climate data - San Francisco

Allie Hsu

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Temperature Changes in San Francisco

San Francisco temperature changes since 1921 cannot be attributed to becoming a heat island, as it has been developed for over a century

```r
#file.choose()
#read.csv("/home/CAMPUS/achb2017/Climate_Change_Narratives/student_folders/Hsu/AllieHsu_SanFrancisco_Da
climate_data <- read.csv("/home/CAMPUS/achb2017/Climate_Change_Narratives/student_folders/Hsu/AllieHsu_S

head(climate_data)
```

```
##      STATION                         NAME      DATE DAPR MDPR PRCP PSUN
## 1 USW00023272 SAN FRANCISCO DOWNTOWN, CA US 7/1/1921   NA   NA    0   NA
## 2 USW00023272 SAN FRANCISCO DOWNTOWN, CA US 7/2/1921   NA   NA    0   NA
## 3 USW00023272 SAN FRANCISCO DOWNTOWN, CA US 7/3/1921   NA   NA    0   NA
## 4 USW00023272 SAN FRANCISCO DOWNTOWN, CA US 7/4/1921   NA   NA    0   NA
## 5 USW00023272 SAN FRANCISCO DOWNTOWN, CA US 7/5/1921   NA   NA    0   NA
## 6 USW00023272 SAN FRANCISCO DOWNTOWN, CA US 7/6/1921   NA   NA    0   NA
##   SNOW SNWD TAVG TMAX TMIN TOBS TSUN WDFM WSF1 WSFG WSFM WT01 WT03 WT04
## 1    0   NA   NA   76   54   NA   NA   NA   NA   NA   NA   NA   NA   NA
## 2    0   NA   NA   85   60   NA   NA   NA   NA   NA   NA   NA   NA   NA
## 3    0   NA   NA   85   62   NA   NA   NA   NA   NA   NA   NA   NA   NA
## 4    0   NA   NA   64   53   NA   NA   NA   NA   NA   NA   NA   NA   NA
## 5    0   NA   NA   82   52   NA   NA   NA   NA   NA   NA   NA   NA   NA
## 6    0   NA   NA   94   61   NA   NA   NA   NA   NA   NA   NA   NA   NA
##   WT05 WT08 WT11 WT16 WT18
## 1   NA   NA   NA   NA   NA
## 2   NA   NA   NA   NA   NA
## 3   NA   NA   NA   NA   NA
## 4   NA   NA   NA   NA   NA
## 5   NA   NA   NA   NA   NA
## 6   NA   NA   NA   NA   NA
```

```r
str(climate_data)
```

```
## 'data.frame':    35930 obs. of  26 variables:
##  $ STATION: Factor w/ 1 level "USW00023272": 1 1 1 1 1 1 1 1 1 1 ...
##  $ NAME   : Factor w/ 1 level "SAN FRANCISCO DOWNTOWN, CA US": 1 1 1 1 1 1 1 1 1 1 ...
##  $ DATE   : Factor w/ 35930 levels "1/1/1922","1/1/1923",..: 26823 27912 29001 29298 29397 29496 2959
##  $ DAPR   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ MDPR   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ PRCP   : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ PSUN   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ SNOW   : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ SNWD   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ TAVG   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ TMAX   : int  76 85 85 64 82 94 90 79 64 60 ...
##  $ TMIN   : int  54 60 62 53 52 61 61 56 54 52 ...
```

```
##  $ TOBS   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ TSUN   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WDFM   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WSF1   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ WSFG   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ WSFM   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT01   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT03   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT04   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT05   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT08   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT11   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT16   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT18   : int  NA NA NA NA NA NA NA NA NA NA ...
```

```r
names(climate_data)
```

```
##  [1] "STATION" "NAME"    "DATE"    "DAPR"    "MDPR"    "PRCP"    "PSUN"
##  [8] "SNOW"    "SNWD"    "TAVG"    "TMAX"    "TMIN"    "TOBS"    "TSUN"
## [15] "WDFM"    "WSF1"    "WSFG"    "WSFM"    "WT01"    "WT03"    "WT04"
## [22] "WT05"    "WT08"    "WT11"    "WT16"    "WT18"
```

```r
## plot(TMAX~DATE, climate_data)

min(climate_data$TMAX)
```

```
## [1] NA
```
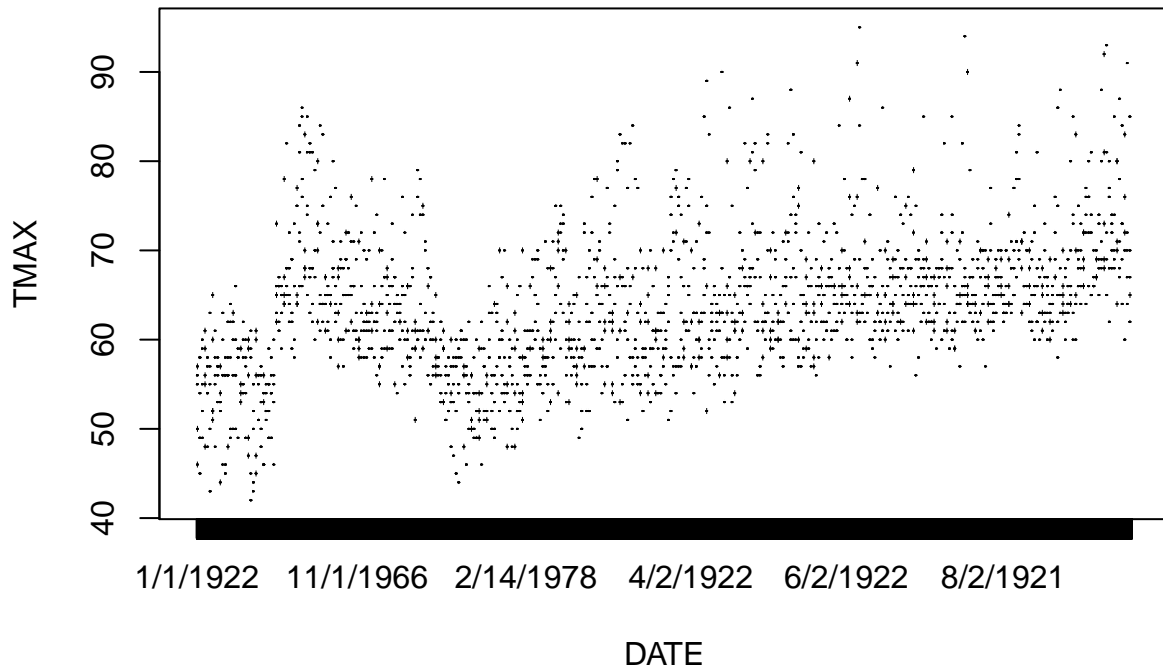
```r
min(climate_data$TMAX, na.rm = T)
```

```
## [1] 35
```

```r
climate_data$TMAX[climate_data$TMAX==-9999] = NA
climate_data$TMIN[climate_data$TMIN==-9999] = NA ## eliminating placeholders which will skew our averag

plot(TMAX~DATE, climate_data[1:1835,], ty='l')
```

```
str(climate_data)
```

