

Time Series Basics

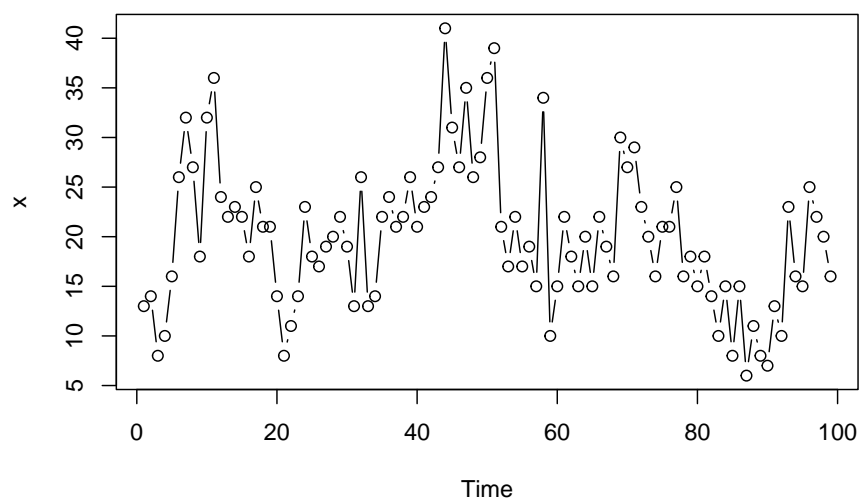
2023-05-05

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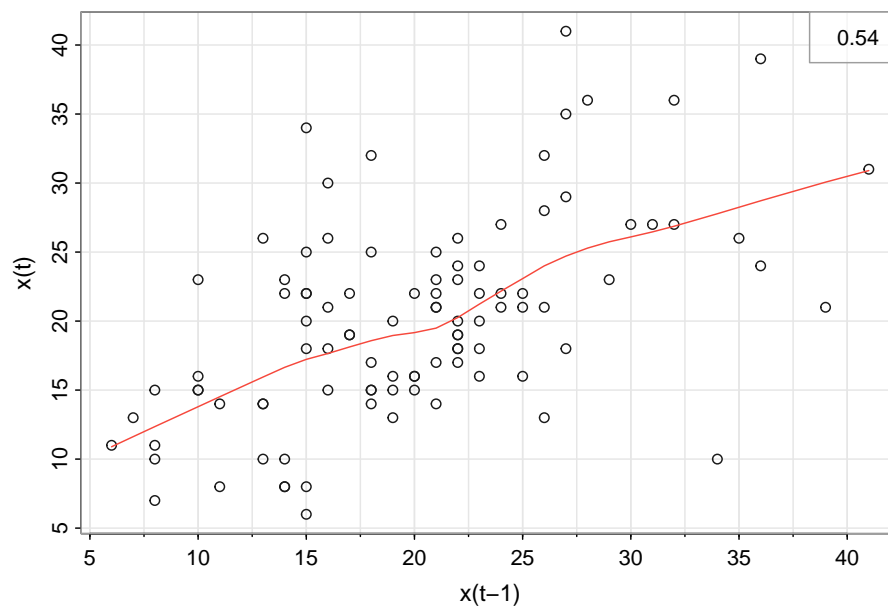
1	quakes	1
2	cmort	5

1 quakes

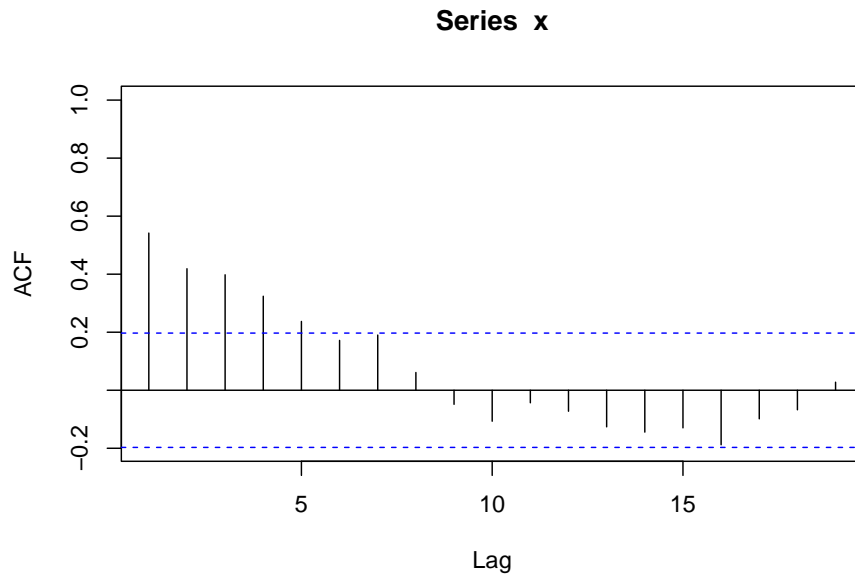
```
x=scan("quakes.dat")
x=ts(x) #this makes sure R knows that x is a time series
plot(x, type="b") #time series plot of x with points marked as "o"
```



```
library(astsa) # See note 1 below
lag1.plot(x,1) # Plots x versus lag 1 of x.
```



```
acf(x, xlim=c(1,19)) # Plots the ACF of x for lags 1 to 19
```

