

# Filtering the hydrograph through sediment transport & channel geometry

ST. ANTHONY FALLS LABORATORY

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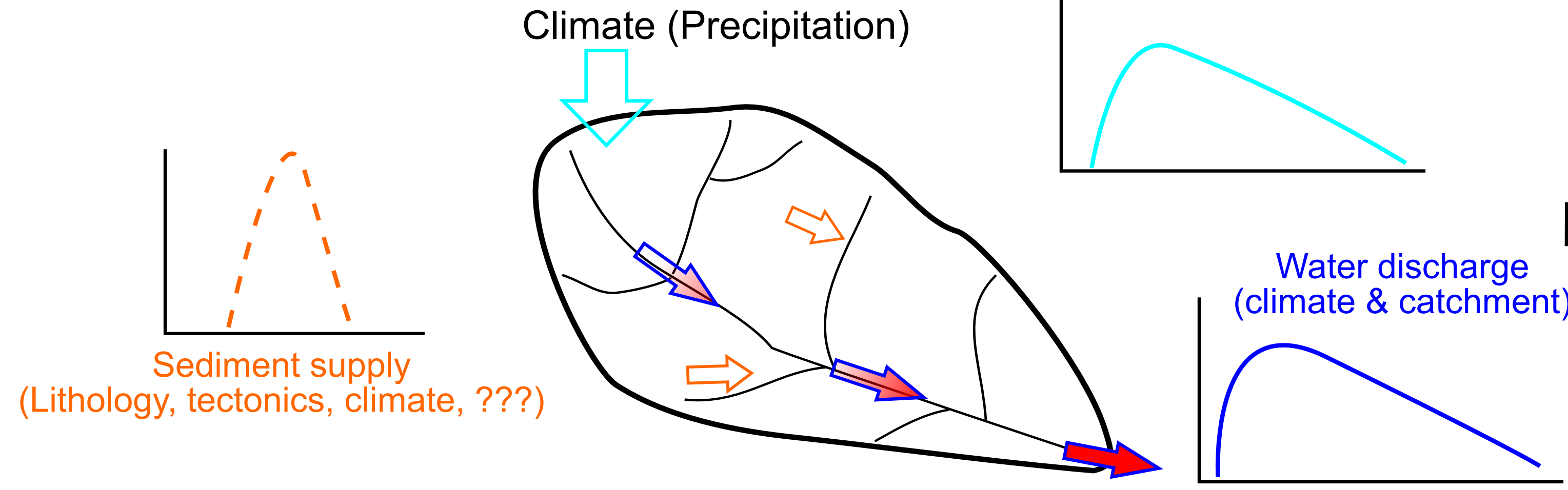
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<sup>4</sup>Earth and Environmental Science, Univ. of Pennsylvania.

