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Numerical study of sedimentation in uniformly vegetated wetlands

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ABSTRACT

Constructed wetlands for wastewater treatment are increasingly recognized as a valid alternative to conventional water treatment methods with a high ecological value. Sediment transport and deposition processes play a key role in determining the treatment performance and the morphological evolution of a wetland, and must be carefully considered both in the design and the maintenance phase. This work presents a 2-D numerical study of the effect of vegetation density on sedimentation in wetlands. A depth-averaged hydrodynamic and mass transport model was applied to a rectangular wetland with uniform vegetation density and flat topography. Sediment settling and resuspension is represented in the model by a first-order source/sink term that depends on grain size and shear velocity. Results show that, for the same inflow discharge, the removal efficiency for relatively small grain sizes is lower in wetlands with higher vegetation density. This is a consequence of the more uniform flow distribution found in more densely vegetated wetlands. However, the condition of total removal of suspended sediment is achieved for higher grain sizes in more sparsely vegetated wetlands, meaning there is a range of relatively large grain sizes for which the removal efficiency is higher for higher vegetation densities.