

The Effect of Grain Interlocking on Thresholds of Motion in Gravel-Bed Rivers

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Background and Motivation

Understanding controlling factors of sediment transport enhances understanding of migration of fluvial systems. The threshold of motion (τ_c^*) describes the shear stress (τ) a fluid must overcome to entrain and transport sediment.

A variety of factors effect τ_c^* . Our goal is to isolate the effect of grain interlocking.

Questions to be Addressed

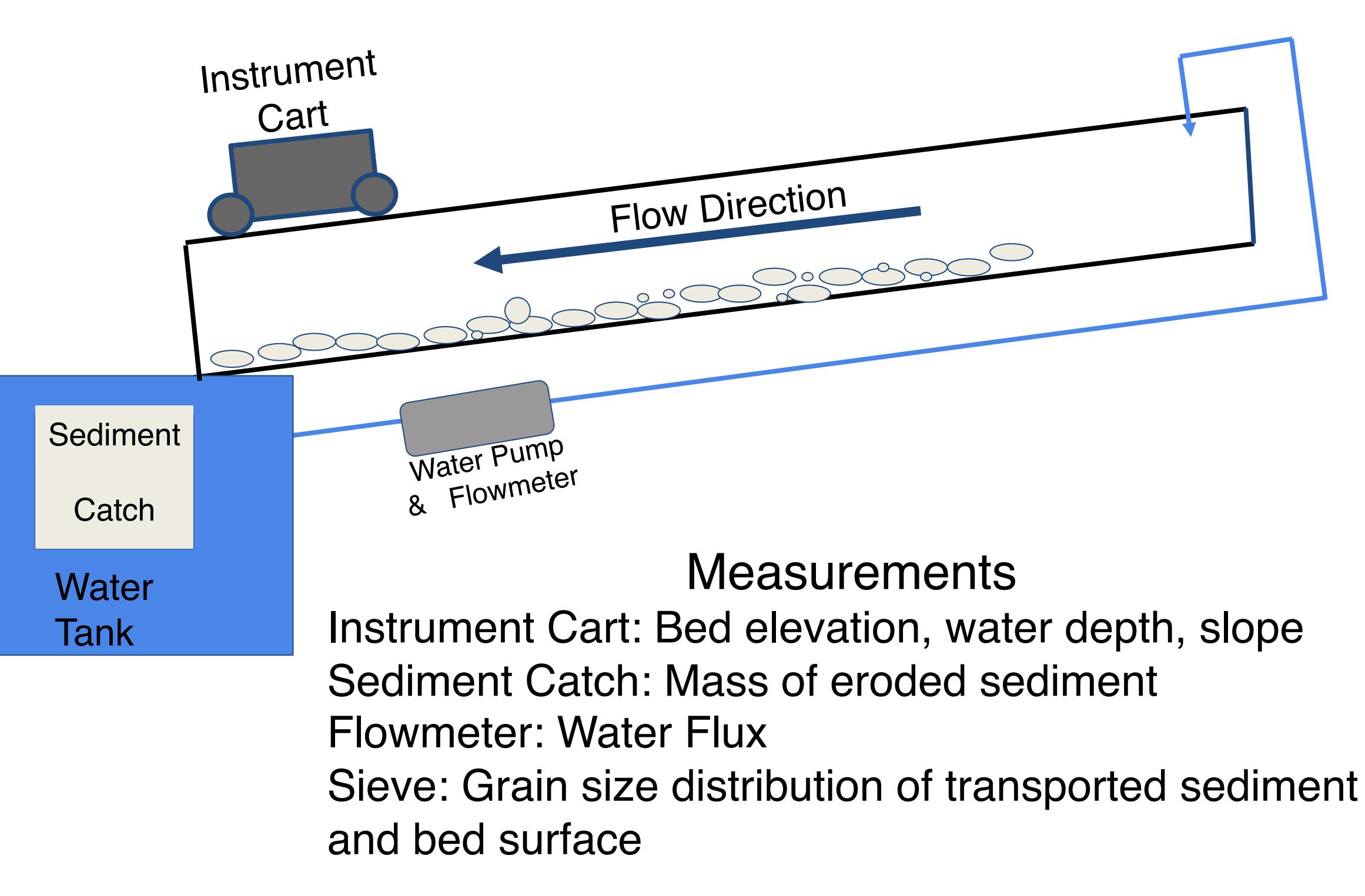
Does the interlocking of grains have a noticeable affect on the threshold of motion in a gravel-bedded system?

