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Numerical modelling of large debris transport during floods

Finaud-Guyot Pascal^{1,2}, Hétier Marc¹ and Rousseau Antoine^{1,3}

Abstract

Nowadays, flood risk is the natural phenomenon that affects the most people in the world, and climate change is likely to increase this trend. Floods, whether in rivers or in urban areas, carry debris that can have a significant impact on hydrodynamics and therefore on risk. Although numerical models are frequently used to anticipate the impacts of floods in order to improve land-use planning and facilitate crisis management, there are few models capable of representing both the flood hydrodynamics and the associated debris transport process. These models, when they exist, are generally based on simplifying assumptions. In this paper, we propose a new operational model that is validated and compared with analytical results, other models and experimental data. The proposed model, implemented in the SW2D software, paves the way for a better representation of debris clogging on hydrodynamics, even with a large number of transported objects.

Keywords

6 keywords, in alphabetic order : contact force, floating cylinders, hydraulic forces, log transport, urban flood, shallow water 2D

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Introduction

Concerning 2.3 billion people over the period 1995-2015, floods are the world main natural disaster [1]. With climate change and its consequences [2], OECD estimates that the flood risk exposure is expected to increase significantly by the end of the century [3] with an increase by 200 to 250% of the global assets value exposed to 100 return period river flood [4]. In this context, and as highlighted in the Sendai Framework for Disaster Risk Reduction 2015-2030 [5], efficient flood models are highly required to anticipate flood impacts for better land-use planning and to facilitate crisis management. Floods frequently lead to the transport of sediments, debris or vehicles [6]. The transported materials can significantly modify the flow characteristics (either the geometry or the physical properties: viscosity, fluid density) [7, 8] and have thus to be taken into account in flood models. Traditional