How dealing with the significance of historical surfacic changes documented from remote-sensed data in mid-sized rivers ?

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Résumé

A majority of European rivers have been extensively affected by diverse anthropogenic activities, including e.g. channelization, sediment mining, and construction of dikes and dams. Against this background, the planimetric analysis based on remote-sensed data is frequently used to document historical planform changes. However, geometric and delineation errors inherently associated with these data often result in poor or even misleading interpretation of measured changes, especially on mid-sized rivers and/or low amplitude surfacic changes. We therefore address the following issue: How dealing with the significance of historical surfacic changes documented from remote-sensed data in mid-sized rivers ?

Our test river corresponds to a 20 m wide meandering sub-tributary of the Upper Rhine, the Lower Bruche. After an initial reconstruction of historical planform changes using two maps and eight orthophotos, we assess the significance of these results within four test sub-reaches thanks to the channel polygon method. First, a sub-reach specific geometric error affecting the data is interpolated with an Inverse Distance Weighting method. A main novelty of our approach consists then in running Monte-Carlo simulation to randomly translate active channels according to the specific geometric error, and extract eroded, deposited and eroded/deposited surfaces. This eventually leads to the production of a Surface of Detection (SoD), which allows evaluating the significance of measured surfacic changes.

Putting the SoD into practice in the lower Bruche shows that only 37% of the total surfacic changes measured in our four sub-reaches are significant. Our results suggest that (i) the geometric error strongly affects the significance of measured changes and (ii) the significance is strongly dependent on the magnitude of surfacic changes. Taking geometric error into account is strongly recommended, regardless of the remote-sensed data used. This is particularly true for mid-sized rivers and/or low amplitude river planform changes, especially in the framework of their sustainable management.

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