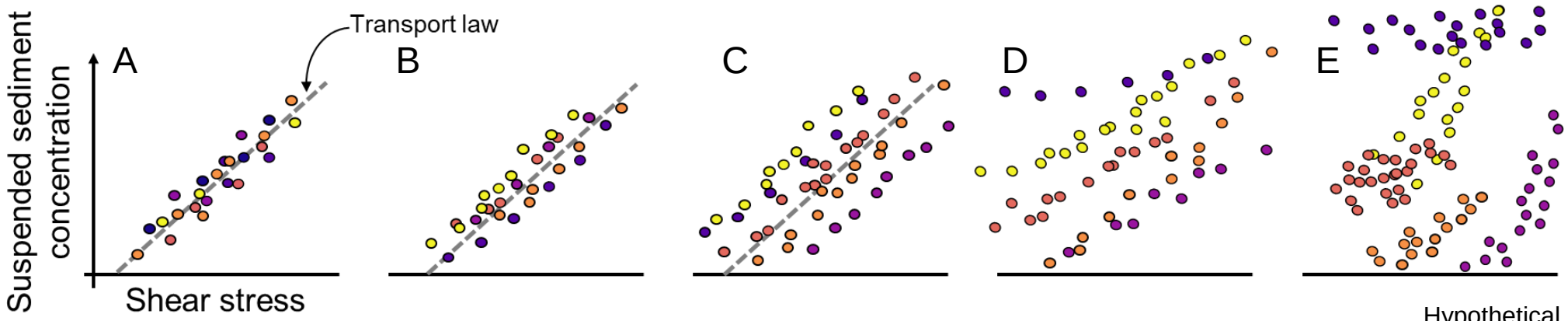
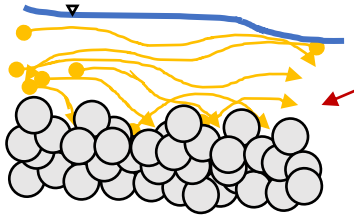
Landscape and river self-organization limit the flux of fine particles



Catchment Processes
(erosion, lithology, land use…)

Suspended Sediment signal scenarios

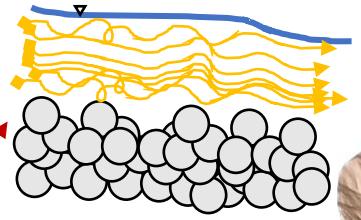
Local control



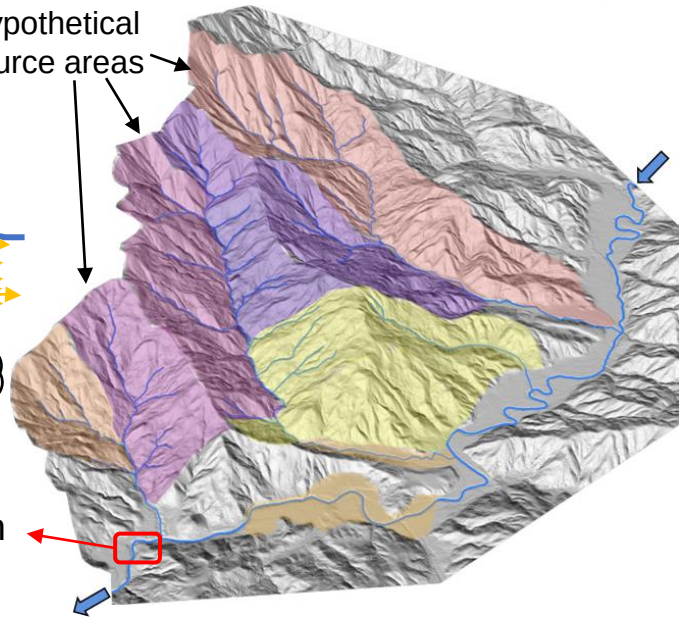
Significant storage within the river corridor enables to shredding/buffering of signals of catchment processes.

