EGU General Assembly 2022

Multi-river Calibration Curve for Passive Acoustic Bedload Transport Monitoring

Presented by :

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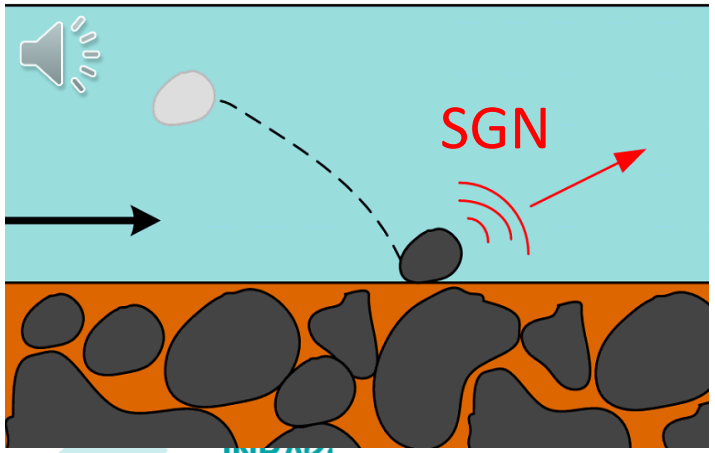
(1) (2) (3)

Monitoring of bedload flux by acoustics (Hydrophone)

- Sediments moving along the bottom of the watercourse generate sounds called self generated noise (SGN). (1)

Bedload self generate noise(1)



Monitoring of bedload flux by acoustics (Hydrophone)

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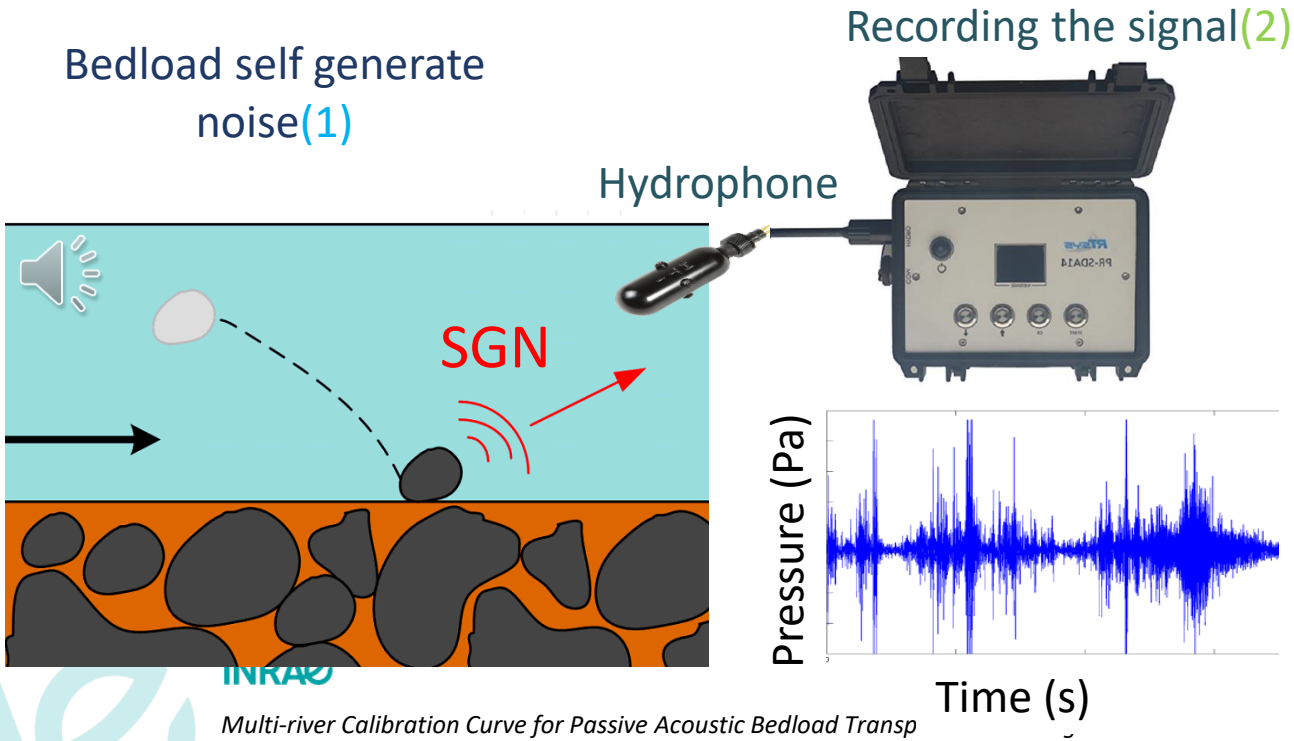


