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Analysing lateral sediment connectivity and its connection to the frequency-magnitude reality in the Fiume Fella system, Northern Italy

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Connectivity has become a widely used concept to understand and evaluate geomorphic processes in catchment systems. Multiple methods have been developed and applied all over the world to model connectivity patterns. These include the Effective Catchment Area (ECA) approach, developed by Fryirs et al. (2007), and the Index of Connectivity (IC) developed by Borselli et al. (2008) and successively modified by Cavalli et al. (2013). The main aim of the present study is to test and evaluate pros and cons of the two different connectivity approaches, i.e. ECA and IC, in an alpine catchment (i.e. Fella River, NE Italy) in the context of debris flow hazards. The Fella catchment is characterised by steep valley slopes and gullies leading down to settlements and high-level infrastructure on the valley floor, thus displaying a high number of elements at risk. In 2003, the area has experienced widespread destruction due to high-magnitude debris-flow events.

The results of the two methods (ECA and IC) show a general agreement, portraying a strong connectivity, especially in the middle part of the river and the tributaries. Due to the steep slope characterizing the Fella subcatchments, a lot of direct slope-channel coupling was observed. The analysis further reveals a strong influence of anthropogenic features, in particular road infrastructure, on the connectivity patterns.

The second part of the study evaluates the effectiveness of the methods employed to represent the patterns of selected frequency-magnitude events. This will be done by comparing the results to a past study carried out in the framework of CHANGES EU project evaluating debris flow impact areas at particular frequency-magnitude events which led to changes in the connectivity patterns of the catchment in terms of bridging disconnected features and, as a consequence, putting the infrastructures in the valley floor at risk.