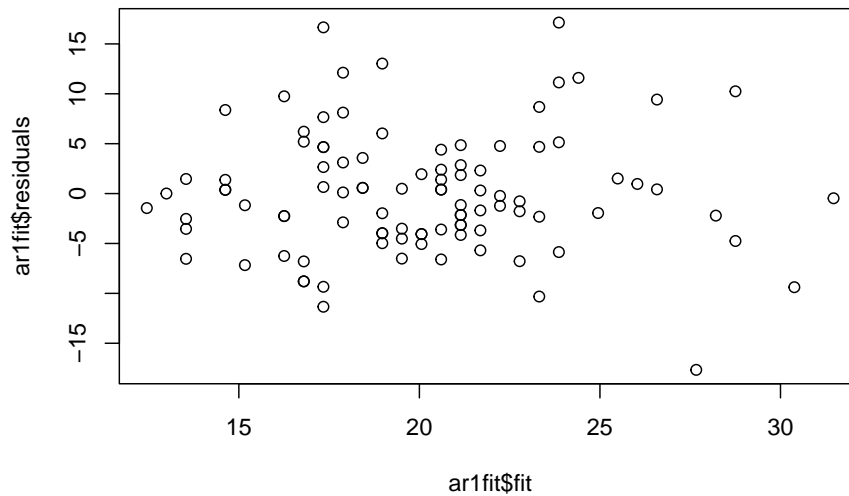


```
xlag1=lag(x,-1) # Creates a lag 1 of x variable. See note 2
y=cbind(x,xlag1) # See note 3 below
ar1fit=lm(y[,1]~y[,2])#Does regression, stores results object named ar1fit
summary(ar1fit) # This lists the regression results
```

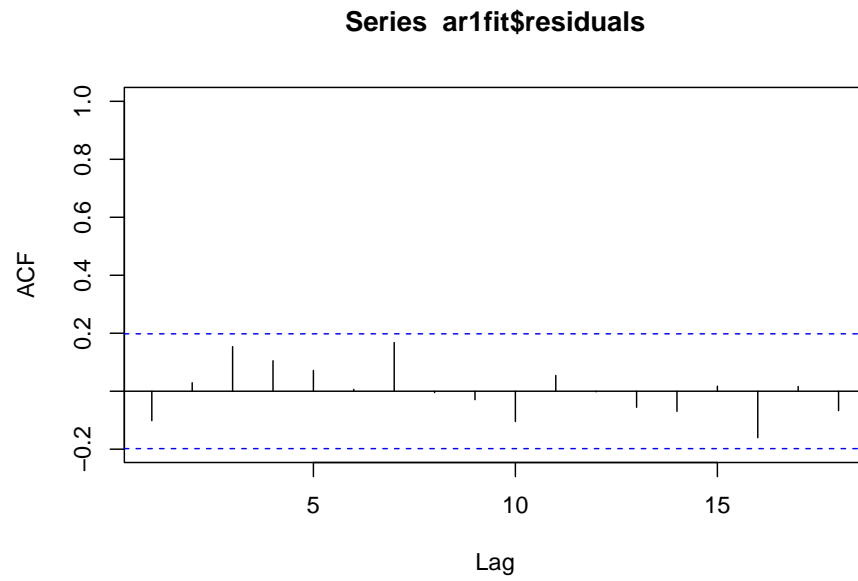
```
##
## Call:
## lm(formula = y[, 1] ~ y[, 2])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.666  -3.901  -0.351   3.050  17.138
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   9.19070    1.81924   5.052 2.08e-06 ***
```

```
## y[, 2]          0.54339    0.08528    6.372 6.47e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.122 on 96 degrees of freedom
## (因为不存在, 2个观察量被删除了)
## Multiple R-squared:  0.2972, Adjusted R-squared:  0.2899
## F-statistic:  40.6 on 1 and 96 DF,  p-value: 6.471e-09

plot(ar1fit$fit, ar1fit$residuals) #plot of residuals versus fits
```

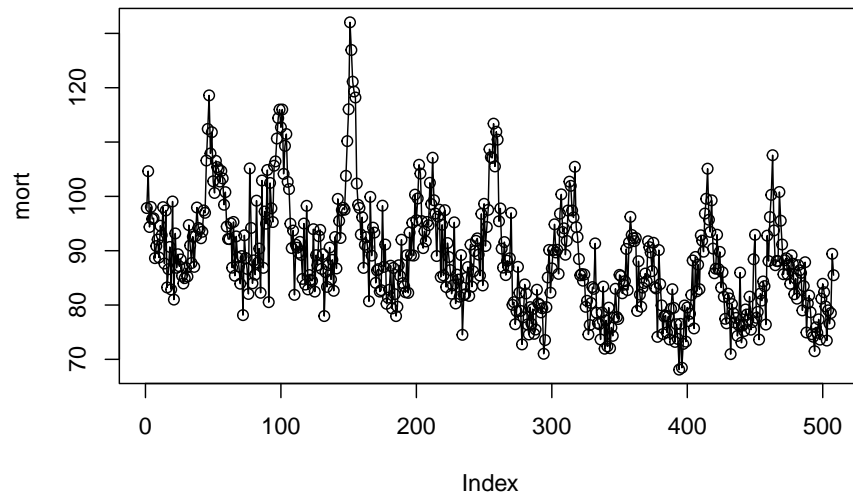


```
acf(ar1fit$residuals, xlim=c(1,18)) # ACF of the residuals for lags 1 to 18
```

