MIMOZA

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Introduction.

This is an R Markdown document that explores some climate data with relevance to Mozambique. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

```
library(esd)
```

```
## Loading required package: ncdf4
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
##
## Attaching package: 'esd'
```

```
## The following object is masked from 'package:base':
##
##     subset.matrix
```

Tidal data and sea level

You can also embed plots, for example: http://www.psmsl.org/data/obtaining/,

IMILAST storm tracks

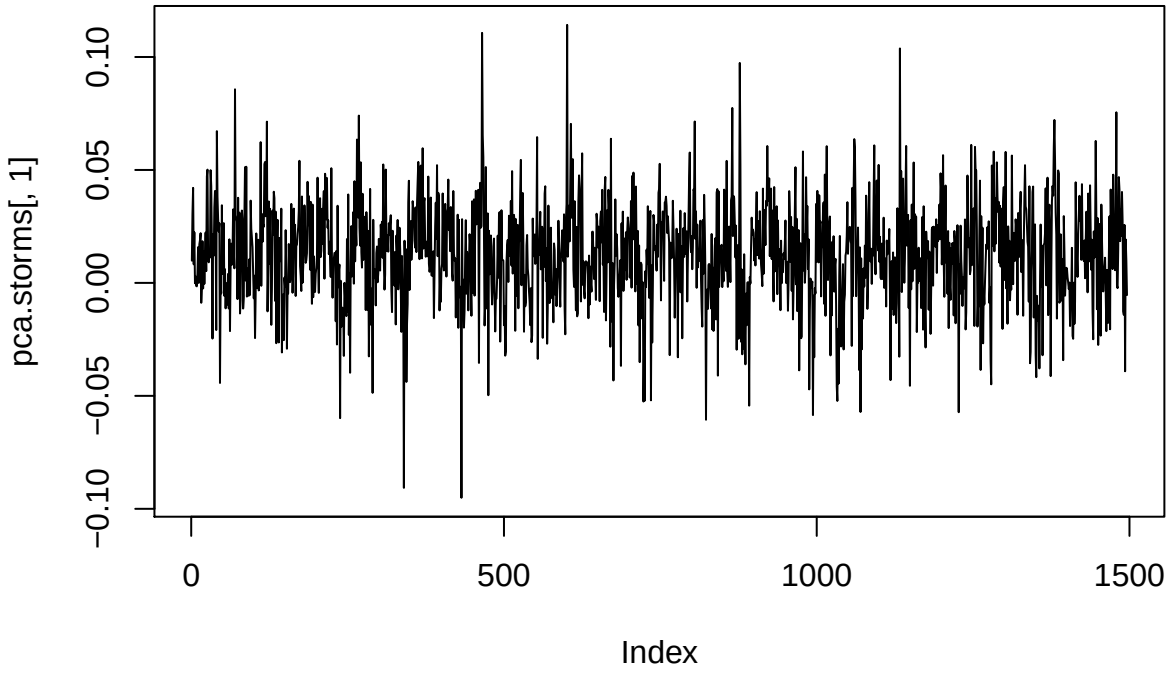
```
if (!file.exists('mimoza.imilast.rda')) {
  imilast.storms <- subset(read.imilast('~/data/IMILAST/ERAinterim_0.75_SH_M07_19790101_20091231.txt'),
                           is=list(lon=c(20,90),lat=c(-40,-5)))
# imilast.storms <- subset(read.imilast('~/data/IMILAST/ERAinterim_1.5_SH_M03_19890101_20090331_ST.txt'
#                           is=list(lon=c(30,90),lat=c(-40,-5)))
  cyclones <- events2trajectory(imilast.storms)
  save(cyclones,file='mimoza.imilast.rda')
} else load('mimoza.imilast.rda')
ii <- is.element(colnames(cyclones),'amp_z850')
mi <- apply(cyclones[,ii],1,min)
storms <- cyclones[mi < 10,]
storms <- attrcp(cyclones,storms)
class(storms) <- class(cyclones)
col <- rgb(0,0,1,1-(mi-min(mi))/diff(range(mi)))
map(storms,verbose=TRUE,lonR=30,latR=0,col=col,lwd=3)
```

```
## [1] "map.trajectory"
## [1] "sphere.trajectory"
```

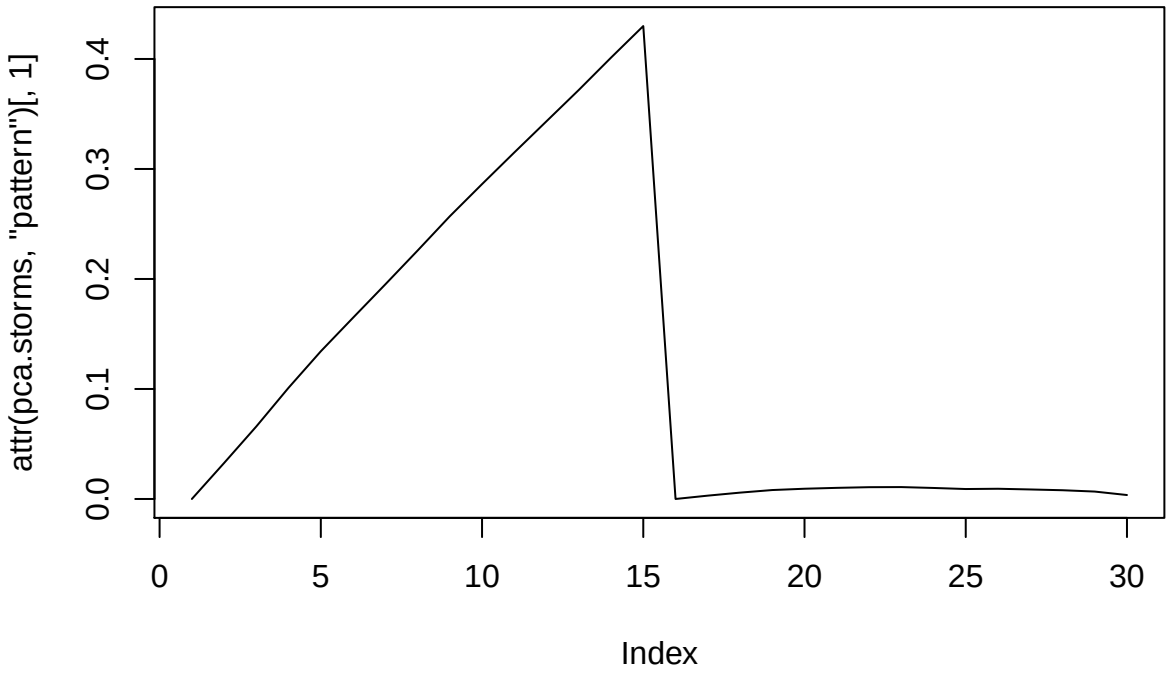
```
pca.storms <- PCA(storms,verbose=TRUE)
```

```
## [1] "calculating anomaly"
## [1] "lon" "lat"
```

