TSE — M2 Statistics and Econometrics
Univariate extreme value theory: Lab session

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Exercice 1: Precipitation extremes at Toulouse-Blagnac

1. Import the precipitation dataset from my webpage http://mribatet.perso.math.cnrs.fr
2. Load the **evd** package.
3. Retrieve the annual maxima from the raw data.
4. Fit a GEV to those annual maxima using the *fgev* function. We suppose that you saved the output of `fgev` to an R object `fitted`. Produce diagnostic plots with the lines of code below and comment.

```
par(mfrow = c(2, 2))
plot(fitted)
```

5. Give 95% confidence intervals for the GEV parameters μ, σ and ξ.
6. Compare the above confidence intervals with those obtained by

```
plot(profile(fitted))
```

What are the main differences between these two types of confidence intervals? Which one would you prefer?

7. Pass the argument `shape = 0` to the `fgev` function and identify which model it corresponds to. How would you proceed to check if the latter model is more appropriate?
8. Give an estimate of the 2–year, 10–year and 100–year return levels.
9. Give profile likelihood based confidence interval for the 10–year return level and comment.
10. Take a break and watch how I am rewritting a code to fit the GEV distribution from scratch...
11. Try to fit a non-stationary GEV model, e.g., with a linear trend for the location parameter μ?

Exercice 2: Yahoo negative log-returns

In this exercise we will conduct an extreme value analysis using exceedances over threshold for the Yahoo log-returns.

1. First install and load the **quantmod** and get the Apple daily prices by invoking

```
getSymbols("AAPL")
AAPL
```

2. Plot the raw time series as well as the negative log-returns (using closing prices).
3. Using the `mrlplot` and the `tcpot` functions, identify sensible thresholds values so that exceedances could be reasonably assumed to be GPD.
4. Follow the same steps as in the previous exercise.
5. Comment what happens when you pass the `mper = 10` option to the `fpot` function.

Exercice 3: You're the boss

This exercise is actually a warm up for your case study. Have a look at https://www.ecad.eu and choose your favourite (environmental) dataset. Perform an extreme value analysis. Do the same with a financial dataset (you can use the quantmod package to retrieve data or anything else)