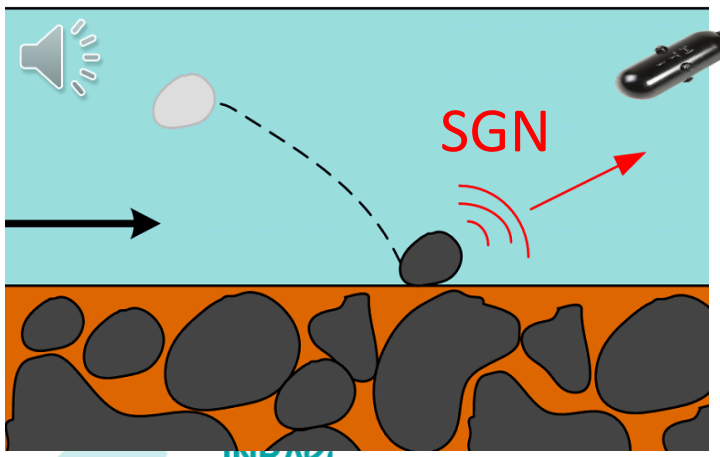
Monitoring of bedload flux by acoustics (Hydrophone)

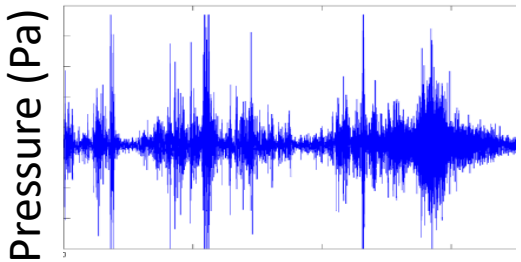
- Sediments moving along the bottom of the watercourse generate sounds called self generated noise (SGN). (1)
- Hydrophone measures the sounds in water. (2)
- Analyzed acoustic signal contains information about bedload flux and grain sized distribution. (3)

Bedload self generate noise(1)

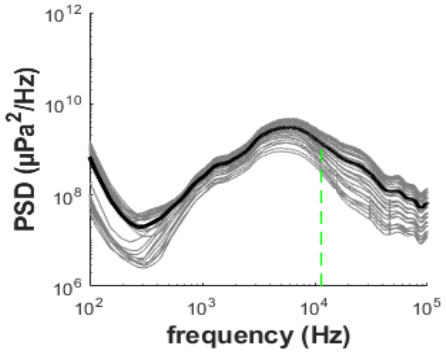
Recording the signal(2)

Hydrophone

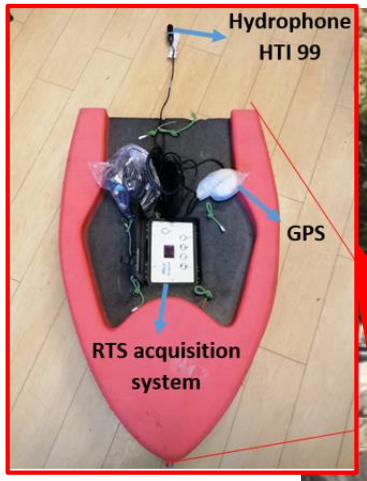




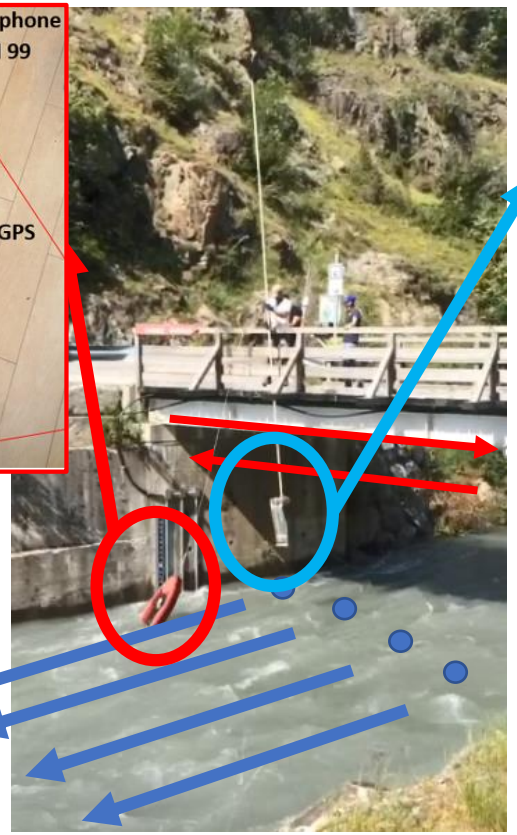
Signal analysis (3)