```
## 'data.frame':    35930 obs. of  26 variables:
##  $ STATION: Factor w/ 1 level "USW00023272": 1 1 1 1 1 1 1 1 1 1 ...
##  $ NAME   : Factor w/ 1 level "SAN FRANCISCO DOWNTOWN, CA US": 1 1 1 1 1 1 1 1 1 1 ...
##  $ DATE   : Factor w/ 35930 levels "1/1/1922","1/1/1923",..: 26823 27912 29001 29298 29397 29496 2959
##  $ DAPR   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ MDPR   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ PRCP   : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ PSUN   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ SNOW   : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ SNWD   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ TAVG   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ TMAX   : int  76 85 85 64 82 94 90 79 64 60 ...
##  $ TMIN   : int  54 60 62 53 52 61 61 56 54 52 ...
##  $ TOBS   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ TSUN   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WDFM   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WSF1   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ WSFG   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ WSFM   : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT01   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT03   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT04   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT05   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ WT08   : int  NA NA NA NA NA NA NA NA NA NA ...
```

```
## $ WT11   : int  NA NA NA NA NA NA NA NA NA NA ...
## $ WT16   : int  NA NA NA NA NA NA NA NA NA NA ...
## $ WT18   : int  NA NA NA NA NA NA NA NA NA NA ...
```

```r
strDates <- as.character(climate_data$DATE)
climate_data$NewDate <- as.Date(strDates, "%m/%d/%Y") ##reformatting dates - NewDate

plot(TMAX~NewDate, climate_data, ty='l') ## plot of daily TMAX data
```
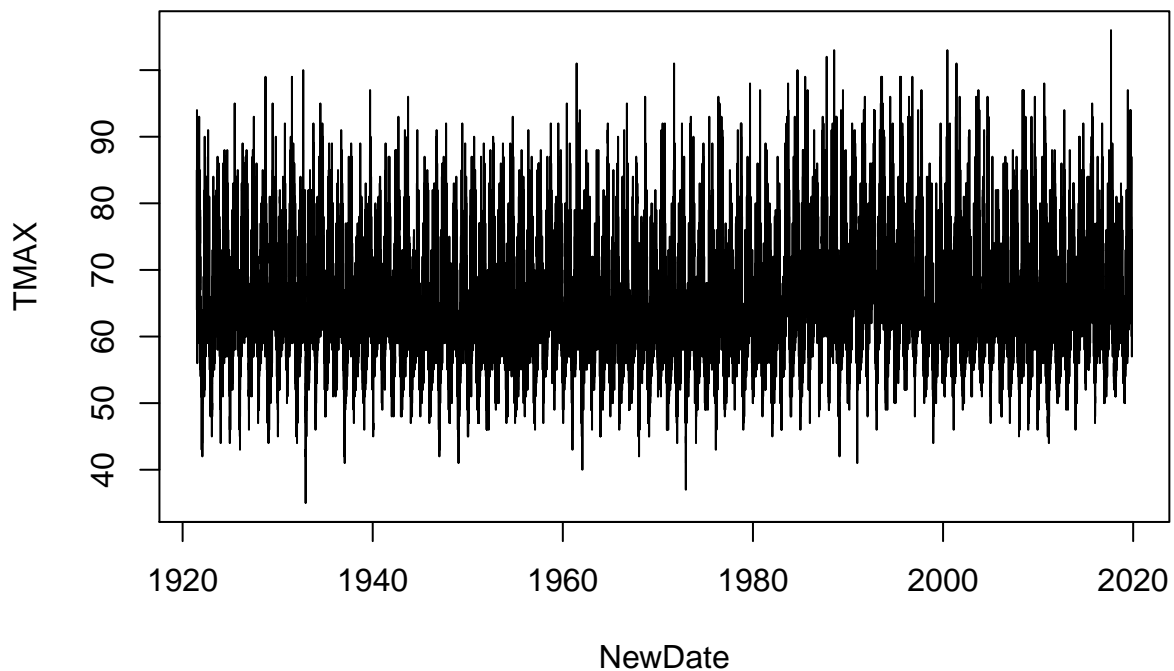

Analyse Climate Data

null hypothesis = slope of best fit line is zero, y-intercept is zero

```r
lm(TMAX ~ NewDate, data=climate_data)
```

```
##
## Call:
## lm(formula = TMAX ~ NewDate, data = climate_data)
##
## Coefficients:
## (Intercept)      NewDate
##   6.372e+01    5.835e-05
```

```r
summary(lm(TMAX ~ NewDate, data=climate_data))
```

```
##
## Call:
```

```
## lm(formula = TMAX ~ NewDate, data = climate_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -27.929  -4.935  -0.867   3.795  41.265
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 6.372e+01  4.010e-02  1588.8   <2e-16 ***
## NewDate     5.835e-05  3.865e-06    15.1   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.6 on 35926 degrees of freedom
##   (2 observations deleted due to missingness)
## Multiple R-squared:  0.006303,   Adjusted R-squared:  0.006275
## F-statistic: 227.9 on 1 and 35926 DF,  p-value: < 2.2e-16
## slightly positive temperature slope (5.835e-05) - highly significant (2e-16 - is much less than 0.05)
## lots of variability, not date driven
```

we reject the null hypothesis!

