Homework #3: Mulivariate Analysis

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Problem 1

```
source('lib.R')

sst <- as.matrix(read.table('data/kaplan-sst-wy-1925-2003-revised.txt'))
sst <- t(matrix(sst[,3],nrow=length(unique(sst[,1])),byrow=T))
sst.lat <- as.matrix(read.table('data/kaplan-sst-wy-1925-2003-II.txt'))
sst.lon <- sst.lat[,2]; sst.lat <- sst.lat[,1]
sst.lon[sst.lon < 0] <- sst.lon[sst.lon < 0] + 360

pdsi <- as.matrix(read.table('data/pdsi-wy-1925-2003.txt'))
pdsi <- t(matrix(pdsi[,3],nrow=length(unique(pdsi[,1])),byrow=T))
pdsi.lat <- as.matrix(read.table('data/pdsi-wy-1925-2003-II.txt'))
pdsi.lon <- pdsi.lat[,2]; pdsi.lat <- pdsi.lat[,1]
pdsi.lon[pdsi.lon < 0] <- pdsi.lon[pdsi.lon < 0] + 360

pacific <- sst.lat > -20 & sst.lon >= 120 & sst.lon <= 280
atlantic <- sst.lat > -20 & sst.lat < 70 & sst.lon >= 250 & sst.lon <= 360
states <- pdsi.lat > 15 & pdsi.lat < 60 & pdsi.lon >= 230 & pdsi.lon <= 295

lon.pac <- sst.lon[pacific]
lat.pac <- sst.lat[pacific]
sst.pac <- sst[,pacific]
lon.atl <- sst.lon[atlantic]
lat.atl <- sst.lat[atlantic]
sst.atl <- sst[,atlantic]
lon.usa <- pdsi.lon[states]
lat.usa <- pdsi.lat[states]
sst.usa <- pdsi[,states]

pac <- my.pca(sst.pac)
atl <- my.pca(sst.atl)
usa <- my.pca(sst.usa)

save(lat, lon, lat.pac, lon.pac, lat.atl, lon.atl, lat.usa, lon.usa, pac, atl,
       usa, file='output/1.Rdata')
```

Figure 1: Reading the data and calculating the statistics.

Problem 1 (i)

```
> layout(rbind(c(1,2),c(3,4)))
> plot(pac$eigf[1:12], type="b", xlab="Modes",
+         ylab="Frac. Var. explained",main="Eigen Variance Spectrum")
> for(i in 1:3){
+         image.plot(interp(lon.pac-360,lat.pac,pac$eigv[,i]),
+                 main=sprintf("Eigen %d",i),legend.mar=6.5)
+         map('world',add=TRUE)
+ }
```

