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Supplement of

Episodic sediment supply to alluvial fans: implications for fan incision and morphometry

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Supplement

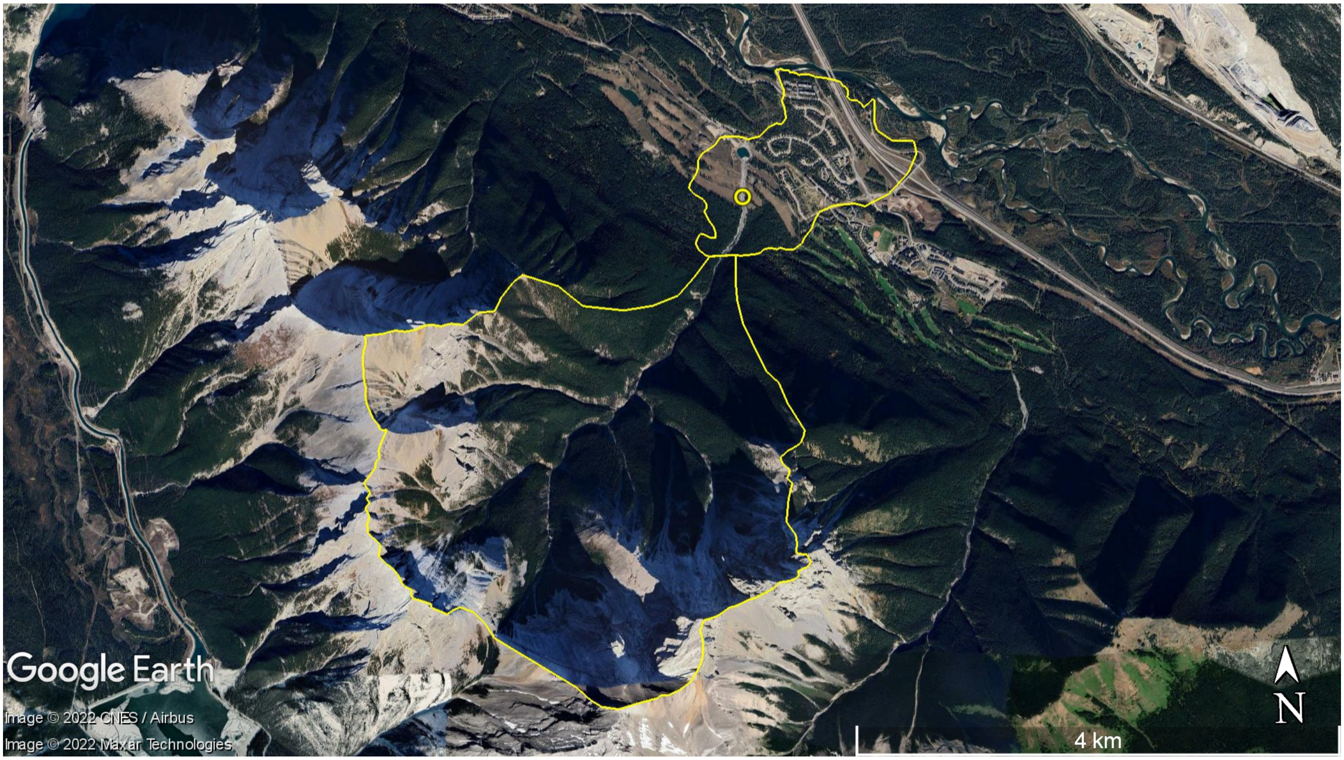

Figure S1. Three Sisters Creek catchment and fan, on the southwest side (right bank) of the Bow River, Alberta, Canada, near the town of Canmore. The surface grain size sample was collected at approximately the location of the yellow circle. Photo © Google Earth.