Global Calibration Curve



Hydrophone



Elwha sampler

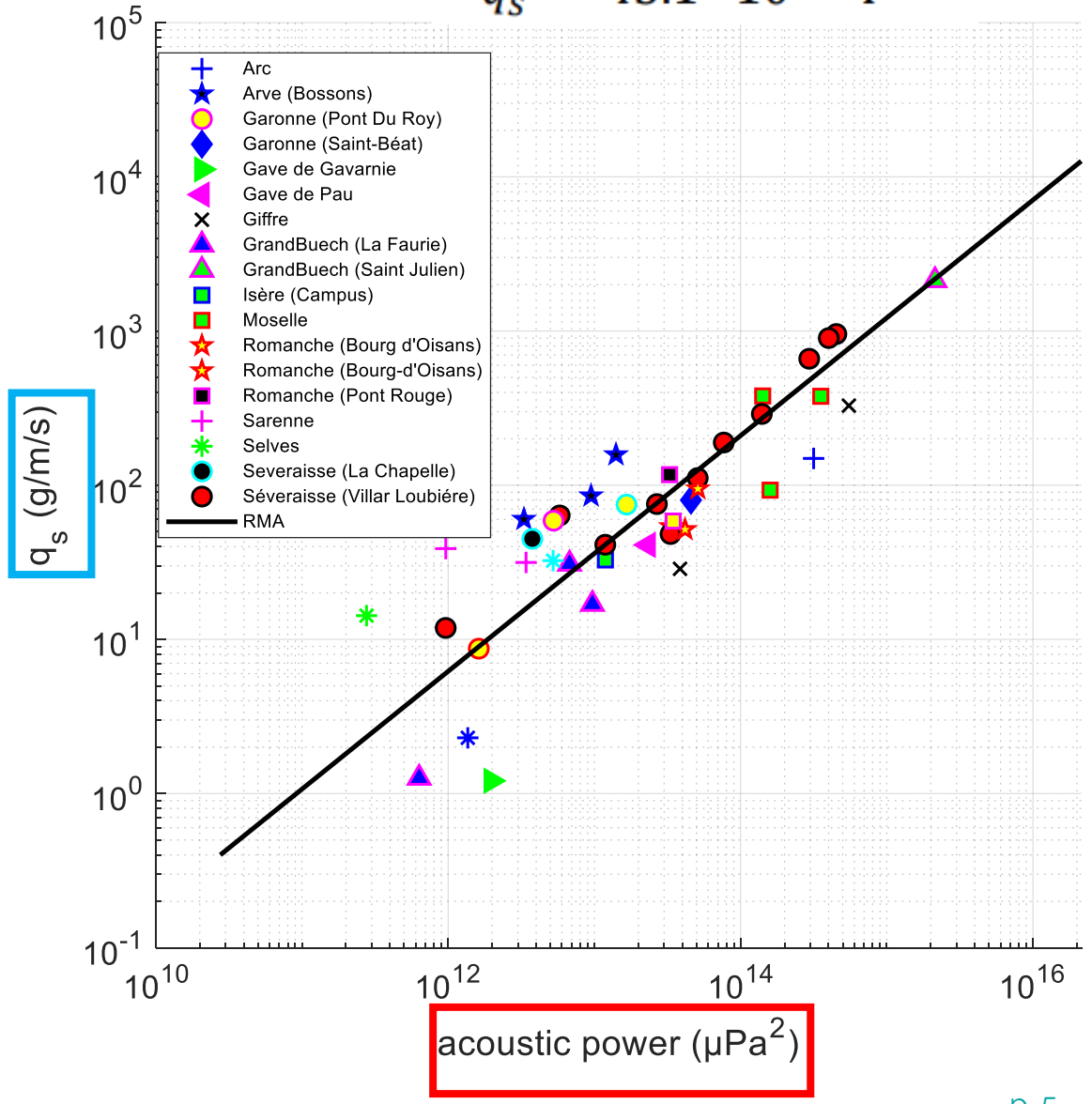
13 Different rivers

42 experiences

(17 + 25 Geay et al. (2021))

