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Accurate drainage network extraction and monitoring in a high-mountain catchment

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We study the accuracy of channel network extraction methods obtained in two subcatchments of an alpine watershed in Switzerland and compare the results to the ones obtained with the real network, carefully monitored with a high precision DGPS during Summer 2011. A 1 x 1 m^2 LiDAR-derived Digital Terrain Model is used for the automatic channel extraction method. We compare automatic and objective geomorphic feature extraction to the more classic methods based on thresholding of drainage area and local slope. The analysis of the drainage density underlined that the results are consistent for channel network derived by proper morphometric approaches compared to the results obtained with the monitored network, while drainage density derived under standard methodologies proved to be unreliable. Our results suggests a careful combination of field validation and automatic morphometric approaches, while they cast serious doubts on classic approaches based on standard topographic thresholds in complex high-mountain environments where heterogeneity of initiation processes is the norm. Moreover, 281 channel heads are analyzed in the Slope-Area (S-A) diagram and classified along two different initiation processes, namely groundwater seeping upward and runoff induced channels. The first ones tend to imply lower topographic thresholds of A and S with respect to those initiated by runoff processes, whereas linear regressions indicate a rather poor inverse relationship between A and S for both mechanisms of channel initiation.