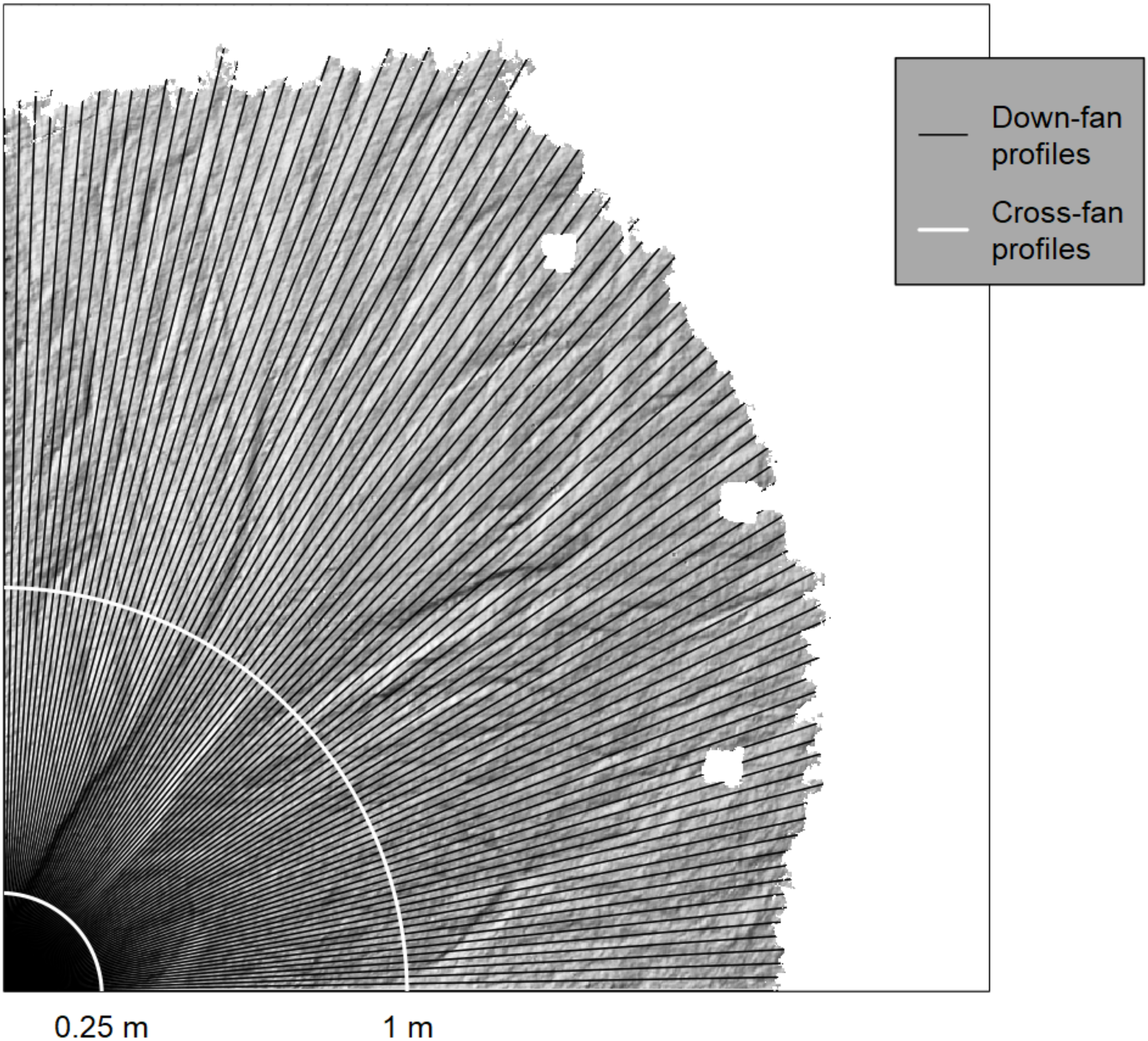

Figure S2. Locations of down-fan and cross-fan transects where measurements were taken. The 88 down-fan transects (black lines) were used to measure fan gradient. The arcuate cross-fan profile at 0.25 m down-fan (inner white line) shows where fan-head entrenchment measurements were conducted. The cross-fan profile at 1 m down-fan (outwer white line) shows where the number of channel threads was measured. Underlying hillshade (displayed with 3 $\times$ elevation exaggeration) is from Run OSC40 at 19 hrs of experimental time, close to the end of the experiment.