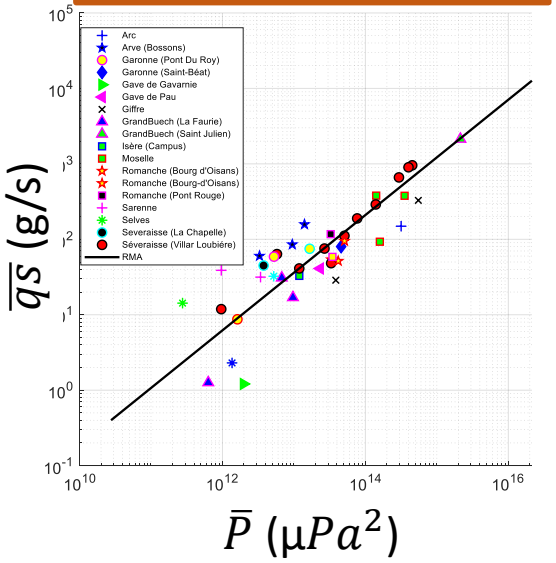
$$R^2 = 0.72$$

$$\bar{q}_s = 43.1 \cdot 10^{-10} \bar{P}^{0.76}$$

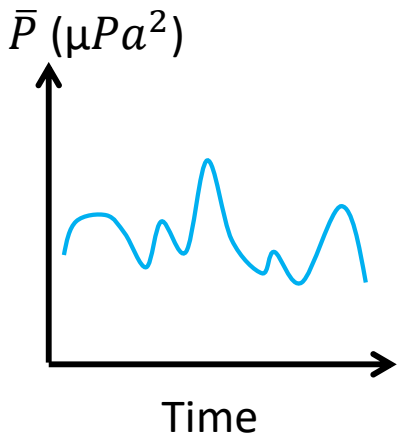


Towards Continuous Monitoring of Bedload Flux?

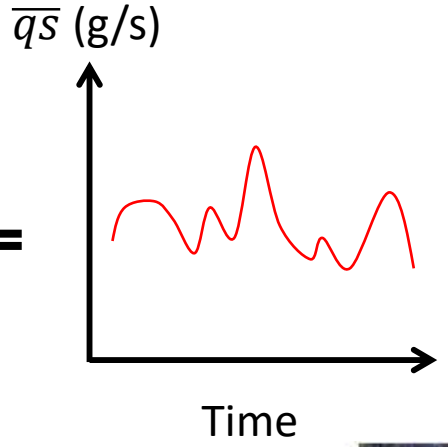
Global calibration curve



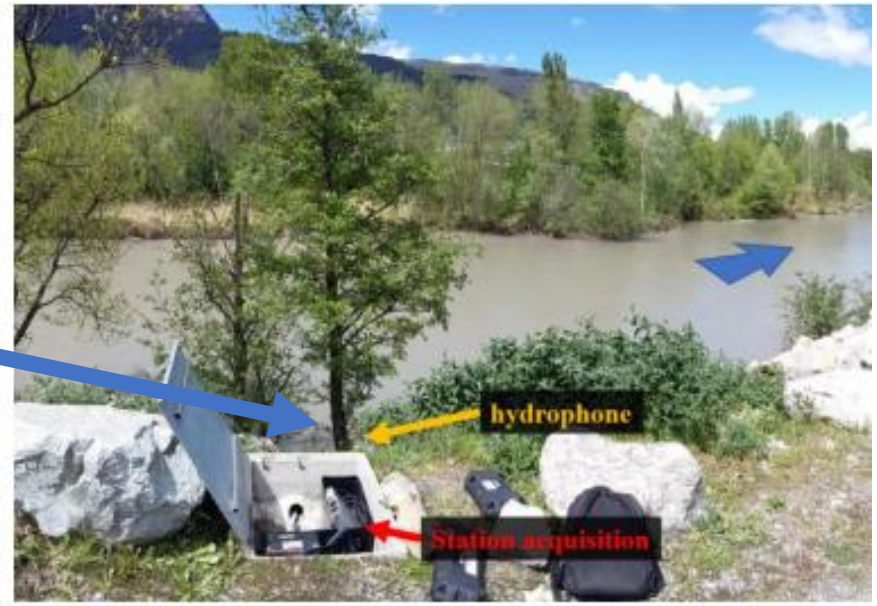
Continuous acoustic measurements



Continuos estimation of bedload flux



Hydrophone installed on river bank



Conclusion

- Acoustic method can be used as indirect method to monitor bedload flux in rivers.
- Field measurements shows encouraging results for the acoustic method.
- Additional investigation is required to develop the acoustic method up to operational use.

