

EDA of Datasets

CO₂:

```
## Observations: 740
## Variables: 7
## $ Year      <int> 1958, 1958, 1958, 1958, 1958, 1958, 1958, ...
## $ Month     <int> 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 1, 2, 3, ...
## $ decimal.date <dbl> 1958.208, 1958.292, 1958.375, 1958.458, 19...
## $ average   <dbl> 315.71, 317.45, 317.50, -99.99, 315.86, 31...
## $ interpolated <dbl> 315.71, 317.45, 317.50, 317.10, 315.86, 31...
## $ trend..season.corr. <dbl> 314.62, 315.29, 314.71, 314.85, 314.98, 31...
## $ X.days    <int> -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1...
```

Arctic Sea Ice Level

```
## Observations: 41
## Variables: 6
## $ year      <int> 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987...
## $ mo        <int> 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9...
## $ data.type <fct> Goddard, Goddard, Goddard, Goddard, Goddard, Goddard...
## $ region    <fct> N, N, N, N, N, N, N, N, N, N, N, N, N, N, N, N...
## $ extent    <dbl> 7.05, 7.67, 7.14, 7.30, 7.39, 6.81, 6.70, 7.41, 7.28...
## $ area      <dbl> 4.58, 4.87, 4.44, 4.43, 4.70, 4.11, 4.23, 4.72, 5.64...
```

Temperature:

```
## Observations: 139
## Variables: 3
## $ Year      <int> 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1...
## $ No_Smoothing <dbl> -0.16, -0.08, -0.10, -0.17, -0.28, -0.32, -0.30, ...
## $ Lowess.5.  <dbl> -0.09, -0.12, -0.16, -0.20, -0.23, -0.25, -0.26, ...
```

Time Series of CO₂:

```
##      Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct
## 1958                314.62 315.29 314.71 314.85 314.98 315.94 315.91 315.61
## 1959 315.70 315.88 315.62 315.56 315.50 315.92 315.66 315.81 316.55 316.19
##      Nov   Dec
## 1958 315.31 315.61
## 1959
```

Time Series of Ice Levels:

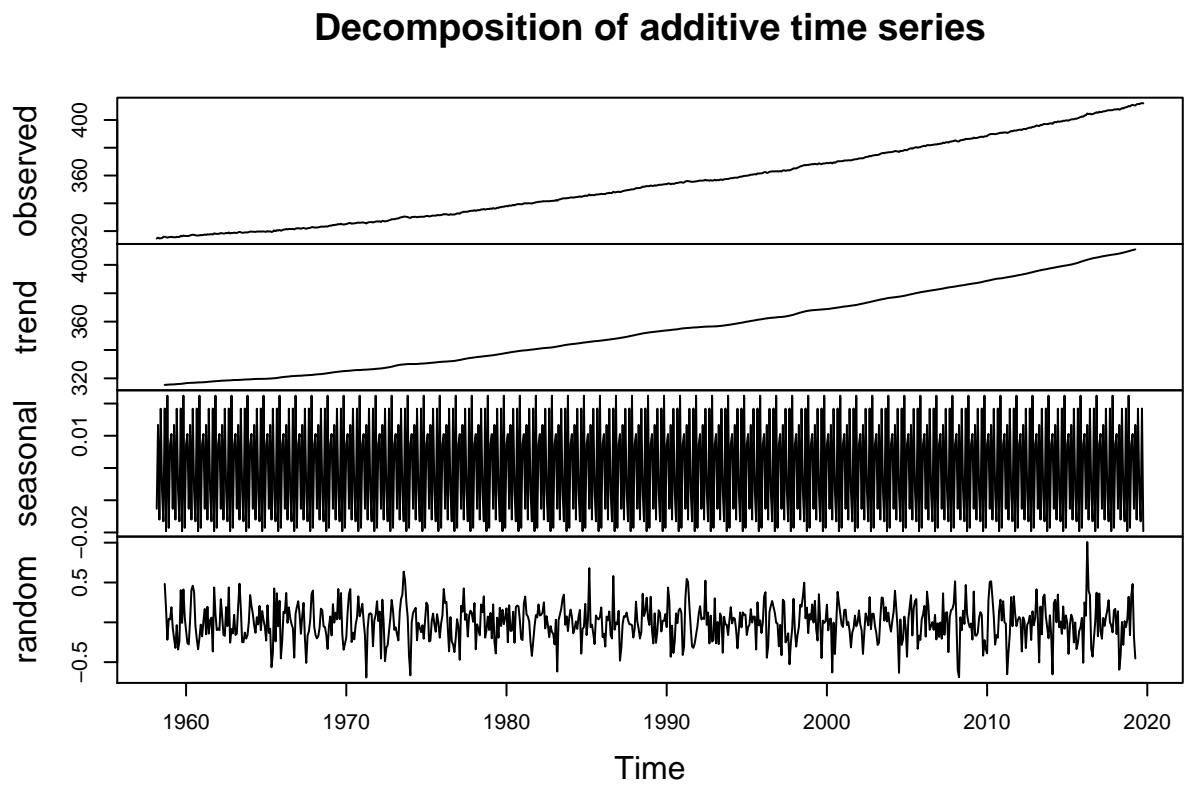
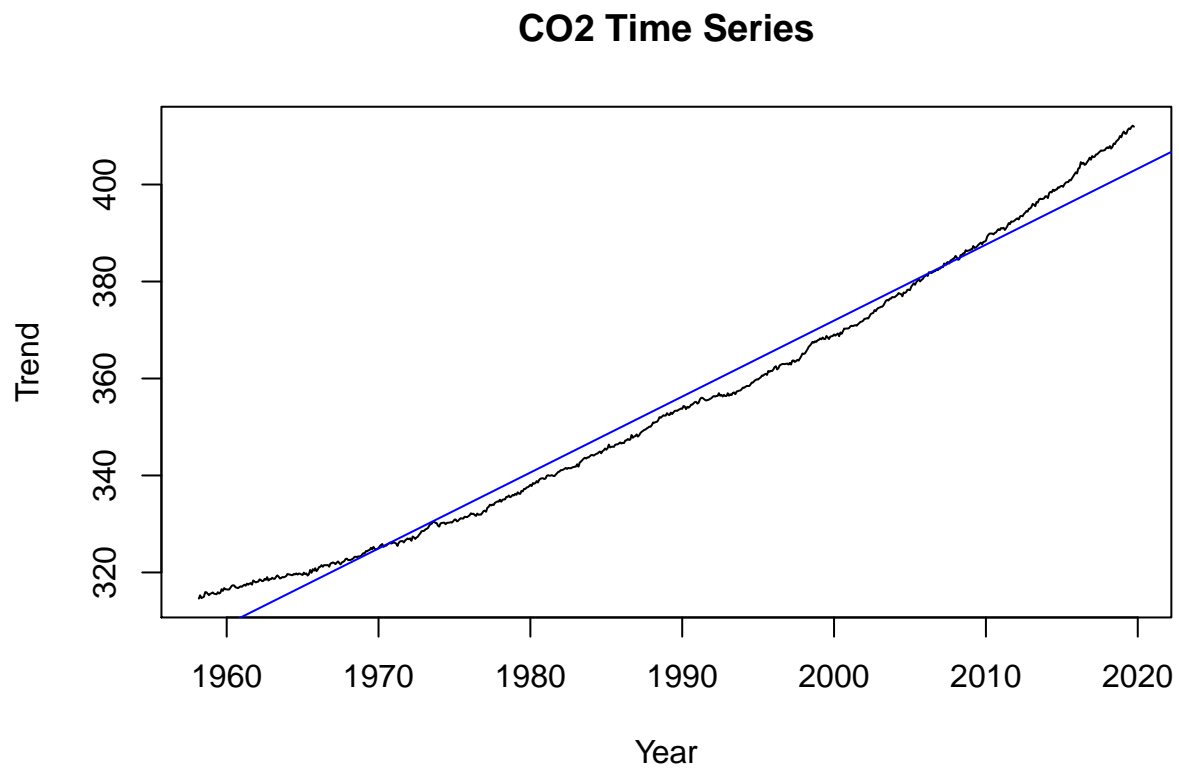
```
## Time Series:
## Start = 1979
## End = 2019
## Frequency = 1
## [1] 4.58 4.87 4.44 4.43 4.70 4.11 4.23 4.72 5.64 5.36 4.86 4.55 4.51 5.43
```

