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# The effect of width variations on the formation and evolution of step-pool morphology: insight from new flume experiments

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Step-pools are ubiquitous morphological features found in steep mountain streams, where large stones are imbricated generating steps and followed by pools with finer material created by the scouring effect of the water flow. Different step-forming mechanisms have been proposed and investigated in the past, mostly with flume experiments and few numerical models, but all previous experimental studies on the subject were conducted in either straight flumes or flumes with a randomly changed width, and with different patterns of sediment feed.
Here we explore the effect of width variations with new experiments conducted in a 8%-steep, 5-m long and 40-cm wide flume at the University of British Columbia. Channel width was changed in a systematic way by progressively adding constant narrowings and widenings with artificial elements, and experiments were run with no sediment feed. Five different geometric configurations were tested and in all of them water discharge was progressively increased by 20% every hour until the bed was completely scoured exposing the bottom of the flume. A poorly sorted grain-size mixture ranging between 0.5 and 64 mm and scaled on natural step-pool channels was used. High-resolution data of bed elevation and surface grain-size were collected every hour, and fractional transport rates were measured with a light-table at 1 Hz frequency at the channel oulet.
Our results show that steps can be effectively generated in an experimental channel even in absence of sediment feed and that width variations, much more than absolute width, play a major control on the location and the type of steps that are generated. While at low flows transversal structures (such as ribs, cells and clusters) made mostly by medium grain sizes develop, at higher flows those are destroyed and steps form, mostly in areas where the width gets narrow because of jamming and where the width gets wide because of preferential deposition caused by velocity decrease.