Thank You

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End of thesis in Dec 2022 ➡ Open to post doc

Publications:

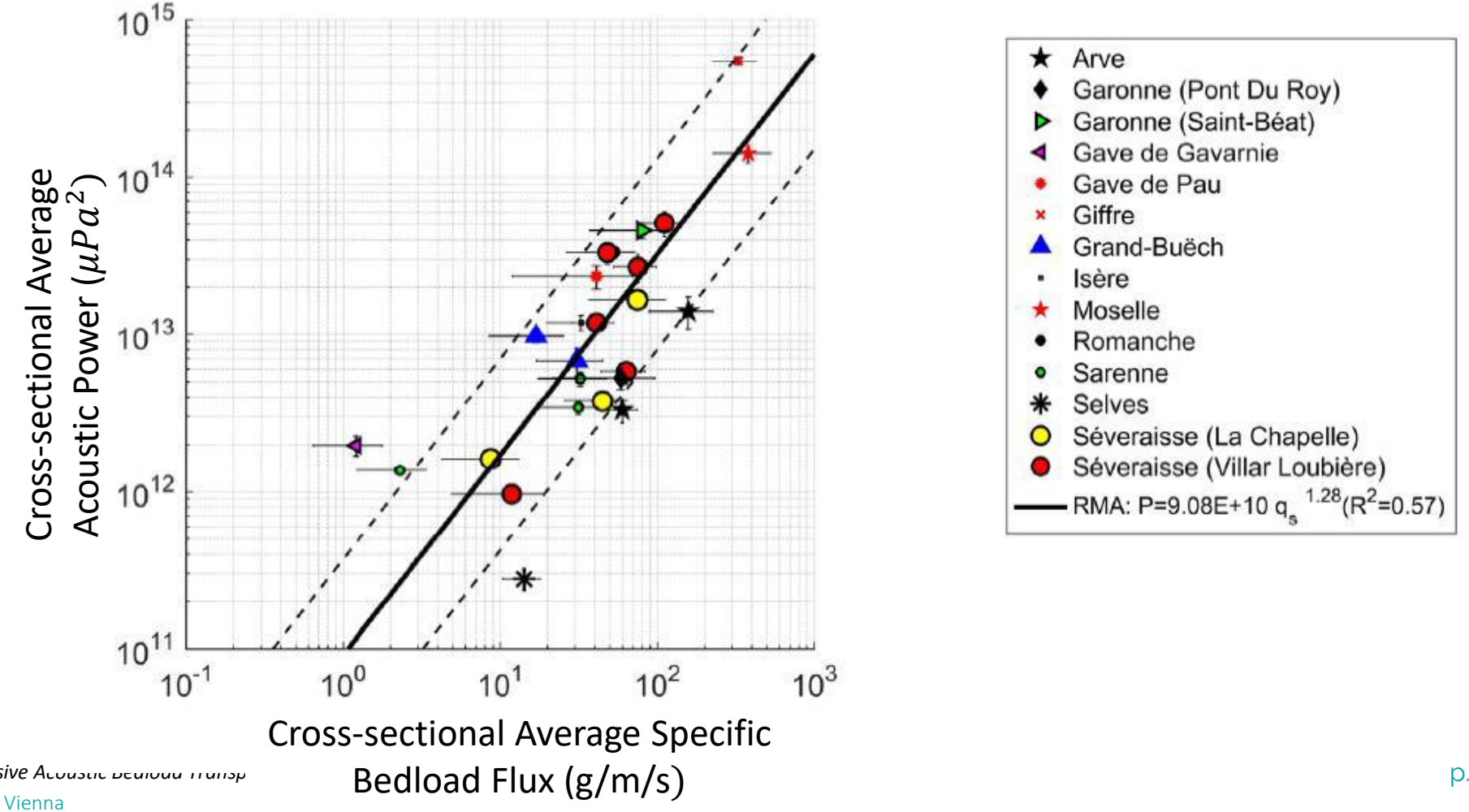
- Development of Model for Acoustic Noise Generated from Bedload in Rivers (DOI: 10.1029/2019JF005242)
- Bedload Monitoring With Hydrophones: A Field Validation (in revesion ESurf)