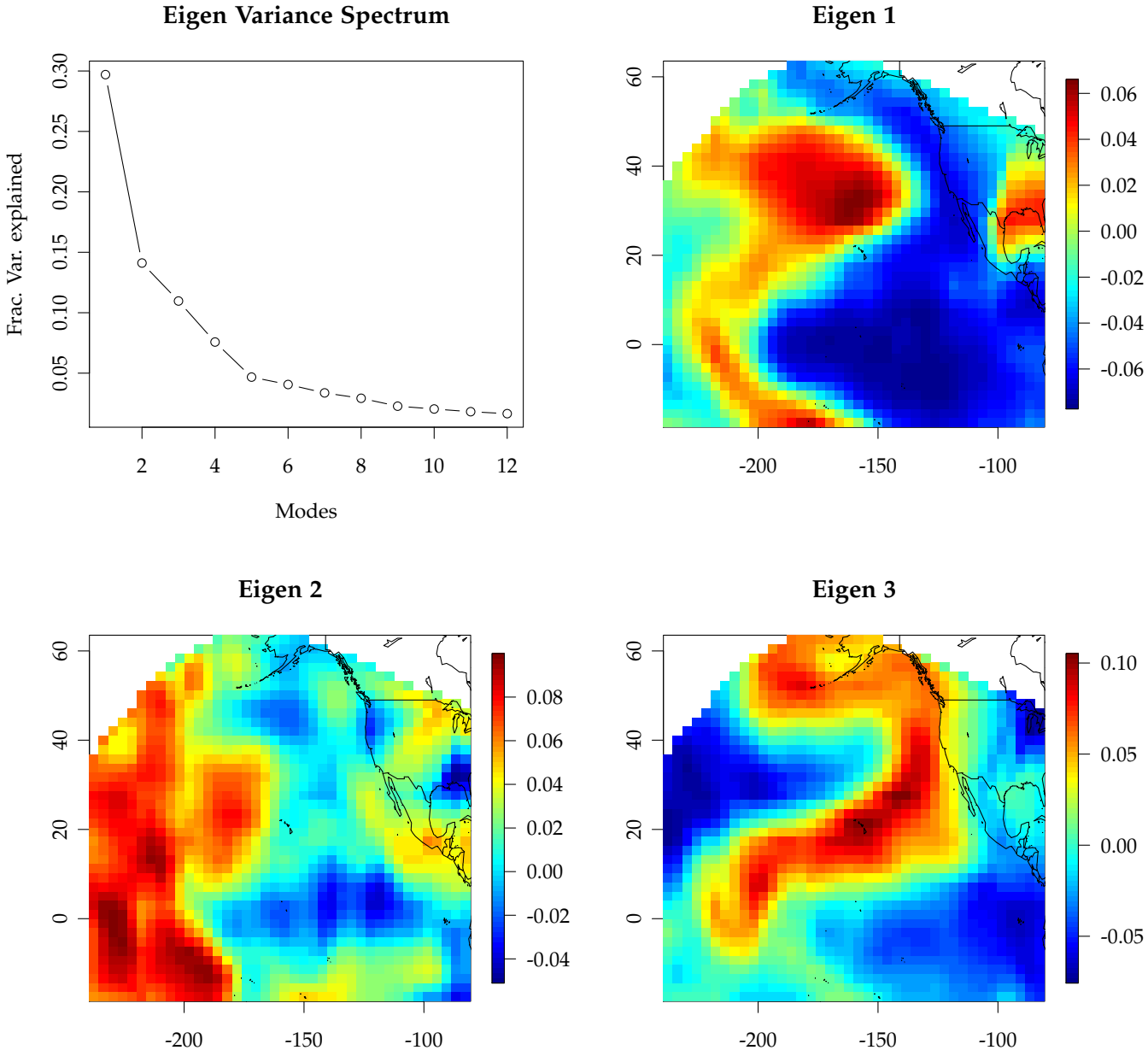


Figure 2: Pacific

```
> layout(cbind(c(1,2,3)))
> for(i in 1:3){
+         plot(ts(pac$pc[,i],start=1925,frequency=1),
+                 main=sprintf("Eig 1 %d",i),ylab='')
+ }
```

