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On the correlation between sediment shape indices and distance travelled in Alpine catchments, a UAV based analysis

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Within river basins, humans require infrastructures to cover their water needs. The basin scale impacts of these infrastructures are difficult, if not impossible, to estimate and therefore medium to long term effects are only partially considered in planning and management decisions.
Available morphodynamic models aim at reproducing river shapes as consequences of changes in sediment transport rates, rather than to capture the dynamics of individual particles within the river network. These models are also often calibrated and validated using sediment transport rates measured in specific locations. These measures are affected by a number of drawbacks: they are expensive, characterised by low accuracy and usually limited to a small range of sediment sizes they focus on.
Recent studies on sediment attrition claim the existence of a “universal” relation between particles mass loss due to saltation and specific shape indices (Novák-Szabó et al., 2018). Once the universality of this relationship will be confirmed by extensive testing in different real litho-morpho-climatic settings, it will become possible to link measurable properties of sediments (e.g. size, shape and lithology) to their travel distance (Cassel et al., 2018). This will represent a fundamental step towards a deeper understanding of sediment transport in mountain/piedmont rivers.
This research aims at the assessment of the applicability of this relationship to estimate sediment travel distance. In order to test the hypothesis of “universality” of the relation between relative mass loss due to attrition and particle shape, we will compare the shape indices of natural sediment characterized by different litho-morphological settings at different distances from their sources.
The selected case study is the Cordevole River basin in North-East Italy. Within this watershed, a small tributary, the Sarzana River, is characterized by the presence of localized outcrops of arenite and metabasalts which, given their very localized sources, will be considered as tracers.
The methodology that will be applied is based on the analyses of field data collected using UAVs. In the field, samples of sediments including the mentioned tracers have been collected at different distances from their sources and their size and shape has been estimated using digital image processing tools. These data allowed the assessment of quantitative correlation between shape changes and distance travelled for each of the selected lithologies, which will be presented and discussed.