```
Python 3.8.5 (default, Sep  3 2020, 21:29:08) [MSC v.1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.19.0 -- An enhanced Interactive Python.

In [1]:
   ...: """
   ...: Created on Fri Sep 17 12:27:22 2021
   ...:
   ...: @author: JingWen.Wang
   ...: """
   ...:
   ...: import       as
   ...: import        as
   ...: import                    as
   ...: import                           as
   ...: from                          import
   ...: from                 import
   ...:
   ...: # Import
   ...:      =   .          '/Users/jingwen.wang/PycharmProjects/KeroTemperature/
Japan_SD_Data.csv'      = ','             =  'Month'
   ...:      =       'Kerosene'
   ...:
   ...: # Plot
   ...:           =    .         2  1         = 10 5      =100        =True
   ...:
   ...: # Usual Differencing
   ...:      0 .                    ='Original Series'
   ...:      0 .             .     1        ='Usual Differencing'
   ...:      0 .          'Usual Differencing'
   ...:      0 .          ='upper right'          =10
   ...:
   ...:
   ...: # Seasonal Differencing
   ...:      1 .                    ='Original Series'
   ...:      1 .             .     12        ='Seasonal Differencing'       ='green'
   ...:      1 .          'Seasonal Differencing'
   ...:    .          ='upper right'          =10
   ...:    .         'Kerosene'          =16
   ...:    .
   ...:
   ...: # !pip3 install pyramid-arima
   ...: import          as
   ...:
   ...: # Seasonal - fit stepwise auto-ARIMA
   ...:               =   .                        =1         =1
   ...:                                ='adf'
   ...:                                 =3        =3    =12
   ...:                                   =0           =True
   ...:                              =None    =1        =True
   ...:                                        ='ignore'
   ...:                                            =True
   ...:                                  =True
   ...:
```

```
...:                .
...:
...: # Forecast - next 7 days
...:            = 24*7
...:                    =                .                  =
             =True
...:                =    .                .       -1            =                  ='MS'
...:
...: # make series for plotting purpose
...:                 =    .                      =
...:                =    .                   0         =
...:                =    .                   1         =
```

Figures now render in the Plots pane by default. To make them also appear inline in the Console, uncheck "Mute Inline Plotting" under the Plots pane options menu.

```
Performing stepwise search to minimize aic
ARIMA(1,0,1)(0,1,1)[12] intercept   : AIC=6247.190, Time=0.38 sec
ARIMA(0,0,0)(0,1,0)[12] intercept   : AIC=6258.001, Time=0.03 sec
ARIMA(1,0,0)(1,1,0)[12] intercept   : AIC=6246.118, Time=0.18 sec
ARIMA(0,0,1)(0,1,1)[12] intercept   : AIC=6246.596, Time=0.18 sec
ARIMA(0,0,0)(0,1,0)[12]             : AIC=6267.884, Time=0.01 sec
ARIMA(1,0,0)(0,1,0)[12] intercept   : AIC=6253.329, Time=0.05 sec
ARIMA(1,0,0)(2,1,0)[12] intercept   : AIC=6240.719, Time=0.51 sec
ARIMA(1,0,0)(2,1,1)[12] intercept   : AIC=6236.567, Time=1.28 sec
ARIMA(1,0,0)(1,1,1)[12] intercept   : AIC=6246.319, Time=0.74 sec
ARIMA(1,0,0)(2,1,2)[12] intercept   : AIC=6232.678, Time=2.31 sec
ARIMA(1,0,0)(1,1,2)[12] intercept   : AIC=6238.911, Time=1.18 sec
ARIMA(0,0,0)(2,1,2)[12] intercept   : AIC=6243.997, Time=2.34 sec
ARIMA(2,0,0)(2,1,2)[12] intercept   : AIC=6226.594, Time=2.64 sec
ARIMA(2,0,0)(1,1,2)[12] intercept   : AIC=6236.896, Time=1.56 sec
ARIMA(2,0,0)(2,1,1)[12] intercept   : AIC=6232.442, Time=1.26 sec
ARIMA(2,0,0)(1,1,1)[12] intercept   : AIC=6244.854, Time=0.41 sec
ARIMA(3,0,0)(2,1,2)[12] intercept   : AIC=6212.917, Time=2.91 sec
ARIMA(3,0,0)(1,1,2)[12] intercept   : AIC=6223.253, Time=1.75 sec
ARIMA(3,0,0)(2,1,1)[12] intercept   : AIC=6217.874, Time=2.10 sec
ARIMA(3,0,0)(1,1,1)[12] intercept   : AIC=6231.814, Time=0.52 sec
ARIMA(3,0,1)(2,1,2)[12] intercept   : AIC=6210.031, Time=3.36 sec
