LGCIV 2055 Analysis and Mitigation of floods – Assignment 2 - Floods in Hotton?

Studying the impact and finding solutions to mitigate the risks of floods.

In July 2021, no fewer than 1300 homes were affected out of the 2200 in the municipality of Hotton by an exceptional flooding of the Ourthe River. With the current context of climate change, the risk of floods has increased in a dramatic manner, and residents are concerned about what might happen in the future. Therefore, the municipality requested a study on the floods that could occur within its territory, in such a way they could be protected at least for an event with a return period of 25 years. The study comprises an assessment of the current ability of the territory to cope with such a flood, and a proposal of measures to limit or eliminate the risk of flooding in this case.

You are asked to perform numerical simulations of the flow in the Ourthe River in case of this important discharge event (return period of 25 years). To do this, various numerical softwares have been assigned to the groups of students as follows:

- Group A (Yoram & Laure) Watlab
- Group B (Florent) Watlab
- Group D (Francisco & Lucille) Telemac
- Group I (Nathan & Bastien) Watlab
- Group H (Félix & Louis) Hec-Ras

To help you with this task, a first assignment was dedicated to the study of typical discharges in the Ourthe river, that crosses the city of Hotton. As a reminder, the goal was to determine the return period associated with various discharges. You are therefore able to adapt your methodology from this previous assignment to calculate the discharge corresponding to a 25-year return period.

To determine the extent of the area where the simulations should take place, you can use the Walonmap geographical database (https://geoportail.wallonie.be/walonmap) to find the region around Hotton that was impacted by the July 2021 flood, and the region that is expected to be impacted for events with specific return periods.

Ideally, the computation mesh should start next to the old quarry (see Figure 1) and end at the railway tunnel (see Figure 2). A preliminary version of the computational mesh can be provided by the supervisory team upon request. You are free to adapt it according to your specific needs.

A set of Digital Elevation Models (DEMs) are provided on Moodle but note that you can use any relevant data provided by the Service Public de Wallonie (Géoportail de la Wallonie, Hydrométrie en Wallonie).

Figure 1 Start of the computational mesh.

Figure 2 End of the computational mesh.

The requested work for this assignment comprises the following steps:

1. A reference simulation with constant discharge corresponding to a 25-year return period as upstream boundary condition.
   This simulation should enable you to answer at least the following questions: Which parts of the city are flooded? Which areas should be protected as a priority? Which protective measures could be considered?
   The reference simulation and the mitigation measures should be proposed by 26 November. No simulations of the mitigation measures are required at this stage: your proposals will be discussed with the supervisory team.
2. A simulation with the implementation of the mitigation measures in the model. The same constant discharge (return period 25 years) must be used as upstream boundary condition. This simulation should enable you to answer at least the following questions: What do you observe? Which areas are really protected? Do the results meet your expectations? Is the situation aggravating in other areas? Discuss the effectiveness of your measures.
   This simulation should be proposed by 03 December.
3. A simulation of a past flooding event with a peak discharge corresponding approximatively to a 25-year return period. The full hydrograph must be used as upstream boundary condition in this case. Such an event can be found by exploring the SPW Hydrométrie website (https://hydrometrie.wallonie.be/home.html), looking for discharges at the Hotton station.
   This simulation should enable you to answer at least the following questions: Are there any differences in results between a simulation with a constant discharge and a full hydrograph as boundary condition? Why ?
   This simulation should be proposed by 10 December.

You will present your results under the form of a poster during the last class session. The poster should contain relevant information about the data you used, your assumptions, the software

used, your results, and your conclusions. Posters will be displayed in the Passelecq room after this session, so please take care when preparing them!