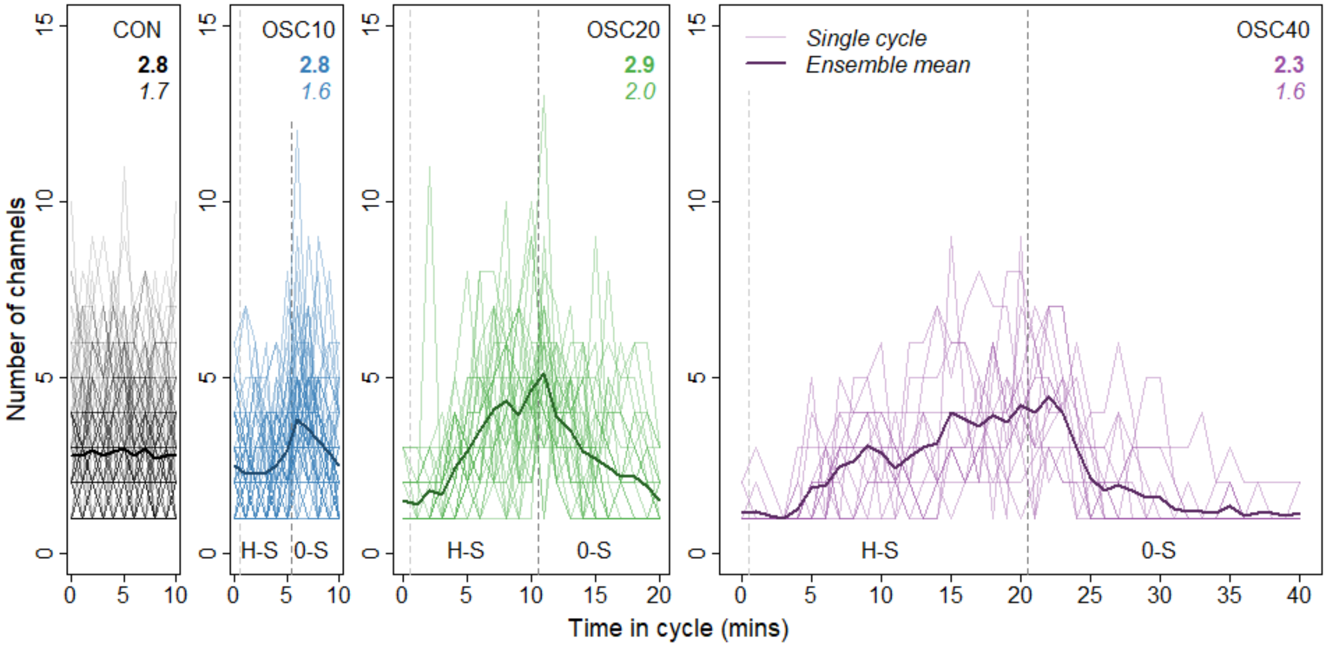

Figure S3. Number of **connected** channels at a transect 0.5 m down-fan, versus time in experimental cycle. Thin lines represent each individual high-zero sediment supply cycle; thick line is the ensemble mean. H-S denotes high-supply period; 0-S denotes zero-supply. Coloured text indicates each experiment's time-averaged **mean** and *standard deviation*.

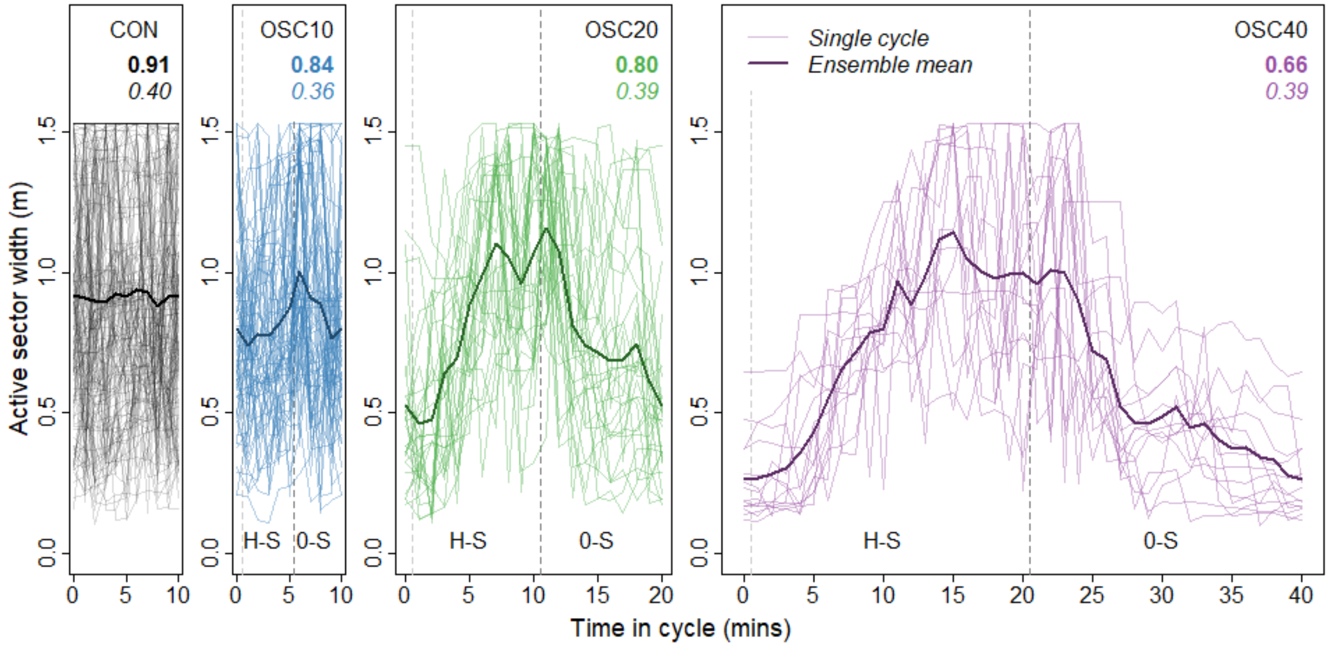

Figure S4. Width of active sector measured across **connected** channels at a transect 1 m down-fan, versus time in experimental cycle. Thin lines represent each individual high-zero sediment supply cycle; thick line is the ensemble mean. Coloured text indicates each experiment's time-averaged **mean** and *standard deviation*.

