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The importance of source area mapping for rockfall hazard analysis

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A problem in the characterization of the area affected by rockfall is the correct source areas definition. Different positions or different size of the source areas along a cliff result in different possibilities of propagation and diverse interaction with passive countermeasures present in the area. Through the use of Hy-Stone (Crosta et al., 2004), a code able to perform 3D numerical modeling of rockfall processes, different types of source areas were tested on a case study slope along the western flank of the Mt. de La Saxe (Courmayeur, AO), developing between 1200 and 2055 m s.l.m. The first set of source areas consists of unstable rock masses identified on the basis of field survey and Terrestrial Laser Scanning (IMAGEO, 2011). A second set of source areas has been identified by using different thresholds of slope gradient. We tested slope thresholds between 50° and 75° at 5° intervals. The third source area dataset has been generating by performing a kinematic stability analysis. For this analysis, we mapped the join sets along the rocky cliff by means of the software COLTOP 3D (Jaboyedoff, 2004), and then we identified the portions of rocky cliff where planar/wedge and toppling failures are possible assuming an average friction angle of 35°. Through the outputs of the Hy-Stone models we extracted and analyzed the kinetic energy, height of fly and velocity of the blocks falling along the rocky cliff in order to compare the controls of different source areas. We observed strong variations of kinetic energy and fly height among the different models, especially when using unstable masses identified through Terrestrial Laser Scanning. This is mainly related to the size of the blocks identified as susceptible to failure. On the contrary, the slope gradient thresholds does not have a strong impact on rockfall propagation. This contribution highlights the importance of a careful and appropriate mapping of rockfall source area for rockfall hazard analysis and the design of passive countermeasures.