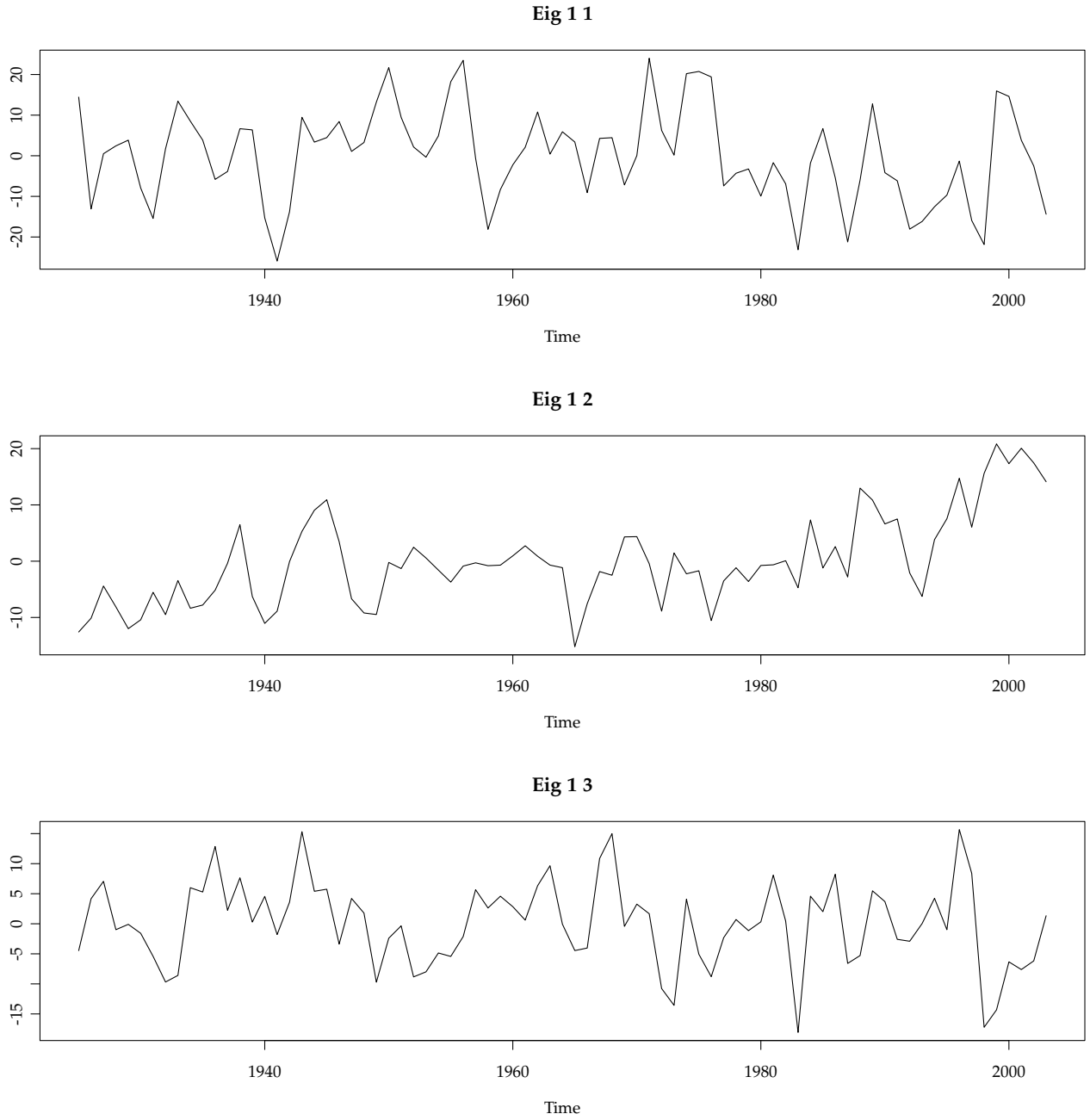


Figure 3: Pacific

Problem 1 (ii)

Problem 1 (iii)

```
> layout(rbind(c(1,2),c(3,4)))
> plot(atl$eigf[1:12], type="b", xlab="Modes",
+         ylab="Frac. Var. explained",main="Eigen Variance Spectrum")
> for(i in 1:3){
+         image.plot(interp(lon.atl-360,lat.atl,atl$eigv[,i]),
+                 main=sprintf("PC%d",i),legend.mar=6.5)
+         map('world',add=TRUE)
+ }
```

