High-Resolution Suspended Sediment Concentration Dynamics along River Corridors

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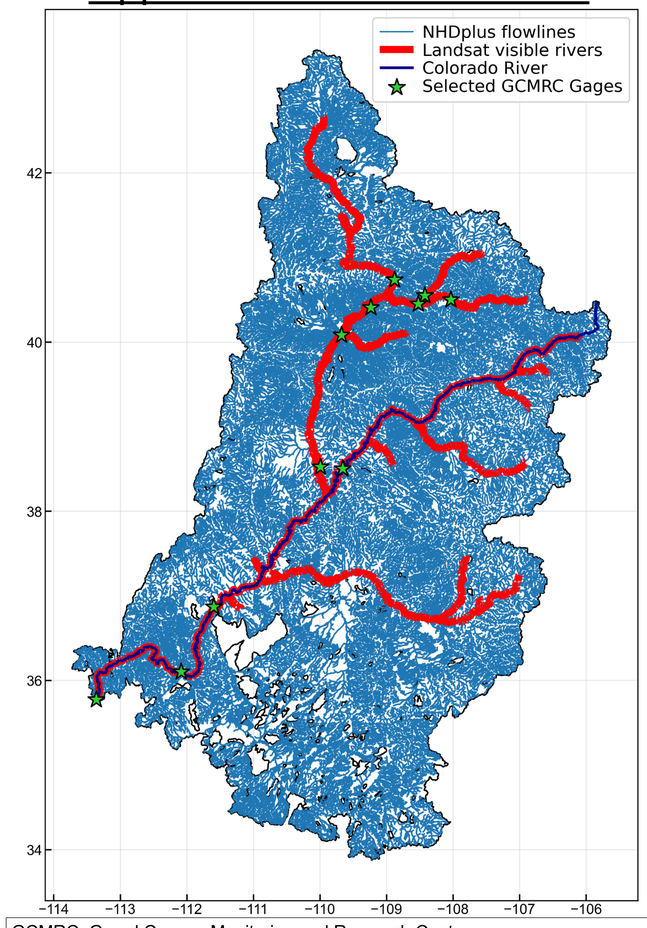
Motivation

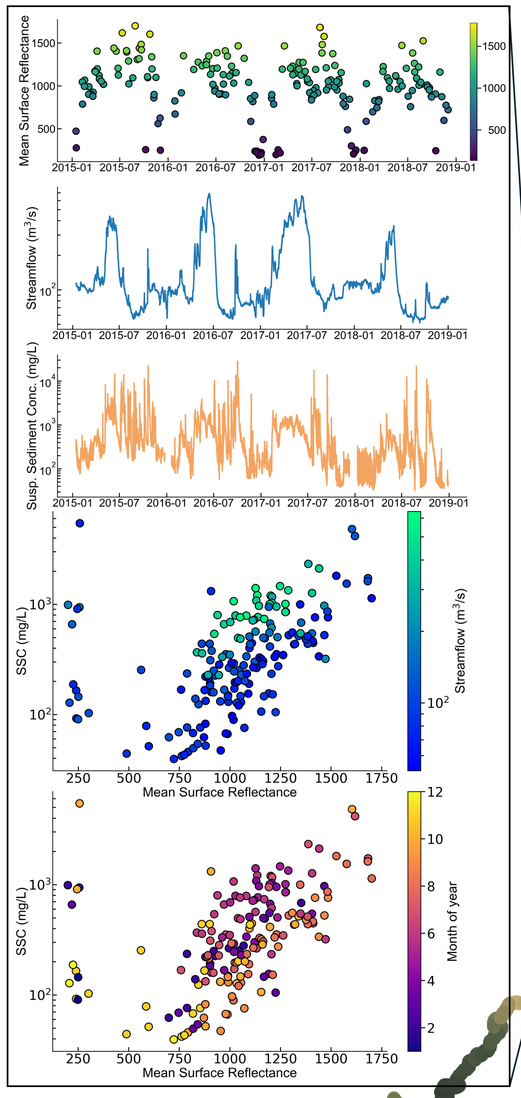
Suspended sediment concentration (SSC) plays a critical role in riverine systems, influencing ecosystem health, water quality, and sediment transport and deposition. While reach-scale hydraulics determine the available shear stress during a flood and thus sediment flux, the type and quantity of suspended sediment within a river are derived from watershed processes and near-channel properties. A river's visual color can be monitored from remote sensed images, where the color is a combination of SSC, organic matter, and other particulate pollutants carried by the river. Here we pair high-resolution records of SSC and remotely sensed imagery to investigate the spatial and temporal patterns within river color along river corridors. Preliminary geospatial analysis reveals that mean SSC weakly increases with drainage area, raising questions about the mechanisms driving SSC changes downstream. Understanding the dynamics of water color and its relation to SSC changes within a river corridor represents a critical launching pad for leveraging remotely sensed images to predict sediment flux, monitor concentration patterns, and inform strategies for watershed management.