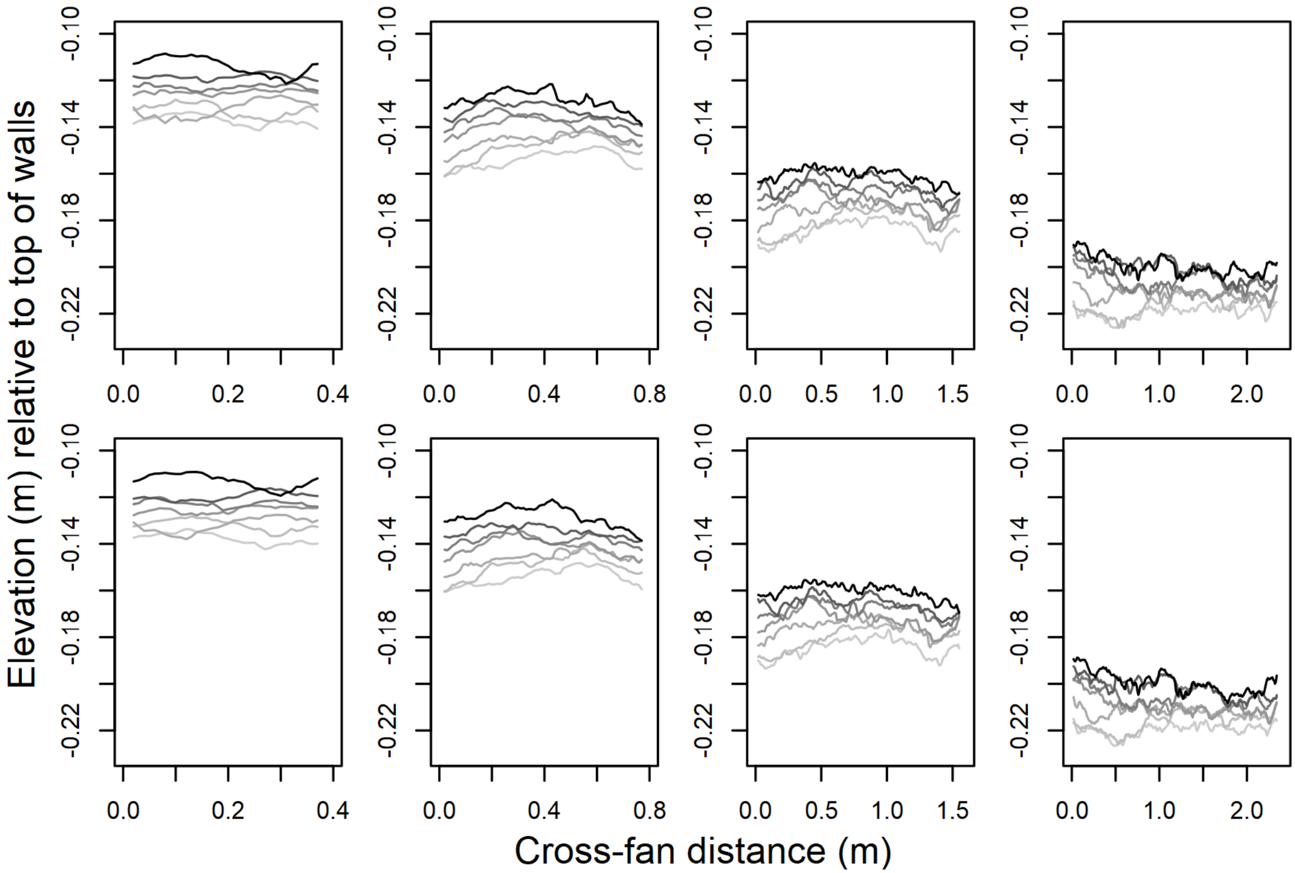

Figure S5. Fan elevation at arcuate cross-fan profiles in Run OSC10, located 0.25, 0.5, 1.0 and 1.5 m downfan (left to right). **Upper panel:** examples of fan topography at the end of zero-supply periods. **Lower panel:** examples of fan topography at the end of high-supply periods. Example data are from time steps 80 minutes apart; darker colours denote later time steps.

