



*Water Resources Research*

Supporting Information for

**Unifying Advective and Diffusive Descriptions of Bedform Pumping in the Benthic Biolayer of Streams**

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**Introduction.** This Supplemental Information includes tables summarizing the experimental conditions used for each of the Elliott and Brooks experiments included in this study (Table S1), and inferred parameter values obtained by fitting the advective (Tables S2) and diffusive (Table 3) models to these data.

Exp ID	Bedform Type	Sand <sup>1</sup>	Bed Depth ( $d_b$ , m)	Bedform Geometry		Stream Conditions		
				Wavelength ( $\lambda$ , m)	Height ( $H$ , m)	Depth ( $d$ , m)	Velocity ( $V$ , m s <sup>-1</sup> )	Shear Velocity ( $u_*$ , m s <sup>-1</sup> )
8	natural ripples	M	0.13	0.3	0.0114	0.0645	0.132	0.0159
9	triangular ripples	M	0.135	0.178	0.0254	0.0645	0.132	0.02439
12	triangular ripples	M	0.126	0.088	0.0127	0.0648	0.132	0.01953
14	triangular ripples	M	0.22	0.088	0.0127	0.0648	0.086	0.01286
15	triangular ripples	M	0.22	0.178	0.0254	0.0648	0.087	0.01426
16	triangular ripples	M	0.22	0.24	0.0189	0.0648	0.107	0.0171
17	natural ripples	F	0.225	0.14	0.012	0.0645	0.087	0.014

<sup>1</sup>Streambed consisted of medium-grained (“M”,  $d_g = 0.47$  mm,  $\sigma_g = 0.0013$  mm,  $\theta = 0.325$ ,  $K_h = 1.1$  mm s<sup>-1</sup>) or fine-grained (“F”,  $d_g = 0.13$  mm,  $\sigma_g = 0.0013$  mm,  $\theta = 0.295$ ,  $K_h = 0.079$  mm s<sup>-1</sup>) sand

**Table S1.** Experimental Conditions for EB’s experiments included in this study.

Exp ID		$h_m$ (mm) (s.d.) <sup>1</sup>		$h_w = V_w / A$ (cm) (s.d.) <sup>1</sup>	
		<i>Inferred</i>	<i>Predicted</i> <sup>2</sup>	<i>Inferred</i>	<i>Experimental Estimate</i> <sup>3</sup>
8	>0.9999	0.57 (0.11)	0.20 (0.04)	16.7 (1.0)	11.6 (1.2)
9	>0.9999	0.29 (0.03)	0.31 (0.09)	12.4 (0.4)	11.3 (1.1)
12	>0.9999	0.12 (0.01)	0.20 (0.04)	9.4 (0.3)	11.5 (1.2)
14	>0.9998	0.042 (0.008)	0.086 (0.02)	8.8 (0.5)	11.9 (1.2)
15	>0.9999	0.24 (0.02)	0.13 (0.04)	14.4 (0.3)	12.5 (1.3)
16	>0.9999	0.32 (0.03)	0.15 (0.03)	12.5 (0.4)	12.5 (1.3)
17	>0.9999	0.11 (.01)	0.086 (0.02)	10.6 (0.4)	12.5 (1.3)

<sup>1</sup>Standard Deviation generated during the model fitting step (inferred values) or calculated from the Variance Formula assuming a CV for all parameters of 10% (predicted values).

<sup>2</sup>Predicted with equation (7)

<sup>3</sup>Estimated from the ratio of reported volume of water in the flume (excluding pore volume) and reported bed surface area

**Table S2.** Advective model fitting results.

Exp ID		$E_0 \times 10^{-7} \text{ (m}^2 \text{ s}^{-1}) \text{ (s.d.)}^1$		$a \text{ (m}^{-1}) \text{ (s.d.)}^1$	
	$R^2$	<i>Inferred</i>	<i>Predicted</i> <sup>2</sup>	<i>Inferred</i>	<i>Predicted</i> <sup>3</sup>
8	>0.9999	5.87 (0.80)	8.12 (1.66)	7.6 (2.1)	8.77 (7.6)
9	>0.9998	3.76 (0.82)	4.09 (0.72)	19.6 (5.4)	20.8 (19.6)
12	>0.9999	2.1 (0.2)	1.71 (0.31)	56 (2.81)	51.2 (56)
14	>0.9999	0.60 (0.065)	0.60 (0.12)	49.9 (3)	51.2 (50)
15	>0.9998	4.17 (0.59)	3.39 (0.60)	27.8 (1.9)	20.8 (27.8)
16	>0.9998	3.7 (0.47)	4.53 (0.79)	13.5 (2.0)	13.2 (13.5)
17	>0.9999	0.107 (0.0092)	0.122 (0.023)	24.1 (1.5)	28.9 (24.1)

<sup>1</sup>Standard Deviation generated during the model fitting step (inferred values) or calculated from the Variance Formula assuming a CV for all parameters of 10% (predicted values).

<sup>2</sup>Equation (16a)

<sup>3</sup>Equation (16b)

**Table S3.** Diffusive model fitting results.