Upper Colorado River Basin

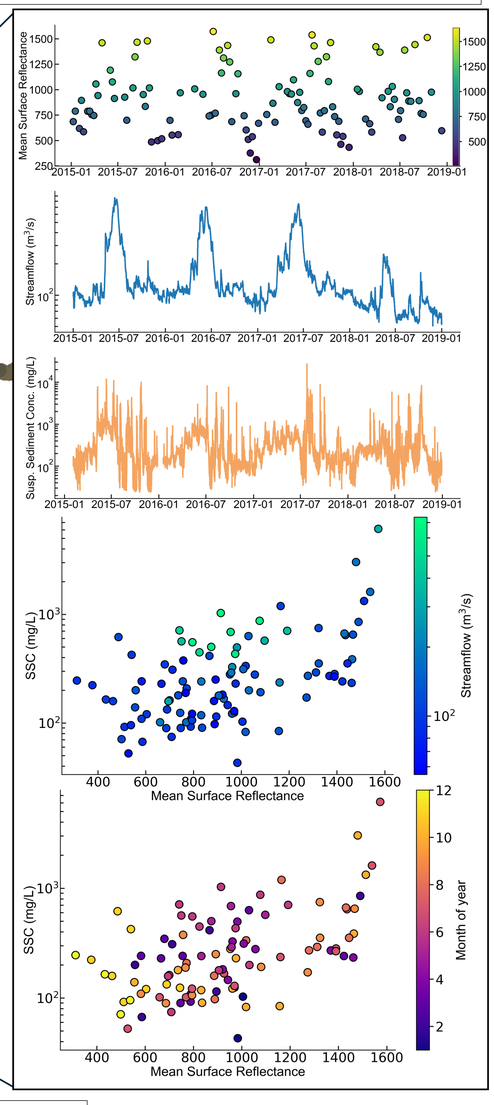


GCMRC: Grand Canyon Monitoring and Research Center.
These sites are high-resolution (15-minute) measurements of streamflow and suspended sediment concentration.
Mean Surface Reflectance: Landsat reflectance values of the river, averaged between red, green, blue, and NIR bands.

Gardner, J. R., Yang, X., Topp, S. N., Ross, M. R. V., Altenau, E. H., & Pavelsky, T. M. (2021). The Color of Rivers. *Geophysical Research Letters*, *48*(1), e2020GL088946. https://doi.org/10.1029/2020GL088946
Grand Canyon Monitoring and Research Center. (2017). *Discharge, Sediment, and Water Quality Monitoring Application* [Dataset]. https://www.gcmrc.gov/



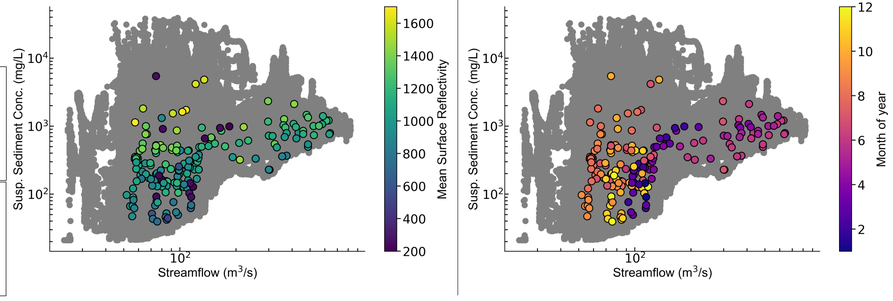
Summer Average Visible Color in the Colorado River Basin



Key Points

- Correlations between river reflectance and SSC show that SSC increases with river reflectance, while the connections between streamflow and reflectance are weaker.
- High-resolution SSC records reveal novel time-dependent patterns not observed with discrete samples of water quality.
- Low values for reflectance often occur during the winter months.

Missing Portions of High-Resolution Data



Future Work

- Exploration of site connectivity.
  - How does river color and SSC change along rivers and what factors affect changes in SSC and color?
- Exploration of color differences between rivers.
  - How does river color change between rivers and their respective environments (climate, soils, land use, organic matter)?

Abstract QR

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