

## **Spatiotemporal stochastic open-channel flow. II: Simulation experiments**

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**Abstract:** Spatiotemporal solutions for open-channel flow are obtained in a stochastic setting using field data on parameter variability. Statistical descriptions of the flow variables are estimated through Monte Carlo simulation using finite difference equations for a 10-km reach of the Columbia River. Results indicate considerable uncertainty in predicted flow behavior: ensemble coefficients of variation at different space-time locations ranged from 0.18-0.60 for flow velocity and from 0.04-0.13 for flow depth. The band widths between the 16% and 84% quantiles were typically 0.6-1.4 m/s and 5-7 m, respectively, for velocity and depth. Probability distributions for predicted velocities were found to be gamma, lognormal, or Weibull, whereas those for depth were normal, gamma, and, in a few cases, lognormal. The various quantiles of the predicted variables are associated with notions of risk, reliability, and variability that influence engineering decisions. Sensitivity of the level of uncertainty in predicted flow variables to the level of uncertainty in the parameters is investigated for a generalized stream system through fractional factorial analysis of coefficients of variation. Uncertainty in predicted flow velocity was most sensitive to the uncertainty in the channel cross-section geometry, particularly scale and shape parameters for flow area. Uncertainty in predicted flow depth was predominantly sensitive to the uncertainty in channel bed slope.