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A method for automatic outlining of talus cones from digital elevation data based on sectorial histograms

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The rapid evolution of topography in alpine settings driven by climate change has attracted much interest, among others because of the presence of unstable valley slopes. These slopes are often covered by post-glacial talus cones, that may suffer various-scale mass movements including rock and landslides. The scree slopes are often unvegetated, however in some settings young forests or shrubs may cover them. Since these slopes are mostly of loose material, decadal meteorological events, or excess discharge from glacial or snow meltwater may lead to sudden incision. Such suddenly incised valleys (that actually cause local base level drops) then may pave the way for medium-sized or major landslides. The slopes slightly steeper than the angle of repose may remain temporarily metastable, especially if they are vegetated. Removal of vegetation may change their stability situation. If such slopes are also connected with outlets of hanging valleys that are common in post-glacial geomorphic settings, the sediment discharge from the upstream area is completely deposited at the slopes of the talus cones. In long run the slopes become even more oversteepened.

The identification and monitoring of such talus cones on decadal scale, therefore, are of major importance, since they often host potentially endangered man-made structures as well. For this purpose, high-accuracy digital elevation data are the most suitable. The development of current technologies of elevation data acquisition multiplied the amount of available accurate data. These vast datasets generate imminent need

for fast and automated processing techniques. Feature extraction methods are applied widely in geoscience, since they provide preprocessed feature sets that allow focused research work. There has been a number of methods developed for automated enhancement of ridges, valleys, drainage network, etc.

With unconventional processing techniques applied on high-resolution, high-accuracy digital terrain models (DTM) it is possible to detect automatedly well developed talus cones. Sectorial summation and statistical analysis of slope angle histograms provide special infomation to outline even the smaller talus cones. The outlined extent of the cone then can be analysed for slope angles and can be compared to angle of repose of the (stable) talus cones made of the same material in the vicinity.