```
## disaggregate into month and year variables
climate_data$Month = format(as.Date(climate_data$NewDate), format = "%m")
climate_data$Year = format(climate_data$NewDate, format="%Y")

MonthlyTMAXMean = aggregate(TMAX ~ Month + Year, climate_data, mean)
MonthlyTMAXMean$YEAR = as.numeric(MonthlyTMAXMean$Year)
MonthlyTMAXMean$MONTH = as.numeric(MonthlyTMAXMean$Month)

str(MonthlyTMAXMean)
```

```
## 'data.frame':    1181 obs. of  5 variables:
##  $ Month: chr  "07" "08" "09" "10" ...
##  $ Year : chr  "1921" "1921" "1921" "1921" ...
##  $ TMAX : num  66.9 65.4 71.1 68.1 64.1 ...
##  $ YEAR : num  1921 1921 1921 1921 1921 ...
##  $ MONTH: num  7 8 9 10 11 12 1 2 3 4 ...
```

```
plot(MonthlyTMAXMean$TMAX, ty='l')
```
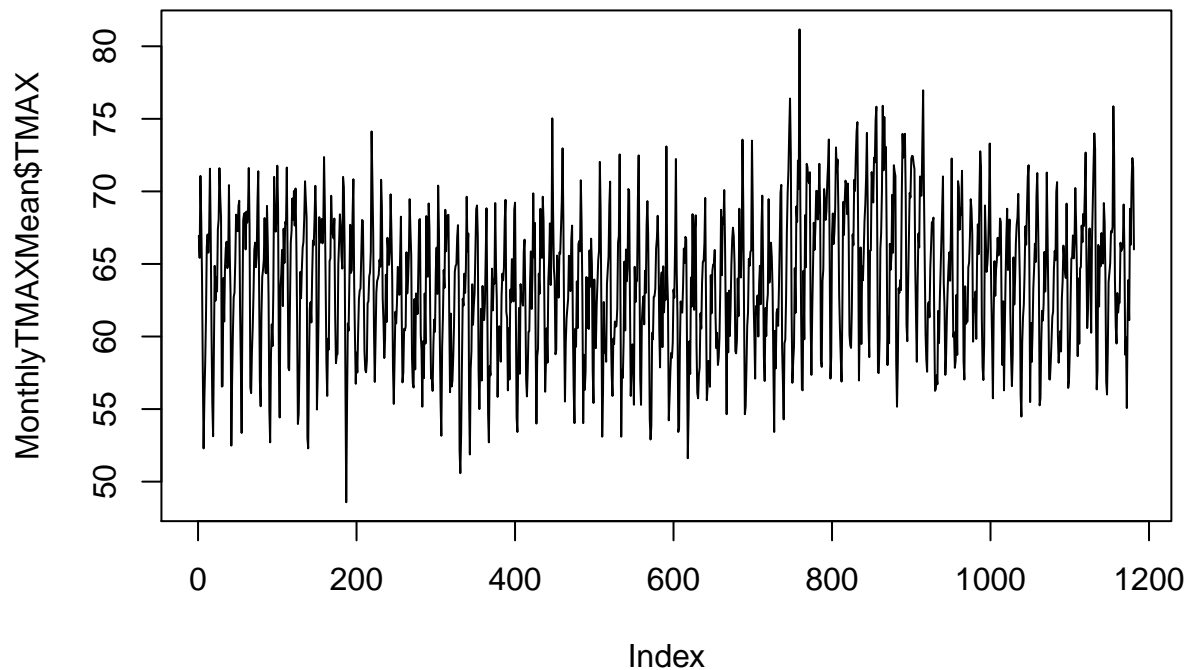
```r
MonthlyTMINMean = aggregate(TMIN ~ Month + Year, climate_data, mean)
MonthlyTMINMean$YEAR = as.numeric(MonthlyTMINMean$Year)

MonthlyTMINMean$YEAR = as.numeric(MonthlyTMINMean$Year)
MonthlyTMINMean$MONTH = as.numeric(MonthlyTMINMean$Month)
head(MonthlyTMINMean)
```

```
##   Month Year      TMIN YEAR MONTH
## 1    07 1921 52.64516 1921     7
## 2    08 1921 53.67742 1921     8
## 3    09 1921 55.50000 1921     9
## 4    10 1921 54.87097 1921    10
## 5    11 1921 51.50000 1921    11
## 6    12 1921 48.09677 1921    12
```

```r
plot(MonthlyTMINMean$TMIN, ty='l')
```
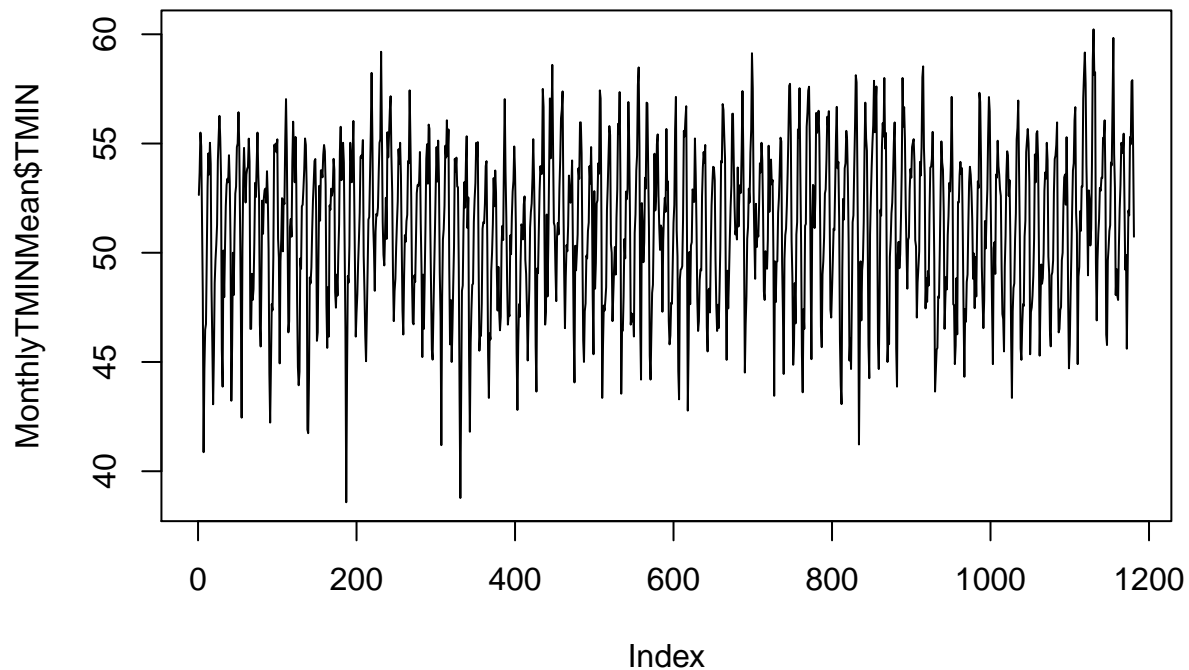
```
Months = c("January", "February", "March", "April", "May", "June",
"July", "August", "September", "October", "November", "December")