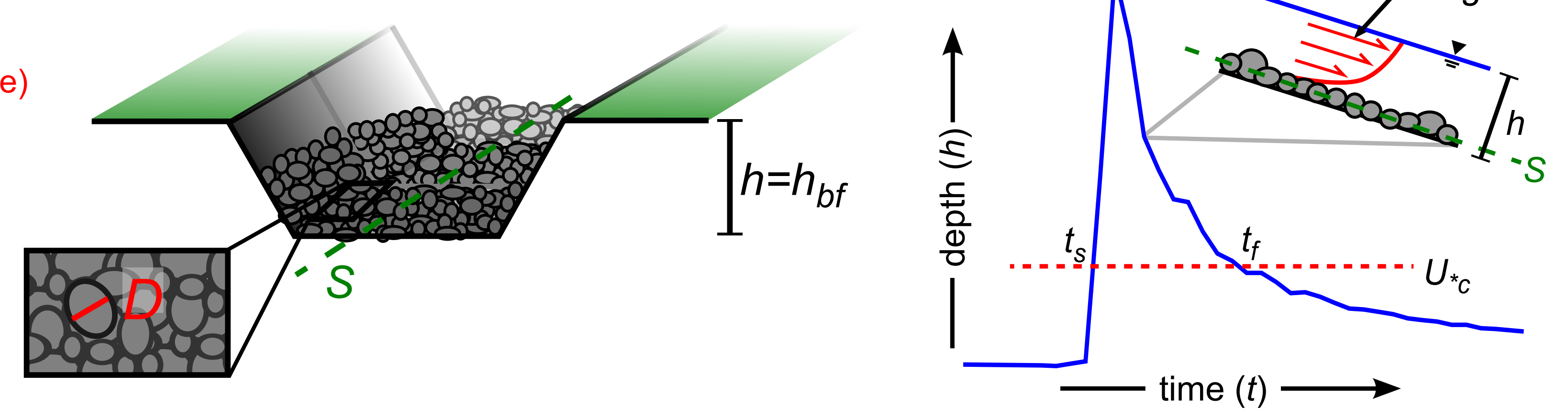
colinbphillips@gmail.com



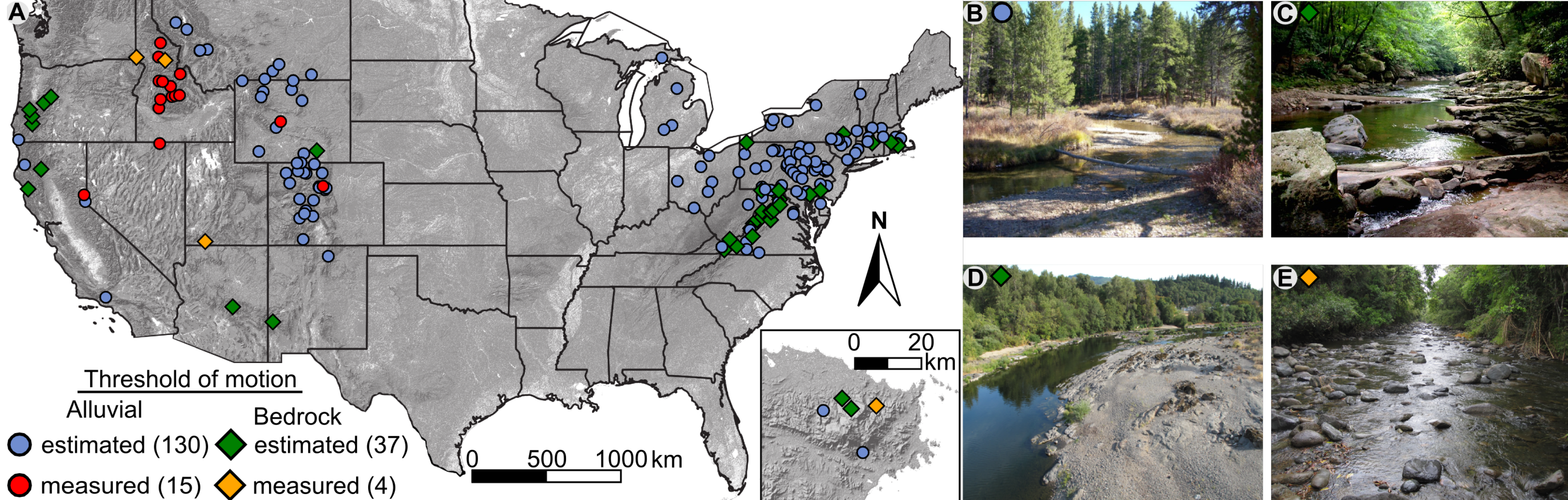
## Hypothetical catchment



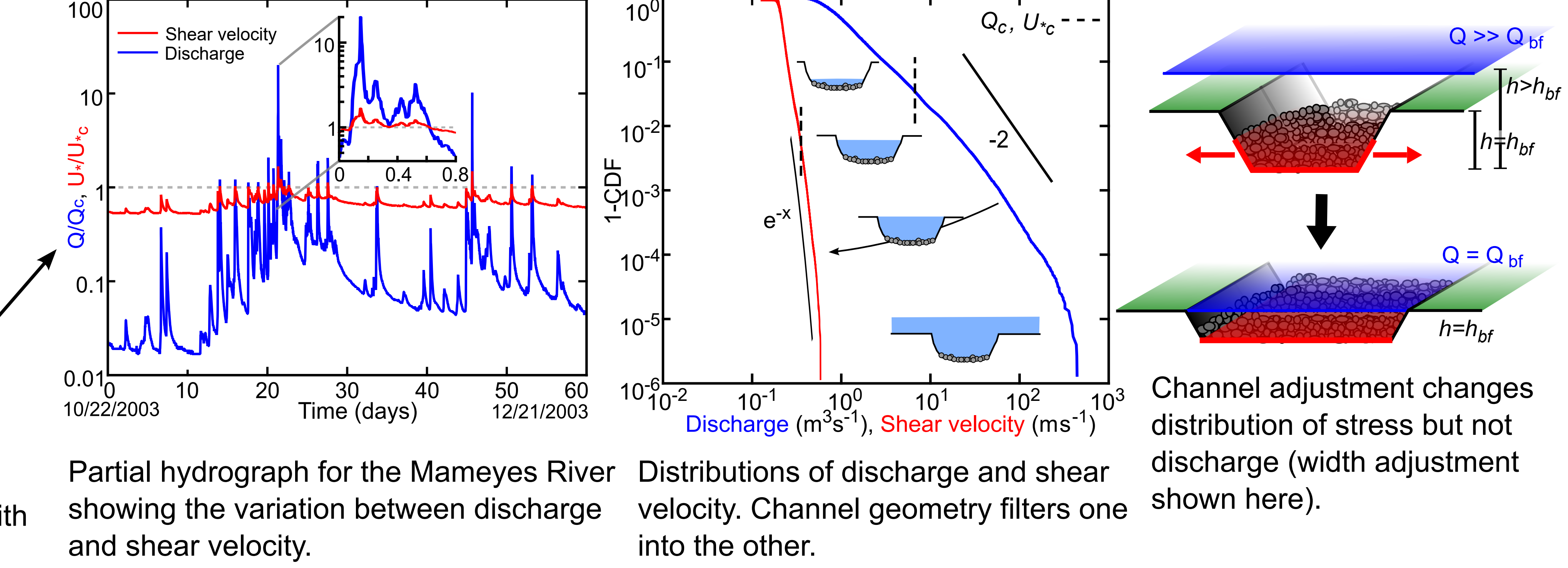
## Field site measurements



## Field site locations



## Hydrographs and statistical scaling of Discharge and Shear velocity



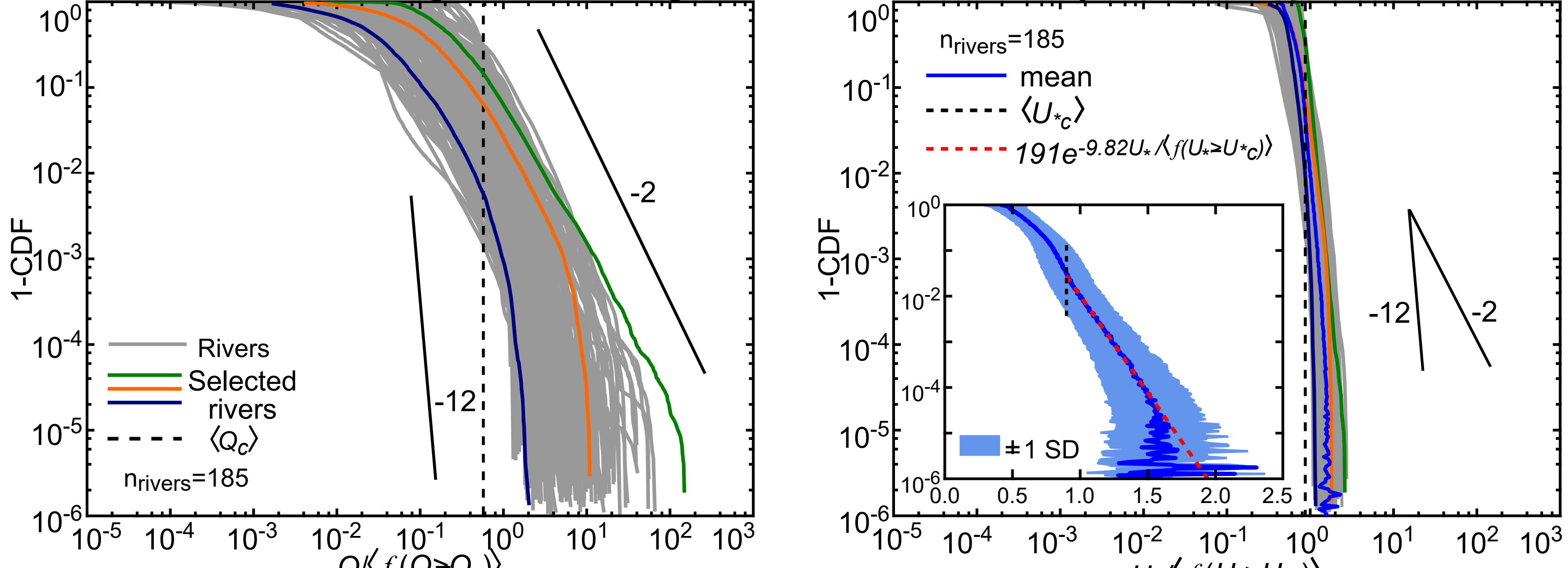
Locations of 186 USGS stream gages analyzed in this study. Field sites span a wide variety of climatic, lithologic, and tectonic