Minimal interaction (washload) leads to a more direct signal of external factors (e.g. land use, climate, lithology, and storm recurrence)

Source control



Hypothetical source areas



SSC Sampling location

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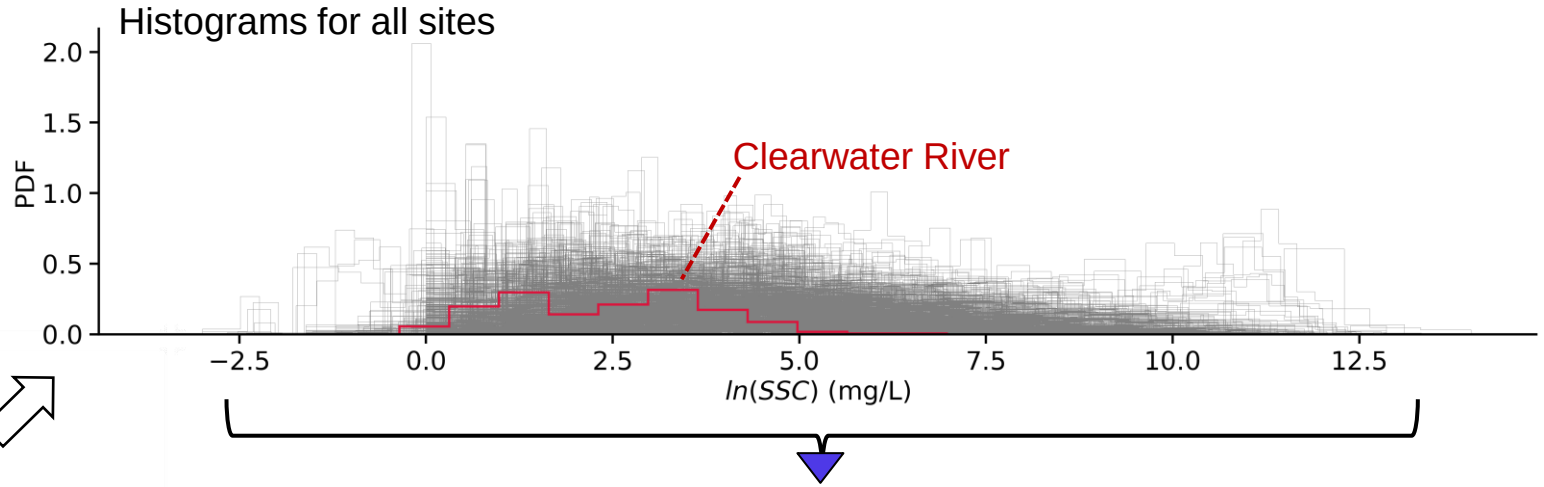
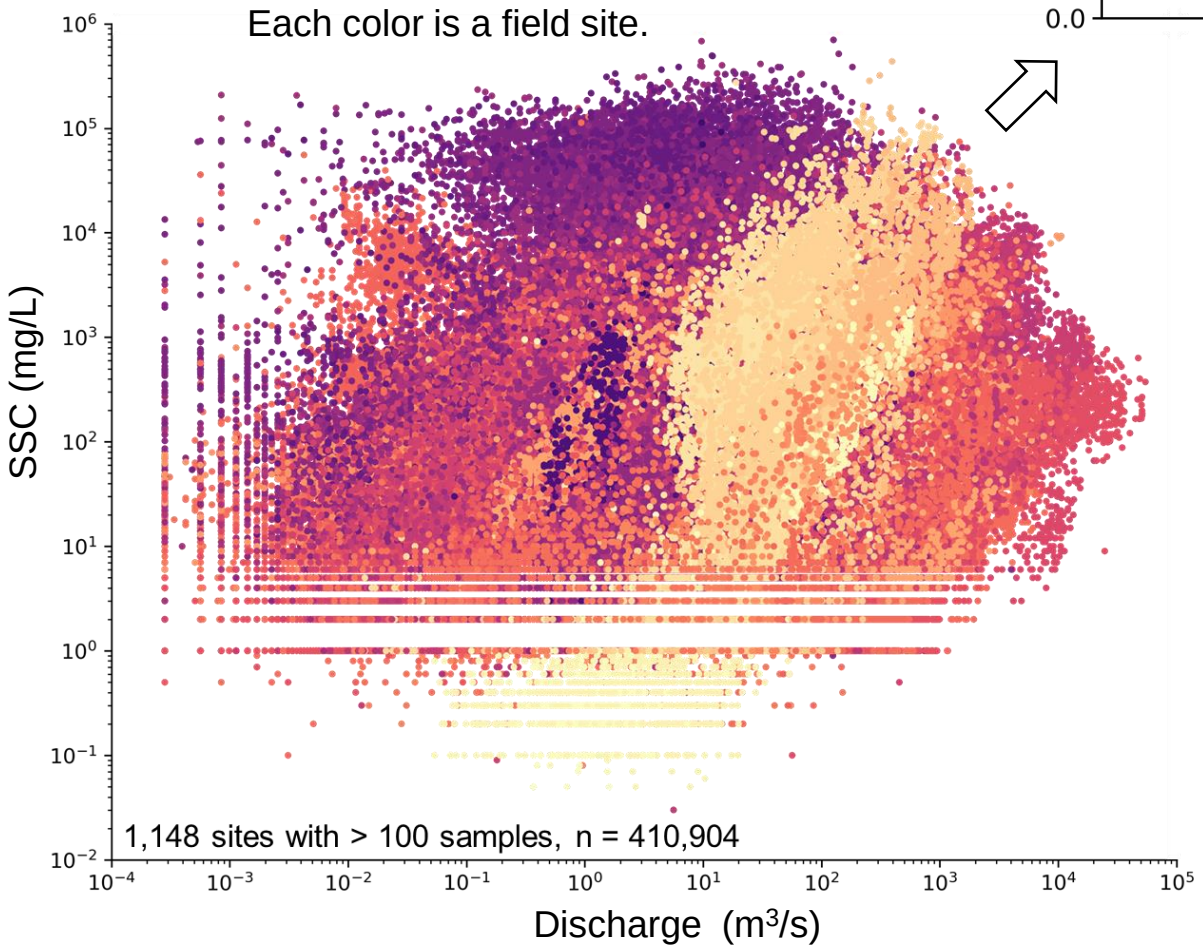
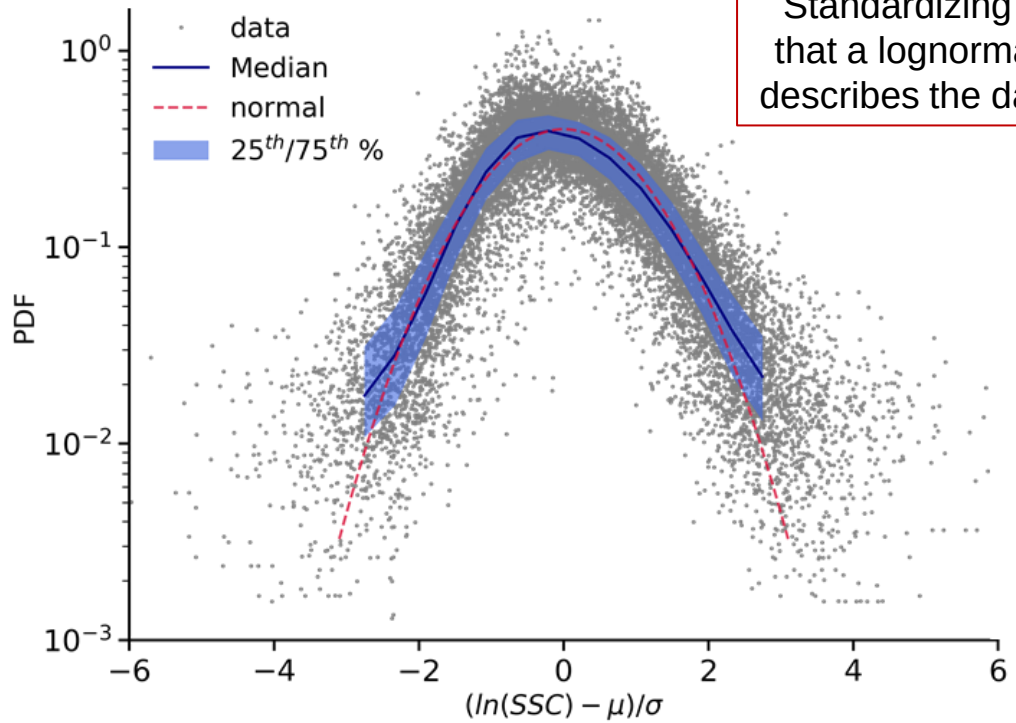
Suspended sediment dynamics – US Geological National Water Quality Assessment Database