# Create a panel so I can see all the figures at once.
par(mfrow=c(4,3), mar=c(5, 4, 3, 2) + 0.1)
TMAXresult <- NA
for (i in 1:12){
#plot(MonthlyTMAXMean£TMAX[MonthlyTMAXMean£Month==i], ty='l')
plot(TMAX~YEAR,
data=MonthlyTMAXMean[MonthlyTMAXMean$MONTH==i,],
ty='l', las=1, xlim=c(1940, 2020), main=Months[i])
Month.lm <- lm(TMAX~YEAR, data=MonthlyTMAXMean[MonthlyTMAXMean$MONTH==i,])
summary(Month.lm)
abline(coef(Month.lm), col="red")
TMAXresult <- rbind(TMAXresult,
cbind(Months[i], round(coef(Month.lm)[2], 4),
round(summary(Month.lm)$coefficients[2,4],4),
round(summary(Month.lm)$r.squared, 3)))
}
```
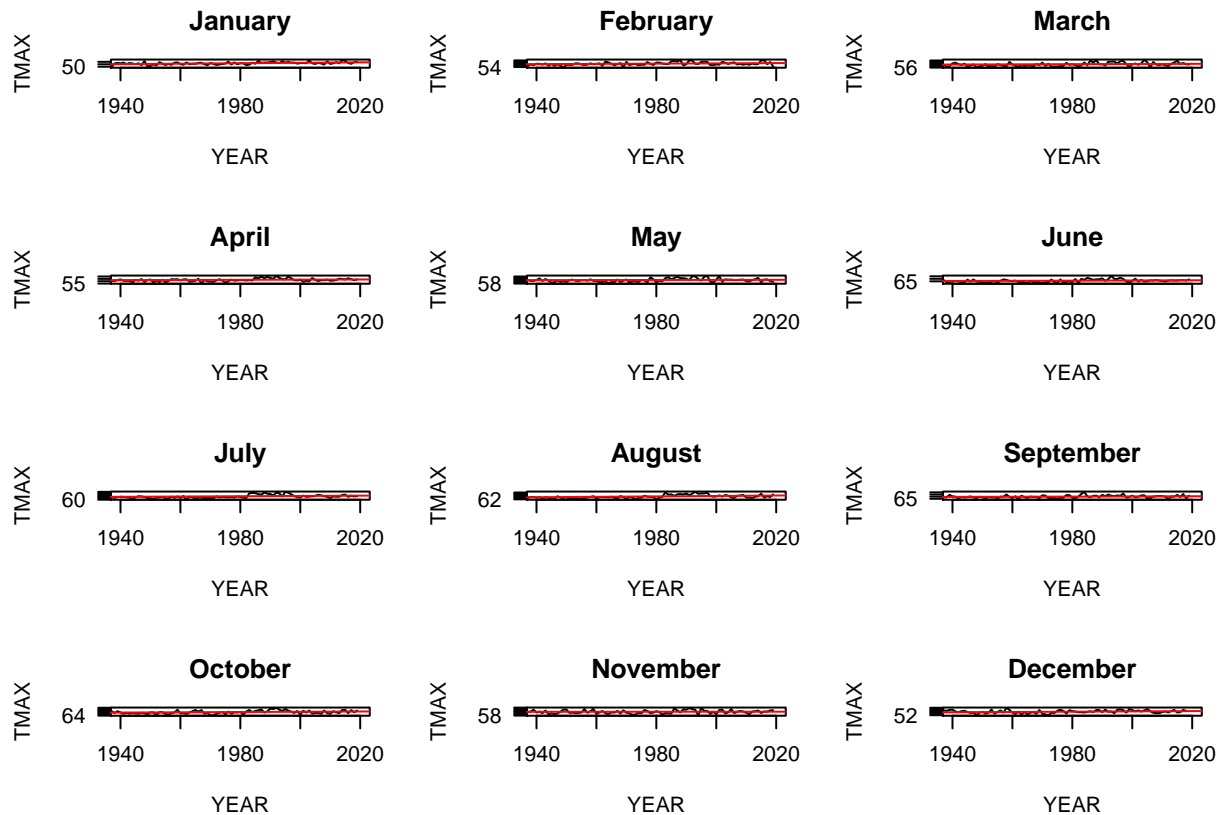
```r
par(mfrow=c(4,3), mar=c(5, 4, 3, 2) + 0.1)
TMINresult <- NA
for (i in 1:12){
#plot(MonthlyTMAXMean£TMAX[MonthlyTMINMean£Month==i], ty='l')
plot(TMIN~YEAR,
data=MonthlyTMINMean[MonthlyTMINMean$MONTH==i,],
ty='l', las=1, xlim=c(1940, 2020), main=Months[i])
Month.lm <- lm(TMIN~YEAR, data=MonthlyTMINMean[MonthlyTMINMean$MONTH==i,])
summary(Month.lm)
abline(coef(Month.lm), col="red")
TMINresult <- rbind(TMINresult,
cbind(Months[i], round(coef(Month.lm)[2], 4),
round(summary(Month.lm)$coefficients[2,4],4),
round(summary(Month.lm)$r.squared, 3)))
}
```
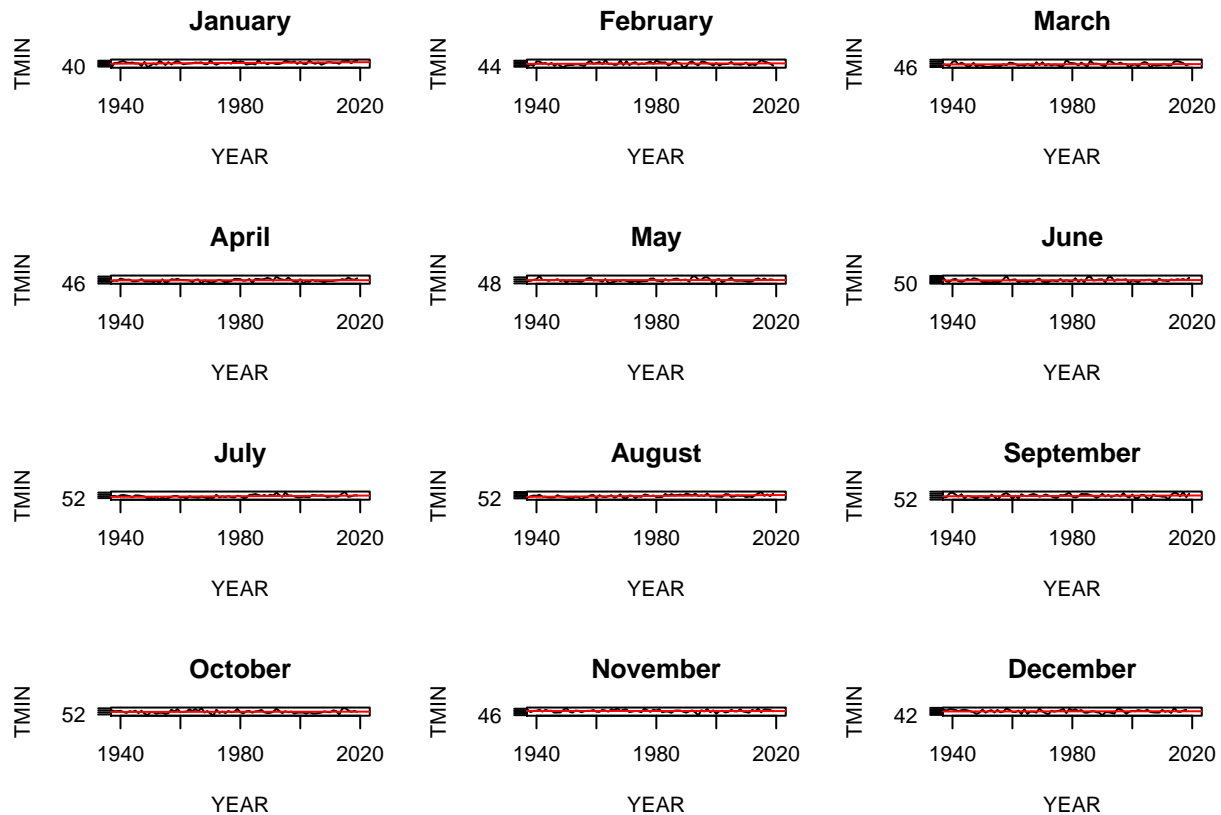
```r
MonthlyTMINMean = aggregate(TMIN ~ Month + Year, climate_data, mean)
MonthlyTMINMean$YEAR = as.numeric(MonthlyTMINMean$Year)
# Fixing the Format of Month and Year as numeric
MonthlyTMINMean$YEAR = as.numeric(MonthlyTMINMean$Year)
MonthlyTMINMean$MONTH = as.numeric(MonthlyTMINMean$Month)
head(MonthlyTMINMean)
```

```
##   Month Year     TMIN YEAR MONTH
## 1    07 1921 52.64516 1921     7
## 2    08 1921 53.67742 1921     8
## 3    09 1921 55.50000 1921     9
## 4    10 1921 54.87097 1921    10
## 5    11 1921 51.50000 1921    11
## 6    12 1921 48.09677 1921    12
```

```r
## Makes a table
library(xtable)
Results <- data.frame(Month = TMINresult[c(2:13),1],
TMINSlope = TMINresult[c(2:13),2],
TMIN_P = as.numeric(TMINresult[c(2:13),3]),
TMINRsq = TMINresult[c(2:13),4],