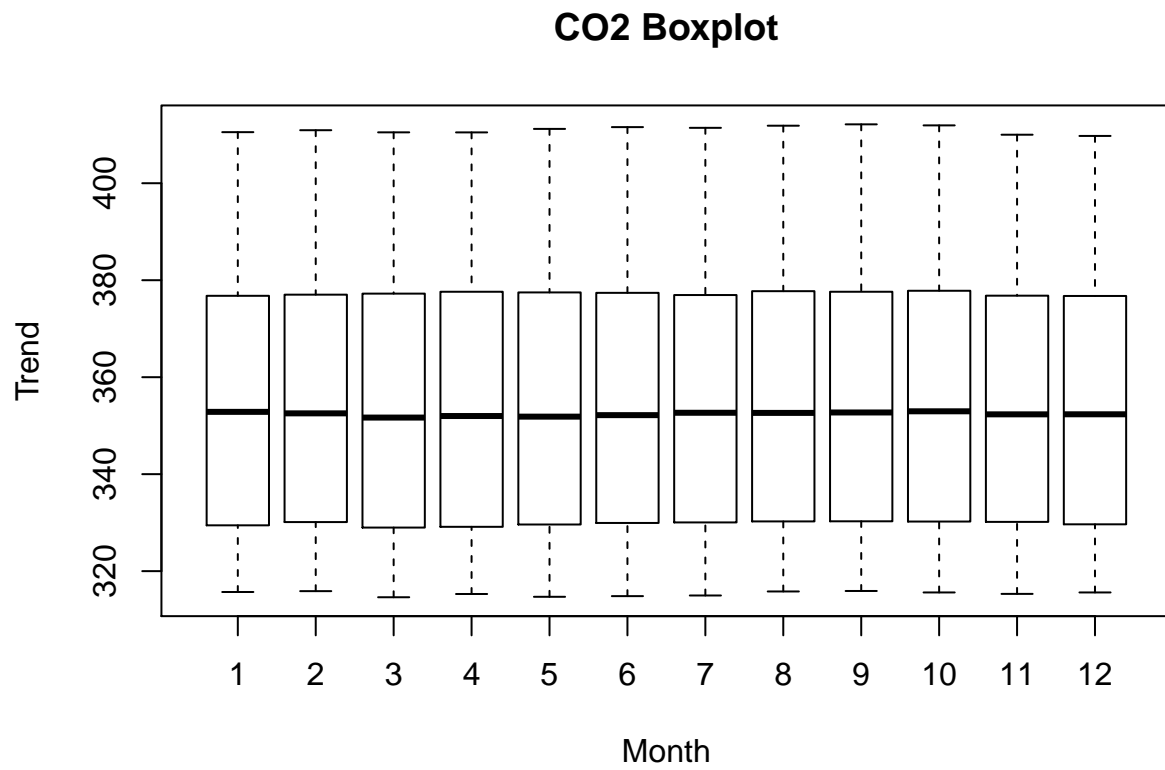
```
## [15] 4.58 5.13 4.43 5.62 4.89 4.30 4.29 4.35 4.59 4.03 4.05 4.39 4.07 4.01
## [29] 2.82 3.26 3.76 3.34 3.21 2.41 3.78 3.74 3.42 2.91 3.35 3.35 3.13
```

Time Series of Temperature:

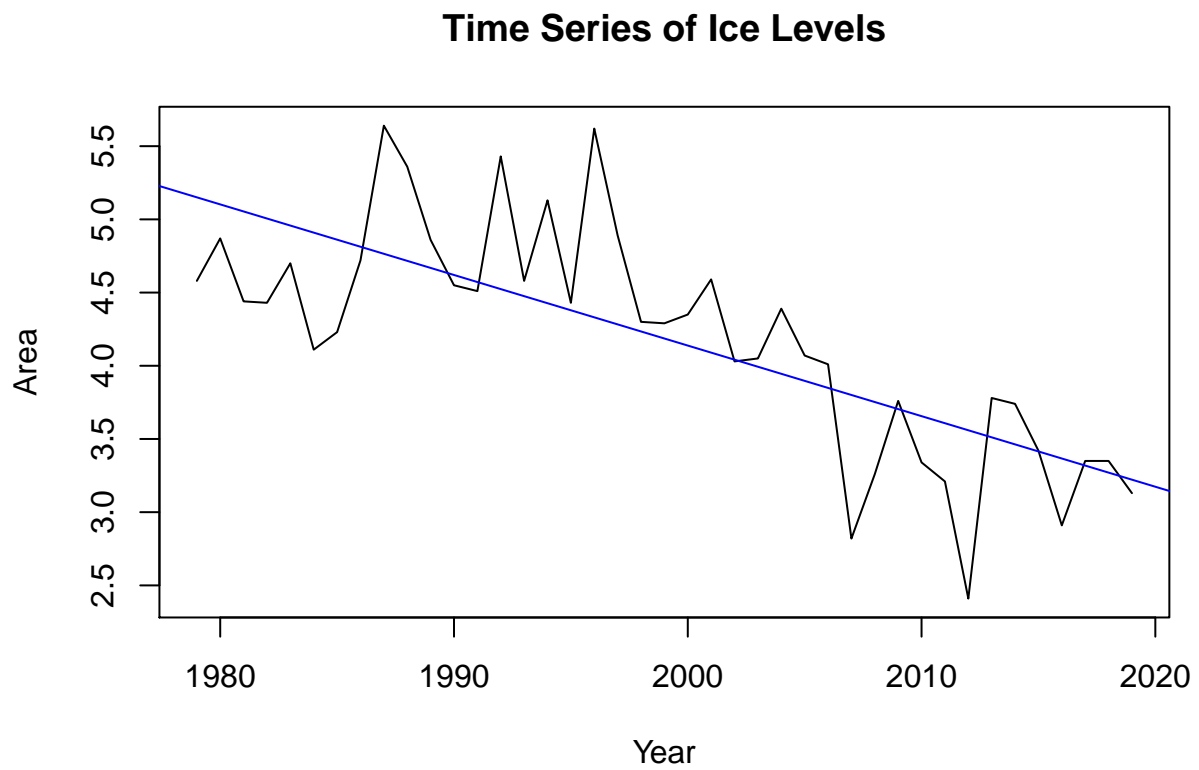
```
## Time Series:
## Start = 1880
## End = 2018
## Frequency = 1
## [1] -0.09 -0.12 -0.16 -0.20 -0.23 -0.25 -0.26 -0.26 -0.26 -0.25 -0.24
## [12] -0.25 -0.26 -0.25 -0.23 -0.21 -0.19 -0.17 -0.16 -0.17 -0.19 -0.23
## [23] -0.26 -0.28 -0.31 -0.34 -0.36 -0.37 -0.39 -0.41 -0.41 -0.39 -0.35
## [34] -0.33 -0.31 -0.31 -0.30 -0.30 -0.30 -0.30 -0.28 -0.27 -0.26 -0.24
## [45] -0.23 -0.22 -0.22 -0.21 -0.20 -0.19 -0.19 -0.19 -0.18 -0.17 -0.16
## [56] -0.14 -0.11 -0.07 -0.02 0.03 0.06 0.09 0.10 0.10 0.07 0.04
## [67] 0.00 -0.04 -0.07 -0.08 -0.08 -0.07 -0.07 -0.07 -0.07 -0.06 -0.05
## [78] -0.04 -0.01 0.02 0.03 0.02 -0.01 -0.02 -0.04 -0.05 -0.06 -0.05
## [89] -0.03 -0.02 0.00 0.01 0.00 0.00 0.01 0.02 0.04 0.07 0.12
## [100] 0.16 0.20 0.21 0.22 0.21 0.21 0.22 0.24 0.27 0.30 0.33
## [111] 0.33 0.32 0.33 0.33 0.34 0.37 0.40 0.42 0.45 0.47 0.50
## [122] 0.52 0.55 0.58 0.61 0.62 0.63 0.63 0.64 0.64 0.65 0.66
## [133] 0.69 0.74 0.78 0.83 0.87 0.91 0.96
```

Plot of CO_2 :