- No consistent trend between SSC~Q.
- For each site data appear to be approximately lognormally distributed suggesting that a catchment's SSC signal can be well described by a common probability distribution function.





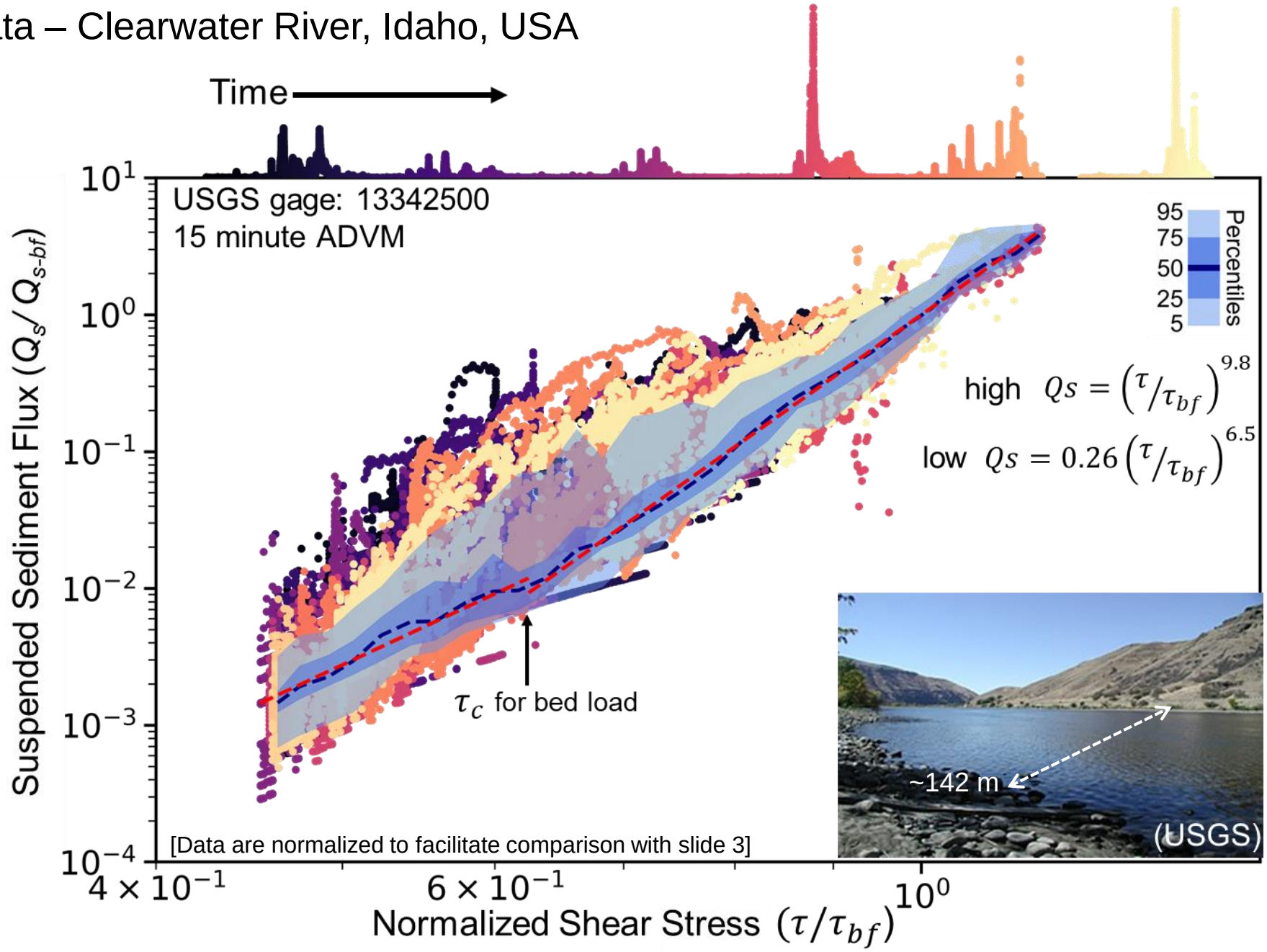


Standardizing data reveals that a lognormal distribution describes the data cloud well.

Importance of High resolution data – Clearwater River, Idaho, USA

Key points High resolution data show substantial complexity in time around a well defined set of trends. The first order nonlinear trend with shear stress indicates a system where the flux is controlled by local hydraulics and the fluid momentum. Deviations from the trend may contain signals of on catchment processes.