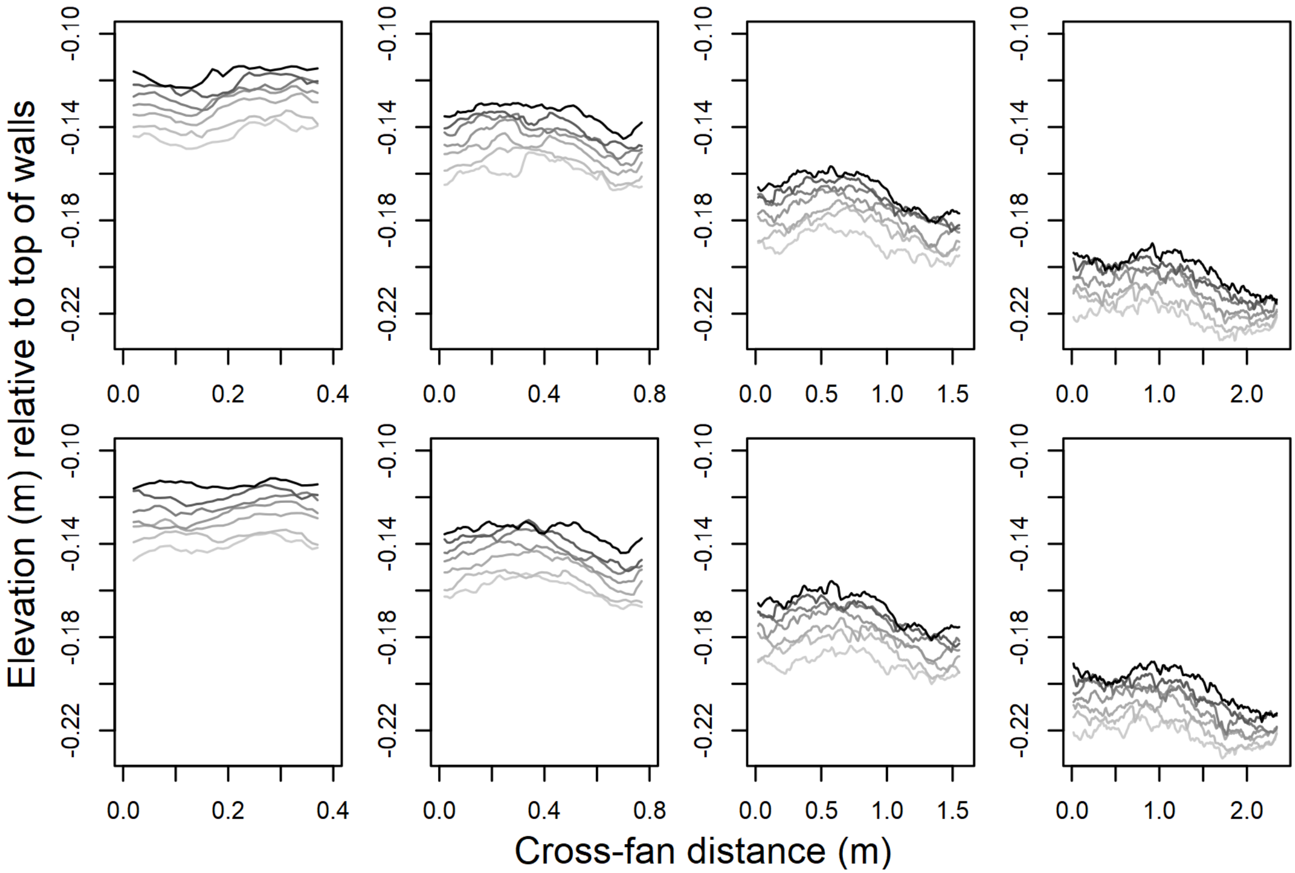

Figure S6. Fan elevation at arcuate cross-fan profiles in Run OSC20, located 0.25, 0.5, 1.0 and 1.5 m downfan (left to right). **Upper panel:** examples of fan topography at the end of zero-supply periods. **Lower panel:** examples of fan topography at the end of high-supply periods. Example data are from time steps 80 minutes apart; darker colours denote later time steps.