TMAXSlope = TMAXresult[c(2:13),2],
TMAX_P = as.numeric(TMAXresult[c(2:13),3]),
TMAXRsq = TMAXresult[c(2:13),4])
Results$starTMIN = "NS"

## Shows which months are significant!
```

```r
Results$starTMIN[Results$TMIN_P <= .05] = "*"
Results$starTMIN[Results$TMIN_P < 0.01] = "**"
Results$starTMIN[Results$TMIN_P < 0.001] = "***"
Results$starTMAX = "NS"
Results$starTMAX[Results$TMAX_P < 0.05] = "*"
Results$starTMAX[Results$TMAX_P < 0.01] = "**"
Results$starTMAX[Results$TMAX_P < 0.001] = "***"
Results$TMINslope=paste(Results$TMINSlope, Results$starTMIN)
Results$TMAXslope=paste(Results$TMAXSlope, Results$starTMAX)
colnames(Results) <- c("Month", "2", "3", "R^2", "5", "6",
"R^2", "8", "9", "Slope TMIN", "Slope TMAX")
print(xtable(Results[,c(1, 10, 4, 11, 7)]))
```

```
## % latex table generated in R 3.6.0 by xtable 1.8-4 package
## % Fri Dec  6 14:45:24 2019
## \begin{table}[ht]
## \centering
## \begin{tabular}{rlllll}
##    \hline
##  & Month & Slope TMIN & R\verb|^|2 & Slope TMAX & R\verb|^|2.1 \\
##    \hline
## 1 & January & 0.0301 *** & 0.122 & 0.0448 *** & 0.229 \\
##    2 & February & 0.008 NS & 0.01 & 0.0229 * & 0.056 \\
##    3 & March & 0.0035 NS & 0.003 & 0.0145 NS & 0.017 \\
##    4 & April & 0.0019 NS & 0.001 & 0.0151 NS & 0.02 \\
##    5 & May & 1e-04 NS & 0 & 0.0061 NS & 0.004 \\
##    6 & June & 0.0034 NS & 0.005 & 0.0188 NS & 0.036 \\
##    7 & July & 0.0165 *** & 0.111 & 0.0264 ** & 0.075 \\
##    8 & August & 0.0268 *** & 0.215 & 0.038 *** & 0.151 \\
##    9 & September & 0.0095 NS & 0.027 & 0.0196 NS & 0.037 \\
##    10 & October & 0.0033 NS & 0.005 & 0.0208 * & 0.061 \\
##    11 & November & -0.0017 NS & 0.001 & 0.0016 NS & 0 \\
##    12 & December & 0.003 NS & 0.002 & 0.0222 * & 0.067 \\
##     \hline
## \end{tabular}
## \end{table}
```

From here we see that the months January, July, and August see strong significance in the rise of both their minimum and maximum temperature. Feburary, October, and December also have significant changes in their minimum temperature.

