Question: Autocorrelation in weather

PokMan Ho (CID: 01786076)

Hypothesis: Annual temperature (^{o}C) is influenced by the previous year.

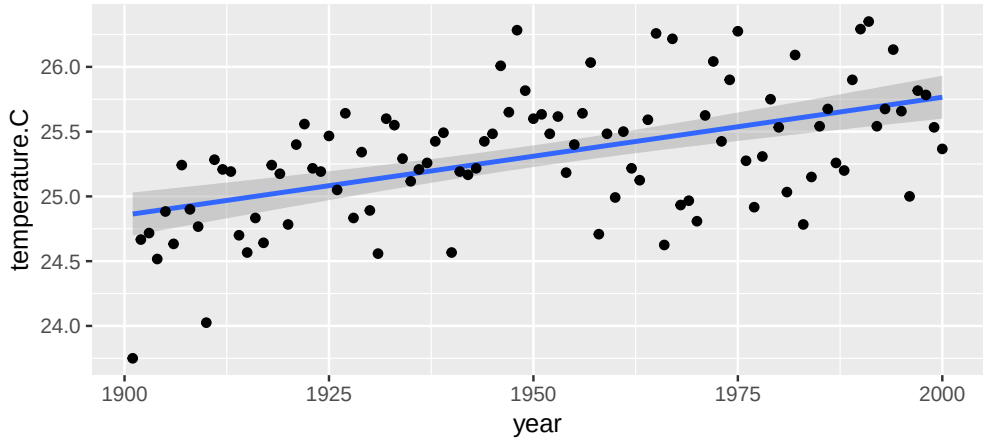
1 Load KeyWestAnnualMeanTemperature.Rdata

```
> load("../Data/KeyWestAnnualMeanTemperature.RData");ls()

[1] "ats"
```

2 Examine correlation coefficient of data

```
> print(b<-unlist(cor(ats,method = "spearman"))[1,2])

[1] 0.5255559
```

3 Plot data

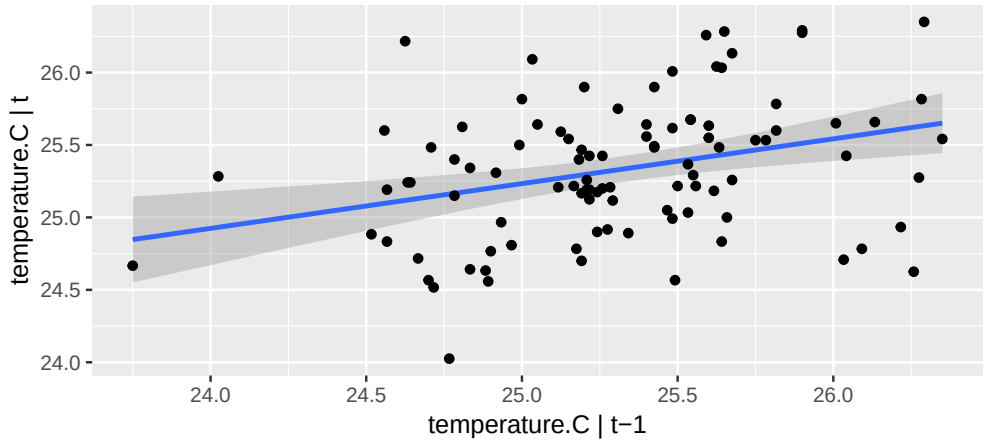


Annual temperature of Key West, Florida for the 20th century

Pairing annual temperature by shifting yearly data by 1

```
> ats.0<-data.frame(ats[,2][1:dim(ats)[1]-1],ats[,2][2:dim(ats)[1]])
```

