Doctoral student: IZARIF Yassine

- **Workpackage 2 EAUENV: "Computational modeling for water and environmental management".**
- **Supervisors : Pr. Nour-Eddine LAFTOUHI**
- **Subject title and description: Thesis**

Predictive hydrological modelling of the behavior of a mountainous catchment under climate change and contribution to the recharge of a downstream aquifer: the case of Zat watershed (Marrakech- Morocco).

- **Overview of the subject**

The Zat watershed, one of the most important in the Marrakech High Atlas, is located in an arid to semi-arid climate. The quantity of water available is low and varies with space and time. In addition to water scarcity and uneven distribution, the region is subject to increasing water demand and flood risks, which can endanger people's lives and infrastructure.

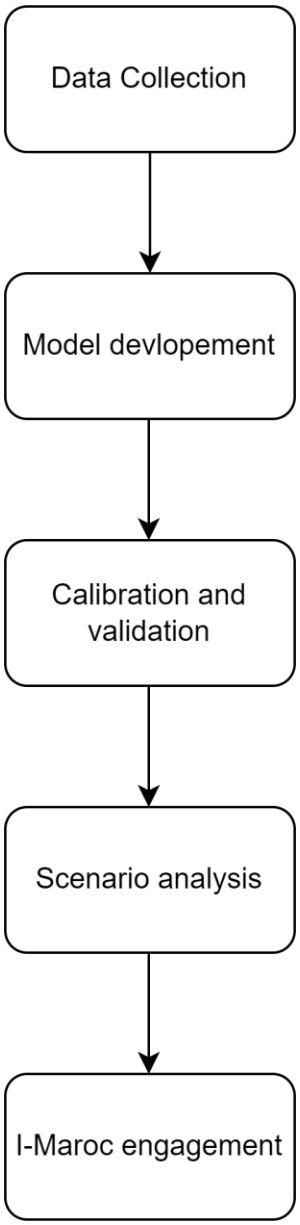
In this context, Modeling surface waters is essential to development as it provides valuable insights into water availability, flood risks, and environmental impacts. It helps in making informed decisions regarding water resource management, infrastructure planning, and mitigating the effects of climate change. By accurately predicting and understanding surface water dynamics, modeling supports sustainable development and ensures efficient utilization of water resources for various sectors including agriculture, industry, and human settlements.

- **Subject objectives**

By modeling the behavior of the Zat watershed surface waters in the context of climate change we aim to achieve several objectives, which can include:

1. Assesing hydrological impacts.
2. Predicting extreme events.
3. Evaluating water supply and demand.
4. Assesing ecosystem impacts.
5. Supporting adaptation and mitigation strategies.
6. Providing policy and planning support to Moroccan authorities involved in water managemnt.

- **Progress report**



the modeling of surface waters using the HEC-RAS (Hydrologic Engineering Centers' River Analysis System) software. The modeling efforts aim to enhance our understanding of water dynamics, assess hydrological impacts, and support water resource management and planning.

Data Collection:

Significant progress has been made in collecting relevant data for the surface water modeling project. This includes acquiring topographic surveys, cross-section data, and hydraulic boundary conditions required for input into the HEC-RAS software. Additionally, data on

river flow rates, precipitation patterns, and other relevant parameters have been gathered from various sources to ensure comprehensive data coverage.

Model Development:

The development of the HEC-RAS models is underway and progressing well. Our team has successfully implemented the necessary input data into the software, including river geometries, channel roughness coefficients, and boundary conditions. The models are being refined and calibrated to accurately represent the behavior of the surface waters in the study area.

Calibration and Validation:

Efforts are being made to calibrate and validate the HEC-RAS models to ensure their accuracy and reliability. Calibration involves adjusting model parameters to match observed data, while validation includes comparing model results with independent measurements. This iterative process is crucial for improving the performance of the models and enhancing their predictive capabilities.

Scenario Analysis:

We are conducting scenario analyses using the calibrated HEC-RAS models to assess the impact of various factors on surface water systems. These scenarios include changes in land use, climate conditions, and water management strategies. The results obtained from these analyses will provide valuable insights into the potential consequences of different scenarios and support decision-making processes.

I-Maroc Engagement:

Active engagement with I-Maroc is ongoing to ensure that the modeling efforts address their needs and concerns. Regular seminars and workshops are being conducted to gather input, discuss findings, and gather feedback on the modeling outcomes. This collaborative approach fosters a better understanding of surface water dynamics and facilitates the translation of modeling results into practical actions.

Next Steps:

Moving forward, we will continue to refine the HEC-RAS models based on the calibration and validation process. Additionally, we will expand the scenario analyses to explore a broader range of potential conditions and their implications. The project team will maintain close collaboration with colleagues from I-Maroc to ensure that the modeling results are effectively integrated into water resource management and decision-making processes.

Conclusion:

The progress made in modeling surface waters using the HEC-RAS software demonstrates significant advancements in our understanding of water dynamics and their implications for water resource management. Through data collection, model development, calibration, validation, scenario analysis, and I-Maroc engagement, we are on track to deliver robust modeling outcomes that can inform sustainable development and improve decision-making related to surface water systems.