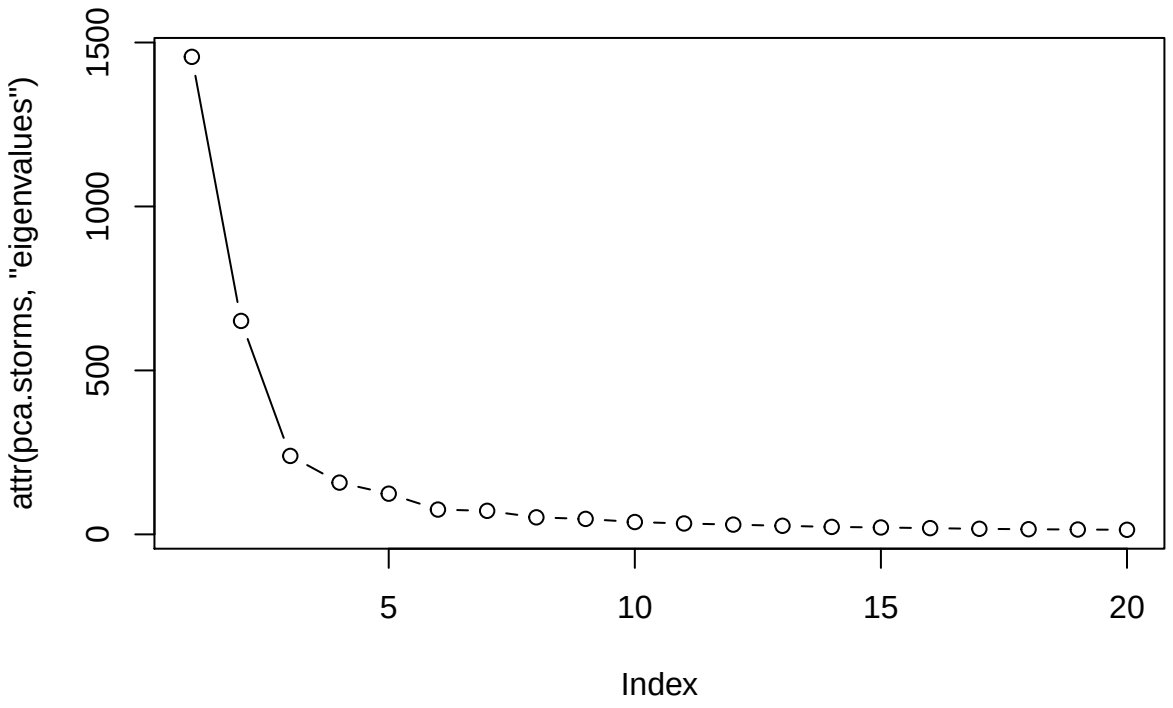
```
plot(pca.storms[,1],type='l')
```




```
plot(attr(pca.storms,'pattern')[,1],type='l')
```



```
plot(attr(pca.storms,'eigenvalues'),type='b')
```



GHCND temperature and precipitation

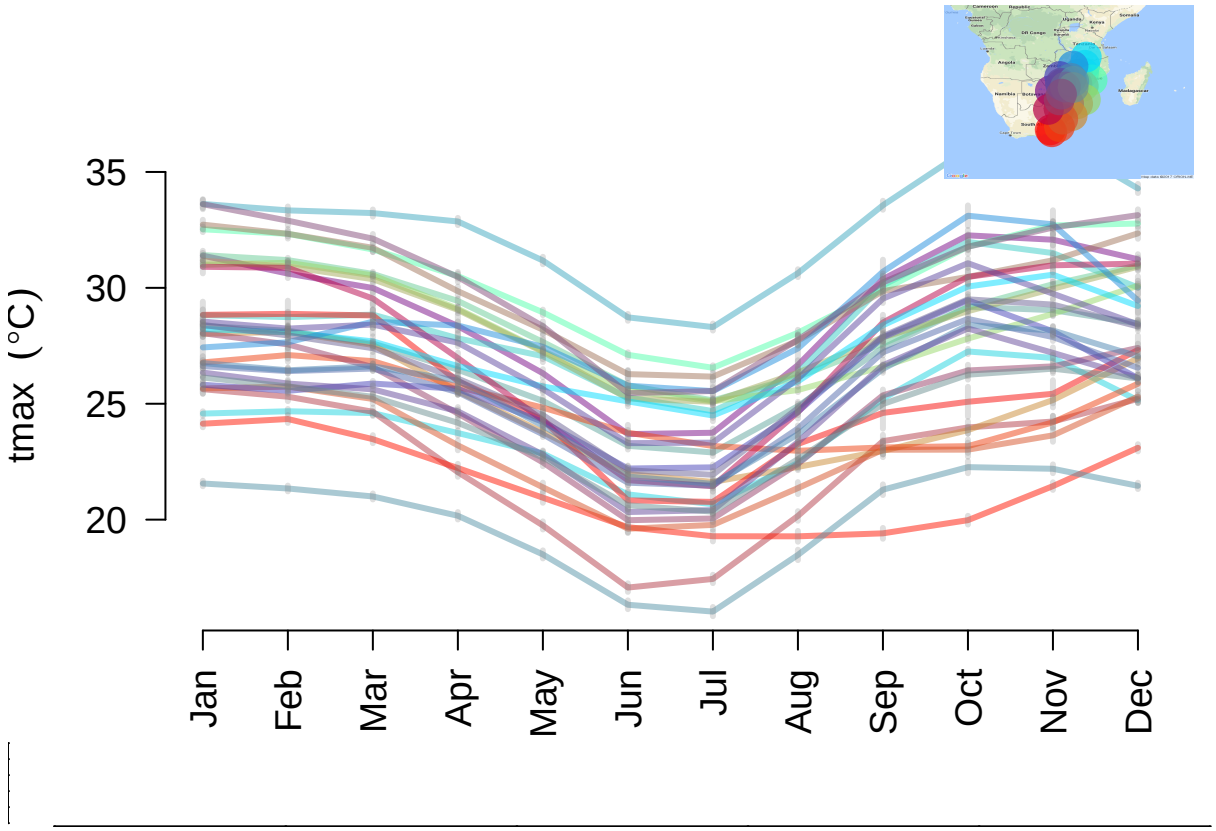
```
## get the GHCND data
if (!file.exists('mimoza.ghcnd.rda')) {
  ## Daily maximum temperature
  ss <- select.station(lon=c(27,37),lat=c(-40,-10),src='ghcnd',nmin=30,param='tmax')
  tmax <- station(ss,verbose=TRUE)
  ## Daily minimum temperature
  ss <- select.station(lon=c(27,37),lat=c(-40,-10),src='ghcnd',nmin=30,param='tmin')
  tmin <- station(ss,verbose=TRUE)
  ## Daily precipitation
  ss <- select.station(lon=c(31,37),lat=c(-40,-10),src='ghcnd',nmin=30,param='precip')
  precip <- station(ss,verbose=TRUE)
  ## Set bad (missing) data to NA
  z <- coredata(tmax); z[z < -20] <- NA; z[z > 70] <- NA; z -> coredata(tmax)
  z <- coredata(tmin); z[z < -20] <- NA; z[z > 70] <- NA; z -> coredata(tmin)
  z <- coredata(precip); z[z < 0] <- NA; z[z > 700] <- NA; z -> coredata(precip)
  ## Save in R-binary for convenience.
  save(tmax,tmin,precip,file='mimoza.ghcnd.rda')
} else load ('mimoza.ghcnd.rda')
```

Maximum temperature - mean seasonal cycle

```
plot(aggregate(tmax,month),new=FALSE)
```

