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Data-driven LES of turbulence and solute transport in a natural stream[1] ALI KHOSRONEJAD, JESSICA KOZAREK, AMY HANSEN, KRISTOPHER GUENTZEL, MIKI HONDZO, Univ of Minn - Minneapolis, PETER WILCOCK, Utah State University, MICHELE GUALA, JACQUES FINLAY, FOTIS SOTIROPOULOS, Univ of Minn - Minneapolis, ST. ANTHONY FALLS LAB TEAM, UTAH STATE UNIVERSITY TEAM — We develop and validate a coupled 3D numerical model for carrying out high-resolution large-eddy simulations of turbulence and solute transport for a conservative tracer in a natural stream, the Eagle Creek, located ∼ 30 miles south of Minneapolis, Minnesota. We employ the Curvilinear Immersed Boundary method along with a convection-diffusion module to simulate the transient transport of momentum and contaminant concentrations. The detailed geometry of the stream, which is about 135m long, 2.5m wide, and 0.2cm deep is surveyed and used as the simulation domain. The geometry and position of large woody debris in the channel were included in the simulation to account for their effect on the transport of momentum and concentration. The numerical simulation is carried out on a grid with 25 million nodes under two tracer injection conditions, including a pulse and a plateau release. Comprehensive field measurement data is used to validate the flow and concentration field. It is shown that the simulations can accurately capture the spatial and temporal characteristics of the solute transport processes observed in the field and resolve the underlying physical phenomena at unprecedented resolution.

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