EGU24-17477, updated on 26 Apr 2024
https://doi.org/10.5194/egusphere-egu24-17477
EGU General Assembly 2024

Lagrangian description for the drift of large floating debris in rivers during floods

Damien Sansen, Pierre Archambeau, Michel Pirotton, Sébastien Erpicum, and Benjamin Dewals
Hydraulics in Environmental and Civil Engineering (HECE), Research Unit Urban & Environmental Engineering (UEE), University of Liège, Belgium

During floods, the drift of floating debris is a common phenomenon that may exacerbate the flood con-sequences. These objects often have the potential to induce clogging, particularly when they accumulate at bridge piers and obstruct river flow. Accurately predicting such clogging or other interaction with fixed structures is essential for enhancing flood risk assessment and management.

To effectively model their effect, the fundamental dynamics of floating objects must be investigated, as well as debris-structures interactions. The latter requires a model for obstacle generation, collision detec-tion and simulation of the influence of collisions on the debris dynamics. Besides, detailed validation against high quality laboratory data is a prerequisite before considering reliable model application to real-world rivers.

In this research, improvements have been brought to the Lagrangian modelling of large floating debris colliding with fixed obstacles. A promising approach involves discretizing obstacles into rectangles, for which the mathematical description of the collision process is known. Furthermore, the proposed method reproduces the effect of collisions by adjusting the debris dynamics rather than forcing its trajectory after collision. The debris motion modelled by the developed 2D Lagrangian model leads to plausible trajecto-ries, generally in agreement with experimental data. The model also succeeds in recreating clogging situa-tions. Precise consideration of collision dynamics makes it possible to distinguish between temporary and permanent clogging, depending on certain parameters such as the adopted geometry and the debris size. Extra developments are still necessary for extending these findings to the context of real-world rivers.