Geophysical Research Abstracts
Vol. 20, EGU2018-9976, 2018
EGU General Assembly 2018

Frequency, age and magnitude of rock-slope failures derived from lake sediments (Lake Oeschinen, CH)

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Recurrence rates of rock-slope failures are often unknown in subaerial deposits. Large rock-slope failures impacting on lakes can initiate coupled multi-risks, e.g. dam breakages or massive outburst floods. Lake sediments may provide a setting to resolve multistage repeated rock-fall activity in time and space, and improve our understanding of the interactions between lake and sediments after an impact of rock material.
Lake Oeschinen (CH) is a rock-avalanche dammed lake dated at ∼2550 cal yrs BP and is thus significantly younger than the Kandersteg rock avalanche in its close vicinity, dated at ∼9500 cal yrs BP. Evidence of at least 10 rock-slope failure events since lake formation were found in the lake sediment archive. The age model is based on radiocarbon dating, historic chronicles and a varve chronology in the upper ∼5.6 m of the sediment record and surprises with high recurrence rates (∼1/300 yrs, with higher rates in the last few centuries). The event deposits were assessed in time and space using seismic- and core-to-core-correlation in the lake and aerial photos of potential scarp niches. Calculations of Newmark displacements at the potential scarp niches made it possible to show coincidence with four (pre-) historic earthquakes, one of which is the well-documented prehistoric ∼2200 cal yrs BP earthquake that supposedly triggered a massive rock slide from Mount Spitzstein. Six multistage rock-slope failures from one single mountain flank of Mount Spitzstein could be distinguished due to continuous lake background sedimentation between the single events. We also correlated a witnessed lake-outburst flood with a rock fall in 1846 AD.
Here we show with our polymethodical approach in Lake Oeschinen how lake sediment archives can help to refine recurrence rates and magnitudes of subaerial rock-slope failures. (Knapp et al., in review JGR)