Severaisse River 2021

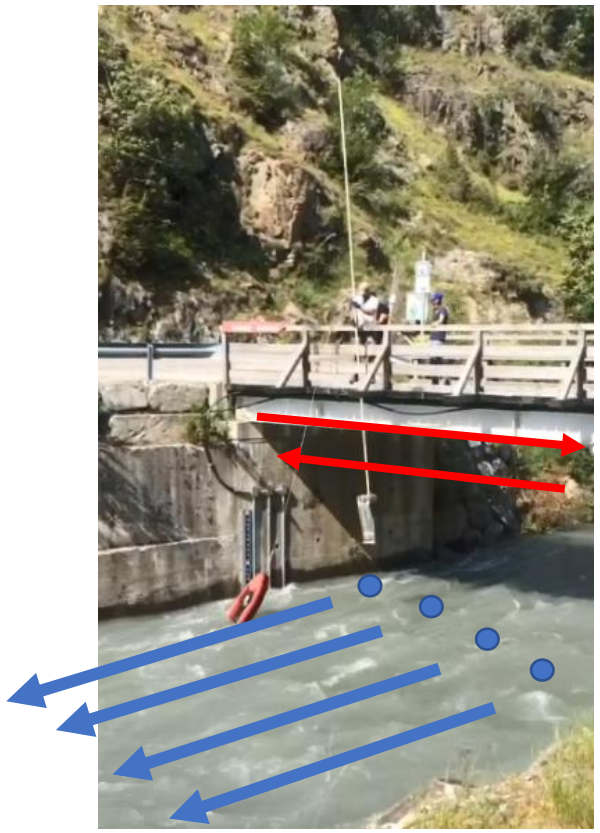
Field Campaign 2021-Objectives

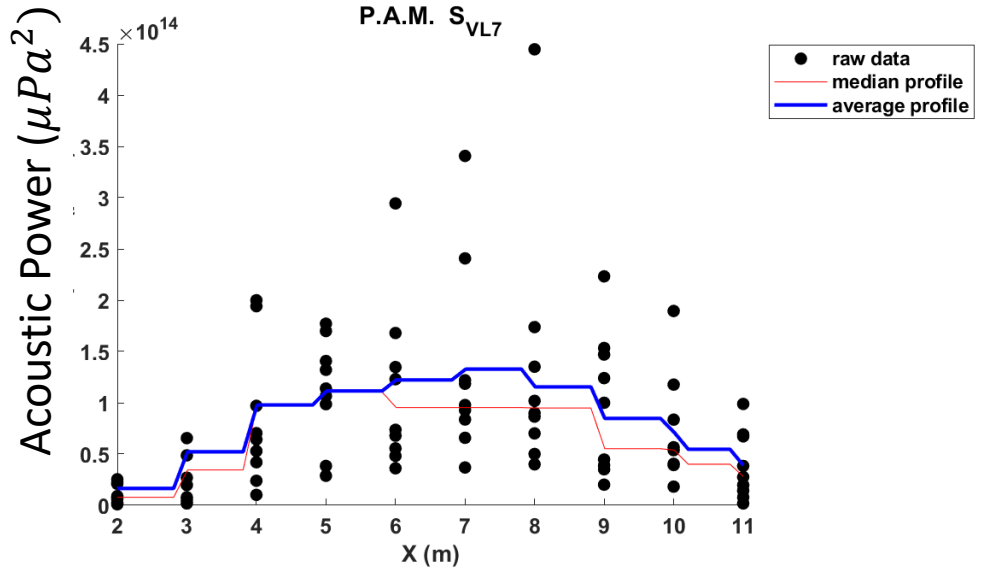
Objectives:

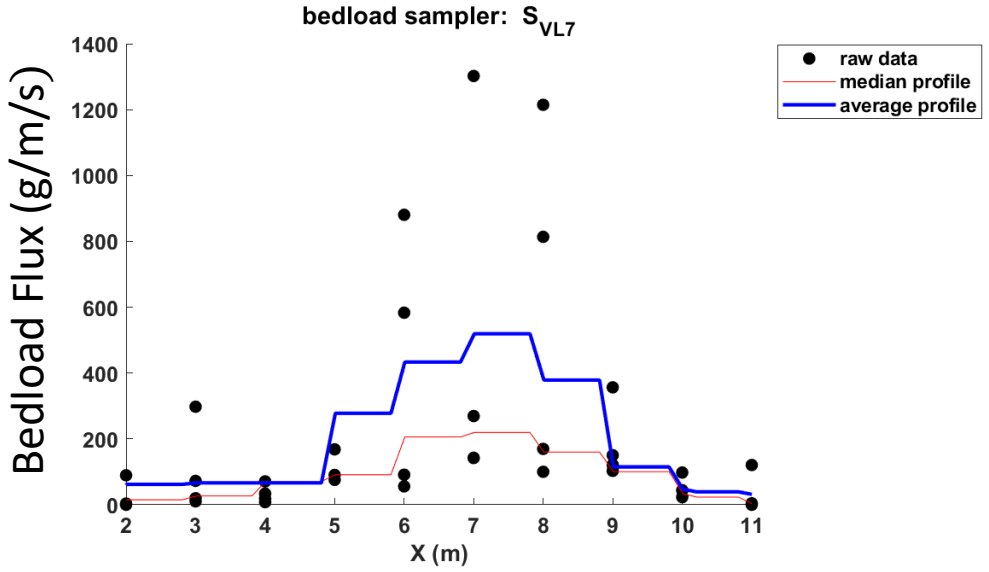
- Reinforce the robustness of the calibration curve (Geay et al. 2020)



