Meuse river annual maximal discharge

HW

May 24, 2018

Meuse annual maximal discharge

```
## Loading required package: mgcv
## Loading required package: nlme
## This is mgcv 1.8-38. For overview type 'help("mgcv-package")'.
```

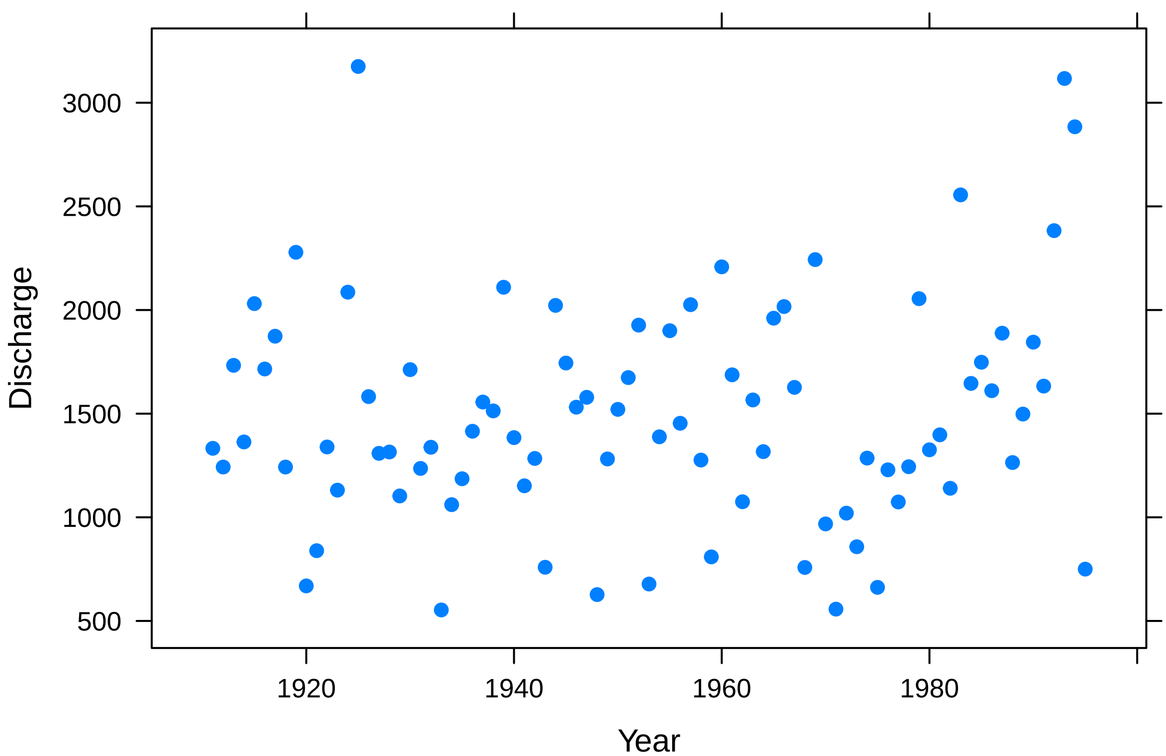
```
# import meuse data
source("Day1_meuse.data.R")
attach(meuse)
require(lattice) #this package is used to generate plots
```

```
## Loading required package: lattice
```

```
names(meuse)
```

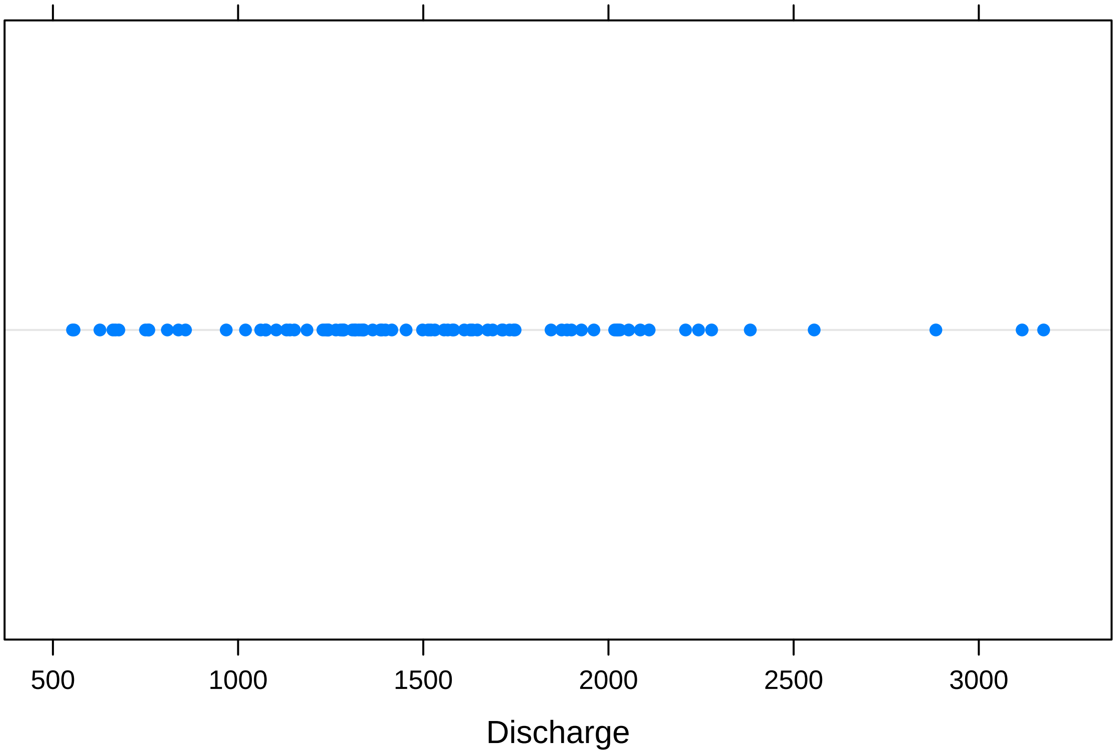
```
## [1] "Year"      "Discharge"
```

```
xyplot(Discharge~Year,pch=19)
```

