Geophysical Research Abstracts
Vol. 18, EGU2016-3660, 2016
EGU General Assembly 2016

Application of Continuous-Time Batch Markovian Arrival Processes and Particle Tracking Model to Probabilistic Sediment Transport Modeling

Christina Tsai and Serena Hung
National Taiwan University, Taiwan (cwstsai@ntu.edu.tw)

To more precisely describe particle movement in surface water, both the random particle arrival process at the receiving water and the stochastic particle movement in the receiving water should be carefully considered in sediment transport modeling. In this study, a stochastic framework is developed for a probabilistic description of discrete particle transport through a probability density function of sediment concentrations and transport rates. In order to more realistically describe the particle arrivals into receiving waters at random times and with a probabilistic particle number in each arrival, the continuous-time batch Markovian arrival process is introduced. The particle tracking model (PTM) composed of physically based stochastic differential equations (SDEs) for particle trajectory is then used to depict the random movement of particles in the receiving water. Particle deposition and entrainment processes are considered in the model. It is expected that the particle concentrations in the receiving water and particle transport rates can be mathematically expressed as a stochastic process. Compared with deterministic modeling, the proposed approach has the advantage of capturing any randomly selected scenarios (or realizations) of flow and sediment properties. Availability of a more sophisticated stochastic process for random particle arrival processes can assist in quantifying the probabilistic characteristics of sediment transport rates and concentrations. In addition, for a given turbidity threshold, the risk of exceeding a pre-established water quality standard can be quantified as needed.