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# Prediction and forecast of Suspended Sediment Concentration (SSC) on the Upper Yangtze basin

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Sediment transport in suspension may represent 90% or more of the global annual flux of sediment. For instance, more than 99% of the sediment supplied to the sea by the Yangtze River is suspended load. Suspended load is an important component for understanding channel dynamics and landscape evolution. Sediments transported in suspension are a major source of nutrients for aquatic organisms in riparian and floodplain habitats, and play a beneficial role acting as a sink in the carbon cycle. Excess of fine sediments may also have adverse effects. It can impair fish spawning by riverbed clogging, disturb foraging efficiency of hunting of river fauna, cause algae and benthos scouring, reduce or inhibit exchanges through the hyporheic region. Accumulation of fine sediments in reservoirs reduces storage capacity. Although fine sediment dynamics has been the focus of many studies, the current knowledge of sediment sources, transfer, and storage is inadequate to address fine sediment dynamics in the landscape. The theoretical derivation of a complete model for suspended sediment transport at the basin scale, incorporating small scale processes of production and transport, is hindered because the underlying mechanisms are produced at different non-similar scales. Availability of long-term reliable data on suspended sediment dynamics is essential to improve our knowledge on transport processes and to develop reliable sediment prediction models. Over the last 60 years, the Yangtze River Commission has been measuring the daily Suspended Sediment Concentration (SSC) at the Pingshan station. This dataset provides a unique opportunity to examine temporal variability and controls of fine sediment dynamics in the Upper Yangtze basin. The objective of this study is to describe temporal variation of fine sediment dynamics at the Pingshan station making use of the extensive sediment monitoring program undertaken at that location. We test several strategies of prediction and forecast applied to the long time series of SSC and streamflow. By changing the base variables between strategies, we improve our understanding of the phenomena driving SSC. Prediction and forecasts are obtained from the various input data sets based on a novel probabilistic data-driven technique, the Generalized Pareto Uncertainty (GPU), which requires very little parametrization. Addressing uncertainty explicitly, this methodology recognizes the stochastic nature of SSC. The GPU was inspired in machine learning concepts and benefits from advances in multi-objective optimization techniques to discard most explicit assumptions about the nature of the uncertainty being modeled. Assumptions that do remain are the need to specify a model for eventual non-stationarity of the series and that there are enough observations to conveniently model the uncertainty. In this contribution, several models are tested with conditioned inputs to focus on specific processes leading affecting SSC. For example, the influence of seasonal and local contributions to SSC can be separated by conditioning the probability estimation on seasonal and local drivers. Probabilistic forecasting models for SSC that account for different drivers of the phenomena are discussed.