Comparison of the surface velocity of a debris flow at the Gadria creek using pulse compression radar and digital particle image velocimetry (DPIV).

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A central aspect of protection against debris flows is the understanding of the process. The flow velocity is an important parameter which is used, for example, in the dimensioning of protective structures, for technical building protection and for early warning systems. The measurement of the surface velocity which is regarded as the maximum velocity occurring within a debris flow, is therefore an essential link in the chain of fundamental process research and applied protection against natural hazards.

Due to the further development of various technologies such as video technology and high-frequency radar technology, the non-contact measurement of the surface speed of a debris flow has improved significantly in recent years. Radar technology provides a wide aspect of applications in alpine mass movements such as debris flows, avalanches and rockfall and is able to detect such processes up to a range of 2500 meters in distance. An additional beneficial feature is the possibility of non-contact measurement of the surface velocity. In the catchment area of the Gadria basin (South Tyrol, Italy), the measuring station, which has been in operation since 2016, has been extended by a pulse compression radar and a new HD video camera. On July 26, 2019 a debris flow consisting of several surges was recorded with both the radar and the HD video camera.
camera. To obtain surface velocity data from the video material, the material was analyzed and evaluated using digital particle image velocimetry by making use of the MATLAB software and its freely accessible ADD-On "PIVlab".

The results of the compared surface velocity data showed a value of up to 0.74 according to the statistical mean of the coefficient of determination. The results demonstrate the high effectiveness of the pulse compression radar and the DPIV analysis in a wide range of the assessment of surface velocity of natural debris flows. There is great potential in both measuring systems and the chosen comparative analysis provides a blueprint for future recorded debris flows.