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Whipple pg. DR-1

Data Repository

Rates and Processes of Bedrock Incision by the Upper Ukak River since the 1912
Novarupta Ash Flow in the Valley of Ten Thousand Smokes, Alaska

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DATA REPOSITORY TABLE 1. CROSS SECTION DATA

Section	Gradient		Outer Channel		Inner Channel			Erosion Rate		K	Flute Depth	Abrasion Rate <sup##< sup=""></sup##<>
	Bedrock*	Water	Width (m)	Depth (m)	Width (m)	Depth (m)	Facies [#]	Max. ^{**} (myr ⁻¹)	Min. ^{##} (myr ⁻¹)	x 10 ⁻⁴ (m ² yr ⁻¹)	(m)	(myr ⁻¹)
1	0.143	0.216	22.8	3.5	3.7	nm	A	--	--	--	0.3	0.0035
2	0.196	0.096	23.9	3.3	4.4	> 5.9 ^{\$}	A	0.11	0.07	> 1.43	nm	--
3	0.031	0.158	12.9	1.9	4.2	> 6.9 ^{\$}	A	0.10	0.08	> 10.52	0.1	0.0012
4	0.097	0.059	20.7	3.8	3.7	5.2	A	0.11	0.06	2.54	0.2	0.0024
5	0.042	0.053	20.8	3.3	9.5	2.6	A	0.07	0.03	2.87	nm	--
6	0.048	0.058	19.6	2.2	9.9	2.3	A	0.05	0.03	2.34	nm	--
6b	0.065	0.057	29.0	3.6	2.7	3.6	A	0.08	0.04	2.67	nm	--
7	0.053	0.050	15.4	3.2	2.4	> 7.4 ^{\$}	A	0.12	0.09	> 6.64	0.3	0.0035
8	0.022	0.131	14.6	1.5	1.2	> 8.3 ^{\$}	A	0.12	0.10	> 18.23	0.5	0.0059
9	0.039	0.021	15.4	2.6	10.8	3.7	B	0.07	0.04	4.57	N/A	--
10	0.007	0.036	36.8	1.0	10.6	0.9	B	0.02	0.01	6.41	N/A	--
11	0.015	0.023	28.9	0.8	5.0	3.6	B	0.05	0.04	11.50	N/A	--
12	0.031	0.004	35.5	0.8	4.4	6.3	B	0.08	0.07	9.60	N/A	--
13	0.007	0.029	15.6	0.9	8.6	1.5	B	0.03	0.02	11.23	N/A	--
14	0.083	0.009	N/A	N/A	14.0	7.3	A	0.09	0.09	4.15	N/A	--

Notes: nm – not measured; N/A – not applicable

* Gradient of initial bedrock surface profile (used in estimates of local K values)

^{\$} Minimum estimate only, bottom not reached with probe[#] Facies A – 20-50 cm thick sandstone, Schmidt Hammer = 59±3; Facies B – 1-6 cm thick sandstone and siltstone beds, Schmidt Hammer = 46±6^{**} Total depth of incision (inner plus outer channel) divided by 85 years^{##} Depth of inner channel incision divided by 85 years^{##} Minimum rate of abrasion wear evidenced in erosional flutes, derived assuming 85 years of abrasion

DATA REPOSITORY TABLE 2. FORWARD MODELING RESULTS

Constant K'			Weak Lithology (sections 7-14)			Variable K'		
n	K' *	Ssq [§]	n	K' *	Ssq [§]	n	ΔK' #	Ssq [§]
.1	.09	47.04	.1	.09	10.45	.2	1.2	39.51
.2	.15	43.22	.2	.14	6.63	.3	1.4	32.53
.3	.21	47.18	.3	.26	4.82	.4	1.8	34.77
.4	.31	60.18	.4	.44	4.97	.5	2.0	39.79
.5	.45	78.73	.5	.72	6.38	.6	2.4	51.37
.6	.63	96.0	.6	1.18	8.94			
			.7	1.90	12.39			
			.8	3.70	14.63			

