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Sediment matters: From scale to scale

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Rainfall and runoff induced erosion and sediment transport in hydrological watersheds have great importance in scientific research studies as well as engineering practice. Numerous methods are available for the research and practical aspects of sediment transport technology. Estimation of sediment can be made by time series analysis, empirical or mechanistic equations, monitoring, sampling, surveying, remote sensing or geographical information systems. As monitoring and sampling sediment transport process are costly and not easy to implement yet, modeling has become an alternating tool. Data-based empirical models as well as process-based hydrological models are available for this purpose, yet modeling is difficult and challenging. Challenges related to the modeling sediment matters are discussed in this study with an emphasis on the process-based sediment transport models. Challenges encountered in the modeling technology are the variability in the estimate of sediment calculated by each model, data requirement for the calibration of model parameters, complexity in the calibration and validation stages of the process-based models, uncertainty in the transport capacity approach, etc. In this study, data-based or process-based models are considered at scales from a watershed to a hillslope. Field and laboratory data are studied for estimating sediment transport in hydrological watersheds. Process-based models are paid a particular attention with the micro-topographical structure at the hillslope-scale. Experimental studies for obtaining input variables required for the models are also touched upon. For this aim, laboratory-scale experimental research studies are shared; rainfall simulator for rainfall-runoff-sediment transport, sediment threshold in rigid boundary channels. Outputs of the former are used for the development of hillslope-scale empirical and numerical rainfall-runoff-sediment transport models while the latter is used for providing numerical models to such practical purposes as the sewer and drainage system design.