M.Sc. Thesis

DEFINING THE NEEDS FOR A CATCHMENT DIGITAL TWIN

Context: in recent years, the concept of Digital Twins has gained remarkable traction across various sectors, revolutionizing how we understand and manage natural and human (complex) systems. A Digital Twin is a virtual representation of a physical entity, with a typical "twinning" connection where real-world data inform the virtual model, and vice versa outputs from the virtual model inform decisions in the real world. One of the areas where this technology holds immense potential is Civil engineering, and in particular catchment management. By developing a Digital Twin for catchments, we can gain valuable insights into the hydrological and ecological dynamics, leading to more informed decisions and practices around flood management, water resources, water quality and beyond.

Objective: to explore a preliminary case study where to understand how to develop a Digital Twin to replicate the physical processes underpinning surface runoff of a catchment. You will be able to decide the focus of the research during the proposal stage. For example, you may want to focus on developing a framework for Digital Twins for rainfall-runoff catchment; or you may prefer investigate what models and sensors would be needed for a Digital Twin (how they are twinned).

Methodology: by combining real-time data, predictive modeling, and collaborative decision-making, the Digital Twin empowers us to adopt proactive and sustainable practices. To identify available data for a catchment of reference, and to explore how an hydrodynamic model (e.g. SOBEK Suite by Deltares) can be "twinned" with such data is fundamental for this study. Understanding the actual capability of the Digital Twin (e.g. for flood forecasting and prevention, for managing water resources, etc.) is one of the questions to answer during this MSc, as well as to identify barriers and challenges for its implementation and transferability.

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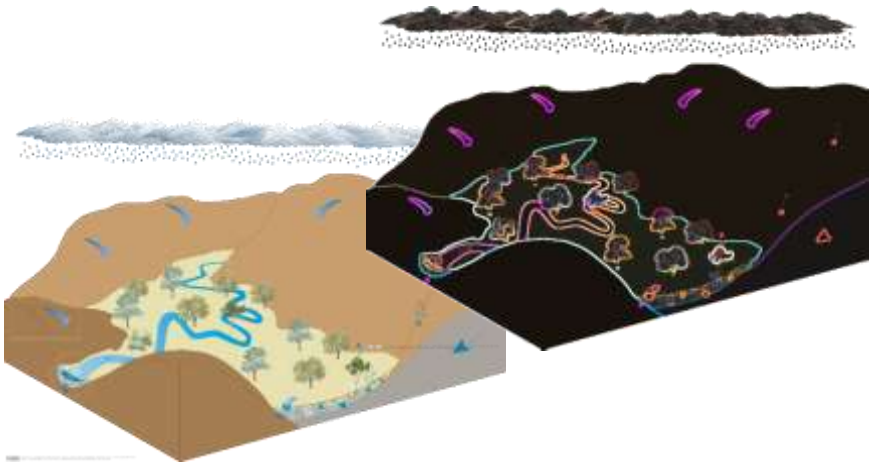

Figure 1. How could a Digital Twin for a catchment look like?