x03-Discharge of River Elbe: Homework Project

2025-11-18

The project is related to the lab exercise "Discharge of River Elbe: Date and Time Computation, Data Management and Plotting with R".

1 Task 1: Distribution of discharge

Interpret the results of Sections 3.3 and 3.4. Discuss which of the plots best shows the shape of the **distribution** of discharge data. You can include up to 4 plots. Add a compact table with the statistical parameters for the observational period (min, max, $\bar{x}, s_x$, median, geometric mean and quartiles).

Then discuss all results (parameters and figures) in connection.

1.1 Compare Distribution Models

Analyze and discuss the different data transformations (no transformation, $\ln(x)$, and $\ln(x - b)$). Justify which transformation/model provides the best overall fit for the discharge data and explain why the others are less suitable.

1.2 Extreme Value Analysis (Optional, + 1 page)

Estimate the 100-year flood by using the right one-sided 1% prediction interval.

- Aggregate the data to yearly extremes using functions like `group_by(year)` and `summarize(max_flow = max(discharge))`. This step is crucial for extreme value analysis, as it ensures the data reflects the largest event per year, which is the basis for estimating rare events like the 100- or 1000-year flood.
- Choose a proper distribution model, e.g. logarithmic transformation, similar to the results before. Compare the chosen model with the empirical quantiles. See lab manual "Distribution and Confidence Intervals of Maple Leaf Samples" as an example.
- Consider to use the Extended Data Set (starting from 1806) for this analysis to maximize the record length.

2 Task 2: Dry and wet years

Analyse the data and identify 2 dry and 2 wet years. Try to spot years with different seasonal characteristics, e.g. one with a dry winter and the other with a dry summer, or one with a wet winter and a dry summer and so on.

Describe the selected years with appropriate plots, e.g. time series from Section 3.2 or annual cumulative sums (Section 3.5). A boxplot, histograms or own ideas are also possible (2-4 plots at maximum).

3 Outline and formal requirements

3.1 Outline

Combine all tasks together and tell a story, using a standard scientific outline, the so-called IMRAD scheme:

1. Introduction
2. Methods
3. Results
4. Discussion
5. References

Please consult Wikipedia for a detailed explanation.

As it is a tiny report, Methods and Results may be merged in this case. However, Introduction and Discussion must be separated. Use the internet and find about 2-3 literature references for the Discussion.

3.2 Workflow

1. Draft: draft your report. The first draft is usually somewhat longer.
2. Refine: Discuss and select only the most important parts, and create the final version adhering to the page limit.

Communicate in your team, with other teams and with tutors

- Primary Goal: Communication should promote community learning. Post approaches and specific questions in the Matrix[1] chat group so everyone can benefit.
- Teamwork: Discuss ideas within your team and with other colleagues first. Private channels for teamwork are allowed.
- In the chatroom, please formulate specific questions (e.g., "How to format the numbers on a log-transformed axis?") and avoid asking only, "Is this correct?"
- Contribute: Actively contribute to answering your classmates' questions!

3.3 Report formatting instructions

To ensure clarity and efficiency, please adhere to the following strict page limits and formatting guidelines.

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[1]TU Dresden uses the Matrix instant messenger.

3.3.1 Page limits and content focus

- Core Content Limit: The main body of the report (Introduction, Methods & Results, Discussion) must not exceed 4 A4 pages.
- This limit forces you to distill the essential messages and choose only the most important figures.
- The Title Page (Cover Sheet) and the List of References do not count towards the 4-page limit.
- Quality First: The goal is Quality instead of quantity! Use the limited space to focus on the interpretation and discussion of your findings.

3.3.2 Text and visual balance

- The report must have a good balance between explanatory text and supporting figures/tables.
- Avoid reports that are dominated by either large amounts of text or excessive, unexplained graphics.
- Selectivity: Only include figures and statistical output that are essential to support your claims in the text. Avoid "dumping" unnecessary output.

3.3.3 Readability and citation standards

- Use a font size of 11 or 12 points.
- A line spacing of 1.2 lines is recommended to improve readability.
- Figures: **font size** of annotations must be well readable.
- Citation: Cite literature properly using the author-year style. Good examples can be found at the APA style web page.

3.4 Submission

You will have 2.5 weeks time for the preparation of the report. Then upload it as PDF or HTML document and (optionally) your .R or Quarto (.qmd) scripts to the **File** folder of your group in the OPAL[2] learning management system. Submissions after the deadline cannot be considered.

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[2]OPAL is the learning managament platform used by TU Dresden.