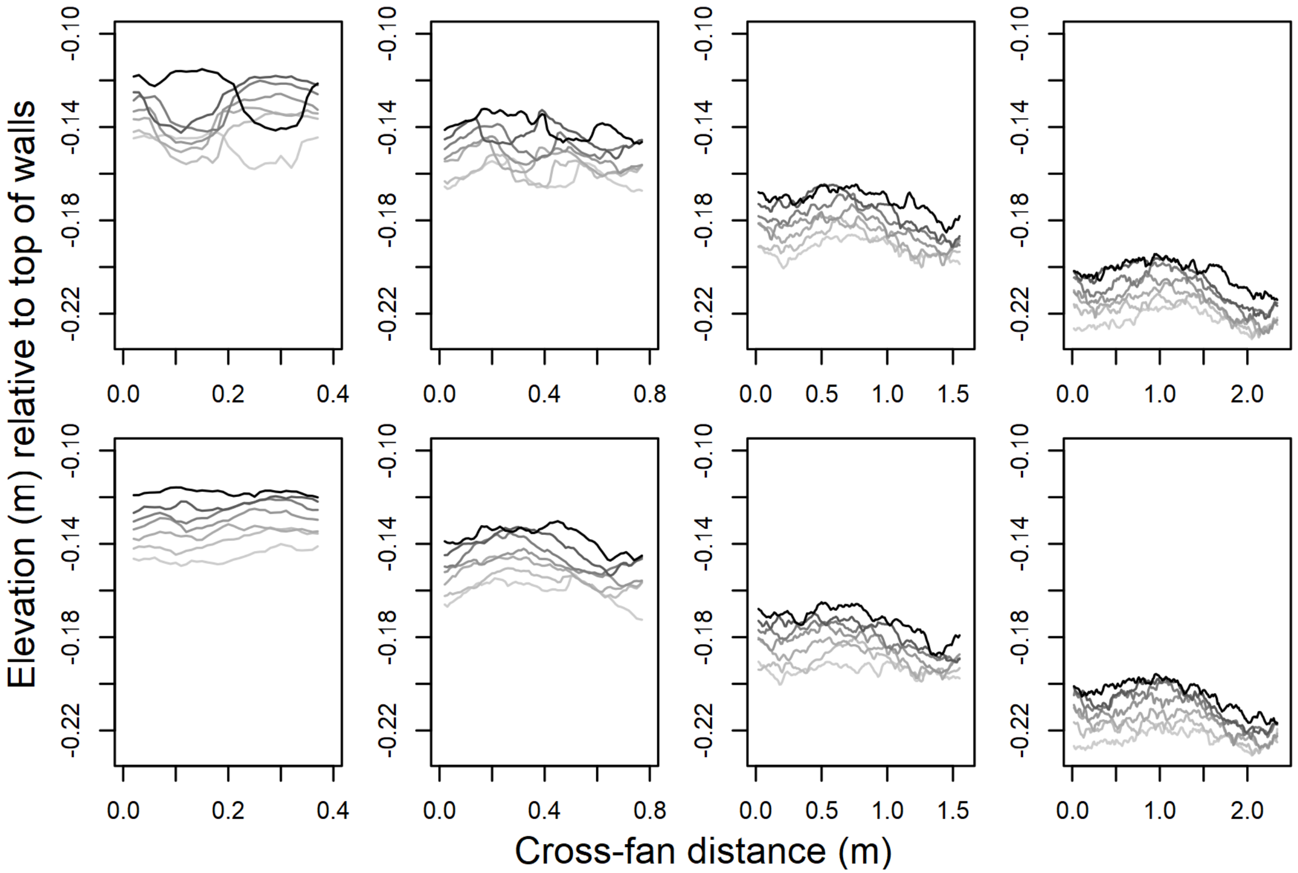

Figure S7. Fan elevation at arcuate cross-fan profiles in Run OSC40, located 0.25, 0.5, 1.0 and 1.5 m downfan (left to right). **Upper panel:** examples of fan topography at the end of zero-supply periods. **Lower panel:** examples of fan topography at the end of high-supply periods. Example data are from time steps 80 minutes apart; darker colours denote later time steps.

