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The influence of distinct types of aquatic vegetation on the flow field

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The Sustainable management of fluvial systems dealing with flood prevention, erosion protection and restoration of rivers and estuaries requires implementation of soft/green-engineering methods. In-stream aquatic vegetation can be regarded as one of these as it plays an important role for both river ecology (function) and geomorphology (form).
The goal of this research is to offer insight gained from pilot experimental studies on the effects of a number of different elements modeling instream, aquatic vegetation on the local flow field. It is hypothesized that elements of the same effective "blockage" area but of distinct characteristics (structure, porosity and flexibility), will affect both the mean and fluctuating levels of the turbulent flow to a different degree.
The above hypothesis is investigated through a set of rigorous set of experimental runs which are appropriately designed to assess the variability between the interaction of aquatic elements and flow, both quantitatively and qualitatively. In this investigation three elements are employed to model aquatic vegetation, namely a rigid cylinder, a porous but rigid structure and a flexible live plant (Cupressus Macrocarpa).
Firstly, the flow field downstream each of the mentioned elements was measured under steady uniform flow conditions employing acoustic Doppler velocimetry. Three-dimensional flow velocities downstream the vegetation element are acquired along a measurement grid extending about five-fold the element's diameter. These measurements are analyzed to develop mean velocity and turbulent intensity profiles for all velocity components. A detailed comparison between the obtained results is demonstrative of the validity of the above hypothesis as each of the employed elements affects in a different manner and degree the flow field.
Then a flow visualization technique, during which fluorescent dye is injected upstream of the element and images are captured for further analysis and comparison, was employed to visualize the flow structures shed downstream the aquatic elements. This method allows to further observe qualitatively and visually identify the different characteristics of the eddies advected downstream, conclusively confirming the results of the aforementioned experimental campaign.