Quantitative geomorphological and environmental analysis requires the adoption of mapping units, well-defined spatial domains as basic mapping units which provide local boundaries to aggregate environmental and morphometric variables and to perform calculations. Grid cells, typically aligned with a digital elevation model, are the standard mapping unit choice. A wiser choice is represented by slope units, irregular terrain partitions delimited by drainage and divide lines, bearing a stronger relation with the underlying topography, absent in grid cell-based analyses.

We developed a software for the automatic delineation of slope units, given a digital elevation model. Delineation is adaptive, in that slope units of different shape and, most importantly, different size, are delineated according to local terrain characteristics.
Moreover, we devised an optimisation procedure for the size of slope units, suitable for study areas of arbitrarily large size and with varying degrees of heterogeneity. Figure below shows an example of different slope unit delineations with different sizes (A, B, C). Different delineations are nested into each other (D, E). The figure also shows landslides in the area, for illustrative purposes.

We suggest the use of the slope unit map for different terrain zonations, including landslide susceptibility modelling, hydrological and erosion modelling, geo-environmental, ecological, forestry, agriculture and land use/land cover studies requiring the identification of homogeneous terrain domains facing distinct directions.

![Example of different slope unit delineations with different sizes (A, B, C)](image)

**Results**

We applied slope units delineation for many scientific papers studying different areas of the world and for different purposes, including landslide susceptibility zonation, aggregation of results of cell-based slope stability models, earthquake-induced landslide prediction, and optimization of landslide mapping from satellite images.

We recently applied the approach to the whole of Italy, resulting in a map containing about 330,000 slope unit polygons of different sizes and shapes, and with varying local granularity. The map is available for download on our website.
Granting institutions

- Project RFI-SERVICE

To know more

Software and maps available at the wesite of CNR IRPI’s Geomorphology group »

Citations:


Other works that make use of slope units obtained with the software:


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