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What can we learn from sediment connectivitiy indicies regarding natural hazard processes in torrent catchments?

Daria Schmutz, Markus Zimmermann, and Margreth Keiler
University of Bern, Institute of Geography, Bern, Switzerland (daria.schmutz@students.unibe.ch)

Sediment connectivity is defined as the degree of coupling between sediment sources and sinks in a system and describes the effectiveness of the transfer of sediment from hillslopes into channels and within channels (Bracken et al. 2015). Borselli et al. (2008) developed a connectivity index (IC) based on digital terrain models (DTMs). Cavalli et al. (2013) adapted this index for mountainous catchments. These measures of connectivity provide overall information about connectivity pattern in the catchment, thus the understanding of sediment connectivity can help to improve the hazard analysis in these areas. Considering the location of settlements in the alpine regions, high sediment transfer can pose a threat to villages located nearby torrents or at the debris cones. However, there is still a lack of studies on the linkage between IC and hazardous events with high sediment yield in alpine catchments.

In this study, the expressiveness and applicability of IC is tested in relation with hazardous events in several catchments of the Bernese and Pennine Alps (Switzerland). The IC is modelled based on DTMs (resolution 2 m or if available 0.5 m) indicating the surface from the time before and after a documented hazardous event and analysed with respect to changes in connectivity caused by the event. The spatial pattern of connectivity is compared with the observed sediment dynamic during the event using event documentations. In order to validate the IC, a semi-quantitative field connectivity index (FIC) is developed addressing characteristics of the channel, banks and slopes and applied in a selection of the case studies.

First analysis shows that the IC is highly sensitive to the resolution and quality of the DTM. Connectivity calculated by the IC is highest along the channel. The general pattern of connectivity is comparable applying the IC for the DTM before and after the event. Range of the connectivity values gained from IC modelling is highly specific for each study area and so are their changes by the events. Whereas some slopes show an increased connectivity, others are less connected or not affected according to the IC. Further results of the comparison between the FIC and the IC and an evaluation of both indices in the context of hazardous events will be presented.

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