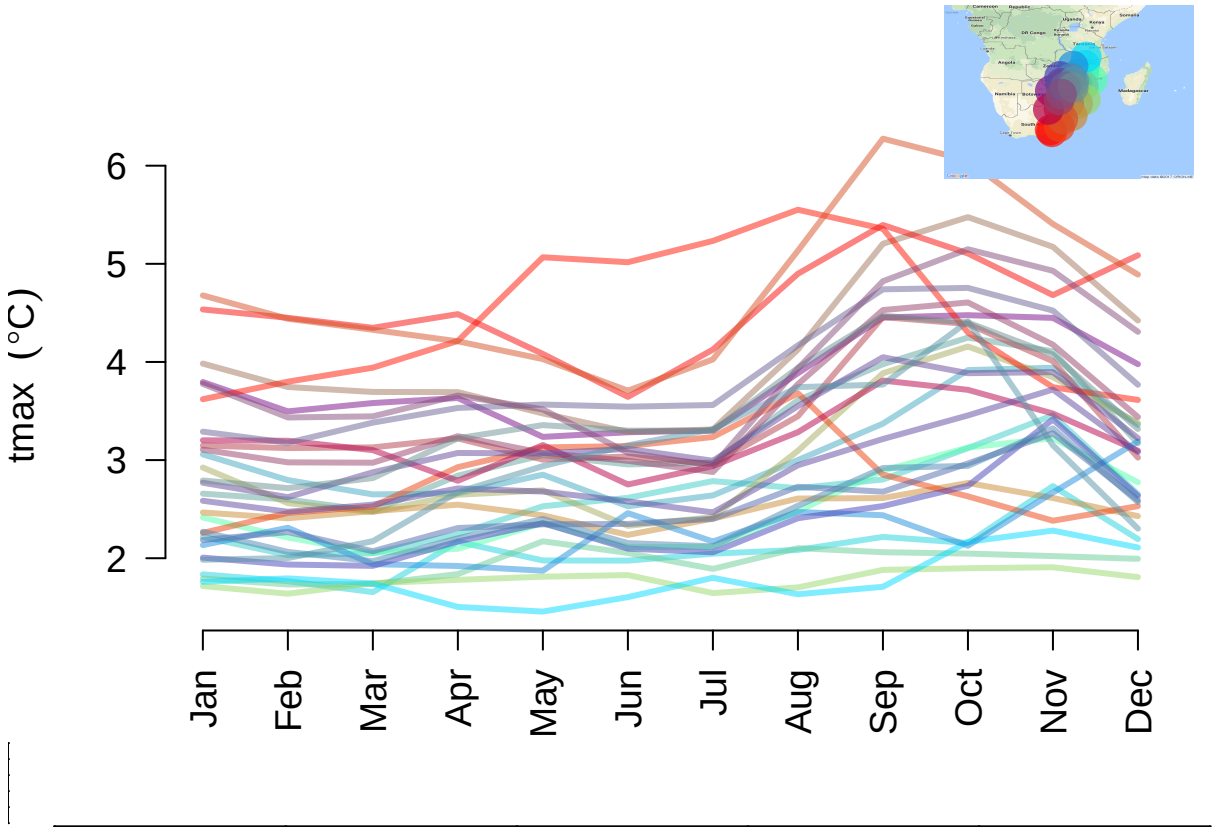
```
## Loading required package: RgoogleMaps
```

```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```




```
plot(aggregate(tmax,month,FUN='sd'),new=FALSE)
```

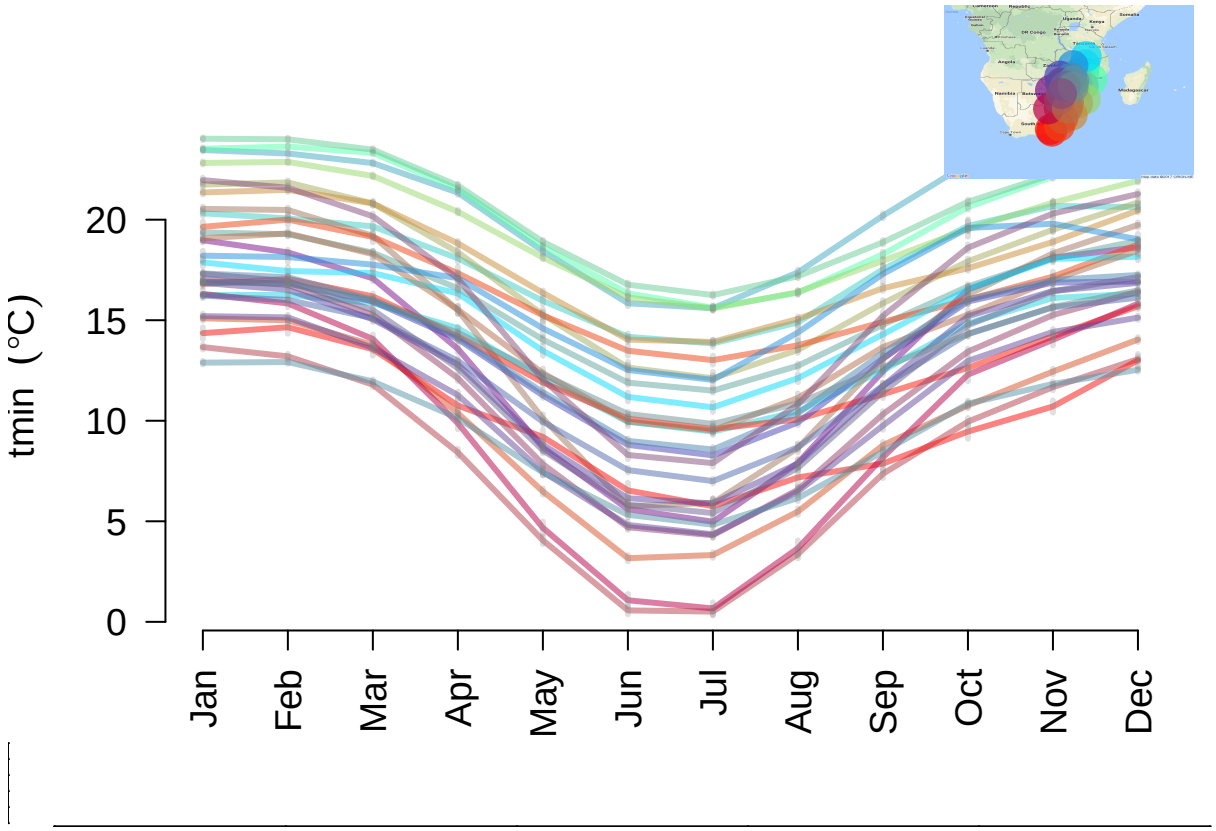
```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```



Minimum temperature - mean seasonal cycle

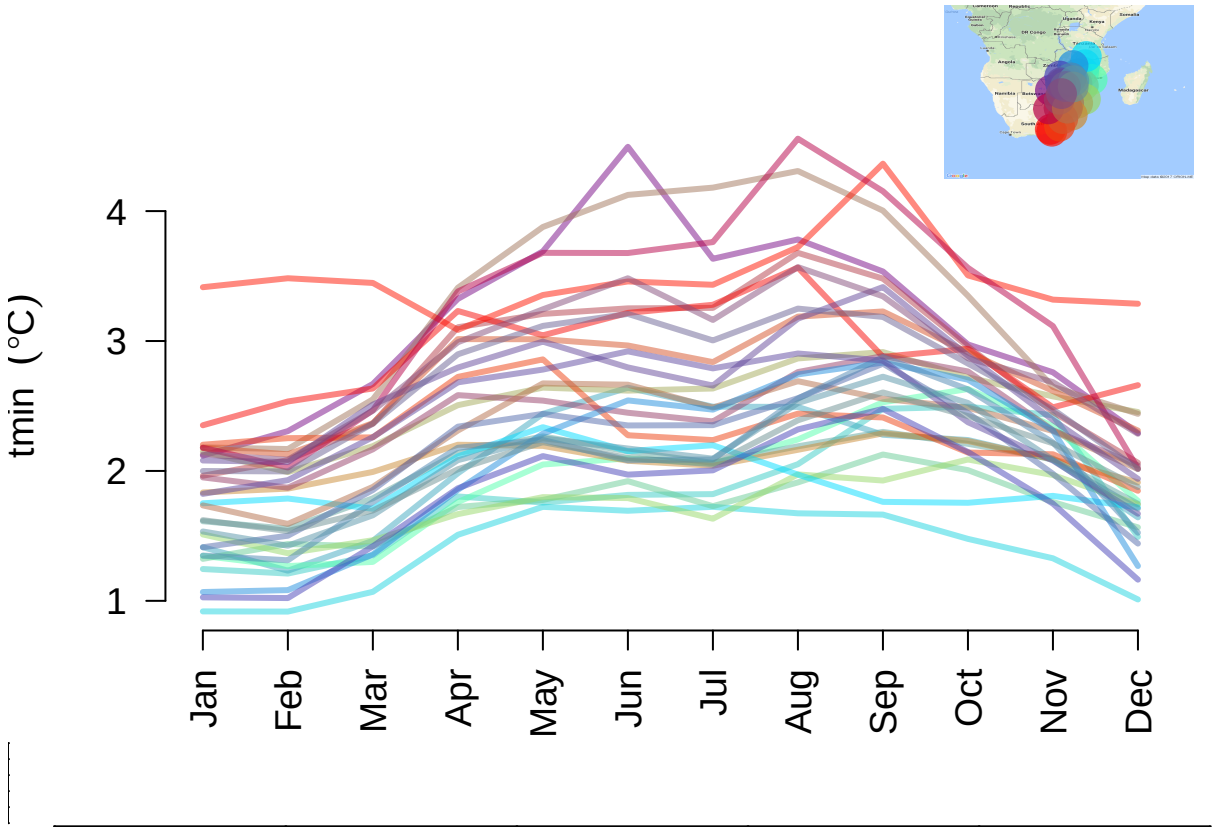
```
plot(aggregate(tmin,month),new=FALSE)
```

```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```