^{*} Best-fit K' for given n[§] Ssq – Sum of squared errors (difference between modeled and observed thalweg elevation)[#] $\Delta K' = K'_{\text{weak}}/K'_{\text{resist}}$ (K'_{weak} : sections 7-14; K'_{resist} : sections 2-6b)

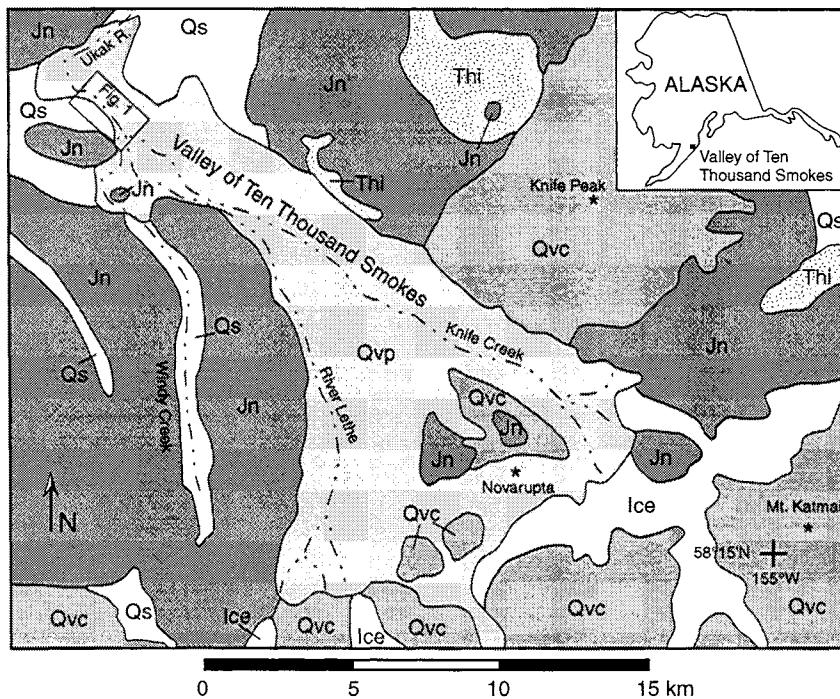


Figure DR-1. Geologic map adapted from Riehle et al. (1993). Box shows location of study reach, shown in Figure 1. Map units: Qs – Quaternary sediments; Qvp – pyroclastic deposits of 1912 eruption; Qvc – Quaternary volcanic domes and central-vent complexes; Thi – Tertiary intrusions; Jn – Jurassic Naknek Formation.