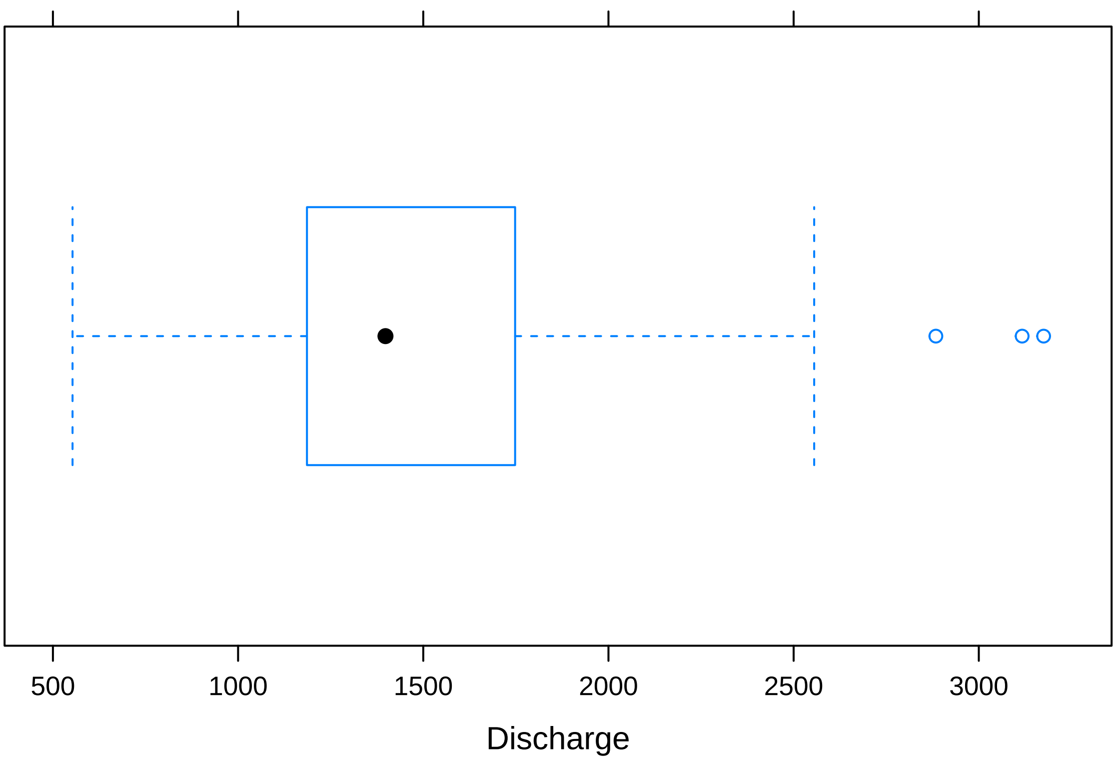


Meuse annual maximal discharge

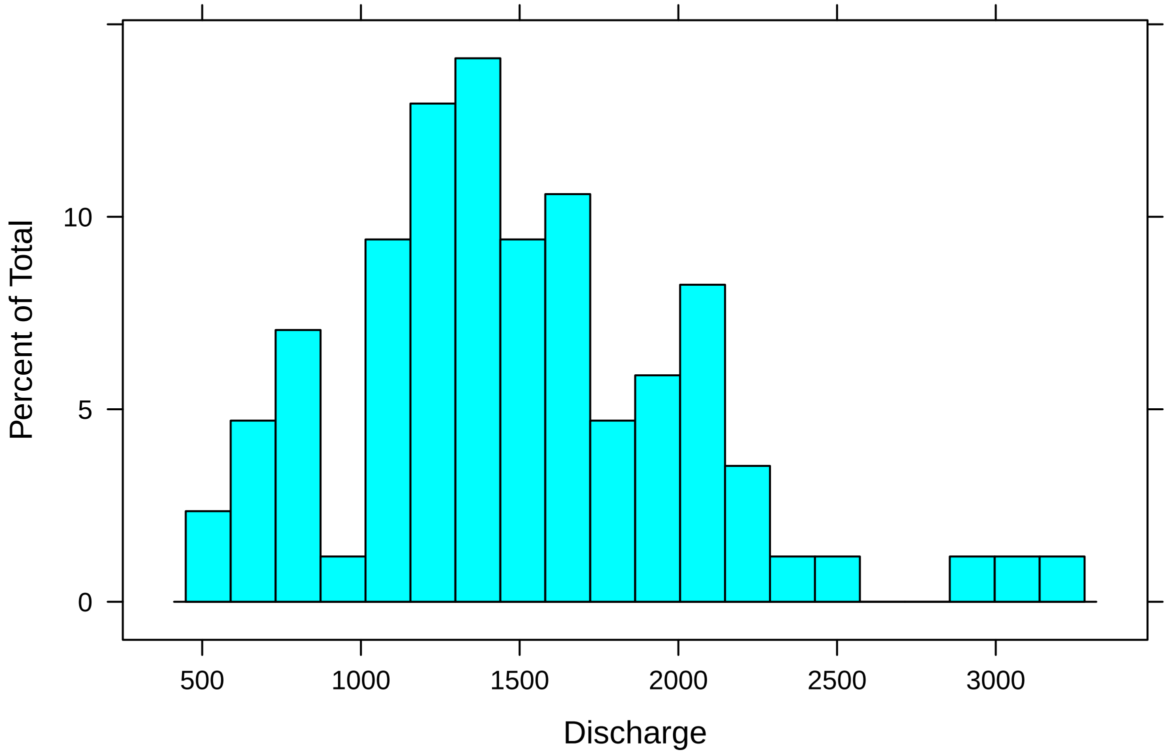
```
dotplot(Discharge)
```




```
bwplot(Discharge)
```

