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# Numerical simulations of flow around vegetation with Telemac2D: application on laboratory experiments and on the Isère river (France)



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**Abstract**:

Vegetation is a common feature of rivers. In these systems, the plants can significantly affect hydrodynamics and sediment transport. Indeed, vegetation deflects (blocking effect) and reduces (roughness effect) the flows, decreases the sediment transport capacity, and causes the deposition of particles within the plants. Vegetation also influences the morphological evolution of streams by controlling bank erosion, encouraging aggradation of alluvial bars and secondary channels, and by contributing to floodplain development. Thus, it is necessary to take into account the processes associated with vegetation in the numerical codes for fluvial environments.

In hydrodynamic numerical models, the effect of the vegetation is represented either by increasing the bed roughness or by adding a drag force. In this study, we propose to compare these two approaches with Telemac2D. More specifically, the ability of the friction laws of Baptist *et al.* (2007), and the drag force method to reproduce the flow velocities around vegetation patches was explored for emergent and submerged conditions, and for rigid and flexible plants. The friction law of Lindner (1982) was also evaluated for rigid emergent vegetation. For this purpose, the laboratory experiments of Pasche and Rouve (1985), Zong and Nepf (2012) and Bouma et al. (2013) were numerically simulated. A vegetated bar of the Isère river (France) was also modelled.

Preliminary results show that the friction law of Baptist and the drag force method give very similar results on the selected test cases. These methods enable to estimate correctly the flow velocities for emergent and submerged rigid plants (Figure 1). The results obtained with the friction law of Lindner (only dedicated to emergent rigid plants) are less satisfying. The vortices associated to the presence of vegetation are reproduced by the three tested methods. The flow velocity field around a flexible vegetation is estimated with a lower accuracy. This result indicates that further developments are required to incorporate the effects of the reconfiguration of flexible vegetation in the models.

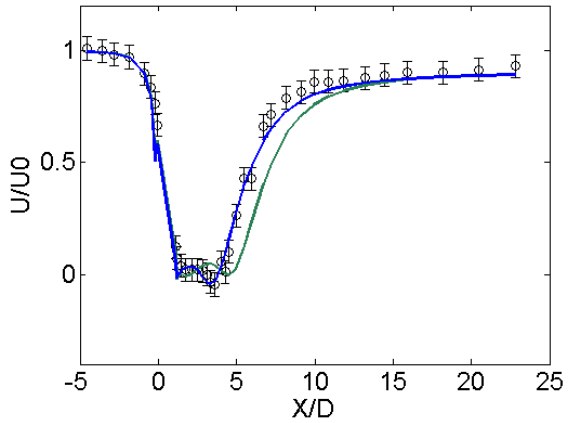


Figure 1: Longitudinal evolution of flow velocity around a circular patch of rigid emergent cylinders. The patch is located between the abscissas 0 and 0.2. The circular dots correspond to the measurements. The blue line corresponds to flow velocities estimated with the drag force method. The green line corresponds to flow velocities estimated with the friction law of Lindner.

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