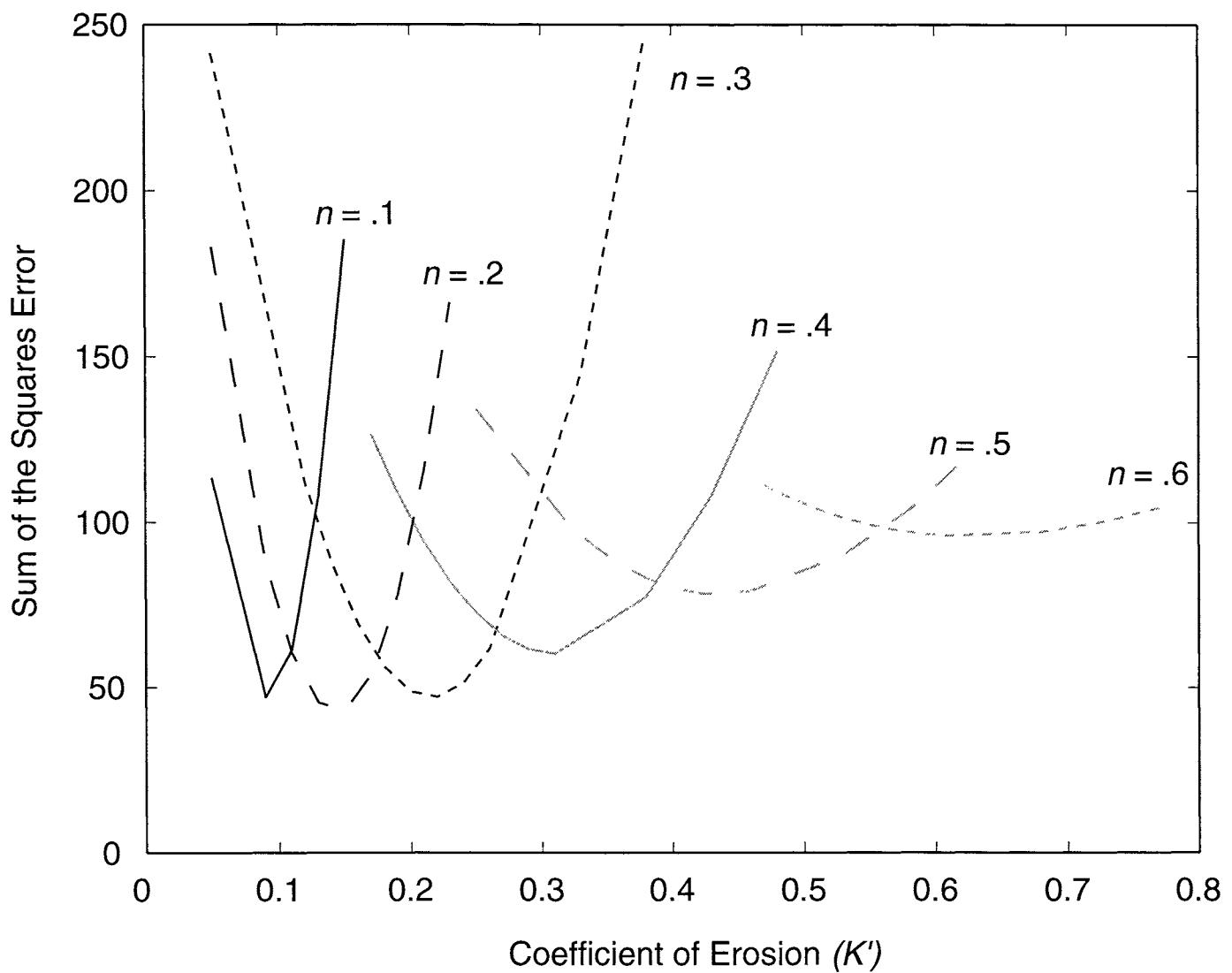


Figure DR-2. Results of best-fit forward model parameter search for $K' = \text{constant}$. Error in y-axis is the misfit between modeled and observed thalweg elevations. Minima of plotted curves show best-fit values of K' for the given n value. Best-fit values are $K' = 0.15$ and $n = 0.2$. However, there is significant misfit in all cases.