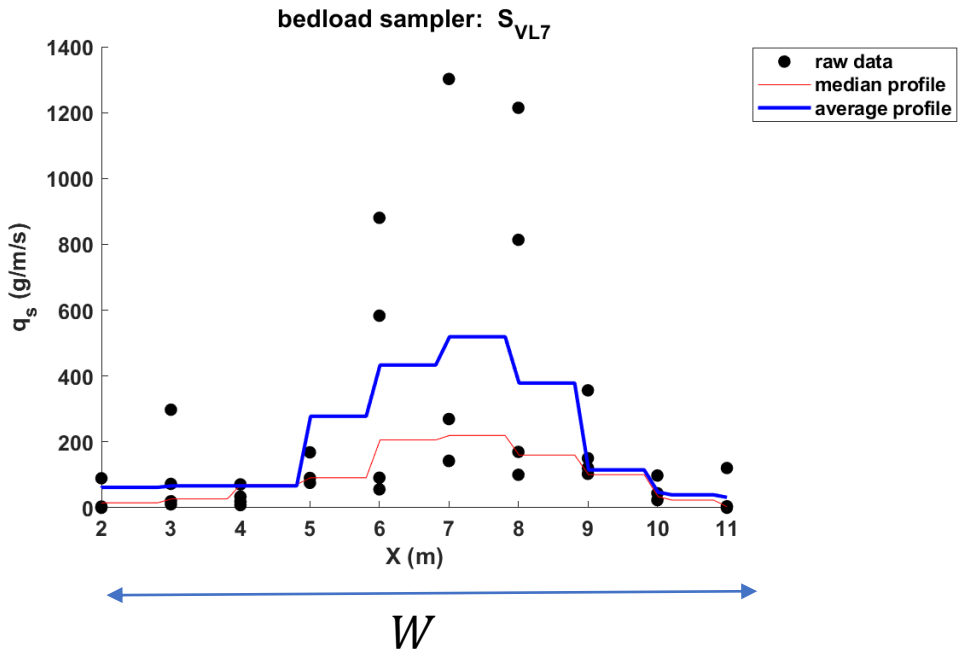
Acoustic and Bedload Flux Prof

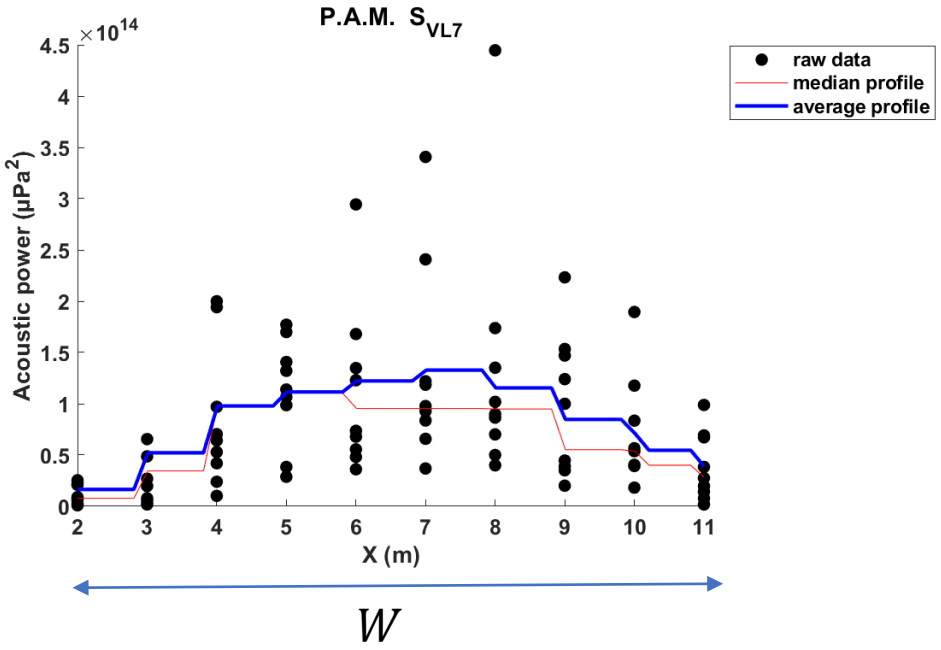






Acoustic and Bedload Flux Cross-sectional Average Values





$$\bar{q_s} = \frac{\int_0^W q_{s,x} dx}{W},$$

$$\bar{P} = \frac{\int_0^W P_x dx}{W},$$

