



Measurement of avalanche front velocity from high-speed terrestrial digital photogrammetry

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Avalanche flow models are important tools for avalanche risk mitigation. Artificial avalanche release can provide data for validation of flow models as for example the run-out distance reached by the avalanche. Here we attempt to measure in time the position and velocity of the front of the avalanche in order to provide dynamic data for model calibration. Experiments have been carried out on the full-scale avalanche experimental site at Lautaret pass (French Alps). High speed terrestrial photogrammetry is used to obtain Digital Elevation Models (DEM) during an avalanche release. Recent advances in digital commercial cameras allow acquiring up to 4 frames per second with 10-20 Mpixels of resolution. The principal point position, the focal length and the lens distortion are obtained from calibration, indicating a negligible pincushion distortion but a significant lens decentration. The camera calibration parameters enable to triangulate two stereo-pairs on ground control points within 6 cm of orientation residuals. A specific DEM generated for comparison with a laser scan DEM reveals a ± 11 cm of random error but no systematic discrepancy. Finally, avalanche front positions and velocities are calculated from a 30 s sequence of stereo pairs acquired during an artificial release with 2 cameras synchronized with digital wireless radio transceivers.