Risk Analytics - Practical 2

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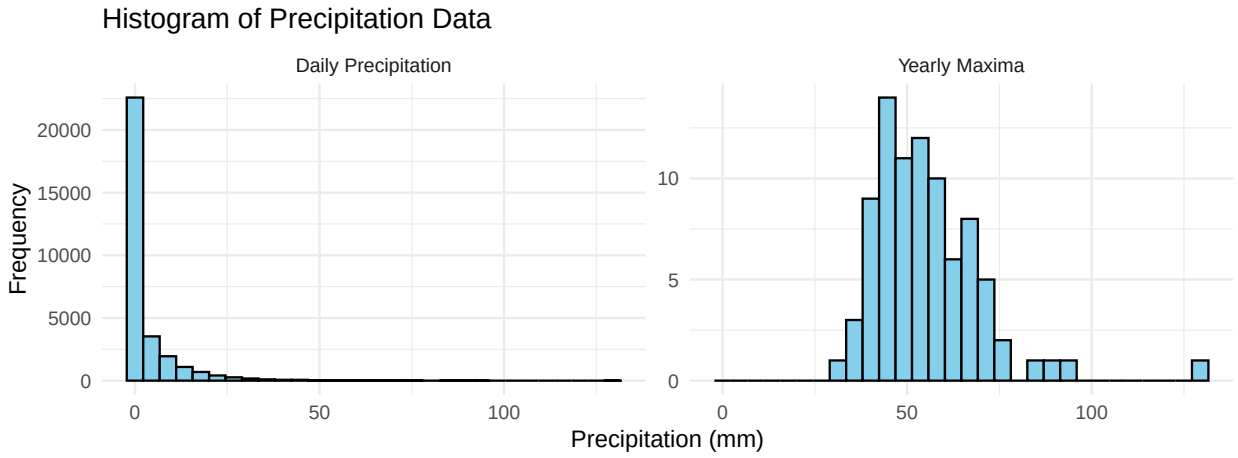
Part 1: Block maxima approach

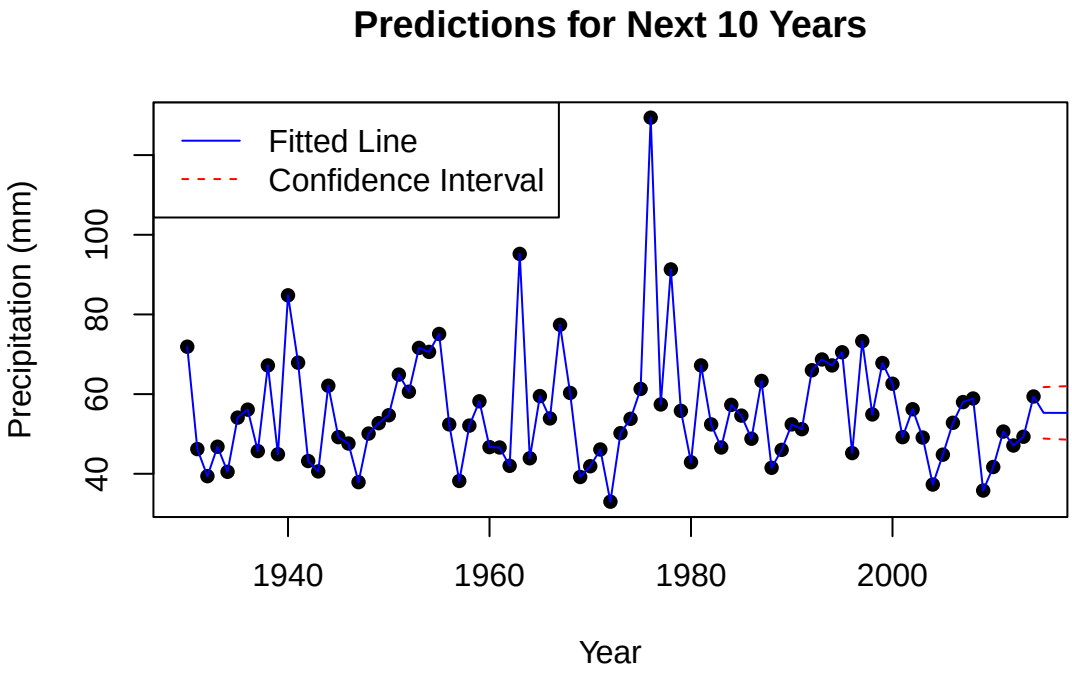
a) Read in the data and plot daily precipitation historgram & b) Extract yearly maxima and plot histogram



