Hydrol. Earth Syst. Sci. Discuss., 6, C3141–C3143, 2010
www.hydrol-earth-syst-sci-discuss.net/6/C3141/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Reading the bed morphology of a mountain stream: a geomorphometric study on high-resolution topographic data" *by* S. Trevisani et al.

F. Comiti (Referee)

francesco.comiti@unibz.it

Received and published: 16 January 2010

General comments:

The paper presents a very interesting geomorphometric methodology which has the potential to discriminate bed morphology in mountain streams in a automated or semi-automated way, provided that high-resolution topographic data (LiDAR) are available. Indeed, the increasing use of airborne and terrestrial laser scanner is definitely going to change or at least to complement the traditional approach of fluvial geomorphologists, and such a method could allow to map stream morphology in remote, inaccessible

areas where field work is highly difficult. The analysis deployed builds on solid geostatistic indices and thus appear quite sound, especially because of its ability to work at different spatial scales. However, a cross-comparison of its predictive performance against different approaches such as wavelet analysis or algorithms specifically developed to identify steps in high-gradient streams (e.g. Milzow et al., 2006; Zimmermann et al. 2008) would be highly desirable in the near future. Classification of mountain channel morphology is a very tricky topic, on which consensus among geomorphologists is still lacking. The classification of Montgomery and Buffington (1997) is probably the most applied at present at the reach scale, and had seemingly "taken over" the classification by Grant et al. (1990). However, Zimmermann (2009) recently advocated for "step pool" the unit scale status only (for the classification at the unit scale, the most suited for high-gradient streams is probably the one by Halwas and Church, 2002), because at the reach scale the inherent randomness of step location and the complex 2D step arrangement very often lead to a cascade channel type. This is particularly true for the Rio Cordon, where long, "clean" step pool reaches are not present. Indeed, also flow resistance at the reach scale was not found substantially different between step pool and cascade reaches not only in the Rio Cordon (Comiti et al., 2007). Therefore, the inability of the geomorphometric method to clearly distinguish between these two reach categories could either derive from the specific configuration of the Rio Cordon or reflect a more general fact, i.e. at a reach scale cascade and step pool are not that different. Tests on a different channel featuring longer, more defined step pool reaches is thus needed, but in case of deep pools the associated laser beam attenuation could make non-bathymetric LiDAR data unsuitable for the analysis.

Specific comments:

At p. 7289, second paragraph: I do not agree that processes have an almost immediate effect on streambed morphology. If fact, we know that high-gradient rivers have very stable beds which require infrequent floods to be mobilized, and sediment-transporting flows occur for only a very short duration (Lenzi et al., 2006). The propagation of sediment/bed disturbances downstream would require relatively more time compared to lower gradient gravel bed rivers.

What is the relative portion of the bed where the laser attenuation by water has likely affected bed topography ? Would the use of a bathymetric LiDAR be substantial improvement ?

Would the Authors envisage a possible better performance of the method for a higher resolution of DTM (say 0.25m), provided by a larger point density ? This comment follows Thompson's one on the likely poor identification of some boulders.

On the same line, given the increased use of terrestrial laser scanners, could the Authors comment on the possible advantages (or disadvantages as well) for their geostatistic method of using a terrestrial rather than a airborne LiDAR systems ?

Additional References cited:

Comiti F, Mao L, Wilcox A, Wohl E and Lenzi MA (2007) Field-derived relationships for flow velocity and resistance in high-gradient streams. Journal of Hydrology, 340, 48–62.

Halwas KL and Church M (2002) Channel units in small, high gradient streams on Vancouver Island, British Columbia. Geomorphology, 43 (3-4), 243-256

Lenzi MA, Mao L and Comiti F (2006) Effective discharge for sediment transport in a mountain river: computational approaches and geomorphic effectiveness. Journal of Hydrology, 326, 257-276.

Zimmermann A (2009) Experimental investigations of step-pool channel formation and stability. PhD thesis, University of British Columbia, Vancouver, Canada, 359 pp,

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 7287, 2009.