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Use of flexible protection systems against debris flows

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A new and efficient way to protect from debris flows is the use of flexible barrier systems. The system presented here consists of a ring net that is spanned by support ropes with integrated energy absorbers. Barriers with larger span widths are additionally equipped with post. The load bearing system has been taken from todays common rockfall protection systems. However, compared to a rockfall that can be simulated as a rigid impacting body, the loading by the debris flow and the interaction with the flexible net are the unknowns that are investigated in the actual research project.

A fully instrumented field barrier has been installed in the Illgraben River in Switzerland offering 5-6 large debris flows per year. The automatic measurement system now recorded the filling process of the full-scale system on video together with the acting rope forces and the filling height over the time. The characteristics of the debris flows like flow velocity and density are determined through other devices run by the WSL in the Illgraben.

To study the influence of different barrier parameters such as the mesh size, barrier stiffness etc. additional small-scale laboratory experiments allow extensive parameter studies. Comparative scaling calculation show the usability of the lab results transferred to field barriers.

All obtained results are finally used to build up a numerical model that can be used for the load specification within specially developed Finite Element software [1]. This enables fully detailed simulation and the guarantees the transferability of the results to other barrier sites and projects.

[1] Volkwein A. (2005) Numerical Simulation of flexible rockfall protection systems, Proc. Computing in civil engineering. Cancun: ASCE.