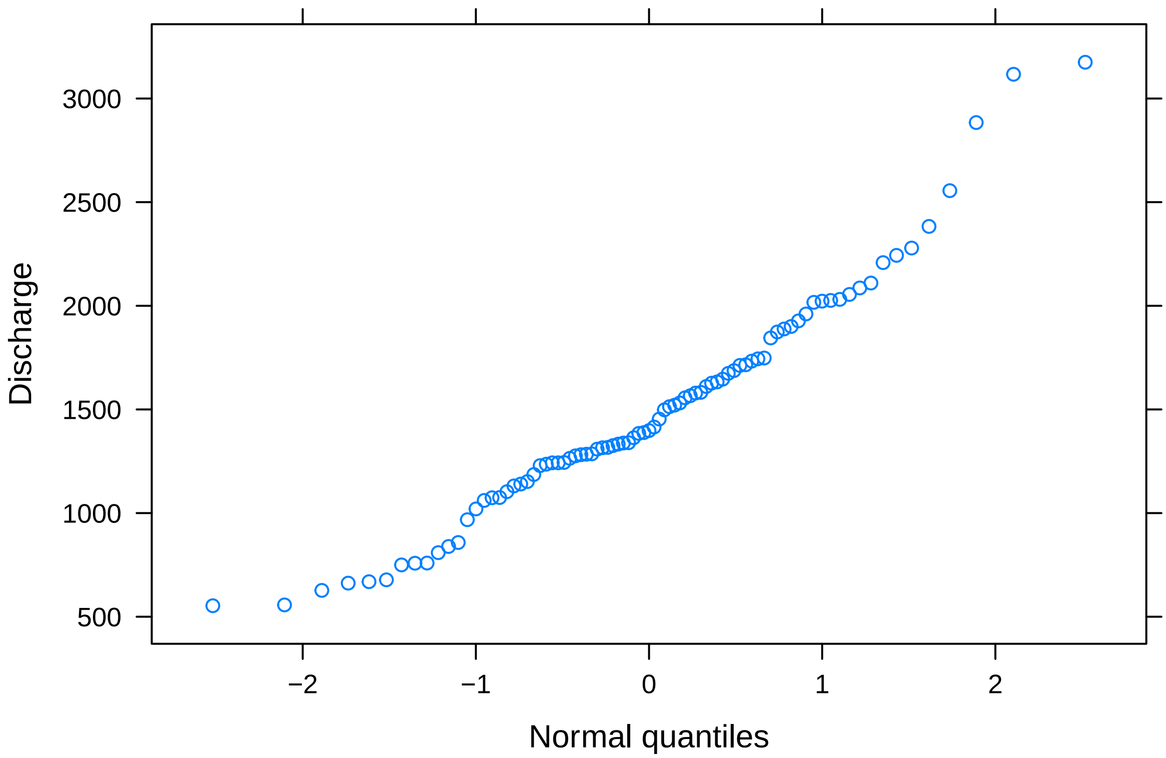


```
histogram(Discharge,n=20)
```

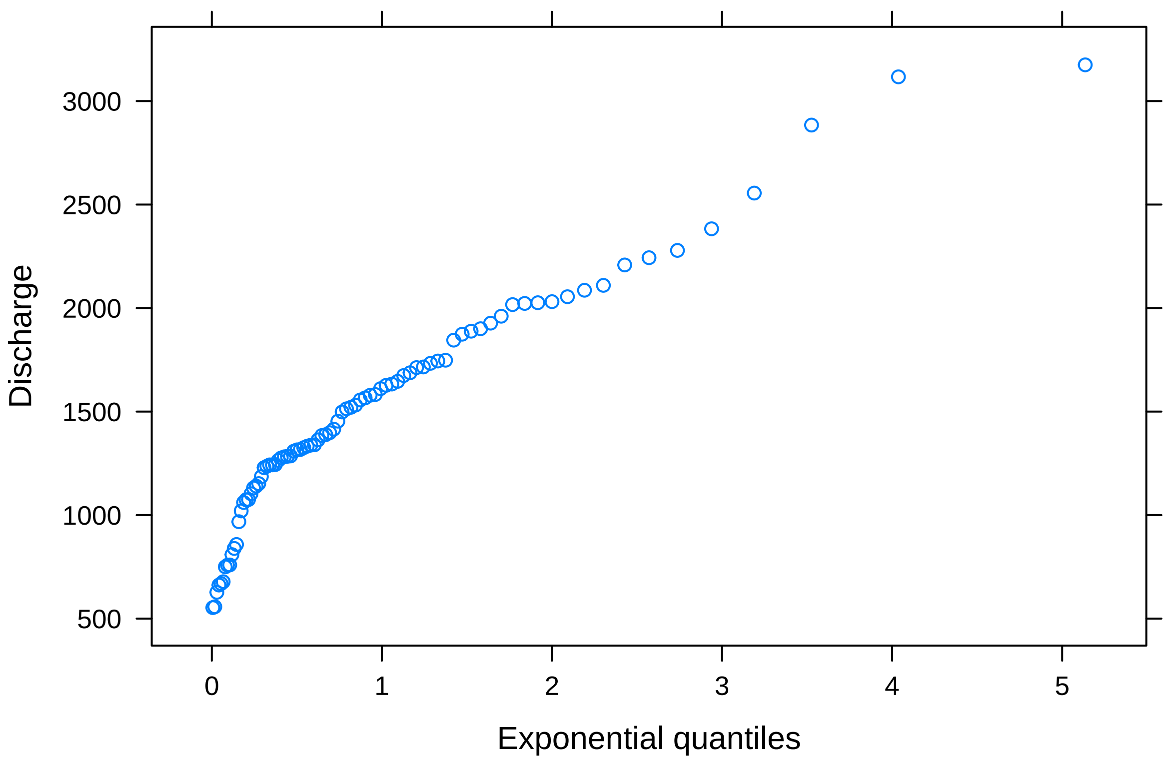


Normal and exponential QQ plots

```
qqmath(Discharge,xlab="Normal quantiles")
```

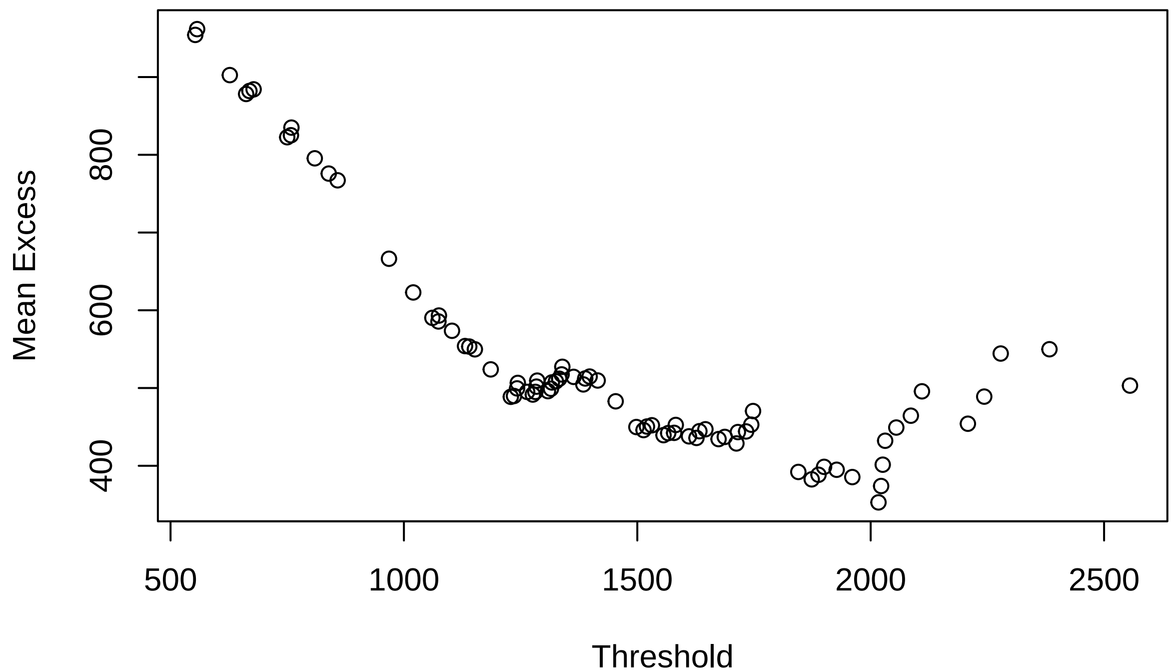



```r
# QQplot for Extreme Value Analysis
qqmath(Discharge,distribution = qexp,xlab="Exponential quantiles")
```