```
plot(aggregate(tmin,month,FUN='sd'),new=FALSE)
```

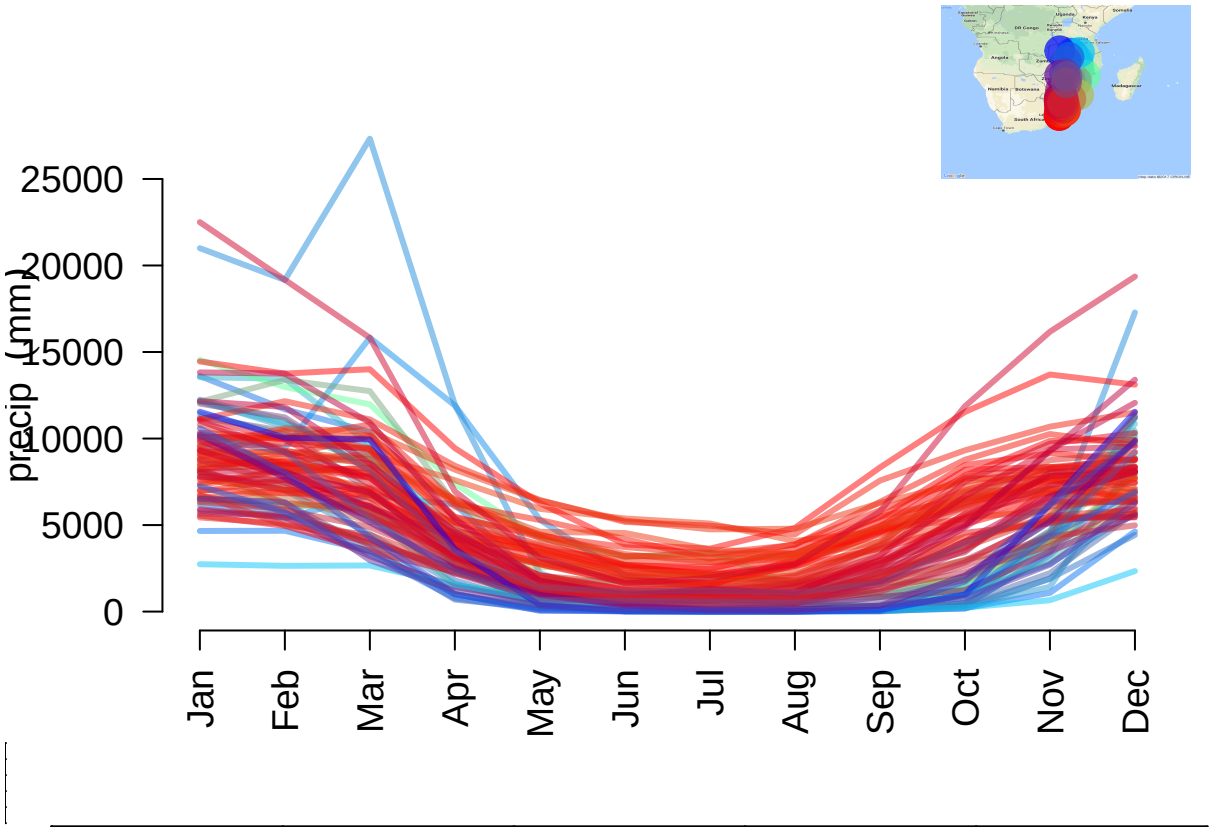
```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```



Precipitation - mean seasonal cycle

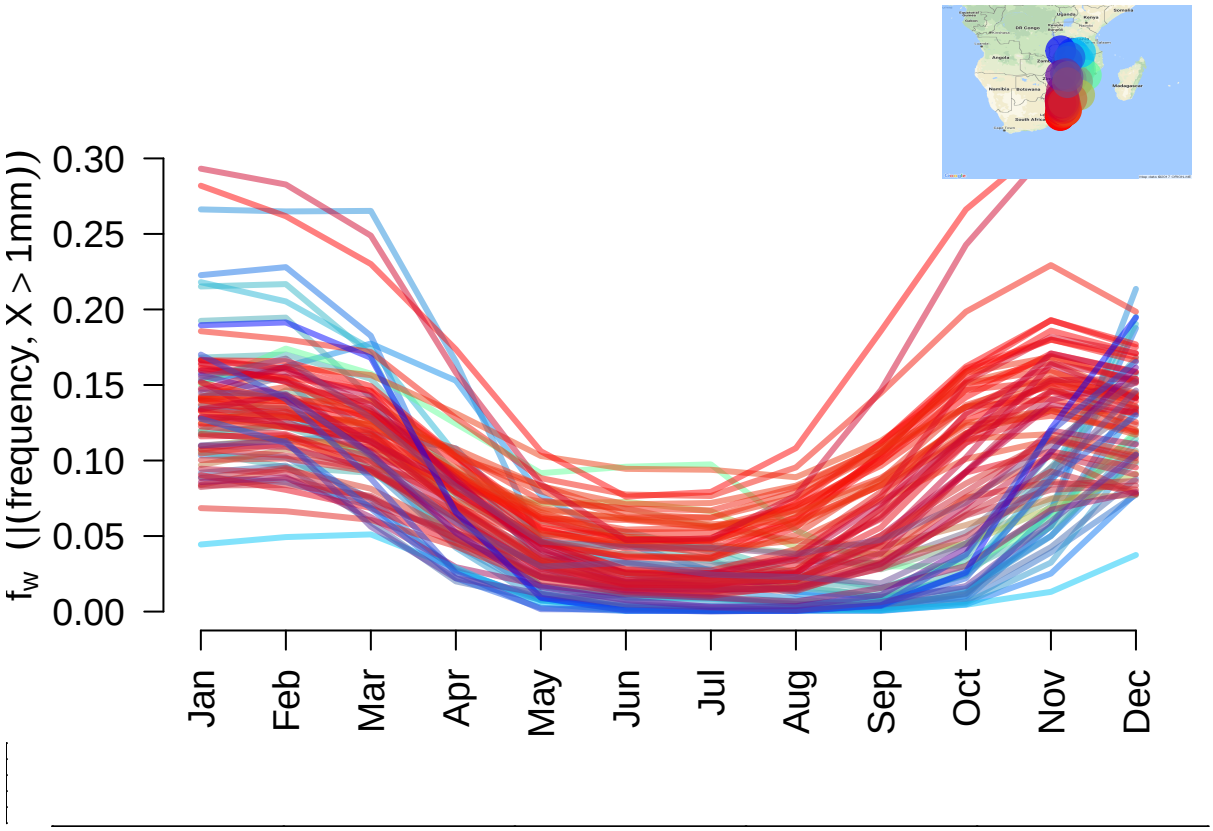
```
plot(aggregate(precip,month,FUN='sum'),new=FALSE)
```

```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```



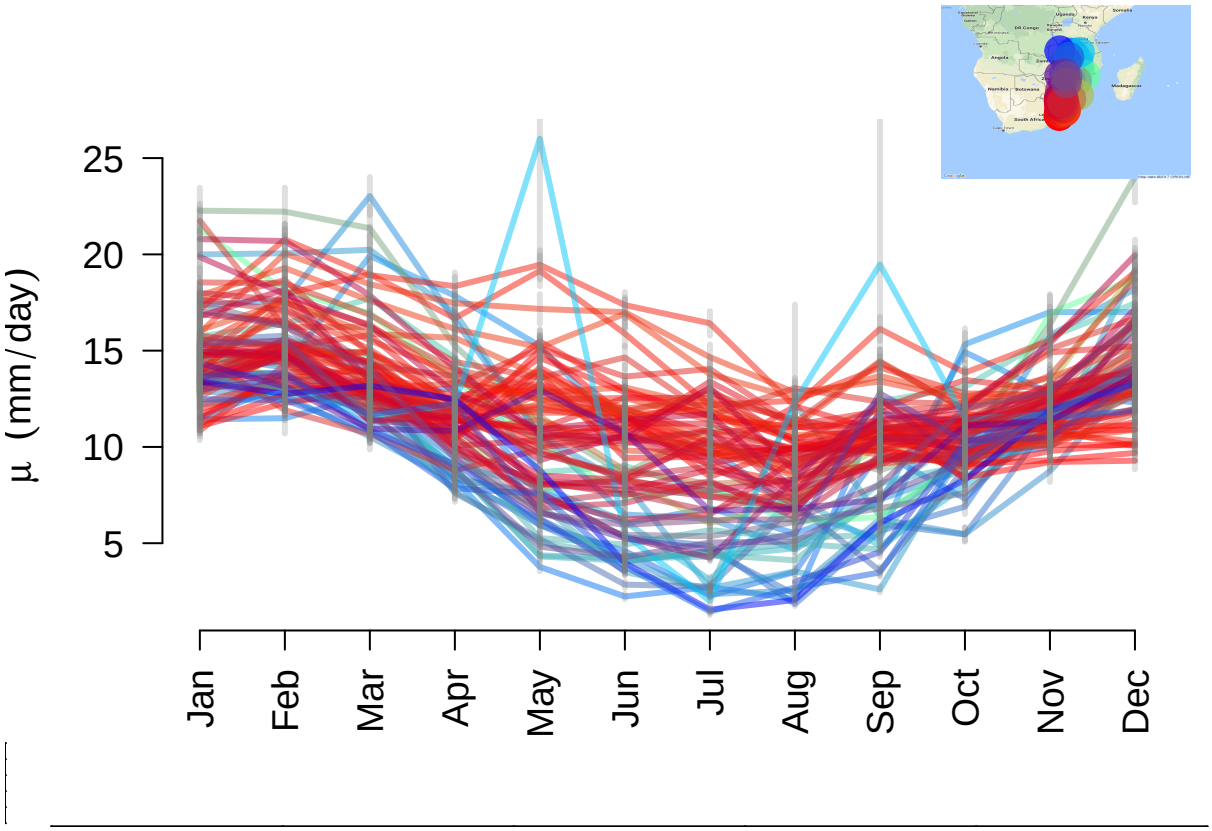

