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Natural Hazards and Earth System Sciences

Summary on the NHESS Special Issue "Rockfall protection – from hazard identification to mitigation measures"

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1 Summary of the Special Issue

This special issue on rockfall protection is the outcome of the 2008 Interdisciplinary Workshop on Rockfall Protection that took place in Morschach, Switzerland (Volkwein et al., 2008). It was the aim of this workshop to bring together professionals and scientists from different occupation fields but all of them dealing with rockfall. Especially rockfall protection can most effectively be solved by interaction between the involved disciplines. The result was an interesting meeting of geologists, geomorphologists, computational programmers, engineers, and people with a geographical background.

The workshop covered the different steps for rockfall risk management, from hazard identification to mitigation measures. This also describes the range of contributions of this special issue in NHESS on rockfall. Altogether 16 articles have been submitted, evaluated, reviewed, and published. The single papers as listed in the following paragraphs each covering different aspects in the field of rockfall. A jointly written review paper tries to capture the state of the art and to collect most of the relevant references into one single document (Volkwein et al., 2011). This special issue and the review paper now provide a comprehensive overview for people new on the subject, people needing a rather complete literature overview or for decision makers in practice interested in the advances in research, or simply for every person involved with rockfall and willing to treat rockfall protection as an integral task.

The onset susceptibility and probability define the initiation of rockfall and can be evaluated in different ways. Krautblatter and Moser (2009) observed a natural rockface for four years and evaluated the rockfall events during this time. Different release conditions for rockfall are handled by Mavrouli et al. (2009), Arosio et al. (2009), and Loye et al. (2009) covering seismic activities, rockface deformations, and geomorphological indicators, respectively.

The rockfall propagation in the transition zone is then best evaluated by trajectory simulations as described by Masuya et al. (2009). A challenge is the knowledge and the modelling of the boulder ground interaction during the moving process. Labiouse and Heidenreich (2009) therefore describe experimental investigations on this topic and Bourrier et al. (2009) set up a Bayesian model that can be integrated into trajectory simulation codes. Along the transition zone the rockfall often also faces vegetation that has braking and energy absorbing capabilities. Ciabocco et al. (2009) study these effects for coppice structures and Rammer et al. (2010) evaluate a 3-D-rockfall model within a forest.

After the definition of release scenarios and the modelling of rockfall trajectories, the next steps for rockfall risk management are the drawing of hazard (Abbruzzese et al., 2009) and risk (Agliardi et al., 2009) maps. To reduce the exposure to rockfall, first priority should be given to an appropriate land use planning. However, if rockfall threatens existing buildings and infrastructures, artificial protection measures are unavoidable. Today's knowledge allows retention of rockfall with a kinetic energy of several thousand kilojoules. The design of earth structures such as embankments is described by Ronco et al. (2009) and by Lambert et al. (2009) where the embankments are built of geocells. Tachibana et al. (2010) studied the impact of rockfall on concrete structures. The design and testing of flexible steel fences against rockfall are described by Peila and Ronco (2009).

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2 Concluding remarks

All the contributions listed above would not have been possible if the people dealing with rockfall weren't so enthusiastic on this topic. But this seems understandable: Rockfall is an alarming and yet at the same time a fascinating natural hazard. Alarming, if one faces only small blocks impacting a car roof: 20 kg will go right through it like a bullet; 80 kg will compress the whole roof, leaving no place for the passengers. It is fascinating, on the other hand, if one sees a free fall rockfall experiment used to design a protection system: After the release of the rock it accelerates without any noise while it develops its destructive capacity. This breathtaking quietness lasts a couple of seconds until the rock is caught with a big bang by the protection system.

Therefore and due to all the work that has been done so far, and despite still many unsolved problems, today's advances in this field are enormous and worth being published. A big advantage of the actual research are of course the computational possibilities. These enable a steadily improving calculation of release probabilities, prediction of trajectories, and design of protective structures. We are therefore interested what the future will bring.

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