The majority of daily precipitation values are below 10 mm. Extreme precipitation values above 40 mm are rare but present. A Generalized Extreme Value (GEV) distribution may be suitable for the extremes, while a Gamma might fit overall data.

The yearly maxima are right-skewed, with extreme values reaching above 120 mm. This suggests GEV modeling is appropriate for analyzing these extremes.

c) Fit a linear model to yearly maxima and predict next 10 years



The linear model suggests a steady increase in yearly maximum precipitation. This method sees oversimplify the complexities of extreme precipitation patterns.

d) Fit GEV models and compare AIC/BIC

```
## AIC (Constant Parameters): 672.9433
```

```
## AIC (Time-Varying Location): 674.8906
```

```
## BIC (Constant Parameters): 680.2712
```

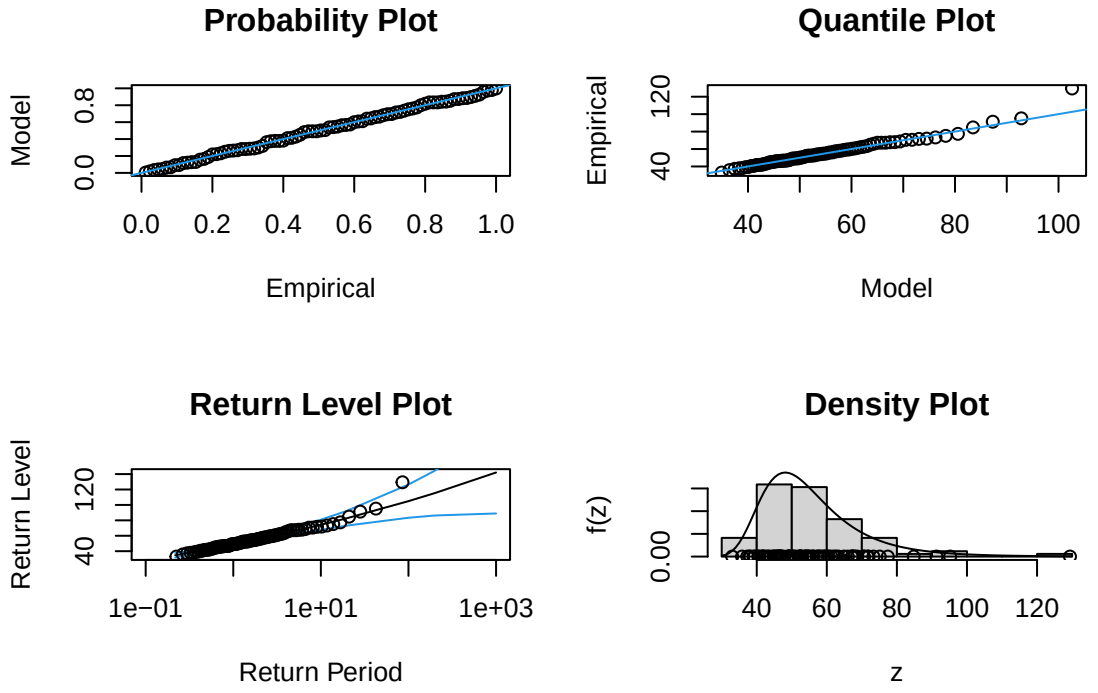
```
## BIC (Time-Varying Location): 684.6612
```