```
plot(aggregate(precip,month,FUN='wetfreq'),new=FALSE)
```

```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```




```
plot(aggregate(precip,month,FUN='wetmean'),new=FALSE)
```

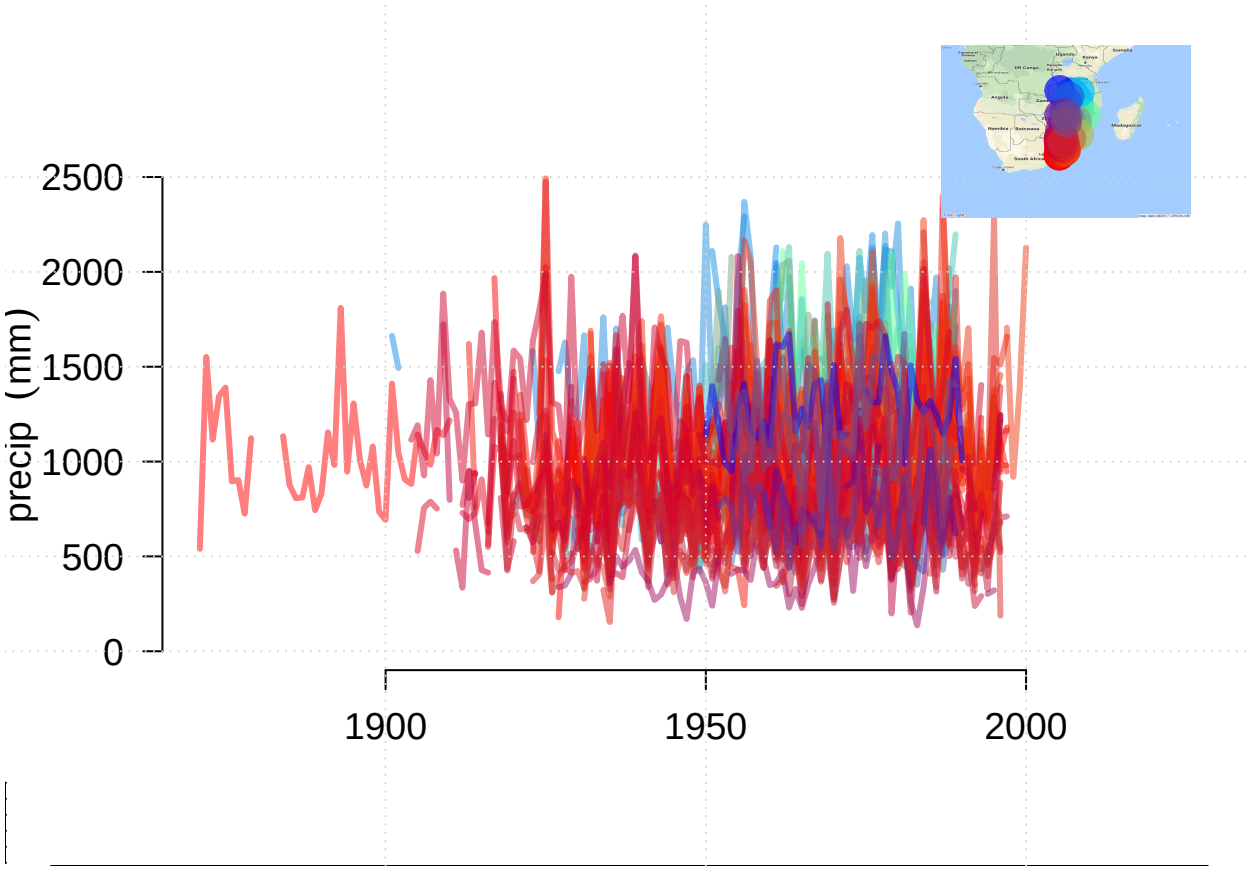
```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```



Precipitation - long-term variations

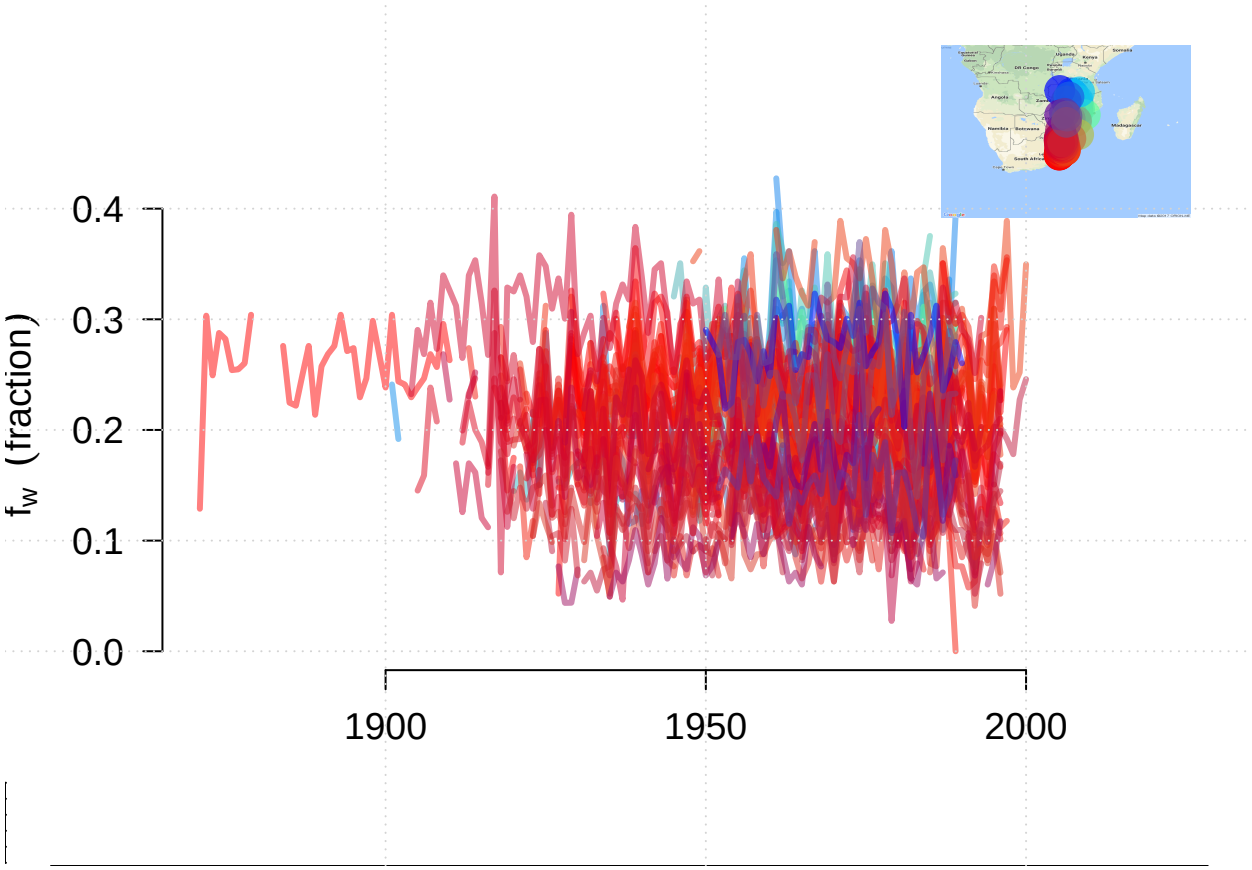
```
plot(annual(precip,FUN='sum'),new=FALSE); grid()
```

