Shallow flow field induced by large horizontal coherent structures in squeeze ecological systems

S.H Truong

Department of Civil Engineering, Thuyloi University
Hanoi, Vietnam

Un Ji

Department of Land, Water and Environment Research, Korea Institute of Civil Engineering and Building Technology
Seoul, South Korea

L.K Phan

Department of Civil Engineering, Thuy loi University
Hanoi, Vietnam

W.S.J Uijttewaal

Faculty of Civil Engineering and Geosciences, Hydraulic Department, Delft University of Technology
Delft, The Netherlands

In recent decades, large coherent structures in the mixing layer at the edge of the vegetation region have been increasingly realized. The transverse exchange of momentum and mass between the vegetation region and the adjacent areas induced by these structures is the crux of nature-based solutions. Unfortunately, along the Mekong Delta, Vietnam, the ecological system has been rapidly destroyed and degraded into narrow strips of less than 50 m due to the increasing demand to create more space for local fish farming. As a result, shorelines and riverbanks at those locations are eroding significantly. The knowledge of the impacts of this so-called squeezed condition on the shallow flow field in the vegetation regions is still in its infancy. A unique laboratory experiment mimicking squeezed vegetation was conducted in a shallow flume of the Fluid Mechanics Laboratory at the Delft University of Technology. The Particle Image Velocimetry (PIV) at a sampling rate of 10 Hz was applied to measure the instantaneous movement of flow at the free surface in and surrounding the vegetation region. The results suggest that reducing the width of ecological systems will strongly affect the pattern of the large coherent structures. A narrow ecological system makes it impossible for the flow field inside the vegetation to be able to reach its equilibrium state. The large horizontal coherent structures in squeeze systems occur more frequently and less regularly. In this context, the transverse momentum fluxes increase. The time and space for the sediment to be deposited are restricted.