Advanced GIS and Remote Sensing

Toward an Optimized Rainfall Monitoring Network across the Kellerwald Region

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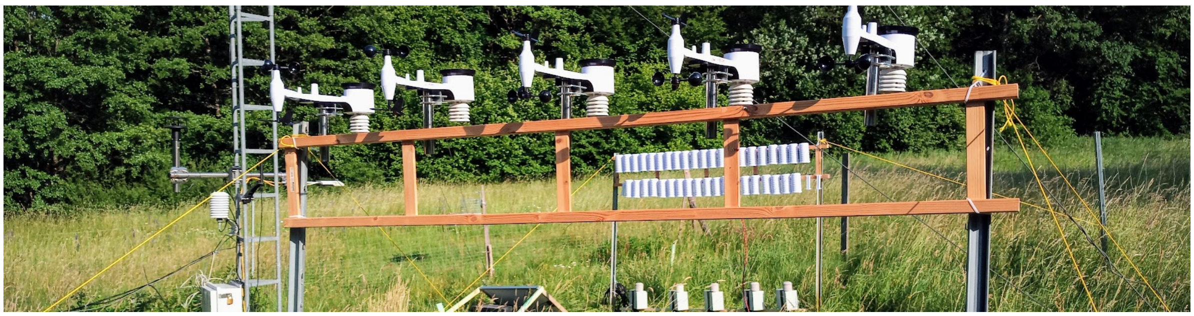

Course objective

Throughout this course you will learn how to **design, analyse, and evaluate a spatially explicit hydrological monitoring network**.
Your overarching goal is to develop a *reproducible and defensible rain-gauge network concept* for the Kellerwald region (~200 km^2).
This is not a purely technical mapping task, but a research-oriented design challenge that connects spatial reasoning, remote-sensing data, and hydrological process understanding.

The project evolves in three conceptual phases:

1. **Exploration** – Identify what makes a precipitation network "good" or "bad", and define what "optimal" could mean in this context.

2. **Development** – Apply methods learned in class (Kriging, radar bias correction, RS integration, uncertainty analysis) to iteratively refine your network.

3. **Synthesis** – Present and defend a transparent, reproducible network design that links rainfall monitoring to hydrological response at sub-catchment scale.

Final deliverables

At the end of the course each group submits **three complementary products**:

1. Transparent repository (core submission)

A public or shared repository (e.g. GitHub, GitLab, or institutional server) that contains: - All data sources, scripts, and documentation used to derive your final network.
- A reproducible workflow that shows how you went from raw data to station selection and evaluation.
- Clear version control and short README explaining structure and logic.
The repository represents the **traceable backbone** of your project and demonstrates reproducibility and collaboration.

2. Poster

A concise visual summary of: - The final proposed network (map and rationale).
- The main methodological steps (e.g. interpolation, uncertainty analysis).
- Key results or validation indicators.
- A short reflection on limitations and future improvement.
The poster must communicate the project as if presented at a professional hydrology or GIS conference.

3. Five-minute pitch (presentation)

Each group presents their poster in a short oral pitch (max 5 min).
The goal is to **argue convincingly** why your design is optimal *for its chosen criteria* (coverage, efficiency, hydrological adequacy).
The pitch should demonstrate technical understanding, critical reasoning, and teamwork.

Evaluation criteria (final synthesis)

Each submission is evaluated across **five dimensions**, 0–2 points each (max 10 pts):

Criterion	0	1	2
Spatial reasoning	arbitrary placement	partial coverage of key gradients	systematic physio-graphic logic (Luv–Lee, elevation, forest density)
Hydrological integration	no link to runoff	implicit link to subcatch-ments	explicit precipitation–discharge coupling and closure logic
Methodological rigour	ad-hoc reasoning	partial quantitative justification	reproducible workflow using kriging, RS, or uncertainty metrics
Transparency & reproducibility	no documen-tation	partial scripts / missing metadata	complete, documented, and reproducible repository
Communication quality	unclear poster / pitch	partially coherent argument	clear, concise, and scientifically convincing presentation

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Competition element

The Kellerwald Network Design Project is structured as a **friendly competition**:
the group achieving the highest total score becomes the *Course Design Champion*.
In case of a tie, the tiebreaker is **Hydrological integration**, since the final goal is a coherent rainfall–runoff framework, not aesthetic map design.

Learning outcome

By completing the full project you will be able to: - Formulate and test design hypotheses for spatial monitoring networks.
- Apply geostatistical, RS, and modelling tools to evaluate network performance.
- Document and communicate your workflow transparently.
- Defend a reasoned, evidence-based concept of “optimality” in hydrological monitoring.