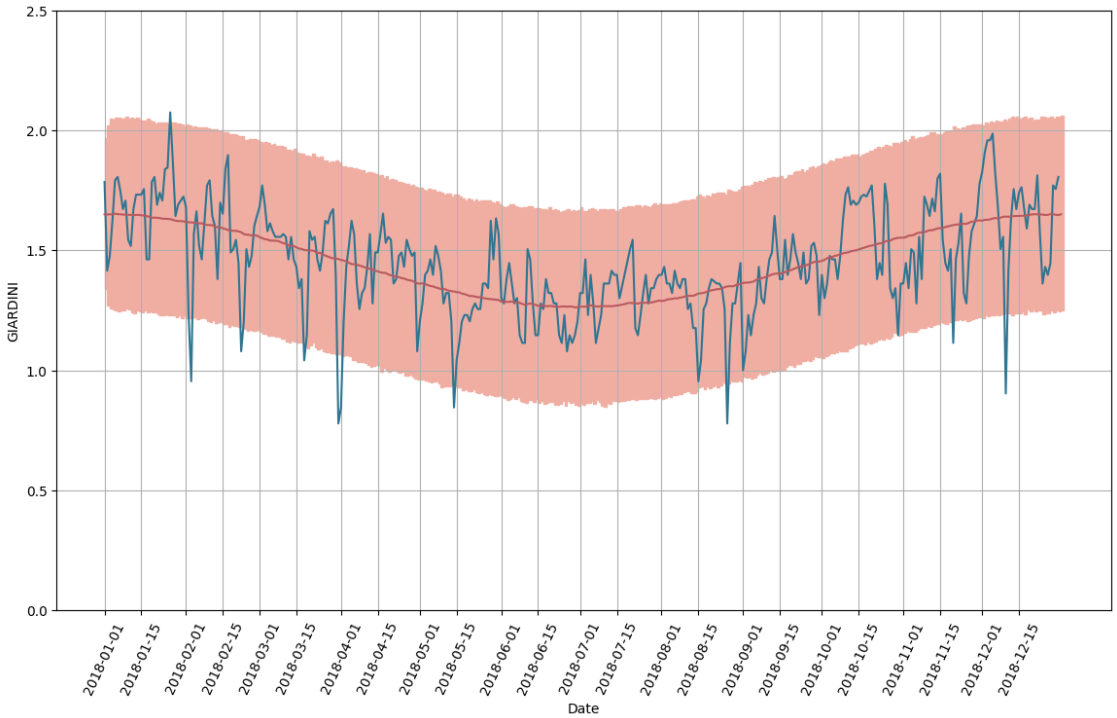
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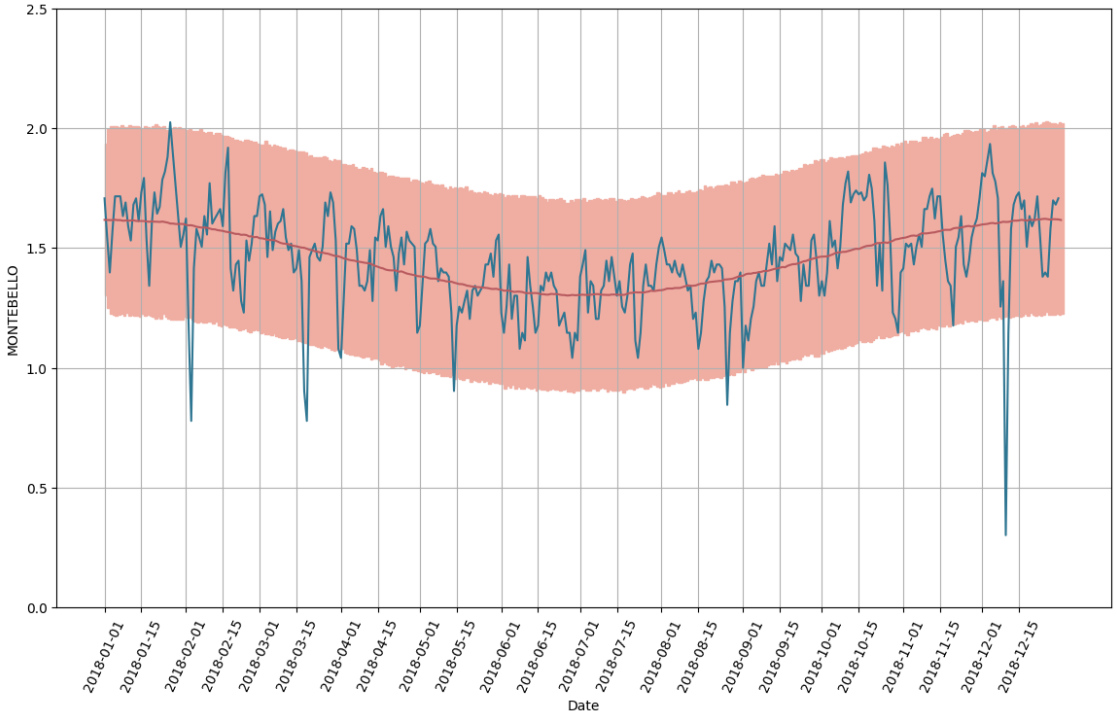