regimes. Each field site has 10 years of 15 minute instantaneous discharge data, with channel slope, grain size, and channel geometry measured in the field.

Partial hydrograph for the Mameyes River showing the variation between discharge and shear velocity.

Distributions of discharge and shear velocity. Channel geometry filters one into the other.

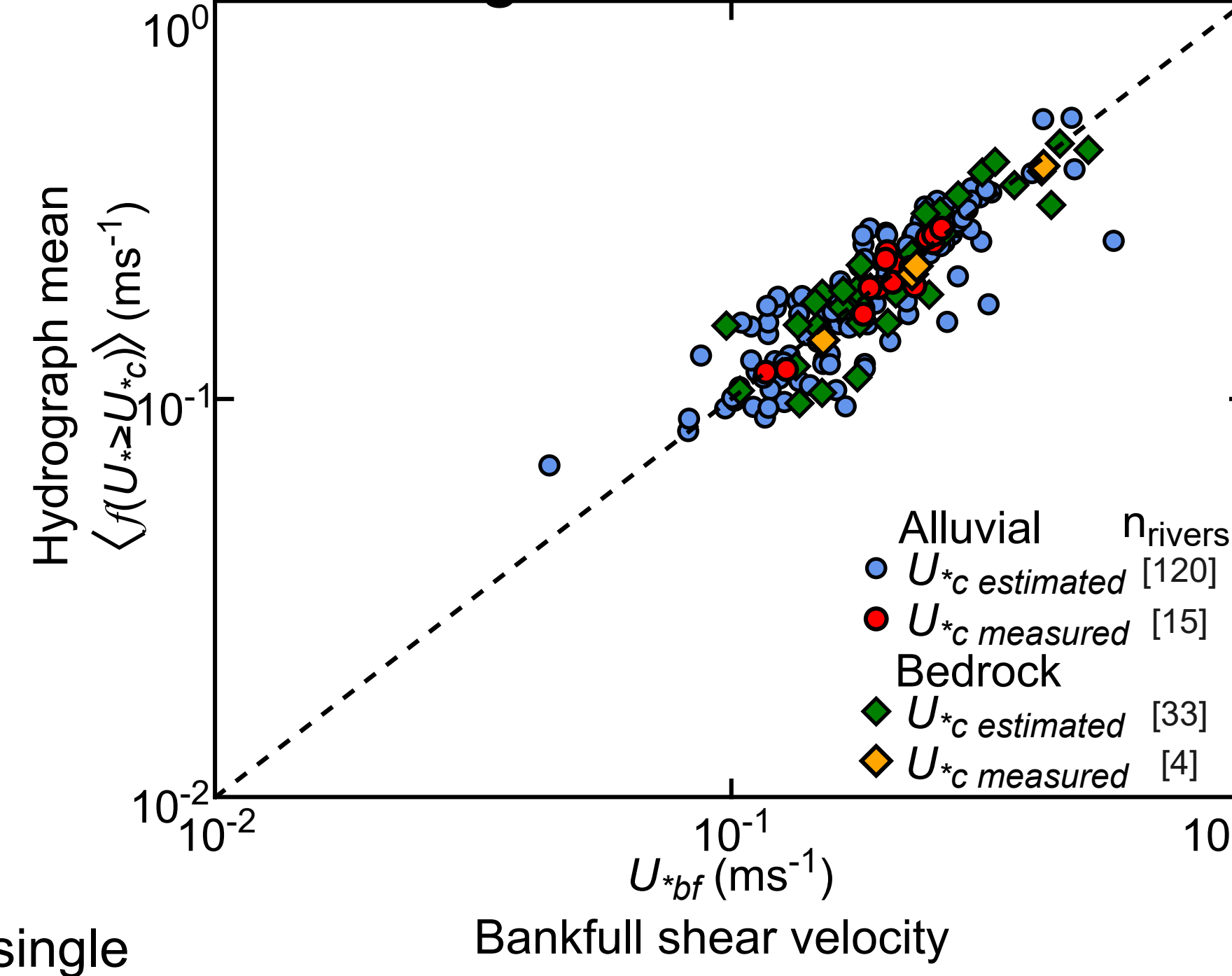
Channel adjustment changes distribution of stress but not discharge (width adjustment shown here).

