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A low cost strategy to monitor the expansion and contraction of the flowing stream network in mountainous headwater catchments

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Streams are dynamic features in the landscape. The flowing stream network expands and contracts, connects and disconnects in response to rainfall events and seasonal changes in catchment wetness. Sections of the river system that experience these wet and dry cycles are often referred to as temporary streams. Temporary streams are abundant and widely distributed freshwater ecosystems. They account for more than half of the total length of the global stream network, are unique habitats and form important hydrological and ecological links between the uplands and perennial streams. However, temporary streams have been largely unstudied, especially in mountainous headwater catchments. The dynamic character of these systems makes it difficult to monitor them. We describe a low-cost, do-it-yourself strategy to monitor the occurrence of water and flow in temporary streams. We evaluate this strategy in two headwater catchments in Switzerland. The low cost sensor network consists of electrical resistivity sensors, water level switches, temperature sensors and flow sensors. These sensors are connected to Arduino microcontrollers and data loggers, which log the data every 5 minutes. The data from the measurement network are compared with observations (mapping of the temporary stream network) as well as time lapse camera data to evaluate the performance of the sensors. We look at how frequently the output of the sensors (presence and absence of water from the ER and water level data, and flow or no-flow from the flow sensors) corresponds to the observed channel state. This is done for each sensor, per sub-catchment, per precipitation event and per sensor location to determine the best sensor combination to monitor temporary streams in mountainous catchments and in which situation which sensor combination works best. The preliminary results show that the sensors and monitoring network work well. The data from the sensors corresponds with the observations and provides information on the expansion of the stream network pattern.