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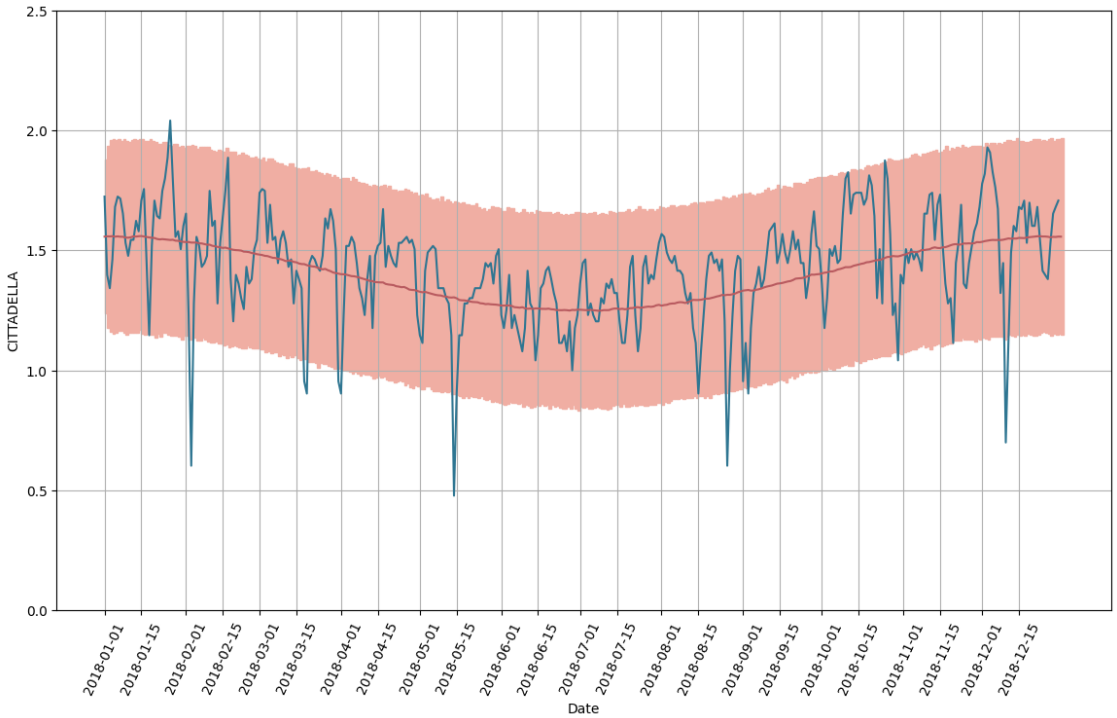
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