```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```



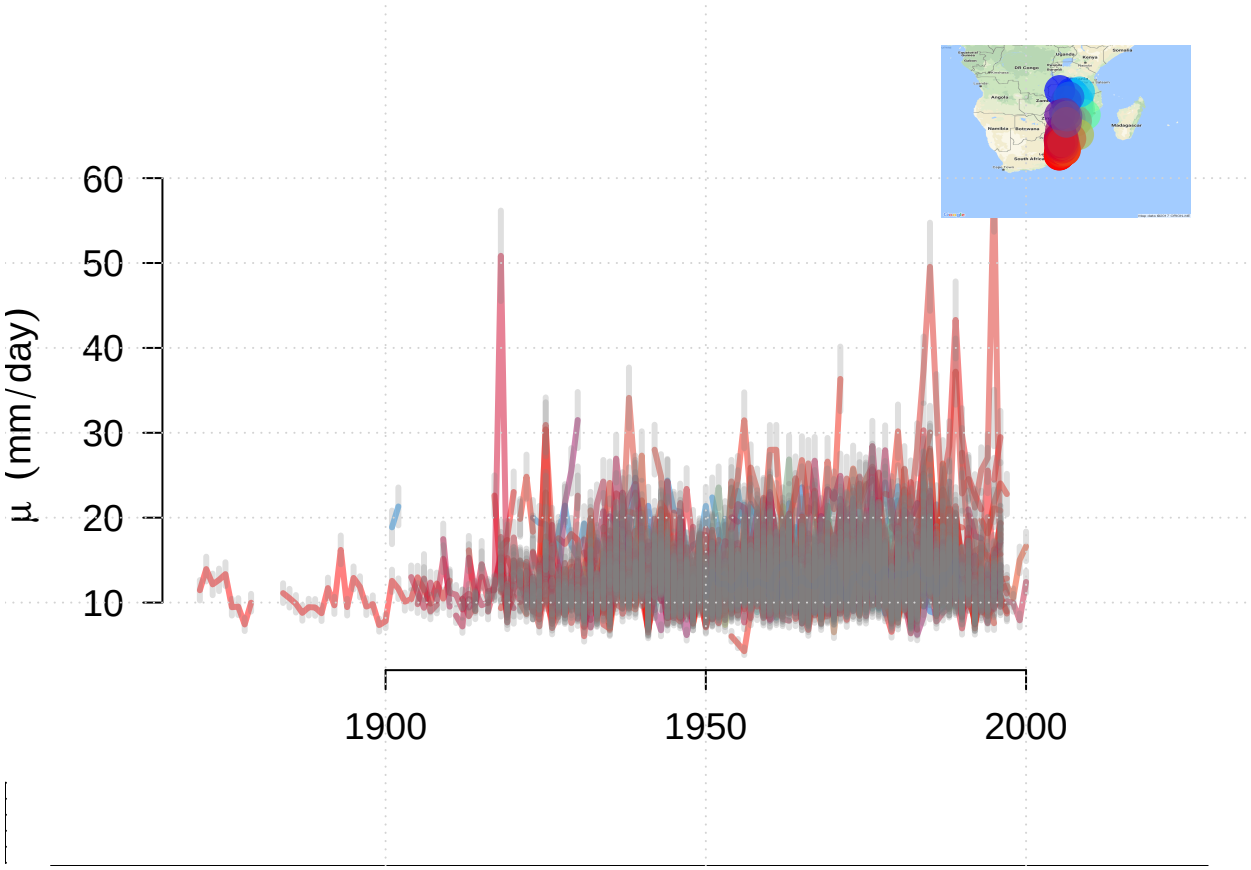

```
plot(annual(precip,FUN='wetfreq'),new=FALSE); grid()
```

```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```



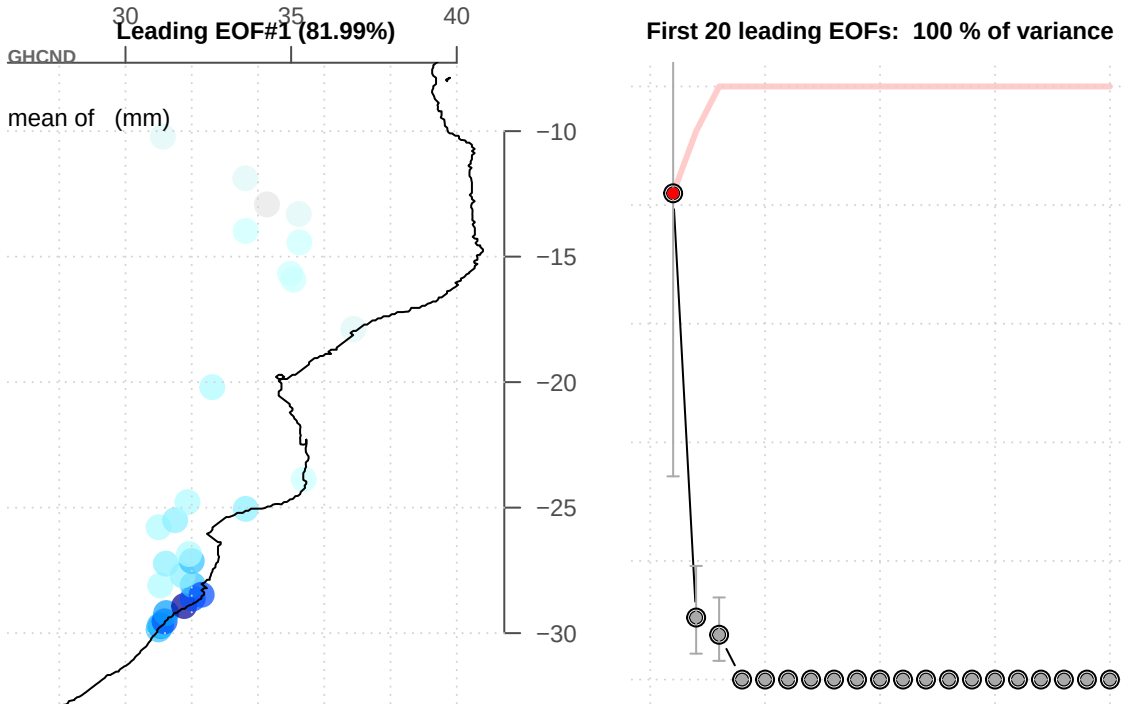