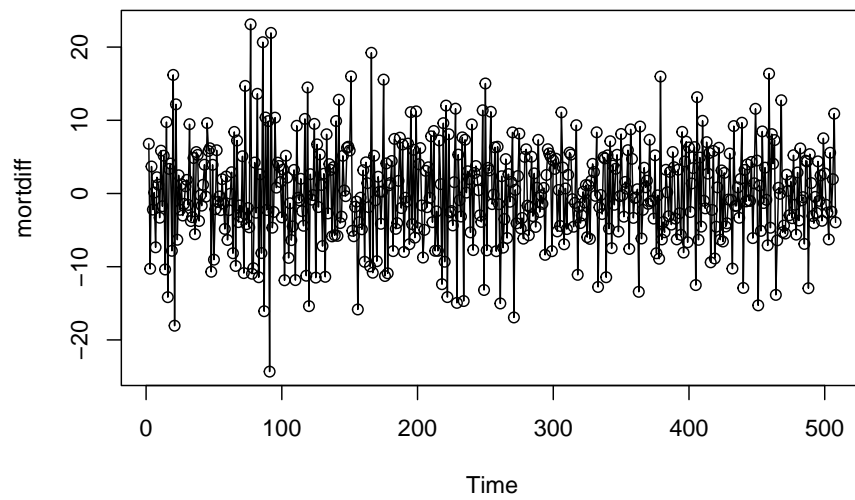


2 cmort

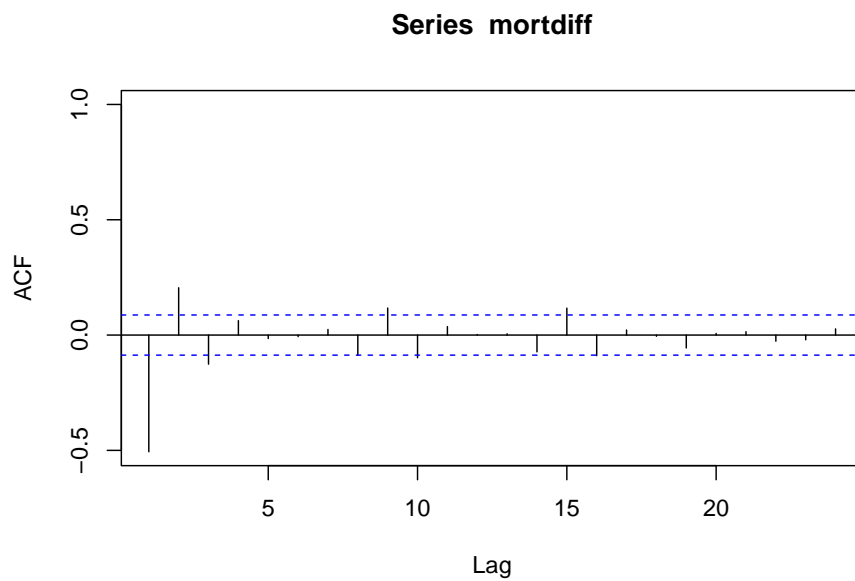
```
mort=scan("cmort.dat")  
plot(mort, type="o") # plot of mortality rate
```



```
mort=ts(mort)
mortdiff=diff(mort,1) # creates a variable =  $x(t) - x(t-1)$ 
plot(mortdiff,type="o") # plot of first differences
```



```
acf(mortdiff,xlim=c(1,24)) # plot of first differences, for 24 lags
```



```

mortdiffflag1=lag(mortdiff,-1)
y=cbind(mortdiff,mortdiffflag1) # bind first differences and lagged first differences

mortdiffar1=lm(y[,1]~y[,2]) # AR(1) regression for first differences
summary(mortdiffar1) # regression results

##
## Call:
## lm(formula = y[, 1] ~ y[, 2])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -19.2758  -3.8753  -0.0953   3.5725  20.8169
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.04627    0.25900  -0.179    0.858
## y[, 2]      -0.50636    0.03838 -13.195 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.826 on 504 degrees of freedom
## （因为不存在，2个观察量被删除了）
## Multiple R-squared:  0.2568, Adjusted R-squared:  0.2553
## F-statistic: 174.1 on 1 and 504 DF,  p-value: < 2.2e-16

acf(mortdiffar1$residuals, xlim = c(1,24)) # ACF of residuals for 24 lags.

```