## Statistical scaling of discharge and shear velocity for all field sites

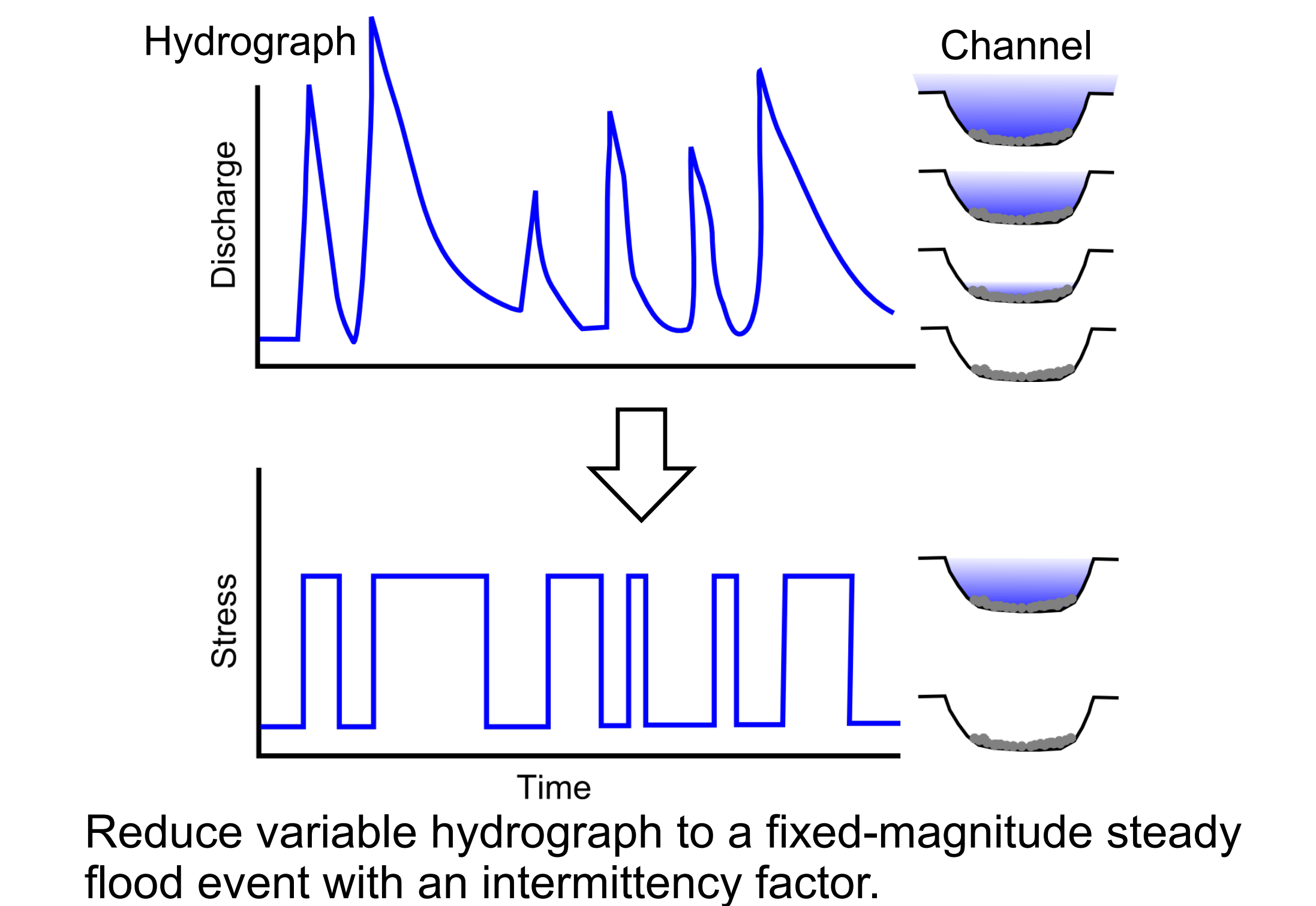


Distributions of discharge and shear velocity for all fields sites. Shear velocity distributions collapse to a single functional form when scaled by the mean shear velocity above the threshold of motion, while discharge does not.