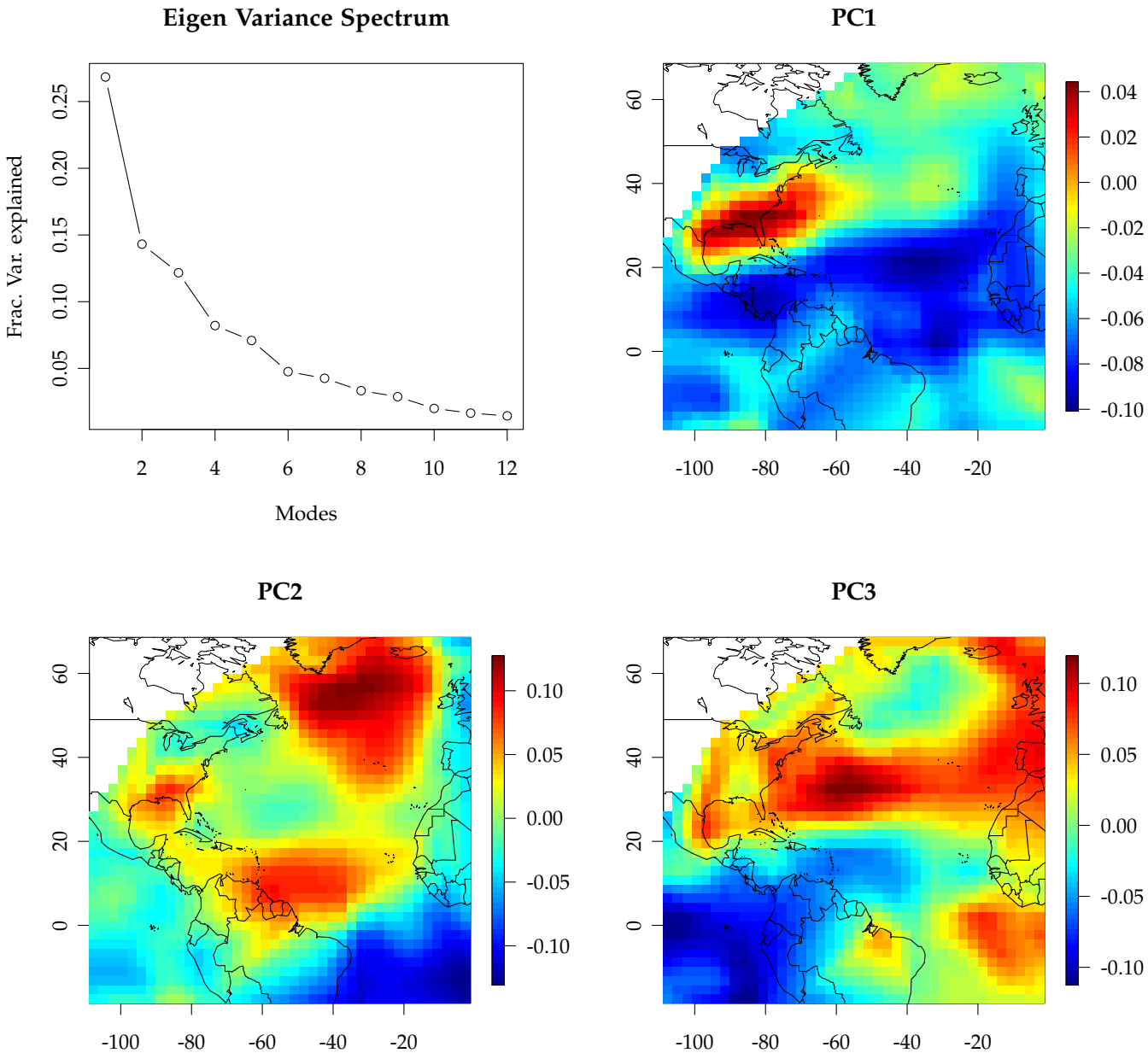
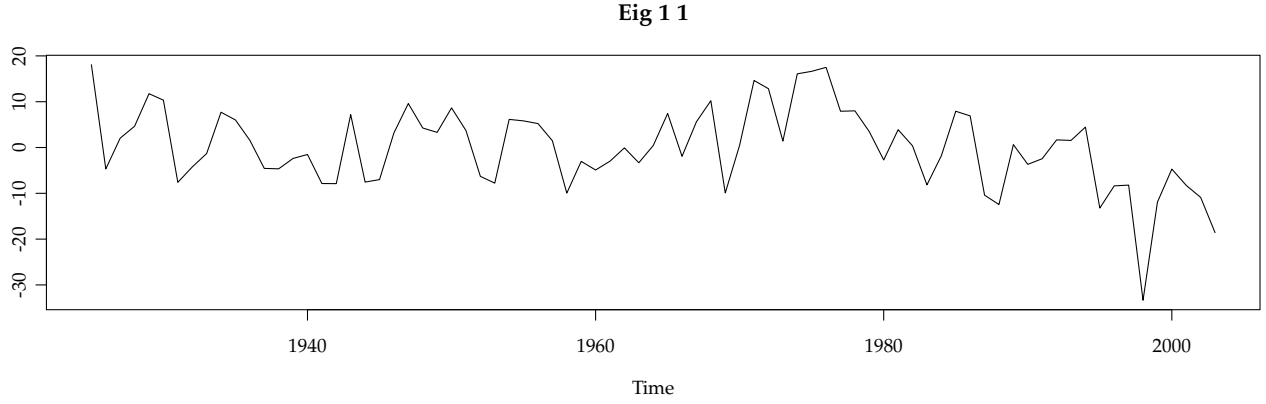