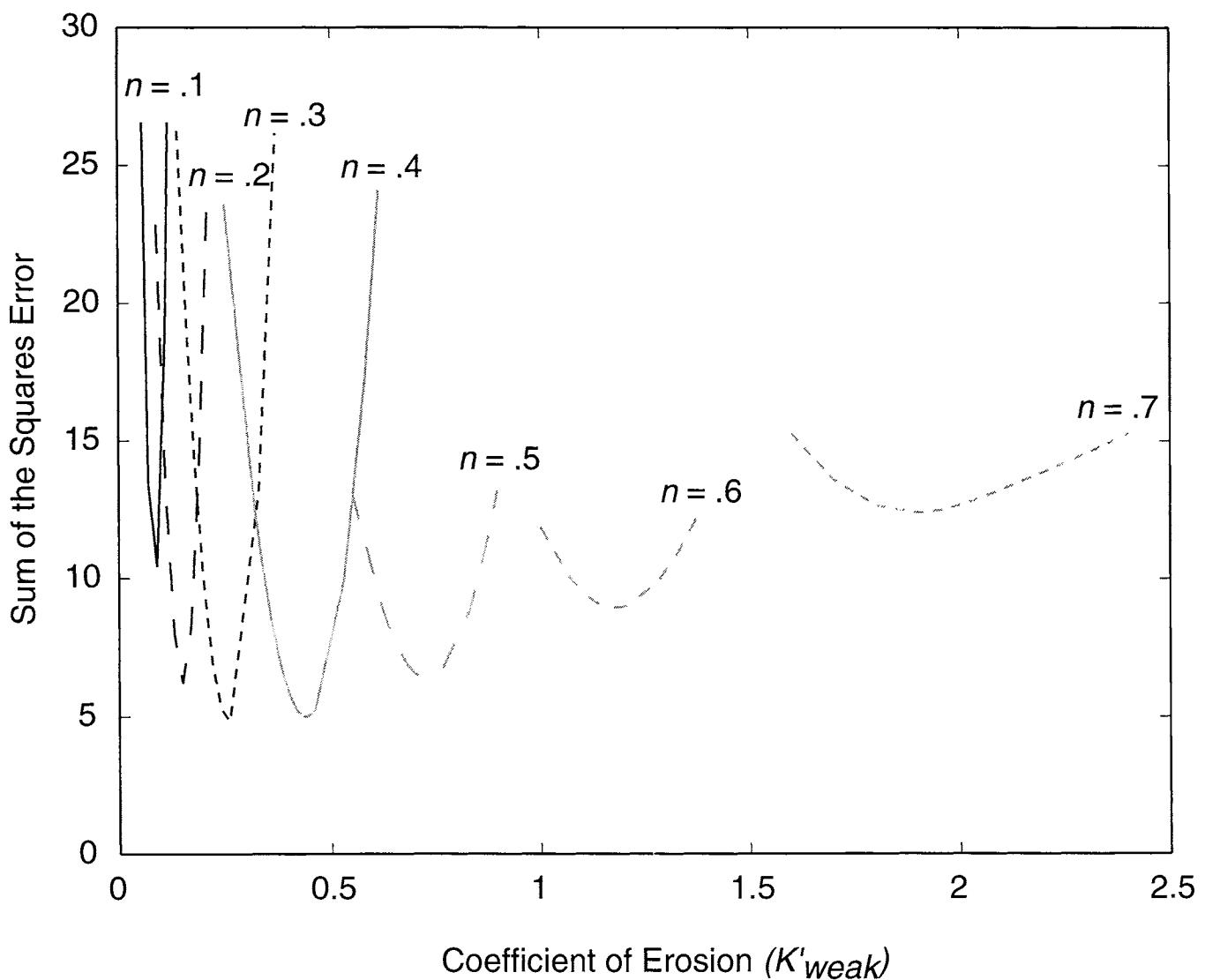


Figure DR-3. Results of best-fit forward model parameter search for n and K'_{weak} (fit to sections 7-14 only). Error in y-axis is the misfit between modeled and observed thalweg elevations. Minima of plotted curves show best-fit values of K' for the given n value. Best-fit values are $K' = 0.26 - 0.44$ and $n = 0.3 - 0.4$. However, simulations with n values in the range 0.4 ± 0.2 produce acceptable fits to the data.