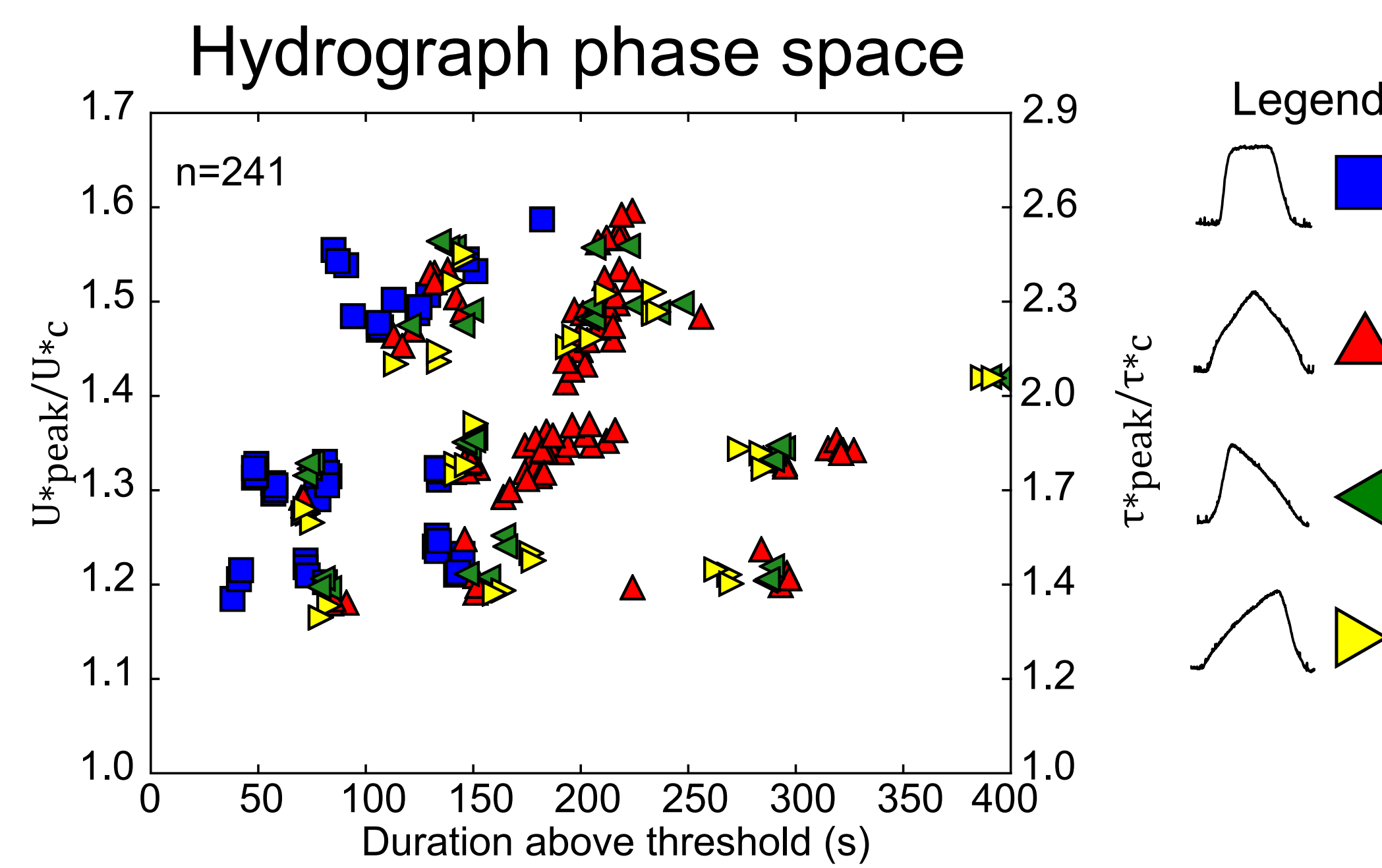
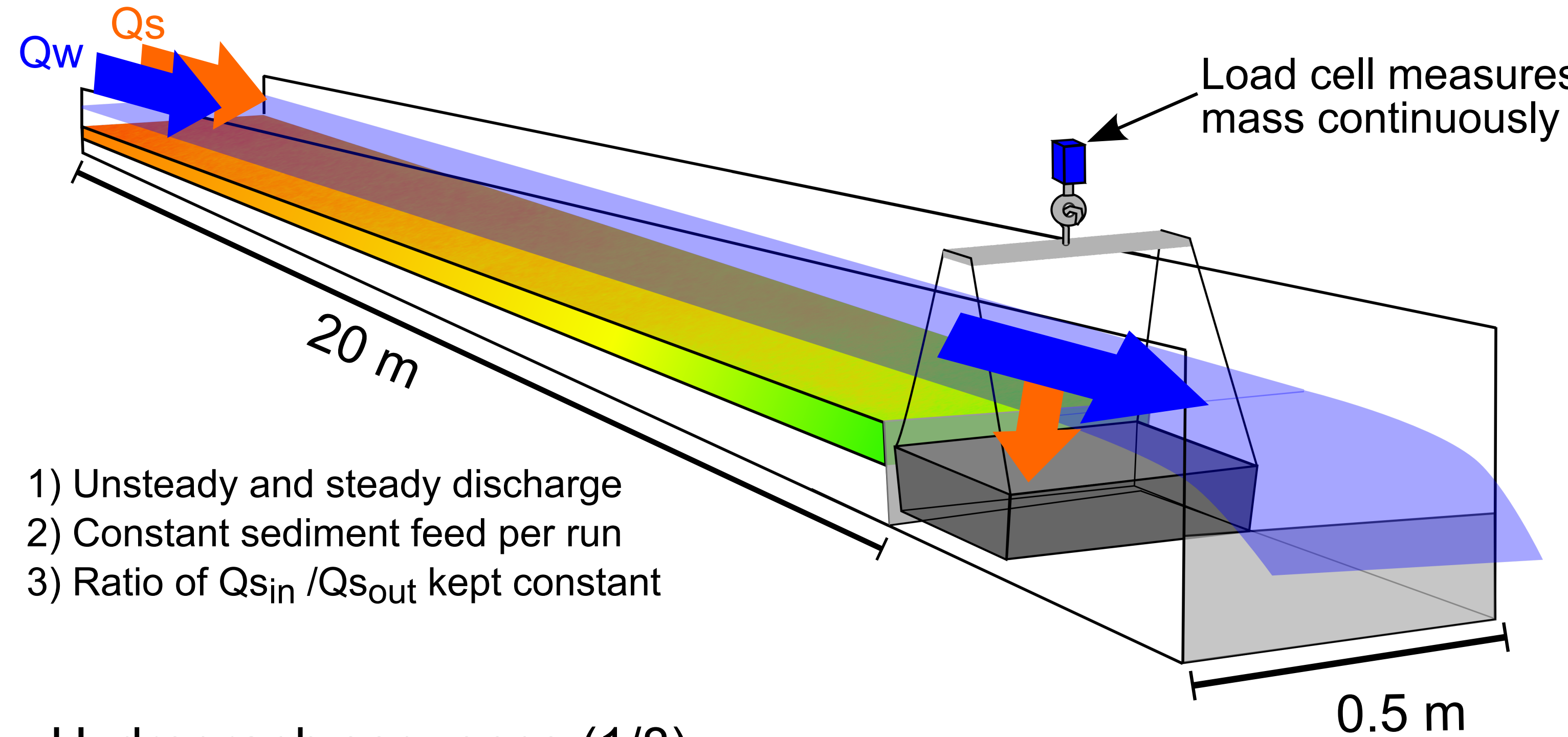
## Average stress is bankfull



