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Invited Presentation: A new approach to model suspended sediment load: Stochastic prediction and uncertainty estimation

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A New Approach to Model Suspended Sediment Load: Stochastic Prediction and Uncertainty Estimation

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Abstract: We introduce a parsimonious and stochastic model rooted in multivariate probability theory and Bayesian network to describe the relationship between Suspended Sediment Load (SSL) and river discharge. Erosion, transport and deposition of sediments are key ecosystem functions that shape the face of the Earth. Sediment transfer forms global geological cycle and global geochemical cycling, and influences marine and coastal ecosystem functioning, as well as evolution of deltas, coastal landforms and landscape. A majority (70-90%) of sediment load of different rivers around the globe is delivered during the high-flow/flood events. Understanding and quantifying the nonlinear relationships between river discharge and sediment delivery, however, is a challenge. In this study, we identify influential modes of sediment delivery in different rivers, and employ them for prediction of sediment load dependent on river discharge. We define 70th percentile of historical river discharge as threshold for high-flow events, and model the correlation structure between discharge volume and SSL extracted from high-flow events. The proposed framework draws sample from the joint probability distribution of SSL and river discharge, and conditions marginal distribution of SSL on discharge volume. This model relaxes the need for a detailed description of physical properties of the watershed and climatic forcing, and explores the critical information about the watershed sedimentation processes that are stored in historical data for prediction purposes. The proposed model is probabilistic, an approach which accurately represents the stochastic nature of sedimentation processes at the watershed. We test this framework for seven major rivers in the U.S., results of which show promising performance to predict SSL and its likelihood given different discharge levels.

***Keywords**:* Sediment Transport; Suspended Sediment Load; Stochastic Modeling; Copula; Uncertainty Analysis.