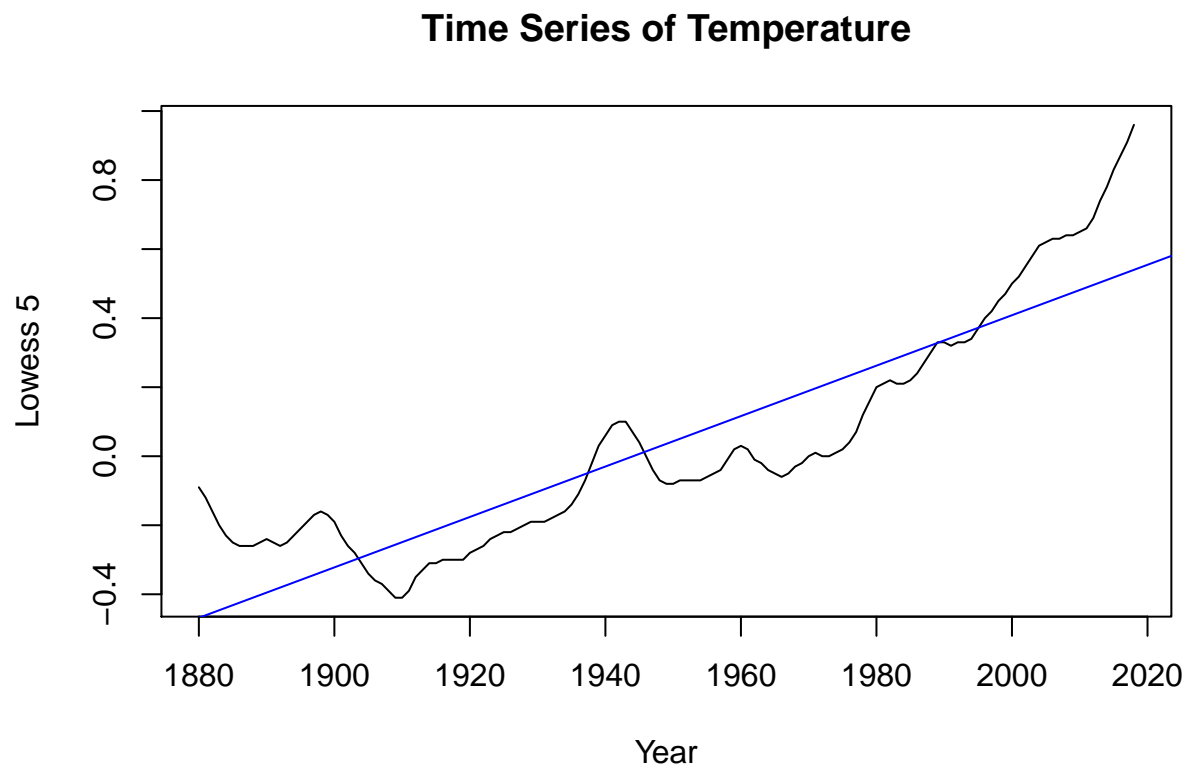




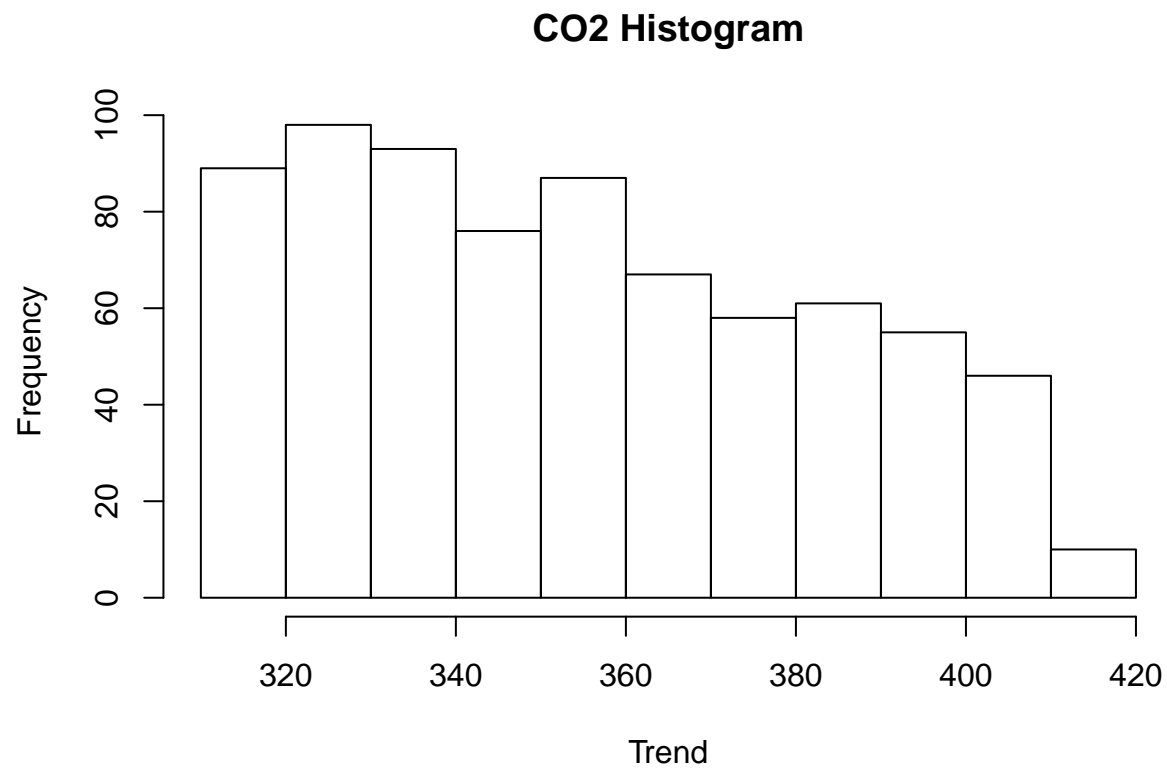
Plot of Ice Levels:



Plot of Temperature:



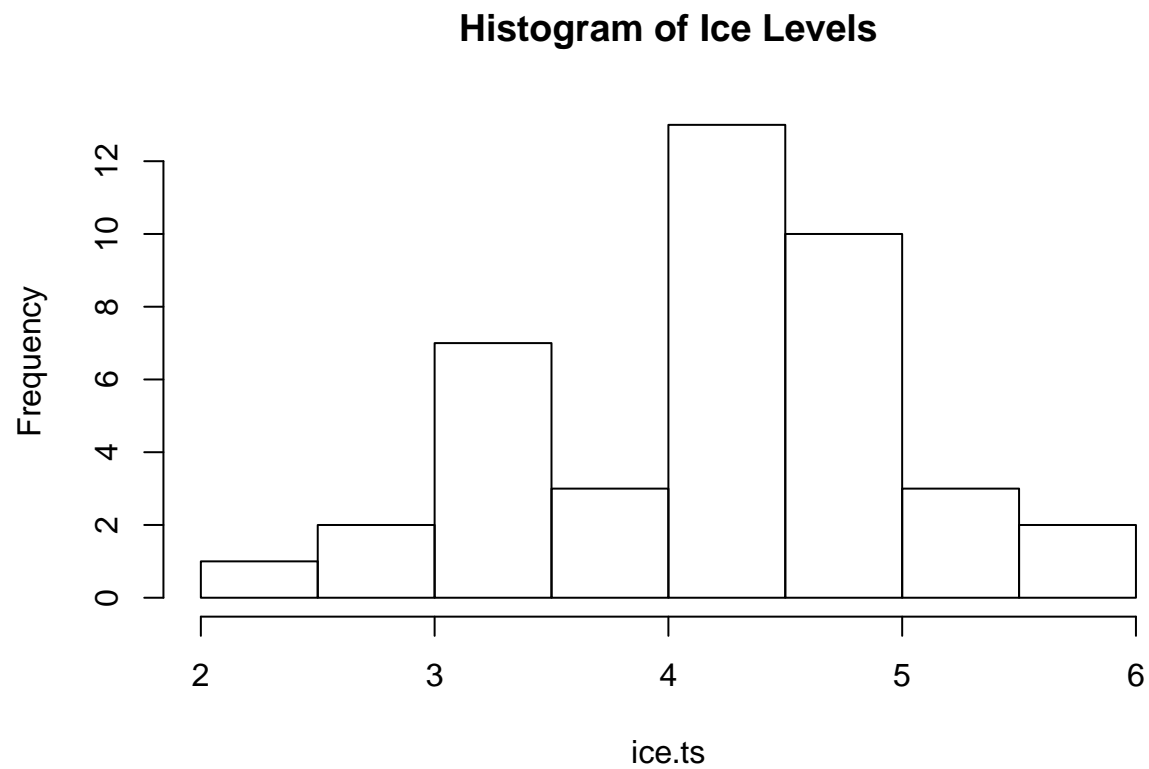
Histogram and KS test of CO_2 :



```
## Warning in ks.test(c02.ts, "dnorm"): ties should not be present for the
## Kolmogorov-Smirnov test

##
## One-sample Kolmogorov-Smirnov test
##
## data: c02.ts
## D = 1, p-value < 0.00000000000000022
## alternative hypothesis: two-sided
```