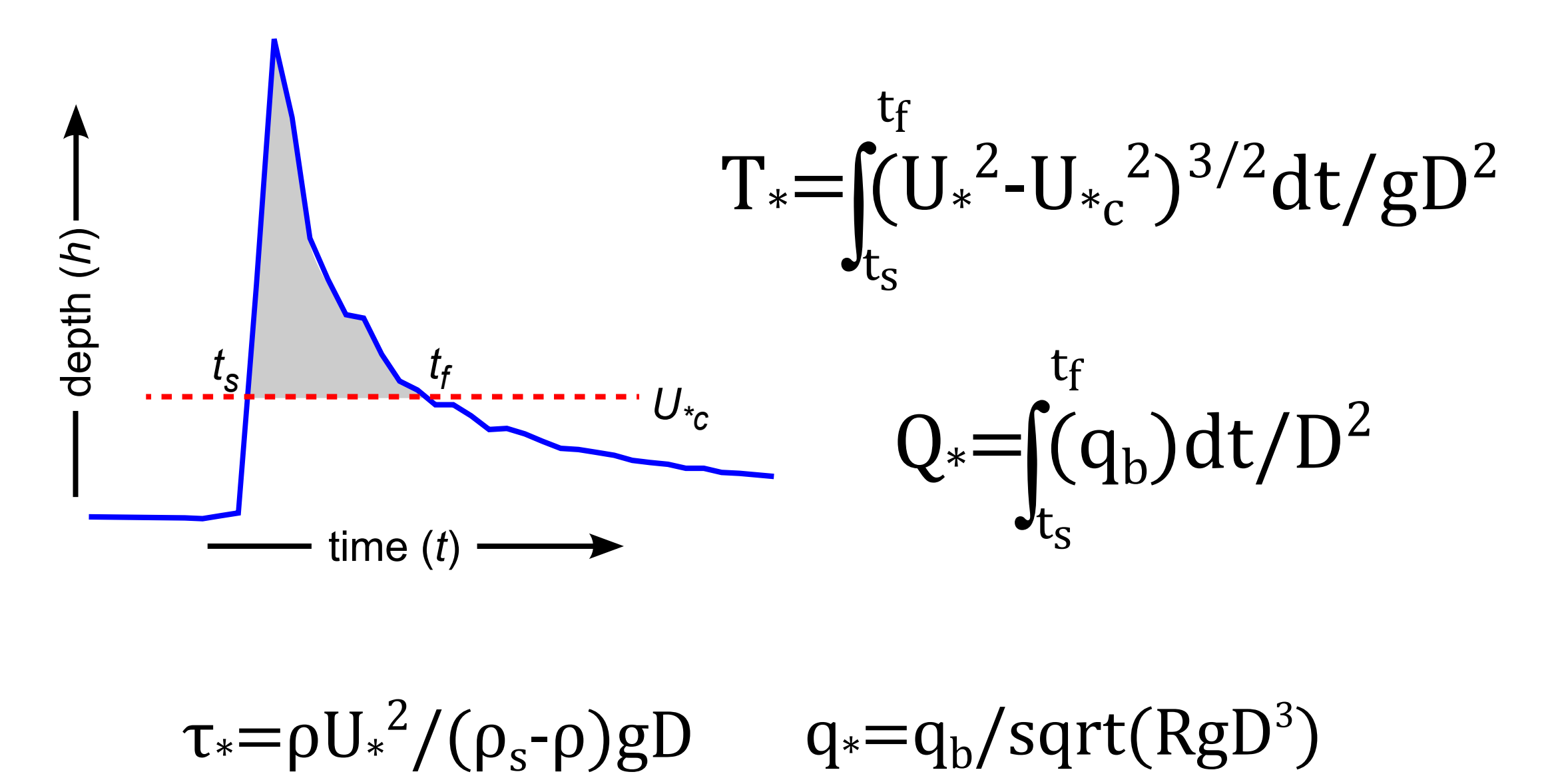
## Conclusion A - Long timescale approximation



