The importance of storms in the generation of graded bedrock rivers

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Abstract

Steady-state (graded) profiles of modern and past bedrock rivers are commonly used in studies of active tectonics and global and regional climate change. We generate graded bedrock river profiles by coupling bedrock incision and sediment transport in a series of numerical experiments, and we show the form of the profile to be critically dependent on the variability (storminess) of the prevailing climate and relatively insensitive to changes in the mean climate. Climate variability also explains the observation that graded river profiles compromise between uniformly distributing and globally minimizing energy dissipation, and we propose a simple field test to characterize the variability of past and present climates.