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Interactive comment on "Robust extraction of thalwegs network from DTM: application on badlands" *by* N. Thommeret et al.

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The paper presents an interesting method to extract badland thalwegs network from both virtual and LiDAR DTM by combining terrain morphology indices (plan curvature and convergence index) with a drainage algorithm. The results suggest, by comparison of the obtained networks with those obtained using the usual drainage area criteria and to the reference networks, great potential for the convergence-index-based method to accurately extract thalwegs networks.

The work is really interesting since it addresses some important issues related to automatic channel extraction from digital terrain models using a pure morphometric approach as alternative to the classic methods of flow direction calculation (eg. D8 by O'Challagan and Mark, 1984). Having said that, in this short communication I want to

focus my attention to few critical issues. I will appreciate it if the authors would clarify these before publication.

1) I would like to bring to the authors' attention to the work published along similar lines, that is, related to objective methodologies for river network extraction from high resolution topography using curvature and other morphometric indices. Such references include the work of Lashermes et al. (2007), Eshani and Quiel (2008), Tarolli and Dalla Fontana (2009), Passalacqua et al. (2010), and Pirotti and Tarolli (2010). I believe that presenting the current work relatively to other similar developments adds to the paper and enlarges its perspective.

2) Looking at pag. 886, cap. 3.1.3 one can read these sentences: "so to highlight the significant cells which should effectively correspond to gully floors from proposed morphological criteria, a threshold is applied on each grid (CI_T for the CI grid and PC_T for the PC grid)" then "Indeed, the Gaussian distribution of the CI values allows setting CI_T as mean value minus twice the standard deviation (σ)". The concept of threshold criteria based on landform curvature was also used by Lashermes et al. (2007). They identified the transition from hillslope to valley through the quantile-quantile plot of curvature. This work shows that not all the convergent pixels present in the landscape are channelized. Tarolli and Dalla Fontana (2009) proposed a methodology based on landform curvature (calculated with Laplacian of elevations) for channel heads recognition where they considered n-times σ of Laplacian of elevations in order to analyze different thresholds for channel heads detection. Why the authors did not consider also other thresholds of σ? Why the choice was only 2σ? Is this choice supported by any statistical analysis? This issue is really important.

3) The authors used the Zevenbergen and Thorne (1987) method for curvature calculation eq. 1 pag. 885, but it is not specified what kernel was used for the calculation. Is this a 3x3 moving window? The authors for example specified then, that the Convergence Index (CI) was calculated using a 3x3 moving window. I bring this issue up as Pirotti and Tarolli (2010) demonstrated that the window size for curvature calculations

is an important factor. In their investigation, where a 1 m LiDAR-derived DTM was considered, they found that the best combination for detecting channels is a curvature window size of 15 x 15 pixels. That specific window size is a function of the size of the features to be detected. This observation can help in planning multiple feature extractions, which consider different sizes of the elements of interest. What is the bankfull width of the analyzed channels? Why did the authors consider in their analysis for each network domain a two-meter wide buffer as a basis on which to test the suitability of extracted channel? Is there a relation between this buffer and the real bankfull width? Discussion on these issues by the authors will add to the paper significantly.

4) Others suggestions: What are the LiDAR data specifications, and DTM vertical accuracy? Are the same used in the work of Bretar et al. (2009)? A location map of the study area and a picture taken in the field should be showed in order to improve the work.

References

Bretar, F., Chauve, A., Bailly, J.S., Mallet, C., and Jacome, A.: Terrain surfaces and 3-D landcover classification from small footprint full-waveform lidar data: application to badlands, Hydrol. Earth Syst. Sci., 13, 1531-1544, 2009.

Eshani, A.H., and Quiel, F.,: Geomorphometric feature analysis using morphometric parameterization and artificial neural networks, Geomorphology, 99, 1-12, 2008.

Lashermes B., Foufoula-Georgiou, E., and Dietrich, W.E.,: Channel network extraction from high resolution topography using wavelets, Geophysical Research Letters, 34, L23S04, 2007.

O'Callaghan, J.F., and Mark, D.M.: The extraction of drainage networks from digital elevation data. Comput, Vision Graphics Image Process., 28, 328-344, 1984.

Passalacqua, P., Do Trung, T., Foufoula-Georgiou, E., Sapiro, G., and Dietrich, W.E.: A geometric framework for channel network extraction from lidar: Nonlinear diffusion and

geodesic paths, Journal of Geophysical Research, 115, F01002, 2010.

Pirotti, F., and Tarolli, P.: Suitability of LiDAR point density and derived landform curvature maps for channel network extraction, Hydrological Processes, doi: 10.1002/hyp.7582, 2010.

Tarolli, P., and Dalla Fontana, G.,: Hillslope to valley transition morphology: new opportunities from high resolution DTMs, Geomorphology, 113, 47-56, 2009.

Zevenbergen, L.W., and Thorne, C.: Quantitative analysis of land surface topography, Earth Surface Processes and Landforms, 12, 47-56, 1987.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 879, 2010.