

## NetFluv – Research Network in Fluvial Hydraulics

### Summary

Fluvial Hydraulics may be defined as the discipline geared toward the joint study of hydrodynamics and mechanics of erosion, deposition and transport of sediment in open-channels with mobile boundaries. Hazard mitigation has expanded the field, incorporating mitigation of consequences of floods, torrential flows and dam-break flows.

Fluvial Hydraulics is a key technical discipline as it provides the characterization of the physical substrate upon which bio-chemical, biological, ecological, social and economic strata are built.

Fluvial hydraulics is simultaneously science and engineering practice, requiring thus an open approach towards international research developments and, at the same time, an effort to implement local actions. Such is the goal of the Portuguese fluvial hydraulics academic community (PFHAC): i) to carry out fundamental research, to increase the general body of knowledge, and applied research in tune with actual local needs and ii) to provide academic expertise for concrete, local, river interventions and, in general, surface waters governance.

To fulfil its objectives, the PFHAC has, in the past decade, been active in a wide range of topics. Its publication track record has been above average for civil engineering standards (Annex S1, table 1), including the researcher with highest h-index in that area and some of the most productive young senior researchers. However, as the country faces the need for increased activity in the characterization of surface waters and flood hazards, the societal impact of the PFHAC must be incremented.

Having in mind the issues above, the current 5-year plan proposal's general objectives are to increment PFHAC's potential for involvement as technical advisor for river planning and governance, simultaneously maintaining its academic performance.

The specific objectives are: i) to carry out fundamental research in the topics that have been traditionally strong in the group and that guarantee a good publication record; ii) to carry out fundamental and applied research in areas that are relevant for fluvial practice, namely in Portugal.

A number of research actions have been design to fulfil these objectives, organized in two large groups:

A) Fundamental research on flow hydrodynamics and mechanics of sediment transport. It includes five research actions: A1) Hydrodynamic characterization of vertical and momentum exchange in gravel beds; A2) Dispersion of suspended solids in the vegetated reaches, A3) Detailed flow structure in evolving

local scour cavities, A4) Sub-particle turbulence models for SPH (e.g., Figure 1); A5) Flow structure and sediment transport interaction during flood events.

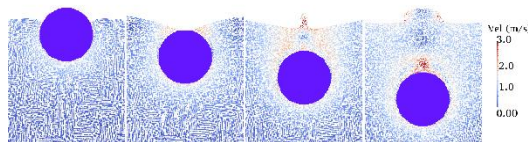


Figure 1. Sedimentation modelling using meshless methods.

B) Fundamental and applied research on river flooding, river morphology and hazard mitigation. Includes four research actions: B1) Local scour mitigation measures, B2) River morphodynamics, B3) Large-scale flood modelling, B4) Modelling dam-breach and torrential flows (Figure 3).

In Portugal, as a member state of the EU, the Water Framework Directive regulates the protection of inland surface waters, demanding that all water bodies are thoroughly characterized in the next 10 years, including, their hydrodynamics and sediment dynamics. Actions of type A are in tune with this demand.

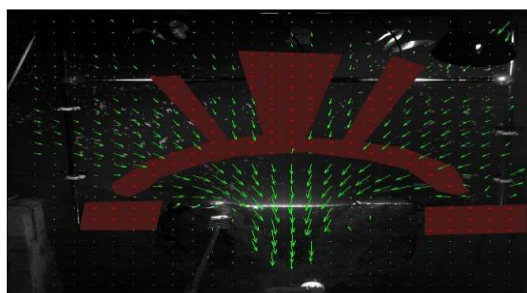


Figure 2. LSPIV applied to dam breaching test. Surface velocity maps in the breach vicinity.

Actions B2, B3 and B4 are designed to improve mathematical simulation tools, earlier developed by project members, incorporating new phenomenological insights, thus bridging the gap between fundamental research and engineering applications. They are applicable to, for instance, integrated municipal emergency and internal emergency plans, both mandatory for municipalities and dam owners. Action B1 provided the technical knowledge need to design local scour mitigation measures.

The proposed actions are not meant to open new lines of work but to consolidate the links among team members and to strengthen ongoing research. They are well articulated with the work plans of ongoing projects led by team members and address specific needs in terms of equipment and human resources. In this respect, it is noted the PFHAC is small in number of senior researchers. It is thus crucial that motivated

# NetFluv

### Project Reference

RECI/ECM-HID/0371/2012

### Leading Institution

UBI – Universidade da Beira Interior (Portugal)

### Partners

LNEC – National Laboratory for Civil Engineering (Portugal), IST-ID – Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento (Portugal), FCT NOVA – NOVA School of Science and Technology (Portugal)

### CERIS Principal Investigator

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### CERIS Research Team

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### Funding

FCT – Fundação para a Ciência e a Tecnologia

### Period

2013-2018

### Total

299 147.00€

### CERIS

165 332.00€

### Project Website

<http://www.civil.ist.utl.pt/~ruif/FCT/NetFluv/>

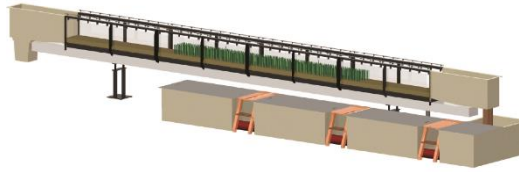
young researchers are enrolled and find ground to develop their contributions.

The publication record of PFHAC has greatly benefited from new instrumentation, acquired in the last 7 years (Figure 3).

This project was fundamental to sustain the growth in academic production it funded maintenance and upgrading of equipment.

Because of the very nature of Fluvial Hydraulics, mostly oriented for the common good and not for market-driven product development, PFHAC's research efforts heavily depend on public funding. Hence, the core of the present projects' budget concerns human resources

and equipment for which private funding would be impossible to obtain. Other major expenses, such as missions for divulgation, have been covered by other sources of private and public funds.



*Figure 3. Schematic view of the recirculating tilting flume of the Laboratory of Hydraulics.*