The constant GEV model has slightly lower AIC and BIC values, indicating better fit compared to the time-varying model. Therefore, the constant model is recommended.

e) Diagnostic plots of GEV fit

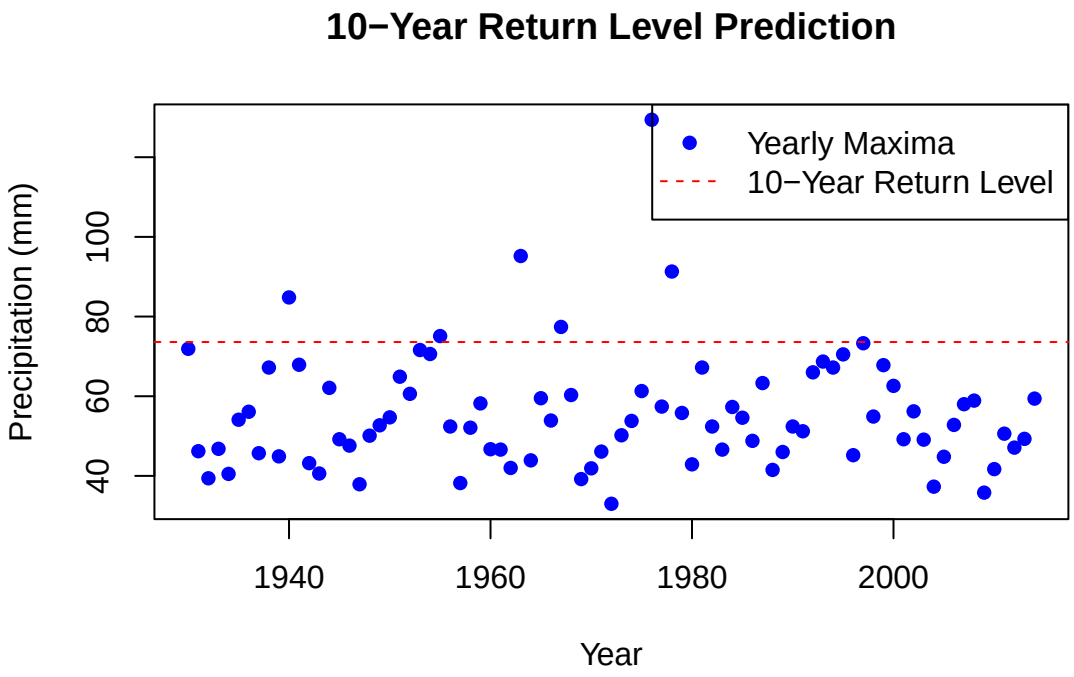
```
## $conv
## [1] 0
##
## $nllh
## [1] 333.4716
##
```

```
## $mle
## [1] 48.92521354  9.97227559  0.08329645
##
## $se
## [1] 1.21298615 0.90492022 0.07773763
```



Diagnostic plots suggest the model fits the data well, as evidenced by the quantile and return-level plots. Slight deviations at extremes should be noted, as they may affect predictions.

f) Predict the 10-year return level and plot



The 10-year return level is approximately 73.61 mm. Few historical events exceed this level.

g) Count exceedances for return levels

```
##        10        20        50        85
##  73.60759  82.53069  94.90440 102.45270
```

```
## 10 20 50 85
##  6  4  2  1
```

The historical counts above the 10-, 20-, 50-, and 85-year return levels are 6, 4, 2, and 1 respectively.

h) Return period for 100 mm of precipitation

```
## Return period for 100 mm precipitation: 71.70624 years
```

i) Probability of exceeding 150 mm in a given year

```
## Probability of exceeding 150 mm in a day at least once in a year: 0.2094091
```