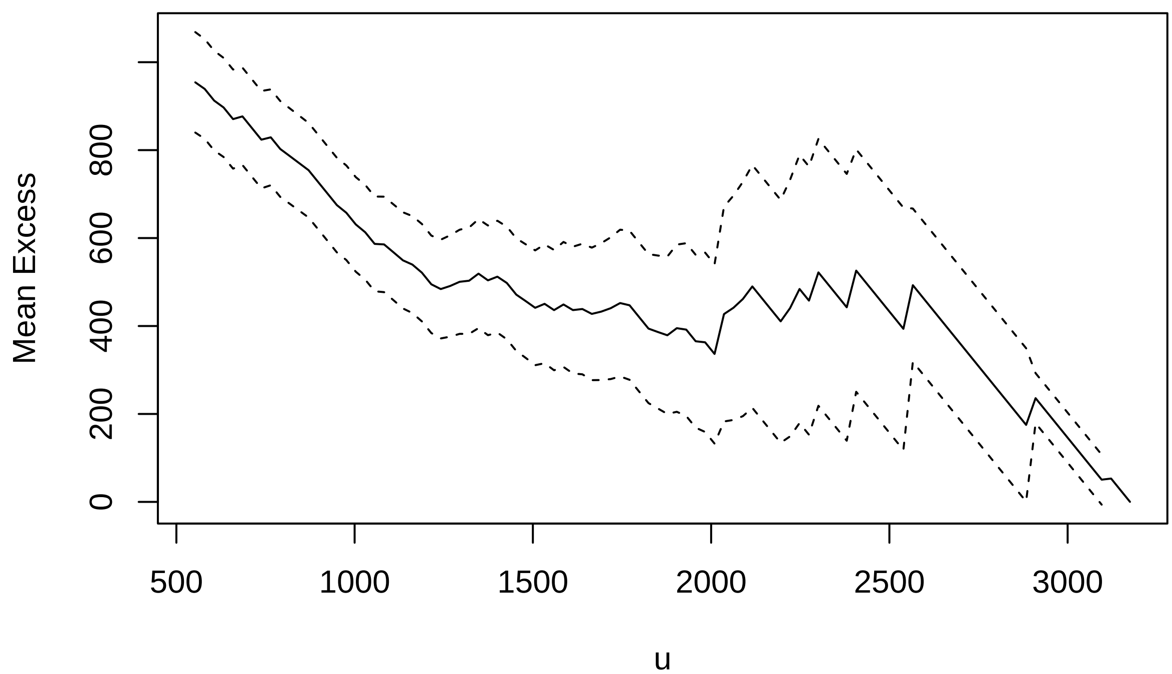


Two versions of the excess plot

```
# evir library: excess plot
library(evir)
meplot(Discharge) #note: the last two values are left out by default! keep that in mind
```




```
# ismev library: excess plot
mrl.plot(Discharge)
```




```
# notice that meplot has a parameter omit=3: three largest values are omitted
?meplot
```

GEV and Gumbel model fits

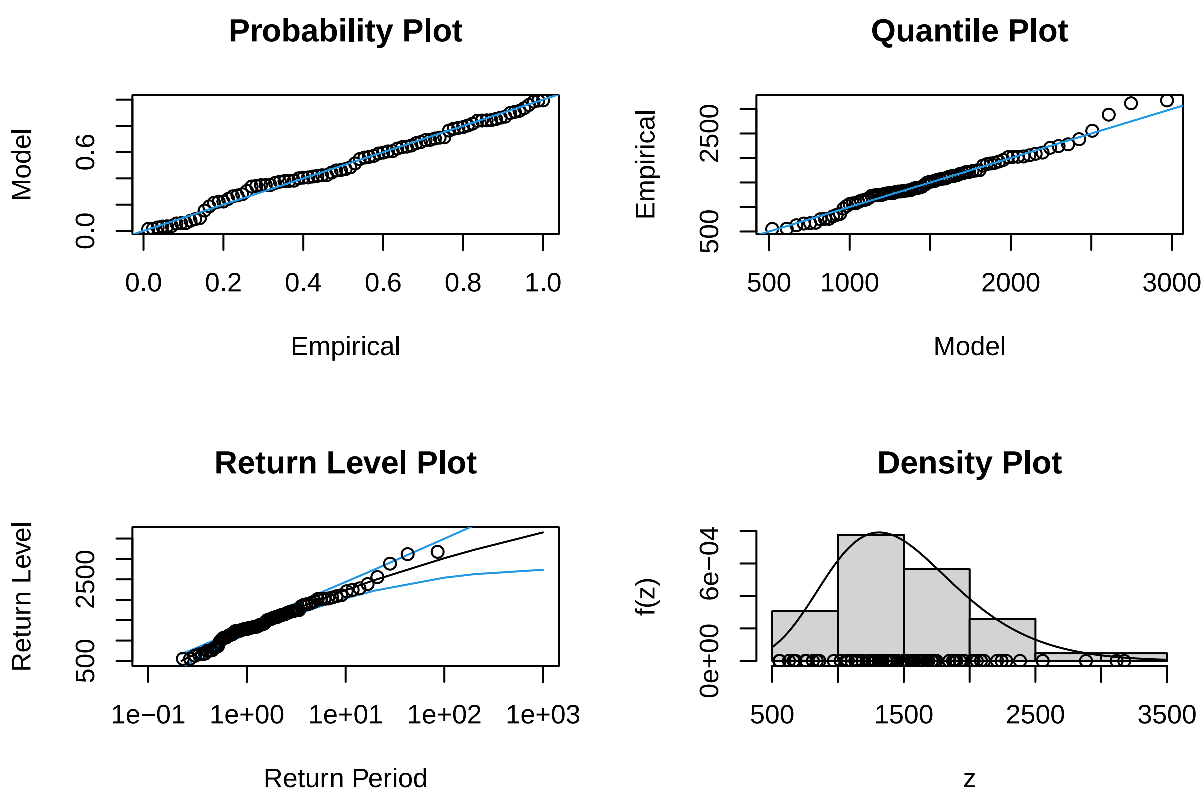
```r
meuse.GEV=gev.fit(Discharge)
```

```
## $conv
## [1] 0
##
## $nllh
## [1] 651.7391
##
## $mle
## [1] 1267.22749758  466.79293305   -0.09242819
##
## $se
## [1] 56.23478470 39.50002047  0.06987249
```