Figure 4: Atlantic

Problem 2

```
> layout(cbind(c(1,2,3)))
> for(i in 1:3){
+         plot(ts(atl$pc[,i],start=1925,frequency=1),
+                 main=sprintf("Eig 1 %d",i),ylab='')
+ }
```



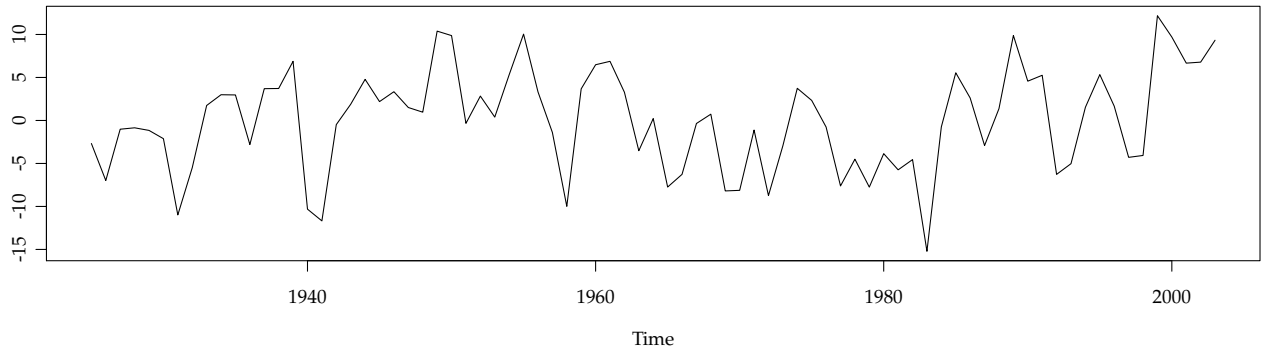


Figure 5: Pacific

```
> layout(rbind(c(1,2),c(3,4)))
> plot(usa$eigf[1:12], type="b", xlab="Modes",
+         ylab="Frac. Var. explained",main="Eigen Variance Spectrum")
> for(i in 1:3){
+         image.plot(interp(lon.usa-360,lat.usa,usa$eigv[,i]),
+                 main=sprintf("PC%d",i),legend.mar=6.5)
+         map('world',add=TRUE)
+ }
```

