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Introducing an R-package for calculating channel width and other basic metrics for irregular river polygons

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The width of fluvial streams and channel beds is an important metric for a large number of hydraulic, geomorphic and ecologic applications. For example, for a given discharge the local channel width determines the water flow velocity and thus the sediment transport capacity of a reach. Since streams often have irregular shapes with uneven channel banks, the channel width strongly varies along the channel.

Although, the geometry of streams or their beds can be measured easily in the field (e.g. with a Total Station or GPS) or from maps or aerial images in a GIS, the width of the stream cannot be identified objectively without further data processing, since the results are more or less irregular polygons with sometimes bended shapes. An objective quantification of the channel width and other metrics requires automated algorithms that are applicable over a range of channel shapes and spatial scales.

Here, we present a lightweight software suite with a small number of functions that process 2D or 3D geometrical data of channels or channel beds. The software, written as an R-package, accepts various text data formats and can be configured through five parameters. It creates interactive overview plots (if desired) and produces three basic channel metrics: the centerline, the channel width along the centerline and the slope along the centerline. The centerline is an optimized line that minimizes the distances to both channel banks. This centerline gives also a measure for the real length and slope of the channel. From this centerline perpendicular transects are generated which allow for the calculation of the channel width where they intersect with the channel banks.

Briefly, we present an example and demonstrate the importance of these metrics in a use case of a steep stream, the Erlenbach stream in Switzerland. We were motivated to develop and publish the algorithm in an open-source framework, since only proprietary solutions were available at that time. The software is developed in R and is published under GNU GPL meaning it is free to use, edit and copy. This makes the software available also to users who do not own a MATLAB or ARCMAP license for which similar products exist.