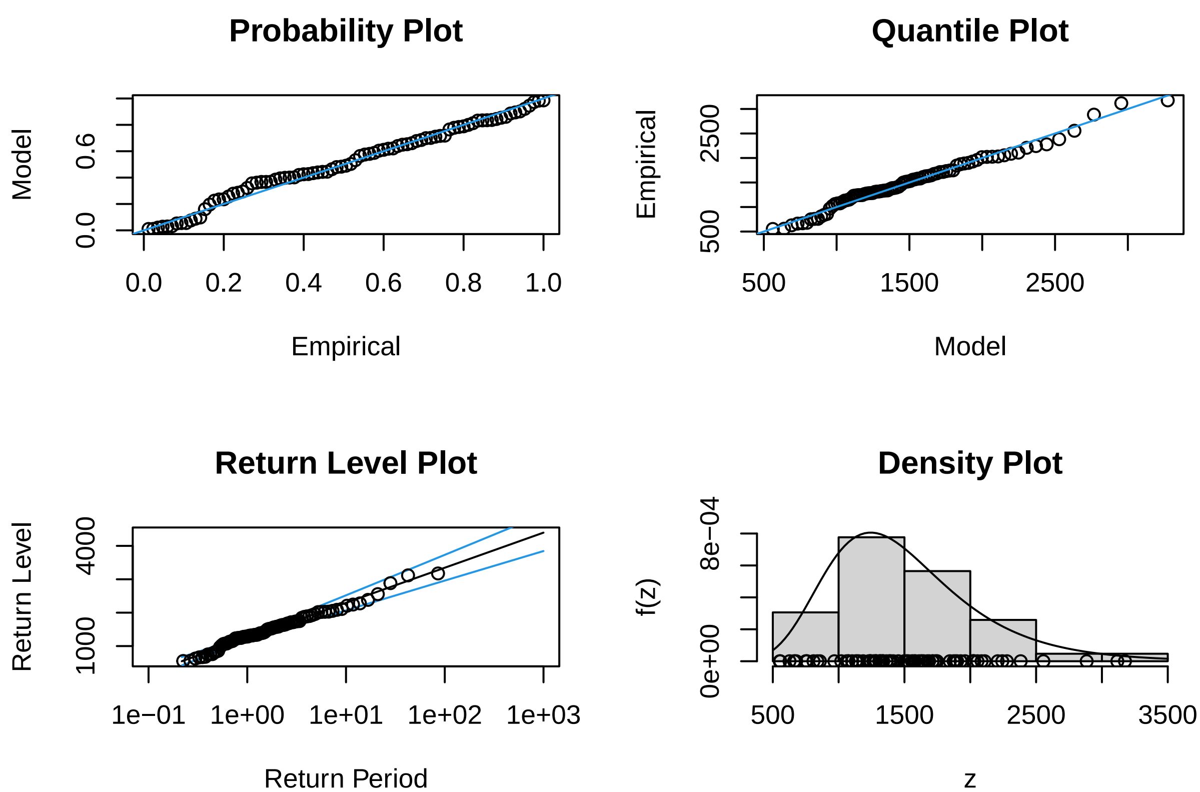
```r
meuse.GUM=gum.fit(Discharge)
```

```
## $conv
## [1] 0
##
## $nllh
## [1] 652.4664
##
## $mle
## [1] 1243.567  456.454
##
## $se
## [1] 52.30127 37.67075
```

```r
# plot diagnostics
gev.diag(meuse.GEV)
```

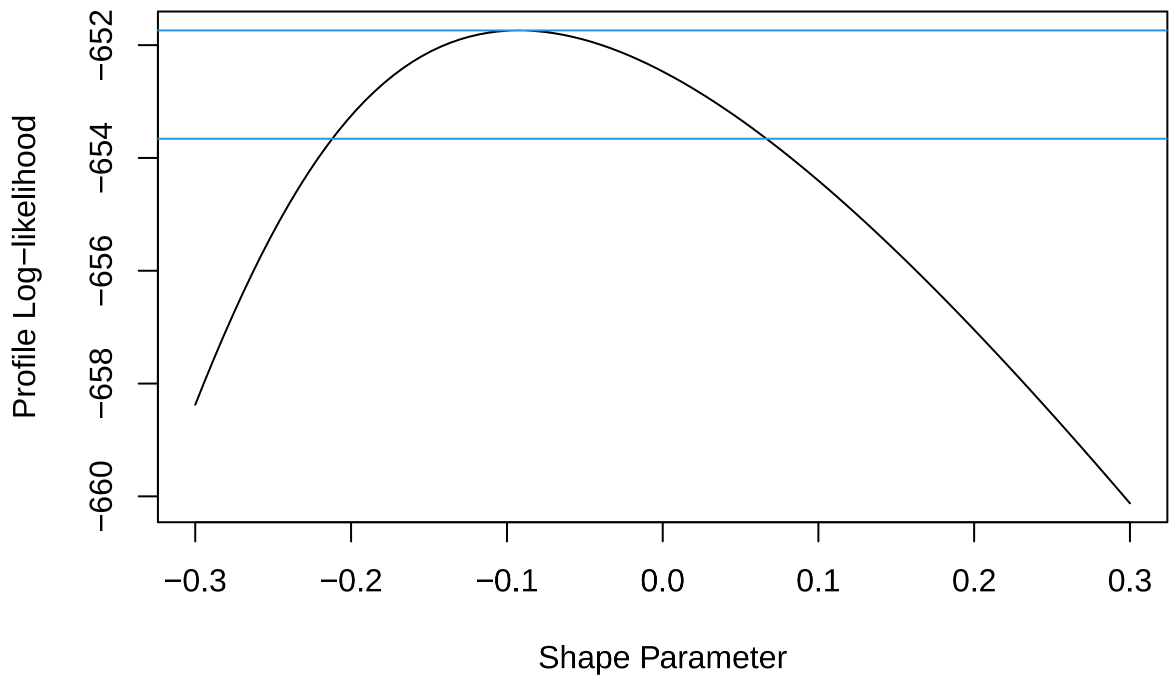



```
gum.diag(meuse.GUM)
```



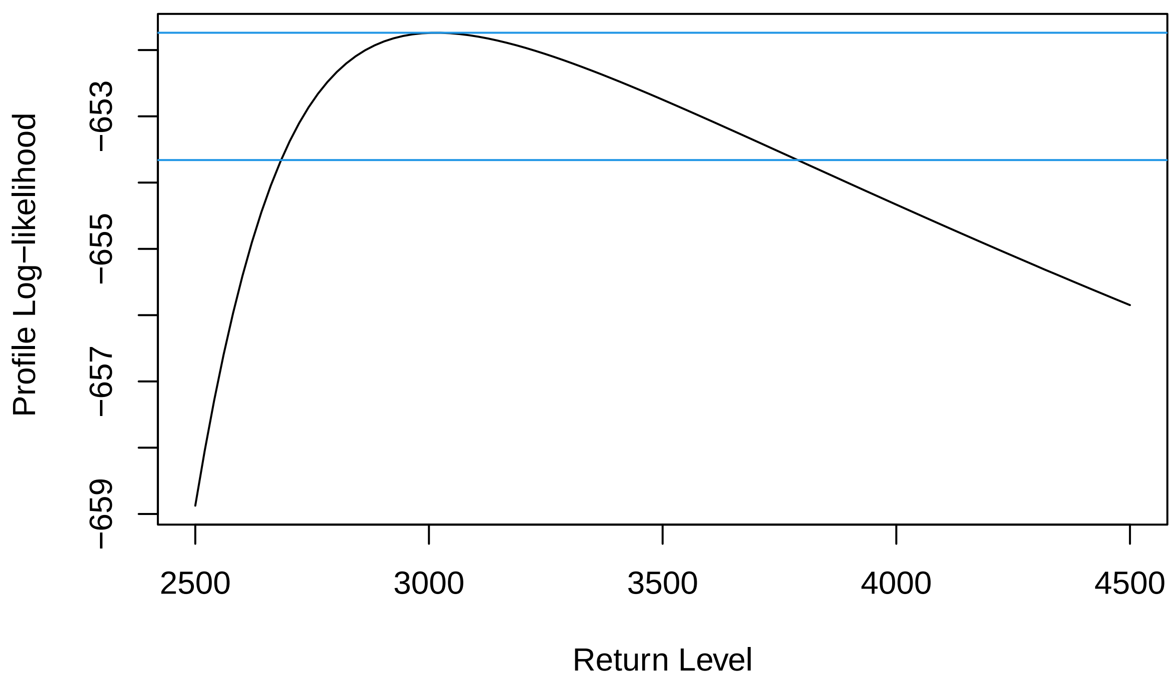
```
gev.profxi(meuse.GEV, -0.3, 0.3)    #-.3,.3 -> here we need to enter a range in which we want to search
```

```
## If routine fails, try changing plotting interval
```




```
gev.prof(meuse.GEV,100, 2500, 4500) # 2500,4500
```

```
## If routine fails, try changing plotting interval
```



