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Hydrology and Earth System Sciences Discussions

Interactive comment on "Accurate stream extraction from large, radar-based elevation models" *by* M. Metz et al.

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The authors submitted an interesting manuscript on a really important topic for modern hydrology. The drainage network automatic extraction procedure from Digital Elevation Models is frequently minimized by GIS-Hydrology Users. Very often DEMs are blindly preprocessed using the available commercial softwares that have inside routines developed many years ago. So the topic is surely of wide interest.

Concerning the specific contents of the manuscript there are some comments and suggestions listed below.

Preface.

In the manuscript, DEMs at medium resolution (10-30 meters), useful for Hydrological analysis at basin scale, are considered. So these DEMs should be able to provide a realistic representation of the terrain in order to extract morphometric parameters useful for rainfall-runoff models or/and for other hydrological modeling.

Comments & suggestions.

Comment n. 1. The drainage network extraction is not a planimetric problem but a 3-D problem. The identification of the correct (or better realistic) network structure is important but it is also important to provide realistic altimetric channel profiles. There are many hydrological parameters that could be affected by wrong slope channel estimation (Top-index, NRCS Time concentration method, etc...etc) and so slope=0 should be avoided.

Comment n.2. The drainage network extraction is a complex procedure that should include together pit/sink filling, flow-directions methods and channel head identification. Simplifying or keeping separate these steps should be avoided. In the manuscript only the flat area or sink problem is accurately considered while the other two steps probably are too simply developed respect to what the literature proposes. Fixing a contributing area threshold to identify the channel head could not have negative effects in the described applications but, generally speaking, it is an old approach. At the same time it could not be correct using the MFD method for both channel and hillslope cells.... probably it is better to use a single flow method (not necessarily D8 method) for channel cells and $D\infty$ for hillslope areas.

Comment n.3 The evaluation of the obtained blue lines is an other hot topic. Authors have available around 1200 observed points to judge DEMs with million cells and probably this information is not enough to conclude that a method is better than another one. In the figure 1 (here showed at the end of this comment text) there is an example to clarify this point. We have a digitized map and two blue lines obtained by two different extraction methods. I am sure that if we compare the performance using observed

points we could be not able to see the macro-differences among the drainage networks showed in the figure. Consequently the suggestion is to evaluate the obtained blue lines estimating the morphometric and geomorphologic parameters: Horton parameters, flow length, meandering properties...indeed in general it is more important that an extraction procedure is able to provide a realistic blue line (hydrologically speaking) instead to provide a blue line near the observed points not reproducing a good pattern.

In the following there is list of papers where there are described and supported in details all these comments:

GRIMALDI S., NARDI F., DI BENEDETTO F., ISTANBULLUOGLU E., BRAS R.L. (2007) “A physically-based method for removing pits in digital elevation models” Advances in Water Resources, Volume 30, Issue 10, pages 2151-2158. NARDI F., S. GRIMALDI, M. SANTINI, A. PETROSELLI AND L. UBERTINI (2008) “Hydrogeomorphic properties of simulated drainage patterns using digital elevation models: the flat area issue" Hydrological Science Journal, 53(6). SANTINI M., GRIMALDI S., RULLI M.C., PETROSELLI A., NARDI F., (2009) “Pre-Processing algorithms and landslide modelling on remotely sensed DEMs” Geomorphology, vol. 113, pages 110-125, doi: 10.1016/j.geomorph.2009.03.023.. Passalacqua, P., T. Do Trung, E. Foufoula-Georgiou, G. Sapiro, and W. E. DietricH (2010), A geometric framework for channel network extraction from lidar: Nonlinear diffusion and geodesic paths, J. Geophys. Res., 115, F01002, doi:10.1029/2009JF001254.

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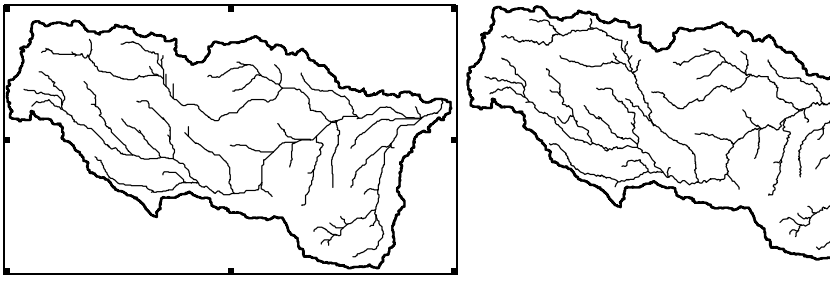
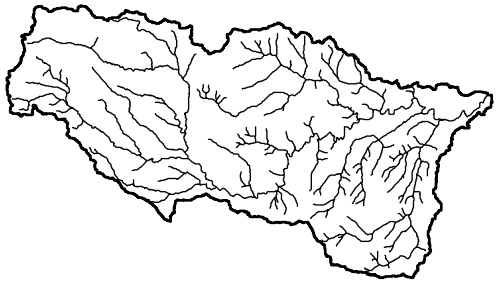
Figure 1: Rigo Basin (84 Km^2), Italy



river network extracted with ArcInfo-D8

river network extracted with PEM4PI



Digitized river network