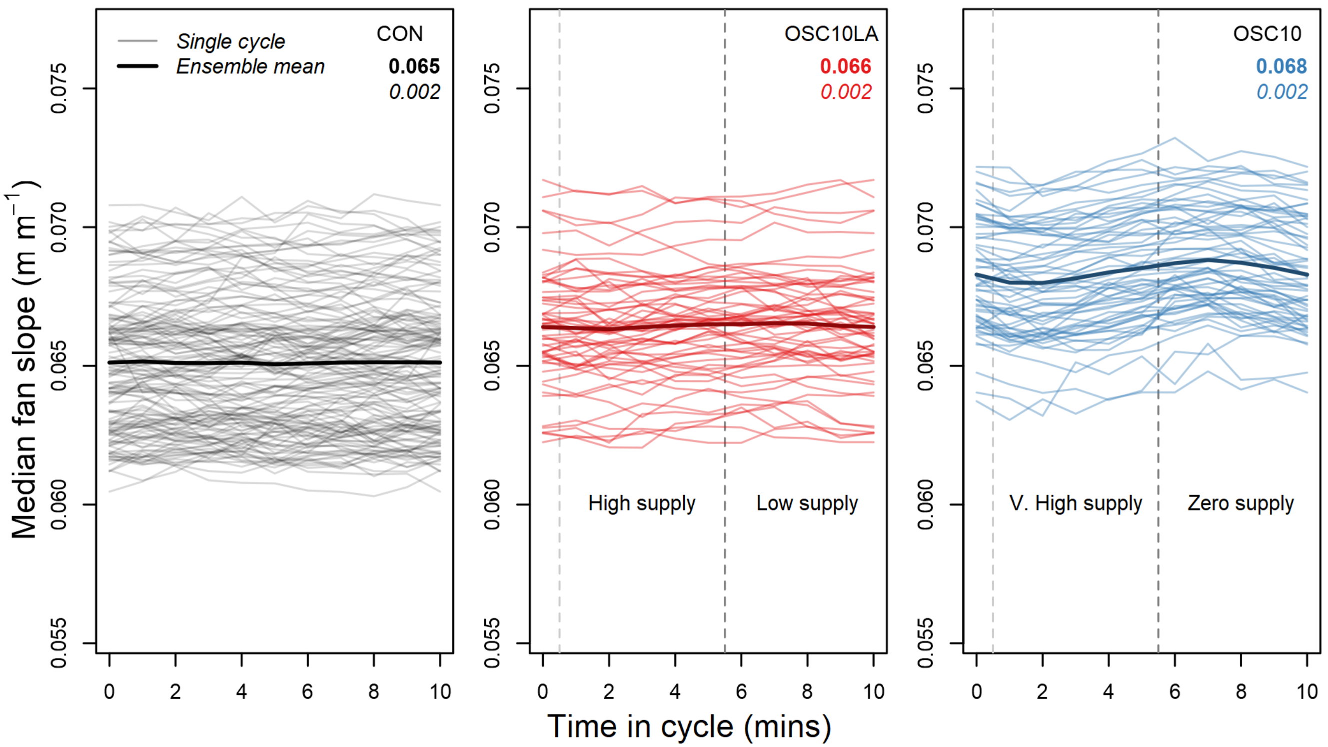

Figure S8. Median fan slope versus time in experimental cycle, for Runs CON, OSC10LA and OSC10. Run OSC10LA has the same mean sediment supply rate and timing of supply oscillations as Run OSC10, but has lower-amplitude (LA) oscillations. Thin lines represent each individual high-zero-supply cycle; thick line is the ensemble mean. Coloured text indicates each experiment's time-averaged **mean** and *standard deviation*.