January

```r
plot(TMAX~YEAR, data=MonthlyTMAXMean[MonthlyTMAXMean$Month=="01",],
ty='l', xlim=c(1950, 2020))
January.lm <- lm(TMAX~YEAR, data=MonthlyTMAXMean[MonthlyTMAXMean$Month=="01",])
summary(January.lm)
```
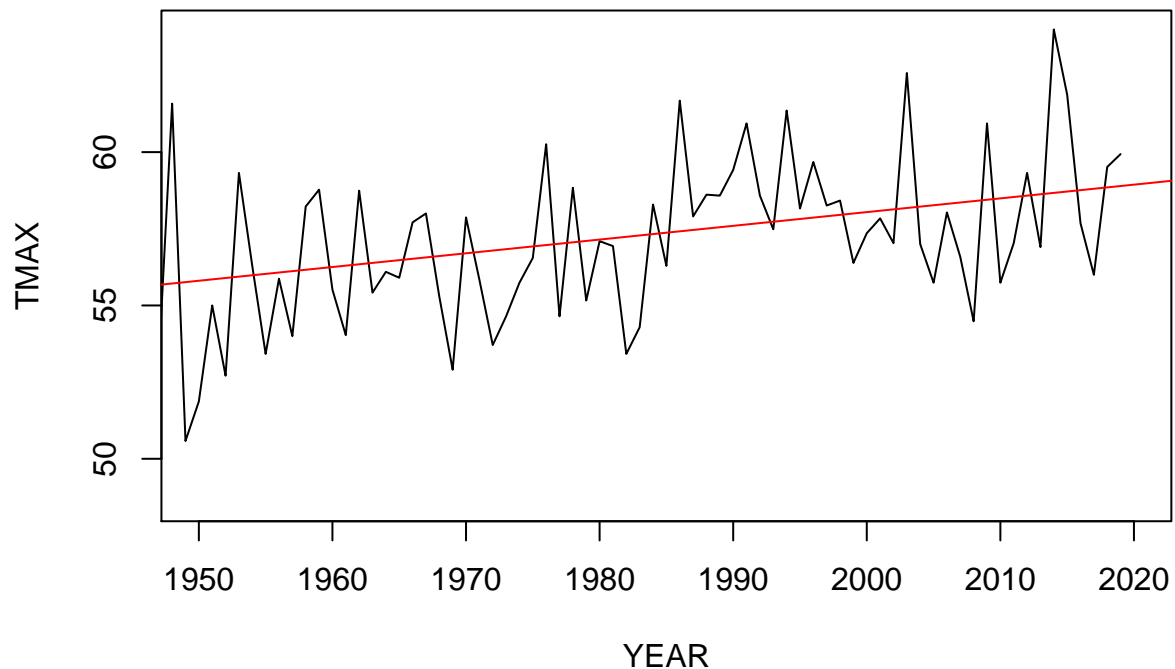
```
##
## Call:
## lm(formula = TMAX ~ YEAR, data = MonthlyTMAXMean[MonthlyTMAXMean$Month ==
##     "01", ])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -6.6428 -1.5843 -0.2245  1.5296  5.8649
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -31.473738  16.507514  -1.907   0.0596 .
## YEAR          0.044758   0.008376   5.343 6.14e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.346 on 96 degrees of freedom
## Multiple R-squared:  0.2292, Adjusted R-squared:  0.2212
## F-statistic: 28.55 on 1 and 96 DF,  p-value: 6.137e-07
```

```r
abline(coef(January.lm), col="red")
```



```r
## July
plot(TMAX~YEAR, data=MonthlyTMAXMean[MonthlyTMAXMean$Month=="07",],
ty='l', xlim=c(1950, 2020))
July.lm <- lm(TMAX~YEAR, data=MonthlyTMAXMean[MonthlyTMAXMean$Month=="07",])
summary(July.lm)
```

```
##
## Call:
## lm(formula = TMAX ~ YEAR, data = MonthlyTMAXMean[MonthlyTMAXMean$Month ==
##     "07", ])
##
## Residuals:
```
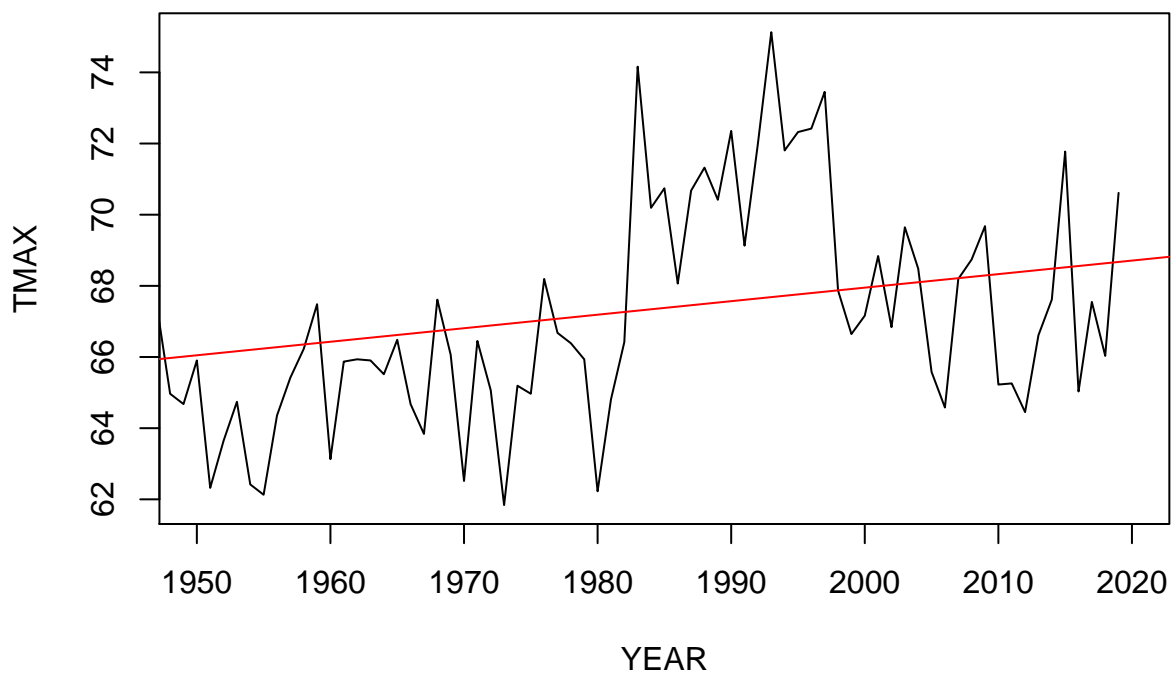
```
##     Min      1Q  Median      3Q     Max
## -5.2249 -1.8191 -0.5002  1.4231  7.3548
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 13.904058  18.587980   0.748  0.45626
## YEAR         0.026420   0.009435   2.800  0.00616 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.683 on 97 degrees of freedom
## Multiple R-squared:  0.0748, Adjusted R-squared:  0.06526
## F-statistic: 7.842 on 1 and 97 DF,  p-value: 0.00616
```

```r
abline(coef(July.lm), col="red")
