MIXFLUX – Mixing Layers in Fluvial Systems

Summary

The project MixFluv – Mixing layers in Fluvial Systems aimed at characterizing the most common mixing layers in rivers, such as the flow in compound channels and confluences. The interaction between flows with different velocity and water depths in the case of compound channels (main channel and adjacent floodplains) and with different directions and velocities in the case of confluences generates a rather complex flow structure to be understood for efficient river and flood managements. The relevance of such flows is related to the momentum and mass transfers which may comprise, for instance, sediment or pollutant transport. Moreover, the flow structures in these mixing layers have a strong influence in the inundation hazard, hydromorphology, sediment transport, interaction with vegetation and river bank stabilization. By means of laboratory and field experiments and numerical modelling, these issues were addressed in MixFluv. The experimental flow characterization in mixing layers included laboratory and field experiments. The controlled conditions in the laboratorial flumes allowed the detailed characterization of the turbulent structure and its longitudinal evolution, the coherence structures formation and stabilization and the bottom morphology. Real scale prototype experiments were crucial to validate the conclusions obtained in the laboratory flumes. Moreover, the results obtained in the experimental component were used for numerical model validation and calibration. The experimental campaign was carried out in different flumes with the main objective of characterizing in detail compound channel flows. Different configurations were tested namely straight uniform and non-uniform flows and converging floodplains (Figure 1). The influence of the vegetation and the occupation of the floodplains by vegetation and urban areas in the flood levels were quantified. For the confluences, different geometries of the tributaries and of the discharge in each one allowed a comprehensive characterization of the flows in confluences (Figure 2). Furthermore, the sediment transport and the bottom morphology were evaluated and their relation with the flow structure were further described. Similarities between mixing processes in compound channels and confluences were studied. The possibility to transpose the main results obtained in the laboratory to the real world was evaluated by field measurements. For these experiments, an innovative robotic platform was further developed and tested for shallow water flows in different case studies. The present project gave to river engineers and scientists new awareness and tools for a better river management. In the end, different criteria to conduct an efficient simulation of such flows was proposed together with good practice measures for inundation hazard evaluation, river restauration and bank stabilization.

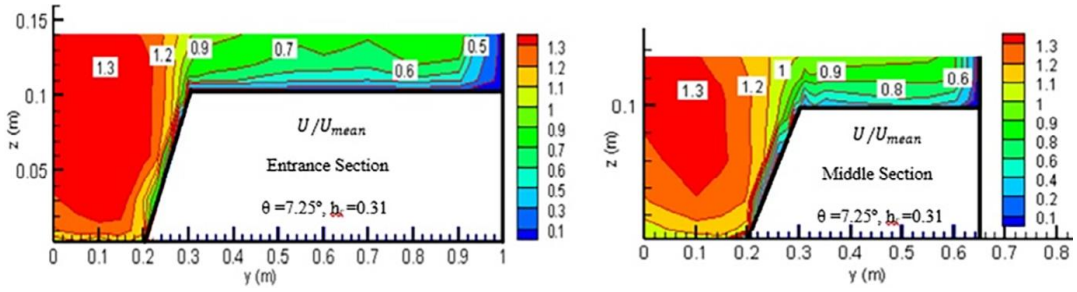

Figure 1. Compound channel with converging floodplains: Non-dimensional time averaged velocity (entrance and middle sections).

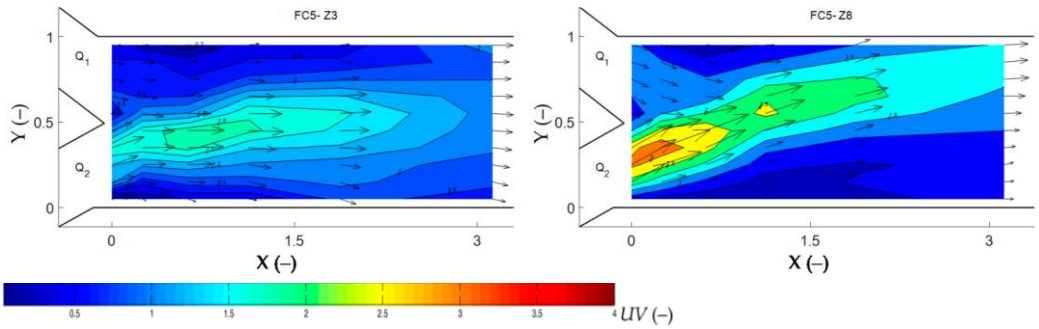

Figure 2. Confluence flows: Non-dimensional time averaged velocity magnitude UV and velocity vectors u and v (for one flow case Q1=3l/s and Q2=7 l/s and 2 elevations).

Project Reference

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Leading Institution

LNEC – National Laboratory for Civil Engineering (Portugal)

Partners

IST-ID – Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento (Portugal)

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237 340.70€

CERIS

15 748.90€

Project Website

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