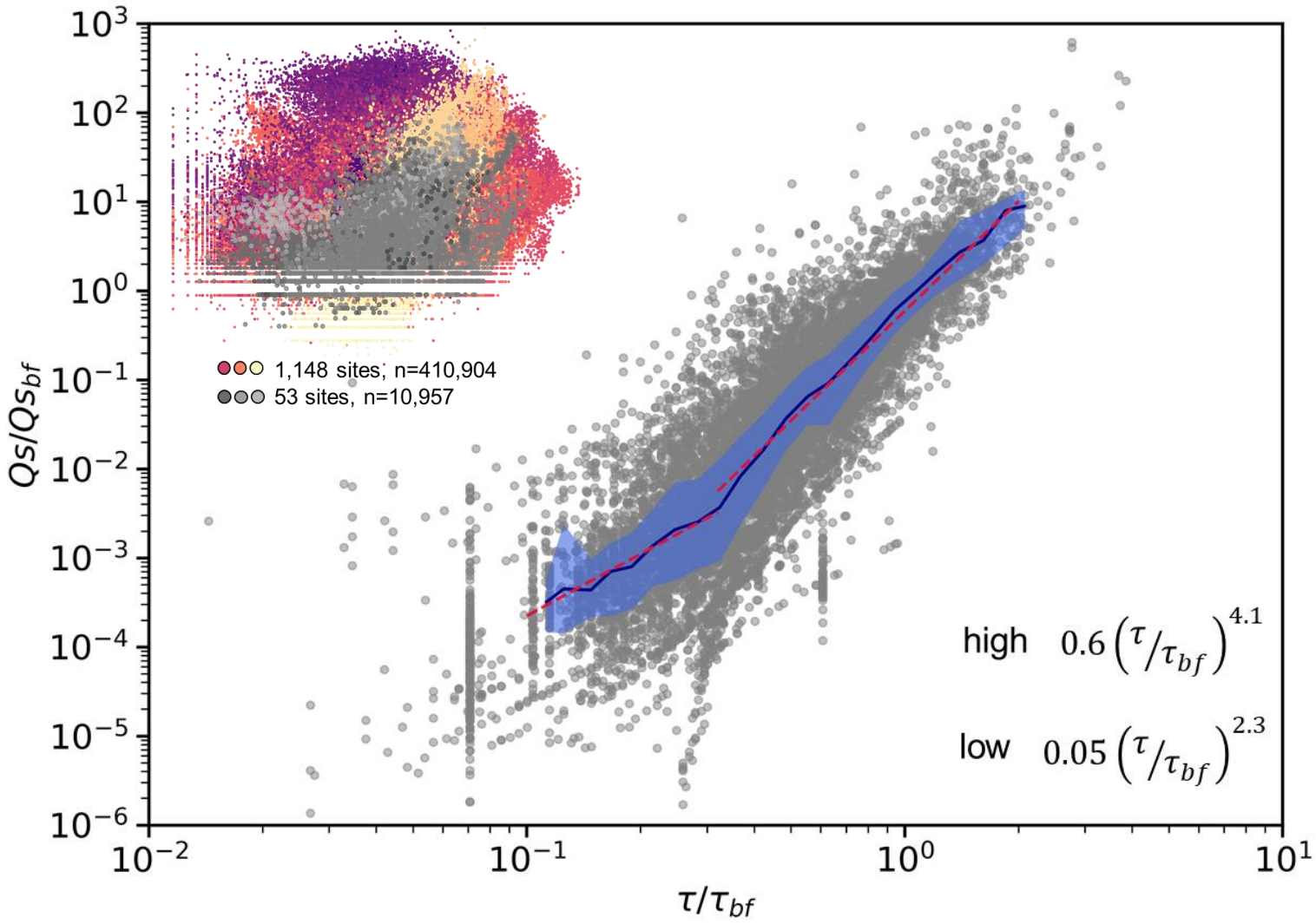
High resolution data reveal processes that may be obscured (presence of scaling break due to bed mobility) within low resolution data. A nonlinear trend is expected based on Rouse-Vanoni profile flux models, however the slope break indicates the importance of other processes.



Channel self-organization limits the flux of fine material from watersheds

Key points The multi-site data synthesis demonstrates that normalizing by the suspended sediment flux by the bankfull τ and bankfull flux (Qs_{bf}) results in a collapse of the observed data onto a single function that describes a self-organizing structure for suspended sediment transport in watersheds.

The shear stress (τ) is limited in self-organized channels by bank stability. By limiting τ, channel geometry also limits how much sediment can be transported in suspension. The bankfull τ represents the average value for the distribution of flows capable of destabilizing the channel. The origins of the collapse provided by the bankfull flux are less clear (though Qs_{bf} is linearly correlated to the average), the observed scaling suggests a surprising degree of organization within the supply of material to the channel throughout the catchment. That the flux can be understood to a first order through two variables at the reach scale suggests strong support for the role of near or in channel storage and autogenic processes in setting the flux of fine particles and erosion rates of watersheds. Between scenarios A-C from the introduction.



- 53 sites have necessary data to compute shear stress with an independently identified bankfull discharge to identify τ_{bf}.

Please do not hesitate to email me with questions!