EGU24-15967, updated on 26 Apr 2024
https://doi.org/10.5194/egusphere-egu24-15967
EGU General Assembly 2024

An operational framework for improving the resilience of inland waterways and floodplains to the impacts of flood-induced dike breach hazard

Benjamin Dewals[1], Joris Hardy[1], Davide Mastricci[2], Vincent Schmitz[1], Alexis Melitsiotis[2], Michel Pirotton[1], Sébastien Erpicum[1], and Pierre Archambeau[1]

[1]University of Liege, Urban & Environmental Engineering, HECE, Belgium (b.dewals@uliege.be)

[2]EXUS AI Labs, Athens, Greece

Early warning is critical to enhance the resilience of communities and infrastructures towards a wide range of natural and human-caused hazards. As a part of a broader initiative aiming at improving the resilience of waterways to multi-hazards risk (earthquake, fog, wind, low flow …), we present here components of an operational hazard assessment tool focusing on the impact of dike breaching. The system is developed and showcased on a study site located in Belgium, involving major waterways such as a stretch of river Meuse, a parallel navigation channel and tributaries.

The modelling strategy builds on three steps. Step one is a machine-learning-based hydrological model which provides quick estimates of flow rate at the upstream ends of the domain. The model was trained based on observed flow rates and precipitation data at rain gauges distributed across the catchments.

Step 2 consists in a detailed hydrodynamic modelling reproducing the flow in the navigation channels and simulating breach development, flow through the breach, as well as in the floodplains. This approach is accurate and detailed; but too slow for rea-time prediction, i.e., operational use. Therefore, Step 3 consists in combining a quick and efficient simplified dike breach model to estimate breach hydrograph and produce inundation maps in the floodplains by spatial interpolation in a collection of pre-computed results of the detailed hydrodynamic model (Step 2).

The model structure will be detailed, and results will be presented and discussed.

This research is co-funded by the European Union’s Horizon Europe Innovation Actions under grant agreement No. 101069941 (PLOTO project: https://ploto-project.eu/).