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Analysis of a two-way coupled model for Large Wood transport

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ORSA2D_WT is a numerical model that simulates the transport of Large Wood during flood events. It includes a finite volume, first order accurate, Roe-Riemann solver for the solution of the Shallow Water Equations and a Discrete Element Model for the dynamic computation of the entrainment and motion of cylindrical floating bodies. The flow field resulting from the Shallow Water Equations solver is employed to calculate the forces acting on the floating bodies and, consequently, their trajectories.
Such one-way coupled approach is adequate to simulate the motion of few wooden pieces on the water surface. However, from the hydraulic standpoint, the most interesting phenomenon is the transport of a large number of logs and eventually their arrest upstream of inline structures, like bridge piers or check-dams. Under such conditions, the effect of the logs presence and of the span occlusion on the flow needs also to be simulated.
An additional routine is thus included in ORSA2D_WT with the aim of considering the effect of the wooden bodies on the fluid. The hydrodynamic force exerted by the water on the body is used to compute the opposite component, which is then distributed on the cells surrounding each wooden piece. The effect of the different strategies for force distribution is thus evaluated to gain a balance between accuracy and computational time.