And plot the paired data



Linear Model of an annual temperature against its previous year

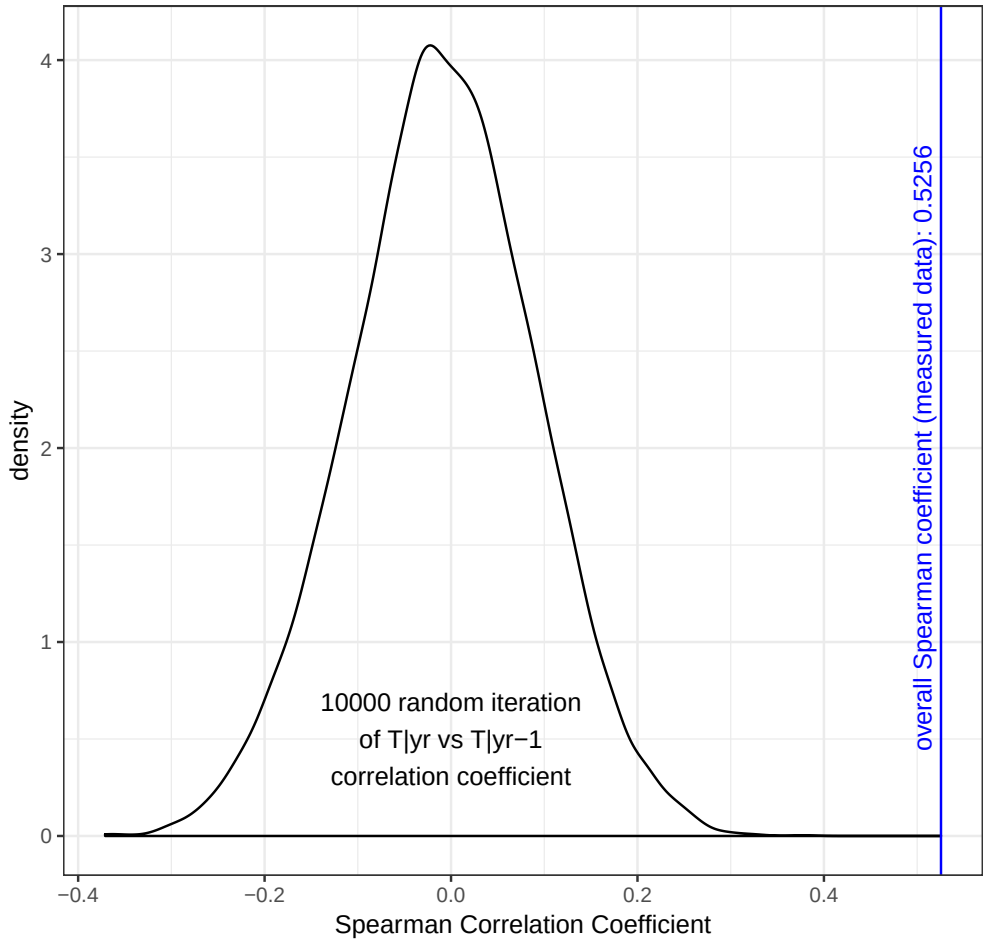
4 Sample Spearman correlation 10K times by random shuffles

```
> dm<-1e4
> a<-rep(NA,dm)
> i<-1
> for(x in 1:dm){
+
+   ## shuffle data into random pairs
+   ats.0<-sample(ats[,2],dim(ats)[1],replace = F)
+   ats.0<-data.frame(ats.0[1:length(ats.0)-1],ats.0[2:length(ats.0)])
+
+   ## Spearman correlation on newly-shuffled pairs
+   a[i]<-unlist(cor(ats.0,method = "spearman"))[1,2]
+   i<-i+1
+ }
```

With Spearman correlation coefficient mean (from sampling) calculated as:

```
> mean(a)

[1] -0.009448687
```

5 Fraction of sampling > overall coefficient (approx. p.val)



function of randomized Temperature correlation with real Spearman coefficie

```
> length(a[which(a>b)])/length(a)
```

```
[1] 0
```

6 Discussion

Correlation coefficient from overall (Sec.2) and sampled (Sec.4) were different with strong statistical significance (Sec.5, p<<0.01). It showed that the current year temperature is influenced/correlated with previous year's.