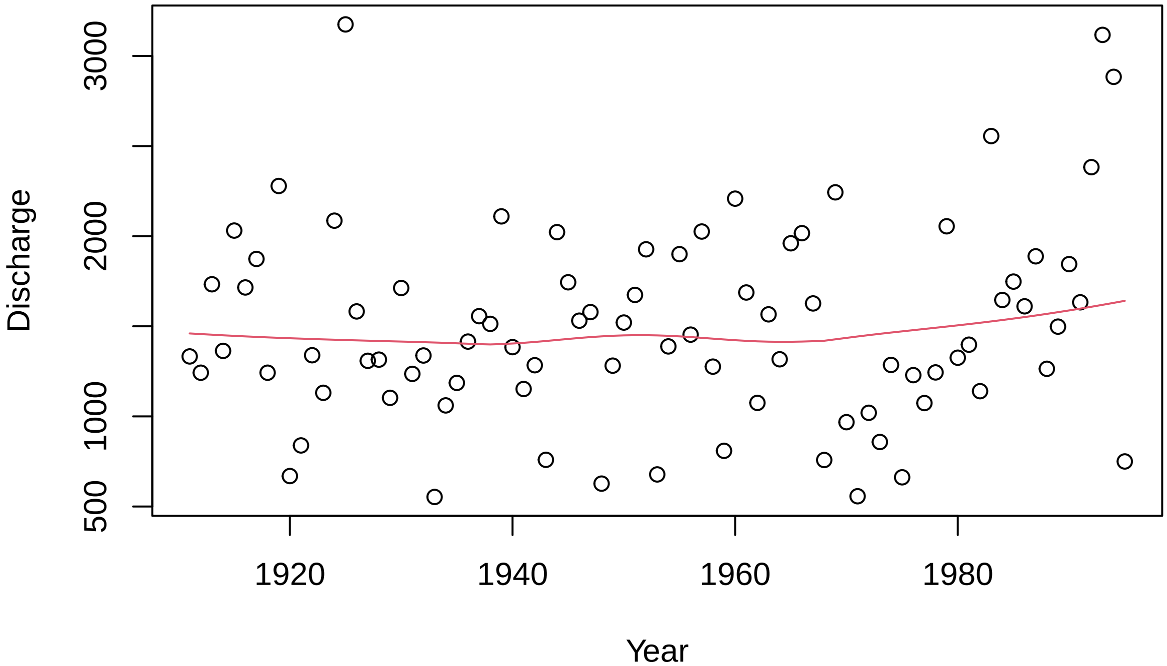
CON-
CLUSION =

Same conclusion as Beirlant et al.: Gumbel model is better than GEV model.

NEW ANALYSIS OF THAT DATA

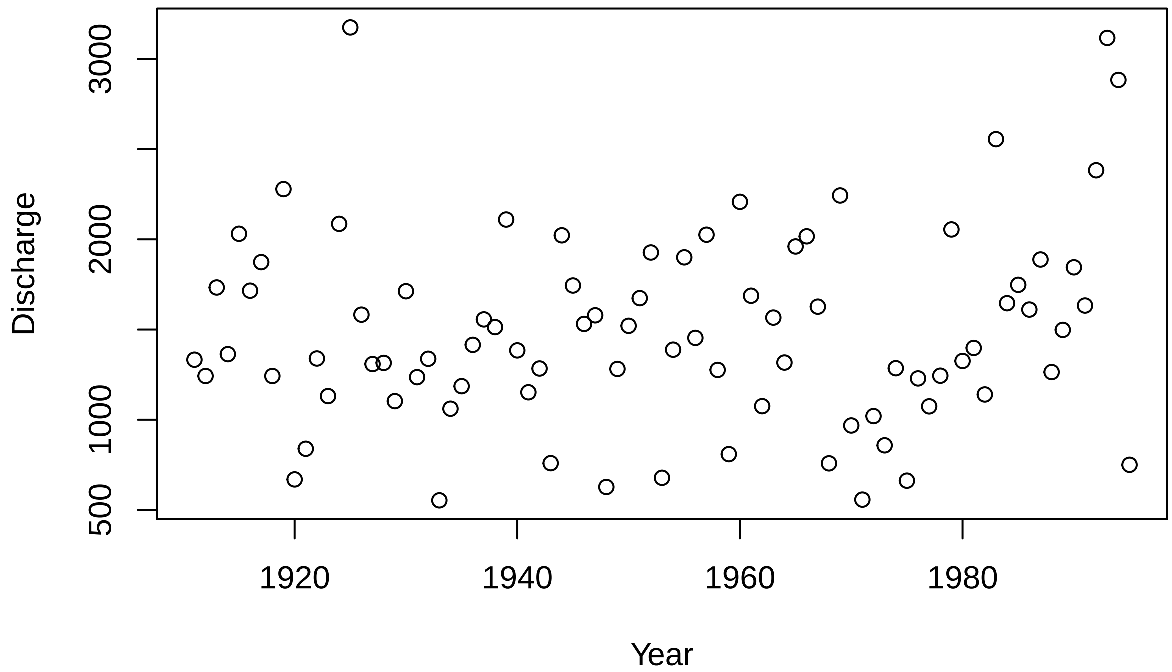
Discussion: are there outliers?

```
plot(meuse)
lines(lowess(meuse),col=2)
```



Which years?

```
# there seems to be an outlier: which year?
plot(meuse)
###  For interactivity execute the commands of chunk in the CONSOLE
# CLICK on point in Plot window [ESC  to end]
identify(meuse)
```




```
## integer(0)
```

```
which.max(meuse$Discharge)
```

```
## [1] 15
```

