

Numerical experiment on driftwood dynamics considering rootwad effect and wood collision

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Abstract

Driftwood is one of serious problems in a river environment. In several countries, such as Indonesia, Japan, and Italy, the driftwood frequently appears in a river basin, and it can alter the channel bed, flow configuration by wood deposition and jam formation. Therefore, the studies related to driftwood have been actively conducted by many researchers to understand the mechanism of driftwood dynamics. In particular, wood motion by collision is one of the difficult issues in the numerical simulation because the calculation for wood collision requires significantly expensive calculation time due to small time step.

Thus, this study conducted the numerical simulation in consideration of the wood motion by water flow and wood collision to understand the wood dynamics in terms of computation. We used the 2D (two-dimensional) depth-averaged velocity model, Nays2DH, which is a Eulerian model to calculate the water flow on the generalized coordinate. A Lagrangian type driftwood model, which expresses the driftwood as connected sphere shape particles, was employed to Nays2DH. In addition, the present study considered root wad effect by using larger diameter for a particle at a head of driftwood. An anisotropic bed friction was considered for the sliding motion dependent on stemwise, streamwise and motion directions. We particularly considered changeable draft at each particle and projection area by an angle between stemwise and flow directions to precisely reproduce the wood motions. The simulation results were compared with experimental results to verify the model. As a result, the simulation results showed good agreement with experimental results. Through this study, it would be expected that this model is a useful tool to predict the driftwood effect in the river flow.

Keywords : Computational driftwood modelling, Driftwood collision, Rootwad effect, Distinct element method, 2D-hydrodynamic model

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