Geophysical Research Abstracts
Vol. 21, EGU2019-17100-1, 2019
EGU General Assembly 2019

Effective Representation of Vegetation in Flume Experiments Using Surrogates

Robert C. Houseago (1), Bas Bodewes (1), Stuart J. McLelland (1), and Daniel R. Parsons (2)

(1) School of Environmental Sciences, University of Hull, UK (r.houseago@hull.ac.uk), (2) Energy and Environment Institute, University of Hull, UK

Appropriate representation of biotic influences and effects in experimental physical modeling is essential to improve the understanding of complex ecohydraulic processes that shape the natural environment. There is therefore a need to develop guidance and best practice on how to most effectively incorporate such processes in experimental investigations. For example, recent work has used scaled surrogates to represent vegetation in order to provide the ability to control independent plant features, aiding the identification of associated thresholds within hydraulic and morphodynamic processes. However, a common challenge for scaling vegetation in flumes is the requirement to represent geometric properties and dynamic behaviour across a range of space and time scales.

This work presents guidance on techniques to produce surrogates of biotic effects, including representation of riparian vegetation, and submerged aquatic vegetation in riverine and coastal environments. Methodological approaches are also detailed from recent experimental research that evaluate the use of living plants, physical artificial object surrogates, and chemical surrogates, such as Extracellular Polymeric Substances (EPS).

Live vegetation (such as Alfalfa) has been used widely in flume experiments to represent natural riparian vegetation, enabling advances in the understanding of biotic influences on morphodynamics. This work highlights the importance of considering vegetation properties, such as age and density, by detailing the associated influence on sediment erosion rates. Furthermore, assessment of mimicking vegetation existence using chemical surrogates through controlled use of EPS has been investigated. This chemical surrogate approach provides a potential alternative to using living plants in flumes, thus omitting some of the husbandry issues associated with vegetation in laboratories.

Physical surrogates offer an additional method of representing vegetation in flumes, which provide some control over the vegetation variables. It is vital that an artificial object, such as a flexible seagrass plant, is representative of natural species. A methodological approach is detailed to ensure geometric and dynamic similarity is achieved, along with results demonstrating the hydrodynamic differences between accurately modelled versus a simplistic surrogate.

The combined results from these experiments illustrate approaches of representing vegetation in physical experiments through the use of surrogates, along with detailing the important scaling considerations that have a fundamental influence on flow behaviour and sediment processes. Accurate acquisition of constrained ecohydraulic data using any biological surrogate is fundamental to advance the understanding of flow-biota interactions, and the subsequent robust parametrisation of morphodynamic models.