```
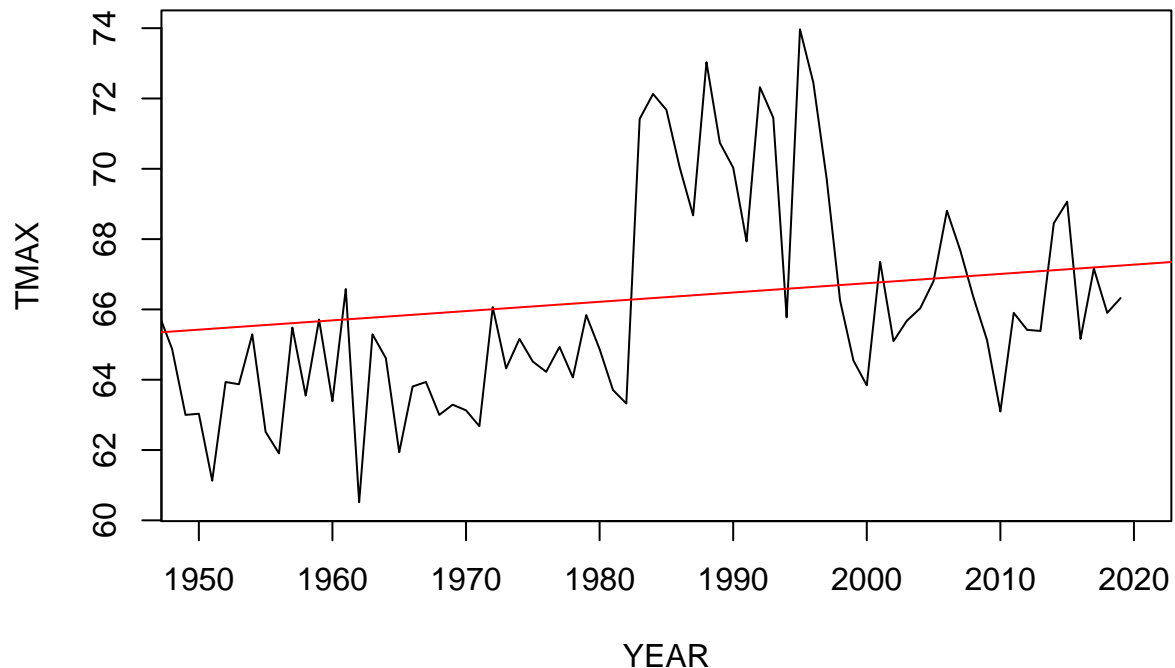


```r
##August
plot(TMAX~YEAR, data=MonthlyTMAXMean[MonthlyTMAXMean$Month=="08",],
ty='l', xlim=c(1950, 2020))
August.lm <- lm(TMAX~YEAR, data=MonthlyTMAXMean[MonthlyTMAXMean$Month=="08",])
summary(August.lm)
```

```
##
## Call:
## lm(formula = TMAX ~ YEAR, data = MonthlyTMAXMean[MonthlyTMAXMean$Month ==
##     "08", ])
##
```
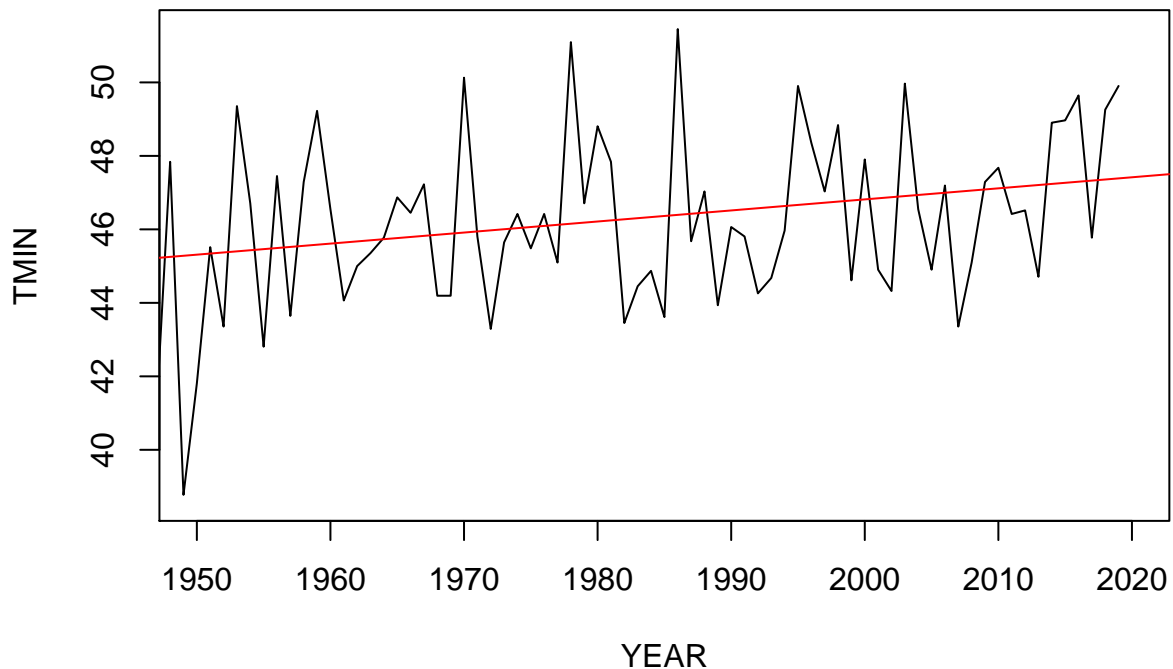
```
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.0847 -1.7490 -0.3958  1.5673  7.4454
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -8.074746  18.004941  -0.448    0.655
## YEAR         0.038012   0.009139   4.160 6.89e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.598 on 97 degrees of freedom
## Multiple R-squared:  0.1514, Adjusted R-squared:  0.1426
## F-statistic:  17.3 on 1 and 97 DF,  p-value: 6.893e-05
```

```r
abline(coef(August.lm), col="red")
```



```r
## January
plot(TMIN~YEAR, data=MonthlyTMINMean[MonthlyTMINMean$Month=="01",],
ty='l', xlim=c(1950, 2020))
January.lm <- lm(TMIN~YEAR, data=MonthlyTMINMean[MonthlyTMINMean$Month=="01",])
summary(January.lm)
```

```
##
## Call:
## lm(formula = TMIN ~ YEAR, data = MonthlyTMINMean[MonthlyTMINMean$Month ==
##     "01", ])
```

```
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.5076 -1.8122  0.1856  1.6429  5.0568
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -13.34830   16.23815  -0.822 0.413095
## YEAR          0.03008    0.00824   3.651 0.000425 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.307 on 96 degrees of freedom
## Multiple R-squared:  0.1219, Adjusted R-squared:  0.1128
## F-statistic: 13.33 on 1 and 96 DF,  p-value: 0.0004255
abline(coef(January.lm), col="red")
