# IMPACT OF FLOW-DURATION CURVE TEMPORAL RESOLUTION ON SEDIMENT LOAD ESTIMATES

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**Abstract** Evaluation of sediment transport feature is often required in stream management or restoration works. The sediment transport capacity is a common indicator used to examine such feature. To investigate the composite sediment transport capacity for stream flows with different recurrent interval, the flow duration curve is usually adopted for the annual sediment load calculation. Flow-duration curves are usually developed using average daily streamflow observations from a United States Geological Survey (USGS) surface water station. In the semi-arid and arid southwestern U.S., however, average daily streamflow observations may not be sufficient for development of accurate flow-duration curves. The flashy response to short-duration, high-intensity precipitation may not be captured in the average daily streamflow record. Errors associated with the estimation of the flow-duration curves directly impact the accuracy of annual sediment load estimates made with models such as Sediment Impact Assessment Model (SIAM). The extent of this error has not been quantified.

The U.S. Army Corps of Engineers (USACE) developed SIAM module in HEC-RAS model for conducting rapid evaluation of sediment transport potential within channels. SIAM uses stream flow-duration curves and sediment transport capacity estimates to simulate annual average sediment load within a watershed. This model was used to examine the difference between sediment transport capacity calculations based on flow-duration curves derived from 15-minute high temporal-resolution data and daily-averaged data. Eight sites in southwestern U.S. were selected for this study, based on data availability and site accessibility. Original USGS hydrographs at these sites were retrieved and digitized to generate 15-min data series and corresponding flow duration curves. The USGS published daily-average flow data were used to produce low-resolution flow-duration curves. The SIAM model was then applied to calculate the annual sediment transport capacity for different flow duration curves.

The results show that that use of high-temporal resolution flow-duration curves in SIAM modeling led to sediment load estimates as high as an order of magnitude greater than those derived from average daily flow-based flow-duration curves. It is primarily due to peak flows captured by the high resolution data. This trend is not affect by particle size distribution and associated uncertainty, and the inaccuracy of estimation on roughness coefficients. The result implies risks associated with using the low-temporal resolution data in planning and designing works in water resources management. Strong correlation was found between sediment loads by high-temporal resolution flows and daily flows, which suggest the possibility to predict actual transport capacity using currently available data. Analysis also shows strong correlation between sediment loads by the largest flows and by all flows involved in a flow-duration curve. In addition, sediment load by the largest flow is of large proportion in total sediment load. These results imply that the geomorphic features of arid and semiarid ephemeral streams are mainly determined by large flows.