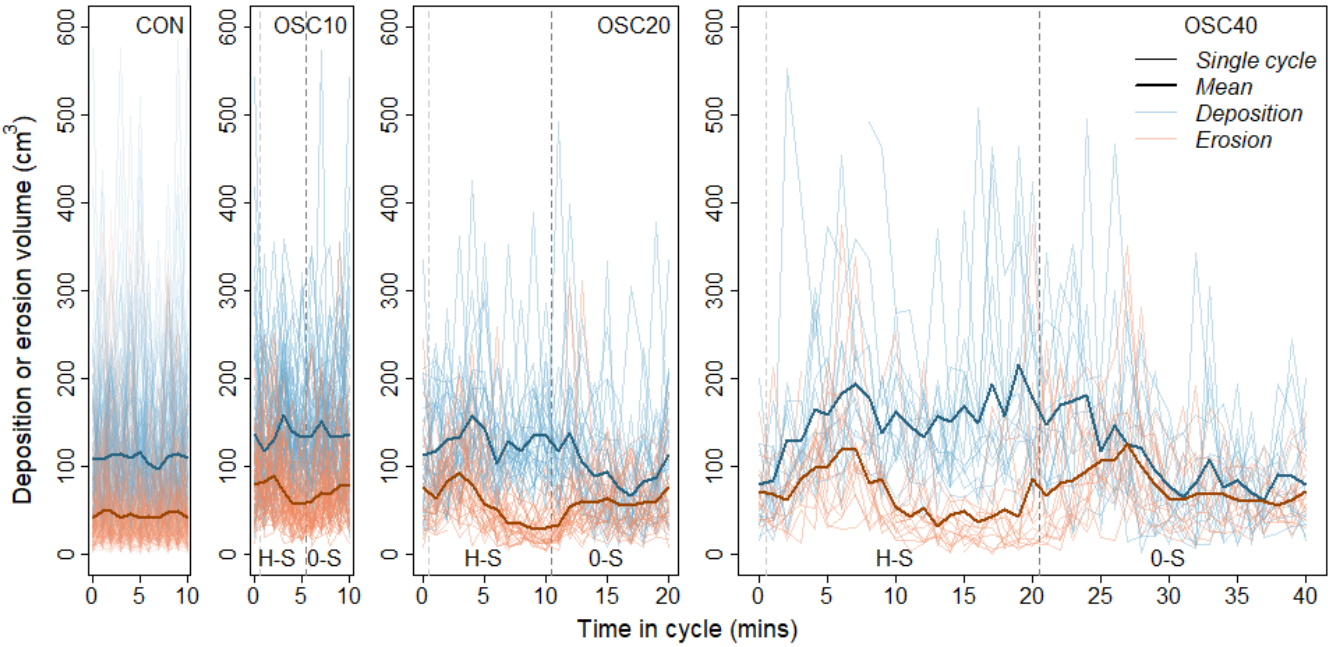

Figure S9. Deposition (blue) and erosion (red) volumes across the whole fan, versus time in the sediment supply oscillation cycle. The thin lines represent each individual supply oscillation cycle; the thick lines are the ensemble means. H-S denotes the high-supply period; 0-S denotes zero-supply.

Table S1. The percentage of total sediment load or yield made up by bedload in mountain streams.

Study	Location	% Bedload
Schoklitsch 1926 [1]	"Alpine Mountain Rivers"	70
Mcpherson 1971	Two O'Clock Creek, Alberta, Canada	0.5
Bradley and Mears 1980	Boulder Creek, Colorado, USA	90
Hayward 1980	Torlesse Stream, Canterbury, NZ	90
Alvera and García-Ruiz 2000	Izas catchment, Spain	30
Lenzi et al. 2003	Rio Cordon, Italy	24
Métivier et al. 2004	Ürümqi River (Chinese Tian Shan)	45[2]
Meunier et al. 2006	Torrent de St Pierre, France	15–60[3]
Pratt-Sitaula et al. 2007	Marsyandi River, Nepal	36
Alexandrov et al. 2009	Nahal Eshtemoa, Israel	5

[1] As cited in Jarocki (1957), p104.

[2] At the range front.

[3] Values quoted are minimum and maximum during a week of observations.

References

Alexandrov, Y., Cohen, H., Laronne, J. B., and Reid, I.: Suspended sediment load, bed load, and dissolved load yields from a semiarid drainage basin: A 15-year study, Water Resources Research, 45, W08 408, https://doi.org/https://doi.org/10.1029/2008WR007314, 2009.

Alvera, B. and García-Ruiz, J. M.: Variability of Sediment Yield from a High Mountain Catchment, Central Spanish Pyrenees, Arctic, Antarctic, and Alpine Research, 32, 478–484, https://doi.org/10.1080/15230430.2000.12003392, 2000.

Bradley, W. C. and Mears, A. I.: Calculations of Flows Needed to Transport Coarse Fraction of Boulder Creek Alluvium at Boulder, Colorado, GSA Bulletin, 91, 1057–1090, https://doi.org/10.1130/GSAB-P2-91-1057, 1980.

Hayward, J. A.: Hydrology and stream sediments in a mountain catchment, Tussock Grasslands and Mountain Lands Institute, Lincoln College, 1980.

Jarocki, W.: A study of sediment (Badanie rumowiska), This edition translated from Polish and published by the National Science Foundation and the Department of the Interior, 1957.

Lenzi, M. A., Mao, L., and Comiti, F.: Interannual variation of suspended sediment load and sediment yield in an alpine catchment, Hydrological Sciences Journal, 48, 899–915, https://doi.org/10.1623/hysj.48.6.899.51425, 2003.

Mcpherson, H.: Dissolved, suspended and bed load movement patterns in Two O'Clock Creek, Rocky Mountains, Canada, summer, 1969, Journal of Hydrology, 12, 221–233, https://doi.org/https://doi.org/10.1016/0022-1694(71)90007-2, 1971.

Métivier, F., Meunier, P., Moreira, M., Crave, A., Chaduteau, C., Ye, B., and Liu, G.: Transport dynamics and morphology of a high mountain stream during the peak flow season: The Ürümqi River (Chinese Tian Shan), in: River Flow: Proceedings of the Second International Conference on Fluvial Hydraulics, edited by Greco, M., pp. 761–777, Taylor and Francis, Philadelphia, 2004.

Meunier, P., Métivier, F., Lajeunesse, E., Mériaux, A., and Faure, J.: Flow pattern and sediment transport in a braided river: The "Torrent de St Pierre" (French Alps), Journal of Hydrology, 330, 496–505, https://doi.org/10.1016/j.jhydrol.2006.04.009, 2006.

Pratt-Sitaula, B., Garde, M., Burbank, D. W., Oskin, M., Heimsath, A., and Gabet, E.: Bedload-to-suspended load ratio and rapid bedrock incision from Himalayan landslide-dam lake record, Quaternary Research, 68, 111–120, https://doi.org/https://doi.org/10.1016/j.yqres.2007.03.005, 2007.

Schoklitsch, A.: Geschiebebewegung in Flüssen und an Stauwerken, Springer-Verlag, Vienna, 1926.