CHAPTER2

March 13, 2025

1 Chapter 2: Current frequency of threshold exceedance

In this chapter the current frequency of exceeding the threshold determined in chapter 1 wil be analysed. This is done by looking at the available observation data of the catchment area of the Wien River. This observation data is available through eWaterCycle. As determined in chapter 1, the Wien River is designed for a 1000-year discharge return period. The observation data is unlikely to cover a period of 1000 years, so we will need to extrapolate it to estimate the discharge corresponding to a 1000-year return period and determine the return period of the previously established threshold.

1.1 General

eWaterCycle provides access to the Caravan dataset. This dataset contains data on rainfall, potential evaporation and discharge for all the catchments in the different Camel datasets. The Caravan dataset contains a Camel dataset of the catchment of the Wien River. This catchment area is loaded below:

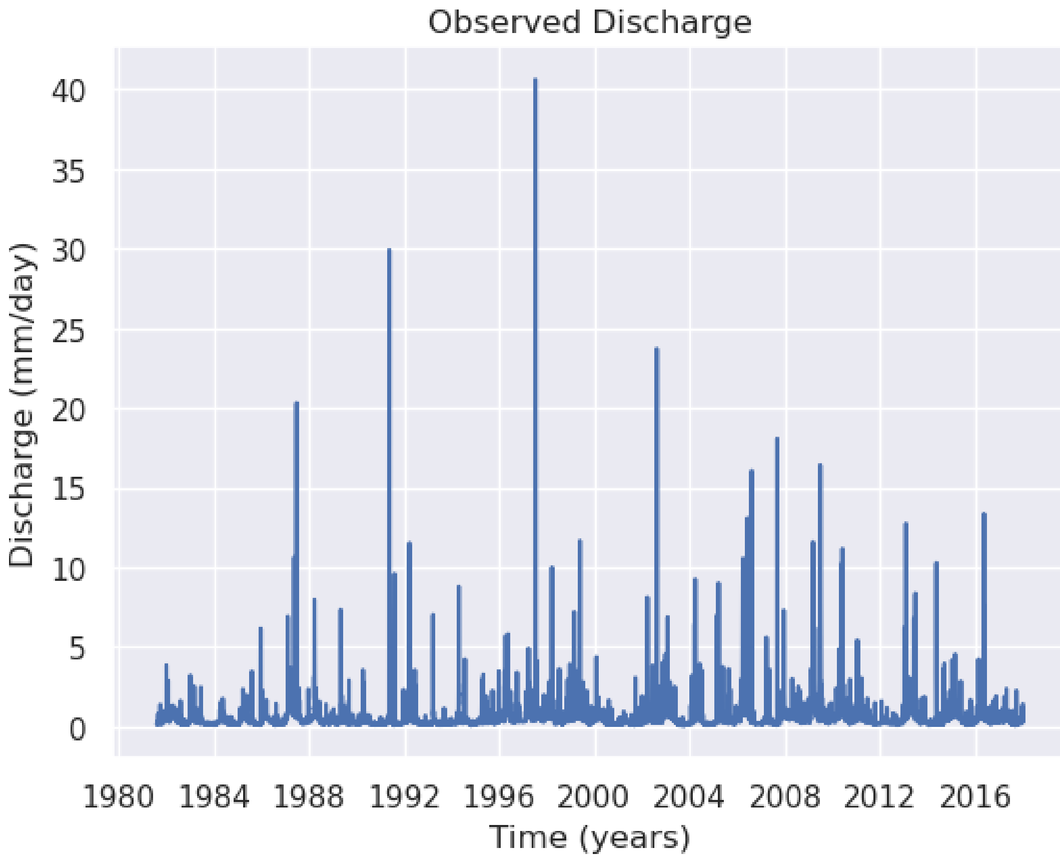
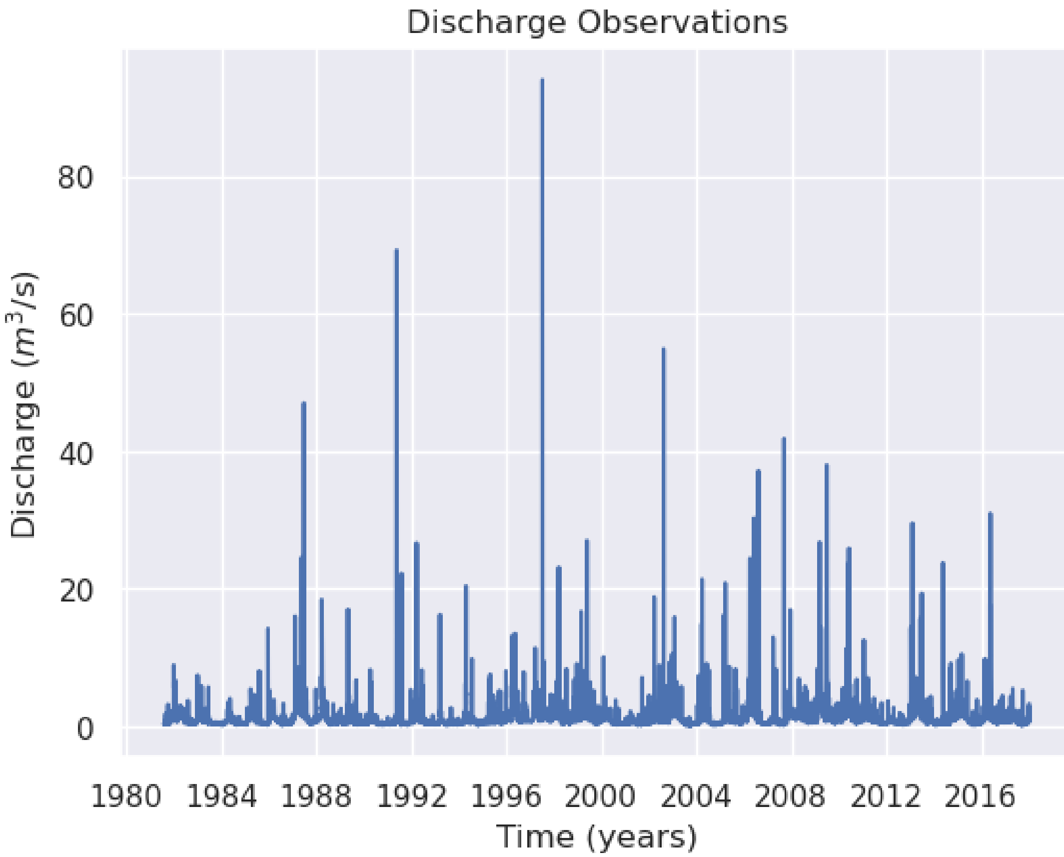


Figure 1: Example Description

Since the threshold values determined in chapter 2 are in m3/s, the observed discharge data, now in mm/d, is converted to m3/s as well.



The maximum discharge of the observed data can be extracted, and amounts to 94.05 m3/s.

```
94.05234565654797
```

The observed discharge data can be used to calculate the return periods of the normally distributed threshold values. This is done using the Generalized Extreme Value distribution. The return periods of the observed discharge data are shown with red dots in the graph below. A line is fitted through those points, and extrapolated to calculate the return period of the threshold value, which is not present in the observation data.

The daily discharge data has been plotted below to be able to see the return periods of the observed discharges. From these values, the returnperiods for the threshold values can later be extrapolated.

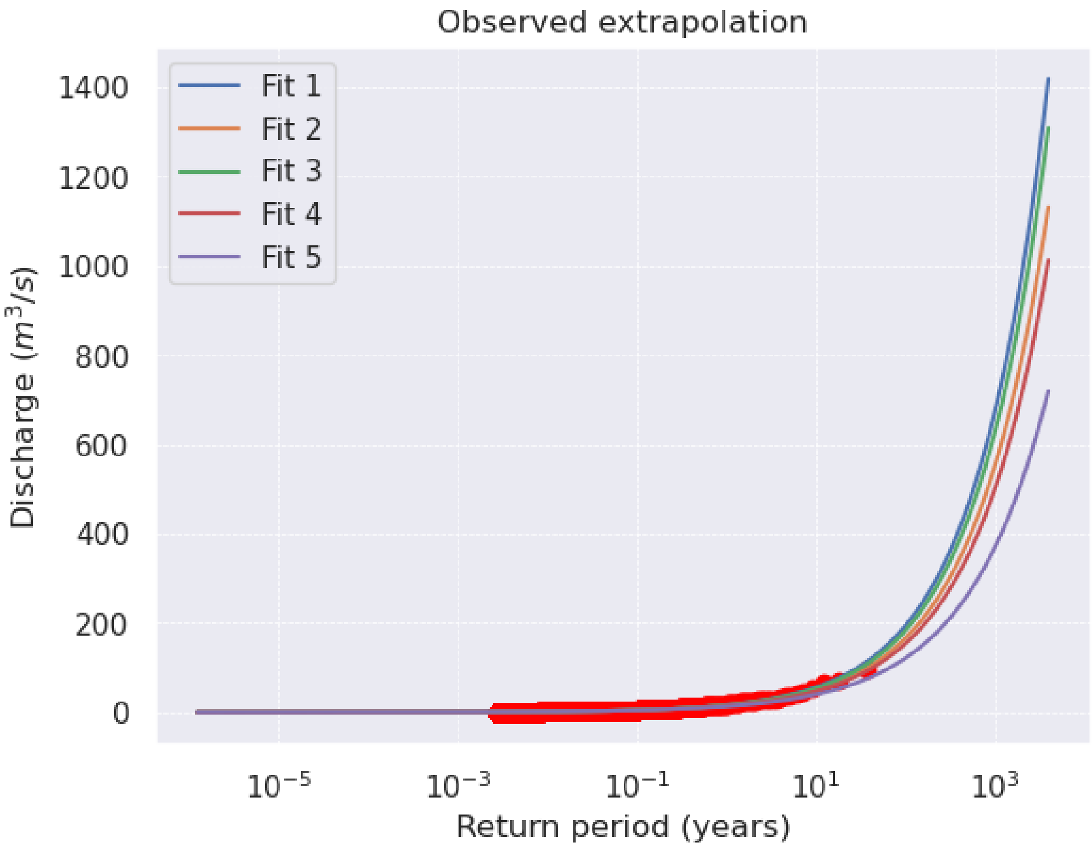
```
For y = 530, the x_value is 640.908 for fit 1


For y = 530, the x_value is 922.727 for fit 2


For y = 530, the x_value is 729.261 for fit 3
```

```
For y = 530, the x_value is 1117.978 for fit 4

For y = 530, the x_value is 2098.402 for fit 5
```



Below both the normal distribution of the exceedance threshold values and the return periods of discharges are plotted below. This graph shows the return period and the probability density are related to the discharge. A discharge value more to the right of the normal distribution, has a higher return period, but also has a longer probability of actually causing flooding of the U4 subway line.

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[31], line 47
     44 # Make second axis
     45 ax2 = ax1.twinx()
---> 47 ax2.plot(discharge_threshold, return_period, label="return periods",␣
 ↪color='green')
     48 ax2.set_ylabel("Return period (years)")
     49 ax2.tick_params(axis='y')
```

```
NameError: name 'return_period' is not defined
```