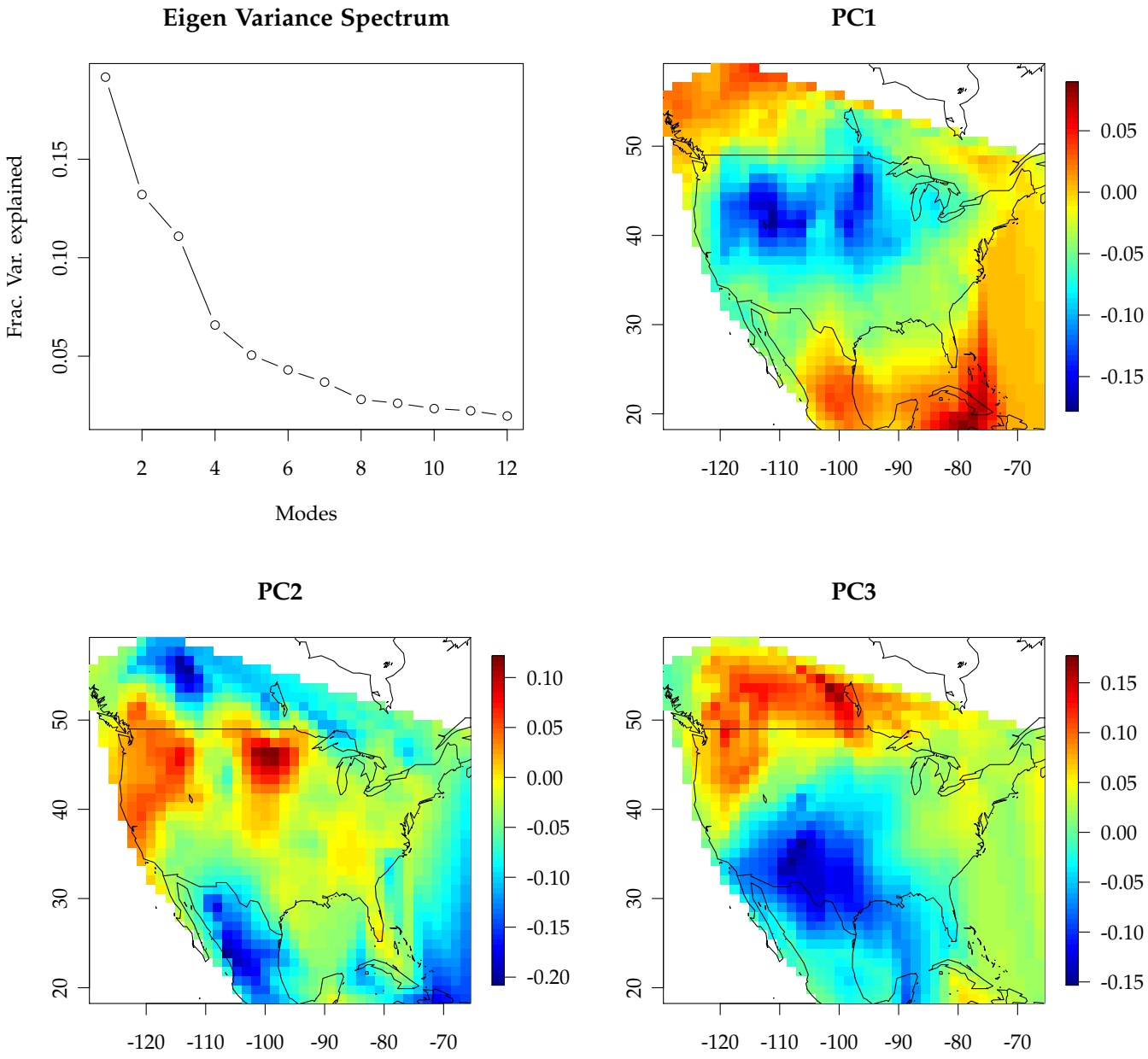


Figure 6: States

```
> layout(cbind(c(1,2,3)))
> for(i in 1:3){
+         plot(ts(usa$pc[,i],start=1925,frequency=1),
+                 main=sprintf("PC%d",i),ylab='')
+ }
```

