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Comparison of long-term evolutionary trajectories of two ephemeral channels after channel-forming extraordinary floods

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Analyses of the evolutionary trajectories of braided ephemeral channels enable identification of trends, magnitudes and periodicity of the processes that affect the channels. In addition to infrequent great floods, relatively frequent, small discharge events have been shown to be important for the evolution of ephemeral channels. However, evolutionary trajectories have rarely been studied in small ephemeral rivers, that predominantly transport gravel, cobles and boulders.

Ephemeral tributary channels typify the Colorado River basin (USA), and two examples are Bronco Creek and Eldorado Canyon. These streams experienced extraordinary great floods in 1971 and 1974 respectively, and they are comparable to each other in both basin size, and climatic conditions. Annual precipitation is less than 50 cm, and the average temperature of each month is above 7°C. More importantly, earlier studies have shown similarities in the hydraulics and geomorphic characteristics of the extraordinary floods, which removed the pre-flood bar and braiding structure from the channels. Thus, these two channels are ideal for comparisons of their evolutionary trajecties. Moreover, the availability of high-resolutions aerial photographs for both channels since 1954 allowed for decadal analyses.

Our research has analyzed and compared the long-term evolutionary trajectories of the two ephemeral channels within Colorado River Basin based on series of aerial photos and digital elevation models. (1) We detected the development and adjustment of braiding since the extraordinary floods. The detected parameters include the braiding index, bar area and number, channel area and width, confluence number and density, and the proportion of inactive and active areas. (2) We also analyzed the time required for the ephemeral river system to evolve back to its prior state before the high magnitude floods. Finally, (3) we analyzed whether these temporal changes in channel evolution can reveal new insights as to climatic and environmental conditions for these un-gauged basins.