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Supplement of

Optimization of passive acoustic bedload monitoring in rivers by signal inversion

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Additional Supporting Information (Files uploaded separately)

Recording samples and bedload flux data are presented in (Nasr, Mohamad; Johannot, Adele ; Geay, Thomas ; Zanker, Sebastien ; Recking, Alain; Le Guern, Jules (2022), “Optimization of passive acoustic bedload monitoring in rivers by signal inversion ”, Mendeley Data, V1, doi: 10.17632/vygy6tsy5n.1)

S1. Measured and inversed acoustic profiles

This section presents the dataset for the global calibration curves (Geay et al., 2020; Nasr et al., 2023) and the inversed global calibration curve presented section 6.2 in the manuscript.

Table S1. A summary of the measured sites of and their corresponding characteristics. Where S is the local slope of the river, W is the width of the river section, $\alpha_{\lambda s}$ is the attenuation coefficient for the spherical model, H is the average water level, V is the flow velocity, $\overline{q_s}$ and $\bar{P}$ are the cross-sectional average specific bedload flux and acoustic power respectively.

River	**Location**	**S (m/m)**	**W (m)**	$\boldsymbol{\alpha_{\lambda,s}}$	**H (m)**	**V (m/s)**	**Bedload GSD $\boldsymbol{D_{50}}$ (mm)**	$\bar{q}_s$ **(g/s/m)**	$\boldsymbol{\bar{P}}$ **($\boldsymbol{10^{12}\ \mu Pa^2}$)**	$\boldsymbol{\bar{P}}$ **inversed ($\boldsymbol{10^{12}\ \mu Pa^2/m^2}$)**
Arc	Chamousset	0.002	48	$2\cdot10^{-4}$	1.6	1.9	33.7	149.2	316.1	10.8
Arve	Bossons	0.0075	14	0.06	1.35	2.01	1.4	157.7	14.06	4.5
					1.2	1.73	1.4	60.1	3.30	1.05
					1.22	2.1	1.6	85.3	9.5	0.58
Garonne	Pont Du Roy	0.003	22	0.003	1.63	1.88	3.5	58.9	5.3	0.19
	Saint-Béat	0.0041	32	0.006	1.25	2.31	3.5	80.1	45.8	3.60
Gave de Gavarnie	Villelongue	0.003	27	0.003	0.7	1.70	1.9	1.2	1.97	0.10
Gave de Pau	Ayzac-Ost	0.003	35.3	0.003	1.53	2.50	3.9	41.0	23.3	1.02
Giffre	Samoëns	0.003	31	0.005	0.9	1.83	6.8	328.2	550.52	37.3
					0.72	1.4	3	28.7	38.5	1.5

River	**Location**	**S (m/m)**	**W (m)**	$\boldsymbol{\alpha_{\lambda,s}}$	**H (m)**	**V (m/s)**	**Bedload GSD $\boldsymbol{D_{50}}$ (mm)**	$\bar{q}_s$ **(g/s/m)**	$\boldsymbol{\bar{P}}$ $\boldsymbol{(10^{12}\ \mu Pa^2)}$	$\boldsymbol{\bar{P}}$ **inversed** $\boldsymbol{(10^{12}\ \mu Pa^2/m^2)}$
GrandBuech	La Faurie	0.007	13.5	0.02	0.65	1.65	40.8	30.8	6.76	0.36
					0.69	1.75	19.3	16.9	9.70	0.74
					0.61	1.39	5.7	1.3	0.6	0.04
	Saint Julien en Beauchêne	0.017	15.5	0.01	0.92	3.0	37	2130	2137	606
Isère	Campus	0.0005	60	10^{-4}	2.8	1.41	2.0	32.7	11.90	0.58
Moselle	Bainville-aux-Miroirs	0.0011	16	0.011	2.8	1.94	19.6	379.3	141.7	12
					2.6	2	-	356.5	353.6	23
					2	1.88	-	92.8	159.3	9.9
Romanche	Le Bourg d Oisans/Centre	0.0013	33	$1.5\cdot10^{-4}$	1.2	1.39	0.9	53.9	33.4	1.5
					1.18	1.6	1.2	51.6	41.7	1.5
					1.64	1.9	0.9	94.9	51.1	2.5
	Le Bourg d’Oisans Pont Rouge	0.0013	36	$4.6\cdot10^{-4}$	1.46	1.4	5.5	117.1	32.7	2.6
					1.59	1.5	26	58.5	34.6	1.8
Sarenne	Le Bourg-d Oisans/ Pont de Bassey	0.0013	8	$4.6\cdot10^{-4}$	0.44	1.05	3.3	31.6	3.4	0.10
					0.49	0.97	5.8	32.4	5.2	0.17
					0.46	0.92	-	2.3	1.4	0.06
	d’Oisans 3 Ponts	0.0013	11	0.005	0.52	0.8	1.7	38.8	1	0.02
Selves	Le Puech	0.025	10	0.14	0.98	1.61	2.9	14.3	0.28	0.09

