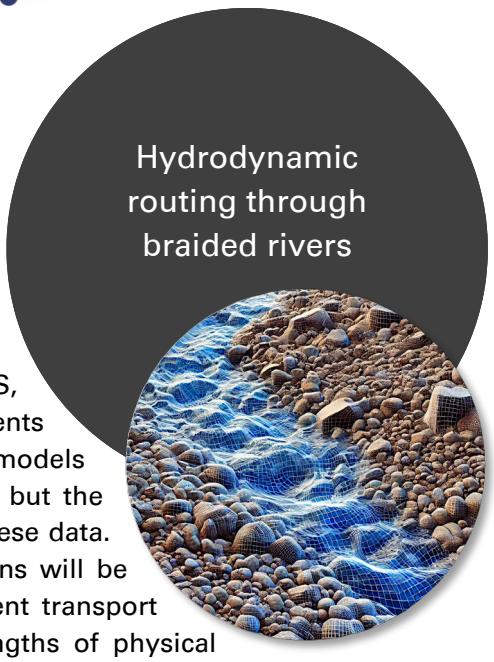
Universität Stuttgart

IWS Department of Hydraulic Engineering and Water Resources Management
Prof. Dr.-Ing. Silke Wieprecht

M.Sc. Topic

"Hydrodynamic routing through braided rivers"



Background

Fluvial geomorphology investigates how river systems sculpt their landscapes by interacting with sediment and water over time, shaping channels, floodplains, and valley systems. These interactions are particularly challenging in braided rivers, characterized by a dynamic network of parallel channels that continuously reshape flow and sediment transport trajectories. In flume experiments at IWS, braided systems have been studied in long-term experiments (>300 h runtime). In multiple instances, digital elevation models (DEMs) were obtained with laser scans and echosounders, but the local flow and sediment trajectories remain undetected in these data. Therefore, in this Master's thesis, numerical flow simulations will be programmed to simulate flow and related potential sediment transport trajectories. The thesis builds on the complementary strengths of physical flume experiments and numerical simulations. Working alongside experts in numerical modeling and model coupling, the student will develop a computational mesh and create Python scripts to automatically interpolate elevation information from more than one hundred physical flume experiments onto mesh nodes. These mesh topographies will be auto-run through efficient numerical solvers, and the results will be examined with the guidance of geomorphology specialists to identify distinctive flow velocity patterns associated with morphological units in braided rivers. Regular meetings with the supervisors ensure thorough support in programming, numerical simulation techniques, data analysis, and a deeper exploration of fluvial geomorphology.

Thesis Overview

1. Familiarize with geomorphological concepts in river ecosystems.
2. Familiarize with the open-source software TELEMAC and Python.
3. Create an initial mesh and numerical simulation workflow ("the manual approach").
4. Automate topography interpolation on meshes and the numerical simulation workflow.
5. Organize and export hydraulic model results in accordance with geomorphic patterns.
6. Analyze and interpret flow routes related to specific geomorphic structures.

Required Skills

1. Basic understanding of numerical simulations of rivers (e.g., MMM lecture).
2. Basic understanding of sediment transport and fluvial geomorphology (e.g., MMM or IRME).
3. Desired: Existing skills or willingness to learn and work with Python and QGIS.

Apply now!

Supervisors (numerics): Federica Scolari, Andrés Heredia, Dr. sc. (PhD) Sebastian Schwindt

Supervisors (lab): Niklas Henning, Dr.-Ing. Ingo Schnauder

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Examiner: Prof. Dr.-Ing. Silke Wieprecht

The thesis can be written in German or English