```
plot(annual(precip,FUN='wetmean'),new=FALSE); grid()
```

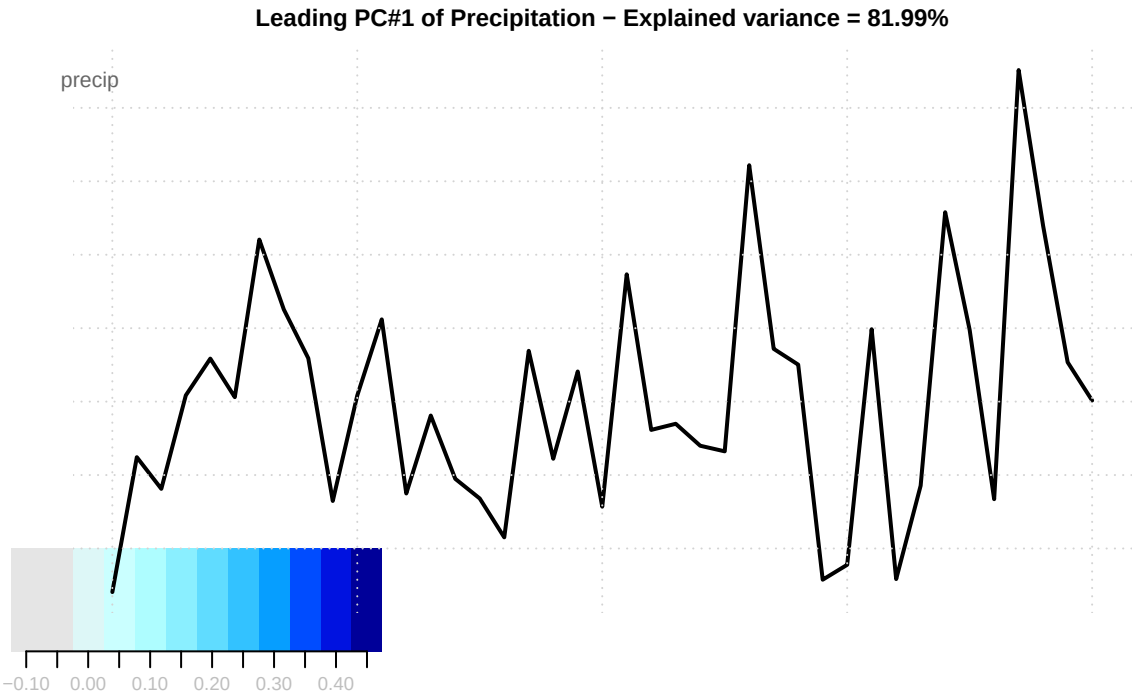
```
## Warning in plotmap(lat(x), lon(x), bgmap, pch = 19, col = col, cex = 2):
## NAs introduced by coercion
```



Spatial patterns of variability in annual precipitation totals

```
Y <- subset(annual(precip,FUN='sum'),it=c(1950,1990))
nv <- apply(coredata(Y),2,'nv')
Y <- subset(Y,is=nv > 36)
Y <- pcafill(Y)
tp.pca<- PCA(Y)
plot(tp.pca,new=FALSE)
```

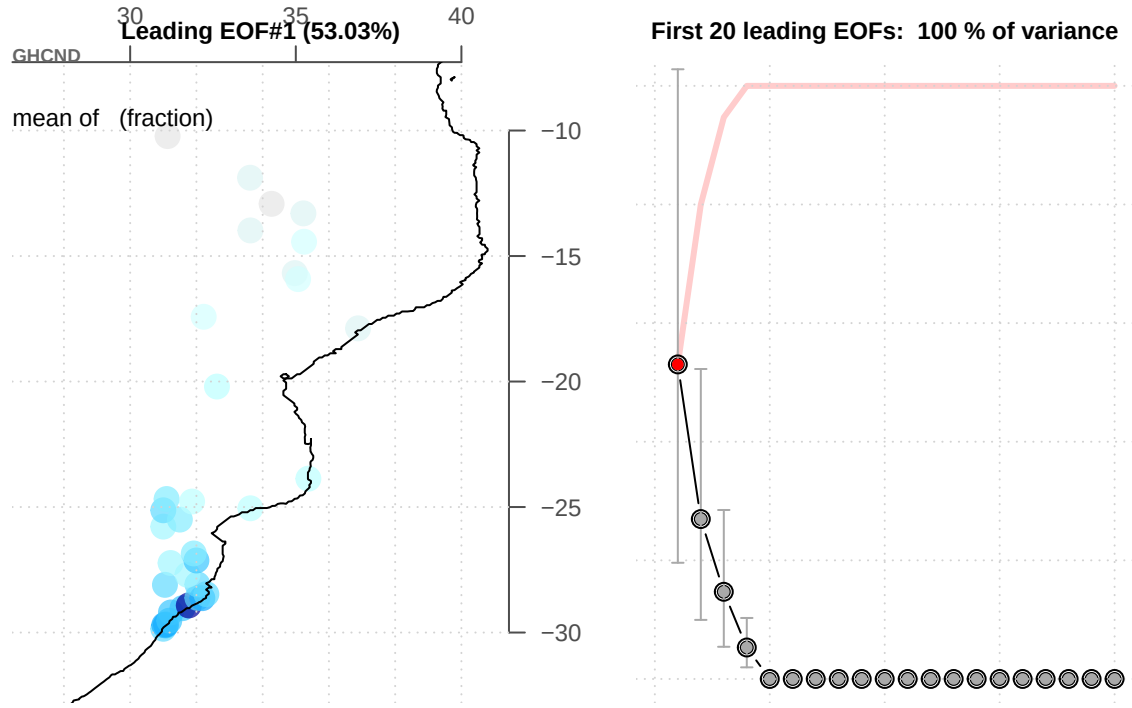


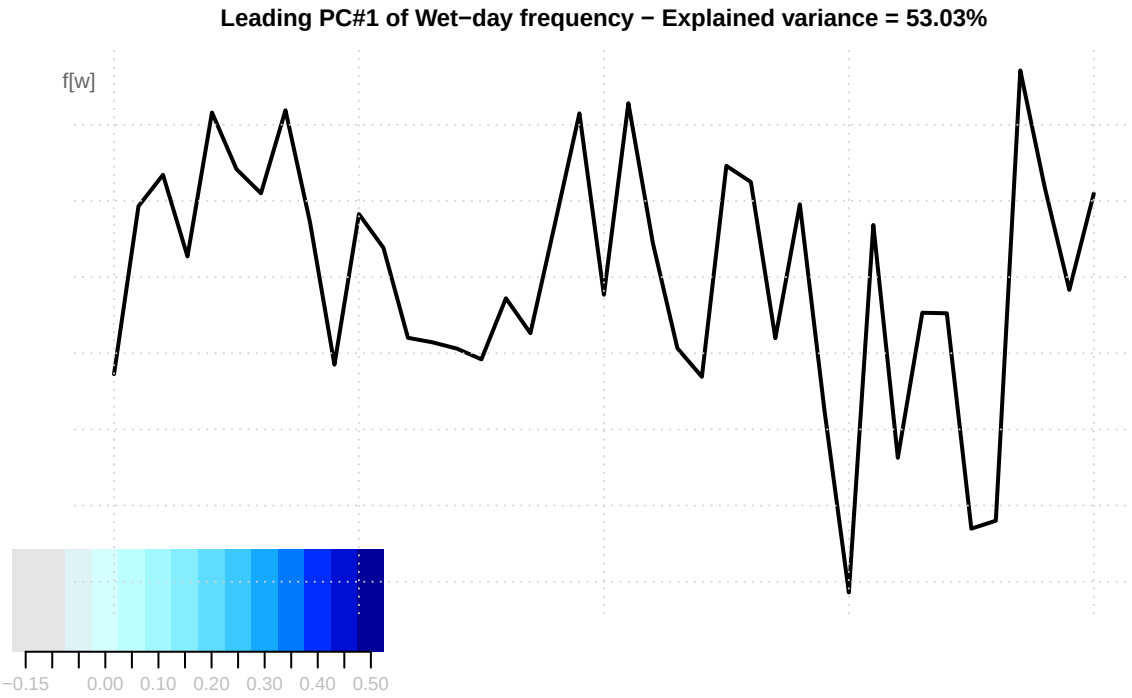


Spatial patterns of variability in annual wet-day frequency

