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Data fusion of aerial and terrestrial LiDAR datasets for sediment transport modelling

Alberto De Luca (1), Sara Cucchiaro (1), Giacomo Blasone (1), Marco Cavalli (2), and Federico Cazorzi (1)

(1) University of Udine, Department of Agriculture and Environmental Sciences, Udine, Italy (alberto.deluca.1@uniud.it), (2) CNR IRPI - National Research Council of Italy, Research Institute for Hydrogeological Protection, Padova, Italy (marco.cavalli@irpi.cnr.it)

Availability of high-resolution morphometric survey datasets is not an issue any longer, especially after the wide adoption of laser scanning technology to collect data. Nevertheless, this abundance of data is not always matched by the techniques and the procedures used to process it and to turn it into information useful for decision makers. The work we present here was aimed at exploiting high-resolution morphometric data collected using two different technologies, i.e. Aerial Laser Scanner (ALS) and Terrestrial Laser Scanner (TLS). The two datasets were combined to generate a series of Digital Elevation Models (DTMs) that were in turn used to assess the effects of the construction of a new check dam on sediment transport modelling in a small Italian mountain catchment (Rio Moscardo).

The fusion of the two datasets allowed the generation of three DTMs. The first DTM (scenario 1, from ALS data only) describes the morphology before the check dam construction. The second DTM (scenario 2, from ALS and TLS data) describes the morphology right after the check dam construction, therefore without upstream debris deposition. The third DTM (scenario 3, from ALS and TLS, modified) describes the morphology a few years after the dam construction, with consistent upstream debris deposition. The three DTMs were used as a basis for the calculation of a spatial sediment Connectivity Index (IC), to assess how different portions of the catchment are connected to the catchment outlet (target) in terms of debris flow delivery. The modelling results clearly show that in scenario 2 the check dam acts as an effective sink for the debris, almost disconnecting the catchment portion upstream to the dam (15% of the catchment area) from the catchment outlet. In scenario 3, where due to debris deposition the slope of the area just upslope to the dam has strongly decreased, the IC values of the catchment portion upstream to the dam revert to the ones shown in scenario 1, where strong connection to the outlet was detected.