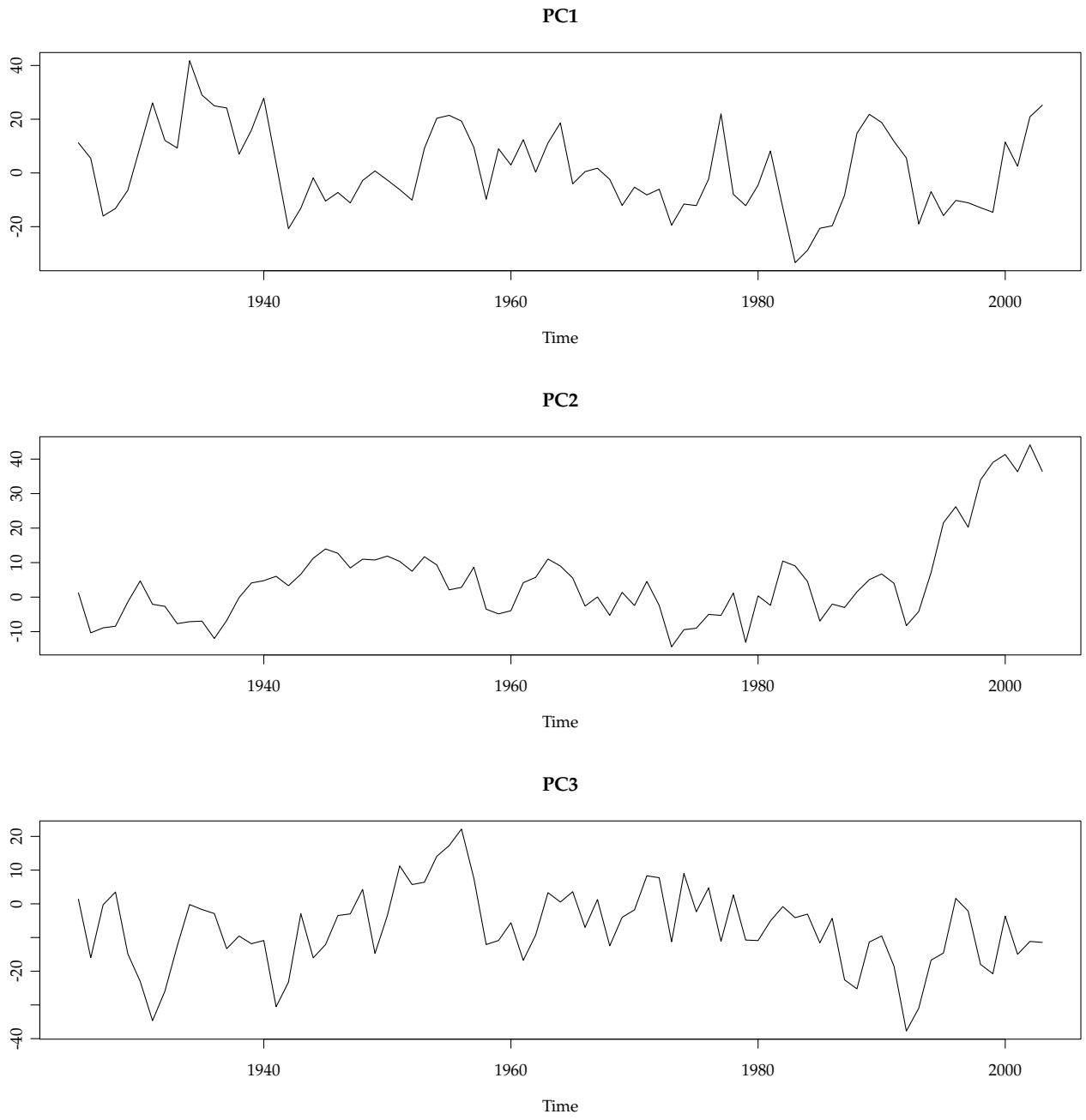


Figure 7: States PC