```
Y <- subset(annual(precip,FUN='wetfreq'),it=c(1950,1990))
nv <- apply(coredata(Y),2,'nv')
Y <- subset(Y,is=nv > 36)
Y <- pcafill(Y)
```

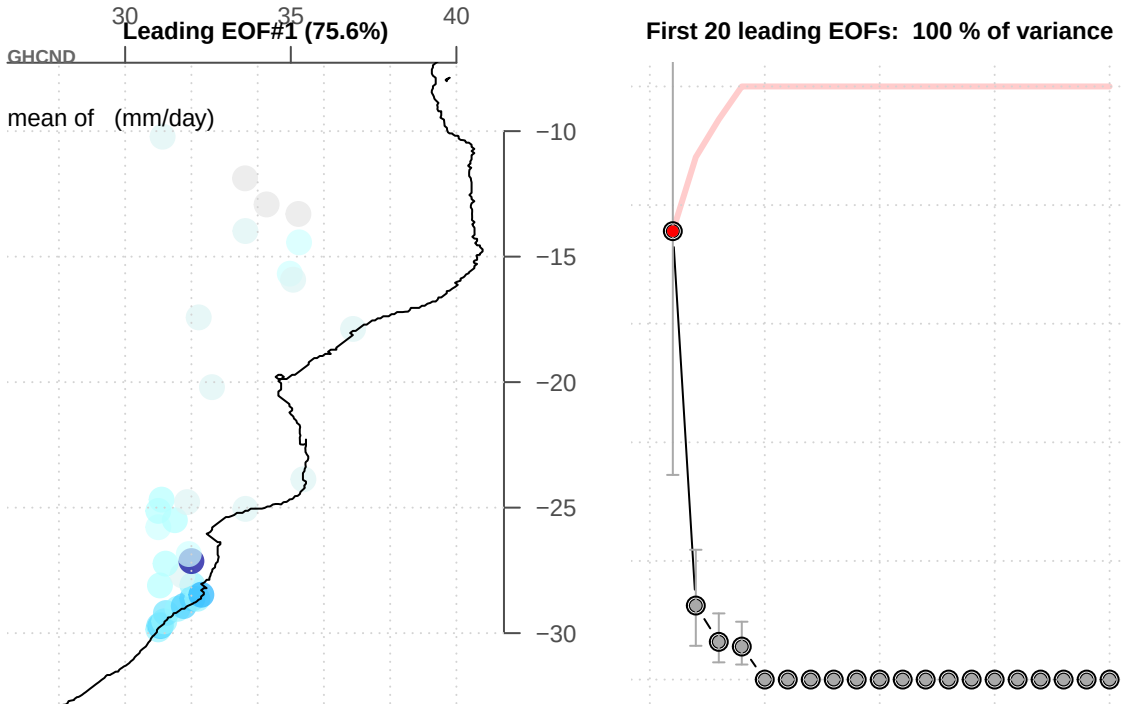
```
fw.pca<- PCA(Y)
plot(fw.pca,new=FALSE)
```

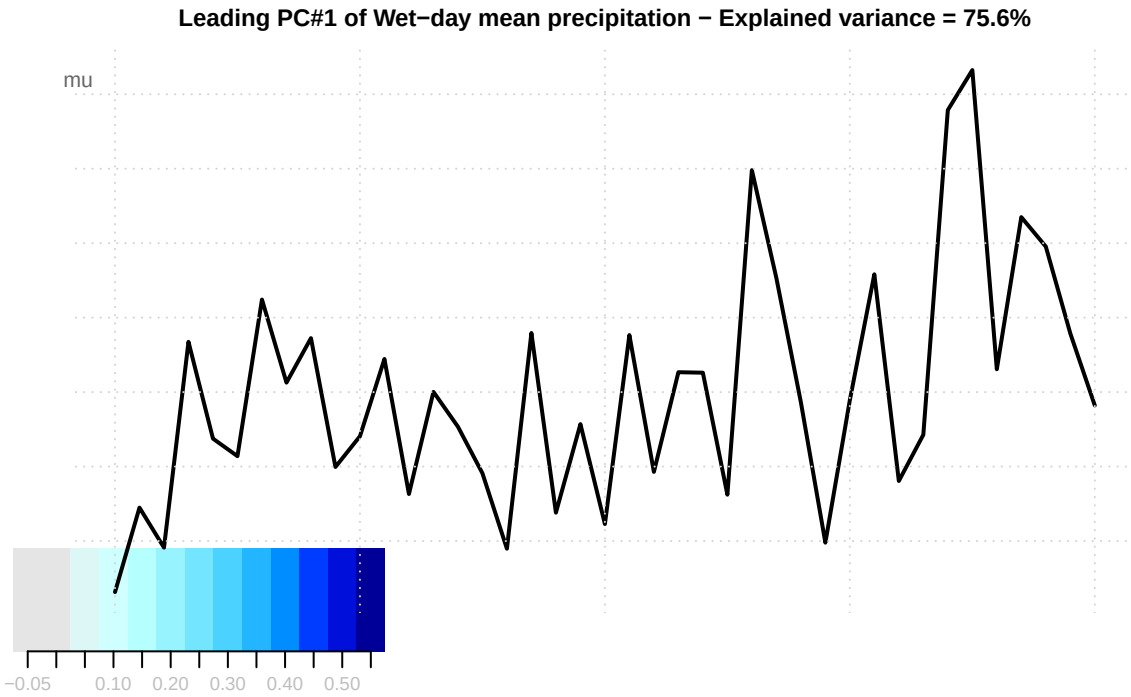




Spatial patterns of variability in annual wet-day mean precipitation

```
Y <- subset(annual(precip,FUN='wetmean'),it=c(1950,1990))
nv <- apply(coredata(Y),2,'nv')
Y <- subset(Y,is=nv > 36)
Y <- pcafill(Y)
mu.pca<- PCA(Y)
plot(mu.pca,new=FALSE)
```


Leading EOF#1 (75.6%)
First 20 leading EOFs: 100 % of variance
GHCND
mean of (mm/day)
30
35
40
−10
−15
−20
−25
−30


Leading PC#1 of Wet−day mean precipitation − Explained variance = 75.6%
mu
−0.05
0.10
0.20
0.30
0.40
0.50