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Multi-Model Comparison of Suspended Sediment Flux in the Sagavanirktok River, Alaska.

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Fluvial sediment transport is an important component of the global sediment budget, yet in-situ monitoring is limited. Researchers and practitioners employ various methods to fill in these gaps, each with their own advantages and drawbacks. In this study, we compare four different models for estimating the total annual suspended solids and daily suspended sediment flux for the Sagavanirktok River in Alaska. These four models include: 1) in-situ turbidity calibration; 2) WBMsed global sediment flux estimates 3) optical remote sensing random forest model; and 4) Long-short term memory (LSTM) model trained on remote sensing and modeled inputs. We focus particularly on the summers of 2022 and 2023, when we have continuous validation data via a USGS discharge gage and turbidity sensors that we installed. We evaluate the accuracy, practicality, and shortcomings of each approach to reconstructing the total suspended sediment flux of the Sagavanirktok River. We highlight the necessity of high temporal resolution (approximately daily) for estimating suspended sediment flux in the Sag. River due to the frequency of high discharge events and variable hysteresis between discharge and sediment load. We find that, for the Sag. River, optical imagery alone does not have sufficient temporal resolution to estimate suspended sediment flux (due to orbit repeat and clouds), despite the accuracy of individual estimates. The geomorphic model, WBMsed, is not accurate enough for the unusual hydrology, but does produce daily estimates. Finally, the LSTM model shows promise in being able to bridge the temporal mismatch between satellite, in-situ, and modeled dataset. The LSTM can take advantage of daily discharge models, while incorporating the accuracy of optical satellite sediment models