Is this effect systematic and quantifiable?

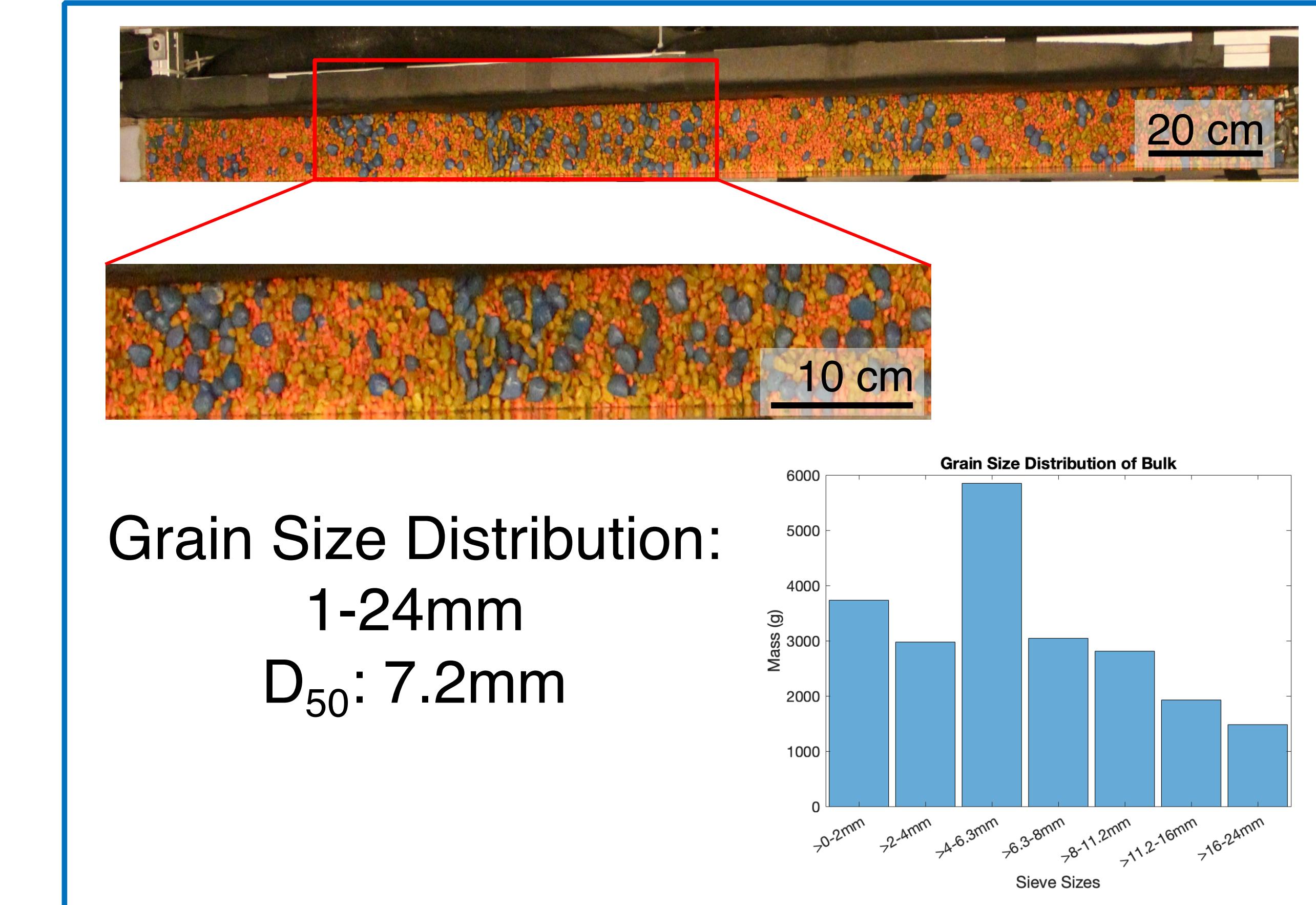
Experimental Setup



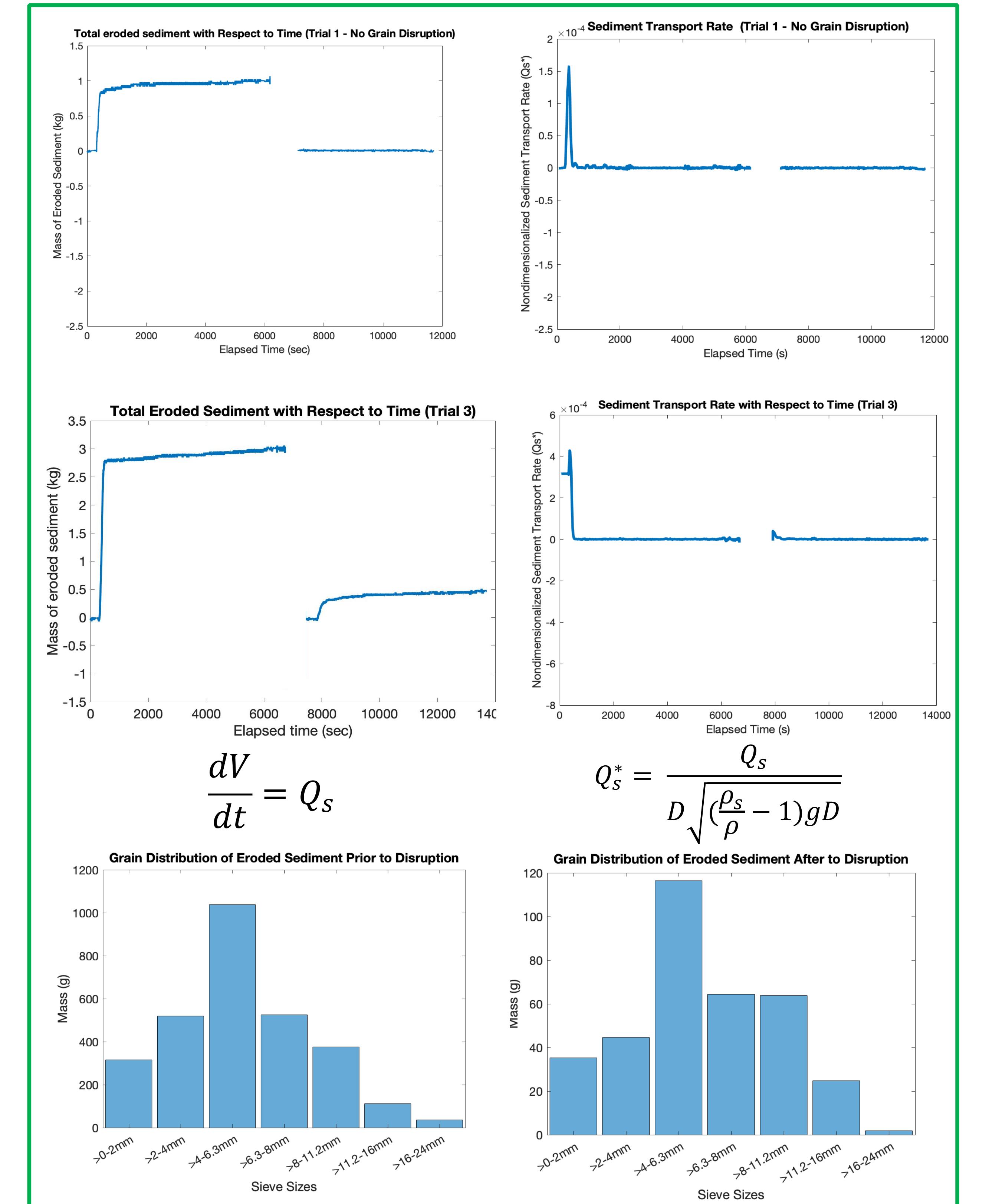
Water exerts constant shear stress on bed load eroding grains with $\tau_c^* \leq \tau$ until bed is at equilibrium.



