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Rockfall hazard assessments coupling the Matterock and Cadanav approaches in the Val de Bagnes, Switzerland

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In Switzerland, many inhabitants and infrastructures are subject to natural hazards like rockfalls in mountain areas. In order to prevent unconsidered risks, it is essential to investigate hazardous phenomena and plan land-use restrictions and/or mitigation measures. In the present study, the Alpine villages of Lourtier and Les Morgnes (Val de Bagnes, Switzerland) are threatened by a 300 m high and 1'000 m long cliff. A barrier has already been built below the cliff to protect the village from rockfalls. In order to assess the remaining risk and suggest efficient mitigation works if necessary, detailed investigations are focused on internal parameters (especially about structural settings) and external factors (especially about water infiltration and impacts of a close dam gallery) leading to rockfall events. The study area is located in an old glacial valley at 1'000 m.a.s.l. and is affected by an important debutressing. The cliff is mainly composed by micaschists and gneiss and past tectonic conditions has created a significant schistosity.

Detailed field observations were carried out during summer 2012. Terrestrial LiDAR was also performed in order to complete field structural surveys. According to the Matterock approach, 7 discontinuity sets are detected and are controlling toppling and wedge sliding, principal failure mechanisms affecting the cliffs. Moreover, the thin schistosity also contributes to delimit many small rock compartments (of about few dm3). Even if water infiltration was observed in several discontinuities, no evidences of water leak from the dam gallery are noted up to now. According to the CADANAV approach and calibrating by historical records, multiple 2D and 3D rockfall runouts are simulated to extract energies and involved frequencies for blocks to reach the villages. Four preferential runout corridors are highlighted. In agreement with past events and simulation results, the barrier seems reducing the exposure of the village; nevertheless, further investigations will still be carried out to confirm it.