



**HAL**  
open science

# Predicting the flow in the floodplains with evolving land occupations during extreme flood events

Sébastien Proust

► **To cite this version:**

Sébastien Proust. Predicting the flow in the floodplains with evolving land occupations during extreme flood events. France. 2014, pp.1. hal-02600363

**HAL Id: hal-02600363**

**<https://hal.inrae.fr/hal-02600363>**

Submitted on 16 May 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Copyright



## Predicting the flow in the floodplains with evolving land occupations during extreme flood events

### Context

- + Increasing human settlements over the floodplains
- + Climate change: impact on the return period  $T$  of extreme floods (e.g. Hirabayashi *et al.*, 2013)
- + European Flood Directive: assessing the **flow depths** and **velocities** for extreme event scenarios ( $T > 1000$ -year)
- + Protection of nuclear installations against flooding events with  $T = 10000$ -year, cf. report n°3 of ASN (2013)
- + **No field data** for such periods  $T$  to validate the models
- + Still largely unexplored physical processes for such  $T$

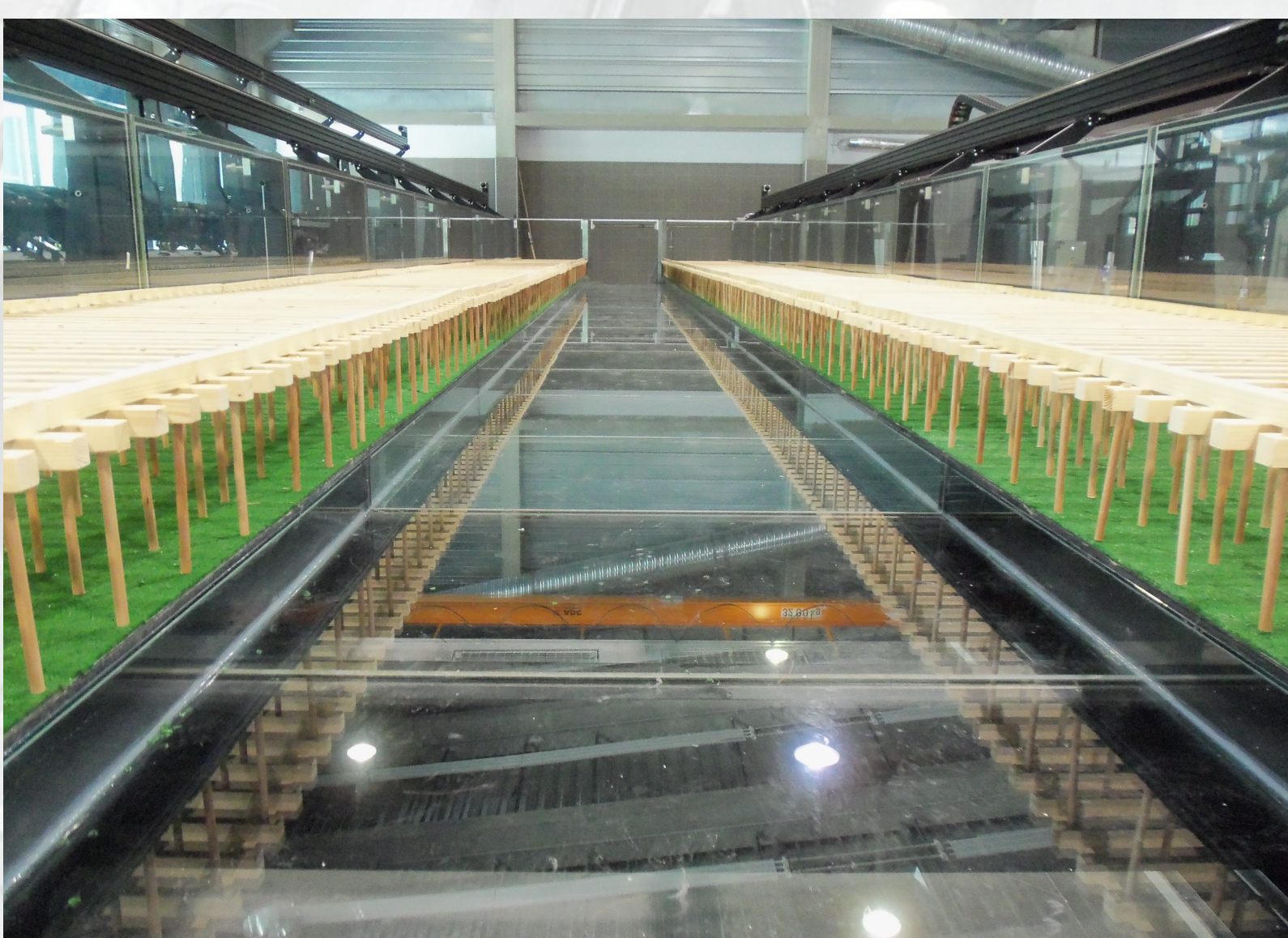


Ochlockonee River, 1975. Picture taken by J.C. Rosenau

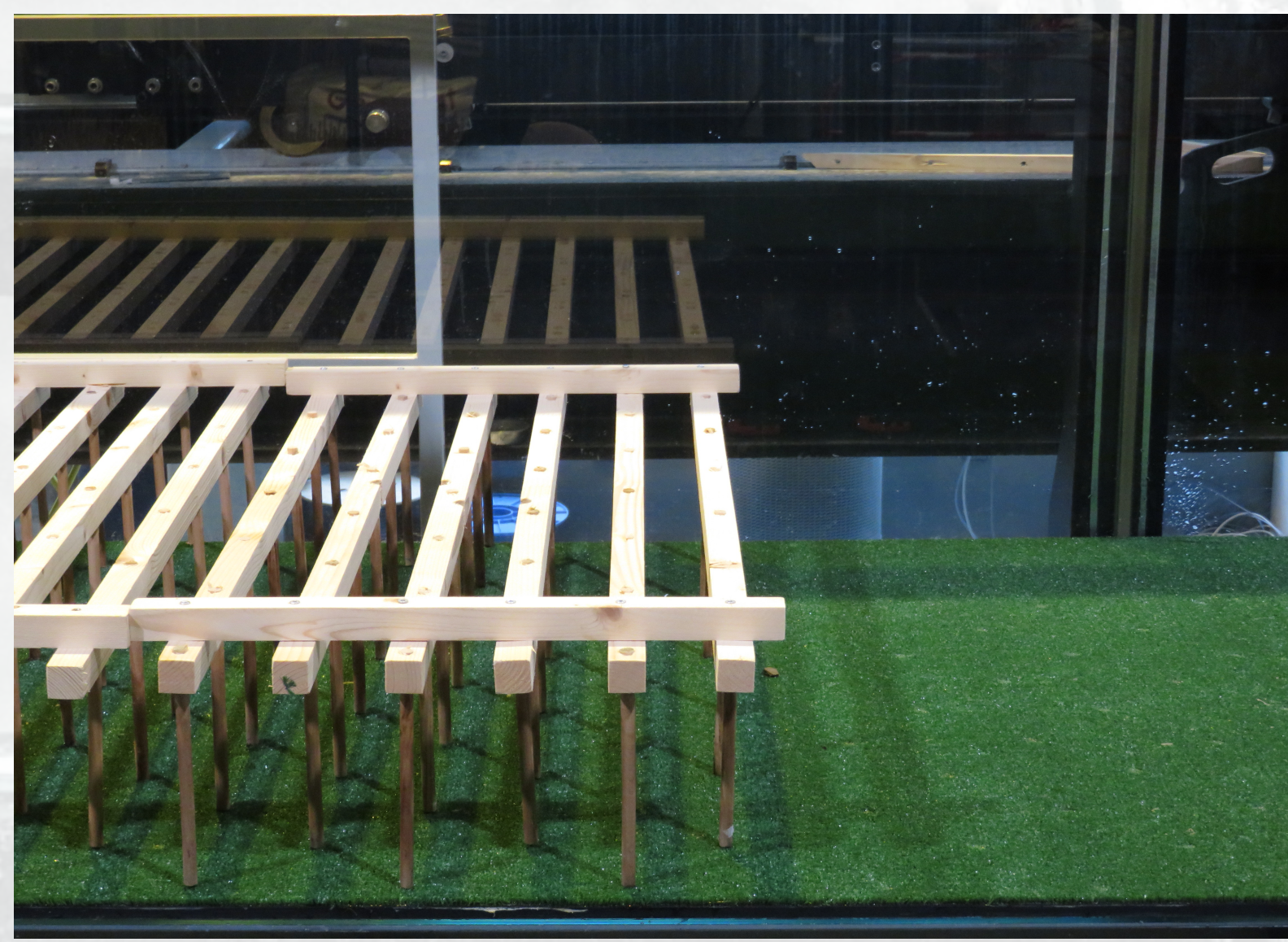
### Objective

To improve the flood hazard assessment (flow depths and velocities) in floodplains by:

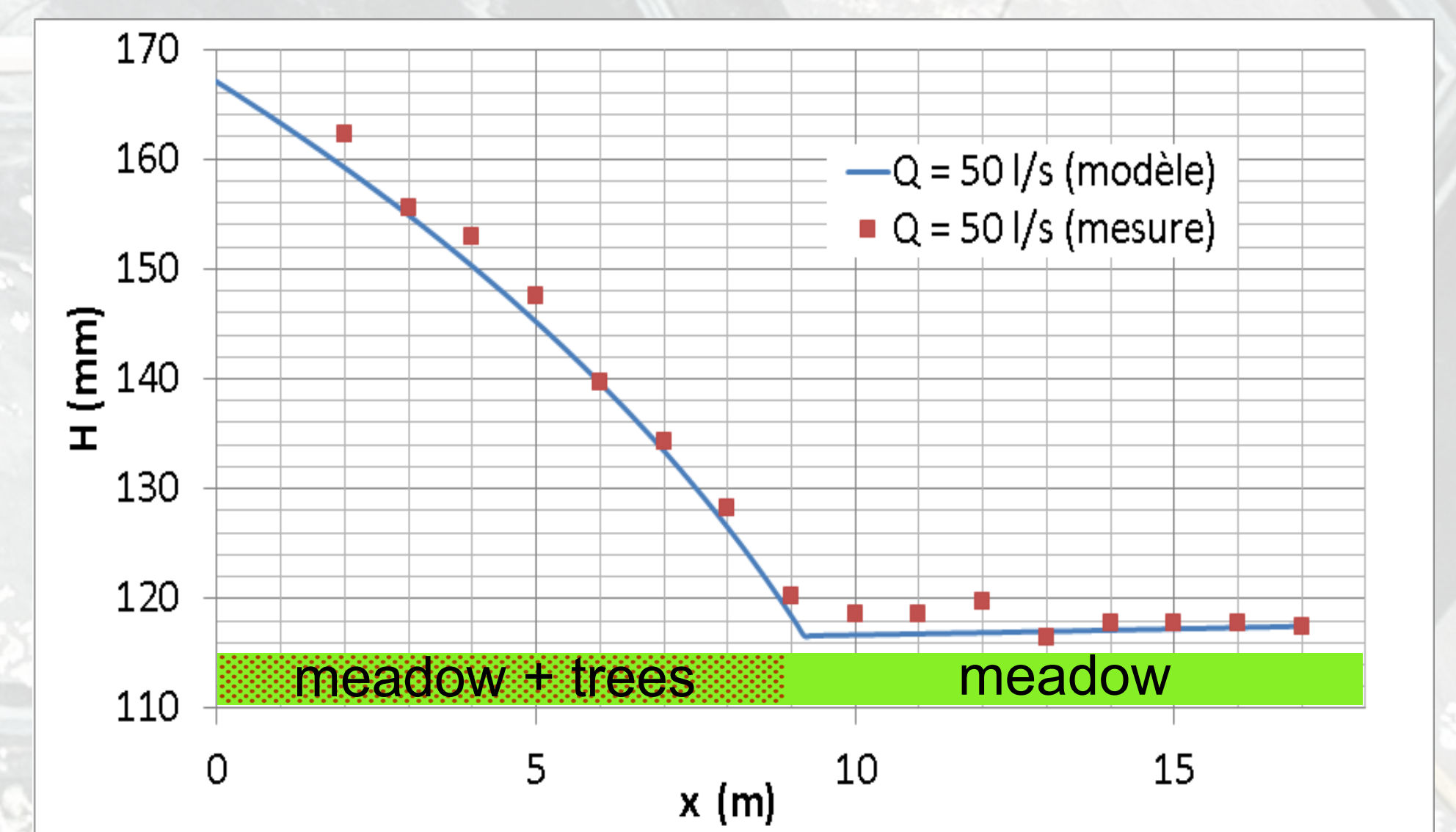
- 1) investigating in laboratory flumes the hydrodynamic processes associated with extreme flood flows for **various flow rate magnitudes** ( $T$  ranging from 100 to 10000-year) and **various land occupations**, and notably, the FLOW RESistance in the presence of **meadows**, **trees**, and **houses** (called "roughnesses")
- 2) assessing if the existing modeling practices that are used for  $T \sim 100$ -year are still valid to predict the floodplain flow for  $T > 1000$ -year



Flume at Irstea-Lyon (18m x 3m), floodplains covered by dense meadow and trees (PhD of V. Dupuis)



Longitudinal roughness transition "trees + meadow (9m) / meadow (9m)"



Flow depth  $H$  versus downstream distance  $x$ . Transition "trees + meadow / meadow". ID model against measurements

### Methodology

1) **Experimental investigation** into the effects of longitudinal and lateral transitions in roughness, of vertical transition from emergence to low submergence of the roughness elements, of interspersed families of roughness elements

2) **Comparison experimental data / numerical modelling (1D to 3D)**. The classical methodologies to model flow resistance will be evaluated and improved to better capture the physics irrespective of the return period  $T$

3) **The codes and methods will be applied to the floods at Besançon**. Events with  $T = 100, 1000$  and  $10000$ -year will be simulated with both classical and improved methods, and uncertainties on flow depths and velocities will be estimated.

**Partners:** IRSTEA-Lyon, LMFA, IMFT, EDF (France); UCL, SPW DO222 (Belgium); IST, LNEC (Portugal); UiA (Norway)  
**Coordination:** S. Proust, IRSTEA-Lyon, sebastien.proust@irstea.fr