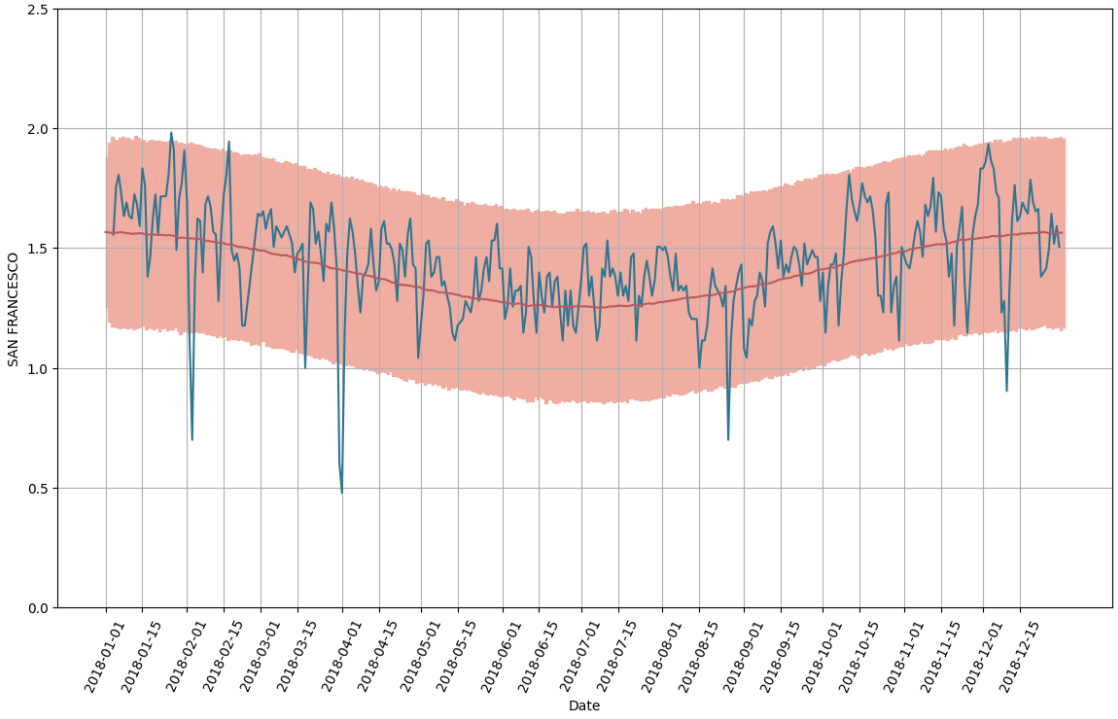
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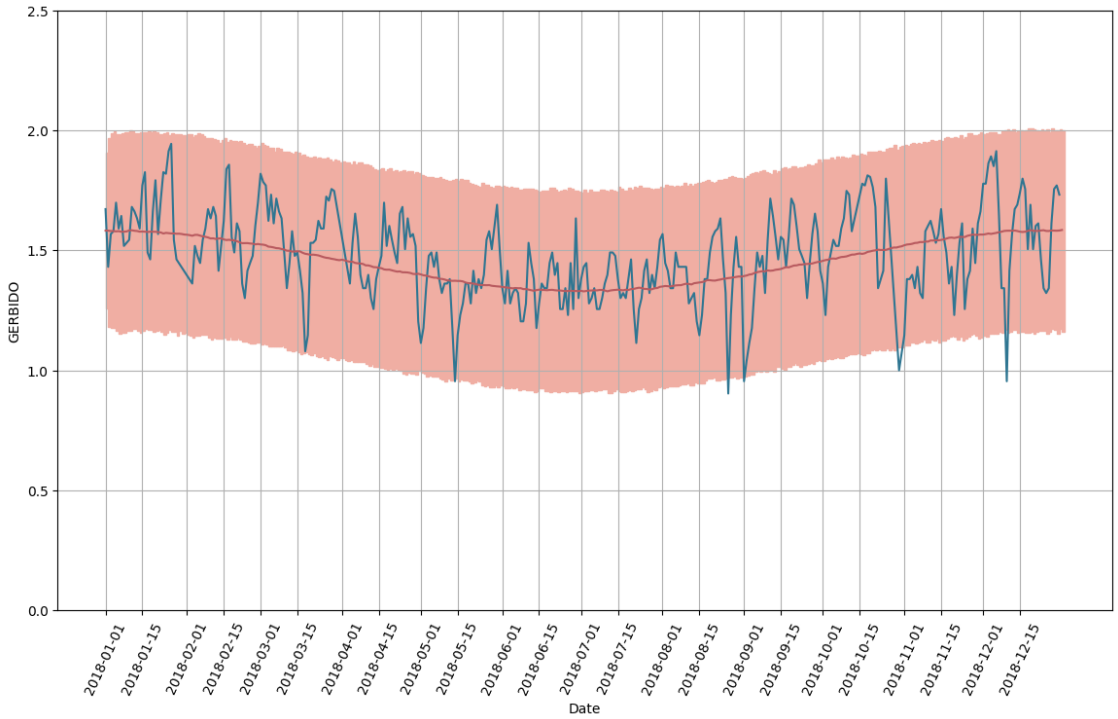