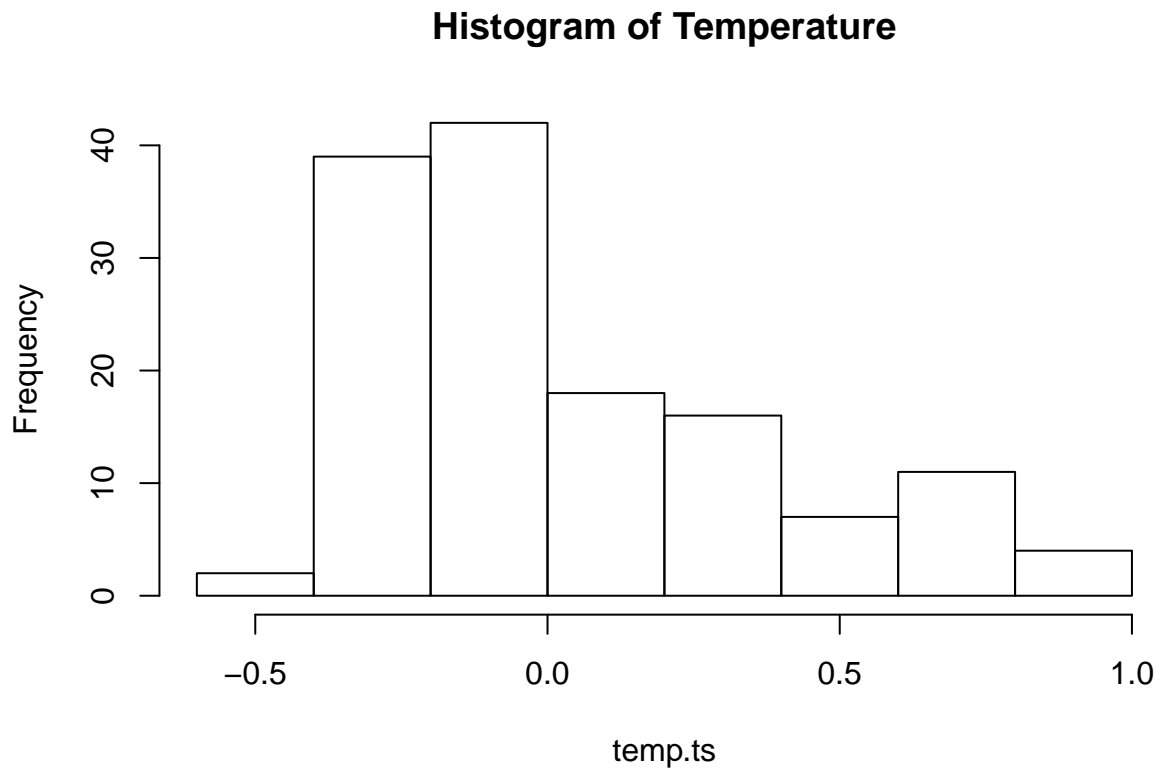
Histogram and KS test of Ice Levels:



```
## Warning in ks.test(ice.ts, "dnorm"): ties should not be present for the
## Kolmogorov-Smirnov test

##
## One-sample Kolmogorov-Smirnov test
##
## data: ice.ts
## D = 1, p-value < 0.00000000000000022
## alternative hypothesis: two-sided
```


Histogram and KS test of Temperature:



```
## Warning in ks.test(temp.ts, "dnorm"): ties should not be present for the
## Kolmogorov-Smirnov test

##
## One-sample Kolmogorov-Smirnov test
##
## data: temp.ts
## D = 0.74836, p-value < 0.00000000000000022
## alternative hypothesis: two-sided
```

Test Stationary of CO_2 :

```
##
## Augmented Dickey-Fuller Test
##
## data: c02.ts
## Dickey-Fuller = -0.32052, Lag order = 9, p-value = 0.99
## alternative hypothesis: stationary
```

Test Stationary of Ice Levels:

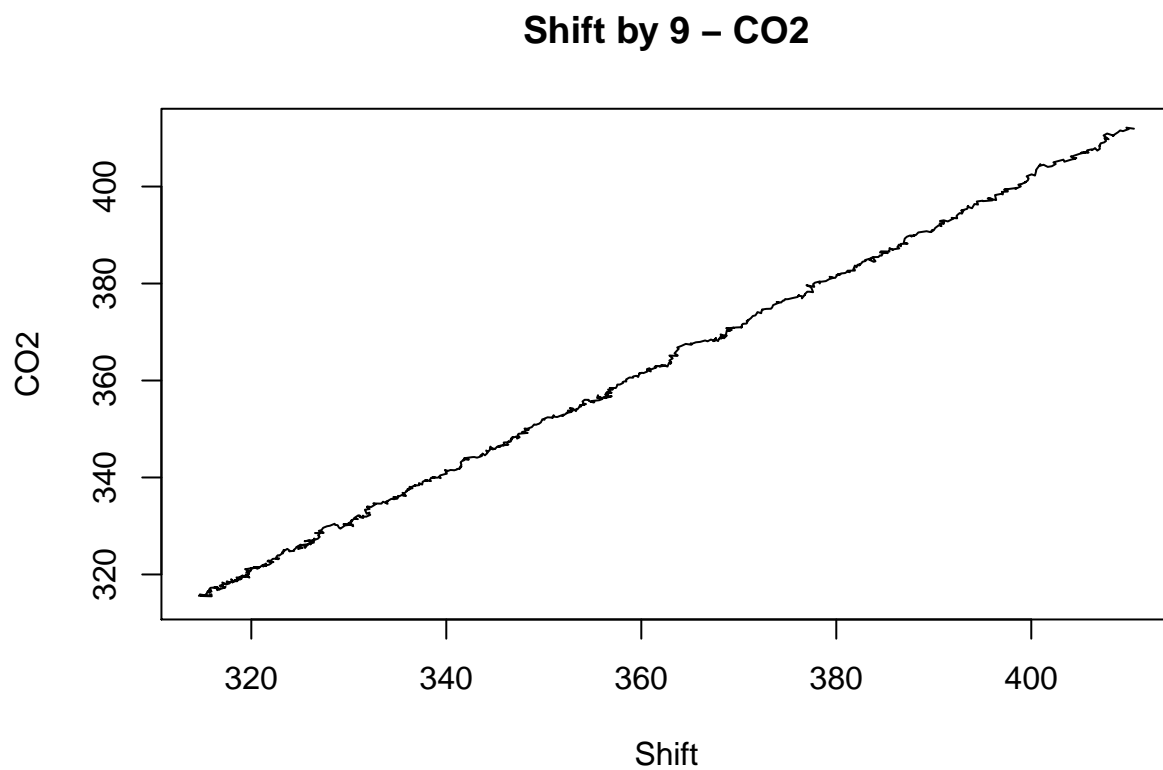
```
##
## Augmented Dickey-Fuller Test
```

```
##  
## data: ice.ts  
## Dickey-Fuller = -2.0717, Lag order = 3, p-value = 0.5454  
## alternative hypothesis: stationary
```