River	**Location**	**S (m/m)**	**W (m)**	$\boldsymbol{\alpha_{\lambda,s}}$	**H (m)**	**V (m/s)**	**Bedload GSD** $\boldsymbol{D_{50}}$ **(mm)**	$\bar{q}_s$ **(g/s/m)**	$\boldsymbol{\bar{P}}$ $\boldsymbol{(10^{12}\ \mu Pa^2)}$	$\boldsymbol{\bar{P}}$ **inversed** $\boldsymbol{(10^{12}\ \mu Pa^2/m^2)}$
Séveraisse	Villar Loubiére	0.011	12.5	0.058	0.7	1.65	5.1	75.4	26.8	2.76
					0.75	1.53	11.3	41.1	11.9	1.55
					0.76	1.63	38.8	48.2	33.2	4.71
					0.88	1.57	54.3	111.3	50.9	6.70
					0.82	1.48	62.1	63.7	5.8	0.51
					0.73	1.79	0.0	11.9	0.96	0.17
					0.75	2.28	28.9	189.2	76.8	8.0
					0.78	2.73	31.5	956.7	452	74.1
					0.91	2.76	20.3	289.8	139.7	54.7
					1.01	2.68	36.1	900.3	401.1	299.1
					0.81	2	42.6	661.1	294.8	47.6
	La Chapelle	0.0145	14	0.02	0.46	2.06	0.0	44.9	3.8	0.17
					0.36	2.03	23.4	74.9	16.6	0.46
					0.37	1.56	0.0	8.7	1.6	0.06

S2 Attenuation coefficient

In this section we present a river slope-based empirical equation to predict the attenuation coefficient of rives. The attenuation coefficients measured are best correlated with the local slope of the river (Geay et al., 2019). The fitted relations between slope and attenuation coefficient for both cylindrical ($\boldsymbol{\alpha_{\lambda s}}$) and spherical ($\boldsymbol{\alpha_{\lambda s}}$) model are as follows:

$$\boldsymbol{\alpha_{\lambda s}} = 11.13 \cdot S^{1.12} \tag{S1}$$

$$\boldsymbol{\alpha_{\lambda s}} = 1720 \cdot S^{2.28} \tag{S2}$$

The data supporting these empirical equations are presented in Table S2.

Table S2. The data for reach river used to fit the empirical formulas in Eq. (S1) and Eq. (S2).

River	Slope (m/m)	$\boldsymbol{\alpha_{\lambda s}}$	$\boldsymbol{\alpha_{\lambda s}}$
Arve (Bossons)	0.0075	0.057	0.095
Giffre	0.003	0.005	0.0068
GrandBuech (La Faurie)	0.007	0.02	0.04
Isère (Campus)	0.0005	3·10-5	0.0019
Moselle	0.0011	0.0011	0.0064
Romanche (Bourg-d''Oisans)	0.0013	$1.5\cdot10^{-4}$	0.0023
Sarenne	0.0013	$4.6\cdot10^{-4}$	0.0078
Selves	0.025	0.14	0.2
Séveraisse (Villar Loubiére)	0.011	0.058	0.08
Arc	0.002	$1.6\cdot10^{-4}$	0.0046
Romanche (Pont Rouge)	0.0013	$3.7\cdot10^{-4}$	0.0047
Loire	0.0002	~0	0.049
'Veneon	0.011	0.033	0.012
IsereGresy	0.0018	0.003	0.0052
Leysse	0.001	0.0007	0.095

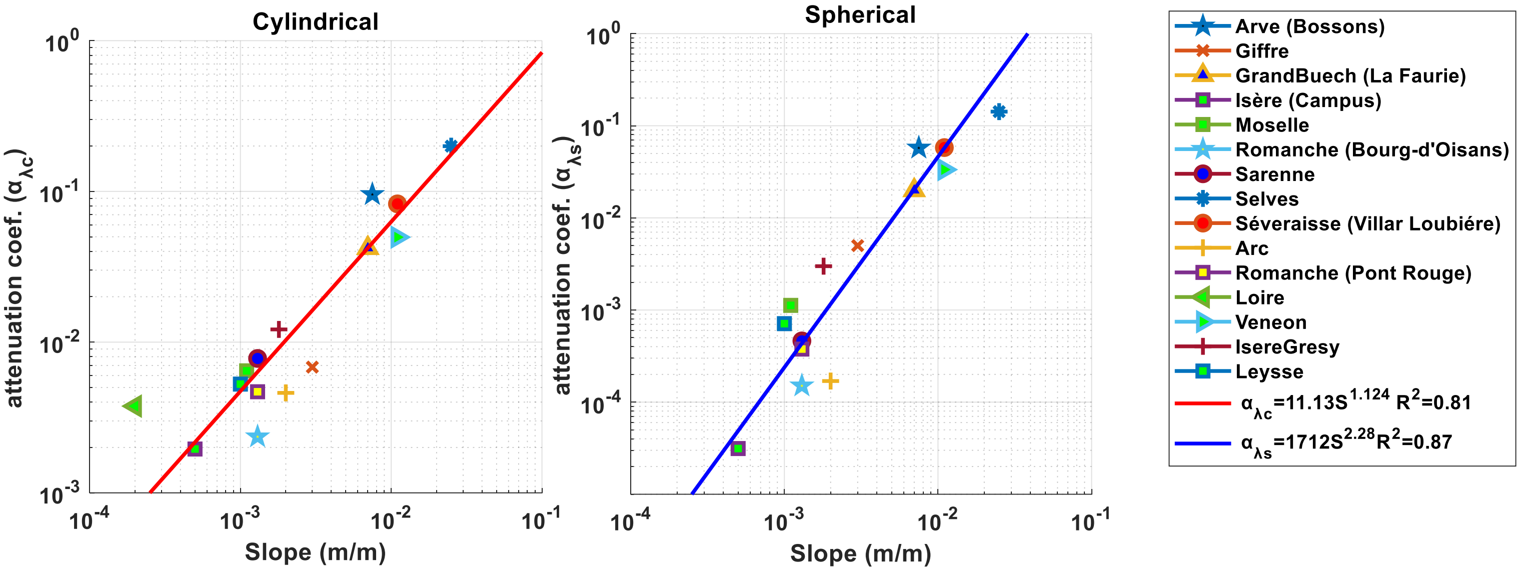

Figure S1. Relation between the local slope of the river and the attenuation coefficient for the cylindrical model (left) and spherical model (right) (Nasr, 2023).

Reference

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