```



```
## July
plot(TMIN~YEAR, data=MonthlyTMINMean[MonthlyTMINMean$Month=="07",],
ty='l', xlim=c(1950, 2020))
July.lm <- lm(TMIN~YEAR, data=MonthlyTMINMean[MonthlyTMINMean$Month=="07",])
summary(July.lm)
```

```
##
## Call:
## lm(formula = TMIN ~ YEAR, data = MonthlyTMINMean[MonthlyTMINMean$Month ==
```

```
##     "07", ])
##
## Residuals:
##     Min     1Q  Median      3Q     Max
## -3.0323 -0.9165 -0.0554  0.8423  4.1406
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 21.461506   9.309211   2.305 0.023274 *
## YEAR         0.016463   0.004725   3.484 0.000743 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.344 on 97 degrees of freedom
## Multiple R-squared:  0.1112, Adjusted R-squared:  0.1021
## F-statistic: 12.14 on 1 and 97 DF,  p-value: 0.0007426
```
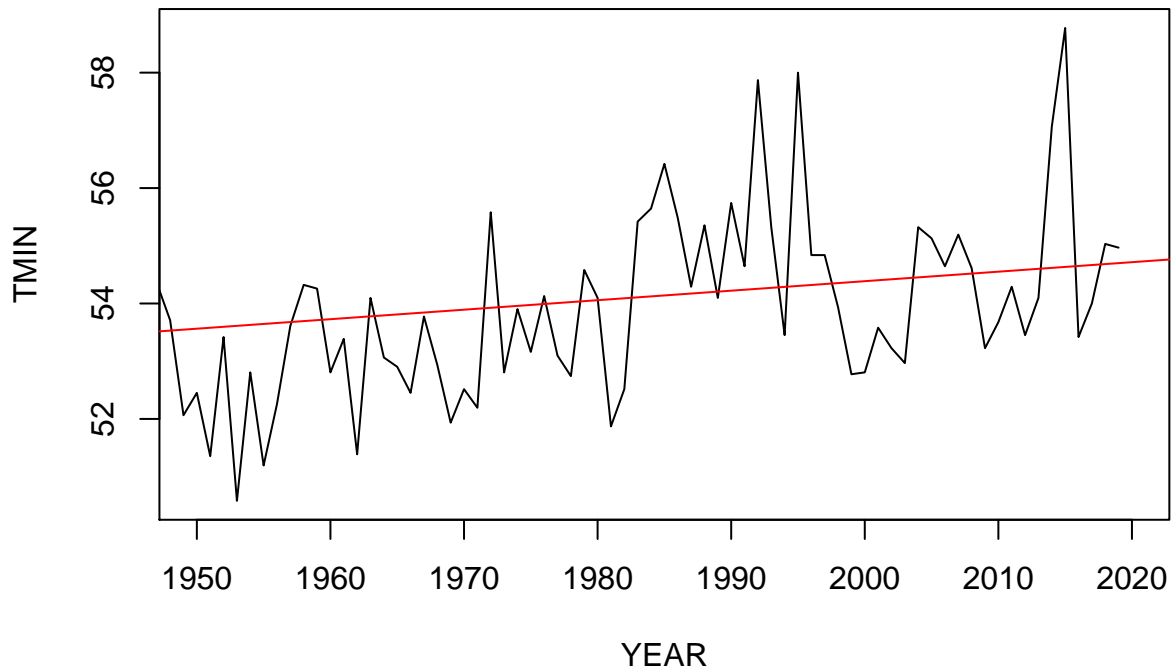
```
abline(coef(July.lm), col="red")
```



```
##August
plot(TMIN~YEAR, data=MonthlyTMINMean[MonthlyTMINMean$Month=="08",],
ty='l', xlim=c(1950, 2020))
August.lm <- lm(TMIN~YEAR, data=MonthlyTMINMean[MonthlyTMINMean$Month=="08",])
summary(August.lm)
```

```
##
## Call:
```

```
## lm(formula = TMIN ~ YEAR, data = MonthlyTMINMean[MonthlyTMINMean$Month ==
##     "08", ])
##
## Residuals:
##     Min     1Q  Median      3Q     Max
## -3.7772 -1.0142 -0.0739  1.2758  4.2278
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.000972  10.249707   0.195    0.846
## YEAR         0.026798   0.005202   5.151 1.36e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.479 on 97 degrees of freedom
## Multiple R-squared:  0.2148, Adjusted R-squared:  0.2067
## F-statistic: 26.53 on 1 and 97 DF,  p-value: 1.36e-06
```
```
abline(coef(August.lm), col="red")
```