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## Comment on nhess-2021-85

Manuel López-Vicente (Referee)

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Referee comment on "Multiscale analysis of surface roughness for the improvement of natural hazard modelling" by Natalie Brožová et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-85-RC1>, 2021

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It would be appropriate to reconsider the manuscript 'nhess-2021-85' for a new evaluation after MODERATE corrections. Authors have evaluated the performance of seven terrain-analysis algorithms, calculated with three moving window areas and extending this analysis to three pixel sizes, to assess surface roughness in two Alpine areas with different land covers and affected by distinct dynamic processes in the last few years. Therefore, this study is complex and ambitious. The main goal is to identify the best approach to improve gravitational mass flow simulations. The methodology is explained with enough detail, and data and results statistical analysis seem adequate and correct, and thus, conclusions may be sound. Results discussion is complete, and conclusions are clear, concise and to-the-point. However, I have some questions and comments that should be answered and addressed by authors, namely:

- Abstract. Include the method/s used to generate the DSM and the DEM, e.g. LiDAR, SfM. The type of method influences the point density, and thus, the ability of the obtained models to accurately capture macro-, meso- and micro-features of the landscape.

- Abstract. Authors compare the results of "surface roughness" based on DSM vs. those obtained from DTM. I have serious doubts that this is correct. In a DSM, all landscape features are included, and thus, the corresponding values of surface roughness are associated to those features. However, the information captured in a DTM is mainly controlled by the ground elevation, without most of the features included in the DSM. From a strict point of view, a DTM is the sum of the DEM and the main landscape geomorphic features like rivers, cliffs, crests, and breaking points. Therefore, the surface roughness derived from a DSM and a DTM of the same site is always qualitatively different. Besides, the digital height model (DHM=DSM-DTM) obtained in different land uses is different because of the distinct features that characterise each land use. All these aspects should be clarified in a revised version.

- Abstract. What is the novel aspect of this study? I suggest highlighting the actual contribution of this study based on the available literature. To clearly present these aspects will make the article more attractive for potential readers.

- L.33-34. Please, provide more information of the six cited studies or choose the three most relevant studies. In my opinion, it is not necessary to include six articles to support one statement. Do the same in L.42-43 with the 5 references: include more information of the modelling approaches.

- L.102-104. These two sentences are very interesting. I suggest authors extend the explanation of this approach.

- L.134: Which features were included in the DTM? I assume that all landscape features were represented in the DSM. However, it is not clear which features were included in the DTM, apart from the DEM. This is an important aspect, because the derived products from the DSM and DTM -as the surface roughness and terrain roughness- are qualitatively different, and thus, it has no sense to compare them in a direct way.

- Section 2.1 and Figure 1. What is the criteria followed and the method used to draw the boundaries of the two study areas?

- L.156. Add the country of the SenseFly company, as you did it in line 171 with DJI.

- Discussion. I would like to know the average size of the landscape features included in the analysis of this study. Besides, authors should evaluate the relationship between the size of the features and the extension of each window area. Maybe, if some features are much smaller than the window area, the information of those features is blurred. Maybe, the suitable window area may depends on the average dimensions of the features. This idea should be discussed.

- Discussion. Did you establish the thresholds for distinguishing between the roughness categories before running the algorithms or after obtaining the results? This aspect has to be clearly explained, and the numerical criteria to propose those thresholds too.