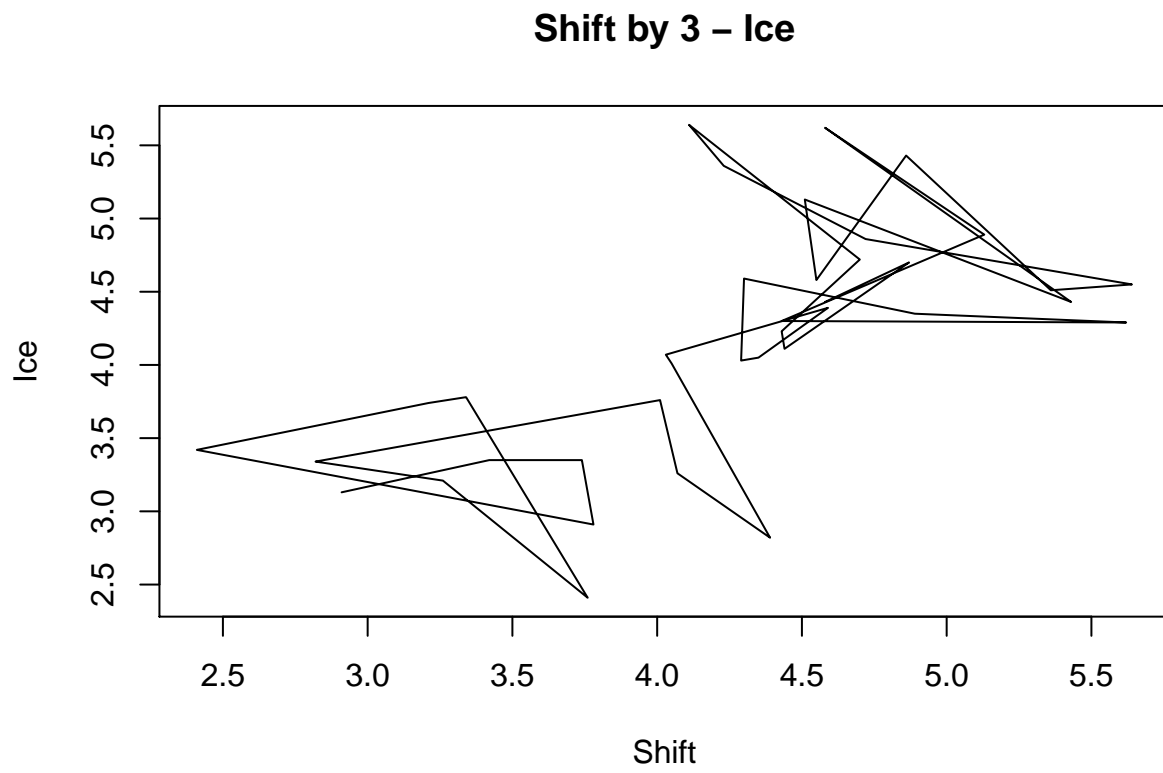
Test Stationary of Temperature:

```
## Warning in adf.test(temp.ts): p-value greater than printed p-value  
##  
## Augmented Dickey-Fuller Test  
##  
## data: temp.ts  
## Dickey-Fuller = -0.10387, Lag order = 5, p-value = 0.99  
## alternative hypothesis: stationary
```

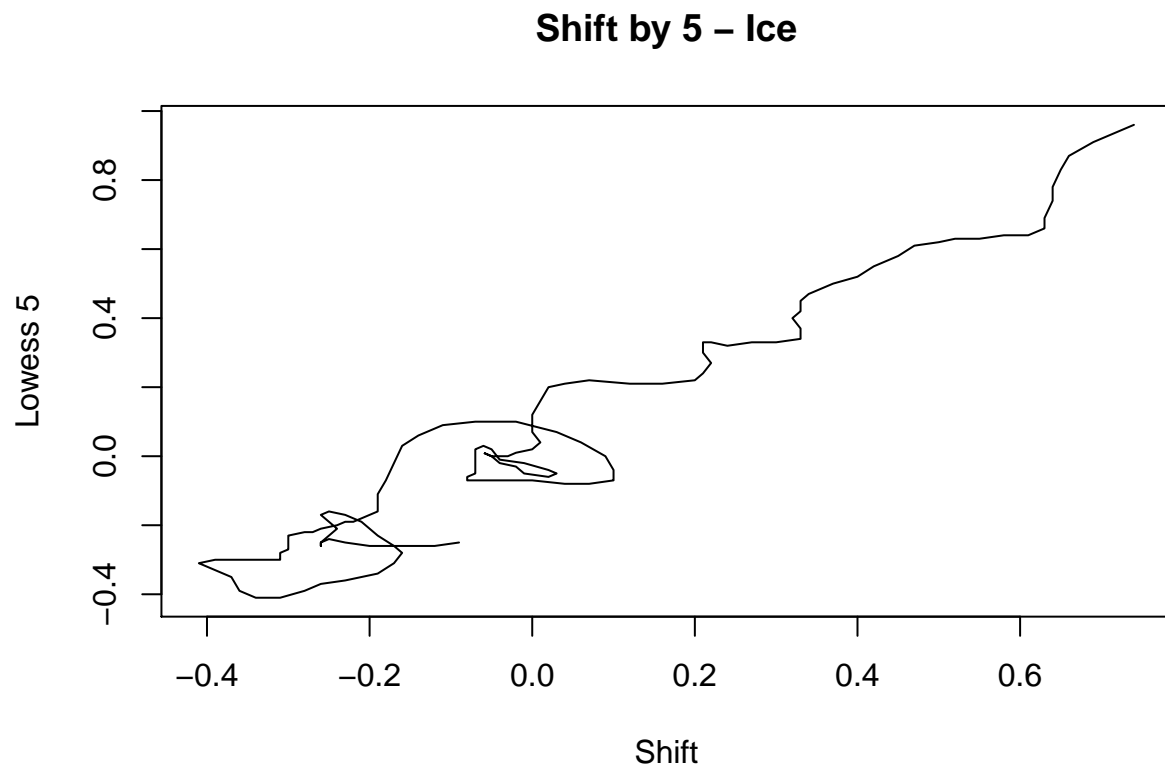
Shift CO_2 by 5:



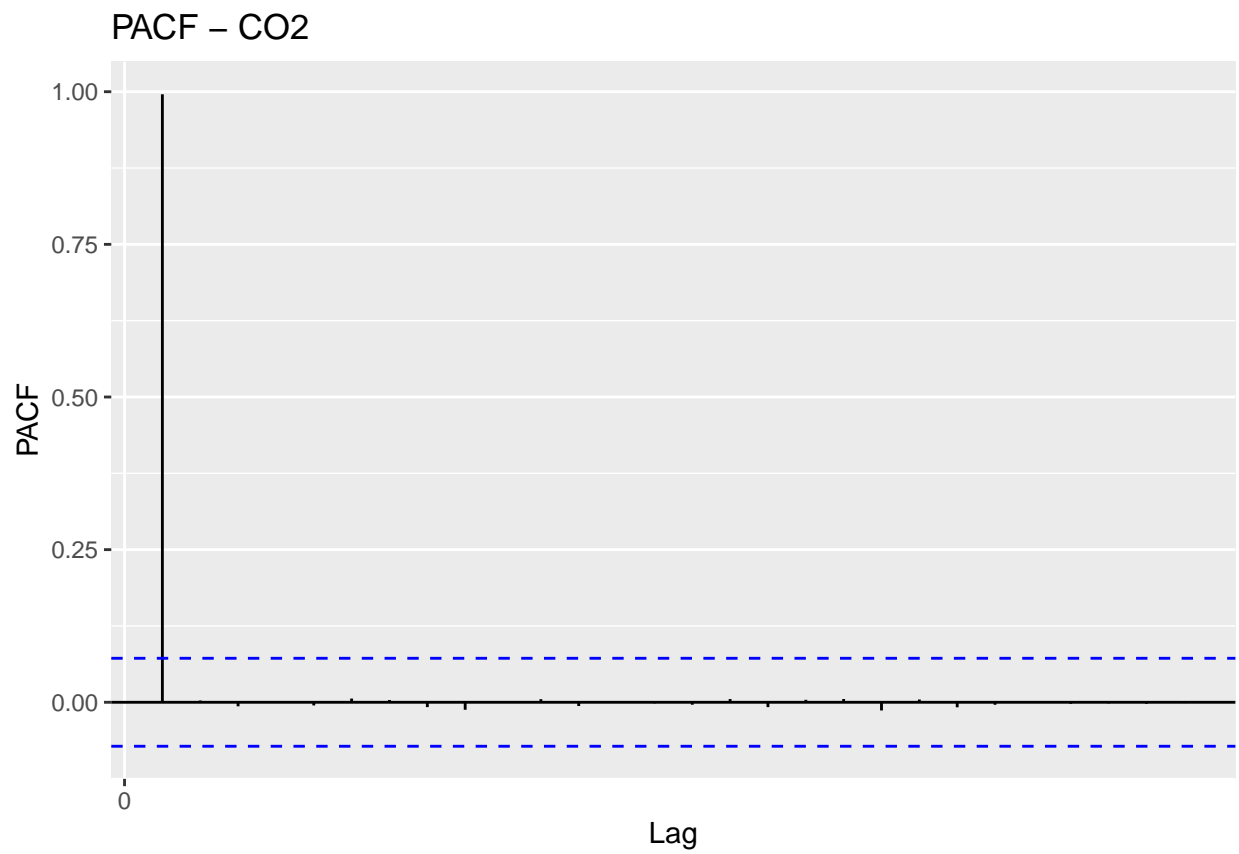
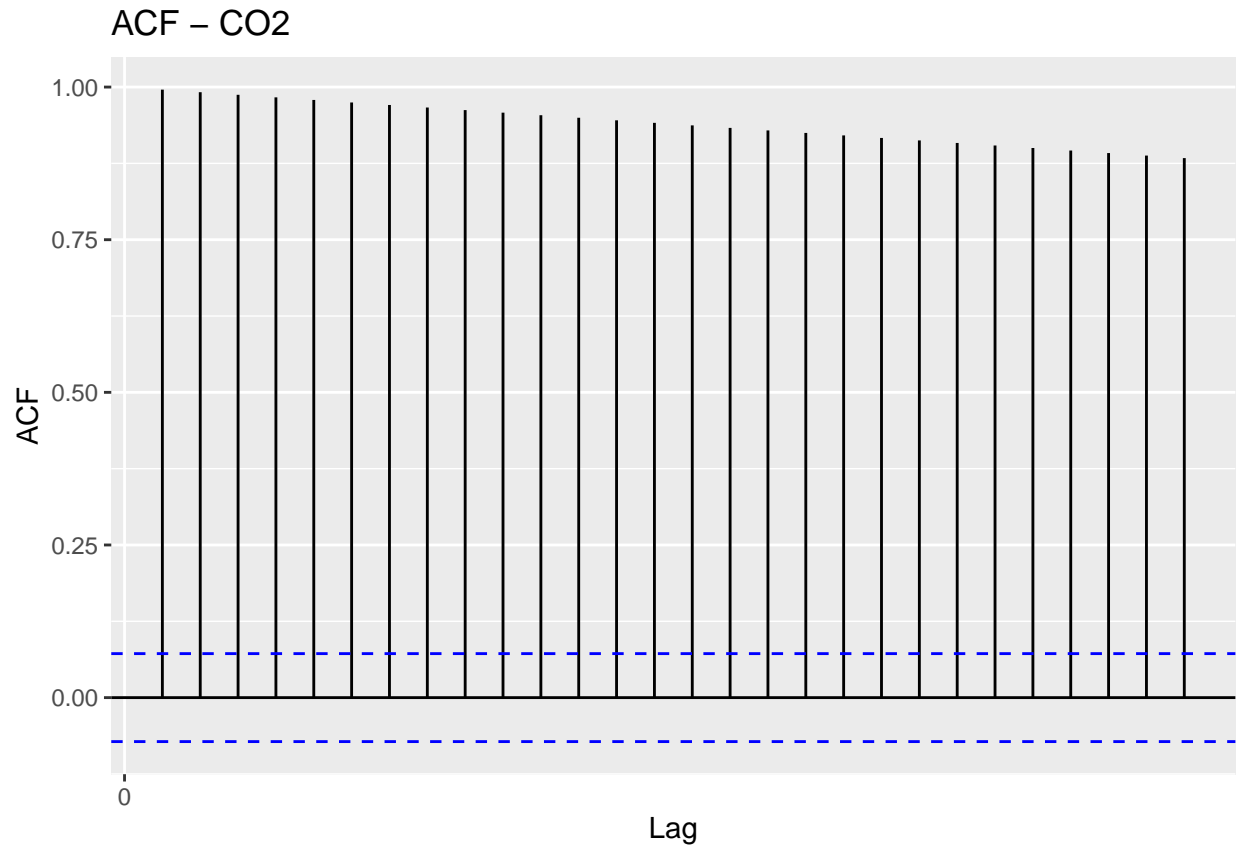
Shift Ice Levels by 3:



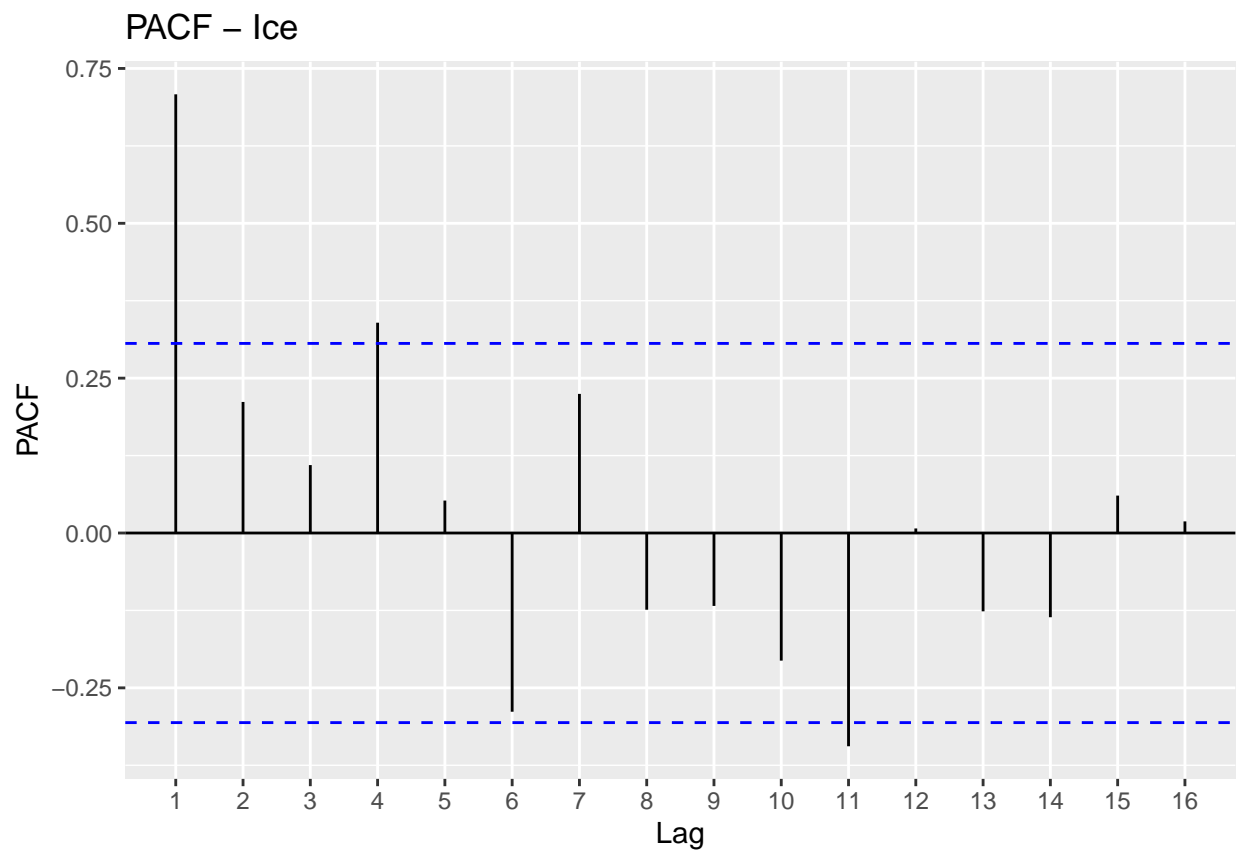
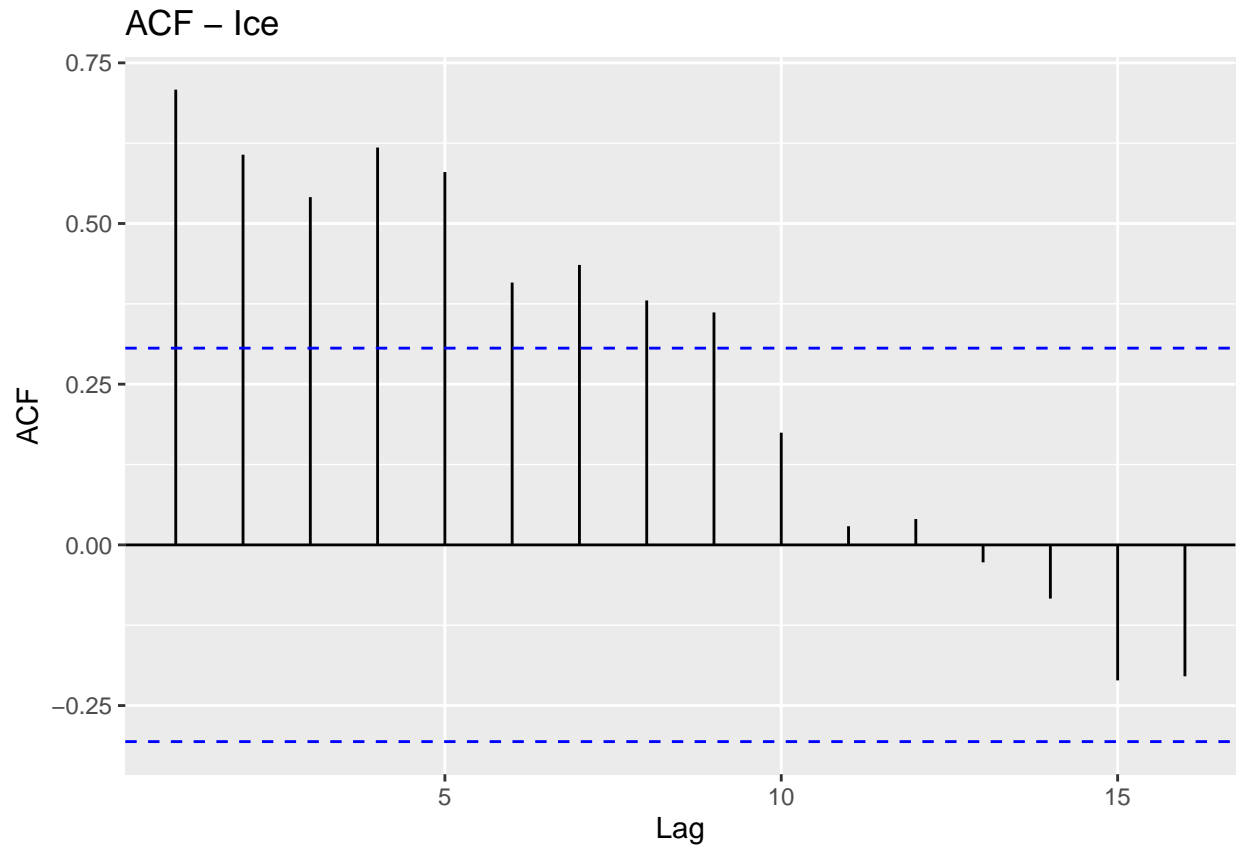
Shift Temperature by 5:

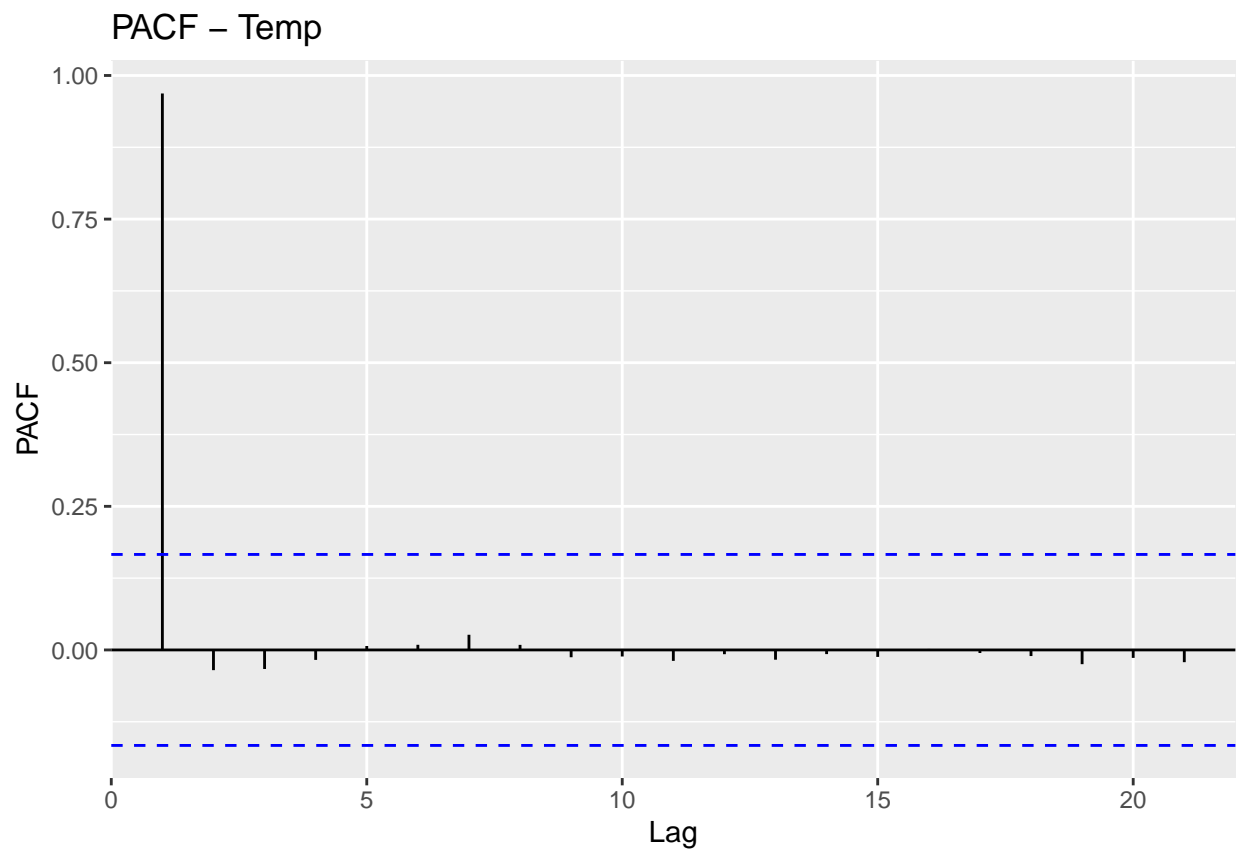
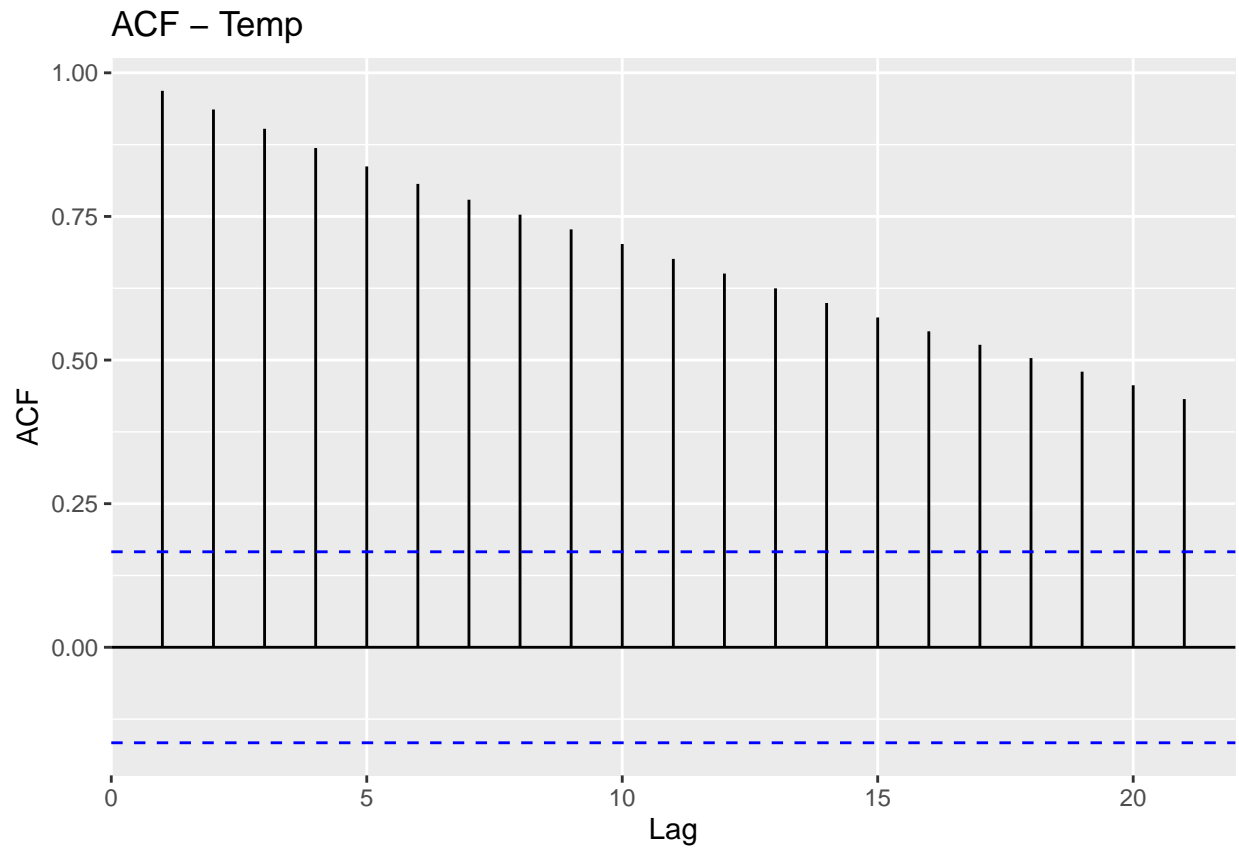