ARIMA(3,0,1)(1,1,2)[12] intercept   : AIC=6222.855, Time=2.18 sec
ARIMA(3,0,1)(2,1,1)[12] intercept   : AIC=6216.020, Time=2.32 sec
ARIMA(3,0,1)(1,1,1)[12] intercept   : AIC=6233.855, Time=0.75 sec
ARIMA(2,0,1)(2,1,2)[12] intercept   : AIC=6213.203, Time=4.70 sec
ARIMA(3,0,2)(2,1,2)[12] intercept   : AIC=6209.013, Time=6.35 sec
ARIMA(3,0,2)(1,1,2)[12] intercept   : AIC=6225.362, Time=3.25 sec
ARIMA(3,0,2)(2,1,1)[12] intercept   : AIC=6214.310, Time=4.77 sec
ARIMA(3,0,2)(1,1,1)[12] intercept   : AIC=6236.453, Time=1.06 sec
ARIMA(2,0,2)(2,1,2)[12] intercept   : AIC=6207.983, Time=5.13 sec
ARIMA(2,0,2)(1,1,2)[12] intercept   : AIC=6222.807, Time=4.03 sec
ARIMA(2,0,2)(2,1,1)[12] intercept   : AIC=6214.200, Time=3.74 sec
ARIMA(2,0,2)(1,1,1)[12] intercept   : AIC=6234.619, Time=1.17 sec
ARIMA(1,0,2)(2,1,2)[12] intercept   : AIC=6214.714, Time=3.66 sec
ARIMA(2,0,3)(2,1,2)[12] intercept   : AIC=6205.869, Time=5.44 sec
```

```
 ARIMA(2,0,3)(1,1,2)[12] intercept   : AIC=6221.468, Time=4.68 sec
 ARIMA(2,0,3)(2,1,1)[12] intercept   : AIC=6212.554, Time=4.46 sec
 ARIMA(2,0,3)(1,1,1)[12] intercept   : AIC=6233.566, Time=1.64 sec
 ARIMA(1,0,3)(2,1,2)[12] intercept   : AIC=6209.641, Time=3.40 sec
 ARIMA(3,0,3)(2,1,2)[12] intercept   : AIC=6200.430, Time=6.24 sec
 ARIMA(3,0,3)(1,1,2)[12] intercept   : AIC=6208.919, Time=6.15 sec
 ARIMA(3,0,3)(2,1,1)[12] intercept   : AIC=6202.712, Time=5.81 sec
 ARIMA(3,0,3)(1,1,1)[12] intercept   : AIC=inf, Time=2.08 sec
 ARIMA(3,0,3)(2,1,2)[12]             : AIC=6210.741, Time=5.74 sec

Best model:  ARIMA(3,0,3)(2,1,2)[12] intercept
Total fit time: 114.525 seconds

In [2]:              .
Out[2]:
<class 'statsmodels.iolib.summary.Summary'>
"""
                                     SARIMAX Results
==========================================================================================
=======
Dep. Variable:                                        y   No. Observations:
235
Model:             SARIMAX(3, 0, 3)x(2, 1, [1, 2], 12)   Log Likelihood
-3088.215
Date:                                 Fri, 17 Sep 2021   AIC
6200.430
Time:                                         12:46:25   BIC
6241.316
Sample:                                             0   HQIC
6216.935
                                                  - 235
Covariance Type:                                  opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept  -5.648e+04   2.75e+04     -2.057      0.040    -1.1e+05   -2659.536
ar.L1          0.2382      0.061      3.908      0.000       0.119       0.358
ar.L2         -0.3980      0.042     -9.507      0.000      -0.480      -0.316
ar.L3          0.8451      0.053     16.030      0.000       0.742       0.948
ma.L1         -0.1024      0.095     -1.084      0.278      -0.288       0.083
ma.L2          0.4196      0.069      6.098      0.000       0.285       0.554
ma.L3         -0.7337      0.074     -9.882      0.000      -0.879      -0.588
ar.S.L12      -0.5953      0.131     -4.556      0.000      -0.851      -0.339
ar.S.L24      -0.5025      0.087     -5.761      0.000      -0.673      -0.332
ma.S.L12       0.3993      0.157      2.540      0.011       0.091       0.707
ma.S.L24       0.3296      0.118      2.797      0.005       0.099       0.560
sigma2      7.736e+10      0.019   4.06e+12      0.000    7.74e+10    7.74e+10
==========================================================================================
Ljung-Box (L1) (Q):                   0.16   Jarque-Bera (JB):                45.55
Prob(Q):                              0.69   Prob(JB):                         0.00
Heteroskedasticity (H):               0.32   Skew:                            -0.63
Prob(H) (two-sided):                  0.00   Kurtosis:                         4.83
==========================================================================================

Warnings:
```

```
[1] Covariance matrix calculated using the outer product of gradients (complex-step).
[2] Covariance matrix is singular or near-singular, with condition number 4.74e+27.
Standard errors may be unstable.
"""
```

In [3]: