

University of Stuttgart  
Germany

Python Programming for Water Resources  
Engineering and Research

# GUI using Python for extrapolation of a Hydrograph



Detailed Project Plan Presentation  
Group: **HASA**

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&  
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# Introduction to the Project idea

## Recalling the Idea


Retrieval of Discharge data from Gauging stations (e.g., from Neckar River BW, Germany )




Sorting and Analyzing the data in hand and plotting the Hydrograph



To extrapolate return periods beyond the length of the observation period using Gumbel distributed-extrapolation as the prediction model



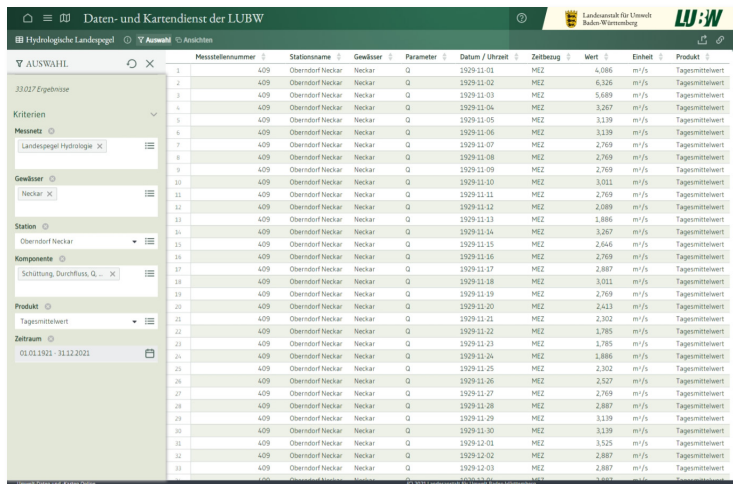
Extrapolating for flood events such as 50-, 100-, 200-, 500-, and 1000-year floods



Designing a GUI for the prediction model to display the results

# Introduction to the Project idea

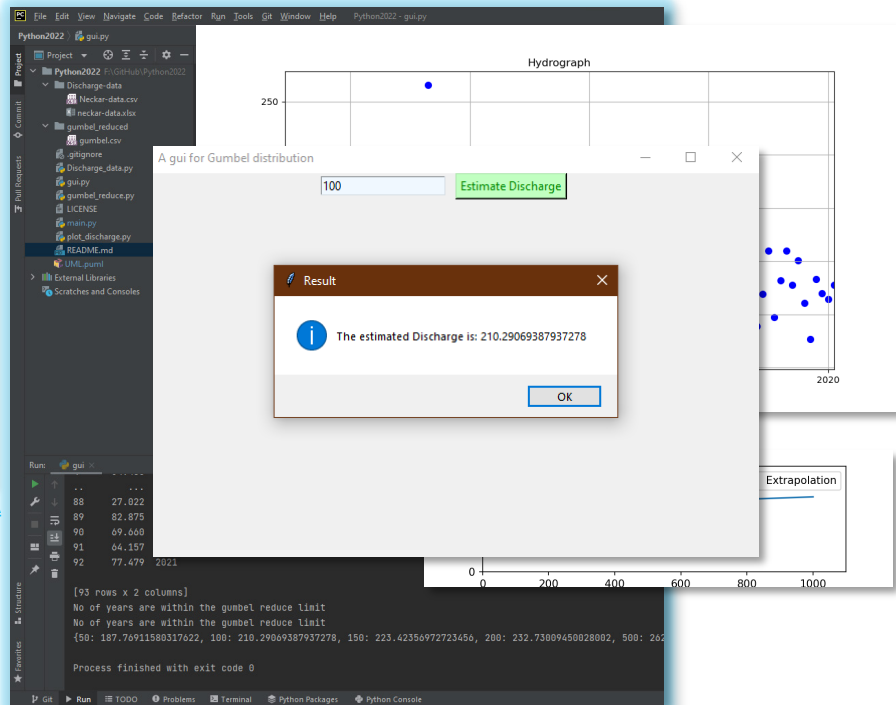
## Current status



The screenshot shows the 'Daten- und Kartendienst der LUBW' website. The table displays hydrological data for the 'Neckar' station. The columns include: Messstellennummer, Stationsname, Gewässer, Parameter, Datum / Uhrzeit, Zeitbezug, Wert, Einheit, and Produkt. The data is filtered for the period 01.01.1921 to 31.12.2021.

Messstellennummer	Stationsname	Gewässer	Parameter	Datum / Uhrzeit	Zeitbezug	Wert	Einheit	Produkt
1	Oberrdorf Neckar	Neckar	Q	1929-11-01	MEZ	4,086	m³/s	Tagessmittelwert
2	Oberrdorf Neckar	Neckar	Q	1929-11-02	MEZ	6,326	m³/s	Tagessmittelwert
3	Oberrdorf Neckar	Neckar	Q	1929-11-03	MEZ	5,689	m³/s	Tagessmittelwert
4	Oberrdorf Neckar	Neckar	Q	1929-11-04	MEZ	3,267	m³/s	Tagessmittelwert
5	Oberrdorf Neckar	Neckar	Q	1929-11-05	MEZ	3,139	m³/s	Tagessmittelwert
6	Oberrdorf Neckar	Neckar	Q	1929-11-06	MEZ	3,139	m³/s	Tagessmittelwert
7	Oberrdorf Neckar	Neckar	Q	1929-11-07	MEZ	2,769	m³/s	Tagessmittelwert
8	Oberrdorf Neckar	Neckar	Q	1929-11-08	MEZ	2,769	m³/s	Tagessmittelwert
9	Oberrdorf Neckar	Neckar	Q	1929-11-09	MEZ	2,769	m³/s	Tagessmittelwert
10	Oberrdorf Neckar	Neckar	Q	1929-11-10	MEZ	3,011	m³/s	Tagessmittelwert
11	Oberrdorf Neckar	Neckar	Q	1929-11-11	MEZ	2,769	m³/s	Tagessmittelwert
12	Oberrdorf Neckar	Neckar	Q	1929-11-12	MEZ	2,089	m³/s	Tagessmittelwert
13	Oberrdorf Neckar	Neckar	Q	1929-11-13	MEZ	1,886	m³/s	Tagessmittelwert
14	Oberrdorf Neckar	Neckar	Q	1929-11-14	MEZ	3,267	m³/s	Tagessmittelwert
15	Oberrdorf Neckar	Neckar	Q	1929-11-15	MEZ	2,646	m³/s	Tagessmittelwert
16	Oberrdorf Neckar	Neckar	Q	1929-11-16	MEZ	2,769	m³/s	Tagessmittelwert
17	Oberrdorf Neckar	Neckar	Q	1929-11-17	MEZ	2,887	m³/s	Tagessmittelwert
18	Oberrdorf Neckar	Neckar	Q	1929-11-18	MEZ	3,011	m³/s	Tagessmittelwert
19	Oberrdorf Neckar	Neckar	Q	1929-11-19	MEZ	2,769	m³/s	Tagessmittelwert
20	Oberrdorf Neckar	Neckar	Q	1929-11-20	MEZ	2,413	m³/s	Tagessmittelwert
21	Oberrdorf Neckar	Neckar	Q	1929-11-21	MEZ	2,302	m³/s	Tagessmittelwert
22	Oberrdorf Neckar	Neckar	Q	1929-11-22	MEZ	1,785	m³/s	Tagessmittelwert
23	Oberrdorf Neckar	Neckar	Q	1929-11-23	MEZ	1,785	m³/s	Tagessmittelwert
24	Oberrdorf Neckar	Neckar	Q	1929-11-24	MEZ	1,886	m³/s	Tagessmittelwert
25	Oberrdorf Neckar	Neckar	Q	1929-11-25	MEZ	2,302	m³/s	Tagessmittelwert
26	Oberrdorf Neckar	Neckar	Q	1929-11-26	MEZ	2,527	m³/s	Tagessmittelwert
27	Oberrdorf Neckar	Neckar	Q	1929-11-27	MEZ	2,769	m³/s	Tagessmittelwert
28	Oberrdorf Neckar	Neckar	Q	1929-11-28	MEZ	2,887	m³/s	Tagessmittelwert
29	Oberrdorf Neckar	Neckar	Q	1929-11-29	MEZ	3,139	m³/s	Tagessmittelwert
30	Oberrdorf Neckar	Neckar	Q	1929-11-30	MEZ	3,139	m³/s	Tagessmittelwert
31	Oberrdorf Neckar	Neckar	Q	1929-12-01	MEZ	3,525	m³/s	Tagessmittelwert
32	Oberrdorf Neckar	Neckar	Q	1929-12-02	MEZ	2,887	m³/s	Tagessmittelwert
33	Oberrdorf Neckar	Neckar	Q	1929-12-03	MEZ	2,887	m³/s	Tagessmittelwert

<https://udo.lubw.baden-wuerttemberg.de/public/q/3MD4H4f2pgsu7JaXsmlRIAR>



Screenshot of the code from PyCharm

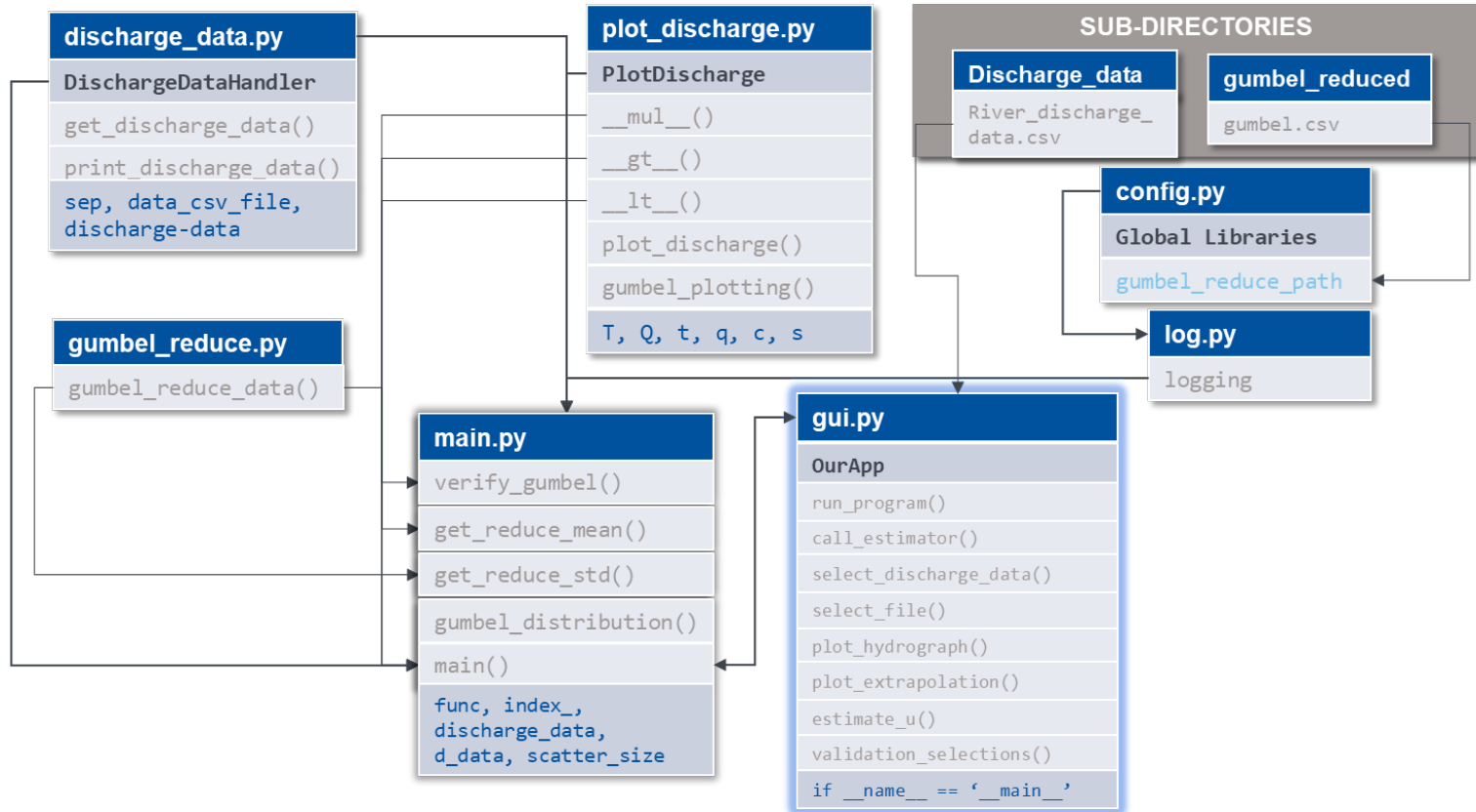
# Problem Statements

- **Sorting the discharge data**
  - Formatting the available discharge data (river Neckar)
  - Fixing date time format and finding the annual maxima
- **Gumbel distribution**
  - Understanding how to use Gumbel distribution
  - Sorting and extracting Gumbel reduced data and using it efficiently in the distribution
- **Classes**
  - Writing the custom classes and integrating the auxiliary components
- **GUI**
  - Displaying the output Plots within the GUI

# Functionality

- Extracts discharge data
- Finds annual maxima and plotting the hydrograph
- Loads the Gumbel reduce data
- Calculates the parameters for Gumbel extrapolation
- Determines Gumbel extrapolation discharge values
- Plots the obtained values
- Displays the discharge data and the graphs in a GUI

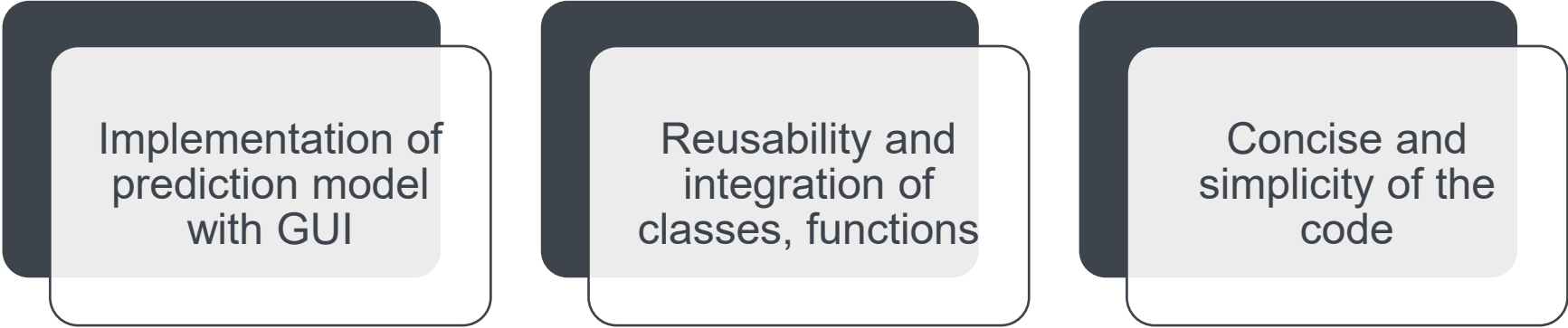
# Qualitative diagram of the code blocks



# Constituent elements

- 2 Classes
- Magic methods
- GUI
- Plots
- Logging
- Wrapper function

# Goals



Implementation of  
prediction model  
with GUI

Reusability and  
integration of  
classes, functions

Concise and  
simplicity of the  
code



# Timeline for developing the Program

## Week-2 Feb

- Integration of Auxiliary Components
- Modify custom classes
- Completion of GUI

## Week-3 Feb

- Optional components – “Wiki/ web Docs”
- Compliance of PEP-8 Style

## Week-4 Feb

- Finishing README
- Refinements and checking the entire project
- Final Submission

# Resource Allocation

## Aswath

- Class: DischargeDataHandler
- GUI Design
- Overall Structure and PEP-8 Styling

## Akash

- Class: PlotDischarge
- gumbel\_reduce(),  
gumbel\_distribution() functions
- verify\_gumbel() → wrapper function

## Together

- main() Script
- Code Organization
- Integration of GUI
- Auxiliary components
- Final Refinements



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# Thank you!



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WAREM 2020-21

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# Questions?