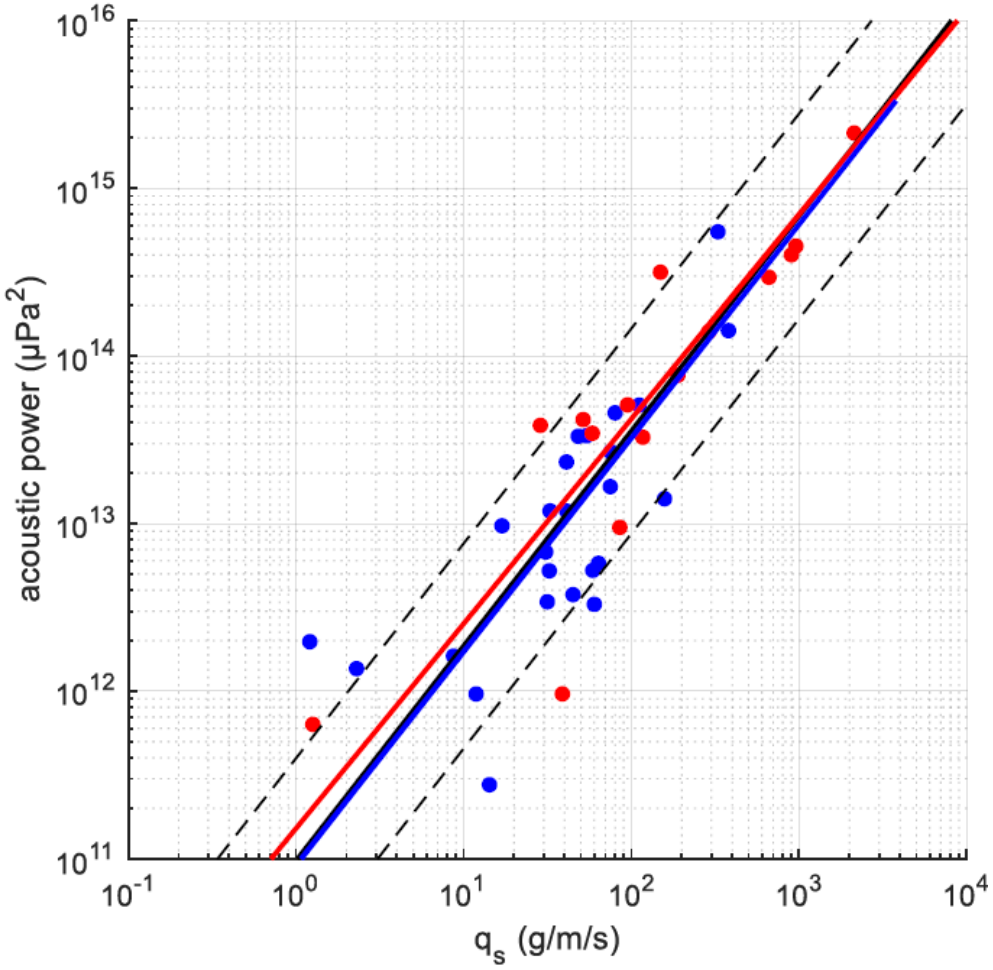
Results-Calibration Curve

42 points

2021
2017-2018
All data

$$\bar{P} = a\bar{q}_s^b$$

	$a\ (10^{10})$	b	R^2
2017-2018	9	1,27	0.57
2021	15.1	1.22	0.78
All Data	9.7	1.28	0.72



Global Calibration curve

Correlation of bank measuremetns of acoustic map