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an experimental study and observations

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In July 2021, a catastrophic river flood occurred in West-Europe. In parts of Belgium, Germany, and the Netherlands, 150 to more than 250 mm of rain fell in 48 hours, changing small streams into raging rivers. For instance, the discharge of the River Ahr increased from approximately 10 m^3/s to 1000 m^3/s, destroying towns built in the narrow river valley. Hereby, large amounts of floating debris from building rubble were brought into the rivers, together with other trash and natural driftwood from riparian trees and forests. Part of this debris accumulated at river bridges, where it constricted openings, decreasing the discharge capacity and therefore raising upstream flood levels .

In this context, this study aims to determine the role of floating debris during the 2021 floods. The project is divided into two parts: first we characterize debris accumulations and locations during the floods, then we will experimentally examine the behaviour under typical flow conditions.

For the characterization of floating debris, photos of debris accumulations at bridges in Belgium, Germany and The Netherlands are being analysed. This results in a large database, detailing for every accumulation its geographic location, bridge characteristics (geometry of bridge, openings and piers), accumulation characteristics (total width and length, contents, location at bridge) and typical sizes of constituent debris pieces.

Building on these results, flume experiments on debris accumulation at bridges will be performed to examine the effect of debris and bridge geometries on water levels (backwater rise) and discharge capacity. Further experimental details will be based on the debris characterization database, including typical bridge types, debris content and debris sizes. This will also include a more specific study of the effect of plastic and trash in debris, given their significant presence within the debris accumulations of this flood compared to the natural driftwood accumulations more commonly studied in literature. The experimental results are then expected be used to develop management strategies and design guidelines, leading to the prevention and mitigation of debris accumulation at hydraulic structures.