ACF and PACF of CO_2 :



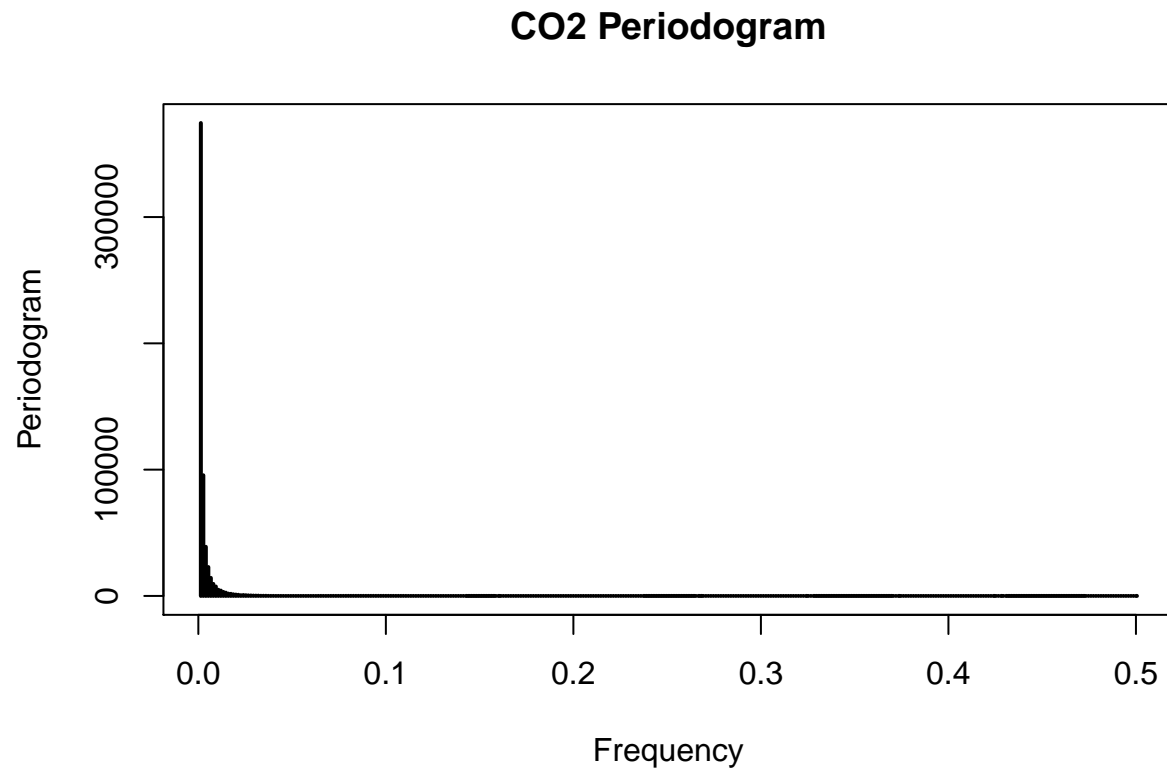
ACF and PACF of Ice Levels:



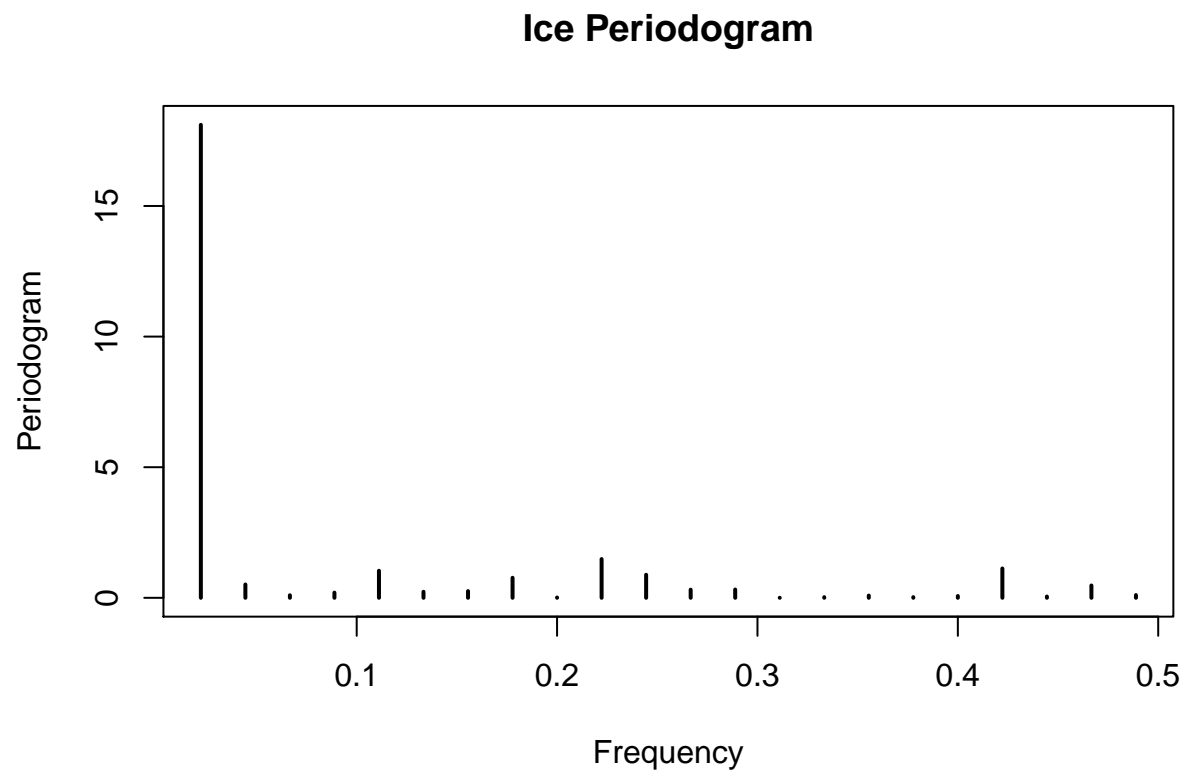
ACF and PACF of Temperature:

Periodogram of CO_2 :

```
## Registered S3 methods overwritten by 'TSA':  
##   method      from  
##   fitted.Arima forecast  
##   plot.Arima   forecast
```



Periodogram Ice Levels:



Periodogram Temperature:

