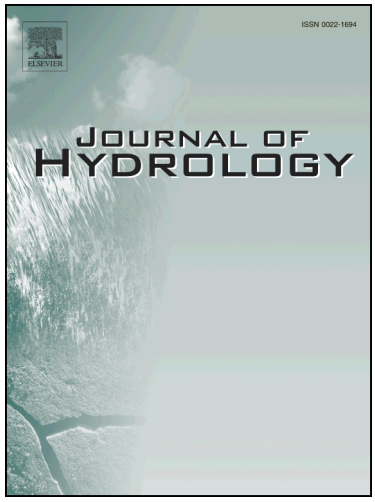

Research papers

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Exact solution of the Linear Parabolic Approximation for flow-depth based diffusive flow routing

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Abstract

The Linearized Parabolic Approximation of the Saint Venant Equations is often used for flood routing, but the corresponding analytic solutions usually neglect the downstream boundary conditions. This is an issue because the presence of hydraulic structures at the end of a river reach, or natural morphologic conditions, may influence the wave propagation. In order to take into account realistic boundary conditions, namely a stage-hydrograph upstream and a stage-discharge relationship downstream, a new set of exact solutions of the Linearized Parabolic Approximation of the Saint Venant Equations with uniformly distributed lateral inflows is presented. This exact solution is demonstrated by using it as a building block in a simplified flood routing model, whose numerical results are compared with those supplied by laboratory experiments from literature. Finally, the new solutions are used to analyze the range of validity of semi-infinite channel models. The comparison shows that semi-infinite channel models are accurate when convective effects are prevailing on diffusive effects, and the downstream boundary condition corresponds to uniform flow conditions. In addition, the results show that semi-infinite channel models based on the knowledge