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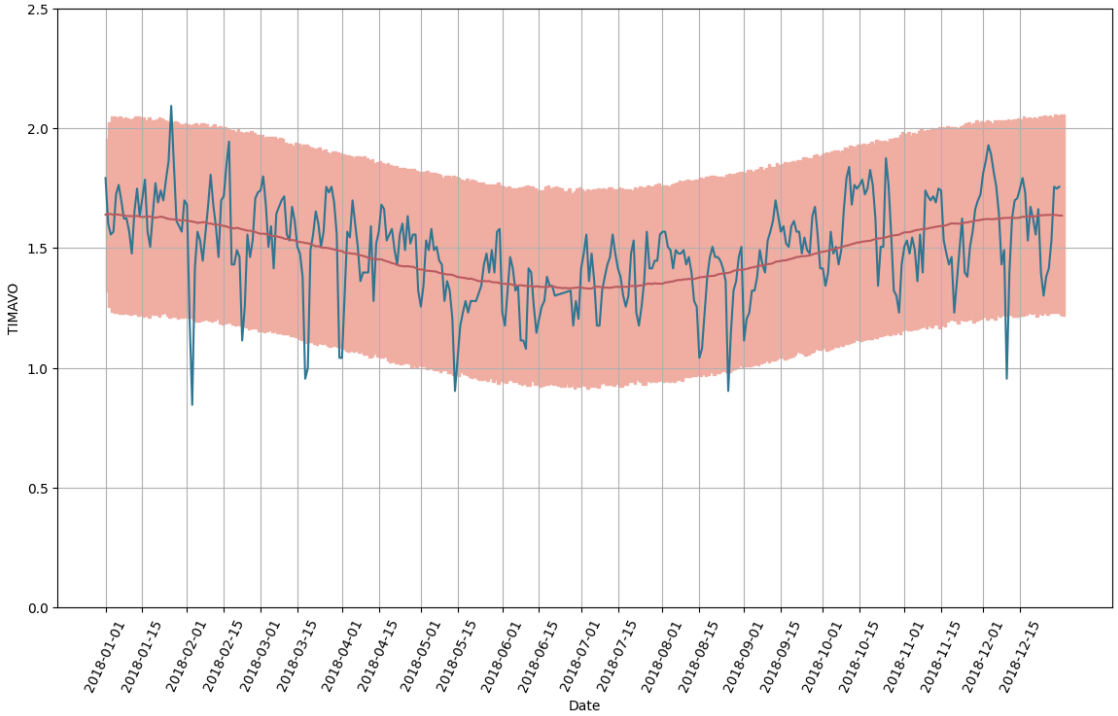
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