Outliers

```
Year[15]; Year[85]
```

```
## [1] 1925
```

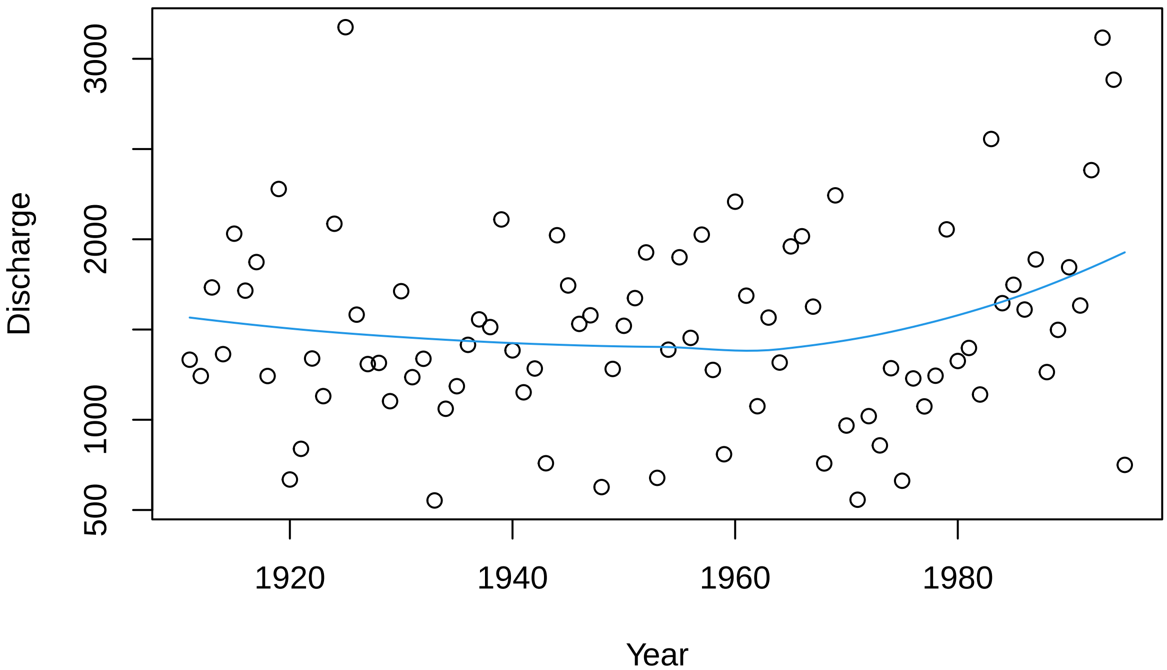
```
## [1] 1995
```

Remove outliers

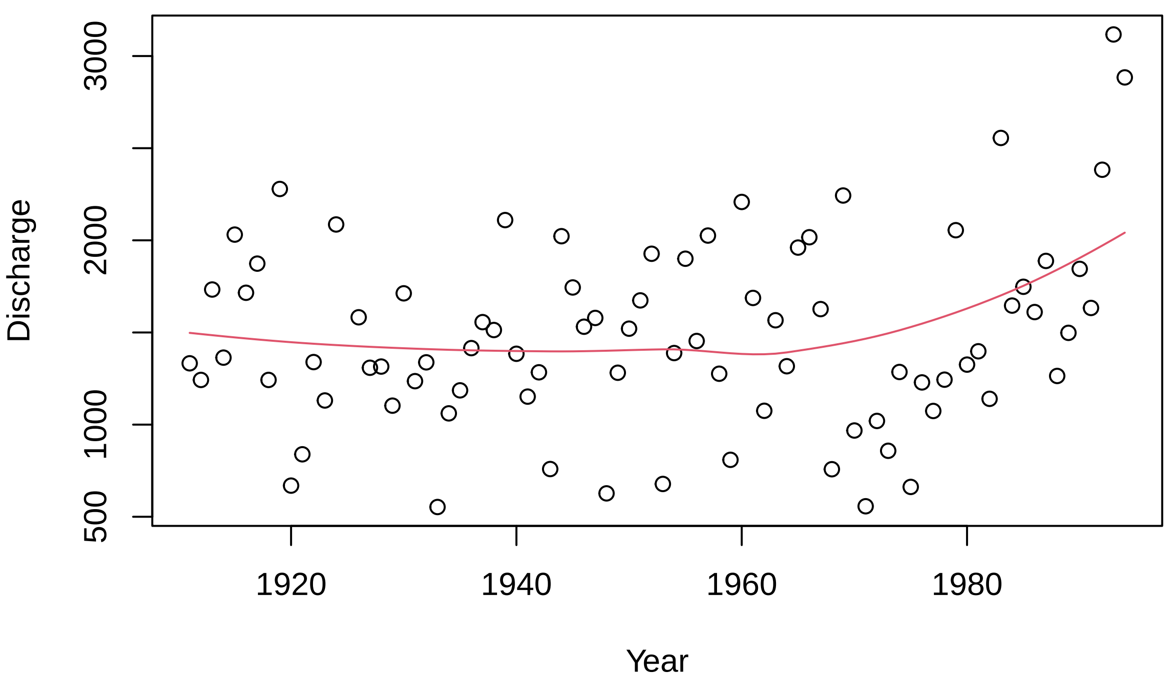
```
mm2 = data.frame(cbind(Year[c(-15,-85)],Discharge[c(-15,-85)]))
colnames(mm2) = c("Year","Discharge")
```

Recompute and display the overall trend without outlier

```
## plot a moving expected value / mean?
plot(meuse) # with outlier
# using "loess"" instead of "lowess""
lines(meuse$Year,
predict(loess(Discharge ~ Year,
data=meuse,span=1.2)) ,col=4)
```




```r
plot(mm2) # without outlier
lines(mm2$Year,
predict(loess(Discharge ~ Year,
data=mm2,span=1.2)) ,col=2)
```



Including the trend into the GEV analysis

```r
## storing the trend
meuse.loess =
as.data.frame(
```

```r
predict(loess(Discharge ~ Year,
data=mm2,span=1.2)))
colnames(meuse.loess)="CE"

## storing the analysis

meuse.GEVloess =
gev.fit(mm2$Discharge,ydat=meuse.loess,mul=1)
```

