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Some consideration on geomatic approach to morphometric parameter determination of a drainage basin

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This paper presents the results of a comparison between traditional and automatic quantitative geomorphic analysis applied to some drainage basins belonging to the Biferno River basin (Molise – Italy). In the area of study, 10 drainage basins, with hierarchic order from 4^{th} to 5^{th}, have been taken into account.

In order to obtain the automatic extraction of the hydrographical network, the starting point was a DEM of 40 m/pixel resolution, obtained from the digitalization of contour lines and elevation points on a topographic map at a scale 1:25000. The softwares used were ESRI, ARCGIS (and its "Hydro" extension) and the open source program JGRASS (Hydrologis).

The algorithms which were applied for its definition were the "D8" algorithm (Jenson, Domingue, 1988) and the "Dinf" algorithm (Tarboton, 1997). The use of these algorithms allowed us to calculate and track in an automatic way the *flow direction*, i.e. the elaboration of a raster map where each cell contains the preferential flow direction. This map was successively processed in order to obtain an hydrographical network of the selected basins.

The MANUAL digitalization of the hydrographical network was carried out by means of the ESRI ARCVIEW GIS 3.2 software, using the extension "Autosnap". The starting point was the geomorphologic interpretation of IGM (Italian Geographical Military Institute) topographic maps at a scale 1:25000 and aerial photos. In this way, three informative layers. A second step consisted in calculating, for each basin and its

hydrographical network, some linear and surface parameters, such as the Bifurcation Ratio (R) and the Drainage Density (D). The last one, together with the Hierarchical Anomaly Index (Δa), was used to calculate more complex parameters, such as the mean annual unitary suspended sediment yield (Tu), according to the methodology proposed by Ciccacci (Ciccacci et al., 1980).

The automatically derived drainage networks show a good correspondence with the ones obtained by means of traditional techniques. A more detailed analysis on both elevation and graphic characteristics of fluvial networks showed that the Dinf parameter provides a better approximation of the actual fluvial network than the D8 parameter. A significant difference among the three fluvial networks is shown only for the first order river segments, with an river segment loss between 20% (Dinf) and 30% (D8), according to traditional methodology and the automatic approach respectively. On the other hand, for the river segment of higher order, the difference is very low and no reduction in hierarchical order of the main river segment is observed.

As for the parameters calculated according to the quantitative geomorphic analysis, the same considerations can be derived about the reduction of the values shown by the data. In particular, no significant variation of the Drainage Density and the Hierarchical Anomaly Index is evident. On the other hand, the Tu, calculated from such parameters, shows variation up to 20-30%. The reduction is about 10-20% in case the fluvial network is calculated by means of the Dinf method.

In conclusion, the results of the study show that an automatically derived hydrographical network, obtained by means of the Dinf algorithm, is much more similar to reality than an hydrographical network produced by traditional geomorphological technique
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