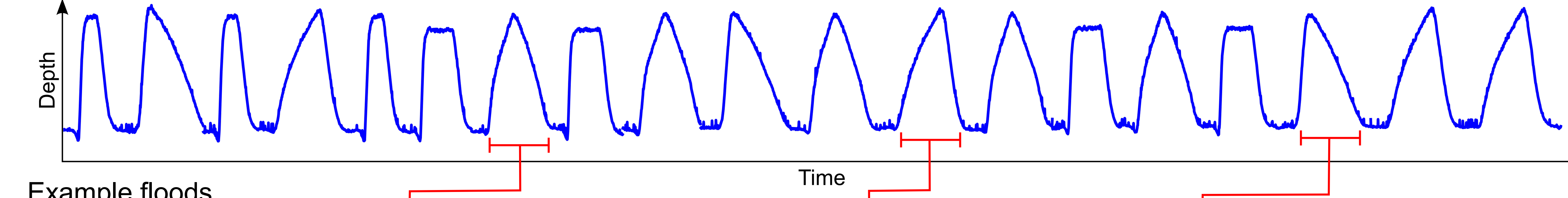
## Laboratory flume experiments on flow transience and bed load sediment transport



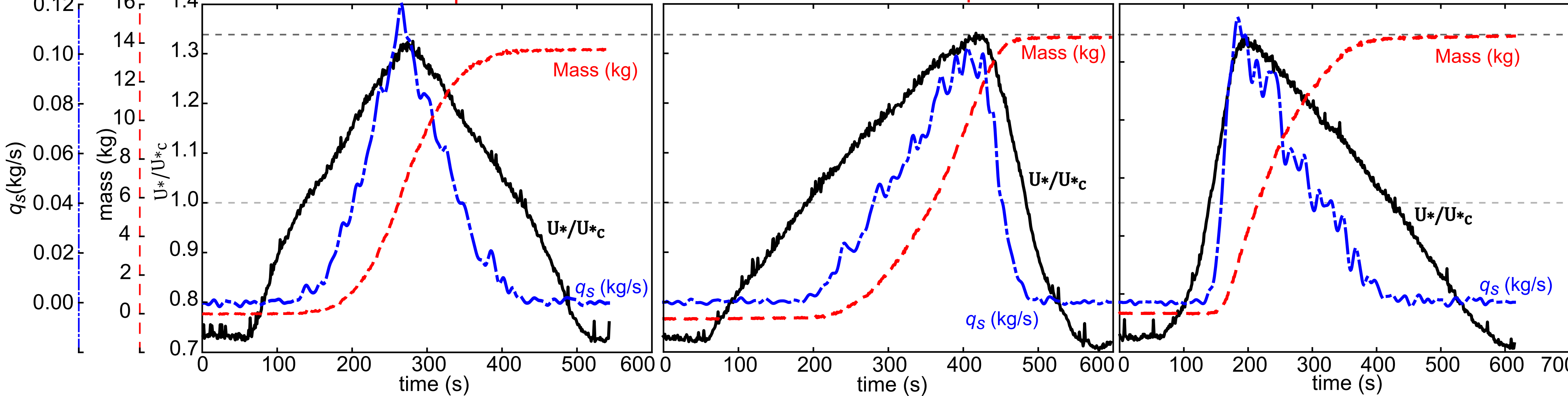
## Dimensionless integrated Forcing & Flux



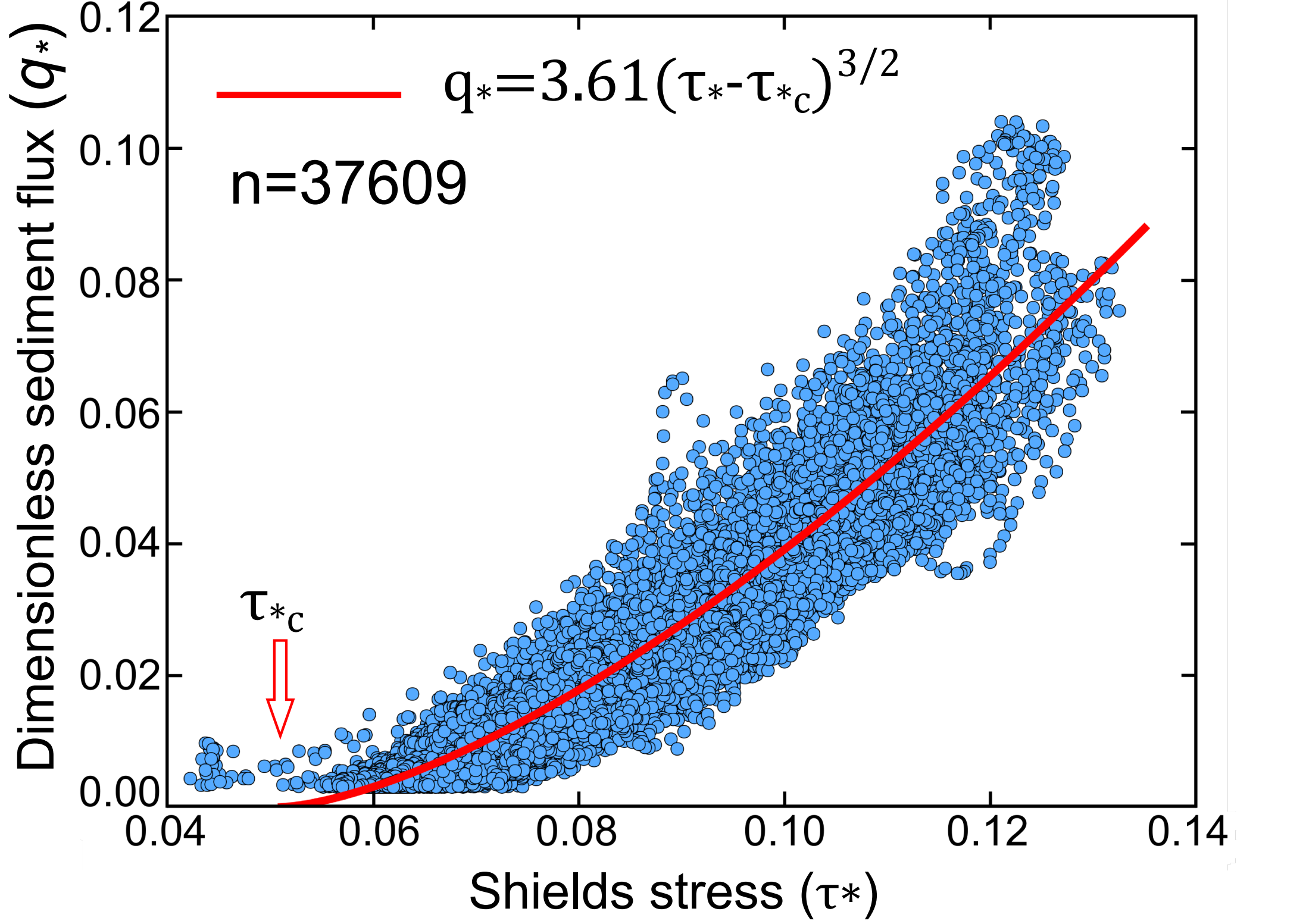
## Hydrograph sequence (1/8)