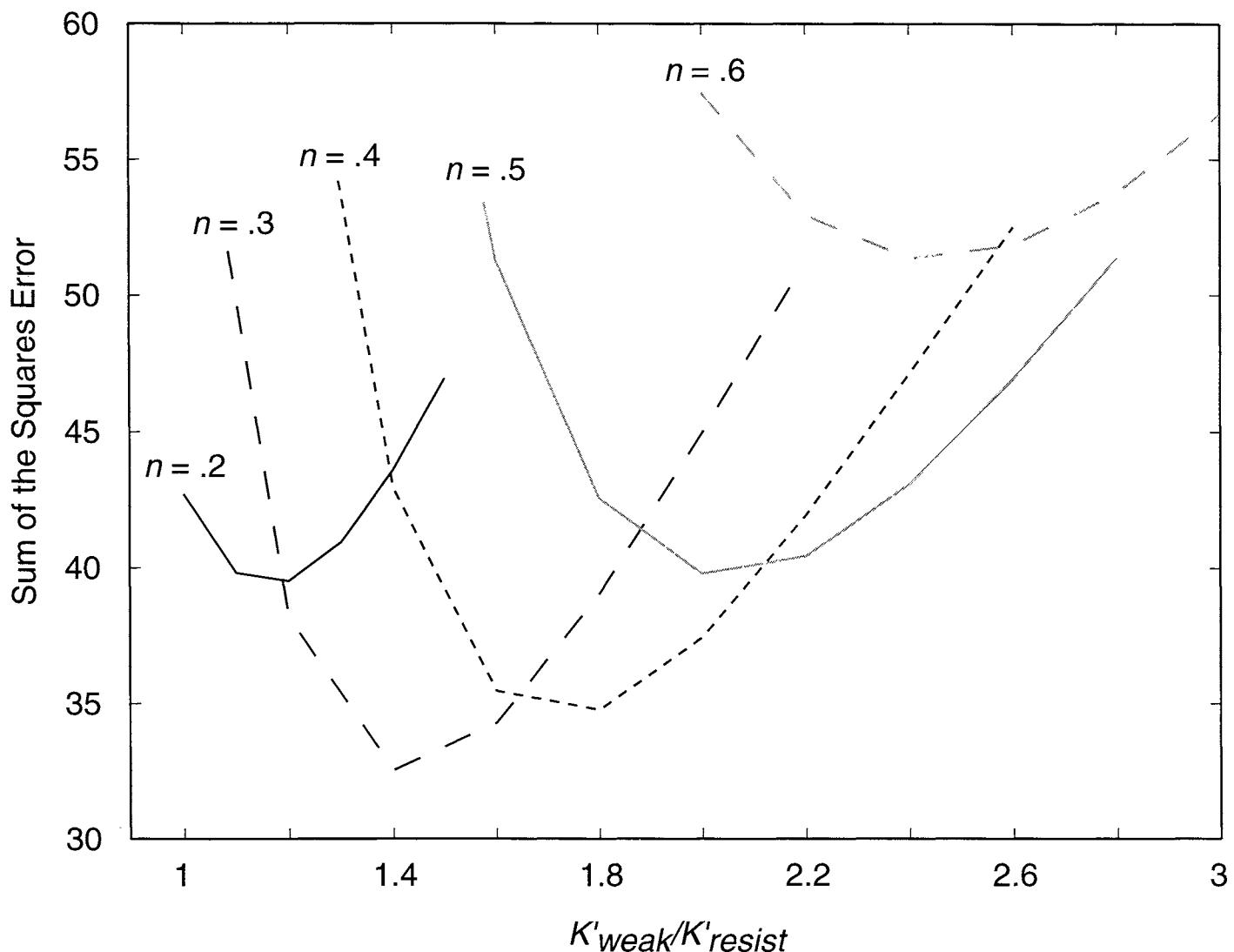


Figure DR-4. Results of best-fit forward model parameter search for the difference in erodibility between sections 7-14 (K'_{weak}) and sections 2-6b (K'_{resist}) using the best-fit pairs of K'_{weak} and n from Fig. DR-2. Error in y-axis is the misfit between modeled and observed thalweg elevations. Minima of plotted curves show best-fit values of $K'_{\text{weak}}/K'_{\text{resist}}$ for the given n value. Best-fit values are $K'_{\text{weak}}/K'_{\text{resist}} = 1.2 - 2.0$ and $n = 0.2 - 0.5$.