Runoff-generated debris flows, sediment entrainment, and sediment transport: The hydrology of a steep mountain catchment through the eyes of an environmental sensor network.

Debris flows and sediment-rich floods are common transport processes in steep mountain catchments. Rapid movement, high discharges, and the transport of large quantities of coarse-grained sediment characterize these hydrologically-driven processes, which significantly influence the morphology of downstream reaches and pose hazards to proximal communities. Despite the ubiquity of debris flows, many questions remain about the mechanics of initiation, volumetric flow increase, and sediment transport. Natural laboratories consisting of environmental sensor networks in debris-flow prone channels provide great opportunities to quantify these hydrological processes. This talk will first introduce the technologies used to monitor a steep catchment (automated sensors and video recording, terrestrial and airborne laser scanning, and RFID tracer particles) and then summarize the results from four years of measurements during which 15 different debris-flow events occurred. Particular attention will be given to how rapid runoff following intense rainfall concentrates sediment to initiate a debris-flow event, how these flows increase in volume through the entrainment of bed sediment, and how these flows transport sediment.