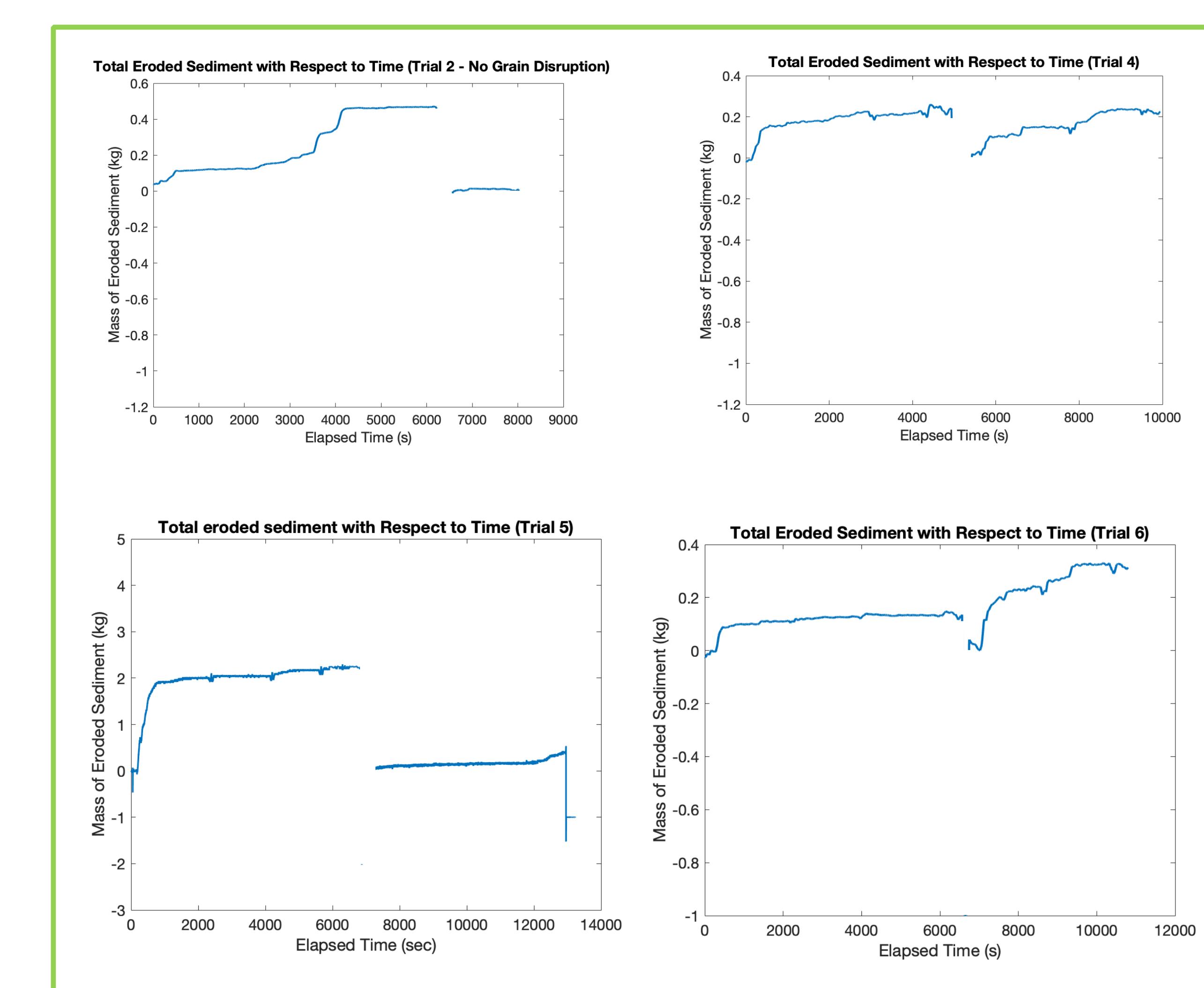
Grain Size Distribution



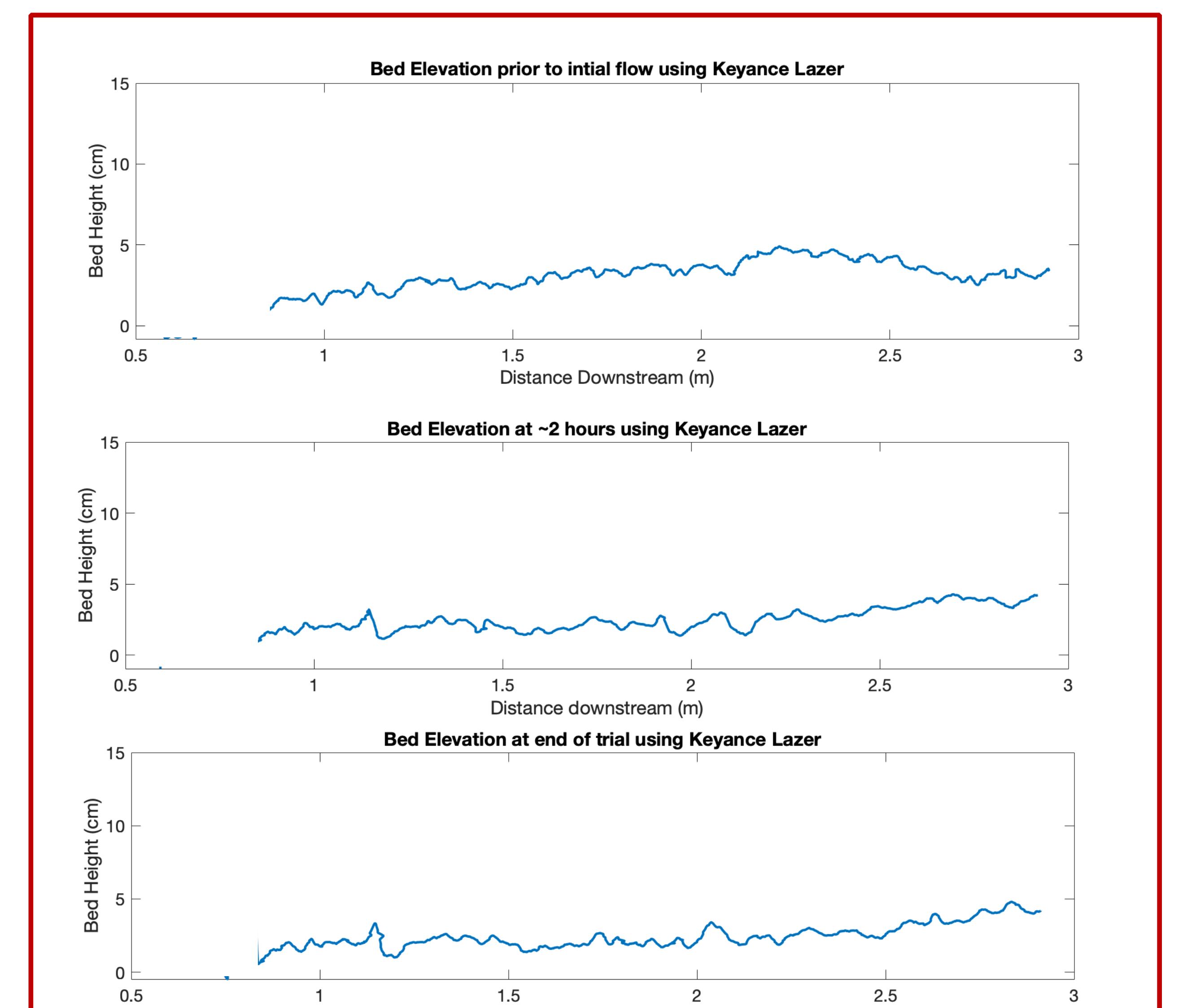
Sediment Transport



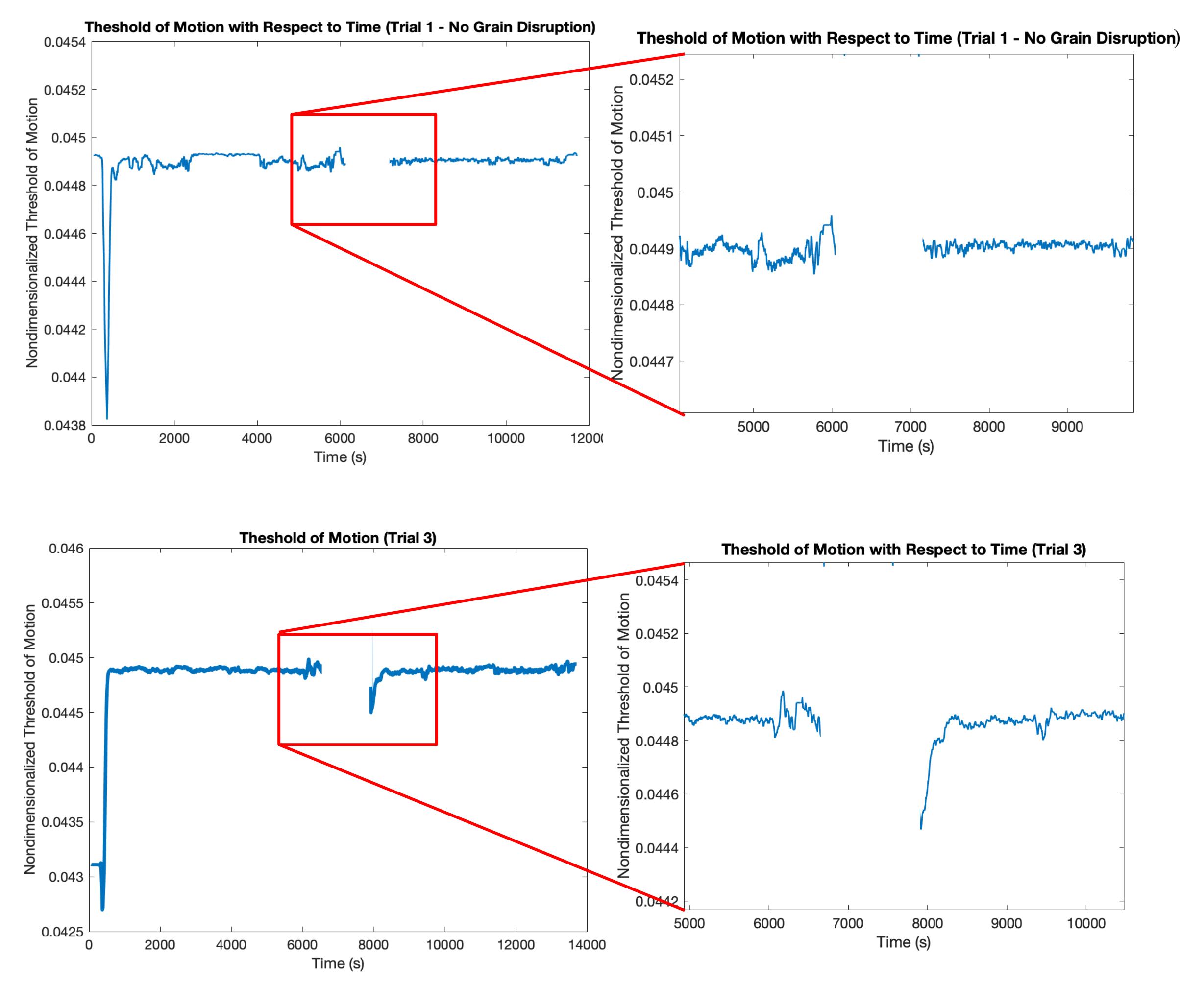
Sediment Erosion



Evolution of Bed



Thresholds of Motion



Final Thoughts & Future Work

- The effect of grain interlocking has a noticeable effect on the threshold of motion.
- This experimental method successfully isolates the effect of grain interlocking.
- Increase sample size to better confine the reduction in the threshold of motion.
- Analyze photographs of bed for visual interpretation of changes in bed geometry.

Acknowledgements

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References

- Wilcock, P. R. and Crowe, J. C (2003), Surface-based transport model for mixed-sized sediment
- Johnson (2016), Gravel threshold of motion: a state function of sediment transport disequilibrium?
- Masteller, C. C., and N. J. Finnegan (2017), Interplay between grain protrusion and sediment entrainment in an experimental flume
- Lamb, M. P., W. E. Dietrich, and J. G. Venditti (2008), Is the critical Shields stress for incipient sediment motion dependent on channel-bed slope?