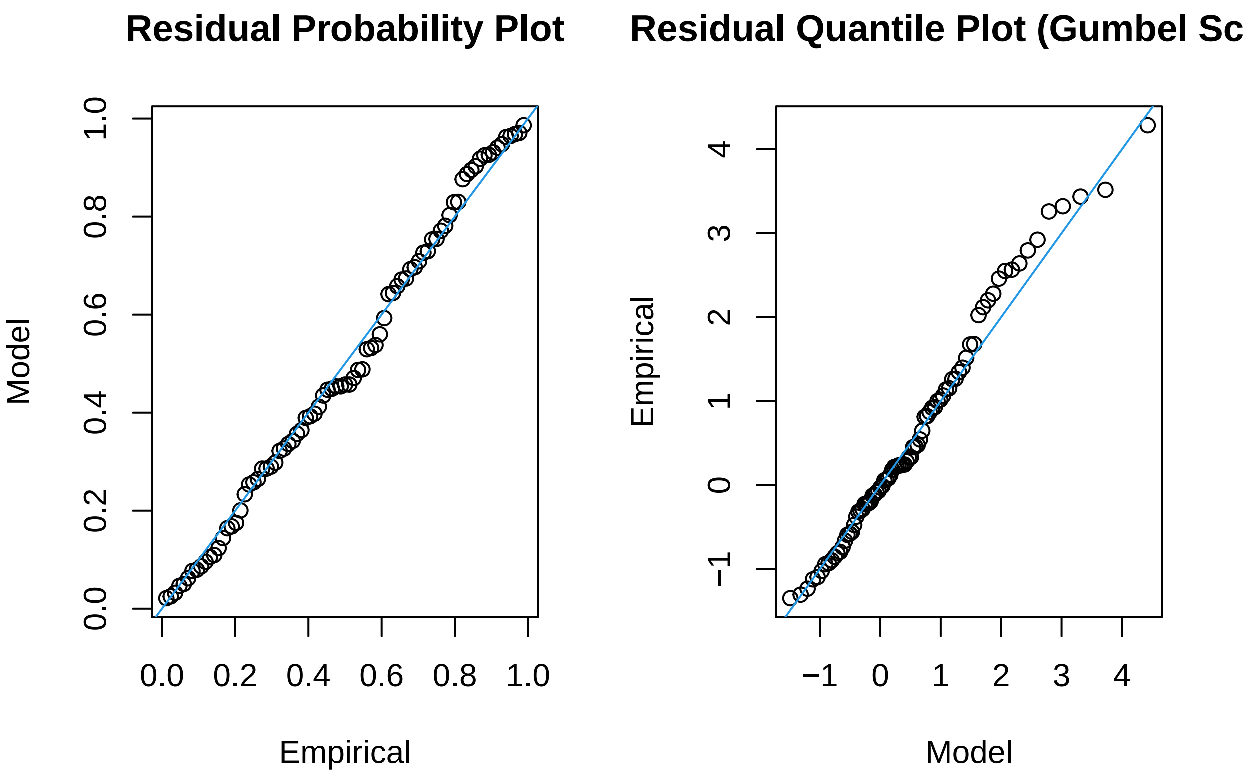
```
## $model
## $model[[1]]
## [1] 1
##
## $model[[2]]
## NULL
##
## $model[[3]]
## NULL
##
##
## $link
## [1] "c(identity, identity, identity)"
##
## $conv
## [1] 0
##
## $nllh
## [1] 626.0944
##
## $mle
## [1] -565.6358230    1.2503048  444.8021881   -0.2478829
##
## $se
## [1] 459.2310104   0.3076333  41.7348940   0.1019319
```

```r
meuse.GUMloess =
gum.fit(mm2$Discharge,ydat=meuse.loess,mul=1)
```

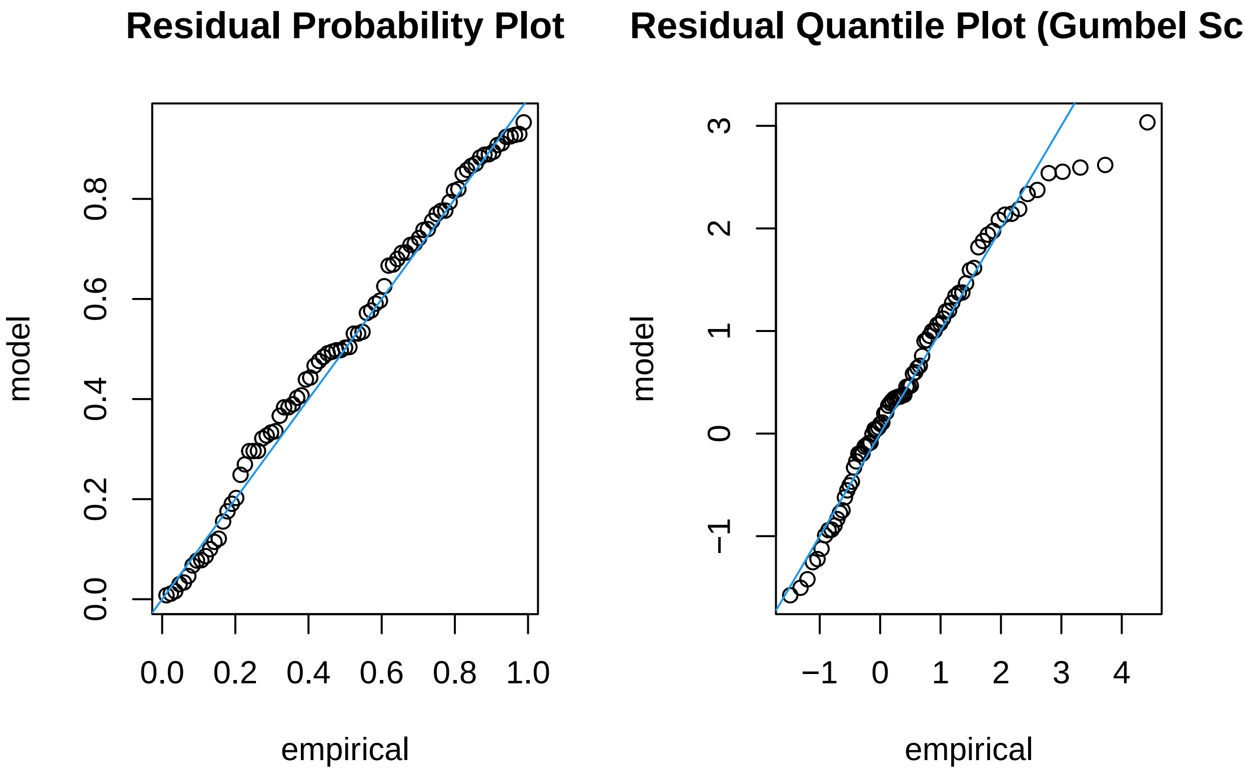
```
## $model
## $model[[1]]
## [1] 1
##
## $model[[2]]
## NULL
##
##
## $link
## [1] "identity" "identity"
##
## $conv
## [1] 0
##
## $nllh
## [1] 628.848
```

```
##
## $mle
## [1] -517.972727    1.181311  416.943658
##
## $se
## [1] 479.8024394   0.3172017  34.7996008
```

```r
# plot diagnostics
gev.diag(meuse.GEVloess)
```




```r
gum.diag(meuse.GUMloess)
```




```
## compare the negative log-likelihoods (nllh)
meuse.GEVloess$nllh
```

```
## [1] 626.0944
```

```
meuse.GUM$nllh
```

```
## [1] 652.4664
```

CONCLUSION

GEV model fits the residuals better than Gumbel model.