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Unit stream power as a base for regional river typology

Eric HALLOT, Geoffrey HOUBRECHTS, Yannick LEVECQ, and François PETIT
University of LIEGE, Geography, LHGF, LIEGE, Belgium (eric.hallot@ulg.ac.be)

In order to assess the hydromorphological quality of surface waters, stakeholders need river typologies accurate and functional enough to be a really efficient management tool. From a typological study based a broad set of hydromorphological field data, we have shown that some variables, like the unit stream power (ω), are particularly appropriate to describe the dynamics of a river. Initial results of repeated measurement in more than 80 sites revealed a regional differentiation based on critical values of stream power at bankfull discharge.

The aim of this study is to present a unit stream power mapping for the whole network based on general equation $\omega = \rho.g.Q.S/w$, with ρ the density of water, g the acceleration due to gravity, Q the discharge, S the slope and w the channel width). Slope is extracted from DEM. Bankfull discharge and width estimations are furnished by allometric equations using the watershed area. Different coefficients are used according to regional differentiations based on bedload size and watershed permeability. The statistical significance of all equations was tested by covariance analysis. A correction taking into account the used log-log scale, was also applied to the obtained allometric equations (Fergusson, 1988).

Using a 30 x 30 meters DEM, GIS routines were developed. A first one automatically sectorizes the network and a second evaluates the unit streamspower in each location. We propose a 7-level classification in accordance with the associated morphological processes describe in the literature (from fixed meanders to step-pools system). The mapping unit starts at the Strahler second order.

Our results not only support a regional typology, but moreover allow us to describe natural regions in function of river dynamics and to estimate the resistance of restoration works like vegetal techniques. It can also provide estimates of the excess stream power (the fraction of the actual stream power exceeding the power at which bedload particles start to move)

(Fergusson, R.,I., 1988. River loads underestimated by rating curves, Water Resour. Res., 24(7), 1217–1219.)