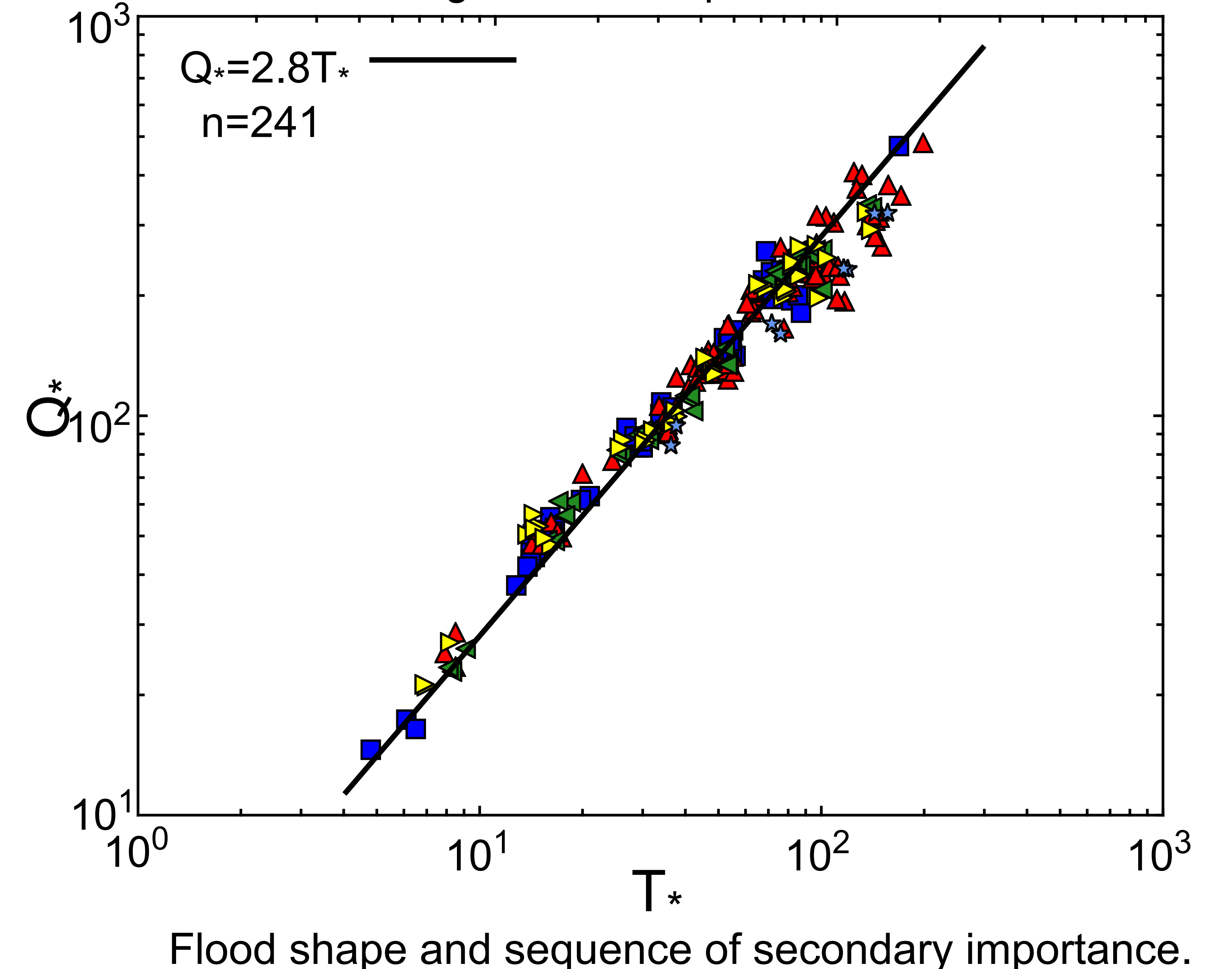
## Example floods



## Bulk transport law & threshold of motion



## Linear scaling between impulse and total flux



Complex transport phenomena occurs at timescales within floods.

Conclusion B - Transient floods may be approximated by steady flow with equal  $T_*$ .

