

Large rock-slope failures impacting on lakes - Reconstruction of events and deciphering mobility processes at Lake Oeschinen (CH) and Lake Eibsee (D)

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Among single event landslide disasters large rock-slope failures account for 75% of disasters with more than 1000 casualties. The precise determination of recurrence rates and failure volumes combined with an improved understanding of mobility processes are essential to better constrain runout models and establish early warning systems.

Here we present the data sets from the two alpine regions Lake Oeschinen (CH) and Lake Eibsee (D) to show how lake studies can help to decipher the multistage character of rock-slope failures and to improve the understanding of the processes related to rock avalanche runout dynamics.

We focus on such that impacted on a (paleo-) lake for two main reasons.

First, the lake background sedimentation acts as a natural chronometer, which enables the stratigraphic positioning of events and helps to reconstruct the event history. This way it becomes possible to (i) decipher the multistage character of the failure of a certain rock slope and maybe detect progressive failure, (ii) determine the recurrence rates of failures at that certain rock slope, and (iii) consider energies based on estimated failure volumes, fall heights and deposition patterns. Hence, the interactions between a rock-slope failure, the water reservoir and the altered rock-slope are better understood.

Second, picturing a rock avalanche running through and beyond a lake, we assume the entrainment of water and slurry to be crucial for the subsequent flow dynamics. The entrainment consumes a large share of the total energy, and orchestrates the mobility leading to fluidization, a much higher flow velocity and a longer runout-path length than expected.

At Lake Oeschinen (CH) we used lake sediment cores and reflection seismic profiles in order to reconstruct the 2.5 kyrs spanning rock-slope failure history including 10 events, six of which detached from the same mountain flank, and correlated them with (pre-) historical data.

The Lake Eibsee records provide insights into the impact of the rock-slope failure at Mount Zugspitze on the presumed Eibsee paleolake 3.7 kyrs ago. We have been working on seismic profiles and sediment cores from the lake as well as on geoelectrical profiles and terrestrial sediments in the runout path aiming at the reconstruction of mobility processes related to the impact and leading to an extraordinarily long runout.